PN-ABH-590

# VIRGIN ISLANDS RESOURCE MANAGEMENT COOPERATIVE

Biosphere Reserve Research Reports

---

No. 23 MAN'S LONG-TERM IMPACT ON SEDIMENTATION: EVIDENCE FROM SALT POND DEPOSITS
*by Maynard M. Nichols and Grace S. Brush*

No. 24 RECREATIONAL USES OF MARINE RESOURCES IN THE VIRGIN ISLANDS NATIONAL PARK AND BIOSPHERE RESERVE: TRENDS AND CONSEQUENCES
*by Caroline S. Rogers, Larry McLain and Evonne S. Zullo*

No. 25 ASSESSMENT OF ANCHOR DAMAGE AND CARRYING CAPACITY OF SEAGRASS BEDS IN FRANCIS AND MAHO BAYS FOR GREEN SEA TURTLES
*by Susan L. Williams*

No. 26 BUCK ISLAND FISH AND SHELLFISH POPULATIONS
*by William Tobias, Eric Telemaque and Michael Davis*

No. 27 INITIAL INVENTORY OF THREE PERMANENT FOREST PLOTS IN THE VIRGIN ISLANDS NATIONAL PARK
*by John E. Earhart, Anne E. Reilly and Matt Davis*

No. 28 GEOCHEMISTRY OF ST. JOHN AND INFLUENCE ON MARINE SYSTEMS
*by Carlos R. Ramos-Perez and Cindy Gines-Sanchez*

---

U.S. MAN AND THE BIOSPHERE PROGRAM

Virgin Islands National Park

September, 1988

The Virgin Islands Resource Management Cooperative (VIRMC) was formed in 1982. Signatories to the Memorandum of Understanding are: Virgin Islands National Park, the Department of Planning and Natural Resources of the U.S. Virgin Islands Government (Division of Fish and Wildlife and Division of Natural Resources Management), University of the Virgin Islands, West Indies Laboratory, Island Resources Foundation, Eastern Caribbean Natural Area Management Program, U.S. Geological Survey, U.S. Fish and Wildlife Service, Southern Forest Experiment Station, University of Puerto Rico (Sea Grant Program and the Center for Energy and Environment Research), Caribbean Fishery Management Council, the Ministry of Natural Resources and Labor of the British Virgin Islands Government, and the British Virgin Islands National Parks Trust.

The objectives of the cooperative are:

1. To establish a Virgin Islands Resource Management Cooperative for the purpose of providing coordinated research, extension, and educational support of programs to achieve full benefits of island forests, wildlife, water resources, the marine environment, and historic areas and their associated resources for their cultural, social, commercial, economic, and recreational utilization and enjoyment.

2. To provide for the direction and management of the Cooperative by forming an Executive Committee, comprised of one representative from each of the organizations who are parties to this agreement, which will a) elect annually a Chairman from the membership of the Executive Committee to serve for a term of one year, b) appoint an Executive Officer to a staff position to coordinate the work of the cooperative, c) appoint technical committees and project leaders, d) provide for the orderly process of development and implementation of policy, and e) foster cooperative activities and relationships among participating parties and with other agencies and institutions.

3. To coordinate and facilitate financial and other support for research on environmentally acceptable uses of forests, wildlife, the marine environment and historic areas, and their associated resources in order to provide for their better management.

4. To provide for the collective utilization of the unique attributes and resources (personnel, facilities, equipment, and other support services) of the parties as they may relate to objectives pursued under this agreement.

5. To plan for appropriate dissemination, publication, and application of research and information.

PN-ABH-590

# VIRGIN ISLANDS RESOURCE MANAGEMENT COOPERATIVE

BIOSPHERE RESERVE
RESEARCH REPORT NO. 23

## MAN'S LONG-TERM IMPACT ON SEDIMENTATION: EVIDENCE FROM SALT POND DEPOSITS

Maynard M. Nichols and Grace S. Brush
Island Resources Foundation
St. Thomas, U.S. Virgin Islands

U.S. MAN AND THE BIOSPHERE PROGRAM

Virgin Islands National Park

September, 1988

PN-ABH-590

# MAN'S LONG-TERM IMPACT ON SEDIMENTATION: EVIDENCE FROM SALT POND DEPOSITS

1988

BIOSPHERE RESERVE REPORT NO. 23

MAYNARD M. NICHOLS and GRACE S. BRUSH
ISLAND RESOURCES FOUNDATION
ST. THOMAS, U.S. VIRGIN ISLANDS

U.S. DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

AND

VIRGIN ISLANDS RESOURCE MANAGEMENT COOPERATIVE
VIRGIN ISLANDS NATIONAL PARK
P.O. BOX 7789, ST. THOMAS
U.S. VIRGIN ISLANDS 00801

LOCAL CONTRACTING AGENT
ISLAND RESOURCES FOUNDATION
RED HOOK BOX 33, ST. THOMAS
U.S. VIRGIN ISLANDS 00802
(NPS CONTRACT NO. CX-0001-3-0048)

ABSTRACT

Coastal ecosystems of the Virgin Islands Biosphere Reserve, St. John, are subject to stress of sedimentation from watershed erosion, both natural and man-induced. A pilot study was initiated at Mandal Pond and Reef Bay mangrove swamp on the southern coast of St. John to determine sedimentation rates and to discover if the rates have changed in response to man's historical activity in the watershed. The results reveal the deposits are ordered in time, display horizons and preserve components produced in the pond/swamp or derived from the watershed. Radiocarbon ages of intertidal peat indicate that both sites have submerged at a uniform rate of 0.08 cm/yr. Submergence exceeds sediment infilling at Mandal Pond whereas infilling exceeds submergence at Reef Bay. Consequently, the swamp size at Reef Bay and water depth decrease with time, depositional units change and watershed-derived alluvium encroaches on the swamp. Despite man's activity, no massive effect of sedimentation on the swamp is observed. Man's effects are relatively small in comparison to the long-term natural evolution of the system.

ACKNOWLEDGEMENTS

Ian Jones of St. Thomas, V.I. provided field assistance. Dr. Willard N. Harman of the State University College, Oneonta, N.Y. provided tentative identification of salt pond gastropods.

# TABLE OF CONTENTS


| | Page |
|---|---|
| Abstract | i |
| Acknowledgements | ii |
| Table of Contents | iii |
| List of Tables | iv |
| List of Figures | iv |
| Introduction | 1 |
| Site Description | 2 |
| Objectives | 5 |
| Rationale and Approach | 5 |
| Methods | 6 |
| Results | 8 |
| Interpretation | 18 |
| Management Strategies | 21 |
| Conclusions | 22 |
| Literature Cited | 23 |
| Appendix I | 25 |

## LIST OF TABLES


| | | Page |
|---|---|---|
| Table 1. | Age and depth of samples dated by radiocarbon analyses. | 11 |
| Table 2. | Sedimentation rates for cores from Mandal Pond and Reef Bay mangrove swamp based on radiocarbon age determinations. Average is integrated average from zero age to oldest age. | 13 |
| Table 3. | Pollen data from Core 1, Mandal Pond, in terms of abundance, average and adjusted sedimentation rate. Average sedimentation rates based on $^{14}C$ dates at 35 cm (560$\pm$120yr/BP) and 52 cm (880$\pm$120yr/BP). | 16 |
| Table 4. | Pollen data from Core 5, Reef Bay, in terms of abundance, average and adjusted sedimentation rate. | 17 |


## LIST OF FIGURES


| | | Page |
|---|---|---|
| Figure 1. | Location of study sites and configuration of Reef Bay mangrove swamp and Mandal Pond. Dots are probe sites and sediment thickness in meters. Triangles are core locations. | 3 |
| Figure 2. | Stratigraphic section through Reef Bay deposits showing major depositional units, relationships, and radiocarbon age. | 9 |
| Figure 3. | Radiocarbon age and depth below approximate mean low water of samples from Reef Bay, dots; and Mandal Pond, triangles. | 10 |
| Figure 4. | Changes of core lithology, estimated chronology based on $^{14}C$ dates, composition of coarse fractions, pollen abundance and number of pollen types as well as sedimentation rates based on relative pollen concentration, dots, and radiocarbon dates, dashed. Core 1 from Mandal Pond, May, 1986. | 15 |

## INTRODUCTION

Coastal ecosystems on Caribbean oceanic islands are subject to stress of sedimentation produced by watershed erosion. Part of the sediment is a natural input whereas another part can be caused by man's varied use of the land dating back 270 years to deforestation and sugar agriculture. As tropical forests were destroyed, soil erosion likely set in, soil composition changed, stream loads increased and sedimentation in coastal sinks likely accelerated. The present status of the coastal ecosystems therefore, can be partly a product of past mismanagement as well as present-day use. The effects of man are superimposed on the natural processes. The central problem poses three key questions for management: (1) What is the status of present-day sedimentation rates in relation to natural or "baseline" rates prior to man's intervention? (2) Are the present rates increasing or decreasing in comparison to the recent past? (3) If recent trends continue, what future sedimentation rates are predicted?

Much research has been done on erosion rates and sediment yield induced by deforestation, farming and mining, for example Gilbert (1917), Douglas (1967) and Meade and Trimble (1974). Very little has been done however, to measure changes in the rate that sediment goes into storage in coastal sinks. Most erosion or yield rates are determined from measurements of stream sediment loads at time scales of years or a decade, for example, Lugo et al. (1980). A few data come from weirs or reservoirs, before and after a change of land-use (Wolman, 1967; McCall et al. 1984). Much less is known about rates of erosion and sedimentation at time scales of decades and centuries, a scale at which much human activity prevails. The gap in knowledge is widened by the fact that most erosion and sedimentation rates are determined for continental areas whereas few data are available for oceanic islands. This gap is amplified by recent findings of Milliman and Meade (1983). On a worldwide basis, oceanic islands, for example in the western Pacific, have higher rates of sediment yield than elsewhere, 1,000 tons/km$^2$/yr, a rate 2.5 times greater than the Asia mainland. This is attributed to steep slopes, heavy rainfall and intense human activity.

Although the island of St. John has an undeveloped appearance today, its past contained a cultural landscape. Like other islands in the region there are mountainside terraces, plantation ruins, an old road network, impoverished soils and secondary or introduced vegetation (Lugo et al. 1983). Watersheds are dissected into narrow guts and steep stream banks. It remains to determine where the eroded sediment goes. Does it go into storage in stream valleys and coastal sinks? As the coastal systems evolve by sediment infilling and streams dominate, flowing into the sea, are coral reefs threatened by sedimentation?

## SITE DESCRIPTION

The study sites are located in coastal environments that are likely sinks for sediment supplied from their watersheds, a mangrove swamp and a salt pond. The sites lie on the south coast of St. John (Figure 1) where annual average rainfall on the watersheds ranges 114 to 140 cm (Bowden, 1970). The watershed of Reef Bay mangrove swamp covers 5.63 $km^2$ and the average slope is 19%. The main valley is filled with alluvium and vegetated in lowlands with dry evergreen thicket and in uplands with gallery and basin moist forest. Higher slopes are covered by dry evergreen woodland (Woodbury and Weaver, 1984). The watershed of Mandal Pond covers 1.33 $km^2$ and has an average slope of 40% (Hubbard et al. 1985). Dry evergreen woodland is the dominant vegetation. Choice of the Reef Bay site provides an example of watershed having a history of substantial human activity. Changes of land use are marked and these are well documented by Tyson (1984;1985). In contrast, the Mandal Pond watershed and vicinity is relatively free of historical human activity (Tyson, 1986). Therefore, natural conditions likely prevailed while settlement proceeded elsewhere on St. John.

The environment of deposition in the Reef Bay mangrove swamp and vicinity consists of four zones that vary with distance seaward from the river valley and with decreasing elevation: (1) An alluvial lowland of dry evergreen thicket. (2) A zone of Laguncularia racemosa (white mangrove) 75 to 100 m wide and a canopy height of 7 to 9 m with numerous dead and dying trees. (3) Farther seaward, a zone 60 to 80 m wide and 30 to 50 cm below zone two, is Avicennia germinans (black mangrove) with heights less than three meters. The "scrubbiness" of this zone and the open areas of dead trees indicate this zone lacks vitality. Scrubbiness is characteristic of mangroves subject to high soil salinity (Cintron et al. 1978). (4) Behind the barrier along the seaward swamp edge is a fringe of Rhizophora mangle (red mangrove) in a band 5 to 8 m wide at elevations of 20 to 40 cm below zone two. The trees are mainly less than 2 m high.

Water in the mangrove swamp is stagnant and circulation is restricted by the numerous dead trees. During rainy periods the swamp receives intermittent inflow mainly from a stream along the northwest side and secondarily from an intermittent stream that enters on the east side. Swamp water discharges across the barrier through a channel 110 m long and 8 to 20 m wide (Figure 1). During normal conditions the entrance is blocked by littoral sand and therefore, fine fluvial sediment is likely retained in the swamp. Because the channel is straight for a considerable distance and its sand bed attains depths of 1.5 to 2.0 m below sea level, it is likely a man-made cut. Examination of aerial photography dated 1947, reveals that the swamp once contained a small pond in eastern reaches. Additionally, a U.S. Coast and Geodetic Survey Chart dated 1919, reveals the swamp contained a small lagoon connected to Reef Bay, in western reaches. The swamp and enclosed pond or lagoon reportedly were

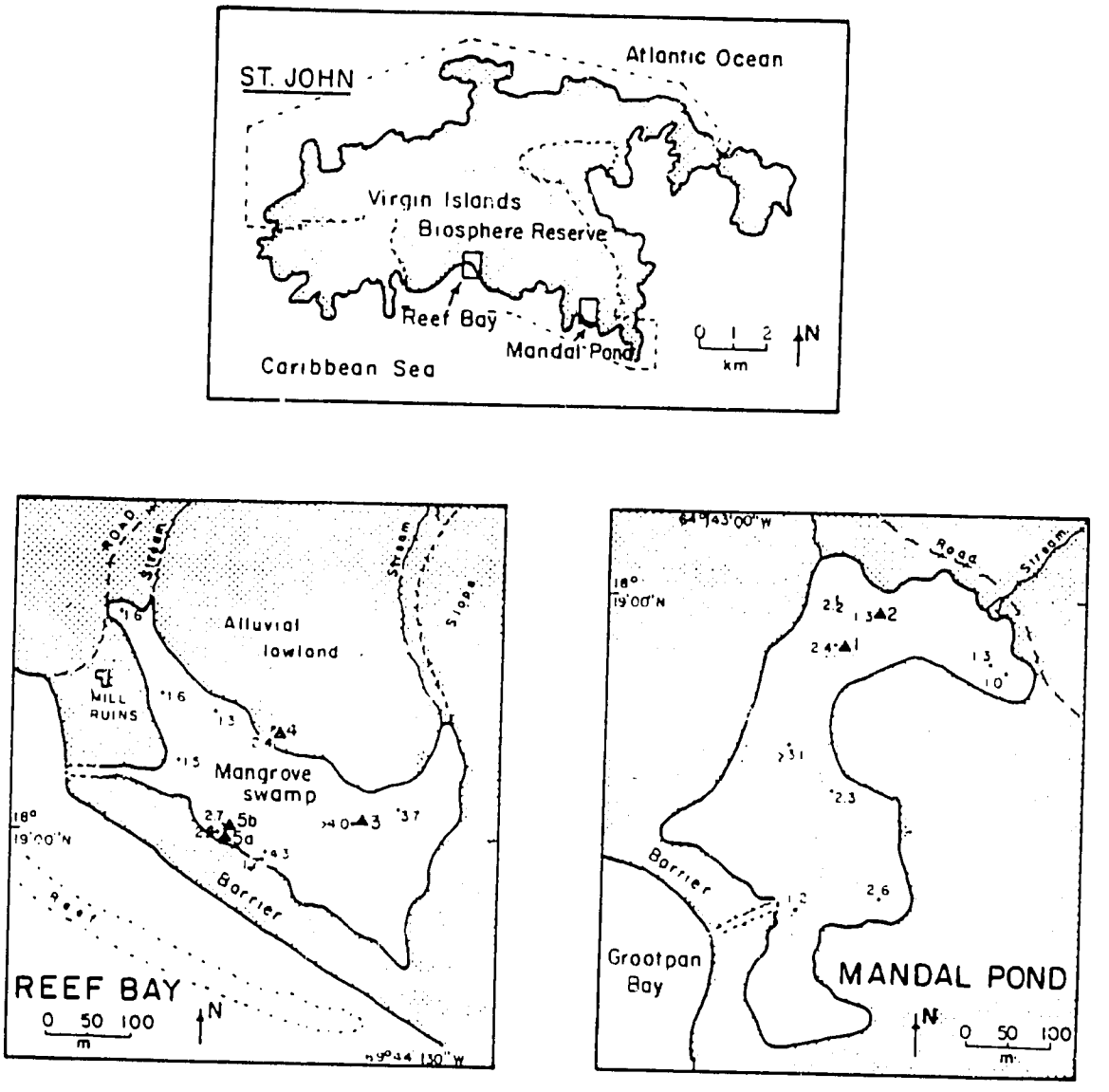



Figure 1. Location of study sites and configuration of Reef Bay mangrove swamp and Mandal Pond. Dots are probe sites and sediment thickness in meters. Triangles are core locations.

used as places to dump sugar factory wastes. Edges of the swamp are inhabited by numerous land crabs, Cardisoma guanhumi. By burrowing into the near-surface sediments 30 to 35 cm, the crabs mix the upper 30 to 70 cm of sediment and thus can destroy sediment stratification and the recent geologic record.

Mandal Pond occupies a drowned stream valley of Cob Gut. This is evidenced by alluvium that underpins the filling of pond deposits. Additionally, reentrant "arms" of the pond lead into small tributary streams. The drowned appearance of the shoreline is interrupted by a very small delta protruding pondward at the entrance to Cob Gut. On its seaward side the pond is enclosed by a sand and cobble barrier about 1.8 to 2.5 m high. The barrier is dissected in its central part by a channel 84 m long, 7 m wide and 0.3 to 1.2 m deep. This channel is likely an artificial cut and its course is displayed in a 1947 aerial photograph as well as on a 1919 U.S. Coast and Geodetic Survey Chart. Although the channel is choked with mangroves it likely allows discharge of overflow flood water into Grootpan Bay. In contrast, seawater likely enters the pond from the ocean through the channel during infrequent periods of high waves and storm surge. During normal conditions the pond is essentially a closed system and provides a good trap for sedimentary materials.

Water depths in the pond after rainy periods range 0.6 to 1.3 m. In aerial photographs dated 1965 however, the pond floor displays a white tone. This is indicative of salt efflorescence and hence, subaerial exposure during drought periods. When the pond is full, local wind waves can stir up fine "soupy" bottom sediment and render the water turbid. Therefore, near-surface sediment is subject to physical mixing. Bioturbation of the sediment however, is limited by the scarcity of macrofauna. The pond fauna consists of numerous microfauna less than 2 mm size, mainly gastropods, of the species Assiminea succinea or Littoridine sphinctostoma. Since the shores are steeply sloping, mangroves are limited to a narrow irregular fringe along the pond edge.

Both sites are subject to infrequent disturbances as droughts and hurricanes. Droughts can last 2 to more than 20 years or 66% of the time according to the Palmer Drought Severity Index (Bowden, 1970). Drought weakens the protective vegetal soil cover and provides favorable conditions for fires. Droughts are often terminated by rainstorms or hurricane floods which are conducive to rapid soil erosion and sediment discharge. Landfall hurricanes on St. John have an estimated recurrence interval of five per century (Mills et al. 1964). Most sediment in fluvial systems is transported during short periods of infrequent storms. Consequently, flood deposits are likely to have sharp lithologic changes.

## OBJECTIVES

This study aims to determine if the sediment deposits of the mangrove swamp and salt pond contain an interpretable record of long-term changes in response to natural processes and human disturbance in the watershed. This broad objective resolves into four sub-objectives: (1) to determine if the record of sediment accumulation is ordered in time, forms horizons and is sufficiently complete for stratigraphic and geochronologic analyses; (2) to determine what constituents are preserved in the deposits that bear a relation to watershed source; (3) to date horizons that exhibit a significant vertical change in composition or lithology and to determine the rate of sedimentation between dated horizons; (4) to document the sedimentation impacts on the salt pond and mangrove systems.

## RATIONALE AND APPROACH

An initial premise for study is that the mangrove swamp and salt pond systems are essentially closed systems and sinks for sediment supplied from their watersheds. This is likely because they are near, or slightly below, the fluvial base level and they lie behind barriers protected from wave action. Additionally, submergence by the relative rise of sea level in the past several thousand years enables sediment to accumulate and be preserved. Data on submergence is provided in a subsequent section. Therefore, depositional processes in the sinks should produce an accumulation of sediment that is ordered in time. Further, the deposits should naturally archive the time history of sediment input that varies with climate, streamflow, vegetal cover, and watershed land use. Changes in accumulation rate of watershed-derived sediment in the sink are likely proportional to changes in the watershed sediment input. The resulting changes in the deposits therefore, can be keyed to prospective causes in the watershed. In some instances these are known from historical information or can be determined from pollen analyses. Instead of comparing volume or mass of sediment in the sink with that of source in a mass balance context, this study deals with changes in rates of sedimentation. Therefore, it is an inverse solution to detecting historical changes in the watershed. The approach focuses on long-term changes recorded in cores at time-scales of centuries to a few millennia. It provides a means to explore whether present rates are unique or continuous with the past, unidirectional or cyclic. The approach is a potential research strategy that can strengthen watershed management and development of a Biosphere Reserve on St. John.

Success of the approach depends on several initial assumptions. It assumes direct delivery of sediment from the source to the sink without extensive storage or secondary erosion from stream valleys. Further, it assumes that watershed-derived sediment in the sink can be differentiated from sediment produced in the sink. It assumes that sedimentary

components are preserved in the deposits and that they are free of post-depositional redistribution and extensive mixing. The validity, or fallacy, of these assumptions is indicated by results of this study.

Pollen grains from terrestrial plants are particularly useful for stratigraphic and geochronologic studies. They enter coastal sinks from the atmosphere and are transported like fine sediment, eventually deposited, buried and preserved in sediment deposits. Once diagnostic pollen assemblages or species ratios are determined, the vertical change of pollen composition in the deposits can be linked to changes in the history of a watershed vegetation, which is associated with changes of land use. If the time of the land use change is known from historical information, then pollen horizons provide a means to date the deposits. Once dates are assigned to pollen horizons, or acquired by radiometric dating, then sedimentation rates can be determined between dated horizons. The relative concentration of pollen per unit volume between dated horizons indicates the relative rate of sedimentation, assuming constant input of major marker pollen. Because the range of radiometric isotope analyses is limited, pollen analyses is the chief means of dating deposits in the time span of about 80 to 400 years before the present (B.P.).

The geochronologic and stratigraphic approach employing pollen analyses has been successful for detecting effects of land use on small lakes, for example, Davis (1976) and Haworth et al. (1984), and in estuaries, Brush (1984); Brush and Davis (1984). Application to other coastal systems and to subtropical environments remains to be explored.

## METHODS

### Field Methods

The thickness of soft or loose sediment above a firm base or layer in the deposits was determined by manual probing with a 4.3 m length steel rod. Depths of refusal to penetration and thickness of interlayers along transects or at points were noted and recorded.

Borings were made at selected stations with a Davis peat sampler. This is essentially a small piston corer that takes 30 cm long sections in a 3.8 cm diameter core barrel. By adding extensions, relatively undisturbed replicate cores (2 to 4) were obtained to 2.6 m depth.

Short cores were obtained by driving a 7.6 cm diameter PVC pipe into the sediment to depths of 53 cm. Replicate cores were cut lengthwise, photographed, X-rayed for structure and subsampled at 1 to 3.8 cm intervals for analyses of water content, grain size and coarse fraction. Other subsamples were frozen for geochemical and radiometric analyses.

Stations were positioned by pacing, ranging and compass bearings using topographic maps and aerial photographs for base reference.

## Laboratory Methods

In the laboratory, water content was determined gravimetrically by weight loss on drying following procedures of Dawson (1959).

Davis cores were examined under a binocular microscope noting the gross lithology, color, relative firmness, minor structures and composition including organic and carbonate content. Subsamples were washed over a 63μ size sieve to separate sand and mud. The fine fraction was further analyzed for silt and clay content by pipette following Folk (1961). The coarse fraction was analyzed for composition of components by a frequency count of at least 200 grains under a binocular microscope.

The chronology of the lower core section was determined by assaying horizons for radiocarbon activity. The radiocarbon ages reported here were made by Geochron Labs and Beta Analytic using the $CO_2$ method. The material reportedly was pretreated by first removing rootlets and concentrated by dispersion in a large volume of water whereby the clays and organic matter were eluted away from any sand and silt by decantation. The clayey organic fraction was then dispersed in dilute HCl to remove carbonates, filtered, washed, rinsed to neutrality, dried and roasted in oxygen to recover carbon dioxide from the organic matter. All counting was normal and sample size was adequate. In collecting samples for radiocarbon analysis, efforts were made to avoid contamination following handling procedures of Polach and Golson (1966). To minimize errors due to compaction, samples were initially obtained near the top of an alluvium base. Subsequent samples were obtained to avoid sediment disturbance, physical mixing and root contamination. All ages are calculated using a half-life value for C-14 of 55% and stated in years before the present, 1950 A.D. (B.P.).

The $^{137}Cs$ activity of near-surface sediment was determined by gamma ray counting using a lithium-drifted germunium detector and multichannel analyzer. The $^{137}Cs$ radio-isotope is a product of nuclear weapon testing and fallout activity. The sediment chronology is derived from activity peaks in vertical profiles assuming the first appearance of $^{137}Cs$ coincides with 1950 and peak activity represents 1963, the year of peak nuclear testing.

Pollen was extracted at the Johns Hopkins University following basic procedures of Fraegri and Iversen (1969). In brief, this involves first weighing a 1.5 ml subsample wet and dry and then treating it with dilute hydrochloric and hydrofluoric acid. The samples were then acetylyzed using a mixture of sulfuric acid and acetic anhydride. Following extraction the entire residue of the sediment used was stored in 25 ml of tertiary butyl alcohol. Aliquots of the stored residue (0.1 ml) were

mounted in silicone oil on microscope slides. The slides were examined for pollen at 400 x magnification with counts of 150 or more. Values for total pollen are expressed as concentration, number per gram dry sediment and individual types as percentage of total pollen. Average rates of sedimentation in cm/yr were obtained by dividing the length of the core between the dated horizons by the number of years between the horizons. Mass rates of sediment accumulation, $g/cm^2/yr$, were calculated by dividing cumulative dry weight of sediment between the dated horizons by the number of years. Additionally, pollen concentrations in the sediments were used to calculate sedimentation rates for individual increments of the core. The average sedimentation rate was adjusted according to the concentration of the pollen in the sediment, by assuming that the average pollen concentration in the cores is proportional to the long-term average sedimentation rate. Therefore, changes in sedimentation rate for a single increment, x, can be estimated by dividing the average pollen concentration, $\bar{P}$, by the pollen concentration in a single increment, Pi, and multiplying by the average sedimentation rate (obtained from radiocarbon dates), $\bar{M}s$, as follows:

$$X = \frac{\bar{P}}{Pi} \cdot \bar{M}s$$

## RESULTS

### Thickness

The thickness of soft deposits lying above a firm base, which is usually alluvium, is illustrated in Figure 1. Thickness in central reaches of Reef Bay swamp is greater than 4.0 m and landward of the barrier it attains 4.3 m. Thickness decreases landward toward the west stream entrance. Near station 5 interlayers of shell and sandy gravel are encountered between 1.6 and 2.7 m depth. In Mandal Pond the fill of soft sediment ranges from more than 3.1 m thick in central reaches to 1.0 m and 1.2 m in landward and seaward zones. Cores from station 1 and 2 reveal that the firm base is alluvium.

### Depositional Units

By examining the gross lithology of cores that penetrate the deposits beneath the Reef Bay mangrove swamp, four units are recognized:

1. Alluvium, the deepest and most landward unit consists of poorly sorted gravelly clay or mixtures of sand and clay with angular rock and quartz fragments. A few fragments are iron-stained or weathered. The sediment is non-calcareous and structureless except for root structures that depart a mottled appearance of dark grey in a matrix of light grey.

2. Lagoonal, the central unit in lower core sections consists of dark grey silty clay with abundant organic debris. Shell layers are pronounced and fossil fauna is abundant. The shells consist of oyster, clam, mussels and lagoonal foraminifera including species of Streblus and Nonionella.

3. Mangrove peat, an intermediate unit at mid-depth, is the most widespread unit. It is dark brown or reddish brown and spongy in consistency. Fauna is scarce except for a few arenaceous foraminifera. Organic debris, roots and leaves dominate. Since living red mangroves normally inhabit the lower intertidal zone, this peat is a good reference of former sea level positions.

4. Swamp clay, the topmost unit is inhabited by white mangrove. It consists of dark grey silty clay with one to five percent organic debris. A few arenaceous foraminifera are present. The clay is very firm and structureless except for light grey color mottles. This sediment is likely deposited in ponded water following periods of high stream inflow.

Stratigraphic Relations

When the buried depositional units are compared from core to core in a section with distance seaward from the alluvial lowland, vertical and lateral relationships are displayed as shown in Figure 2. The most significant features are: (1) Along the seaward edge of the alluvial lowland, core 4, alluvium overlies mangrove peat in a seaward prograding relationship. (2) Buried mangrove peat in core 4 between 1 and 2 m depth overlies alluvium in a transgressive relationship, a trend indicating that peat extended farther landward in the past. (3) In central reaches, core 3, lagoonal deposits are replaced upward by mangrove peat and then by mangrove swamp clay. This change denotes shoaling conditions.

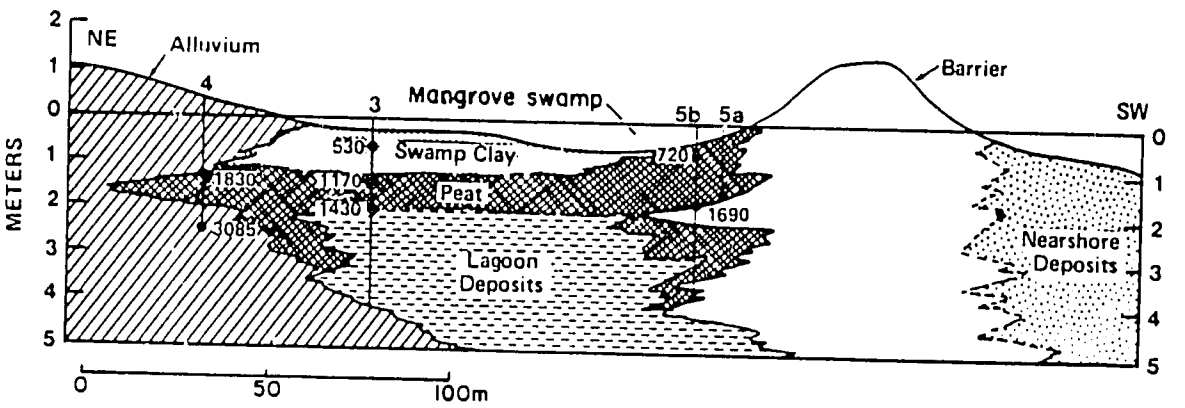



Figure 2. Stratigraphic section through Reef Bay deposits showing major depositional units, relationships, and radiocarbon age.

(4) Along the landward edge of the barrier, cores 5a, 5b, mangrove peat overlaps barrier sediment near the surface whereas barrier sediment underlies peat at depth. The overall relation is a slight onlap of lagoonal deposits over barrier sediment. At intermediate depths tongues of barrier sediment locally protrude into lagoon deposits in a relation indicative of storm washovers.

## Submergence

Changes in the elevation of sea level relative to the land over hundreds to several thousand years may be inferred from radiocarbon dates of the peat. This assumes that formation of the peat has occurred in the intertidal zone and that mean range of the tide has been the same during the time span under consideration. Prior study of the Mangrove Lagoon, St. Thomas, by Nichols et al. (1977), shows that the elevation of red mangrove is close to (±8cm) mean low water referred to local tidal datum, a site where the mean range is 27 cm. Although part of the mangrove peat may have developed in ponds isolated from the tide, which are subject to seasonal changes of pond level produced by precipitation and drought, over the long term the peat level is likely linked to sea level rise. The data obtained from radiocarbon age determinations of peat and organic debris contained in near-basal strata, which is relatively free of compaction effects, is illustrated in Figure 3. Depths are corrected to approximate mean low water level. Table 1 lists the age and depth of samples analyzed. The data are relatively consistent in indicating a continuous rise of sea level since 3,300 years B.P. at a rate of 0.08 cm/yr.

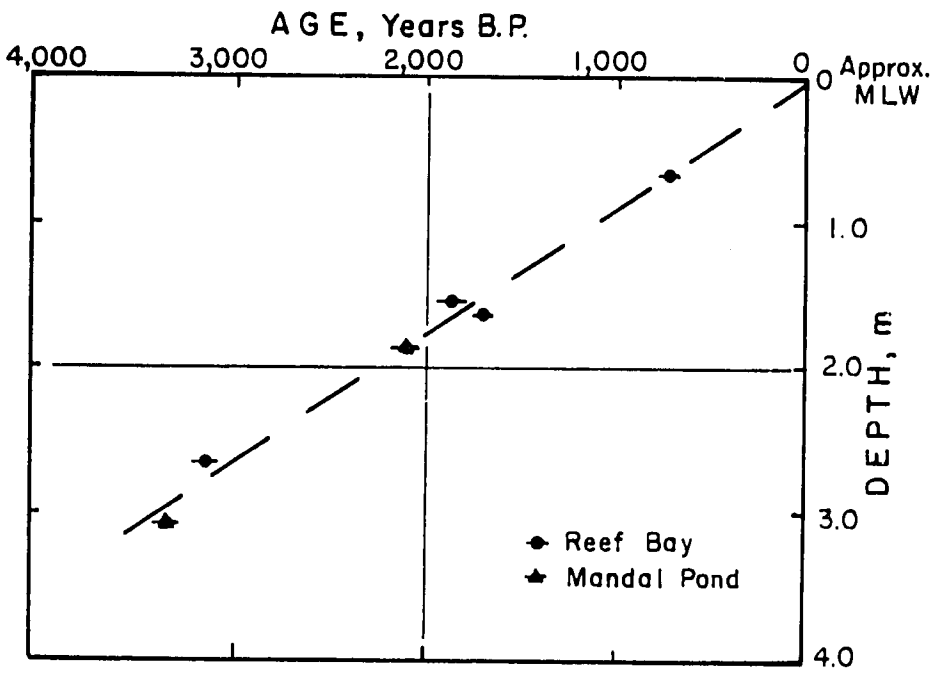



Figure 3. Radiocarbon age and depth below approximate mean low water of samples from Reef Bay, dots; and Mandal Pond, triangles.

Table 1. Age and Depth of Samples Dated by Radiocarbon Analyses

| Sample Field | Lab Number | Midpoint Depth Below Sediment Surface, m | Midpoint Depth Below Approximate Low Water, m | Character of Material | Age Years B.P. |
|---|---|---|---|---|---|
| 1b | Beta-19521 | 0.35 | 0.99 | Organic fragments in silty clay | 560 ± 90 |
| 1b | Beta-18849 | 0.53 | 1.17 | Organic debris in silty clay | 880 ± 120 |
| 1 | Geochron-GX12606 | 2.39 | 3.03 | Organic peat debris in clay | 3,300 ± 165 |
| 2 | Beta-18848 | 1.24 | 1.88 | Organic fragments in sandy clay | 2,090 ± 110 |
| 3b | Beta-19522 | 0.36 | 0.66 | Peaty clay | 530 ± 60 |
| 3 | Beta-18847 | 1.09 | 1.39 | Peat | 1,170 ± 100 |
| 3 | Geochron-GX12607 | 1.73 | 2.03 | Peaty clay | 1,430 ± 80 |
| 4 | Geochron-GX12608 | 1.74 | 1.54 | Peat | 1,830 ± 140 |
| 4 | Geochron-GX12609 | 2.82 | 2.62 | Organic fragments in clayey gravel | 3,085 ± 135 |
| 5b | Beta-19524 | 0.50 | 0.72 | Peat | 720 ± 60 |
| 5a | Beta-19523 | 1.45 | 1.67 | Peat | 1,690 ± 90 |

## Sedimentation Rates

Radiocarbon dates also provide valuable information on the rate of sedimentation assuming sediment accretion is vertical. Because the sediment is dominately fine-grained and subject to compaction with time as accretion proceeds, the sediment volume deposited between dated horizons is converted into weight per unit area. This avoids the uncertainties of compaction inherent in the use of thickness (cm/yr) as an expression of rate of sedimentation. The conversion starts with the average water content on a dry weight basis between the dated core horizons. Then the porosity is determined and in turn the percentage volume of solid grains assuming a grain density of 2.65 $g/cm^3$ for sand, silt and clay, and 1.3 $g/cm^3$ for peat. Subsequently, the product of the percentage volume of solid grains and the grain density times the sedimentation rate in cm/yr, yields the sedimentation rate in $g/cm^2/yr$.

The sedimentation rate derived for Mandal Pond averages 0.042 $g/cm^2/yr$ whereas for central reaches of Reef Bay swamp (cores 3 and 4) it averages 0.082 $g/cm^2/yr$, two times greater (Table 2). Relatively young material from the upper part of Mandal Pond core 1 has about the same sedimentation rate as older material from the lower part of the core. However, in relatively young material from cores 3 and 4 in Reef Bay swamp, the rates are faster than for older material in lower parts of the cores, a fivefold increase in core 4. The young material in core 4 however, does not allow determination of an age younger than 1830 years B.P. because it is mixed by land crabs and lacks organic matter. Radioactivity of $^{137}Cs$ for surface material is relatively low, 0.1817 pci/g, indicating an age older than 35 years.

## Sediment Characteristics

The results of textural and compositional analyses for core 1, Mandal Pond, are shown in Figure 4. Sand, silt and clay percentages vary within narrow limits, mainly 8%, 23% and 69% respectively. Water content diminishes from a peak of 92% in "soupy" surface sediments to 41% in relatively firm sediment at 65 cm. Organic content is relatively low, less than 2% dry weight, except of thin layers and laminae at 0-2, 40-41, 51-57 and 111-121 cm depth that are enriched 5% or more. Most of the enriched layers are in the form of algal deposits whereas elsewhere detrital fragments of leaves, twigs and seeds are common. Algal laminae are prominent and interlayered with carbonate sand layers in bands 1 mm to 2 cm thick between 200 and 260 cm depth.

The coarse fractions, i.e. sand fractions more than 62μ, consist of calcium carbonate particles, quartz and feldspar, organic detritus and shells or tests of microfossils including ostracods, foraminifera, diatoms and gastropods. Although the coarse fractions generally make up less than 10% of the total sample by weight, they are a useful indicator of changes in pond conditions or sediment input. Carbonate particles make up higher percentages of the coarse fractions in the upper 60 cm and lower 90 to 260 cm of core 1. The distribution of carbonate percentage displays a peak at the 35 cm depth, an estimated date of 1600 A.D.

Table 2. Sedimentation rates for cores from Mandal Pond and Reef Bay mangrove swamp based on radiocarbon age determinations. Average is integrated average from zero age to oldest age.

| Core Number | Depth Interval, cm | Age Span, yrs | Sedimentation Rate, cm/yr | Sedimentation Rate, $g/cm^2/yr$ |
|---|---|---|---|---|
| 1b MP | 0 - 35 | 560 | 0.063 | 0.032 |
| 1b MP | 35 - 53 | 320 | 0.056 | 0.027 |
| 1 MP | 53 - 239 | 2,420 | 0.077 | 0.037 |
| 1 Average | 0 - 239 | 3,300 | 0.072 | 0.042 |
| 2 MP | 0 - 124 | 2,090 | 0.059 | 0.030 |
| 3b RB | 0 - 36 | 530 | 0.068 | 0.056 |
| 3 RB | 36 - 109 | 640 | 0.114 | 0.069 |
| 3 RB | 109 - 173 | 260 | 0.246 | 0.048 |
| 3 Average | 0 - 173 | 1,430 | 0.119 | 0.064 |
| 4 RB | 0 - 174 | 1,830 | 0.092 | 0.173 |
| 4 RB | 174 - 282 | 1,255 | 0.088 | 0.032 |
| 4 Average | 0 - 282 | 3,085 | 0.091 | 0.101 |
| 5b RB | 0 - 50 | 720 | 0.069 | 0.016 |
| 5a RB | 50 - 145 | 970 | 0.098 | 0.014 |
| 5a Average | 0 - 145 | 1,690 | 0.086 | 0.011 |

MP is Mandal Pond; RB is Reef Bay mangrove swamp.

(Figure 4) whereas in more recent time percentages are less. The carbonate is likely produced by precipitation in the pond or in near-surface sediment during periods of drought and high evaporation.

Microfossils are dominated by ostracods throughout core 1. Percentages are more than 20% in silty clay zones in lower parts of the core, for example at 148 cm, 185 cm and 215 cm. Foraminifera tests are abundant in lower parts of the core, 145-250 cm depth, but absent or scarce in upper parts above 145 cm. In contrast, gastropods, mainly species of Assiminea succinea or Littoridina sphinctostoma, make up about 0.5 to 1 percent of the coarse fraction in the upper 90 cm or last 1,400 years. At the 35 to 42 cm depth they form a distinct horizon with percentages of 1 to 6%.

Coarse fraction composition in cores from Reef Bay is characterized by large percentages of organic debris and less than one percent carbonate. Quartz, feldspar and rock particles make up 2 to 11 percent of the particles. The upper one meter of sediment is devoid of microfossils except for a few arenaceous foraminifera. Below one meter, in a zone including the lower lagoon deposits, shell, ostracods and calcareous foraminifera are present in addition to traces of coral debris.

Pollen grains in core 1, Mandal Pond, are preserved in the sediment and they are relatively abundant and diverse. Fifty-one different types are tentatively differentiated and classified according to morphological characteristics. Pollen descriptions by assigned artificial names are given in Appendix I. A minimal number of only four types irregularly increases upward in the core from 16.5 cm reaching 15 in surface sediment. Between 24 cm and 50 cm depth, or 1600 to 1150 A.D., five to twelve types occur. The trends in the upper 50 cm of core 5 from Reef Bay, are similar to these in core 2 from Mandal Pond.

The abundance of pollen grains in core 1 ranges 5,200 to 29,000 grains per gram of sediment per square centimeter (Figure 4). The concentrations are minimal at the 16.5 to 17.0 cm depth, an estimated time 1720 A.D. The abundance irregularly increases upward in the core reaching a peak at 3 to 3.5 cm depth or about 1930 A.D. (Table 3). Pollen abundance in core 5, from Reef Bay, is similar to core 1 except the upward increasing concentrations begin at the 50-51 cm depth (Table 4).

An extremely abundant, small (12 to 16 microns) smooth spheroidal pollen grain with no apertures occurs in sections of the core from Mandal Pond, but was virtually absent from Reef Bay. This taxon may belong to members of Cupressaceae which includes the genus Juniperus. An abundance of this component is found in core 1 between the 15.5 and 40.5 cm depth. The most abundant pollen type with the widest stratigraphic range is a tricolporate pollen grain in the J-group, which may include the genus Rhizophora (red mangrove). Pollen type D-4

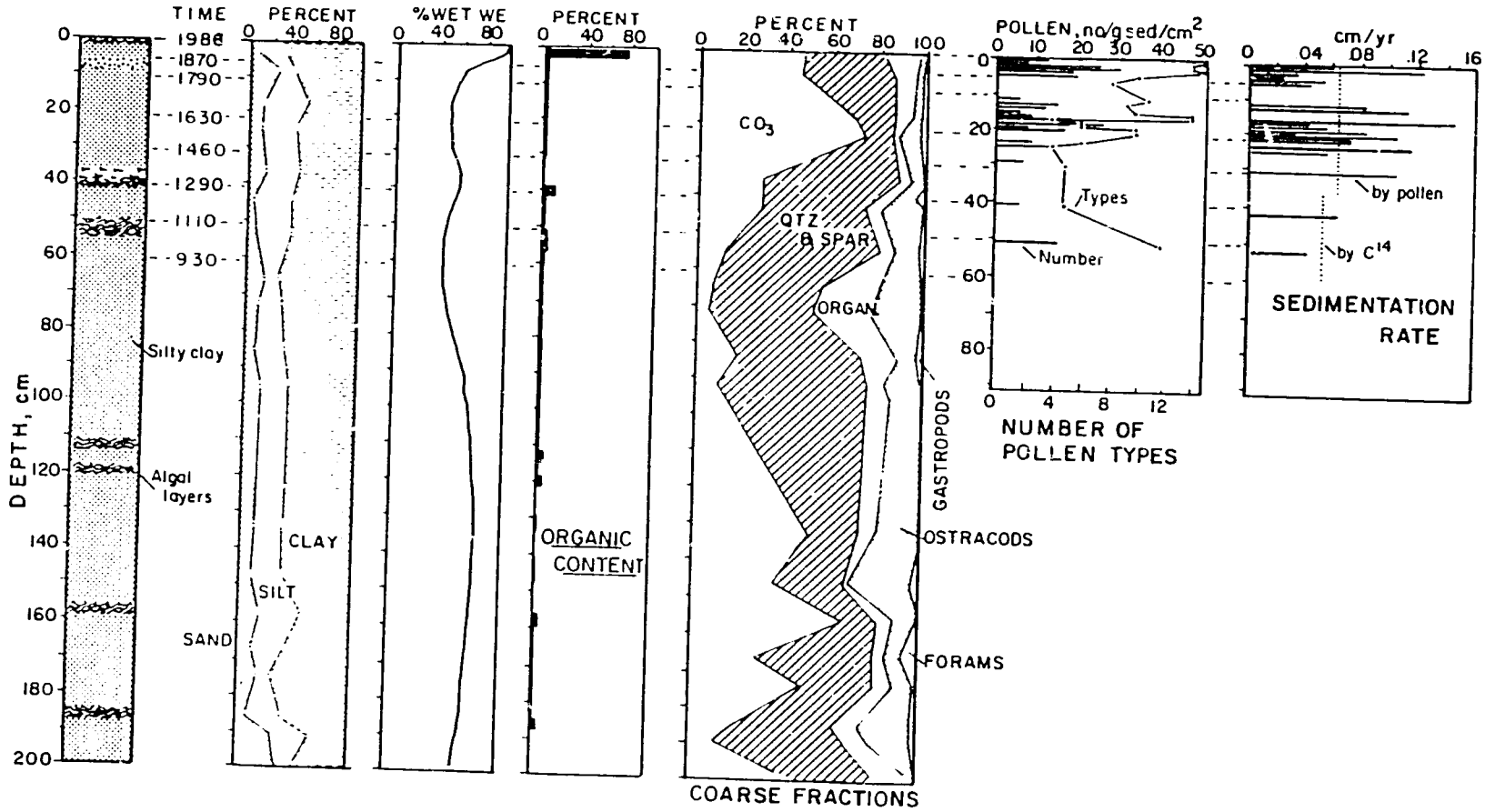



Figure 4. Changes of core lithology, estimated chronology based on $^{14}C$ dates, composition of coarse fractions, pollen abundance and number of pollen types as well as sedimentation rates based on relative pollen concentration, dots, and radiocarbon dates, dashed. Core 1 from Mandal Pond, May, 1986.

Table 3. Pollen data from Core 1, Mandal Pond, in terms of abundance, average and adjusted sedimentation rate. Average sedimentation rates based on $^{14}C$ dates at 35 cm (560±90yrBP) and 52 cm (880±120yrBP).

| Depth cm | Dry (bulk) density g sed/cc | Pollen accumulation no/sq cm$^2$ | Pollen accumulation no/g sed/sq cm$^2$ | Average sedimentation rate cm/yr | Adjusted sedimentation rate cm/yr |
|---|---|---|---|---|---|
| Top | 0.502 | 6167 | 12285 | 0.06 | 0.06 |
| 1.5-2.5 | 0.438 | 3167 | 7230 | 0.06 | 0.12 |
| 2.5-3.0 | 0.457 | 11667 | 25529 | 0.06 | 0.03 |
| 3.0-3.5 | 0.511 | 15000 | 29354 | 0.06 | 0.02 |
| 3.5-4.0 | 0.452 | 8000 | 17699 | 0.06 | 0.05 |
| 4.0-4.5 | 0.473 | 9333 | 19732 | 0.06 | 0.04 |
| 11.0-11.5 | --- | 5000 | --- | 0.06 | 0.08 |
| 11.5-12.0 | 0.487 | 3333 | 6845 | 0.06 | 0.11 |
| 15.0-15.5 | 0.511 | 2667 | 5218 | 0.06 | 0.14 |
| 15.5-16.0 | 0.557 | 8667 | 15559 | 0.06 | 0.04 |
| 16.0-16.5 | 0.546 | 7000 | 12820 | 0.06 | 0.05 |
| 16.5-17.0 | 0.449 | 2333 | 5197 | 0.06 | 0.16 |
| 17.0-17.5 | 0.521 | 3333 | 6398 | 0.06 | 0.11 |
| 17.5-18.0 | 0.607 | 5000 | 8237 | 0.06 | 0.08 |
| 18.0-18.5 | 0.405 | 8000 | 19753 | 0.06 | 0.05 |
| 18.5-19.0 | 0.461 | 12333 | 26753 | 0.06 | 0.03 |
| 19.0-19.5 | 0.535 | 4000 | 7477 | 0.06 | 0.10 |
| 19.5-20.0 | 0.354 | 5667 | 16008 | 0.06 | 0.07 |
| 23.0-23.5 | 0.359 | 3333 | 9285 | 0.06 | 0.11 |
| 23.5-24.0 | 0.551 | 7000 | 12704 | 0.06 | 0.05 |
| 29.5-30.0 | 0.550 | 4000 | 7273 | 0.06 | 0.10 |
| 40.5-41.0 | 0.577 | 4000 | 6932 | 0.05 | 0.06 |
| 50.5-51.0 | 0.414 | 6000 | 14492 | 0.05 | 0.04 |

Table 4: Pollen data from Core 5, Reef Bay, in terms of abundance, average and adjusted sedimentation rate

| Depth cm | Dry (bulk) density g sed/cc | Pollen accumulation no/sq cm | Pollen accumulation no/g sed/sq cm | Average sedimentation rate cm/yr | Adjusted sedimentation rate cm/yr |
|---|---|---|---|---|---|
| 0-1 | 0.4731 | 6333 | 13387 | 0.07 | 0.05 |
| 1-2 | 0.4465 | 5833 | 13064 | 0.07 | 0.05 |
| 2-3 | 0.5135 | 5000 | 9737 | 0.07 | 0.06 |
| 3-4 | 0.3129 | 4750 | 15180 | 0.07 | 0.06 |
| 20-21 | 0.3625 | 3833 | 10575 | 0.07 | 0.08 |
| 40-41 | 0.3225 | 3000 | 9302 | 0.07 | 0.10 |
| 50-51 | 0.3192 | 2167 | 6788 | 0.07 | 0.14 |

which resembles the grass Sparganium (burreed) is common in sediments from Reef Bay, but is found only rarely in Mandal Pond sediments. H-4, which resembles pollen of Quercus (oak) is common in Mandal Bay, but not in Reef Bay, core 5.

Rates of sedimentation based on the concentration of pollen between radiocarbon dated horizons and the surface are shown in Figure 4, Tables 3 and 4. Whereas the average rates are 0.06, 0.05 and 0.07 cm/yr in Mandal Pond, core 1, the adjusted rates are highly variable ranging from 0.02 to 0.16 cm/yr in the upper part of the core, and from 0.03 to 0.24 cm/yr in the section of the core from 200 to 300 cm. In core 1, Mandal Pond, the most prominent feature is a peak, 0.16 cm/yr, at the 16.5-17.0 cm depth, or an estimated age of about 1720 A.D. Near-surface sedimentation rates are similar to those at depths of 11 to 15 cm as well as those at 16.5-17.5 cm, and 19-19.5, 29.5-30 cm.

The average rate is 0.07 cm/yr in core 5 from Reef Bay, with adjusted rates ranging from .05 to .14 cm/yr. Rates in Reef Bay decreased in recent years relative to Mandal Pond.

## INTERPRETATION

The results show that deposits accumulating in the coastal sinks meet most of the requirements for stratigraphic and geochronologic analyses. Many of the assumptions noted in the approach hold. That the record of sediment accumulation is ordered in time is revealed by the radiocarbon age versus depth plot whereby points follow a linear trend. This trend not only holds for near-basal material from core to core (Figure 3) but for material from mid-depths in individual cores except for peat deposits of core 3, 1.5 to 2.0 m depth. This peat is subject to compaction because of its high initial water content. Therefore, peat of a certain age lies below the depth at which it was originally produced. The cores do not exhibit discontinuous contacts between layers or depositional units indicating hiatuses. Instead, most contacts are gradational and surface sediments are continuous with deposits of the recent past.

Although the deposits lack distinct stratification and appear homogenous, except for banding in the lower part of core 1, analyses reveal that horizons are present. They are evident in some of the X-ray radiographs as subtle changes of tone which reflect changes of sediment density associated with variations of sediment compaction, texture and composition. Some horizons consist of an abundance of gastropods; others consist of organic layers, changes in the ratio of carbonate to quartz and feldspar grains and vertical changes in the abundance and composition of pollen types. Sediment mixing therefore, must proceed within narrow vertical intervals, except for the upper part of Reef Bay core 4 which is heavily bioturbated by land crabs.

Preservation of sedimentary components in the deposits is relatively good. Although pond-produced algal layers diminish just below the surface in core 1, peat is preserved in layers 1 to 2 m thick in cores from Reef Bay. Carbonate grains are preserved throughout cores 1 and 2 despite the anoxic and reduced state of the sediment indicated by the black and dark grey color. The vertical variations of percentage carbonate grains likely result from variations in dilution of carbonate by input of terrigenous clay and in supply of carbonate by precipitation from pond water or sediment pore water. Precipitation can be induced by excess evaporation during drought. Alternately, precipitation can be caused by contact of calcium-rich fresh water with saline pond water during fresh water inflow. Post-depositional carbonate dissolution is likely limited because ostracod valves occur throughout pond cores 1 and 2. Pollen grains are not only preserved in the deposits but bear a relation to watershed sources. Many types of pollen, other than mangrove types produced in or around the swamp and pond, occur in the deposits. Of note is the increase of diversity since about 1600 A.D., the variable number of types during the "sugar era", and the marked increase of diversity since about 1850 A.D. which is evidence of additional species introduction.

Clay is the chief sediment supplied from the watershed. Sand and gravel layers indicative of intense stream flooding caused by hurricanes are limited to the lower part of core 1, below 214 cm. Although the watershed source of the clay has not been confirmed by mineralogic analyses, supply from marine areas is unlikely since marine clay sources are unknown and the systems are largely isolated from the sea. Clay content increases upward in core 1 about 17 cm depth, or since 1690 A.D., a trend paralleling higher coarse fraction percentages of quartz and feldspar. Some of the feldspar grains are angular and weathered indicating a watershed source. In Reef Bay core 3, clay content is high, 68-78%, in near-surface sediment about 90 cm depth. Watershed influence in recent years is also evidenced by stratigraphic relationships in cores 3 and 4 whereby alluvium overlies peat and progrades seaward over swamp clay. These deposits however, include accumulation during both pre-settlement and post-settlement periods.

The long-term change in thickness of the deposits, core lithology, sediment composition, stratigraphic relations and in radiocarbon chronology are part of the natural evolution of the system. However, the rate and degree of evolution vary with location. Both Mandal Pond and Reef Bay mangrove swamp occupy valleys excavated by ancestral streams when sea level was lower prior to 3,000 years B.P. The streams likely flowed through valleys to a shoreline located farther seaward than at present. By 3,000 years B.P., the global sea level rise inundated the valleys forming a narrow estuary at Mandal and an embayment at Reef Bay. Longshore drift of material across entrances to these systems formed spits or barriers, thus partly isolating them from the sea. At Mandal a pond formed though it must have had intermittent exchange with the sea to allow introduction of marine microfauna. At Reef Bay a lagoon formed with an open connection to the sea allowing lagoon fauna and occasional introduction of reef debris.

Continued rise of sea level after 3,000 years B.P. flooded and enlarged both systems. At Mandal Pond the enlargement is maintained today since the rate of sea level rise proceeds faster than the rate of sediment infilling. If the pace of infilling and sea level rise continue, the pond may be expected to increase its present water depths and continue its natural condition. In contrast, enlargement of Reef Bay lagoon was arrested about 2,000 years B.P. by growth of mangroves and lateral infilling. The infilling consisted mainly of mangrove peat which likely segmented the lagoon into ponds and thus reduced tidal exchange and promoted barrier growth further isolating the system. By about 1000 years B.P. isolation from the sea was nearly complete and vertical sedimentation reached an elevation that converted the red mangrove habitat to a black and white mangrove habitat. Peat development was replaced by silt and clay from the watershed and alluvium prograded into the swamp further reducing the swamp size, drainage and capacity to absorb and store sediment. Owing to the erratic nature of flood discharges near base level, the depocenter or focus of sedimentation within the system has likely shifted with time and location. Low zones behind the barrier and eastern reaches must receive some accumulation while western reaches, which are very shallow, likely by-pass part of the clayey sediment load into Reef Bay during high freshwater discharge. In summary, the long-term pace of infilling in landward zones of Reef Bay swamp in the last 2,000 years has slightly exceeded the pace of sea level rise. Today the swamp is at the brink of extinction. It is no wonder that the swamp is stagnant and mangrove stands are dying or dead.

The influence of human activities on sedimentation rates in the upper part of cores from Reef Bay is slight compared to the long-term natural variations over 3,000 years. Although rates at Reef Bay are one and one-half to two times greater than at Mandal Pond, the ratio of pond sink area to watershed area is much smaller (0.01) compared to Mandal Pond (0.07). Therefore, the relative storage capacity of Reef Bay swamp is less per unit area of watershed than Mandal Pond. The most marked increase in sedimentation rates is noted in the upper part of core 4 but short-term changes cannot be separated from the long-term trends at present. Core 5 reveals little change in sedimentation rate over the last 350 years. It is evident however, that release of upland sediment during the sugar era did not eliminate the mangrove swamp though it may have accelerated sedimentation in some sectors.

A speculation is that sediment released by sugar agriculture may have been partly stabilized in terraces near its source. Another part may be stored in the stream valley behind plantation impoundments, boundary line walls or in alluvial bars. That is, the main "wave" of sugar era sediment may be stored in the valley for decades or a century, until the next large hurricane capable of eroding it again and transporting it into the coastal sink. This threat is especially critical because the mangrove swamp is nearly filled with sediment and offers little buffering capacity against massive flood inputs. Thus, despite man's concern the system appears doomed as a long-continued natural mangrove swamp. With its demise will come a further contraction in the remaining coastal resources of the Biosphere Reserve. Only a major effort can hope to arrest the decline and, in turn, conserve nearshore coral reefs.

## MANAGEMENT STRATEGIES

Since one of the aims of developing a Biosphere Reserve on St. John is to provide a scientific basis for managing the Reserve, several strategies are offered to illustrate prospective application of results. It is assumed that maintaining the integrity of St. John's nearshore coral reefs is of priority importance.

1. Manage from an evolutionary baseline. Despite man's historical use of the watershed at Reef Bay (Tyson, 1986) and possible "mismanagement", the findings indicate no massive sedimentation effect. From the perspective of a century and millennium time scale, man's activity in the watershed and resultant change in coastal systems are part of a long-term evolutionary process. Therefore, the Biosphere Reserve needs to be managed essentially as a "natural area" rather than managed "back" toward pristine conditions. Human management efforts can relieve stress temporarily on coastal ecosystems and postpone damage to coral reefs, but evolution of the systems is likely, to continue so long as rate of sedimentation exceeds the global rise of sea level. The following strategies therefore are offered to slow the pace of natural processes rather than to interrupt or reverse their direction.

2. Manage to improve entrance exchange. Although both systems have former man-made channels to the sea, these are clogged by mangroves, and littoral drift. As a result, swamp water is stagnant and pond, water "dead" especially during periods of drought and low water. Subaerial exposure and hypersalinity place an added stress on the swamp system, one that has already lost its vitality at Reef Bay. Any measure that would open the existing channels and create a "valve" to control exchange with the sea during extreme conditions would be of benefit. The valve is needed not only to reduce subaerial exposure during drought but to retain fine sediment during floods by "ponding" water and sediment and thus mitigate the threat of sedimentation on coral reefs. A small effort could produce a large improvement and help postpone the long-term consequences.

3. Manage to stabilize bottom sediments. Although Mandal Pond has a capacity to absorb more watershed sediment, shoaling water depth allows wind waves to resuspend clayey bottom sediment and render the water turbid. Contact sports such as water skiing would amplify turbidity. Turbidity reduces light penetration as well as growth of benthic algal that stabilize the bottom sediments. Resuspension can be minimized by any measure that will calm the water for longer periods, and reduce wave fetch. Benthic algal growth can be encouraged by improving light penetration.

4. Manage to control sediment input at its source. Since the Reef Bay swamp has little capacity to absorb and store sediment, it is important to minimize man-produced sediment sources, i.e. to stabilize sediment near its source in the watershed, in stream beds,

on exposed banks and alluvial slopes. Former impoundments and retaining walls that are eroded through, or back-filled to capacity, should be renovated. Vegetation types with good stabilizing capability should be encouraged. Techniques are provided by Black, Crow and Eidsness, $CH_2M$ (1979).

## CONCLUSIONS

1. The record of sedimentation in the coastal sinks studied is ordered in time and displays horizons defined mainly by vertical changes in the composition of components.

2. Constituents of the sediment are relatively well-preserved. Watershed-derived sediment is distinguished by the type of pollen grains, the clay content, quartz and feldspar grains, and stratigraphic relationship between alluvium and coastal deposits.

3. The sedimentary record of Mandal Pond archives a time-history of submergence by global sea level rise and infilling for 3,300 years. Submergence exceeds infilling and the pond may be expected to persist. Composition of the deposits changes with respect to percentages of clay, carbonate and organic content in response to changes of watershed and pond-produced sediment input. These changes are likely caused by alternate wet and dry periods varying irregularly over time spans of 20 to 500 years.

4. Surface sediments of the pond are not unique but exhibit characteristics similar to those deposited over the last 100 years. Sedimentation rates for the last 300 years are relatively low and vary within narrow limits, a feature consistent with the history of little human activity in the watershed.

5. The sedimentary record of Reef Bay mangrove swamp reveals a history whereby sediment infilling rates exceed submergence. Consequently, depositional units change with shoaling and contraction in size of the system over the last 3,000 years. They proceed from old alluvium to lagoon deposits, to peat, swamp clay and young alluvium.

6. Near-surface deposits on the landward edge of the swamp are changing from swamp clay to alluvium as sedimentation rates in the last 1,800 years accelerated fivefold. Despite man's substantial historical activity in the watershed, no massive effect of sedimentation on the swamp is observed. Man's effects are small in view of the long-term natural evolution.

7. If recent sedimentation rates continue or increase, the swamp is doomed as a natural mangrove swamp. With its loss of storage capacity comes a threat to nearshore reefs. Human efforts can only postpone the long-term consequences.

## LITERATURE CITED


Black, Crow and Eidsness, $CH_2M$, 1979. A sediment reduction program. Gainesville, Florida contract report for the Government of the U.S. Virgin Islands, 100 p.

Bowden, M. J. and Fischman, N., 1970. Climate, water balance, and climatic change in the Northwest Virgin Islands. St. Thomas, U.S. Virgin Islands, Caribbean Research Institute, 127 p.

Brush, G. S., 1984. Patterns of recent sediment accumulation in Chesapeake Bay (Virginia-Maryland, U.S.A.) tributaries. Chem. Geol. 44:227-242.

Brush, G. S. and Davis, F. W., 1984. Stratigraphic evidence of human disturbance in an estuary. Quaternary Research, 22:91-108.

Cintron, G., Lugo, A. E., Pool, D. J., and Morris, G., 1978. Mangroves of xeric environments. Biotropica 10:110-121.

Davis, M. B., 1976. Erosion rates and land-use history in southern Michigan. Environ. Conserv. 3:139-148.

Dawson, R. F., 1959. Laboratory manual in soil mechanics. Pitman, New York.

Douglas, I., 1967. Man, vegetation and the sediment yields of rivers. Nature 215:925-928.

Folk, R. L., 1961. Petrology of sedimentary rocks. Austin: Hemphill's; Texas, 154 pp.

Fraegri, K. and Iversen, J., 1964. Textbook of pollen analysis. Haefner, New York, New York.

Gilbert, G. R., 1917. Hydraulic mining debris in the Sierra Nevada. U.S. Geo. Survey Prof. Paper, 105 p.

Haworth, E. Y. and Lund, J., 1984. Lake sediments and environmental history. Minneapolis, University of Minnesota Press.

Hubbard, D. K., Stump, J. D., and Carter, B., 1985. Sedimentation and reef development in Hawksnest, Fish and Reef Bays, St. John, USVI. VIRMC Research Series, Subtask 6, 172 p.

Lugo, A. E., Quinones, F., and Weaver, P. L., 1980. Erosion and sedimentation of Puerto Rico watersheds. Caribbean Jour. Sci. 16:143.

Lugo, A. E., Schmidt, R., and Brown, S., 1983. Tropical forests in the Caribbean. Ambio 10:318-324.

Meade, R. H. and Trimble, S. W., 1974. Changes in sediment loads in rivers of the Atlantic drainage of the United States since 1900: Proceedings of symposium on the effects of man on the interface of the hydrological cycle with the physical environment; Paris, France. Int. Assoc. Hydrol. Sci. Pub. 113:99-104.

McCall, P. L., Robbins, J. A., and Matisoff, G., 1984. $^{137}Cs$ and $^{210}Pb$ transport and geochronologies in urbanized reservoirs with rapidly increasing sedimentation rates. Chemical Geol. 44:33-65.

Milliman, J. D. and Meade, R. H., 1983. World-wide delivery of river sediment to the oceans. Jour. Geol. 91:1-21.

Mills, F., Lewis, L., and Hall, P., 1964. Hurricane data analysis for 20 Caribbean Islands, 1492-1963. Caribbean Research Institute, 15 p.

Nichols, M. and Towle, E., 1977. Water, sediments and ecology of the Mangrove Lagoon and Benner Bay, St. Thomas, Tech. Report 1. St. Thomas, Virgin Islands: Island Resources Foundation, 159 p.

Polach, H. A. and Golson, J., 1966. Collection of specimens for radiocarbon dating and interpretation of results. Manual No. 2. Canberra, Australia: Australian Institute of Aboriginal Studies: Australian National University, 42 p.

Tyson, G. F., 1984. A history of land use on St. John, 1718-1950 (Preliminary report), St. Thomas, Virgin Islands, U.S. Department of Interior, National Park Service, 91 p.

Tyson, G. F., 1986. Historic land use in the Reef Bay, Fish Bay and Hawksnest Bay watersheds St. John, U.S. Virgin Islands, 1719-1950. Report, St. Thomas, Virgin Islands: VIRMC II Research series. U.S. Department of Interior, National Park Service, 49 p.

Wolman, G., 1967. A cycle of sedimentation and erosion in urban river channels. Geogr. Ann. 49:385-395.

Woodbury, R. O. and Weaver, P. L., 1984. The vegetation of St. John and Hassell Island. U.S. Virgin Islands, Report to the Virgin Islands National Park Service.

## APPENDIX I

## KEY TO POLLEN TYPES, ST. JOHN

A: Spores with trilete marks

A-1: spherical; punctate to verrucate; 23 microns
A-2: Lycopodium
A-3: punctate; with spines; 70 microns
A-4: smooth; 60 microns

B: Spores of pollen without apertures; spherical

B-1: smooth with a central indentation; 14-16 microns
B-2: punctate; 14-16 microns
B-3: large, regularly spaced spines; 14-16 microns
B-4: smooth; 46 microns
B-5: verrucate; 35 microns

C: Monolete spores or monocolpate pollen

C-1: thick, smooth exine; 37 microns
C-2: smooth; furrow with a well-developed margo; 74x23 microns
C-3: irregularly spaced short spines; 60 microns
C-4: punctate; 14 microns
C-5: reticulate; 32 microns

D: Monoporate pollen

D-1: pore not well defined; Cyperaceae type; 27 microns
D-2: well defined pore; no annulus; 16 microns
D-3: pore with well defined annulus; Gramineae type; 48 microns
D-4: Sparganium type

E: Diporate pollen

E-1: smooth; 14 microns

F: Triporate pollen

F-1: smooth to striate and regulate; shape and pore structure resembles Betula; 16 microns
F-2: non-aspidate pore; well developed annulus; resembles Celtis; 16 microns
F-3: Corylus type

APPENDIX I (continued)

G. Multiporate pollen

G-1: pores with annuli located along the equator; 21 microns
G-2: 3 to 5 pores; smooth; resembles Carva; 45 microns
G-3: many discrete pores; without annuli; smooth; resembles Caryophyllaceae; 57 microns
G-4: many pores; striate; 14 microns
G-5: 3 to 4 to 5 pores; regulate; resembles Ulmus
G-6: 4 to 5 pores; resembles Alnus, but without arcs; 12 microns

H: Tricolpate pollen

H-1: smooth; 16 microns
H-2: striate; 18 microns
H-3: finely reticulate; 16 microns
H-4: verrucate; resembles Quercus; 20 to 40 microns H-4-a: same as above but with possible pore; resembles Fagus
H-5: gemmate; resembles Ilex
H-6: coarsely reticulate; 40x18 microns
H-7: distinct spines irregularly and sparsely distributed; 23 microns
H-8: Acer type
H-9: thick, smooth exine; 37 microns
H-10: smooth; 45 microns

I: Four-furrowed pollen

I-1: punctate; resembles Fraxinus; 30 microns
I-2: striate; 23 microns

J: Tricolporate pollen

J-1: smooth; pores of varying size; 16-20 microns
J-1-a: same as above but sparsely punctate
J-2: smooth to punctate; "Rhizophora" type; 23 microns
J-3: reticulate to striate; 23 microns
J-4: Anacardiaceae type
J-5: short furrows with annular pores; punctate; Tilia and/or Nyssa type
J-6: punctate; beaded-type ornamentation; long thin furrow with very small pore; 30 microns

K: Six furrows and pores

K-1: smooth; 16-20 microns

Acacia

Typha

Ambrosia type

XN-ABH-590-A

# VIRGIN ISLANDS RESOURCE MANAGEMENT COOPERATIVE

BIOSPHERE RESERVE
RESEARCH REPORT NO. 24

## RECREATIONAL USES OF MARINE RESOURCES IN THE VIRGIN ISLANDS NATIONAL PARK AND BIOSPHERE RESERVE: TRENDS AND CONSEQUENCES

Caroline S. Rogers,
Larry McLain and Evonne S. Zullo
Virgin Islands National Park
St. John, U.S. Virgin Islands

U.S. MAN AND THE BIOSPHERE PROGRAM

Virgin Islands National Park

September, 1988

XN-ABH-590-A

# RECREATIONAL USES OF MARINE RESOURCES IN THE VIRGIN ISLANDS NATIONAL PARK AND BIOSPHERE RESERVE: TRENDS AND CONSEQUENCES

1988

BIOSPHERE RESERVE REPORT NO. 24

CAROLINE S. ROGERS
LARRY McLAIN
EVONNE S. ZULLO
VIRGIN ISLANDS NATIONAL PARK
ST. JOHN, U.S. VIRGIN ISLANDS

U.S. DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

AND

VIRGIN ISLANDS RESOURCE MANAGEMENT COOPERATIVE
VIRGIN ISLANDS NATIONAL PARK
P.O. BOX 7789, ST. THOMAS
U.S. VIRGIN ISLANDS 00801

LOCAL CONTRACTING AGENT
ISLAND RESOURCES FOUNDATION
RED HOOK BOX 33, ST. THOMAS
U.S. VIRGIN ISLANDS 00802
(NPS CONTRACT NO. CX-0001-3-0048)

28

## ABSTRACT

Recreational uses of the waters and beaches of Virgin Islands National Park and Biosphere Reserve on St. John, U.S. Virgin Islands, have increased dramatically in the last 10 years. Recreational visits to the park have risen from less than 100,000 prior to 1967 to over 750,000 in 1986. Annual visitation to Trunk Bay beach, the most heavily used beach in the park, has risen from under 20,000 people in 1966 to almost 170,000 in 1986. The average number of boats per day in park waters increased from less than 10 in 1966 to about 80 in 1986.

One consequence has been the degradation of the park's marine resources, particularly some of the coral reefs and seagrass beds along the north shore of the island which receives the heaviest use. Anchor damage and damage from boats striking or grounding on reefs is evident. Seagrass beds in popular bays have deteriorated.

Based on field work and examination of National Park Service (NPS) records, this report documents some of the trends and consequences of increased recreational uses of the park's resources and some recent efforts to protect them. Its purpose is to provide a basis for future management actions designed to balance increased visitation with protection of fragile marine resources.

ACKNOWLEDGMENTS

Many people assisted us with this project. We especially appreciated the efforts of Dan Cooke, David Vekasy, Ken Blonder, and Joe Luttman. John Miller, the park's Resources Management Specialist, assisted in several aspects of the work. Rafe Boulon's concern over damage from boat groundings was largely responsible for increasing our awareness of unacceptable reef destruction in the park. We thank him for assisting with installation of marker buoys and for supplying useful records for Windswept Reef. Thanks also to Chief Ranger Larry Guth and Supervisory Park Ranger Richard Jones for supplying National Park Service records and assisting us with their interpretation.

TABLE OF CONTENTS

ABSTRACT i
ACKNOWLEDGMENTS ii
TABLE OF CONTENTS iii
LIST OF TABLES iv
LIST OF FIGURES v
INTRODUCTION 1
METHODS 1
Field observations of damage to marine resources 1
Examination of National Park Service records 5
RESULTS 6
Coral breakage at Windswept and Hawksnest Reefs 6
Anchor damage survey 6
Trends in uses of park beaches and waters 10
DISCUSSION 21
Recommendations for monitoring and documentation 25
of trends in recreational uses of marine resources 25
Specific recommendations for Virgin Islands National Park 26
CONCLUSION 27
LITERATURE CITED 28
APPENDIX I 30

## LIST OF TABLES

Table 1. Boat counts from aerial photographs. 16
Table 2. Incidences of damage and violations. 19

## LIST OF FIGURES


| | | |
|---|---|---|
| Figure 1. | St. John study sites. | 2 |
| Figure 2. | Aerial photographs showing locations of Windswept Reef and Hawksnest Bay patch reefs 1 - 4. | 4 |
| Figure 3. | Coral breakage at Windswept Reef. | 7 |
| Figure 4. | Coral breakage at Hawksnest Bay patch reefs 1 - 4 | 8 |
| Figure 5a. | Bottom type for boats anchored in 0 - 5 meters in northern and western bays of St. John. | 11 |
| Figure 5b. | Bottom type for boats anchored in 6 - 10 meters in northern and western bays of St. John. | 11 |
| Figure 5c. | Bottom type for boats anchored in 11 meters and deeper in northern and western bays of St. John. | 12 |
| Figure 6. | Recreational visitors to Virgin Islands National Park from 1957 - 1986. | 13 |
| Figure 7. | Monthly recreational visits to Virgin Islands National Park in 1966, 1976, and 1986. | 13 |
| Figure 8. | Annual visitation to Trunk Bay beach from 1966 - 1986. | 14 |
| Figure 9. | Average number of boats per day in park waters from 1966 - 1986. | 16 |
| Figure 10. | Average number of boats per day in northern and western bays on St. John, 1984 - 1986. | 17 |
| Figure 11. | Average number of boats per day in Caneel and Francis Bays from 1984 - 1986. | 18 |
| Figure 12. | Boat distribution in northern and western bays of St. John. | 20 |
| Figure 13. | Growth in British Virgin Islands charterboat fleet from 1969 - 1980. | 22 |

## INTRODUCTION

Throughout the Caribbean, tourism and coastal development are exerting severe pressure on the natural resources of many islands and countries. More and more tourists are visiting parks and protected areas in the region. The purpose of this study was to document the trends in recreational uses of the waters and beaches of Virgin Islands National Park and Biosphere Reserve on St. John, U.S. Virgin Islands, and to assess the degradation of the marine resources attributable to recreational activities. Robinson (1973, 1976) drew attention to environmental damage associated with recreation in Virgin Islands National Park in the 1970's, prior to the dramatic increase in visitation.

Virgin Islands National Park (VINP) consists of 2,816 ha of federally owned land on St. John, and 2,287 ha of marine waters (Fig. 1). The terrestrial area of the park was established in 1956. In 1962, the park boundaries were expanded "...in order to preserve for the benefit of the public significant coral gardens, marine life, and seascapes..."(16 U.S.C. 398). Both northern and southern waters were added to the park at this time.

This study focused primarily on documenting the increase in the number of boats visiting VINP and on evaluating the environmental damage associated with boating. Recreational fishing can adversely affect not only fish and shellfish populations but also the reefs themselves, e.g., when fish traps land on and smash coral colonies and divers overturn corals to extricate lobsters. Unfortunately, lack of information on the magnitude of recreational fishing and changes in the intensity of fishing over time preclude its evaluation here. This study was one of several Virgin Islands Resource Management Cooperative (VIRMC) projects conducted between 1984 and 1987 which were designed to provide the information necessary to manage the coral reefs, seagrass beds, and fisheries of St. John.

## METHODS

Assessment of trends and impacts from boating and other recreational uses of marine resources was based on fieldwork at selected sites around St. John and analysis of National Park Service documents, specifically Boat Patrol Logs, Monthly Public Use Reports, Case Incident Records, and Lifeguard Logs.

### Field observations of damage to marine resources

Study sites Recreation in VINP waters is concentrated most heavily in the northern and northwestern bays. Consequently, we selected Solomon, Honeymoon, Caneel, Scott, Hawksnest, Trunk, Cinnamon, Maho, Francis, and Leinster Bays (Fig. 1) for studies of anchor damage (see below).

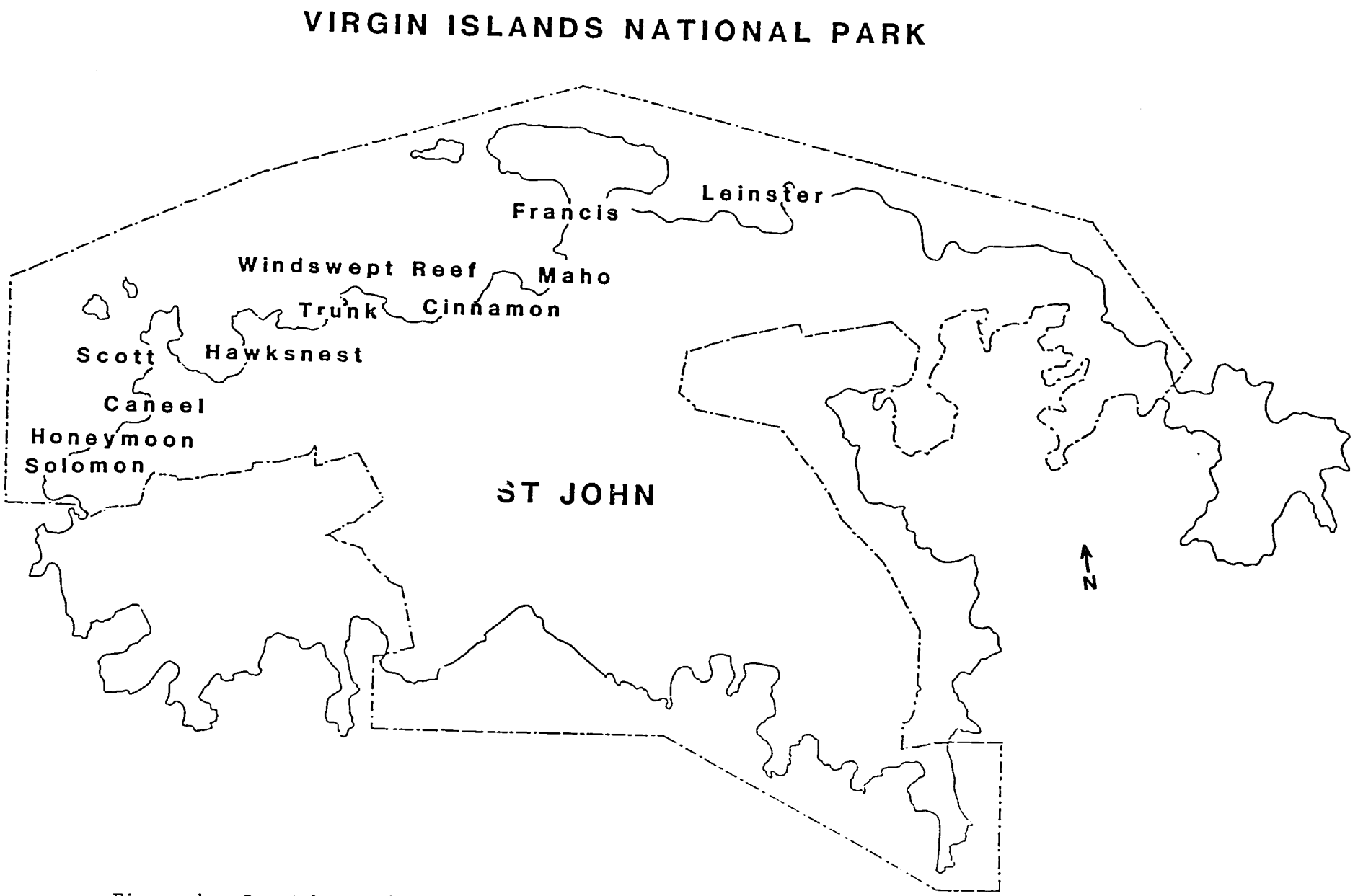



Figure 1. St. John study sites. Broken line indicates boundary of Virgin Islands National Park.

Observations by park staff and others indicated that Windswept Reef and Hawksnest Bay patch reefs (Figs. 1, 2) have suffered severe damage from boats striking or running aground on the reefs. Windswept Reef fringes the point which lies between Trunk and Cinnamon Bays, two of the most popular bays in the park. Hawksnest Bay has become an increasingly popular anchorage, particularly for day sailors. An increase in the number of snorkelers is also resulting in more damage to coral colonies. These reefs are extremely shallow, making them particularly vulnerable. Windswept Reef and four patch reefs in Hawksnest were examined on a monthly basis for evidence of physical damage. Boats do not generally anchor on the Windswept and Hawksnest Reefs, and most damage is from boats running aground or from snorkelers.

Breakage of coral colonies: Windswept and Hawksnest It is very difficult to quantify physical damage to coral reefs, whether from anchors, boat groundings, careless snorkelers, or other causes, because of their structural complexity. The shallowest reef areas, where much of the damage occurs, are especially hard to survey because they are impossible to swim over. We estimated damage by swimming parallel transects across the reef areas and counting the number of freshly broken branches of elkhorn coral, *Acropora palmata*, and by measuring the "length" and "width" of each fracture area or stump (Rogers et al., 1982). (No attempt was made to swim the same transects on each survey, although the entire reef was surveyed each time.) Because most fracture areas were elliptical, the length and width measurements were used to calculate areas using the formula for an ellipse (Area = length x width x 0.8). *Acropora palmata* is the most abundant coral on these study reefs and suffered the most breakage. We considered it important to estimate the area of the branch fractures because physical damage is a function of both number and size of breaks.

Making observations at monthly intervals proved most effective in assessing damage. With greater frequency, it is often not possible to differentiate fresh breaks from older ones, and breaks could be counted more than once. Algae rapidly grow over freshly broken areas (sometimes within one week), and if the observation intervals exceed a month, breaks occurring since the last observation will no longer be discernible.

In addition, from June 1985 until January 1987, Rafe Boulon, from the V.I. Division of Fish and Wildlife, kept records of the number of boats which struck or grounded on Windswept Reef which lies below his house on Windswept Point.

Anchor damage survey The purpose of the anchor survey, performed between January and March 1987, was to assess damage and potential damage caused by boats anchoring in National Park waters. For each bay surveyed, the following information was collected: time of survey, boat length, type of boat, type of anchor, length of anchor chain, amount of chain resting on the bottom, bottom type (coral, seagrass, sand, rubble, pavement, and



36

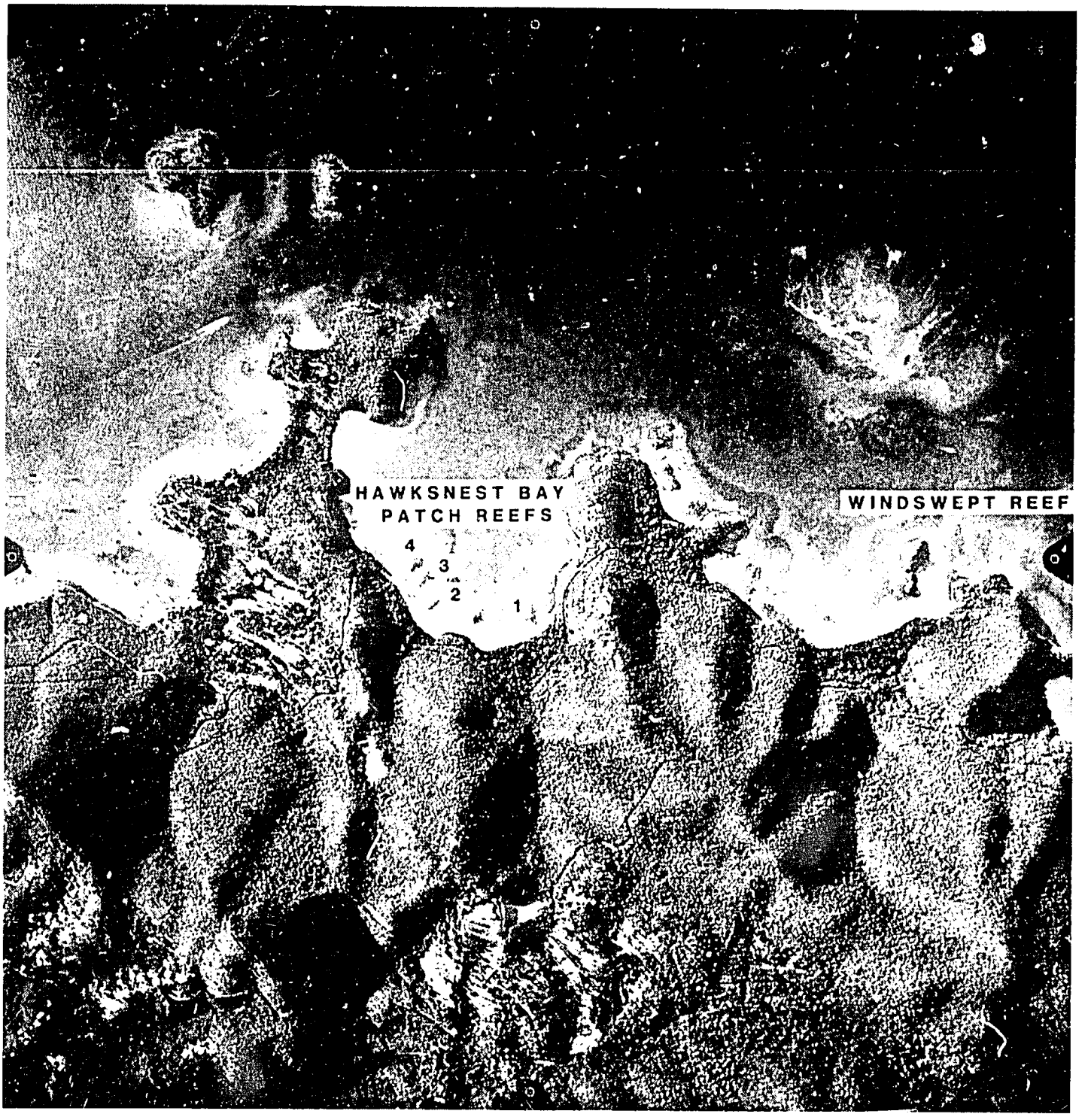



Figure 2. Aerial photograph showing locations of Windswept Reef and Hawksnest Bay patch reefs 1 - 4.



31

mud). Damage observed was given a subjective rating of negligible to severe.

Examination of National Park Service records

Boat patrol logs and monthly public use logs National Park Service rangers patrol the northern and western waters of the park almost daily, recording the number of boats in each of the several bays. The data are summarized and incorporated into monthly public use logs. Unfortunately, boat patrol logs for individual days are available only from 1984-1986, and we can not trace trends in the number of boats in specific bays prior to these years. However, we used figures for the total number of visitors on boats in park waters each month from the public use logs to calculate the average number of boats per day in the park from 1966 to 1986. In most cases, rangers estimated the total number of visitors using a formula which assumed five passengers per boat. However, the same formula was not consistently used prior to September, 1981, and we can not determine the actual number of boats each month because the raw data were discarded. (The different factors used for passengers per boat could possibly result in discrepancies of as much as 20% in the final totals.) Consequently, graphs of the data presented below should be used only as indicators of trends.

Aerial photographs taken over several years were used to discern the trend in numbers of boats in several St. John bays. For most years, photographs were taken on just one day. Clearly, this method has many biases, e.g., inconsistencies in time of day photographs were taken or season of the year, but it is another source of historical information.

Monthly public use logs were also used to estimate the total number of visitors to the park from 1971 through 1986 and to obtain information on the use of Trunk Bay beach, the beach on the north side of the island which has the heaviest use. For 1980 through 1986, we added figures for land-based tours (transportation of people in large taxi-buses) and other individuals on the beach (derived from logs kept by the lifeguards) to arrive at a figure for total number of visitors to Trunk Bay each month. The format for the monthly report was changed in 1979. Consequently, for the years prior to 1980 we estimated the use of Trunk Bay by adding 56% of the total beach visitors for several park beaches to visitors associated with the land tours. (We derived this percentage from the 1980 data which had specific values for Trunk Bay as well as totals for all beaches which were considered.) Once again, the figures are approximate and based on some assumptions, but the trends are evident.

Case incident records National Park Service employees use Case Incident Records to document the circumstances of a variety of non-criminal events. We reviewed records from 1976 to 1987 for evidence of damage to natural resources (for example, taking of

reef organisms as souvenirs) or of conflicts arising from the different uses of park waters and violations of regulations designed to protect natural resources.

Lifeguard logs Lifeguard logs are filled out daily at Cinnamon and Trunk Bay beaches. They are available only for certain months from 1981-1986. Because the logs were not filled out consistently and completely, they provide limited information on such things as removal of marine organisms, number of boats entering restricted areas, and number of people standing on coral colonies near the underwater trail at Trunk Bay.

## RESULTS

### Coral breakage at Windswept and Hawksnest Reefs

Graphs of the number of broken coral branches and the mean area per break at Windswept and the Hawksnest reefs indicate damage to *A. palmata* colonies from careless snorkelers, boat strikes, and heavy swells (Figs. 3, 4). In the winter of 1986, northern swells appeared to be the major cause of damage, particularly at Windswept Reef. Many of the elkhorn colonies had small fractures at the tips of their branches. Larger breaks seemed to be associated with boat damage and frequently bore patches of anti-fouling paint from the bottoms of boats which had struck or grounded on the reefs. In some cases, for example in October, 1986 on Hawksnest patch reef 3, a boat had caused so much structural damage (over an area of about 100 $m^2$) that it was impossible to quantify it. Also, on Windswept Reef in December, one boat remained on the reef for four days, after which it was dragged off across the corals.

Three large marker buoys were installed along the seaward edge of Windswept Reef on May 30, 1986, to warn boaters of the reef's location. Observations following placement of the buoys indicated a decrease in the number of broken coral branches until December when heavy northern swells rolled into the reef. Records provided by Rafe Boulon showed that at least 23 boats hit the reef from June 1985 until May 1986, while only 2 boats were observed to hit the reef following installation of the marker buoys (Appendix I).

### Anchor damage survey

Of the 186 boats surveyed, 32% were anchored in seagrasses and 14% in coral communities, with the remainder on sand, mud, or pavement. Many sites which now have barren sand or pavement could previously have had seagrass beds or coral communities which deteriorated with an increase in anchor damage. Of the 26 anchors found on coral bottoms, 7 (27%) were causing minor damage and 3 (12%) were causing moderate or severe damage, with the rest causing no apparent damage. Of 60 anchors in seagrasses, 18 (30%) were causing minor damage, and 17 (28%) moderate or severe damage, with the rest causing no apparent damage.

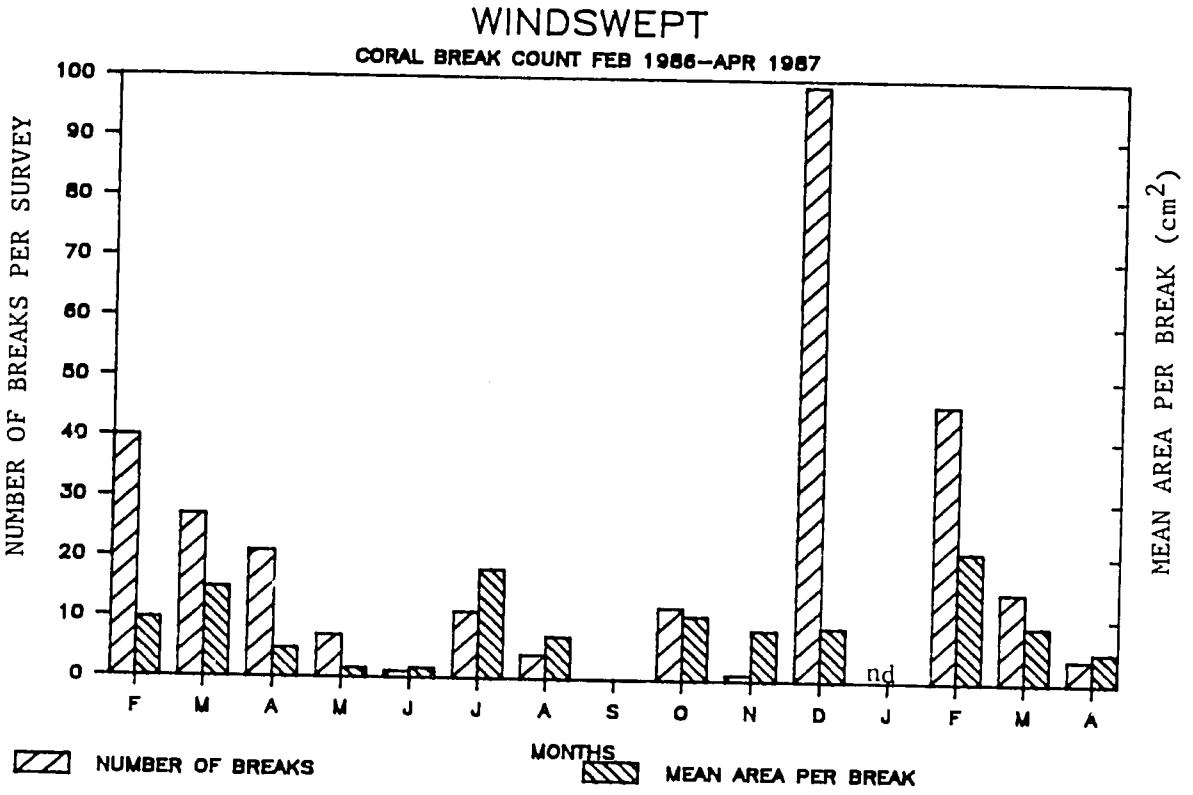
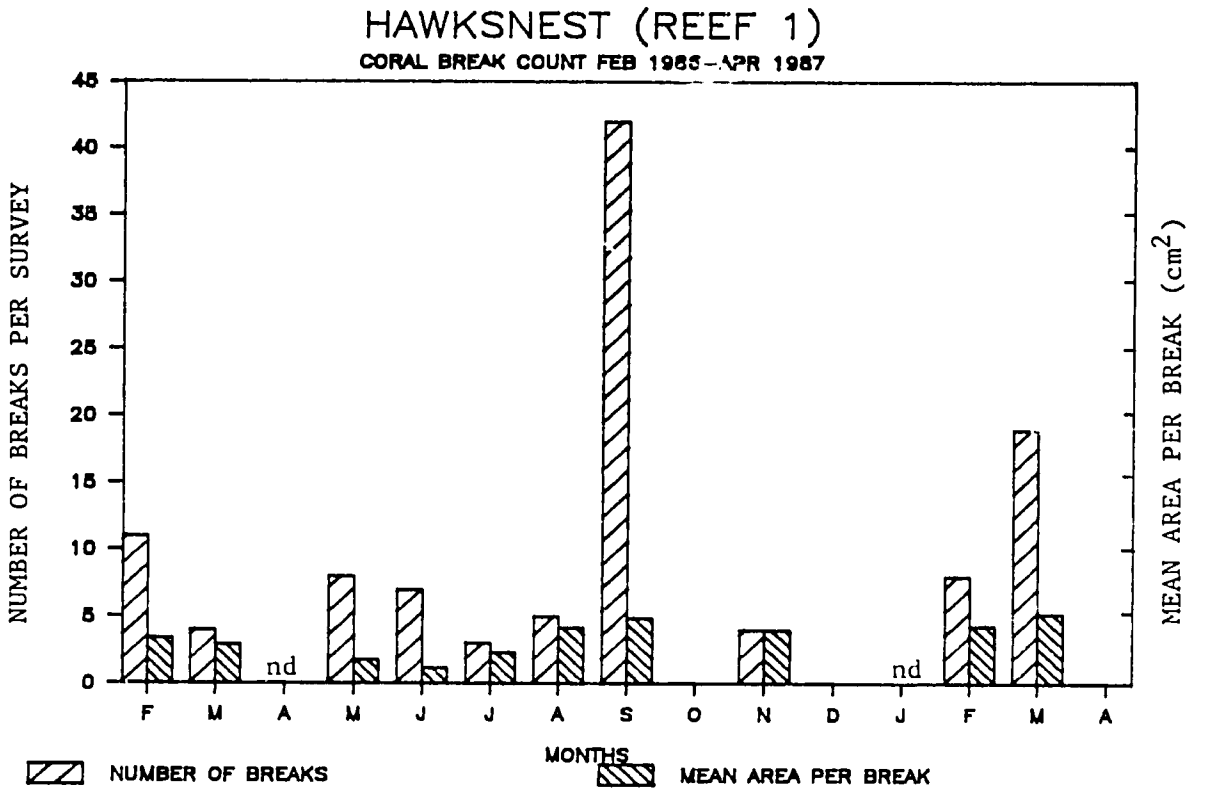



Figure 3. Coral breakage at Windswept Reef. Absence of a bar indicates there were no breaks. nd = no data.



40



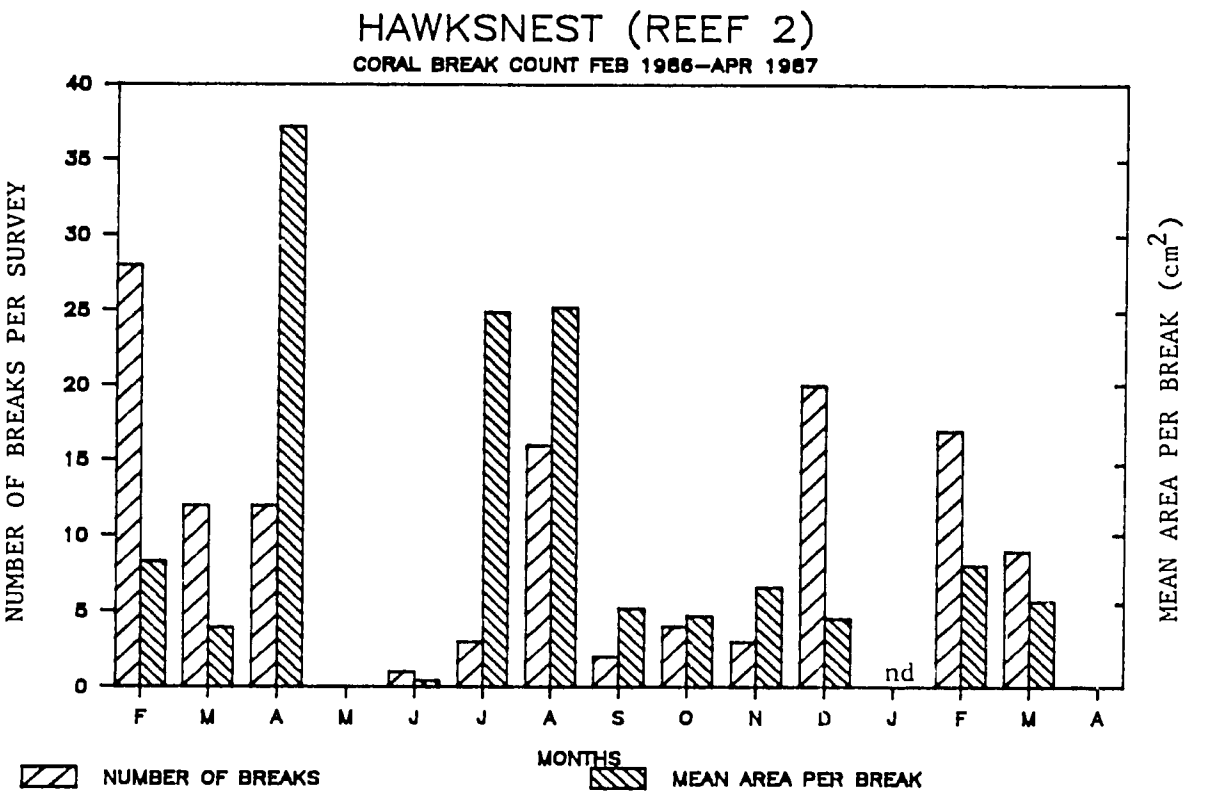
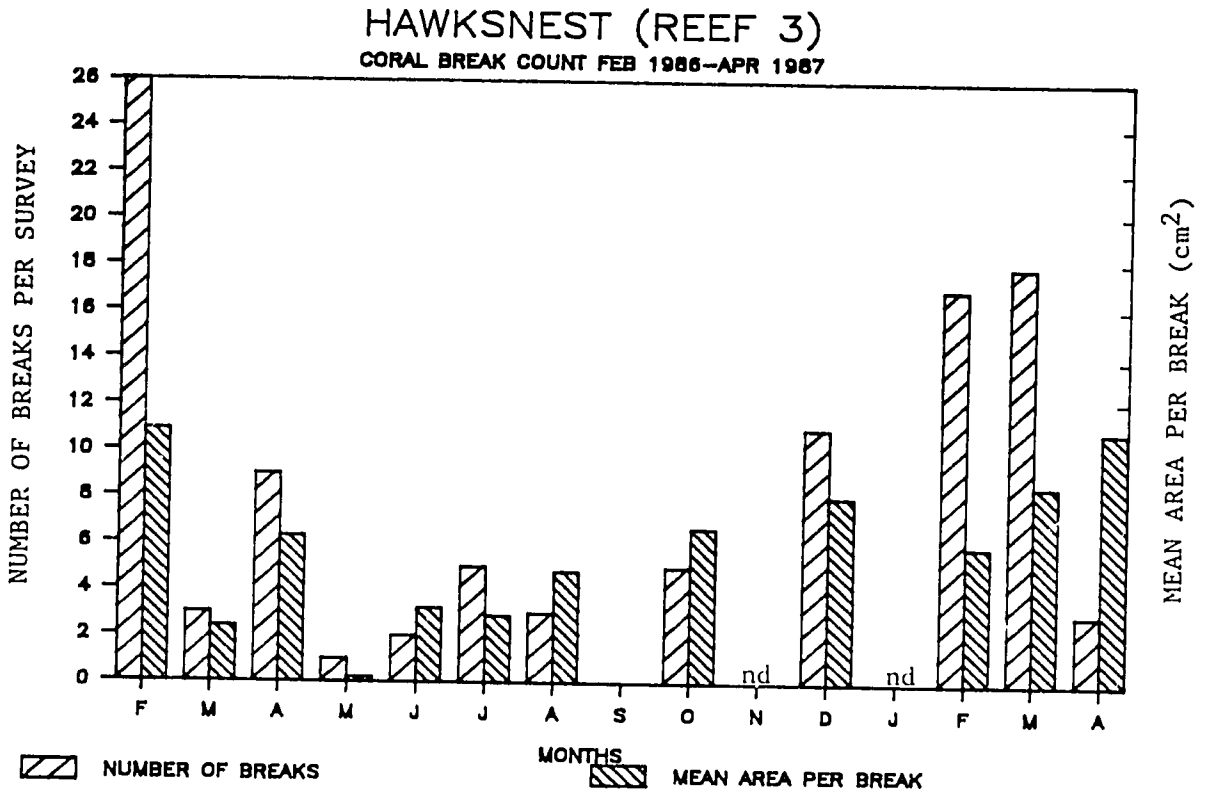




Figure 4. Coral breakage at Hawksnest Bay patch reefs 1 - 4.



41



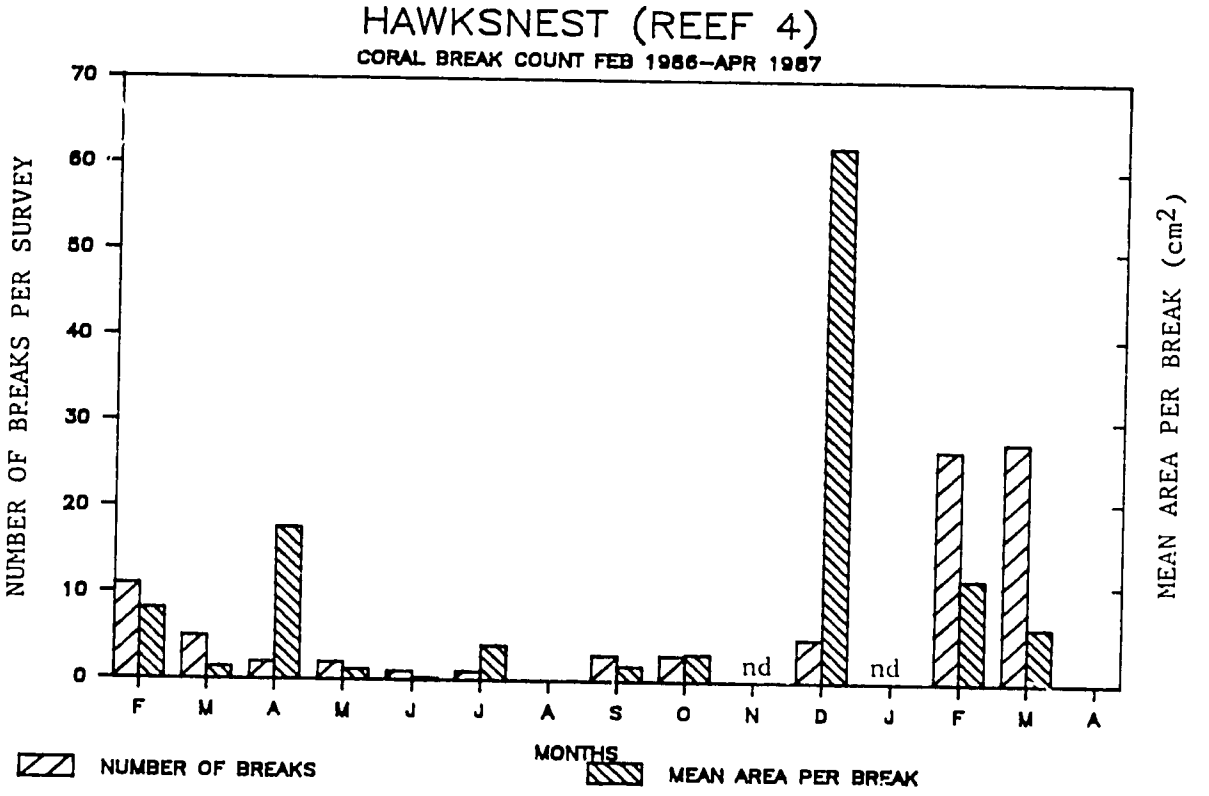




Figure 4. (continued)



42

About 56% of the boats were anchored in 5 m or less, 39% in 6-10 m, and 6% in 11 m or deeper water. In general, the deeper the anchor, the less likely it was to be found on sensitive coral or seagrass communities (Figs. 5a, 5b, 5c) which tend to occur near shore in most of the bays surveyed.

More disturbance to benthic communities is often associated with the chain attached to the anchor than with the anchor itself. As the winds and currents shift, a boat can swing through a complete circle with concomitant disturbance to the bottom from the sweep of the anchor chain. Consequently, there is the potential for 60 ha of bottom to be damaged each year at current use levels, based on an average chain length of 7.7 m, and almost 30,000 boats per year.

Trends in uses of park beaches and waters

Park visitation The estimated number of recreational visitors to the park climbed from less than 100,000 prior to 1967 to over 750,000 in 1986 (Fig. 6). Comparison of the number of recreational visitors on a monthly basis for 1966, 1976, and 1986 clearly shows a dramatic increase and, at least for 1976 and 1986, some seasonality in use patterns (Fig. 7). Most people come to St. John in the winter with March the peak month. There is a decrease in the spring, with a jump in July corresponding to the 4th of July weekend. September and October are the slowest months.

Trunk Bay beach and underwater snorkeling trail Trunk Bay beach is the most heavily used beach on St. John. Estimates indicate an increase in annual visitation from just under 20,000 people in 1966 to almost 170,000 in 1986 (Fig. 8). Sometimes over 1,000 people are on the beach on a given day. One of the main attractions is the underwater snorkeling trail established in the early 1960's. According to park staff and residents of the island, the trail has deteriorated substantially as a result of people standing on corals, breaking coral branches while snorkeling, and removing organisms as souvenirs. Lifeguards report frequent removal of sea fans and corals, although examination of their logs reveals few formal records of such incidences. In one month alone, lifeguards observed over 200 people standing on corals, most of them near the underwater trail. The logs do not indicate if they were on living or dead coral, but even standing on dead coral can be detrimental because it is a good substrate for new coral settlement and growth. The cruise ship "Norway" began visiting St. John in December 1986, and a few hundred passengers are transported one day every week to Trunk Bay, where they snorkel on the reef in the western portions of the bay and down towards adjacent Jumbie Bay. The impact from snorkelers is consequently no longer concentrated only at the underwater trail. Some people have recommended closure of the Trunk Bay trail to allow it to recover. However, we do not think it advisable to close this trail now and open another trail for visitors. Robinson (1973) noted 14 years ago

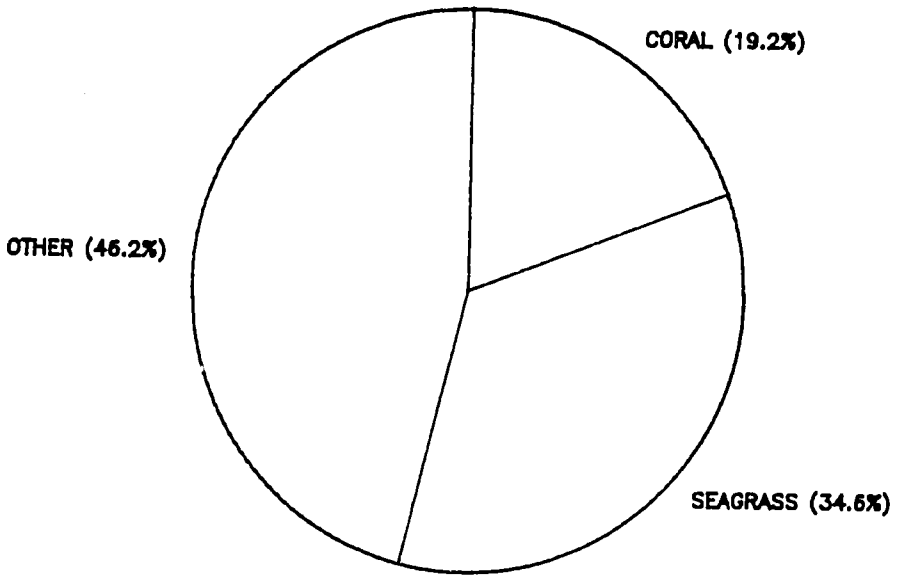



Figure 5a. Bottom type for boats anchored in 0 - 5 meters in northern and western bays of St. John.

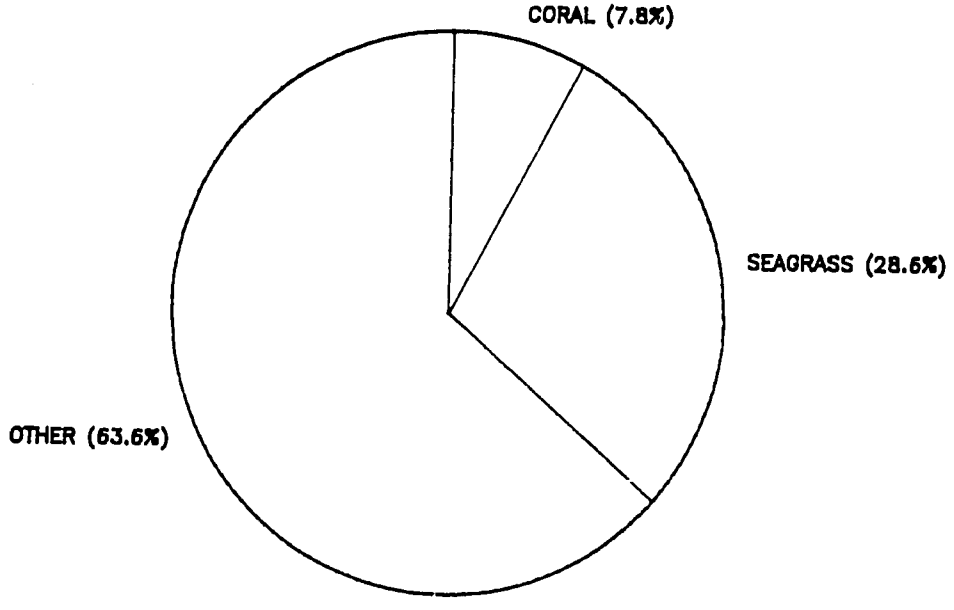



Figure 5a. Bottom type for boats anchored in 6 - 10 meters in northern and western bays of St. John.

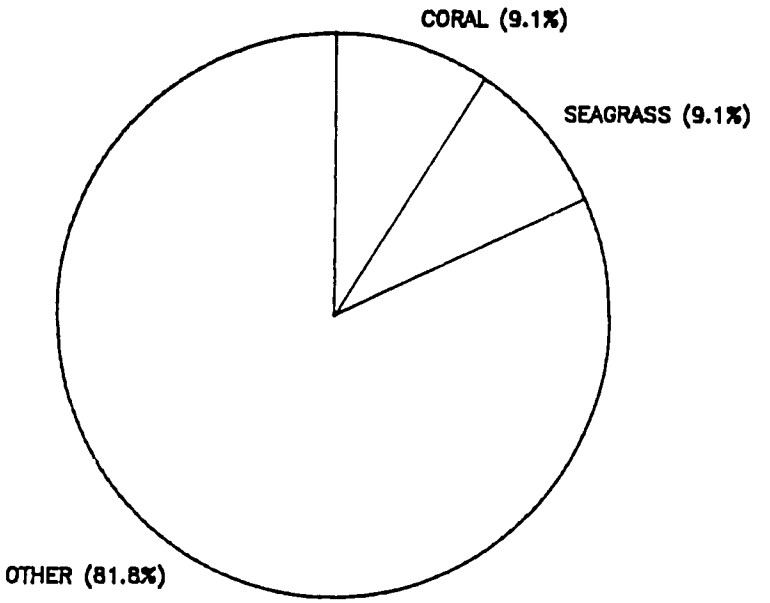



Figure 5c. Bottom type for boats anchored in 11 meters and deeper in northern and western bays of St. John.



45

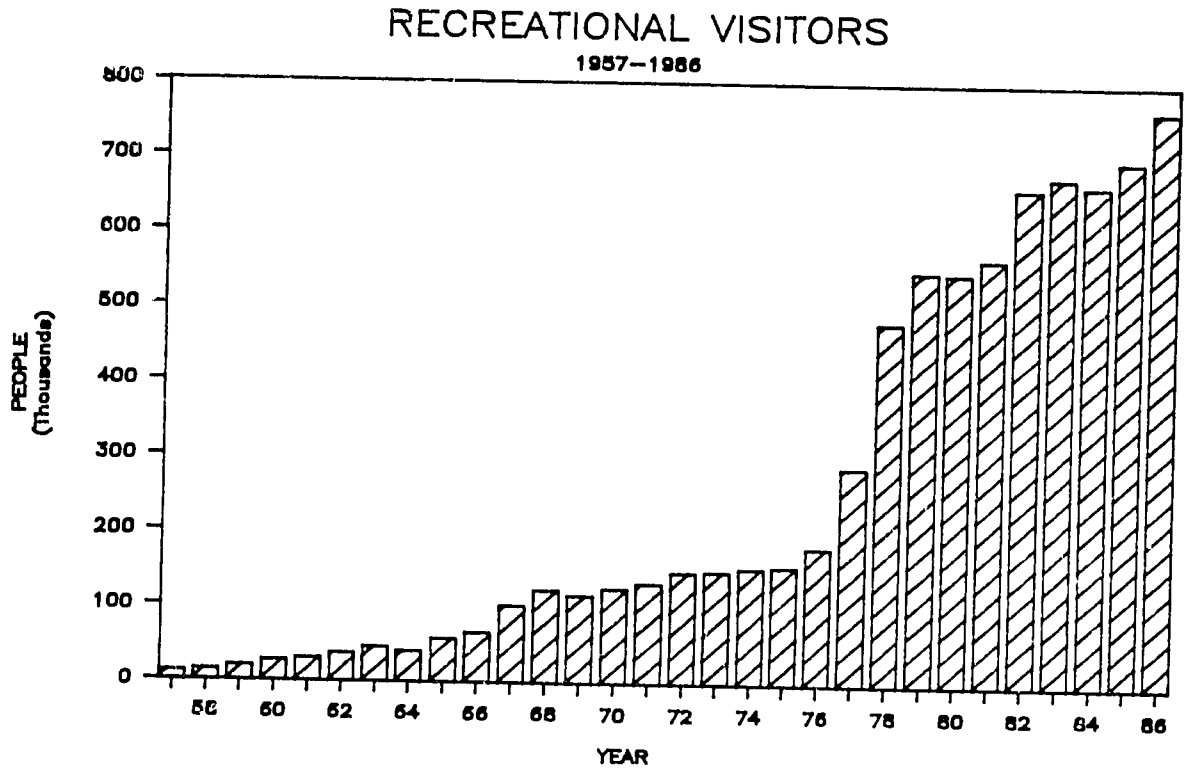



Figure 6. Recreational visitors to VINP from 1957 - 1986.

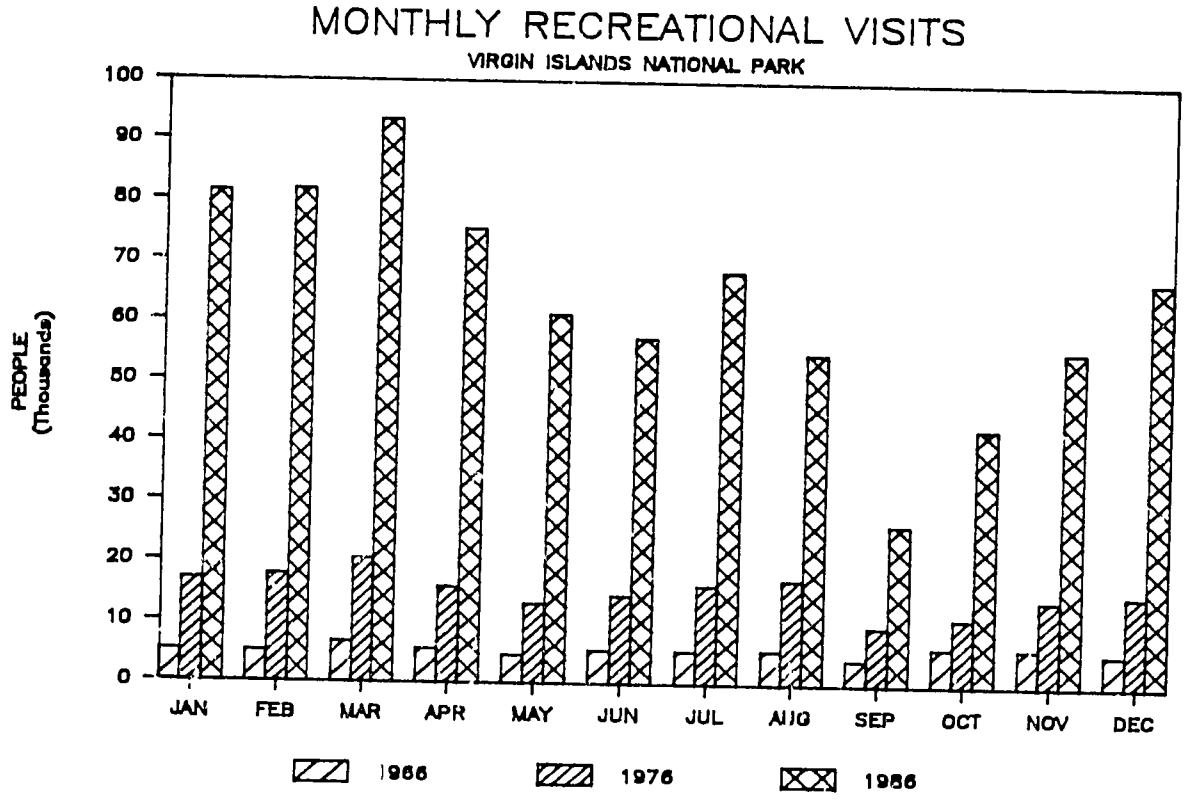



Figure 7. Monthly recreational visits to VINP in 1966, 1976, and 1986.



46

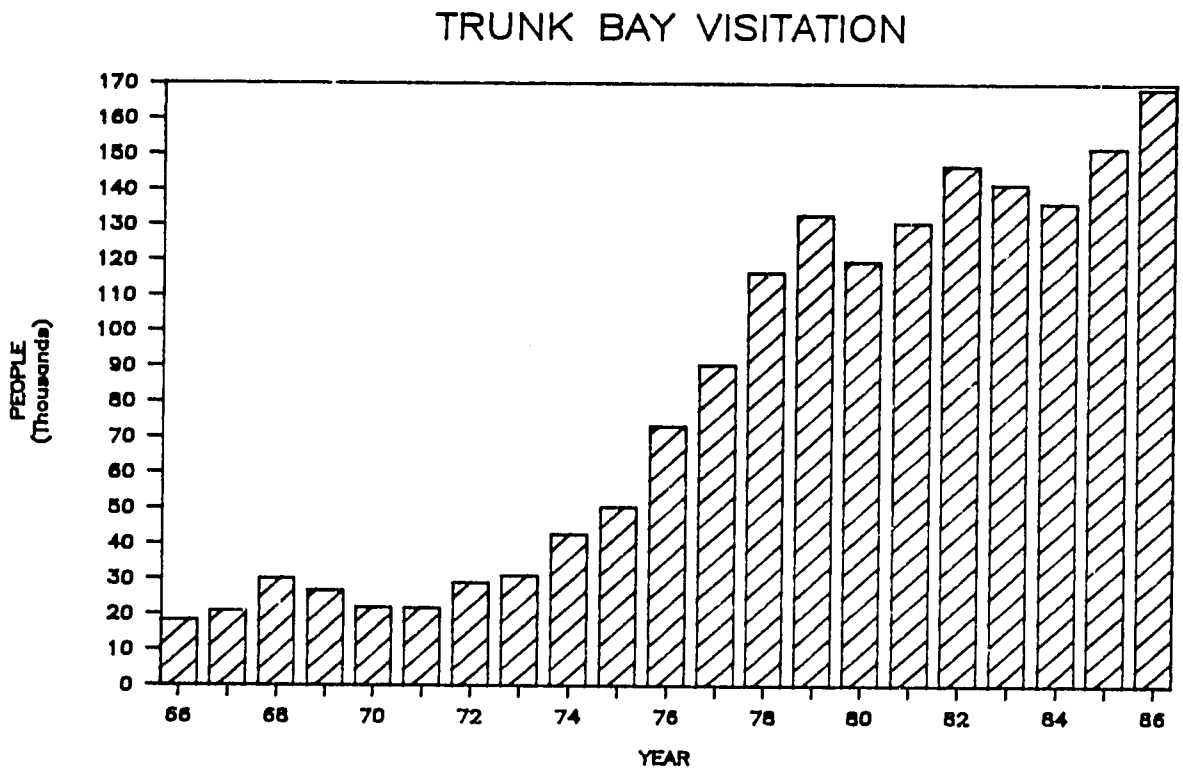



Figure 8. Annual visitation to Trunk Bay beach from 1966 - 1986.



41

that the trail is "not all within a proper reef, but rather in an area where coral growth occurs directly on hard rock bottom and boulders". He also noted poor conditions for reef growth here because of consistently heavy seas during winter months. While the trail has undoubtedly suffered from extensive use, the amount of deterioration over the years has probably been exaggerated, and it still provides a good snorkeling experience for most visitors.

Boating in Virgin Islands National Park waters The average number of boats per day in park waters, estimated from boat patrol logs and monthly public use reports, ranged from less than 10 in 1966 to about 80 in 1986 (Fig. 9). There was a fairly steady increase beginning in 1977 and a sharp increase between 1981 and 1982. There was some evidence of leveling off between 1982 and 1985, but another marked increase in 1986. Examination of aerial photographs reflects the dramatic increase in boating as well (Table 1).

A closer look at the number of boats in northern and western bays from 1984-1986 (the only years for which there are daily data), shows at least a slight increase for all months in 1986 except October (Fig. 10). Caneel Bay and Francis Bay, the two most heavily used bays in the park, had increases for most months in 1986 (Fig. 11). Examination of the distribution of boats along the northern and western shores of St. John (Fig. 12) indicates the popularity of Caneel and Francis Bays. It should be noted that Caneel Bay here refers to not only Caneel Bay proper, but also Solomon, Honeymoon, and Scott Bays as well, because all of these were combined on boat patrol logs. Consequently, Francis is probably the single most heavily used anchorage in the park.

Mini-cruise ships In addition to the increased calls by large cruise ships such as the "Norway" -- which generally do not anchor in park waters but which discharge passengers who use the park beaches -- there has been an increase in the number of mini-cruise ships which actually anchor in the park, particularly since 1984. The Newport and Nantucket Clippers are 207' long and sometimes anchor in very shallow water as they draw only 9'. Their anchors, which weigh one ton each, have been observed in coral communities and seagrass beds in Maho, Francis, Cinnamon, and Leinster Bays. The skipper of the "Newport Clipper" met with the Research Biologist and Concessions Specialist to discuss park concerns over damage to bottom communities. There is some evidence that single large anchors actually do more damage than several small anchors, at least to seagrass beds. The skipper was very accommodating, and voluntarily began to anchor in less sensitive areas which were far less convenient. Understandably, he expressed concern over all the other boats which are continuing to anchor on coral and seagrass communities.

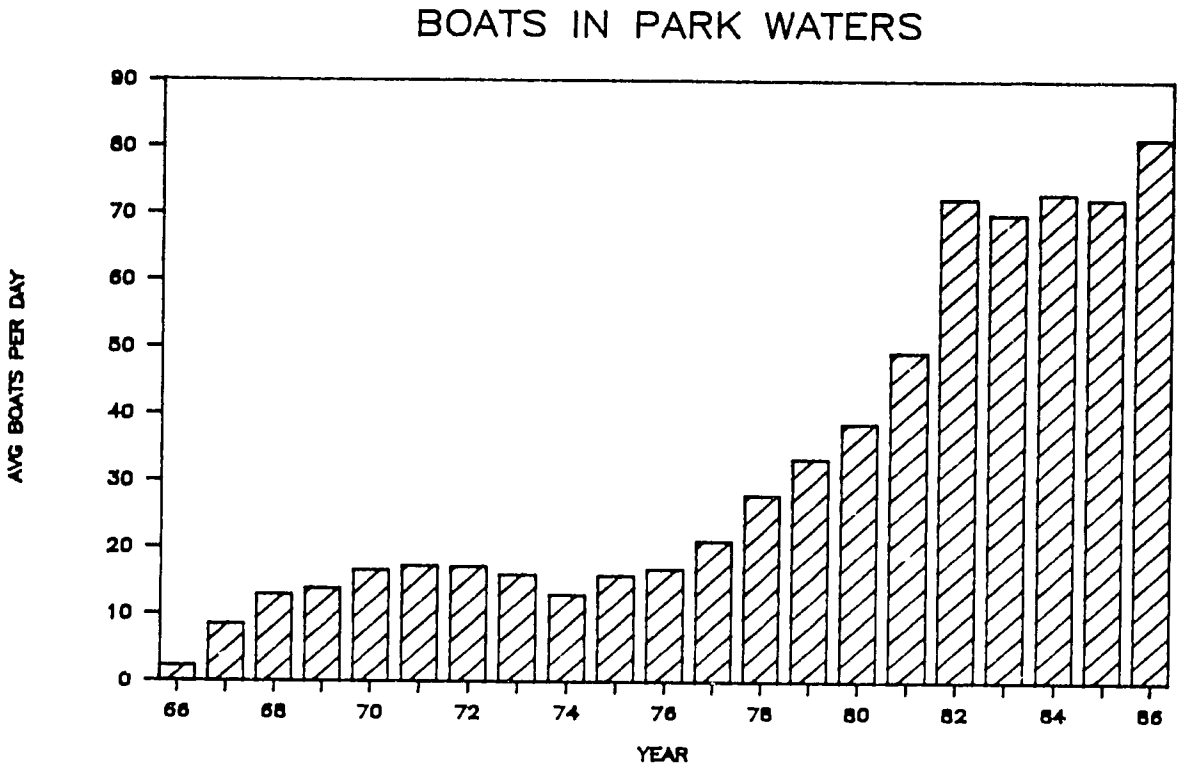



Figure 9. Average number of boats per day in park waters from 1966 - 1986.

Table 1. Boat count made from aerial photographs of St. John

| | 1946 | 1965 | 1971 | 1978 | 1983 |
|---|---|---|---|---|---|
| CANEEL BAY | 1 | 11 | 4 | 12 | 53 |
| CORAL BAY | 2 | 0 | 3 | 1 | 24 |
| SALTPOND BAY | 1 | 0 | 0 | 0 | 3 |
| LAMESHUR BAYS | 0 | 1 | 1 | 3 | 0 |
| CRUZ BAY | 2 | 12 | 18 | 32 | 53 |
| Total | 6 | 24 | 26 | 48 | 133 |

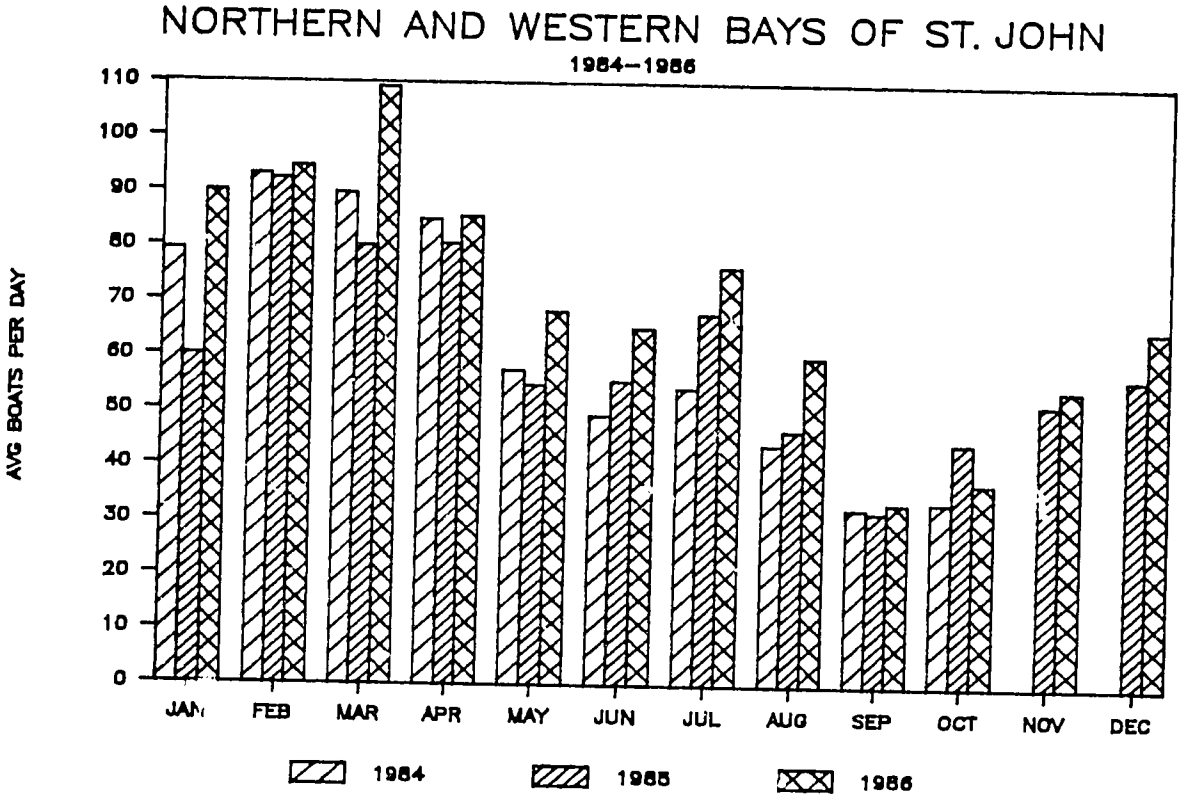
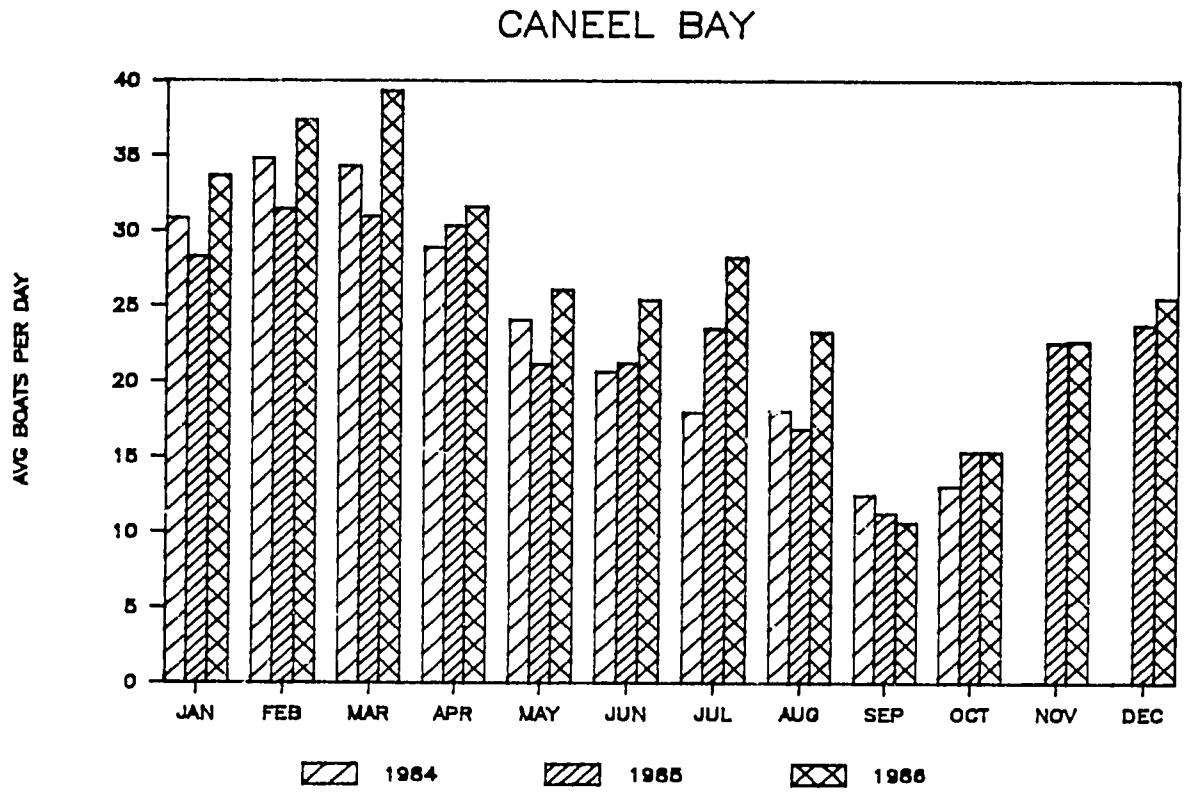



Figure 10. Average number of boats per day in northern and western bays of St. John, 1984 - 1986.



60



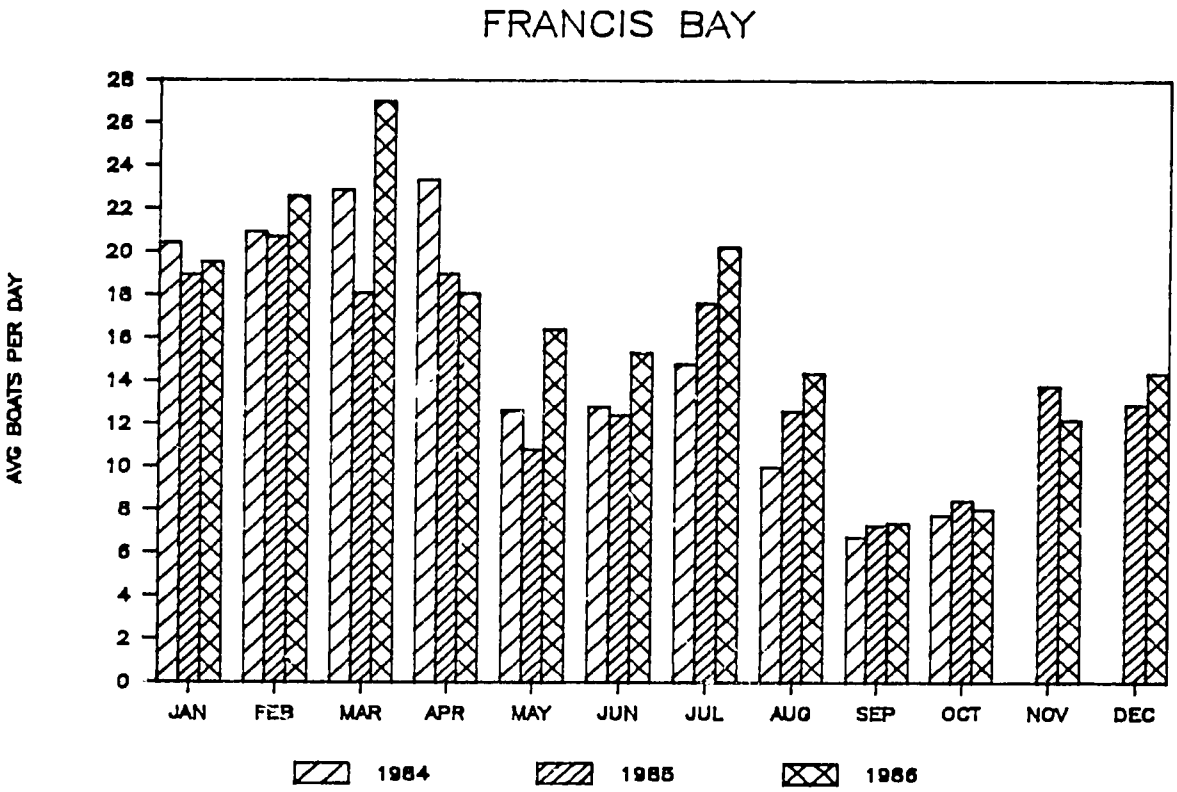




Figure 11. Average number of boats per day in Caneel and Francis Bays, 1984 - 1986.

Incidences of damage and violation of park regulations from NPS logs Based on case incident records, boat patrol logs, and lifeguard logs, the number of incidences of damage to marine ecosystems or possible conflicts among different groups using the resources were very low (Table 2). These numbers are undoubtedly underestimates and reflect inconsistencies in filling out the NPS forms. Unless observations of these violations are recorded more rigorously in the future, the NPS records can not be used to provide data on environmental degradation and conflicts among resource users.

Table 2. Incidences of damage and violations

| INCIDENT | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| OIL SPILL & POLLUTION | 1 | 2 | 2 | 2 | 1 | 5 | 0 | 1 | 4 | 2 | 4 | 24 |
| BOATS ON REEFS | 2 | 5 | 5 | 3 | 3 | 5 | 6 | 0 | 3 | 7 | 7 | 46 |
| WATER SKIING | 3 | 6 | 2 | 1 | 3 | 8 | 3 | 0 | 3 | 4 | 1 | 34 |
| ILLEGAL REMOVAL OF CORAL, ETC. | 0 | 0 | 1 | 2 | 4 | 5 | 5 | 3 | 1 | 1 | 1 | 23 |
| ILLEGAL FISHING | 2 | 5 | 1 | 4 | 1 | 19 | 13 | 7 | 7 | 1 | 3 | 63 |
| SPEARFISHING | 1 | 3 | 1 | 3 | 1 | 1 | 6 | 2 | 5 | 1 | 2 | 26 |
| SPEARGUN POSSESSION | 1 | 3 | 4 | 4 | 1 | 1 | 2 | 17 | 3 | 4 | 3 | 43 |

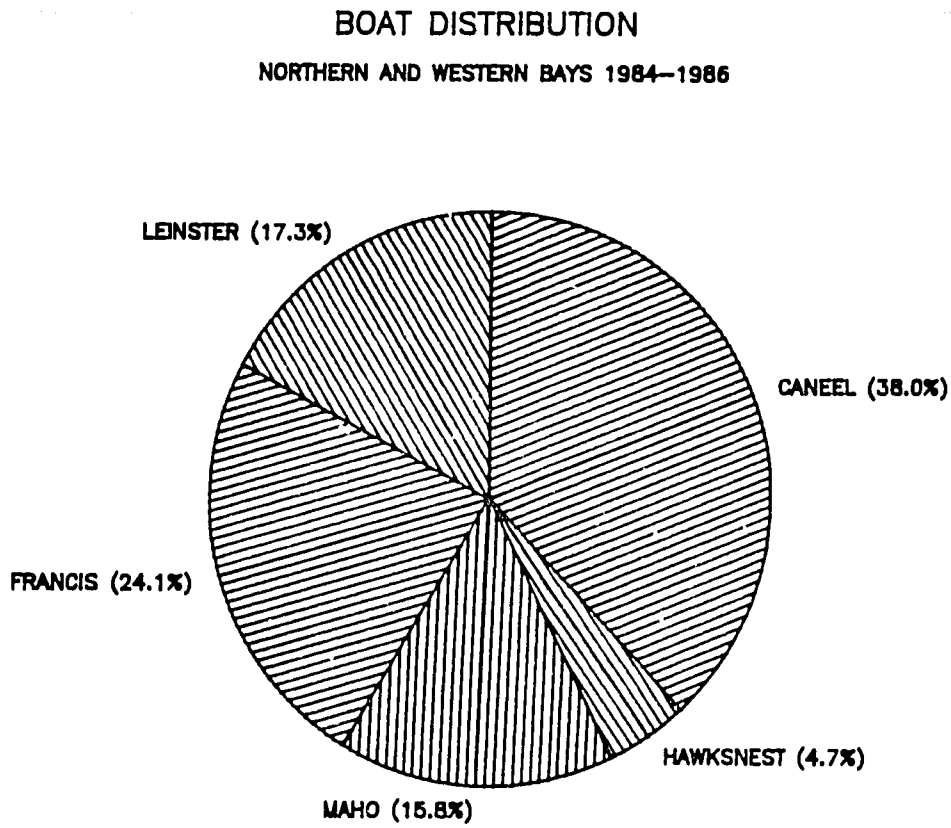



Figure 12. Boat distribution in northern and western bays of St. John.

## DISCUSSION

There is a growing recognition of the severity of damage associated with increased recreational uses of marine resources in the Caribbean, and a realization that tourism and resource protection are intrinsically interdependent. However, few systematic reports on trends in recreation or its consequences are available. Johannes' (1975) review of "Pollution and degradation of coral reef communities" does not refer to this type of destruction. Examination of the subjects of papers presented at the International Coral Reef Symposia from 1977 to 1985 shows an increase in the number of presentations on reef conservation and management, with, in some cases, specific references to degradation accompanying increases in tourism and overuse. Tilmant (1987) recently reviewed adverse effects of recreation on coral reefs, citing examples from Australia and Florida. For the British Virgin Islands (BVI), Jackson (1981) stated that, "As far as water-borne tourism is concerned, there are indications that the British Virgin Islands is approaching her physical saturation levels". The fleet of charter boats alone increased 10 times between 1969 and 1980 (Figure 13; Jackson, 1980).

There are numerous examples of severe, localized damage to marine ecosystems attributable to recreation. In a survey of stresses affecting Caribbean reefs, many resource managers and scientists reported damage from anchors (e.g., from cruiseships and dive boats), from boat groundings, and from people walking on reef flats and removing corals as souvenirs (Rogers, 1985). Most respondents felt that the reefs were deteriorating from a variety of causes. Construction of marinas and boatyards to support recreational boating have had serious environmental consequences, particularly in mangrove areas.

Tilmant and Schmahl (1981) attempted to assess visitor damage to patch reefs in Biscayne National Park by counting the number of damaged corals observed in timed visual surveys. Four of the eight study reefs received three or more times the number of visitors as the control reefs. They estimated annual visitation to all of the reefs at about 3600 people. Six boats grounded on the reefs during the 3 year study, damaging large individual coral colonies. Although Tilmant and Schmahl (1981) found a linear correlation between reef use and physical damage, damage from natural causes such as sea swells appeared to mask damage from people swimming and spearfishing near the reefs.

In comparison, within Virgin Islands National Park, adverse effects of recreational activities are far more evident and dramatic. Single boat groundings have frequently caused several square meters of destruction. Four boats hit Windswept Reef in one afternoon. In one week, the underwater snorkeling trail at Trunk Bay receives more visitors than the Biscayne study reefs receive in one year. Perhaps the Biscayne National Park study reefs are deeper than the St. John reefs and therefore less



54'

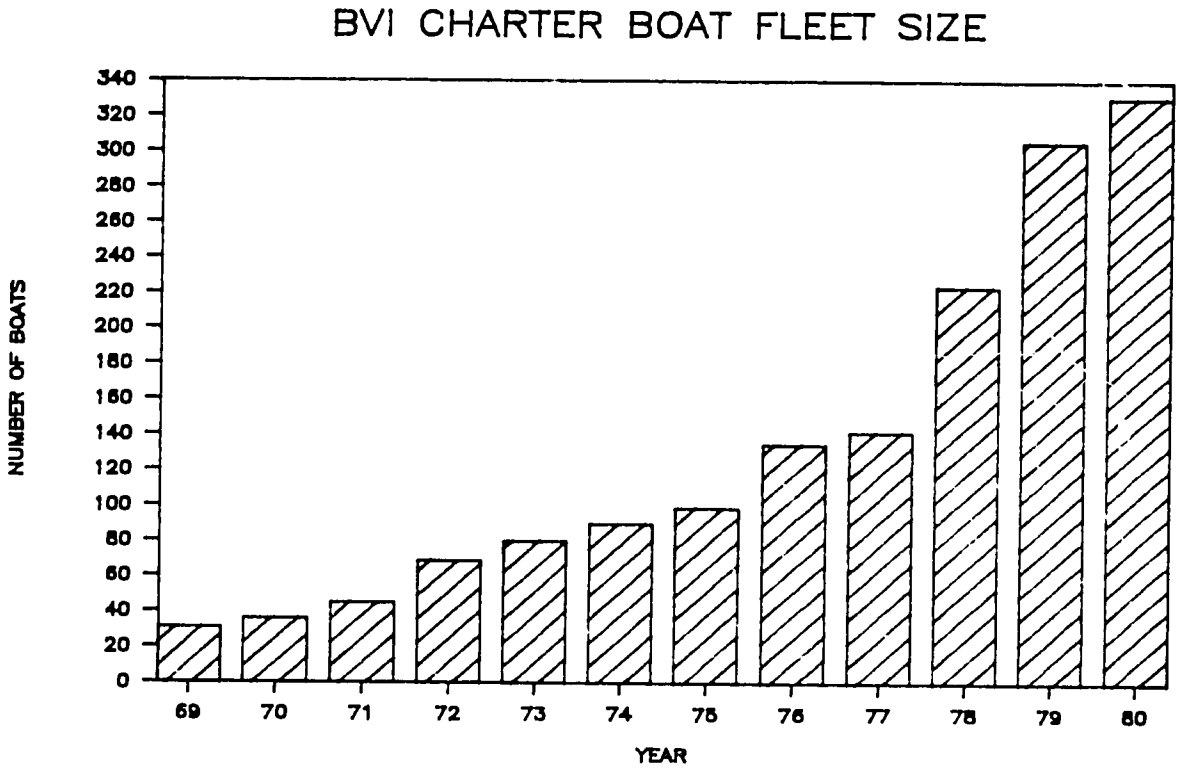



Figure 13. Growth in British Virgin Islands charter boat fleet from 1969 - 1980. (Data from Jackson, 1980).



55

vulnerable to damage from snorkelers who tend to remain near the surface of the water.

As in the Biscayne National Park study, it was not always possible to differentiate "natural" from visitor damage on the St. John reefs (see Robinson, 1973). Examples of natural damage include 1) scraping away of tissue and sometimes underlying skeletal material by fireworms (Hermodice carunculata), snails (Coralliophila abbreviata), and some fish species, 2) weakening of coral skeletons through action of boring bivalves and other organisms, 3) abrasion from transportation and deposition of sediment particles, and 4) overturning and smashing of corals during heavy seas. Numerous small fractures in the shallowest zones, especially in inaccessible areas, generally indicate damage from heavy swells and waves.

White band disease and other coral diseases have not been directly correlated with human activities although Peters (1984) suggests that injuries to corals from snorkelers and divers and adverse environmental conditions, such as high turbidity and sediment, could increase the frequency of occurrence. White band disease occurs throughout the Caribbean (Rogers, 1985). National Park Service photographs from the early 1970's at Buck Island Reef National Monument, St. Croix, and a diagram appearing in Robinson (1973) indicate presence of white band disease on Virgin Islands reefs at that time. It is not known if the dramatic increase in visitation to Caribbean coral reef areas and damage resulting from recreational activities have been accompanied by increases in coral diseases.

Sometimes damage is clearly the result of recreational activities. On a number of occasions, we saw dinghies go up on the Hawksnest patch reefs and larger boats hit Windswept. We also observed blue or red anti-fouling bottom paint on coral colonies during our surveys, clearly indicating destruction by boats striking or grounding on the reefs. Divers and snorkelers damage corals by bumping into them or standing on them, and by overturning colonies to reach lobsters. Isolated, broken branches a few feet below the surface of the water usually are a sign of careless or inexperienced snorkelers. Collection of hard corals and sea fans as souvenirs, and black corals in deeper water for making jewelry also takes place.

Residents and tourists who walk on shallow reef flats do considerable damage in some areas. A particularly glaring example is Buccoo Reef, Tobago. In a 1986 letter to the Director of the Conservation Monitoring Centre, International Union for the Conservation of Nature and Natural Resources, the President of the Crusoe Reef Society wrote: "Buccoo Reef has been under severe pressure over the last 20 years. Storms have uprooted large sections of coral and disease has further killed off complete colonies. Man, with apparent ignorance, has put the final touch, plowing areas with different types of anchors, carving channels with the indiscriminate use of outboard engines



-56

and with the protection of various footwear, trampled whatever was left into the sand. Approximately 95% of the shallow reef area has been destroyed. The remaining 5% will disappear within the next two years."

Recently, concern over the enormous quantity of plastic entering the ocean's waters from many sources, including pleasure boats, has increased (Laist, 1987). Fish and birds ingest plastic particles and die. Plastic bags wrap around corals and suffocate the tissues underneath. Reefs in Haulover Bay, St. John, receive large amounts of plastic and other trash from passing boats and probably from Road Town Harbor, Tortola. Large plastic bags full of trash from cruise ships have been found in USVI waters.

In 1977, Gladfelter et al. (1977) assessed human influences at the Buck Island Reef National Monument off St. Croix by examining disturbance from mooring chains and from boats striking the reef. Surprisingly, they found a higher percentage of live coral in areas swept by the chains, concluding that the chains reduced cover by benthic algae which compete with corals for space. One would expect that abrasion by these chains would kill at least small coral colonies. (The authors do not provide information on size or number of corals in their study plots.) At least in the seagrass beds on St. John, anchor chains scour out large areas of the bottom. Scars from boat propellers, and presumably from anchors as well, can take decades to recover (Zieman, 1976).

In a recent VIRMC study, Williams (1987) noted an apparent decrease in the extent of the seagrass beds in Francis and Maho Bays over the last 30 years judging from a series of aerial photographs and comparison of recent benthic maps with a map from 1959 (Kumpf and Randall, 1961). Although the relatively large population of green sea turtles (an estimated 50 individuals) which grazes on these grasses may be stressing them, much of the damage observed in these bays and the general deterioration of the grasses are at least partially attributable to anchoring. As noted above, Francis Bay is probably the most popular anchorage in Virgin Islands National Park. Williams (1987) recommended prohibiting anchoring in as large an area as feasible in Francis and Maho Bays. The present study showed that 46% of the boats surveyed in park waters were damaging seagrass or coral bottoms.

To date, VINP has been spared the extensive damage associated with anchoring of commercial boats such as the shrimp boats in Dry Tortugas, Florida (Davis, 1977) and dramatic groundings of large ships such as the "Wellwood" which damaged an estimated 7.53 ha (75,275 $m^2$) of coral reef bottom off the Florida Keys (Jaap, 1984). However, the amount of damage to park resources currently associated with mini-cruise ships and smaller boats is unacceptable and will only increase unless some management actions are taken.

Some positive steps have been taken:

1. Recent research by the Virgin Islands Resource Management Cooperative has focused attention on the degradation of marine ecosystems in Virgin Islands National Park, and the park's Research and Resources Management staff has developed a Shoreline Management Plan in an effort to balance protection of the park's resources with increased pressure from visitors. Installation of moorings in Francis Bay and other critical, sensitive near shore areas is a key element in this plan. Benthic maps produced in 1984 for the bays in VINP have been an especially good basis for the plan (Beets et al., 1986). As described above, marker buoys are helping to reduce damage to vulnerable reefs. Also, small portions of the seagrass beds in Francis and Maho Bays have been marked off as "no anchoring zones".

2. Wayside exhibits and brochures are being developed to educate visitors as to the fragility of reef areas within VINP. Interpretive programs are focusing more and more on marine resource degradation and possible solutions. NPS is producing a short educational film for cruise ship passengers.

3. The British Virgin Islands National Parks Trust cooperated with dive tour operators to establish moorings at the Wreck of the Rhone Marine Park to decrease anchor damage at this very popular dive site near Salt Island.

4. Looe Key National Marine Sanctuary in Florida has a very effective mooring system (see Halas, 1985), and Billy Causey, the Sanctuary Manager, wrote that "the installation of the buoys has been the most beneficial effort that we could have undertaken to protect our reefs". Similar moorings are being considered for VINP. Educational brochures have been especially helpful.

<u>Recommendations for monitoring and documentation of trends in recreational uses of marine resources</u>

The following recommendations may be useful to people responsible for managing marine protected areas.

1. Record number of visitors, number of boats, and patterns of resource use.

2. Record number of new breaks of branching coral colonies on shallow, heavily visited reefs.

3. Record number of conspicuous anchor scars in seagrass beds.

4. At a minimum, record bottom communities in popular anchorages. When feasible, produce benthic maps.

5. Take sequential underwater photographs from the same locations to document changes in reef structure, e.g., along underwater snorkeling trails.

6. Use aerial photographs to discern large scale changes over time (especially useful for seagrass beds).

7. In some instances it may be feasible to establish transects of seagrass beds and reefs to provide quantitative information for documenting trends in density and amounts of living cover.

Specific recommendations for Virgin Islands National Park

1. Implement the new Shoreline Management Plan; consider further zoning of park waters for certain activities (e.g., fishing) to avoid conflicts among resource users (see Kelleher, 1985 on zoning for Great Barrier Reef, Australia; see Putney, 1987, on resource users in VINP).

2. Consider minimum depth or minimum distance from shore requirements for anchoring in areas where anchoring is allowed.

3. Increase awareness of park regulations and environmental concerns within the park through a series of seminars at the new Virgin Islands Biosphere Reserve Center, through production of more informative brochures for visitors and through further development of interpretive programs (snorkel trips, evening programs, shorewalks); brochures could include information on locations of particularly vulnerable reefs for distribution to charter boat companies and others.

4. Continue long-term monitoring of selected reefs and initiate monitoring of other reefs as necessary; use underwater video cameras to document conditions at the Trunk Bay underwater trail and other key reef sites.

5. Monitor recovery of anchor scars in seagrass beds.

6. Establish a water quality monitoring program in VINP to determine if sewage, oil, and fuel from boats are causing deterioration of water quality in park waters.

7. Consider excluding mini-cruise ships from park waters, or limit them to one or two bays and require that they establish and use moorings.

8. Work toward closer cooperation between the Division of Research and Resources Management and rangers and interpreters to ensure accuracy of information presented to visitors; devise new forms which will be more useful in documenting environmental damage.

## Conclusion

The National Park Service has the responsibility and the obligation to manage Virgin Islands National Park not only as a national park but as a biosphere reserve. As a biosphere reserve, VINP should serve as a protected area for comparison with unprotected areas to allow assessment of environmental trends. Currently, marine resources of Virgin Islands National Park and Biosphere Reserve are suffering unacceptable degradation from development and tourism. More effective management measures are urgently needed to increase protection of these resources.



60'

## LITERATURE CITED


Beets, J., Lewand, L., and Zullo, E. S., 1986. Marine community descriptions and maps of bays within the Virgin Islands National Park/Biosphere Reserve. VIRMC I Research Series Report No. 2.

Davis, G. E., 1977. Anchor damage to a coral reef on the coast of Florida. Biol. Conserv., 11:29-34.

Gladfelter, W. B., Gladfelter, E. H., Monahan, R. K., Ogden, J. C. and Dill, R. F., 1977. Environmental studies of Buck Island Reef National Monument, St. Croix, USVI. Report prepared for the National Park Service. 137 pp.

Halas, J. C., 1985. A unique mooring system for reef management in the Key Largo National Marine Sanctuary. Proc. Fifth International Coral Reef Congress, 4:237-242.

Jaap, W. C., 1984. The ecology of the south Florida coral reefs: a community profile. U.S. Fish & Wildl. Serv. FWS/OBS - 82/08. 138 pp.

Jackson, I. L., 1980. Study of the pleasure boat industry in the British Virgin Islands with emphasis on charter boats. 89 pp.

Jackson, I. L., 1981. A system of marine parks and protected areas for the British Virgin Islands. Eastern Caribbean Natural Area Management Program and BVI Government Report. 69 pp.

Johannes, R. E., 1975. Pollution and degradation of coral communities. In: E. J. Ferguson Wood and R E. Johannes (eds.): Tropical Marine Pollution, Elsevier Oceanography Series, 12.

Kelleher, G., 1985. The Great Barrier Reef Marine Park. In: Marine Parks and Conservation: Challenge and Promise 2:17-28.

Kumpf, H. E., and Randall, H. A., 1961. Charting the marine environments of St. John, U.S. Virgin Islands. Bull. Mar. Sci., 11:543-551.

Laist, D. W., 1987. Overview of the biological effects of lost and discarded plastic debris in the marine environment. Mar. Poll. Bull., 18:319-326.

Peters, E. C., 1981. A survey of cellular reactions to environmental stress and disease in Caribbean scleractinian corals. Helgo. Meers., 37:113-137.




61

Putney, A., 1987. Data synthesis and development of a basis for zoning of the Virgin Islands Biosphere Reserve. VIRMC II Research Series Report No. 15.

Robinson, A. H., 1973. Natural vs. visitor-related damage to shallow water corals; recommendations for visitor management and the design of underwater nature trails in the Virgin Islands. National Park Service Report. 23 pp.

Robinson, A. H., 1976. Recreation, interpretation and environmental education in marine parks: concepts, planning, techniques and future directions. In: Proceedings, An International Conference on Marine Parks and Reserves, Japan. IUCN Publications New Series, No. 37:99-119.

Rogers, C. S., 1985. Degradation of Caribbean and western Atlantic coral reefs and decline of associated fisheries. Proc. Fifth International Coral Reef Congress, 6:491-496.

Rogers, C. S., Suchanek, T. H., and Pecora, F. A., 1982. Effects of Hurricanes David and Frederic (1979) on shallow *Acropora palmata* reef communities: St. Croix, U.S. Virgin Islands. Bull. Mar. Sci., 32:532-548.

Tilmant, J. T., 1987. Impacts of recreational activities on coral reefs. In: B. Salvat (ed.): Human impacts on coral reefs; facts and recommendations. Antenne Museum, E.P.H.E., French Polynesia. pp. 195-214.

Tilmant, J. T., and Schmahl, G. P., 1981. A comparative analysis of coral damage on recreationally used reefs within Biscayne National Park, Florida. Proc. Fourth International Coral Reef Symposium, 1:187-192.

Williams, S. W., 1987. Assessment of anchor damage and carrying capacity of seagrass beds in Francis and Maho bays for green sea turtles. VIRMC III Research Series Report No. 25.

Zieman, J. C., 1976. The ecological effects of physical damage from motor boats on turtle grass beds in southern Florida. Aquat. Bot., 2:127-139.

APPENDIX I

WINDSWEPT REEF
Boats that struck or grounded
on reef from Jun 1985-Jan 1987

| DATE | TIME | BOAT TYPE | BOAT STRUCK REEF | BOAT GROUNDED ON REEF |
|---|---|---|---|---|
| JUN-23-85 | 1400 | POWER BOAT (16') | X | |
| JUL-14-85 | 0915 | POWER BOAT (22') | | X |
| JUL-26-85 | 0600 | POWER BOAT (25') | X | |
| JUL-26-85 | 1500 | POWER BOAT (16') | X | |
| JUL-27-85 | 1820 | POWER BOAT (40') | X | |
| JUL-31-85 | 1700 | SAIL BOAT (36') | X | |
| AUG-04-85 | 0900 | POWER BOAT (50') | X | |
| AUG-04-85 | 1700 | POWER BOAT (25') | X | |
| AUG-18-85 | 1700 | POWER BOAT (20') | | X |
| SEP-02-85 | 1320 | POWER BOAT (18') | X | |
| SEP-04-85 | 1530 | POWER BOAT (14') | X | |
| SEP-04-85 | 1615 | SAIL BOAT (26') | X | |
| SEP-08-85 | 0945 | POWER BOAT (14') | X | |
| SEP-08-85 | 1517 | SAIL BOAT (36') | X | |
| DEC-08-85 | 1100 | POWER BOAT (26') | X | |
| DEC-08-85 | 1535 | POWER BOAT (22') | X | |
| DEC-08-85 | 1630 | SAIL BOAT (28') | X | |
| DEC-08-85 | 1702 | SAIL BOAT (45') | X | |
| DEC-24-85 | 1930 | SAIL BOAT (36') | | X |
| FEB-21-86 | 1900 | POWER BOAT (18') | X | |
| APR-30-86 | 2030 | POWER BOAT ( ? ) | X | |
| MAY-04-86 | 1040 | POWER BOAT (12') | X | |
| MAY-04-86 | 1605 | POWER BOAT (10') | X | |
| NOV-05-86 | 1530 | POWER BOAT (10') | X | |
| JAN-18-87 | 2030 | SAIL BOAT (30') | X | |



63

~~XN-590~~
XN-AB4-590-B

# VIRGIN ISLANDS RESOURCE MANAGEMENT COOPERATIVE

BIOSPHERE RESERVE
RESEARCH REPORT NO. 25

## ASSESSMENT OF ANCHOR DAMAGE AND CARRYING CAPACITY OF SEAGRASS BEDS IN FRANCIS AND MAHO BAYS FOR GREEN SEA TURTLES

Susan L. Williams
West Indies Laboratory
Fairleigh Dickinson University
St. Croix, U.S. Virgin Islands

U.S. MAN AND THE BIOSPHERE PROGRAM

NATIONAL PARK SERVICE

Virgin Islands National Park

September, 1988

64

XN-ABH-590-B

# ASSESSMENT OF ANCHOR DAMAGE AND CARRYING CAPACITY OF SEAGRASS BEDS IN FRANCIS AND MAHO BAYS FOR GREEN SEA TURTLES

1988

BIOSPHERE RESERVE REPORT NO. 25

SUSAN L. WILLIAMS
WEST INDIES LABORATORY
FAIRLEIGH DICKINSON UNIVERSITY
ST. CROIX, U.S. VIRGIN ISLANDS

U.S. DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

AND

VIRGIN ISLANDS RESOURCE MANAGEMENT COOPERATIVE
VIRGIN ISLANDS NATIONAL PARK
P.O. BOX 7789, ST. THOMAS
U.S. VIRGIN ISLANDS 00801

LOCAL CONTRACTING AGENT
ISLAND RESOURCES FOUNDATION
RED HOOK BOX 33, ST. THOMAS
U.S. VIRGIN ISLANDS 00802
(NPS CONTRACT NO. CX-0001-3-0048)

65

## ABSTRACT

Over the past two decades, there has been a serious decline in the seagrass beds in Francis and Maho Bays, St. John, U.S. Virgin Islands. These beds provide habitat and food for one of the largest populations of the endangered species of sea turtles, Chelonia mydas L., the green sea turtle, in U.S. jurisdiction. The population size was estimated at 50 subadult turtles. These turtles exert heavy grazing pressure on the leaves of their preferred food, the seagrass Thalassia, in the bays. In addition to grazing pressure, the seagrass beds are seriously disturbed by the increasing number of boats that anchor in the seagrass, damaging roots and rhizomes. Up to 10% of the seagrass beds in the bays is presently damaged by anchors.

The effects of the grazing and anchor damage were evident in the extremely low productivity of the fragile, achlorotic, short and narrow Thalassia leaves. A carrying capacity for the turtle population was calculated based on this productivity and the feeding requirements of the turtles, estimated by observing turtles directly and remotely using radiotelemetry. The carrying capacity was estimated at 11-31 subadult turtles, indicating that the population may be in danger of decline. The grazing behavior of the turtles differed from the patterns reported previously in that the turtles fed throughout the day without taking characteristic midday breaks in feeding. This difference may be in response to the poor quality and quantity of food provided by the seagrasses in the bays.

Although anchor scars in the bay recovered little during the course of the study, some recovery of Thalassia occurred inside fences that excluded anchor damage and turtles. After 3 months, Thalassia blades inside the fences were significantly longer than outside and the productivity per shoot increased.

In order to protect the turtle population from further habitat degradation, it will be necessary to reduce the damage done by boats in anchoring the seagrass beds in the bays.




- 66

ACKNOWLEDGMENTS

I am indebted to Dan Cooke who executed all phases of logistical, field, and laboratory work, often without assistance. We express our appreciation to the National Park Service, St. John, for its vital logistical support and interest; in particular, Dr. Caroline Rogers, Vonnie Zullo, and the numerous volunteers who assisted Dan Cooke. Rafe Boulon of the Department of Conservation and Cultural Affairs, Division of Fish & Wildlife Service cooperated by helping tag turtles and providing statistics on the turtle population. My interest in this research was initiated through Dr. John Ogden, who facilitated the work through support from the West Indies Laboratory and who offered advice, provided tracking gear, and assisted in a census of the turtle population. Helmut Gieben, Doug Kesling, and Lance Robinson also assisted in this census.



61

TABLE OF CONTENTS


| | Page |
|---|---|
| Abstract | i |
| Acknowledgments | ii |
| Table of Contents | iii |
| List of Tables | iv |
| List of Figures | v |
| Introduction | 1 |
| Stress to *Thalassia* | 1 |
| The research problem | 3 |
| Methods | 5 |
| Seagrass distribution | 5 |
| Seagrass shoot density | 5 |
| Disturbances to seagrass rhizomes and roots | 5 |
| *Thalassia* productivity | 7 |
| Ecology of green turtles: grazing and movement patterns | 7 |
| Turtle exclusion fences | 8 |
| Results | 9 |
| Seagrass distribution | 9 |
| Disturbances to seagrasses | 16 |
| *Thalassia* leaf productivity | 17 |
| Observations on green sea turtles in Francis and Maho Bays | 19 |
| Carrying capacity for green sea turtles | 20 |
| Potential for recovery of *Thalassia* from disturbances | 23 |
| Discussion | 25 |
| Recommendations for management | 27 |
| Recommendations for research | 28 |
| Literature Cited (per Handbook) | 29 |




68

## LIST OF TABLES


| | | Page |
|---|---|---|
| 1. | Density and biomass of *Thalassia* leaf shoots in Maho and Francis Bays. | 10 |
| 2. | Leaf density of *Halodule* and *Syringodium* in bays on the north shore of St. John. | 16 |
| 3. | Frequency of scars in seagrass beds left by anchors or feeding activities of rays. | 19 |
| 4. | Productivity of *Thalassia* leaves in Francis, Maho, and Great Lameshur Bays. | 21 |
| 5. | Percentages of time spent by radio-tagged green turtles in different areas of seagrass beds in Francis and Maho Bays. | 22 |
| 6. | Calculation of the carrying capacity of *Thalassia* in Francis and Maho Bays for green sea turtles. | 22 |
| 7. | Changes in size of anchor scars. | 23 |
| 8. | Comparison of productivity of *Thalassia* leaves grazed by turtles (controls) and protected from turtle grazing and anchor damage (exclosures). | 24 |




69

## LIST OF FIGURES


| | | Page |
|---|---|---|
| 1. | Location of seagrass beds within Francis and Maho Bays, St. John, U. S. Virgin Islands. | 4 |
| 2. | Map of bays on St. John. | 6 |
| 3. | *Thalassia* coverage in three seagrass beds in April 1986. | 11 |
| 4. | *Thalassia* coverage in one seagrass bed in April 1986. | 12 |
| 5. | *Thalassia* coverage in one seagrass bed in September 1986. | 13 |
| 6. | *Thalassia* coverage in three seagrass beds in December 1986. | 14 |
| 7. | *Thalassia* coverage in a seagrass bed in December 1986. | 15 |
| 8. | Mean number of boats anchoring overnight in Francis and Maho Bays. | 18 |




70

# INTRODUCTION

Seagrass beds are valuable natural resources that are easily disturbed by virtue of their coastal location. Once disturbed, seagrass beds can take decades to recover and important functions provided by seagrasses are lost. Such functions include: 1) provision of food, shelter, and nursery areas for many animals including commercially valuable and endangered species; 2) stabilization of sediments and thus protection of coastlines from storm damage; 3) active recycling of elements including heavy and trace metals; 4) ecological linkages with other ecosystems, including mangroves, coral reefs and the deep sea. Mitigation procedures that have been developed for disturbed seagrass beds are imperfect, costly, and labor intensive. This report will discuss disturbances to seagrass beds in Francis Bay and Maho Bay (hereafter referred to as FB and MB respectively) within the National Park on St. John, U.S. Virgin Islands. This study was undertaken to assess whether the seagrasses in FB and MB require protection in order to preserve their ecological functions and the large population of endangered green sea turtles which reside in the bays and utilize the seagrasses for food.

Caribbean seagrass beds growing in less than 15 m water depth, are typically mixed species assemblages of the seagrasses Thalassia testudinum Banks ex Konig, Syringodium filiforme, Kutzing, and Halodule wrightii Aschers. and various macroalgae. Thalassia (turtlegrass) is the dominant species in terms of plant size, leaf shoot density, biomass, and production. Thalassia is the climax species, able to outcompete other seagrasses in the habitat (Williams 1984, 1985, 1987). Various herbivores also prefer Thalassia to other seagrass species (Ogden and Lobel 1978). The ecological functions and biological diversity of seagrass beds in the Caribbean and southeast United States are expressed best in Thalassia beds (Zieman 1982). For such reasons, most seagrass research in the Caribbean and southeast U.S., including this study, has focused on Thalassia.

## Stress to Thalassia

Stress or disturbance to seagrass beds can be categorized into two types having different severity: 1) disturbance to the above-ground photosynthetic portion of the plants, particularly the leaves, and 2) disturbance to the below-ground portion of the plants, i.e., the roots and rhizomes.



- 71

Stress to leaves The less stressful type of disturbance is damage to the above-ground plant. The primary agents of this stress are animals that eat seagrass leaves, thus removing the photosynthetic organ of the plant, although hurricanes can also cause leaf removal. Repeated removal of leaves causes a decline in *Thalassia* productivity (Greenway 1974).

This report considers the chronic stress to *Thalassia* that green sea turtles (*Chelonia mydas*) cause by grazing on *Thalassia* leaves, their preferred food.

Green turtles do not crop *Thalassia* indiscriminately but create discrete grazing scars in the seagrass bed where they return every 7-10 days to crop new leaf growth almost to the substratum. It is hypothesized that this peculiar grazing strategy evolved in response to the poor nutritional quality of seagrass forage. Seagrass leaves are high in lignin, cellulose, and tannins and low in nitrogen; however, young newly-formed leaves have less fiber and almost twice as much protein. Repeated cropping of leaves would assure the turtles of a higher quality food in the regrown leaves.

Although initially repeated cropping stimulates leaf growth, eventually the ability of *Thalassia* to recover after leaf removal declines. Stress to the plant is indicated by slower growth and decreasing leaf shoot density, leaf width and rhizome diameter. The cause of the stress is hypothesized to be nutrient deprivation. Nutrients required for seagrass growth are supplied primarily by remineralization of organic matter from detritus in the sediments (Klug 1980). Leaf cropping by turtles greatly reduces accumulation of detritus within the seagrass bed (Thayer et al. 1985).

Stress to below-ground biomass The second type of stress to seagrasses is disturbance to the roots and rhizomes. This stress tends to be acute because the below-ground portion of the plants is largely responsible for the stability and resiliency of seagrass beds. The roots are the major organs for acquiring nutrients for growth and the rhizome acts as a storage organ, providing carbohydrates for regrowth when leaves are removed (Dawes and Lawrence 1979, Dawes et al. 1979). Areal extension of seagrass beds occurs primarily by vegetative propagation of the rhizome (Tomlinson 1974). The roots and rhizomes provide a stable specialized sedimentary environment for the complex microbial communities responsible for regenerating nutrients required by the seagrasses (Klug 1980, Kenworthy et al. 1982). Once the roots and rhizomes are disturbed, recovery of seagrasses is very slow, on the



72

order of decades (Kelly et al. 1971, Patriquin 1975, Zieman 1976). Once damaged, a Thalassia rhizome takes at least one year to develop a new meristem (Fuss and Kelly 1969). Motor boat propellers, anchors, use of dynamite as a fishing practice, and dredge and fill operations are the principal causes of this type of seagrass disturbance although a minor amount can be caused by feeding activities of benthic fauna, such as rays (Williams et al. 1985).

## The research problem

Francis and Maho Bays contain seagrass beds of Thalassia, Syringodium, Halodule, and various macroalgae (Fig. 1). The seagrasses there are subjected to both categories of stress described above. The bays are the habitat of a large population of green turtles. Grazing by these turtles is so extensive that no discrete grazing scars surrounded by uncropped Thalassia are found. Instead, the bays resemble one huge grazing scar. This observation suggests two points. One, seagrass may be in limited supply as turtle food. Two, all seagrass in the bays is under the stress of leaf removal by grazing turtles, leaving no uncropped plants for regeneration of leaves.

In addition to intensive grazing of leaves, the seagrass roots and rhizomes are being damaged by boat anchors. Over the past several years, the National Park Service (NPS) has documented a dramatic increase in boat usage in FB and MB.

Francis and Maho Bays are a refuge for the endangered green turtle and it is paramount that its habitat be preserved. Disturbance to the seagrasses in FB and MB thus is not limited to the potential subsequent loss of the valuable functions provided by seagrass vegetation but also may include impact on an endangered species. The objectives of this study were to assess the impact of grazing and anchor damage on the seagrass beds of FB and MB to determine the effect such damage has on the green turtle population, and to provide data necessary for resource management plans for the NPS.



73

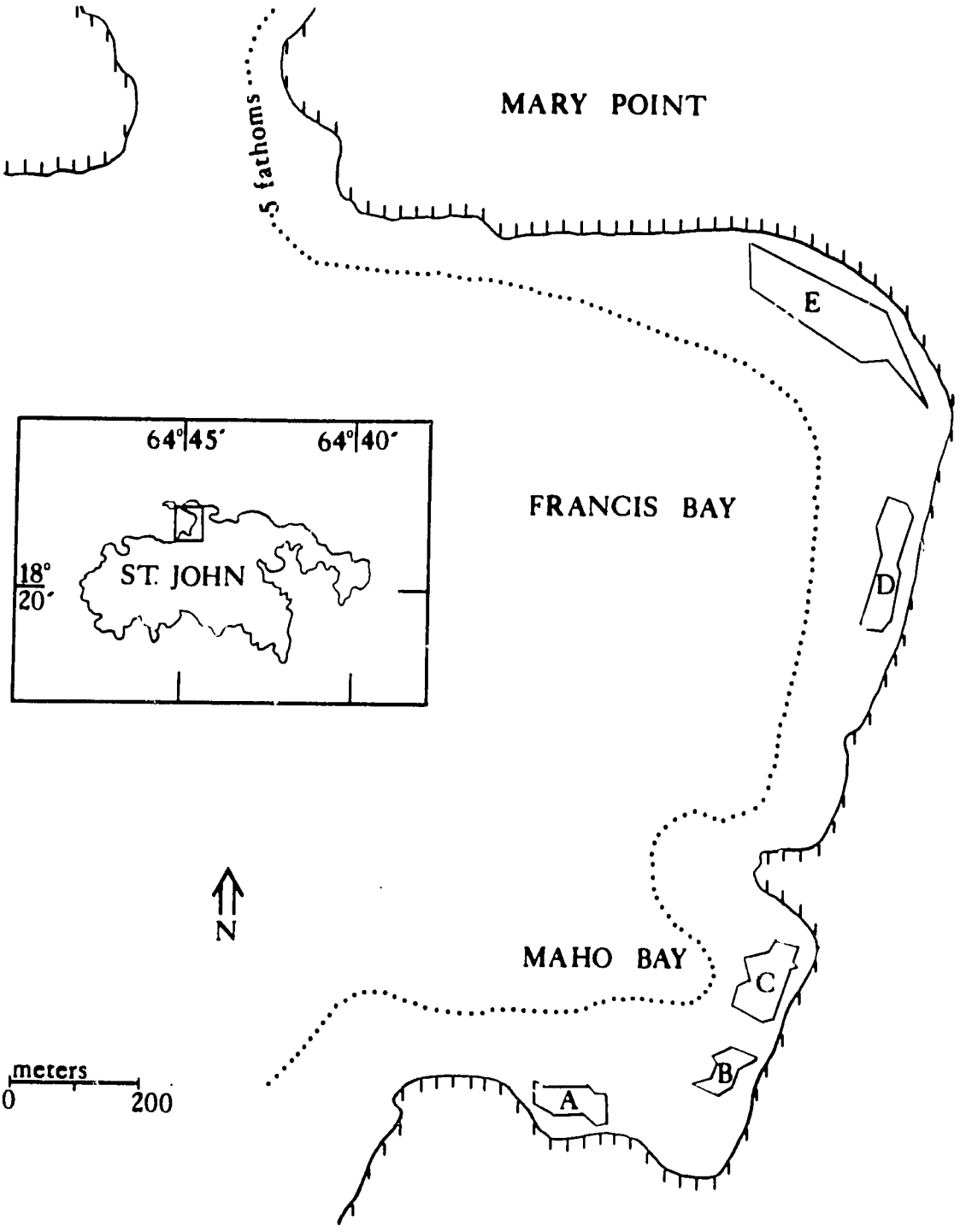



Figure 1. Location of seagrass beds within Francis and Maho Bays, St. John, U.S. Virgin Islands.



74

## METHODS

### Seagrass distribution

An underwater survey of Francis Bay and Maho Bay was made in April 1986 by towing a diver on a sled behind a boat. Seagrass beds thus located were mapped. A 100 m reference transect was placed along the long axis of the bed (i.e., parallel to the shoreline). Successive transects were laid perpendicular to the 100 m reference transect at 10 m intervals. The presence of various seagrass species was recorded every m along the long reference transect and on the intersecting transect. Qualitative descriptions of *Thalassia* leaf shoot density (hereafter referred to as shoot density or density) were recorded likewise. "Good" refers to a shoot density of *Thalassia* per $m^2$ of > 200 shoots, "fair" to 100-200, and "sparse" to < 100. The beds were mapped again in December 1986.

The following bays on the north shore of St. John were surveyed for *Thalassia*: Hawksnest, Trunk, Cinnamon, and Leinster (Fig. 2).

### Seagrass shoot density

Counts of leaves or shoots of each seagrass species were made in August 1986 in Hawksnest, Trunk, Cinnamon, Francis, and Maho bays using 10-20 1/4 $m^2$ quadrats dropped haphazardly from the surface.

Shoot density of *Thalassia* from FB and MB was converted to biomass using a regression between shoot density and dry weight after epiphyte removal using 5% HCl.

### Disturbances to seagrass rhizomes and roots

The density of scars in seagrass beds in FB and MB caused by anchors or feeding activities of stingrays was counted along 50 transects of 10 x 1 m. Ten transects were evenly spaced within each of five seagrass beds (Fig 1). A scar was recognized by a depression in the sediments where damaged rhizomes and few shoots were usually visible. Anchor scars were distinguished from ray feeding scars by being deeper, more elongated, and having more broken rhizomes. Ten anchor scars were measured and marked in June 1986. These scars were remeasured monthly for 7 months. The error associated with measurement was $\pm$ 5 cm. The frequency of boat anchoring in FB and MB was determined daily by counting the boats anchored overnight.



75

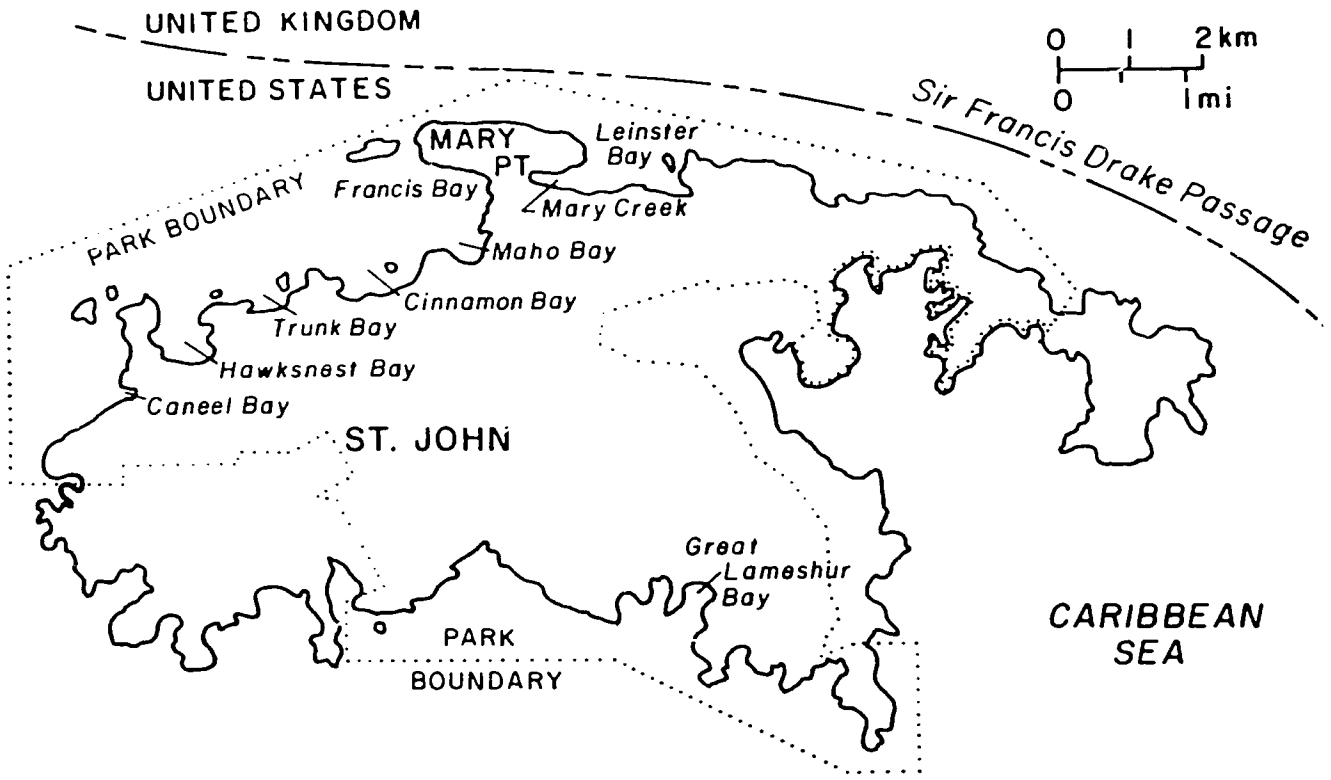



Figure 2. Map of bays on St. John.

Historical records of boat visitation were obtained from the National Park Service. Rays and green sea turtles were censused daily for 105 days along a transect 800 x 1 m in the swim area of FB (site D, Fig. 1).

Thalassia productivity

Thalassia leaf productivity was measured 7 times primarily in MB due to labor constraints. Once, productivity was measured simultaneously in MB and Great Lameshur Bay (GLB). Measurements in GLB were taken in the middle of GLB ca. 50 m from shore. All leaves within 1/4 $m^2$ quadrats were stapled above the meristem and collected 10-11 days later, following procedures of Zieman (1974). Leaf lengths and widths were measured. Epiphytes were removed from leaves with 5% HCl. Leaves were rinsed with fresh water and dried at 90° C and weighed.

Ecology of green turtles: grazing and movement patterns

The goal of this research section was to determine an estimate of the size of the turtle population in FB and MB, feeding rates, and diurnal patterns in feeding.

The size of the turtle population was estimated by daily direct observations by one individual for 10 months. A second estimate was made during one day in August by 5 individuals sighting turtles in defined sections of the bays. The Division of Fish and Wildlife (DFW) independently made three Snabel estimates of the population via capture-recapture techniques during 1986 (R. Boulon, personal communication).

The behavior and grazing rate of Chelonia on Thalassia was determined by observing 11 individual turtles for 57 hours as they fed. Grazing rates were calculated from estimates of the mean dive time of the turtle, mean number of bites taken per dive, and mean number of hours spent feeding per day. A "home range" is defined as the area traversed by a turtle during a normal 24 h day.

Diurnal patterns of grazing and movement of turtles within the bays were also monitored remotely using radiotelemetry (Ogden et al. 1983). Turtles were caught in a 200 x 10 m barrier net placed along the seaward edge of a seagrass bed. Turtles were herded into the net and then brought to the surface by swimmers. Turtles were measured, weighed, and tagged with NMFS monel tags. A subset of these individuals was surgically implanted with ultrasonic transmitters before all were released at the

capture site. The transmitters were 1 x 3-cm cylinders operating at unique frequencies and pulse intervals (Sonotronics, Tucson, AZ.) Antibiotic-coated transmitters were inserted subcutaneously into a 3-cm incision made between the left rear flipper and plastron after local anesthetization. The incision was sutured with digestible gut or nylon. A total of 5 turtles were tagged with transmitters.

Turtles were tracked using a directional hydrophone connected to a receiver and headphone on a small boat inside a transmitting range of 200 m maximum.

Turtle exclusion fences

In order to assess the potential for recovery of Thalassia, turtles and boats were excluded from areas of seagrass in 3 m water depth in the southern part of MB (site A, Fig. 1). Two 4 x 4 m fences of 6 inch (15.2-cm) mesh, extending from the sediment to just above the surface of the water, were placed in the seagrass bed on 1 August 1986. The corners of the fences were supported and anchored by steel reinforcing bars (rebars). Polypropylene guy ropes were attached from each corner and anchored to more rebars driven into the sediment. The emergent fence was painted fluorescent green and surrounded by buoys to alert boaters.

Placement of the fences was determined in the following manner. Fewer boats utilize the southern portion of MB where the fences would be less of a hazard to navigation. We sought to find areas in this section of MB that a priori were as similar as possible in terms of Thalassia density and productivity; however, these parameters are highly variable in FB and MB. Four sites in as similar Thalassia density as possible were identified as large enough for a fence, although one site was visibly more dense. Four productivity measurements were duplicated within each site (n= 8 per site). Two-way analysis of variance (ANOVA) of shoot density leaf, leaf growth rates, and productivity was used to select the most homogeneous sites for the fences and control areas (i.e., among sites, within sites). The site chosen did not differ significantly ($p < 0.05$) in the average leaf elongation rate; however, there were significant differences in density of Thalassia ($p < 0.05$) and productivity ($p < 0.01$). There were no significant differences among plots within a site nor did a site-subplot interaction occur.

Six productivity plots were then established in each exclosure and likewise outside each exclosure (controls). Plots were located in the center of the exclosures to minimize disturbance from the fences and were rotated to new areas at each sampling time to minimize experimental clipping of Thalassia. The control productivity plots were rotated likewise. Nested ANOVA's were used to detect differences in Thalassia productivity among treatments. Fences were checked for fouling and cleaned when necessary.

## RESULTS

### Seagrass distribution

Seagrass distribution in FB and MB has been declining. Kumpf and Randall (1961) reported seagrass beds extending unbroken to the 10 fathom (60'; 18.3 m) depth contour in both bays. Aerial photographs taken in 1975 showed the outlines of discrete small seagrass beds occurring shallower than 18.3 m. These outlines appear relatively unchanged in 1986 but seagrass coverage appears thinner. Seagrass beds of Thalassia, Syringodium, and Halodule cover 54,692 $m^2$ of the bottom of FB and MB (Figs. 3-7). Presently Thalassia is restricted to < 4 m (12') water depth and covers only 39,564 $m^2$ of the delimited seagrass beds. Thalassia typically occurs with Syringodium in the middle of the beds while Syringodium and Halodule grow below the lower depth limit of Thalassia to 6.2 m (20').

The mean density of Thalassia leaf shoots in FB and MB ranged from 80-200 shoots $m^{-2}$, with the density in FB slightly higher than in MB (Table 1). Using a regression between shoot density and dry weight, above-ground biomass was calculated to range from 1.8-4.6 g $m^{-2}$ (Table 1). The leaf shoots appeared unhealthy. There was a reduced number of leaves per shoot (mean = 2.3 $\pm$ 0.5) (Zieman 1982). Leaves were very short and narrow, with a mean length of 3.9 $\pm$ 1.82 cm and width of 4 $\pm$ 0.7 mm (n = 265 leaves. The leaf material was very achlorotic, fragile and easily broken off by handling. It is difficult to estimate shoot density from leaf counts of Halodule because of the variable number of leaves per shoot. Syringodium shoots typically have two leaves, thus, half the leaf density is a reasonable estimate of shoot density.

Table 1. Density and biomass of Thalassia leaf shoots in Maho and Francis Bays. Mean values +/- 1 s.d., n = 10 1/4 $m^2$ quadrats.

| Site | # shoots $m^{-2}$ | g dry $m^{-2}$ |
|---|---|---|
| Maho Bay | | |
| A | 80 ± 85.4 | 1.8 ± 1.96 |
| B | 138 ± 77.1 | 3.2 ± 1.77 |
| C | 134 ± 76.0 | 3.1 ± 1.75 |
| Francis Bay | | |
| D | 200 ± 72.4 | 4.6 ± 1.67 |
| E | 152 ± 76.1 | 3.5 ± 1.75 |

FB and MB represent the only source of Thalassia for turtle grazing on the north shore of St. John between Hawksnest Point and Leinster Point. There was a large Thalassia bed on the south side of Mary Creek in Leinster Bay but most of the Thalassia was on a flat too shallow (<1 m water depth) for grazing by turtles. There was no evidence of grazing on this Thalassia. Watermelon Bay had a small amount of Thalassia growing among rocks in <0.5, water depth. This Thalassia also was ungrazed. The other bays surveyed had no Thalassia. Halodule and Syringodium were found in other northshore bays (Table 2).



80

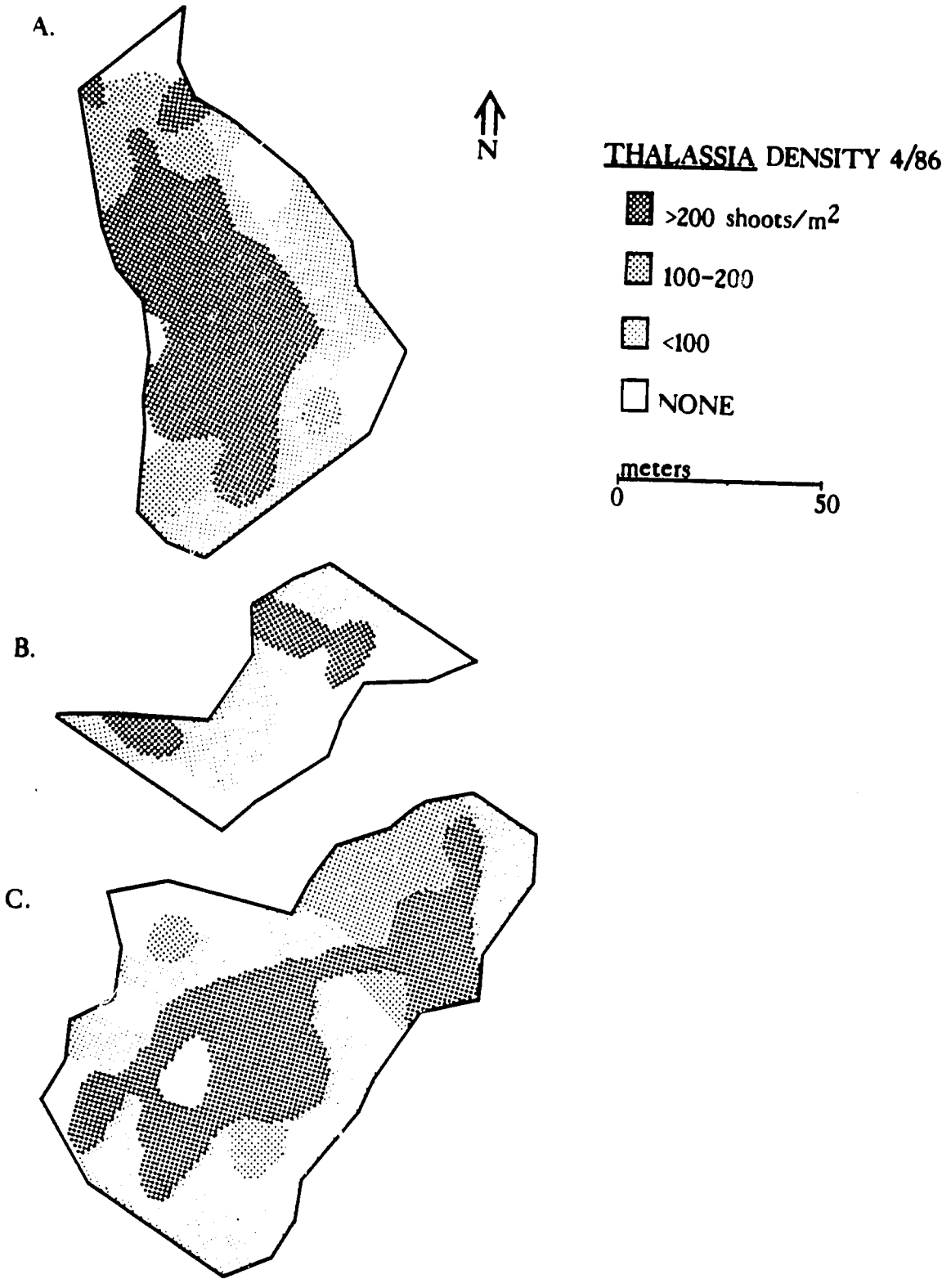



Figure 3. Thalassia coverage in three seagrass beds in April 1986. Refer to Fig. 1 for location within Francis and Maho Bays.

D.

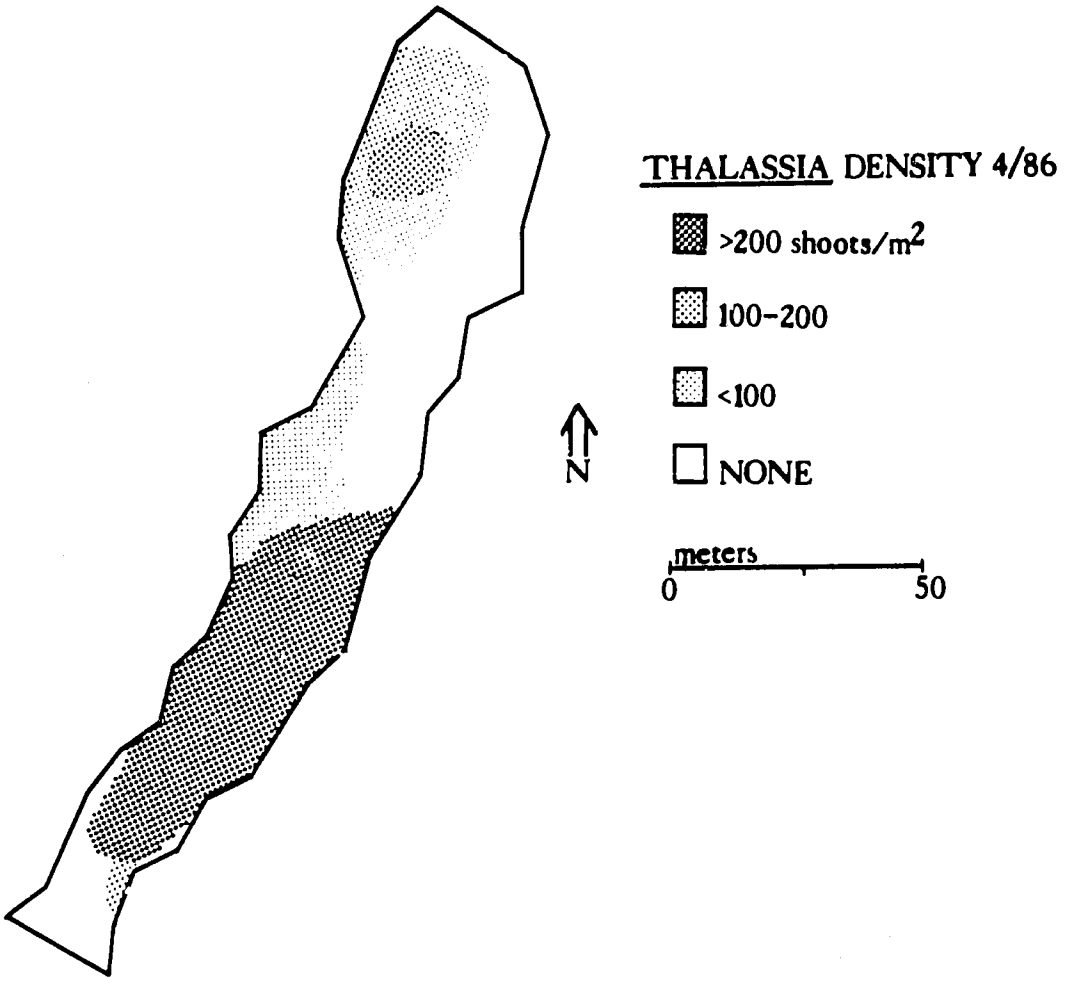



Figure 4. Thalassia coverage in one seagrass bed in April 1986. Refer to Fig. 1 for location within Francis and Maho Bays.

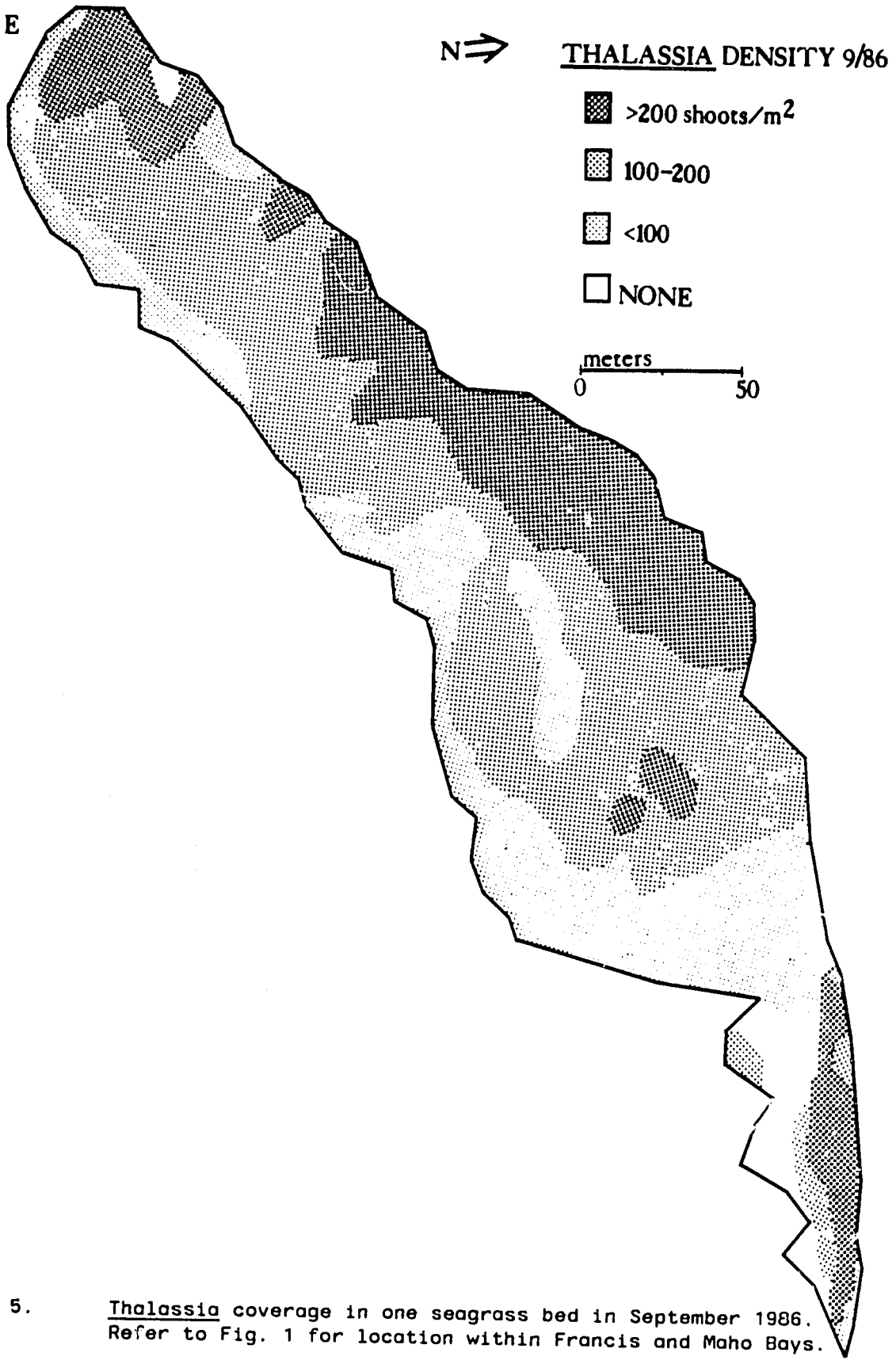



Figure 5. Thalassia coverage in one seagrass bed in September 1986. Refer to Fig. 1 for location within Francis and Maho Bays.

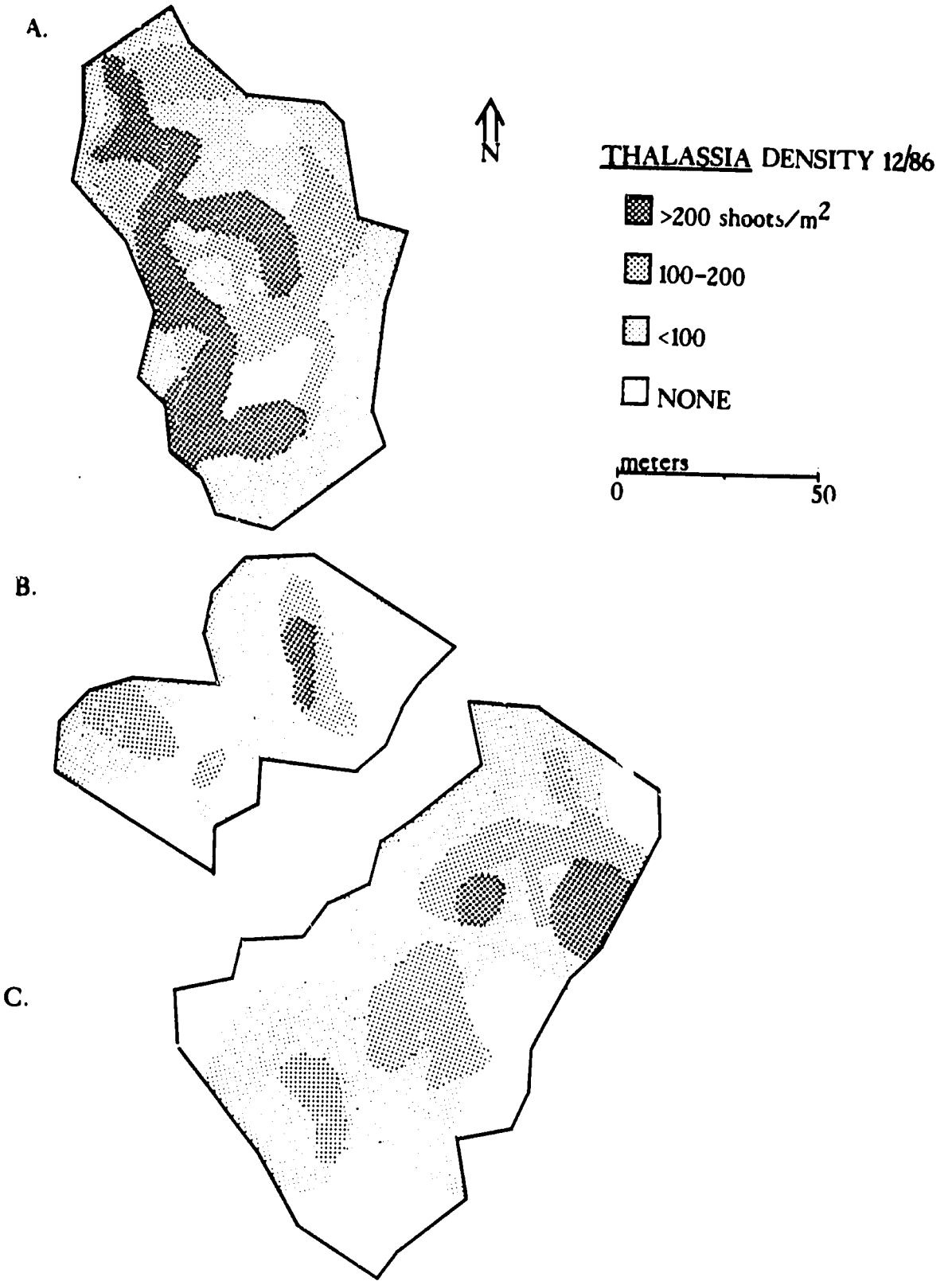



Figure 6. Thalassia coverage in three seagrass beds in December 1986. Refer to Fig. 1 for location within Francis and Maho Bays.

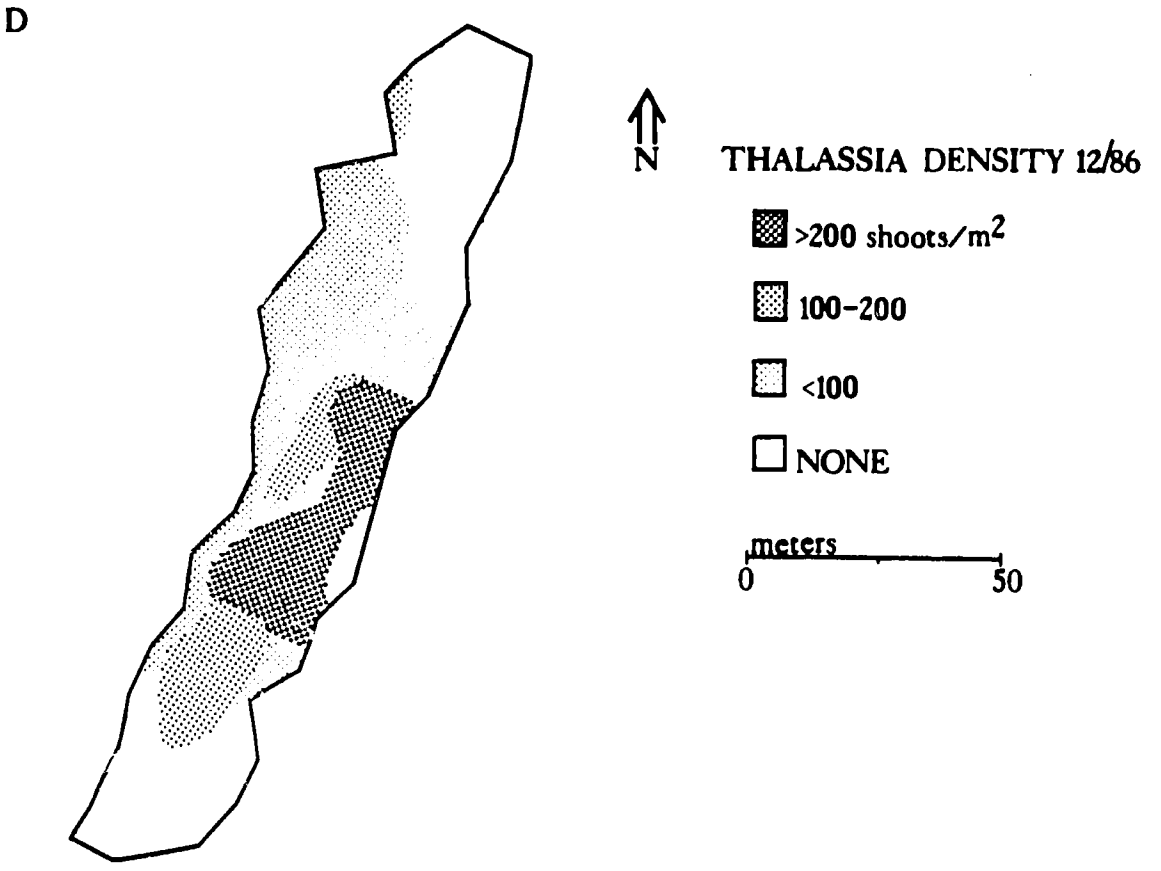



Figure 7. Thalassia coverage in a seagrass bed in December 1986. Refer to Fig. 1 for location in Francis and Maho Bays.



-85-

Table 2. Leaf density of Halodule and Syringodium in bays on the north shore of St. John. Mean values +/- s.d.; n = 20.

| Site | Depth (m) | # Leaves $m^2$ | |
|---|---|---|---|
| | | Halodule | Syringodium |
| Hawksnest Bay | | | |
| western section | 3.1 | 290 ± 141 | 5 ± 10 |
| | 6.1 | 113 ± 98 | 50 ± 48 |
| between public section and Gibney private section[1] | 6.1 | 84 ± 71 | 154 ± 102 |
| Trunk Bay[2] | 6.1 | 143 ± 65 | 0 ± 0 |
| Cinnamon Bay | | | |
| Peter Bay area | 6.1 | 209 ± 115 | 21 ± 3 |

[1]near channel markers
[2]western end of beach by swim buoys

## Disturbances to seagrasses

In MB and FB the major disturbances to seagrasses are boat anchor damage and grazing by green sea turtles. Southern stingrays (*Dasyatis americana*) and bonefish (*Albula vulpes*) create only minor disturbances in FB and MB. Grazing by green sea turtles will be treated in a separate section.

Anchor damage Damage to seagrass roots and rhizomes occurs when boat anchors are set in seagrass. When placed, anchors sever roots and rhizomes. When anchors are pulled up they disturb the sediments by exposing them to highly oxygenated seawater and remove roots and rhizomes from the sediments. Damage multiplies when anchors are dragged through the bottom as inexperienced boat operators use power to set anchors or when several attempts are made to set an anchor.

Boating activities have increased demonstrably in FB and MB (Fig. 8). In 1986, an average of ca. 10 more boats per day anchored than in 1984 or 1985. During the years data were taken, peak anchorage occurred in January through April. In 1986 over 1000 boats anchored in the

bays in both March and April. On certain weekends, 100 boats per day anchored in the bays. Reduced activity occurred over several years from August through October with minimum activity in September. Weekend days harbor more boats than midweek days. These figures are conservative because they represent only boats anchoring overnight and thus do not include the daily turnover of day visitations.

Recognizable anchor scars left in the seagrass beds ranged from 0-1 scar per 10 $m^2$ (Table 3.) The average size of the scars was 0.16 $m^2$. Scars were most numerous along the beach of MB (sites B and C, Fig. 1). This area is the preferred anchorage for a large fleet of pleasure boats that arrives on most holiday weekends when 10-30 boats were rafted together. These boats have been responsible for the loss of research quadrats from the seagrass beds. In contrast, the buoyed area designated for swimming only in FB (site D, Fig. 1.) had no recognizable anchor scars.

Bioturbation The feeding activities of rays cause characteristic scars in the bottom (Williams *et al*. 1985); however, the resultant damage to seagrass roots and rhizomes is not as severe as that created by anchors. Except for the protected swim area of FB (site D, Fig. 1.), scars judged to be caused by rays were less frequent than anchor scars (Table 3). Rays tend to be excluded from well-developed seagrass beds (Ogden 1976), which is another indication of the status of the seagrass in FB and MB. The average sighting of rays on the census transects conducted was one ray every 3.6 $\pm$ 1.9 days or 1 ray per 2857 $m^2$.

Several hundred bonefish were observed feeding in groups of roughly 20 which would merge occasionally into a large school. When schooled, bonefish created a large sediment cloud which settled onto the seagrass blades. Bonefish, however, did not break and expose rhizomes.

Thalassia leaf productivity

The productivity of leaves was measured 9 times from April through November 1986 (Table 4), excluding measurements made during the turtle exclusion experiment to be described later. Productivity ranged from 33-97 mg dry weight $m^{-2}$ $d^{-1}$.

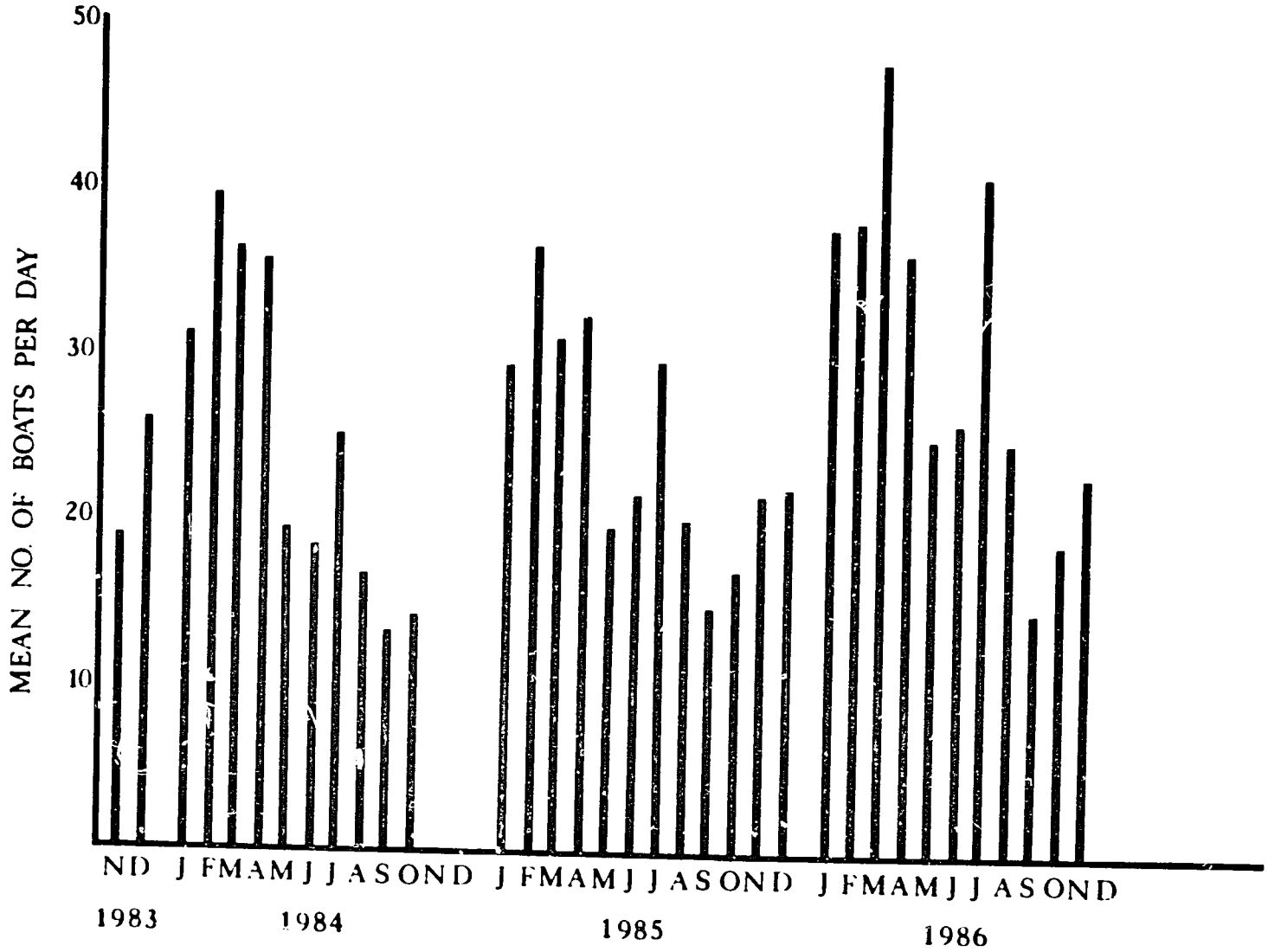



Figure 8. Mean number of boats anchoring overnight in Francis and Maho Bays.

Table 3. Frequency of scars in seagrass beds left by anchors or feeding activities of rays. Mean values +/- s.d., n = 10 transects.

| Site | # Scars 10 $m^{-2}$ | |
|---|---|---|
| | anchor | boat |
| Maho Bay | | |
| A | 0.5 ± 0.1 | 0.3 ± 0.5 |
| B | 0.6 ± 0.8 | 0.1 ± 0.3 |
| C | 1.0 ± 1.2 | 0.2 ± 0.4 |
| Francis Bay | | |
| D | 0 ± 0 | 0.2 ± 0.4 |
| E | 0.1 ± 0.3 | 0.1 ± 0.3 |

The effects of disturbances on the net productivity of the seagrass beds in FB and MB is shown in the comparison (September 1986) between MB and Great Lameshur Bay. GLB is on the south shore of St. John and has few turtles and relatively little usage by boaters, although there may be other, less obvious factors that differ. The mean areal productivity in GLB differed significantly from that in MB at a similar depth ($p < 0.001$). The productivity of Thalassia in GLB was 2.6 times greater than in MB, attributable in part to significantly higher shoot density in GLB ($p < 0.02$). More importantly, the average leaf growth per individual shoot was also significantly higher in GLB ($p < 0.001$). Thalassia in GLB was green and healthy appearing.

## Observations on green sea turtles in Francis and Maho Bays

The green sea turtle population size in FB and MB is estimated at roughly 50 subadults (4-60 kg, averaging 26.2 kg; R. Boulon, pers. com.). The average frequency of turtles sighted on the census transects was 3.1 ± 1.1 turtles per day or 1 turtle per 258 $m^2$. The turtles sighted on the transects were usually one or more of 5-6 individuals. In 1986, DFW tagged 62 individuals during 7 captures in FB and MB (R. Boulon, pers. com). Only three

of these marked individuals were subsequently recaptured and many untagged individuals remain, indicating a fairly high turnover of turtles in the bays. At least 6 individuals, however, maintained their home ranges throughout the 8 months of observation and three recaptured turtles were found where originally caught. The population size remained fairly constant during the study indicating that emigration from the bays was equal to immigration into the bays.

Five turtles were implanted with radio transmitters. One turtle was lost immediately upon release, either moving out of the bays or remaining undetected in the bays due to a disfunctional transmitter. Two turtles were tracked for 103 h between 0430-1200 h, 87 h between 1200-1800 h, and 12 h between 1800-2400 h over 27 days before their transmitters fell out. These individuals were then observed in their home ranges until the end of the study (5 additional months). The other two turtles were tracked for 57 h between 0430-1200 h, 40 h between 1200-1800 h, and 3 h between 1800-2400 h over 17 days before they left the bays.

These radio-tagged turtles maintained discrete home ranges 300 m in diameter, that included areas of the bottom covered by Thalassia and rocks where the turtles slept. Each morning the turtles left their rest area to begin feeding on seagrass approximately 2 h after dawn. The turtles continued to feed for 9 h before retiring to the rocks to sleep. Occasionally a turtle would sleep at midday. No movement occurred at night. The behavior of the turtles tracked was similar to that of other turtles observed in the bays.

The average time that turtles spent on a dive to feed was 3 minutes 52 seconds $\pm$ 1 min. 27 seconds, ranging from 1-9.25 min. During each dive, an average of 20 $\pm$ 4 bites of seagrass were taken per minute, ranging from 10-36. Turtles bit off the upper exposed half of whole shoots of Thalassia, although occasionally an entire shoot would become detached due to the fragility of the seagrass. The frequency of consumption of plants was Thalassia > Syringodium > Halodule and algae.

## Carrying capacity for green sea turtles

Net productivity of Thalassia in FB and MB was estimated to be sufficient to support 11-31 subadult green turtles (Table 6). This estimate is quite close but lower than the estimated population size of 50 turtles. The calculation assumes that all Thalassia productivity goes

to turtle grazing while in reality an undetermined amount of detritus is formed and a minimal amount goes to other herbivores. Syringodium, Halodule, and algae were not considered as food although they were utilized by the turtles. The calculation suggests that if such alternate resources are not utilized at a rate equivalent to grazing of Thalassia, then the resident turtle population would cause a reduction of Thalassia standing stock at a rate of 1-7% $d^{-1}$.

Table 4. Productivity of Thalassia leaves in Francis (FB), Maho (MB), and Great Lameshur (GLB) Bays. Mean values +/- s.d. (s.d. in parenthesis for shoot density). Data are from 1986.

| Date | Site | n | Shoot Density | Productivity | | New Leaf Production |
|---|---|---|---|---|---|---|
| | | | | mg dry $m^{-2}$ $d^{-1}$ | ug dry shoot $^{-1}d^{-1}$ | # $m^{-2}$ $d^{-1}$ |
| 4/8-22 | MB-A | 10 | 67(48) | 33.0 ± 25.8 | 480 ± 82 | 7.3 ± 5.9 |
| | MB-B | 10 | 121(65) | 42.0 ± 23.6 | 350 ± 110 | 3.0 ± 3.2 |
| 5/16-27 | MB-A | 10 | 75(67) | 57.1 ± 32.6 | 670 ± 200 | 4.0 ± 4.1 |
| | MB-B | 10 | 128(76) | 33.3 ± 21.5 | 480 ± 170 | 8.0 ± 5.5 |
| 6/2-13 | MB-A | 32 | 140(46) | 80.6 ± 31.3 | 590 ± 160 | 9.4 ± 5.4 |
| 9/6-14 | MB-A | 10 | 166(53) | 96.5 ± 43.9 | 590 ± 150 | 11.2 ± 5.2 |
| | GLB | 10 | 222(45) | 252.3 ± 70.5 | 1240 ± 260 | 6.6 ± 2.8 |
| 11/12-20 | MB-A | 10 | 164(46) | 72.5 ± 16.0 | 450 ± 78 | 8.3 ± 3.2 |
| | FB | 10 | 202(53) | 86.5 ± 23.0 | 440 ± 130 | 7.5 ± 4.3 |



91

Table 5. Percentages of time spent by radio-tagged green turtles in different areas of seagrass beds in Francis and Maho Bays.

| | TYPE OF SEAGRASS BED | |
|---|---|---|
| | Syringodium and Algae | Syringodium and Thalassia |
| Turtle | | |
| 1 | 50 | 50 |
| 2 | 20 | 80 |
| 3 | 100 | 0 |
| 4 | 0 | 100 |

Table 6. Calculation of the carrying capacity of Thalassia in Francis and Maho Bays for green sea turtles. Data from this study.

| | |
|---|---|
| Grazing Requirements for *Chelonia* | |
| Consumption of *Thalassia*: | 11.5 mg dry bite $^{-1}$ turtle$^{-1}$ |
| Feeding rate: | 1200 bites turtle$^{-1}$ h$^{-1}$ |
| Feeding duration: | 9 h turtle$^{-1}$ d$^{-1}$ |
| Grazing rate: | 124.2 g dry turtle$^{-1}$ d$^{-1}$ |
| *Thalassia* Production | |
| Size of *Thalassia* beds: | 39,463 m$^2$ |
| *Thalassia* productivity: | 33-97 mg dry m$^{-2}$ d$^{-1}$ |
| Total *Thalassia* production: | 1,302 g dry d$^{-1}$ |
| Carrying Capacity: | 11-31 subadult turtles |
| Estimated Impact of Population on *Thalassia* | |
| Population size: | 50 subadult turtles |
| Grazing requirements: | 6210 g dry population$^{-1}$ d$^{-1}$ |
| Grazing requirements unsupported by *Thalassia* productivity: | 2,382-4,908 g dry d$^{-1}$ |
| *Thalassia* standing crop: | 72,612-181,530 g dry |
| Rate of loss of standing crop to grazing: | 1-7% d$^{-1}$ |



92

## Potential for recovery of Thalassia from disturbances

Anchor scars There was little recolonization of anchor scars by seagrasses during 7 months (Table 7). The age of the scars when marked was unknown thus 6 months represent a minimum recovery period. Swells acted to fill the scars with sediment. Regrowth of *Halodule* occurred more frequently than *Syringodium* or *Thalassia* regrowth. *Thalassia* regrowth was limited to one rhizome in one scar.

Turtle Exclusion Experiment There were no significant differences in productivity parameter when exclosures were established in August 1986 (Table 8). After 3 months of being excluded from turtle grazing and anchor damage, *Thalassia* inside the fences showed higher rates of productivity per shoot than the controls. The leaves of *Thalassia* in the exclosure were significantly longer ($p < 0.001$) than those outside: $6.4 \pm 2.7$ cm versus $3.7 \pm 1.8$ ($n = 67$).

Table 7. Changes in size of anchor scars. Length and width of scars in cm. No change in size indicated by "nc".

| DATE | 4/14 | 5/16 | 6/23 | 7/24 | 8/23 | 9/20 | 10/26 | 11/30 |
|---|---|---|---|---|---|---|---|---|
| Scar | | | | | | | | |
| 1 | 35x25 | nc | 35x30 | 45x25 | 55x35 | 40x35 | 25x30 | 35x25 |
| 2 | 45x30 | nc | nc | 35x30 | nc | 40x35 | nc | 40x25 |
| 3 | 50x30 | nc | 50x40 | nc | nc | 40x30 | nc | 35x25 |
| 4 | 60x35 | 60x30 | nc | 40x35 | 55x55 | 40x40 | 30x30 | nc |
| 5 | 45x30 | 40x30 | 35x35 | 35x20 | 40x25 | 35x30 | 35x35 | 35x25 |
| 6 | 35x30 | nc | 40x35 | nc | nc | 40x45 | 35x35 | 30x25 |
| 7 | 40x50 | 35x50 | 55x40 | 50x30 | nc | 45x40 | 45x35 | 35x40 |
| 8 | 70x40 | 60x40 | 55x40 | 60x35 | 55x45 | 55x40 | 35x20 | nc |
| 9 | 40x40 | nc | 45x35 | 50x40 | 60x45 | 50x45 | 45x45 | nc |
| 10 | 40x30 | 45x35 | nc | 50x35 | nc | 40x35 | 40x40 | 45x40 |

Table 8. Comparison of productivity of Thalassia leaves grazed by turtles (controls) and protected from turtle grazing and anchor damage (exclosures). Mean values +/- s.d. n = 6. Mass in dry weight.

| Date | Months Elapsed | Treatment | | Shoot Density | Productivity | | |
|---|---|---|---|---|---|---|---|
| | | | | | mg $m^{-2}$ $d^{-1}$ | ug shoot $^{-1}$ $d^{-1}$ | new lvs $m^{-2}$ $d^{-1}$ |
| 8/1 | 0 | Controls | | | | | |
| | | | East | 85 ± 35 | 42.0 ± 16.0 | 630 ± 520 | 4.3 ± 1.1 |
| | | | West | 83 ± 45 | 53.2 ± 14.9 | 600 ± 171 | 3.3 ± 1.7 |
| | | Exclosures | | | | | |
| | | | East | 117 ± 58 | 52.8 ± 16.3 | 490 ± 110 | 5.4 ± 2.2 |
| | | | West | 100 ± 32 | 64.0 ± 14.8 | 670 ± 100 | 3.6 ± 1.5 |
| 10/31 | 3 | Controls | | | | | |
| | | | East | 109 ± 34 | 67.3 ± 23.7 | 630 ± 200 | 6.0 ± 2.1 |
| | | | West | 177 ± 32 | 78.7 ± 17.3 | 450 ± 85 | 8.7 ± 2.1 |
| | | Exclosures | | | | | |
| | | | East | 147 ± 41 | 108.0 ± 20.0 | 750 ± 170 | 7.5 ± 2.3 |
| | | | West | 106 ± 23 | 95.3 ± 19.8 | 910 ± 150 | 3.8 ± 0.8 |



94

## DISCUSSION

The seagrass beds in FB and MB are very stressed. The extent of the beds has declined dramatically since the 1960's (Kumpf and Randall 1961). This study is the first comprehensive survey of the seagrass in FB and MB since then although Beets and Lewand (1984) described one transect across a depth gradient in MB where seagrass grew to a lower depth of 3 m.

Stress is also evident in the extremely low productivity of Thalassia in FB and MB. A typical range in leaf productivity for Thalassia is 0.7-27 g dry $m^{-2}$ $d^{-1}$ (using carbon conversions and data of McRoy and McMillan 1977; assuming 90% of whole plant productivity is contributed by leaves, Patriquin 1973). Thalassia leaves produce 1-6 g dry $m^{-2}$ $d^{-1}$ in slightly deeper beds in Tague Bay (hereafter referred to as "TB"), St. Croix (Williams, unpublished data). Lameshur Bay on the south shore of St. John provides the best available example of an undisturbed seagrass bed for comparison to FB and MB. Although areal productivity of Thalassia in LB is only in mg $m^{-2}$ $d^{-1}$, the rate is twice as great as in MB.

Density and biomass of photosynthetic shoots and leaf growth rate all contribute to areal productivity. Leaf shoot density is somewhat lower in FB and MB but still within the range of the more undisturbed seagrass beds above for comparison. For example, density of Thalassia ranges from 132-236 shoots $m^{-2}$ in TB on St. Croix and 152-276 in LB. The comparatively low productivity in FB and MB is apparently more a function of sparse stunted leaves and slow growth rates than shoot density. Leaf and biomass in FB and MB ranges from 2-5 g $m^{-2}$ compared to 15-81 in TB (Williams unpubl. data). Thalassia leaves in FB and MB grow < 2 mm $d^{-1}$. Typical rates range from 2-6 mm $d^{-1}$ (McRoy and McMillan 1977).

Similar studies on the effects of grazing by green sea turtles on Thalassia productivity have been made in St. Croix (Tighe 1981, Miller 1981, Zieman et al. 1984). The results are not strictly comparable to FB and MB because no shoot-specific productivity values are available from St. Croix where leaf biomass of turtle-grazed Thalassia is an order of magnitude higher than in FB and MB.

The green sea turtle population in FB and MB is one of the largest in U.S. territory. Grazing by turtles in FB and MB is more intensive than reported elsewhere (Bjorndal 1980, Ogden et al. 1983). Except for a small area in FB, the turtles graze all the seagrass in the bays

rather than creating grazing scars buffered by adjacent ungrazed seagrass. Turtles in FB and MB graze continuously for 9 h daily instead of resting at midday. Despite feeding throughout the day, the turtles consume half the amount reported elsewhere ( $\geq$ 200 g dry turtles$^{-1}$ d$^{-1}$ Fenchel et al. 1979, Bjorndal 1980, Thayer et al. 1982). Consumption rates, however, may be related to turtle size. Turtles in FB and MB were smaller than the 50-170 kg size in the studies cited above. Such differences in feeding behaviour may occur in response to reduced food sources in FB and MB. Thalassia productivity is very low. Achlorotic leaves suggests nitrogen stress and thus poor quality forage.

The suboptimal quality of FB and MB as habitat for the turtles is also expressed in its low carrying capacity of 1 subadult turtle per 1000-3600 m$^2$. Bjorndal (1981) calculated a much higher capacity of 1 turtle per 72 m$^2$ for a less disturbed Thalassia bed despite using a higher consumption rate. The turtle population in FB and MB is presently at or above its carrying capacity. If alternate food resources cannot be utilized at the necessary rate, a decline in the population is predicted. If declines in the seagrass or its productivity continue, the carrying capacity will be further reduced. Whether green turtles have become concentrated in FB and MB in response to the decline of seagrass beds on St. John over the years is unknown. FB and MB, however, are presently the sole source of Thalassia, the turtles' preferred food, on most of the north shore of St. John. Other bays on the north shore support smaller populations of juvenile turtles.

Damage to the seagrass caused by anchors in FB and MB is more serious than grazing by turtles because anchors destroy the regenerative capacity of seagrass roots and rhizomes. An average of 2.5-6.5 m$^2$ of the bottom of the bays is destroyed by boat anchors every day. If one quarter of the damage occurs in the existing seagrass beds, 0.7-1.8% of the seagrass beds will be lost yearly and the carrying capacity for turtles will be reduced accordingly.

Thalassia is extremely slow to recover from disturbances and often requires decades once roots and rhizomes are uprooted (e.g., Fuss and Kelly 1969, Kelly et al. 1971, Patriquin 1975, Zieman 1976). Uprooted quarter m$^2$ plots completely surrounded by a dense well-developed seagrass bed on St. Croix required 4-5 years to recover their former seagrass vegetation (Williams unpubl. data). Initial regrowth into anchor scars in this study took at least 6 months and the colonizing plant was Halodule more frequently than Thalassia. Although only 3 months of data



96

were obtained after the turtle (and boat) exclosures were established, initial results are promising for recovery of Thalassia when protected. Longer leaves inside the exclosures provided more photosynthetic area and although areal productivity changed little, the productivity per shoot increased.

Recommendations for management

The seagrass beds in FB and MB are in critical need of preservation. They provide a large population of endangered green turtles with the only source of their preferred food Thalassia on the north shore of St. John. The bays are at or above their carrying capacity for the turtles. This carrying capacity appears low compared to less disturbed Thalassia as a result of the suboptimal seagrass forage (i.e., low productivity, low biomass). Perhaps in response to the poor food resources, which are nevertheless the best available, the turtles exhibit deviations from the feeding behavior observed in less disturbed seagrass beds.

Reduction or elimination of anchorage in the existing seagrass beds is recommended. The temporary buoys established in September 1986 in the seagrass beds in FB appeared to be effective at restricting boats. Restrictive demarcation of boats in the bays should extend as far beyond the lower depth limit of seagrass growth as feasible. The additional zone may enable the beds to expand after several years; presently, this would be the only means of increasing the carrying capacity of the beds and reducing the grazing stress--assuming that the turtle population does not increase.

The consequences of taking no management action are profound, given the increase in boating activity and the decline in the seagrass beds to their current fragile state. Sustained loss of the seagrass would have a large effect on the turtle population. Loss of the seagrass could also result in loss of the valuable beaches in FB and MB. Seagrasses exert considerable influence on water motion and sediment transport processes and stabilize sediments (Scoffin 1970, Burrell and Schubel 1977, Fonseca et al. 1982, Fonseca et al. 1983). Although sparse, the seagrass beds in FB and MB may be preventing beach erosion.

Procedures for mitigation of loss of seagrass beds have been developed; they include transplantation of intact plugs of seagrass of seedlings (Thorhaug and Austin 1976, Lindall et al. 1979, Thayer et al. 1982, Phillips and Lewis 1983). Presently, however, results from



97

experimental restorations are not consistent (Fonseca 1987). Seedlings are prohibitively expensive at $182,900/hectare and their survival is < 30%. Plugs show a higher survival rate and cost $27,000-85,000/hectare. Plugs need to be taken from a nearby source seagrass bed. Because of the resultant damage to the source bed and the long recovery time involved, the plug technique has been recommended only where there are nearby source beds scheduled for destruction. Material for FB and MB would have to come from the south shore. Because of the relatively steep slope of FB and MB and the exposure to ocean swells, transplanted plugs are likely to fare poorly and seedlings would not be recommended. If these procedures are pursued, transplants would require protection from anchors and grazers.

Recommendations for research

The following list provides recommendations for research topics to follow this study:

1. Determine the amount of forage other than *Thalassia* in the turtles' diets and calculate a carrying capacity including all food resources.

2. Determine the nutritional quality of the forage (protein and carbohydrate analyses).

3. Monitor changes in productivity and shoot density of *Thalassia* in the exclusion cages every 4-5 months for at least 1 year. If cages are removed, observe grazing on the previously protected *Thalassia* to determine if it is preferred.

4. Map the seagrass beds every 3-5 years.

5. Monitor anchoring that occurs in the seagrass beds.

6. Monitor the turtle population for changes in size and growth rates of individuals.

7. Monitor seagrass size, density, and productivity within areas protected from boating activities.



98

## LITERATURE CITED


Beets, J. and Lewand, L., 1984. Marine community descriptions and maps of bays within the Virgin Islands National Park/Biosphere Reserve, St. John, U.S. Virgin Islands. Draft report to VIRMC, #1.1.

Bjorndal, K.A., 1980. Nutrition and grazing behavior of the green turtle Chelonia mydas. Mar. Biol., 56:147-154.

Bjorndal, K.A., 1981. The consequences of herbivory for the life history pattern of the Caribbean green turtle, Chelonia mydas. In: K.A. Bjorndal (Editor), Biology and conservation of sea turtles. Smithsonian Institution Press, Washington, D.C., pp. 111-116.

Burrell, D.C. and Schubel, J.R., 1977. Seagrass ecosystem oceanography. In: C.P. McRoy and C. Helfferich (Editors), Seagrass ecosystems: a scientific perspective. Marcel Dekker, New York, pp. 195-232.

Dawes, C.J., Bird, K., Durako, M., Goddard, R., Hoffman, W., and McIntosh, R., 1979. Chemical fluctuations due to seasonal and cropping effects on an algal-seagrass community. Aquat. Bot., 6:79-86.

Dawes, C.J. and Lawrence, J.M., 1979. Effects of blade removal on the proximate composition of the rhizome of the seagrass Thalassia testudinum Banks ex Konig. Aquat. Bot., 7:255-266.

Fenchel, T.M., McRoy, C.P., Ogden, J.C., Parker, P., and Rainey, W.E., 1979. Symbiotic cellulose degradation in green turtles, Chelonia mydas L. Appl. Environ. Microbiol., 37:348-350.

Fonseca, M.S., 1987. Habitat development applications: use of seagrass transplanting for habitat development on dredged material. In: M.C. Landin and H.K. Smith (Editors), Beneficial uses of dredged material: Proceedings of the 1st interagency workshop. USACE Tech. Report D-87-1, pp. 145-150.

Fonseca, M.S., Fisher, J.S., Zieman, J.C., and Thayer, G.W., 1982. Influences of the seagrass, Zostera marina L. on current flow. Est. Coast. Shelf Sci., 15:351-364.




99

Fonseca, M.S., Zieman, J.C., Thayer, G.W., and Fisher, J.S., 1983. The role of current velocity in structuring eelgrass (Zostera marina L.) meadows. Est. Coast. Shelf Sci., 17:367-380.

Fuss, C.M. and Kelly, J.A., 1969. Survival and growth of sea grasses transplanted under artificial conditions. Bull. Mar. Sci., 19:351-365.

Greenway, M., 1974. The effects of cropping on the growth of Thalassia testudinum (Konig) in Jamaica. Aquaculture, 4:199-206.

Kelly, J.A., Fuss, C.M., and Hall, J.R., 1971. The transplanting and survival of turtle grass, Thalassia testudinum, in Boca Ciega Bay, Florida. Fish. Bull., 69:273-280.

Kenworthy, W.J., Zieman, J.C., and Thayer, G.W., 1982. Evidence for the influence of seagrasses on the benthic nitrogen cycle in a coastal plain estuary near Beaufort, North Carolina (USA). Oecologia (Berl.), 54:152-158.

Kumpf, H.E. and Randall, H.A., 1961. Charting the marine environments of St. John, U.S. Virgin Islands. Bull. Mar. Sci., 11:543-551.

Klug, M.J., 1980. Detritus-decomposition relationships. In: R.C. Phillips and C.P. McRoy (Editors), Handbook of seagrass biology: an ecosystem perspective. Garland STPM Press, New York, pp. 225-245.

Lindall, W.N., Jr., Mager, A., Jr., Thayer, G.W., and Ekberg, D. R., 1979. Estuarine habitat mitigation planning in the southeast. In: G.A. Swanson (Tech. Coord.), The mitigation symposium: a national workshop on mitigating losses of fish and wildlife habitats. U.S. Dept. Agric., Fort Collins, CO, pp. 129-135.

McRoy, C.P., and McMillan, C., 1977. Productivity and physiological ecology of seagrasses. In: C.P. McRoy and C. Helfferich (Editors), Seagrass ecosystems: a scientific perspective. Marcel Dekker, New York, pp. 53-88.

Miller, S.L., 1981. Some plant responses to habitual heavy grazing by Chelonia mydas L. Unpubl. student report. West Indies Laboratory, St. Croix, U.S. Virgin Islands, 22 pp.

Ogden, J.C., 1976. Some aspects of herbivore-plant relationships in Caribbean reefs and seagrass beds. Aquat. Bot., 2:103-116.

Ogden, J.C., Robinson, L., Whitlock, K., Dagenhart, H., and Cebula, R., 1983. Diel foraging patterns in juvenile green turtles (Chelonia mydas L.) in St. Croix, United States Virgin Islands. J. Exp. Mar. Biol. Ecol., 66:199-205.

Ogden, J.C. and Lobel, P.S., 1978. The role of herbivorous fishes and urchins in coral reef communities. Env. Biol. Fish., 3:49-63.

Patriquin, D.G., 1973. Estimation of growth rate, production , and age of the marine angiosperm Thalassia testudinum Konig. Carib. J. Sci., 13:111-123.

Patriquin, D.G., 1975. "Migration" of blowouts in seagrass beds at Barbados and Carriacou, West Indies, and its ecological and geological implications. Aquat. Bot., 1:163-189.

Phillips, R.C. and Lewis, R.L., III, 1983. Influence of environmental gradients on variations in leaf widths and transplant success in North American seagrasses. Mar. Tech. Soc. J., 17:59-68.

Scoffin, T.P., 1970. The trapping and binding of subtitdal carbonate sediments by marine vegetation in Bimini Lagoon, Bahamas. J. Sed. Petrol. 40:249-273.

Thayer, G.W., Bjorndal, K.A., Ogden, J.C., Williams, S.L., and Zieman, J.C., 1985. Role of large herbivores in seagrass communities. Estuaries, 7:351-376.

Thayer, G.W., Engel, D.W., and Bjorndal, K.A., 1982. Evidence for short-circuiting of the detritus cycle of seagrass beds by the green turtle, Chelonia mydas L. J. Exp. Mar. Biol. Ecol., 62:173-183.

Thorhaug, A. and Austin, C.B., 1976. Restoration of seagrasses with economic analysis. Environ. Conserv., 3:259-268.

Tighe, S.A., 1981. Grazing of seagrasses by the green turtle (Chelonia mydas) in St. Croix, U.S.V.I. Rutherford, New Jersey, Fairleigh Dickinson Univ., 33 p.p. MS thesis.

Tomlinson, P.B., 1974. Vegetative morphology meristem dependence-the foundation of productivity in seagrasses. Aquaculture, 4:107-130.

Williams, S.L., 1984. Seagrass ecosystem succession: a manipulative experiment. Proc. Assoc. Is. Mar. Labs. Carib., 18:6.

Williams, S.L., 1985. Factors affecting seagrass recolonization. Estuaries, 8:16A.

Williams, S.L., 1987. Competition between the seagrasses Thalassia testudinum and Syringodium filiforme in a Caribbean lagoon. Mar. Ecol. Prog. Ser., in press.

Williams, S.L., Breda, V.A., Anderson, T.W., and Nyden B.B., 1985. Growth and sediment disturbances of Caulerpa spp. (Chlorophyta) in a submarine canyon. Mar. Ecol. Prog. Ser., 21:275-281.

Zieman, J.C., 1974. Methods for the study of the growth and production of turtle grass, Thalassia testudinum Konig. Aquaculture, 4:139-142.

Zieman, J.C., 1976. The ecological effects of physical damage from motor boats on turtle grass beds in southern Florida. Aquat. Bot., 2:127-139.

Zieman, J.C., 1982. The ecology of the seagrasses of south Florida: a community profile. U.S. Fish & Wildlife Service, Office of Biological Sciences, Washington, D.C. FWS/OBS-82/25, 158 pp.

Zieman, J.C., Iverson, R.L., and Ogden, J.C., 1984. Herbivory effects on Thalassia testudinum leaf growth and nitrogen content. Mar. Ecol. Prog. Ser., 15:151-158.



102

XN-ABH-590-C

# VIRGIN ISLANDS RESOURCE MANAGEMENT COOPERATIVE

BIOSPHERE RESERVE
RESEARCH REPORT NO. 26

## BUCK ISLAND FISH AND SHELLFISH POPULATIONS

William Tobias
Department of Planning and Natural Resources
Division of Fish and Wildlife
St. Croix, U.S. Virgin Islands

Eric Telemaque
West Indies Laboratory
Fairleigh Dickinson University
St. Croix, U.S. Virgin Islands

Michael Davis
Virgin Islands National Park
St. Croix, U.S. Virgin Islands

U.S. MAN AND THE BIOSPHERE PROGRAM

Virgin Islands National Park

September, 1988

102

XN-ABH-590-C

# BUCK ISLAND FISH AND SHELLFISH POPULATIONS

1988

BIOSPHERE RESERVE REPORT NO. 26

WILLIAM TOBIAS
DEPARTMENT OF PLANNING AND NATURAL RESOURCES
DIVISION OF FISH AND WILDLIFE
ST. CROIX, U.S. VIRGIN ISLANDS

ERIC TELEMAQUE
WEST INDIES LABORATORY
FAIRLEIGH DICKINSON UNIVERSITY
ST. CROIX, U.S. VIRGIN ISLANDS

MICHAEL DAVIS
VIRGIN ISLANDS NATIONAL PARK
ST. CROIX, U.S. VIRGIN ISLANDS

U.S. DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

AND

VIRGIN ISLANDS RESOURCE MANAGEMENT COOPERATIVE
VIRGIN ISLANDS NATIONAL PARK
P.O. BOX 7789, ST. THOMAS
U.S. VIRGIN ISLANDS 00801

LOCAL CONTRACTING AGENT
ISLAND RESOURCES FOUNDATION
RED HOOK BOX 33, ST. THOMAS
U.S. VIRGIN ISLANDS 00802
(NPS CONTRACT NO. CX-0001-3-0048)

104

# ABSTRACT

A fish and shellfish (conch and lobster) population study was conducted from November 1985 through June 1986 at Buck Island Reef National Monument (BUIS), St. Croix, U. S. Virgin Islands. The objectives of the project were: (1) to replicate fish census studies conducted by previous researchers in BUIS and compare their results to the present study; (2) to evaluate the impact of commercial trap fishing on BUIS reef fish and lobster populations; (3) to collect baseline data on conch and lobster populations at specific sites within BUIS; (4) to determine the effectiveness of the protective legislation at BUIS in sustaining or increasing fish and shellfish populations; and (5) to develop a long-term monitoring scheme for BUIS fish and shellfish populations.

Based on reef fish community census studies at BUIS, an area of limited fishing pressure, and Tague Bay, an area of unrestricted fishing pressure, BUIS reef fishes are decreasing at a rate equal to or greater than reef fishes at Tague Bay. The most abundant group of commercially important reef fish species present within BUIS are the herbivores, represented by the surgeonfishes (blue tang, and ocean surgeonfish) and parrotfishes (stoplight, princess, redtail and red band).

Mean conch density in the seagrass bed west of Buck Island for the six-month study period was 1 conch/7m$^2$. More than 98% of the conch censused were juveniles--those lacking a flared lip.

The average density of Caribbean spiny lobster for the six-month study period at the west patch reef (WPR), north patch reef (NPR) and south fringing reef (SFR) was 1.2 lobster/624 m$^2$, 1.5 lobster/165 m$^2$ and 1.3 lobster/1500 m$^2$, respectively.

Based on past sampling interviews with commercial fishermen and fish trap studies conducted in BUIS, estimates on commercial fishing effort with fish traps in BUIS indicate that 6,656 lbs. of reef fish and 1,996 lbs. of lobster may be removed from BUIS waters each year by 16 fish traps hauled twice/week. Additionally, an estimated 8,320 lbs. of fish are removed by 29 fish traps adjacent to BUIS waters. Although limited to two lobster and two conch/person/day from BUIS waters, the recreational harvest of these resources, unknown at present, may be substantial, based on 60,000 BUIS visitors/year.

Due to the small size of the protected area afforded by BUIS, reef fish and shellfish (conch and lobster) are adversely impacted by a relatively small but concentrated commercial and recreational fishing effort both in and adjacent to park waters. This impact may be exacerbated by the environmental degradation of the coral reef ecosystem due to natural and man-induced causes.




105

## ACKNOWLEDGEMENTS

The authors wish to thank Hector Rivera, Theodore Skov and Willy Ventura of the Division of Fish and Wildlife for their assistance during various phases of the field work, and Jim Beets for his analysis of biostatistical reef fish data. This project could not have been accomplished without the logistical support and interest provided by the National Park Service, St. Croix, in particular, by Supervisory Ranger Felix Revello and Ranger Joel Tutein. Dr. William B. Gladfelter of West Indies Laboratory provided help with methods and statistical procedures, and Dr. John Ogden of West Indies Lab edited the final drafts of the manuscript. This is Contribution No. 173 of the West Indies Laboratory, Fairleigh Dickinson University, St. Croix, U. S. Virgin Islands.

## TABLE OF CONTENTS

Abstract..... i
Acknowledgements..... ii
Table of Contents.....iii
List of Tables..... iv
List of Figures..... iv
Introduction..... 1
Methods..... 2
  Reef Fish..... 2
  Conch..... 5
  Lobster..... 5
  Fishing Effort..... 5
Results..... 6
  Reef Fish..... 6
  Conch..... 9
  Lobster..... 10
  Fishing Effort..... 10
Discussion..... 10
  Fish Community Structure..... 10
  Conch..... 12
  Lobster..... 13
  Fishing Effort..... 13
Conclusions..... 14
Recommendations..... 15
References..... 17



107

## LIST OF TABLES

1. A comparison of reef fish species census data for BUIS and Tague Bay. .....19

2. Number of individuals, relative abundance (percent) and mean size of commercially important reef fish species observed at BUIS, January - June 1986.....22

3. Biostatistical comparison of the 12 most common species of reef fish caught in fish traps deployed in BUIS and adjacent waters, Tague Bay and Lang Bank.....23

4. Conch census data for two permanent transect areas located east of "E" buoy within the boundaries of BUIS.....24

5. Lobster census data for three survey areas (West Patch Reef, North Patch Reef and South Fringing Reef) within the boundaries of BUIS.....25

6. Data on fish trap effort in, near, and adjacent to BUIS.....26

## LIST OF FIGURES

1. The location of fish and shellfish study sites at Buck Island Reef National Monument and commercial fish traps.....27



108

## INTRODUCTION

Buck Island Reef National Monument (BUIS), located approximately 9.0 km (5.6 mi.) northeast of Christiansted, St. Croix, and 1.6 km (1.0 mi.) north of Tague Bay, St. Croix, consists of a land mass of 0.7 sq. km (180 ac) and surrounding marine environs of 3.0 sq. km (740 ac). Managed by the U. S. Department of the Interior, National Park Service, BUIS receives approximately 60,000 visitors each year.

In an effort to preserve the marine resources within the boundaries of BUIS without completely restricting traditional local commercial fishing, protective legislation was enacted during acquisition of Buck Island by the National Park Service in 1962. This was done to prohibit fishing of any type within the area designated as the "marine gardens" (the area within the eastern barrier reef system of Buck Island) and to allow fish trapping and line fishing in the remaining waters. Lobster and conch fishing were reduced to two spiny lobster and two conch per person per day outside the "marine gardens". The effects of this protective legislation within BUIS on commercial fisheries are not fully known. Despite this limited protection, concessionaires and park rangers report that they have observed a severe decline in BUIS fish populations over the years. Fish populations at BUIS are believed to be decreasing at nearly the same rate as adjacent St. Croix reef areas because of the impact from trap fishing, the principal commercial fishing method employed by artisanal fishermen.

The traditional Virgin Islands commercial fishery is a multi-species, multi-method fishery, due to both the limited availability of any one species for profitable commercial exploitation year-round and the artisanal nature of the fishery. This fishery has been and continues to be based upon fisheries resources associated with the narrow insular shelf around the U.S. and British Virgin Islands. Data presented by Olsen and LaPlace (1978), Olson et al. (1983) and Wood and Olsen (1983) show that these resources have been over-harvested in the past or are approaching the limits of their resource potential.

Fish community structure at BUIS was studied by Gladfelter et al. (1977) using visual census techniques. Their results indicate that the fish community at the eastern barrier reef system of Buck Island consisted of a high abundance of individuals (several species of parrotfish, damselfish and snappers); however, species diversity was low. Those individuals present were relatively large in size. Simpson (1979) studied the



109

changes in fish community structure at BUIS monthly over a one-year period by visual techniques and employed fish traps to study the effects of fishing pressure on the growth rate and size of fish in BUIS vs. Tague Bay. Fish abundance was found to be greater during the fall and winter months and diversity varied according to the type of habitat available. Based on fish trapping results, only two species of fish were found to be significantly larger within BUIS (low fishing pressure) than in Tague Bay (moderate fishing pressure). Differences in the rate of growth of fishes were not apparent with the methods used during the study period.

This report represents the results of a cooperative study, conducted by the Division of Fish and Wildlife (DFW), Fairleigh Dickinson's West Indies Laboratory (WIL), and the National Park Service (NPS), on the Buck Island fish and shellfish populations during the period November 1985 to June 1986. The objectives of the project were: (1) to replicate fish census studies conducted by previous researchers in BUIS and compare these results to the present study; (2) to evaluate the impact of commercial trap fishing on BUIS reef fish and lobster populations; (3) to collect baseline data on conch and lobster populations at specific sites within BUIS; (4) to determine the effectiveness of the protective legislation at BUIS in sustaining or increasing fish and shellfish populations; and (5) to develop a long-term monitoring scheme for BUIS fish and shellfish populations. Emphasis was placed on resurveying specific habitat areas studied by previous researchers and standardizing new methodologies for assessing previously unsurveyed marine resources. The DFW assumed overall project responsibility and conducted census surveys of commercially important fisheries resources including reef fish, conch and lobster. The WIL maintained administrative responsibility for the project and conducted reef fish census surveys. The NPS provided logistical support including boat transportation to the study site, diving assistance, establishment of study transects and a visual survey of the commercial trap fishing effort in and adjacent to BUIS waters.

## METHODS

### Reef Fish

The present fish community structure at BUIS was determined by employing visual census techniques, consisting of replicate 15-20 minute timed censuses with scuba equipment, at four sites (north patch reef - NPR, south patch reef - SPR, reef crest - RC, and deep fore reef/bank bottom - FR) (Figure 1). These sites were located in the "marine gardens", which is an area restricted to all fishing. Two sites in Tague Bay (Patch Reef #2 and Patch Reef #8) were also selected for comparative purposes (Figure 1 in Gladfelter and Gladfelter, 1978, reef fish census).



110

These patch reefs represent areas of heavy fishing pressure and were the subject of earlier studies. Censusing methods were identical to those used in previous studies to permit comparative data analysis. Each study site was circled by one or more divers and all species of fish were recorded. The number of replicate censuses varied between three and four depending on the number of divers available. The variability in diver data collection was reduced by employing the same divers throughout the study.

The NPR and SPR sites at Buck Island were identical to those areas surveyed by Gladfelter et al. (1977), Gladfelter and Gladfelter (1980) and by Simpson (1979). The NPR was located landward of the North Scuba Cut and consisted of a dense matrix of dead elkhorn coral (Acropora palmata) covered by a mixed algal turf. The patch reef rose from 3 m water depth to the surface and was surrounded by rocky bottom substrate on three sides and sand on the fourth side. The approximate size of the NPR is 165 $m^2$. The SPR was located northwest of the main channel entrance to the "marine gardens" and was approximately the same size as the NPR. The patch reef consists of an elevated open platform with loose coral rubble and some live Acropora palmata and Montastrea annularis. It was surrounded by a sandy bottom 3 m deep.

The RC and FR study sites were identical to those surveyed by Gladfelter et al. (1977). A 150-m long by 25-m wide transect, originating near the entrance of the snorkeling trail, was established over the reef crest in a northerly direction. The transect bisected the reef crest, sandy bank bottom, and two offshore patch reefs or "haystacks". The "haystacks" consisted of the elkhorn coral Acropora palmata growing from a bottom depth of 10 m to within 1 m of the surface.

The fish census sites in Tague Bay, Patch Reef #2 and Patch Reef #8, were identical to those surveyed by Gladfelter and Gladfelter (1978). Both patch reefs were located in the eastern portion of Tague Bay in 3-5 m water depth and consisted of carbonate pavement and dead Acropora palmata surrounded by turtle grass (Thalassia testudinum) and manatee grass (Syringodium filiforme). The areas of Patch Reef #2 and Patch Reef #8 were 2,500 $m^2$ and 850 $m^2$, respectively.

Diurnal fish censuses were conducted monthly from November through May for the Buck Island sites. The Tague Bay sites were censused diurnally in April and June 1986. Nocturnal censuses were conducted at the Buck Island sites in June 1986. The fish species censused were placed in the following abundance categories based on numbers present (Simpson, 1979):

| Abundance Category | Number of Fish |
|---|---|
| 1 | 1 |
| 2 | 2-5 |
| 3 | 6-10 |
| 4 | 11-24 |
| 5 | 25-50 |
| 6 | 51-100 |
| 7 | > 100 |

The abundance of commercially important reef fish species was determined by employing a random point, visual census technique (Bohnsack and Bannerot 1983; Boulon et al. 1985) monthly for a period of six months at the four study sites previously designated for the fish community structure study within the BUIS. The selection of key fish species of commercial/artisanal importance was based upon (1) biostatistical (length/weight) measurements obtained from port sampling surveys of the catch of commercial fishermen fishing in or adjacent to BUIS, and (2) biostatistical measurements obtained from the catch of commercial trap fishermen from Lang Bank who participated in the Division of Fish and Wildlife biostatistical reef fish sampling program (Clavijo et al. 1986).

Four fish traps, one each at the four study sites used by Simpson (1979) (two in BUIS - NPR and SPR and two in Tague Bay - patch reef #18 (Gladfelter and Gladfelter 1978) and Tague Bay back reef northwest of patch reef #18), were deployed to obtain individual lengths and weights of commercial fish species. The fish traps deployed were typical single funnel West Indian "arrowhead" or "chevron" traps with a downward-opening funnel in the apex of the "V".

Dimensions of the traps were similar to those deployed by Simpson (1979), approximately 1.5 m wide, 1.25 m long and 0.5 m high. The traps were constructed with a wood frame and supports of locally cut "bunchberry" sticks over which is fastened 3.2 cm hexagonal mesh galvanized wire. Soak time for all traps was initially 7 days; however, injured fishes observed in Buck Island fish traps necessitated hauling these traps twice weekly. Munro (1974) has shown that total catch is relatively constant for a soak time of 6-7 days. The length/weight measurements of commercial fish species were compared to identical fish species caught by commercial fish trap fishermen in the immediate vicinity of Buck Island and on Lang Bank reefs to the east to determine if significant differences existed in the length and weight of fishes due to fishing pressure.

## Conch

The abundance of queen conch (*Strombus gigas*) 10 m deep, in BUIS was censused along two 332 m long parallel strip transects, four meters in width extending due east from a point approximately 30 m east of "E" buoy, through a large seagrass bed comprised of *Thalassia testudinum* and *Syringodium filiforme* (Figure 1). Transect depth was 10 m. This seagrass bed, near the western park border, represents the only major conch habitat area at Buck Island. The seagrass bed is bordered to the north by coral reef, to the west by a steep dropoff at the shelf edge, to the south by a sandy algal plain 17 m deep, and to the east by Buck Island. Total seagrass bed area is approximately $16 \times 10^5 m^2$. The transect lines consisted of nylon line secured to steel stakes driven into the bottom substrate, thus supporting the line 30.5 - 45.7 cm above the bottom. This was necessary to allow free movement of the conch through the study area. Adult and juvenile conchs were counted in a two-meter wide strip on both sides of the transect line, following a technique used by Boulon (1985). Conch transects were conducted monthly for a period of six months to establish density.

## Lobster

Lobster population censuses were made monthly for a period of six months at three study sites within BUIS: (1) the patch reef located due north of the west end of Buck Island behind the barrier reef designated as the west patch reef (WPR), (2) the NPR, and (3) south fringing reef (SFR), east of the "marine gardens" entrance (Figure 1). The three sites were selected because they represent typical reef communities within BUIS, were surveyable using diving or snorkeling techniques, and represent good lobster habitat. The census survey consisted of a 15-minute timed search for both spiny lobster (*Panulirus argus*) and spotted lobster (*Panulirus guttatus*). The numbers of lobsters observed and size class (spiny lobsters only): legal $\geq$ 3.5 in. carapace length or short: $<$3.5 in.) were recorded. Lobsters were censused visually and size classes were estimated to minimize lobster disturbance. Diver observations were compared to verify lobster counts.

## Fishing Effort

Approximately 90% of all commercial fishing effort in BUIS is by trapping. A determination of trapping effort within and adjacent to BUIS waters was made by the NPS and DFW. At Buck Island, two park rangers conducted a visual survey, one ranger stationed on the Buck Island observation tower and another patrolling offshore in a

boat. The ranger on the observation tower was able to observe fishing activities throughout most of the northern and western waters of the Monument; Buck Island topography obscured the view of remaining waters. The ranger in the patrol boat observed fishing activities in the remaining southern and easternmost waters of the Monument. The "boat ranger" also obtained registration numbers of each fishing boat. Each ranger recorded trapping locations of each boat on a map. Radio contact between the rangers and later after-observation debriefings were used to compare and coordinate fish trap counts to obtain accurate information on trap locations and numbers. Rangers were deployed at observation locations prior to arrival of fishing boats from 0800-0900 hours over a period of four months on Wednesdays and Saturdays, traditional fishing days. Commercial artisanal fishermen have seldom been observed on other days when early morning patrols have been conducted.

DFW personnel conducted weekly port sampling interviews with commercial fish trap fishermen fishing adjacent to BUIS waters to obtain pertinent catch/effort information. Vessel registration numbers were compared with data obtained by the NPS to accurately access fishing effort.

## RESULTS

### Reef Fish

The relative abundance of reef fish species present at the BUIS and Tague Bay study sites, based on census surveys made from November 1985 - June 1986, are shown in Table I. This data was compared to similar reef fish census data collected by Simpson (1979) for BUIS NPR and SPR sites, Gladfelter and Gladfelter (1980) for the BUIS FR site, and Gladfelter and Gladfelter (1978) for Tague Bay Patch Reefs #2 and #3.

During this study, the Scaridae (parrotfishes) represented the most abundant family of fishes present at the NPR (27%), followed by the Pomacentridae (damselfishes) (19%), Labridae (wrasses) (14%), Acanthuridae (surgeonfishes) (12%) and Haemulidae (grunts) (11%) families. Similar relative abundance values were reported by Simpson (1979) for parrotfishes and damselfishes; however, more grunt species (15%) (particularly small mouth and French grunts) were recorded than labrids (13%).

The order of relative abundance for the reef fish families censused during this study, and that by Simpson (1979) at the SPR, were parrotfishes (21 and 22%,

respectively), damselfishes (17 and 18%, respectively), wrasses (13% each), grunts (11.0 and 12.5%, respectively) and surgeonfishes (11 and 12%, respectively). Differences in species abundance between the two censuses occurred with princess parrotfishes, threespot damselfishes, blackear wrasses and bluestriped grunts which were more abundant in Simpson's studies.

Differences in relative abundance values for reef fishes present at the FR study site were more apparent than either the NPR or SPR sites. Gladfelter and Gladfelter (1980) indicates that damselfishes (29%), parrotfishes (12%), surgeonfishes (10%) and wrasses (10%) represented the most abundant reef fishes. The present study indicates that the order of relative abundance has shifted to parrotfishes (31%), damselfishes (23%), wrasses (13%) and surgeonfishes (12%). Lutjanids (snappers) decreased in abundance from 9.0% to 2.9%.

Changes in relative abundance of reef fishes at Tague Bay Patch Reefs #2 and #8 are also apparent. Gladfelter and Gladfelter (1978) indicates that parrotfishes, damselfishes, wrasses and grunts dominated Patch Reef #2 (relative abundance = 23%, 13%, 12% and 10%, respectively). Our studies indicated that the order of relative abundance was parrotfishes (24%), grunts (18%), damselfish (14%) and surgeonfish (10%). Reef fish species increasing in abundance included redband parrotfish, French grunts and bluestriped grunts. Snappers increased from 2 to 9%.

At Patch Reef #8, grunts decreased in relative abundance from 17 to 11%, parrotfishes increased from 16 to 22%, damselfishes remained relatively stable at 12%, wrasses decreased from 9 to 1% and surgeonfishes increased from 4 to 12%.

Reef fishes of importance to commercial fish trap fishermen were censused at BUIS NPR, SPR, RC and FR study sites monthly from January through June 1986. A total of 42 species representing 17 families were censused.

Table 2 represents the six-month average of the number of individuals, relative abundance, and mean size of commercially important reef fish species observed at the four study sites within BUIS waters. Based on relative abundance, 19% of the fish observed at the NPR were ocean surgeonfish, 17% were blue tang, 15% were stoplight parrotfish and 9% were French grunt. Dominant fish species at the SPR were blue tang and French grunt (17% each), stoplight parrotfish (15%) and ocean surgeonfish (14%). The FR and RC were dominated by blue tang (29% and 45%,



115

respectively), ocean surgeonfish (24% and 17% respectively) and stoplight parrotfish (19% and 16% respectively). A greater number of commercially important fish species were recorded for the FR than for any other study site at BUIS; however, the monthly average for total number of fish present was greatest for the RC site.

The mean size of the most abundant commercially important reef fish species, such as the stoplight parrotfish, blue tang and ocean surgeonfish, was greater at the FR study site than at the other three Buck Island locations. The smallest individuals were recorded at the SPR.

Although habitat types of the study sites at BUIS and the Virgin Islands Biosphere Reserve in St. John were not identical, general comparisons of the reef fish community can be made between similar reef environs. Surgeonfish (ocean surgeonfish and blue tang) dominated the reef fish community present at the NPR and SPR (56% and 36% respectively) while accounting for only 12% of the fish community of the Hawksnest Bay patch reef site in St. John. Parrotfish represented 32% and 21%, respectively, at the NPR and SPR compared to 52% at the Hawksnest Bay patch reef. A total of 23% of the reef fish at the NPR and SPR were grunts versus only 3% at the Hawksnest Bay site. Snappers represented 10% and 1% of the fish community at the NPR and SPR, respectively; however, 28% of the reef fish at the Hawksnest Bay patch reef were snappers.

The FR at BUIS was comprised of 53% surgeonfish (29% blue tang and 24% ocean surgeonfish), 26% parrotfish, 3% snapper and 2% grunts. The Hawksnest Bay lower forereef was comprised of 30% surgeonfish (doctorfish), 23% parrotfish and 12% each snappers and grunts. A second area in St. John, Great Lameshur Bay lower forereef, consisted of 39% parrotfish, 17% snappers, 14% grunts and 10% surgeonfish (doctorfish).

Based on relative abundance, the RC site at BUIS was represented by 61% surgeonfish (45% blue tang and 16% ocean surgeonfish), 23% parrotfish and 7% snapper. The Hawksnest Bay upper fore reef, in comparison, had 69% grunts, 8% parrotfish, 8% doctorfish and 8% snapper.

Estimated sizes for commercial fishery reef fishes were generally larger for species censused at BUIS compared to the same species censused at the St. John Virgin Islands Biosphere Reserve.

A comparison of the lengths and weights of the 12 most common species of reef fish caught in the fish traps deployed at BUIS NPR and SPR and Tague Bay Patch Reef

#18 and back reef sites was made to fishes caught by commercial fish trap fishermen from waters adjacent to BUIS and Lang Bank (Table 3). During the month of June, a total of 14 species and 93 individual fishes were trapped in BUIS waters and 17 species and 156 individuals in Tague Bay. Significant differences were noted in the number of individuals and number of species trapped between Buck Island and Tague Bay. Statistical analysis of data (student's t-test) demonstrated that Buck Island had a consistently lower number of individuals trapped. Fish species trapped in Tague Bay and not appearing in BUIS traps included white spotted filefish, yellowtail snapper, queen parrotfish, Nassau grouper, doctorfish, dusky damselfish and redtail parrotfish. Fish species trapped in BUIS traps but not appearing in Tague Bay traps included bar jack, red hind, princess parrotfish, scrawled trunkfish, yellow goatfish and blue striped grunt.

Of the 12 most common species of reef fish caught in fish traps listed in Table 3, only three species, *Sparisoma viride* (stoplight parrotfish), *Acanthurus coeruleus* (blue tang) and *Acanthurus bahianus* (ocean surgeonfish), were caught in sufficient abundance from BUIS and Tague Bay traps to provide an adequate sample for statistical analysis between the four areas. Analysis of length and weight data (Student's t-test) indicates that for *S. viride* both lengths and weights of fishes caught at BUIS and Tague Bay were significantly less than *S. viride* caught in adjacent waters or on Lang Bank. No statistical difference was observed for lengths and weights of *S. viride* from BUIS and Tague Bay at the $p<.05$ level. No significant differences were observed for weights of *A. coeruleus* between any areas; however, fish lengths were significantly greater from Lang Bank. *A. bahianus* lengths were significantly greater at BUIS adjacent waters and Lang Bank compared to BUIS or Tague Bay. In turn, BUIS ocean surgeonfish were larger than those from Tague Bay. Significant differences existed at each area for *A. bahianus* weights.

## Conch

Conch census data are shown in Table 4. The mean conch density along both Transects A and B was 1 conch/7 $m^2$ (0.14 conch/$m^2$) (S.D. = 0.025 and 0.013, respectively). Juvenile conch, those lacking a flared lip, outnumbered adults 41:1 on Transect A and 90:1 on Transect B. The average number of conch censused per month was 4 adults and 165 juveniles on Transect A and 2 adults and 179 juveniles on Transect B.

Conch transect lines were found broken in the fifth month of the study. Due to the presence of fish traps near the study area, it is believed that one or more fish traps may have become entangled in the transect lines during hauling and resulted in the broken lines. Transect lines were subsequently reestablished with a two-week delay of data collection.

Lobster

Monthly census data for spiny, lobster observed at the WPR, NPR and south fringing reef (SFR) from January through June 1986, is shown in Table 5. Lobster species censused included *Panulirus argus*, the Caribbean spiny lobster, and *P. guttatus*, the spotted lobster. The average density of Caribbean spiny lobster for the six-month study period at the WPR, NPR and SFR was 1.2 lobster/624 $m^2$, 1.5 lobster/165 $m^2$ and 1.3 lobster/1500 $m^2$, respectively. The average density of spotted lobster for the same period for the WPR, NPR and SFR was 1.4/624 $m^2$, 1.3/165 $m^2$ and 1.3/1500 $m^2$, respectively.

Fishing Effort

Commercial fishermen engaged in fish trapping were observed in three vessels both in and near BUIS each morning observations were made by the NPS. An additional four fishermen in two separate vessels, fishing adjacent to BUIS, were interviewed by DFW port sampling agents. Locations of fish traps deployed in, near and adjacent to BUIS are shown in Figure 1. A total of 12 fishermen in five different vessels fished 45 fish traps in or adjacent to BUIS waters (16 traps inside BUIS, 11 traps near BUIS and 18 traps in waters adjacent to BUIS) (Table 6). Two vessels were operating both inside and within 100 m of BUIS, two vessels operated only in waters adjacent to BUIS and one vessel operated solely in BUIS.

## DISCUSSION

Fish Community Structure

When compared to fish community census studies conducted by Simpson (1979) for BUIS NPR and SPR sites, the present study indicates that an average of 38% of the fish species censused increased in number, 34% of the species decreased in number and 30% remained unchanged. Although shifts in the abundance of individual reef fishes censused were apparent, the relative abundance values for the reef fish families were quite similar using comparable census techniques. Appreciable changes were observed in the decrease of grunts and Bermuda chub presently observed

at the NPR, and grunts, snappers and surgeonfish at the SPR. Both study sites in addition to the FR site are in the protected waters of BUIS "marine gardens", where there is no fishing pressure.

Compared to Gladfelter et. al. (1977) studies at BUIS FR, the present fish census indicates that 24% of the fish species censused increased in abundance, 51% decreased and 25% remained unchanged. Most notable decreases in fish abundance occurred in the snapper, grouper and damselfish families. A 168% increase in parrotfishes was observed in the present study at the FR site.

Data collected by Gladfelter et. al. (1977) and Gladfelter and Gladfelter (1980) for BUIS indicated high abundances of urchin-eating fish species, including black margate, spanish grunt, caesar grunt and queen triggerfish. These species were not observed in the present study. The black sea urchin, Diadema antillarum, once abundant in waters of BUIS and Tague Bay, St. Croix, as well as throughout the Caribbean, suffered heavy mortality from January 1983 to January 1984 due to an unknown water-borne pathogen transported by ocean currents (Lessios et al., 1984). Because of Diadema's ability to affect algal and coral community diversity and compete with herbivorous fishes for available food (Ogden et al., 1973; Ogden and Lobel, 1978; Lessios et. al., 1984), a severe decline in Diadema population numbers would subsequently result in domination of the coral community by faster growing benthic algae, a reduction in overall benthic community diversity and an increase in food supply for herbivorous fishes. In time, a greater algal biomass would also be able to support a greater number of herbivorous fishes. The presence of greater numbers of herbivorous fishes, particularly parrotfish, on the FR may be a result of an increase in algal food supply and a decrease in predators (lutjanids and serranids).

The FR area censused lies adjacent to the Underwater Trail, which is visited by tens of thousands of snorkelers each year. The decrease in predator fishes in this area may be related to the increase in snorkelers on the coral reef, assuming zero mortality due to no fishing pressure.

Tague Bay fish census surveys, compared to similar work by Gladfelter and Gladfelter (1978), indicate that 47% of the reef fish species censused increased in abundance, 37% decreased in abundance and 16% remained unchanged. Depending upon area, those species increasing in abundance included snappers as well as grunts and parrotfishes.

Reef fishes at BUIS are decreasing at a rate equal to or greater than reef fishes at Tague Bay. It would be anticipated that an area subject to unlimited or heavy fishing pressure, such as Tague Bay, would show a significantly greater decrease in relative abundance of reef fishes than BUIS, where fishing pressure is limited. This discrepancy may be due to the ability of the large contiguous reef area of Tague Bay to better absorb fishing pressure. Due to the small size of the protected area afforded by BUIS, reef fish populations are adversely impacted by a relatively small but concentrated fishing effort.

The relative abundance of commercially important reef fishes at Buck Island is similar to that of Tague Bay and St. Croix in general. The most abundant reef fish species are the surgeonfishes, represented by the blue tang and ocean surgeonfish, followed by the parrotfishes (stoplight, princess, redtail, red band) and grunts (French grunt, smallmouth, white and bluestripe). By weight, the order of priority would be parrotfish, followed by grunt and/or surgeonfish depending upon seasonal abundance (Simpson, 1979; Gladfelter and Gladfelter, 1980). Herbivores dominate the fish fauna of BUIS with the larger fish occurring in the FR area. Similar reef fishes of commercial importance occur in the Virgin Islands Biosphere Reserve on St. John; however, their relative abundance differs from those fishes found at BUIS and St. Croix. In general, the relative abundance of herbivores, parrotfishes and surgeonfishes, is greater at BUIS and St. Croix.

Based on a comparison of lengths and weights of trap-caught stoplight parrotfish (*S. viride*), blue tang (*A. coeruleus*) and ocean surgeonfish (*A. bahianus*) from BUIS, Tague Bay, BUIS adjacent waters and Lang Bank, only ocean surgeonfish were significantly larger in BUIS waters where fishing effort is limited. Blue tang were significantly larger and stoplight parrotfish were both larger and weighed more in waters adjacent to BUIS and Lang Bank than within BUIS or Tague Bay. This further illustrates the ineffectiveness of the existing fishing regulations in BUIS to sustain or improve fish populations within park waters.

## Conch

Census results at BUIS indicate the western grassbed is a natural conch nursery area. More than 98% of the conch censused were juveniles -- those lacking a flared lip. At no time were substantial numbers of adult conch observed.

Hesse (1979) found juvenile conch (<10 cm) to be sedentary with mobility increasing with size. Conch larger than 16 cm (up to 3 years in age) had ranges too large to be established (Berg, 1976).

Although not observed in BUIS waters, commercial conch divers with the aid of SCUBA equipment were observed harvesting conch adjacent to the western and southern park boundaries where water depth increases to 17 m. It is believed that as the conch mature in the BUIS western grassbed, they migrate to deeper water adjacent to the park and are harvested by commercial divers.

The western grassbed of BUIS has an area of approximately 1.6 x $10^5$ sq. m. At a density 1 conch/7 $m^2$, a conch population of approximately 22,857 individuals is estimated to reside in this area. This represents a potential biomass of 7,300 kg that this predominantly juvenile cohort would produce if allowed to mature at an average of 320 g dressed meat wt/conch (Tobias, 1987).

Under the present park regulations, two conch/person/day may be removed from BUIS waters. With approximately 60,000 visitors each year at Buck Island, the removal of conch by recreational users has the potential to be significant. Under Federal or Virgin Islands law, there is no minimum size limit on conch. Removing juveniles from the population before they reach sexual maturity can have drastic effects on nearby adult populations which depend on the juveniles for recruitment (Boulon et al. 1985).

Lobster

The abundance of the Caribbean spiny lobster within BUIS is related to habitat availability, food supply and seasonal migrations inshore and offshore. Greatest abundance of spiny lobster was found at the NPR; however, this data may be biased since the structural complexity of this site afforded better observational access than the WPR or the SFR. Similar densities of the spotted lobster were also observed.

Park regulations also permit the removal of two lobster/person/day from waters outside the "marine gardens". Significant but unknown quantities of lobster are believed to be taken by recreational users each year.

Fishing Effort

Port sampling interviews with fishermen fishing adjacent to BUIS (N=15) indicate that an average of 7.5 fish (4.0 lbs.) per trap are taken back to port. Based on 16 fish

traps deployed in BUIS with an average take-home catch of 4.0 lbs./trap and hauled twice/week, approximately 6,656 lbs. of reef fish (13,312 fish at 0.5 lbs. each) would be removed per year. The 29 fish traps outside BUIS would account for another 8,320 lbs. of fish/year (11 traps hauled twice/week and 18 traps hauled once/week) (or 16,704 reef fish), assuming similar catch rates.

Port samples from commercial fish trap fishermen on Lang Bank from January through December 1986 (N=112) indicate that 1,593 lobster were caught from 2,051 fish trap hauls for a catch rate of 0.78 lobster/trap. BUIS and Lang Bank are adjacent to each other on the same insular shelf; however, available lobster habitat is different at BUIS and fish trapping is restricted to the western park area where lobster habitat may be less desirable. Based on fish traps set at BUIS NPR and SPR, a total of ten trap hauls resulted in the capture of six spotted lobster for a catch rate of 0.6 lobster/trap. Based on lobster census surveys, the abundance of spiny lobster was equal to the abundance of spotted lobster at the areas surveyed. It is assumed that spiny lobster and spotted lobster abundances are equal and the catch rates of lobster in fish traps outside of BUIS "marine gardens" are similar to those deployed at the NPR and SPR. Under these assumptions, 16 traps in BUIS waters would produce 998 lobster/year (16 traps hauled twice/week). At an average weight of 2.0 lbs./lobster, an annual harvest of 1,996 lbs. may be estimated.

## CONCLUSIONS

Reef fish census studies, supported by statistical analysis of length/weight measurements of commercially important reef fish species, indicate that the protective regulations enacted by the National Park Service have been ineffective in maintaining or enhancing BUIS fishery resources. Due to the small area encompassed by BUIS, major adverse impacts may be incurred from a relatively small but concentrated commercial fishing effort in and adjacent to park waters. Although restricted by bag limits on conch and lobster for commercial harvest, recreational user groups, due to their great numbers, contribute to the decline of these limited resources.

In addition to adverse impact by commercial and recreational fishing pressure, fisheries resources at BUIS have also been affected by environmental changes resulting from coral mortality due to white-band disease, *Diadema* mass mortality, and the physical impact of 60,000 visitors/year on the reef ecosystem.

## RECOMMENDATIONS

The following short-term and long-term recommendations have been made to more thoroughly define the impacts of continued limited fishing pressure on the fishery resources in BUIS.

(1) All fish traps deployed in BUIS waters should be properly marked with surface floats having the respective color pattern assigned to the commercial fisherman, as required under V.I. Code, ACT 3330. This will allow for an accurate count of both fish traps within BUIS and registered commercial fishermen.

(2) Commercial fish trap catches can be monitored visually, both in and adjacent to park waters by diver surveys conducted the day prior to traditional trap hauling days, to assess catch rates and catch composition of fish and lobster.

(3) Fish census studies can be repeated at NPR, SPR and RC/FR study sites and compared to previous work.

(4) Tag and recapture studies can be conducted on the more abundant commercially sought reef fishes (i.e. scarids, acanthurids, haemulids and lutjanids) to determine home range and immigration/emigration in park waters.

(5) Permanent conch transects should be established in the western grassbed to monitor conch population changes. This data can be compared to baseline data provided in this study.

(6) Permanent conch transects should be established for population assessment purposes in adjacent waters where the animals are commercially harvested.

(7) Subadult size conch in the BUIS western grassbed should be tagged to monitor migration patterns from the nursery area to offshore grounds.

(8) Commercial conch divers in waters adjacent to BUIS should be interviewed periodically to determine catch/effort data.

(9) Lobster census studies of the NPR, WPR and SFR sites should be repeated and compared to the baseline data from this study and to similar sites selected from Tague Bay.

(10) The impact by recreational fishermen on conch and lobster resources in BUIS should be monitored by contact interviews.

The marine ecosystems in an area as small as BUIS are dependent upon and affected by marine ecosystems in adjacent waters. The general decline in reef fish resources at BUIS is simply a reflection of the general condition of St. Croix reefs. Although it would be ideal to prohibit all fishing at BUIS and establish a marine sanctuary -- supplying larvae and juveniles of fish and shellfish to naturally propagate St. Croix reefs -- simply prohibiting the harvest of fish, conch and lobster within BUIS may not be sufficient to reverse or stabilize negative trends. Comprehensive management plans for all inshore resources by all user groups in the U. S. Virgin Islands are essential to maintain the integrity of fish and shellfish stocks for the present and to improve them for the benefit of future Virgin Islanders and visitors alike.

## REFERENCES


Berg, C. J. 1976. Growth of the queen conch Strombus gigas, with a discussion of the practicality of its mariculture. Mar. Bio. 34: 191-199.

Bohnsack, J. A. and S. P. Bannerot. 1983. A random point census technique for visually assessing coral reef fishes. In: C. A. Barons and S. A. Bortone (eds.), The Visual Assessment of Fish Populations in the Southeastern United States: 1982 Workshop, South Carolina Sea Grant Consortium Tech. Report 1, SC-SG-TR-01-83, pp. 14-17.

Boulon, R. H., J. Beets and V. Small. 1985. Long-term monitoring of fisheries in the Virgin Islands Biosphere Reserve. Biosphere Reserve Research Report #13, 32 p.

Clavijo, I. E., W. Tobias and C. Jennings. 1986. State/Federal Cooperative Statistics Program - U.S. Virgin Islands: Completion Report, April 1, 1983 - March 31, 1986. Department of Conservation and Cultural Affairs, State/Federal Cooperative Statistics Program Report: Project No. SF-22, Segments 1-3, 29 p.

Gladfelter, W. B., E.H. Gladfelter, R.K. Monahan, J.C. Ogden and R. F. Dill. 1977. Environmental studies of Buck Island Reef National Monument. U. S. National Park Service Report. 144 pp.

Gladfelter, W. B. and E. H. Gladfelter. 1978. Fish community structure as a function of habitat structure on West Indian patch reefs. Rev. Biol. Trop. 26 (Suppl.1): pp. 65-84.

Gladfelter, W. B., D. K. Hubbard, R. C. Carpenter and G. S. Simpson. 1979. Environmental Studies of Buck Island Reef National Monument, St. Croix, U.S.V.I. II. U. S. National Park Service Report. 168 p.

Gladfelter, E. H. and W. B. Gladfelter. 1980. Environmental Studies of Buck Island Reef National Monument III. U. S. National Park Service Report. 116 p.

Hesse, K. O. 1979. Movement and migration of queen conch Strombus gigas in the Turks and Caicos Islands. Bull. Mar. Sci., 29(3): 303-311.

Lessios, H. A., D. R. Robertson and J. D. Cubit. 1984. Spread of Diadema mass mortality through the Caribbean. Science 226:335-337.




125

Munro, J. C. 1974. The mode of operation of Antillean fish traps and the relationships between ingress, escapement, catch and soak. J. Cons. Int. Explor. Mer. 35:337-350.

Ogden, J. C., R. A. Brown and N. Salesky. 1973. Grazing by the echinoid Diadema antillarum Philippi: formation of halos around West Indian patch reefs. Science 182:715-717.

Ogden, J. C. and P. S. Lobel. 1978. The role of herbivorous fishes and urchins in coral reef communities. Env. Biol. Fish. 3(1):49-63.

Olsen, D. A. and J. A. LaPlace. 1978. A study of a Virgin Islands grouper fishery based on breeding aggregation. Proc. Gulf & Carib. Fish. Inst. 31st. Ann. Sess. pp. 130-144.

Olsen, D. A., R. S. Wood and W. J. Tobias. 1983. A preliminary economic analysis of cost returns of commercial fishermen using fish traps along the insular shelf of the U. S. Virgin Islands. Dept. Cons. and Cultural Affairs, Div. Fish and Wildlife, NMFS Ann. Rept.

Simpson, G. S. 1979. Fish community dynamics, In. Environmental Studies of Buck Island Reef National Monument, St. Croix, U.S.V.I. II by E. H. Gladfelter, W. B. Gladfelter, D. K. Hubbard, R. C. Carpenter and G. S. Simpson. U. S. National Park Service Report, 168 p.

Tobias, W. 1987. Biostatistical data on commercially harvested queen conch, Strombus gigas, from the insular shelf around St. Croix, U.S. Virgin Islands. Caribbean Fisheries Management Council Tech. Rept. 19pp.

Wood, R. S. and D. A. Olsen. 1983. Application of biological knowledge to the management of the Virgin Islands conch fishery. Proc. Gulf and Carib. Fish. Inst. 35th Ann. Sess. pp 112-121.

TABLE 1. Relative abundance of reef fish species censused at BUIS North Patch Reef (Site 1), South Patch Reef (Site 2), Forereef (Site 3) and Tague Bay Patch Reefs #2 (Site 4) and #8 (Site 5), during VIRMC III Study (a) compared to data collection by Simpson (1979)(b), Gladfelter and Gladfelter (1980) (c), and Gladfelter and Gladfelter (1978)(d).

| FAMILY / SPECIES | N=6 Site 1 | | N=6 Site 2 | | N=5 Site 3 | | N=5 Site 4 | | N=2 Site 5 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | a | b | a | b | a | c | a | d | a | d |
| SYNONDONTIDAE | | | | | | | | | | |
| *Synodus intermedius* (sand diver) | 0.2 | 0.6 | 0.4 | 1.3 | 0.0 | 2.0 | 0.0 | 0.0 | 0.0 | 0.6 |
| HOLOCENTRIDAE | | | | | | | | | | |
| *Holocentrus ascensionis* (squirrelfish) | 2.6 | 0.0 | 2.1 | 0.2 | 1.9 | 0.0 | 6.3 | 8.7 | 3.2 | 3.5 |
| AULOSTOMIDAE | | | | | | | | | | |
| *Aulostomus maculatus* (trumpetfish) | 1.2 | 1.5 | 0.6 | 1.2 | 2.1 | 2.5 | 0.0 | 1.4 | 2.6 | 1.7 |
| SERRANIDAE | | | | | | | | | | |
| *Epinephelus fulvus* (coney) | (0.7) | (0.0) | (0.8) | (1.0) | (0.3) | (5.5) | (1.8) | (2.1) | (0.0) | (2.9) |
| *Epinephelus guttatus* (red hind) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| *Hypoplectrus unicolor* (butter hamlet) | 0.0 | 0.0 | 0.4 | 0.5 | 0.0 | 2.0 | 0.6 | 1.4 | 0.0 | 1.2 |
| *Serranus tigrinus* (harlequin bass) | 0.0 | 0.0 | 0.2 | 0.5 | 0.3 | 0.5 | 0.6 | 0.7 | 0.0 | 0.0 |
| | 0.7 | 0.0 | 0.2 | 0.0 | 0.0 | 1.0 | 0.6 | 0.0 | 0.0 | 1.7 |
| PRIACANTHIDAE | | | | | | | | | | |
| *Priacanthus cruentatus* (glasseye snapper) | 0.4 | 1.5 | 0.0 | 1.7 | 0.0 | N/A | 0.0 | 0.0 | 0.0 | 1.2 |
| CARANGIDAE | | | | | | | | | | |
| *Caranx ruber* (bar jack) | 1.7 | 2.4 | 2.7 | 1.5 | 2.4 | 3.0 | 3.8 | 0.7 | 7.1 | 0.0 |
| EMMELICHTHYIDAE | | | | | | | | | | |
| *Intermia vittata* (boga) | 0.0 | 0.0 | 0.4 | 0.0 | 0.3 | 2.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| LUTJANIDAE | | | | | | | | | | |
| *Lutjanus apodus* (schoolmaster snapper) | (5.9) | (5.8) | (3.2) | (4.7) | (2.9) | (9.0) | (8.8) | (2.2) | (9.7) | (4.7) |
| *Lutjanus mahogani* (mahogany snapper) | 2.2 | 2.9 | 0.4 | 1.7 | 0.5 | 4.0 | 0.0 | 0.0 | 1.3 | 1.2 |
| *Ocyurus chrysurus* (yellowtail snapper) | 1.5 | 0.9 | 1.4 | 0.8 | 1.1 | 2.5 | 3.8 | 0.0 | 5.2 | 1.2 |
| | 2.2 | 2.0 | 1.4 | 2.2 | 1.3 | 2.5 | 5.0 | 2.2 | 3.2 | 2.3 |
| GERREIDAE | | | | | | | | | | |
| *Gerres cinereus* (yellowfin mojarra) | 1.8 | 0.7 | 2.4 | 2.0 | 0.3 | N/A | 1.3 | 0.0 | 0.0 | 1.7 |



127

TABLE 1. (continued)

| FAMILY / SPECIES | N=6 Site 1 a | N=6 Site 1 b | N=6 Site 2 a | N=6 Site 2 b | N=5 Site 3 a | N=5 Site 3 c | N=5 Site 4 a | N=5 Site 4 d | N=2 Site 5 a | N=2 Site 5 d |
|---|---|---|---|---|---|---|---|---|---|---|
| HAEMULIDAE | | | | | | | | | | |
| *Haemulon aurolineatum* (tomtate grunt) | (10.8) | (15.3) | (11.0) | (12.5) | (3.0) | (5.5) | (18.2) | (10.0) | (10.5) | (16.8) |
| *Haemulon carbonarium* (caesar grunt) | 0.0 | 0.2 | 0.2 | 0.2 | 0.0 | 0.5 | 0.0 | 0.0 | 0.0 | 0.0 |
| *Haemulon chrysargyreum* (smallmouth grunt) | 1.7 | 1.2 | 1.5 | 0.0 | 0.3 | 0.5 | 0.0 | 0.0 | 0.7 | 2.9 |
| *Haemulon flavolineatum* (French grunt) | 2.3 | 4.8 | 0.8 | 0.0 | 0.5 | 0.0 | 0.0 | 0.0 | 1.3 | 3.5 |
| *Haemulon sciurus* (bluestriped grunt) | 4.0 | 5.7 | 6.1 | 7.0 | 1.9 | 2.5 | 8.8 | 4.3 | 2.0 | 4.0 |
| *Haemulon plumieri* (white grunt) | 1.5 | 1.2 | 0.0 | 2.8 | 0.0 | 1.0 | 8.8 | 1.4 | 6.5 | 2.9 |
| | 1.3 | 2.5 | 2.4 | 2.5 | 0.3 | 1.0 | 0.6 | 4.3 | 0.0 | 3.5 |
| MULLIDAE | | | | | | | | | | |
| *Mulloidichthys martinicus* (yellowtail goatfish) | (2.9) | (2.7) | (4.9) | (4.0) | (2.2) | (3.0) | (4.4) | (5.0) | (7.8) | (4.6) |
| | 1.7 | 2.3 | 3.5 | 2.3 | 1.1 | 2.5 | 1.3 | 1.4 | 2.6 | 1.7 |
| *Pseudupeneus maculatus* (spotted goatfish) | 1.2 | 0.4 | 1.4 | 1.7 | 1.1 | 0.5 | 3.1 | 3.6 | 5.2 | 2.9 |
| KYPHOSIDAE | | | | | | | | | | |
| *Kyphosus sectatrix* (Bermuda chub) | 0.7 | 2.7 | 0.0 | 0.0 | 1.6 | 2.5 | 0.0 | 0.0 | 0.0 | 0.0 |
| CHAETODONTIDAE | | | | | | | | | | |
| *Chaetodon capistratus* (foureye butterflyfish) | 0.3 | 1.1 | 2.4 | 2.0 | 1.3 | 2.0 | 2.5 | 2.9 | 1.9 | 1.7 |
| POMACENTRIDAE | | | | | | | | | | |
| *Abudefduf saxatilis* (sergeant major) | (18.7) | (17.5) | (17.3) | (18.0) | (22.8) | (29.0) | (13.8) | (12.9) | (11.7) | (13.3) |
| *Abudefduf taurus* (night sergeant) | 2.3 | 3.1 | 1.2 | 0.0 | 1.6 | 3.0 | 1.9 | 1.4 | 0.0 | 1.7 |
| *Chromis cyanea* (blue chromis) | 1.8 | 1.5 | 0.4 | 0.2 | 0.0 | N/A | 0.0 | 0.0 | 0.0 | 0.0 |
| *Chromis multilineatus* (brown chromis) | 0.0 | 0.0 | 0.0 | 0.0 | 5.9 | 5.5 | 0.0 | 0.0 | 0.0 | 0.0 |
| *Microspathodon chrysurus* (yellowtail damselfish) | 0.0 | 0.0 | 0.0 | 0.0 | 3.8 | 4.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 2.3 | 2.4 | 2.0 | 4.0 | 5.1 | 5.0 | 1.9 | 0.7 | 2.6 | 2.3 |
| *Eupomacentrus diencaeus* (longfin damselfish) | 0.3 | 0.0 | 0.8 | N/A | 0.5 | N/A | 0.0 | 0.0 | 0.0 | 0.0 |
| *Eupomacentrus fuscus* (dusky damselfish) | 5.3 | 5.0 | 4.1 | 4.0 | 2.4 | 4.5 | 0.0 | 3.6 | 0.0 | 2.9 |
| *Eupomacentrus leucostictus* (beaugregory) | 1.7 | 0.4 | 5.6 | 2.3 | 0.0 | 0.5 | 5.0 | 3.6 | 1.9 | 0.6 |
| *Eupomacentrus planifrons* (threespot damselfish) | 2.3 | 4.8 | 3.2 | 6.2 | 2.4 | 4.5 | 4.4 | 1.4 | 5.2 | 3.5 |
| *Eupomacentrus variabilis* (cocoa damselfish) | 2.7 | 0.3 | 0.0 | 1.3 | 1.1 | 2.0 | 0.6 | 2.2 | 2.0 | 2.3 |
| LABRIDAE | | | | | | | | | | |
| *Clepticus parrai* (creole wrasse) | (13.5) | (12.5) | (13.0) | (13.3) | (12.9) | (9.5) | (5.6) | (12.3) | (0.7) | (8.7) |
| *Halichoeres poeyi* (blackear wrasse) | 0.0 | 0.0 | 0.0 | 0.0 | 2.7 | 3.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| *Halichoeres bivittatus* (slippery dick) | 0.5 | 4.2 | 0.4 | 4.5 | 0.3 | 2.5 | 0.0 | 2.2 | 0.0 | 1.7 |
| *Halichoeres radiatus* (puddingwife) | 4.0 | 1.6 | 3.8 | 0.7 | 0.8 | 1.0 | 0.0 | 3.6 | 0.0 | 2.9 |
| *Thalassoma bifasciatum* (bluehead) | 2.2 | 0.6 | 2.1 | 1.3 | 1.1 | 1.0 | 0.0 | 2.2 | 0.7 | 1.2 |
| | 6.8 | 6.1 | 6.7 | 6.8 | 8.0 | 2.0 | 5.6 | 4.3 | 0.0 | 2.9 |

TABLE 1. (continued)

| FAMILY SPECIES | N=6 Site 1 a | N=6 Site 1 b | N=6 Site 2 a | N=6 Site 2 b | N=5 Site 3 a | N=5 Site 3 c | N=5 Site 4 a | N=5 Site 4 d | N=2 Site 5 a | N=2 Site 5 d |
|---|---|---|---|---|---|---|---|---|---|---|
| SCARIDAE | | | | | | | | | | |
| *Scarus croicensis* (striped parrotfish) | (27.4) | (25.4) | (21.3) | (21.7) | (30.8) | (11.5) | (24.4) | (23.0) | (22.2) | 15.7) |
| *Scarus taeniopterus* (princess parrotfish) | 5.2 | 2.4 | 4.5 | 2.3 | 6.2 | 0.5 | 5.0 | 4.3 | 5.8 | 3.5 |
| *Scarus ventula* (queen parrotfish) | 1.2 | 3.9 | 0.2 | 3.7 | 2.1 | 2.0 | 0.0 | 4.3 | 0.0 | 3.5 |
| *Sparisoma aurofrenatum* (redband parrotfish) | 3.8 | 3.9 | 0.6 | 1.2 | 4.6 | N/A | 0.0 | 0.0 | 2.6 | 0.0 |
| *Sparisoma chrysopterum* (redtail parrotfish) | 2.2 | 1.6 | 2.0 | 2.3 | 3.2 | 2.5 | 5.0 | 1.4 | 0.0 | 0.6 |
| *Sparisoma radians* (bucktooth parrotfish) | 1.3 | 1.6 | 1.8 | 2.0 | 1.9 | 0.5 | 2.5 | 1.4 | 0.0 | 0.6 |
| *Sparisoma rubripinne* (redfin parrotfish) | 0.0 | 0.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2.9 | 0.0 | 1.2 |
| *Sparisoma viride* (stoplight parrotfish) | 2.5 | 1.3 | 1.8 | 0.2 | 3.2 | 2.5 | 0.6 | 0.0 | 0.7 | 0.0 |
| *Scaridae* (juvenile parrotfish) | 5.5 | 4.5 | 5.5 | 3.7 | 5.6 | 3.5 | 5.0 | 3.6 | 5.8 | 2.3 |
| | 5.7 | 5.9 | 4.9 | 6.3 | 4.0 | N/A | 6.3 | 5.1 | 7.3 | 4.0 |
| BLENNIDAE | | | | | | | | | | |
| *Hemiemblemaria simulus* (wrasse blenny) | 0.5 | N/A | 0.9 | N/A | 0.0 | N/A | 0.0 | 0.0 | 0.0 | 0.0 |
| *Ophioblennius atlanticus* (redlip blenny) | 0.0 | N/A | 0.0 | N/A | 0.0 | 2.2 | 0.0 | 1.4 | 0.0 | 0.0 |
| GOBIIDAE | | | | | | | | | | |
| *Gobiidae* (gobies) | 0.3 | N/A | 0.8 | N/A | 0.0 | N/A | 0.0 | 2.2 | 0.0 | 2.3 |
| ACANTHURIDAE | | | | | | | | | | |
| *Acanthurus bahianus* (ocean surgeonfish) | (12.2) | (9.9) | (10.9) | (12.3) | (12.3) | (10.0) | (10.0) | (7.9) | (12.4) | (4.0) |
| *Acanthurus chirurgus* (doctorfish) | 5.5 | 4.3 | 4.5 | 6.2 | 4.8 | 5.0 | 5.0 | 4.3 | 6.5 | 2.3 |
| *Acanthurus coeruleus* (blue tang) | 1.0 | 0.7 | 0.9 | 1.3 | 0.8 | 0.0 | 0.6 | 1.4 | 0.7 | 0.0 |
| | 5.7 | 4.9 | 5.5 | 4.8 | 6.7 | 5.0 | 4.4 | 2.2 | 5.2 | 1.7 |
| TETRAODONTIDAE | | | | | | | | | | |
| *Tetraodontidae* (puffers) | 0.0 | N/A | 0.4 | N/A | 0.3 | N/A | 1.3 | 0.7 | 0.7 | 1.2 |

TABLE 2. Number of individuals, relative abundance (percent) and mean size of commercially important reef fish species observed at the four study sites within the BUIS waters, January - June 1986. Fish size is expressed in millimeters.

Location: BUCK ISLAND REEF NATIONAL MONUMENT

| Study Site: | NORTH PATCH REEF | | | | SOUTH PATCH REEF | | | | FORE REEF | | | | REEF CREST | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. Censuses: | SIX-MONTH AVERAGE | | | | SIX-MONTH AVERAGE | | | | SIX-MONTH AVERAGE | | | | SIX-MONTH AVERAGE | | | |
| SPECIES | Tot. # Indiv. | Rel. Abund. (%) | Mean Size | Stand. Deviat. | Tot. # Indiv. | Rel. Abund. (%) | Mean Size | Stand. Deviat. | Tot. # Indiv. | Rel. Abund. (%) | Mean Size | Stand. Deviat. | Tot. # Indiv. | Rel. Abund. (%) | Mean Size | Stand. Deviat. |
| stoplight parrotfish | 22 | 15.3 | 213.4 | 152.4 | 22 | 14.6 | 160.0 | 114.3 | 30 | 19.0 | 271.8 | 88.9 | 40 | 16.0 | 269.2 | 20.3 |
| redtail parrotfish | 3 | 2.1 | 320.0 | 22.9 | 6 | 4.0 | 261.6 | 88.9 | 5 | 3.2 | 246.4 | 43.2 | 4 | 1.6 | 248.9 | 45.7 |
| queen parrotfish | 5 | 3.5 | 307.3 | 68.6 | | | | | 1 | 0.6 | 246.4 | 50.8 | 10 | 4.0 | 108.2 | 48.3 |
| red band parrotfish | | | | | < 1 | 0.3 | 152.4 | - | 5 | 3.2 | 172.7 | 20.3 | 2 | 0.8 | 154.9 | 7.6 |
| princess parrotfish | 2 | 1.4 | 259.1 | 22.9 | | | | | 2 | 1.3 | 218.4 | 17.8 | 1 | 0.4 | 68.9 | 30.5 |
| redfin parrotfish | < 1 | 0.3 | 177.8 | 25.4 | 1 | 0.7 | 147.3 | 48.3 | | | | | 1 | 0.4 | 254.0 | 13.7 |
| rainbow parrotfish | | | | | < 1 | 0.3 | 635.0 | - | | | | | | | | |
| white grunt | < 1 | 0.3 | 304.8 | 0 | 8 | 5.3 | 287.0 | 43.2 | 1 | 0.6 | 165.1 | 71.1 | | | | |
| bluestriped grunt | 2 | 1.4 | 289.6 | 38.1 | 2 | 1.3 | 297.2 | 5.1 | 1 | 0.6 | 210.8 | 25.4 | 1 | 0.4 | 82.8 | 25.4 |
| French grunt | 13 | 9.1 | 134.6 | 27.9 | 27 | 17.9 | 88.9 | 33.0 | 2 | 1.3 | 142.2 | 5.1 | | | | |
| smallmouth grunt | 8 | 5.6 | 127.0 | 20.3 | | | | | | | | | | | | |
| porkfish | | | | | | | | | < 1 | 0.3 | 304.8 | - | < 1 | 0.2 | 254.0 | 0 |
| margate | < 1 | 0.3 | 304.8 | - | | | | | | | | | | | | |
| mutton snapper | 1 | 0.7 | 482.6 | 73.7 | | | | | | | | | | | | |
| schoolmaster snapper | 6 | 4.2 | 299.7 | 50.8 | | | | | 1 | 0.6 | 243.8 | 50.8 | 13 | 5.2 | 314.9 | 38.1 |
| mahogany snapper | 2 | 1.4 | 241.3 | 40.6 | 1 | 0.7 | 241.3 | 12.7 | 1 | 0.6 | 210.8 | 25.4 | 5 | 2.0 | 205.7 | 50.8 |
| yellowtail snapper | 1 | 0.7 | 190.5 | 5.1 | < 1 | 0.3 | 152.4 | - | 4 | 2.5 | 289.6 | 58.4 | | | | |
| gray snapper | | | | | | | | | | | | | < 1 | 0.2 | 254.0 | - |
| lane snapper | | | | | | | | | | | | | < 1 | 0.2 | 203.2 | - |
| black durgeon | | | | | | | | | | | | | 1 | 0.4 | 304.8 | 0 |
| scrawled filefish | | | | | < 1 | 0.3 | 457.2 | - | | | | | | | | |
| French angelfish | 1 | 0.7 | 261.6 | 7.6 | | | | | | | | | < 1 | 0.2 | 355.6 | - |
| rock beauty | | | | | | | | | < 1 | 0.3 | 203.2 | - | | | | |
| red hind | | | | | < 1 | 0.3 | 254.0 | - | | | | | | | | |
| grasby | | | | | | | | | < 1 | 0.3 | 279.4 | 12.7 | | | | |
| tiger grouper | | | | | | | | | < 1 | 0.3 | 381.0 | 76.2 | < 1 | 0.2 | 254.0 | - |
| blue tang | 25 | 17.4 | 162.6 | 72.2 | 27 | 17.9 | 129.5 | 66.0 | 46 | 29.2 | 167.6 | 43.2 | 113 | 45.1 | 144.8 | 43.2 |
| doctorfish | 4 | 2.8 | 154.9 | 35.6 | 8 | 5.3 | 63.5 | 22.9 | 1 | 0.6 | 182.9 | 38.1 | 1 | 0.4 | 50.8 | - |
| surgeonfish | 27 | 18.8 | 121.9 | 60.9 | 21 | 14.0 | 114.3 | 53.3 | 37 | 23.5 | 124.5 | 35.6 | 42 | 16.8 | 119.4 | 25.4 |
| yellow goatfish | 6 | 4.2 | 172.7 | 35.6 | 10 | 6.6 | 241.3 | 22.9 | 1 | 0.6 | 210.8 | 12.7 | 2 | 0.8 | 228.6 | - |
| spotted goatfish | < 1 | 0.3 | 76.2 | 0 | 3 | 2.0 | 121.9 | 25.4 | 1 | 0.6 | 119.4 | 38.1 | | | | |
| bar jack | 4 | 2.8 | 200.7 | 93.9 | 3 | 2.0 | 266.7 | 81.3 | | | | | | | | |
| horse-eye jack | | | | | | | | | 10 | 6.3 | 226.1 | 114.3 | 4 | 1.6 | 246.4 | 6.8 |
| Bermuda chub | 3 | 2.1 | 177.8 | 17.8 | | | | | 2 | 1.3 | 134.6 | 40.6 | 2 | 0.8 | 222.0 | 71.1 |
| squirrelfish | 2 | 1.4 | 228.6 | 30.5 | 2 | 1.3 | 182.9 | 53.3 | | | | | 2 | 0.8 | 218.4 | 25.4 |
| smooth trunkfish | | | | | | | | | 1 | 0.6 | 139.7 | 15.2 | | | | |
| barracuda | < 1 | 0.3 | 1219.2 | 0 | < 1 | 0.3 | 762.0 | - | 1 | 0.6 | 647.7 | - | < 1 | 0.2 | 533.4 | - |
| sennet | | | | | | | | | | | | | 3 | 1.2 | 254.0 | - |
| yellowfin mojarra | 2 | 1.4 | 205.7 | 27.9 | 3 | 2.0 | 210.8 | 48.3 | 1 | 0.6 | 228.6 | 76.2 | | | | |
| jolthead porgy | | | | | < 1 | 0.3 | 304.8 | 50.8 | | | | | | | | |
| cuddingwife wrasse | 2 | 1.4 | 193.0 | 60.9 | 3 | 2.0 | 254.0 | 33.0 | 1 | 0.6 | 254.0 | - | < 1 | 0.2 | 254.0 | - |
| cero mackerel | | | | | | | | | < 1 | 0.3 | 609.6 | - | | | | |
| TOTAL # OF SPECIES: | 24 | | | | 23 | | | | 27 | | | | 25 | | | |

TABLE 3. Biostatistical comparison of the 12 most common species of reef fish caught in fish traps deployed in BUIS and adjacent waters, Tague Bay and Lang Bank. Data from waters adjacent to BUIS and Lang Bank were obtained from commercial fishermen. Fish size is expressed in millimeters and weight in grams.

| FAMILY / SPECIES | LOCATION: BUIS TRAPS | | | | | TAGUE BAY TRAPS | | | | | BUIS ADJACENT WATERS | | | | | LANG BANK | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | LENGTH | | WEIGHT | | | LENGTH | | WEIGHT | | | LENGTH | | WEIGHT | | | LENGTH | | WEIGHT | |
| | N | $\bar{x}$ | Sx | $\bar{x}$ | Sx | N | $\bar{x}$ | Sx | $\bar{x}$ | Sx | N | $\bar{x}$ | Sx | $\bar{x}$ | Sx | N | $\bar{x}$ | Sx | $\bar{x}$ | Sx |
| Holocentridae | | | | | | | | | | | | | | | | | | | | |
| Holocentrus ascensionis (squirrelfish) | 4 | 209.5 | 11.3 | 326.8 | 53.1 | 28 | 204.7 | 12.8 | 216.7 | 41.2 | 0 | - | - | - | - | 21 | 214.2 | 19.9 | 239.3 | 74.4 |
| Serranidae | | | | | | | | | | | | | | | | | | | | |
| Epinephelus guttatus (red hind) | 4 | 313.4 | 65.1 | 686.2 | 325.0 | 0 | - | - | - | - | 0 | - | - | - | - | 16 | 301.3 | 60.5 | 595.3 | 489.7 |
| Lutjandae | | | | | | | | | | | | | | | | | | | | |
| Lutjanus apodus (schoolmaster snapper) | 2 | 351.0 | 29.7 | 1125.0 | 247.5 | 1 | 205.0 | - | 200.0 | - | 0 | - | - | - | - | 7 | 278.1 | 34.6 | 467.9 | 141.9 |
| HAEMULIDAE | | | | | | | | | | | | | | | | | | | | |
| Haemulon plumieri (white grunt) | 1 | 225.0 | - | 250.0 | - | 9 | 200.0 | 15.2 | 257.2 | 69.1 | 105 | 207.8 | 23.9 | 225.9 | 59.5 | 96 | 220.5 | 28.4 | 249.5 | 50.3 |
| Haemulon sciurus (bluestriped grunt) | 4 | 221.8 | 45.5 | 375.0 | 210.2 | 0 | - | - | - | - | 15 | 225.2 | 17.8 | 273.5 | 73.1 | 15 | 238.5 | 9.4 | 306.7 | 39.5 |
| Mullidae | | | | | | | | | | | | | | | | | | | | |
| Mulloidichthys martinicus (yellow goatfish) | 7 | 238.6 | 21.7 | 403.5 | 104.5 | 1 | 240.0 | - | 300.0 | - | 0 | - | - | - | - | 26 | 209.3 | 11.9 | 180.8 | 40.8 |
| Scaridae | | | | | | | | | | | | | | | | | | | | |
| Sparisoma viride (stoplight parrotfish) | 11 | 261.4 | 24.3 | 503.6 | 118.0 | 13 | 245.1 | 32.3 | 384.4 | 160.5 | 28 | 294.8 | 33.7 | 584.8 | 181.9 | 32 | 285.1 | 22.3 | 574.2 | 127.2 |
| Sparisoma chrysopterium (redtail parrotfish) | 3 | 226.7 | 23.1 | 316.7 | 104.1 | 5 | 237.9 | 21.2 | 327.1 | 137.3 | 41 | 246.0 | 20.9 | 317.1 | 76.5 | 48 | 227.0 | 7.2 | 392.1 | 60.5 |
| Scarus taeniopterus (princess parrotfish) | 4 | 292.2 | 43.3 | 556.3 | 214.5 | 0 | - | - | - | - | 0 | - | - | - | - | 10 | 255.0 | 15.8 | 390.0 | 52.9 |
| Sparisoma aurofrenatum | 3 | 204.3 | 24.0 | 241.7 | 52.0 | 4 | 217.5 | 17.6 | 237.5 | 47.9 | 0 | — | — | — | — | 17 | 211.5 | 6.3 | 247.1 | 26.3 |
| Acanthuridae | | | | | | | | | | | | | | | | | | | | |
| Acanthurus coeruleus (blue tang) | 23 | 165.3 | 16.1 | 194.8 | 60.5 | 54 | 177.8 | 19.4 | 217.0 | 74.1 | 29 | 172.8 | 24.2 | 206.0 | 57.7 | 54 | 186.1 | 40.8 | 212.3 | 64.6 |
| Acanthurus bahianus (ocean surgeonfish) | 29 | 171.7 | 32.0 | 192.2 | 94.8 | 15 | 150.4 | 21.3 | 115.7 | 38.7 | 21 | 197.4 | 10.5 | 244.0 | 37.8 | 30 | 189.7 | 16.8 | 204.2 | 66.9 |

TABLE 4. Conch (*Strombus gigas*) census data for two permanent transect areas located east of "E" buoy within the boundaries of BUIS. Transect A (north transect) depth = 8.0m: Transect B (south transect) depth = 8.2m. Transect locations are shown in Figure 1.

| | TRANSECT A | | | | | | TRANSECT B | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DATE | Transect Length(m) | Transect Area($m^2$) | Number Juveniles | Number Adults | Total Conch | Density (Conch/$m^2$) | Transect Length(m) | Transect Area($m^2$) | Number Juveniles | Number Adults | Total Conch | Density (Conch/$m^2$) |
| 1/24/86* | 200 | 800 | 129 | 13 | 142 | .18 | - | - | - | - | - | - |
| 2/21/86** | 322 | 1288 | 139 | 3 | 142 | .11 | 322 | 1288 | 168 | 5 | 173 | .13 |
| 3/21/86 | 322 | 1288 | 185 | 2 | 187 | .15 | 322 | 1288 | 165 | 4 | 169 | .13 |
| 4/18/86 | 322 | 1288 | 154 | 3 | 157 | .12 | 322 | 1288 | 187 | 1 | 188 | .15 |
| 5/29/86 | NO DATA - TRANSECT DISTURBED | | | | | | NO DATA - TRANSECT DISTURBED | | | | | |
| 6/12/86*** | 365 | 1460 | 188 | 2 | 129 | .13 | 322 | 1288 | 179 | 0 | 179 | .14 |
| 6/26/86 | 322 | 1288 | 193 | 0 | 193 | .15 | 322 | 1288 | 198 | 2 | 200 | .16 |

* preliminary transect run

** permanent transects established - 322m in length

*** transects re-established (Transect A - 365m - temporary)

TABLE 5. Lobster census data for three survey areas (West Patch Reef, North Patch Reef and South Fringing Reef) within the boundaries of BUIS. Survey areas are shown in Figure 1.

| STUDY AREAS: | WEST PATCH REEF (624m²) | | | | NORTH PATCH REEF (165m²) | | | | SOUTH FRINGING REEF (1500m²) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *P. argus* | #/m² | *P. guttatus* | #/m² | *P. argus* | #/m² | *P. guttatus* | #/m² | *P. argus* | #/m² | *P. guttatus* | #/m |
| Date: 1/24/86 | 0 | 0 | 0 | 0 | 1+* | 1/165 | 0 | 0 | 2(1+) | 1/1000 | 0 | 0 |
| 2/21/86 | 4(3+) | 1/167 | 1 | 1/500 | 2+ | 1/83 | 3 | 1/56 | 1+ | 1/1429 | 0 | 0 |
| 3/21/86 | 0 | 0 | 2 | 1/333 | 0 | 0 | 3 | 1/56 | 0 | 0 | 3 | 1/500 |
| 4/18/86 | 0 | 0 | 2 | 1/333 | 3(2+) | 1/56 | 1 | 1/165 | 2+ | 1/1000 | 2 | 1/1000 |
| 5/29/86 | 1+ | 1/500 | 0 | 0 | 4(3+) | 1/12 | 0 | 0 | 3(1+) | 1/500 | 2 | 1/1000 |
| 6/26/86 | 0 | 0 | 3 | 1/500 | 1 | 1/165 | 1 | 1/165 | 0 | 0 | 1 | 1/1429 |

* (+) indicates *P. argus* of legal harvestable size (carapace length ≥ 3.5 inches)

TABLE 6. Data on fish trap effort in, near*, and adjacent** to Buck Island Reef National Monument.

| | Boat Number | Number Fishermen | NUMBER OF TRAPS Inside Monument | Near Monument | Adjacent Monument |
|---|---|---|---|---|---|
| | 1 | 2 | 8 | 7 | - |
| | 2 | 3 | 3 | 4 | - |
| | 3 | 3 | 5 | - | - |
| | 4 | 2 | - | - | 8 |
| | 5 | 2 | - | - | 10 |
| TOTALS: | 5 | 12 | 16 | 11 | 18 |

* Near BUIS indicates within 100 m of boundary

** Adjacent BUIS indicates >100 m <300 m of boundary

# BUCK ISLAND REEF NATIONAL MONUMENT

LEGEND

NPR - North Patch Reef
SPR - South Patch Reef
WPR - West Patch Reef
SFR - South Fringing Reef
RC - Reef Crest
FR - Fore Reef
⊗ - Ranger Observation Tower

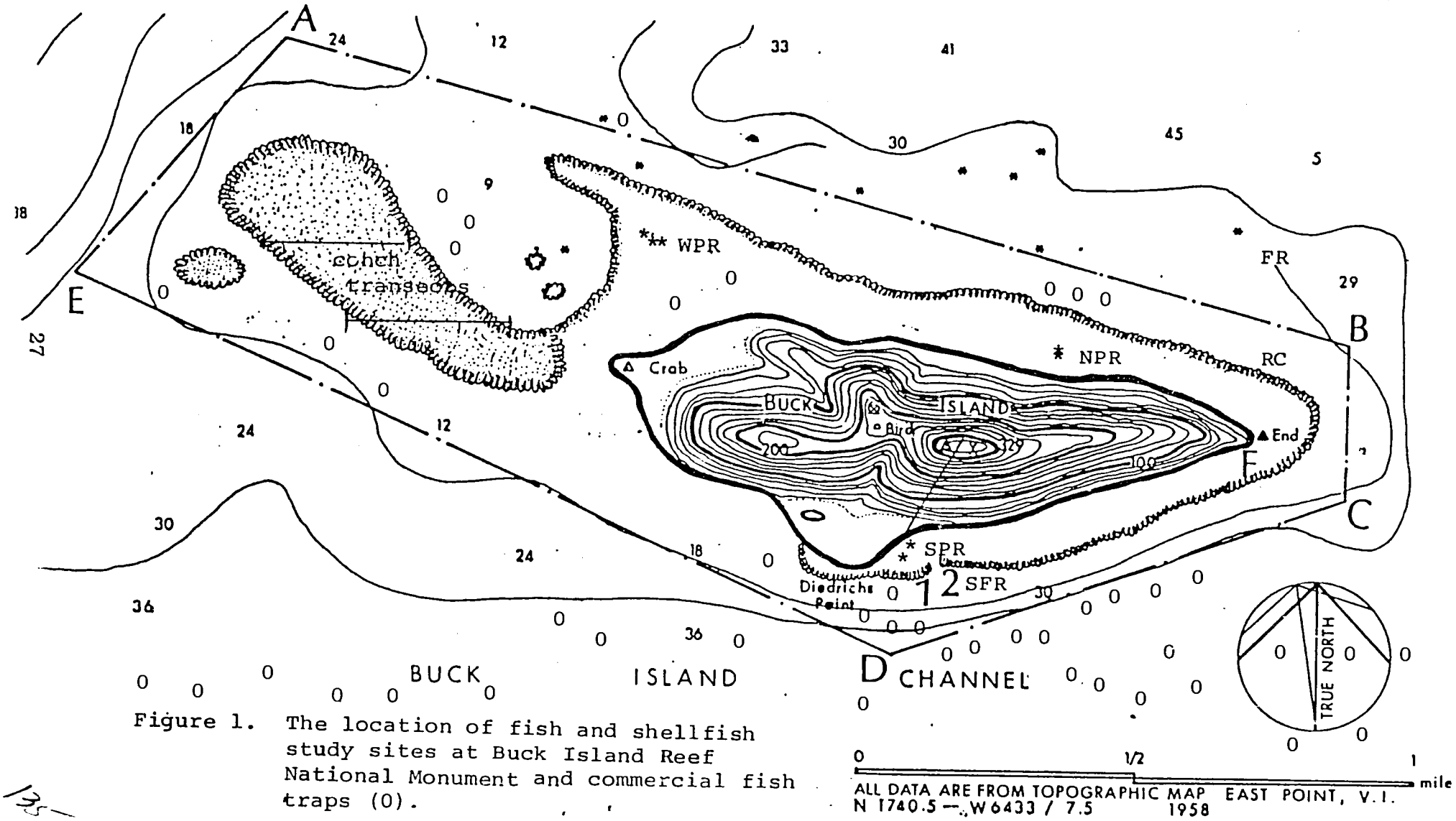



Figure 1. The location of fish and shellfish study sites at Buck Island Reef National Monument and commercial fish traps (0).

135

XN -ABH -590-D

# VIRGIN ISLANDS RESOURCE MANAGEMENT COOPERATIVE

BIOSPHERE RESERVE
RESEARCH REPORT NO. 27

## INITIAL INVENTORY OF THREE PERMANENT FOREST PLOTS IN THE VIRGIN ISLANDS NATIONAL PARK

John E. Earhart
World Wildlife Fund-Conservation Foundation

Anne E. Reilly
New York Botanical Garden

Matt Davis
University of Pennsylvania

U.S. MAN AND THE BIOSPHERE PROGRAM

Virgin Islands National Park

September, 1988

XN-ABH-590-D

# INITIAL INVENTORY OF THREE PERMANENT FOREST PLOTS IN THE VIRGIN ISLANDS NATIONAL PARK

1988

BIOSPHERE RESERVE REPORT NO. 27

JOHN E. EARHART
SENIOR FELLOW
WORLD WILDLIFE FUND-CONSERVATION FOUNDATION

ANNE E. REILLY
NEW YORK BOTANICAL GARDEN

MATT DAVIS
UNIVERSITY OF PENNSYLVANIA

U.S. DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

AND

VIRGIN ISLANDS RESOURCE MANAGEMENT COOPERATIVE
VIRGIN ISLANDS NATIONAL PARK
P.O. BOX 7789, ST. THOMAS
U.S. VIRGIN ISLANDS 00801

LOCAL CONTRACTING AGENT
ISLAND RESOURCES FOUNDATION
RED HOOK BOX 33, ST. THOMAS
U.S. VIRGIN ISLANDS 00802
(NPS CONTRACT NO. CX-0001-3-0048)

137

## ABSTRACT

A quantitative forest inventory was conducted in three permanent study plots within the boundaries of the Virgin Islands National Park on the island of St. John, U.S.V.I. Plot One, on Bordeaux Mountain, is located in the Reef Bay watershed and is 1 hectare (ha) (100m x 100m). Plot Two is found in the L'Esperance area of St. John in the Fish Bay watershed and measures .5 ha (50m x 50m) in area. Plot Three is located on the north coast of the island in the Hawksnest Bay watershed and is also .5 ha (50m x 50x). All stems with a diameter at breast height (DBH, at 1.3 meters) greater than or equal to 5cm were sampled. Information gathered included taxonomic identification, DBH measurements in centimeters, tree heights in meters and spatial distribution within the study plot. With these data, basal area, relative density, relative dominance and relative frequency values were calculated by species.

Plot One (Bordeaux) is located in upland moist forest. A total of 62 species were identified representing 33 families with a basal area of 31.08 square meters from the 2348 stems sampled. The five most important species based on calculation of ecological importance value or I.V. (sum of relative density, relative dominance and relative frequency values) included: Guapira fragrans (I.V.=34.79); Pimenta racemosa (I.V.=32.37); Inga fagifolia (I.V.=31.61); Acacia muricata (I.V.=29.20); and Byrsonima coriacea (I.V.=25.66). Together these five species make up 51.19% of the total importance value.

Plot Two (L'Esperance) is also located in upland moist forest. A total of 39 species were identified representing 26 families with a basal area of 15.82 square meters from the 1199 stems sampled. The five most ecologically important species included: Ardisia obovata (I.V.=67.35); Guapira fragrans (I.V.=38.08); Inga fagifolia (I.V.=21.00); Andira inermis (I.V.=19.09); and Ocotea coriacea (I.V.=13.74). These five trees make up 53.09% of the total importance value.

Plot Three (Hawksnest) is located in the dry evergreen woodland vegetation type. A total of 54 species representing 26 families were identified. The total basal area for the plot was 13.269 square meters from the 1327 sampled stems. The five most ecologically important species included: Melicoccus bijugatus (I.V.=102.67); Guapira fragrans (I.V.=28.46); Bursera simaruba (I.V.=16.23); Ocotea coriacea (I.V.=15.38); and Krugiodendron ferreum (I.V.=12.80). Melicoccus bijugatus an introduced species, makes up 34.22% of the importance value and the five combined total 58.51% of the importance value.

Each study plot has been located in a critical study watershed as determined by VIRMC. The study will be long-term (20 years) and will generate information on the dynamics of secondary forests including growth rates, basic ecology, phytosociology, impact of previous land use

practices, and the role of exotic plant species. Information gathered from this study will provide information to develop strategies for forest management, ecosystem restoration and rare species conservation. It is hoped that this initial inventory will also facilitate additional ancillary studies both in the permanent plots as well as in the watersheds where they are located.

ACKNOWLEDGEMENTS

This phase of the project is a continuation of the VIRMC II support to the study. In both phases we received a great deal of support from a variety of institutions and individuals. The Cooperative Extension Service of the University of the Virgin Islands has been involved with this effort since its conception and has supplied staff time and technical expertise. John Matuszak coordinated this cooperation and remains an active participant in the project. The New York Botanical Gardens and particularly Drs. Ghillean Prance and Scot Mori and Pedro Acevado made several trips to the island to work on plot establishment and the taxonomy. Dr. Roy Woodbury has also been involved with the project since the start and did most of the tree identification work. The Yale School of Forestry and Environmental Studies' Tropical Resources Institute facilitate Anne Reilly's travel to St. John. Dr. Caroline Rogers of the Virgin Islands National Park helped in plot establishment, logistics and provided the encouragement and logistical support that help get things accomplished. Finally, Mrs. Sandra Gavin spent countless hours on editing and calculations of this document.



149

TABLE OF CONTENTS

Abstract.....i

Acknowledgements.....iii

Table of Contents.....iv

List of Tables.....v

List of Figures.....vi

Introduction.....1

Methodology.....2

Study Site.....2

Plot Locations.....3

Bordeaux-Plot One.....3

L'Esperance-Plot Two.....5

Hawksnest-Plot Three.....6

Plot Layout.....6

Data Collection.....7

Results.....11

Conclusions.....25

Literature Cited.....25

Appendix I.....27

Appendix II.....75

Appendix III.....101

LIST OF TABLES

1. Bordeaux Total Species and Importance Value 5.

2. L'Esperance Total Species Importance Value 10.

3. Hawksnest Total Species Importance Value 14.

4. Ten Most Important Species In Each Plot 23.



142

LIST OF FIGURES

1. Map of St. John with Plot Locations 4.

2. Computer Generated Stem Map Plot One from X-Y Coordinates 19.

3. Computer Generated Stem Map Plot Two from X-Y Coordinates 20.

4. Computer Generated Stem Map Plot Three from X-Y Coordinates 21.

# INTRODUCTION

Several recent documents have stressed the need to enhance research and improve management techniques in secondary forest areas in the tropics (Department of State 1930; O.T.A. 1984; World Resources Institute 1986). Vast areas of secondary forests throughout the Neotropics have been overlooked as potentially productive areas due to lack of information on basic ecology and silvicultural possibilities. These areas could potentially be managed for timber and fuelwood in such a manner so as to maintain a high percentage of the ecological integrity while simultaneously relieving pressure on other more critical primary habitats. This situation is especially true in the Caribbean where the land pressure situation is critical and only small amounts of primary forest remain to protect wildlife and watershed resources. Although substantial strides have been made in the last several years, there continues to be a paucity of baseline data available on the dynamics of secondary forests in the Caribbean.

In an effort to gain additional knowledge in this area, the New York Botanical Garden (NYBG) has initiated a long-term secondary forest dynamics study in three critical watersheds in the Virgin Islands National Park. Although not a member of the Virgin Islands Resource Management Cooperative (VIRMC), the NYBG has received substantial support from both Phase II and Phase III VIRMC Research Series supported by the United States National Park Service (NPS). The following report will provide a brief description of the process and progress developed to date on the establishment of the study. The main purpose of this document is to provide the reader with sufficient information on both the methodology and results of the initial inventory so as to be a useful tool for the initiation of ancillary studies or field training exercises in the plots or the same watersheds.

It must be remembered that the overall goal of this effort is to provide forest management information to natural resource professionals and policy makers in the Caribbean to allow for the improved use and management of forest resources. The NYBG is committed to monitoring the plots over a period of twenty years to greatly enhance current knowledge on successional patterns of degraded secondary forests. Only through these types of detailed investigations can appropriate silvicultural prescriptions be developed. Additionally, periodic results will allow for decisions to be made in the hope that the current level of resource degradation can be reduced.

Very little analysis of collected data has been provided in this document. Rather, specific analytical results will be forthcoming via scientific publications in forestry and botanical journals during the twenty year life of the study. Obviously, all such information will be made available immediately to both VIRMC and the Virgin Islands National Park.

The specific purpose of this first phase of the study was to establish the plots and conduct an initial inventory that would provide baseline information on the floristic composition of three forested areas on the island of St. John. The short-term objectives are to identify all trees in each of the three study plots, determine the diameter at breast height (DBH) to facilitate basal area analysis, measure the heights of selected stems to allow for height calculations via regression analysis, and to measure the spatial distribution of the sampled trees.

Remeasuring will be conducted at specific time intervals not to exceed five years. Once these concurrent data are compared with previous information, the long-term objectives of the study can be completed.

These long-term objectives include the following:

- Description of the dynamics and successional patterns of secondary forests on St. John. Data to be gathered include: tree growth, tree mortality and recruitment, taxonomy, physiognomy, competitive strategies and vertical stratification;

- Analysis of the impact of introduced species on the development of natural forest stands;

- Analysis of the role played by major disturbances such as hurricanes;

- Determination of the impact of previous land-use practices on the recovery of the natural forest;

- Production of management strategies for the preservation of endangered plant species.

## METHODOLOGY

### Study Site

St. John was chosen as the site of this long-term study for a number of reasons. From the ecological development standpoint, St. John is similar to many other islands in the Lesser Antilles. The current vegetation is similar to that of nearby islands (Beard 1945; Beard 1949; Little 1969; Woodbury and Little 1976).

Furthermore, the island was also subjected to the same mass exploitation and forest removal that most of the islands of the region. This, combined with the introduction of domestic animals and exotic plant species, has totally altered the natural vegetation in many parts of the Caribbean.

The plots are located in both a Biosphere Reserve and a U.S. National Park. This has given the investigators confidence that the likelihood of the plots being protected over the course of the study is good. Additionally, with the Biosphere Reserve status, the potential for information dissemination, regional significance and training opportunities is much greater.

The Virgin Islands National Park has good information on the status of the natural vegetation at the time the island became a park. A series of aerial photographs dating back to 1954 can be used to evaluate the vegetative changes over time. Assuming that the study areas have been subjected to little or no anthropogenic disturbance in this thirty year period, it would at least on the surface seem that the forest has returned in very natural fashion given the presence of domestic animals and exotic plants.

Finally, there have been a number of previous studies looking at the vegetation of St. John (Robertson 1957; Little and Wadsworth 1964; Ewel and Whitmore 1973; Little et al. 1974; Forman and Hahn 1980; Weaver and Woodbury 1982; Woodbury and Weaver 1987). However, none of these have looked at long-term changes in the forest or the effects of historical land-use practices on stand development.

## Plot Locations

The plots are located in same watersheds where other VIRMC supported research is currently being conducted. This was done to lend a watershed approach to research activities and hopefully reinforce results found in other investigations. The three watersheds were chosen because of current resource pressures and their distinct development histories. As a result, the three plots were located in the Reef Bay, Fish Bay, and Hawksnest Bay watersheds. Through the use of aerial photographs and extensive ground reconnaissance, the study areas were identified. All three plots were selected so as to be relatively accessible on foot yet sufficiently off main thoroughfares so as to avoid vandalism or edge effect. (Approximate plot locations can be seen in Figure 1.)

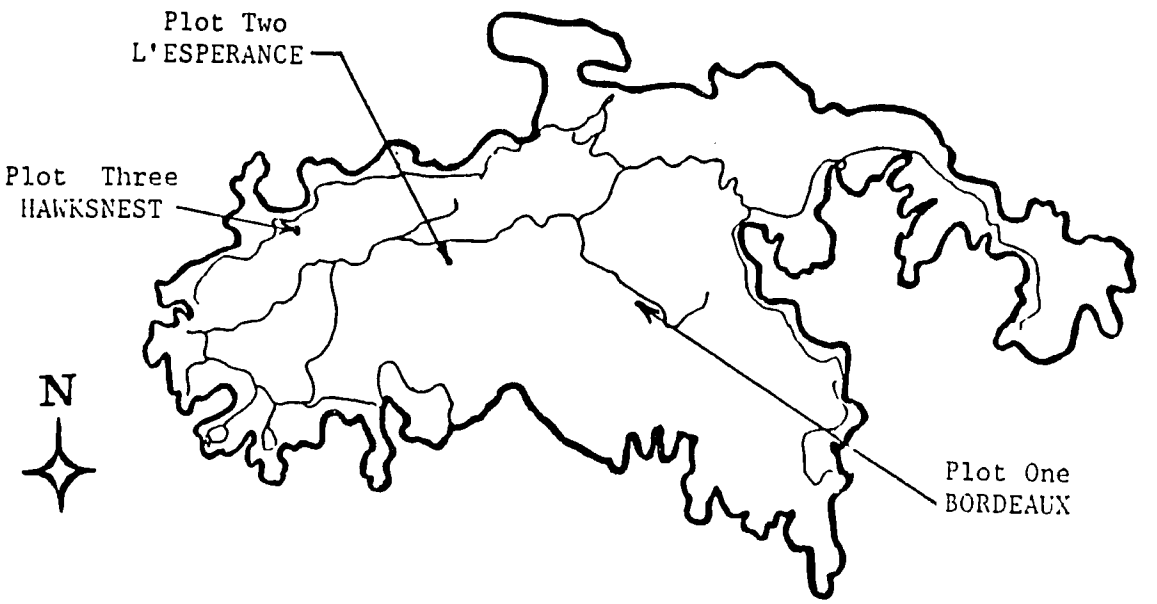
## Bordeaux-Plot One

Bordeaux Plot (see Appendix I for summary data) was first established in 1984. It is located just off the Bordeaux Mountain dirt road at approximately 2.5 kilometers from the Centerline Road turnoff, at an



146

FIGURE 1. Map of St. John with Plot Locations






141

elevation of 280 meters. At utility pole #31403-026 the trail to the plot heads off in a southwest direction down the gut towards Reef Bay Plantation ruins. The plot begins at approximately one kilometer from the Bordeaux Mountain Road. This plot is one hectare (100m x 100m).

The plot is located in secondary forest and has been variously classified as: moist forest (Robertson 1957); subtropical moist forest (Ewel and Whitmore 1973); evergreen broadleaf forest (Teytaud 1983,); and upland moist forest (Woodbury and Weaver 1987). The continuous canopy is approximately 15-20 meters with occasional emergent trees reaching 25 meters. A third lower synusia or continuous canopy layer is made up of several shade tolerant species and advance growth trees attaining a height of between 5-10 meters.

According to historical records, it appears that the area was last farmed approximately one hundred years ago (Tyson 1986). There is a great deal of evidence of previous farming activity within the plot including small bench terraces, artifacts and exotic fruit trees. Tyson (1986) also estimates that sugar cane, a very demanding crop, was grown in the area for somewhat less than one hundred years. Cattle were also grazed in the area. Later analysis will attempt to ascertain the effects of land-use practices on natural regeneration and stand development.

The plot is located on very steep slopes across a intermittent stream bed with north and south facing aspect. The soil series is Cramer (CrF), which is the most common on the island. It is characterized as a well drained clay loam on moderately sloping to steep areas, shallow and well-drained (Rivera et al. 1970). This series is of volcanic origin with reaction values in the 6.1-7.3 pH range.

## L'Esperance-Plot Two

L'Esperance Plot (see Appendix II for data) was initiated in 1985. It is located in the central part of the island approximately 5 kilometers from Cruz Bay. The plot is just off Centerline Road at an elevation of 195 meters and can be found by walking down Rte. 10 at L'Esperance for approximately 1 kilometer and then walking up Fish Bay stream for .5 kilometers in a northeasterly direction. It is a 50m x 100m rectangular, .5 hectare plot oriented in an east-west direction.

According to previous vegetation studies, Plot Two is also located in moist forest. There are three main synusia, although the heights are generally smaller than on Bordeaux. The authors estimate the stand to be somewhat younger than Bordeaux, approximately 60-70 years old. The area was also subjected to several decades of intensive agriculture as evidenced by the presence of terracing. The L'Esperance area has experienced a similar land-use history as Plot One.

The topography is moderately steep and the plot orientation again allows for north/south aspects across the Fish Bay stream. The soil in the L'Esperance area is of the same Cramer (CrF) series, but is thinner and the evidence of past erosion is more pronounced.

Hawksnest-Plot Three

The third plot is located on the north shore of St. John in the Hawksnest Bay area. It can be located by travelling along the Northshore Road, approximately 5.0 kilometers from Cruz Bay. At the end of greater Hawksnest Beach, the road makes a left turn and the plot can be found 500 meters up the Hawksnest Stream bed, by walking in a southeast direction. This plot is also .5 hectares measuring 50m x 100m in a north-south orientation and is located at an elevation of 12 meters.

Ewel and Whitmore (1973) classified this area as subtropical moist forest, differing from both Robertson (1957), who classified the area as dry forest and Woodbury and Weaver (1987), who classified the area as the upland version of the dry evergreen woodland. The area has two basic canopy levels, 5-10 meters and 10-12 meters with occasional emergents in the 15-20 meter range. Overall tree heights are generally shorter in Plot Three when compared with Plots One and Two. The authors estimated that this area was the last of the three plots to be abandoned. Tyson (1986) indicates that the area was subjected to plantation cropping for nearly 200 years, and empirical observations indicate that the area was heavily abused with a great deal more erosion when compared to the other plots; there is virtually no topsoil left.

The plot is laid out in an east-west orientation across the Hawksnest stream bed. The soil survey (Rivera et al., 1970) indicates that the plot is located on Cramer (CrE) series, also a gravelly clay loam and somewhat less sloped topography. The east side of Plot Three is moderately sloped with the west side located on a very steep area.

It is interesting to note that the NPS unfortunately decided to put a large parking lot and reroute the road very close to the Hawksnest plot which required a clearcut of the surrounding forest. The authors plan to look into the possibility of conducting habitat restoration studies in the parking lot area.

Plot Layout

Although there has been little consistency in the layout of quantitative forest inventory studies (Campbell et al. 1986), it was determined by study participants that one full hectare in a 100m x 100m grid and two half hectare plots in a 50m x 50m grid, would be most appropriate for this study. This approach will be evaluated after the first reinventory work to determine its effectiveness. At each plot a compass bearing was chosen and a baseline transect was established along that bearing. This initial baseline was 100 meters and stakes were

planted at 10 meter intervals along the baseline. A perpendicular baseline was then established and a grid of subplots measuring 10m x 10m were staked out and tied with survey line. Each subplot was assigned a number, i.e. 1A-10J in the Plot One, for a total of 100 subplots and 1A-5J in Plot Two and Plot Three, for a total of 50 subplots each. The subplot demarcation facilitated spatial distribution measures and relative frequency calculation for both species and families.

## Data Collection

At each site all stems were measured and DBHs were recorded for all trees measuring five centimeters or greater. The DBH was measured at 1.3 meters and this point was spray painted to allow for the accuracy of future measurements. If a tree was branched below the DBH mark it was classified as a multiple stem (under STEM in data sheets with M= multiple stem and S= straight bole), but was considered as one tree in these initital computer generated stem maps.

Once the DBHs were calculated, the basal area (BA AREA in the data sheets) of each tree was determined using the following equation:

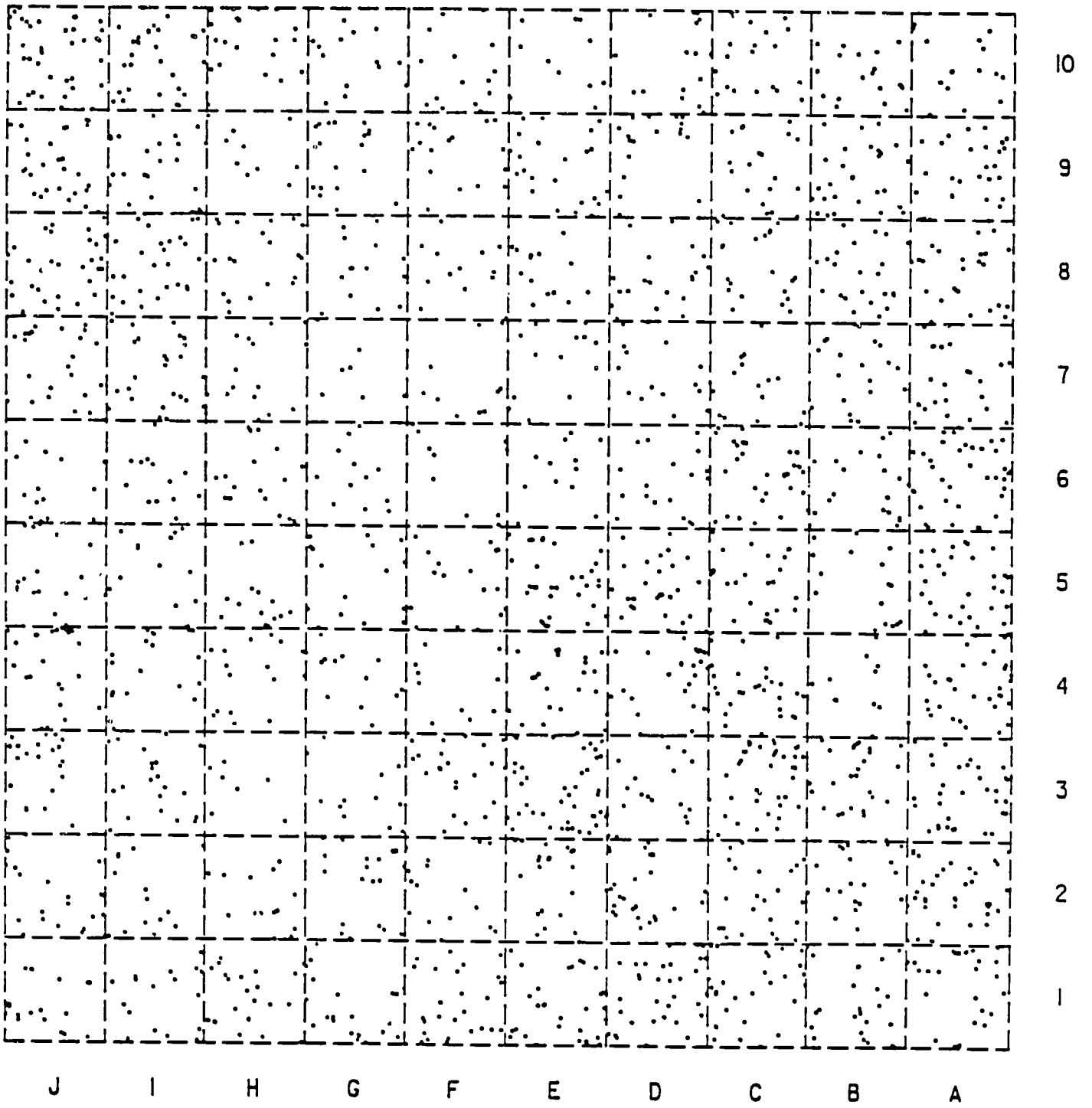
$$\text{Basal Area} = .000078539816 \times \text{DBH}^2$$

Once measured and recorded, each stem was tagged with an aluminum numbered marker (TAG in data sheets) and identified. Species (SPECIES in data sheets) were identified by using the nomenclature of Cronquist (1968) and referenced with Little and Wadsworth (1964), Little et al., (1974), and Acevedo (1985). When questions arose, voucher specimens were returned to the NYBG for specialist review. As can be seen from the data sheets, all species have now been identified. The representative family of each species are also given in the appendices (FAM in the data sheets). The NYBG has established a St. John collection within its herbarium and has recently initiated an entire Flora of the island as a follow-up to this and the Woodbury and Weaver studies.

The trees were then measured within each subplot (SPLT in the data sheets) and assigned X-Y coordinates up to ten meters (X-Y in the data sheets) using a metric tape and measuring to the nearest centimeter. These data were left in relative terms (on a subplot level) to allow for rapid locating by other workers once they are in the appropriate subplot. Thus, it should be easy to find a particular stem for future studies. Figures 2-4 present a computer generated plot of all stems in each plot based on the X-Y coordinates.

The authors had originally planned to collect data on the heights (HGT in the data sheets) of all recorded stems. This information is needed to determine the vertical stratification in the stands of the

FIGURE 2. Computer Generated Stem Map for Plot One from X-Y Coordinates.






151

FIGURE 3. Computer Generated Stem Map for Plot Two from X-Y Coordinates.

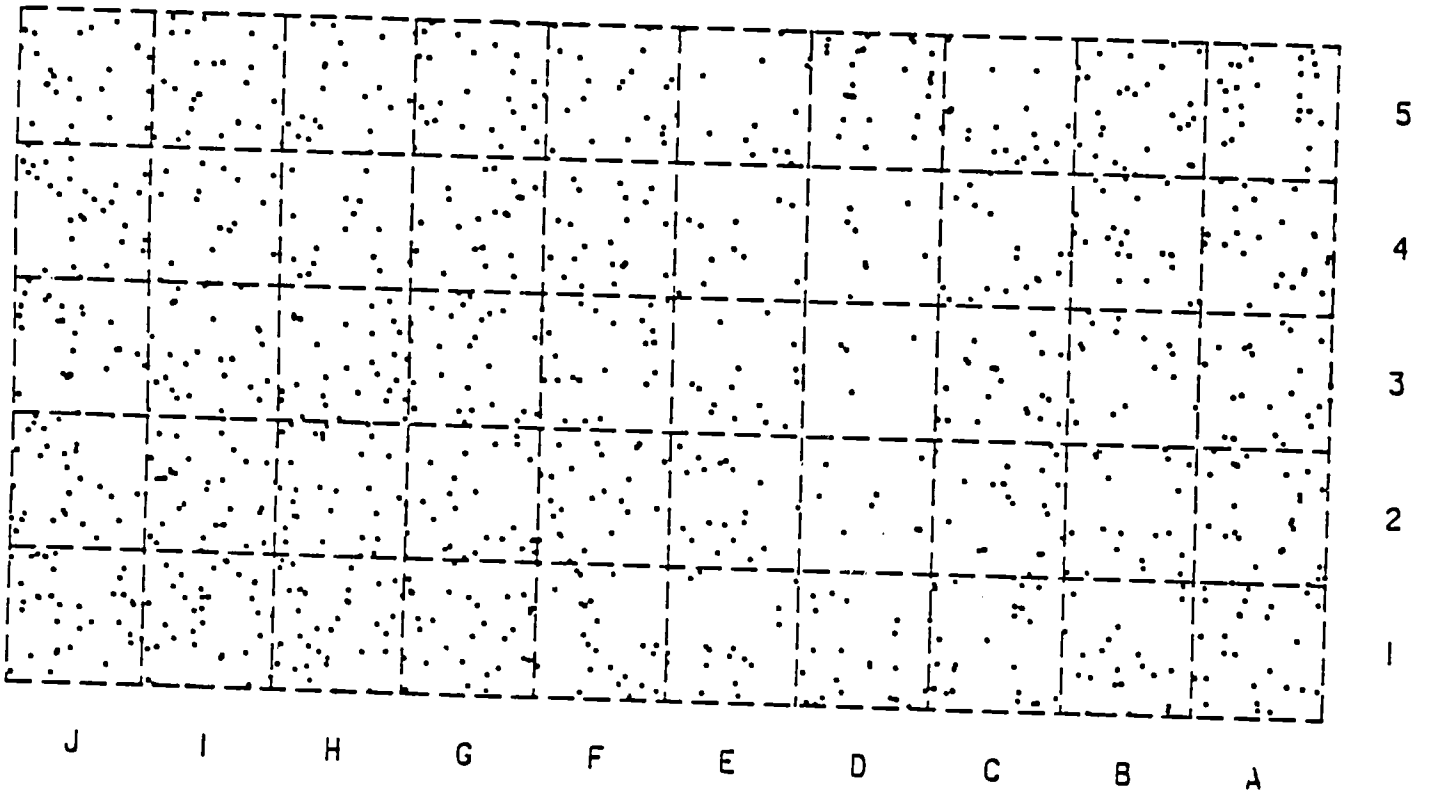
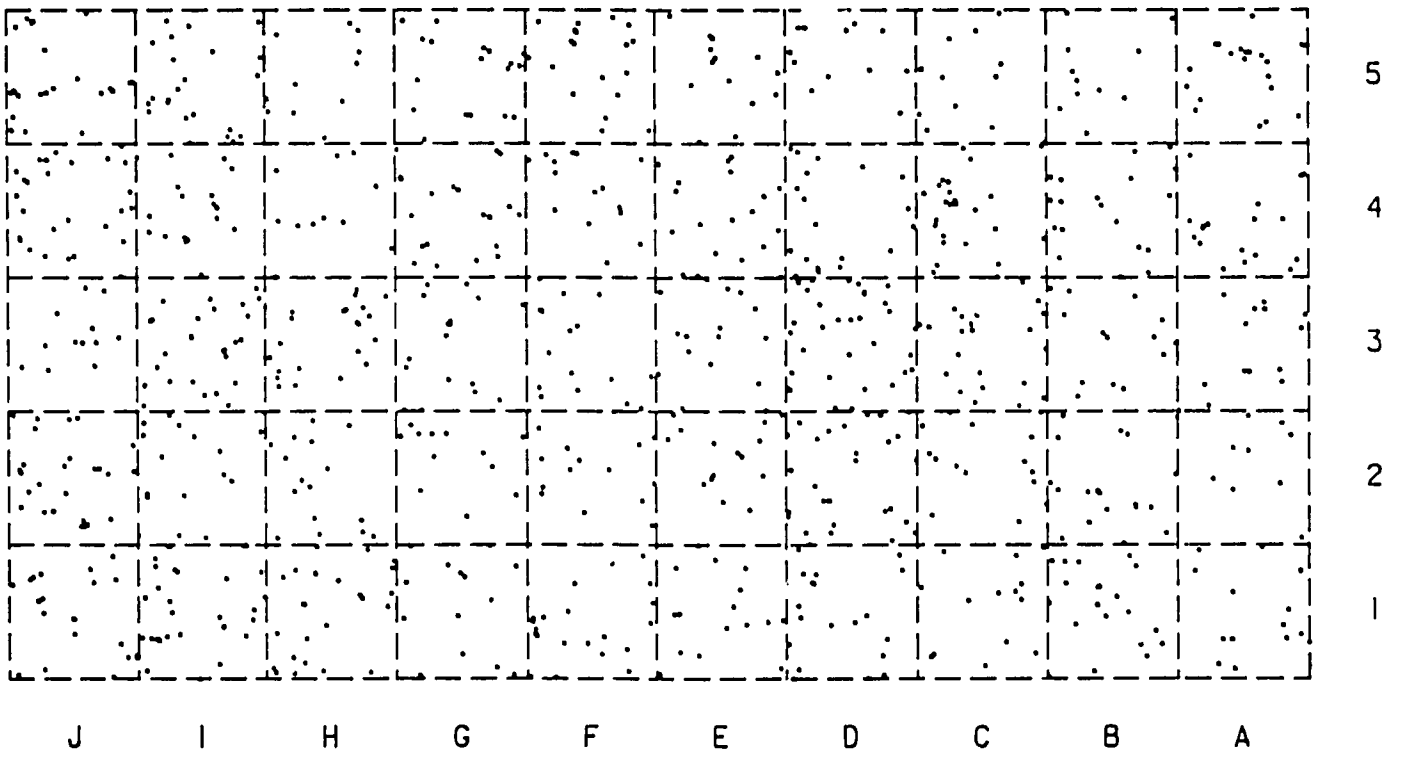


FIGURE 4. Computer Generated Stem Map for Plot Three from X-Y Coordinates.



various study sites. Two methods were employed to determine tree heights to the nearest meter. A range finder was used at the base of the stem where tree tops could be best seen in that location and a clinometer was employed with trigonometric triangulation in situations where the stem top could be better seen at a distance. Unfortunately, due to the density of canopy and the roughness of the terrain, the tree measurement process was much more time consuming than anticipated. As a result, the investigators were unable to finish all tree height measurements. Sufficient information has been gathered to calculate unmeasured tree with regression equations, however, the data sheets only reflect actual measured stems as the study plan calls for complete measurements in the near future.

Additional information was also collected during the course of the data collection. Several trees died (DEAD in the data sheets) or appeared senescent (SICK in the data sheet) during the plot layout and mensuration. This, along with date, is included in the STATUS column on the data sheets. A number of trees were windthrown during the tropical depression storm Klaus in November of 1984 and if still alive are noted as WTHW with date in the data sheet. All of these data can be found in the STATUS column in the various appendices.

## RESULTS

A summary of these initial data can be found in Tables 1-3. Plot One, on Bordeaux mountain (1.0 ha), had a total of 62 species representing 49 genera and 33 families. The basal area of the total 2348 stems 5cm DBH or greater is 31.08 sq. meters. The ecological importance value (I.V.) was calculated for each species. The value is a sum of the relative density, relative dominance and relative frequency of each species within the plot and provides a general idea of the particular importance of individual species of the forest. The five most ecologically important species in the plot make up 51.19% of the total I.V. and include: Guapira fragrans (I.V.=34.79), Pimenta racemosa (I.V.=32.35), Inga fagifolia (I.V.=31.61), Acacia muricata (I.V.=29.20), and Byrsonima coriacea (I.V.=25.66). Together the ten most important species make up 72.78% of the total importance value. All of the top five important species are upper canopy trees. Table 4 provides a list of the top ten species for each plot.

Plot Two, at L'Esperance (.5 ha), had a species richness of 39 species. This total species count represented 33 genera and 26 families. The 1199 sampled stems had a total basal area of 15.82 sq. meters. The five most ecologically important species in the plot include: Ardisia obovata (I.V.=67.35), Guapira fragrans (I.V.=38.08), Inga fagifolia ( I.V.=21.00), Andira inermis (I.V.=19.09), and Ocotea coriacea (I.V.=13.74). Together, these five make up 53.09% of the total I.V. Of this group, only one, Ardisia obovata, is considered a lower canopy species, with the rest being co-dominant trees within the continuous canopy. The ten most important species total 72.82% of the I.V. within the plot.

Plot Three, located in Hawksnest Bay area (.5 ha), had a total of 54 species. This is somewhat surprising as, being a dry forest, it was thought to be less diverse. This species total represented 43 genera and 26 families and the 1327 total stems sampled had a basal area of 13.269 sq. meters. The five most important species include: Melicoccus bijugatus (I.V.=102.67), Guapira fragrans (I.V.=28.46), Bursera simaruba (I.V.=16.23), Ocotea coriacea (I.V.=15.38), and Krugiodendron ferreum (I.V.=12.80). These five trees make up 58.51% of the importance value in this forest type. Of these species, only Krugiodendron ferreum is considered as lower canopy species. Both Krugiodendron ferreum and Bursera simaruba are very indicative of dry forest types. One dominant species, Melicoccus bijugatus, is an introduced tree yet makes up 34.22% of the total I.V.. The fruit of this exotic tree is highly desired by local populations and is perhaps so abundant in this coastal forest due to its being favored. The ten most important trees make up 72.63% of the total importance value.



15

TABLE 1

ST. JOHN FOREST DYNAMICS STUDY

1.

BORDEAUX TOTAL SPECIES AND IMPORTANCE VALUE
(Alphabetical Order)

| NUM | SPECIES | FAMILY | NO.TR | OCCR | B.A. | TOTALS %R.Dn. | %R.F. | %R.Dm. | I.V. | STATUS |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Acacia muricata (L.)Willd | MIMOSACEAE | 248 | 32 | 4.6450 | 10.56 | 3.69 | 14.95 | 29.20 | N |
| 2 | A. westiana DC. | MIMOSACEAE | 3 | 2 | 0.0084 | 0.13 | 0.23 | 0.03 | 0.39 | N |
| 3 | Adenanthera pavonina L. | MIMOSACEAE | 1 | 1 | 0.0027 | 0.04 | 0.12 | 0.01 | 0.17 | N/R |
| 4 | Allophylus racemosus Sw. | SAPINDACEAE | 4 | 3 | 0.0199 | 0.17 | 0.35 | 0.06 | 0.58 | N |
| 5 | Amyris elemifera L. | RUTACEAE | 2 | 1 | 0.0090 | 0.09 | 0.12 | 0.03 | 0.23 | N |
| 6 | Andira inermis (Wright) HBK | FABACEAE | 9 | 7 | 0.0547 | 0.38 | 0.81 | 0.18 | 1.37 | N |
| 7 | Ardisia obovata Desv. | MYRSINACEAE | 222 | 56 | 0.9665 | 9.45 | 6.46 | 3.11 | 19.02 | N |
| 8 | Bourreria succulenta Jacq | BORAGINACEAE | 22 | 12 | 0.1706 | 0.94 | 1.38 | 0.55 | 2.87 | N |
| 9 | Bursera simaruba (L.)Sarg | BURSERACEAE | 1 | 1 | 0.0035 | 0.04 | 0.12 | 0.01 | 0.17 | N |
| 10 | Byrsonima coriacea (Sw)DC | MALPIGHIACEAE | 152 | 44 | 4.3869 | 6.47 | 5.07 | 14.11 | 25.66 | N |
| 11 | Capparis amplissima Lam. | CAPPARIDACEAE | 3 | 3 | 0.0433 | 0.13 | 0.35 | 0.14 | 0.61 | N/R |
| 12 | C. cynophallophora L. | CAPPARIDACEAE | 17 | 11 | 0.0850 | 0.72 | 1.27 | 0.27 | 2.27 | N |
| 13 | C.indica (L.) Fawc.&Rer. | CAPPARIDACEAE | 7 | 5 | 0.0560 | 0.30 | 0.58 | 0.18 | 1.06 | N |
| 14 | Casearia decandra Jacq. | FLACOURTIACEAE | 11 | 8 | 0.0306 | 0.47 | 0.92 | 0.10 | 1.49 | N |
| 15 | C. guianensis (Aubl.)Urb. | FLACOURTIACEAE | 15 | 13 | 0.0685 | 0.64 | 1.50 | 0.22 | 2.36 | N |
| 16 | C. sylvestris Sw. | FLACOURTIACEAE | 3 | 2 | 0.0088 | 0.13 | 0.23 | 0.03 | 0.39 | N |

1.

NO.TR.= Number of Trees of this Species
OCCR= Occurance in Subplots
B.A.= Basal Area Square Meters by Species
%R.Dn.= % Relative Density
%R.Dm.= % Relative Dominance
I.V.= Importance Value (Sum %R.Dn.+%R.F.+%R.Dm.)
%R.F.= % Relative Frequency
STATUS= N=Native;I=Introduced;R=Rare or Endangered



156

TABLE 1 (Continued)

ST. JOHN FOREST DYNAMICS STUDY

1.

BORDEAUX TOTAL SPECIES AND IMPORTANCE VALUE
(Alphabetical Order)

| NUM | SPECIES | FAMILY | NO.TR | OCCR | B.A. | TOTALS %R.Dn. | %R.F. | %R.Dm. | I.V. | STATUS |
|---|---|---|---|---|---|---|---|---|---|---|
| 17 | Chrysophyllum pauciflorum Lam. | SAPOTACEAE | 7 | 6 | 0.0518 | 0.30 | 0.69 | 0.17 | 1.16 | N |
| 18 | Citharexylum fruticosum L | VERBENACEAE | 14 | 9 | 0.0887 | 0.60 | 1.04 | 0.29 | 1.92 | N |
| 19 | Clusia rosea Jacq. | CLUSIACEAE | 20 | 5 | 0.2380 | 0.85 | 0.58 | 0.77 | 2.19 | N |
| 20 | Coccothrinax alta (Cook) Becc. | PALMAE | 8 | 7 | 0.0517 | 0.34 | 0.81 | 0.17 | 1.31 | N |
| 21 | Cordia alliodora (Ruis & Pav.) Oken | BORAGINACEAE | 23 | 15 | 0.3185 | 0.98 | 1.73 | 1.02 | 3.73 | N |
| 22 | C. collococca L. | BORAGINACEAE | 9 | 7 | 0.0576 | 0.38 | 0.81 | 0.19 | 1.38 | N |
| 23 | C. laevigata Lam. | BORAGINACEAE | 1 | 1 | 0.0043 | 0.04 | 0.12 | 0.01 | 0.17 | N |
| 24 | C. sulcata DC | BORAGINACEAE | 26 | 17 | 0.2554 | 1.11 | 1.96 | 0.82 | 3.89 | N |
| 25 | Cupania triquetra A.Rich. | SAPINDACEAE | 1 | 1 | 0.0152 | 0.04 | 0.12 | 0.05 | 0.21 | N |
| 26 | Didymopanax morototoni (Aubl.) Decne & Pl. | ARALIACEAE | 11 | 10 | 0.2392 | 0.47 | 1.15 | 0.77 | 2.39 | N |
| 27 | Drypetes alba Poit. | EUPHORBIACEAE | 9 | 7 | 0.0268 | 0.38 | 0.81 | 0.09 | 1.28 | N |
| 28 | Eugenia biflora (L.) DC. | MYRTACEAE | 4 | 4 | 0.0145 | 0.17 | 0.46 | 0.05 | 0.68 | N |
| 29 | E. monticola (Sw.) DC. | MYRTACEAE | 10 | 6 | 0.0657 | 0.43 | 0.69 | 0.21 | 1.33 | N |
| 30 | Faramea occidentalis (L.) A.Rich. | RUBIACEAE | 65 | 38 | 0.1689 | 2.77 | 4.38 | 0.54 | 7.69 | N |
| 31 | Ficus citrifolia Mill. | MORACEAE | 1 | 1 | 0.0068 | 0.04 | 0.12 | 0.02 | 0.18 | N |
| 32 | F. trigonata L. | MORACEAE | 3 | 1 | 0.2166 | 0.13 | 0.12 | 0.70 | 0.94 | N |

1.

NO.TR.= Number of Trees of this Species
OCCR= Occurance in Subplots
B.A.= Basal Area Square Meters by Species
%R.Dn.= % Relative Density
%R.Dm.= % Relative Dominance
I.V.= Importance Value (Sum %R.Dn.+%R.F.+%R.Dm.)
%R.F.= % Relative Frequency
STATUS= N=Native;I=Introduced;R=Rare or Endangered



15

TABLE 1 (Continued)

ST. JOHN FOREST DYNAMICS STUDY

1.

BORDEAUX TOTAL SPECIES AND IMPORTANCE VALUE
(Alphabetical Order)

| NUM | SPECIES | FAMILY | NO.TR | OCCR | B.A. | TOTALS %R.Dn. | %R.F. | %R.Dm. | I.V. | STATUS |
|---|---|---|---|---|---|---|---|---|---|---|
| 33 | Guapira fragrans (DC.) Little | NYCTAGINACEAE | 296 | 82 | 3.9545 | 12.61 | 9.46 | 12.72 | 34.79 | N |
| 34 | Guazuma ulmifolia Lam. | STERCULIACEAE | 30 | 24 | 1.4044 | 1.28 | 2.77 | 4.52 | 8.56 | N |
| 35 | Guettarda scabra (L.)Lamb | RUBIACEAE | 49 | 23 | 0.2222 | 2.09 | 2.65 | 0.71 | 5.45 | N |
| 36 | Hymenaea courbaril L. | CAESALPINACEAE | 7 | 4 | 0.5191 | 0.30 | 0.46 | 1.67 | 2.43 | N |
| 37 | Ilex urbaniana Loes. | AQUIFOLIACEAE | 10 | 4 | 0.0857 | 0.43 | 0.46 | 0.28 | 1.16 | N/R |
| 38 | Inga fagifolia (L.)Willd. | MIMOSACEAE | 259 | 77 | 3.6371 | 11.03 | 8.88 | 11.70 | 31.61 | N |
| 39 | Krugiodendron ferreum (Vahl) Urb. | RHAMNACEAE | 4 | 3 | 0.0186 | 0.17 | 0.35 | 0.06 | 0.58 | N |
| 40 | Licaria salicifolia (Sw.) Kosterm | LAURACEAE | 17 | 12 | 0.1208 | 0.72 | 1.38 | 0.39 | 2.50 | N |
| 41 | L. triandra (Sw.) Kosterm | LAURACEAE | 3 | 3 | 0.0652 | 0.13 | 0.35 | 0.21 | 0.68 | N |
| 42 | Linociera caribaea (Jacq) Knobl. | OLEACEAE | 89 | 31 | 0.4357 | 3.79 | 3.58 | 1.40 | 8.77 | N |
| 43 | Macfadyena unguis-cati (L.) Gentry | BIGNONIACEAE | 1 | 1 | 0.0031 | 0.04 | 0.12 | 0.01 | 0.17 | N |
| 44 | Mangifera indica (L.) | ANACARDIACEAE | 3 | 2 | 0.0274 | 0.13 | 0.23 | 0.09 | 0.45 | I |
| 45 | Margaritaria noblis (L.f.),Muell.& Arg. | EUPHORBIACEAE | 2 | 2 | 0.0353 | 0.09 | 0.23 | 0.11 | 0.43 | N |
| 46 | Maytenus elliptica (Lam.) Krug & Urb. | CELASTRACEAE | 8 | 4 | 0.1447 | 0.34 | 0.46 | 0.47 | 1.27 | N |
| 47 | Morisonia americana L. | CAPPARIDACEAE | 35 | 20 | 0.1857 | 1.49 | 2.31 | 0.60 | 4.39 | N |
| 48 | Myrcia citrifolia (Aubrl.) Urb. | MYRTACEAE | 36 | 22 | 0.1429 | 1.53 | 2.54 | 0.46 | 4.53 | N |

1.

NO.TR.= Number of Trees of this Species
OCCR= Occurance in Subplots
B.A.= Basal Area Square Meters by Species
%R.Dn.= % Relative Density
%R.Dm.= % Relative Dominance
I.V.= Importance Value (Sum %R.Dn.+%R.F.+%R.Dm.)
%R.F.= % Relative Frequency
STATUS= N=Native;I=Introduced;R=Rare or Endangered

TABLE 1 (Continued)

ST. JOHN FOREST DYNAMICS STUDY

1.

BORDEAUX TOTAL SPECIES AND IMPORTANCE VALUE
(Alphabetical Order)

| NUM | SPECIES | FAMILY | NO.TR | OCCR | B.A. | TOTALS %R.Dn. | %R.F. | %R.Dm. | I.V. | STATUS |
|---|---|---|---|---|---|---|---|---|---|---|
| 49 | Myrciaria floribunda (West.ex Willd) Berg. | MYRTACEAE | 3 | 2 | 0.0116 | 0.13 | 0.23 | 0.04 | 0.40 | N |
| 50 | Ocotea antillana Meisn. | LAURACEAE | 1 | 1 | 0.0232 | 0.04 | 0.12 | 0.07 | 0.23 | N/R |
| 51 | O. coriacea (Sw.) Britt. | LAURACEAE | 108 | 50 | 0.6953 | 4.60 | 5.77 | 2.24 | 12.60 | N |
| 52 | O. sintenisii Urb. | LAURACEAE | 11 | 6 | 0.1458 | 0.47 | 0.69 | 0.47 | 1.63 | N/R |
| 53 | Ouratea littoralis Urb. | OCHNACEAE | 1 | 1 | 0.0020 | 0.04 | 0.12 | 0.01 | 0.16 | N |
| 54 | Picrasma antillana (Egg.) Urb. | SIMAROUBACEAE | 2 | 1 | 0.0526 | 0.09 | 0.12 | 0.17 | 0.37 | N/R |
| 55 | Pimenta racemosa (Mill.) Moore | MYRTACEAE | 317 | 77 | 3.1042 | 13.50 | 8.88 | 9.99 | 32.37 | N |
| 56 | Pouteria multiflora (DC.) Eyma | SAPOTACEAE | 11 | 5 | 0.1166 | 0.47 | 0.58 | 0.38 | 1.42 | N |
| 57 | Sabinea florida (Vahl)DC. | FABACEAE | 2 | 2 | 0.0082 | 0.09 | 0.23 | 0.03 | 0.34 | N |
| 58 | Spondias mombin L. | ANACARDIACEAE | 2 | 2 | 0.1119 | 0.09 | 0.23 | 0.36 | 0.68 | N |
| 59 | Tabebuia heterophylla (DC.) Britt. | BIGNONIACEAE | 67 | 38 | 2.6805 | 2.85 | 4.38 | 8.62 | 15.86 | N |
| 60 | Ternstroemia peducularis DC. | THEACEAE | 4 | 4 | 0.0601 | 0.17 | 0.46 | 0.19 | 0.83 | N |
| 61 | Trichostigma octandrum (L.) Walter | PHYTOLACCACEAE | 3 | 2 | 0.0105 | 0.13 | 0.23 | 0.03 | 0.39 | N |
| 62 | Zanthoxylum martinicense (Lam.) DC. | RUTACEAE | 35 | 26 | 0.6757 | 1.49 | 3.00 | 2.17 | 6.66 | N |
| | | TOTALS | 2348 | 867 | 31.0797 | 100.00 | 100.00 | 100.00 | 300.00 | |

1.

NO.TR.= Number of Trees of this Species
OCCR= Occurance in Subplots
B.A.= Basal Area Square Meters by Species
%R.Dn.= % Relative Density
%R.Dm.= % Relative Dominance
I.V.= Importance Value (Sum %R.Dn.+%R.F.+%R.Dm.)
%R.F.= % Relative Frequency
STATUS= N=Native;I=Introduced;R=Rare or Endangered



154

TABLE 2

ST. JOHN FOREST DYNAMICS STUDY

1.

L'ESPERANCE TOTAL SPECIES AND IMPORTANCE VALUE
(Alphabetical Order)

| NUM | SPECIES | FAMILY | NO.TR | OCCR | B.A. | TOTALS %R.Dn. | %R.F. | %R.Dm. | I.V. | STATUS |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Andira inermis HBK. | FABACEAE | 73 | 34 | 0.7888 | 6.09 | 8.02 | 4.98 | 19.09 | N |
| 2 | Ardisia obovata Devs. | MYRSINACEAE | 491 | 50 | 2.3114 | 40.95 | 11.79 | 14.61 | 67.35 | N |
| 3 | Bourreria succulenta Jacq | BORAGINACEAE | 6 | 5 | 0.0259 | 0.50 | 1.18 | 0.16 | 1.84 | N |
| 4 | Bursera simaruba (L)Sarg. | BURSERACEAE | 3 | 2 | 0.0598 | 0.25 | 0.47 | 0.38 | 1.10 | N |
| 5 | Capparis amplissima Lam. | CAPPARIDACEAE | 2 | 2 | 0.0299 | 0.17 | 0.47 | 0.19 | 0.83 | N/R |
| 6 | Casearia decandra Jacq. | FLACOURTIACEAE | 8 | 7 | 0.0398 | 0.67 | 1.65 | 0.25 | 2.57 | N |
| 7 | C. guianensis (Aubl) Urb. | FLACOURTIACEAE | 19 | 10 | 0.093881 | 1.58 | 2.36 | 0.59 | 4.54 | N |
| 8 | C. sylvestris Sw. | FLACOURTIACEAE | 2 | 2 | 0.0055 | 0.17 | 0.47 | 0.03 | 0.67 | N |
| 9 | Chrysophyllum eggersii Pierre | SAPOTACEAE | 2 | 1 | 0.0575 | 0.17 | 0.24 | 0.36 | 0.77 | N/R |
| 10 | C. pauciflorum Lam. | SAPOTACEAE | 45 | 28 | 0.4414 | 3.75 | 6.60 | 2.79 | 13.15 | N |
| 11 | Citharexylum fruticosum L | VERBENACEAE | 2 | 2 | 0.0205 | 0.17 | 0.47 | 0.13 | 0.77 | N |
| 12 | Clusia rosea Jacq. | CLUSIACEAE | 15 | 7 | 0.3704 | 1.25 | 1.65 | 2.34 | 5.24 | N |
| 13 | Coccothrinax alta (Cook) Beccari | PALMAE | 1 | 1 | 0.0100 | 0.08 | 0.24 | 0.06 | 0.38 | N |
| 14 | Cordia alliodora (Ruis & Pav.) Oken | BORAGINACEAE | 17 | 11 | 0.292512 | 1.42 | 2.59 | 1.85 | 5.86 | N |
| 15 | C. collococca L. | BORAGINACEAE | 1 | 1 | 0.0065 | 0.08 | 0.24 | 0.04 | 0.36 | N |
| 16 | Cupania triquetra A.Rich. | SAPINDACEAE | 1 | 1 | 0.0060 | 0.08 | 0.24 | 0.04 | 0.36 | N |

1.

NO.TR.= Number of Trees of this Species
OCCR= Occurance in Subplots
B.A.= Basal Area Square Meters by Species
%R.Dn.= % Relative Density
%R.Dm.= % Relative Dominance
I.V.= Importance Value (Sum %R.Dn.+%R.F.+%R.Dm.)
%R.F.= % Relative Frequency
STATUS= N=Native;I=Introduced;R=Rare or Endangered

TABLE 2 (Continued)

ST. JOHN FOREST DYNAMICS STUDY

1.

L'ESPERANCE TOTAL SPECIES AND IMPORTANCE VALUE
(Alphabetical Order)

| NUM | SPECIES | FAMILY | NO.TR | OCCR | B.A. | TOTALS %R.Dn. | %R.F. | %R.Dm. | I.V. | STATUS |
|---|---|---|---|---|---|---|---|---|---|---|
| 17 | Daphnopsis americana spp. caribaea(Gris.)Nevil | THYMELAEACEAE | 25 | 15 | 0.2191 | 2.09 | 3.54 | 1.38 | 7.01 | N |
| 18 | Erythroxylum rotundifolium Lunan | ERYTHROXYLACEAE | 14 | 8 | 0.0475 | 1.17 | 1.89 | 0.30 | 3.35 | N |
| 19 | Eugenia biflora (L.) DC. | MYRTACEAE | 2 | 2 | 0.0077 | 0.17 | 0.47 | 0.05 | 0.69 | N |
| 20 | E. monticola (SW.) DC. | MYRTACEAE | 14 | 7 | 0.077297 | 1.17 | 1.65 | 0.49 | 3.31 | N |
| 21 | Faramea occidentalis (L.) A. Rich. | RUBIACEAE | 10 | 8 | 0.035330 | 0.83 | 1.89 | 0.22 | 2.94 | N |
| 22 | Ficus trigonata L. | MORACEAE | 2 | 2 | 0.4372 | 0.17 | 0.47 | 2.76 | 3.40 | N |
| 23 | Guapira fragrans (DC.) Little | NYCTAGINACEAE | 67 | 33 | 3.9105 | 5.59 | 7.78 | 24.71 | 38.08 | N |
| 24 | Guazuma ulmifolia Lam. | STERCULIACEAE | 3 | 3 | 0.3901 | 0.25 | 0.71 | 2.47 | 3.42 | N |
| 25 | Guettarda parviflora Vahl. | RUBIACEAE | 42 | 17 | 0.2915 | 3.50 | 4.01 | 1.84 | 9.35 | N |
| 26 | G. scabra (L.) Lam. | RUBIACEAE | 51 | 18 | 0.2910 | 4.25 | 4.25 | 1.84 | 10.34 | N |
| 27 | Hymenaea courbaril L. | CAESALPINACEAE | 19 | 12 | 1.4627 | 1.58 | 2.83 | 9.24 | 13.66 | N |
| 28 | Inga fagifolia (L.)Willd. | MIMOSACEAE | 59 | 32 | 1.349668 | 4.92 | 7.55 | 8.53 | 21.00 | N |
| 29 | Mangifera indica L. | ANACARDIACEAE | 1 | 1 | 0.057680 | 0.08 | 0.24 | 0.36 | 0.68 | I |
| 30 | Margaritaria nobilis (L.f.) Muell.& Arg. | EUPHORBIACEAE | 13 | 9 | 0.824281 | 1.08 | 2.12 | 5.21 | 8.42 | N |
| 31 | Maytenus elliptica (Lam.) Krug & Urb. | CELASTRACEAE | 1 | 1 | 0.0021 | 0.08 | 0.24 | 0.01 | 0.33 | N |
| 32 | Melicoccus bijugatus Jacq | SAPINDACEAE | 23 | 11 | 0.2570 | 1.92 | 2.59 | 1.62 | 6.14 | I |

1.

NO.TR.= Number of Trees of this Species
OCCR= Occurance in Subplots
B.A.= Basal Area Square Meters by Species
%R.Dn.= % Relative Density
%R.Dm.= % Relative Dominance
I.V.= Importance Value (Sum %R.Dn.+%R.F.+%R.Dm.)
%R.F.= % Relative Frequency
STATUS= N=Native;I=Introduced;R=Rare or Endangered

TABLE 2 (Continued)

ST. JOHN FOREST DYNAMICS STUDY

1.

L'ESPERANCE TOTAL SPECIES AND IMPORTANCE VALUE
(Alphabetical Order)

| NUM | SPECIES | FAMILY | NO.TR | OCCR | B.A. | TOTALS %R.Dn. | %R.F. | %R.Dm. | I.V. | STATUS |
|---|---|---|---|---|---|---|---|---|---|---|
| 33 | Myrcia citrifolia (Aubrl.) Urb. | MYRTACEAE | 3 | 2 | 0.013331 | 0.25 | 0.47 | 0.08 | 0.81 | N |
| 34 | Myrciaria floribunda (West. ex Willd) Berg. | MYRTACEAE | 40 | 15 | 0.1904 | 3.34 | 3.54 | 1.20 | 8.08 | N |
| 35 | Ocotea coriacea (SW.) Britt. | LAURACEAE | 48 | 29 | 0.4577 | 4.00 | 6.84 | 2.89 | 13.74 | N |
| 36 | Psidium amplexicaule Pers | MYRTACEAE | 17 | 10 | 0.0623 | 1.42 | 2.36 | 0.39 | 4.17 | N/R |
| 37 | Sabinea florida (Vahl)DC. | FABACEAE | 11 | 6 | 0.032686 | 0.92 | 1.42 | 0.21 | 2.54 | N |
| 38 | Tabebuia heterophylla (DC.) Britt. | BIGNONIACEAE | 43 | 16 | 0.7871 | 3.94 | 3.77 | 4.97 | 12.69 | N |
| 39 | Zanthoxylum martinicensis (Lam.) DC. | RUTACEAE | 3 | 3 | 0.088192 | 0.28 | 0.71 | 0.56 | 1.54 | N |
| | | TOTALS | 1199 | 424 | 15.824 | 100.4 | 100.0 | 100.2 | 300.6 | |

1.

NO.TR.= Number of Trees of this Species
OCCR= Occurance in Subplots
B.A.= Basal Area Square Meters by Species
%R.Dn.= % Relative Density
%R.Dm.= % Relative Dominance
I.V.= Importance Value (Sum %R.Dn.+%R.F.+%R.Dm.)
%R.F.= % Relative Frequency
STATUS= N=Native;I=Introduced;R=Rare or Endangered



- 187

TABLE 3

ST. JOHN FOREST DYNAMICS STUDY

1.

HAWKSNEST TOTALS SPECIES AND IMPORTANCE VALUE
(Alphabetical Order)

| NUM | SPECIES | FAMILY | NO.TR | OCCR | B.A. | TOTALS %R.Dn. | %R.F. | %R.Dm. | I.V. | STATUS |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Acacia muricata (L) Willd | MIMOSACEAE | 1 | 1 | 0.0186 | 0.08 | 0.14 | 0.08 | 0.29 | N |
| 2 | Amyris elemifera L. | RUTACEAE | 3 | 2 | 0.0143 | 0.23 | 0.11 | 0.23 | 0.56 | N |
| 3 | Andira inermis (Wright.) HBK. | FABACEAE | 26 | 13 | 0.2451 | 1.96 | 1.85 | 1.96 | 5.77 | N |
| 4 | Ardisia obovata Desv. | MYRCINACEAE | 33 | 13 | 0.1259 | 2.49 | 0.95 | 2.49 | 5.92 | N |
| 5 | Bourreria succulenta Jacq | BORAGINACEAE | 38 | 17 | 0.5269 | 2.86 | 3.97 | 2.86 | 9.70 | N |
| 6 | Bumelia obovata (Lam.) A. DC | SAPOTACEAE | 6 | 2 | 0.0406 | 0.45 | 0.31 | 0.45 | 1.21 | N |
| 7 | Bumelia salicifolia (L.) Sw. | SAPOTACEAE | 1 | 1 | 0.0289 | 0.08 | 0.22 | 0.08 | 0.37 | N |
| 8 | Bursera simaruba (L) Sarg | BURSERACEAE | 37 | 18 | 1.413661 | 2.79 | 10.65 | 2.79 | 16.23 | N |
| 9 | Calyptranthes thomasiana Berg. | MYRTACEAE | 1 | 1 | 0.0036 | 0.08 | 0.03 | 0.08 | 0.18 | N/R |
| 10 | Capparis amplissima Lam. | CAPPARIDACEAE | 9 | 5 | 0.0675 | 0.68 | 0.51 | 0.68 | 1.87 | N/R |
| 11 | C. cynophallophora L. | CAPPARIDACEAE | 7 | 7 | 0.0284 | 0.53 | 0.21 | 0.53 | 1.27 | N |
| 12 | C. indica (L.) Fawc.& Rendle | CAPPARIDACEAE | 8 | 5 | 0.0322 | 0.60 | 0.24 | 0.60 | 1.45 | N |
| 13 | C. frondosa Jacq. | CAPPARIDACEAE | 2 | 2 | 0.0048 | 0.15 | 0.04 | 0.15 | 0.34 | N |
| 14 | Casearia decandra Jacq. | FLACOURTIACEAE | 23 | 9 | 0.0967 | 1.73 | 0.73 | 1.73 | 4.20 | N |
| 15 | C. guianensis (Aubl.)Urb. | FLACOURTIACEAE | 13 | 10 | 0.0623 | 0.98 | 0.47 | 0.98 | 2.43 | N |
| 16 | C. sylvestris Sw. | FLACOURTIACEAE | 2 | 2 | 0.0053 | 0.15 | 0.04 | 0.15 | 0.34 | N |

1.

NO.TR.= Number of Trees of this Species
OCCR= Occurance in Subplots
B.A.= Basal Area Square Meters by Species
%R.Dn.= % Relative Density
%R.Dm.= % Relative Dominance
I.V.= Importance Value (Sum %R.Dn.+%R.F.+%R.Dm.)
%R.F.= % Relative Frequency
STATUS= N=Native;I=Introduced;R=Rare or Endangered

TABLE 3 (Continued)

ST. JOHN FOREST DYNAMICS STUDY

1.

HAWKSNEST TOTALS SPECIES AND IMPORTANCE VALUE
(Alphabetical Order)

| NUM | SPECIES | FAMILY | NO.TR | OCCR | B.A. | TOTALS %R.Dn. | %R.F. | %R.Dm. | I.V. | STATUS |
|---|---|---|---|---|---|---|---|---|---|---|
| 17 | Chrysophyllum pauciflorum Lam. | SAPOTACEAE | 5 | 2 | 0.0423 | 0.38 | 0.32 | 0.38 | 1.07 | N |
| 18 | Citharexylum fruticosum L | VERBENACEAE | 24 | 16 | 0.2243 | 1.81 | 1.69 | 1.81 | 5.31 | N |
| 19 | Coccothrinax alta (Cook) Beccari | PALMAE | 5 | 4 | 0.0213 | 0.38 | 0.16 | 0.38 | 0.91 | N |
| 20 | Coccoloba krugii Lindeau | POLYGONACEAE | 20 | 5 | 0.1355 | 1.51 | 1.02 | 1.51 | 4.04 | N |
| 21 | C. microstachya Willd. | POLYGONACEAE | 12 | 3 | 0.1441 | 0.90 | 1.09 | 0.90 | 2.89 | N |
| 22 | Comocladia dodonaea (L.) Urb. | ANACARDIACEAE | 1 | 1 | 0.0035 | 0.08 | 0.03 | 0.08 | 0.18 | N |
| 23 | Cordia alliodora (Ruis & Pav.) Oken | BORAGINACEAE | 12 | 8 | 0.1164 | 0.90 | 0.88 | 0.90 | 2.69 | N |
| 24 | C. collococca L. | BORAGINACEAE | 14 | 11 | 0.1522 | 1.06 | 1.15 | 1.06 | 3.26 | N |
| 25 | Eyrthroxylum rotundifolium L. | ERYTHROXYLACEAE | 7 | 6 | 0.0234 | 0.53 | 0.18 | 0.53 | 1.23 | N |
| 26 | Eugenia biflora (L.) DC. | MYRTACEAE | 28 | 13 | 0.1120 | 2.11 | 0.84 | 2.11 | 5.06 | N |
| 27 | E. monticola (Sw.) DC. | MYRTACEAE | 37 | 24 | 0.1748 | 2.79 | 1.32 | 2.79 | 6.89 | N |
| 28 | E. procera (Sw.) Poir | MYRTACEAE | 2 | 1 | 0.0136 | 0.15 | 0.10 | 0.15 | 0.40 | N |
| 29 | Exostema caribaeum (Jacq) Roem & Schult. | RUBIACEAE | 1 | 1 | 0.0073 | 0.08 | 0.06 | 0.08 | 0.21 | N |
| 30 | Ficus citrifolia Mill. | MORACEAE | 14 | 10 | 0.0758 | 1.06 | 0.57 | 1.06 | 2.68 | N |
| 31 | Guapira fragrans (DC.) Little | NYCTAGINACEAE | 81 | 31 | 2.1570 | 6.10 | 16.25 | 6.10 | 28.46 | N |
| 32 | Guettarda elliptica Sw. | RUBIACEAE | 2 | 2 | 0.0098 | 0.15 | 0.07 | 0.15 | 0.38 | N |

1.

NO.TR.= Number of Trees of this Species
OCCR= Occurance in Subplots
B.A.= Basal Area Square Meters by Species
%R.Dn.= % Relative Density
%R.Dm.= % Relative Dominance
I.V.= Importance Value (Sum %R.Dn.+%R.F.+%R.Dm.)
%R.F.= % Relative Frequency
STATUS= N=Native;I=Introduced;R=Rare or Endangered

TABLE 3 (Continued)

ST. JOHN FOREST DYNAMICS STUDY

1.

HAWKSNEST TOTALS SPECIES AND IMPORTANCE VALUE
(Alphabetical Order)

| NUM | SPECIES | FAMILY | NO.TR | OCCR | B.A. | TOTALS %R.Dn. | %R.F. | %R.Dm. | I.V. | STATUS |
|---|---|---|---|---|---|---|---|---|---|---|
| 33 | G. parviflora Vahl | RUBIACEAE | 67 | 20 | 0.3091 | 5.05 | 2.33 | 5.05 | 12.43 | N |
| 34 | G. scabra (L.) Lamb. | RUBIACEAE | 13 | 7 | 0.0695 | 0.98 | 0.52 | 0.98 | 2.48 | N |
| 35 | Krugiodendron ferreum (Vahl) Urban | RHAMNACEAE | 70 | 19 | 0.2986 | 5.28 | 2.25 | 5.28 | 12.80 | N |
| 36 | Leucaena leucocephala (Lam.) deWit | MIMOSACEAE | 3 | 3 | 0.0207 | 0.23 | 0.16 | 0.23 | 0.61 | N |
| 37 | Licaria salicifolia (Sw.) Kosterm | LAURACEAE | 4 | 4 | 0.0112 | 0.30 | 0.08 | 0.30 | 0.69 | N |
| 38 | Mangifera indica L. | ANACARDIACEAE | 1 | 1 | 0.1987 | 0.08 | 1.50 | 0.08 | 1.65 | I |
| 39 | Margaritaria nobilis L.f., Muell.-Arg. | EUPHORBIACEAE | [illegible] | 1 | 0.0297 | 0.15 | 0.22 | 0.15 | 0.53 | N |
| 40 | Mastichodendron foetidissimum (Jacq)Cron | SAPOTACEAE | 4 | 2 | 0.0390 | 0.30 | 0.29 | 0.30 | 0.90 | N |
| 41 | Maytenus elliptica (Lam.) Krug.& Urb. | CELASTRACEAE | 33 | 11 | 0.1954 | 2.49 | 1.47 | 2.49 | 6.45 | N |
| 42 | Melicoccus bijugatus Jacq | SAPINDACEAE | 488 | 38 | 3.8645 | 36.77 | 29.12 | 36.77 | 102.67 | I |
| 43 | Myrciaria floribunda (West ex Willd) Berg. | MYRTACEAE | 1 | 1 | 0.0208 | 0.08 | 0.16 | 0.08 | 0.31 | N |
| 44 | Ocotea coriacea (Sw.) Britt. | LAURACEAE | 77 | 33 | 0.5013 | 5.80 | 3.78 | 5.80 | 15.38 | N |
| 45 | Palicourea domingensis (Jacq) DC. | RUBIACEAE | 1 | 1 | 0.0037 | 0.08 | 0.03 | 0.08 | 0.18 | N |
| 46 | Piscidia carthagenensis Jacq. | FABACEAE | 9 | 7 | 0.0443 | 0.68 | 0.33 | 0.68 | 1.69 | N |
| 47 | Pisonia subcordata Sw. | NYCTAGINACEAE | 4 | 2 | 0.8388 | 0.30 | 6.32 | 0.30 | 6.92 | N |
| 48 | Plumeria alba L. | EUPHORBIACEAE | 2 | 2 | 0.0116 | 0.15 | 0.09 | 0.15 | 0.39 | N |

1.

NO.TR.= Number of Trees of this Species
OCCR= Occurance in Subplots
B.A.= Basal Area Square Meters by Species
%R.Dn.= % Relative Density
%R.Dm.= % Relative Dominance
I.V.= Importance Value (Sum %R.Dn.+%R.F.+%R.Dm.)
%R.F.= % Relative Frequency
STATUS= N=Native;I=Introduced;R=Rare or Endangered



165

TABLE 3 (Continued)

ST. JOHN FOREST DYNAMICS STUDY

HAWKSNEST TOTALS SPECIES AND IMPORTANCE VALUE 1.
(Alphabetical Order)

| NUM | SPECIES | FAMILY | NO.TR | OCCR | B.A. | TOTALS %R.Dn. | %R.F. | %R.Dm. | I.V. | STATUS |
|---|---|---|---|---|---|---|---|---|---|---|
| 49 | Sabinea florida (Vahl)DC. | FABACEAE | 18 | 11 | 0.0805 | 1.36 | 0.61 | 1.36 | 3.32 | N |
| 50 | Solanum polygamum Vahl | SOLANACEAE | 1 | 1 | 0.0023 | 0.08 | 0.02 | 0.08 | 0.17 | N |
| 51 | Spondias mombin L. | ANACARDIACEAE | 2 | 2 | 0.0995 | 0.15 | 0.75 | 0.15 | 1.05 | N |
| 52 | Tabebuia heterophyllum (DC.) Britton | BIGNONIACEAE | 27 | 11 | 0.2655 | 2.03 | 2.00 | 2.03 | 6.07 | N |
| 53 | Tetrazygia elaeagnoides (Sw.) DC. | MELASTOMATACEAE | 15 | 10 | 0.1585 | 1.13 | 1.19 | 1.13 | 3.46 | N |
| 54 | Zanthoxylum martinicense (Lam.) DC. | RUTACEAE | 2 | 2 | 0.0339 | 0.15 | 0.26 | 0.15 | 0.56 | N |
| | DEAD STEM | | 8 | 4 | 0.0447 | 0.60 | 0.34 | 0.60 | 1.54 | |
| | | TOTALS | 1327 | 439 | 13.26986 | 100 | 100 | 100 | 300 | |

1.

NO.TR.= Number of Trees of this Species
OCCR= Occurance in Subplots
B.A.= Basal Area Square Meters by Species
%R.Dn.= % Relative Density
%R.Dm.= % Relative Dominance
I.V.= Importance Value (Sum %R.Dn.+%R.F.+%R.Dm.)
%R.F.= % Relative Frequency
STATUS= N=Native;I=Introduced;R=Rare or Endangered



164

TABLE 4

TEN MOST IMPORTANT SPECIES IN EACH PLOT

| | SPECIES | I.V. | % OF TOTAL |
|---|---|---|---|
| BORDEAUX | Guapira fragrans | 34.79 | 11.60 |
| | Pimenta racemosa | 32.37 | 10.79 |
| | Inga fagifolia | 31.61 | 10.54 |
| | Acacia muricata | 29.20 | 9.73 |
| | Byrsonima coriacea | 25.66 | 8.55 |
| | Ardisia obovata | 19.01 | 6.34 |
| | Tabebuia heterophylla | 15.85 | 5.28 |
| | Ocotea coriacea | 12.59 | 4.20 |
| | Linociera caribaea | 8.76 | 2.92 |
| | Guazuma ulmifolia | 8.56 | 2.85 |
| | | 218.40 | 72.80 |
| L'ESPERANCE | Ardisia obovata | 67.35 | 22.45 |
| | Guapira fragrans | 38.08 | 12.69 |
| | Inga fagifolia | 21.00 | 7.00 |
| | Andira inermis | 19.09 | 6.36 |
| | Ocotea coriacea | 13.74 | 4.58 |
| | Hymenaea courbaril | 13.66 | 4.55 |
| | Chrysophyllum pauciflorum | 13.15 | 4.38 |
| | Tabebuia heterophylla | 12.69 | 4.23 |
| | Guettarda scabra | 10.34 | 3.45 |
| | Guettarda parviflora | 9.35 | 3.12 |
| | | 218.45 | 72.82 |
| HAWKSNEST | Melicoccus bijugatus | 102.67 | 34.22 |
| | Guapira fragrans | 28.46 | 9.49 |
| | Bursera simaruba | 16.23 | 5.41 |
| | Ocotea coriacea | 15.38 | 5.13 |
| | Krugiodendron ferreum | 12.80 | 4.27 |
| | Guettarda parviflora | 12.43 | 4.14 |
| | Bourreria succulenta | 9.70 | 3.23 |
| | Pisonia subcordata | 6.92 | 2.31 |
| | Eugenia monticola | 6.85 | 2.28 |
| | Maytenus elliptica | 6.45 | 2.15 |
| | | 217.89 | 72.63 |

## CONCLUSIONS

Three permanent forest dynamic study plots, one measuring a hectare and the other two .5 hectares have been established in critical watersheds in the Virgin Islands National Park and Biosphere Reserve on the island of St. John. An initial inventory of all stems 5cm and larger including their identification, DBH, subplot location, X-Y coordinates and heights has been completed. This information will be used in future analyses to determine the floristics of the plots, growth rates of the trees, mortality and recruitment, spatial distribution and vertical stratification. The plots will be monitored at timely intervals over the twenty year life of the project to develop conclusions on the successional pattern and dynamics, competitive strategies, the impact of historical land-use trends and the introduction of exotic plant species on secondary forest in the Caribbean.

The raw data from this inventory has been provided in Appendices I-III in the hope that such information will facilitate other research projects both in the study plots and in the watersheds in which they are located. Ultimately, this information will be useful in the formulation of sound natural resource policy leading to biological conservation and sustainable development in the Caribbean.

## LITERATURE CITED


Acevedo, P., 1985. Los Bejucos de Puerto Rico, Vol. 1. U.S.D.A. Forest Service. GTA-50-58, 331 pp.

Beard, J.S., 1945. Forestry in the leeward islands: The British Virgin Islands. Development and Welfare in the West Indies. Bulletin 7A, 16 pp.

Beard, J.S., 1949. The natural vegetation of the windward and leeward islands. Oxford Forestry Mem. No. 21, 192 pp.

Campbell, D.G., D.C. Daly, G.T. Prance, and U.W. Maciel, 1986. Quantitative ecological inventory of terre firme and virzca tropical forest on the Rio Xingu. Britonnia, 38(4):369-393.

Cronquist, A., 1968. The evolution and classification of flowering plants. Houghton Mifflin Co., Boston, MA.

Department of State, 1980. The world's tropical forests: a policy, strategy and program for the United States. Pub. No. 9117, 53 pp.

Ewel, J.J. and J.L. Whitmore, 1973. The ecological life zones of Puerto Rico and the U.S. Virgin Islands. U.S.D.A. Forest Service Res. Paper ITF-18, 72 pp.

Forman, R.T.T. and D.C. Hahn, 1980. Spatial patterns of trees in a Caribbean semi-evergreen forest. Ecology, 61(6):1267-1274.

Little, E.L. and F.H. Wadsworth, 1964. Common trees of Puerto Rico and the Virgin Islands: Vol. 1. Ag. Handbook No. 49, U.S.D.A. Forest Service, Washington, D.C., 548 pp.

Little, E.L., R.O. Woodbury and F.H. Wadsworth, 1974. Common trees of Puerto Rico and the Virgin Islands: Vol. 2. Ag. Handbook No. 449, U.S.D.A. Forest Service, Washington, D.C., 1024 pp.

Little, E.L. 1969. Trees of Jost Van Dyke (British Virgin Island). U.S.D.A. Forest Service Res. Paper ITF-9, 12 pp.

Office of Technology Assessment, 1984. Technologies to sustain tropical forest resources. OTA-F0214, Washington, D.C., 343 pp.

Rivera, L.H. and W.D. Frederick, C. Farris, E.H. Jensen, L. Davis, C.D. Palmer, L.F. Jackson, and W.E. McKinzie, 1970. Soil Survey, Virgin Islands of the United States. U.S.D.A. Soil Conservation Service, 78 pp.

Robertson, W.B., 1957. Biology report: Initial study and development survey. V.I. National Park, U.S.N.P.S., Washington, D.C.

Teytand, R., 1983. Mapping of climatic, topographic, and daphic factors, existing vegetation, and potential natural vegetation in St. John, with recommendations for research on the economic impacts of vegetation management. Second Draft, Island Resources Foundation, St. Thomas, U.S.V.I.

Tyson, G.F., 1986. A history of land use on St. John, 1718-1950. Preliminary report: A report of the V.I. National Park, 90 pp.

Weaver, P.L. and R.O. Woodbury, 1982. Vegetation survey on St. John, U.S.V.I. Proceedings of the Ninth Symposium of Natural Resources, D.N.R., San Juan, Puerto Rico, pp. 169-183.

Woodbury, R.O. and E.L. Little, 1976. Flora of Buck Island Reef Nat. Mon (U.S.V.I.), U.S.D.A. Forest Service Res. Paper ITF-19, 27 pp.

Woodbury, R.O. and P.L. Weaver, 1987. The vegetation of St. John and Hassel Island, U.S.V.I. A report to the U.S. National Park Service, 98 pp.

World Resources Institute, 1986. Tropical forests: A call for action. Part I. W.R.I., Washington, D.C. 49 pp.

DATA SHEETS FOR ST. JOHN FOREST DYNAMICS STUDY APPENDIX I.

Date: August, 1987
Plot Numbers: 1(1A-10J)
Plot Locale: Bordeaux Mtn.

| TAG | STM | SPLT | FAM | SPECIES | DBH86 | BA AREA | HGT | X | Y | STATUS |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | S | 1A | NYCT | Guap frag | 7.40 | 0.0043 | 7.90 | 2.40 | 2.33 | |
| 2 | S | 1A | MIMO | Acac muri | 13.10 | 0.0135 | 14.5 | 1.76 | 3.45 | |
| 3 | S | 1A | MIMO | Acac muri | 13.90 | 0.0152 | | 0.54 | 5.47 | |
| 4 | S | 1A | BIGN | Tabe hete | 19.10 | 0.0287 | 13.3 | 1.28 | 7.12 | |
| 5 | S | 1A | MIMO | Acac muri | 6.90 | 0.0037 | | 1.31 | 8.48 | |
| 6 | S | 1A | MIMO | Acac muri | 10.40 | 0.0085 | 11.8 | 1.22 | 9.87 | |
| 7 | S | 1A | NYCT | Guap frag | 5.70 | 0.0026 | | 4.92 | 9.26 | |
| 8 | S | 1A | NYCT | Guap frag | 5.10 | 0.0020 | | 2.96 | 8.54 | |
| 9 | S | 1A | BIGN | Tabe hete | 36.80 | 0.1064 | 17.3 | 3.24 | 7.77 | |
| 10 | S | 1A | MIMO | Acac muri | 13.20 | 0.0137 | | 4.20 | 9.39 | |
| 11 | S | 1A | RUBI | Guet scab | 6.90 | 0.0037 | 8.51 | 3.56 | 9.58 | |
| 12 | S | 1A | MIMO | Acac muri | 18.30 | 0.0263 | | 5.20 | 9.30 | |
| 13 | S | 1A | MIMO | Acac muri | 18.60 | 0.0272 | | 5.32 | 9.30 | |
| 14 | S | 1A | RUBI | Guet scab | 9.40 | 0.0069 | 10.9 | 5.52 | 9.46 | |
| 15 | S | 1A | NYCT | Guap frag | 6.20 | 0.0030 | | 9.20 | 8.30 | |
| 16 | S | 1A | MIMO | Acac muri | 15.50 | 0.0189 | | 9.90 | 8.35 | |
| 17 | S | 1A | MIMO | Acac muri | 13.10 | 0.0135 | | 8.80 | 7.56 | |
| 18 | S | 1A | MYRT | Pime race | 7.10 | 0.0040 | 8.81 | 7.87 | 7.49 | |
| 19 | S | 1A | MIMO | Acac muri | 27.50 | 0.0594 | | 6.86 | 7.46 | SICK 3/86 |
| 20 | S | 1A | OLEA | Lino cari | 8.10 | 0.0052 | 13.0 | 8.10 | 5.26 | |
| 21 | S | 1A | MIMO | Acac muri | 16.40 | 0.0211 | | 3.28 | 4.95 | |
| 22 | S | 1A | MIMO | Acac muri | 14.90 | 0.0174 | | 2.62 | 3.77 | |
| 23 | S | 1A | LAUR | Ocot cori | 7.00 | 0.0038 | | 3.35 | 2.58 | |
| 24 | S | 1A | MIMO | Acac muri | 9.60 | 0.0072 | | 4.77 | 0.37 | |
| 25 | S | 1A | NYCT | Guap frag | 5.20 | 0.0021 | | 5.26 | 0.23 | |
| 26 | S | 1A | MIMO | Acac muri | 10.90 | 0.0093 | | 7.10 | 0.81 | |
| 27 | S | 1B | MIMO | Acac muri | 12.60 | 0.0125 | | 8.62 | 3.75 | |
| 28 | S | 1B | MIMO | Acac muri | 14.40 | 0.0163 | | 1.15 | 0.07 | |
| 29 | S | 1B | MIMO | Acac muri | 13.00 | 0.0133 | 14.5 | 1.30 | 0.22 | |
| 30 | S | 1B | MIMO | Acac muri | 12.20 | 0.0117 | | 1.53 | 2.31 | |
| 31 | S | 1B | MIMO | Acac muri | 20.90 | 0.0343 | | 3.74 | 0.50 | |
| 32 | S | 1B | MYRT | Pime race | 11.40 | 0.0102 | | 4.16 | 0.80 | |
| 33 | S | 1B | MIMO | Acac muri | 12.30 | 0.0119 | | 4.42 | 1.47 | |
| 34 | S | 1B | MIMO | Inga fagi | 7.20 | 0.0041 | 8.81 | 3.87 | 2.54 | |
| 35 | S | 1B | MIMO | Acac muri | 14.50 | 0.0165 | | 2.63 | 4.11 | |
| 36 | M | 1B | MYRT | Pime race | 8.00 | 0.0050 | 8.51 | 1.84 | 5.04 | |
| 37 | M | 1B | MYRT | Pime race | 6.50 | 0.0033 | | 2.10 | 5.06 | |
| 38 | S | 1B | MIMO | Acac muri | 9.60 | 0.0072 | 15.5 | 2.83 | 5.72 | |
| 39 | S | 1B | MIMO | Acac muri | 21.10 | 0.0350 | | 0.71 | 9.50 | |
| 40 | M | 1B | MYRT | Pime race | 9.90 | 0.0077 | 11.5 | 2.40 | 8.64 | |
| 41 | M | 1B | MYRT | Pime race | 7.60 | 0.0045 | | 2.50 | 8.68 | |



110

APPENDIX I. (Continued)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 42 | S | 1B | MIMO | Acac | muri | 10.50 | 0.0087 | | 4.69 | 7.90 |
| 43 | S | 1B | MIMO | Acac | muri | 8.50 | 0.0057 | | 4.80 | 7.82 |
| 44 | S | 1B | MIMO | Acac | muri | 11.20 | 0.0099 | | 9.90 | 9.73 |
| 45 | M | 1B | CAES | Hyme | cour | 27.00 | 0.0573 | 16.7 | 9.28 | 8.95 |
| 46 | M | 1B | CAES | Hyme | cour | 24.90 | 0.0487 | | 8.70 | 8.94 |
| 47 | M | 1B | CAES | Hyme | cour | 27.20 | 0.0581 | | 9.00 | 8.33 |
| 48 | S | 1B | MIMO | Acac | muri | 12.20 | 0.0117 | | 5.20 | 6.04 |
| 49 | S | 1B | RUBI | Guet | scab | 5.50 | 0.0024 | 9.42 | 4.58 | 3.80 |
| 50 | S | 1B | MIMO | Acac | muri | 10.00 | 0.0079 | | 4.50 | 3.38 |
| 51 | S | 1B | MIMO | Acac | muri | 17.70 | 0.0246 | | 5.07 | 3.04 |
| 52 | S | 1B | MIMO | Acac | muri | 10.60 | 0.0088 | | 8.97 | 3.40 |
| 53 | S | 1B | MYRT | Pime | race | 35.20 | 0.0973 | | 9.40 | 1.99 |
| 54 | S | 1B | MIMO | Acac | muri | 18.90 | 0.0281 | | 9.12 | 0.94 |
| 55 | S | 1C | MIMO | Acac | muri | 18.30 | 0.0263 | | 2.80 | 1.23 |
| 56 | S | 1C | MIMO | Inga | fagi | 9.40 | 0.0069 | 12.4 | 4.66 | 0.07 |
| 57 | S | 1C | MYRT | Pime | race | 15.30 | 0.0184 | | 6.28 | 2.47 |
| 58 | S | 1C | MYRT | Pime | race | 17.80 | 0.0249 | | 1.17 | 4.52 |
| 59 | S | 1C | MYRT | Pime | race | 13.80 | 0.0150 | | 0.10 | 6.04 |
| 60 | S | 1C | MYRT | Pime | race | 5.80 | 0.0026 | | 0.25 | 7.09 |
| 61 | M | 1C | MYRT | Pime | race | 8.70 | 0.0059 | 12.1 | 0.66 | 7.95 |
| 62 | M | 1C | MYRT | Pime | race | 8.90 | 0.0062 | | 0.50 | 7.95 |
| 63 | S | 1C | MYRT | Pime | race | 8.30 | 0.0054 | | 9.30 | 0.74 |
| 64 | S | 1C | MYRT | Pime | race | 6.80 | 0.0036 | | 0.45 | 9.40 |
| 65 | S | 1C | MYRT | Pime | race | 14.30 | 0.0161 | | 2.45 | 9.60 |
| 66 | M | 1C | MYRT | Pime | race | 5.40 | 0.0023 | | 3.80 | 8.83 |
| 67 | M | 1C | MYRT | Pime | race | 6.30 | 0.0031 | | 3.19 | 8.79 |
| 68 | S | 1C | MYRT | Pime | race | 9.50 | 0.0071 | | 4.10 | 9.20 |
| 69 | S | 1C | MYRT | Pime | race | 13.40 | 0.0141 | | 9.07 | 9.80 |
| 70 | M | 1C | MYRT | Pime | race | 9.80 | 0.0075 | | 9.70 | 9.80 |
| 71 | S | 1C | NYCT | Guap | frag | 5.00 | 0.0020 | 4.25 | 9.92 | 6.62 |
| 72 | S | 1C | MYRT | Pime | race | 22.70 | 0.0405 | | 8.44 | 6.27 |
| 73 | S | 1C | NYCT | Guap | frag | 8.70 | 0.0059 | | 9.63 | 5.76 |
| 74 | S | 1C | MIMO | Acac | muri | 13.80 | 0.0150 | 15.8 | 9.16 | 5.15 |
| 75 | M | 1C | MIMO | Acac | muri | 15.20 | 0.0181 | | 9.12 | 5.35 |
| 76 | M | 1C | MIMO | Acac | muri | 9.00 | 0.0064 | | 9.12 | 5.44 |
| 77 | S | 1C | MYRT | Pime | race | 10.10 | 0.0080 | | 5.49 | 5.27 |
| 78 | M | 1C | MYRT | Pime | race | 14.10 | 0.0156 | | 4.21 | 7.28 |
| 79 | M | 1C | MYRT | Pime | race | 6.50 | 0.0033 | | 3.99 | 7.32 |
| 80 | S | 1C | MYRT | Pime | race | 12.30 | 0.0119 | | 3.61 | 6.28 |
| 81 | S | 1C | MIMO | Acac | muri | 12.50 | 0.0123 | | 8.10 | 3.60 |
| 82 | S | 1C | MIMO | Acac | muri | 8.70 | 0.0059 | | 9.15 | 1.96 |
| 83 | S | 1C | MIMO | Acac | muri | 18.10 | 0.0257 | | 6.66 | 0.74 |
| 2712 | S | 1C | NYCT | Guap | frag | 13.10 | 0.0257 | | 2.15 | 6.92 |
| 2713 | S | 1C | MYRT | Pime | race | 5.10 | 0.0135 | | 7.21 | 4.78 |
| 84 | S | 1D | NYCT | Guap | frag | 5.60 | 0.0025 | 7.90 | 1.99 | 0.92 |
| 85 | S | 1D | MIMO | Acac | muri | 9.00 | 0.0064 | | 3.18 | 2.39 |
| 86 | S | 1D | MIMO | Acac | muri | 13.10 | 0.0135 | | 0.62 | 3.09 |
| 87 | S | 1D | MIMO | Acac | muri | 15.10 | 0.0179 | 15.5 | 0.96 | 4.19 |

APPENDIX I. (Continued)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 88 | S | 1D | MIMO | Acac | muri | 13.80 | 0.0150 | | 0.13 | 5.16 |
| 89 | S | 1D | MYRT | Pime | race | 11.90 | 0.0111 | | 0.20 | 8.61 |
| 90 | M | 1D | MIMO | Acac | muri | 14.20 | 0.0158 | | 0.76 | 8.61 |
| 91 | M | 1D | MIMO | Acac | muri | 11.50 | 0.0104 | | 0.57 | 8.71 |
| 92 | M | 1D | MIMO | Acac | muri | 12.20 | 0.0117 | | 0.50 | 8.96 |
| 93 | M | 1D | MIMO | Acac | muri | 15.70 | 0.0194 | | 0.50 | 9.80 |
| 94 | S | 1D | NYCT | Guap | frag | 5.00 | 0.0020 | 8.20 | 1.07 | 9.90 |
| 95 | S | 1D | NYCT | Guap | frag | 9.20 | 0.0066 | | 3.71 | 8.02 |
| 96 | S | 1D | NYCT | Guap | frag | 5.30 | 0.0022 | | 3.87 | 9.80 |
| 97 | S | 1D | VERB | Cith | frut | 6.10 | 0.0029 | 4.25 | 6.20 | 8.02 |
| 98 | M | 1D | BIGN | Tabe | hete | 5.90 | 0.0027 | 7.90 | 7.15 | 8.00 |
| 99 | M | 1D | BIGN | Tabe | hete | 6.40 | 0.0032 | | 6.88 | 7.92 |
| 100 | S | 1D | CAPP | Mori | amer | 8.40 | 0.0055 | 4.86 | 1.19 | 7.37 |
| 101 | M | 1D | MIMO | Acac | muri | 12.70 | 0.0127 | | 6.90 | 6.92 |
| 102 | M | 1D | MIMO | Acac | muri | 15.20 | 0.0181 | | 6.85 | 6.79 |
| 103 | M | 1D | MIMO | Acac | muri | 12.30 | 0.0119 | | 6.80 | 6.60 |
| 104 | M | 1D | MIMO | Acac | muri | 11.20 | 0.0099 | | 6.97 | 6.46 |
| 105 | M | 1D | MIMO | Acac | muri | 10.40 | 0.0085 | 17.0 | 6.64 | 6.46 |
| 106 | S | 1D | NYCT | Guap | frag | 5.60 | 0.0025 | 6.07 | 4.47 | 7.82 |
| 107 | M | 1D | MIMO | Acac | muri | 9.20 | 0.0066 | | 2.80 | 6.61 |
| 108 | M | 1D | MIMO | Acac | muri | 10.60 | 0.0088 | | 2.89 | 6.49 |
| 109 | M | 1D | MIMO | Acac | muri | 8.80 | 0.0061 | | 3.40 | 4.85 |
| 110 | M | 1D | MIMO | Acac | muri | 12.30 | 0.0119 | | 2.80 | 4.70 |
| 111 | M | 1D | MIMO | Acac | muri | 12.50 | 0.0123 | | 2.86 | 4.60 |
| 112 | M | 1D | MIMO | Acac | muri | 11.40 | 0.0102 | 12.7 | 3.92 | 3.99 |
| 113 | M | 1D | MIMO | Acac | muri | 13.70 | 0.0147 | | 4.25 | 3.90 |
| 114 | S | 1D | MIMO | Acac | muri | 12.80 | 0.0129 | | 4.37 | 2.87 |
| 115 | S | 1D | MYRT | Pime | race | 5.50 | 0.0024 | | 5.37 | 2.46 |
| 116 | M | 1D | MIMO | Acac | muri | 10.70 | 0.0090 | | 3.82 | 6.42 |
| 117 | M | 1D | MIMO | Acac | muri | 12.40 | 0.0121 | | 4.08 | 6.76 |
| 118 | S | 1D | MIMO | Acac | muri | 12.50 | 0.0123 | | 4.94 | 6.54 |
| 119 | M | 1D | MIMO | Acac | muri | 9.70 | 0.0074 | | 5.10 | 4.40 |
| 120 | M | 1D | MIMO | Acac | muri | 9.50 | 0.0071 | | 5.32 | 4.10 |
| 121 | S | 1D | MIMO | Acac | muri | 12.50 | 0.0123 | | 6.06 | 0.15 |
| 122 | M | 1D | MYRT | Pime | race | 6.50 | 0.0033 | | 7.57 | 2.33 |
| 123 | M | 1D | MYRT | Pime | race | 6.30 | 0.0031 | | 7.57 | 2.48 |
| 124 | M | 1D | MIMO | Acac | muri | 13.00 | 0.0133 | | 8.63 | 3.34 |
| 125 | M | 1D | MIMO | Acac | muri | 15.40 | 0.0186 | | 9.10 | 3.50 |
| 126 | S | 1D | MIMO | Acac | muri | 9.80 | 0.0075 | | 8.73 | 4.60 |
| 127 | S | 1D | MIMO | Acac | muri | 9.20 | 0.0066 | | 9.80 | 1.20 |
| 128 | M | 1D | MIMO | Acac | muri | 8.50 | 0.0057 | | 8.96 | 0.80 |
| 129 | M | 1D | MIMO | Acac | muri | 12.50 | 0.0123 | | 8.64 | 0.86 |
| 130 | S | 1D | NYCT | Guap | frag | 5.30 | 0.0022 | | 9.09 | 1.05 |
| 131 | S | 1D | NYCT | Guap | frag | 8.80 | 0.0061 | 8.20 | 8.75 | 8.10 |
| 132 | S | 1E | BORA | Bour | succ | 5.50 | 0.0024 | 4.86 | 0.91 | 0.80 |
| 133 | S | 1E | MIMO | Acac | muri | 8.30 | 0.0054 | | 0.70 | 0.15 |
| 134 | S | 1E | NYCT | Guap | frag | 5.10 | 0.0020 | | 1.99 | 0.17 |
| 135 | S | 1E | MYRT | Pime | race | 14.00 | 0.0154 | | 1.99 | 0.45 |



172

APPENDIX I. (Continued)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 135 | S | 1E | MYRT | Pime | race | 14.00 | 0.0154 | | 1.99 | 0.45 |
| 136 | M | 1E | BORA | Bour | succ | 9.30 | 0.0068 | 7.59 | 2.61 | 1.52 |
| 137 | M | 1E | BORA | Bour | succ | 6.70 | 0.0035 | | 2.48 | 0.62 |
| 138 | M | 1E | NYCT | Guap | frag | 20.00 | 0.0314 | | 2.66 | 0.52 |
| 139 | M | 1E | NYCT | Guap | frag | 17.10 | 0.0230 | | 2.72 | 1.66 |
| 140 | M | 1E | NYCT | Guap | frag | 9.30 | 0.0068 | | 2.63 | 1.89 |
| 141 | M | 1E | MIMO | Acac | muri | 12.70 | 0.0127 | | 2.04 | 3.64 |
| 142 | M | 1E | MIMO | Acac | muri | 11.30 | 0.0100 | | 1.85 | 3.90 |
| 143 | M | 1E | BORA | Bour | succ | 7.90 | 0.0049 | 9.42 | 0.25 | 3.69 |
| 144 | M | 1E | BORA | Bour | succ | 5.00 | 0.0020 | | 3.45 | 3.61 |
| 145 | M | 1E | BORA | Bour | succ | 6.70 | 0.0035 | | 0.31 | 3.82 |
| 146 | M | 1E | MYRT | Pime | race | 16.80 | 0.0222 | 9.72 | 0.61 | 5.06 |
| 147 | M | 1E | MYRT | Pime | race | 19.20 | 0.0290 | | 0.65 | 5.25 |
| 148 | M | 1E | MIMO | Acac | muri | 9.30 | 0.0068 | | 1.11 | 7.60 |
| 149 | M | 1E | MIMO | Acac | muri | 11.80 | 0.0109 | | 1.30 | 7.60 |
| 150 | S | 1E | BORA | Cord | alli | 6.70 | 0.0035 | 12.7 | 0.33 | 5.20 |
| 151 | S | 1E | NYCT | Guap | frag | 17.10 | 0.0230 | | 2.64 | 8.30 |
| 152 | S | 1E | OLEA | Lino | cari | 5.50 | 0.0024 | 6.68 | 2.30 | 8.10 |
| 153 | M | 1E | VERB | Cith | frut | 5.50 | 0.0024 | 8.51 | 3.41 | 7.70 |
| 154 | M | 1E | VERB | Cith | frut | 6.20 | 0.0030 | | 3.60 | 7.70 |
| 155 | S | 1E | OLEA | Lino | cari | 9.30 | 0.0068 | | 3.74 | 7.59 |
| 156 | S | 1E | RUTA | Zant | mart | 10.20 | 0.0082 | 12.1 | 8.38 | 7.82 |
| 157 | S | 1E | OLEA | Lino | cari | 6.30 | 0.0031 | 7.29 | 9.45 | 9.20 |
| 158 | M | 1E | LAUR | Ocot | cori | 6.70 | 0.0035 | 6.07 | 6.74 | 5.52 |
| 159 | M | 1E | LAUR | Ocot | cori | 9.70 | 0.0074 | | 6.97 | 5.65 |
| 160 | S | 1E | BORA | Cord | alli | 15.60 | 0.0191 | 13.3 | 6.78 | 3.90 |
| 161 | M | 1E | VERB | Cith | frut | 12.30 | 0.0119 | | 6.13 | 3.98 |
| 162 | M | 1E | VERB | Cith | frut | 10.70 | 0.0090 | 11.5 | 6.02 | 4.10 |
| 163 | S | 1E | CAPP | Mori | amer | 7.60 | 0.0045 | 8.51 | 4.53 | 2.69 |
| 164 | M | 1E | RUTA | Zant | mart | 7.90 | 0.0049 | | 4.67 | 1.86 |
| 165 | M | 1E | RUTA | Zant | mart | 11.50 | 0.0104 | 11.2 | 4.77 | 1.66 |
| 166 | S | 1E | BORA | Cord | coll | 10.30 | 0.0083 | 10.9 | 6.90 | 0.10 |
| 167 | S | 1E | LAUR | Lica | sali | 5.10 | 0.0020 | 4.86 | 7.60 | 4.80 |
| 168 | S | 1E | BORA | Cord | coll | 11.70 | 0.0108 | | 8.00 | 0.90 |
| 169 | S | 1E | RUTA | Zant | mart | 6.30 | 0.0031 | 9.11 | 8.96 | 1.60 |
| 170 | S | 1E | RUTA | Zant | mart | 7.70 | 0.0047 | 10.6 | 9.30 | 1.40 |
| 171 | S | 1E | MYRT | Pime | race | 16.20 | 0.0206 | | 9.48 | 0.80 |
| 172 | S | 1F | MYRT | Pime | race | 12.30 | 0.0119 | | 0.41 | 1.47 |
| 173 | S | 1F | NYCT | Guap | frag | 9.10 | 0.0065 | | 1.33 | 1.52 |
| 174 | S | 1F | RUBI | Guet | scab | 5.70 | 0.0026 | | 3.35 | 1.33 |
| 175 | S | 1F | PALM | Cocc | alta | 10.10 | 0.0080 | 5.47 | 4.10 | 3.23 |
| 176 | S | 1F | BORA | Cord | alli | 15.50 | 0.0189 | 12.7 | 1.77 | 4.57 |
| 177 | S | 1F | BORA | Cord | alli | 8.70 | 0.0059 | 13.0 | 2.30 | 1.64 |
| 178 | M | 1F | NYCT | Guap | frag | 12.70 | 0.0127 | | 0.40 | 6.11 |
| 179 | M | 1F | NYCT | Guap | frag | 6.10 | 0.0029 | | 0.42 | 6.29 |
| 180 | S | 1F | LAUR | Ocot | cori | 5.80 | 0.0026 | 7.90 | 0.70 | 6.60 |
| 181 | S | 1F | BORA | Cord | coll | 13.30 | 0.0139 | 13.6 | 0.48 | 8.75 |
| 182 | S | 1F | LAUR | Lica | sali | 12.60 | 0.0125 | 12.7 | 4.20 | 7.76 |
| 183 | S | 1F | RUTA | Zant | mart | 9.10 | 0.0065 | | 4.80 | 7.10 |
| 184 | S | 1F | BORA | Cord | coll | 7.90 | 0.0049 | 10.3 | 5.50 | 9.02 |

APPENDIX I. (Continued)

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 185 | S | 1F | MYRT | Pime | race | 18.10 | 0.0257 | 13.6 | 6.92 | 7.33 | |
| 186 | S | 1F | MIMO | Inga | fagi | 7.60 | 0.0045 | | 8.82 | 8.28 | |
| 187 | S | 1F | MYRT | Pime | race | 30.10 | 0.0712 | 10.7 | 9.11 | 7.50 | |
| 188 | S | 1F | BORA | Cord | alli | 7.90 | 0.0049 | 13.3 | 6.42 | 4.06 | |
| 189 | S | 1F | FLAC | Case | deca | 5.70 | 0.0026 | 9.42 | 4.32 | 4.95 | |
| 190 | M | 1F | RUBI | Guet | scab | 5.50 | 0.0024 | | 5.01 | 2.42 | |
| 191 | M | 1F | RUBI | Guet | scab | 9.00 | 0.0064 | | 5.63 | 0.63 | |
| 192 | M | 1F | RUBI | Guet | scab | 8.40 | 0.0055 | | 5.63 | 0.72 | |
| 193 | S | 1F | NYCT | Guap | frag | 5.60 | 0.0025 | | 5.78 | 0.30 | |
| 194 | S | 1F | RUTA | Zant | mart | 7.40 | 0.0043 | 10.6 | 6.56 | 2.72 | |
| 195 | S | 1F | NYCT | Guap | frag | 7.50 | 0.0044 | | 8.19 | 2.55 | |
| 196 | S | 1F | LAUR | Ocot | cori | 6.40 | 0.0032 | 7.90 | 8.05 | 2.24 | |
| 197 | S | 1F | BORA | Cord | alli | 13.10 | 0.0135 | 12.7 | 8.05 | 1.10 | |
| 198 | S | 1F | NYCT | Guap | frag | 9.60 | 0.0072 | | 7.67 | 0.48 | |
| 199 | S | 1F | RUBI | Guet | scab | 5.30 | 0.0022 | 8.51 | 8.32 | 0.27 | |
| 200 | S | 1G | RUBI | Fara | occi | 5.40 | 0.0023 | 3.95 | 0.70 | 0.67 | |
| 201 | S | 1G | MYRT | Pime | race | 19.30 | 0.0293 | | 1.53 | 2.00 | |
| 202 | S | 1G | MYRT | Pime | race | 21.00 | 0.0346 | 14.5 | 0.08 | 5.38 | |
| 203 | S | 1G | MYRT | Pime | race | 13.40 | 0.0141 | | 0.80 | 4.80 | |
| 204 | M | 1G | MYRT | Pime | race | 17.40 | 0.0238 | | 1.24 | 4.90 | |
| 205 | M | 1G | MYRT | Pime | race | 15.20 | 0.0181 | | 1.24 | 5.20 | |
| 206 | S | 1G | NYCT | Guap | frag | 6.30 | 0.0031 | | 8.90 | 9.62 | |
| 207 | S | 1G | MYRT | Pime | race | 24.20 | 0.0460 | 18.2 | 9.45 | 8.05 | |
| 208 | S | 1G | RUTA | Zant | mart | 28.30 | 0.0629 | 19.7 | 9.95 | 9.05 | |
| 209 | S | 1G | BORA | Cord | alli | 13.40 | 0.0141 | 13.6 | 9.90 | 7.43 | |
| 210 | S | 1G | MYRT | Pime | race | 24.60 | 0.0475 | | 9.21 | 6.15 | |
| 211 | M | 1G | MYRT | Pime | race | 15.60 | 0.0191 | | 6.70 | 4.70 | |
| 212 | M | 1G | MYRT | Pime | race | 6.70 | 0.0035 | | 6.80 | 4.80 | |
| 213 | M | 1G | MYRT | Pime | race | 14.00 | 0.0154 | | 9.89 | 4.19 | |
| 214 | M | 1G | MYRT | Pime | race | 11.20 | 0.0099 | | 9.89 | 4.26 | |
| 215 | S | 1G | NYCT | Guap | frag | 12.90 | 0.0131 | | 7.16 | 2.54 | |
| 216 | S | 1G | MIMO | Inga | fagi | 23.20 | 0.0423 | 15.1 | 7.16 | 2.20 | DEAD11/86 |
| 217 | S | 1G | BORA | Cord | coll | 5.30 | 0.0022 | 7.29 | 5.30 | 2.57 | |
| 218 | M | 1G | RUTA | Zant | mart | 22.10 | 0.0384 | 16.1 | 2.18 | 1.15 | |
| 219 | S | 1G | RUTA | Zant | mart | 10.80 | 0.0092 | | 5.35 | 1.00 | |
| 225 | S | 1G | NYCT | Guap | frag | 6.30 | 0.0031 | | 4.60 | 0.80 | |
| 226 | S | 1G | BORA | Cord | alli | 20.40 | 0.0327 | 16.1 | 4.75 | 0.40 | |
| 227 | S | 1G | NYCT | Guap | frag | 9.00 | 0.0064 | | 3.92 | 0.12 | |
| 228 | S | 1G | CAPP | Mori | amer | 6.70 | 0.0035 | 4.25 | 7.78 | 2.50 | |
| 229 | S | 1G | NYCT | Guap | frag | 7.40 | 0.0043 | | 9.20 | 1.70 | |
| 230 | S | 1H | BORA | Cord | alli | 12.00 | 0.0113 | 13.9 | 0.35 | 0.15 | |
| 231 | S | 1H | NYCT | Guap | frag | 3.20 | 0.0053 | | 1.62 | 3.73 | |
| 232 | S | 1H | MYRT | Pime | race | 7.50 | 0.0044 | | 3.45 | 3.73 | |
| 233 | S | 1H | MYRT | Pime | race | 7.50 | 0.0044 | | 4.74 | 5.42 | |
| 234 | S | 1H | MIMO | Inga | fagi | 5.50 | 0.0024 | | 5.03 | 4.06 | |
| 235 | S | 1H | MYRT | Pime | race | 6.20 | 0.0030 | | 4.90 | 6.89 | |
| 236 | S | 1H | PALM | Cocc | alta | 9.50 | 0.0071 | 3.34 | 0.95 | 6.70 | |
| 237 | S | 1H | MYRT | Euge | bifl | 5.40 | 0.0023 | 7.29 | 0.12 | 7.70 | |
| 238 | S | 1H | MYRS | Ardi | obov | 6.00 | 0.0028 | 10.0 | 5.78 | 5.00 | |
| 239 | S | 1H | BIGN | Tabe | hete | 46.50 | 0.1698 | 19.1 | 7.90 | 6.55 | |



174

APPENDIX I. (Continued)

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 240 | M | 1H | CLUS | Clus | rose | 13.40 | 0.0141 | 20.3 | 6.36 | 6.34 | VINE |
| 240a | M | 1H | CLUS | Clus | rose | 10.70 | 0.0090 | | 6.36 | 6.34 | |
| 240b | M | 1H | CLUS | Clus | rose | 5.90 | 0.0027 | | 6.36 | 6.34 | |
| 240c | M | 1H | CLUS | Clus | rose | 8.10 | 0.0052 | | 6.36 | 6.34 | |
| 240d | M | 1H | CLUS | Clus | rose | 7.50 | 0.0044 | | 6.36 | 6.34 | |
| 240e | M | 1H | CLUS | Clus | rose | 6.50 | 0.0033 | | 6.36 | 6.34 | |
| 240f | M | 1H | CLUS | Clus | rose | 7.20 | 0.0041 | | 6.36 | 6.34 | |
| 241 | S | 1H | MIMO | Inga | fagi | 8.30 | 0.0054 | | 8.40 | 8.15 | |
| 242 | S | 1H | MIMO | Inga | fagi | 14.80 | 0.0172 | | 9.30 | 7.20 | |
| 243 | S | 1H | MIMO | Inga | fagi | 9.30 | 0.0068 | | 8.56 | 7.70 | |
| 244 | S | 1H | BIGN | Tabe | hete | 17.40 | 0.0238 | | 7.62 | 6.14 | |
| 245 | S | 1H | RUBI | Fara | occi | 7.20 | 0.0041 | 4.86 | 6.95 | 3.26 | |
| 246 | S | 1H | MYRT | Pime | race | 5.90 | 0.0027 | | 9.62 | 2.18 | |
| 247 | S | 1H | MYRS | Ardi | obov | 9.20 | 0.0066 | 11.8 | 8.94 | 2.02 | |
| 248 | S | 1H | BORA | Bour | succ | 8.30 | 0.0054 | 12.4 | 5.60 | 2.32 | |
| 249 | S | 1H | MYRT | Pime | race | 14.40 | 0.0163 | | 6.50 | 0.78 | |
| 250 | M | 1H | MYRT | Pime | race | 11.90 | 0.0111 | | 4.18 | 0.60 | |
| 251 | M | 1H | MYRT | Pime | race | 13.90 | 0.0152 | | 4.18 | 0.79 | |
| 252 | S | 1I | CAPP | Mori | amer | 9.30 | 0.0068 | 7.29 | 0.48 | 1.33 | |
| 253 | S | 1I | MYRT | Pime | race | 13.80 | 0.0150 | | 0.74 | 0.28 | |
| 254 | S | 1I | BIGN | Tabe | hete | 23.40 | 0.0430 | | 0.61 | 4.54 | |
| 255 | S | 1I | FLAC | Case | guia | 7.30 | 0.0042 | 9.11 | 0.28 | 6.82 | |
| 256 | S | 1I | MYRS | Ardi | obov | 10.70 | 0.0090 | 9.72 | 0.80 | 7.14 | |
| 257 | S | 1I | MYRS | Ardi | obov | 9.70 | 0.0074 | | 0.36 | 8.69 | |
| 258 | M | 1I | LAUR | Lica | sali | 8.00 | 0.0050 | 13.3 | 2.98 | 6.07 | |
| 259 | M | 1I | LAUR | Lica | sali | 9.10 | 0.0065 | | 2.98 | 6.66 | |
| 260 | S | 1I | RUBI | Fara | occi | 6.30 | 0.0031 | | 3.41 | 6.85 | |
| 261 | S | 1I | BIGN | Tabe | hete | 15.80 | 0.0196 | 12.7 | 5.13 | 5.38 | SICK 1/87 |
| 262 | S | 1I | MIMO | Inga | fagi | 12.30 | 0.0119 | | 6.90 | 6.04 | |
| 263 | S | 1I | BIGN | Tabe | hete | 13.70 | 0.0147 | | 6.93 | 6.35 | |
| 264 | S | 1I | MYRT | Pime | race | 16.10 | 0.0204 | | 9.25 | 5.80 | |
| 265 | S | 1I | RUBI | Fara | occi | 5.00 | 0.0020 | | 8.11 | 3.60 | |
| 266 | S | 1I | MYRS | Ardi | obov | 11.30 | 0.0100 | 8.51 | 7.52 | 2.86 | |
| 267 | S | 1I | CAPP | Capp | indi | 19.50 | 0.0299 | 5.47 | 4.95 | 1.13 | |
| 268 | S | 1I | FABA | Andi | iner | 15.20 | 0.0181 | 6.68 | 7.70 | 0.37 | |
| 269 | S | 1I | MIMO | Inga | fagi | 27.10 | 0.0577 | | 3.69 | 0.62 | |
| 270 | M | 1J | RUBI | Guet | scab | 10.60 | 0.0088 | | 1.80 | 0.48 | |
| 271 | M | 1J | RUBI | Guet | scab | 12.30 | 0.0119 | | 1.80 | 0.66 | |
| 272 | S | 1J | MIMO | Inga | fagi | 23.10 | 0.0419 | 17.0 | 4.48 | 0.90 | |
| 273 | S | 1J | BIGN | Macf | ungu | 6.30 | 0.0031 | 13.0 | 4.12 | 0.70 | VINE |
| 274 | S | 1J | FLAC | Case | guia | 8.00 | 0.0050 | 8.51 | 3.98 | 2.67 | |
| 275 | S | 1J | MIMO | Inga | fagi | 13.30 | 0.0139 | | 1.80 | 5.72 | |
| 276 | S | 1J | MYRS | Ardi | obov | 7.10 | 0.0040 | | 1.58 | 5.72 | |
| 277 | S | 1J | MIMO | Inga | fagi | 8.20 | 0.0053 | | 4.67 | 6.02 | |
| 278 | S | 1J | NYCT | Guap | frag | 7.30 | 0.0042 | | 7.39 | 6.96 | |
| 279 | S | 1J | MIMO | Inga | fagi | 19.70 | 0.0305 | 19.1 | 8.03 | 7.05 | |
| 280 | S | 1J | MIMO | Inga | fagi | 27.70 | 0.0603 | 17.9 | 6.52 | 3.00 | |
| 281 | S | 1J | MIMO | Inga | fagi | 6.90 | 0.0037 | | 6.14 | 2.09 | |
| 282 | S | 1J | RUBI | Fara | occi | 7.50 | 0.0044 | 5.16 | 7.47 | 2.76 | |
| 283 | S | 1J | MALP | Byrs | cori | 38.20 | 0.1146 | 18.2 | 8.75 | 2.11 | |

APPENDIX I. (Continued)

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 284 | S | 1J | MYRS | Ardi | obov | 6.60 | 0.0034 | | 8.75 | 2.53 | |
| 285 | S | 1J | MYRS | Ardi | obov | 10.30 | 0.0083 | | 9.61 | 3.40 | |
| 286 | S | 1J | NYCT | Guap | frag | 14.50 | 0.0165 | | 9.61 | 3.55 | |
| 287 | S | 1J | MYRT | Pime | race | 6.30 | 0.0031 | | 9.90 | 3.55 | |
| 288 | S | 1J | MALP | Byrs | cori | 7.20 | 0.0041 | 8.20 | 9.97 | 2.68 | |
| 289 | S | 2J | MIMO | Inga | fagi | 20.20 | 0.0320 | 20.3 | 8.26 | 0.30 | |
| 290 | S | 2J | RUTA | Zant | mart | 8.90 | 0.0062 | 12.1 | 8.69 | 1.66 | |
| 291 | S | 2J | EUPH | Marg | nobi | 10.00 | 0.0079 | 13.0 | 9.94 | 7.00 | |
| 292 | S | 2J | STER | Guaz | ulmi | 18.80 | 0.0278 | 15.8 | 9.70 | 9.60 | |
| 293 | S | 2J | MYRT | Pime | race | 18.60 | 0.0272 | | 9.80 | 8.33 | |
| 294 | S | 2J | MIMO | Inga | fagi | 5.10 | 0.0020 | | 9.03 | 6.70 | |
| 295 | S | 2J | MIMO | Inga | fagi | 13.10 | 0.0135 | 14.8 | 8.61 | 6.04 | |
| 296 | S | 2J | MYRT | Pime | race | 5.20 | 0.0021 | | 8.03 | 9.90 | |
| 297 | S | 2J | PALM | Cocc | alta | 9.50 | 0.0071 | 3.95 | 5.85 | 5.38 | |
| 298 | S | 2J | MIMO | Inga | fagi | 10.40 | 0.0085 | | 6.42 | 2.49 | |
| 299 | S | 2J | MYRT | Pime | race | 8.60 | 0.0058 | | 6.32 | 1.76 | |
| 300 | S | 2J | MALP | Byrs | cori | 15.00 | 0.0177 | 14.2 | 4.78 | 1.12 | |
| 301 | S | 2J | MIMO | Inga | fagi | 14.40 | 0.0163 | | 3.80 | 3.29 | |
| 302 | S | 2J | MALP | Byrs | cori | 6.60 | 0.0034 | | 3.80 | 3.92 | |
| 303 | S | 2J | MALP | Byrs | cori | 7.70 | 0.0047 | | 0.65 | 7.39 | |
| 304 | S | 2J | MIMO | Inga | fagi | 19.80 | 0.0308 | | 0.45 | 4.21 | |
| 305 | S | 2J | NYCT | Guap | frag | 7.50 | 0.0044 | 8.20 | 0.19 | 4.11 | |
| 306 | S | 2J | MALP | Byrs | cori | 24.00 | 0.0452 | 17.6 | 0.22 | 2.25 | |
| 307 | S | 2J | MIMO | Inga | fagi | 10.40 | 0.0085 | | 1.29 | 2.03 | |
| 308 | S | 2J | PALM | Cocc | alta | 7.40 | 0.0043 | 3.34 | 2.22 | 0.84 | |
| 309 | S | 2J | MALP | Byrs | cori | 31.40 | 0.0774 | | 2.41 | 0.50 | |
| 310 | S | 2J | NYCT | Guap | frag | 9.20 | 0.0066 | | 0.07 | 0.22 | |
| 311 | S | 2I | MIMO | Inga | fagi | 6.90 | 0.0037 | | 8.01 | 0.61 | |
| 312 | S | 2I | MIMO | Inga | fagi | 17.80 | 0.0249 | | 5.06 | 0.42 | |
| 313 | S | 2I | STER | Guaz | ulmi | 18.40 | 0.0266 | 16.1 | 4.43 | 1.85 | |
| 314 | S | 2I | BORA | Cord | sulc | 17.40 | 0.0238 | 16.4 | 5.92 | 1.53 | |
| 315 | S | 2I | MYRT | Pime | race | 9.00 | 0.0064 | | 5.75 | 3.81 | |
| 316 | S | 2I | MALP | Byrs | cori | 23.40 | 0.0430 | 19.7 | 9.04 | 6.27 | |
| 317 | S | 2I | MALP | Byrs | cori | 21.80 | 0.0373 | | 8.74 | 7.88 | |
| 318 | S | 2I | MALP | Byrs | cori | 12.40 | 0.0121 | | 8.70 | 8.10 | |
| 319 | S | 2I | MIMO | Inga | fagi | 8.50 | 0.0057 | | 7.22 | 8.67 | |
| 320 | S | 2I | MIMO | Inga | fagi | 11.50 | 0.0104 | | 5.91 | 4.73 | |
| 321 | S | 2I | RUTA | Zant | mart | 26.50 | 0.0552 | 23.4 | 0.16 | 9.00 | |
| 322 | S | 2I | BORA | Cord | sulc | 7.80 | 0.0048 | 11.5 | 2.94 | 1.20 | |
| 2714 | S | 2I | BORA | Cord | coll | 5.00 | 0.0020 | 7.29 | 3.65 | 2.57 | |
| 2715 | S | 2I | MIMO | Inga | fagi | 5.10 | 0.0020 | | 0.22 | 9.65 | |
| 323 | S | 2H | SAPO | Chry | pauc | 8.10 | 0.0052 | 10.0 | 7.65 | 2.30 | |
| 324 | S | 2H | BIGN | Tabe | hete | 17.90 | 0.0252 | | 4.95 | 2.49 | |
| 325 | S | 2H | MIMO | Inga | fagi | 14.60 | 0.0167 | | 4.42 | 2.53 | |
| 326 | S | 2H | BIGN | Tabe | hete | 35.00 | 0.0962 | 16.7 | 2.78 | 2.80 | |
| 327 | M | 2H | CLUS | Clus | rose | 7.10 | 0.0040 | 20.6 | 3.11 | 2.60 | VINE |
| 327a | M | 2H | CLUS | Clus | rose | 19.50 | 0.0299 | | 5.45 | 8.07 | |
| 327b | M | 2H | CLUS | Clus | rose | 9.50 | 0.0071 | | 8.12 | 6.20 | |
| 328 | S | 2H | LAUR | Ocot | cori | 7.30 | 0.0042 | 8.20 | 5.45 | 5.98 | |
| 329 | S | 2H | MIMO | Inga | fagi | 6.10 | 0.0029 | | 8.12 | 6.20 | |



176

APPENDIX I. (Continued)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 330 | S | 2H | RUTA | Zant | mart | 12.00 | 0.0113 | | 9.65 | 6.33 |
| 331 | S | 2H | MIMO | Inga | fagi | 5.30 | 0.0022 | | 5.45 | 8.07 |
| 332 | S | 2H | LAUR | Ocot | cori | 7.70 | 0.0047 | 9.11 | 3.58 | 9.51 |
| 333 | S | 2H | MIMO | Inga | fagi | 10.00 | 0.0079 | | 2.61 | 7.55 |
| 334 | S | 2H | MIMO | Inga | fagi | 6.20 | 0.0030 | 9.72 | 3.22 | 6.80 |
| 335 | S | 2H | NYCT | Guap | frag | 13.00 | 0.0133 | | 1.05 | 4.35 |
| 336 | S | 2H | MIMO | Inga | fagi | 8.00 | 0.0050 | | 1.05 | 1.03 |
| 337 | M | 2H | LAUR | Ocot | cori | 12.10 | 0.0115 | | 1.40 | 0.32 |
| 338 | M | 2H | LAUR | Ocot | cori | 6.90 | 0.0037 | | 1.20 | 0.08 |
| 2716 | S | 2H | RUBI | Fara | occi | 6.10 | 0.0029 | | 3.08 | 0.10 |
| 339 | S | 2G | RUTA | Zant | mart | 11.80 | 0.0109 | 13.9 | 6.36 | 0.62 |
| 340 | S | 2G | SAPO | Chry | pauc | 10.80 | 0.0092 | 11.2 | 6.22 | 1.52 |
| 341 | S | 2G | RUBI | Fara | occi | 5.70 | 0.0026 | | 8.08 | 8.16 |
| 342 | S | 2G | RUBI | Guet | scab | 6.40 | 0.0032 | 8.81 | 8.32 | 9.87 |
| 343 | S | 2G | MYRS | Ardi | obov | 12.20 | 0.0117 | | 8.13 | 9.97 |
| 344 | S | 2G | BIGN | Tabe | hete | 25.50 | 0.0511 | | 6.28 | 9.70 |
| 345 | S | 2G | MIMO | Inga | fagi | 25.60 | 0.0515 | 19.1 | 3.88 | 7.88 |
| 346 | S | 2G | RUBI | Fara | occi | 5.60 | 0.0025 | | 3.86 | 7.11 |
| 347 | S | 2G | RUBI | Fara | occi | 9.10 | 0.0065 | 6.68 | 8.12 | 6.60 |
| 348 | S | 2G | BIGN | Tabe | hete | 8.90 | 0.0062 | | 4.32 | 5.91 |
| 349 | S | 2G | NYCT | Guap | frag | 12.50 | 0.0123 | 13.6 | 3.25 | 5.70 |
| 350 | S | 2G | NYCT | Guap | frag | 6.10 | 0.0029 | | 2.66 | 7.84 |
| 351 | S | 2G | RUBI | Fara | occi | 6.30 | 0.0031 | 5.47 | 1.24 | 8.60 |
| 352 | M | 2G | MYRS | Ardi | obov | 5.70 | 0.0026 | | 1.28 | 8.68 |
| 353 | M | 2G | MYRS | Ardi | obov | 5.00 | 0.0020 | | 1.06 | 8.74 |
| 354 | S | 2G | MIMO | Inga | fagi | 9.10 | 0.0065 | 12.1 | 0.93 | 8.68 |
| 355 | S | 2G | MYRS | Ardi | obov | 6.00 | 0.0028 | 8.20 | 0.18 | 7.15 |
| 356 | S | 2G | MIMO | Inga | fagi | 7.60 | 0.0045 | | 2.50 | 5.80 |
| 357 | S | 2G | BORA | Cord | alli | 6.20 | 0.0030 | 10.6 | 2.58 | 1.40 |
| 358 | S | 2G | BORA | Cord | alli | 14.40 | 0.0163 | 14.5 | 2.08 | 1.04 |
| 359 | S | 2G | RUTA | Zant | mart | 7.10 | 0.0040 | | 5.50 | 0.17 |
| 360 | S | 2G | NYCT | Guap | frag | 5.40 | 0.0023 | | 0.39 | 0.63 |
| 361 | M | 2F | STER | Guaz | ulmi | 19.90 | 0.0311 | 14.8 | 6.34 | 0.12 |
| 362 | M | 2F | STER | Guaz | ulmi | 18.40 | 0.0266 | 14.2 | 6.14 | 0.35 |
| 363 | M | 2F | STER | Guaz | ulmi | 28.20 | 0.0625 | | 6.63 | 0.37 |
| 364 | S | 2F | LAUR | Ocot | cori | 7.70 | 0.0047 | | 7.63 | 1.88 |
| 365 | S | 2F | MYRT | Pime | race | 16.90 | 0.0224 | 12.7 | 9.62 | 2.70 |
| 366 | M | 2F | MYRT | Pime | race | 6.90 | 0.0037 | | 5.53 | 2.25 |
| 367 | M | 2F | MYRT | Pime | race | 7.40 | 0.0043 | 10.3 | 5.72 | 2.04 |
| 368 | S | 2F | MYRT | Pime | race | 23.70 | 0.0441 | | 8.87 | 5.39 |
| 369 | S | 2F | FLAC | Case | deca | 5.80 | 0.0026 | 7.90 | 9.44 | 5.75 |
| 370 | S | 2F | NYCT | Guap | frag | 5.70 | 0.0026 | | 9.71 | 6.75 |
| 371 | S | 2F | MYRS | Ardi | obov | 10.70 | 0.0090 | | 9.95 | 9.00 |
| 372 | S | 2F | MIMO | Inga | fagi | 16.30 | 0.0209 | | 7.84 | 7.30 |
| 373 | S | 2F | NYCT | Guap | frag | 6.30 | 0.0031 | | 7.73 | 7.80 |
| 374 | S | 2F | NYCT | Guap | frag | 29.40 | 0.0679 | 16.1 | 2.60 | 9.66 |
| 375 | M | 2F | MYRS | Ardi | obov | 7.30 | 0.0042 | 9.72 | 1.60 | 9.54 |
| 376 | M | 2F | MYRS | Ardi | obov | 6.00 | 0.0028 | | 1.76 | 9.60 |
| 377 | S | 2F | LAUR | Ocot | cori | 15.30 | 0.0184 | 11.8 | 4.02 | 5.00 |
| 378 | S | 2F | FLAC | Case | deca | 6.40 | 0.0032 | 8.20 | 2.87 | 3.30 |



177

APPENDIX I. (Continued)

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 379 | S | 2F | OLEA | Lino | cari | 6.50 | 0.0033 | 9.11 | 1.52 | 1.40 | |
| 380 | S | 2F | RUTA | Zant | mart | 9.80 | 0.0075 | 10.0 | 1.02 | 1.02 | |
| 381 | S | 2E | FLAC | Case | deca | 5.10 | 0.0020 | 8.20 | 0.09 | 5.10 | |
| 382 | M | 2E | NYCT | Guap | frag | 24.50 | 0.0471 | | 6.00 | 0.72 | |
| 383 | M | 2E | NYCT | Guap | frag | 16.40 | 0.0211 | | 7.10 | 0.95 | |
| 384 | S | 2E | NYCT | Guap | frag | 22.00 | 0.0380 | | 6.83 | 2.77 | |
| 385 | S | 2E | NYCT | Guap | frag | 12.70 | 0.0127 | 12.4 | 6.42 | 3.05 | |
| 386 | S | 2E | OLEA | Lino | cari | 10.00 | 0.0079 | 9.42 | 7.70 | 4.49 | |
| 387 | S | 2E | NYCT | Guap | frag | 8.20 | 0.0053 | | 8.00 | 5.72 | |
| 388 | S | 2E | NYCT | Guap | frag | 8.00 | 0.0050 | | 7.90 | 5.80 | |
| 389 | S | 2E | NYCT | Guap | frag | 8.30 | 0.0054 | 12.1 | 9.32 | 6.70 | |
| 390 | S | 2E | MIMO | Inga | fagi | 19.00 | 0.0284 | | 9.10 | 9.85 | |
| 391 | S | 2E | NYCT | Guap | frag | 31.10 | 0.0760 | | 8.40 | 9.80 | |
| 392 | S | 2E | VERB | Cith | frut | 7.30 | 0.0042 | | 5.09 | 6.67 | |
| 393 | M | 2E | NYCT | Guap | frag | 6.40 | 0.0032 | 12.1 | 2.10 | 8.56 | |
| 394 | M | 2E | NYCT | Guap | frag | 6.50 | 0.0033 | | 1.85 | 8.25 | |
| 395 | S | 2E | NYCT | Guap | frag | 7.90 | 0.0049 | | 0.95 | 6.80 | |
| 396 | S | 2E | NYCT | Guap | frag | 9.50 | 0.0071 | | 4.31 | 6.07 | |
| 397 | M | 2E | MIMO | Acac | muri | 15.80 | 0.0196 | | 3.42 | 4.80 | |
| 398 | M | 2E | MIMO | Acac | muri | 14.60 | 0.0167 | 14.2 | 3.62 | 5.05 | |
| 399 | M | 2E | CAPP | Capp | indi | 7.30 | 0.0042 | 8.20 | 1.40 | 3.40 | |
| 400 | M | 2E | CAPP | Capp | indi | 5.70 | 0.0026 | | 1.48 | 3.60 | |
| 401 | M | 2E | NYCT | Guap | frag | 9.20 | 0.0066 | | 2.38 | 3.93 | SICK11/86 |
| 402 | M | 2E | NYCT | Guap | frag | 9.30 | 0.0068 | | 2.25 | 4.00 | |
| 403 | S | 2E | OLEA | Lino | cari | 8.80 | 0.0061 | | 5.22 | 3.54 | |
| 404 | S | 2E | LAUR | Ocot | cori | 8.90 | 0.0062 | 10.9 | 4.31 | 3.32 | |
| 405 | S | 2E | NYCT | Guap | frag | 15.40 | 0.0186 | | 4.61 | 2.64 | |
| 406 | S | 2E | OLEA | Lino | cari | 5.20 | 0.0021 | 6.68 | 3.17 | 1.32 | |
| 407 | S | 2E | NYCT | Guap | frag | 6.70 | 0.0035 | | 3.12 | 0.94 | |
| 408 | S | 2E | NYCT | Guap | frag | 5.80 | 0.0026 | | 2.71 | 0.08 | |
| 409 | S | 2D | NYCT | Guap | frag | 6.80 | 0.0036 | | 9.15 | 2.68 | |
| 410 | S | 2D | BURS | Burs | sima | 6.70 | 0.0035 | 5.77 | 9.42 | 3.01 | |
| 411 | S | 2D | NYCT | Guap | frag | 9.70 | 0.0074 | | 9.30 | 3.61 | |
| 412 | S | 2D | BORA | Bour | succ | 5.30 | 0.0022 | 8.20 | 8.37 | 4.28 | |
| 413 | M | 2D | MIMO | Acac | muri | 15.00 | 0.0177 | | 8.80 | 4.50 | |
| 414 | M | 2D | MIMO | Acac | muri | 14.40 | 0.0163 | | 8.60 | 4.37 | |
| 415 | M | 2D | MIMO | Acac | muri | 14.20 | 0.0158 | | 9.20 | 4.20 | |
| 416 | S | 2D | NYCT | Guap | frag | 7.80 | 0.0048 | | 9.65 | 5.25 | |
| 417 | S | 2D | OLEA | Lino | cari | 12.90 | 0.0131 | 12.7 | 9.30 | 5.67 | |
| 418 | S | 2D | NYCT | Guap | frag | 10.40 | 0.0085 | | 9.79 | 8.90 | |
| 419 | S | 2D | OLEA | Lino | cari | 5.30 | 0.0022 | | 9.85 | 9.20 | |
| 420 | S | 2D | NYCT | Guap | frag | 35.10 | 0.0968 | 15.8 | 6.29 | 9.25 | |
| 421 | S | 2D | MYRT | Myrc | citr | 6.70 | 0.0035 | 7.90 | 6.00 | 9.71 | |
| 422 | S | 2D | NYCT | Guap | frag | 24.70 | 0.0479 | | 5.50 | 8.55 | |
| 423 | M | 2D | MYRT | Pime | race | 14.80 | 0.0172 | 10.9 | 5.80 | 8.60 | |
| 424 | M | 2D | MYRT | Pime | race | 15.30 | 0.0184 | | 2.94 | 8.90 | |
| 425 | M | 2D | MYRT | Pime | race | 6.20 | 0.0030 | | 3.20 | 9.05 | |
| 426 | S | 2D | RUBI | Guet | scab | 6.00 | 0.0028 | 9.42 | 0.30 | 5.03 | |
| 427 | S | 2D | RUBI | Guet | scab | 5.50 | 0.0024 | 8.20 | 0.60 | 4.00 | |
| 428 | M | 2D | MYRT | Pime | race | 10.30 | 0.0083 | | 3.41 | 3.35 | |



178

APPENDIX I. (Continued)

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 429 | M | 2D | MYRT | Pime | race | 8.80 | 0.0061 | | 3.34 | 3.60 | |
| 430 | M | 2D | MYRT | Pime | race | 9.20 | 0.0066 | | 3.21 | 3.44 | |
| 431 | S | 2D | CAPP | Mori | amer | 5.50 | 0.0024 | 6.68 | 5.70 | 6.85 | |
| 432 | S | 2D | MYRT | Pime | race | 11.60 | 0.0106 | | 7.30 | 6.20 | |
| 433 | S | 2D | MIMO | Acac | muri | 9.00 | 0.0064 | | 7.20 | 3.55 | |
| 434 | S | 2D | MIMO | Acac | muri | 13.00 | 0.0133 | | 7.52 | 3.32 | |
| 435 | S | 2D | BORA | Cord | alli | 7.30 | 0.0042 | 10.6 | 6.98 | 2.45 | |
| 436 | S | 2D | MIMO | Acac | muri | 17.70 | 0.0246 | | 6.72 | 1.47 | |
| 437 | M | 2D | MIMO | Acac | muri | 24.00 | 0.0452 | | 5.82 | 2.00 | |
| 438 | M | 2D | MIMO | Acac | muri | 15.70 | 0.0194 | | 5.80 | 2.25 | |
| 439 | M | 2D | MYRT | Pime | race | 12.30 | 0.0119 | | 5.21 | 2.30 | |
| 440 | M | 2D | MYRT | Pime | race | 12.30 | 0.0119 | | 5.35 | 2.61 | |
| 441 | S | 2D | BORA | Bour | succ | 5.70 | 0.0026 | 9.72 | 5.35 | 2.61 | |
| 442 | M | 2D | MIMO | Acac | muri | 7.60 | 0.0045 | | 1.08 | 9.98 | |
| 443 | M | 2C | MYRT | Pime | race | 6.40 | 0.0032 | | 9.47 | 0.23 | |
| 444 | S | 2C | BIGN | Tabe | hete | 6.00 | 0.0028 | | 8.86 | 1.53 | |
| 445 | M | 2C | MIMO | Acac | muri | 9.10 | 0.0065 | | 8.41 | 1.53 | |
| 446 | M | 2C | MIMO | Acac | muri | 13.50 | 0.0143 | | 8.70 | 1.23 | |
| 447 | S | 2C | MIMO | Acac | muri | 14.60 | 0.0167 | 14.8 | 8.12 | 0.62 | |
| 448 | S | 2C | MIMO | Acac | muri | 9.80 | 0.0075 | | 6.60 | 0.92 | |
| 449 | S | 2C | BORA | Cord | alli | 9.90 | 0.0077 | 12.7 | 8.17 | 4.40 | |
| 450 | M | 2C | MYRT | Pime | race | 12.50 | 0.0123 | | 7.25 | 7.30 | |
| 451 | M | 2C | MYRT | Pime | race | 11.80 | 0.0109 | | 7.25 | 7.40 | |
| 452 | M | 2C | MIMO | Acac | muri | 18.80 | 0.0278 | 19.4 | 7.90 | 8.15 | |
| 453 | M | 2C | MIMO | Acac | muri | 17.70 | 0.0246 | | 7.90 | 7.85 | |
| 454 | M | 2C | MIMO | Acac | muri | 14.90 | 0.0174 | | 7.25 | 8.05 | |
| 455 | S | 2C | NYCT | Guap | frag | 9.40 | 0.0069 | | 7.76 | 9.30 | |
| 456 | S | 2C | MIMO | Acac | muri | 13.40 | 0.0141 | | 6.62 | 9.80 | |
| 457 | S | 2C | RUBI | Guet | scab | 6.00 | 0.0028 | 10.3 | 4.81 | 7.00 | |
| 458 | S | 2C | MIMO | Acac | muri | 8.30 | 0.0054 | | 5.06 | 4.65 | |
| 459 | M | 2C | MYRT | Pime | race | 13.50 | 0.0143 | | 5.42 | 3.35 | |
| 460 | M | 2C | MYRT | Pime | race | 10.50 | 0.0087 | | 5.51 | 3.00 | |
| 461 | M | 2C | MYRT | Pime | race | 9.70 | 0.0074 | | 3.67 | 2.35 | 463 DEAD |
| 462 | M | 2C | MYRT | Pime | race | 15.30 | 0.0184 | | 3.67 | 2.00 | |
| 463 | M | 2C | MYRT | Pime | race | 5.50 | 0.0024 | | 3.52 | 2.25 | |
| 464 | S | 2C | MYRT | Pime | race | 14.40 | 0.0163 | 14.2 | 3.45 | 1.00 | |
| 465 | M | 2C | MYRT | Pime | race | 8.90 | 0.0062 | | 2.99 | 0.50 | |
| 466 | M | 2C | MYRT | Pime | race | 8.20 | 0.0053 | | 3.01 | 0.30 | |
| 467 | M | 2C | MYRT | Pime | race | 10.20 | 0.0082 | | 1.12 | 0.39 | |
| 468 | M | 2C | MYRT | Pime | race | 6.60 | 0.0034 | | 1.20 | 0.42 | |
| 469 | S | 2C | MIMO | Acac | muri | 19.00 | 0.0284 | | 0.97 | 2.10 | |
| 470 | S | 2C | MIMO | Acac | muri | 11.40 | 0.0102 | | 1.59 | 7.09 | |
| 471 | S | 2C | RUBI | Guet | scab | 5.30 | 0.0022 | 9.72 | 1.02 | 7.62 | |
| 472 | S | 2C | RUBI | Guet | scab | 5.00 | 0.0020 | | 0.27 | 8.21 | |
| 473 | S | 2C | MIMO | Acac | muri | 8.00 | 0.0050 | | 2.89 | 5.20 | |
| 474 | S | 2C | MIMO | Acac | muri | 11.10 | 0.0097 | | 4.30 | 4.20 | |
| 475 | M | 2C | MIMO | Acac | muri | 21.90 | 0.0377 | 20.0 | 0.42 | 4.04 | |
| 476 | M | 2C | MIMO | Acac | muri | 16.60 | 0.0216 | | 0.30 | 4.04 | |
| 477 | S | 2B | RUBI | Guet | scab | 6.30 | 0.0031 | 8.81 | 7.07 | 2.50 | |
| 478 | S | 2B | RUBI | Guet | scab | 6.20 | 0.0030 | | 9.89 | 5.00 | |

APPENDIX I. (Continued)

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 479 | S | 2B | MIMO | Acac | muri | 9.90 | 0.0077 | | 7.87 | 5.25 | |
| 480 | M | 2B | MYRT | Pime | race | 13.50 | 0.0143 | | 6.64 | 5.10 | |
| 481 | M | 2B | MYRT | Pime | race | 6.60 | 0.0034 | | 6.58 | 5.00 | |
| 482 | S | 2B | MIMO | Acac | muri | 14.00 | 0.0154 | | 6.58 | 5.00 | |
| 483 | M | 2B | MYRT | Pime | race | 10.60 | 0.0088 | | 6.72 | 9.55 | |
| 484 | M | 2B | MYRT | Pime | race | 10.10 | 0.0080 | | 6.72 | 9.30 | |
| 485 | S | 2B | MIMO | Acac | muri | 9.20 | 0.0066 | | 6.41 | 9.30 | |
| 487 | S | 2B | MIMO | Acac | muri | 14.10 | 0.0156 | | 5.89 | 9.70 | |
| 488 | S | 2B | MIMO | Acac | muri | 21.80 | 0.0373 | | 5.65 | 8.30 | |
| 489 | M | 2B | MIMO | Acac | muri | 20.20 | 0.0320 | | 1.95 | 9.75 | |
| 490 | S | 2B | MIMO | Acac | muri | 18.40 | 0.0266 | | 0.63 | 9.60 | |
| 490 | S | 2B | RUBI | Guet | scab | 4.90 | 0.0019 | | 0.63 | 9.60 | |
| 491 | S | 2B | MIMO | Acac | muri | 8.50 | 0.0057 | | 1.60 | 8.00 | |
| 492 | S | 2B | RUBI | Fara | occi | 7.20 | 0.0041 | 5.16 | 1.12 | 7.00 | |
| 493 | S | 2B | RUBI | Guet | scab | 7.90 | 0.0049 | 12.1 | 4.24 | 5.80 | |
| 494 | S | 2B | RUBI | Guet | scab | 5.70 | 0.0026 | | 5.58 | 5.90 | |
| 495 | S | 2B | MIMO | Acac | muri | 10.90 | 0.0093 | | 5.12 | 4.20 | |
| 496 | S | 2B | MIMO | Acac | muri | 15.90 | 0.0199 | | 4.66 | 3.90 | |
| 498 | S | 2B | RUTA | Zant | mart | 5.40 | 0.0023 | | 5.09 | 3.35 | DEAD 1/87 |
| 499 | S | 2B | MYRT | Pime | race | 13.10 | 0.0135 | 11.5 | 4.87 | 1.50 | |
| 500 | S | 2B | MIMO | Acac | muri | 18.40 | 0.0266 | | 0.55 | 4.40 | |
| 501 | S | 2A | MYRS | Ardi | obov | 5.70 | 0.0026 | 6.99 | 9.92 | 0.46 | |
| 502 | S | 2A | RUBI | Fara | occi | 5.60 | 0.0025 | | 8.92 | 0.56 | |
| 503 | S | 2A | VERB | Cith | frut | 9.40 | 0.0069 | 12.1 | 7.59 | 0.42 | |
| 504 | S | 2A | NYCT | Guap | frag | 8.20 | 0.0053 | | 7.49 | 0.38 | |
| 505 | S | 2A | RUBI | Fara | occi | 5.60 | 0.0025 | 7 | 5.42 | 4.60 | |
| 506 | S | 2A | MIMO | Acac | muri | 17.30 | 0.0235 | | 5.39 | 3.80 | |
| 507 | S | 2A | BIGN | Tabe | hete | 29.30 | 0.0674 | 19.4 | 8.24 | 3.70 | |
| 508 | S | 2A | MIMO | Acac | muri | 8.10 | 0.0052 | | 8.24 | 4.20 | |
| 509 | S | 2A | MIMO | Acac | muri | 21.80 | 0.0373 | | 9.23 | 4.60 | |
| 510 | S | 2A | NYCT | Guap | frag | 7.10 | 0.0040 | | 9.05 | 5.15 | |
| 511 | S | 2A | OLEA | Lino | cari | 6.60 | 0.0034 | 9.72 | 6.99 | 2.10 | |
| 512 | S | 2A | RUBI | Guet | scab | 5.60 | 0.0025 | | 8.28 | 4.50 | |
| 513 | S | 2A | MIMO | Acac | muri | 19.10 | 0.0287 | | 7.55 | 5.90 | |
| 514 | S | 2A | RUBI | Guet | scab | 5.50 | 0.0024 | | 8.49 | 6.15 | |
| 515 | S | 2A | RUBI | Guet | scab | 6.60 | 0.0034 | | 9.95 | 3.80 | |
| 516 | S | 2A | NYCT | Guap | frag | 5.40 | 0.0023 | | 8.93 | 8.70 | |
| 517 | S | 2A | RUBI | Guet | scab | 6.20 | 0.0030 | | 9.42 | 8.95 | |
| 518 | S | 2A | RUBI | Guet | scab | 5.50 | 0.0024 | | 9.42 | 9.15 | |
| 519 | S | 2A | MYRT | Pime | race | 10.80 | 0.0092 | | 7.11 | 6.75 | |
| 520 | S | 2A | VERB | Cith | frut | 6.40 | 0.0032 | | 6.56 | 7.35 | SICK 3/86 |
| 521 | S | 2A | MYRT | Pime | race | 6.50 | 0.0033 | | 5.82 | 8.00 | |
| 522 | S | 2A | RUBI | Guet | scab | 7.80 | 0.0048 | | 3.97 | 7.50 | |
| 523 | S | 2A | BIGN | Tabe | hete | 22.20 | 0.0387 | | 3.41 | 7.00 | |
| 524 | S | 2A | CAPP | Mori | amer | 5.10 | 0.0020 | 6.68 | 0.20 | 9.17 | |
| 525 | S | 2A | NYCT | Guap | frag | 7.50 | 0.0044 | | 1.58 | 8.30 | |
| 526 | S | 2A | CAPP | Mori | amer | 6.40 | 0.0032 | 6.68 | 1.31 | 7.95 | |
| 527 | S | 2A | MIMO | Acac | muri | 16.30 | 0.0209 | | 3.71 | 6.20 | |
| 528 | S | 2A | RUBI | Guet | scab | 7.60 | 0.0045 | | 4.36 | 5.95 | |
| 529 | S | 2A | OLEA | Lino | cari | 7.90 | 0.0049 | 10.9 | 5.34 | 4.45 | |

APPENDIX I. (Continued)

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 530 | S | 2A | OLEA | Lino | cari | 8.20 | 0.0053 | | 3.86 | 2.00 | |
| 531 | S | 2A | MYRS | Ardi | obov | 6.00 | 0.0028 | | 2.28 | 2.05 | |
| 532 | S | 2A | MIMO | Acac | muri | 10.00 | 0.0079 | | 2.19 | 3.10 | |
| 533 | S | 2A | BIGN | Tabe | hete | 22.60 | 0.0401 | | 2.14 | 3.78 | |
| 534 | S | 2A | MIMO | Acac | muri | 12.00 | 0.0113 | | 2.31 | 4.05 | |
| 535 | S | 2A | CAPP | Mori | amer | 9.10 | 0.0065 | 9.11 | 0.35 | 5.40 | |
| 536 | S | 2A | OLEA | Lino | cari | 8.30 | 0.0054 | | 2.02 | 4.05 | |
| 537 | S | 2A | NYCT | Guap | frag | 5.20 | 0.0021 | | 1.18 | 3.40 | |
| 538 | S | 3A | NYCT | Guap | frag | 6.30 | 0.0031 | | 1.87 | 0.85 | |
| 539 | S | 3A | MIMO | Acac | muri | 21.80 | 0.0373 | | 2.52 | 0.90 | |
| 540 | S | 3A | MIMO | Acac | muri | 13.20 | 0.0137 | | 0.50 | 2.84 | |
| 541 | S | 3A | MYRT | Euge | mont | 7.60 | 0.0045 | 10.0 | 0.84 | 2.90 | |
| 542 | S | 3A | MIMO | Acac | muri | 13.00 | 0.0133 | | 1.52 | 4.00 | |
| 543 | S | 3A | MYRS | Ardi | obov | 5.80 | 0.0026 | | 0.54 | 4.00 | |
| 544 | S | 3A | NYCT | Guap | frag | 7.30 | 0.0042 | | 1.51 | 5.00 | |
| 545 | S | 3A | MYRT | Euge | mont | 6.70 | 0.0035 | 10.3 | 2.40 | 5.15 | |
| 546 | S | 3A | MIMO | Acac | muri | 16.30 | 0.0209 | | 0.38 | 6.13 | |
| 547 | M | 3A | BIGN | Tabe | hete | 11.30 | 0.0100 | | 0.57 | 6.25 | DEAD 7/86 |
| 548 | M | 3A | BIGN | Tabe | hete | 17.20 | 0.0232 | | 0.58 | 6.25 | |
| 549 | S | 3A | VERB | Cith | frut | 7.70 | 0.0047 | 10.3 | 0.83 | 7.30 | |
| 550 | S | 3A | NYCT | Guap | frag | 7.20 | 0.0041 | | 3.10 | 6.25 | |
| 551 | S | 3A | MIMO | Acac | muri | 12.30 | 0.0119 | | 3.27 | 7.30 | |
| 552 | S | 3A | OLEA | Lino | cari | 5.70 | 0.0026 | 8.51 | 4.04 | 8.00 | |
| 553 | S | 3A | MYRT | Myrc | citr | 5.70 | 0.0026 | 9.11 | 4.31 | 7.50 | |
| 554 | S | 3A | RUBI | Guet | scab | 8.50 | 0.0057 | | 5.12 | 7.30 | |
| 555 | S | 3A | NYCT | Guap | frag | 7.60 | 0.0045 | | 4.76 | 4.80 | |
| 556 | S | 3A | MIMO | Acac | muri | 28.50 | 0.0638 | | 6.45 | 9.40 | |
| 557 | S | 3A | MIMO | Acac | muri | 8.30 | 0.0054 | | 6.50 | 9.50 | |
| 558 | S | 3A | MYRT | Pime | race | 6.70 | 0.0035 | | 7.67 | 7.50 | |
| 559 | S | 3A | MIMO | Acac | muri | 14.50 | 0.0165 | 15.5 | 7.83 | 8.40 | |
| 560 | S | 3A | MYRT | Pime | race | 8.90 | 0.0062 | | 9.39 | 9.70 | |
| 561 | S | 3A | OLEA | Lino | cari | 8.80 | 0.0061 | | 9.39 | 4.20 | |
| 562 | S | 3A | MYRT | Pime | race | 10.00 | 0.0079 | 10.6 | 9.32 | 3.50 | |
| 563 | S | 3A | NYCT | Guap | frag | 5.30 | 0.0022 | | 6.70 | 5.50 | |
| 564 | S | 3A | MIMO | Acac | muri | 20.90 | 0.0343 | | 6.95 | 4.70 | W/CLUSIA |
| 565 | S | 3A | MIMO | Acac | muri | 19.60 | 0.0302 | | 6.95 | 3.75 | |
| 566 | S | 3A | RUBI | Guet | scab | 5.30 | 0.0022 | | 6.14 | 2.30 | |
| 567 | S | 3A | NYCT | Guap | frag | 5.00 | 0.0020 | | 5.47 | 1.30 | SICK 7/86 |
| 568 | S | 3A | MIMO | Acac | muri | 9.00 | 0.0064 | | 6.19 | 1.45 | |
| 569 | S | 3A | NYCT | Guap | frag | 6.20 | 0.0030 | | 7.06 | 1.35 | |
| 570 | M | 3A | RUBI | Guet | scab | 8.30 | 0.0054 | 13.2 | 7.10 | 1.60 | |
| 571 | M | 3A | RUBI | Guet | scab | 10.00 | 0.0079 | | 7.21 | 1.75 | |
| 572 | S | 3A | RUBI | Guet | scab | 6.50 | 0.0033 | | 7.96 | 1.05 | |
| 573 | S | 3A | OLEA | Lino | cari | 6.00 | 0.0028 | 9.11 | 5.66 | 1.20 | |
| 574 | M | 3B | MIMO | Acac | muri | 18.40 | 0.0266 | | 2.08 | 0.20 | |
| 575 | S | 3B | MIMO | Acac | muri | 24.30 | 0.0464 | | 2.08 | 0.20 | |
| 576 | M | 3B | BIGN | Tabe | hete | 16.20 | 0.0206 | 15.8 | 4.31 | 2.50 | |
| 577 | M | 3B | BIGN | Tabe | hete | 13.10 | 0.0135 | | 2.41 | 4.10 | |
| 578 | S | 3B | RUBI | Guet | scab | 8.70 | 0.0059 | | 2.01 | 3.85 | |
| 579 | S | 3B | MIMO | Acac | muri | 18.10 | 0.0257 | | 3.49 | 4.30 | |

APPENDIX I. (Continued)

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 580 | S | 3B | NYCT | Guap | frag | 8.00 | 0.0050 | | 1.04 | 7.30 | |
| 581 | S | 3B | MIMO | Acac | muri | 10.50 | 0.0087 | | 0.74 | 9.27 | |
| 582 | M | 3B | CAPP | Mori | amer | 8.20 | 0.0053 | 7.90 | 3.78 | 8.60 | |
| 583 | M | 3B | CAPP | Mori | amer | 5.00 | 0.0020 | | 3.78 | 9.00 | |
| 583 | S | 3B | MIMO | Acac | muri | 23.10 | 0.0419 | | 3.78 | 9.00 | |
| 585 | S | 3B | RUBI | Fara | occi | 5.00 | 0.0020 | | 4.35 | 7.75 | |
| 586 | S | 3B | LAUR | Ocot | cori | 5.50 | 0.0024 | 4.86 | 4.85 | 9.60 | |
| 587 | S | 3B | NYCT | Guap | frag | 6.00 | 0.0028 | | 5.04 | 9.45 | |
| 588 | S | 3B | MIMO | Acac | muri | 20.70 | 0.0337 | | 5.32 | 9.30 | |
| 589 | S | 3B | MIMO | Acac | muri | 11.50 | 0.0104 | | 5.44 | 9.05 | |
| 590 | S | 3B | MIMO | Acac | muri | 14.70 | 0.0170 | | 8.54 | 9.70 | |
| 591 | S | 3B | VERB | Cith | frut | 7.00 | 0.0038 | | 4.95 | 6.95 | SICK 1/87 |
| 592 | S | 3B | NYCT | Guap | frag | 8.60 | 0.0058 | | 5.67 | 6.30 | |
| 593 | S | 3B | MIMO | Acac | muri | 13.10 | 0.0135 | | 5.09 | 6.35 | |
| 594 | S | 3B | RUBI | Fara | occi | 5.50 | 0.0024 | 7 | 3.72 | 4.75 | |
| 595 | S | 3B | OLEA | Lino | cari | 6.60 | 0.0034 | | 5.62 | 3.20 | DEAD 3/86 |
| 596 | S | 3B | MIMO | Acac | muri | 10.80 | 0.0092 | | 4.35 | 2.90 | |
| 597 | S | 3B | RUBI | Fara | occi | 5.00 | 0.0020 | | 6.52 | 2.65 | |
| 598 | S | 3B | MYRT | Pime | race | 8.50 | 0.0057 | | 6.87 | 2.50 | |
| 599 | S | 3B | MYRT | Pime | race | 9.90 | 0.0077 | 11.2 | 8.31 | 3.15 | |
| 600 | S | 3B | MYRT | Pime | race | 6.10 | 0.0029 | | 9.54 | 4.75 | |
| 601 | S | 3B | MIMO | Acac | muri | 15.50 | 0.0189 | | 9.78 | 5.55 | |
| 602 | S | 3B | MYRT | Pime | race | 5.70 | 0.0026 | 8.81 | 7.40 | 5.60 | |
| 2717 | S | 3B | RUBI | Fara | occi | 5.50 | 0.0024 | | 7.78 | 8.74 | |
| 603 | S | 3C | BIGN | Tabe | hete | 41.00 | 0.1320 | 23.1 | 0.45 | 8.10 | |
| 604 | S | 3C | MIMO | Acac | muri | 16.80 | 0.0222 | | 0.98 | 9.10 | |
| 605 | S | 3C | MALP | Byrs | cori | 23.10 | 0.0419 | 17.6 | 1.2[illegible] | 8.95 | |
| 606 | S | 3C | MALP | Byrs | cori | 13.80 | 0.0150 | | 1.27 | 8.10 | |
| 607 | S | 3C | RUBI | Fara | occi | 5.10 | 0.0020 | | 1.27 | 7.00 | |
| 608 | S | 3C | BIGN | Tabe | hete | 17.10 | 0.0230 | | 1.52 | 7.10 | |
| 609 | S | 3C | MYRS | Ardi | obov | 5.40 | 0.0023 | | 1.48 | 6.05 | |
| 610 | S | 3C | MYRS | Ardi | obov | 7.00 | 0.0038 | 10.[illegible] | 2.42 | 8.10 | |
| 611 | S | 3C | MYRS | Ardi | obov | 7.50 | 0.0044 | | 3.15 | 8.70 | |
| 612 | S | 3C | MIMO | Acac | muri | 8.20 | 0.0053 | | 2.91 | 4.15 | |
| 613 | S | 3C | NYCT | Guap | frag | 14.20 | 0.0158 | | 2.20 | 4.20 | |
| 614 | S | 3C | MIMO | Acac | muri | 11.20 | 0.0099 | | 0.85 | 3.28 | |
| 615 | M | 3C | MYRT | Pime | race | 11.90 | 0.0111 | 11.5 | 3.05 | 1.15 | |
| 616 | M | 3C | MYRT | Pime | race | 8.00 | 0.0050 | | 3.10 | 1.40 | |
| 617 | M | 3C | MIMO | Acac | muri | 12.00 | 0.0113 | | 2.85 | 2.15 | |
| 618 | M | 3C | MIMO | Acac | muri | 10.40 | 0.0085 | | 2.85 | 2.35 | |
| 619 | S | 3C | MYRS | Ardi | obov | 6.60 | 0.0034 | | 2.72 | 3.40 | |
| 620 | S | 3C | NYCT | Guap | frag | 9.50 | 0.0071 | | 3.94 | 2.55 | |
| 621 | S | 3C | MALP | Byrs | cori | 12.50 | 0.0123 | 14.5 | 5.12 | 3.80 | |
| 622 | S | 3C | MIMO | Acac | muri | 15.70 | 0.0194 | | 5.12 | 1.05 | |
| 623 | M | 3C | LAUR | Ocot | cori | 11.40 | 0.0102 | | 7.04 | 1.60 | |
| 624 | M | 3C | LAUR | Ocot | cori | 8.20 | 0.0053 | | 6.72 | 2.05 | |
| 625 | S | 3C | NYCT | Guap | frag | 10.60 | 0.0088 | | 8.31 | 2.30 | |
| 626 | S | 3C | NYCT | Guap | frag | 6.10 | 0.0029 | | 9.01 | 0.50 | |
| 627 | S | 3C | NYCT | Guap | frag | 15.70 | 0.0194 | 13.0 | 9.94 | 3.90 | |
| 628 | S | 3C | MIMO | Inga | fagi | 9.30 | 0.0068 | 10.0 | 7.70 | 4.06 | |

APPENDIX I. (Continued)

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 629 | S | 3C | MIMO | Acac | muri | 23.20 | 0.0423 | | 4.81 | 4.55 | |
| 630 | S | 3C | MYRS | Ardi | obov | 5.40 | 0.0023 | | 5.16 | 4.88 | |
| 631 | S | 3C | LAUR | Ocot | cori | 8.70 | 0.0059 | 9.11 | 8.21 | 6.25 | |
| 632 | S | 3C | BIGN | Tabe | hete | 9.40 | 0.0069 | | 6.72 | 7.70 | |
| 633 | M | 3C | MYRS | Ardi | obov | 6.70 | 0.0035 | 5.47 | 6.95 | 7.38 | |
| 634 | M | 3C | MYRS | Ardi | obov | 5.10 | 0.0020 | | 9.95 | 7.60 | |
| 635 | M | 3C | MYRS | Ardi | obov | 5.00 | 0.0020 | | 8.10 | 7.38 | |
| 636 | S | 3C | MALP | Byrs | cori | 15.50 | 0.0189 | | 6.47 | 8.55 | |
| 637 | S | 3C | MIMO | Inga | fagi | 14.30 | 0.0161 | 15.8 | 6.24 | 8.55 | |
| 638 | S | 3C | MALP | Byrs | cori | 13.70 | 0.0147 | | 5.90 | 9.20 | |
| 639 | S | 3C | MYRS | Ardi | obov | 10.20 | 0.0082 | | 5.93 | 9.55 | |
| 640 | S | 3C | BIGN | Tabe | hete | 28.80 | 0.0651 | | 5.81 | 9.35 | |
| 641 | S | 3C | RUBI | Guet | scab | 9.90 | 0.0077 | 13.6 | 4.79 | 9.00 | |
| 642 | S | 3C | LAUR | Ocot | cori | 6.50 | 0.0033 | | 3.43 | 8.25 | |
| 643 | S | 3C | MALP | Byrs | cori | 17.90 | 0.0252 | | 3.34 | 9.35 | |
| 644 | S | 3C | OCHN | Oura | lito | 5.10 | 0.0020 | 7.29 | 3.47 | 9.65 | |
| 645 | S | 3C | MYRS | Ardi | obov | 6.00 | 0.0028 | | 3.25 | 8.50 | |
| 646 | S | 3C | LAUR | Ocot | cori | 7.20 | 0.0041 | | 3.72 | 7.20 | |
| 647 | S | 3D | MYRS | Ardi | obov | 6.00 | 0.0028 | | 2.46 | 8.54 | |
| 648 | S | 3D | NYCT | Guap | frag | 20.70 | 0.0337 | | 1.63 | 7.55 | |
| 649 | M | 3D | LAUR | Lica | sali | 15.30 | 0.0184 | 11.5 | 3.52 | 6.65 | |
| 650 | M | 3D | LAUR | Lica | sali | 5.40 | 0.0023 | | 3.72 | 6.95 | |
| 651 | S | 3D | MALP | Byrs | cori | 28.00 | 0.0616 | | 2.81 | 3.40 | |
| 652 | S | 3D | MYRS | Ardi | obov | 5.30 | 0.0022 | | 1.88 | 2.93 | |
| 653 | S | 3D | NYCT | Guap | frag | 11.70 | 0.0108 | | 2.31 | 2.25 | DEAD 3/86 |
| 654 | S | 3D | MYRT | Myrc | citr | 5.50 | 0.0024 | 6.38 | 2.12 | 1.70 | |
| 655 | S | 3D | MYRT | Myrc | citr | 5.10 | 0.0020 | | 0.03 | 0.83 | |
| 656 | S | 3D | NYCT | Guap | frag | 16.10 | 0.0204 | | 0.08 | 0.40 | |
| 657 | S | 3D | NYCT | Guap | frag | 10.70 | 0.0090 | | 0.70 | 0.05 | |
| 658 | S | 3D | NYCT | Guap | frag | 11.60 | 0.0106 | | 9.10 | 0.26 | |
| 659 | S | 3D | CLUS | Clus | rose | 15.80 | 0.0196 | 17.9 | 9.90 | 0.40 | VINE |
| 660 | S | 3D | BIGN | Tabe | hete | 32.30 | 0.0819 | | 10.00 | 0.22 | |
| 661 | S | 3D | NYCT | Guap | frag | 16.50 | 0.0214 | 16.1 | 10.00 | 2.42 | |
| 662 | S | 3D | NYCT | Guap | frag | 8.10 | 0.0052 | | 8.42 | 3.25 | |
| 663 | S | 3D | NYCT | Guap | frag | 7.90 | 0.0049 | 10.3 | 5.66 | 3.80 | |
| 664 | S | 3D | MYRS | Ardi | obov | 7.30 | 0.0042 | | 6.01 | 4.15 | |
| 665 | S | 3D | OLEA | Lino | cari | 8.80 | 0.0061 | 11.8 | 6.69 | 4.34 | |
| 666 | S | 3D | MYRT | Pime | race | 6.00 | 0.0028 | | 8.10 | 4.95 | |
| 667 | S | 3D | NYCT | Guap | frag | 20.20 | 0.0320 | | 7.32 | 5.90 | |
| 668 | S | 3D | NYCT | Guap | frag | 19.60 | 0.0302 | | 4.05 | 8.90 | |
| 669 | S | 3D | LAUR | Ocot | cori | 16.40 | 0.0211 | 13.0 | 8.94 | 7.58 | |
| 2718 | S | 3D | LAUR | Ocot | cori | 7.20 | 0.0041 | 6.68 | 4.62 | 9.95 | |
| 670 | S | 3E | NYCT | Guap | frag | 12.40 | 0.0121 | | 0.62 | 9.45 | |
| 671 | S | 3E | MYRT | Myrc | citr | 7.90 | 0.0049 | 10.6 | 1.27 | 8.62 | |
| 672 | S | 3E | BIGN | Tabe | hete | 28.50 | 0.0638 | | 1.14 | 7.85 | |
| 673 | S | 3E | MIMO | Acac | muri | 22.70 | 0.0405 | 16.1 | 0.70 | 8.02 | |
| 674 | S | 3E | MYRS | Ardi | obov | 6.70 | 0.0035 | 10.3 | 1.76 | 9.20 | |
| 675 | S | 3E | NYCT | Guap | frag | 29.90 | 0.0702 | 13.9 | 2.40 | 8.75 | |
| 676 | M | 3E | MYRS | Ardi | obov | 6.40 | 0.0032 | | 2.06 | 6.68 | |
| 677 | M | 3E | MYRS | Ardi | obov | 6.10 | 0.0029 | | 2.15 | 6.80 | |

APPENDIX I. (Continued)

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 678 | S | 3E | BIGN | Tabe | hete | 27.50 | 0.0594 | | 2.58 | 6.35 | |
| 679 | S | 3E | NYCT | Guap | frag | 9.20 | 0.0066 | | 0.92 | 4.70 | |
| 680 | S | 3E | OLEA | Lino | cari | 8.10 | 0.0052 | | 1.01 | 4.30 | |
| 681 | S | 3E | OLEA | Lino | cari | 7.90 | 0.0049 | 9.72 | 0.72 | 2.62 | |
| 682 | S | 3E | LAUR | Ocot | cori | 12.30 | 0.0119 | | 0.17 | 2.17 | |
| 683 | S | 3E | OLEA | Lino | cari | 5.10 | 0.0020 | | 1.38 | 2.20 | |
| 684 | S | 3E | MYRT | Myrc | citr | 5.20 | 0.0021 | 4.25 | 1.13 | 1.32 | |
| 685 | M | 3E | NYCT | Guap | frag | 14.80 | 0.0172 | | 1.82 | 0.62 | |
| 686 | M | 3E | NYCT | Guap | frag | 6.70 | 0.0035 | | 1.67 | 0.19 | |
| 687 | M | 3E | NYCT | Guap | frag | 8.10 | 0.0052 | | 2.76 | 0.70 | |
| 688 | M | 3E | NYCT | Guap | frag | 8.90 | 0.0062 | | 2.67 | 0.75 | |
| 689 | M | 3E | NYCT | Guap | frag | 13.20 | 0.0137 | | 2.67 | 0.79 | |
| 690 | M | 3E | NYCT | Guap | frag | 7.90 | 0.0049 | | 2.87 | 0.69 | |
| 691 | S | 3E | OLEA | Lino | cari | 6.10 | 0.0029 | | 3.42 | 1.05 | |
| 692 | S | 3E | BORA | Bour | succ | 16.00 | 0.0201 | 11.2 | 3.90 | 0.98 | |
| 693 | S | 3E | OLEA | Lino | cari | 8.70 | 0.0059 | 10.0 | 3.90 | 1.60 | |
| 694 | S | 3E | MYRS | Ardi | obov | 7.00 | 0.0038 | | 4.50 | 1.00 | |
| 695 | S | 3E | OLEA | Lino | cari | 10.40 | 0.0085 | | 5.66 | 1.10 | |
| 696 | S | 3E | NYCT | Guap | frag | 22.60 | 0.0401 | | 9.38 | 0.90 | |
| 697 | M | 3E | OLEA | Lino | cari | 6.30 | 0.0031 | | 9.84 | 2.00 | |
| 698 | M | 3E | OLEA | Lino | cari | 14.00 | 0.0154 | | 9.92 | 2.10 | |
| 699 | S | 3E | EUPH | Marg | nobi | 18.70 | 0.0275 | 14.2 | 8.75 | 2.40 | |
| 700 | S | 3E | MYRS | Ardi | obov | 9.20 | 0.0066 | | 7.34 | 2.50 | |
| 701 | S | 3E | MYRS | Ardi | obov | 8.60 | 0.0058 | 10.3 | 7.97 | 3.25 | |
| 702 | S | 3E | MYRS | Ardi | obov | 5.20 | 0.0021 | | 6.33 | 2.40 | |
| 703 | S | 3E | MYRS | Ardi | obov | 5.50 | 0.0024 | | 4.55 | 3.60 | |
| 704 | S | 3E | OLEA | Lino | cari | 9.40 | 0.0069 | | 3.24 | 3.15 | |
| 705 | S | 3E | NYCT | Guap | frag | 6.60 | 0.0034 | | 1.50 | 2.25 | |
| 706 | S | 3E | MYRS | Ardi | obov | 9.60 | 0.0072 | 10.0 | 3.80 | 4.25 | |
| 707 | S | 3E | MYRS | Ardi | obov | 8.10 | 0.0052 | | 3.14 | 5.03 | |
| 708 | S | 3E | MYRT | Pime | race | 6.00 | 0.0028 | | 5.40 | 9.80 | |
| 709 | S | 3E | NYCT | Guap | frag | 10.70 | 0.0090 | | 7.98 | 5.85 | |
| 710 | M | 3E | MYRS | Ardi | obov | 5.80 | 0.0026 | | 8.45 | 6.85 | |
| 711 | M | 3E | MYRS | Ardi | obov | 5.30 | 0.0022 | | 8.62 | 7.00 | |
| 712 | S | 3E | RUBI | Fara | occi | 5.70 | 0.0026 | 5.16 | 9.20 | 6.40 | |
| 713 | S | 3E | LAUR | Ocot | cori | 14.50 | 0.0165 | 11.8 | 9.12 | 7.25 | |
| 714 | S | 3E | MYRS | Ardi | obov | 5.50 | 0.0024 | | 8.97 | 9.70 | |
| 715 | S | 3E | MIMO | Inga | fagi | 18.00 | 0.0254 | | 9.12 | 9.85 | SICK11/86 |
| 2719 | S | 3E | NYCT | Guap | frag | 6.50 | 0.0033 | 10.0 | 4.23 | 4.90 | |
| 2720 | S | 3E | RUBI | Fara | occi | 5.20 | 0.0021 | | 8.50 | 5.30 | |
| 716 | S | 3F | BIGN | Tabe | hete | 11.90 | 0.0111 | | 0.35 | 9.50 | |
| 717 | S | 3F | BIGN | Tabe | hete | 14.50 | 0.0165 | 14.5 | 2.23 | 9.00 | |
| 718 | S | 3F | SIMA | Picr | anti | 24.20 | 0.0460 | 15.8 | 4.08 | 9.80 | |
| 719 | S | 3F | NYCT | Guap | frag | 39.20 | 0.1207 | | 1.45 | 7.20 | |
| 720 | S | 3F | MYRS | Ardi | obov | 8.70 | 0.0059 | | 0.15 | 6.80 | |
| 721 | S | 3F | MYRS | Ardi | obov | 6.30 | 0.0031 | | 3.13 | 6.05 | |
| 722 | S | 3F | NYCT | Guap | frag | 13.50 | 0.0143 | | 1.22 | 3.45 | |
| 723 | S | 3F | MYRS | Ardi | obov | 7.20 | 0.0041 | | 2.08 | 2.05 | |
| 724 | S | 3F | NYCT | Guap | frag | 19.80 | 0.0308 | | 4.02 | 1.40 | |
| 725 | M | 3F | MYRS | Ardi | obov | 9.00 | 0.0064 | 9.11 | 5.21 | 2.15 | |



184

APPENDIX I. (Continued)

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 726 | M | 3F | MYRS | Ardi obov | 7.20 | 0.0041 | | 5.45 | 2.15 | |
| 727 | M | 3F | MYRS | Ardi obov | 8.20 | 0.0053 | | 6.10 | 2.30 | |
| 728 | S | 3F | MYRS | Ardi obov | 7.10 | 0.0040 | | 6.15 | 0.59 | |
| 729 | S | 3F | ANAC | Spon momb | 32.50 | 0.0830 | 14.8 | 5.01 | 4.85 | |
| 730 | M | 3F | NYCT | Guap frag | 50.30 | 0.1987 | | 5.01 | 5.35 | |
| 733 | S | 3F | OLEA | Lino cari | 6.30 | 0.0031 | | 6.55 | 6.60 | |
| 734 | S | 3F | MYRS | Ardi obov | 6.00 | 0.0028 | | 6.65 | 6.70 | |
| 735 | S | 3F | LAUR | Ocot cori | 8.70 | 0.0059 | | 5.79 | 7.20 | |
| 736 | S | 3F | MIMO | Inga fagi | 13.70 | 0.0147 | | 6.45 | 8.10 | |
| 737 | S | 3F | LAUR | Ocot cori | 6.20 | 0.0030 | | 7.97 | 6.20 | |
| 738 | S | 3F | MYRS | Ardi obov | 7.10 | 0.0040 | | 9.30 | 7.55 | |
| 739 | S | 3F | FLAC | Case deca | 7.30 | 0.0042 | 9.42 | 8.75 | 7.90 | |
| 740 | S | 3F | SIMA | Picr anti | 9.20 | 0.0066 | 8.81 | 9.42 | 9.30 | |
| 751 | S | 3F | OLEA | Lino cari | 6.20 | 0.0030 | | 6.24 | 9.40 | |
| 741 | S | 3G | LAUR | Ocot cori | 5.90 | 0.0027 | | 0.74 | 6.80 | BENT 1/87 |
| 742 | S | 3G | RUBI | Fara occi | 5.50 | 0.0024 | | 2.45 | 6.00 | |
| 743 | S | 3G | MIMO | Inga fagi | 7.20 | 0.0041 | | 2.99 | 3.75 | |
| 744 | S | 3G | CELA | Mayt elli | 7.10 | 0.0040 | 4.86 | 0.56 | 3.15 | |
| 745 | S | 3G | MYRS | Ardi obov | 10.70 | 0.0090 | | 0.28 | 0.53 | |
| 746 | S | 3G | MIMO | Inga fagi | 38.70 | 0.1176 | | 1.60 | 0.90 | |
| 747 | S | 3G | NYCT | Guap frag | 16.20 | 0.0206 | | 6.16 | 1.95 | |
| 748 | S | 3G | RUBI | Fara occi | 5.30 | 0.0022 | | 6.55 | 2.90 | |
| 749 | S | 3G | BORA | Cord alli | 24.20 | 0.0460 | 17.9 | 8.52 | 3.40 | |
| 750 | S | 3G | BORA | Cord alli | 10.60 | 0.0088 | | 6.12 | 3.50 | DEAD 3/86 |
| 752 | M | 3G | SAPI | Allo race | 6.70 | 0.0035 | 7.59 | 9.88 | 8.00 | |
| 753 | M | 3G | SAPI | Allo race | 8.50 | 0.0057 | 9.42 | 9.86 | 8.00 | |
| 754 | S | 3G | BIGN | Tabe hete | 36.10 | 0.1024 | 22.4 | 9.45 | 9.60 | |
| 755 | S | 3G | MYRS | Ardi obov | 8.20 | 0.0053 | | 9.95 | 9.55 | |
| 756 | S | 3H | MALP | Byrs cori | 31.00 | 0.0755 | 19.7 | 3.76 | 5.40 | |
| 757 | S | 3H | NYCT | Guap frag | 14.50 | 0.0165 | 13.6 | 2.31 | 3.75 | |
| 758 | S | 3H | LAUR | Ocot cori | 9.00 | 0.0064 | | 2.04 | 1.45 | |
| 759 | S | 3H | MIMO | Inga fagi | 21.40 | 0.0360 | 18.2 | 9.32 | 2.10 | |
| 760 | S | 3H | MIMO | Inga fagi | 16.70 | 0.0219 | | 6.81 | 4.50 | |
| 761 | S | 3H | NYCT | Guap frag | 8.10 | 0.0052 | 10.0 | 8.27 | 5.60 | |
| 762 | S | 3H | MIMO | Inga fagi | 13.50 | 0.0143 | 14.5 | 8.10 | 7.10 | |
| 763 | S | 3H | NYCT | Guap frag | 5.50 | 0.0024 | | 9.50 | 6.50 | |
| 2758 | S | 3H | MIMO | Inga fagi | 5.20 | 0.0021 | | 6.70 | 0.80 | SICK 1/87 |
| 764 | S | 3I | MIMO | Inga fagi | 6.60 | 0.0034 | | 0.45 | 8.65 | |
| 765 | M | 3I | CAES | Hyme cour | 34.50 | 0.0935 | 23.4 | 3.90 | 9.75 | |
| 766 | M | 3I | CAES | Hyme cour | 41.90 | 0.1379 | | 3.50 | 9.20 | |
| 767 | S | 3I | MIMO | Inga fagi | 9.00 | 0.0064 | | 6.14 | 8.25 | |
| 768 | S | 3I | MIMO | Inga fagi | 5.40 | 0.0023 | | 5.36 | 6.85 | |
| 769 | S | 3I | NYCT | Guap frag | 5.30 | 0.0022 | | 4.90 | 7.00 | |
| 770 | S | 3I | MYRT | Pime race | 6.10 | 0.0029 | | 5.31 | 6.40 | |
| 771 | S | 3I | MIMO | Inga fagi | 6.50 | 0.0033 | | 4.74 | 5.65 | |
| 772 | S | 3I | MIMO | Inga fagi | 7.80 | 0.0048 | 10.0 | 5.45 | 5.30 | |
| 773 | S | 3I | MIMO | Inga fagi | 6.30 | 0.0031 | | 4.01 | 4.60 | |
| 774 | S | 3I | NYCT | Guap frag | 5.70 | 0.0026 | | 2.09 | 4.05 | |
| 775 | S | 3I | MALP | Byrs cori | 23.20 | 0.0423 | 16.7 | 0.85 | 1.75 | |
| 776 | S | 3I | MIMO | Inga fagi | 5.50 | 0.0024 | | 1.00 | 1.35 | |

APPENDIX I. (Continued)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 777 | S | 3I | NYCT | Guap | frag | 9.30 | 0.0068 | | 2.80 | 1.40 |
| 778 | S | 3I | MALP | Byrs | cori | 22.10 | 0.0384 | 18.8 | 4.39 | 2.35 |
| 779 | S | 3I | MIMO | Inga | fagi | 6.20 | 0.0030 | | 7.74 | 1.60 |
| 780 | S | 3I | MYRT | Pime | race | 9.70 | 0.0074 | | 9.56 | 0.45 |
| 781 | S | 3I | MYRT | Pime | race | 14.90 | 0.0174 | 12.4 | 9.22 | 4.20 |
| 782 | S | 3I | MYRT | Pime | race | 7.80 | 0.0048 | | 8.78 | 9.20 |
| 783 | S | 3I | MALP | Byrs | cori | 32.20 | 0.0814 | | 9.75 | 9.00 |
| 2721 | S | 3I | MIMO | Inga | fagi | 5.10 | 0.0020 | | 8.29 | 4.60 |
| 784 | S | 3J | MYRT | Pime | race | 11.20 | 0.0099 | | 4.45 | 9.10 |
| 785 | S | 3J | MYRT | Pime | race | 5.90 | 0.0027 | 6.99 | 4.78 | 8.40 |
| 786 | S | 3J | MYRT | Pime | race | 5.00 | 0.0020 | | 4.42 | 7.00 |
| 787 | S | 3J | MYRT | Pime | race | 7.40 | 0.0043 | | 5.12 | 9.60 |
| 788 | S | 3J | MYRT | Pime | race | 6.60 | 0.0034 | | 4.65 | 6.55 |
| 789 | M | 3J | MYRT | Pime | race | 10.70 | 0.0090 | | 4.42 | 5.50 |
| 790 | M | 3J | MYRT | Pime | race | 11.60 | 0.0106 | 13.0 | 4.42 | 5.35 |
| 791 | M | 3J | MYRT | Pime | race | 5.80 | 0.0026 | | 5.39 | 4.15 |
| 792 | M | 3J | MYRT | Pime | race | 6.00 | 0.0028 | | 5.43 | 4.00 |
| 793 | M | 3J | MYRT | Pime | race | 5.20 | 0.0021 | | 5.41 | 3.90 |
| 794 | M | 3J | MYRT | Pime | race | 8.80 | 0.0061 | | 3.41 | 0.80 |
| 795 | M | 3J | MYRT | Pime | race | 14.30 | 0.0161 | | 3.60 | 0.65 |
| 796 | S | 3J | NYCT | Guap | frag | 16.10 | 0.0204 | | 6.15 | 2.40 |
| 797 | S | 3J | LAUR | Ocot | cori | 5.20 | 0.0021 | | 7.98 | 2.30 |
| 798 | S | 3J | MIMO | Inga | fagi | 5.20 | 0.0021 | | 8.01 | 2.45 |
| 799 | S | 3J | MIMO | Acac | muri | 9.90 | 0.0077 | | 9.51 | 4.60 |
| 800 | S | 3J | CAPP | Capp | ampl | 7.30 | 0.0042 | 7.59 | 5.40 | 8.07 |
| 801 | S | 3J | MIMO | Acac | muri | 13.50 | 0.0143 | 15.5 | 6.82 | 7.40 |
| 802 | M | 3J | MYRT | Pime | race | 4.80 | 0.0018 | | 7.97 | 7.70 |
| 803 | M | 3J | MYRT | Pime | race | 8.30 | 0.0054 | | 7.31 | 7.90 |
| 804 | S | 3J | MYRT | Pime | race | 7.00 | 0.0038 | | 6.85 | 8.60 |
| 805 | S | 3J | MYRT | Pime | race | 11.30 | 0.0100 | | 8.80 | 8.45 |
| 806 | S | 3J | MIMO | Acac | muri | 13.90 | 0.0152 | 14.5 | 8.87 | 7.25 |
| 807 | S | 3J | MIMO | Acac | muri | 15.00 | 0.0177 | | 9.42 | 9.30 |
| 808 | S | 3J | MYRT | Pime | race | 14.10 | 0.0156 | 11.8 | 9.58 | 8.40 |
| 809 | S | 4J | MYRS | Ardi | obov | 6.20 | 0.0030 | | 6.49 | 0.14 |
| 810 | S | 4J | MIMO | Acac | muri | 15.30 | 0.0184 | | 5.92 | 0.27 |
| 811 | S | 4J | MYRT | Pime | race | 13.40 | 0.0141 | | 4.45 | 9.91 |
| 812 | S | 4J | MIMO | Inga | fagi | 11.20 | 0.0099 | | 8.02 | 5.05 |
| 813 | S | 4J | MALP | Byrs | cori | 21.80 | 0.0373 | | 9.20 | 6.20 |
| 814 | S | 4J | MYRT | Pime | race | 10.20 | 0.0082 | | 9.00 | 8.40 |
| 815 | S | 4J | MYRT | Pime | race | 13.30 | 0.0139 | | 9.80 | 9.60 |
| 816 | S | 4J | MYRT | Pime | race | 6.70 | 0.0035 | 9.11 | 7.64 | 5.15 |
| 817 | S | 4J | MYRT | Pime | race | 17.10 | 0.0230 | 14.2 | 6.38 | 6.65 |
| 818 | S | 4J | MYRT | Pime | race | 7.10 | 0.0040 | | 7.10 | 9.15 |
| 819 | S | 4J | MIMO | Inga | fagi | 28.30 | 0.0629 | 17.6 | 6.98 | 9.20 |
| 820 | M | 4J | MYRT | Pime | race | 9.80 | 0.0075 | | 5.49 | 9.55 |
| 821 | M | 4J | MYRT | Pime | race | 11.20 | 0.0099 | | 5.30 | 9.45 |
| 822 | S | 4J | STER | Guaz | ulmi | 17.10 | 0.0230 | 14.2 | 5.00 | 9.70 |
| 823 | S | 4J | MIMO | Acac | muri | 7.10 | 0.0040 | | 4.10 | 9.70 |
| 824 | S | 4J | NYCT | Guap | frag | 5.90 | 0.0027 | | 3.86 | 9.60 |
| 825 | S | 4J | MIMO | Acac | muri | 8.20 | 0.0053 | 13.3 | 3.86 | 9.40 |



186

APPENDIX I. (Continued)

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 826 | S | 4J | MIMO | Acac | muri | 21.50 | 0.0363 | | 3.50 | 9.60 | |
| 827 | S | 4J | MYRT | Pime | race | 10.50 | 0.0087 | 11.8 | 2.79 | 8.40 | |
| 828 | S | 4J | MIMO | Acac | muri | 6.20 | 0.0030 | | 4.82 | 4.45 | |
| 829 | S | 4J | MYRT | Pime | race | 16.20 | 0.0206 | 11.2 | 4.54 | 4.00 | |
| 830 | S | 4J | MIMO | Acac | muri | 17.60 | 0.0243 | | 2.81 | 5.25 | |
| 831 | S | 4J | MIMO | Acac | muri | 6.00 | 0.0028 | | 4.69 | 2.45 | |
| 832 | S | 4J | MYRT | Pime | race | 12.40 | 0.0121 | | 4.17 | 1.00 | |
| 833 | S | 4J | MYRT | Pime | race | 10.80 | 0.0092 | | 0.70 | 2.20 | |
| 834 | S | 4I | MIMO | Acac | muri | 36.80 | 0.1064 | | 9.56 | 0.91 | SICK 1/87 |
| 835 | S | 4I | MYRT | Pime | race | 9.30 | 0.0068 | | 9.20 | 0.20 | |
| 836 | S | 4I | MIMO | Acac | muri | 18.20 | 0.0260 | | 9.40 | 3.45 | |
| 837 | S | 4I | STER | Guaz | ulmi | 26.30 | 0.0543 | 15.8 | 9.31 | 3.75 | |
| 838 | S | 4I | BORA | Bour | succ | 7.80 | 0.0048 | 8.51 | 7.91 | 3.60 | |
| 839 | S | 4I | NYCT | Guap | frag | 6.80 | 0.0036 | | 9.40 | 7.35 | |
| 840 | S | 4I | MYRT | Euge | bifl | 6.80 | 0.0036 | 11.2 | 9.40 | 6.60 | |
| 841 | M | 4I | RUBI | Guet | scab | 6.20 | 0.0030 | 9.42 | 5.91 | 8.71 | |
| 842 | M | 4I | RUBI | Guet | scab | 5.00 | 0.0020 | | 5.65 | 8.70 | |
| 843 | S | 4I | MYRT | Pime | race | 5.80 | 0.0026 | | 5.80 | 9.75 | |
| 844 | S | 4I | RUTA | Zant | mart | 10.50 | 0.0087 | 13.3 | 5.30 | 9.50 | |
| 845 | S | 4I | MIMO | Acac | muri | 18.20 | 0.0260 | | 5.15 | 9.40 | |
| 846 | S | 4I | BORA | Cord | sulc | 8.90 | 0.0062 | 10.6 | 5.30 | 8.30 | |
| 847 | M | 4I | MYRT | Myrc | flor | 9.10 | 0.0065 | 7.59 | 6.47 | 5.80 | |
| 848 | M | 4I | MYRT | Myrc | flor | 5.40 | 0.0023 | | 6.39 | 5.80 | |
| 849 | S | 4I | BORA | Cord | sulc | 6.60 | 0.0034 | 10.3 | 6.55 | 5.85 | |
| 850 | S | 4I | LAUR | Cord | laev | 7.40 | 0.0043 | 10.6 | 1.66 | 9.80 | |
| 851 | S | 4I | MIMO | Inga | fagi | 6.90 | 0.0037 | | 1.26 | 9.75 | |
| 852 | S | 4I | CAES | Hyme | cour | 27.30 | 0.0585 | 20.9 | 0.70 | 7.20 | |
| 853 | S | 4I | BORA | Cord | alli | 7.30 | 0.0042 | 11.8 | 2.62 | 4.35 | |
| 854 | S | 4I | BORA | Bour | succ | 8.00 | 0.0050 | 9.72 | 0.60 | 4.65 | |
| 855 | S | 4I | MYRS | Ardi | obov | 7.10 | 0.0040 | | 1.10 | 3.10 | |
| 856 | S | 4H | MIMO | Inga | fagi | 20.60 | 0.0333 | | 9.16 | 1.60 | |
| 857 | S | 4H | MALP | Byrs | cori | 11.50 | 0.0104 | | 8.80 | 2.00 | |
| 858 | S | 4H | MIMO | Inga | fagi | 5.50 | 0.0024 | | 7.46 | 1.85 | |
| 859 | S | 4H | MYRS | Ardi | obov | 10.40 | 0.0085 | | 7.10 | 0.80 | |
| 860 | S | 4H | BORA | Cord | sulc | 15.50 | 0.0189 | | 7.58 | 5.50 | |
| 861 | S | 4H | MIMO | Inga | fagi | 6.60 | 0.0034 | | 7.93 | 6.40 | |
| 862 | S | 4H | RUTA | Zant | mart | 7.10 | 0.0040 | 11.5 | 9.40 | 7.90 | |
| 863 | S | 4H | MIMO | Inga | fagi | 6.60 | 0.0034 | | 8.10 | 7.80 | |
| 864 | S | 4H | MIMO | Inga | fagi | 28.20 | 0.0625 | 19.1 | 5.50 | 8.95 | SICK11/86 |
| 865 | S | 4H | NYCT | Guap | frag | 11.00 | 0.0095 | | 3.46 | 9.40 | |
| 866 | S | 4H | RUBI | Fara | occi | 6.20 | 0.0030 | 4.86 | 2.50 | 8.75 | |
| 867 | S | 4H | MALP | Byrs | cori | 20.00 | 0.0314 | | 0.35 | 7.80 | |
| 868 | S | 4H | MYRT | Pime | race | 5.80 | 0.0026 | | 0.05 | 7.70 | |
| 869 | S | 4H | MALP | Byrs | cori | 23.00 | 0.0415 | 20.6 | 3.21 | 5.10 | |
| 870 | M | 4H | LAUR | Ocot | cori | 10.20 | 0.0082 | 14.8 | 0.15 | 5.45 | |
| 871 | M | 4H | LAUR | Ocot | cori | 9.80 | 0.0075 | | 0.20 | 5.15 | |
| 872 | S | 4H | MIMO | Inga | fagi | 10.60 | 0.0088 | | 3.85 | 6.30 | |
| 873 | S | 4H | STER | Guaz | ulmi | 30.50 | 0.0731 | 20.0 | 3.60 | 1.05 | |
| 874 | S | 4G | MIMO | Inga | fagi | 8.50 | 0.0057 | | 7.85 | 3.45 | |
| 875 | S | 4G | MYRT | Pime | race | 9.20 | 0.0066 | | 8.50 | 6.80 | |



181

APPENDIX I. (Continued)

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 876 | S | 4G | MIMO | Inga | fagi | 23.60 | 0.0437 | | 8.20 | 7.10 | |
| 877 | S | 4G | SAPO | Pout | mult | 10.70 | 0.0090 | 15.8 | 7.12 | 6.90 | |
| 878 | S | 4G | BIGN | Tabe | hete | 15.70 | 0.0194 | | 6.38 | 7.40 | |
| 879 | S | 4G | RUBI | Guet | scab | 8.10 | 0.0052 | 10.3 | 8.58 | 9.45 | |
| 880 | S | 4G | CAPP | Capp | ampl | 7.30 | 0.0042 | 10.6 | 2.79 | 7.05 | |
| 881 | S | 4G | MYRT | Pime | race | 10.30 | 0.0083 | | 0.45 | 4.20 | |
| 882 | S | 4G | PALM | Cocc | alta | 9.20 | 0.0066 | 18.8 | 0.95 | 3.65 | |
| 883 | S | 4G | FLAC | Case | guia | 6.50 | 0.0033 | 11.5 | 4.03 | 5.30 | |
| 884 | S | 4G | MYRT | Pime | race | 15.80 | 0.0196 | | 4.50 | 2.45 | |
| 885 | S | 4G | LAUR | Lica | tria | 12.30 | 0.0119 | 16.1 | 3.39 | 0.75 | |
| 886 | S | 4F | MYRS | Ardi | obov | 5.10 | 0.0020 | | 7.35 | 1.00 | |
| 887 | S | 4F | MIMO | Inga | fagi | 13.60 | 0.0145 | | 8.75 | 4.90 | |
| 888 | S | 4F | MIMO | Inga | fagi | 42.20 | 0.1399 | 18.5 | 8.85 | 5.85 | |
| 889 | S | 4F | BORA | Cord | sulc | 10.10 | 0.0080 | 12.1 | 8.12 | 8.60 | |
| 890 | S | 4F | LAUR | Ocot | cori | 5.90 | 0.0027 | | 9.10 | 6.65 | |
| 891 | S | 4F | RUBI | Fara | occi | 7.00 | 0.0038 | | 0.90 | 5.30 | |
| 892 | S | 4F | NYCT | Guap | frag | 25.60 | 0.0515 | 19.4 | 0.75 | 8.25 | |
| 893 | S | 4F | MYRS | Ardi | obov | 6.30 | 0.0031 | | 4.48 | 2.30 | |
| 894 | S | 4F | MIMO | Inga | fagi | 18.10 | 0.0257 | | 3.61 | 1.40 | |
| 895 | S | 4F | MYRS | Ardi | obov | 8.00 | 0.0050 | | 1.26 | 2.25 | |
| 896 | S | 4E | MYRS | Ardi | obov | 4.60 | 0.0017 | | 8.46 | 0.97 | |
| 897 | S | 4E | MYRS | Ardi | obov | 7.80 | 0.0048 | | 6.35 | 1.00 | |
| 898 | M | 4E | MYRS | Ardi | obov | 6.60 | 0.0034 | 6.07 | 5.75 | 2.70 | |
| 899 | M | 4E | MYRS | Ardi | obov | 5.90 | 0.0027 | | 5.50 | 2.65 | |
| 900 | S | 4E | MIMO | Inga | fagi | 20.30 | 0.0324 | | 4.65 | 2.50 | |
| 901 | S | 4E | MYRS | Ardi | obov | 9.80 | 0.0075 | | 6.03 | 4.50 | |
| 902 | S | 4E | RUBI | Fara | occi | 5.10 | 0.0020 | | 5.10 | 8.15 | |
| 903 | S | 4E | BIGN | Tabe | hete | 13.70 | 0.0147 | | 7.47 | 5.50 | |
| 904 | S | 4E | STER | Guaz | ulmi | 28.50 | 0.0638 | 15.5 | 7.20 | 5.60 | |
| 905 | S | 4E | MYRS | Ardi | obov | 8.90 | 0.0062 | | 6.85 | 5.90 | |
| 906 | S | 4E | RUBI | Fara | occi | 5.10 | 0.0020 | | 8.90 | 8.05 | |
| 907 | S | 4E | RUBI | Fara | occi | 6.00 | 0.0028 | | 4.85 | 8.25 | |
| 908 | S | 4E | MYRS | Ardi | obov | 6.10 | 0.0029 | | 4.96 | 7.75 | |
| 909 | M | 4E | NYCT | Guap | frag | 18.50 | 0.0269 | | 2.41 | 6.05 | |
| 910 | M | 4E | NYCT | Guap | frag | 17.00 | 0.0227 | | 2.41 | 6.25 | |
| 911 | S | 4E | PALM | Cocc | alta | 9.60 | 0.0072 | 13.3 | 2.25 | 7.00 | |
| 912 | S | 4E | LAUR | Ocot | cori | 8.50 | 0.0057 | 9.72 | 2.25 | 7.50 | |
| 913 | S | 4E | MYRT | Myrc | citr | 14.50 | 0.0165 | 11.5 | 0.65 | 8.00 | |
| 914 | S | 4E | CAPP | Capp | ampl | 21.10 | 0.0350 | 14.8 | 1.39 | 6.15 | |
| 915 | S | 4E | MYRS | Ardi | obov | 9.50 | 0.0071 | | 2.89 | 4.40 | |
| 916 | S | 4E | MYRS | Ardi | obov | 8.40 | 0.0055 | | 3.03 | 0.23 | |
| 917 | S | 4E | LAUR | Ocot | cori | 16.30 | 0.0209 | | 0.31 | 0.50 | |
| 918 | S | 4E | EUPH | Dryp | alba | 5.50 | 0.0024 | 7.29 | 1.25 | 4.25 | |
| 919 | S | 4E | MALP | Byrs | cori | 16.00 | 0.0201 | 13.6 | 0.08 | 2.00 | |
| 2722 | S | 4E | MYRS | Ardi | obov | 7.10 | 0.0040 | | 9.80 | 2.30 | WITHKOWM86 |
| 920 | S | 4D | LAUR | Ocot | cori | 6.60 | 0.0034 | | 0.05 | 0.30 | |
| 921 | S | 4D | LAUR | Ocot | cori | 8.30 | 0.0054 | | 6.79 | 0.18 | |
| 922 | S | 4D | MYRS | Ardi | obov | 5.80 | 0.0026 | | 7.07 | 2.05 | |
| 923 | M | 4D | LAUR | Lica | sali | 10.00 | 0.0079 | 11.8 | 7.68 | 3.60 | |
| 924 | M | 4D | LAUR | Lica | sali | 8.70 | 0.0059 | | 6.97 | 3.75 | |

APPENDIX I. (Continued)

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 925 | M | 4D | NYCT | Guap | frag | 23.00 | 0.0415 | | 9.71 | 3.75 | |
| 926 | M | 4D | NYCT | Guap | frag | 6.50 | 0.0033 | | 9.31 | 5.80 | |
| 927 | S | 4D | LAUR | Ocot | cori | 14.60 | 0.0167 | 13.3 | 8.48 | 4.35 | |
| 928 | S | 4D | MYRS | Ardi | obov | 6.50 | 0.0033 | | 9.25 | 8.10 | |
| 929 | S | 4D | NYCT | Guap | frag | 20.60 | 0.0333 | | 6.07 | 8.00 | |
| 930 | S | 4D | MYRS | Ardi | obov | 6.20 | 0.0030 | | 2.53 | 9.45 | |
| 931 | S | 4D | MYRT | Myrc | citr | 5.30 | 0.0022 | 7.59 | 1.31 | 8.40 | |
| 932 | S | 4D | MYRS | Ardi | obov | 5.90 | 0.0027 | | 1.16 | 8.15 | |
| 933 | S | 4D | LAUR | Ocot | cori | 11.80 | 0.0109 | | 0.86 | 8.25 | |
| 934 | S | 4D | NYCT | Guap | frag | 16.10 | 0.0204 | | 0.15 | 6.55 | |
| 935 | S | 4D | NYCT | Guap | frag | 7.10 | 0.0040 | | 0.83 | 7.20 | |
| 936 | S | 4D | OLEA | Lino | cari | 10.60 | 0.0088 | 9.42 | 2.81 | 6.90 | |
| 937 | S | 4D | BIGN | Tabe | hete | 12.20 | 0.0117 | | 2.81 | 7.00 | |
| 938 | S | 4D | NYCT | Guap | frag | 6.60 | 0.0034 | | 1.55 | 6.80 | |
| 939 | S | 4D | MYRS | Ardi | obov | 5.90 | 0.0027 | 5.16 | 1.41 | 5.85 | |
| 940 | S | 4D | NYCT | Guap | frag | 13.20 | 0.0137 | | 2.01 | 5.00 | |
| 941 | S | 4D | MYRS | Ardi | obov | 7.20 | 0.0041 | | 2.44 | 4.35 | |
| 942 | M | 4D | LAUR | Ocot | cori | 7.90 | 0.0049 | | 4.04 | 5.95 | |
| 943 | M | 4D | LAUR | Ocot | cori | 8.50 | 0.0057 | | 5.01 | 6.10 | |
| 944 | S | 4D | NYCT | Guap | frag | 9.50 | 0.0071 | | 1.52 | 2.90 | |
| 945 | M | 4D | NYCT | Guap | frag | 7.70 | 0.0047 | 9.72 | 1.68 | 0.46 | |
| 946 | M | 4D | NYCT | Guap | frag | 6.70 | 0.0035 | | 1.57 | 0.52 | |
| 947 | S | 4D | NYCT | Guap | frag | 7.50 | 0.0044 | | 0.45 | 2.65 | |
| 2724 | S | 4D | NYCT | Guap | frag | 6.40 | 0.0032 | | 8.05 | 0.45 | |
| 948 | S | 4C | MIMO | Acac | muri | 15.90 | 0.0199 | | 8.31 | 1.00 | |
| 949 | S | 4C | MYRS | Ardi | obov | 6.40 | 0.0032 | | 8.31 | 2.14 | |
| 950 | S | 4C | NYCT | Guap | frag | 11.70 | 0.0108 | 9.42 | 3.10 | 9.64 | |
| 951 | S | 4C | NYCT | Guap | frag | 5.70 | 0.0026 | | 9.12 | 4.15 | |
| 952 | S | 4C | NYCT | Guap | frag | 8.70 | 0.0059 | | 9.37 | 4.68 | |
| 953 | S | 4C | MYRS | Ardi | obov | 6.00 | 0.0028 | | 9.50 | 5.83 | |
| 954 | S | 4C | MYRT | Pime | race | 6.30 | 0.0031 | | 7.82 | 3.11 | |
| 955 | S | 4C | MIMO | Acac | muri | 14.30 | 0.0161 | 17.3 | 6.57 | 4.20 | |
| 956 | S | 4C | LAUR | Ocot | cori | 10.20 | 0.0082 | | 7.06 | 6.05 | |
| 957 | S | 4C | ARAL | Didy | moro | 24.30 | 0.0464 | 13.9 | 9.75 | 6.85 | |
| 958 | S | 4C | NYCT | Guap | frag | 15.60 | 0.0191 | | 9.80 | 9.24 | |
| 959 | S | 4C | EUPH | Dryp | alba | 6.00 | 0.0028 | 4.86 | 9.90 | 9.90 | |
| 960 | S | 4C | MIMO | Acac | muri | 17.70 | 0.0246 | | 6.60 | 9.20 | |
| 961 | S | 4C | NYCT | Guap | frag | 12.80 | 0.0129 | | 4.24 | 6.60 | |
| 962 | S | 4C | MIMO | Acac | muri | 19.80 | 0.0308 | 11.2 | 5.34 | 4.78 | |
| 963 | S | 4C | MYRS | Ardi | obov | 5.40 | 0.0023 | | 4.92 | 4.98 | |
| 964 | S | 4C | MYRS | Ardi | obov | 5.40 | 0.0023 | | 4.21 | 5.73 | |
| 965 | M | 4C | MYRS | Ardi | obov | 6.10 | 0.0029 | 7.29 | 3.67 | 5.30 | |
| 966 | S | 4C | MYRS | Ardi | obov | 5.40 | 0.0023 | | 4.47 | 4.50 | |
| 967 | S | 4C | MIMO | Acac | muri | 25.20 | 0.0499 | 17.3 | 2.75 | 5.10 | |
| 968 | S | 4C | NYCT | Guap | frag | 6.00 | 0.0028 | | 4.66 | 0.30 | |
| 969 | S | 4C | BIGN | Tabe | hete | 27.80 | 0.0607 | 20.0 | 2.85 | 2.65 | |
| 970 | S | 4C | NYCT | Guap | frag | 8.50 | 0.0057 | | 2.75 | 2.00 | SICK 3/86 |
| 971 | S | 4C | MYRS | Ardi | obov | 7.30 | 0.0042 | | 1.50 | 2.00 | |
| 972 | S | 4C | MIMO | Acac | muri | 19.80 | 0.0308 | 20.6 | 1.27 | 1.87 | |
| 973 | S | 4C | MYRS | Ardi | obov | 7.40 | 0.0043 | | 1.10 | 4.24 | |

APPENDIX I. (Continued)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 974 | S | 4C | NYCT | Guap frag | 7.30 | 0.0042 | | 0.50 | 3.95 |
| 983 | S | 4C | OLEA | Lino cari | 5.20 | 0.0021 | | 2.88 | 3.80 |
| 2725 | M | 4C | MYRS | Ardi obov | 6.30 | 0.0031 | | 3.51 | 5.43 |
| 2726 | S | 4C | RUBI | Fara occi | 5.10 | 0.0020 | | 6.94 | 4.30 |
| 975 | S | 4B | MIMO | Acac muri | 16.50 | 0.0214 | | 7.20 | 3.60 |
| 976 | S | 4B | MYRT | Pime race | 9.00 | 0.0064 | 10.6 | 7.30 | 3.65 |
| 977 | S | 4B | MYRS | Ardi obov | 7.10 | 0.0040 | | 9.60 | 5.20 |
| 978 | S | 4B | RUBI | Fara occi | 5.50 | 0.0024 | | 7.85 | 5.65 |
| 979 | S | 4B | CAPP | Mori amer | 5.40 | 0.0023 | 5.77 | 4.20 | 7.90 |
| 980 | S | 4B | MIMO | Acac muri | 19.60 | 0.0302 | | 3.28 | 9.70 |
| 981 | S | 4B | RUBI | Fara occi | 5.70 | 0.0026 | 4.86 | 3.10 | 6.95 |
| 982 | S | 4B | BIGN | Tabe hete | 13.90 | 0.0152 | | 3.35 | 6.45 |
| 984 | S | 4B | BIGN | Tabe hete | 21.70 | 0.0370 | | 3.45 | 3.30 |
| 985 | S | 4B | MYRT | Pime race | 5.70 | 0.0026 | | 3.55 | 0.16 |
| 986 | S | 4B | NYCT | Guap frag | 11.40 | 0.0102 | | 0.05 | 1.51 |
| 2727 | S | 4B | RUBI | Fara occi | 5.10 | 0.0020 | | 2.90 | 3.00 |
| 987 | S | 4A | NYCT | Guap frag | 6.20 | 0.0030 | | 7.90 | 2.25 |
| 988 | S | 4A | MIMO | Acac muri | 17.80 | 0.0249 | 17.0 | 5.76 | 1.90 |
| 989 | S | 4A | NYCT | Guap frag | 6.00 | 0.0028 | | 4.50 | 1.10 |
| 990 | S | 4A | RUBI | Fara occi | 5.30 | 0.0022 | 6.68 | 7.10 | 3.10 |
| 991 | S | 4A | OLEA | Lino cari | 7.80 | 0.0048 | 7.59 | 8.20 | 2.80 |
| 992 | S | 4A | MIMO | Acac muri | 23.00 | 0.0415 | | 8.30 | 3.65 |
| 993 | S | 4A | NYCT | Guap frag | 5.40 | 0.0023 | | 7.50 | 5.45 |
| 994 | S | 4A | MYRT | Pime race | 6.70 | 0.0035 | | 8.10 | 6.10 |
| 995 | S | 4A | MIMO | Acac muri | 22.00 | 0.0380 | 17.6 | 8.50 | 7.00 |
| 996 | S | 4A | MIMO | Acac muri | 18.30 | 0.0263 | | 6.25 | 5.75 |
| 997 | S | 4A | MIMO | Acac muri | 8.10 | 0.0052 | | 6.10 | 5.65 |
| 998 | S | 4A | MYRT | Myrc citr | 6.80 | 0.0036 | 8.81 | 4.80 | 7.10 |
| 999 | S | 4A | MIMO | Acac muri | 14.80 | 0.0172 | | 4.40 | 9.10 |
| 1000 | M | 4A | CAPP | Mori amer | 10.60 | 0.0088 | 8.51 | 3.60 | 9.95 |
| 1401 | S | 4A | MIMO | Acac muri | 11.20 | 0.0099 | | 0.70 | 9.80 |
| 1402 | S | 4A | MIMO | Acac muri | 14.80 | 0.0172 | | 1.85 | 8.45 |
| 1403 | S | 4A | MIMO | Acac muri | 10.30 | 0.0083 | | 0.60 | 7.10 |
| 1404 | S | 4A | MYRT | Myrc citr | 5.30 | 0.0022 | 7.59 | 0.72 | 6.80 |
| 1405 | S | 4A | NYCT | Guap frag | 5.20 | 0.0021 | | 0.06 | 6.12 |
| 1406 | S | 4A | MIMO | Acac muri | 12.40 | 0.0121 | | 0.15 | 5.60 |
| 1407 | S | 4A | MIMO | Acac muri | 12.30 | 0.0119 | | 1.25 | 4.90 |
| 1408 | S | 4A | NYCT | Guap frag | 8.60 | 0.0058 | 12.1 | 1.30 | 4.25 |
| 1409 | S | 4A | MIMO | Acac muri | 12.00 | 0.0113 | | 1.10 | 4.15 |
| 1410 | S | 4A | MIMO | Acac muri | 10.70 | 0.0090 | | 0.30 | 3.45 |
| 1411 | S | 4A | MIMO | Acac muri | 13.90 | 0.0152 | | 2.27 | 3.90 |
| 1412 | S | 4A | NYCT | Guap frag | 13.00 | 0.0133 | | 2.75 | 7.25 |
| 1413 | S | 4A | OLEA | Lino cari | 7.60 | 0.0045 | 10.9 | 3.75 | 4.10 |
| 1414 | S | 4A | NYCT | Guap frag | 7.40 | 0.0043 | | 5.65 | 4.80 |
| 1415 | S | 4A | CAPP | Mori amer | 8.80 | 0.0061 | 9.42 | 0.41 | 1.40 |
| 1416 | S | 4A | MIMO | Acac muri | 13.80 | 0.0150 | | 1.27 | 0.65 |
| 2728 | S | 4A | NYCT | Guap frag | 5.00 | 0.0020 | | 1.72 | 3.15 |
| 2729 | S | 4A | LAUR | Lica sali | 5.10 | 0.0020 | | 5.05 | 1.70 |
| 1419 | M | 5A | CAPP | Mori amer | 8.80 | 0.0061 | 8.51 | 3.57 | 0.25 |
| 1420 | S | 5A | CAPP | Capp cyno | 5.80 | 0.0026 | 5.77 | 0.80 | 1.15 |



190

APPENDIX I. (Continued)

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1421 | S | 5A | MIMO | Acac | muri | 12.50 | 0.0123 | | 0.50 | 2.80 | |
| 1422 | S | 5A | MIMO | Acac | muri | 10.20 | 0.0082 | | 1.00 | 4.25 | |
| 1423 | S | 5A | MIMO | Acac | muri | 13.00 | 0.0133 | | 2.05 | 2.65 | |
| 1424 | S | 5A | MIMO | Acac | muri | 13.40 | 0.0141 | 18.8 | 1.80 | 4.60 | |
| 1425 | S | 5A | MYRT | Pime | race | 5.50 | 0.0024 | 8.81 | 0.40 | 5.60 | |
| 1426 | S | 5A | MIMO | Acac | muri | 16.10 | 0.0204 | | 0.70 | 5.80 | |
| 1427 | S | 5A | MIMO | Acac | muri | 9.40 | 0.0069 | | 1.80 | 5.70 | |
| 1428 | S | 5A | MIMO | Acac | muri | 19.80 | 0.0308 | | 1.90 | 8.40 | |
| 1429 | S | 5A | MIMO | Acac | muri | 13.20 | 0.0137 | | 3.85 | 7.45 | |
| 1430 | S | 5A | NYCT | Guap | frag | 8.00 | 0.0050 | | 4.35 | 8.80 | |
| 1431 | S | 5A | MYRT | Myrc | citr | 6.30 | 0.0031 | 6.99 | 3.90 | 9.00 | |
| 1432 | S | 5A | MYRT | Pime | race | 9.00 | 0.0064 | | 4.60 | 9.00 | |
| 1433 | S | 5A | NYCT | Guap | frag | 5.30 | 0.0022 | 6.38 | 5.85 | 8.50 | |
| 1434 | S | 5A | MIMO | Acac | muri | 11.00 | 0.0095 | | 6.00 | 7.50 | |
| 1435 | S | 5A | MYRS | Ardi | obov | 7.40 | 0.0043 | 8.81 | 7.70 | 8.15 | |
| 1436 | S | 5A | BIGN | Tabe | hete | 33.00 | 0.0855 | 18.2 | 8.90 | 8.05 | w/Clusia |
| 1437 | S | 5A | MYRS | Ardi | obov | 5.30 | 0.0022 | | 8.90 | 6.60 | |
| 1438 | S | 5A | MYRT | Pime | race | 6.90 | 0.0037 | | 8.50 | 5.15 | |
| 1439 | S | 5A | MYRT | Pime | race | 5.50 | 0.0024 | | 6.70 | 5.90 | |
| 1440 | S | 5A | MIMO | Acac | muri | 10.70 | 0.0090 | | 4.25 | 3.95 | |
| 1441 | S | 5A | MIMO | Acac | muri | 15.70 | 0.0194 | 17.0 | 4.15 | 1.75 | |
| 1442 | S | 5A | MIMO | Acac | muri | 11.60 | 0.0106 | | 5.10 | 1.20 | |
| 1443 | S | 5A | CAPP | Mori | amer | 10.00 | 0.0079 | 8.20 | 4.85 | 2.75 | |
| 1444 | S | 5A | MYRT | Pime | race | 5.10 | 0.0020 | | 6.10 | 1.80 | |
| 1445 | S | 5A | MIMO | Acac | muri | 21.40 | 0.0360 | | 8.50 | 0.30 | |
| 1446 | M | 5A | MIMO | Acac | muri | 15.30 | 0.0184 | | 7.50 | 2.00 | SICK 3/86 |
| 1447 | S | 5A | MIMO | Acac | muri | 18.70 | 0.0275 | | 8.05 | 3.10 | |
| 1448 | S | 5A | MIMO | Acac | muri | 11.90 | 0.0111 | | 8.85 | 3.95 | |
| 1417 | S | 5A | RUBI | Guet | scab | 5.80 | 0.0026 | 7.29 | 0.39 | 0.10 | |
| 1418 | S | 5A | MIMO | Acac | muri | 15.60 | 0.0191 | | 3.40 | 0.80 | |
| 2730 | S | 5A | NYCT | Guap | frag | 5.30 | 0.0022 | | 7.20 | 6.70 | |
| 2731 | M | 5A | MIMO | Acac | muri | 10.10 | 0.0080 | | 8.00 | 1.90 | |
| 1449 | S | 5B | MIMO | Acac | muri | 11.70 | 0.0108 | | 0.95 | 1.25 | |
| 1450 | S | 5B | MIMO | Acac | muri | 13.20 | 0.0137 | | 1.25 | 1.00 | |
| 1451 | S | 5B | MIMO | Acac | muri | 18.10 | 0.0257 | | 1.70 | 0.80 | |
| 1452 | S | 5B | LAUR | Ocot | cori | 12.40 | 0.0121 | 12.1 | 2.40 | 1.00 | |
| 1453 | S | 5B | MYRT | Pime | race | 9.40 | 0.0069 | 13.0 | 3.40 | 0.40 | |
| 1454 | S | 5B | MIMO | Acac | muri | 19.60 | 0.0302 | | 2.80 | 3.00 | |
| 1455 | S | 5B | MYRT | Myrc | citr | 7.70 | 0.0047 | 10.0 | 1.85 | 4.70 | |
| 1456 | S | 5B | NYCT | Guap | frag | 15.80 | 0.0196 | | 2.10 | 4.85 | |
| 1457 | S | 5B | MYRT | Pime | race | 9.90 | 0.0077 | 9.42 | 2.75 | 6.75 | |
| 1458 | S | 5B | MIMO | Acac | muri | 20.00 | 0.0314 | | 1.95 | 8.30 | |
| 1459 | S | 5B | NYCT | Guap | frag | 11.40 | 0.0102 | | 5.28 | 9.75 | |
| 1460 | S | 5B | MIMO | Acac | muri | 23.50 | 0.0434 | | 5.85 | 7.90 | |
| 1461 | S | 5B | OLEA | Lino | cari | 8.20 | 0.0053 | 11.2 | 9.60 | 7.60 | |
| 1462 | S | 5B | NYCT | Guap | frag | 7.60 | 0.0045 | | 9.50 | 9.30 | |
| 1463 | S | 5B | MIMO | Inga | fagi | 7.30 | 0.0042 | 10.3 | 8.80 | 5.80 | |
| 1464 | S | 5B | NYCT | Guap | frag | 7.50 | 0.0044 | | 9.30 | 3.95 | |
| 1465 | S | 5C | MYRT | Myrc | citr | 10.30 | 0.0083 | 8.51 | 1.39 | 2.30 | |
| 1466 | M | 5C | MALP | Byrs | cori | 49.90 | 0.1956 | 18.2 | 3.22 | 2.20 | |

APPENDIX I. (Continued)

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1468 | S | 5C | NYCT | Guap | frag | 5.50 | 0.0024 | | 3.90 | 1.00 | |
| 1469 | S | 5C | NYCT | Guap | frag | 12.30 | 0.0119 | | 4.35 | 1.25 | |
| 1470 | S | 5C | MIMO | Inga | fagi | 16.30 | 0.0209 | 10.6 | 4.20 | 1.85 | |
| 1471 | S | 5C | NYCT | Guap | frag | 5.90 | 0.0027 | | 5.90 | 2.90 | |
| 1472 | S | 5C | FABA | Sabi | flor | 7.90 | 0.0049 | 12.1 | 3.60 | 5.00 | |
| 1473 | S | 5C | NYCT | Guap | frag | 9.90 | 0.0077 | | 1.30 | 3.45 | |
| 1474 | S | 5C | NYCT | Guap | frag | 7.10 | 0.0040 | | 2.90 | 6.15 | |
| 1475 | S | 5C | RUBI | Fara | occi | 5.10 | 0.0020 | | 2.00 | 8.20 | |
| 1476 | S | 5C | OLEA | Lino | cari | 7.90 | 0.0049 | 10.0 | 2.10 | 8.10 | |
| 1477 | S | 5C | LAUR | Ocot | cori | 7.70 | 0.0047 | | 5.82 | 8.60 | |
| 1478 | S | 5C | RUBI | Fara | occi | 6.80 | 0.0036 | 5.47 | 2.45 | 7.35 | |
| 1479 | M | 5C | CAPP | Mori | amer | 6.80 | 0.0036 | 7.90 | 4.15 | 7.50 | |
| 1480 | M | 5C | CAPP | Mori | amer | 8.80 | 0.0061 | | 3.75 | 7.55 | |
| 1481 | S | 5C | SAPO | Chry | pauc | 14.90 | 0.0174 | 13.6 | 9.70 | 9.70 | |
| 1482 | S | 5C | MYRS | Ardi | obov | 9.40 | 0.0069 | | 8.65 | 8.00 | |
| 1483 | S | 5C | LAUR | Ocot | cori | 8.60 | 0.0058 | | 6.45 | 5.60 | SICK 3/86 |
| 1484 | S | 5C | NYCT | Guap | frag | 10.70 | 0.0090 | | 7.35 | 4.85 | |
| 1485 | S | 5C | CELA | Mayt | elli | 12.00 | 0.0113 | 12.4 | 8.20 | 4.70 | |
| 1486 | S | 5C | CAPP | Capp | cyno | 6.40 | 0.0032 | 8.20 | 9.65 | 5.85 | |
| 1487 | S | 5C | PALM | Cocc | alta | 8.00 | 0.0050 | 3.64 | 9.60 | 6.00 | |
| 1488 | M | 5C | BIGN | Tabe | hete | 13.00 | 0.0133 | 13.6 | 9.90 | 5.60 | |
| 1489 | M | 5C | BIGN | Tabe | hete | 15.10 | 0.0179 | | 9.80 | 5.60 | |
| 1490 | S | 5C | OLEA | Lino | cari | 7.80 | 0.0048 | 10.6 | 9.95 | 2.20 | |
| 1491 | S | 5C | RUBI | Fara | occi | 5.20 | 0.0021 | | 7.50 | 1.15 | |
| 2732 | S | 5C | RUBI | Fara | occi | 5.10 | 0.0020 | | 4.20 | 1.25 | |
| 2733 | S | 5C | MYRS | Ardi | obov | 5.10 | 0.0020 | | 4.10 | 4.80 | |
| 1492 | S | 5D | RUBI | Fara | occi | 5.40 | 0.0023 | | 0.30 | 0.15 | |
| 1493 | S | 5D | FLAC | Case | sylv | 6.80 | 0.0036 | 8.51 | 1.92 | 1.55 | |
| 1494 | S | 5D | NYCT | Guap | frag | 21.80 | 0.0373 | | 2.67 | 0.90 | |
| 1495 | S | 5D | CAPP | Capp | cyno | 10.90 | 0.0093 | 8.51 | 4.10 | 0.19 | |
| 1496 | S | 5D | MYRS | Ardi | obov | 7.40 | 0.0043 | | 4.38 | 1.60 | |
| 1497 | S | 5D | MIMO | Inga | fagi | 10.50 | 0.0087 | | 5.21 | 3.30 | |
| 1498 | S | 5D | MYRT | Myrc | citr | 9.50 | 0.0071 | 12.7 | 4.95 | 3.60 | |
| 1499 | S | 5D | OLEA | Lino | cari | 6.10 | 0.0029 | 8.20 | 4.75 | 3.65 | |
| 1500 | M | 5D | MALP | Byrs | cori | 19.00 | 0.0284 | | 3.92 | 3.40 | |
| 1501 | M | 5D | MALP | Byrs | cori | 21.40 | 0.0360 | | 4.06 | 3.50 | |
| 1502 | S | 5D | NYCT | Guap | frag | 16.90 | 0.0224 | | 3.19 | 4.10 | |
| 1503 | S | 5D | CAPP | Capp | cyno | 12.00 | 0.0113 | 10.0 | 1.08 | 4.85 | |
| 1504 | S | 5D | NYCT | Guap | frag | 7.70 | 0.0047 | | 2.21 | 7.20 | |
| 1505 | S | 5D | MIMO | Inga | fagi | 13.90 | 0.0152 | | 3.71 | 6.40 | |
| 1506 | S | 5D | MIMO | Inga | fagi | 17.30 | 0.0235 | | 5.01 | 5.85 | |
| 1507 | S | 5D | MYRT | Pime | race | 8.40 | 0.0055 | | 4.87 | 7.40 | |
| 1508 | S | 5D | NYCT | Guap | frag | 6.30 | 0.0031 | | 3.99 | 9.50 | |
| 1509 | M | 5D | LAUR | Ocot | cori | 6.30 | 0.0031 | 10.3 | 4.15 | 7.90 | |
| 1510 | M | 5D | LAUR | Ocot | cori | 6.30 | 0.0031 | | 4.21 | 7.95 | |
| 1511 | S | 5D | OLEA | Lino | cari | 5.70 | 0.0026 | 6.68 | 6.23 | 6.75 | |
| 1512 | M | 5D | LAUR | Ocot | cori | 5.10 | 0.0020 | | 8.61 | 9.10 | |
| 1513 | M | 5D | LAUR | Ocot | cori | 9.00 | 0.0064 | | 8.42 | 9.20 | |
| 1514 | M | 5D | LAUR | Ocot | cori | 8.20 | 0.0053 | | 8.85 | 9.40 | |
| 1515 | S | 5D | NYCT | Guap | frag | 5.30 | 0.0022 | | 8.51 | 6.35 | |



- 192

APPENDIX I. (Continued)

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1516 | S | 5D | MALP | Byrs | cori | 18.00 | 0.0254 | 13.9 | 9.69 | 4.10 | |
| 1517 | S | 5D | NYCT | Guap | frag | 6.60 | 0.0034 | | 8.10 | 3.20 | |
| 1518 | S | 5D | SAPO | Chry | pauc | 11.20 | 0.0099 | 14.2 | 7.79 | 2.50 | |
| 1519 | S | 5D | NYCT | Guap | frag | 25.70 | 0.0519 | | 7.50 | 3.20 | |
| 1520 | S | 5D | RUBI | Guet | scab | 5.90 | 0.0027 | 8.81 | 7.50 | 2.30 | |
| 1521 | S | 5D | LAUR | Ocot | cori | 11.50 | 0.0104 | | 8.70 | 1.40 | |
| 1661 | M | 5D | MYRS | Ardi | obov | 6.50 | 0.0033 | | 6.34 | 4.70 | |
| 1662 | M | 5D | MYRS | Ardi | obov | 5.30 | 0.0022 | | 5.70 | 4.65 | |
| 1522 | S | 5E | MYRT | Pime | race | 8.10 | 0.0052 | | 0.25 | 1.50 | |
| 1523 | S | 5E | MYRT | Pime | race | 5.50 | 0.0024 | | 2.08 | 0.75 | |
| 1524 | S | 5E | OLEA | Lino | cari | 6.80 | 0.0036 | | 1.49 | 2.50 | |
| 1525 | S | 5E | MIMO | Inga | fagi | 14.10 | 0.0156 | | 1.01 | 4.40 | |
| 1526 | S | 5E | NYCT | Guap | frag | 9.10 | 0.0065 | | 0.99 | 4.95 | |
| 1527 | S | 5E | RUBI | Fara | occi | 5.50 | 0.0024 | | 2.20 | 4.45 | |
| 1528 | S | 5E | NYCT | Guap | frag | 16.60 | 0.0216 | 15.1 | 2.95 | 3.55 | |
| 1529 | M | 5E | MYRS | Ardi | obov | 8.90 | 0.0062 | | 2.64 | 5.25 | |
| 1530 | M | 5E | MYRS | Ardi | obov | 6.30 | 0.0031 | | 2.09 | 5.80 | |
| 1531 | S | 5E | MYRS | Ardi | obov | 10.50 | 0.0087 | | 1.71 | 5.85 | |
| 1532 | S | 5E | OLEA | Lino | cari | 7.40 | 0.0043 | 9.11 | 1.27 | 6.55 | |
| 1533 | S | 5E | NYCT | Guap | frag | 5.70 | 0.0026 | | 0.79 | 7.80 | |
| 1534 | S | 5E | MALP | Byrs | cori | 28.80 | 0.0651 | 16.1 | 5.37 | 8.45 | |
| 1535 | M | 5E | NYCT | Guap | frag | 12.50 | 0.0123 | | 6.45 | 9.00 | |
| 1536 | M | 5E | NYCT | Guap | frag | 5.20 | 0.0021 | | 6.65 | 9.00 | |
| 1537 | M | 5E | BORA | Bour | succ | 6.50 | 0.0033 | 3.95 | 6.52 | 8.80 | |
| 1538 | M | 5E | BORA | Bour | succ | 5.30 | 0.0022 | | 6.62 | 8.70 | |
| 1539 | M | 5E | LAUR | Ocot | sint | 9.00 | 0.0064 | 10.3 | 7.52 | 8.80 | |
| 2734 | M | 5E | LAUR | Ocot | sint | 5.50 | 0.0024 | | 8.04 | 9.00 | |
| 1540 | S | 5E | MYRT | Myrc | citr | 7.00 | 0.0038 | 9.11 | 7.82 | 8.80 | |
| 1541 | S | 5E | LAUR | Ocot | sint | 13.00 | 0.0133 | 10.9 | 9.80 | 9.30 | |
| 1542 | S | 5E | MYRS | Ardi | obov | 6.40 | 0.0032 | | 7.05 | 6.25 | |
| 1543 | S | 5E | OLEA | Lino | cari | 6.20 | 0.0030 | | 3.57 | 5.20 | |
| 1544 | S | 5E | BIGN | Tabe | hete | 11.50 | 0.0104 | 11.5 | 5.10 | 4.20 | |
| 1545 | M | 5E | BORA | Bour | succ | 26.50 | 0.0552 | 13.9 | 5.64 | 4.22 | SICK 1/87 |
| 1546 | M | 5E | BORA | Bour | succ | 5.30 | 0.0022 | | 5.49 | 4.05 | |
| 1547 | S | 5E | OLEA | Lino | cari | 5.20 | 0.0021 | | 5.71 | 3.40 | |
| 1548 | S | 5E | OLEA | Lino | cari | 6.00 | 0.0028 | | 7.10 | 4.22 | |
| 1549 | S | 5E | NYCT | Guap | frag | 6.60 | 0.0034 | | 7.30 | 4.22 | |
| 1550 | S | 5E | MYRS | Ardi | obov | 5.90 | 0.0027 | 8.20 | 8.02 | 3.70 | |
| 1551 | S | 5E | RUBI | Guet | scab | 6.90 | 0.0037 | | 7.75 | 4.30 | DEAD 7/86 |
| 1552 | S | 5E | MYRS | Ardi | obov | 12.60 | 0.0125 | 10.3 | 6.60 | 0.96 | |
| 1553 | S | 5E | LAUR | Ocot | cori | 6.10 | 0.0029 | 9.11 | 6.44 | 0.80 | |
| 1554 | S | 5E | CAPP | Capp | cyno | 7.30 | 0.0042 | 7.59 | 6.20 | 0.50 | |
| 1555 | S | 5E | BIGN | Tabe | hete | 29.10 | 0.0665 | | 5.94 | 0.50 | |
| 1556 | S | 5E | MIMO | Inga | fagi | 17.70 | 0.0246 | | 5.80 | 1.35 | |
| 1663 | S | 5E | MYRS | Ardi | obov | 5.50 | 0.0024 | | 9.52 | 6.80 | |
| 1557 | S | 5F | BIGN | Tabe | hete | 13.90 | 0.0152 | 13.3 | 0.60 | 1.55 | |
| 1558 | S | 5F | MYRS | Ardi | obov | 6.50 | 0.0033 | | 0.15 | 2.10 | |
| 1559 | S | 5F | CAPP | Capp | cyno | 6.30 | 0.0031 | 7.59 | 0.97 | 4.05 | |
| 1560 | S | 5F | MALP | Byrs | cori | 19.20 | 0.0290 | | 2.31 | 3.95 | |
| 1561 | S | 5F | NYCT | Guap | frag | 25.80 | 0.0523 | | 3.59 | 5.75 | |



103

APPENDIX I. (Continued)

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1562 | S | 5F | NYCT | Guap | frag | 10.90 | 0.0093 | | 1.10 | 7.75 | |
| 1563 | S | 5F | LAUR | Ocot | sint | 6.90 | 0.0037 | 6.07 | 0.90 | 7.85 | |
| 1564 | S | 5F | NYCT | Guap | frag | 19.90 | 0.0311 | | 1.64 | 8.55 | |
| 1565 | S | 5F | MYRS | Ardi | obov | 7.60 | 0.0045 | | 6.78 | 6.40 | |
| 1566 | S | 5F | MYRS | Ardi | obov | 12.00 | 0.0113 | | 7.80 | 7.50 | |
| 1567 | S | 5F | MIMO | Inga | fagi | 8.90 | 0.0062 | | 9.10 | 9.00 | |
| 1568 | S | 5F | MYRT | Pime | race | 13.00 | 0.0133 | | 7.21 | 5.55 | |
| 1569 | S | 5F | NYCT | Guap | frag | 19.60 | 0.0302 | | 6.28 | 5.25 | |
| 1570 | S | 5F | LAUR | Ocot | cori | 10.30 | 0.0083 | 11.5 | 2.83 | 0.09 | |
| 1571 | S | 5F | BIGN | Tabe | hete | 13.10 | 0.0135 | 13.6 | 4.92 | 0.32 | |
| 1572 | S | 5F | LAUR | Lica | tria | 23.20 | 0.0423 | 17.0 | 9.58 | 2.15 | |
| 1664 | S | 5F | LAUR | Ocot | sint | 5.20 | 0.0021 | 7.29 | 9.00 | 0.28 | |
| 1573 | M | 5G | LAUR | Ocot | sint | 9.30 | 0.0068 | 11.8 | 0.30 | 0.70 | |
| 1574 | M | 5G | LAUR | Ocot | sint | 5.30 | 0.0022 | | 0.26 | 0.85 | |
| 1575 | M | 5G | LAUR | Ocot | sint | 5.30 | 0.0022 | | 0.54 | 0.75 | |
| 1576 | S | 5G | MYRS | Ardi | obov | 7.20 | 0.0041 | | 0.26 | 2.05 | |
| 1577 | S | 5G | MYRT | Euge | bifl | 8.00 | 0.0050 | 11.5 | 4.24 | 0.55 | |
| 1578 | S | 5G | MIMO | Inga | fagi | 26.50 | 0.0552 | | 1.98 | 5.70 | |
| 1579 | S | 5G | MIMO | Inga | fagi | 15.20 | 0.0181 | | 0.20 | 6.50 | |
| 1580 | S | 5G | NYCT | Guap | frag | 8.60 | 0.0058 | | 0.55 | 8.65 | |
| 1581 | S | 5G | SAPO | Pout | mult | 14.50 | 0.0165 | 16.7 | 3.39 | 8.10 | |
| 1582 | S | 5G | MYRS | Ardi | obov | 7.30 | 0.0042 | | 9.69 | 8.90 | |
| 1583 | S | 5G | MALP | Byrs | cori | 23.50 | 0.0434 | 21.8 | 9.39 | 7.70 | |
| 1584 | S | 5G | MIMO | Inga | fagi | 24.20 | 0.0460 | 20.9 | 9.63 | 7.95 | |
| 1585 | S | 5G | RUBI | Fara | occi | 7.60 | 0.0045 | | 8.54 | 6.10 | |
| 1586 | S | 5G | NYCT | Guap | frag | 14.90 | 0.0174 | | 6.12 | 3.10 | |
| 1587 | S | 5G | SAPO | Pout | mult | 7.80 | 0.0048 | 11.5 | 6.54 | 1.40 | |
| 1588 | S | 5G | MYRS | Ardi | obov | 9.80 | 0.0075 | 9.72 | 8.82 | 0.16 | |
| 1665 | S | 5G | SAPO | Pout | mult | 5.60 | 0.0025 | 9.42 | 3.91 | 9.10 | |
| 1666 | S | 5G | RUBI | Fara | occi | 5.20 | 0.0021 | | 9.87 | 1.90 | |
| 1589 | S | 5H | MIMO | Inga | fagi | 7.40 | 0.0043 | | 1.62 | 1.60 | |
| 1590 | S | 5H | PHYT | Tric | octa | 7.80 | 0.0048 | | 3.20 | 0.95 | VINE |
| 1591 | S | 5H | MIMO | Inga | fagi | 20.80 | 0.0340 | | 2.54 | 1.20 | |
| 1592 | S | 5H | MIMO | Inga | fagi | 21.70 | 0.0370 | | 3.80 | 0.21 | |
| 1593 | S | 5H | NYCT | Guap | frag | 11.00 | 0.0095 | | 4.07 | 0.35 | |
| 1594 | S | 5H | RUBI | Fara | occi | 5.60 | 0.0025 | | 4.46 | 1.50 | |
| 1595 | S | 5H | MIMO | Inga | fagi | 31.20 | 0.0765 | | 4.80 | 3.50 | |
| 1596 | S | 5H | OLEA | Lino | cari | 11.20 | 0.0099 | | 5.41 | 8.40 | |
| 1597 | S | 5H | MIMO | Inga | fagi | 19.50 | 0.0299 | | 6.48 | 8.20 | |
| 1598 | S | 5H | PHYT | Tric | octa | 5.80 | 0.0026 | | 5.42 | 3.85 | VINE |
| 1599 | M | 5H | NYCT | Guap | frag | 8.50 | 0.0057 | | 6.73 | 2.33 | |
| 1600 | M | 5H | NYCT | Guap | frag | 5.60 | 0.0025 | | 6.70 | 2.45 | |
| 1601 | S | 5H | MIMO | Inga | fagi | 24.20 | 0.0460 | | 8.45 | 1.05 | |
| 1667 | S | 5H | RUBI | Fara | occi | 5.10 | 0.0020 | | 3.37 | 2.65 | |
| 1668 | S | 5H | RUBI | Fara | occi | 5.50 | 0.0024 | | 7.89 | 2.85 | |
| 1602 | S | 5I | FLAC | Case | sylv | 6.30 | 0.0031 | 7.90 | 1.75 | 0.19 | |
| 1603 | S | 5I | FLAC | Case | sylv | 5.20 | 0.0021 | | 2.01 | 0.04 | DEAD 7/86 |
| 1604 | S | 5I | NYCT | Guap | frag | 5.30 | 0.0022 | | 2.99 | 2.15 | |
| 1605 | S | 5I | MIMO | Inga | fagi | 18.00 | 0.0254 | | 0.99 | 2.60 | |
| 1606 | M | 5I | BORA | Cord | sulc | 16.80 | 0.0222 | 14.8 | 1.56 | 5.40 | DEAD 7/86 |



194

APPENDIX I. (Continued)

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1607 | M | 5I | BORA | Cord | sulc | 9.30 | 0.0068 | | 1.56 | 5.55 | |
| 1608 | S | 5I | ARAL | Didy | moro | 14.10 | 0.0156 | 12.7 | 3.50 | 8.70 | |
| 1609 | S | 5I | BORA | Cord | sulc | 19.40 | 0.0296 | | 6.79 | 7.70 | |
| 1610 | S | 5I | BORA | Bour | succ | 7.60 | 0.0045 | 11.5 | 6.79 | 7.95 | |
| 1611 | S | 5I | MYRS | Ardi | obov | 6.40 | 0.0032 | | 8.52 | 9.30 | |
| 1612 | S | 5I | MYRT | Myrc | citr | 7.50 | 0.0044 | 8.81 | 8.59 | 4.80 | |
| 1613 | S | 5I | MIMO | Acac | muri | 5.70 | 0.0026 | | 9.68 | 3.70 | |
| 1669 | S | 5I | MIMO | Inga | fagi | 5.20 | 0.0021 | | 2.38 | 9.60 | |
| 1670 | S | 5I | LAUR | Ocot | sint | 5.80 | 0.0026 | 9.11 | 3.10 | 9.20 | |
| 1671 | S | 5I | MYRS | Ardi | obov | 8.60 | 0.0058 | | 4.61 | 6.00 | |
| 1614 | S | 5J | MIMO | Acac | muri | 8.60 | 0.0058 | | 4.10 | 0.17 | |
| 1615 | S | 5J | MIMO | Acac | muri | 8.60 | 0.0058 | 11.8 | 4.09 | 3.20 | |
| 1616 | S | 5J | FLAC | Case | guia | 5.80 | 0.0026 | 6.99 | 2.14 | 2.80 | |
| 1617 | S | 5J | RUTA | Zant | mart | 11.20 | 0.0099 | 12.7 | 0.08 | 3.10 | |
| 1618 | S | 5J | MIMO | Acac | muri | 18.70 | 0.0275 | | 0.45 | 5.00 | |
| 1619 | S | 5J | MIMO | Acac | muri | 18.20 | 0.0260 | | 2.52 | 4.80 | |
| 1620 | S | 5J | MIMO | Acac | muri | 27.90 | 0.0611 | 17.6 | 1.64 | 7.95 | |
| 1621 | S | 5J | MYRT | Myrc | flor | 6.00 | 0.0028 | 7.29 | 4.97 | 8.90 | |
| 1622 | S | 5J | MYRT | Pime | race | 8.80 | 0.0061 | | 6.94 | 5.30 | |
| 1623 | S | 5J | MYRT | Pime | race | 9.00 | 0.0064 | | 8.26 | 4.60 | |
| 1624 | S | 5J | MYRT | Pime | race | 16.70 | 0.0219 | | 8.84 | 4.30 | |
| 1625 | S | 5J | MYRT | Pime | race | 7.50 | 0.0044 | | 7.30 | 3.25 | |
| 1626 | S | 5J | STER | Guaz | ulmi | 27.30 | 0.0585 | 16.7 | 6.82 | 3.40 | |
| 1627 | S | 5J | MYRT | Pime | race | 8.90 | 0.0062 | 12.1 | 5.20 | 1.20 | |
| 1628 | S | 5J | MYRT | Pime | race | 9.00 | 0.0064 | | 8.20 | 9.75 | |
| 1630 | S | 5J | MYRT | Pime | race | 12.30 | 0.0119 | | 7.32 | 9.60 | |
| 1672 | S | 5J | BORA | Bour | succ | 5.00 | 0.0020 | 8.20 | 6.70 | 9.90 | |
| 1640 | S | 6J | MYRT | Pime | race | 6.80 | 0.0036 | | 7.58 | 0.52 | |
| 1641 | S | 6J | MYRT | Pime | race | 12.00 | 0.0113 | | 8.24 | 2.70 | |
| 1642 | S | 6J | MYRT | Pime | race | 6.20 | 0.0030 | | 6.58 | 0.18 | |
| 1643 | S | 6J | MYRT | Pime | race | 13.00 | 0.0133 | | 5.92 | 0.45 | |
| 1644 | S | 6J | MYRT | Pime | race | 14.90 | 0.0174 | 16.1 | 7.02 | 2.00 | |
| 1645 | S | 6J | ARAL | Didy | moro | 22.30 | 0.0391 | 17.9 | 6.37 | 2.30 | |
| 1646 | S | 6J | MYRT | Myrc | citr | 5.60 | 0.0025 | 6.68 | 6.90 | 3.30 | |
| 1647 | S | 6J | RUBI | Guet | scab | 7.40 | 0.0043 | 10.6 | 9.01 | 6.40 | |
| 1648 | M | 6J | MYRT | Pime | race | 5.80 | 0.0026 | | 8.10 | 7.90 | |
| 1649 | M | 6J | MYRT | Pime | race | 7.90 | 0.0049 | | 8.20 | 8.00 | |
| 1650 | M | 6J | MYRT | Pime | race | 15.50 | 0.0189 | | 6.17 | 6.90 | |
| 1651 | M | 6J | MYRT | Pime | race | 14.80 | 0.0172 | | 6.17 | 7.00 | |
| 1652 | S | 6J | MYRT | Pime | race | 12.80 | 0.0129 | | 4.62 | 6.20 | |
| 1653 | S | 6J | CAES | Hyme | cour | 28.80 | 0.0651 | 24.9 | 0.20 | 6.00 | |
| 1654 | S | 6J | MYRT | Myrc | citr | 7.30 | 0.0042 | 5.77 | 1.27 | 3.35 | |
| 1655 | S | 6J | BIGN | Tabe | hete | 7.80 | 0.0048 | 6.99 | 1.32 | 0.39 | |
| 1632 | S | 6I | LAUR | Ocot | cori | 6.30 | 0.0031 | | 3.01 | 0.55 | DEAD 7/86 |
| 1656 | S | 6I | NYCT | Guap | frag | 10.90 | 0.0093 | | 8.01 | 3.75 | |
| 1657 | S | 6I | MYRT | Pime | race | 13.40 | 0.0141 | 13.6 | 7.51 | 6.15 | |
| 1658 | S | 6I | MYRT | Pime | race | 7.20 | 0.0041 | | 6.48 | 6.00 | |
| 1659 | S | 6I | MYRT | Pime | race | 7.20 | 0.0041 | | 5.85 | 6.30 | |
| 1660 | S | 6I | MYRT | Pime | race | 14.50 | 0.0165 | | 5.33 | 5.80 | |
| 1673 | S | 6I | MYRT | Pime | race | 9.40 | 0.0069 | | 5.12 | 9.65 | |

APPENDIX I. (Continued)

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1674 | S | 6I | MIMO | Inga | fagi | 6.80 | 0.0036 | | 5.72 | 2.15 | |
| 1675 | S | 6I | MIMO | Inga | fagi | 33.70 | 0.0892 | 20.3 | 4.90 | 2.20 | |
| 1676 | S | 6I | NYCT | Guap | frag | 20.40 | 0.0327 | | 3.24 | 2.45 | |
| 1677 | S | 6I | LAUR | Ocot | cori | 6.30 | 0.0031 | | 3.62 | 4.15 | |
| 1678 | S | 6I | LAUR | Ocot | cori | 6.60 | 0.0034 | 7.29 | 2.10 | 5.00 | |
| 1679 | S | 6I | MYRT | Pime | race | 8.90 | 0.0062 | | 0.70 | 2.75 | |
| 1680 | S | 6H | MYRS | Ardi | obov | 6.80 | 0.0036 | 7.29 | 8.99 | 4.55 | |
| 1681 | S | 6H | LAUR | Ocot | cori | 7.30 | 0.0042 | | 8.10 | 2.60 | |
| 1682 | S | 6H | NYCT | Guap | frag | 6.00 | 0.0028 | 7.29 | 7.60 | 2.55 | |
| 1683 | S | 6H | MIMO | Inga | fagi | 13.40 | 0.0141 | | 8.06 | 4.70 | |
| 1684 | S | 6H | FLAC | Case | guia | 8.60 | 0.0058 | 7.90 | 7.21 | 3.65 | |
| 1685 | S | 6H | MYRS | Ardi | obov | 5.50 | 0.0024 | | 5.25 | 6.15 | |
| 1686 | S | 6H | MYRS | Ardi | obov | 11.30 | 0.0100 | | 5.62 | 9.15 | |
| 1687 | S | 6H | LAUR | Ocot | cori | 5.40 | 0.0023 | | 4.82 | 9.25 | |
| 1688 | S | 6H | SAPO | Chry | pauc | 6.60 | 0.0034 | 8.51 | 4.62 | 3.35 | |
| 1689 | S | 6H | OLEA | Lino | cari | 7.60 | 0.0045 | 10.3 | 4.12 | 2.55 | |
| 1690 | M | 6H | MYRS | Ardi | obov | 7.30 | 0.0042 | | 2.70 | 0.90 | |
| 1691 | M | 6H | MYRS | Ardi | obov | 6.30 | 0.0031 | | 3.10 | 0.36 | |
| 1692 | S | 6H | STER | Guaz | ulmi | 24.20 | 0.0460 | 17.0 | 1.23 | 0.36 | |
| 1693 | S | 6H | MALP | Byrs | cori | 26.20 | 0.0539 | 24.3 | 1.72 | 0.60 | |
| 1694 | S | 6H | MYRS | Ardi | obov | 8.90 | 0.0062 | | 2.19 | 4.40 | |
| 1695 | S | 6H | MALP | Byrs | cori | 22.90 | 0.0412 | | 2.98 | 7.40 | |
| 1696 | S | 6H | MALP | Byrs | cori | 9.30 | 0.0068 | | 0.45 | 5.70 | SICK11/86 |
| 2735 | S | 6H | RUBI | Fara | occi | 5.20 | 0.0021 | | 5.85 | 9.45 | |
| 1697 | S | 6G | RUBI | Fara | occi | 5.00 | 0.0020 | | 9.01 | 4.70 | |
| 1698 | S | 6G | LAUR | Lica | tria | 11.90 | 0.0111 | 14.5 | 7.28 | 2.05 | |
| 1699 | S | 6G | NYCT | Guap | frag | 5.30 | 0.0022 | | 5.61 | 3.95 | |
| 1700 | S | 6G | MYRS | Ardi | obov | 6.20 | 0.0030 | | 5.29 | 8.00 | |
| 1701 | S | 6G | MYRS | Ardi | obov | 5.00 | 0.0020 | | 6.84 | 7.30 | |
| 1702 | S | 6G | MIMO | Aden | pavo | 5.90 | 0.0027 | 7.59 | 5.80 | 8.90 | |
| 1703 | S | 6G | MIMO | Inga | fagi | 9.00 | 0.0064 | | 4.78 | 9.65 | |
| 1704 | S | 6G | MIMO | Inga | fagi | 7.90 | 0.0049 | | 4.07 | 4.70 | |
| 1705 | S | 6G | MIMO | Inga | fagi | 7.20 | 0.0041 | | 4.19 | 1.60 | |
| 1706 | M | 6G | SAPO | Pout | mult | 18.00 | 0.0254 | 18.8 | 1.78 | 1.45 | |
| 1707 | M | 6G | SAPO | Pout | mult | 7.00 | 0.0038 | | 2.12 | 1.30 | |
| 1708 | M | 6G | SAPO | Pout | mult | 10.20 | 0.0082 | | 1.95 | 1.55 | |
| 1709 | S | 6G | SAPI | Cupa | triq | 13.90 | 0.0152 | | 1.95 | 2.45 | DEAD 7/86 |
| 1710 | S | 6G | MIMO | Inga | fagi | 6.40 | 0.0032 | | 2.84 | 5.50 | |
| 1711 | S | 6F | MIMO | Inga | fagi | 6.40 | 0.0032 | | 9.45 | 9.90 | |
| 1712 | S | 6F | MALP | Byrs | cori | 20.30 | 0.0324 | 16.4 | 8.91 | 9.20 | |
| 1713 | S | 6F | BORA | Cord | sulc | 5.90 | 0.0027 | 7.90 | 7.75 | 7.55 | |
| 1714 | S | 6F | MIMO | Inga | fagi | 8.60 | 0.0058 | | 7.27 | 6.95 | |
| 1715 | S | 6F | MIMO | Inga | fagi | 5.40 | 0.0023 | | 7.36 | 4.60 | |
| 1716 | S | 6F | SAPI | Allo | race | 5.50 | 0.0024 | 7.59 | 0.05 | 7.50 | |
| 1717 | S | 6F | BORA | Cord | sulc | 10.80 | 0.0092 | 12.1 | 0.20 | 8.30 | |
| 1718 | S | 6F | NYCT | Guap | frag | 5.00 | 0.0020 | | 0.92 | 1.15 | |
| 1719 | S | 6F | NYCT | Guap | frag | 5.40 | 0.0023 | | 0.89 | 0.25 | |
| 1720 | S | 6F | MALP | Byrs | cori | 8.70 | 0.0059 | 10.3 | 4.04 | 1.10 | |
| 1721 | S | 6E | MIMO | Inga | fagi | 35.10 | 0.0968 | | 8.90 | 0.35 | |
| 1722 | S | 6E | STER | Guaz | ulmi | 17.20 | 0.0232 | 13.0 | 5.25 | 4.45 | |

APPENDIX I. (Continued)

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1723 | S | 6E | LAUR | Lica | sali | 10.70 | 0.0090 | 11.8 | 5.80 | 6.25 | |
| 1724 | S | 6E | MIMO | Acac | west | 5.40 | 0.0023 | | 7.20 | 6.85 | DEAD 7/86 |
| 1725 | S | 6E | RUTA | Zant | mart | 8.00 | 0.0050 | 17.0 | 4.31 | 8.55 | |
| 1726 | S | 6E | MYRT | Pime | race | 15.30 | 0.0184 | | 3.75 | 9.20 | |
| 1727 | M | 6E | CAPP | Capp | cyno | 9.30 | 0.0068 | 7.29 | 0.90 | 8.55 | |
| 1728 | M | 6E | CAPP | Capp | cyno | 5.30 | 0.0022 | | 1.02 | 8.70 | |
| 1729 | M | 6E | SAPO | Chry | pauc | 6.50 | 0.0033 | 12.7 | 3.29 | 6.55 | |
| 1730 | M | 6E | SAPO | Chry | pauc | 6.70 | 0.0035 | | 3.36 | 6.65 | |
| 1731 | S | 6E | MYRT | Pime | race | 8.10 | 0.0052 | | 3.21 | 5.70 | |
| 1732 | S | 6E | CAPP | Mori | amer | 5.50 | 0.0024 | 6.99 | 3.60 | 3.95 | |
| 1733 | S | 6E | NYCT | Guap | frag | 5.50 | 0.0024 | | 8.31 | 3.95 | |
| 1734 | S | 6E | NYCT | Guap | frag | 7.70 | 0.0047 | | 1.29 | 1.10 | |
| 1735 | S | 6D | NYCT | Guap | frag | 23.50 | 0.0434 | | 9.20 | 0.90 | |
| 1736 | S | 6D | MIMO | Inga | fagi | 16.40 | 0.0211 | | 8.66 | 3.15 | |
| 1737 | S | 6D | RUTA | Zant | mart | 15.10 | 0.0179 | 16.4 | 8.89 | 5.70 | |
| 1738 | S | 6D | BORA | Cord | sulc | 14.00 | 0.0154 | 12.4 | 7.21 | 8.35 | |
| 1739 | S | 6D | NYCT | Guap | frag | 7.50 | 0.0044 | | 6.20 | 8.55 | DEAD 7/86 |
| 1740 | S | 6D | MIMO | Inga | fagi | 7.90 | 0.0049 | | 6.32 | 4.15 | |
| 1741 | M | 6D | STER | Guaz | ulmi | 17.40 | 0.0238 | 15.8 | 5.45 | 2.51 | |
| 1742 | M | 6D | STER | Guaz | ulmi | 14.60 | 0.0167 | | 5.25 | 2.85 | |
| 1743 | M | 6D | STER | Guaz | ulmi | 16.10 | 0.0204 | | 5.55 | 2.90 | |
| 1744 | S | 6D | MYRT | Pime | race | 12.60 | 0.0125 | | 4.01 | 2.75 | |
| 1745 | S | 6D | NYCT | Guap | frag | 5.90 | 0.0027 | | 2.63 | 1.00 | |
| 1746 | S | 6D | MIMO | Inga | fagi | 14.30 | 0.0161 | 15.8 | 2.00 | 0.65 | |
| 1747 | S | 6D | NYCT | Guap | frag | 6.10 | 0.0029 | | 1.75 | 0.45 | |
| 1748 | M | 6D | FLAC | Case | deca | 6.10 | 0.0029 | 7.90 | 0.25 | 4.90 | |
| 1749 | M | 6D | FLAC | Case | deca | 5.60 | 0.0025 | | 0.25 | 5.15 | |
| 1750 | M | 6D | FLAC | Case | deca | 6.30 | 0.0031 | | 0.40 | 5.10 | |
| 1751 | S | 6D | MIMO | Inga | fagi | 22.10 | 0.0384 | | 0.35 | 5.60 | |
| 1752 | S | 6D | NYCT | Guap | frag | 5.40 | 0.0023 | | 3.71 | 6.25 | |
| 1753 | S | 6D | NYCT | Guap | frag | 7.70 | 0.0047 | | 1.30 | 9.30 | |
| 2736 | S | 6D | MYRS | Ardi | obov | 5.00 | 0.0020 | | 6.32 | 3.15 | |
| 2737 | S | 6D | MYRS | Ardi | obov | 5.00 | 0.0020 | | 1.87 | 5.25 | |
| 2738 | S | 6D | CAPP | Mori | amer | 5.20 | 0.0021 | 6.07 | 1.20 | 7.55 | |
| 1754 | S | 6C | EUPH | Dryp | alba | 6.30 | 0.0031 | 7.59 | 9.45 | 9.30 | |
| 1755 | S | 6C | BORA | Cord | sulc | 14.40 | 0.0163 | 13.0 | 9.20 | 9.75 | |
| 1756 | S | 6C | MIMO | Inga | fagi | 6.10 | 0.0029 | 4.86 | 7.63 | 8.50 | |
| 1757 | S | 6C | OLEA | Lino | cari | 5.80 | 0.0026 | | 7.30 | 8.10 | |
| 1758 | S | 6C | FABA | Andi | iner | 10.60 | 0.0088 | 9.72 | 6.70 | 8.40 | |
| 1759 | S | 6C | MYRT | Pime | race | 14.90 | 0.0174 | | 6.40 | 8.35 | |
| 1760 | S | 6C | BORA | Cord | alli | 16.40 | 0.0211 | 12.7 | 6.80 | 9.70 | |
| 1761 | S | 6C | EUPH | Dryp | alba | 6.10 | 0.0029 | 4.25 | 6.75 | 7.30 | |
| 1762 | S | 6C | NYCT | Guap | frag | 34.50 | 0.0935 | | 7.30 | 6.80 | |
| 1763 | M | 6C | MYRS | Ardi | obov | 6.10 | 0.0029 | | 8.50 | 5.60 | |
| 1764 | M | 6C | MYRS | Ardi | obov | 10.30 | 0.0083 | | 8.90 | 5.80 | |
| 1765 | M | 6C | NYCT | Guap | frag | 14.60 | 0.0167 | | 8.25 | 1.20 | |
| 1766 | M | 6C | NYCT | Guap | frag | 8.30 | 0.0054 | | 7.85 | 1.10 | |
| 1767 | S | 6C | MIMO | Inga | fagi | 17.90 | 0.0252 | | 7.05 | 1.05 | |
| 1768 | S | 6C | BIGN | Tabe | hete | 15.40 | 0.0186 | 16.7 | 5.50 | 4.00 | |
| 1769 | S | 6C | OLEA | Lino | cari | 8.90 | 0.0062 | | 4.75 | 2.80 | DEAD11/86 |

APPENDIX I. (Continued)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 1770 | S | 6C | OLEA | Lino | cari | 6.20 | 0.0030 | 8.20 | 4.30 | 5.30 |
| 1771 | S | 6C | RUBI | Fara | occi | 6.30 | 0.0031 | 5.47 | 4.40 | 3.50 |
| 1772 | S | 6C | RUBI | Fara | occi | 5.90 | 0.0027 | | 2.90 | 1.20 |
| 1773 | S | 6C | MIMO | Acac | muri | 21.50 | 0.0363 | | 0.13 | 1.90 |
| 1774 | M | 6C | MYRS | Ardi | obov | 7.70 | 0.0047 | | 0.65 | 3.60 |
| 1775 | M | 6C | MYRS | Ardi | obov | 6.10 | 0.0029 | | 1.20 | 3.80 |
| 1778 | S | 6C | MIMO | Acac | muri | 24.90 | 0.0487 | | 1.90 | 4.05 |
| 1779 | M | 6C | RUBI | Guet | scab | 5.80 | 0.0026 | 10.6 | 2.52 | 5.20 |
| 1780 | S | 6C | MIMO | Inga | fagi | 5.30 | 0.0022 | | 2.55 | 5.40 |
| 1781 | M | 6C | RUBI | Guet | scab | 7.10 | 0.0040 | | 2.55 | 5.35 |
| 1782 | S | 6C | RUBI | Fara | occi | 5.60 | 0.0025 | 6.07 | 2.21 | 5.42 |
| 1783 | S | 6C | NYCT | Guap | frag | 15.50 | 0.0189 | | 1.55 | 6.25 |
| 1784 | S | 6C | MYRS | Ardi | obov | 5.50 | 0.0024 | | 2.01 | 7.55 |
| 1785 | S | 6C | RUBI | Fara | occi | 5.40 | 0.0023 | | 1.25 | 7.50 |
| 1786 | S | 6C | MYRS | Ardi | obov | 5.90 | 0.0027 | | 1.00 | 6.10 |
| 1787 | S | 6C | NYCT | Guap | frag | 11.40 | 0.0102 | | 0.65 | 5.60 |
| 1788 | S | 6C | LAUR | Lica | sali | 5.00 | 0.0020 | 8.51 | 9.45 | 0.70 |
| 2739 | S | 6C | EUPH | Dryp | alba | 5.10 | 0.0020 | | 5.52 | 0.60 |
| 1789 | S | 6B | MYRS | Ardi | obov | 7.00 | 0.0038 | | 9.95 | 0.45 |
| 1790 | S | 6B | MYRT | Pime | race | 11.80 | 0.0109 | | 9.42 | 1.65 |
| 1791 | S | 6B | MYRT | Pime | race | 15.80 | 0.0196 | | 8.00 | 2.90 |
| 1792 | S | 6B | MYRS | Ardi | obov | 7.90 | 0.0049 | | 9.50 | 6.65 |
| 1793 | S | 6B | MYRS | Ardi | obov | 5.40 | 0.0023 | | 7.30 | 6.70 |
| 1794 | S | 6B | NYCT | Guap | frag | 17.40 | 0.0238 | | 6.55 | 5.90 |
| 1795 | S | 6B | MYRT | Myrc | citr | 5.80 | 0.0026 | 6.99 | 7.55 | 3.50 |
| 1796 | S | 6B | OLEA | Lino | cari | 6.80 | 0.0036 | | 4.35 | 7.60 |
| 1797 | S | 6B | MYRT | Euge | mont | 5.90 | 0.0027 | 10.0 | 3.00 | 7.25 |
| 1798 | S | 6B | MIMO | Acac | muri | 21.50 | 0.0363 | | 2.65 | 9.00 |
| 1799 | M | 6B | NYCT | Guap | frag | 16.50 | 0.0214 | | 1.95 | 9.50 |
| 1800 | M | 6B | NYCT | Guap | frag | 13.40 | 0.0141 | | 2.40 | 9.80 |
| 1801 | S | 6B | MYRT | Euge | mont | 14.10 | 0.0156 | 11.5 | 2.50 | 5.85 |
| 1802 | S | 6B | MIMO | Acac | muri | 10.00 | 0.0079 | | 2.20 | 3.20 |
| 1803 | S | 6B | MYRT | Myrc | citr | 7.60 | 0.0045 | 7.90 | 2.60 | 2.00 |
| 1804 | S | 6B | MYRS | Ardi | obov | 5.20 | 0.0021 | | 2.05 | 1.75 |
| 1805 | S | 6B | MYRS | Ardi | obov | 6.80 | 0.0036 | | 1.25 | 0.50 |
| 1806 | S | 6B | MIMO | Acac | muri | 22.20 | 0.0387 | | 1.00 | 1.00 |
| 1807 | M | 6B | LAUR | Ocot | cori | 6.60 | 0.0034 | 9.72 | 1.00 | 1.25 |
| 1810 | M | 6B | LAUR | Ocot | cori | 5.00 | 0.0020 | | 0.10 | 4.50 |
| 1808 | S | 6B | MIMO | Acac | muri | 16.70 | 0.0219 | | 0.10 | 4.50 |
| 1809 | S | 6B | OLEA | Lino | cari | 5.90 | 0.0027 | 8.81 | 1.05 | 5.10 |
| 1811 | S | 6A | MIMO | Acac | muri | 10.90 | 0.0093 | | 8.95 | 2.30 |
| 1812 | S | 6A | MIMO | Acac | muri | 18.40 | 0.0266 | | 8.45 | 0.60 |
| 1813 | S | 6A | MYRT | Myrc | citr | 6.10 | 0.0029 | 6.68 | 8.20 | 0.35 |
| 1814 | S | 6A | MYRT | Euge | bifl | 6.80 | 0.0036 | 8.81 | 9.60 | 3.80 |
| 1815 | S | 6A | NYCT | Guap | frag | 8.90 | 0.0062 | | 9.70 | 3.90 |
| 1816 | S | 6A | NYCT | Guap | frag | 8.80 | 0.0061 | | 5.15 | 7.90 |
| 1817 | S | 6A | MIMO | Acac | muri | 19.00 | 0.0284 | | 7.82 | 6.25 |
| 1818 | S | 6A | MIMO | Acac | muri | 20.40 | 0.0327 | | 8.00 | 6.85 |
| 1819 | S | 6A | MYRS | Ardi | obov | 6.50 | 0.0033 | | 8.70 | 7.52 |
| 1820 | S | 6A | NYCT | Guap | frag | 6.10 | 0.0029 | | 9.70 | 7.70 |



178

APPENDIX I. (Continued)

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1821 | S | 6A | MIMO | Acac | muri | 24.20 | 0.0460 | | 6.75 | 9.60 | |
| 1822 | S | 6A | CAPP | Capp | cyno | 6.20 | 0.0030 | 5.77 | 5.75 | 9.60 | |
| 1823 | S | 6A | MIMO | Acac | muri | 11.80 | 0.0109 | | 4.60 | 8.40 | |
| 1824 | S | 6A | OLEA | Lino | cari | 5.80 | 0.0026 | | 4.10 | 6.40 | |
| 1825 | S | 6A | MYRT | Myrc | citr | 5.40 | 0.0023 | 5.77 | 6.90 | 5.00 | |
| 1826 | S | 6A | NYCT | Guap | frag | 11.60 | 0.0106 | | 6.85 | 8.65 | |
| 1827 | S | 6A | MIMO | Acac | muri | 20.00 | 0.0314 | | 3.90 | 8.15 | |
| 1828 | M | 6A | MIMO | Acac | muri | 13.10 | 0.0135 | | 3.00 | 8.05 | SICK11/86 |
| 1829 | M | 6A | MIMO | Acac | muri | 11.80 | 0.0109 | | 2.80 | 8.35 | |
| 1830 | M | 6A | MIMO | Acac | muri | 12.10 | 0.0115 | | 2.70 | 8.75 | |
| 1831 | S | 6A | LAUR | Ocot | cori | 5.60 | 0.0025 | 6.07 | 2.10 | 8.80 | |
| 1832 | S | 6A | MIMO | Acac | muri | 19.70 | 0.0305 | | 1.00 | 8.90 | |
| 1833 | S | 6A | MYRT | Pime | race | 5.40 | 0.0023 | | 1.65 | 7.85 | |
| 1834 | S | 6A | MYRT | Pime | race | 5.50 | 0.0024 | | 0.75 | 6.10 | |
| 1835 | S | 6A | BIGN | Tabe | hete | 26.70 | 0.0560 | 16.4 | 0.40 | 5.65 | |
| 1836 | S | 6A | MIMO | Acac | muri | 6.80 | 0.0036 | | 0.80 | 5.10 | DEAD 6/86 |
| 1837 | S | 6A | MYRS | Ardi | obov | 5.70 | 0.0026 | | 1.60 | 5.25 | |
| 1838 | S | 6A | NYCT | Guap | frag | 8.70 | 0.0059 | | 2.50 | 5.25 | |
| 1839 | S | 6A | MYRT | Pime | race | 6.00 | 0.0028 | 7.90 | 0.15 | 5.85 | |
| 1840 | S | 6A | MIMO | Acac | muri | 17.40 | 0.0238 | | 0.80 | 4.20 | |
| 1841 | S | 6A | MIMO | Acac | muri | 10.80 | 0.0092 | | 1.05 | 3.50 | |
| 1842 | S | 6A | NYCT | Guap | frag | 6.70 | 0.0035 | | 1.60 | 1.45 | |
| 1843 | S | 6A | LAUR | Ocot | cori | 7.30 | 0.0042 | | 3.20 | 0.35 | |
| 1844 | S | 6A | MIMO | Acac | muri | 16.50 | 0.0214 | | 3.40 | 0.40 | |
| 1845 | S | 6A | MIMO | Acac | muri | 14.90 | 0.0174 | | 5.90 | 0.60 | |
| 1846 | M | 6A | CAPP | Mori | amer | 7.10 | 0.0040 | | 6.55 | 2.95 | |
| 1847 | M | 6A | CAPP | Mori | amer | 5.20 | 0.0021 | 9.11 | 6.60 | 2.85 | |
| 1848 | S | 6A | OLEA | Lino | cari | 5.00 | 0.0020 | | 6.15 | 4.30 | DEAD 6/86 |
| 1849 | S | 6A | MYRT | Myrc | citr | 5.30 | 0.0022 | 14.8 | 5.25 | 2.40 | |
| 1850 | S | 7A | OLEA | Lino | cari | 7.50 | 0.0044 | | 0.60 | 0.55 | |
| 1851 | S | 7A | MIMO | Acac | muri | 15.20 | 0.0181 | 17.9 | 2.60 | 1.90 | |
| 1852 | S | 7A | OLEA | Lino | cari | 5.50 | 0.0024 | | 3.05 | 3.05 | |
| 1853 | S | 7A | MIMO | Acac | muri | 11.30 | 0.0100 | | 3.20 | 4.60 | |
| 1854 | S | 7A | MIMO | Acac | muri | 26.80 | 0.0564 | | 4.45 | 5.50 | |
| 1855 | S | 7A | MYRT | Pime | race | 7.90 | 0.0049 | | 0.35 | 6.35 | |
| 1856 | S | 7A | LAUR | Lica | sali | 5.50 | 0.0024 | 7.90 | 1.20 | 6.15 | |
| 1857 | S | 7A | RUTA | Zant | mart | 30.20 | 0.0716 | 18.2 | 6.20 | 8.10 | |
| 1858 | S | 7A | NYCT | Guap | frag | 19.20 | 0.0290 | | 6.35 | 9.90 | |
| 1859 | S | 7A | MYRT | Euge | mont | 7.40 | 0.0043 | 7.90 | 7.00 | 7.80 | |
| 1860 | S | 7A | CAPP | Mori | amer | 9.40 | 0.0069 | 7.90 | 7.85 | 7.85 | |
| 1861 | S | 7A | MYRT | Euge | mont | 9.80 | 0.0075 | 11.5 | 6.70 | 4.20 | |
| 1862 | S | 7A | MIMO | Acac | muri | 11.50 | 0.0104 | | 4.20 | 0.80 | |
| 1863 | S | 7A | MYRT | Pime | race | 5.50 | 0.0024 | | 5.30 | 0.07 | |
| 1864 | S | 7A | MIMO | Acac | muri | 17.50 | 0.0241 | | 6.45 | 1.20 | |
| 1865 | S | 7A | NYCT | Guap | frag | 8.90 | 0.0062 | | 6.55 | 2.70 | |
| 1866 | S | 7A | NYCT | Guap | frag | 9.60 | 0.0072 | | 7.60 | 2.50 | |
| 1867 | S | 7A | FLAC | Case | deca | 5.10 | 0.0020 | 9.42 | 9.20 | 2.25 | |
| 1868 | S | 7A | OLEA | Lino | cari | 5.20 | 0.0021 | | 9.15 | 2.20 | DEAD 6/86 |
| 1869 | S | 7A | MIMO | Acac | ripa | 6.30 | 0.0031 | | 8.00 | 4.70 | |
| 1870 | S | 7A | MYRS | Ardi | obov | 6.20 | 0.0030 | | 8.65 | 9.75 | |

APPENDIX I. (Continued)

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2741 | S | 7A | RHAM | Krug | ferr | 5.00 | 0.0020 | | 4.20 | 5.40 | |
| 2742 | S | 7A | MIMO | Acac | west | 6.20 | 0.0030 | | 7.75 | 7.90 | |
| 2743 | S | 7A | NYCT | Guap | frag | 5.40 | 0.0023 | | 8.60 | 1.80 | |
| 2744 | S | 7A | MYRS | Ardi | obov | 6.00 | 0.0028 | | 9.52 | 0.50 | |
| 1871 | S | 7B | MYRT | Pime | race | 16.70 | 0.0219 | | 1.25 | 5.75 | |
| 1872 | M | 7B | LAUR | Lica | sali | 5.20 | 0.0021 | | 2.15 | 6.25 | |
| 1873 | M | 7B | LAUR | Lica | sali | 5.20 | 0.0021 | 10.6 | 2.25 | 5.95 | |
| 1874 | S | 7B | BORA | Cord | alli | 10.30 | 0.0083 | | 3.00 | 7.90 | DEAD 7/86 |
| 1875 | S | 7B | FLAC | Case | guia | 5.40 | 0.0023 | 7.59 | 3.50 | 8.30 | |
| 1876 | S | 7B | MIMO | Acac | muri | 31.50 | 0.0779 | | 3.95 | 4.50 | |
| 1877 | S | 7B | LAUR | Ocot | cori | 11.40 | 0.0102 | | 3.90 | 3.40 | |
| 1878 | S | 7B | NYCT | Guap | frag | 27.10 | 0.0577 | | 6.00 | 1.20 | |
| 1879 | S | 7B | MYRS | Ardi | obov | 7.00 | 0.0038 | | 5.15 | 0.52 | |
| 1880 | M | 7B | MYRS | Ardi | obov | 7.60 | 0.0045 | | 6.60 | 2.60 | |
| 1881 | M | 7B | MYRS | Ardi | obov | 10.30 | 0.0083 | | 6.60 | 2.75 | |
| 1882 | S | 7B | NYCT | Guap | frag | 10.00 | 0.0079 | | 4.80 | 6.00 | |
| 1883 | S | 7B | VERB | Cith | frut | 8.30 | 0.0054 | 13.9 | 5.10 | 9.70 | |
| 1884 | S | 7B | NYCT | Guap | frag | 25.30 | 0.0503 | | 5.55 | 9.95 | |
| 1885 | S | 7B | MYRS | Ardi | obov | 5.70 | 0.0026 | | 7.00 | 6.95 | |
| 1886 | S | 7B | BIGN | Tabe | hete | 8.50 | 0.0057 | 10.0 | 7.10 | 5.00 | |
| 1887 | M | 7B | CAPP | Mori | amer | 8.20 | 0.0053 | 6.68 | 9.80 | 1.85 | |
| 1888 | M | 7B | CAPP | Mori | amer | 5.90 | 0.0027 | | 9.85 | 1.45 | |
| 1889 | S | 7B | MIMO | Inga | fagi | 5.20 | 0.0021 | | 9.15 | 7.40 | |
| 1890 | S | 7B | BORA | Bour | succ | 8.60 | 0.0058 | 8.51 | 8.50 | 8.30 | |
| 1891 | S | 7B | BORA | Cord | alli | 6.00 | 0.0028 | | 8.25 | 8.50 | DEAD 3/86 |
| 2745 | S | 7B | MYRT | Euge | mont | 5.20 | 0.0021 | 7.29 | 0.52 | 3.70 | |
| 2746 | S | 7B | MYRS | Ardi | obov | 5.10 | 0.0020 | | 5.90 | 0.62 | |
| 1892 | S | 7C | MALP | Byrs | cori | 26.30 | 0.0543 | 19.4 | 0.60 | 1.35 | |
| 1893 | S | 7C | MYRS | Ardi | obov | 6.20 | 0.0030 | | 0.90 | 0.25 | |
| 1894 | S | 7C | SAPI | Allo | race | 10.30 | 0.0083 | 9.11 | 3.20 | 4.65 | |
| 1895 | S | 7C | NYCT | Guap | frag | 11.30 | 0.0100 | | 4.80 | 2.80 | |
| 1896 | S | 7C | NYCT | Guap | frag | 18.50 | 0.0269 | 18.2 | 5.20 | 3.90 | |
| 1897 | S | 7C | MYRS | Ardi | obov | 6.90 | 0.0037 | | 4.20 | 4.45 | |
| 1898 | S | 7C | RUTA | Zant | mart | 15.10 | 0.0179 | 18.2 | 4.90 | 9.70 | |
| 1899 | S | 7C | MIMO | Inga | fagi | 8.10 | 0.0052 | | 6.65 | 6.90 | |
| 1900 | S | 7C | MIMO | Inga | fagi | 15.60 | 0.0191 | | 6.95 | 6.65 | |
| 1901 | S | 7C | MIMO | Inga | fagi | 15.90 | 0.0199 | | 6.85 | 5.95 | |
| 1902 | S | 7C | MYRT | Pime | race | 10.30 | 0.0083 | | 5.30 | 0.45 | |
| 1903 | S | 7C | CAPP | Mori | amer | 10.80 | 0.0092 | | 8.60 | 0.75 | |
| 1904 | S | 7C | MIMO | Inga | fagi | 7.70 | 0.0047 | | 9.10 | 1.00 | |
| 1905 | S | 7C | CAPP | Mori | amer | 12.70 | 0.0127 | 10.3 | 9.75 | 3.35 | |
| 1906 | M | 7C | MYRT | Pime | race | 10.30 | 0.0083 | | 7.60 | 5.10 | |
| 1907 | M | 7C | MYRT | Pime | race | 7.10 | 0.0040 | | 7.70 | 5.20 | |
| 1908 | S | 7D | NYCT | Guap | frag | 13.40 | 0.0141 | | 0.05 | 4.10 | |
| 1909 | S | 7D | MIMO | Inga | fagi | 22.90 | 0.0412 | 20.0 | 0.32 | 1.40 | |
| 1910 | S | 7D | MIMO | Inga | fagi | 18.10 | 0.0257 | | 1.12 | 3.35 | |
| 1911 | M | 7D | MIMO | Inga | fagi | 15.90 | 0.0199 | | 1.50 | 3.95 | |
| 1912 | M | 7D | MIMO | Inga | fagi | 17.90 | 0.0252 | | 1.75 | 3.90 | |
| 1913 | S | 7D | MIMO | Inga | fagi | 12.70 | 0.0127 | | 1.00 | 5.70 | |
| 1914 | S | 7D | BORA | Cord | alli | 10.80 | 0.0092 | 12.7 | 4.45 | 8.00 | |



200

APPENDIX I. (Continued)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 1915 | S | 7D | FLAC | Case | deca | 5.00 | 0.0020 | 7.90 | 5.85 | 3.65 |
| 1916 | S | 7D | LAUR | Ocot | cori | 6.00 | 0.0028 | | 4.75 | 3.00 |
| 1917 | S | 7D | RUTA | Zant | mart | 29.20 | 0.0670 | | 3.65 | 0.85 |
| 1918 | S | 7D | BORA | Cord | sulc | 7.30 | 0.0042 | 9.42 | 6.85 | 2.55 |
| 1919 | S | 7D | FLAC | Case | guia | 5.50 | 0.0024 | 5.77 | 8.10 | 3.10 |
| 1920 | S | 7D | MYRT | Pime | race | 5.70 | 0.0026 | | 9.10 | 5.50 |
| 1921 | S | 7D | NYCT | Guap | frag | 8.30 | 0.0054 | | 8.35 | 7.00 |
| 1922 | S | 7D | NYCT | Guap | frag | 6.20 | 0.0030 | | 8.60 | 7.55 |
| 1923 | S | 7D | ANAC | Spon | momb | 19.20 | 0.0290 | 17.0 | 8.70 | 9.70 |
| 1924 | S | 7D | BORA | Cord | sulc | 8.20 | 0.0053 | 11.8 | 6.25 | 9.95 |
| 1925 | S | 7E | MYRT | Pime | race | 5.90 | 0.0027 | | 1.35 | 5.45 |
| 1926 | S | 7E | CAPP | Capp | indi | 11.70 | 0.0108 | 6.68 | 1.40 | 7.90 |
| 1927 | S | 7E | NYCT | Guap | frag | 5.60 | 0.0025 | | 2.50 | 8.45 |
| 1928 | S | 7E | MYRT | Pime | race | 10.10 | 0.0080 | | 2.40 | 9.80 |
| 1929 | S | 7E | NYCT | Guap | frag | 6.20 | 0.0030 | | 3.25 | 8.40 |
| 1930 | S | 7E | MYRS | Ardi | obov | 5.90 | 0.0027 | | 4.80 | 6.50 |
| 1931 | S | 7E | NYCT | Guap | frag | 48.30 | 0.1832 | | 3.90 | 2.65 |
| 1932 | S | 7E | MYRS | Ardi | obov | 6.30 | 0.0031 | 11.2 | 7.30 | 6.70 |
| 1933 | S | 7E | MYRS | Ardi | obov | 11.90 | 0.0111 | 12.4 | 8.75 | 8.55 |
| 1934 | M | 7E | MIMO | Inga | fagi | 9.70 | 0.0074 | | 9.35 | 2.55 |
| 1935 | M | 7E | MIMO | Inga | fagi | 16.40 | 0.0211 | | 9.60 | 2.50 |
| 1936 | M | 7E | MIMO | Inga | fagi | 7.70 | 0.0047 | | 9.65 | 2.35 |
| 1937 | S | 7E | NYCT | Guap | frag | 24.80 | 0.0483 | | 9.90 | 1.45 |
| 1938 | S | 7E | RUTA | Zant | mart | 12.80 | 0.0129 | 20.9 | 7.90 | 0.35 |
| 1939 | S | 7E | NYCT | Guap | frag | 5.30 | 0.0022 | | 7.25 | 9.65 |
| 1940 | S | 7F | LAUR | Ocot | cori | 7.80 | 0.0048 | 8.81 | 0.75 | 3.40 |
| 1941 | S | 7F | LAUR | Lica | sali | 11.10 | 0.0097 | 14.5 | 1.00 | 3.10 |
| 1942 | S | 7F | LAUR | Lica | sali | 12.80 | 0.0129 | 13.6 | 2.30 | 1.20 |
| 1943 | S | 7F | MIMO | Inga | fagi | 7.40 | 0.0043 | | 2.80 | 1.07 |
| 1944 | S | 7F | MYRT | Pime | race | 13.30 | 0.0139 | | 5.05 | 0.70 |
| 1945 | S | 7F | MIMO | Inga | fagi | 5.20 | 0.0021 | | 6.95 | 2.30 |
| 1946 | M | 7F | SAPO | Pout | mult | 18.50 | 0.0269 | 20.3 | 8.40 | 2.90 |
| 1947 | M | 7F | SAPO | Pout | mult | 10.10 | 0.0080 | | 8.55 | 2.90 |
| 1948 | M | 7F | SAPO | Pout | mult | 5.30 | 0.0022 | | 8.50 | 3.10 |
| 1949 | S | 7F | MALP | Byrs | cori | 15.20 | 0.0181 | 15.1 | 7.65 | 5.45 |
| 1950 | S | 7F | STER | Guaz | ulmi | 72.70 | 0.4151 | 18.2 | 2.85 | 9.55 |
| 1951 | S | 7F | MYRT | Pime | race | 10.00 | 0.0079 | | 0.60 | 9.70 |
| 1952 | S | 7G | RUTA | Zant | mart | 32.30 | 0.0819 | 37.9 | 0.30 | 2.60 |
| 1953 | S | 7G | MIMO | Inga | fagi | 27.70 | 0.0603 | | 4.45 | 2.40 |
| 1955 | S | 7G | BIGN | Tabe | hete | 48.40 | 0.1840 | | 6.50 | 5.05 |
| 1954a | M | 7G | CLUS | Clus | rose | 7.80 | 0.0048 | | 5.70 | 5.30 |
| 1954b | M | 7G | CLUS | Clus | rose | 10.60 | 0.0088 | 23.4 | 5.70 | 5.30 |
| 1954c | M | 7G | CLUS | Clus | rose | 5.80 | 0.0026 | | 5.70 | 5.30 |
| 1954d | M | 7G | CLUS | Clus | rose | 5.80 | 0.0026 | | 5.70 | 5.30 |
| 1954e | M | 7G | CLUS | Clus | rose | 11.50 | 0.0104 | | 5.70 | 5.30 |
| 1954f | M | 7G | CLUS | Clus | rose | 11.00 | 0.0095 | | 5.70 | 5.30 |
| 1956 | S | 7G | MYRS | Ardi | obov | 6.40 | 0.0032 | 11.2 | 4.80 | 7.00 |
| 1957 | S | 7G | BIGN | Tabe | hete | 15.40 | 0.0186 | 15.8 | 9.00 | 9.90 |
| 1958 | M | 7G | MYRS | Ardi | obov | 8.50 | 0.0057 | | 8.50 | 2.65 |
| 1959 | M | 7G | MYRS | Ardi | obov | 9.40 | 0.0069 | | 9.20 | 1.95 |

APPENDIX I. (Continued)

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1960 | S | 7H | NYCT | Guap | frag | 8.20 | 0.0053 | | 1.40 | 1.20 | |
| 1961 | S | 7H | MYRS | Ardi | obov | 5.60 | 0.0025 | | 0.10 | 7.50 | |
| 1962 | S | 7H | MYRT | Pime | race | 11.20 | 0.0099 | | 0.20 | 9.65 | |
| 1963 | S | 7H | MYRT | Pime | race | 8.10 | 0.0052 | | 3.60 | 9.50 | |
| 1964 | S | 7H | LAUR | Ocot | anti | 17.20 | 0.0232 | 15.8 | 5.40 | 7.50 | |
| 1965 | S | 7H | MYRS | Ardi | obov | 10.10 | 0.0080 | | 4.85 | 3.35 | |
| 1966 | M | 7H | MYRS | Ardi | obov | 5.10 | 0.0020 | | 5.25 | 2.40 | Dd11/86wt |
| 1967 | M | 7H | MYRS | Ardi | obov | 5.70 | 0.0026 | | 5.95 | 2.90 | |
| 1968 | S | 7H | NYCT | Guap | frag | 5.40 | 0.0023 | 6.68 | 3.80 | 0.65 | |
| 1969 | S | 7H | MIMO | Inga | fagi | 5.80 | 0.0026 | | 4.80 | 0.20 | |
| 1970 | S | 7H | LAUR | Lica | sali | 15.20 | 0.0181 | 15.1 | 7.35 | 3.30 | |
| 1971 | S | 7H | MIMO | Inga | fagi | 5.90 | 0.0027 | | 7.95 | 2.65 | |
| 1972 | M | 7H | MYRS | Ardi | obov | 9.80 | 0.0075 | | 7.10 | 5.00 | |
| 1973 | M | 7H | MYRS | Ardi | obov | 8.50 | 0.0057 | | 6.75 | 5.55 | |
| 1974 | S | 7H | BIGN | Tabe | hete | 13.50 | 0.0143 | | 7.00 | 8.30 | |
| 1975 | S | 7H | MYRT | Pime | race | 13.70 | 0.0147 | | 5.80 | 8.00 | |
| 1984 | S | 7H | RUBI | Fara | occi | 5.20 | 0.0021 | | 9.90 | 2.60 | |
| 1976 | S | 7I | BIGN | Tabe | hete | 22.20 | 0.0387 | | 2.20 | 7.95 | |
| 1977 | S | 7I | NYCT | Guap | frag | 6.40 | 0.0032 | | 2.15 | 7.35 | |
| 1978 | M | 7I | MYRS | Ardi | obov | 8.40 | 0.0055 | | 2.65 | 8.25 | |
| 1979 | M | 7I | MYRS | Ardi | obov | 12.90 | 0.0131 | | 2.75 | 8.25 | |
| 1980 | M | 7I | MYRS | Ardi | obov | 5.80 | 0.0026 | | 2.75 | 8.35 | |
| 1981 | S | 7I | RUBI | Fara | occi | 5.00 | 0.0020 | 3.95 | 2.55 | 6.20 | |
| 1982 | S | 7I | NYCT | Guap | frag | 7.50 | 0.0044 | | 2.55 | 2.34 | |
| 1983 | S | 7I | MYRS | Ardi | obov | 7.00 | 0.0038 | | 2.00 | 2.00 | |
| 1985 | S | 7I | MALP | Byrs | cori | 15.60 | 0.0191 | | 0.25 | 1.38 | DEAD 3/86 |
| 1986 | S | 7I | LAUR | Ocot | cori | 11.20 | 0.0099 | 11.2 | 0.00 | 0.74 | WITHROWN85 |
| 1987 | S | 7I | MALP | Byrs | cori | 35.40 | 0.0984 | 21.8 | 3.95 | 0.20 | |
| 1988 | S | 7I | MALP | Byrs | cori | 15.60 | 0.0191 | | 4.65 | 0.35 | |
| 1989 | S | 7I | MYRT | Pime | race | 7.00 | 0.0038 | | 4.30 | 1.30 | |
| 1990 | S | 7I | MALP | Byrs | cori | 12.10 | 0.0115 | | 3.25 | 2.60 | |
| 1991 | S | 7I | FABA | Andi | iner | 7.00 | 0.0038 | 6.38 | 3.95 | 5.90 | |
| 1992 | S | 7I | MALP | Byrs | cori | 18.70 | 0.0275 | | 4.15 | 6.25 | |
| 1993 | S | 7I | MYRS | Ardi | obov | 5.10 | 0.0020 | | 4.10 | 5.40 | |
| 1994 | M | 7I | MALP | Byrs | cori | 17.10 | 0.0230 | | 3.25 | 9.50 | SICK 1/87 |
| 1995 | M | 7I | MALP | Byrs | cori | 7.00 | 0.0038 | | 3.40 | 9.50 | |
| 1996 | M | 7I | MALP | Byrs | cori | 23.90 | 0.0449 | | 3.55 | 9.65 | |
| 1997 | M | 7I | MALP | Byrs | cori | 10.90 | 0.0093 | | 3.75 | 9.70 | |
| 1998 | S | 7I | MALP | Byrs | cori | 8.30 | 0.0054 | | 7.40 | 9.25 | |
| 1999 | S | 7I | BIGN | Tabe | hete | 28.00 | 0.0616 | | 6.80 | 7.90 | |
| 2000 | S | 7I | MYRT | Pime | race | 8.30 | 0.0054 | | 7.20 | 7.60 | |
| 2001 | S | 7I | MIMO | Inga | fagi | 6.80 | 0.0036 | | 0.27 | 4.25 | |
| 2002 | S | 7I | MALP | Byrs | cori | 19.50 | 0.0299 | | 9.50 | 9.60 | |
| 2003 | S | 7I | MIMO | Inga | fagi | 22.60 | 0.0401 | | 7.15 | 4.15 | |
| 2004 | S | 7I | MYRT | Pime | race | 11.30 | 0.0100 | | 7.80 | 3.05 | |
| 2005 | S | 7I | MYRT | Pime | race | 10.10 | 0.0080 | | 8.95 | 2.80 | |
| 2006 | S | 7I | MYRT | Pime | race | 7.30 | 0.0042 | 10.0 | 7.50 | 2.10 | |
| 2007 | S | 7I | MYRT | Pime | race | 5.40 | 0.0023 | | 9.80 | 1.10 | |
| 2008 | S | 7J | MYRT | Pime | race | 8.80 | 0.0061 | | 0.25 | 0.05 | |
| 2009 | S | 7J | MYRT | Pime | race | 7.80 | 0.0048 | | 1.75 | 0.70 | |



101

APPENDIX I. (Continued)

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2010 | S | 7J | MYRT | Pime | race | 8.30 | 0.0054 | | 2.25 | 2.40 | |
| 2011 | S | 7J | MYRT | Pime | race | 5.10 | 0.0020 | | 0.62 | 3.40 | |
| 2012 | S | 7J | MIMO | Inga | fagi | 12.40 | 0.0121 | | 1.05 | 7.40 | |
| 2013 | S | 7J | MALP | Byrs | cori | 6.40 | 0.0032 | 5.77 | 2.20 | 9.20 | |
| 2014 | S | 7J | MALP | Byrs | cori | 14.00 | 0.0154 | | 2.25 | 8.70 | |
| 2015 | S | 7J | MALP | Byrs | cori | 16.60 | 0.0216 | | 2.70 | 7.89 | |
| 2016 | S | 7J | MALP | Byrs | cori | 14.10 | 0.0156 | | 3.45 | 6.10 | |
| 2017 | S | 7J | MALP | Byrs | cori | 6.40 | 0.0032 | | 3.95 | 5.15 | |
| 2018 | S | 7J | MALP | Byrs | cori | 28.70 | 0.0647 | 17.3 | 3.60 | 4.35 | |
| 2019 | S | 7J | MALP | Byrs | cori | 23.50 | 0.0434 | | 5.85 | 2.20 | |
| 2020 | S | 7J | MYRT | Pime | race | 9.20 | 0.0066 | | 5.65 | 3.10 | |
| 2021 | S | 7J | NYCT | Guap | frag | 7.00 | 0.0038 | | 7.50 | 1.69 | |
| 2022 | S | 7J | MYRT | Pime | race | 8.10 | 0.0052 | | 7.80 | 4.20 | |
| 2023 | S | 7J | MYRT | Pime | race | 12.30 | 0.0119 | | 9.90 | 1.80 | |
| 2024 | S | 7J | MYRT | Pime | race | 8.10 | 0.0052 | 11.8 | 8.20 | 7.70 | |
| 2025 | S | 7J | MIMO | Inga | fagi | 12.10 | 0.0115 | | 8.20 | 8.30 | |
| 2026 | S | 7J | MYRT | Pime | race | 5.50 | 0.0024 | | 9.95 | 9.90 | |
| 2027 | S | 7J | MYRT | Pime | race | 8.20 | 0.0053 | | 7.80 | 8.30 | |
| 2028 | S | 7J | MALP | Byrs | cori | 17.80 | 0.0249 | | 9.20 | 8.00 | |
| 2029 | S | 7J | MYRT | Pime | race | 11.00 | 0.0095 | | 7.50 | 8.50 | |
| 2030 | M | 7J | MALP | Byrs | cori | 8.60 | 0.0058 | | 7.20 | 9.00 | |
| 2031 | M | 7J | MALP | Byrs | cori | 16.90 | 0.0224 | 19.1 | 7.25 | 9.20 | |
| 2032 | S | 7J | MIMO | Inga | fagi | 5.30 | 0.0022 | 8.20 | 4.55 | 8.80 | |
| 2033 | S | 7J | MYRT | Pime | race | 9.70 | 0.0074 | | 3.25 | 0.81 | |
| 2034 | S | 8J | MYRT | Pime | race | 9.80 | 0.0075 | | 8.45 | 0.15 | |
| 2035 | M | 8J | MALP | Byrs | cori | 7.20 | 0.0041 | | 8.45 | 0.45 | SICK 11/86 |
| 2036 | M | 8J | MALP | Byrs | cori | 8.00 | 0.0050 | | 8.35 | 1.20 | |
| 2037 | S | 8J | MYRT | Pime | race | 6.60 | 0.0034 | | 9.60 | 3.25 | |
| 2038 | S | 8J | MYRT | Pime | race | 7.50 | 0.0044 | | 9.90 | 5.95 | |
| 2039 | S | 8J | MIMO | Inga | fagi | 8.20 | 0.0053 | | 9.30 | 6.65 | |
| 2040 | S | 8J | MALP | Byrs | cori | 6.30 | 0.0031 | | 6.25 | 8.49 | DEAD 7/86 |
| 2041 | S | 8J | MALP | Byrs | cori | 16.40 | 0.0211 | | 5.70 | 8.17 | |
| 2042 | S | 8J | MYRT | Myrc | citr | 5.80 | 0.0026 | 6.99 | 7.90 | 5.36 | |
| 2043 | S | 8J | AQUI | Ilex | urba | 9.70 | 0.0074 | 10.3 | 7.55 | 2.90 | |
| 2044 | M | 8J | MYRT | Myrc | citr | 6.10 | 0.0029 | | 6.65 | 4.42 | |
| 2045 | M | 8J | MYRT | Myrc | citr | 11.20 | 0.0099 | | 6.50 | 4.50 | |
| 2046 | S | 8J | MYRT | Pime | race | 7.00 | 0.0038 | 10.0 | 5.65 | 5.32 | |
| 2047 | S | 8J | MYRT | Pime | race | 5.30 | 0.0022 | | 4.95 | 4.99 | |
| 2048 | S | 8J | MALP | Byrs | cori | 21.60 | 0.0366 | 17.0 | 6.95 | 2.56 | |
| 2049 | S | 8J | MALP | Byrs | cori | 8.60 | 0.0058 | | 6.30 | 1.40 | |
| 2050 | S | 8J | NYCT | Guap | frag | 6.20 | 0.0030 | | 4.95 | 0.70 | |
| 2051 | S | 8J | MIMO | Inga | fagi | 8.30 | 0.0054 | | 4.95 | 1.90 | |
| 2052 | S | 8J | NYCT | Guap | frag | 5.20 | 0.0021 | 7.90 | 3.00 | 1.20 | |
| 2053 | S | 8J | MYRT | Pime | race | 6.90 | 0.0037 | | 1.25 | 2.10 | |
| 2054 | S | 8J | MALP | Byrs | cori | 11.90 | 0.0111 | | 2.50 | 4.80 | |
| 2055 | S | 8J | MALP | Byrs | cori | 24.30 | 0.0464 | | 1.60 | 5.45 | |
| 2056 | S | 8J | MALP | Byrs | cori | 5.50 | 0.0024 | | 0.90 | 4.60 | |
| 2057 | S | 8J | ARAL | Didy | moro | 12.70 | 0.0127 | 10.0 | 0.55 | 4.60 | |
| 2058 | M | 8J | AQUI | Ilex | urba | 6.30 | 0.0031 | 9.42 | 0.60 | 5.63 | |
| 2059 | M | 8J | AQUI | Ilex | urba | 9.60 | 0.0072 | | 0.48 | 5.77 | |



203

APPENDIX I. (Continued)

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2060 | S | 8J | MALP | Byrs | cori | 14.00 | 0.0154 | 9.42 | 1.15 | 7.00 | |
| 2061 | S | 8J | MALP | Byrs | cori | 6.70 | 0.0035 | | 1.85 | 7.40 | |
| 2062 | S | 8J | MALP | Byrs | cori | 8.60 | 0.0058 | | 1.95 | 8.42 | |
| 2063 | S | 8J | MYRS | Ardi | obov | 6.70 | 0.0035 | 9.11 | 0.22 | 7.77 | |
| 2064 | S | 8J | AQUI | Ilex | urba | 5.20 | 0.0021 | 5.16 | 0.40 | 9.60 | |
| 2065 | S | 8J | MYRS | Ardi | obov | 5.10 | 0.0020 | | 5.60 | 8.85 | |
| 2066 | S | 8J | MYRT | Pime | race | 5.10 | 0.0020 | | 9.46 | 1.98 | |
| 2067 | S | 8J | MYRT | Pime | race | 5.50 | 0.0024 | | 1.80 | 3.42 | DEAD 7/86 |
| 2068 | S | 8I | MALP | Byrs | cori | 8.20 | 0.0053 | | 9.50 | 0.30 | |
| 2069 | S | 8I | MYRT | Pime | race | 5.30 | 0.0022 | | 8.40 | 1.40 | |
| 2070 | S | 8I | MYRT | Pime | race | 11.60 | 0.0106 | | 9.40 | 1.90 | |
| 2071 | S | 8I | MYRT | Pime | race | 5.10 | 0.0020 | | 9.40 | 3.90 | |
| 2072 | S | 8I | MALP | Byrs | cori | 22.20 | 0.0387 | 20.3 | 8.30 | 3.90 | |
| 2073 | S | 8I | MYRT | Pime | race | 6.10 | 0.0029 | | 9.15 | 7.30 | |
| 2074 | S | 8I | MIMO | Inga | fagi | 16.40 | 0.0211 | | 6.90 | 9.49 | |
| 2075 | S | 8I | NYCT | Guap | frag | 5.70 | 0.0026 | | 6.25 | 9.95 | |
| 2076 | S | 8I | MYRS | Ardi | obov | 5.10 | 0.0020 | | 5.85 | 8.85 | |
| 2077 | S | 8I | LAUR | Ocot | sint | 15.60 | 0.0191 | 13.3 | 4.55 | 7.10 | |
| 2078 | S | 8I | RUBI | Guet | scab | 11.80 | 0.0109 | 12.7 | 4.25 | 6.51 | |
| 2079 | S | 8I | RUBI | Fara | occi | 5.70 | 0.0026 | 6.38 | 3.85 | 5.10 | |
| 2080 | S | 8I | MALP | Byrs | cori | 17.00 | 0.0227 | | 6.50 | 6.20 | |
| 2081 | S | 8I | ARAL | Didy | moro | 15.20 | 0.0181 | 13.0 | 5.20 | 5.00 | |
| 2082 | S | 8I | MYRS | Ardi | obov | 7.20 | 0.0041 | 12.7 | 6.65 | 2.50 | |
| 2083 | S | 8I | MYRT | Pime | race | 6.50 | 0.0033 | | 6.50 | 0.95 | |
| 2084 | S | 8I | NYCT | Guap | frag | 6.90 | 0.0037 | | 4.85 | 1.80 | |
| 2085 | S | 8I | NYCT | Guap | frag | 6.10 | 0.0029 | | 3.95 | 2.89 | |
| 2086 | S | 8I | MYRS | Ardi | obov | 5.60 | 0.0025 | | 2.85 | 3.15 | |
| 2087 | S | 8I | MYRS | Ardi | obov | 5.70 | 0.0026 | | 3.70 | 7.35 | |
| 2088 | S | 8I | MYRS | Ardi | obov | 11.30 | 0.0100 | | 2.65 | 7.70 | |
| 2089 | S | 8I | MIMO | Inga | fagi | 19.20 | 0.0290 | | 1.45 | 9.45 | |
| 2090 | S | 8I | NYCT | Guap | frag | 9.00 | 0.0064 | | 0.87 | 9.55 | |
| 2091 | S | 8I | NYCT | Guap | frag | 6.40 | 0.0032 | | 2.15 | 7.09 | |
| 2092 | S | 8I | RUBI | Guet | scab | 9.90 | 0.0077 | | 0.72 | 5.60 | WTRW 2/87 |
| 2093 | S | 8I | MALP | Byrs | cori | 17.20 | 0.0232 | | 1.95 | 2.95 | |
| 2094 | M | 8I | MYRS | Ardi | obov | 6.50 | 0.0033 | | 1.90 | 2.70 | |
| 2095 | M | 8I | MYRS | Ardi | obov | 9.80 | 0.0075 | | 1.90 | 2.51 | |
| 2096 | M | 8I | MYRS | Ardi | obov | 8.00 | 0.0050 | | 1.45 | 2.35 | |
| 2097 | S | 8H | NYCT | Guap | frag | 7.70 | 0.0047 | | 7.75 | 0.50 | |
| 2098 | S | 8H | MYRS | Ardi | obov | 6.50 | 0.0033 | | 7.80 | 1.56 | |
| 2099 | S | 8H | MYRS | Ardi | obov | 8.40 | 0.0055 | | 8.30 | 2.30 | |
| 2100 | S | 8H | THEA | Tern | pedu | 9.60 | 0.0072 | 6.07 | 9.20 | 5.56 | |
| 2101 | S | 8H | MALP | Byrs | cori | 18.30 | 0.0263 | | 9.00 | 9.50 | |
| 2102 | S | 8H | MYRT | Myrc | citr | 7.90 | 0.0049 | 7.59 | 8.80 | 9.10 | |
| 2103 | S | 8H | MIMO | Inga | fagi | 5.00 | 0.0020 | 6.38 | 7.00 | 9.24 | |
| 2104 | S | 8H | CAPP | Mori | amer | 17.10 | 0.0230 | 8.81 | 7.70 | 5.70 | |
| 2105 | S | 8H | MYRS | Ardi | obov | 5.50 | 0.0024 | | 7.25 | 5.45 | |
| 2106 | S | 8H | LAUR | Ocot | cori | 8.70 | 0.0059 | 13.3 | 5.65 | 1.90 | |
| 2107 | S | 8H | MYRT | Pime | race | 9.20 | 0.0066 | | 3.95 | 3.30 | |
| 2108 | M | 8H | LAUR | Ocot | cori | 5.00 | 0.0020 | | 4.45 | 8.20 | |
| 2109 | M | 8H | LAUR | Ocot | cori | 7.90 | 0.0049 | | 4.40 | 7.80 | |



204

APPENDIX I. (Continued)

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2110 | M | 8H | LAUR | Ocot | cori | 9.10 | 0.0065 | | 4.30 | 7.69 | |
| 2111 | S | 8H | LAUR | Ocot | sint | 32.90 | 0.0850 | 23.1 | 3.65 | 9.40 | |
| 2112 | S | 8H | MIMO | Inga | fagi | 7.50 | 0.0044 | | 1.40 | 9.60 | |
| 2113 | S | 8H | LAUR | Ocot | cori | 6.00 | 0.0028 | | 0.49 | 9.01 | |
| 2114 | S | 8H | NYCT | Guap | frag | 17.10 | 0.0230 | | 0.90 | 6.10 | |
| 2115 | S | 8H | MIMO | Inga | fagi | 8.20 | 0.0053 | | 0.60 | 5.85 | |
| 2116 | S | 8H | MYRT | Pime | race | 8.10 | 0.0052 | | 1.25 | 3.92 | |
| 2117 | S | 8H | MYRT | Pime | race | 15.20 | 0.0181 | | 1.45 | 3.40 | |
| 2747 | S | 8H | RUBI | Fara | occi | 5.00 | 0.0020 | | 3.75 | 7.30 | |
| 2118 | S | 8G | MIMO | Inga | fagi | 7.10 | 0.0040 | | 8.60 | 0.45 | |
| 2119 | M | 8G | MYRS | Ardi | obov | 15.10 | 0.0179 | 11.2 | 6.55 | 4.01 | |
| 2120 | M | 8G | MYRS | Ardi | obov | 7.20 | 0.0041 | | 5.80 | 6.20 | |
| 2121 | S | 8G | NYCT | Guap | frag | 6.30 | 0.0031 | | 5.70 | 4.85 | |
| 2122 | S | 8G | BORA | Cord | sulc | 11.80 | 0.0109 | 12.1 | 5.55 | 4.90 | |
| 2123 | S | 8G | MALP | Byrs | cori | 13.40 | 0.0141 | | 6.30 | 7.80 | |
| 2124 | S | 8G | MIMO | Inga | fagi | 10.40 | 0.0085 | | 6.45 | 8.85 | |
| 2125 | S | 8G | MYRT | Pime | race | 11.30 | 0.0100 | | 3.10 | 9.50 | |
| 2126 | S | 8G | MALP | Byrs | cori | 11.40 | 0.0102 | 16.7 | 3.20 | 7.15 | |
| 2127 | S | 8G | LAUR | Ocot | cori | 8.10 | 0.0052 | | 4.10 | 4.90 | WIRW 2/87 |
| 2128 | S | 8G | MIMO | Inga | fagi | 6.00 | 0.0028 | | 5.70 | 2.21 | |
| 2129 | S | 8G | MIMO | Inga | fagi | 7.50 | 0.0044 | | 2.95 | 0.95 | |
| 2130 | S | 8G | MYRS | Ardi | obov | 5.50 | 0.0024 | | 0.75 | 1.20 | |
| 2131 | S | 8G | MIMO | Inga | fagi | 7.10 | 0.0040 | | 0.35 | 4.10 | |
| 2132 | S | 8G | STER | Guaz | ulmi | 10.30 | 0.0083 | 9.72 | 0.40 | 5.85 | |
| 2133 | S | 8F | RUBI | Fara | occi | 5.50 | 0.0024 | 5.77 | 8.60 | 7.10 | |
| 2134 | S | 8F | MALP | Byrs | cori | 35.10 | 0.0968 | 26.4 | 7.95 | 3.65 | |
| 2135 | S | 8F | MIMO | Inga | fagi | 7.90 | 0.0049 | | 8.70 | 1.00 | |
| 2136 | S | 8F | NYCT | Guap | frag | 5.50 | 0.0024 | 7.29 | 5.80 | 4.40 | |
| 2137 | M | 8F | FABA | Andi | iner | 5.80 | 0.0026 | | 4.85 | 4.95 | |
| 2138 | M | 8F | FABA | Andi | iner | 7.00 | 0.0038 | | 4.70 | 5.00 | |
| 2139 | M | 8F | FABA | Andi | iner | 7.60 | 0.0045 | 9.42 | 4.55 | 5.05 | |
| 2140 | S | 8F | MIMO | Inga | fagi | 5.60 | 0.0025 | | 4.30 | 2.95 | |
| 2141 | S | 8F | MIMO | Inga | fagi | 6.40 | 0.0032 | | 2.55 | 6.52 | |
| 2142 | S | 8F | MALP | Byrs | cori | 23.90 | 0.0449 | | 0.90 | 7.10 | |
| 2143 | S | 8F | MALP | Byrs | cori | 22.80 | 0.0408 | | 1.45 | 4.60 | |
| 2144 | S | 8F | BORA | Cord | sulc | 7.10 | 0.0040 | 10.6 | 1.60 | 4.10 | |
| 2145 | S | 8F | LAUR | Ocot | cori | 11.80 | 0.0109 | | 6.70 | 9.50 | |
| 2146 | S | 8F | MYRT | Pime | race | 9.10 | 0.0065 | | 7.05 | 6.35 | DEAD 7/86 |
| 2147 | S | 8F | LAUR | Ocot | cori | 7.30 | 0.0042 | | 0.20 | 0.20 | |
| 2148 | S | 8E | MIMO | Inga | fagi | 7.40 | 0.0043 | 15.8 | 7.55 | 1.48 | |
| 2149 | S | 8E | LAUR | Ocot | cori | 11.40 | 0.0102 | 6.99 | 6.10 | 2.55 | |
| 2150 | S | 8E | LAUR | Ocot | cori | 7.50 | 0.0044 | | 5.50 | 2.70 | DEAD 7/86 |
| 2151 | S | 8E | RUTA | Zant | mart | 20.80 | 0.0340 | 20.3 | 7.75 | 3.82 | |
| 2152 | S | 8E | BORA | Cord | coll | 9.10 | 0.0065 | 13.6 | 8.75 | 4.55 | |
| 2153 | S | 8E | MIMO | Inga | fagi | 7.40 | 0.0043 | | 7.80 | 6.05 | |
| 2154 | S | 8E | MIMO | Inga | fagi | 6.50 | 0.0033 | | 9.65 | 7.10 | |
| 2155 | S | 8E | MIMO | Inga | fagi | 9.40 | 0.0069 | 11.8 | 9.15 | 6.80 | |
| 2156 | M | 8E | MIMO | Inga | fagi | 9.30 | 0.0068 | | 7.75 | 6.30 | |
| 2157 | M | 8E | MIMO | Inga | fagi | 18.70 | 0.0275 | | 7.55 | 6.30 | |
| 2158 | S | 8E | NYCT | Guap | frag | 6.40 | 0.0032 | | 6.95 | 6.45 | |



205

APPENDIX I. (Continued)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 2159 | S | 8E | MYRT | Pime | race | 21.00 | 0.0346 | | 4.60 | 8.50 |
| 2160 | S | 8E | MIMO | Inga | fagi | 6.00 | 0.0028 | | 3.80 | 5.55 |
| 2161 | M | 8E | MYRT | Pime | race | 9.90 | 0.0077 | | 2.15 | 2.75 |
| 2162 | M | 8E | MYRT | Pime | race | 11.60 | 0.0106 | | 2.00 | 2.64 |
| 2163 | M | 8E | MYRT | Pime | race | 5.30 | 0.0022 | | 1.85 | 2.62 |
| 2749 | S | 8E | RUBI | Fara | occi | 5.00 | 0.0020 | | 4.05 | 1.78 |
| 2164 | S | 8D | NYCT | Guap | frag | 10.30 | 0.0083 | 11.5 | 9.25 | 0.25 |
| 2165 | S | 8D | MIMO | Inga | fagi | 5.70 | 0.0026 | | 9.82 | 1.50 |
| 2166 | S | 8D | MIMO | Inga | fagi | 5.40 | 0.0023 | | 9.05 | 2.85 |
| 2167 | S | 8D | MYRT | Pime | race | 11.60 | 0.0106 | | 8.21 | 2.90 |
| 2168 | S | 8D | STER | Guaz | ulmi | 17.50 | 0.0241 | 15.8 | 6.60 | 3.95 |
| 2169 | S | 8D | BORA | Cord | sulc | 14.50 | 0.0165 | 15.5 | 6.05 | 3.75 |
| 2170 | S | 8D | MIMO | Inga | fagi | 21.50 | 0.0363 | | 5.40 | 1.20 |
| 2171 | S | 8D | MIMO | Inga | fagi | 7.70 | 0.0047 | | 4.40 | 2.80 |
| 2172 | M | 8D | CAPP | Mori | amer | 8.30 | 0.0054 | | 2.82 | 0.50 |
| 2173 | M | 8D | CAPP | Mori | amer | 9.00 | 0.0064 | | 2.71 | 0.70 |
| 2174 | M | 8D | CAPP | Mori | amer | 5.70 | 0.0026 | 10.3 | 2.50 | 0.65 |
| 2175 | S | 8D | MIMO | Inga | fagi | 5.90 | 0.0027 | | 2.76 | 2.25 |
| 2176 | S | 8D | MIMO | Inga | fagi | 6.60 | 0.0034 | | 1.90 | 4.05 |
| 2177 | S | 8D | BORA | Cord | sulc | 8.00 | 0.0050 | 11.5 | 1.92 | 4.35 |
| 2178 | M | 8D | MIMO | Inga | fagi | 5.60 | 0.0025 | | 1.56 | 4.75 |
| 2179 | M | 8D | MIMO | Inga | fagi | 8.00 | 0.0050 | | 1.45 | 4.75 |
| 2180 | S | 8D | MALP | Byrs | cori | 20.50 | 0.0330 | | 0.32 | 5.25 |
| 2181 | S | 8D | BORA | Cord | alli | 17.30 | 0.0235 | 18.5 | 0.75 | 6.35 |
| 2182 | S | 8D | MALP | Byrs | cori | 12.70 | 0.0127 | 15.8 | 1.90 | 7.30 |
| 2183 | S | 8D | MYRT | Pime | race | 9.60 | 0.0072 | | 6.20 | 6.20 |
| 2184 | S | 8D | MYRT | Pime | race | 8.60 | 0.0058 | | 8.10 | 9.25 |
| 2185 | S | 8D | MALP | Byrs | cori | 24.70 | 0.0479 | | 3.95 | 9.65 |
| 2186 | S | 8D | BORA | Cord | coll | 5.10 | 0.0020 | | 9.65 | 4.15 |
| 2187 | S | 8C | MIMO | Inga | fagi | 9.70 | 0.0074 | | 7.82 | 1.20 |
| 2188 | S | 8C | MIMO | Inga | fagi | 5.30 | 0.0022 | | 6.90 | 2.50 |
| 2189 | S | 8C | MALP | Byrs | cori | 13.90 | 0.0152 | | 8.25 | 3.10 |
| 2190 | S | 8C | MALP | Byrs | cori | 7.20 | 0.0041 | | 8.04 | 3.70 |
| 2191 | S | 8C | MIMO | Inga | fagi | 11.60 | 0.0106 | | 8.33 | 4.10 |
| 2192 | S | 8C | BIGN | Tabe | hete | 5.10 | 0.0020 | 6.38 | 8.95 | 7.25 |
| 2193 | S | 8C | BIGN | Tabe | hete | 5.50 | 0.0024 | | 8.81 | 7.40 |
| 2194 | S | 8C | MIMO | Inga | fagi | 6.70 | 0.0035 | | 9.40 | 9.70 |
| 2195 | S | 8C | FABA | Andi | iner | 6.30 | 0.0031 | 8.51 | 8.05 | 9.55 |
| 2196 | S | 8C | MIMO | Inga | fagi | 6.50 | 0.0033 | | 5.55 | 8.05 |
| 2197 | S | 8C | MIMO | Inga | fagi | 6.60 | 0.0034 | | 4.60 | 8.40 |
| 2198 | S | 8C | FLAC | Case | guia | 6.60 | 0.0034 | 11.5 | 4.16 | 8.70 |
| 2199 | S | 8C | FLAC | Case | guia | 8.40 | 0.0055 | 11.5 | 4.10 | 8.90 |
| 2200 | S | 8C | MIMO | Inga | fagi | 12.80 | 0.0129 | | 3.30 | 9.60 |
| 2201 | S | 8C | FLAC | Case | guia | 8.80 | 0.0061 | 10.0 | 3.82 | 4.85 |
| 2202 | S | 8C | MALP | Byrs | cori | 20.30 | 0.0324 | | 1.82 | 4.05 |
| 2203 | S | 8C | BORA | Cord | sulc | 9.60 | 0.0072 | 12.1 | 1.52 | 4.35 |
| 2204 | S | 8C | LAUR | Ocot | cori | 7.30 | 0.0042 | | 2.26 | 2.30 |
| 2205 | S | 8C | MIMO | Inga | fagi | 9.80 | 0.0075 | | 2.00 | 1.10 |
| 2206 | S | 8C | MIMO | Inga | fagi | 10.00 | 0.0079 | | 2.82 | 1.75 |
| 2207 | S | 8C | STER | Guaz | ulmi | 29.90 | 0.0702 | 15.8 | 2.55 | 3.00 |



206

APPENDIX I. (Continued)

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2208 | S | 8B | OLEA | Lino | cari | 6.20 | 0.0030 | 7.29 | 8.75 | 3.10 | |
| 2209 | S | 8B | MIMO | Inga | fagi | 14.90 | 0.0174 | | 9.35 | 5.90 | |
| 2210 | S | 8B | RUBI | Fara | occi | 5.10 | 0.0020 | 6.07 | 8.30 | 6.20 | |
| 2211 | S | 8B | OLEA | Lino | cari | 6.00 | 0.0028 | | 7.54 | 5.70 | |
| 2212 | S | 8B | NYCT | Guap | frag | 27.40 | 0.0590 | | 7.32 | 6.85 | |
| 2213 | S | 8B | OLEA | Lino | cari | 7.90 | 0.0049 | | 6.70 | 9.50 | DEAD 7/86 |
| 2214 | S | 8B | CAPP | Capp | indi | 6.30 | 0.0031 | | 3.50 | 8.90 | WITHRW 2/8 |
| 2215 | S | 8B | NYCT | Guap | frag | 5.80 | 0.0026 | | 2.45 | 8.70 | |
| 2216 | S | 8B | BORA | Bour | succ | 10.10 | 0.0080 | 6.68 | 5.62 | 7.80 | |
| 2217 | M | 8B | NYCT | Guap | frag | 5.40 | 0.0023 | | 0.30 | 7.85 | |
| 2218 | M | 8B | NYCT | Guap | frag | 11.50 | 0.0104 | | 0.25 | 7.75 | |
| 2219 | S | 8B | OLEA | Lino | cari | 5.20 | 0.0021 | | 2.81 | 5.75 | |
| 2220 | S | 8B | PHYT | Tric | octa | 6.30 | 0.0031 | | 3.21 | 4.80 | |
| 2221 | M | 8B | FLAC | Case | guia | 10.60 | 0.0088 | 11.5 | 5.04 | 4.95 | |
| 2222 | M | 8B | FLAC | Case | guia | 7.70 | 0.0047 | | 5.89 | 6.05 | |
| 2223 | S | 8B | OLEA | Lino | cari | 6.50 | 0.0033 | | 4.80 | 3.05 | |
| 2224 | S | 8B | OLEA | Lino | cari | 7.90 | 0.0049 | 11.5 | 5.64 | 1.07 | |
| 2225 | M | 8B | RUTA | Amyr | elem | 7.40 | 0.0043 | 7.59 | 6.52 | 2.40 | |
| 2226 | M | 8B | RUTA | Amyr | elem | 7.80 | 0.0048 | | 6.85 | 2.60 | |
| 2227 | S | 8B | NYCT | Guap | frag | 8.20 | 0.0053 | 11.2 | 6.95 | 2.70 | |
| 2228 | S | 8B | OLEA | Lino | cari | 5.30 | 0.0022 | | 3.88 | 2.05 | |
| 2229 | M | 8B | OLEA | Lino | cari | 5.40 | 0.0023 | | 2.52 | 2.90 | |
| 2230 | M | 8B | OLEA | Lino | cari | 6.70 | 0.0035 | | 2.66 | 2.85 | |
| 2231 | S | 8B | OLEA | Lino | cari | 6.00 | 0.0028 | | 1.65 | 2.75 | |
| 2232 | S | 8B | OLEA | Lino | cari | 6.60 | 0.0034 | | 1.68 | 2.95 | |
| 2233 | M | 8B | OLEA | Lino | cari | 7.80 | 0.0048 | | 2.30 | 1.50 | |
| 2234 | M | 8B | OLEA | Lino | cari | 6.30 | 0.0031 | | 2.42 | 1.40 | |
| 2235 | S | 8B | NYCT | Guap | frag | 5.40 | 0.0023 | | 3.05 | 0.70 | |
| 2236 | M | 8A | MORA | Ficu | trig | 25.40 | 0.0507 | | 8.48 | 3.20 | |
| 2237 | M | 8A | MORA | Ficu | trig | 32.00 | 0.0804 | 11.5 | 8.70 | 2.80 | |
| 2238 | M | 8A | MORA | Ficu | trig | 33.00 | 0.0855 | | 9.45 | 3.05 | |
| 2239 | S | 8A | OLEA | Lino | cari | 5.50 | 0.0024 | | 9.95 | 6.00 | |
| 2240 | S | 8A | NYCT | Guap | frag | 8.80 | 0.0061 | | 9.20 | 6.25 | |
| 2241 | M | 8A | CAPP | Capp | indi | 6.60 | 0.0034 | | 8.82 | 6.10 | |
| 2242 | M | 8A | CAPP | Capp | indi | 5.30 | 0.0022 | 6.38 | 8.82 | 6.40 | |
| 2243 | S | 8A | OLEA | Lino | cari | 4.60 | 0.0017 | | 7.30 | 7.10 | |
| 2244 | S | 8A | OLEA | Lino | cari | 6.90 | 0.0037 | | 7.98 | 7.60 | |
| 2245 | S | 8A | OLEA | Lino | cari | 6.20 | 0.0030 | | 2.00 | 9.10 | DEAD 3/86 |
| 2246 | M | 8A | CAPP | Mori | amer | 6.20 | 0.0030 | | 3.50 | 8.90 | WITRW 2/87 |
| 2247 | M | 8A | CAPP | Mori | amer | 5.90 | 0.0027 | | 3.00 | 8.80 | |
| 2248 | S. | 8A | OLEA | Lino | cari | 7.40 | 0.0043 | | 0.50 | 7.25 | |
| 2249 | S | 8A | BORA | Cord | alli | 16.30 | 0.0209 | | 3.25 | 6.80 | |
| 2250 | S | 8A | MYRT | Euge | mont | 10.40 | 0.0085 | | 2.95 | 5.80 | |
| 2251 | S | 8A | OLEA | Lino | cari | 9.70 | 0.0074 | | 2.72 | 6.90 | DEAD 7/86 |
| 2252 | S | 8A | OLEA | Lino | cari | 6.40 | 0.0032 | | 3.40 | 6.10 | |
| 2253 | S | 8A | MYRT | Euge | mont | 12.60 | 0.0125 | | 4.97 | 6.30 | |
| 2254 | S | 8A | OLEA | Lino | cari | 6.90 | 0.0037 | | 4.92 | 5.40 | |
| 2255 | S | 8A | OLEA | Lino | cari | 5.70 | 0.0026 | | 5.40 | 3.20 | |
| 2256 | S | 8A | OLEA | Lino | cari | 7.70 | 0.0047 | | 5.62 | 3.30 | |
| 2257 | M | 8A | CAPP | Mori | amer | 9.50 | 0.0071 | 7.59 | 5.82 | 3.50 | |



201

APPENDIX I. (Continued)

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2258 | M | 8A | CAPP | Mori | amer | 5.00 | 0.0020 | | 5.75 | 3.70 | |
| 2259 | M | 8A | CAPP | Mori | amer | 6.80 | 0.0036 | | 6.67 | 3.25 | |
| 2260 | M | 8A | CAPP | Capp | cyno | 6.20 | 0.0030 | 4.86 | 7.05 | 2.30 | |
| 2261 | M | 8A | CAPP | Capp | cyno | 6.60 | 0.0034 | | 7.85 | 2.65 | |
| 2262 | M | 8A | NYCT | Guap | frag | 42.90 | 0.1445 | | 7.99 | 0.25 | |
| 2750 | M | 8A | NYCT | Guap | frag | 13.50 | 0.0143 | | 8.32 | 0.21 | |
| 2263 | S | 8A | OLEA | Lino | cari | 9.70 | 0.0074 | | 4.15 | 0.90 | |
| 2264 | S | 8A | NYCT | Guap | frag | 14.40 | 0.0163 | | 2.30 | 1.40 | |
| 2265 | S | 8A | RHAM | Krug | ferr | 10.30 | 0.0083 | 7.29 | 1.45 | 1.90 | |
| 2266 | S | 8A | MIMO | Acac | muri | 20.70 | 0.0337 | | 0.57 | 1.75 | |
| 2267 | M | 8A | CELA | Mayt | elli | 13.00 | 0.0133 | 12.1 | 0.82 | 0.80 | |
| 2268 | M | 8A | CELA | Mayt | elli | 19.10 | 0.0287 | | 0.82 | 0.65 | |
| 2269 | M | 8A | CELA | Mayt | elli | 23.60 | 0.0437 | | 0.82 | 0.50 | |
| 2270 | M | 8A | CELA | Mayt | elli | 11.50 | 0.0104 | | 0.79 | 0.20 | |
| 2271 | M | 9A | CLUS | Clus | rose | 31.80 | 0.0794 | 12.4 | 1.15 | 2.10 | VINE |
| 2271a | M | 9A | CLUS | Clus | rose | 7.50 | 0.0044 | | 1.42 | 1.40 | |
| 2751 | M | 9A | CLUS | Clus | rose | 12.40 | 0.0121 | | 1.87 | 3.10 | |
| 2272 | S | 9A | OLEA | Lino | cari | 6.60 | 0.0034 | | 1.42 | 1.40 | |
| 2273 | S | 9A | RHAM | Krug | ferr | 5.00 | 0.0020 | 7.29 | 2.45 | 0.04 | |
| 2274 | S | 9A | LAUR | Ocot | cori | 5.40 | 0.0023 | | 2.70 | 2.05 | |
| 2275 | S | 9A | LAUR | Ocot | cori | 6.00 | 0.0028 | | 2.45 | 4.05 | |
| 2276 | S | 9A | NYCT | Guap | frag | 6.40 | 0.0032 | | 1.46 | 4.20 | |
| 2277 | S | 9A | OLEA | Lino | cari | 7.60 | 0.0045 | | 1.92 | 5.35 | |
| 2278 | S | 9A | FLAC | Casa | guia | 7.50 | 0.0044 | 8.51 | 1.01 | 7.05 | |
| 2279 | S | 9A | MYRT | Pime | race | 6.20 | 0.0030 | | 0.78 | 7.95 | |
| 2280 | S | 9A | OLEA | Lino | cari | 5.00 | 0.0020 | 5.77 | 1.19 | 7.55 | |
| 2281 | S | 9A | VERB | Cith | frut | 13.00 | 0.0133 | 13.3 | 1.21 | 7.65 | SICK 3/86 |
| 2282 | S | 9A | MYRT | Pime | race | 5.20 | 0.0021 | | 2.75 | 5.20 | |
| 2283 | S | 9A | RHAM | Krug | ferr | 9.00 | 0.0064 | 8.51 | 3.40 | 4.30 | |
| 2284 | S | 9A | NYCT | Guap | frag | 10.00 | 0.0079 | | 2.80 | 7.15 | |
| 2285 | S | 9A | MYRS | Ardi | obov | 5.60 | 0.0025 | | 2.90 | 9.00 | |
| 2286 | S | 9A | NYCT | Guap | frag | 9.50 | 0.0071 | | 4.25 | 6.90 | SICK 3/86 |
| 2287 | S | 9A | OLEA | Lino | cari | 6.70 | 0.0035 | | 6.06 | 2.30 | |
| 2288 | S | 9A | BORA | Bour | succ | 16.20 | 0.0206 | 8.51 | 6.10 | 2.45 | SICK 3/86 |
| 2289 | S | 9A | NYCT | Guap | frag | 7.70 | 0.0047 | | 1.50 | 6.72 | |
| 2290 | S | 9A | CAPP | Capp | cyno | 10.00 | 0.0079 | 4.55 | 8.22 | 0.07 | |
| 2291 | S | 9A | NYCT | Guap | frag | 8.40 | 0.0055 | | 8.76 | 0.21 | |
| 2292 | S | 9A | NYCT | Guap | frag | 14.90 | 0.0174 | | 9.22 | 0.15 | |
| 2293 | S | 9A | VERB | Cith | frut | 12.10 | 0.0115 | 7.59 | 9.52 | 2.70 | |
| 2294 | S | 9A | NYCT | Guap | frag | 7.40 | 0.0043 | | 5.30 | 3.80 | |
| 2295 | S | 9A | FABA | Sabi | flor | 6.50 | 0.0033 | 6.38 | 6.09 | 4.10 | |
| 2296 | S | 9A | NYCT | Guap | frag | 24.30 | 0.0464 | | 8.62 | 4.55 | |
| 2297 | S | 9A | NYCT | Guap | frag | 17.00 | 0.0227 | | 6.45 | 8.20 | |
| 2298 | S | 9A | NYCT | Guap | frag | 5.20 | 0.0021 | | 7.10 | 7.50 | |
| 2299 | S | 9A | LAUR | Ocot | cori | 6.00 | 0.0028 | | 9.01 | 7.65 | |
| 2300 | S | 9A | PALM | Cocc | alta | 9.00 | 0.0064 | 12.7 | 4.50 | 8.85 | |
| 2301 | S | 9B | NYCT | Guap | frag | 7.90 | 0.0049 | | 0.82 | 0.75 | |
| 2302 | S | 9B | CAPP | Capp | cyno | 9.70 | 0.0074 | | 1.09 | 1.25 | SICK7/86 |
| 2303 | S | 9B | MYRS | Ardi | obov | 10.50 | 0.0087 | | 2.96 | 0.70 | WIRW 2/87 |
| 2304 | M | 9B | LAUR | Ocot | cori | 20.90 | 0.0343 | | 2.61 | 2.85 | |



206

APPENDIX I. (Continued)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 2305 | M | 9B | LAUR | Ocot | cori | 7.50 | 0.0044 | | 2.61 | 3.10 |
| 2306 | S | 9B | MYRS | Ardi | obov | 9.30 | 0.0068 | 8.81 | 3.35 | 2.70 |
| 2307 | S | 9B | MIMO | Inga | fagi | 17.30 | 0.0235 | | 5.21 | 1.75 |
| 2308 | S | 9B | BORA | Cord | alli | 15.40 | 0.0186 | 14.8 | 7.62 | 0.56 |
| 2309 | S | 9B | MIMO | Inga | fagi | 9.40 | 0.0069 | | 8.30 | 0.40 |
| 2310 | S | 9B | CAPP | Capp | cyno | 6.10 | 0.0029 | 5.77 | 9.30 | 0.56 |
| 2311 | S | 9B | LAUR | Ocot | cori | 6.70 | 0.0035 | | 9.85 | 2.00 |
| 2312 | S | 9B | MIMO | Inga | fagi | 6.50 | 0.0033 | 7.90 | 8.60 | 2.00 |
| 2313 | S | 9B | MIMO | Inga | fagi | 12.70 | 0.0127 | | 7.55 | 2.20 |
| 2314 | S | 9B | LAUR | Ocot | cori | 9.60 | 0.0072 | | 5.85 | 4.05 |
| 2315 | S | 9B | NYCT | Guap | frag | 5.80 | 0.0026 | | 5.80 | 4.15 |
| 2316 | M | 9B | MYRS | Ardi | obov | 5.90 | 0.0027 | | 0.35 | 5.70 |
| 2317 | M | 9B | MYRS | Ardi | obov | 9.50 | 0.0071 | | 0.60 | 5.15 |
| 2318 | S | 9B | OLEA | Lino | cari | 6.40 | 0.0032 | 8.81 | 3.00 | 6.45 |
| 2319 | S | 9B | MYRT | Pime | race | 7.40 | 0.0043 | | 3.20 | 6.20 |
| 2320 | S | 9B | MIMO | Inga | fagi | 11.70 | 0.0108 | | 3.25 | 6.75 |
| 2321 | S | 9B | MYRT | Pime | race | 15.90 | 0.0199 | | 4.00 | 7.10 |
| 2322 | S | 9B | MIMO | Inga | fagi | 8.50 | 0.0057 | | 3.25 | 9.30 |
| 2323 | S | 9B | MIMO | Inga | fagi | 12.40 | 0.0121 | | 4.95 | 8.90 |
| 2324 | S | 9B | LAUR | Ocot | cori | 10.30 | 0.0083 | | 6.80 | 5.20 |
| 2325 | S | 9B | MIMO | Inga | fagi | 5.30 | 0.0022 | | 6.60 | 6.85 |
| 2326 | S | 9B | BORA | Cord | sulc | 11.90 | 0.0111 | 13.3 | 8.05 | 3.40 |
| 2327 | S | 9B | LAUR | Ocot | cori | 8.10 | 0.0052 | | 9.20 | 3.00 |
| 2328 | S | 9B | MIMO | Inga | fagi | 6.30 | 0.0031 | | 8.52 | 5.80 |
| 2329 | S | 9B | VERB | Cith | frut | 9.10 | 0.0065 | 10.6 | 8.70 | 9.20 |
| 2752 | S | 9B | RUBI | Fara | occi | 5.10 | 0.0020 | 5.77 | 1.50 | 7.25 |
| 2330 | S | 9C | MIMO | Inga | fagi | 6.70 | 0.0035 | | 1.40 | 0.25 |
| 2331 | S | 9C | BORA | Cord | sulc | 9.70 | 0.0074 | 12.4 | 3.92 | 0.62 |
| 2332 | S | 9C | MALP | Byrs | cori | 19.80 | 0.0308 | 17.9 | 4.45 | 0.50 |
| 2333 | S | 9C | MIMO | Inga | fagi | 6.50 | 0.0033 | | 4.85 | 1.40 |
| 2334 | S | 9C | MYRT | Pime | race | 13.60 | 0.0145 | 13.0 | 4.13 | 2.85 |
| 2335 | S | 9C | MALP | Byrs | cori | 9.40 | 0.0069 | | 3.62 | 3.95 |
| 2336 | S | 9C | MIMO | Inga | fagi | 14.30 | 0.0161 | | 1.40 | 7.70 |
| 2337 | S | 9C | MALP | Byrs | cori | 21.60 | 0.0366 | | 2.30 | 8.20 |
| 2338 | S | 9C | MALP | Byrs | cori | 15.60 | 0.0191 | | 2.20 | 9.40 |
| 2339 | S | 9C | MIMO | Inga | fagi | 5.50 | 0.0024 | | 5.01 | 6.20 |
| 2340 | M | 9C | MALP | Byrs | cori | 18.90 | 0.0281 | | 5.30 | 6.35 |
| 2341 | M | 9C | MALP | Byrs | cori | 13.00 | 0.0133 | | 5.30 | 6.70 |
| 2342 | M | 9C | MALP | Byrs | cori | 17.90 | 0.0252 | | 6.40 | 2.70 |
| 2343 | M | 9C | MALP | Byrs | cori | 15.40 | 0.0186 | | 6.42 | 3.00 |
| 2344 | S | 9C | BORA | Cord | sulc | 10.00 | 0.0079 | 11.5 | 1.30 | 2.95 |
| 2345 | S | 9C | MIMO | Inga | fagi | 7.10 | 0.0040 | 10.0 | 6.25 | 5.25 |
| 2346 | S | 9C | NYCT | Guap | frag | 5.30 | 0.0022 | | 8.00 | 4.55 |
| 2347 | M | 9C | MYRT | Pime | race | 10.20 | 0.0082 | | 8.20 | 5.40 |
| 2348 | M | 9C | MYRT | Pime | race | 10.70 | 0.0090 | | 8.20 | 5.30 |
| 2349 | S | 9C | MIMO | Inga | fagi | 6.30 | 0.0031 | 9.11 | 8.00 | 8.35 |
| 2350 | S | 9C | MIMO | Inga | fagi | 6.20 | 0.0030 | | 7.00 | 8.75 |
| 2351 | M | 9C | MALP | Byrs | cori | 11.80 | 0.0109 | | 6.90 | 8.90 |
| 2352 | M | 9C | MALP | Byrs | cori | 13.00 | 0.0133 | | 7.15 | 9.05 |
| 2753 | S | 9C | BIGN | Tabe | hete | 5.10 | 0.0020 | 7.29 | 8.85 | 0.27 |



101

APPENDIX I. (Continued)

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2353 | S | 9D | NYCT | Guap | frag | 5.20 | 0.0021 | | 1.32 | 0.04 | |
| 2354 | S | 9D | MIMO | Inga | fagi | 10.90 | 0.0093 | | 1.25 | 1.65 | |
| 2355 | S | 9D | MIMO | Inga | fagi | 5.70 | 0.0026 | 7.59 | 2.45 | 7.80 | |
| 2356 | S | 9D | MALP | Byrs | cori | 26.50 | 0.0552 | 20.6 | 3.08 | 9.10 | |
| 2357 | S | 9D | MIMO | Inga | fagi | 7.30 | 0.0042 | | 2.95 | 9.70 | |
| 2358 | S | 9D | MALP | Byrs | cori | 6.90 | 0.0037 | | 3.60 | 9.75 | |
| 2359 | S | 9D | MIMO | Inga | fagi | 5.10 | 0.0020 | | 3.15 | 8.55 | |
| 2360 | S | 9D | MIMO | Inga | fagi | 5.30 | 0.0022 | | 3.20 | 8.15 | |
| 2361 | S | 9D | MYRT | Pime | race | 8.60 | 0.0058 | | 5.50 | 8.30 | |
| 2362 | S | 9D | MALP | Byrs | cori | 8.50 | 0.0057 | | 6.25 | 9.75 | |
| 2363 | S | 9D | RUTA | Zant | mart | 12.50 | 0.0123 | 17.3 | 7.90 | 9.65 | |
| 2364 | S | 9D | STER | Guaz | ulmi | 15.30 | 0.0184 | 15.5 | 9.20 | 8.60 | |
| 2365 | S | 9D | MALP | Byrs | cori | 27.30 | 0.0585 | | 7.80 | 7.35 | |
| 2366 | S | 9D | RUBI | Guet | scab | 5.50 | 0.0024 | 9.72 | 8.16 | 7.45 | |
| 2367 | S | 9D | MIMO | Inga | fagi | 7.00 | 0.0038 | | 8.30 | 7.85 | |
| 2368 | S | 9D | MIMO | Inga | fagi | 7.90 | 0.0049 | | 8.20 | 5.90 | |
| 2369 | S | 9D | FABA | Andi | iner | 8.10 | 0.0052 | 8.51 | 8.70 | 3.90 | |
| 2370 | S | 9D | MIMO | Inga | fagi | 7.10 | 0.0040 | | 9.05 | 2.00 | |
| 2371 | S | 9D | MALP | Byrs | cori | 23.00 | 0.0415 | | 9.10 | 0.30 | |
| 2372 | S | 9E | MALP | Byrs | cori | 18.90 | 0.0281 | | 0.35 | 2.50 | |
| 2373 | S | 9E | MALP | Byrs | cori | 24.60 | 0.0475 | 19.7 | 1.20 | 1.30 | |
| 2374 | S | 9E | MIMO | Inga | fagi | 10.90 | 0.0093 | | 1.60 | 1.85 | |
| 2375 | S | 9E | MALP | Byrs | cori | 21.30 | 0.0356 | | 1.79 | 0.20 | |
| 2376 | S | 9E | MIMO | Inga | fagi | 10.40 | 0.0085 | | 2.85 | 1.40 | |
| 2377 | S | 9E | NYCT | Guap | frag | 5.70 | 0.0026 | | 3.40 | 0.45 | SICK 3/86 |
| 2378 | S | 9E | MIMO | Inga | fagi | 19.40 | 0.0296 | | 5.20 | 0.62 | |
| 2379 | S | 9E | MYRT | Pime | race | 11.80 | 0.0109 | | 5.45 | 3.55 | |
| 2380 | S | 9E | MYRT | Pime | race | 6.20 | 0.0030 | 8.81 | 2.35 | 6.35 | |
| 2381 | S | 9E | MIMO | Inga | fagi | 12.90 | 0.0131 | | 1.90 | 6.60 | |
| 2382 | S | 9E | MYRT | Pime | race | 9.50 | 0.0071 | | 1.13 | 9.30 | |
| 2383 | S | 9E | STER | Guaz | ulmi | 18.00 | 0.0254 | 16.1 | 2.00 | 8.40 | |
| 2384 | S | 9E | MYRT | Pime | race | 16.70 | 0.0219 | | 4.50 | 5.60 | |
| 2385 | S | 9E | MYRT | Pime | race | 5.40 | 0.0023 | | 7.65 | 2.45 | |
| 2386 | S | 9E | MYRT | Pime | race | 15.60 | 0.0191 | | 7.70 | 3.75 | |
| 2387 | S | 9E | BIGN | Tabe | hete | 43.50 | 0.1486 | 25.8 | 8.50 | 4.50 | |
| 2388 | S | 9E | RUTA | Zant | mart | 9.30 | 0.0068 | 15.8 | 9.20 | 4.15 | |
| 2389 | S | 9E | MYRT | Pime | race | 6.30 | 0.0031 | | 8.91 | 5.80 | |
| 2390 | S | 9E | MYRT | Pime | race | 10.40 | 0.0085 | | 9.90 | 6.35 | |
| 2391 | S | 9E | MYRT | Pime | race | 9.30 | 0.0068 | | 9.00 | 8.00 | |
| 2392 | S | 9E | MYRT | Pime | race | 6.00 | 0.0028 | | 7.10 | 7.15 | |
| 2393 | S | 9E | MYRT | Pime | race | 23.60 | 0.0437 | | 6.70 | 9.55 | |
| 2394 | S | 9E | MYRT | Pime | race | 20.20 | 0.0320 | | 8.60 | 9.50 | |
| 2395 | M | 9F | MYRT | Pime | race | 24.90 | 0.0487 | | 1.40 | 9.30 | |
| 2396 | M | 9F | MYRT | Pime | race | 14.10 | 0.0156 | | 1.55 | 9.15 | |
| 2397 | S | 9F | MYRT | Pime | race | 15.70 | 0.0194 | | 2.20 | 9.20 | |
| 2398 | S | 9F | MYRT | Pime | race | 5.40 | 0.0023 | | 0.60 | 6.50 | |
| 2399 | S | 9F | MYRT | Pime | race | 6.00 | 0.0028 | | 0.35 | 4.55 | |
| 2400 | S | 9F | RUTA | Zant | mart | 9.40 | 0.0069 | 15.5 | 0.40 | 2.85 | |
| 2401 | S | 9F | MYRT | Pime | race | 5.30 | 0.0022 | | 3.01 | 2.90 | |
| 2402 | S | 9F | RUTA | Zant | mart | 9.40 | 0.0069 | 19.1 | 4.85 | 2.60 | |

APPENDIX I. (Continued)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 2403 | S | 9F | ARAL | Didy | moro | 15.90 | 0.0199 | 15.5 | 8.00 | 0.62 |
| 2404 | S | 9F | RUBI | Fara | occi | 7.40 | 0.0043 | 5.16 | 7.75 | 4.30 |
| 2405 | S | 9F | STER | Guaz | ulmi | 20.20 | 0.0320 | 17.6 | 7.70 | 6.35 |
| 2406 | S | 9F | LAUR | Ocot | cori | 11.80 | 0.0109 | 13.3 | 5.60 | 7.60 |
| 2407 | S | 9F | RUBI | Fara | occi | 5.40 | 0.0023 | 3.64 | 5.95 | 7.30 |
| 2408 | S | 9F | LAUR | Ocot | cori | 6.90 | 0.0037 | | 7.40 | 8.50 |
| 2409 | S | 9F | ARAL | Didy | moro | 12.50 | 0.0123 | 15.5 | 7.85 | 8.85 |
| 2410 | S | 9F | MYRT | Pime | race | 6.50 | 0.0033 | | 9.10 | 8.90 |
| 2411 | S | 9F | MYRT | Pime | race | 9.20 | 0.0066 | | 8.85 | 7.05 |
| 2412 | S | 9F | LAUR | Ocot | cori | 11.00 | 0.0095 | 12.7 | 9.60 | 6.45 |
| 2413 | S | 9G | RUTA | Zant | mart | 5.80 | 0.0026 | 9.42 | 1.20 | 1.15 |
| 2414 | S | 9G | MIMO | Inga | fagi | 9.50 | 0.0071 | | 4.40 | 4.30 |
| 2415 | S | 9G | MORA | Ficu | citr | 9.30 | 0.0068 | 10.6 | 4.65 | 6.80 |
| 2416 | S | 9G | RUBI | Fara | occi | 5.00 | 0.0020 | 7.29 | 4.40 | 7.70 |
| 2417 | S | 9G | MIMO | Inga | fagi | 8.00 | 0.0050 | | 3.95 | 7.90 |
| 2418 | S | 9G | RUBI | Fara | occi | 6.00 | 0.0028 | 4.55 | 3.90 | 8.25 |
| 2419 | S | 9G | MIMO | Inga | fagi | 20.30 | 0.0324 | 14.5 | 4.40 | 8.95 |
| 2420 | S | 9G | MIMO | Inga | fagi | 6.00 | 0.0028 | | 7.20 | 4.60 |
| 2421 | S | 9G | MALP | Byrs | cori | 39.20 | 0.1207 | | 7.05 | 2.60 |
| 2422 | S | 9G | LAUR | Ocot | cori | 8.80 | 0.0061 | | 7.10 | 0.50 |
| 2423 | S | 9G | MIMO | Inga | fagi | 6.60 | 0.0034 | | 8.80 | 1.90 |
| 2424 | S | 9G | STER | Guaz | ulmi | 20.70 | 0.0337 | 14.2 | 8.70 | 2.60 |
| 2425 | S | 9G | NYCT | Guap | frag | 8.50 | 0.0057 | | 9.50 | 2.65 |
| 2426 | S | 9G | MIMO | Inga | fagi | 7.70 | 0.0047 | | 9.30 | 6.55 |
| 2427 | S | 9G | FLAC | Case | guia | 6.80 | 0.0036 | 6.68 | 8.85 | 6.90 |
| 2428 | S | 9G | MYRS | Ardi | obov | 6.10 | 0.0029 | 7.59 | 7.30 | 8.95 |
| 2429 | S | 9G | MIMO | Inga | fagi | 9.10 | 0.0065 | | 7.92 | 8.90 |
| 2430 | M | 9G | MYRT | Pime | race | 6.10 | 0.0029 | | 8.90 | 8.80 |
| 2431 | M | 9G | MYRT | Pime | race | 6.10 | 0.0029 | | 9.10 | 8.70 |
| 2432 | S | 9G | MIMO | Inga | fagi | 8.70 | 0.0059 | | 9.25 | 8.50 |
| 2433 | M | 9H | LAUR | Ocot | cori | 10.20 | 0.0082 | | 1.80 | 9.25 |
| 2434 | M | 9H | LAUR | Ocot | cori | 11.00 | 0.0095 | | 1.75 | 9.45 |
| 2435 | S | 9H | MIMO | Inga | fagi | 8.90 | 0.0062 | | 1.10 | 4.60 |
| 2436 | M | 9H | MALP | Byrs | cori | 19.20 | 0.0290 | | 1.85 | 2.85 |
| 2437 | M | 9H | MALP | Byrs | cori | 23.00 | 0.0415 | | 1.95 | 3.00 |
| 2438 | S | 9H | MALP | Byrs | cori | 19.30 | 0.0293 | | 5.00 | 4.40 |
| 2439 | S | 9H | MALP | Byrs | cori | 23.20 | 0.0423 | | 6.00 | 3.80 |
| 2440 | S | 9H | LAUR | Ocot | cori | 11.10 | 0.0097 | | 6.40 | 6.55 |
| 2441 | S | 9H | LAUR | Ocot | cori | 12.70 | 0.0127 | | 7.05 | 4.90 |
| 2442 | S | 9H | RUBI | Guet | scab | 9.10 | 0.0065 | 12.7 | 8.10 | 7.10 |
| 2443 | M | 9H | MYRS | Ardi | obov | 12.40 | 0.0121 | | 7.40 | 8.05 |
| 2444 | M | 9H | MYRS | Ardi | obov | 8.50 | 0.0057 | | 7.50 | 8.05 |
| 2445 | M | 9H | MYRS | Ardi | obov | 5.30 | 0.0022 | | 7.80 | 7.90 |
| 2446 | M | 9H | MYRS | Ardi | obov | 8.10 | 0.0052 | | 7.85 | 8.20 |
| 2447 | M | 9H | MYRS | Ardi | obov | 8.00 | 0.0050 | 9.11 | 8.00 | 8.25 |
| 2448 | S | 9H | MYRS | Ardi | obov | 6.10 | 0.0029 | | 9.90 | 9.55 |
| 2449 | S | 9I | MYRT | Pime | race | 10.50 | 0.0087 | 10.9 | 0.95 | 8.45 |
| 2450 | S | 9I | LAUR | Ocot | cori | 6.70 | 0.0035 | 9.72 | 3.20 | 7.55 |
| 2451 | S | 9I | LAUR | Ocot | cori | 8.60 | 0.0058 | 9.72 | 2.90 | 6.75 |
| 2452 | S | 9I | MYRS | Ardi | obov | 5.30 | 0.0022 | 8.81 | 0.10 | 6.85 |



211

APPENDIX I. (Continued)

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2453 | S | 9I | MYRS | Ardi | obov | 5.10 | 0.0020 | | 3.05 | 5.20 | |
| 2454 | S | 9I | MYRS | Ardi | obov | 5.00 | 0.0020 | | 1.15 | 2.40 | |
| 2455 | S | 9I | MYRT | Pime | race | 6.00 | 0.0028 | | 0.50 | 0.15 | |
| 2456 | S | 9I | NYCT | Guap | frag | 6.30 | 0.0031 | 10.3 | 1.10 | 0.10 | |
| 2457 | S | 9I | RUBI | Guet | scab | 15.90 | 0.0199 | 14.2 | 1.50 | 0.20 | |
| 2458 | S | 9I | MALP | Byrs | cori | 35.90 | 0.1012 | | 5.55 | 1.55 | |
| 2459 | S | 9I | MYRS | Ardi | obov | 6.20 | 0.0030 | | 4.70 | 5.10 | |
| 2460 | S | 9I | ARAL | Didy | moro | 7.70 | 0.0047 | 9.72 | 4.80 | 6.75 | |
| 2461 | S | 9I | MALP | Byrs | cori | 10.20 | 0.0082 | | 5.40 | 9.50 | |
| 2462 | S | 9I | MIMO | Inga | fagi | 21.50 | 0.0363 | | 6.05 | 6.05 | SICK 3/86 |
| 2463 | S | 9I | THEA | Tern | pedu | 12.10 | 0.0115 | 11.5 | 6.30 | 3.75 | |
| 2464 | M | 9I | MYRS | Ardi | obov | 5.20 | 0.0021 | | 5.95 | 3.60 | |
| 2465 | M | 9I | MYRS | Ardi | obov | 6.50 | 0.0033 | | 6.00 | 3.60 | |
| 2466 | S | 9I | MYRT | Myrc | citr | 7.30 | 0.0042 | 6.68 | 7.85 | 0.85 | |
| 2467 | S | 9I | MYRT | Myrc | citr | 5.50 | 0.0024 | 6.38 | 9.80 | 2.75 | |
| 2468 | S | 9I | MALP | Byrs | cori | 11.40 | 0.0102 | | 9.50 | 3.75 | |
| 2469 | S | 9I | MYRT | Pime | race | 6.40 | 0.0032 | | 8.40 | 3.80 | |
| 2470 | S | 9I | MIMO | Inga | fagi | 13.20 | 0.0137 | | 8.90 | 7.45 | |
| 2471 | S | 9I | MALP | Byrs | cori | 15.40 | 0.0186 | | 9.80 | 7.45 | |
| 2472 | S | 9I | MIMO | Inga | fagi | 5.30 | 0.0022 | | 9.75 | 7.25 | |
| 2473 | S | 9I | MYRS | Ardi | obov | 6.50 | 0.0033 | | 0.75 | 0.45 | |
| 2474 | S | 9J | AQUI | Ilex | urba | 19.20 | 0.0290 | | 2.00 | 8.95 | SICK 7/86 |
| 2475 | S | 9J | MYRT | Myrc | citr | 6.70 | 0.0035 | 8.20 | 2.15 | 8.50 | |
| 2476 | S | 9J | MIMO | Inga | fagi | 8.20 | 0.0053 | | 3.00 | 3.75 | |
| 2477 | S | 9J | AQUI | Ilex | urba | 14.80 | 0.0172 | 12.7 | 1.95 | 2.65 | |
| 2478 | S | 9J | BIGN | Tabe | hete | 37.10 | 0.1081 | 16.1 | 2.15 | 2.20 | |
| 2479 | S | 9J | MYRS | Ardi | obov | 7.60 | 0.0045 | | 0.95 | 0.15 | |
| 2480 | S | 9J | MYRT | Pime | race | 5.90 | 0.0027 | | 2.25 | 0.60 | |
| 2481 | S | 9J | MYRT | Pime | race | 10.00 | 0.0079 | | 3.35 | 1.90 | |
| 2482 | S | 9J | MALP | Byrs | cori | 17.90 | 0.0252 | | 3.95 | 1.25 | |
| 2483 | S | 9J | MALP | Byrs | cori | 15.30 | 0.0184 | | 4.90 | 2.35 | |
| 2484 | S | 9J | MYRT | Pime | race | 6.20 | 0.0030 | | 4.45 | 4.25 | |
| 2485 | S | 9J | MYRT | Pime | race | 11.20 | 0.0099 | | 4.60 | 5.25 | |
| 2486 | S | 9J | MIMO | Inga | fagi | 9.20 | 0.0066 | | 5.00 | 5.10 | |
| 2487 | S | 9J | MYRT | Pime | race | 5.20 | 0.0021 | | 4.20 | 8.30 | |
| 2488 | S | 9J | MALP | Byrs | cori | 13.90 | 0.0152 | | 4.45 | 8.20 | |
| 2489 | S | 9J | MIMO | Inga | fagi | 10.10 | 0.0080 | | 5.80 | 6.65 | |
| 2490 | S | 9J | MALP | Byrs | cori | 26.50 | 0.0552 | 14.2 | 8.00 | 5.60 | |
| 2491 | S | 9J | MALP | Byrs | cori | 9.20 | 0.0066 | | 7.70 | 3.65 | |
| 2492 | S | 9J | MIMO | Inga | fagi | 6.30 | 0.0031 | | 8.25 | 4.20 | |
| 2493 | S | 9J | MIMO | Inga | fagi | 5.20 | 0.0021 | | 8.45 | 4.00 | |
| 2494 | S | 9J | MALP | Byrs | cori | 18.40 | 0.0266 | | 6.15 | 2.15 | |
| 2495 | S | 9J | MIMO | Inga | fagi | 6.00 | 0.0028 | | 7.35 | 1.80 | SICK 3/86 |
| 2496 | S | 9J | MYRT | Myrc | citr | 5.10 | 0.0020 | 6.38 | 8.15 | 7.05 | |
| 2497 | S | 9J | MIMO | Inga | fagi | 5.00 | 0.0020 | | 2.25 | 9.05 | |
| 2498 | S | 9J | MALP | Byrs | cori | 13.50 | 0.0143 | | 8.65 | 8.40 | |
| 2499 | S | 9J | OLEA | Lino | cari | 9.30 | 0.0068 | | 9.70 | 8.50 | |
| 2754 | S | 9J | MYRT | Myrc | citr | 5.00 | 0.0020 | | 6.50 | 4.60 | |
| 2755 | S | 9J | MYRT | Pime | race | 5.00 | 0.0020 | | 6.70 | 1.50 | |
| 2500 | S | 10J | AQUI | Ilex | urba | 12.40 | 0.0121 | 11.5 | 9.40 | 9.50 | |



212

APPENDIX I. (Continued)

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2501 | S | 10J | MYRT | Pime | race | 11.60 | 0.0106 | | 9.85 | 9.00 | |
| 2502 | S | 10J | NYCT | Guap | frag | 5.80 | 0.0026 | | 9.00 | 9.85 | |
| 2503 | S | 10J | MIMO | Inga | fagi | 5.90 | 0.0027 | | 8.70 | 8.80 | |
| 2504 | S | 10J | BIGN | Tabe | hete | 7.80 | 0.0048 | 11.2 | 7.90 | 8.10 | |
| 2505 | S | 10J | MYRT | Pime | race | 7.00 | 0.0038 | | 8.25 | 8.50 | |
| 2506 | S | 10J | MYRT | Pime | race | 6.80 | 0.0036 | | 9.90 | 7.95 | |
| 2507 | S | 10J | ARAL | Didy | moro | 17.50 | 0.0241 | 15.1 | 8.55 | 6.20 | |
| 2508 | S | 10J | MIMO | Inga | fagi | 7.40 | 0.0043 | | 7.90 | 4.90 | |
| 2509 | S | 10J | MIMO | Inga | fagi | 10.00 | 0.0079 | | 6.75 | 5.50 | |
| 2510 | S | 10J | AQUI | Ilex | urba | 6.00 | 0.0028 | 7.90 | 7.10 | 4.45 | |
| 2511 | S | 10J | MIMO | Inga | fagi | 6.00 | 0.0028 | | 8.50 | 4.95 | |
| 2512 | S | 10J | NYCT | Guap | frag | 9.70 | 0.0074 | 8.81 | 7.52 | 1.65 | |
| 2513 | S | 10J | NYCT | Guap | frag | 9.30 | 0.0068 | | 8.00 | 1.40 | |
| 2514 | M | 10J | MYRT | Pime | race | 10.60 | 0.0088 | | 8.85 | 0.62 | |
| 2515 | M | 10J | MYRT | Pime | race | 7.20 | 0.0041 | | 8.90 | 0.75 | |
| 2516 | M | 10J | MYRT | Pime | race | 5.10 | 0.0020 | | 6.70 | 1.25 | |
| 2517 | M | 10J | MYRT | Pime | race | 5.40 | 0.0023 | | 6.60 | 1.35 | |
| 2518 | S | 10J | MYRT | Pime | race | 7.40 | 0.0043 | | 5.85 | 3.15 | |
| 2519 | S | 10J | MYRT | Pime | race | 7.10 | 0.0040 | | 6.80 | 5.95 | |
| 2520 | S | 10J | MYRT | Pime | race | 8.40 | 0.0055 | | 7.05 | 8.55 | |
| 2521 | S | 10J | MYRS | Ardi | obov | 5.50 | 0.0024 | 6.38 | 3.55 | 9.00 | |
| 2522 | S | 10J | MALP | Byrs | cori | 12.90 | 0.0131 | | 3.40 | 9.05 | |
| 2523 | S | 10J | NYCT | Guap | frag | 16.30 | 0.0209 | | 3.60 | 7.80 | |
| 2524 | S | 10J | BIGN | Tabe | hete | 12.20 | 0.0117 | 12.4 | 4.42 | 7.70 | |
| 2525 | S | 10J | MIMO | Acac | muri | 17.80 | 0.0249 | 17.3 | 3.75 | 6.45 | |
| 2526 | S | 10J | MALP | Byrs | cori | 11.20 | 0.0099 | | 4.25 | 2.80 | |
| 2527 | S | 10J | MALP | Byrs | cori | 6.20 | 0.0030 | | 3.70 | 3.05 | |
| 2528 | S | 10J | THEA | Tern | pedu | 15.00 | 0.0177 | 10.3 | 3.62 | 2.10 | DEAD 3/86 |
| 2529 | S | 10J | MALP | Byrs | cori | 17.20 | 0.0232 | | 4.42 | 1.25 | |
| 2530 | S | 10J | MIMO | Inga | fagi | 11.10 | 0.0097 | | 4.72 | 0.09 | |
| 2531 | S | 10J | MYRT | Pime | race | 5.50 | 0.0024 | | 4.72 | 0.20 | |
| 2532 | S | 10J | MYRT | Myrc | citr | 6.80 | 0.0036 | 6.07 | 2.60 | 0.04 | |
| 2533 | S | 10J | MALP | Byrs | cori | 8.30 | 0.0054 | | 1.60 | 0.10 | |
| 2534 | S | 10J | MYRT | Pime | race | 6.40 | 0.0032 | | 0.75 | 2.40 | |
| 2535 | S | 10J | MYRT | Pime | race | 5.60 | 0.0025 | | 0.80 | 4.80 | |
| 2536 | S | 10J | BIGN | Tabe | hete | 7.60 | 0.0045 | 10.6 | 2.55 | 6.75 | |
| 2537 | S | 10J | MYRS | Ardi | obov | 9.60 | 0.0072 | | 1.25 | 6.95 | |
| 2538 | M | 10J | CELA | Mayt | elli | 10.10 | 0.0080 | | 1.00 | 6.75 | |
| 2539 | M | 10J | CELA | Mayt | elli | 18.00 | 0.0254 | 11.2 | 0.75 | 6.85 | |
| 2540 | S | 10J | BIGN | Tabe | hete | 18.10 | 0.0257 | | 0.70 | 7.75 | |
| 2756 | S | 10J | NYCT | Guap | frag | 5.20 | 0.0021 | | 0.90 | 8.65 | |
| 2541 | S | 10I | CAPP | Capp | cyno | 9.60 | 0.0072 | 7.59 | 9.00 | 8.10 | |
| 2542 | M | 10I | CAPP | Capp | cyno | 7.70 | 0.0047 | | 6.60 | 9.95 | |
| 2543 | M | 10I | CAPP | Capp | cyno | 5.90 | 0.0027 | 4.25 | 6.55 | 9.90 | |
| 2544 | S | 10I | MYRT | Pime | race | 5.80 | 0.0026 | | 5.45 | 8.25 | |
| 2545 | S | 10I | BIGN | Tabe | hete | 22.10 | 0.0384 | 20.0 | 6.00 | 7.75 | |
| 2546 | S | 10I | BIGN | Tabe | hete | 23.60 | 0.0437 | | 7.00 | 7.10 | |
| 2547 | S | 10I | MALP | Byrs | cori | 15.50 | 0.0189 | | 7.00 | 6.55 | |
| 2548 | S | 10I | MALP | Byrs | cori | 10.30 | 0.0083 | | 7.60 | 6.65 | |
| 2549 | S | 10I | MYRS | Ardi | obov | 5.10 | 0.0020 | 8.20 | 7.15 | 6.70 | |

APPENDIX I. (Continued)

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2550 | S | 10I | MALP | Byrs | cori | 20.10 | 0.0317 | | 7.70 | 5.35 | |
| 2551 | S | 10I | MIMO | Inga | fagi | 12.20 | 0.0117 | | 7.75 | 4.40 | |
| 2552 | S | 10I | NYCT | Guap | frag | 6.00 | 0.0028 | | 8.45 | 4.35 | |
| 2553 | S | 10I | MYRT | Pime | race | 5.30 | 0.0022 | | 8.90 | 1.75 | |
| 2554 | S | 10I | MYRT | Pime | race | 6.20 | 0.0030 | | 7.95 | 2.00 | |
| 2555 | S | 10I | MALP | Byrs | cori | 20.20 | 0.0320 | | 8.50 | 0.95 | |
| 2556 | S | 10I | MYRT | Myrc | citr | 5.60 | 0.0025 | 6.38 | 9.50 | 0.85 | |
| 2557 | S | 10I | BIGN | Tabe | hete | 26.80 | 0.0564 | | 4.80 | 1.55 | |
| 2558 | S | 10I | LAUR | Ocot | cori | 10.80 | 0.0092 | 9.42 | 4.70 | 4.75 | |
| 2559 | S | 10I | MALP | Byrs | cori | 5.70 | 0.0026 | | 5.20 | 6.15 | |
| 2560 | S | 10I | MYRS | Ardi | obov | 5.10 | 0.0020 | | 6.00 | 7.65 | |
| 2561 | S | 10I | MYRT | Myrc | citr | 5.60 | 0.0025 | 8.81 | 5.00 | 7.85 | |
| 2562 | S | 10I | NYCT | Guap | frag | 5.70 | 0.0026 | | 4.05 | 9.20 | |
| 2563 | S | 10I | MALP | Byrs | cori | 14.40 | 0.0163 | | 3.50 | 3.45 | |
| 2564 | M | 10I | LAUR | Ocot | cori | 8.70 | 0.0059 | | 1.55 | 7.25 | |
| 2565 | M | 10I | LAUR | Ocot | cori | 5.00 | 0.0020 | | 1.50 | 7.15 | |
| 2566 | S | 10I | MYRS | Ardi | obov | 6.20 | 0.0030 | | 1.30 | 7.20 | |
| 2567 | S | 10I | MYRS | Ardi | obov | 11.10 | 0.0097 | | 0.45 | 7.80 | |
| 2568 | M | 10I | MYRS | Ardi | obov | 7.50 | 0.0044 | | 0.35 | 4.70 | |
| 2569 | M | 10I | MYRS | Ardi | obov | 5.10 | 0.0020 | | 0.55 | 4.45 | |
| 2570 | S | 10I | MIMO | Inga | fagi | 12.30 | 0.0119 | | 2.90 | 2.10 | |
| 2571 | S | 10I | MYRT | Myrc | citr | 8.10 | 0.0052 | 9.72 | 2.30 | 1.55 | |
| 2572 | M | 10I | AQUI | Ilex | urba | 6.00 | 0.0028 | | 2.85 | 0.50 | |
| 2573 | M | 10I | AQUI | Ilex | urba | 5.00 | 0.0020 | 9.11 | 3.10 | 0.55 | |
| 2574 | M | 10H | MALP | Byrs | cori | 22.70 | 0.0405 | | 9.90 | 0.60 | |
| 2575 | M | 10H | MALP | Byrs | cori | 8.20 | 0.0053 | | 9.85 | 1.00 | |
| 2576 | S | 10H | BIGN | Tabe | hete | 31.20 | 0.0765 | | 9.65 | 4.00 | |
| 2577 | S | 10H | MYRS | Ardi | obov | 8.00 | 0.0050 | | 9.20 | 6.85 | |
| 2578 | S | 10H | MYRS | Ardi | obov | 7.30 | 0.0042 | | 8.30 | 6.65 | |
| 2579 | S | 10H | MIMO | Inga | fagi | 15.50 | 0.0189 | | 9.70 | 8.40 | |
| 2580 | S | 10H | MYRS | Ardi | obov | 7.50 | 0.0044 | | 9.70 | 9.80 | |
| 2581 | S | 10H | THEA | Tern | pedu | 17.40 | 0.0238 | 9.72 | 7.50 | 9.85 | |
| 2582 | S | 10H | LAUR | Ocot | cori | 8.80 | 0.0061 | | 7.15 | 9.00 | |
| 2583 | M | 10H | MYRS | Ardi | obov | 4.80 | 0.0018 | | 6.95 | 8.80 | |
| 2584 | M | 10H | MYRS | Ardi | obov | 5.60 | 0.0025 | | 7.05 | 8.80 | |
| 2585 | S | 10H | MALP | Byrs | cori | 20.70 | 0.0337 | | 7.15 | 6.15 | |
| 2586 | S | 10H | MYRS | Ardi | obov | 6.00 | 0.0028 | 7.29 | 8.80 | 4.45 | |
| 2587 | S | 10H | NYCT | Guap | frag | 30.60 | 0.0735 | | 4.25 | 3.50 | |
| 2588 | S | 10H | EUPH | Dryp | alba | 6.00 | 0.0028 | | 3.50 | 5.45 | SICK 2/87 |
| 2589 | M | 10H | MALP | Byrs | cori | 20.40 | 0.0327 | | 3.25 | 6.90 | |
| 2590 | M | 10H | MALP | Byrs | cori | 15.90 | 0.0199 | | 3.15 | 6.70 | |
| 2591 | S | 10H | LAUR | Ocot | cori | 10.40 | 0.0085 | | 5.00 | 9.85 | |
| 2592 | S | 10H | LAUR | Ocot | cori | 9.80 | 0.0075 | | 3.20 | 9.90 | |
| 2593 | M | 10H | LAUR | Ocot | cori | 6.10 | 0.0029 | | 1.30 | 8.00 | |
| 2594 | M | 10H | LAUR | Ocot | cori | 6.30 | 0.0031 | | 1.20 | 7.95 | |
| 2595 | S | 10H | MALP | Byrs | cori | 13.90 | 0.0152 | | 1.35 | 6.90 | |
| 2596 | S | 10H | MYRS | Ardi | obov | 7.60 | 0.0045 | | 2.70 | 2.95 | |
| 2597 | S | 10H | MIMO | Inga | fagi | 5.40 | 0.0023 | | 0.65 | 3.80 | |
| 2598 | S | 10H | MIMO | Inga | fagi | 5.50 | 0.0024 | | 0.75 | 0.05 | |
| 2599 | S | 10G | MALP | Byrs | cori | 26.00 | 0.0531 | | 9.55 | 6.80 | |



24

APPENDIX I. (Continued)

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2600 | S | 10G | MIMO | Inga | fagi | 5.30 | 0.0022 | | 8.95 | 6.25 | |
| 2601 | S | 10G | MALP | Byrs | cori | 32.30 | 0.0819 | | 8.55 | 5.40 | |
| 2602 | S | 10G | MYRS | Ardi | obov | 6.50 | 0.0033 | | 6.75 | 7.00 | |
| 2603 | S | 10G | STER | Guaz | ulmi | 14.70 | 0.0170 | 12.7 | 6.45 | 8.85 | |
| 2604 | S | 10G | MYRS | Ardi | obov | 6.00 | 0.0028 | | 5.50 | 7.70 | |
| 2605 | S | 10G | MIMO | Inga | fagi | 15.40 | 0.0186 | | 3.15 | 4.80 | |
| 2606 | S | 10G | RUBI | Fara | occi | 5.70 | 0.0026 | | 2.95 | 4.35 | |
| 2607 | S | 10G | EUPH | Dryp | alba | 7.80 | 0.0048 | | 0.90 | 4.75 | |
| 2608 | S | 10G | BIGN | Tabe | hete | 6.50 | 0.0033 | | 6.15 | 2.50 | |
| 2609 | S | 10G | MYRT | Pime | race | 5.90 | 0.0027 | | 6.32 | 1.50 | |
| 2610 | S | 10G | STER | Guaz | ulmi | 23.90 | 0.0449 | 16.4 | 8.25 | 0.80 | |
| 2611 | S | 10G | MIMO | Inga | fagi | 16.90 | 0.0224 | | 0.21 | 2.60 | |
| 2757 | S | 10G | RUBI | Fara | occi | 5.00 | 0.0020 | | 3.25 | 8.05 | |
| 2612 | S | 10F | MIMO | Inga | fagi | 9.60 | 0.0072 | | 8.15 | 0.75 | |
| 2613 | S | 10F | BORA | Bour | succ | 6.80 | 0.0036 | 10.6 | 6.55 | 0.42 | |
| 2614 | S | 10F | MIMO | Inga | fagi | 10.40 | 0.0085 | | 7.15 | 1.40 | |
| 2615 | S | 10F | MYRT | Pime | race | 22.80 | 0.0408 | | 8.80 | 4.95 | |
| 2616 | S | 10F | RUBI | Fara | occi | 6.50 | 0.0033 | 4.86 | 7.90 | 8.00 | |
| 2617 | S | 10F | MIMO | Inga | fagi | 9.90 | 0.0077 | | 6.60 | 9.51 | |
| 2618 | S | 10F | MALP | Byrs | cori | 29.60 | 0.0688 | | 2.60 | 9.90 | |
| 2619 | S | 10F | MIMO | Inga | fagi | 29.90 | 0.0702 | | 4.65 | 2.94 | |
| 2620 | M | 10F | BORA | Cord | sulc | 6.70 | 0.0035 | 9.72 | 3.30 | 0.85 | |
| 2621 | M | 10F | BORA | Cord | sulc | 6.00 | 0.0028 | | 3.10 | 0.84 | |
| 2622 | S | 10F | LAUR | Ocot | cori | 5.60 | 0.0025 | | 1.95 | 1.92 | |
| 2623 | S | 10F | MYRT | Pime | race | 19.30 | 0.0293 | | 2.05 | 3.12 | |
| 2624 | S | 10F | MIMO | Inga | fagi | 6.10 | 0.0029 | | 1.45 | 4.00 | |
| 2625 | S | 10F | NYCT | Guap | frag | 5.80 | 0.0026 | | 2.80 | 0.15 | DEAD 3/86 |
| 2626 | S | 10F | OLEA | Lino | cari | 6.30 | 0.0031 | | 5.45 | 5.41 | DEAD 7/86 |
| 2627 | S | 10F | RUBI | Fara | occi | 5.70 | 0.0026 | | 1.70 | 6.56 | |
| 2628 | S | 10E | MYRT | Pime | race | 19.60 | 0.0302 | | 8.75 | 8.97 | |
| 2629 | S | 10E | MIMO | Inga | fagi | 6.10 | 0.0029 | | 8.90 | 6.40 | |
| 2630 | S | 10E | STER | Guaz | ulmi | 12.70 | 0.0127 | | 6.20 | 5.04 | DEAD 7/86 |
| 2631 | S | 10E | STER | Guaz | ulmi | 24.50 | 0.0471 | 19.7 | 5.15 | 3.95 | |
| 2632 | M | 10E | MIMO | Inga | fagi | 11.70 | 0.0108 | | 3.50 | 9.15 | |
| 2633 | M | 10E | MIMO | Inga | fagi | 18.80 | 0.0278 | | 3.30 | 9.45 | |
| 2634 | S | 10E | MALP | Byrs | cori | 6.30 | 0.0031 | | 3.05 | 9.10 | SICK 3/86 |
| 2635 | S | 10E | EUPH | Dryp | alba | 5.20 | 0.0021 | 4.86 | 2.10 | 7.05 | |
| 2636 | M | 10E | ANAC | Mang | indi | 7.60 | 0.0045 | | 2.10 | 2.75 | |
| 2637 | M | 10E | ANAC | Mang | indi | 16.30 | 0.0209 | 10.3 | 1.85 | 2.30 | |
| 2638 | S | 10E | MYRT | Pime | race | 11.40 | 0.0102 | | 1.55 | 0.61 | |
| 2639 | S | 10E | MYRT | Pime | race | 18.70 | 0.0275 | | 0.75 | 3.03 | |
| 2640 | S | 10E | RUTA | Zant | mart | 15.90 | 0.0199 | 18.5 | 9.90 | 1.50 | |
| 2641 | S | 10D | MYRT | Pime | race | 7.60 | 0.0045 | | 7.80 | 2.16 | |
| 2642 | S | 10D | ANAC | Mang | indi | 5.10 | 0.0020 | 3.64 | 9.60 | 5.65 | |
| 2643 | S | 10D | ARAL | Didy | moro | 14.30 | 0.0161 | 13.9 | 6.20 | 9.59 | |
| 2644 | S | 10D | STER | Guaz | ulmi | 17.10 | 0.0230 | 16.4 | 3.00 | 1.59 | |
| 2645 | S | 10D | MIMO | Inga | fagi | 7.90 | 0.0049 | | 2.90 | 2.41 | |
| 2646 | S | 10D | EUPH | Dryp | alba | 7.00 | 0.0038 | 10.0 | 2.60 | 6.00 | |
| 2647 | S | 10D | MIMO | Inga | fagi | 8.40 | 0.0055 | | 1.60 | 8.85 | |
| 2648 | S | 10D | FLAC | Case | guia | 9.20 | 0.0066 | 14.2 | 1.90 | 9.84 | |



215

APPENDIX I. (Continued)

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2649 | S | 10D | MALP | Byrs | cori | 9.40 | 0.0069 | | 1.50 | 9.79 | |
| 2650 | S | 10D | MYRT | Pime | race | 15.40 | 0.0186 | | 1.30 | 9.21 | |
| 2651 | S | 10D | MIMO | Inga | fagi | 10.50 | 0.0087 | | 0.15 | 5.82 | |
| 2652 | S | 10D | LAUR | Ocot | cori | 7.90 | 0.0049 | | 1.20 | 3.41 | DEAD 6/86 |
| 2653 | S | 10D | MIMO | Inga | fagi | 6.70 | 0.0035 | | 1.30 | 0.78 | |
| 2654 | S | 10D | RUTA | Zant | mart | 22.50 | 0.0398 | 20.0 | 0.86 | 0.20 | |
| 2655 | S | 10D | MIMO | Inga | fagi | 8.70 | 0.0059 | | 1.70 | 5.87 | |
| 2656 | S | 10D | FABA | Andi | iner | 7.70 | 0.0047 | 7.90 | 6.85 | 2.21 | |
| 2657 | S | 10C | LAUR | Ocot | cori | 9.50 | 0.0071 | | 9.50 | 2.00 | |
| 2658 | S | 10C | MYRT | Pime | race | 7.40 | 0.0043 | | 9.70 | 4.20 | |
| 2659 | S | 10C | MIMO | Inga | fagi | 10.00 | 0.0079 | | 8.50 | 5.62 | |
| 2660 | S | 10C | MIMO | Inga | fagi | 9.10 | 0.0065 | | 8.20 | 6.82 | |
| 2661 | S | 10C | SAPO | Pout | mult | 10.90 | 0.0093 | 14.5 | 6.20 | 8.99 | |
| 2662 | S | 10C | MALP | Byrs | cori | 23.20 | 0.0423 | | 4.60 | 8.01 | |
| 2663 | S | 10C | MIMO | Inga | fagi | 29.80 | 0.0697 | | 2.70 | 9.42 | |
| 2664 | S | 10C | MIMO | Acac | muri | 8.30 | 0.0054 | 13.0 | 2.40 | 8.34 | |
| 2665 | S | 10C | MALP | Byrs | cori | 7.60 | 0.0045 | | 3.70 | 6.65 | |
| 2666 | S | 10C | MALP | Byrs | cori | 15.80 | 0.0196 | | 8.50 | 2.72 | |
| 2667 | S | 10C | MALP | Byrs | cori | 7.20 | 0.0041 | | 7.80 | 2.35 | DEAD 6/86 |
| 2668 | S | 10C | MIMO | Inga | fagi | 5.50 | 0.0024 | 8.20 | 5.55 | 2.29 | |
| 2669 | S | 10C | MIMO | Inga | fagi | 6.80 | 0.0036 | | 3.90 | 2.75 | |
| 2670 | S | 10C | MALP | Byrs | cori | 12.80 | 0.0129 | | 3.50 | 2.40 | |
| 2671 | S | 10C | STER | Guaz | ulmi | 20.30 | 0.0324 | 14.5 | 6.00 | 6.12 | |
| 2672 | S | 10C | MYRT | Pime | race | 14.00 | 0.0154 | | 5.80 | 6.70 | |
| 2673 | S | 10C | MIMO | Inga | fagi | 6.00 | 0.0028 | | 1.20 | 3.21 | |
| 2674 | S | 10C | MALP | Byrs | cori | 16.90 | 0.0224 | | 0.98 | 1.55 | |
| 2675 | S | 10B | BORA | Cord | sulc | 5.60 | 0.0025 | 8.20 | 8.80 | 1.95 | |
| 2676 | S | 10B | ARAL | Didy | moro | 19.70 | 0.0305 | 16.7 | 7.20 | 5.85 | |
| 2677 | S | 10B | MYRS | Ardi | obov | 6.00 | 0.0028 | | 9.40 | 4.30 | |
| 2678 | S | 10B | MIMO | Inga | fagi | 9.30 | 0.0068 | | 9.40 | 6.92 | |
| 2679 | S | 10B | MYRS | Ardi | obov | 9.70 | 0.0074 | | 6.80 | 6.75 | |
| 2680 | S | 10B | MYRT | Pime | race | 8.60 | 0.0058 | 10.6 | 5.30 | 5.95 | |
| 2681 | S | 10B | MYRS | Ardi | obov | 9.90 | 0.0077 | | 3.45 | 6.20 | |
| 2682 | S | 10B | OLEA | Lino | cari | 25.50 | 0.0511 | 16.4 | 3.70 | 4.60 | |
| 2683 | S | 10B | MIMO | Inga | fagi | 8.60 | 0.0058 | | 3.90 | 4.19 | |
| 2684 | S | 10B | MYRS | Ardi | obov | 6.30 | 0.0031 | | 4.90 | 3.75 | |
| 2685 | S | 10B | MIMO | Inga | fagi | 5.40 | 0.0023 | | 7.25 | 1.66 | |
| 2686 | S | 10B | MALP | Byrs | cori | 11.90 | 0.0111 | | 7.45 | 0.90 | |
| 2687 | S | 10B | MYRS | Ardi | obov | 10.60 | 0.0088 | 9.11 | 3.10 | 2.77 | |
| 2688 | S | 10B | LAUR | Ocot | cori | 10.60 | 0.0088 | | 1.32 | 7.22 | |
| 2689 | M | 10B | MYRS | Ardi | obov | 11.50 | 0.0104 | | 1.17 | 3.10 | |
| 2690 | S | 10B | BORA | Cord | coll | 9.50 | 0.0071 | 10.0 | 0.97 | 2.85 | |
| 2690 | M | 10B | MYRS | Ardi | obov | 5.60 | 0.0025 | | 1.27 | 2.90 | |
| 2692 | S | 10B | MYRT | Pime | race | 6.90 | 0.0037 | | 2.65 | 1.25 | |
| 2693 | S | 10B | OLEA | Lino | cari | 13.80 | 0.0150 | 11.2 | 0.50 | 0.61 | |
| 2694 | S | 10A | MIMO | Inga | fagi | 14.40 | 0.0163 | | 9.80 | 8.95 | |
| 2695 | S | 10A | LAUR | Ocot | cori | 7.10 | 0.0040 | 9.42 | 9.90 | 8.59 | |
| 2696 | S | 10A | MYRT | Euge | mont | 7.50 | 0.0044 | 7.90 | 8.60 | 7.30 | |
| 2697 | S | 10A | FLAC | Case | deca | 6.70 | 0.0035 | 7.59 | 7.25 | 3.35 | |
| 2698 | S | 10A | MYRS | Ardi | obov | 7.30 | 0.0042 | 5.47 | 8.25 | 0.20 | |



216

APPENDIX I. (Continued)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 2699 | S | 10A | NYCT | Guap | frag | 6.80 | 0.0036 | | 6.55 | 2.81 |
| 2700 | S | 10A | MYRS | Ardi | obov | 8.10 | 0.0052 | | 6.20 | 4.39 |
| 2701 | S | 10A | MYRS | Ardi | obov | 6.30 | 0.0031 | 7.29 | 6.10 | 4.41 |
| 2702 | S | 10A | MIMO | Inga | fagi | 9.90 | 0.0077 | | 3.50 | 7.42 |
| 2703 | S | 10A | STER | Guaz | ulmi | 17.10 | 0.0230 | 12.1 | 2.50 | 8.35 |
| 2704 | S | 10A | MIMO | Inga | fagi | 6.10 | 0.0029 | | 3.50 | 4.54 |
| 2705 | S | 10A | LAUR | Ocot | cori | 10.10 | 0.0080 | 8.81 | 1.85 | 4.21 |
| 2706 | S | 10A | FLAC | Case | guia | 6.20 | 0.0030 | 8.51 | 1.20 | 3.90 |
| 2707 | M | 10A | NYCT | Guap | frag | 5.90 | 0.0027 | | 1.40 | 1.55 |
| 2708 | M | 10A | NYCT | Guap | frag | 8.90 | 0.0062 | | 1.35 | 0.92 |
| 2709 | M | 10A | NYCT | Guap | frag | 8.10 | 0.0052 | 9.42 | 1.20 | 0.90 |
| 2710 | S | 10A | MYRS | Ardi | obov | 6.40 | 0.0032 | | 4.90 | 0.65 |
| 2711 | S | 10A | LAUR | Ocot | cori | 7.10 | 0.0040 | | 3.10 | 6.61 |
| | | | | | | 2348 | 31.08 | | | |

DATA SHEETS FOR ST. JOHN FOREST DYNAMICS STUDY APPENDIX II.

Date: August, 1987
Plot Number: 2(1A-5J)
Plot Locale: L'Esperance

| TAG | STM | SPLT | FAM | SPECIES | DBH85 | BA AREA | HGT | X | Y | STATUS |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | S | 1A | MYRT | Euge mcnt | 7.20 | 0.0040 | 7.9 | 0.45 | 2.14 | |
| 3 | S | 1A | RUBI | Guet scab | 13.90 | 0.0151 | | 1.58 | 2.29 | |
| 4 | S | 1A | RUBI | Fara occi | 5.50 | 0.0023 | 5.5 | 2.78 | 2.40 | |
| 5 | S | 1A | SAPO | Chry pauc | 8.10 | 0.0051 | | 3.98 | 0.56 | |
| 6 | S | 1A | SAPO | Chry pauc | 11.10 | 0.0096 | | 4.09 | 3.62 | |
| 7 | S | 1A | ERYT | Eryt rotu | 6.00 | 0.0028 | | 2.08 | 5.88 | |
| 8 | S | 1A | MYRS | Ardi obov | 7.20 | 0.0040 | | 0.53 | 8.58 | |
| 9 | S | 1A | RUBI | Guet scab | 9.50 | 0.0070 | | 1.40 | 9.50 | |
| 10 | S | 1A | ERYT | Eryt rotu | 6.20 | 0.0030 | | 4.10 | 8.40 | |
| 11 | S | 1A | MIMO | Inga fagi | 31.00 | 0.0754 | | 4.40 | 7.60 | |
| 12 | S | 1A | ERYT | Eryt rotu | 6.20 | 0.0030 | | 5.92 | 9.65 | |
| 13 | S | 1A | THYM | Daph amer | 9.30 | 0.0067 | | 6.17 | 8.75 | |
| 14 | S | 1A | SAPO | Chry pauc | 5.30 | 0.0022 | | 9.20 | 9.60 | |
| 15 | S | 1A | BORA | Cord alli | 12.50 | 0.0122 | 8.5 | 9.10 | 8.70 | |
| 16 | S | 1A | RUBI | Guet scab | 6.90 | 0.0037 | | 6.50 | 7.65 | |
| 17 | S | 1A | RUBI | Guet scab | 5.90 | 0.0027 | 9.7 | 6.58 | 7.76 | |
| 18 | S | 1A | MYRT | Myrc citr | 9.30 | 0.0067 | | 7.60 | 6.10 | |
| 19 | S | 1A | MYRS | Ardi obov | 6.00 | 0.0028 | | 6.78 | 4.73 | |
| 20 | S | 1A | FLAC | Case sylv | 6.80 | 0.0036 | 4.3 | 7.62 | 4.82 | |
| 21 | S | 1A | LAUR | Ocot cori | 5.50 | 0.0023 | | 9.40 | 6.02 | |
| 22 | S | 1A | FABA | Andi iner | 6.30 | 0.0031 | 3.0 | 8.89 | 2.90 | |
| 23 | S | 1A | LAUR | Ocot cori | 7.40 | 0.0043 | | 5.28 | 2.47 | |
| 24 | S | 1A | SAPO | Chry pauc | 6.00 | 0.0028 | | 4.98 | 0.65 | |
| 25 | S | 1A | THYM | Daph amer | 9.20 | 0.0066 | 6.1 | 5.01 | 1.17 | |
| 26 | S | 1A | FABA | Andi iner | 9.50 | 0.0070 | | 9.80 | 2.90 | |
| 27 | S | 1A | LAUR | Ocot cori | 8.00 | 0.0050 | 7.3 | 8.89 | 0.99 | |
| 28 | S | 1B | MYRS | Ardi obov | 5.40 | 0.0022 | | 1.80 | 0.40 | |
| 29 | S | 1B | MYRS | Ardi obov | 8.20 | 0.0052 | | 1.75 | 0.80 | |
| 30 | S | 1B | FLAC | Case guia | 6.50 | 0.0033 | 5.2 | 4.70 | 0.05 | |
| 31 | S | 1B | MYRS | Ardi obov | 6.40 | 0.0032 | | 4.85 | 0.15 | |
| 32 | S | 1B | NYCT | Guap frag | 30.40 | 0.0725 | 4.9 | 5.45 | 2.35 | |
| 33 | S | 1B | MYRS | Ardi obov | 8.60 | 0.0058 | 6.7 | 5.95 | 2.26 | |
| 34 | S | 1B | SAPO | Chry pauc | 5.80 | 0.0026 | | 2.92 | 3.04 | |
| 35 | S | 1B | SAPO | Chry pauc | 5.70 | 0.0025 | 7.3 | 3.85 | 3.70 | |
| 36 | S | 1B | MYRS | Ardi obov | 9.60 | 0.0072 | | 4.21 | 4.53 | |
| 37 | S | 1B | MYRS | Ardi obov | 5.50 | 0.0023 | | 1.63 | 3.40 | |
| 38 | S | 1B | MYRT | Myrc flor | 8.20 | 0.0052 | 7.0 | 0.90 | 8.75 | |
| 39 | S | 1B | MYRS | Ardi obov | 8.60 | 0.0058 | | 0.83 | 9.68 | |
| 40 | S | 1B | MYRS | Ardi obov | 8.10 | 0.0051 | | 9.26 | 8.90 | |
| 41 | S | 1B | MYRS | Ardi obov | 9.50 | 0.0070 | | 5.80 | 6.55 | |
| 42 | S | 1B | MYRS | Ardi obov | 7.40 | 0.0043 | | 6.50 | 5.60 | |



218

APPENDIX II. (Continued)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 43 | S | 1B | RUBI | Guet | parv | 5.90 | 0.0027 | 4.0 | 6.97 | 4.75 |
| 44 | S | 1B | MYRS | Ardi | obov | 7.80 | 0.0047 | | 5.78 | 3.36 |
| 45 | S | 1B | SAPO | Chry | pauc | 8.50 | 0.0056 | 6.4 | 9.85 | 6.11 |
| 46 | S | 1B | MIMO | Inga | fagi | 19.30 | 0.0292 | | 8.42 | 4.38 |
| 47 | S | 1B | MIMO | Inga | fagi | 14.60 | 0.0167 | | 7.78 | 2.72 |
| 48 | S | 1B | MYRS | Ardi | obov | 8.60 | 0.0058 | | 8.72 | 2.90 |
| 49 | S | 1B | LAUR | Ocot | cori | 6.40 | 0.0032 | | 7.90 | 0.12 |
| 50 | S | 1C | MYRS | Ardi | obov | 5.00 | 0.0019 | | 0.42 | 1.13 |
| 51 | S | 1C | FABA | Andi | iner | 5.50 | 0.0023 | 4.9 | 1.82 | 0.74 |
| 52 | S | 1C | MYRS | Ardi | obov | 5.80 | 0.0026 | | 2.10 | 0.67 |
| 53 | S | 1C | LAUR | Ocot | cori | 11.30 | 0.0100 | | 3.31 | 0.85 |
| 54 | S | 1C | MYRS | Ardi | obov | 10.70 | 0.0089 | | 3.24 | 1.50 |
| 55 | S | 1C | MYRS | Ardi | obov | 6.70 | 0.0035 | | 3.68 | 3.34 |
| 56 | S | 1C | MIMO | Inga | fagi | 16.20 | 0.0206 | | 3.72 | 7.15 |
| 57 | S | 1C | MYRS | Ardi | obov | 5.40 | 0.0022 | | 2.51 | 6.76 |
| 58 | S | 1C | FABA | Andi | iner | 14.20 | 0.0158 | | 3.15 | 7.70 |
| 59 | S | 1C | MIMO | Inga | fagi | 12.90 | 0.0130 | | 1.89 | 9.30 |
| 60 | S | 1C | MIMO | Inga | fagi | 13.70 | 0.0147 | | 3.70 | 7.84 |
| 61 | S | 1C | SAPO | Chry | pauc | 5.30 | 0.0022 | | 3.20 | 9.40 |
| 62 | S | 1C | MYRS | Ardi | obov | 5.50 | 0.0023 | | 3.81 | 9.92 |
| 63 | S | 1C | MYRS | Ardi | obov | 8.30 | 0.0054 | | 4.70 | 9.95 |
| 64 | S | 1C | MIMO | Inga | fagi | 11.70 | 0.0107 | | 8.25 | 9.53 |
| 65 | S | 1C | MIMO | Inga | fagi | 8.60 | 0.0058 | | 9.80 | 9.30 |
| 66 | S | 1C | MYRS | Ardi | obov | 5.20 | 0.0021 | | 9.70 | 9.00 |
| 67 | S | 1C | MYRT | Myrc | citr | 6.30 | 0.0031 | 5.8 | 9.30 | 5.23 |
| 68 | S | 1C | SAPO | Chry | pauc | 13.60 | 0.0145 | 10.6 | 5.75 | 5.27 |
| 69 | S | 1C | SAPO | Chry | pauc | 6.20 | 0.0030 | | 8.07 | 3.37 |
| 70 | S | 1C | MIMO | Inga | fagi | 10.40 | 0.0084 | | 9.42 | 3.42 |
| 71 | S | 1C | MYRT | Myrc | citr | 6.60 | 0.0034 | | 8.20 | 3.02 |
| 72 | S | 1C | SAPO | Chry | pauc | 5.60 | 0.0024 | | 8.71 | 1.25 |
| 73 | S | 1C | LAUR | Ocot | cori | 12.30 | 0.0118 | | 8.23 | 1.45 |
| 74 | S | 1C | MIMO | Inga | fagi | 7.10 | 0.0039 | | 9.62 | 1.58 |
| 75 | S | 1D | MIMO | Inga | fagi | 8.30 | 0.0054 | | 0.29 | 1.08 |
| 76 | S | 1D | CAES | Hyme | cour | 40.60 | 0.1294 | | 1.50 | 0.20 |
| 77 | M | 1D | CAES | Hyme | cour | 29.20 | 0.0669 | 21.3 | 2.94 | 0.78 |
| 78 | M | 1D | CAES | Hyme | cour | 36.80 | 0.1063 | | 3.08 | 1.18 |
| 79 | S | 1D | LAUR | Ocot | cori | 6.00 | 0.0028 | | 2.50 | 0.66 |
| 80 | S | 1D | FABA | Andi | iner | 6.10 | 0.0029 | | 2.62 | 3.00 |
| 81 | S | 1D | SAPI | Meli | biju | 12.80 | 0.0128 | 11.2 | 4.50 | 3.05 |
| 82 | S | 1D | SAPI | Meli | biju | 8.80 | 0.0060 | 8.2 | 4.52 | 3.30 |
| 83 | S | 1D | MYRS | Ardi | obov | 6.50 | 0.0033 | | 2.74 | 5.60 |
| 84 | S | 1D | MIMO | Inga | fagi | 12.70 | 0.0126 | | 2.56 | 6.57 |
| 85 | S | 1D | NYCT | Guap | frag | 5.60 | 0.0024 | | 0.06 | 6.64 |
| 86 | S | 1D | MYRS | Ardi | obov | 6.60 | 0.0034 | | 7.50 | 8.43 |
| 87 | S | 1D | MYRS | Ardi | obov | 6.90 | 0.0037 | | 6.38 | 7.90 |
| 88 | S | 1D | MYRS | Ardi | obov | 5.10 | 0.0020 | | 8.90 | 8.20 |
| 89 | S | 1D | MYRS | Ardi | obov | 8.80 | 0.0060 | | 6.70 | 4.18 |
| 90 | S | 1D | MYRS | Ardi | obov | 6.00 | 0.0028 | | 8.70 | 7.12 |

APPENDIX II. (Continued)

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 91 | S | 1D | FABA | Andi | iner | 6.10 | 0.0029 | 7.9 | 8.80 | 4.15 | |
| 92 | S | 1D | FABA | Andi | iner | 15.80 | 0.0196 | | 7.06 | 2.00 | |
| 93 | S | 1D | SAPO | Chry | pauc | 5.60 | 0.0024 | | 6.64 | 1.10 | |
| 94 | S | 1D | MYRS | Ardi | obov | 7.80 | 0.0047 | | 8.04 | 0.64 | |
| 95 | S | 1D | MIMO | Inga | fagi | 8.70 | 0.0059 | | 8.50 | 0.12 | |
| 96 | S | 1D | MYRS | Ardi | obov | 6.50 | 0.0033 | | 9.20 | 0.30 | |
| 97 | S | 1D | NYCT | Guap | frag | 44.30 | 0.1541 | 16.1 | 9.55 | 2.47 | |
| 98 | S | 1E | MYRS | Ardi | obov | 6.40 | 0.0032 | | 4.45 | 0.55 | |
| 99 | S | 1E | MYRS | Ardi | obov | 7.80 | 0.0047 | | 4.70 | 1.50 | |
| 100 | S | 1E | MYRS | Ardi | obov | 8.80 | 0.0060 | | 3.48 | 2.90 | |
| 101 | S | 1E | NYCT | Guap | frag | 38.30 | 0.1152 | | 4.00 | 3.35 | |
| 102 | S | 1E | RUBI | Guet | scab | 11.30 | 0.0100 | 13.1 | 5.21 | 3.50 | |
| 103 | S | 1E | NYCT | Guap | frag | 11.70 | 0.0107 | | 4.90 | 4.10 | |
| 104 | S | 1E | MYRS | Ardi | obov | 6.00 | 0.0028 | | 1.50 | 6.00 | |
| 105 | S | 1E | NYCT | Guap | frag | 21.50 | 0.0363 | | 1.55 | 7.20 | |
| 106 | S | 1E | MIMO | Inga | fagi | 6.80 | 0.0036 | | 0.25 | 9.25 | |
| 107 | S | 1E | FABA | Andi | iner | 8.20 | 0.0052 | | 8.30 | 9.20 | |
| 108 | S | 1E | RUBI | Guet | scab | 8.90 | 0.0062 | 10.0 | 7.60 | 9.70 | |
| 109 | S | 1E | MYRS | Ardi | obov | 5.60 | 0.0024 | | 9.90 | 3.60 | |
| 110 | S | 1E | MYRS | Ardi | obov | 5.60 | 0.0024 | | 9.95 | 2.90 | |
| 111 | S | 1E | CAES | Hyme | cour | 28.80 | 0.0651 | | 7.00 | 4.15 | |
| 112 | S | 1E | CAES | Hyme | cour | 24.40 | 0.0467 | 16.1 | 6.75 | 3.90 | |
| 113 | S | 1E | MYRS | Ardi | obov | 5.90 | 0.0027 | | 6.95 | 2.75 | |
| 114 | S | 1E | MYRS | Ardi | obov | 9.80 | 0.0075 | | 7.25 | 0.70 | |
| 115 | S | 1F | MYRS | Ardi | obov | 5.50 | 0.0023 | | 0.75 | 0.75 | |
| 116 | S | 1F | MYRS | Ardi | obov | 5.80 | 0.0026 | | 1.82 | 1.15 | |
| 117 | S | 1F | MYRS | Ardi | obov | 7.70 | 0.0046 | | 2.75 | 0.32 | |
| 118 | S | 1F | MYRS | Ardi | obov | 6.00 | 0.0028 | | 3.60 | 1.17 | |
| 119 | S | 1F | FABA | Andi | iner | 5.80 | 0.0026 | 3.3 | 3.10 | 1.75 | |
| 120 | S | 1F | MYRS | Ardi | obov | 8.60 | 0.0058 | | 4.25 | 2.40 | |
| 121 | S | 1F | BIGN | Tabe | hete | 6.50 | 0.0033 | 6.1 | 1.00 | 3.55 | |
| 122 | S | 1F | MIMO | Inga | fagi | 10.20 | 0.0081 | | 0.80 | 4.15 | |
| 123 | S | 1F | LAUR | Ocot | cori | 15.70 | 0.0193 | | 1.80 | 4.10 | |
| 124 | S | 1F | MYRS | Ardi | obov | 10.00 | 0.0078 | | 4.21 | 9.35 | |
| 125 | S | 1F | MIMO | Inga | fagi | 6.40 | 0.0032 | | 5.90 | 7.30 | |
| 126 | S | 1F | FABA | Andi | iner | 8.10 | 0.0051 | | 5.35 | 5.80 | |
| 127 | S | 1F | THYM | Daph | amer | 15.70 | 0.0193 | 10.9 | 6.30 | 6.90 | |
| 128 | S | 1F | RUTA | Zant | mart | 12.70 | 0.0126 | 12.2 | 6.60 | 7.10 | |
| 129 | S | 1F | FLAC | Case | guia | 8.20 | 0.0052 | 7.0 | 6.70 | 9.20 | |
| 130 | S | 1F | THYM | Daph | amer | 5.00 | 0.0019 | | 7.00 | 9.50 | DEAD 7/86 |
| 131 | S | 1F | MYRS | Ardi | obov | 5.50 | 0.0023 | 7.3 | 9.85 | 9.95 | |
| 132 | S | 1F | BORA | Cord | alli | 18.50 | 0.0268 | 15.8 | 8.60 | 8.05 | |
| 133 | S | 1F | RUBI | Fara | occi | 5.80 | 0.0026 | 4.3 | 6.35 | 4.75 | |
| 134 | S | 1F | MYRS | Ardi | obov | 10.30 | 0.0083 | | 6.00 | 4.05 | |
| 135 | S | 1F | RUBI | Fara | occi | 5.90 | 0.0027 | 4.6 | 5.40 | 3.60 | |
| 136 | S | 1F | SAPO | Chry | pauc | 10.30 | 0.0083 | | 5.80 | 2.20 | |
| 137 | S | 1F | MYRS | Ardi | obov | 9.50 | 0.0070 | | 6.55 | 0.50 | |
| 138 | S | 1F | BIGN | Tabe | hete | 14.60 | 0.0167 | 11.9 | 9.82 | 2.35 | |



220

APPENDIX II. (Continued)

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 139 | S | 1G | MYRS | Ardi | obov | 7.90 | 0.0049 | | 0.45 | 2.72 | |
| 140 | S | 1G | MYRS | Ardi | obov | 5.10 | 0.0020 | | 0.85 | 2.87 | |
| 141 | S | 1G | RUBI | Fara | occi | 7.90 | 0.0049 | 4.6 | 2.75 | 2.10 | |
| 142 | S | 1G | FABA | Andi | iner | 8.30 | 0.0054 | 7.6 | 3.58 | 1.60 | |
| 143 | S | 1G | MYRT | Myrc | flor | 8.20 | 0.0052 | 8.2 | 5.00 | 0.75 | |
| 144 | S | 1G | MYRT | Myrc | flor | 5.40 | 0.0022 | 6.1 | 5.45 | 2.50 | |
| 145 | S | 1G | RUBI | Guet | parv | 5.10 | 0.0020 | 4.0 | 4.75 | 4.40 | |
| 146 | S | 1G | LAUR | Ocot | cori | 10.20 | 0.0081 | | 3.90 | 5.40 | |
| 147 | S | 1G | RUBI | Guet | parv | 6.60 | 0.0034 | 9.7 | 2.30 | 4.30 | |
| 148 | S | 1G | CAES | Hyme | cour | 42.10 | 0.1392 | | 1.70 | 5.00 | |
| 149 | S | 1G | MYRS | Ardi | obov | 5.80 | 0.0026 | | 0.45 | 6.25 | |
| 150 | S | 1G | BIGN | Tabe | hete | 15.50 | 0.0188 | 14.0 | 0.45 | 6.62 | |
| 151 | S | 1G | THYM | Daph | amer | 10.50 | 0.0086 | 8.2 | 0.15 | 6.62 | |
| 152 | S | 1G | MIMO | Inga | fagi | 20.80 | 0.0339 | | 0.95 | 7.60 | |
| 153 | S | 1G | LAUR | Ocot | cori | 7.40 | 0.0043 | | 2.20 | 7.40 | |
| 154 | S | 1G | MIMO | Inga | fagi | 9.80 | 0.0075 | | 4.45 | 6.70 | |
| 155 | S | 1G | RUBI | Fara | occi | 7.90 | 0.0049 | 5.5 | 5.10 | 7.30 | |
| 156 | S | 1G | MIMO | Inga | fagi | 10.70 | 0.0089 | | 6.25 | 9.75 | |
| 157 | S | 1G | MYRS | Ardi | obov | 9.80 | 0.0075 | | 9.70 | 8.50 | |
| 158 | S | 1G | BIGN | Tabe | hete | 9.90 | 0.0076 | | 9.50 | 7.60 | |
| 159 | S | 1G | MYRS | Ardi | obov | 11.00 | 0.0095 | 7.9 | 9.40 | 7.50 | |
| 160 | S | 1G | MYRS | Ardi | obov | 7.40 | 0.0043 | | 6.60 | 7.65 | |
| 161 | S | 1G | FABA | Andi | iner | 7.20 | 0.0040 | | 7.80 | 5.50 | |
| 162 | S | 1G | BIGN | Tabe | hete | 6.40 | 0.0032 | 8.2 | 8.90 | 5.60 | |
| 163 | S | 1G | MIMO | Inga | fagi | 8.50 | 0.0056 | | 8.75 | 4.80 | |
| 164 | S | 1G | FABA | Andi | iner | 5.40 | 0.0022 | | 9.90 | 2.65 | |
| 165 | S | 1G | MYRS | Ardi | obov | 10.00 | 0.0078 | | 6.70 | 3.50 | |
| 166 | S | 1G | RUBI | Guet | parv | 9.50 | 0.0070 | 9.7 | 8.20 | 2.30 | |
| 167 | S | 1G | MYRS | Ardi | obov | 9.60 | 0.0072 | | 3.62 | 0.40 | |
| 168 | S | 1G | ERYT | Eryt | rotu | 7.10 | 0.0039 | 6.1 | 9.70 | 0.30 | |
| 169 | S | 1H | NYCT | Guap | frag | 12.40 | 0.0120 | | 2.40 | 0.12 | |
| 170 | S | 1H | FABA | Andi | iner | 9.10 | 0.0065 | | 5.06 | 0.06 | |
| 171 | S | 1H | MYRS | Ardi | obov | 5.00 | 0.0019 | | 5.10 | 0.04 | |
| 172 | S | 1H | MYRS | Ardi | obov | 5.10 | 0.0020 | | 5.80 | 2.00 | |
| 173 | S | 1H | BIGN | Tabe | hete | 11.50 | 0.0103 | | 5.72 | 2.45 | |
| 174 | S | 1H | MYRS | Ardi | obov | 7.80 | 0.0047 | | 3.10 | 3.00 | |
| 175 | S | 1H | MYRS | Ardi | obov | 7.70 | 0.0046 | | 1.30 | 3.10 | |
| 176 | S | 1H | MYRS | Ardi | obov | 7.20 | 0.0040 | | 1.28 | 4.40 | |
| 177 | S | 1H | BORA | Cord | alli | 9.30 | 0.0067 | 7.9 | 0.80 | 5.70 | |
| 178 | S | 1H | RUBI | Guet | scab | 5.80 | 0.0026 | | 2.00 | 5.10 | |
| 179 | S | 1H | MYRS | Ardi | obov | 5.20 | 0.0021 | | 0.10 | 7.25 | |
| 180 | S | 1H | MYRS | Ardi | obov | 8.30 | 0.0054 | | 0.70 | 8.34 | |
| 181 | S | 1H | BORA | Cord | alli | 20.40 | 0.0326 | | 1.95 | 8.10 | |
| 182 | S | 1H | BIGN | Tabe | hete | 16.20 | 0.0206 | 7.3 | 4.05 | 9.20 | |
| 183 | S | 1H | BIGN | Tabe | hete | 12.00 | 0.0113 | | 4.25 | 7.55 | |
| 184 | S | 1H | BURS | Burs | sima | 8.20 | 0.0052 | 7.6 | 4.35 | 6.75 | |
| 185 | S | 1H | LAUR | Ocot | cori | 10.10 | 0.0080 | 9.4 | 4.20 | 6.65 | |
| 186 | S | 1H | MYRT | Psid | ampl | 5.50 | 0.0023 | | 5.00 | 5.40 | DEAD11/85 |

APPENDIX II. (Continued)

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 187 | S | 1H | RUBI | Guet | scab | 5.10 | 0.0020 | | 5.50 | 4.55 | |
| 188 | S | 1H | MYRS | Ardi | obov | 5.80 | 0.0026 | | 7.60 | 7.20 | |
| 189 | S | 1H | BIGN | Tabe | hete | 13.00 | 0.0132 | | 8.00 | 7.50 | |
| 190 | S | 1H | MYRT | Myrc | flor | 10.20 | 0.0081 | 9.1 | 8.60 | 9.35 | |
| 191 | S | 1H | MYRS | Ardi | obov | 5.10 | 0.0020 | | 9.45 | 9.60 | |
| 192 | S | 1H | BIGN | Tabe | hete | 7.00 | 0.0038 | | 9.60 | 9.05 | DEAD11/85 |
| 193 | S | 1H | MYRT | Myrc | flor | 6.50 | 0.0033 | 8.5 | 8.80 | 7.35 | |
| 194 | S | 1H | MYRS | Ardi | obov | 5.20 | 0.0021 | | 6.60 | 4.60 | |
| 195 | S | 1H | MYRS | Ardi | obov | 5.60 | 0.0024 | | 8.10 | 5.90 | |
| 196 | S | 1H | MYRT | Myrc | flor | 8.10 | 0.0051 | 7.3 | 7.90 | 4.00 | |
| 197 | S | 1H | MIMO | Inga | fagi | 12.40 | 0.0120 | | 7.22 | 3.30 | |
| 198 | S | 1H | RUBI | Guet | scab | 6.00 | 0.0028 | | 6.41 | 2.90 | |
| 199 | S | 1H | RUBI | Guet | scab | 5.00 | 0.0019 | | 7.10 | 0.76 | |
| 200 | S | 1H | BIGN | Tabe | hete | 8.10 | 0.0051 | | 7.35 | 1.80 | |
| 201 | S | 1H | RUBI | Guet | scab | 7.60 | 0.0045 | | 8.25 | 1.55 | |
| 202 | S | 1H | THYM | Daph | amer | 7.00 | 0.0038 | 5.8 | 9.40 | 3.40 | |
| 203 | S | 1H | BIGN | Tabe | hete | 9.80 | 0.0075 | | 9.60 | 1.90 | DEAD11/85 |
| 204 | M | 1I | MYRS | Ardi | obov | 6.60 | 0.0034 | | 0.12 | 0.90 | |
| 205 | M | 1I | MYRS | Ardi | obov | 7.50 | 0.0044 | | 0.28 | 0.88 | |
| 206 | S | 1I | BIGN | Tabe | hete | 28.70 | 0.0646 | | 1.80 | 0.30 | |
| 207 | S | 1I | MYRT | Myrc | flor | 6.50 | 0.0033 | 8.2 | 3.90 | 2.40 | |
| 208 | M | 1I | RUBI | Guet | parv | 5.80 | 0.0026 | | 4.00 | 2.15 | SICK 7/86 |
| 209 | M | 1I | RUBI | Guet | parv | 6.90 | 0.0037 | | 4.10 | 2.10 | |
| 210 | M | 1I | RUBI | Guet | parv | 7.30 | 0.0041 | 7.9 | 4.25 | 2.20 | |
| 211 | S | 1I | BORA | Cord | alli | 9.00 | 0.0063 | 8.5 | 2.10 | 2.65 | |
| 212 | S | 1I | LAUR | Ocot | cori | 14.60 | 0.0167 | | 1.00 | 3.95 | |
| 213 | S | 1I | MYRT | Myrc | flor | 9.50 | 0.0070 | 7.9 | 0.08 | 5.45 | |
| 214 | S | 1I | BIGN | Tabe | hete | 8.20 | 0.0052 | | 1.20 | 5.65 | |
| 215 | S | 1I | STER | Guaz | ulmi | 20.00 | 0.0314 | 10.0 | 1.71 | 6.70 | |
| 216 | S | 1I | MYRT | Myrc | flor | 7.50 | 0.0044 | | 1.50 | 7.95 | |
| 217 | S | 1I | RUBI | Guet | scab | 5.20 | 0.0021 | | 1.55 | 7.85 | |
| 218 | S | 1I | RUBI | Guet | scab | 6.40 | 0.0032 | | 2.77 | 8.45 | |
| 219 | S | 1I | BIGN | Tabe | hete | 6.10 | 0.0029 | 9.7 | 3.68 | 9.35 | |
| 220 | S | 1I | MYRT | Myrc | flor | 6.10 | 0.0029 | | 3.85 | 9.45 | |
| 221 | S | 1I | RUBI | Guet | scab | 8.00 | 0.0050 | | 4.70 | 8.85 | |
| 222 | S | 1I | MYRS | Ardi | obov | 8.60 | 0.0058 | | 8.35 | 8.95 | |
| 223 | S | 1I | MYRT | Euge | mont | 9.50 | 0.0070 | | 7.20 | 8.25 | |
| 224 | S | 1I | RUBI | Guet | scab | 8.80 | 0.0060 | | 5.65 | 7.25 | |
| 225 | S | 1I | MYRT | Myrc | flor | 6.50 | 0.0033 | 8.5 | 5.55 | 6.65 | |
| 226 | S | 1I | BORA | Cord | alli | 12.70 | 0.0126 | 9.7 | 5.05 | 6.70 | |
| 227 | S | 1I | MYRT | Euge | mont | 8.20 | 0.0052 | 6.7 | 5.55 | 5.85 | |
| 228 | S | 1I | MYRT | Euge | mont | 11.00 | 0.0095 | 9.1 | 6.90 | 6.60 | |
| 229 | M | 1I | MYRS | Ardi | obov | 9.70 | 0.0073 | 7.6 | 7.80 | 7.40 | |
| 230 | M | 1I | MYRS | Ardi | obov | 6.70 | 0.0035 | | 8.00 | 7.35 | |
| 231 | S | 1I | RUBI | Guet | scab | 5.80 | 0.0026 | | 9.60 | 6.10 | |
| 232 | S | 1I | MYRS | Ardi | obov | 7.30 | 0.0041 | | 8.31 | 4.50 | |
| 233 | S | 1I | ERYT | Eryt | rotu | 5.20 | 0.0021 | 6.4 | 5.45 | 4.75 | |
| 234 | S | 1I | MYRS | Ardi | obov | 5.70 | 0.0025 | | 6.20 | 4.10 | |



222

APPENDIX II. (Continued)

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 235 | S | 1I | MYRT | Myrc | flor | 5.40 | 0.0022 | 7.0 | 6.04 | 3.10 | |
| 236 | S | 1I | BIGN | Tabe | hete | 34.60 | 0.0940 | | 7.65 | 3.55 | |
| 237 | S | 1I | MYRS | Ardi | obov | 6.10 | 0.0029 | | 6.47 | 0.05 | |
| 238 | S | 1I | RUBI | Guet | scab | 8.20 | 0.0052 | | 8.90 | 2.90 | |
| 239 | S | 1I | MYRS | Ardi | obov | 4.70 | 0.0017 | | 9.62 | 2.70 | |
| 240 | S | 1I | BORA | Cord | alli | 8.70 | 0.0059 | 8.5 | 9.00 | 0.05 | |
| 241 | S | 1J | RUBI | Guet | parv | 6.00 | 0.0028 | | 9.45 | 0.39 | |
| 242 | S | 1I | ERYT | Eryt | rotu | 6.30 | 0.0031 | 6.1 | 6.15 | 5.65 | DEAD11/85 |
| 243 | S | 1J | RUBI | Guet | parv | 5.30 | 0.0022 | | 2.30 | 6.70 | DEAD11/85 |
| 244 | S | 1J | RUBI | Guet | parv | 5.30 | 0.0022 | 6.1 | 2.75 | 1.45 | |
| 245 | M | 1J | BURS | Burs | sima | 24.70 | 0.0479 | | 0.89 | 3.10 | |
| 246 | M | 1J | BURS | Burs | sima | 9.20 | 0.0066 | | 0.45 | 3.10 | |
| 247 | S | 1J | THYM | Daph | amer | 7.20 | 0.0040 | 7.3 | 0.08 | 3.45 | |
| 248 | S | 1J | RUBI | Guet | parv | 5.70 | 0.0025 | | 1.84 | 4.60 | |
| 249 | S | 1J | MYRT | Euge | bifl | 8.30 | 0.0054 | 7.6 | 0.95 | 3.70 | |
| 250 | S | 1J | RUBI | Guet | parv | 5.60 | 0.0024 | | 0.75 | 5.95 | |
| 251 | S | 1J | RUBI | Guet | parv | 6.50 | 0.0033 | | 0.80 | 6.02 | |
| 252 | S | 1J | RUBI | Guet | parv | 9.00 | 0.0063 | 7.0 | 0.85 | 6.15 | |
| 253 | S | 1J | RUBI | Guet | scab | 5.30 | 0.0022 | | 1.50 | 6.65 | DEAD11/85 |
| 254 | S | 1J | RUBI | Guet | parv | 5.70 | 0.0025 | | 1.85 | 7.90 | DEAD11/85 |
| 255 | S | 1J | RUBI | Guet | parv | 6.00 | 0.0028 | 3.3 | 1.55 | 8.60 | |
| 256 | S | 1J | MYRS | Ardi | obov | 7.30 | 0.0041 | | 6.70 | 9.60 | |
| 257 | S | 1J | MYRT | Myrc | flor | 6.20 | 0.0030 | | 7.40 | 9.30 | |
| 258 | S | 1J | NYCT | Guap | frag | 13.80 | 0.0149 | 8.2 | 6.80 | 8.35 | |
| 259 | S | 1J | BIGN | Tabe | hete | 5.70 | 0.0025 | | 7.95 | 9.50 | |
| 260 | S | 1J | MYRT | Euge | mont | 7.00 | 0.0038 | 9.4 | 8.40 | 9.30 | |
| 261 | S | 1J | MYRT | Euge | mont | 11.20 | 0.0098 | | 9.90 | 9.20 | DEAD 7/86 |
| 262 | S | 1J | RUBI | Guet | scab | 7.70 | 0.0046 | 5.5 | 9.10 | 7.25 | |
| 263 | S | 1J | RUBI | Guet | parv | 5.60 | 0.0024 | 4.3 | 7.85 | 6.35 | |
| 264 | S | 1J | BIGN | Tabe | hete | 10.90 | 0.0093 | | 7.80 | 6.25 | |
| 265 | S | 1J | MYRS | Ardi | obov | 8.00 | 0.0050 | | 6.90 | 6.40 | |
| 266 | S | 1J | MYRT | Myrc | flor | 6.70 | 0.0035 | | 6.28 | 5.75 | |
| 267 | S | 1J | RUBI | Guet | parv | 6.90 | 0.0037 | | 6.45 | 4.50 | |
| 268 | S | 1J | RUBI | Guet | scab | 7.80 | 0.0047 | | 5.41 | 2.60 | |
| 269 | S | 1J | MYRT | Myrc | flor | 5.10 | 0.0020 | | 6.34 | 2.40 | |
| 270 | S | 1J | MYRT | Euge | mont | 7.80 | 0.0047 | | 4.82 | 5.65 | DEAD11/85 |
| 271 | S | 1J | BORA | Cord | alli | 9.30 | 0.0067 | | 3.87 | 4.55 | DEAD 7/86 |
| 272 | S | 1J | ERYT | Eryt | rotu | 5.70 | 0.0025 | 4.6 | 6.45 | 2.15 | |
| 273 | S | 1J | MYRT | Myrc | flor | 5.00 | 0.0019 | | 8.90 | 5.90 | |
| 274 | S | 1J | RUBI | Guet | scab | 7.00 | 0.0038 | | 8.99 | 5.30 | |
| 275 | S | 1J | MYRT | Myrc | flor | 7.00 | 0.0038 | | 8.24 | 1.90 | |
| 276 | S | 1J | BORA | Cord | alli | 18.30 | 0.0263 | 10.0 | 6.80 | 0.75 | |
| 277 | S | 1J | RUBI | Guet | scab | 6.50 | 0.0033 | | 9.72 | 0.78 | |
| 278 | M | 1J | CLUS | Clus | rose | 17.70 | 0.0246 | | 4.74 | 4.05 | SICK11/85 |
| 279 | M | 1J | CLUS | Clus | rose | 17.70 | 0.0246 | | 4.17 | 4.00 | |
| 280 | M | 1J | CLUS | Clus | rose | 17.70 | 0.0246 | | 3.98 | 2.60 | |
| 281 | S | 2J | MYRS | Ardi | obov | 5.90 | 0.0027 | 3.3 | 9.57 | 1.15 | |
| 282 | S | 2J | MYRT | Myrc | flor | 6.30 | 0.0031 | 7.6 | 9.96 | 2.10 | |

APPENDIX II. (Continued)

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 283 | S | 2J | BIGN | Tabe | hete | 7.60 | 0.0045 | 10.9 | 9.15 | 2.00 | |
| 284 | S | 2J | MYRT | Myrc | flor | 9.50 | 0.0070 | | 8.99 | 2.50 | |
| 285 | S | 2J | BIGN | Tabe | hete | 19.70 | 0.0304 | | 6.92 | 2.00 | |
| 286 | S | 2J | MYRS | Ardi | obov | 5.40 | 0.0022 | | 6.04 | 2.50 | |
| 287 | S | 2J | MYRS | Ardi | obov | 8.70 | 0.0059 | | 6.21 | 2.80 | |
| 288 | S | 2J | MYRT | Myrc | flor | 7.80 | 0.0047 | | 9.90 | 4.50 | |
| 289 | S | 2J | MYRT | Myrc | flor | 6.80 | 0.0036 | | 9.68 | 7.20 | |
| 290 | S | 2J | MYRS | Ardi | obov | 8.20 | 0.0052 | | 8.90 | 8.70 | |
| 291 | S | 2J | THYM | Daph | amer | 9.50 | 0.0070 | | 8.37 | 9.70 | DEAD 7/86 |
| 292 | S | 2J | MYRS | Ardi | obov | 8.90 | 0.0062 | | 8.49 | 9.20 | |
| 293 | S | 2J | MYRS | Ardi | obov | 11.40 | 0.0102 | | 7.50 | 7.50 | |
| 294 | S | 2J | MYRS | Ardi | obov | 5.30 | 0.0022 | | 7.96 | 6.80 | |
| 295 | S | 2J | MYRS | Ardi | obov | 9.80 | 0.0075 | | 7.75 | 8.80 | |
| 296 | S | 2J | MYRS | Ardi | obov | 7.10 | 0.0039 | | 5.32 | 7.70 | |
| 297 | S | 2J | MYRS | Ardi | obov | 8.10 | 0.0051 | | 6.24 | 7.00 | |
| 298 | S | 2J | MYRS | Ardi | obov | 12.20 | 0.0116 | 7.3 | 6.72 | 9.55 | |
| 299 | S | 2J | MYRS | Ardi | obov | 5.80 | 0.0026 | | 2.71 | 9.95 | |
| 300 | S | 2J | MYRS | Ardi | obov | 5.00 | 0.0019 | | 5.38 | 7.25 | |
| 301 | S | 2J | MYRS | Ardi | obov | 8.00 | 0.0050 | | 6.04 | 6.00 | |
| 302 | S | 2J | MYRS | Ardi | obov | 7.70 | 0.0046 | | 5.01 | 5.20 | |
| 303 | S | 2J | SAPO | Chry | pauc | 5.80 | 0.0026 | 7.0 | 3.50 | 4.65 | |
| 304 | S | 2J | BORA | Cord | alli | 9.60 | 0.0072 | | 5.80 | 4.10 | DEAD 7/86 |
| 305 | S | 2J | RUBI | Guet | scab | 6.50 | 0.0033 | 6.1 | 2.64 | 3.95 | |
| 306 | S | 2J | MYRS | Ardi | obov | 6.60 | 0.0034 | | 0.68 | 4.20 | |
| 307 | S | 2J | MYRS | Ardi | obov | 9.60 | 0.0072 | | 2.03 | 2.15 | |
| 308 | S | 2J | MYRS | Ardi | obov | 5.40 | 0.0022 | | 3.65 | 0.82 | DEAD11/85 |
| 309 | S | 2J | MYRS | Ardi | obov | 9.80 | 0.0075 | | 5.84 | 4.10 | |
| 310 | S | 2J | MYRS | Ardi | obov | 6.50 | 0.0033 | | 4.71 | 1.80 | |
| 311 | S | 2I | MIMO | Inga | fagi | 13.50 | 0.0143 | 11.6 | 9.12 | 0.56 | |
| 312 | S | 2I | VERB | Cith | frut | 6.30 | 0.0031 | 7.9 | 9.60 | 1.05 | |
| 313 | S | 2I | RUBI | Guet | parv | 7.10 | 0.0039 | 4.0 | 8.70 | 2.00 | |
| 314 | S | 2I | BIGN | Tabe | hete | 17.30 | 0.0235 | | 9.20 | 5.35 | |
| 315 | S | 2I | SAPI | Meli | biju | 9.60 | 0.0072 | 10.0 | 8.95 | 5.40 | |
| 316 | S | 2I | RUTA | Zant | mart | 25.60 | 0.0514 | 3.3 | 8.60 | 5.45 | |
| 317 | S | 2I | FLAC | Case | guia | 7.90 | 0.0049 | 5.0 | 8.25 | 5.85 | |
| 318 | S | 2I | MYRT | Myrc | flor | 11.10 | 0.0096 | | 7.85 | 5.80 | |
| 319 | S | 2I | NYCT | Guap | frag | 9.20 | 0.0066 | | 9.70 | 6.90 | |
| 320 | S | 2I | MYRT | Myrc | flor | 7.10 | 0.0039 | 6.7 | 8.20 | 6.10 | |
| 321 | S | 2I | MYRS | Ardi | obov | 5.00 | 0.0019 | | 9.10 | 8.70 | |
| 322 | S | 2I | MYRS | Ardi | obov | 9.30 | 0.0067 | | 7.80 | 8.55 | |
| 323 | S | 2I | MYRT | Myrc | flor | 8.40 | 0.0055 | 8.0 | 6.85 | 6.90 | |
| 324 | S | 2I | MYRS | Ardi | obov | 7.40 | 0.0043 | | 4.35 | 8.90 | |
| 325 | S | 2I | MYRS | Ardi | obov | 8.90 | 0.0062 | | 4.21 | 9.95 | |
| 326 | S | 2I | MYRT | Myrc | flor | 6.50 | 0.0033 | | 3.40 | 7.70 | |
| 327 | S | 2I | ERYT | Eryt | rotu | 7.00 | 0.0038 | 7.9 | 5.30 | 5.20 | |
| 328 | S | 2I | RUBI | Guet | scab | 5.70 | 0.0025 | 8.8 | 4.18 | 5.45 | |
| 329 | S | 2I | MYRS | Ardi | obov | 8.30 | 0.0054 | | 2.41 | 6.85 | |
| 330 | S | 2I | MYRS | Ardi | obov | 9.80 | 0.0075 | | 0.80 | 6.80 | |



224

APPENDIX II. (Continued)

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 331 | S | 2I | MIMO | Inga | fagi | 19.40 | 0.0295 | | 0.10 | 5.40 | |
| 332 | S | 2I | BORA | Cord | alli | 14.50 | 0.0165 | 13.4 | 1.10 | 3.45 | |
| 333 | S | 2I | MYRS | Ardi | obov | 9.20 | 0.0066 | | 1.25 | 3.10 | |
| 334 | M | 2I | MYRT | Myrc | flor | 7.30 | 0.0041 | 8.2 | 3.53 | 3.30 | |
| 335 | M | 2I | MYRT | Myrc | flor | 5.50 | 0.0023 | | 3.48 | 3.40 | |
| 336 | S | 2I | RUBI | Guet | parv | 9.30 | 0.0067 | 8.2 | 5.41 | 4.70 | |
| 337 | S | 2I | MYRS | Ardi | obov | 7.90 | 0.0049 | | 7.50 | 3.20 | |
| 338 | S | 2I | MYRS | Ardi | obov | 5.80 | 0.0026 | | 7.15 | 3.55 | |
| 339 | S | 2I | FABA | Andi | iner | 12.50 | 0.0122 | 7.9 | 5.56 | 1.05 | |
| 340 | S | 2I | MYRS | Ardi | obov | 13.10 | 0.0134 | | 5.72 | 0.10 | |
| 341 | S | 2I | MYRT | Myrc | flor | 7.20 | 0.0040 | | 4.60 | 2.05 | |
| 342 | S | 2I | MYRT | Myrc | flor | 10.80 | 0.0091 | | 4.00 | 2.10 | |
| 343 | S | 2I | MYRS | Ardi | obov | 9.70 | 0.0073 | | 0.85 | 0.86 | |
| 344 | S | 2I | MYRT | Myrc | flor | 6.10 | 0.0029 | | 2.24 | 0.55 | |
| 345 | S | 2H | BORA | Cord | alli | 11.40 | 0.0102 | 11.9 | 9.15 | 0.96 | |
| 346 | S | 2H | MYRS | Ardi | obov | 5.00 | 0.0019 | | 9.25 | 2.00 | |
| 347 | S | 2H | MYRT | Psid | ampl | 5.10 | 0.0020 | 3.3 | 8.60 | 2.94 | |
| 348 | S | 2H | MYRS | Ardi | obov | 10.60 | 0.0088 | 2.9 | 8.40 | 2.91 | |
| 349 | S | 2H | NYCT | Guap | frag | 5.50 | 0.0023 | | 6.30 | 1.05 | |
| 350 | S | 2H | MYRS | Ardi | obov | 10.00 | 0.0078 | 1.1 | 5.75 | 3.45 | |
| 351 | S | 2H | BORA | Cord | alli | 15.30 | 0.0183 | 9.7 | 8.70 | 4.00 | |
| 352 | S | 2H | MIMO | Inga | fagi | 10.40 | 0.0084 | | 8.50 | 4.90 | DEAD 7/86 |
| 353 | S | 2H | MYRS | Ardi | obov | 8.00 | 0.0050 | | 9.75 | 5.00 | |
| 354 | S | 2H | MIMO | Inga | fagi | 16.10 | 0.0203 | 9.1 | 6.65 | 5.12 | |
| 355 | S | 2H | MYRS | Ardi | obov | 8.30 | 0.0054 | | 6.55 | 8.72 | |
| 356 | S | 2H | MYRS | Ardi | obov | 6.80 | 0.0036 | | 6.55 | 9.06 | |
| 357 | S | 2H | MYRS | Ardi | obov | 5.00 | 0.0019 | | 7.15 | 9.08 | |
| 358 | S | 2H | MYRS | Ardi | obov | 8.60 | 0.0058 | | 8.95 | 6.89 | |
| 359 | S | 2H | MYRS | Ardi | obov | 8.90 | 0.0062 | | 9.70 | 9.14 | |
| 360 | M | 2H | RUBI | Guet | parv | 11.50 | 0.0103 | 12.8 | 9.00 | 9.71 | |
| 361 | M | 2H | RUBI | Guet | parv | 13.10 | 0.0134 | | 8.70 | 9.71 | |
| 362 | S | 2H | SAPO | Chry | pauc | 10.10 | 0.0080 | 12.2 | 6.25 | 9.65 | |
| 363 | S | 2H | MYRS | Ardi | obov | 7.50 | 0.0044 | | 3.10 | 9.88 | |
| 364 | S | 2H | MYRS | Ardi | obov | 11.10 | 0.0096 | 10.3 | 2.80 | 9.00 | |
| 365 | S | 2H | MYRS | Ardi | obov | 5.30 | 0.0022 | | 1.45 | 7.59 | |
| 366 | S | 2H | MYRS | Ardi | obov | 6.70 | 0.0035 | | 3.55 | 7.65 | |
| 367 | M | 2H | LAUR | Ocot | cori | 7.40 | 0.0043 | | 2.90 | 5.14 | |
| 368 | M | 2H | LAUR | Ocot | cori | 12.20 | 0.0116 | 8.5 | 2.65 | 5.21 | |
| 369 | S | 2H | MYRS | Ardi | obov | 7.10 | 0.0039 | | 0.59 | 4.52 | |
| 370 | S | 2H | MYRS | Ardi | obov | 5.50 | 0.0023 | | 0.05 | 4.05 | |
| 371 | S | 2H | MYRS | Ardi | obov | 8.00 | 0.0050 | | 2.30 | 3.31 | |
| 372 | S | 2H | MYRS | Ardi | obov | 6.10 | 0.0029 | 3.0 | 5.40 | 4.91 | |
| 373 | S | 2H | FABA | Andi | iner | 7.70 | 0.0046 | 6.7 | 3.30 | 1.46 | |
| 374 | S | 2H | CAES | Hyme | cour | 17.20 | 0.0232 | 11.6 | 2.10 | 1.40 | |
| 375 | S | 2H | MYRS | Ardi | obov | 5.70 | 0.0025 | | 2.35 | 0.35 | |
| 376 | S | 2H | MYRT | Myrc | flor | 11.40 | 0.0102 | | 3.40 | 0.12 | |
| 377 | S | 2G | MYRS | Ardi | obov | 7.30 | 0.0041 | | 9.95 | 0.20 | |
| 378 | S | 2G | MYRS | Ardi | obov | 7.00 | 0.0038 | | 9.90 | 1.95 | |



225

APPENDIX II. (Continued)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 379 | S | 2G | MYRS | Ardi obov | 7.70 | 0.0046 | | 7.00 | 0.80 | |
| 380 | S | 2G | MYRT | Euge bifl | 5.40 | 0.0022 | | 6.60 | 1.05 | |
| 381 | S | 2G | MYRS | Ardi obov | 5.40 | 0.0022 | | 5.50 | 0.25 | |
| 382 | S | 2G | BIGN | Tabe hete | 6.90 | 0.0037 | | 4.70 | 0.60 | |
| 383 | S | 2G | BORA | Cord alli | 20.90 | 0.0343 | | 6.30 | 3.88 | |
| 384 | S | 2G | MYRS | Ardi obov | 5.40 | 0.0022 | | 7.95 | 3.00 | |
| 385 | S | 2G | BORA | Bour succ | 6.10 | 0.0029 | 7.3 | 8.80 | 4.31 | |
| 386 | S | 2G | MYRS | Ardi obov | 8.30 | 0.0054 | | 6.75 | 4.95 | |
| 387 | S | 2G | MYRS | Ardi obov | 6.90 | 0.0037 | | 8.30 | 7.21 | |
| 388 | S | 2G | MYRS | Ardi obov | 7.30 | 0.0041 | | 4.80 | 5.15 | |
| 389 | S | 2G | MYRS | Ardi obov | 9.30 | 0.0057 | | 6.45 | 6.12 | |
| 390 | S | 2G | LAUR | Ocot cori | 15.40 | 0.0186 | 9.1 | 5.65 | 7.98 | |
| 391 | S | 2G | MYRS | Ardi obov | 9.10 | 0.0065 | | 3.40 | 8.70 | |
| 392 | S | 2G | NYCT | Guap frag | 26.50 | 0.0551 | | 1.75 | 9.35 | |
| 393 | S | 2G | MYRS | Ardi obov | 8.90 | 0.0062 | | 1.70 | 8.76 | |
| 394 | S | 2G | RUBI | Guet scab | 5.70 | 0.0025 | | 0.72 | 7.65 | DEAD11/85 |
| 395 | S | 2G | ERYT | Eryt rotu | 9.40 | 0.0069 | 7.0 | 1.85 | 2.56 | |
| 396 | S | 2G | MIMO | Inga fagi | 6.20 | 0.0030 | | 0.45 | 1.59 | |
| 397 | S | 2G | THYM | Daph amer | 10.20 | 0.0081 | 11.2 | 0.29 | 1.74 | |
| 398 | S | 2G | RUBI | Fara occi | 7.80 | 0.0047 | | 0.25 | 0.75 | |
| 399 | S | 2G | MYRS | Ardi obov | 5.90 | 0.0027 | | 1.15 | 1.00 | |
| 400 | S | 2G | MYRS | Ardi obov | 6.50 | 0.0033 | | 2.70 | 1.67 | |
| 401 | S | 2G | RUBI | Guet parv | 6.60 | 0.0034 | 7.3 | 3.90 | 1.75 | |
| 402 | S | 2F | LAUR | Ocot cori | 11.10 | 0.0096 | | 9.90 | 1.70 | |
| 403 | S | 2F | BIGN | Tabe hete | 6.20 | 0.0030 | 6.1 | 7.50 | 0.20 | |
| 404 | S | 2F | MYRS | Ardi obov | 7.80 | 0.0047 | | 6.45 | 1.00 | |
| 405 | S | 2F | FABA | Andi iner | 5.10 | 0.0020 | | 8.40 | 2.20 | |
| 406 | S | 2F | THYM | Daph amer | 15.80 | 0.0196 | 12.2 | 9.10 | 4.69 | |
| 407 | S | 2F | MIMO | Inga fagi | 5.30 | 0.0022 | | 8.85 | 3.52 | |
| 408 | S | 2F | RUBI | Guet parv | 5.20 | 0.0021 | | 8.25 | 4.03 | DEAD11/85 |
| 409 | S | 2F | FABA | Andi iner | 8.20 | 0.0052 | 6.4 | 5.95 | 4.95 | |
| 410 | S | 2F | FABA | Andi iner | 11.10 | 0.0096 | | 5.05 | 5.50 | |
| 411 | S | 2F | MYRS | Ardi obov | 6.20 | 0.0030 | | 7.55 | 7.09 | |
| 412 | S | 2F | MYRS | Ardi obov | 5.90 | 0.0027 | | 9.05 | 6.45 | |
| 413 | S | 2F | MYRS | Ardi obov | 6.20 | 0.0030 | | 9.90 | 6.56 | |
| 414 | M | 2F | NYCT | Guap frag | 18.10 | 0.0257 | | 8.55 | 8.81 | |
| 415 | M | 2F | NYCT | Guap frag | 17.80 | 0.0248 | | 8.30 | 8.85 | |
| 416 | M | 2F | NYCT | Guap frag | 14.80 | 0.0172 | 10.0 | 8.75 | 8.90 | |
| 417 | S | 2F | MYRS | Ardi obov | 9.70 | 0.0073 | | 5.65 | 8.99 | |
| 418 | S | 2F | MYRS | Ardi obov | 10.50 | 0.0086 | | 5.30 | 8.20 | |
| 419 | S | 2F | MYRS | Ardi obov | 7.00 | 0.0038 | | 2.60 | 8.81 | |
| 420 | S | 2F | MYRS | Ardi obov | 6.80 | 0.0036 | | 2.40 | 9.11 | |
| 421 | M | 2F | MYRS | Ardi obov | 12.10 | 0.0114 | 10.6 | 0.51 | 7.81 | |
| 422 | M | 2F | MYRS | Ardi obov | 9.00 | 0.0063 | | 0.45 | 7.62 | |
| 423 | S | 2F | MYRS | Ardi obov | 5.90 | 0.0027 | | 3.15 | 6.45 | |
| 424 | S | 2F | MYRS | Ardi obov | 5.00 | 0.0019 | | 3.70 | 4.82 | |
| 425 | S | 2F | MYRS | Ardi obov | 6.10 | 0.0029 | | 1.01 | 4.31 | |
| 426 | S | 2F | MYRS | Ardi obov | 6.50 | 0.0033 | | 3.20 | 4.01 | |



226

APPENDIX II. (Continued)

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 427 | S | 2F | RUBI | Fara | occi | 7.80 | 0.0047 | 5.8 | 4.40 | 2.40 | |
| 428 | S | 2F | THYM | Daph | amer | 10.40 | 0.0084 | 12.5 | 8.25 | 2.05 | |
| 429 | S | 2E | EUPH | Marg | nobi | 32.40 | 0.0824 | 12.5 | 8.25 | 2.05 | |
| 430 | M | 2E | SAPO | Chry | pauc | 13.90 | 0.0151 | 10.9 | 6.30 | 1.15 | |
| 431 | M | 2E | SAPO | Chry | pauc | 5.40 | 0.0022 | | 6.15 | 1.25 | |
| 432 | S | 2E | MYRS | Ardi | obov | 5.00 | 0.0019 | | 5.10 | 2.15 | |
| 433 | S | 2E | MIMO | Inga | fagi | 10.10 | 0.0080 | | 5.80 | 3.27 | |
| 434 | S | 2E | NYCT | Guap | frag | 28.90 | 0.0655 | | 7.00 | 3.40 | |
| 435 | S | 2E | MYRS | Ardi | obov | 5.20 | 0.0021 | | 8.95 | 2.91 | |
| 436 | S | 2E | MYRS | Ardi | obov | 6.90 | 0.0037 | | 8.75 | 7.09 | |
| 437 | S | 2E | MIMO | Inga | fagi | 5.50 | 0.0023 | | 7.45 | 7.33 | |
| 438 | S | 2E | MYRS | Ardi | obov | 7.10 | 0.0039 | | 9.35 | 9.00 | |
| 439 | S | 2E | EUPH | Marg | nobi | 25.90 | 0.0526 | 15.8 | 7.90 | 8.19 | |
| 440 | S | 2E | CAES | Hyme | cour | 34.10 | 0.0913 | 17.6 | 5.80 | 8.05 | |
| 441 | S | 2E | MYRS | Ardi | obov | 6.90 | 0.0037 | | 5.25 | 7.41 | |
| 442 | M | 2E | SAPI | Meli | biju | 11.50 | 0.0103 | 12.8 | 3.15 | 6.51 | |
| 443 | M | 2E | SAPI | Meli | biju | 6.50 | 0.0033 | | 3.00 | 6.48 | |
| 444 | S | 2E | MYRT | Psid | ampl | 6.70 | 0.0035 | | 6.25 | 7.84 | DEAD11/85 |
| 445 | S | 2E | MYRS | Ardi | obov | 7.40 | 0.0043 | | 4.20 | 4.25 | |
| 447 | S | 2E | MYRS | Ardi | obov | 9.80 | 0.0075 | | 4.30 | 3.51 | |
| 448 | S | 2E | MYRS | Ardi | obov | 5.80 | 0.0026 | | 0.25 | 4.75 | |
| 449 | S | 2E | MYRS | Ardi | obov | 5.60 | 0.0024 | | 2.75 | 1.61 | |
| 450 | S | 2E | ANAC | Mang | indi | 27.10 | 0.0576 | 11.2 | 3.75 | 0.74 | |
| 451 | S | 2D | MYRS | Ardi | obov | 8.30 | 0.0054 | | 6.75 | 3.01 | |
| 452 | S | 2D | MYRS | Ardi | obov | 7.90 | 0.0049 | | 8.65 | 5.65 | |
| 453 | M | 2D | SAPO | Chry | pauc | 6.40 | 0.0032 | | 8.20 | 8.01 | |
| 454 | M | 2D | SAPO | Chry | pauc | 6.10 | 0.0029 | | 8.00 | 8.22 | |
| 455 | M | 2D | SAPO | Chry | pauc | 16.10 | 0.0203 | 11.2 | 7.80 | 8.09 | |
| 456 | M | 2D | SAPO | Chry | pauc | 18.20 | 0.0260 | | 7.60 | 7.99 | |
| 457 | S | 2D | MIMO | Inga | fagi | 7.90 | 0.0049 | | 4.65 | 5.05 | |
| 458 | S | 2D | SAPO | Chry | pauc | 8.60 | 0.0058 | | 4.35 | 5.87 | |
| 459 | S | 2D | EUPH | Marg | nobi | 42.30 | 0.1405 | | 1.01 | 8.65 | |
| 460 | S | 2D | MYRS | Ardi | obov | 5.30 | 0.0022 | | 1.00 | 3.32 | |
| 461 | S | 2D | FABA | Andi | iner | 18.20 | 0.0260 | | 1.25 | 3.38 | |
| 462 | S | 2C | MIMO | Inga | fagi | 19.60 | 0.0301 | 14.0 | 6.50 | 1.89 | |
| 463 | S | 2C | FABA | Andi | iner | 13.30 | 0.0138 | | 6.10 | 2.01 | |
| 464 | S | 2C | MYRS | Ardi | obov | 6.70 | 0.0035 | | 8.85 | 4.01 | |
| 465 | S | 2C | MYRS | Ardi | obov | 11.50 | 0.0103 | | 9.95 | 9.20 | |
| 466 | S | 2C | MYRS | Ardi | obov | 5.70 | 0.0025 | | 7.75 | 7.01 | |
| 467 | S | 2C | MYRS | Ardi | obov | 8.00 | 0.0050 | | 5.60 | 6.84 | |
| 468 | S | 2C | NYCT | Guap | frag | 29.40 | 0.0678 | 15.2 | 4.75 | 6.92 | |
| 469 | S | 2C | MYRS | Ardi | obov | 5.50 | 0.0023 | | 4.55 | 8.21 | |
| 470 | S | 2C | MYRS | Ardi | obov | 6.70 | 0.0035 | | 4.40 | 5.95 | |
| 471 | M | 2C | MYRS | Ardi | obov | 6.70 | 0.0035 | | 4.05 | 5.51 | |
| 472 | M | 2C | MYRS | Ardi | obov | 5.60 | 0.0024 | | 4.35 | 5.15 | |
| 473 | S | 2C | MYRS | Ardi | obov | 10.80 | 0.0091 | | 1.85 | 8.01 | |
| 474 | S | 2C | FABA | Andi | iner | 12.20 | 0.0116 | 13.1 | 1.22 | 9.80 | |
| 475 | S | 2C | MYRS | Ardi | obov | 7.70 | 0.0046 | | 0.82 | 9.20 | |



227

APPENDIX II. (Continued)

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 476 | S | 2C | MYRS | Ardi | obov | 9.90 | 0.0076 | | 0.63 | 6.95 | |
| 477 | S | 2C | FABA | Andi | iner | 7.40 | 0.0043 | | 1.65 | 5.40 | |
| 478 | S | 2C | MIMO | Inga | fagi | 15.10 | 0.0179 | | 1.40 | 4.80 | |
| 479 | S | 2C | CAES | Hyme | cour | 31.10 | 0.0759 | 17.6 | 0.22 | 3.00 | |
| 480 | S | 2C | MYRS | Ardi | obov | 9.10 | 0.0065 | | 1.75 | 1.79 | |
| 481 | S | 2C | MYRS | Ardi | obov | 8.00 | 0.0050 | | 1.95 | 1.75 | |
| 482 | S | 2C | MIMO | Inga | fagi | 30.20 | 0.0716 | 17.6 | 2.65 | 0.25 | |
| 483 | S | 2B | MIMO | Inga | fagi | 21.30 | 0.0356 | | 9.80 | 0.45 | |
| 484 | S | 2B | MYRS | Ardi | obov | 15.20 | 0.0181 | | 8.25 | 0.45 | |
| 485 | S | 2B | SAPO | Chry | pauc | 26.00 | 0.0530 | 13.1 | 6.05 | 2.30 | |
| 486 | S | 2B | MYRT | Myrc | flor | 9.00 | 0.0063 | | 7.10 | 3.80 | DEAD11/85 |
| 487 | S | 2B | LAUR | Ocot | cori | 6.40 | 0.0032 | 7.3 | 9.50 | 3.45 | |
| 488 | S | 2B | VERB | Cith | frut | 14.90 | 0.0174 | 12.5 | 7.75 | 9.10 | |
| 489 | S | 2B | MYRS | Ardi | obov | 5.50 | 0.0023 | | 7.85 | 9.29 | |
| 490 | S | 2B | NYCT | Guap | frag | 24.20 | 0.0459 | | 7.50 | 9.60 | |
| 491 | S | 2B | MYRS | Ardi | obov | 7.90 | 0.0049 | | 6.80 | 7.55 | |
| 492 | S | 2B | FABA | Andi | iner | 5.20 | 0.0021 | 6.1 | 2.46 | 9.80 | |
| 493 | S | 2B | LAUR | Ocot | cori | 17.40 | 0.0237 | 8.8 | 2.25 | 9.10 | |
| 494 | S | 2B | FABA | Andi | iner | 12.50 | 0.0122 | | 0.62 | 8.72 | |
| 495 | M | 2B | MYRS | Ardi | obov | 7.00 | 0.0038 | | 1.40 | 6.79 | |
| 496 | M | 2B | MYRS | Ardi | obov | 8.10 | 0.0051 | | 1.60 | 6.42 | |
| 497 | S | 2B | MYRS | Ardi | obov | 9.20 | 0.0066 | | 2.05 | 3.65 | |
| 498 | S | 2B | MYRS | Ardi | obov | 7.10 | 0.0039 | | 3.05 | 3.42 | |
| 499 | S | 2B | FABA | Andi | iner | 13.50 | 0.0143 | | 5.75 | 3.50 | |
| 500 | S | 2B | MYRT | Myrc | flor | 9.10 | 0.0065 | | 4.05 | 1.50 | |
| 501 | S | 2B | MYRS | Ardi | obov | 10.40 | 0.0084 | | 3.95 | 0.91 | |
| 502 | S | 2B | MYRT | Myrc | flor | 9.20 | 0.0066 | | 1.00 | 2.01 | |
| 503 | S | 2B | MYRS | Ardi | obov | 5.60 | 0.0024 | | 1.10 | 0.60 | |
| 504 | S | 2A | BIGN | Tabe | hete | 13.10 | 0.0134 | 10.9 | 7.13 | 0.05 | |
| 505 | S | 2A | MYRS | Ardi | obov | 8.50 | 0.0056 | 8.8 | 5.40 | 1.29 | |
| 506 | S | 2A | THYM | Daph | amer | 12.00 | 0.0113 | 12.2 | 6.75 | 3.42 | |
| 507 | S | 2A | MYRS | Ardi | obov | 8.00 | 0.0050 | | 7.05 | 3.85 | |
| 508 | S | 2A | MYRS | Ardi | obov | 5.70 | 0.0025 | | 7.75 | 3.54 | |
| 509 | S | 2A | FABA | Andi | iner | 5.90 | 0.0027 | | 9.00 | 4.26 | |
| 510 | S | 2A | NYCT | Guap | frag | 34.80 | 0.0951 | 13.7 | 9.00 | 8.05 | |
| 511 | S | 2A | FABA | Andi | iner | 20.30 | 0.0323 | | 8.75 | 9.80 | |
| 512 | S | 2A | NYCT | Guap | frag | 33.20 | 0.0865 | | 7.30 | 8.89 | |
| 513 | M | 2A | LAUR | Ocot | cori | 18.80 | 0.0277 | | 7.00 | 8.75 | DEAD 7/86 |
| 514 | M | 2A | LAUR | Ocot | cori | 14.90 | 0.0174 | | 7.25 | 6.30 | |
| 515 | S | 2A | NYCT | Guap | frag | 18.00 | 0.0254 | | 7.15 | 5.80 | |
| 516 | S | 2A | FLAC | Case | deca | 5.80 | 0.0026 | 8.5 | 6.30 | 9.51 | |
| 517 | S | 2A | MYRS | Ardi | obov | 11.20 | 0.0098 | | 3.20 | 8.21 | |
| 518 | M | 2A | MYRS | Ardi | obov | 6.90 | 0.0037 | | 2.15 | 6.75 | |
| 519 | M | 2A | MYRS | Ardi | obov | 5.30 | 0.0022 | | 2.30 | 9.59 | |
| 520 | S | 2A | THYM | Daph | amer | 10.90 | 0.0093 | 11.2 | 1.60 | 8.50 | |
| 521 | S | 2A | RUBI | Guet | scab | 7.30 | 0.0041 | 7.6 | 0.45 | 7.20 | |
| 522 | S | 2A | MYRS | Ardi | obov | 6.80 | 0.0036 | | 2.15 | 6.35 | |
| 523 | S | 2A | NYCT | Guap | frag | 14.20 | 0.0158 | | 2.70 | 4.89 | |



228

APPENDIX II. (Continued)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 524 | S | 2A | LAUR | Ocot | cori | 5.00 | 0.0019 | 6.4 | 2.80 | 4.62 |
| 525 | S | 2A | RUBI | Guet | scab | 6.20 | 0.0030 | 7.3 | 2.60 | 4.24 |
| 526 | S | 2A | MYRS | Ardi | obov | 5.20 | 0.0021 | | 3.35 | 2.65 |
| 527 | S | 2A | RUBI | Guet | scab | 5.00 | 0.0019 | | 3.50 | 2.50 |
| 528 | S | 2A | BIGN | Tabe | hete | 10.90 | 0.0093 | | 1.30 | 0.12 |
| 529 | S | 2A | RUBI | Guet | scab | 6.20 | 0.0030 | | 0.50 | 1.45 |
| 530 | S | 2A | MYRS | Ardi | obov | 6.10 | 0.0029 | | 0.05 | 0.65 |
| 531 | M | 2A | CAES | Hyme | cour | 29.00 | 0.0660 | 12.8 | 0.60 | 0.55 |
| 532 | M | 2A | CAES | Hyme | cour | 41.40 | 0.1346 | | 0.12 | 0.19 |
| 533 | M | 2A | CAES | Hyme | cour | 31.80 | 0.0794 | | 0.40 | 0.20 |
| 534 | S | 3A | RUBI | Guet | scab | 9.50 | 0.0070 | | 1.45 | 1.87 |
| 535 | S | 3A | RUBI | Guet | scab | 7.70 | 0.0046 | | 1.70 | 2.65 |
| 536 | S | 3A | MYRS | Ardi | obov | 5.30 | 0.0022 | | 0.85 | 3.35 |
| 537 | S | 3A | RUBI | Guet | scab | 7.90 | 0.0049 | | 0.05 | 3.82 |
| 538 | S | 3A | BIGN | Tabe | hete | 5.60 | 0.0024 | | 0.03 | 4.85 |
| 539 | S | 3A | RUBI | Fara | occi | 5.60 | 0.0024 | 6.7 | 0.05 | 4.95 |
| 540 | S | 3A | CAES | Hyme | cour | 36.00 | 0.1017 | 14.0 | 2.40 | 5.95 |
| 541 | S | 3A | FABA | Sabi | flor | 5.40 | 0.0022 | 7.9 | 3.00 | 4.25 |
| 542 | S | 3A | RUBI | Guet | scab | 8.00 | 0.0050 | | 0.81 | 8.20 |
| 543 | S | 3A | FABA | Sabi | flor | 6.00 | 0.0028 | 8.2 | 3.20 | 8.95 |
| 544 | S | 3A | ERYT | Eryt | rotu | 5.40 | 0.0022 | 6.7 | 3.80 | 9.48 |
| 545 | M | 3A | MYRS | Ardi | obov | 5.70 | 0.0025 | | 6.30 | 7.71 |
| 546 | M | 3A | MYRS | Ardi | obov | 5.50 | 0.0023 | | 6.20 | 7.25 |
| 547 | S | 3A | CAES | Hyme | cour | 9.40 | 0.0069 | | 6.05 | 7.05 |
| 548 | S | 3A | MIMO | Inga | fagi | 15.00 | 0.0176 | | 6.70 | 7.49 |
| 549 | S | 3A | THYM | Daph | amer | 5.20 | 0.0021 | 8.2 | 8.60 | 7.49 |
| 550 | S | 3A | THYM | Daph | amer | 20.00 | 0.0314 | | 6.80 | 4.00 |
| 551 | S | 3A | FABA | Andi | iner | 7.30 | 0.0041 | | 9.60 | 6.20 |
| 552 | S | 3A | MYRT | Euge | mont | 12.80 | 0.0128 | | 3.50 | 0.45 |
| 553 | S | 3A | NYCT | Guap | frag | 14.50 | 0.0165 | | 7.45 | 3.80 |
| 554 | S | 3A | MYRS | Ardi | obov | 10.50 | 0.0086 | | 4.60 | 3.21 |
| 555 | S | 3A | BORA | Bour | succ | 7.30 | 0.0041 | 8.5 | 7.30 | 0.73 |
| 556 | S | 3A | MYRS | Ardi | obov | 5.80 | 0.0026 | | 8.00 | 0.85 |
| 557 | S | 3A | RUBI | Guet | scab | 5.20 | 0.0021 | | 4.10 | 1.10 |
| 558 | S | 3B | FABA | Andi | iner | 6.10 | 0.0029 | 7.3 | 0.25 | 3.00 |
| 559 | S | 3B | MIMO | Inga | fagi | 9.20 | 0.0066 | 8.5 | 2.00 | 5.20 |
| 560 | S | 3B | NYCT | Guap | frag | 22.10 | 0.0383 | | 3.45 | 5.85 |
| 561 | S | 3B | RUBI | Fara | occi | 5.20 | 0.0021 | 5.2 | 2.10 | 6.90 |
| 562 | S | 3B | THYM | Daph | amer | 10.80 | 0.0091 | 14.6 | 2.35 | 7.54 |
| 563 | S | 3B | RUBI | Guet | scab | 7.80 | 0.0047 | 10.6 | 4.30 | 8.00 |
| 564 | M | 3B | NYCT | Guap | frag | 9.60 | 0.0072 | | 6.50 | 8.40 |
| 565 | M | 3B | NYCT | Guap | frag | 28.20 | 0.0624 | | 6.35 | 8.70 |
| 566 | M | 3B | NYCT | Guap | frag | 23.30 | 0.0426 | 15.2 | 6.40 | 8.90 |
| 567 | S | 3B | FABA | Andi | iner | 7.30 | 0.0041 | 7.0 | 6.35 | 9.40 |
| 568 | S | 3B | FABA | Andi | iner | 6.10 | 0.0029 | | 8.30 | 9.00 |
| 569 | S | 3B | MYRS | Ardi | obov | 6.10 | 0.0029 | | 8.60 | 9.80 |
| 570 | S | 3B | NYCT | Guap | frag | 33.40 | 0.0876 | | 9.00 | 7.10 |
| 571a | M | 3B | CLUS | Clus | rose | 16.30 | 0.0208 | 17.0 | 9.15 | 7.40 |

APPENDIX II. (Continued)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 571b | M | 3B | CLUS | Clus | rose | 8.60 | 0.0058 | | 9.15 | 7.40 |
| 571c | M | 3B | CLUS | Clus | rose | 10.80 | 0.0091 | | 9.15 | 7.40 |
| 571d | M | 3B | CLUS | Clus | rose | 12.30 | 0.0118 | | 9.15 | 7.40 |
| 571e | M | 3B | CLUS | Clus | rose | 7.80 | 0.0047 | | 9.15 | 7.40 |
| 572 | S | 3B | MYRS | Ardi | obov | 9.10 | 0.0065 | | 5.65 | 2.95 |
| 573 | S | 3B | NYCT | Guap | frag | 40.90 | 0.1313 | | 6.55 | 2.30 |
| 574 | S | 3B | MYRS | Ardi | obov | 8.70 | 0.0059 | | 9.75 | 3.20 |
| 575 | S | 3B | MYRS | Ardi | obov | 5.90 | 0.0027 | 9.1 | 9.35 | 1.60 |
| 576 | S | 3C | MYRS | Ardi | obov | 9.80 | 0.0075 | | 0.70 | 1.45 |
| 577 | S | 3C | FABA | Andi | iner | 6.90 | 0.0037 | | 2.10 | 1.82 |
| 578 | S | 3C | BIGN | Tabe | hete | 5.10 | 0.0020 | 7.9 | 1.50 | 3.25 |
| 579 | S | 3C | MYRS | Ardi | obov | 5.30 | 0.0022 | | 2.00 | 3.56 |
| 580 | S | 3C | FLAC | Case | deca | 7.50 | 0.0044 | 10.0 | 0.65 | 6.61 |
| 581 | S | 3C | MYRS | Ardi | obov | 5.90 | 0.0027 | | 2.10 | 6.70 |
| 582 | S | 3C | NYCT | Guap | frag | 16.10 | 0.0203 | | 2.80 | 8.15 |
| 583 | S | 3C | MYRS | Ardi | obov | 5.90 | 0.0027 | | 2.90 | 8.10 |
| 584 | S | 3C | MYRS | Ardi | obov | 5.90 | 0.0027 | | 7.30 | 7.45 |
| 585 | S | 3C | NYCT | Guap | frag | 7.20 | 0.0040 | | 7.90 | 6.05 |
| 586 | S | 3C | MIMO | Inga | fagi | 11.60 | 0.0105 | 11.2 | 7.70 | 5.80 |
| 587 | S | 3C | NYCT | Guap | frag | 33.90 | 0.0902 | | 5.90 | 5.45 |
| 588 | S | 3C | BIGN | Tabe | hete | 8.00 | 0.0050 | | 5.60 | 5.40 |
| 589 | S | 3C | MYRS | Ardi | obov | 6.00 | 0.0028 | | 5.20 | 4.52 |
| 590 | S | 3C | MYRS | Ardi | obov | 9.50 | 0.0070 | 12.2 | 3.20 | 2.49 |
| 591 | S | 3C | MYRS | Ardi | obov | 5.90 | 0.0027 | | 3.10 | 2.20 |
| 592 | S | 3C | NYCT | Guap | frag | 19.20 | 0.0289 | | 6.15 | 3.35 |
| 593 | S | 3C | MYRS | Ardi | obov | 8.30 | 0.0054 | | 6.90 | 1.45 |
| 594 | M | 3C | RUBI | Guet | parv | 9.70 | 0.0073 | | 9.30 | 3.90 |
| 595 | M | 3C | RUBI | Guet | parv | 12.90 | 0.0130 | 14.6 | 9.15 | 3.70 |
| 596 | S | 3C | MYRS | Ardi | obov | 6.50 | 0.0033 | | 9.85 | 1.55 |
| 597 | S | 3C | NYCT | Guap | frag | 17.80 | 0.0248 | | 9.10 | 1.50 |
| 598 | M | 3D | MYRS | Ardi | obov | 5.60 | 0.0024 | | 1.85 | 7.55 |
| 599 | M | 3D | MYRS | Ardi | obov | 6.20 | 0.0030 | | 1.30 | 7.61 |
| 600 | S | 3D | FABA | Andi | iner | 13.40 | 0.0141 | 14.3 | 7.30 | 6.85 |
| 601 | S | 3D | SAPO | Chry | pauc | 13.30 | 0.0138 | 10.3 | 6.90 | 6.50 |
| 602 | S | 3D | MYRS | Ardi | obov | 5.60 | 0.0024 | | 6.40 | 3.40 |
| 603 | S | 3E | FABA | Andi | iner | 12.90 | 0.0130 | | 1.40 | 0.71 |
| 604 | S | 3E | MYRS | Ardi | obov | 6.00 | 0.0028 | | 2.85 | 1.00 |
| 605 | S | 3E | NYCT | Guap | frag | 38.40 | 0.1158 | | 3.35 | 2.25 |
| 606 | S | 3E | LAUR | Ocot | cori | 16.30 | 0.0208 | 13.1 | 0.55 | 4.05 |
| 607 | S | 3E | NYCT | Guap | frag | 59.80 | 0.2808 | | 0.65 | 4.95 |
| 608 | S | 3E | MYRS | Ardi | obov | 8.30 | 0.0054 | | 0.85 | 6.80 |
| 609 | S | 3E | FABA | Andi | iner | 6.00 | 0.0028 | | 2.95 | 9.10 |
| 610 | S | 3E | SAPI | Meli | biju | 15.50 | 0.0188 | 14.9 | 6.50 | 8.30 |
| 611 | S | 3E | NYCT | Guap | frag | 41.40 | 0.1346 | 18.8 | 5.00 | 4.90 |
| 612 | S | 3E | SAPI | Meli | biju | 9.10 | 0.0065 | 8.2 | 5.50 | 3.50 |
| 613 | S | 3E | MYRS | Ardi | obov | 5.90 | 0.0027 | | 5.20 | 1.20 |
| 614 | S | 3E | FABA | Andi | iner | 8.70 | 0.0059 | | 8.50 | 3.65 |
| 615 | S | 3E | FABA | Andi | iner | 13.10 | 0.0134 | | 7.00 | 1.60 |

APPENDIX II. (Continued)

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 616 | M | 3E | SAPI | Meli | biju | 6.60 | 0.0034 | | 6.80 | 2.15 | |
| 617 | M | 3E | SAPI | Meli | biju | 12.70 | 0.0126 | 10.9 | 6.65 | 2.21 | |
| 618 | S | 3E | MYRT | Psid | ampl | 9.70 | 0.0073 | 9.4 | 8.00 | 3.30 | |
| 619 | S | 3F | FABA | Andi | iner | 13.60 | 0.0145 | | 2.00 | 3.54 | |
| 620 | S | 3F | NYCT | Guap | frag | 35.10 | 0.0967 | | 1.35 | 4.41 | |
| 621 | S | 3F | MYRT | Psid | ampl | 8.10 | 0.0051 | 10.0 | 2.10 | 6.54 | |
| 622 | S | 3F | SAPO | Chry | pauc | 6.50 | 0.0033 | 8.5 | 1.45 | 6.65 | |
| 623 | S | 3F | NYCT | Guap | frag | 22.20 | 0.0387 | | 1.60 | 7.49 | |
| 624 | S | 3F | MYRS | Ardi | obov | 5.30 | 0.0022 | | 0.50 | 9.75 | |
| 625 | S | 3F | EUPH | Marg | nobi | 41.80 | 0.1372 | 17.9 | 1.80 | 9.40 | |
| 626 | S | 3F | MYRT | Psid | ampl | 10.60 | 0.0088 | 9.4 | 2.40 | 8.25 | |
| 627 | S | 3F | SAPO | Chry | pauc | 5.80 | 0.0026 | | 4.60 | 7.95 | |
| 628 | S | 3F | MYRS | Ardi | obov | 5.60 | 0.0024 | | 6.00 | 8.85 | |
| 629 | S | 3F | MYRS | Ardi | obov | 7.60 | 0.0045 | | 7.10 | 9.35 | |
| 630 | M | 3F | MYRT | Psid | ampl | 5.90 | 0.0027 | | 9.45 | 7.09 | |
| 631 | M | 3F | MYRT | Psid | ampl | 8.80 | 0.0060 | 7.0 | 9.15 | 7.20 | |
| 632 | M | 3F | MYRT | Psid | ampl | 6.30 | 0.0031 | | 9.00 | 7.12 | |
| 633 | M | 3F | RUBI | Guet | parv | 12.30 | 0.0118 | | 8.95 | 5.40 | |
| 634 | M | 3F | RUBI | Guet | parv | 23.50 | 0.0433 | 12.2 | 8.40 | 5.60 | |
| 635 | S | 3F | MYRS | Ardi | obov | 6.50 | 0.0033 | | 5.20 | 4.45 | |
| 636 | S | 3F | MYRS | Ardi | obov | 12.70 | 0.0126 | 10.0 | 5.45 | 0.85 | |
| 637 | S | 3F | MYRS | Ardi | obov | 10.00 | 0.0078 | | 6.60 | 0.65 | |
| 638 | S | 3F | RUBI | Guet | parv | 5.60 | 0.0024 | 7.6 | 7.10 | 3.65 | |
| 639 | S | 3F | MYPS | Ardi | obov | 5.10 | 0.0020 | | 7.60 | 3.87 | |
| 640 | S | 3F | MYRS | Ardi | obov | 5.80 | 0.0026 | | 8.75 | 3.61 | |
| 641 | S | 3F | FABA | Andi | iner | 6.70 | 0.0035 | 6.1 | 9.80 | 3.58 | |
| 642 | S | 3F | MYRS | Ardi | obov | 5.20 | 0.0021 | | 8.10 | 0.60 | |
| 643 | S | 3G | MYRS | Ardi | obov | 9.30 | 0.0067 | | 0.30 | 1.01 | |
| 644 | S | 3G | MYRS | Ardi | obov | 7.00 | 0.0038 | | 1.25 | 1.22 | |
| 645 | S | 3G | MYRS | Ardi | obov | 6.10 | 0.0029 | | 1.75 | 0.50 | |
| 646 | M | 3G | LAUR | Ocot | cori | 14.40 | 0.0162 | 7.9 | 3.70 | 1.65 | |
| 647 | M | 3G | LAUR | Ocot | cori | 8.50 | 0.0056 | | 4.00 | 1.65 | |
| 648 | S | 3G | RUBI | Guet | parv | 7.80 | 0.0047 | | 4.00 | 4.50 | |
| 649 | S | 3G | MYRS | Ardi | obov | 12.20 | 0.0116 | | 0.50 | 6.70 | |
| 650 | S | 3G | MYRS | Ardi | obov | 6.00 | 0.0028 | | 0.04 | 8.83 | |
| 651 | S | 3G | FABA | Andi | iner | 8.80 | 0.0060 | | 3.00 | 8.65 | SICK11/85 |
| 652 | S | 3G | MYRS | Ardi | obov | 6.20 | 0.0030 | | 4.02 | 8.41 | |
| 653 | S | 3G | MYRS | Ardi | obov | 7.30 | 0.0041 | | 4.60 | 7.91 | |
| 654 | S | 3G | FABA | Andi | iner | 12.90 | 0.0130 | | 8.40 | 8.70 | |
| 655 | S | 3G | RUBI | Guet | scab | 6.30 | 0.0031 | | 5.50 | 9.63 | |
| 656 | S | 3G | MYRS | Ardi | obov | 6.60 | 0.0034 | | 6.35 | 9.85 | |
| 657 | S | 3G | MYRS | Ardi | obov | 8.00 | 0.0050 | | 6.00 | 9.00 | |
| 658 | S | 3G | RUBI | Guet | scab | 7.60 | 0.0045 | 7.3 | 6.90 | 8.15 | |
| 659 | S | 3G | FABA | Andi | iner | 17.20 | 0.0232 | | 5.05 | 6.57 | |
| 660 | S | 3G | RUBI | Guet | scab | 7.90 | 0.0049 | | 5.45 | 5.95 | |
| 661 | S | 3G | MYRS | Ardi | obov | 5.50 | 0.0023 | | 7.80 | 5.84 | |
| 662 | S | 3G | MYRS | Ardi | obov | 8.20 | 0.0052 | | 7.60 | 3.71 | |
| 663 | S | 3G | MYRS | Ardi | obov | 5.40 | 0.0022 | | 5.55 | 2.85 | |

APPENDIX II. (Continued)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 664 | S | 3G | NYCT | Guap | frag | 27.90 | 0.0611 | 12.2 | 5.20 | 1.20 |
| 665 | S | 3G | LAUR | Ocot | cori | 6.30 | 0.0031 | 7.3 | 5.75 | 0.30 |
| 666 | S | 3G | MYRS | Ardi | obov | 8.20 | 0.0052 | | 6.20 | 1.10 |
| 667 | S | 3G | RUBI | Guet | parv | 6.30 | 0.0031 | | 9.95 | 7.50 |
| 668 | S | 3G | RUBI | Guet | scab | 7.80 | 0.0047 | 7.5 | 9.95 | 6.20 |
| 669 | S | 3G | MIMO | Inga | fagi | 16.40 | 0.0211 | 6.0 | 9.70 | 3.10 |
| 670 | S | 3G | MYRS | Ardi | obov | 6.00 | 0.0028 | | 9.60 | 1.18 |
| 671 | M | 3H | MYRS | Ardi | obov | 6.30 | 0.0031 | | 0.30 | 0.40 |
| 672 | M | 3H | MYRS | Ardi | obov | 7.90 | 0.0049 | | 0.25 | 0.45 |
| 673 | S | 3H | MYRS | Ardi | obov | 7.30 | 0.0041 | | 1.75 | 1.70 |
| 674 | S | 3H | NYCT | Guap | frag | 57.10 | 0.2560 | | 1.50 | 2.45 |
| 675 | S | 3H | MYRS | Ardi | obov | 5.10 | 0.0020 | | 0.31 | 1.82 |
| 676 | S | 3H | NYCT | Guap | frag | 34.20 | 0.0918 | | 1.00 | 3.25 |
| 677 | S | 3H | MYRS | Ardi | obov | 6.80 | 0.0036 | | 2.45 | 3.65 |
| 678 | S | 3H | MYRS | Ardi | obov | 16.40 | 0.0211 | 11.6 | 2.90 | 4.51 |
| 679 | S | 3H | MYRS | Ardi | obov | 8.50 | 0.0056 | | 0.23 | 4.81 |
| 680 | S | 3H | MYRS | Ardi | obov | 6.00 | 0.0028 | | 1.20 | 5.15 |
| 681 | S | 3H | SAPO | Chry | pauc | 6.60 | 0.0034 | 6.7 | 0.80 | 6.80 |
| 682 | S | 3H | MYRS | Ardi | obov | 6.80 | 0.0036 | | 1.25 | 7.62 |
| 683 | S | 3H | RUBI | Guet | parv | 5.80 | 0.0026 | | 1.60 | 9.09 |
| 684 | S | 3H | MYRS | Ardi | obov | 7.00 | 0.0038 | | 2.95 | 8.70 |
| 685 | S | 3H | FABA | Andi | iner | 10.50 | 0.0086 | 9.4 | 2.90 | 6.65 |
| 686 | S | 3H | MYRS | Ardi | obov | 10.70 | 0.0089 | | 4.90 | 7.27 |
| 687 | S | 3H | MYRS | Ardi | obov | 8.70 | 0.0059 | | 8.90 | 7.85 |
| 688 | S | 3H | MIMO | Inga | fagi | 19.50 | 0.0298 | | 8.40 | 7.55 |
| 689 | S | 3H | MYRS | Ardi | obov | 5.60 | 0.0024 | | 8.90 | 7.60 |
| 690 | S | 3H | MYRS | Ardi | obov | 6.00 | 0.0028 | | 7.10 | 5.70 |
| 691 | S | 3H | MYRS | Ardi | obov | 7.70 | 0.0046 | | 6.40 | 3.30 |
| 692 | S | 3H | MYRS | Ardi | obov | 5.50 | 0.0023 | | 3.90 | 2.23 |
| 693 | S | 3H | MYRS | Ardi | obov | 10.90 | 0.0093 | 12.8 | 4.80 | 4.05 |
| 694 | S | 3H | MYRS | Ardi | obov | 5.70 | 0.0025 | | 5.30 | 0.25 |
| 695 | S | 3H | MYRS | Ardi | obov | 7.90 | 0.0049 | | 6.40 | 1.23 |
| 696 | S | 3H | MYRS | Ardi | obov | 7.60 | 0.0045 | | 6.60 | 1.89 |
| 697 | S | 3H | MYRS | Ardi | obov | 8.70 | 0.0059 | | 9.75 | 2.15 |
| 698 | S | 3H | MYRS | Ardi | obov | 10.50 | 0.0086 | | 8.20 | 0.30 |
| 699 | S | 3H | MYRS | Ardi | obov | 7.60 | 0.0045 | | 9.80 | 1.50 |
| 700 | S | 3H | MYRT | Myrc | flor | 5.00 | 0.0019 | 8.5 | 8.65 | 2.69 |
| 701 | S | 3I | MYRS | Ardi | obov | 7.30 | 0.0041 | | 1.50 | 1.46 |
| 702 | S | 3I | MIMO | Inga | fagi | 22.10 | 0.0383 | 14.6 | 2.20 | 2.40 |
| 703 | S | 3I | MYRS | Ardi | obov | 6.20 | 0.0030 | | 0.90 | 2.91 |
| 704 | S | 3I | MYRS | Ardi | obov | 10.60 | 0.0088 | | 4.20 | 3.20 |
| 705 | S | 3I | MYRS | Ardi | obov | 7.50 | 0.0044 | | 4.50 | 4.38 |
| 706 | S | 3I | RUBI | Guet | parv | 8.40 | 0.0055 | 8.5 | 3.60 | 4.46 |
| 707 | S | 3I | RUBI | Guet | parv | 6.20 | 0.0030 | | 1.30 | 5.61 |
| 708 | S | 3I | SAPO | Chry | pauc | 12.00 | 0.0113 | 9.7 | 1.55 | 6.60 |
| 709 | S | 3I | RUBI | Guet | parv | 16.00 | 0.0201 | | 1.65 | 6.80 |
| 710 | S | 3I | MYRS | Ardi | obov | 5.20 | 0.0021 | | 3.00 | 9.80 |
| 711 | S | 3I | MYRS | Ardi | obov | 5.40 | 0.0022 | | 5.10 | 7.35 |

APPENDIX II. (Continued)

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 712 | S | 3I | MYRS | Ardi | obov | 5.80 | 0.0026 | | 5.80 | 9.80 | |
| 713 | M | 3I | RUBI | Guet | parv | 9.90 | 0.0076 | | 7.85 | 9.55 | |
| 714 | M | 3I | RUBI | Guet | parv | 14.40 | 0.0162 | | 8.00 | 9.50 | |
| 715 | S | 3I | BIGN | Tabe | hete | 11.40 | 0.0102 | 10.3 | 8.05 | 8.61 | |
| 716 | S | 3I | MYRS | Ardi | obov | 11.20 | 0.0098 | | 8.15 | 8.52 | |
| 717 | M | 3I | MYRS | Ardi | obov | 5.80 | 0.0026 | | 8.25 | 8.45 | |
| 718 | M | 3I | MYRS | Ardi | obov | 6.00 | 0.0028 | | 8.35 | 8.34 | |
| 719 | S | 3I | MYRT | Myrc | flor | 9.90 | 0.0076 | 9.1 | 9.75 | 5.90 | |
| 720 | S | 3I | MYRS | Ardi | obov | 10.00 | 0.0078 | | 6.30 | 4.87 | |
| 721b | M | 3I | CLUS | Clus | rose | 6.40 | 0.0032 | | 7.20 | 3.95 | |
| 721b | M | 3I | CLUS | Clus | rose | 8.40 | 0.0055 | | 7.20 | 3.95 | |
| 722 | S | 3I | MYRS | Ardi | obov | 8.90 | 0.0062 | | 6.90 | 1.61 | |
| 723 | S | 3I | MYRS | Ardi | obov | 6.40 | 0.0032 | | 4.40 | 0.55 | |
| 724 | S | 3I | MYRS | Ardi | obov | 5.60 | 0.0024 | | 7.85 | 1.40 | |
| 725 | S | 3I | BORA | Cord | alli | 20.60 | 0.0333 | 11.2 | 8.20 | 2.00 | |
| 726 | S | 3I | MIMO | Inga | fagi | 20.90 | 0.0343 | | 8.70 | 2.90 | |
| 727 | S | 3I | MYRS | Ardi | obov | 6.30 | 0.0031 | | 8.40 | 4.60 | DEAD 7/86 |
| 728 | S | 3I | MYRS | Ardi | obov | 11.20 | 0.0098 | | 9.40 | 2.55 | |
| 729 | S | 3I | BIGN | Tabe | hete | 57.50 | 0.2596 | 6.4 | 9.95 | 0.45 | |
| 730 | S | 3J | MYRS | Ardi | obov | 7.60 | 0.0045 | | 3.20 | 3.40 | |
| 731 | S | 3J | MYRS | Ardi | obov | 5.30 | 0.0022 | | 2.45 | 4.85 | |
| 732 | S | 3J | MYRS | Ardi | obov | 6.90 | 0.0037 | | 2.25 | 4.91 | |
| 733 | S | 3J | MYRS | Ardi | obov | 5.10 | 0.0020 | | 0.30 | 3.75 | |
| 734 | S | 3J | MYRS | Ardi | obov | 6.80 | 0.0036 | | 0.85 | 4.55 | |
| 735 | S | 3J | MIMO | Inga | fagi | 16.20 | 0.0206 | 11.9 | 2.90 | 6.85 | |
| 736 | S | 3J | FLAC | Case | guia | 5.40 | 0.0022 | 7.0 | 5.10 | 7.90 | |
| 737 | S | 3J | MYRS | Ardi | obov | 9.00 | 0.0063 | | 6.60 | 7.92 | |
| 738 | S | 3J | MYRS | Ardi | obov | 5.00 | 0.0019 | | 7.55 | 8.70 | |
| 739 | S | 3J | MYRS | Ardi | obov | 8.30 | 0.0054 | | 9.00 | 9.75 | |
| 740 | S | 3J | MYRS | Ardi | obov | 6.10 | 0.0029 | | 7.80 | 8.35 | |
| 741 | S | 3J | MYRS | Ardi | obov | 6.70 | 0.0035 | | 9.30 | 8.79 | |
| 742 | S | 3J | MYRS | Ardi | obov | 8.70 | 0.0059 | | 9.60 | 7.88 | |
| 743 | S | 3J | MYRS | Ardi | obov | 9.30 | 0.0067 | | 9.70 | 7.12 | |
| 744 | S | 3J | MYRT | Myrc | flor | 7.20 | 0.0040 | 7.3 | 9.50 | 6.20 | |
| 745 | M | 3J | MYRS | Ardi | obov | 8.80 | 0.0060 | | 6.55 | 6.87 | |
| 746 | M | 3J | MYRS | Ardi | obov | 6.30 | 0.0031 | | 6.90 | 6.81 | |
| 747 | S | 3J | FLAC | Case | deca | 11.80 | 0.0109 | 9.1 | 5.00 | 7.40 | |
| 748 | S | 3J | MYRS | Ardi | obov | 5.70 | 0.0025 | | 5.60 | 5.95 | |
| 749 | S | 3J | MYRS | Ardi | obov | 7.40 | 0.0043 | | 5.75 | 4.65 | |
| 750 | S | 3J | LAUR | Ocot | cori | 5.50 | 0.0023 | 8.8 | 5.90 | 2.86 | |
| 751 | S | 3J | MYRS | Ardi | obov | 12.00 | 0.0113 | | 6.15 | 2.65 | |
| 752 | S | 3J | MYRS | Ardi | obov | 8.70 | 0.0059 | | 6.45 | 2.95 | |
| 753 | S | 3J | RUBI | Guet | parv | 5.40 | 0.0022 | 7.0 | 5.25 | 0.05 | SICK11/85 |
| 754 | S | 3J | CLUS | Clus | rose | 9.80 | 0.0075 | | 9.65 | 1.35 | |
| 755 | S | 4J | FLAC | Case | guia | 8.50 | 0.0056 | 7.3 | 7.85 | 0.57 | |
| 756 | S | 4J | PALM | Cocc | alta | 11.30 | 0.0100 | 10.3 | 5.22 | 0.14 | |
| 757 | S | 4J | CELA | Mayt | elli | 5.20 | 0.0021 | 5.2 | 5.75 | 0.87 | |
| 758 | S | 4J | MYRS | Ardi | obov | 5.20 | 0.0021 | | 5.89 | 2.95 | |

APPENDIX II. (Continued)

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 759 | S | 4J | MYRS | Ardi | obov | 16.80 | 0.0221 | | 6.00 | 4.35 | |
| 760 | S | 4J | MYRS | Ardi | obov | 8.20 | 0.0052 | | 6.90 | 6.25 | |
| 761 | S | 4J | MYRS | Ardi | obov | 6.00 | 0.0028 | | 7.55 | 6.85 | |
| 762 | S | 4J | MYRS | Ardi | obov | 13.40 | 0.0141 | | 8.50 | 7.40 | |
| 763 | S | 4J | MYRS | Ardi | obov | 5.40 | 0.0022 | | 9.15 | 7.80 | |
| 764 | S | 4J | MYRS | Ardi | obov | 10.00 | 0.0078 | | 9.55 | 8.60 | |
| 765 | S | 4J | MYRS | Ardi | obov | 6.30 | 0.0031 | | 9.19 | 9.80 | |
| 766 | S | 4J | MYRS | Ardi | obov | 10.70 | 0.0089 | 8.2 | 8.80 | 8.30 | |
| 767 | S | 4J | MYRS | Ardi | obov | 9.90 | 0.0076 | | 7.90 | 8.60 | |
| 768 | S | 4J | FLAC | Case | guia | 5.60 | 0.0024 | 8.8 | 6.05 | 8.90 | |
| 769 | S | 4J | MYRS | Ardi | obov | 5.00 | 0.0019 | | 6.12 | 7.40 | DEAD11/85 |
| 770 | S | 4J | MYRS | Ardi | obov | 5.00 | 0.0019 | | 4.95 | 6.50 | DEAD11/85 |
| 771 | S | 4J | MYRS | Ardi | obov | 6.40 | 0.0032 | | 4.22 | 5.95 | |
| 772 | S | 4J | MYRS | Ardi | obov | 7.80 | 0.0047 | | 2.65 | 7.05 | |
| 773 | S | 4J | MYRS | Ardi | obov | 10.10 | 0.0080 | | 0.40 | 7.90 | |
| 774 | S | 4J | MYRT | Psid | ampl | 6.40 | 0.0032 | 4.0 | 0.85 | 6.55 | |
| 775 | S | 4J | MYRS | Ardi | obov | 6.50 | 0.0033 | | 2.95 | 5.75 | |
| 776 | S | 4J | EUPH | Marg | nobi | 14.60 | 0.0167 | 9.1 | 3.55 | 5.15 | SICK11/85 |
| 777 | S | 4J | MYRS | Ardi | obov | 10.00 | 0.0078 | | 4.98 | 4.45 | |
| 778 | S | 4J | MYRS | Ardi | obov | 7.50 | 0.0044 | | 5.25 | 4.70 | |
| 779 | S | 4J | MYRS | Ardi | obov | 7.10 | 0.0039 | | 1.90 | 4.05 | |
| 780 | S | 4J | MYRS | Ardi | obov | 6.90 | 0.0037 | | 2.11 | 2.85 | |
| 781 | S | 4J | FLAC | Case | deca | 5.50 | 0.0023 | 7.3 | 0.32 | 3.05 | |
| 782 | S | 4J | MYRS | Ardi | obov | 10.20 | 0.0081 | | 0.50 | 2.25 | |
| 783 | S | 4J | FLAC | Case | guia | 7.10 | 0.0039 | 8.8 | 3.25 | 1.05 | |
| 784 | S | 4I | MYRS | Ardi | obov | 7.00 | 0.0038 | | 9.15 | 0.11 | |
| 785 | S | 4I | MYRS | Ardi | obov | 12.80 | 0.0128 | | 5.55 | 0.04 | |
| 786 | S | 4I | FLAC | Case | deca | 11.00 | 0.0095 | 10.3 | 8.35 | 1.40 | |
| 787 | S | 4I | MYRS | Ardi | obov | 6.10 | 0.0029 | | 5.20 | 2.50 | |
| 788 | S | 4I | MYRS | Ardi | obov | 17.00 | 0.0226 | | 6.50 | 6.20 | |
| 789 | S | 4I | MYRS | Ardi | obov | 7.00 | 0.0038 | | 6.35 | 6.80 | |
| 790 | S | 4I | MYRS | Ardi | obov | 5.80 | 0.0026 | | 9.20 | 6.50 | |
| 791 | S | 4I | MYRS | Ardi | obov | 5.10 | 0.0020 | | 8.85 | 8.20 | |
| 792 | S | 4I | LAUR | Ocot | cori | 14.60 | 0.0167 | 10.9 | 6.10 | 8.90 | |
| 793 | S | 4I | MYRS | Ardi | obov | 9.20 | 0.0066 | | 4.45 | 8.55 | |
| 794 | S | 4I | SAPO | Chry | pauc | 7.60 | 0.0045 | 9.1 | 3.35 | 7.75 | |
| 795 | S | 4I | FLAC | Case | deca | 7.40 | 0.0043 | 10.6 | 0.65 | 8.15 | |
| 796 | S | 4I | LAUR | Ocot | cori | 17.80 | 0.0248 | | 1.40 | 6.10 | |
| 797 | S | 4I | SAPO | Chry | pauc | 6.90 | 0.0037 | | 4.67 | 4.15 | |
| 798 | S | 4I | NYCT | Guap | frag | 28.40 | 0.0633 | 12.8 | 3.55 | 4.50 | |
| 799 | M | 4I | RUBI | Guet | parv | 16.90 | 0.0224 | 12.5 | 3.90 | 3.95 | |
| 800 | M | 4I | RUBI | Guet | parv | 5.30 | 0.0022 | | 3.65 | 3.70 | |
| 801 | S | 4I | MYRS | Ardi | obov | 5.10 | 0.0020 | | 4.65 | 4.15 | |
| 802 | S | 4I | MYRS | Ardi | obov | 6.50 | 0.0033 | | 0.52 | 2.30 | |
| 803 | S | 4H | MYRS | Ardi | obov | 8.10 | 0.0051 | | 8.50 | 0.79 | |
| 804 | S | 4H | FLAC | Case | deca | 5.80 | 0.0026 | 8.8 | 7.80 | 0.95 | |
| 805 | S | 4H | SAPO | Chry | pauc | 5.60 | 0.0024 | | 7.45 | 1.70 | |
| 806 | S | 4H | MYRS | Ardi | obov | 5.30 | 0.0022 | | 9.00 | 2.00 | |



234

APPENDIX II. (Continued)

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 807 | S | 4H | NYCT | Guap | frag | 46.20 | 0.1676 | | 7.25 | 2.85 | |
| 808 | S | 4H | LAUR | Ocot | cori | 9.80 | 0.0075 | | 5.05 | 4.35 | |
| 809 | S | 4H | MYRS | Ardi | obov | 5.30 | 0.0022 | | 9.10 | 5.20 | |
| 810 | S | 4H | NYCT | Guap | frag | 40.30 | 0.1275 | 16.4 | 9.25 | 8.60 | |
| 811 | S | 4H | MYRS | Ardi | obov | 6.80 | 0.0036 | | 5.05 | 6.60 | |
| 812 | S | 4H | MYRS | Ardi | obov | 7.80 | 0.0047 | | 3.55 | 8.70 | |
| 813 | S | 4H | SAPO | Chry | pauc | 17.80 | 0.0248 | | 4.01 | 6.45 | |
| 814 | S | 4H | MYRS | Ardi | obov | 5.00 | 0.0019 | | 1.70 | 9.95 | |
| 815 | S | 4H | MYRS | Ardi | obov | 6.10 | 0.0029 | | 4.45 | 5.50 | |
| 816 | S | 4H | FLAC | Case | guia | 6.30 | 0.0031 | 3.0 | 2.50 | 4.40 | |
| 817 | S | 4H | MYRS | Ardi | obov | 7.30 | 0.0041 | | 2.90 | 2.35 | |
| 818 | S | 4H | MYRS | Ardi | obov | 5.20 | 0.0021 | | 2.35 | 1.35 | |
| 819 | S | 4H | RUBI | Guet | parv | 15.20 | 0.0181 | | 0.12 | 2.05 | |
| 820 | S | 4G | MYRS | Ardi | obov | 9.00 | 0.0063 | | 7.55 | 1.25 | |
| 821 | M | 4G | MYRS | Ardi | obov | 9.10 | 0.0065 | | 9.65 | 2.90 | |
| 822 | M | 4G | MYRS | Ardi | obov | 5.90 | 0.0027 | | 9.59 | 2.80 | |
| 823 | S | 4G | MYRS | Ardi | obov | 6.40 | 0.0032 | | 9.30 | 5.00 | |
| 824 | S | 4G | SAPO | Chry | pauc | 5.00 | 0.0019 | | 6.45 | 4.80 | |
| 825 | S | 4G | MYRS | Ardi | obov | 5.40 | 0.0022 | | 7.25 | 6.80 | |
| 826 | S | 4G | FABA | Andi | iner | 7.80 | 0.0047 | | 7.35 | 7.60 | DEAD 7/86 |
| 827 | S | 4G | MYRT | Psid | ampl | 5.60 | 0.0024 | 4.0 | 4.55 | 9.10 | |
| 828 | S | 4G | MYRS | Ardi | obov | 8.50 | 0.0056 | | 3.85 | 9.20 | |
| 829 | S | 4G | MYRS | Ardi | obov | 5.40 | 0.0022 | | 2.35 | 8.25 | |
| 830 | S | 4G | MYRS | Ardi | obov | 7.10 | 0.0039 | | 2.00 | 7.10 | |
| 831 | S | 4G | EUPH | Marg | nobi | 46.60 | 0.1705 | 17.6 | 1.75 | 7.05 | |
| 832 | S | 4G | MYRS | Ardi | obov | 9.60 | 0.0072 | | 0.75 | 7.85 | |
| 833 | S | 4G | RUTA | Zant | mart | 17.50 | 0.0240 | | 2.80 | 5.70 | |
| 834 | S | 4G | MYRS | Ardi | obov | 6.00 | 0.0028 | | 2.95 | 5.85 | |
| 835 | S | 4G | MYRS | Ardi | obov | 5.50 | 0.0023 | | 3.75 | 5.95 | |
| 836 | S | 4G | MYRS | Ardi | obov | 11.30 | 0.0100 | | 5.00 | 5.40 | |
| 837 | S | 4G | MYRS | Ardi | obov | 6.30 | 0.0031 | | 5.20 | 3.15 | |
| 838 | M | 4G | MYRS | Ardi | obov | 6.30 | 0.0031 | | 4.60 | 3.30 | |
| 839 | M | 4G | MYRS | Ardi | obov | 6.00 | 0.0028 | | 4.51 | 3.25 | |
| 840 | S | 4G | MYRS | Ardi | obov | 7.40 | 0.0043 | | 2.45 | 2.75 | |
| 841 | S | 4G | MYRS | Ardi | obov | 6.50 | 0.0033 | | 4.40 | 1.90 | |
| 842 | M | 4G | MYRS | Ardi | obov | 6.10 | 0.0029 | | 2.21 | 1.20 | |
| 843 | M | 4G | MYRS | Ardi | obov | 10.30 | 0.0083 | | 2.05 | 1.15 | |
| 844 | S | 4F | MYRS | Ardi | obov | 7.80 | 0.0047 | | 9.45 | 2.70 | |
| 845 | S | 4F | MYRS | Ardi | obov | 5.30 | 0.0022 | | 8.40 | 1.25 | |
| 846 | S | 4F | MYRT | Psid | ampl | 5.40 | 0.0022 | 6.7 | 7.08 | 0.65 | |
| 847 | S | 4F | FABA | Andi | iner | 19.80 | 0.0307 | 14.9 | 7.64 | 2.65 | |
| 848 | S | 4F | MYRS | Ardi | obov | 7.10 | 0.0039 | | 6.90 | 3.60 | |
| 849 | S | 4F | MYRT | Psid | ampl | 5.30 | 0.0022 | | 8.95 | 5.45 | SICK11/85 |
| 850 | S | 4F | MYRT | Psid | ampl | 5.10 | 0.0020 | 3.6 | 8.00 | 5.20 | |
| 851 | S | 4F | SAPO | Chry | pauc | 11.30 | 0.0100 | | 7.40 | 7.80 | |
| 852 | S | 4F | MYRS | Ardi | obov | 5.10 | 0.0020 | | 7.85 | 8.55 | |
| 853 | S | 4F | MYRS | Ardi | obov | 6.10 | 0.0029 | | 4.30 | 8.35 | WITHROWN86 |
| 854 | S | 4F | MYRT | Psid | ampl | 6.30 | 0.0031 | 7.6 | 3.85 | 7.30 | |

APPENDIX II. (Continued)

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 855 | S | 4F | FABA | Andi | iner | 8.00 | 0.0050 | | 1.95 | 8.05 | |
| 856 | S | 4F | FABA | Andi | iner | 6.00 | 0.0028 | | 2.35 | 7.02 | |
| 857 | S | 4F | MYRS | Ardi | obov | 7.10 | 0.0039 | | 0.80 | 5.45 | |
| 858 | S | 4F | FABA | Andi | iner | 15.60 | 0.0191 | 12.5 | 3.75 | 5.65 | |
| 859 | S | 4F | MYRS | Ardi | obov | 8.20 | 0.0052 | | 4.95 | 3.95 | |
| 860 | S | 4F | THYM | Daph | amer | 11.20 | 0.0098 | 12.5 | 4.75 | 2.35 | |
| 861 | S | 4F | CAPP | Capp | ampl | 6.30 | 0.0031 | 9.4 | 3.95 | 2.20 | |
| 862 | S | 4F | MIMO | Inga | fagi | 27.50 | 0.0593 | 18.2 | 3.75 | 2.45 | |
| 863 | S | 4F | MYRS | Ardi | obov | 6.40 | 0.0032 | | 4.60 | 0.89 | |
| 864 | S | 4F | MYRS | Ardi | obov | 6.90 | 0.0037 | 6.4 | 0.69 | 1.65 | |
| 865 | S | 4E | FABA | Andi | iner | 11.20 | 0.0098 | 1.7 | 9.65 | 0.35 | |
| 866 | S | 4E | MYRS | Ardi | obov | 5.30 | 0.0022 | | 7.80 | 1.10 | |
| 867 | S | 4E | MYRS | Ardi | obov | 5.20 | 0.0021 | | 7.25 | 2.90 | WITHROWN85 |
| 868 | S | 4E | NYCT | Guap | frag | 42.40 | 0.1411 | 18.2 | 5.55 | 3.75 | |
| 869 | S | 4E | MYRS | Ardi | obov | 5.10 | 0.0020 | | 8.15 | 5.40 | |
| 870 | S | 4E | MYRT | Psid | ampl | 6.80 | 0.0036 | 7.3 | 9.00 | 5.80 | |
| 871 | S | 4E | CAES | Hyme | cour | 34.50 | 0.0934 | 18.8 | 5.50 | 5.75 | |
| 872 | S | 4E | LAUR | Ocot | cori | 16.30 | 0.0208 | 16.4 | 2.30 | 7.45 | |
| 873 | S | 4E | MYRS | Ardi | obov | 5.40 | 0.0022 | | 1.25 | 7.10 | |
| 874 | S | 4E | SAPI | Meli | biju | 7.90 | 0.0049 | 7.6 | 4.80 | 3.20 | |
| 875 | S | 4E | MYRS | Ardi | obov | 5.20 | 0.0021 | | 0.71 | 1.45 | |
| 876 | S | 4D | MYRS | Ardi | obov | 8.10 | 0.0051 | | 6.70 | 0.45 | |
| 877 | S | 4D | NYCT | Guap | frag | 11.80 | 0.0109 | 13.4 | 5.55 | 2.70 | |
| 878 | S | 4D | FABA | Andi | iner | 8.40 | 0.0055 | | 5.65 | 3.00 | |
| 879 | S | 4D | SAPI | Meli | biju | 6.80 | 0.0036 | 8.8 | 6.45 | 5.40 | |
| 880 | S | 4D | SAPO | Chry | pauc | 19.20 | 0.0289 | 15.5 | 7.10 | 6.00 | |
| 881 | S | 4D | RUBI | Fara | occi | 6.80 | 0.0036 | 5.5 | 6.90 | 7.00 | |
| 882 | S | 4D | MYRS | Ardi | obov | 5.10 | 0.0020 | | 2.60 | 7.50 | |
| 883 | S | 4D | MYRS | Ardi | obov | 5.20 | 0.0021 | | 1.15 | 3.65 | |
| 884 | S | 4C | STER | Guaz | ulmi | 44.80 | 0.1576 | | 9.25 | 0.45 | |
| 885 | S | 4C | MYRS | Ardi | obov | 7.30 | 0.0041 | | 7.65 | 0.52 | |
| 886 | S | 4C | MIMO | Inga | fagi | 5.20 | 0.0021 | | 6.45 | 1.35 | |
| 887 | S | 4C | MIMO | Inga | fagi | 22.80 | 0.0408 | | 4.25 | 3.70 | |
| 888 | S | 4C | MIMO | Inga | fagi | 32.20 | 0.0814 | | 6.35 | 6.90 | |
| 889 | S | 4C | RUBI | Guet | scab | 15.70 | 0.0193 | 13.7 | 7.54 | 7.50 | |
| 890 | S | 4C | MYRS | Ardi | obov | 9.10 | 0.0065 | | 8.95 | 8.00 | |
| 891 | S | 4C | LAUR | Ocot | cori | 5.70 | 0.0025 | | 7.95 | 9.00 | |
| 892 | S | 4C | RUBI | Guet | scab | 8.20 | 0.0052 | 8.5 | 6.40 | 9.90 | |
| 893 | S | 4C | FABA | Andi | iner | 6.50 | 0.0033 | | 9.75 | 1.35 | |
| 894 | S | 4C | MYRS | Ardi | obov | 7.70 | 0.0046 | | 0.85 | 4.05 | |
| 895 | S | 4C | NYCT | Guap | frag | 22.90 | 0.0411 | 15.5 | 0.10 | 4.05 | |
| 896 | S | 4C | SAPO | Chry | pauc | 19.70 | 0.0304 | | 1.00 | 2.65 | |
| 897 | S | 4C | MYRS | Ardi | obov | 9.40 | 0.0069 | | 4.20 | 4.40 | |
| 898 | S | 4C | CAPP | Capp | ampl | 18.50 | 0.0268 | 14.0 | 2.50 | 2.05 | |
| 899 | S | 4C | MYRS | Ardi | obov | 6.30 | 0.0031 | | 2.65 | 2.20 | |
| 900 | S | 4C | BIGN | Tabe | hete | 12.30 | 0.0119 | 12.2 | 3.45 | 1.55 | |
| 901 | S | 4C | FABA | Andi | iner | 26.10 | 0.0535 | | 5.01 | 1.20 | |
| 902 | S | 4B | MYRS | Ardi | obov | 11.30 | 0.0100 | | 6.35 | 2.20 | |

APPENDIX II. (Continued)

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 903 | S | 4B | FABA | Andi | iner | 6.20 | 0.0030 | | 5.60 | 4.05 | |
| 904 | S | 4B | MYRS | Ardi | obov | 5.20 | 0.0021 | | 6.50 | 4.20 | |
| 905 | S | 4B | FABA | Andi | iner | 9.60 | 0.0072 | | 6.25 | 4.95 | |
| 906 | S | 4B | NYCT | Guap | frag | 22.70 | 0.0404 | | 7.31 | 5.35 | |
| 907 | S | 4B | FABA | Andi | iner | 7.60 | 0.0045 | | 8.99 | 5.00 | |
| 908 | S | 4B | MYRS | Ardi | obov | 7.00 | 0.0038 | | 9.90 | 5.65 | |
| 909 | S | 4B | FABA | Sabi | flor | 6.90 | 0.0037 | 7.6 | 9.80 | 7.00 | |
| 910 | M | 4B | MYRS | Ardi | obov | 9.40 | 0.0069 | 9.1 | 8.35 | 9.60 | |
| 911 | M | 4B | MYRS | Ardi | obov | 5.10 | 0.0020 | | 8.25 | 9.60 | |
| 912 | S | 4B | FABA | Andi | iner | 9.60 | 0.0072 | | 7.75 | 8.85 | |
| 913 | S | 4B | FABA | Andi | iner | 17.20 | 0.0232 | | 6.05 | 9.75 | |
| 914 | S | 4B | MYRS | Ardi | obov | 10.70 | 0.0089 | | 5.10 | 8.35 | |
| 915 | S | 4B | FABA | Andi | iner | 13.70 | 0.0147 | | 6.90 | 6.10 | WITHROWN85 |
| 916 | S | 4B | FABA | Andi | iner | 6.10 | 0.0029 | | 5.85 | 5.80 | |
| 917 | S | 4B | RUBI | Guet | scab | 7.10 | 0.0039 | | 2.85 | 9.55 | |
| 918 | S | 4B | MYRS | Ardi | obov | 6.20 | 0.0030 | | 3.05 | 4.30 | |
| 919 | S | 4B | MYRS | Ardi | obov | 6.70 | 0.0035 | | 2.35 | 4.20 | |
| 920 | S | 4B | FABA | Andi | iner | 17.00 | 0.0226 | 11.6 | 2.30 | 3.30 | |
| 921 | S | 4B | MYRS | Ardi | obov | 5.30 | 0.0022 | | 4.20 | 2.25 | |
| 922 | S | 4B | LAUR | Ocot | cori | 9.70 | 0.0073 | 12.5 | 0.85 | 0.65 | |
| 923 | S | 4B | NYCT | Guap | frag | 43.30 | 0.1472 | 14.0 | 0.15 | 0.85 | |
| 924 | S | 4A | MYRS | Ardi | obov | 11.80 | 0.0109 | | 9.85 | 5.15 | |
| 925 | S | 4A | CAES | Hyme | cour | 22.80 | 0.0408 | 14.3 | 8.35 | 5.10 | |
| 926 | S | 4A | ERYT | Eryt | rotu | 6.00 | 0.0028 | 7.0 | 6.40 | 0.66 | |
| 927 | S | 4A | ERYT | Eryt | rotu | 6.40 | 0.0032 | 6.7 | 4.35 | 2.20 | |
| 928 | S | 4A | LAUR | Ocot | cori | 6.30 | 0.0031 | | 3.95 | 3.00 | |
| 929 | S | 4A | BORA | Bour | succ | 6.20 | 0.0030 | 7.6 | 6.95 | 4.50 | |
| 930 | M | 4A | LAUR | Ocot | cori | 9.00 | 0.0063 | | 9.65 | 5.80 | |
| 931 | M | 4A | LAUR | Ocot | cori | 17.10 | 0.0229 | 10.0 | 9.90 | 5.50 | |
| 932 | S | 4A | MYRS | Ardi | obov | 10.70 | 0.0089 | | 7.65 | 7.80 | |
| 933 | S | 4A | BORA | Bour | succ | 5.50 | 0.0023 | 7.0 | 8.75 | 9.75 | |
| 934 | S | 4A | RUBI | Guet | scab | 5.70 | 0.0025 | 7.6 | 7.00 | 9.55 | |
| 935 | S | 4A | MYRS | Ardi | obov | 5.80 | 0.0026 | | 6.20 | 8.50 | |
| 936 | S | 4A | MYRS | Ardi | obov | 9.30 | 0.0067 | | 4.90 | 9.85 | |
| 937 | S | 4A | BORA | Cord | alli | 17.10 | 0.0229 | 11.2 | 3.10 | 9.40 | |
| 938 | M | 4A | LAUR | Ocot | cori | 9.50 | 0.0070 | | 7.50 | 6.00 | WITHROWN85 |
| 939 | M | 4A | LAUR | Ocot | cori | 6.30 | 0.0031 | | 7.60 | 0.85 | |
| 940 | S | 4A | THYM | Daph | amer | 7.60 | 0.0045 | 7.6 | 1.50 | 5.95 | |
| 941 | S | 4A | MYRS | Ardi | obov | 5.00 | 0.0019 | | 1.60 | 6.10 | |
| 942 | S | 4A | NYCT | Guap | frag | 6.70 | 0.0035 | | 0.40 | 4.40 | |
| 943 | S | 4A | MYRS | Ardi | obov | 7.40 | 0.0043 | | 0.50 | 4.00 | |
| 944 | S | 4A | THYM | Daph | amer | 14.30 | 0.0160 | 9.4 | 2.30 | 3.10 | |
| 945 | S | 4A | THYM | Daph | amer | 5.20 | 0.0021 | 6.4 | 2.25 | 3.40 | |
| 946 | S | 4A | ERYT | Eryt | rotu | 6.90 | 0.0037 | 5.2 | 4.05 | 6.90 | |
| 947 | S | 4A | ERYT | Eryt | rotu | 7.20 | 0.0040 | 9.1 | 5.80 | 5.70 | |
| 948 | S | 4A | FABA | Sabi | flor | 6.70 | 0.0035 | | 3.10 | 2.10 | |
| 949 | S | 4A | BORA | Cord | alli | 12.80 | 0.0128 | 11.2 | 0.85 | 1.70 | |
| 950 | S | 4A | EUPH | Marg | nobi | 14.70 | 0.0169 | 12.5 | 0.15 | 0.10 | |



251

APPENDIX II. (Continued)

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 951 | S | 5A | FABA | Sabi | flor | 5.30 | 0.0022 | 5.2 | 2.21 | 0.90 | |
| 952 | S | 5A | NYCT | Guap | frag | 5.20 | 0.0021 | | 2.10 | 2.45 | DEAD 7/86 |
| 953 | S | 5A | FABA | Sabi | flor | 6.90 | 0.0037 | 3.6 | 1.25 | 4.35 | |
| 954 | S | 5A | FABA | Andi | iner | 7.00 | 0.0038 | | 2.15 | 5.20 | SICK11/85 |
| 955 | S | 5A | MIMO | Inga | fagi | 11.10 | 0.0096 | 11.2 | 3.00 | 4.55 | |
| 956a | M | 5A | CLUS | Clus | rose | 9.10 | 0.0065 | 13.7 | 2.90 | 5.20 | |
| 956b | M | 5A | CLUS | Clus | rose | 26.20 | 0.0539 | | 2.90 | 5.20 | |
| 957 | S | 5A | NYCT | Guap | frag | 12.50 | 0.0122 | | 2.95 | 6.30 | |
| 958 | S | 5A | CAES | Hyme | cour | 7.90 | 0.0049 | 9.1 | 2.90 | 7.95 | |
| 959 | S | 5A | FABA | Andi | iner | 9.20 | 0.0066 | | 1.70 | 7.85 | |
| 960 | S | 5A | THYM | Daph | amer | 9.50 | 0.0070 | | 1.85 | 8.70 | |
| 961 | S | 5A | MYRS | Ardi | obov | 7.50 | 0.0044 | | 2.05 | 9.60 | |
| 962 | S | 5A | FABA | Sabi | flor | 6.20 | 0.0030 | | 2.95 | 9.10 | |
| 963 | S | 5A | THYM | Daph | amer | 9.20 | 0.0066 | 11.9 | 6.20 | 7.00 | |
| 964 | S | 5A | SAPI | Meli | biju | 5.40 | 0.0022 | 6.1 | 6.75 | 8.90 | |
| 965 | S | 5A | NYCT | Guap | frag | 12.20 | 0.0116 | | 7.25 | 9.80 | |
| 966 | S | 5A | MYRS | Ardi | obov | 9.60 | 0.0072 | | 7.65 | 8.40 | |
| 967 | S | 5A | MYRS | Ardi | obov | 7.60 | 0.0045 | | 8.25 | 8.50 | |
| 968 | S | 5A | THYM | Daph | amer | 9.20 | 0.0066 | 11.6 | 9.05 | 7.20 | |
| 969 | S | 5A | SAPO | Chry | pauc | 7.90 | 0.0049 | 8.8 | 8.60 | 6.50 | |
| 970 | S | 5A | MYRS | Ardi | obov | 8.90 | 0.0062 | | 7.80 | 6.80 | |
| 971 | S | 5A | MYRT | Euge | mont | 5.90 | 0.0027 | 9.1 | 7.40 | 5.40 | |
| 972 | S | 5A | NYCT | Guap | frag | 6.80 | 0.0036 | | 7.35 | 4.10 | |
| 973 | S | 5A | FABA | Sabi | flor | 5.70 | 0.0025 | 8.8 | 8.05 | 2.90 | |
| 974 | S | 5A | NYCT | Guap | frag | 29.60 | 0.0688 | | 8.60 | 2.60 | |
| 975 | S | 5A | FABA | Sabi | flor | 6.20 | 0.0030 | 6.7 | 8.55 | 5.10 | |
| 976 | S | 5B | MYRT | Myrc | flor | 9.50 | 0.0070 | | 0.98 | 0.85 | |
| 977 | S | 5B | FABA | Andi | iner | 6.00 | 0.0028 | | 1.22 | 0.95 | |
| 978 | M | 5B | NYCT | Guap | frag | 12.60 | 0.0124 | | 2.61 | 4.60 | |
| 979 | M | 5B | NYCT | Guap | frag | 27.70 | 0.0602 | | 3.10 | 4.75 | |
| 980 | M | 5B | NYCT | Guap | frag | 6.90 | 0.0037 | | 2.89 | 4.95 | |
| 981 | S | 5B | MYRT | Euge | mont | 7.10 | 0.0039 | 9.7 | 2.00 | 3.65 | |
| 982 | S | 5B | MYRT | Euge | mont | 5.00 | 0.0019 | 5.8 | 1.35 | 3.95 | |
| 983 | S | 5B | MYRT | Euge | mont | 6.10 | 0.0029 | 8.5 | 0.95 | 4.40 | |
| 984 | S | 5B | MYRT | Euge | mont | 7.90 | 0.0049 | | 1.25 | 5.45 | |
| 985 | S | 5B | RUBI | Guet | scab | 7.40 | 0.0043 | 10.9 | 0.65 | 9.40 | |
| 986 | S | 5B | MYRS | Ardi | obov | 5.60 | 0.0024 | | 2.65 | 9.80 | |
| 987 | S | 5B | MYRS | Ardi | obov | 5.80 | 0.0026 | 7.0 | 3.50 | 8.15 | |
| 988 | S | 5B | FABA | Andi | iner | 12.60 | 0.0124 | | 4.60 | 6.80 | |
| 989 | S | 5B | MYRS | Ardi | obov | 5.70 | 0.0025 | | 6.75 | 6.15 | |
| 990 | S | 5B | EUPH | Marg | nobi | 18.00 | 0.0254 | 13.4 | 5.50 | 6.05 | |
| 991 | S | 5B | EUPH | Marg | nobi | 19.50 | 0.0298 | 11.2 | 6.15 | 6.50 | |
| 992 | S | 5B | MYRS | Ardi | obov | 6.50 | 0.0033 | | 5.95 | 8.90 | |
| 993 | S | 5B | MYRS | Ardi | obov | 5.50 | 0.0023 | | 6.90 | 0.95 | |
| 994 | S | 5B | FABA | Sabi | flor | 5.70 | 0.0025 | 7.3 | 8.35 | 9.00 | |
| 995 | S | 5B | RUBI | Guet | scab | 9.10 | 0.0065 | 15.2 | 9.90 | 7.90 | |
| 996 | S | 5B | MYRS | Ardi | obov | 6.50 | 0.0033 | | 9.20 | 7.20 | |
| 997 | S | 5B | THYM | Daph | amer | 5.30 | 0.0022 | 7.0 | 9.95 | 7.10 | |

APPENDIX II. (Continued)

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 998 | S | 5B | MYRS | Ardi | obov | 6.50 | 0.0033 | | 8.30 | 4.60 | |
| 999 | S | 5B | BORA | Bour | succ | 6.90 | 0.0037 | | 7.90 | 3.50 | |
| 1000 | S | 5B | FABA | Andi | iner | 8.80 | 0.0060 | | 8.05 | 3.00 | |
| 1201 | M | 5B | LAUR | Ocot | cori | 12.10 | 0.0114 | 9.4 | 4.45 | 2.00 | |
| 1202 | M | 5B | LAUR | Ocot | cori | 6.00 | 0.0028 | | 4.41 | 1.80 | |
| 1203 | S | 5B | NYCT | Guap | frag | 12.60 | 0.0124 | | 5.33 | 0.10 | |
| 1204 | S | 5B | SAPO | Chry | pauc | 12.40 | 0.0120 | | 6.20 | 0.52 | |
| 1205 | S | 5B | MYRS | Ardi | obov | 10.10 | 0.0080 | | 8.40 | 1.40 | |
| 1206 | S | 5B | THYM | Daph | amer | 8.70 | 0.0059 | 14.0 | 9.65 | 2.20 | |
| 1207 | S | 5C | EUPH | Marg | nobi | 38.40 | 0.1158 | 14.6 | 2.21 | 0.90 | |
| 1208 | S | 5C | BIGN | Tabe | hete | 9.90 | 0.0076 | 10.3 | 4.40 | 0.78 | |
| 1209 | S | 5C | EUPH | Marg | nobi | 8.60 | 0.0058 | 8.2 | 3.90 | 1.10 | SICK11/85 |
| 1210 | S | 5C | MYRS | Ardi | obov | 8.00 | 0.0050 | | 2.95 | 1.90 | |
| 1211 | S | 5C | SAPO | Chry | pauc | 6.10 | 0.0029 | 9.1 | 1.40 | 2.25 | |
| 1212 | S | 5C | NYCT | Guap | frag | 6.20 | 0.0030 | | 3.15 | 2.90 | |
| 1213 | S | 5C | MYRS | Ardi | obov | 7.30 | 0.0041 | | 0.55 | 3.60 | |
| 1214 | S | 5C | MORA | Ficu | trig | 63.30 | 0.3147 | 19.1 | 3.80 | 4.80 | |
| 1215 | S | 5C | LAUR | Ocot | cori | 5.60 | 0.0024 | | 3.10 | 7.60 | |
| 1216 | S | 5C | FABA | Andi | iner | 8.90 | 0.0062 | | 6.50 | 7.60 | |
| 1217 | M | 5C | BIGN | Tabe | hete | 6.60 | 0.0034 | 6.7 | 9.80 | 9.75 | |
| 1218 | M | 5C | BIGN | Tabe | hete | 6.70 | 0.0035 | | 9.90 | 9.95 | |
| 1219 | S | 5C | BIGN | Tabe | hete | 9.00 | 0.0063 | 10.6 | 9.50 | 4.60 | |
| 1220 | S | 5C | FABA | Sabi | flor | 6.40 | 0.0032 | 7.9 | 9.55 | 4.50 | |
| 1221 | S | 5C | CLUS | Clus | rose | 32.80 | 0.0844 | 18.8 | 9.70 | 4.40 | |
| 1222 | S | 5C | MYRS | Ardi | obov | 5.60 | 0.0024 | | 5.30 | 1.65 | |
| 1223 | S | 5C | EUPH | Marg | nobi | 6.20 | 0.0030 | 6.7 | 6.21 | 1.50 | |
| 1224 | S | 5C | FABA | Andi | iner | 22.00 | 0.0380 | 16.4 | 6.10 | 3.35 | |
| 1225 | S | 5C | MYRS | Ardi | obov | 7.50 | 0.0044 | | 8.20 | 2.40 | |
| 1226 | S | 5C | RUBI | Guet | scab | 15.50 | 0.0188 | 13.7 | 8.15 | 3.05 | |
| 1227 | S | 5D | BIGN | Tabe | hete | 18.30 | 0.0263 | 15.8 | 0.20 | 3.15 | |
| 1228 | S | 5D | LAUR | Ocot | cori | 7.60 | 0.0045 | 10.6 | 2.25 | 2.40 | |
| 1229 | S | 5D | RUBI | Guet | scab | 6.10 | 0.0029 | 8.8 | 2.00 | 4.00 | |
| 1230 | S | 5D | MYRS | Ardi | obov | 6.50 | 0.0033 | | 1.20 | 5.50 | |
| 1231 | S | 5D | BIGN | Tabe | hete | 15.70 | 0.0193 | | 1.05 | 6.50 | |
| 1232 | S | 5D | RUBI | Guet | scab | 14.10 | 0.0156 | | 1.12 | 6.80 | |
| 1233 | S | 5D | RUBI | Guet | scab | 10.00 | 0.0078 | | 0.98 | 7.20 | |
| 1234 | S | 5D | BIGN | Tabe | hete | 9.10 | 0.0065 | | 1.01 | 8.65 | |
| 1235 | M | 5D | BIGN | Tabe | hete | 6.90 | 0.0037 | | 2.45 | 9.50 | |
| 1236 | M | 5D | BIGN | Tabe | hete | 11.00 | 0.0095 | | 2.65 | 9.70 | |
| 1237 | S | 5D | MYRS | Ardi | obov | 6.00 | 0.0028 | | 2.65 | 9.70 | |
| 1238 | S | 5D | EUPH | Marg | nobi | 18.60 | 0.0271 | 11.2 | 5.90 | 9.80 | |
| 1239 | S | 5D | MIMO | Inga | fagi | 29.20 | 0.0669 | 18.2 | 6.20 | 8.85 | |
| 1240 | S | 5D | MYRS | Ardi | obov | 6.20 | 0.0030 | | 6.60 | 8.65 | |
| 1241 | S | 5D | RUBI | Guet | scab | 8.90 | 0.0062 | 10.9 | 8.85 | 9.50 | |
| 1242 | S | 5D | BIGN | Tabe | hete | 5.70 | 0.0025 | 6.4 | 8.95 | 9.00 | |
| 1243 | S | 5D | MYRS | Ardi | obov | 8.60 | 0.0058 | 8.8 | 8.95 | 8.50 | |
| 1244 | S | 5D | BIGN | Tabe | hete | 8.70 | 0.0059 | | 7.00 | 7.65 | |
| 1245 | S | 5D | MYRS | Ardi | obov | 6.30 | 0.0031 | | 3.10 | 7.40 | |

APPENDIX II. (Continued)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 1246 | M | 5D | FABA | Andi | iner | 9.20 | 0.0066 | | 6.95 | 6.15 |
| 1247 | M | 5D | FABA | Andi | iner | 6.40 | 0.0032 | | 6.92 | 6.00 |
| 1248 | S | 5D | BORA | Bour | succ | 11.10 | 0.0096 | 10.6 | 7.20 | 5.30 |
| 1249 | S | 5D | MYRT | Euge | mont | 6.70 | 0.0035 | 8.2 | 7.45 | 5.40 |
| 1250 | S | 5D | BIGN | Tabe | hete | 12.40 | 0.0120 | | 6.85 | 5.30 |
| 1251 | S | 5D | MYRS | Ardi | obov | 6.20 | 0.0030 | | 5.60 | 3.60 |
| 1252 | S | 5D | RUBI | Guet | scab | 19.20 | 0.0289 | | 7.60 | 3.55 |
| 1253 | S | 5D | MIMO | Inga | fagi | 35.60 | 0.0995 | 18.2 | 7.90 | 2.30 |
| 1254 | S | 5D | FLAC | Case | sylv | 5.00 | 0.0019 | 6.7 | 5.80 | 1.50 |
| 1255 | S | 5E | MIMO | Inga | fagi | 14.20 | 0.0158 | | 1.45 | 0.20 |
| 1256 | S | 5E | MIMO | Inga | fagi | 17.30 | 0.0235 | | 1.72 | 1.05 |
| 1257 | S | 5E | MIMO | Inga | fagi | 18.10 | 0.0257 | | 2.65 | 1.15 |
| 1258 | S | 5E | MYRT | Myrc | flor | 6.80 | 0.0036 | 8.5 | 4.32 | 0.75 |
| 1259 | S | 5E | SAPI | Meli | biju | 12.50 | 0.0122 | 13.4 | 4.85 | 1.85 |
| 1260 | S | 5E | MYRS | Ardi | obov | 6.40 | 0.0032 | | 4.20 | 2.95 |
| 1261 | S | 5E | MYRS | Ardi | obov | 8.90 | 0.0062 | | 1.15 | 4.05 |
| 1262 | S | 5E | FABA | Andi | iner | 16.80 | 0.0221 | 17.6 | 0.35 | 7.50 |
| 1263 | S | 5E | MYRS | Ardi | obov | 5.30 | 0.0022 | | 0.15 | 8.00 |
| 1264 | S | 5E | MYRS | Ardi | obov | 11.50 | 0.0103 | | 2.45 | 9.90 |
| 1265 | S | 5E | MYRS | Ardi | obov | 6.80 | 0.0036 | | 2.45 | 9.80 |
| 1266 | S | 5E | SAPI | Cupa | triq | 8.80 | 0.0060 | 12.5 | 3.80 | 7.75 |
| 1267 | S | 5E | MIMO | Inga | fagi | 14.60 | 0.0167 | 16.1 | 9.75 | 9.95 |
| 1268 | S | 5E | LAUR | Ocot | cori | 13.00 | 0.0132 | | 8.25 | 6.50 |
| 1269 | S | 5E | MYRS | Ardi | obov | 10.60 | 0.0088 | | 7.65 | 2.25 |
| 1270 | S | 5F | SAPI | Meli | biju | 5.10 | 0.0020 | 4.0 | 1.10 | 1.45 |
| 1271 | S | 5F | MYRT | Psid | ampl | 5.20 | 0.0021 | | 1.25 | 2.10 |
| 1272 | S | 5F | MYRS | Ardi | obov | 5.00 | 0.0019 | 5.2 | 1.15 | 2.60 |
| 1273 | S | 5F | MYRS | Ardi | obov | 13.30 | 0.0138 | | 0.15 | 3.50 |
| 1274 | S | 5F | FLAC | Case | guia | 8.20 | 0.0052 | | 0.98 | 5.60 |
| 1275 | S | 5F | MIMO | Inga | fagi | 35.70 | 0.1000 | | 0.60 | 6.15 |
| 1276 | S | 5F | SAPO | Chry | pauc | 24.50 | 0.0471 | 18.5 | 2.40 | 9.90 |
| 1277 | S | 5F | LAUR | Ocot | cori | 13.00 | 0.0132 | 10.6 | 3.65 | 6.65 |
| 1278 | S | 5F | MYRS | Ardi | obov | 6.30 | 0.0031 | | 2.80 | 8.25 |
| 1279 | S | 5F | CAES | Hyme | cour | 23.60 | 0.0437 | 17.3 | 9.55 | 9.90 |
| 1280 | S | 5F | CAES | Hyme | cour | 43.20 | 0.1465 | 20.1 | 9.10 | 8.00 |
| 1281 | S | 5F | LAUR | Ocot | cori | 8.70 | 0.0059 | | 7.60 | 7.55 |
| 1282 | S | 5F | MYRS | Ardi | obov | 6.50 | 0.0033 | | 6.90 | 5.85 |
| 1283 | S | 5F | BORA | Cord | coll | 9.10 | 0.0065 | 11.2 | 7.25 | 4.55 |
| 1284 | S | 5F | SAPI | Meli | biju | 12.80 | 0.0128 | 14.9 | 4.55 | 5.45 |
| 1285 | S | 5F | FABA | Andi | iner | 27.40 | 0.0589 | | 4.30 | 5.90 |
| 1286 | S | 5F | MYRS | Ardi | obov | 5.00 | 0.0019 | | 2.40 | 3.25 |
| 1287 | S | 5F | MYRS | Ardi | obov | 13.20 | 0.0136 | | 3.80 | 1.60 |
| 1288 | S | 5F | MYRS | Ardi | obov | 12.30 | 0.0118 | | 6.55 | 1.38 |
| 1289 | S | 5F | MIMO | Inga | fagi | 10.20 | 0.0081 | 12.8 | 8.45 | 3.65 |
| 1290 | S | 5F | FABA | Andi | iner | 18.20 | 0.0260 | | 9.50 | 0.62 |
| 1291 | S | 5G | MYRS | Ardi | obov | 5.30 | 0.0022 | | 0.75 | 1.25 |
| 1292 | S | 5G | MYRS | Ardi | obov | 6.70 | 0.0035 | | 1.75 | 2.25 |
| 1293 | S | 5G | MYRS | Ardi | obov | 6.90 | 0.0037 | | 3.41 | 0.82 |

APPENDIX II. (Continued)

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1294 | S | 5G | MYRS | Ardi | obov | 9.90 | 0.0076 | | 4.15 | 2.05 | |
| 1295 | S | 5G | MYRS | Ardi | obov | 8.00 | 0.0050 | | 2.55 | 3.40 | |
| 1296 | S | 5G | MYRS | Ardi | obov | 5.00 | 0.0019 | | 2.91 | 4.35 | |
| 1297 | S | 5G | MYRS | Ardi | obov | 11.60 | 0.0105 | | 0.95 | 3.85 | |
| 1298 | S | 5G | MYRS | Ardi | obov | 11.90 | 0.0111 | | 0.22 | 4.70 | |
| 1299 | S | 5G | MYRS | Ardi | obov | 6.80 | 0.0036 | | 1.05 | 5.70 | |
| 1300 | S | 5G | MYRS | Ardi | obov | 8.10 | 0.0051 | | 2.65 | 6.35 | |
| 1301 | S | 5G | MIMO | Inga | fagi | 14.50 | 0.0165 | | 9.95 | 0.50 | |
| 1302 | S | 5G | MIMO | Inga | fagi | 7.80 | 0.0047 | | 2.36 | 7.60 | |
| 1303 | S | 5G | MYRS | Ardi | obov | 6.60 | 0.0034 | | 2.40 | 9.90 | |
| 1304 | S | 5G | MYRS | Ardi | obov | 9.50 | 0.0070 | | 4.05 | 8.30 | |
| 1305 | S | 5G | MYRS | Ardi | obov | 5.40 | 0.0022 | | 6.85 | 9.00 | |
| 1306 | S | 5G | FLAC | Case | deca | 6.20 | 0.0030 | 11.2 | 8.80 | 9.90 | DEAD11/85 |
| 1307 | S | 5G | MYRS | Ardi | obov | 11.70 | 0.0107 | | 8.95 | 9.80 | |
| 1308 | S | 5G | MYRS | Ardi | obov | 6.00 | 0.0028 | | 9.45 | 9.15 | |
| 1309 | S | 5G | MYRS | Ardi | obov | 11.30 | 0.0100 | | 9.80 | 7.30 | |
| 1310 | S | 5G | MYRS | Ardi | obov | 10.50 | 0.0086 | | 9.00 | 7.20 | |
| 1311 | S | 5G | MYRS | Ardi | obov | 10.10 | 0.0080 | | 5.65 | 7.70 | |
| 1312 | M | 5G | MYRS | Ardi | obov | 12.50 | 0.0122 | | 6.10 | 4.80 | |
| 1313 | M | 5G | MYRS | Ardi | obov | 10.20 | 0.0081 | | 6.20 | 4.60 | |
| 1314 | S | 5G | SAPO | Chry | pauc | 5.60 | 0.0024 | | 8.10 | 3.90 | |
| 1315 | S | 5G | MYRS | Ardi | obov | 5.40 | 0.0022 | | 6.35 | 2.20 | |
| 1316 | S | 5G | MYRS | Ardi | obov | 9.30 | 0.0067 | | 9.52 | 3.55 | |
| 1317 | S | 5G | MYRS | Ardi | obov | 7.70 | 0.0046 | 9.7 | 8.45 | 2.60 | |
| 1318 | S | 5G | MYRS | Ardi | obov | 6.90 | 0.0037 | | 9.10 | 2.40 | |
| 1319 | S | 5H | SAPI | Meli | biju | 5.40 | 0.0022 | 7.9 | 0.45 | 4.00 | |
| 1320 | S | 5H | SAPI | Meli | biju | 11.20 | 0.0098 | 8.5 | 3.30 | 0.10 | |
| 1321 | S | 5H | MYRS | Ardi | obov | 6.80 | 0.0036 | | 3.35 | 1.65 | |
| 1322 | S | 5H | NYCT | Guap | frag | 20.30 | 0.0323 | 13.1 | 1.85 | 3.45 | |
| 1323 | S | 5H | SAPO | Chry | pauc | 9.20 | 0.0066 | | 2.75 | 4.90 | |
| 1324 | S | 5H | MYRS | Ardi | obov | 10.70 | 0.0089 | | 7.20 | 1.85 | |
| 1325 | S | 5H | NYCT | Guap | frag | 11.20 | 0.0098 | | 0.13 | 9.00 | |
| 1326 | S | 5H | STER | Guaz | ulmi | 50.60 | 0.2010 | 15.2 | 2.60 | 8.65 | |
| 1327 | S | 5H | MYRS | Ardi | obov | 7.60 | 0.0045 | | 6.35 | 9.40 | |
| 1328 | S | 5H | SAPO | Chry | pauc | 9.60 | 0.0072 | | 7.95 | 9.45 | |
| 1329 | S | 5H | FLAC | Case | guia | 5.40 | 0.0022 | 7.0 | 6.90 | 6.50 | |
| 1330 | S | 5H | MYRS | Ardi | obov | 5.90 | 0.0027 | | 5.75 | 8.10 | |
| 1331 | S | 5H | SAPO | Chry | egge | 21.70 | 0.0369 | 18.8 | 5.35 | 6.55 | |
| 1332 | S | 5H | MYRS | Ardi | obov | 7.70 | 0.0046 | | 7.00 | 6.30 | |
| 1333 | S | 5H | MIMO | Inga | fagi | 23.10 | 0.0419 | 12.2 | 7.05 | 4.70 | |
| 1334 | S | 5H | MYRS | Ardi | obov | 5.40 | 0.0022 | | 3.80 | 4.20 | |
| 1335 | S | 5H | MYRS | Ardi | obov | 5.60 | 0.0024 | | 7.60 | 2.30 | |
| 1336 | S | 5H | SAPO | Chry | egge | 16.20 | 0.0206 | 13.4 | 8.60 | 2.55 | |
| 1337 | S | 5H | SAPI | Meli | biju | 6.80 | 0.0036 | 7.3 | 9.65 | 2.00 | |
| 1338 | S | 5H | MYRS | Ardi | obov | 9.80 | 0.0075 | | 8.05 | 0.89 | |
| 1339 | S | 5H | MYRS | Ardi | obov | 7.70 | 0.0046 | | 8.85 | 1.10 | |
| 1340 | S | 5I | FLAC | Case | guia | 5.80 | 0.0026 | 8.8 | 0.08 | 0.55 | |
| 1341 | S | 5I | MYRS | Ardi | obov | 11.20 | 0.0098 | | 1.90 | 1.70 | |



241

APPENDIX II. (Continued)

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1342 | S | 5I | FLAC | Case | guia | 8.80 | 0.0060 | 10.6 | 3.45 | 1.95 | |
| 1343 | S | 5I | MYRS | Ardi | obov | 7.00 | 0.0038 | | 3.45 | 2.05 | |
| 1344 | S | 5I | MYRS | Ardi | obov | 5.40 | 0.0022 | | 0.75 | 3.65 | |
| 1345 | S | 5I | MYRS | Ardi | obov | 6.30 | 0.0031 | | 2.90 | 4.95 | |
| 1346 | S | 5I | NYCT | Guap | frag | 33.80 | 0.0897 | | 2.55 | 6.10 | |
| 1347 | S | 5I | FLAC | Case | guia | 5.70 | 0.0025 | 8.2 | 0.75 | 7.65 | |
| 1348 | S | 5I | MORA | Ficu | trig | 39.50 | 0.1225 | 14.6 | 2.58 | 8.60 | |
| 1349 | S | 5I | FLAC | Case | guia | 5.00 | 0.0019 | | 4.70 | 6.40 | DEAD 7/86 |
| 1350 | S | 5I | MYRS | Ardi | obov | 7.90 | 0.0049 | 9.7 | 5.40 | 6.30 | |
| 1351 | S | 5I | NYCT | Guap | frag | 34.10 | 0.0913 | | 7.54 | 8.60 | |
| 1352 | S | 5I | LAUR | Ocot | cori | 10.10 | 0.0080 | 9.1 | 8.65 | 9.65 | |
| 1353 | S | 5I | MYRS | Ardi | obov | 6.60 | 0.0034 | | 8.70 | 8.50 | |
| 1354 | S | 5I | MYRS | Ardi | obov | 7.70 | 0.0046 | | 6.25 | 9.65 | |
| 1355 | S | 5I | MYRS | Ardi | obov | 7.20 | 0.0040 | | 6.75 | 6.30 | |
| 1356 | S | 5I | NYCT | Guap | frag | 31.90 | 0.0799 | | 6.45 | 4.00 | |
| 1357 | S | 5I | MYRS | Ardi | obov | 7.10 | 0.0039 | | 6.60 | 4.00 | |
| 1358 | S | 5I | MYRS | Ardi | obov | 7.20 | 0.0040 | | 6.90 | 3.60 | |
| 1359 | S | 5I | MYRS | Ardi | obov | 9.60 | 0.0072 | | 8.35 | 4.35 | |
| 1360 | S | 5I | FLAC | Case | guia | 14.50 | 0.0165 | 12.8 | 9.20 | 4.85 | |
| 1361 | S | 5I | NYCT | Guap | frag | 7.30 | 0.0041 | 9.1 | 7.05 | 2.90 | |
| 1362 | S | 5I | MIMO | Inga | fagi | 5.60 | 0.0024 | 6.7 | 4.70 | 0.97 | |
| 1363 | S | 5I | MYRS | Ardi | obov | 10.50 | 0.0086 | | 7.30 | 1.10 | |
| 1364 | S | 5I | FLAC | Case | guia | 11.50 | 0.0103 | 12.2 | 8.01 | 0.58 | |
| 1365 | S | 5I | SAPO | Chry | pauc | 11.50 | 0.0103 | 11.6 | 9.82 | 0.71 | |
| 1366 | S | 5J | MYRS | Ardi | obov | 9.40 | 0.0069 | | 0.40 | 1.35 | |
| 1367 | S | 5J | LAUR | Ocot | cori | 8.00 | 0.0050 | | 3.25 | 2.05 | |
| 1368 | S | 5J | LAUR | Ocot | cori | 5.80 | 0.0026 | | 3.90 | 4.15 | |
| 1369 | S | 5J | MYRS | Ardi | obov | 7.10 | 0.0039 | | 0.30 | 4.10 | |
| 1370 | M | 5J | SAPI | Meli | biju | 10.10 | 0.0080 | | 0.35 | 6.60 | |
| 1371 | M | 5J | SAPI | Meli | biju | 21.60 | 0.0366 | 14.0 | 0.25 | 6.75 | |
| 1372 | M | 5J | SAPI | Meli | biju | 20.10 | 0.0317 | | 0.45 | 6.95 | |
| 1373 | M | 5J | SAPI | Meli | biju | 19.30 | 0.0292 | | 0.60 | 6.70 | |
| 1374 | S | 5J | MYRS | Ardi | obov | 5.80 | 0.0026 | | 1.25 | 7.45 | |
| 1375 | S | 5J | FLAC | Case | guia | 5.30 | 0.0022 | 8.2 | 1.32 | 7.30 | |
| 1376 | S | 5J | FLAC | Case | guia | 7.40 | 0.0043 | 9.4 | 2.90 | 9.20 | |
| 1377 | S | 5J | CLUS | Clus | rose | 32.50 | 0.0829 | 10.0 | 3.40 | 5.60 | |
| 1378 | S | 5J | MYRS | Ardi | obov | 6.50 | 0.0033 | | 4.80 | 8.70 | |
| 1379 | S | 5J | SAPI | Meli | biju | 14.40 | 0.0162 | 11.2 | 5.65 | 8.25 | |
| 1380 | S | 5J | MYRS | Ardi | obov | 6.30 | 0.0031 | | 9.00 | 8.10 | |
| 1381 | S | 5J | MYRT | Myrc | flor | 8.10 | 0.0051 | 10.3 | 9.70 | 8.35 | |
| 1382 | S | 5J | MYRS | Ardi | obov | 5.80 | 0.0026 | | 9.96 | 7.00 | |
| 1383 | S | 5J | MYRS | Ardi | obov | 5.90 | 0.0027 | | 8.80 | 6.60 | |
| 1384 | S | 5J | NYCT | Guap | frag | 33.10 | 0.0860 | 14.0 | 7.75 | 5.40 | |
| 1385 | S | 5J | RUBI | Guet | parv | 8.40 | 0.0055 | | 7.50 | 5.00 | DEAD 7/86 |
| 1386 | S | 5J | LAUR | Ocot | cori | 5.80 | 0.0026 | 7.6 | 6.30 | 4.80 | |
| 1387 | S | 5J | SAPO | Chry | pauc | 5.90 | 0.0027 | | 5.55 | 3.35 | |
| 1388 | M | 5J | MYRS | Ardi | obov | 8.60 | 0.0058 | | 6.10 | 1.30 | |
| 1389 | M | 5J | MYRS | Ardi | obov | 5.00 | 0.0019 | | 6.10 | 1.36 | |



242

APPENDIX II. (Continued)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 1390 | S | 5J | MYRS | Ardi obov | 7.10 | 0.0039 | | 6.40 | 0.30 |
| 1391 | S | 5J | MYRS | Ardi obov | 6.50 | 0.0033 | | 7.31 | 3.80 |
| 1392 | S | 5J | FLAC | Case guia | 10.50 | 0.0086 | | 7.95 | 4.40 |
| 1393 | S | 5J | MYRS | Ardi obov | 5.30 | 0.0022 | | 8.02 | 4.35 |
| 1394 | M | 5J | MYRS | Ardi obov | 6.50 | 0.0033 | | 8.97 | 1.40 |
| 1395 | M | 5J | MYRS | Ardi obov | 7.40 | 0.0043 | 7.3 | 9.25 | 1.65 |
| | | | | | 1199 | 15.82 | | | |

DATA SHEETS FOR ST. JOHN FOREST DYNAMICS STUDY

Date: August, 1987
Plot Number: 3(1A-5J)
Plot Locale: Hawksnest

| TAG | STM | SPLIT | FAM | SPECIES | DBH86 | BA | AREA | HGT | X | Y |
|---|---|---|---|---|---|---|---|---|---|---|
| nn | S | 1A | DEAD | STEM | 6.72 | 0.0035 | | | — | — |
| nn | S | 1C | DEAD | STEM | 7.72 | 0.0046 | | | — | — |
| nn | S | 1C | DEAD | STEM | 8.10 | 0.0051 | | | — | — |
| nn | S | 1C | DEAD | STEM | 7.24 | 0.0041 | | | — | — |
| nn | S | 1C | DEAD | STEM | 8.90 | 0.0062 | | | — | — |
| nn | S | 1D | DEAD | STEM | 10.80 | 0.0091 | | | — | — |
| nn | S | 1D | DEAD | STEM | 8.50 | 0.0056 | | | — | — |
| nn | S | 1E | DEAD | STEM | 8.90 | 0.0062 | | | — | — |
| nn | S | 5C | FABA | Andi iner | 14.90 | 0.0174 | | | — | — |
| 1 | S | 1A | MYRC | Ardi obov | 8.30 | 0.0054 | | | 0.05 | 2.71 |
| 2 | S | 1A | LAUR | Ocot cori | 6.73 | 0.0035 | | | 0.70 | 3.31 |
| 3 | S | 1A | MYRC | Ardi obov | 6.53 | 0.0033 | | | 1.80 | 3.01 |
| 4 | S | 1A | FABA | Sabi flor | 8.61 | 0.0058 | | 6.07 | 2.05 | 3.99 |
| 5 | S | 1A | LAUR | Ocot cori | 6.63 | 0.0034 | | | 1.65 | 5.15 |
| 6 | S | 1A | LAUR | Ocot cori | 5.85 | 0.0026 | | | 0.70 | 8.05 |
| 7 | S | 1A | SAPI | Meli biju | 6.00 | 0.0028 | | | 3.55 | 9.82 |
| 8 | S | 1A | POLY | Cocc micr | 15.20 | 0.0181 | | | 8.40 | 9.59 |
| 9 | M | 1A | SAPI | Meli biju | 5.69 | 0.0025 | | | 8.70 | 8.05 |
| 10 | M | 1A | SAPI | Meli biju | 6.49 | 0.0033 | | | 8.55 | 7.90 |
| 11 | M | 1A | SAPI | Meli biju | 7.29 | 0.0041 | | 9.72 | 8.50 | 7.85 |
| 12 | S | 1A | RUBI | Guet elli | 7.80 | 0.0047 | | | 5.85 | 6.45 |
| 13 | S | 1A | SOLA | Sola poly | 5.50 | 0.0023 | | | 5.90 | 2.92 |
| 14 | S | 1A | NYCT | Guap frag | 10.20 | 0.0081 | | 10.6 | 6.60 | 2.95 |
| 15 | M | 1A | SAPI | Meli biju | 5.60 | 0.0024 | | | 5.70 | 0.75 |
| 16 | M | 1A | SAPI | Meli biju | 10.30 | 0.0083 | | | 5.20 | 0.65 |
| 17 | M | 1A | BORA | Cord alli | 16.40 | 0.0211 | | | 6.95 | 1.10 |
| 18 | M | 1A | BORA | Cord alli | 11.90 | 0.0111 | | | 6.80 | 1.40 |
| 19 | M | 1A | BORA | Cord alli | 10.50 | 0.0086 | | | 7.10 | 1.45 |
| 20 | M | 1A | BORA | Cord alli | 7.20 | 0.0040 | | | 7.00 | 1.50 |
| 21 | M | 1A | BORA | Cord alli | 11.50 | 0.0103 | | | 7.35 | 1.15 |
| 22 | S | 1B | SAPI | Meli biju | 17.60 | 0.0243 | | | 1.25 | 2.61 |
| 23 | S | 1B | SAPI | Meli biju | 5.30 | 0.0022 | | | 2.40 | 1.67 |
| 24 | S | 1B | SAPI | Meli biju | 20.10 | 0.0317 | | 10.9 | 2.85 | 2.55 |
| 25 | S | 1B | SAPI | Meli biju | 6.70 | 0.0035 | | | 1.70 | 3.58 |
| 26 | S | 1B | SAPI | Meli biju | 8.25 | 0.0053 | | 7.44 | 3.80 | 4.98 |
| 27 | M | 1B | SAPI | Meli biju | 15.05 | 0.0177 | | | 3.20 | 8.40 |
| 28 | M | 1B | SAPI | Meli biju | 5.10 | 0.0020 | | | 3.55 | 9.00 |
| 29 | M | 1B | SAPI | Meli biju | 13.50 | 0.0143 | | | 3.70 | 9.17 |
| 30 | M | 1B | SAPI | Meli biju | 5.40 | 0.0022 | | | 3.90 | 9.08 |
| 31 | M | 1B | SAPI | Meli biju | 5.55 | 0.0024 | | | 4.10 | 9.12 |
| 32 | S | 1B | SAPI | Meli biju | 5.81 | 0.0026 | | | 7.60 | 8.70 |

APPENDIX III. (Continued)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 33 | S | 1B | FABA | Andi | iner | 10.08 | 0.0079 | 6.38 | 8.70 | 8.75 |
| 34 | S | 1B | LAUR | Ocot | cori | 13.80 | 0.0149 | 15.1 | 9.70 | 8.82 |
| 35 | S | 1B | SAPI | Meli | biju | 5.45 | 0.0023 | | 8.62 | 7.12 |
| 36 | S | 1B | SAPI | Meli | biju | 6.08 | 0.0029 | | 6.15 | 6.82 |
| 37 | S | 1B | SAPO | Bume | sali | 19.19 | 0.0289 | | 6.05 | 6.89 |
| 38 | S | 1B | SAPI | Meli | biju | 11.39 | 0.0101 | | 4.70 | 6.10 |
| 39 | M | 1B | SAPI | Meli | biju | 5.60 | 0.0024 | | 5.55 | 4.65 |
| 40 | M | 1B | SAPI | Meli | biju | 6.78 | 0.0036 | | 4.50 | 5.49 |
| 41 | S | 1B | SAPI | Meli | biju | 6.30 | 0.0031 | | 6.20 | 5.51 |
| 42 | M | 1B | SAPI | Meli | biju | 5.27 | 0.0021 | 11.5 | 9.90 | 5.66 |
| 43 | S | 1B | SAPI | Meli | biju | 8.05 | 0.0050 | | 7.85 | 4.05 |
| 44 | M | 1B | SAPI | Meli | biju | 11.18 | 0.0098 | | 6.45 | 0.55 |
| 45 | M | 1B | SAPI | Meli | biju | 5.10 | 0.0020 | | 6.15 | 0.55 |
| 46 | M | 1B | SAPI | Meli | biju | 8.70 | 0.0059 | | 5.80 | 0.35 |
| 47 | M | 1B | SAPI | Meli | biju | 11.11 | 0.0096 | | 5.85 | 0.45 |
| 48 | S | 1B | LAUR | Ocot | cori | 6.21 | 0.0030 | | 9.95 | 0.15 |
| 49 | S | 1C | ANAC | Mang | indi | 50.30 | 0.1987 | 10.3 | 0.95 | 1.92 |
| 50 | S | 1C | SAPI | Meli | biju | 5.15 | 0.0020 | | 3.20 | 2.75 |
| 51 | S | 1C | SAPI | Meli | biju | 8.39 | 0.0055 | | 4.85 | 0.98 |
| 52 | S | 1C | FABA | Andi | iner | 14.00 | 0.0153 | 10.0 | 3.80 | 6.41 |
| 53 | S | 1C | SAPI | Meli | biju | 12.45 | 0.0121 | | 2.45 | 6.54 |
| 54 | M | 1C | SAPI | Meli | biju | 5.15 | 0.0020 | | 2.00 | 5.91 |
| 55 | M | 1C | SAPI | Meli | biju | 5.50 | 0.0023 | | 1.95 | 5.70 |
| 56 | M | 1C | SAPI | Meli | biju | 7.90 | 0.0049 | | 0.18 | 4.85 |
| 57 | M | 1C | SAPI | Meli | biju | 7.30 | 0.0041 | | 0.22 | 5.25 |
| 58 | S | 1C | SAPI | Meli | biju | 10.25 | 0.0082 | | 2.00 | 7.10 |
| 59 | S | 1C | VERB | Cith | frut | 8.17 | 0.0052 | | 0.35 | 9.79 |
| 60 | M | 1C | SAPI | Meli | biju | 6.85 | 0.0036 | | 2.40 | 9.20 |
| 61 | M | 1C | SAPI | Meli | biju | 5.70 | 0.0025 | | 2.60 | 8.64 |
| 62 | M | 1C | SAPI | Meli | biju | 6.30 | 0.0031 | | 3.05 | 9.00 |
| 63 | M | 1C | SAPI | Meli | biju | 5.82 | 0.0026 | | 2.95 | 9.89 |
| 64 | S | 1C | SAPI | Meli | biju | 5.51 | 0.0023 | | 8.00 | 9.50 |
| 65 | M | 1C | SAPI | Meli | biju | 11.47 | 0.0103 | | 9.75 | 6.81 |
| 66 | M | 1C | SAPI | Meli | biju | 6.40 | 0.0032 | | 6.10 | 5.85 |
| 66 | M | 1C | SAPI | Meli | biju | 11.00 | 0.0095 | | 6.10 | 5.85 |
| 67 | M | 1C | SAPI | Meli | biju | 5.10 | 0.0020 | | 5.95 | 6.01 |
| 67 | M | 1C | SAPI | Meli | biju | 9.93 | 0.0077 | 10.3 | 5.95 | 6.01 |
| 68 | M | 1C | SAPI | Meli | biju | 5.19 | 0.0021 | | 6.30 | 5.96 |
| 68 | M | 1C | SAPI | Meli | biju | 5.70 | 0.0025 | | 6.30 | 5.96 |
| 69 | S | 1C | SAPI | Meli | biju | 6.15 | 0.0029 | | 8.80 | 1.85 |
| 70 | S | 1C | LAUR | Ocot | cori | 8.05 | 0.0050 | | 9.00 | 1.63 |
| 74 | S | 1D | FABA | Andi | iner | 8.60 | 0.0058 | | 1.20 | 8.12 |
| 75 | S | 1D | FABA | Andi | iner | 6.70 | 0.0035 | | 1.40 | 9.25 |
| 76 | M | 1D | SAPI | Meli | biju | 10.10 | 0.0080 | | 2.35 | 2.97 |
| 77 | M | 1D | SAPI | Meli | biju | 5.80 | 0.0026 | | 2.65 | 2.59 |
| 78 | M | 1D | SAPI | Meli | biju | 5.90 | 0.0027 | | 2.30 | 2.70 |
| 79 | M | 1D | SAPI | Meli | biju | 5.20 | 0.0021 | | 2.30 | 2.51 |
| 80 | S | 1D | LAUR | Ocot | cori | 5.10 | 0.0020 | | 2.70 | 1.74 |

APPENDIX III. (Continued)

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 81 | S | 1D | FABA | Andi iner | 5.70 | 0.0025 | | 2.60 | 0.30 |
| 82 | S | 1D | SAPI | Meli biju | 6.90 | 0.0037 | | 3.80 | 0.05 |
| 83 | S | 1D | SAPI | Meli biju | 6.00 | 0.0028 | | 3.90 | 4.73 |
| 84 | S | 1D | SAPI | Meli biju | 5.10 | 0.0020 | | 4.80 | 4.20 |
| 85 | M | 1D | SAPI | Meli biju | 5.90 | 0.0027 | | 7.80 | 7.80 |
| 86 | M | 1D | SAPI | Meli biju | 13.00 | 0.0132 | | 8.15 | 7.90 |
| 87 | M | 1D | SAPI | Meli biju | 10.70 | 0.0089 | | 8.00 | 8.55 |
| 88 | S | 1D | LAUR | Ocot cori | 10.30 | 0.0083 | 9.42 | 8.10 | 7.20 |
| 89 | M | 1D | VERB | Cith frut | 12.50 | 0.0122 | | 7.95 | 7.11 |
| 90 | M | 1D | VERB | Cith frut | 10.80 | 0.0091 | 7.59 | 7.85 | 6.96 |
| 91 | M | 1D | SAPI | Meli biju | 14.50 | 0.0165 | | 6.65 | 4.00 |
| 92 | M | 1D | SAPI | Meli biju | 8.80 | 0.0060 | | 6.40 | 4.22 |
| 93 | M | 1D | SAPI | Meli biju | 5.70 | 0.0025 | | 6.45 | 3.92 |
| 94 | M | 1D | SAPI | Meli biju | 5.60 | 0.0024 | | 6.70 | 3.87 |
| 95 | M | 1D | SAPI | Meli biju | 12.50 | 0.0122 | | 6.30 | 3.75 |
| 96 | M | 1D | SAPI | Meli biju | 5.30 | 0.0022 | | 5.90 | 4.25 |
| 97 | S | 1D | VERB | Cith frut | 5.10 | 0.0020 | | 9.10 | 0.70 |
| 98 | M | 1D | SAPI | Meli biju | 5.20 | 0.0021 | | 9.50 | 0.00 |
| 99 | M | 1D | SAPI | Meli biju | 6.90 | 0.0037 | | 9.80 | 0.05 |
| 100 | M | 1D | SAPI | Meli biju | 5.80 | 0.0026 | | 9.55 | 0.15 |
| 101 | M | 1D | SAPI | Meli biju | 6.90 | 0.0037 | | 8.95 | 4.59 |
| 102 | M | 1D | SAPI | Meli biju | 7.90 | 0.0049 | | 8.65 | 4.63 |
| 103 | M | 1D | SAPI | Meli biju | 6.60 | 0.0034 | | 8.80 | 4.80 |
| 104 | S | 1D | BORA | Cord coll | 10.80 | 0.0091 | | 9.10 | 5.45 |
| 105 | S | 1D | FABA | Andi iner | 12.50 | 0.0122 | 9.11 | 8.75 | 7.85 |
| 106 | S | 1D | LAUR | Ocot cori | 7.30 | 0.0041 | | 9.10 | 9.65 |
| 107 | S | 1D | SAPI | Meli biju | 5.20 | 0.0021 | | 9.85 | 2.60 |
| 108 | S | 1E | SAPI | Meli biju | 5.50 | 0.0023 | | 0.50 | 0.79 |
| 109 | S | 1E | FLAC | Case guia | 5.10 | 0.0020 | | 0.30 | 4.35 |
| 110 | S | 1E | LAUR | Ocot cori | 9.50 | 0.0070 | 9.42 | 1.50 | 4.25 |
| 111 | M | 1E | SAPI | Meli biju | 27.60 | 0.0598 | 9.11 | 3.20 | 8.30 |
| 112 | M | 1E | SAPI | Meli biju | 7.00 | 0.0038 | | 3.00 | 8.15 |
| 113 | M | 1E | SAPI | Meli biju | 11.90 | 0.0111 | | 3.20 | 7.82 |
| 114 | M | 1E | SAPI | Meli biju | 10.20 | 0.0081 | | 3.60 | 7.45 |
| 115 | M | 1E | SAPI | Meli biju | 10.70 | 0.0089 | | 3.80 | 7.62 |
| 116 | M | 1E | SAPI | Meli biju | 8.50 | 0.0056 | | 3.60 | 6.67 |
| 117 | M | 1E | SAPI | Meli biju | 7.40 | 0.0043 | | 3.55 | 6.56 |
| 118 | M | 1E | SAPI | Meli biju | 6.30 | 0.0031 | | 3.40 | 6.50 |
| 119 | M | 1E | SAPI | Meli biju | 7.50 | 0.0044 | | 3.40 | 6.71 |
| 120 | S | 1E | BORA | Cord coll | 8.80 | 0.0060 | | 4.10 | 5.40 |
| 121 | M | 1E | SAPI | Meli biju | 5.00 | 0.0019 | | 3.10 | 4.05 |
| 122 | M | 1E | SAPI | Meli biju | 6.00 | 0.0028 | | 3.40 | 3.96 |
| 123 | M | 1E | SAPI | Meli biju | 5.10 | 0.0020 | | 4.35 | 3.35 |
| 124 | S | 1E | BORA | Cord coll | 14.80 | 0.0172 | 9.72 | 4.65 | 3.79 |
| 125 | S | 1E | RUBI | Guet elli | 8.00 | 0.0050 | | 6.80 | 1.75 |
| 126 | S | 1E | LAUR | Ocot cori | 5.70 | 0.0025 | | 8.20 | 2.00 |
| 127 | M | 1E | SAPO | Bume obov | 7.10 | 0.0039 | 5.77 | 9.80 | 0.35 |
| 128 | M | 1E | SAPO | Bume obov | 6.50 | 0.0033 | | 9.85 | 0.30 |



246

APPENDIX III. (Continued)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 129 | M | 1E | SAPO | Bume | obov | 7.00 | 0.0038 | | 0.20 | 0.43 |
| 130 | M | 1E | SAPO | Bume | obov | 5.50 | 0.0023 | | 0.12 | 0.29 |
| 131 | M | 1E | SAPO | Bume | obov | 7.10 | 0.0039 | | 0.10 | 0.20 |
| 132 | M | 1E | SAPI | Meli | biju | 8.10 | 0.0051 | | 8.65 | 4.82 |
| 133 | M | 1E | SAPI | Meli | biju | 6.30 | 0.0031 | | 3.50 | 4.85 |
| 134 | M | 1E | SAPI | Meli | biju | 7.80 | 0.0047 | | 8.40 | 5.00 |
| 135 | S | 1E | LAUR | Ocot | cori | 7.30 | 0.0041 | | 8.25 | 4.85 |
| 136 | S | 1E | VERB | Cith | frut | 6.90 | 0.0037 | | 8.50 | 8.30 |
| 137 | S | 1E | SAPI | Meli | biju | 8.10 | 0.0051 | | 5.50 | 8.90 |
| 138 | M | 1E | SAPI | Meli | biju | 9.40 | 0.0069 | | 6.85 | 9.95 |
| 139 | M | 1E | SAPI | Meli | biju | 5.10 | 0.0020 | | 6.55 | 9.85 |
| 140 | M | 1E | SAPI | Meli | biju | 5.20 | 0.0021 | | 6.45 | 9.80 |
| 141 | M | 1E | SAPI | Meli | biju | 7.30 | 0.0041 | | 6.35 | 9.85 |
| 142 | M | 1E | SAPI | Meli | biju | 7.20 | 0.0040 | | 6.35 | 9.85 |
| 143 | M | 1E | SAPI | Meli | biju | 11.10 | 0.0096 | | 6.35 | 9.85 |
| 144 | S | 1F | RHAM | Krug | ferr | 5.70 | 0.0025 | | 2.35 | 2.20 |
| 145 | S | 1F | LAUR | Ocot | cori | 5.30 | 0.0022 | | 2.25 | 0.55 |
| 146 | S | 1F | RHAM | Krug | ferr | 5.30 | 0.0022 | | 4.30 | 1.85 |
| 147 | S | 1F | RHAM | Krug | ferr | 6.20 | 0.0030 | | 5.40 | 2.65 |
| 148 | M | 1F | MYRT | Euge | bifl | 7.00 | 0.0038 | 6.68 | 4.12 | 3.12 |
| 149 | M | 1F | MYRT | Euge | bifl | 8.60 | 0.0058 | | 4.10 | 3.00 |
| 150 | S | 1F | FLAC | Case | guia | 7.40 | 0.0043 | | 0.50 | 4.20 |
| 151 | M | 1F | SAPI | Meli | biju | 8.50 | 0.0056 | | 0.32 | 5.70 |
| 152 | M | 1F | SAPI | Meli | biju | 5.50 | 0.0023 | | 0.42 | 5.65 |
| 153 | M | 1E | SAPI | Meli | biju | 5.60 | 0.0024 | | 8.01 | 4.85 |
| 154 | M | 1F | SAPI | Meli | biju | 10.50 | 0.0086 | | 0.55 | 7.15 |
| 155 | M | 1F | SAPI | Meli | biju | 6.20 | 0.0030 | | 0.37 | 7.35 |
| 156 | M | 1F | SAPI | Meli | biju | 7.30 | 0.0041 | | 0.85 | 7.50 |
| 157 | M | 1F | SAPI | Meli | biju | 5.50 | 0.0023 | | 0.72 | 7.62 |
| 158 | M | 1F | SAPI | Meli | biju | 8.50 | 0.0056 | | 0.80 | 7.90 |
| 159 | S | 1F | LAUR | Ocot | cori | 5.70 | 0.0025 | | 1.10 | 9.20 |
| 160 | S | 1F | BORA | Bour | succ | 19.70 | 0.0304 | 8.51 | 3.50 | 8.60 |
| 161 | S | 1F | MYRT | Euge | mont | 8.70 | 0.0059 | 8.81 | 6.40 | 7.10 |
| 162 | S | 1F | MORA | Ficu | citr | 11.50 | 0.0103 | | 6.90 | 5.00 |
| 163 | S | 1F | SAPI | Meli | biju | 5.01 | 0.0019 | | 7.20 | 2.65 |
| 164 | S | 1F | SAPI | Meli | biju | 8.40 | 0.0055 | | 8.80 | 4.56 |
| 165 | S | 1F | RHAM | Krug | ferr | 7.15 | 0.0040 | | 9.60 | 4.45 |
| 166 | S | 1F | BORA | Cord | alli | 13.00 | 0.0132 | 9.72 | 9.65 | 4.25 |
| 167 | S | 1F | RHAM | Krug | ferr | 5.90 | 0.0027 | | 9.40 | 3.70 |
| 168 | S | 1F | SAPI | Meli | biju | 6.80 | 0.0036 | | 9.40 | 3.30 |
| 169 | S | 1F | NYCT | Guap | frag | 16.00 | 0.0201 | 7.90 | 9.30 | 3.20 |
| 170 | S | 1F | SAPO | Bume | obov | 17.20 | 0.0232 | 10.0 | 9.80 | 0.10 |
| 171 | S | 1F | RHAM | Krug | ferr | 5.90 | 0.0027 | | 7.85 | 0.10 |
| 172 | S | 1G | MIMO | Leuc | leuc | 8.50 | 0.0056 | 6.68 | 1.10 | 0.32 |
| 173 | M | 1G | SAPI | Meli | biju | 11.70 | 0.0107 | | 2.40 | 0.85 |
| 174 | M | 1G | SAPI | Meli | biju | 5.50 | 0.0023 | | 2.30 | 0.75 |
| 175 | M | 1G | SAPI | Meli | biju | 5.45 | 0.0023 | | 2.40 | 0.45 |
| 176 | S | 1G | ANAC | Como | dodo | 6.70 | 0.0035 | | 5.00 | 1.85 |

APPENDIX III. (Continued)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 177 | S | 1G | SAPI | Meli | biju | 15.75 | 0.0194 | | 5.35 | 4.69 |
| 178 | S | 1G | SAPI | Meli | biju | 7.70 | 0.0046 | 7.29 | 2.80 | 5.88 |
| 179 | S | 1G | LAUR | Ocot | cori | 8.25 | 0.0053 | | 4.85 | 7.60 |
| 180 | M | 1G | SAPI | Meli | biju | 11.25 | 0.0099 | | 0.90 | 8.40 |
| 181 | M | 1G | SAPI | Meli | biju | 14.10 | 0.0156 | | 1.05 | 9.15 |
| 182 | M | 1G | SAPI | Meli | biju | 9.75 | 0.0074 | | 2.90 | 9.92 |
| 183 | M | 1G | SAPI | Meli | biju | 5.00 | 0.0019 | | 3.00 | 9.70 |
| 184 | S | 1G | MELA | Tetr | elae | 9.00 | 0.0063 | | 5.20 | 7.90 |
| 185 | S | 1G | SAPI | Meli | biju | 6.90 | 0.0037 | | 8.95 | 9.90 |
| 186 | S | 1G | NYCT | Guap | frag | 37.70 | 0.1116 | 11.5 | 9.30 | 7.20 |
| 187 | S | 1G | RHAM | Krug | ferr | 6.00 | 0.0028 | | 6.10 | 8.50 |
| 188 | S | 1G | BORA | Bour | succ | 11.55 | 0.0104 | | 9.50 | 4.50 |
| 189 | S | 1G | RHAM | Krug | ferr | 5.15 | 0.0020 | | 8.25 | 0.25 |
| 190 | S | 1H | PALM | Cocc | alta | 7.90 | 0.0049 | | 2.05 | 0.50 |
| 191 | S | 1H | LAUR | Ocot | cori | 5.00 | 0.0019 | | 5.65 | 0.60 |
| 192 | S | 1H | BORA | Bour | succ | 8.75 | 0.0060 | | 5.40 | 4.00 |
| 193 | S | 1H | CELA | Mayt | elli | 8.30 | 0.0054 | | 2.65 | 6.00 |
| 194 | S | 1H | BORA | Bour | succ | 13.75 | 0.0148 | | 2.85 | 6.30 |
| 195 | S | 1H | MYRT | Euge | mont | 7.63 | 0.0045 | | 0.72 | 5.40 |
| 196 | S | 1H | MYRT | Euge | mont | 5.30 | 0.0022 | | 0.42 | 6.40 |
| 197 | S | 1H | BORA | Bour | succ | 12.10 | 0.0114 | | 0.35 | 8.30 |
| 198 | S | 1H | BORA | Cord | alli | 5.30 | 0.0022 | | 0.21 | 8.81 |
| 199 | S | 1H | BURS | Burs | sima | 19.45 | 0.0297 | | 2.25 | 9.65 |
| 200 | S | 1H | SAPI | Meli | biju | 10.10 | 0.0080 | | 4.50 | 7.32 |
| 201 | M | 1H | BORA | Bour | succ | 7.40 | 0.0043 | | 6.95 | 3.00 |
| 202 | M | 1H | BORA | Bour | succ | 12.00 | 0.0113 | | 6.87 | 2.90 |
| 203 | S | 1H | BURS | Burs | sima | 5.80 | 0.0026 | | 7.10 | 1.20 |
| 204 | S | 1H | BURS | Burs | sima | 7.30 | 0.0041 | 5.47 | 8.00 | 1.60 |
| 205 | S | 1H | FABA | Pisc | cart | 5.80 | 0.0026 | | 9.30 | 0.45 |
| 206 | S | 1H | SAPI | Meli | biju | 31.40 | 0.0774 | 9.42 | 9.50 | 0.80 |
| 207 | S | 1H | SAPI | Meli | biju | 8.10 | 0.0051 | | 9.20 | 3.40 |
| 208 | S | 1H | SAPI | Meli | biju | 10.60 | 0.0088 | 7.59 | 7.25 | 5.60 |
| 209 | M | 1H | SAPI | Meli | biju | 6.20 | 0.0030 | | 7.10 | 5.55 |
| 210 | M | 1H | SAPI | Meli | biju | 5.10 | 0.0020 | | 6.90 | 5.10 |
| 211 | S | 1H | SAPI | Meli | biju | 5.90 | 0.0027 | | 7.90 | 0.40 |
| 212 | S | 1H | MYRC | Ardi | obov | 10.20 | 0.0081 | | 6.10 | 9.85 |
| 213 | S | 1H | SAPI | Meli | biju | 52.00 | 0.2123 | | 7.80 | 8.12 |
| 214 | S | 1H | BURS | Burs | sima | 6.30 | 0.0031 | | 8.75 | 7.57 |
| 215 | S | 1H | CELA | Mayt | elli | 5.70 | 0.0025 | | 6.25 | 7.91 |
| 216 | S | 1H | LAUR | Ocot | cori | 9.20 | 0.0066 | | 6.25 | 7.82 |
| 217 | S | 1I | MYRC | Ardi | obov | 5.60 | 0.0024 | | 0.45 | 8.00 |
| 218 | S | 1I | FLAC | Case | deca | 6.00 | 0.0028 | | 1.80 | 9.95 |
| 219 | S | 1I | FLAC | Case | deca | 7.30 | 0.0041 | | 1.60 | 9.95 |
| 220 | S | 1I | LAUR | Ocot | cori | 39.00 | 0.1194 | | 9.00 | 3.00 |
| 221 | S | 1I | SAPI | Meli | biju | 8.50 | 0.0056 | | 0.15 | 6.10 |
| 222 | S | 1I | SAPI | Meli | biju | 8.00 | 0.0050 | | 1.00 | 5.15 |
| 223 | S | 1I | MYRT | Euge | mont | 7.20 | 0.0040 | | 1.10 | 4.40 |
| 224 | S | 1I | MYRC | Ardi | obov | 5.30 | 0.0022 | | 1.65 | 3.20 |



206

APPENDIX III. (Continued)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 225 | S | 1I | NYCT | Guap | frag | 11.70 | 0.0107 | | 3.15 | 7.50 |
| 226 | S | 1I | FLAC | Case | deca | 5.30 | 0.0022 | | 3.35 | 3.91 |
| 227 | S | 1I | LAUR | Ocot | cori | 6.70 | 0.0035 | | 3.40 | 3.85 |
| 228 | S | 1I | MYRT | Euge | mont | 10.00 | 0.0078 | 11.5 | 3.70 | 4.60 |
| 229 | S | 1I | MYRC | Ardi | obov | 6.00 | 0.0028 | | 6.80 | 3.30 |
| 230 | M | 1I | MYRC | Ardi | obov | 9.00 | 0.0063 | | 7.80 | 3.15 |
| 231 | M | 1I | MYRC | Ardi | obov | 5.40 | 0.0022 | | 7.70 | 3.10 |
| 232 | S | 1I | SAPI | Meli | biju | 8.00 | 0.0050 | | 8.40 | 2.85 |
| 233 | S | 1I | MYRC | Ardi | obov | 8.30 | 0.0054 | 9.42 | 8.55 | 2.95 |
| 234 | S | 1I | SAPI | Meli | biju | 5.90 | 0.0027 | | 9.40 | 0.60 |
| 235 | M | 1I | SAPI | Meli | biju | 7.90 | 0.0049 | | 3.70 | 1.10 |
| 236 | M | 1I | SAPI | Meli | biju | 6.00 | 0.0028 | | 3.70 | 0.80 |
| 237 | M | 1I | SAPI | Meli | biju | 14.40 | 0.0162 | | 3.40 | 0.60 |
| 238 | M | 1I | SAPI | Meli | biju | 7.50 | 0.0044 | | 3.10 | 0.40 |
| 239 | M | 1I | SAPI | Meli | biju | 14.10 | 0.0156 | | 2.95 | 0.10 |
| 240 | M | 1I | SAPI | Meli | biju | 13.40 | 0.0141 | | 3.10 | 0.00 |
| 241 | M | 1I | SAPI | Meli | biju | 8.00 | 0.0050 | | 4.00 | 0.50 |
| 242 | M | 1I | SAPI | Meli | biju | 6.00 | 0.0028 | | 3.80 | 0.10 |
| 243 | M | 1I | SAPI | Meli | biju | 16.60 | 0.0216 | | 3.90 | 0.20 |
| 244 | M | 1I | MYRC | Ardi | obov | 7.20 | 0.0040 | | 9.75 | 3.05 |
| 245 | M | 1I | MYRC | Ardi | obov | 7.40 | 0.0043 | | 9.70 | 2.90 |
| 246 | M | 1I | SAPI | Meli | biju | 8.60 | 0.0058 | | 7.40 | 4.95 |
| 247 | M | 1I | SAPI | Meli | biju | 6.80 | 0.0036 | | 7.35 | 5.10 |
| 248 | M | 1I | MYRC | Ardi | obov | 5.80 | 0.0026 | | 7.60 | 5.80 |
| 249 | M | 1I | MYRC | Ardi | obov | 8.20 | 0.0052 | | 7.70 | 6.40 |
| 250 | S | 1I | MYRC | Ardi | obov | 5.40 | 0.0022 | | 7.20 | 8.15 |
| 251 | S | 1I | MYRC | Ardi | obov | 5.40 | 0.0022 | | 7.00 | 8.00 |
| 252 | S | 1I | MYRT | Euge | mont | 8.00 | 0.0050 | 9.11 | 8.50 | 6.80 |
| 253 | S | 1I | SAPI | Meli | biju | 5.40 | 0.0022 | | 8.70 | 8.40 |
| 254 | M | 1I | RUBI | Guet | parv | 6.30 | 0.0031 | | 9.50 | 6.05 |
| 255 | M | 1I | RUBI | Guet | parv | 7.30 | 0.0041 | | 9.40 | 6.15 |
| 256 | M | 1I | RUBI | Guet | parv | 8.40 | 0.0055 | | 9.30 | 6.25 |
| 257 | S | 1I | MYRT | Euge | mont | 9.50 | 0.0070 | | 8.70 | 9.00 |
| 258 | S | 1I | RUBI | Guet | parv | 10.80 | 0.0091 | | 7.70 | 9.90 |
| 259 | S | 1I | BORA | Bour | succ | 7.60 | 0.0045 | | 7.55 | 9.90 |
| 260 | S | 1J | MYRT | Euge | mont | 5.90 | 0.0027 | | 9.35 | 0.30 |
| 261 | M | 1J | SAPI | Meli | biju | 11.00 | 0.0095 | 9.42 | 2.00 | 9.15 |
| 262 | S | 1J | SAPI | Meli | biju | 7.40 | 0.0043 | | 1.80 | 7.40 |
| 263 | M | 1J | RUBI | Guet | parv | 6.20 | 0.0030 | | 3.50 | 7.20 |
| 264 | M | 1J | RUBI | Guet | parv | 9.00 | 0.0063 | | 3.52 | 7.05 |
| 265 | S | 1J | LAUR | Ocot | cori | 6.40 | 0.0032 | 10.9 | 1.40 | 2.60 |
| 266 | S | 1J | MYRT | Euge | mont | 5.10 | 0.0020 | | 5.05 | 4.45 |
| 267 | S | 1J | NYCT | Guap | frag | 24.20 | 0.0459 | 10.9 | 0.85 | 1.60 |
| 268 | S | 1J | FLAC | Case | deca | 5.50 | 0.0023 | | 0.15 | 1.60 |
| 269 | S | 1J | MYRT | Euge | bifl | 5.60 | 0.0024 | | 0.15 | 1.78 |
| 270 | S | 1J | SAPI | Meli | biju | 5.50 | 0.0023 | | 2.00 | 0.15 |
| 271 | S | 1J | CAPP | Capp | indi | 5.00 | 0.0019 | | 5.05 | 3.35 |
| 272 | S | 1J | NYCT | Guap | frag | 7.00 | 0.0038 | 8.51 | 5.15 | 4.47 |



241

APPENDIX III. (Continued)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 273 | S | 1J | MYRT | Euge | mont | 8.20 | 0.0052 | 7.90 | 7.35 | 0.70 |
| 274 | S | 1J | FLAC | Case | guia | 7.30 | 0.0041 | | 7.40 | 4.90 |
| 275 | S | 1J | MYRC | Ardi | obov | 5.10 | 0.0020 | | 7.50 | 6.00 |
| 276 | M | 1J | MYRT | Euge | bifl | 9.20 | 0.0066 | | 7.80 | 5.80 |
| 277 | M | 1J | MYRT | Euge | bifl | 5.80 | 0.0026 | | 2.77 | 5.85 |
| 278 | S | 1J | MELA | Tetr | elae | 6.20 | 0.0030 | | 7.60 | 7.85 |
| 279 | M | 1J | BORA | Bour | succ | 10.00 | 0.0078 | | 8.20 | 7.60 |
| 280 | M | 1J | BORA | Bour | succ | 14.80 | 0.0172 | | 8.50 | 7.65 |
| 281 | S | 1J | FLAC | Case | deca | 6.10 | 0.0029 | | 8.45 | 7.40 |
| 282 | S | 1J | FLAC | Case | deca | 5.30 | 0.0022 | | 9.80 | 7.00 |
| 283 | S | 1J | MYRC | Ardi | obov | 6.90 | 0.0037 | | 3.75 | 8.20 |
| 284 | M | 1J | SAPI | Meli | biju | 5.30 | 0.0022 | | 1.75 | 9.3 |
| 285 | M | 2J | CELA | Mayt | elli | 9.20 | 0.0066 | | 9.70 | 9.70 |
| 286 | M | 2J | CELA | Mayt | elli | 5.10 | 0.0020 | | 9.60 | 9.80 |
| 287 | M | 2J | CELA | Mayt | elli | 5.00 | 0.0019 | 8.20 | 9.80 | 9.60 |
| 288 | S | 2J | MYRT | Euge | proc | 7.70 | 0.0046 | | 8.00 | 8.70 |
| 289 | S | 2J | RUBI | Guet | scab | 7.90 | 0.0049 | | 7.80 | 9.45 |
| 290 | S | 2J | RUBI | Guet | scab | 15.00 | 0.0176 | 10.0 | 5.40 | 9.40 |
| 291 | M | 2J | RUBI | Guet | parv | 8.00 | 0.0050 | | 4.75 | 9.52 |
| 292 | M | 2J | RUBI | Guet | parv | 7.20 | 0.0040 | | 4.85 | 9.47 |
| 293 | M | 2J | RUBI | Guet | parv | 5.80 | 0.0026 | | 4.30 | 9.60 |
| 294 | M | 2J | RUBI | Guet | parv | 5.00 | 0.0019 | | 4.50 | 9.69 |
| 295 | S | 2J | FLAC | Case | deca | 8.90 | 0.0062 | | 5.40 | 6.49 |
| 296 | S | 2J | CELA | Mayt | elli | 8.90 | 0.0062 | | 5.80 | 5.91 |
| 297 | S | 2J | SAPI | Meli | biju | 6.00 | 0.0028 | | 8.90 | 6.01 |
| 298 | S | 2J | RUBI | Guet | scab | 9.30 | 0.0067 | | 9.20 | 5.60 |
| 299 | S | 2J | BURS | Burs | sima | 18.00 | 0.0254 | 8.51 | 9.10 | 5.38 |
| 300 | M | 2J | NYCT | Guap | frag | 9.80 | 0.0075 | | 8.50 | 3.97 |
| 301 | M | 2J | NYCT | Guap | frag | 8.30 | 0.0054 | | 8.40 | 4.10 |
| 302 | S | 2J | MYRT | Euge | mont | 5.80 | 0.0026 | | 7.70 | 4.56 |
| 303 | S | 2J | SAPI | Meli | biju | 6.20 | 0.0030 | | 5.70 | 3.85 |
| 304 | S | 2J | MYRT | Euge | proc | 10.70 | 0.0089 | 8.20 | 3.40 | 5.70 |
| 305 | S | 2J | VERB | Cith | frut | 15.10 | 0.0179 | 11.8 | 3.00 | 5.72 |
| 306 | S | 2J | FLAC | Case | deca | 7.90 | 0.0049 | 9.42 | 0.39 | 7.45 |
| 307 | S | 2I | BURS | Burs | sima | 31.90 | 0.0799 | 9.72 | 9.60 | 8.19 |
| 308 | M | 2I | RUBI | Guet | parv | 8.00 | 0.0050 | | 9.55 | 9.10 |
| 309 | M | 2I | RUBI | Guet | parv | 5.30 | 0.0022 | | 9.45 | 9.00 |
| 310 | S | 2I | VERB | Cith | frut | 6.80 | 0.0036 | | 7.55 | 9.70 |
| 311 | S | 2J | PALM | Cocc | alta | 6.60 | 0.0034 | 3.34 | 0.35 | 5.49 |
| 312 | S | 2I | VERB | Cith | frut | 6.70 | 0.0035 | 5.77 | 9.30 | 3.80 |
| 313 | S | 2I | FABA | Sabi | flor | 6.50 | 0.0033 | 6.07 | 9.30 | 3.60 |
| 314 | M | 2I | RUBI | Guet | parv | 5.40 | 0.0022 | | 8.15 | 6.60 |
| 315 | M | 2I | RUBI | Guet | parv | 5.10 | 0.0020 | | 7.95 | 6.62 |
| 316 | M | 2I | RUBI | Guet | parv | 6.30 | 0.0031 | | 8.15 | 6.39 |
| 317 | M | 2I | RUBI | Guet | parv | 6.00 | 0.0028 | | 8.20 | 6.30 |
| 318 | S | 2I | MYRT | Euge | mont | 5.90 | 0.0027 | | 6.80 | 8.95 |
| 319 | S | 2I | FABA | Sabi | flor | 7.50 | 0.0044 | | 5.60 | 8.10 |
| 320 | S | 2J | CAPP | Capp | cyno | 7.30 | 0.0041 | 6.07 | 2.35 | 5.31 |



250

APPENDIX III. (Continued)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 321 | M | 2J | RUBI | Guet | parv | 7.30 | 0.0041 | | 2.15 | 1.92 |
| 322 | M | 2J | RUBI | Guet | parv | 5.00 | 0.0019 | | 2.05 | 1.75 |
| 323 | S | 2J | SAPI | Meli | biju | 9.10 | 0.0065 | | 4.35 | 1.81 |
| 324 | S | 2J | SAPI | Meli | biju | 6.00 | 0.0028 | | 4.00 | 1.50 |
| 325 | S | 2J | RUBI | Guet | parv | 9.30 | 0.0067 | | 4.25 | 1.41 |
| 326 | S | 2J | SAPI | Meli | biju | 5.40 | 0.0022 | | 4.50 | 1.36 |
| 327 | S | 2J | PALM | Cocc | alta | 6.70 | 0.0035 | 9.11 | 6.65 | 2.52 |
| 328 | S | 2J | MYRT | Euge | bifl | 7.50 | 0.0044 | | 7.35 | 2.46 |
| 329 | S | 2J | CELA | Mayt | elli | 8.00 | 0.0050 | | 9.10 | 2.81 |
| 330 | S | 2I | LAUR | Ocot | cori | 6.50 | 0.0033 | | 9.98 | 0.70 |
| 331 | S | 2I | CAPP | Capp | cyno | 5.30 | 0.0022 | | 0.12 | 9.89 |
| 332 | M | 2I | FABA | Sabi | flor | 9.00 | 0.0063 | | 0.42 | 8.46 |
| 333 | M | 2I | FABA | Sabi | flor | 7.00 | 0.0038 | | 0.35 | 8.45 |
| 334 | M | 2I | POLY | Cocc | micr | 24.90 | 0.0486 | | 3.60 | 7.01 |
| 335 | M | 2I | POLY | Cocc | micr | 15.20 | 0.0181 | | 3.20 | 6.95 |
| 336 | M | 2I | POLY | Cocc | micr | 8.60 | 0.0058 | | 3.00 | 6.95 |
| 337 | S | 2I | RUBI | Guet | scab | 7.10 | 0.0039 | | 3.30 | 5.26 |
| 338 | M | 2I | RUBI | Guet | parv | 9.70 | 0.0073 | | 2.70 | 4.79 |
| 339 | M | 2I | RUBI | Guet | parv | 7.70 | 0.0046 | | 2.80 | 4.63 |
| 340 | M | 2I | RUBI | Guet | parv | 6.40 | 0.0032 | | 2.85 | 4.50 |
| 341 | M | 2I | RUBI | Guet | parv | 6.20 | 0.0030 | | 6.45 | 3.70 |
| 342 | M | 2I | RUBI | Guet | parv | 5.90 | 0.0027 | | 6.35 | 3.61 |
| 343 | S | 2I | MYRC | Ardi | obov | 5.10 | 0.0020 | | 6.85 | 0.70 |
| 344 | S | 2I | SAPI | Meli | biju | 10.10 | 0.0080 | 12.1 | 4.75 | 0.52 |
| 345 | S | 2H | FLAC | Case | deca | 5.60 | 0.0024 | | 9.60 | 7.51 |
| 346 | M | 2H | RUBI | Guet | parv | 5.40 | 0.0022 | | 7.85 | 8.05 |
| 347 | M | 2H | RUBI | Guet | parv | 5.10 | 0.0020 | | 7.40 | 7.60 |
| 348 | S | 2H | SAPI | Meli | biju | 16.10 | 0.0203 | | 8.50 | 6.50 |
| 349 | M | 2H | FLAC | Case | deca | 8.00 | 0.0050 | | 6.50 | 7.71 |
| 350 | M | 2H | FLAC | Case | deca | 9.40 | 0.0069 | | 6.55 | 7.86 |
| 351 | M | 2H | FLAC | Case | deca | 6.70 | 0.0035 | 8.20 | 6.25 | 7.88 |
| 352 | S | 2H | LAUR | Ocot | cori | 5.20 | 0.0021 | | 6.40 | 9.30 |
| 353 | S | 2H | FLAC | Case | deca | 7.30 | 0.0041 | 6.07 | 7.30 | 4.85 |
| 354 | M | 2H | NYCT | Guap | frag | 15.00 | 0.0176 | 9.11 | 7.85 | 4.01 |
| 355 | M | 2H | NYCT | Guap | frag | 15.70 | 0.0193 | | 7.50 | 4.01 |
| 356 | S | 2H | FLAC | Case | deca | 6.10 | 0.0029 | | 6.65 | 4.35 |
| 357 | S | 2H | CELA | Mayt | elli | 5.10 | 0.0020 | | 9.15 | 0.50 |
| 358 | S | 2H | FLAC | Case | deca | 9.50 | 0.0070 | | 6.30 | 2.00 |
| 359 | S | 2H | BORA | Bour | succ | 21.30 | 0.0356 | | 5.90 | 0.80 |
| 360 | M | 2H | MORA | Ficu | citr | 8.50 | 0.0056 | 6.99 | 5.25 | 5.71 |
| 361 | M | 2H | MORA | Ficu | citr | 7.10 | 0.0039 | | 5.15 | 5.62 |
| 362 | M | 2H | FLAC | Case | deca | 7.50 | 0.0044 | | 3.60 | 8.92 |
| 363 | M | 2H | FLAC | Case | deca | 8.00 | 0.0050 | | 3.50 | 8.94 |
| 364 | M | 2H | FLAC | Case | deca | 7.00 | 0.0038 | | 3.55 | 9.00 |
| 365 | S | 2H | RUBI | Guet | parv | 5.30 | 0.0022 | | 2.70 | 1.85 |
| 366 | S | 2H | BORA | Bour | succ | 11.90 | 0.0111 | | 2.60 | 0.95 |
| 367 | S | 2H | BORA | Bour | succ | 13.00 | 0.0132 | | 1.80 | 0.62 |
| 368 | S | 2G | NYCT | Guap | frag | 25.10 | 0.0494 | | 8.90 | 8.95 |



251

APPENDIX III. (Continued)

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 369 | S | 2G | NYCT | Guap frag | 10.50 | 0.0086 | | 8.30 | 8.30 |
| 370 | S | 2G | CAPP | Capp cyno | 5.00 | 0.0019 | | 7.30 | 8.27 |
| 371 | S | 2G | CAPP | Capp ampl | 9.40 | 0.0069 | | 9.70 | 8.10 |
| 372 | S | 2G | SAPI | Meli biju | 17.00 | 0.0226 | | 6.20 | 8.30 |
| 373 | M | 2G | SAPI | Meli biju | 5.40 | 0.0022 | | 7.15 | 6.58 |
| 374 | M | 2G | SAPI | Meli biju | 7.40 | 0.0043 | | 7.00 | 6.52 |
| 375 | M | 2G | SAPI | Meli biju | 6.30 | 0.0031 | | 7.30 | 6.40 |
| 376 | M | 2G | SAPI | Meli biju | 10.40 | 0.0084 | | 7.15 | 6.40 |
| 377 | M | 2G | SAPI | Meli biju | 6.30 | 0.0031 | | 6.90 | 6.51 |
| 378 | S | 2G | FLAC | Case deca | 10.00 | 0.0078 | 11.5 | 8.20 | 4.05 |
| 379 | M | 2G | SAPI | Meli biju | 5.20 | 0.0021 | | 4.65 | 2.10 |
| 380 | M | 2G | SAPI | Meli biju | 5.80 | 0.0026 | | 4.75 | 1.87 |
| 381 | M | 2G | SAPI | Meli biju | 8.30 | 0.0054 | | 4.70 | 1.75 |
| 382 | M | 2G | SAPI | Meli biju | 5.50 | 0.0023 | | 4.25 | 1.20 |
| 383 | M | 2G | SAPI | Meli biju | 35.00 | 0.0962 | 11.5 | 3.65 | 1.30 |
| 384 | M | 2G | SAPI | Meli biju | 5.20 | 0.0021 | | 4.80 | 1.67 |
| 385 | M | 2G | SAPI | Meli biju | 13.50 | 0.0143 | | 3.50 | 1.85 |
| 386 | M | 2G | SAPI | Meli biju | 13.50 | 0.0143 | | 3.50 | 1.76 |
| 387 | M | 2G | SAPI | Meli biju | 23.30 | 0.0426 | | 3.45 | 1.70 |
| 388 | S | 2G | NYCT | Guap frag | 13.40 | 0.0141 | 11.5 | 3.40 | 6.85 |
| 389 | S | 2G | LAUR | Ocot cori | 7.90 | 0.0049 | | 0.35 | 8.03 |
| 390 | S | 2G | BORA | Bour succ | 7.20 | 0.0040 | 9.11 | 2.70 | 5.82 |
| 391 | S | 2G | LAUR | Ocot cori | 7.80 | 0.0047 | | 0.88 | 3.71 |
| 392 | M | 2F | NYCT | Guap frag | 15.40 | 0.0186 | | 8.90 | 3.80 |
| 393 | M | 2F | NYCT | Guap frag | 18.50 | 0.0268 | 12.4 | 8.70 | 3.80 |
| 394 | S | 2F | LAUR | Lica sali | 5.90 | 0.0027 | | 8.80 | 4.30 |
| 395 | S | 2F | FLAC | Case deca | 9.50 | 0.0070 | | 8.90 | 6.42 |
| 396 | S | 2F | FABA | Pisc cart | 6.90 | 0.0037 | | 9.10 | 8.70 |
| 397 | S | 2F | FLAC | Case guia | 11.90 | 0.0111 | 11.5 | 6.90 | 7.21 |
| 398 | S | 2F | NYCT | Guap frag | 41.20 | 0.1333 | 16.1 | 6.70 | 5.61 |
| 399 | S | 2F | CELA | Mayt elli | 7.00 | 0.0038 | | 6.00 | 6.30 |
| 400 | S | 2F | MYRC | Ardi obov | 5.00 | 0.0019 | | 3.30 | 9.95 |
| 401 | M | 2F | POLY | Cocc micr | 12.70 | 0.0126 | | 5.65 | 2.39 |
| 402 | M | 2F | POLY | Cocc micr | 7.70 | 0.0046 | | 5.35 | 2.45 |
| 403 | M | 2F | POLY | Cocc micr | 7.70 | 0.0046 | | 5.55 | 2.37 |
| 404 | M | 2F | POLY | Cocc micr | 11.90 | 0.0111 | | 5.75 | 2.25 |
| 405 | M | 2F | POLY | Cocc micr | 8.00 | 0.0050 | | 5.80 | 2.19 |
| 406 | M | 2F | POLY | Cocc micr | 10.50 | 0.0086 | | 5.70 | 2.11 |
| 407 | M | 2F | POLY | Cocc micr | 6.80 | 0.0036 | | 5.55 | 2.04 |
| 408 | M | 2F | POLY | Cocc micr | 6.10 | 0.0029 | | 5.10 | 2.56 |
| 409 | S | 2F | MELA | Tetr elae | 16.40 | 0.0211 | 11.2 | 3.70 | 5.61 |
| 410 | S | 2F | MYRT | Euge mont | 5.60 | 0.0024 | 7.29 | 1.36 | 7.50 |
| 411 | S | 2F | LAUR | Ocot cori | 5.30 | 0.0022 | | 0.19 | 8.04 |
| 412 | S | 2F | MYRT | Euge mont | 6.00 | 0.0028 | | 0.19 | 4.61 |
| 413 | S | 2F | RUBI | Guet parv | 6.30 | 0.0031 | | 1.15 | 3.30 |
| 414 | M | 2F | SAPI | Meli biju | 7.30 | 0.0041 | | 0.35 | 1.45 |
| 415 | M | 2F | SAPI | Meli biju | 9.90 | 0.0076 | | 0.50 | 1.12 |
| 416 | M | 2E | RUBI | Guet parv | 5.80 | 0.0026 | | 8.65 | 9.75 |

APPENDIX III. (Continued)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 417 | M | 2E | RUBI | Guet | parv | 13.40 | 0.0141 | 11.5 | 8.58 | 9.94 |
| 418 | M | 2E | RUBI | Guet | parv | 5.90 | 0.0027 | | 8.50 | 9.75 |
| 419 | M | 2E | RUBI | Guet | parv | 12.50 | 0.0122 | | 8.30 | 9.97 |
| 420 | M | 2E | NYCT | Guap | frag | 16.10 | 0.0203 | | 8.10 | 8.62 |
| 421 | M | 2E | NYCT | Guap | frag | 21.60 | 0.0366 | | 7.80 | 8.65 |
| 422 | S | 2E | MYRC | Ardi | obov | 8.40 | 0.0055 | 9.72 | 9.10 | 7.92 |
| 423 | M | 2E | SAPI | Meli | biju | 9.00 | 0.0063 | | 5.60 | 7.63 |
| 424 | M | 2E | SAPI | Meli | biju | 8.00 | 0.0050 | | 5.60 | 7.50 |
| 425 | M | 2E | SAPI | Meli | biju | 11.40 | 0.0102 | | 5.35 | 7.61 |
| 426 | M | 2E | SAPI | Meli | biju | 8.10 | 0.0051 | | 3.75 | 6.92 |
| 427 | M | 2E | SAPI | Meli | biju | 10.00 | 0.0078 | 9.72 | 3.85 | 6.85 |
| 428 | M | 2E | SAPI | Meli | biju | 8.10 | 0.0051 | | 3.75 | 6.79 |
| 429 | M | 2E | SAPI | Meli | biju | 5.80 | 0.0026 | | 3.65 | 6.61 |
| 430 | M | 2E | SAPI | Meli | biju | 5.20 | 0.0021 | | 3.45 | 6.61 |
| 431 | M | 2E | SAPI | Meli | biju | 5.00 | 0.0019 | | 3.80 | 6.61 |
| 432 | S | 2E | SAPI | Meli | biju | 5.70 | 0.0025 | | 2.10 | 7.80 |
| 433 | S | 2E | SAPI | Meli | biju | 5.10 | 0.0020 | | 1.70 | 9.20 |
| 434 | S | 2E | MYRC | Ardi | obov | 6.80 | 0.0036 | | 0.35 | 9.75 |
| 435 | S | 2E | LAUR | Ocot | cori | 10.00 | 0.0078 | 10.6 | 1.85 | 5.17 |
| 436 | M | 2E | SAPI | Meli | biju | 6.20 | 0.0030 | | 5.65 | 5.24 |
| 437 | M | 2E | SAPI | Meli | biju | 7.10 | 0.0039 | | 5.60 | 5.18 |
| 438 | S | 2E | NYCT | Guap | frag | 42.10 | 0.1392 | 14.5 | 5.80 | 4.95 |
| 439 | S | 2E | MYRC | Ardi | obov | 5.60 | 0.0024 | | 6.40 | 4.56 |
| 440 | M | 2E | SAPI | Meli | biju | 5.70 | 0.0025 | | 4.90 | 3.21 |
| 441 | M | 2E | SAPI | Meli | biju | 5.40 | 0.0022 | | 4.95 | 3.65 |
| 442 | S | 2E | LAUR | Ocot | cori | 7.60 | 0.0045 | 9.72 | 2.85 | 2.61 |
| 443 | M | 2D | SAPI | Meli | biju | 5.10 | 0.0020 | | 9.90 | 8.24 |
| 444 | M | 2D | SAPI | Meli | biju | 5.20 | 0.0021 | | 9.95 | 8.11 |
| 445 | M | 2D | SAPI | Meli | biju | 12.30 | 0.0118 | | 9.70 | 8.21 |
| 446 | M | 2D | SAPI | Meli | biju | 7.20 | 0.0040 | | 9.60 | 8.24 |
| 447 | M | 2D | SAPI | Meli | biju | 7.00 | 0.0038 | | 9.00 | 9.15 |
| 448 | M | 2D | SAPI | Meli | biju | 6.30 | 0.0031 | | 8.95 | 9.23 |
| 449 | M | 2D | SAPI | Meli | biju | 8.00 | 0.0050 | | 9.10 | 9.28 |
| 450 | M | 2D | MYRC | Ardi | obov | 8.20 | 0.0052 | | 6.80 | 8.52 |
| 451 | M | 2D | MYRC | Ardi | obov | 10.80 | 0.0091 | | 6.60 | 8.75 |
| 452 | S | 2D | FABA | Andi | iner | 7.80 | 0.0047 | | 7.70 | 7.92 |
| 453 | S | 2D | MYRC | Ardi | obov | 5.80 | 0.0026 | | 9.65 | 5.60 |
| 454 | S | 2D | FABA | Andi | iner | 9.20 | 0.0066 | | 9.85 | 2.45 |
| 455 | M | 2D | SAPI | Meli | biju | 7.50 | 0.0044 | | 9.90 | 2.10 |
| 456 | M | 2D | SAPI | Meli | biju | 9.40 | 0.0069 | | 9.70 | 2.05 |
| 457 | M | 2D | SAPI | Meli | biju | 7.50 | 0.0044 | | 10.00 | 1.74 |
| 458 | M | 2D | SAPI | Meli | biju | 6.00 | 0.0028 | | 9.50 | 1.94 |
| 459 | M | 2D | SAPI | Meli | biju | 6.10 | 0.0029 | | 9.70 | 1.60 |
| 460 | S | 2D | MELA | Tetr | elae | 13.00 | 0.0132 | 13.6 | 7.85 | 4.42 |
| 461 | S | 2D | VERB | Cith | frut | 16.10 | 0.0203 | 14.2 | 7.20 | 3.30 |
| 462 | S | 2D | MYRC | Ardi | obov | 8.90 | 0.0062 | | 6.75 | 3.30 |
| 463 | S | 2D | MYRT | Euge | mont | 8.50 | 0.0056 | 13.3 | 8.55 | 0.90 |
| 464 | S | 2D | LAUR | Ocot | cori | 6.20 | 0.0030 | | 8.25 | 0.03 |

APPENDIX III. (Continued)

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 465 | S | 2D | FABA | Andi iner | 9.60 | 0.0072 | 12.1 | 6.65 | 0.90 |
| 466 | M | 2D | SAPI | Meli biju | 6.10 | 0.0029 | | 6.45 | 1.50 |
| 467 | M | 2D | SAPI | Meli biju | 7.50 | 0.0044 | | 6.55 | 2.35 |
| 468 | M | 2D | SAPI | Meli biju | 10.30 | 0.0083 | | 6.60 | 2.20 |
| 469 | M | 2D | SAPI | Meli biju | 9.80 | 0.0075 | | 6.40 | 2.15 |
| 470 | S | 2D | FABA | Andi iner | 8.40 | 0.0055 | | 4.70 | 6.32 |
| 471 | S | 2D | LAUR | Ocot cori | 6.90 | 0.0037 | | 4.65 | 6.85 |
| 472 | S | 2D | SAPI | Meli biju | 5.40 | 0.0022 | | 5.60 | 8.90 |
| 473 | S | 2D | BORA | Cord coll | 15.50 | 0.0188 | | 3.80 | 9.75 |
| 474 | S | 2D | SAPI | Meli biju | 6.80 | 0.0036 | | 2.80 | 9.70 |
| 475 | S | 2D | SAPI | Meli biju | 8.40 | 0.0055 | | 0.63 | 9.94 |
| 476 | M | 2D | SAPI | Meli biju | 6.00 | 0.0028 | | 2.20 | 7.70 |
| 477 | M | 2D | SAPI | Meli biju | 6.70 | 0.0035 | | 2.10 | 7.82 |
| 478 | M | 2D | SAPI | Meli biju | 7.10 | 0.0039 | | 1.90 | 7.93 |
| 479 | M | 2D | SAPI | Meli biju | 5.20 | 0.0021 | | 1.93 | 7.85 |
| 480 | M | 2D | SAPI | Meli biju | 12.80 | 0.0128 | | 1.70 | 7.40 |
| 481 | S | 2D | BORA | Cord coll | 5.60 | 0.0024 | | 1.50 | 8.10 |
| 482 | M | 2D | SAPI | Meli biju | 7.50 | 0.0044 | | 0.10 | 6.30 |
| 483 | M | 2D | SAPI | Meli biju | 5.60 | 0.0024 | | 0.04 | 6.05 |
| 484 | M | 2D | SAPI | Meli biju | 11.80 | 0.0109 | | 2.50 | 2.54 |
| 485 | M | 2D | SAPI | Meli biju | 14.60 | 0.0167 | | 2.65 | 2.14 |
| 486 | M | 2D | SAPI | Meli biju | 6.10 | 0.0029 | | 2.40 | 2.10 |
| 487 | S | 2D | SAPI | Meli biju | 30.80 | 0.0745 | | 0.85 | 1.69 |
| 488 | S | 2D | LAUR | Ocot cori | 5.00 | 0.0019 | | 2.05 | 2.72 |
| 489 | S | 2D | LAUR | Ocot cori | 8.20 | 0.0052 | | 0.20 | 0.89 |
| 490 | S | 2D | SAPI | Meli biju | 5.00 | 0.0019 | | 1.95 | 0.35 |
| 491 | S | 2C | LAUR | Ocot cori | 6.30 | 0.0031 | | 9.60 | 8.89 |
| 492 | M | 2C | SAPI | Meli biju | 8.40 | 0.0055 | | 8.60 | 6.40 |
| 493 | M | 2C | SAPI | Meli biju | 11.40 | 0.0102 | | 8.70 | 5.85 |
| 494 | S | 2C | EUPH | Marg nobi | 13.60 | 0.0145 | | 9.10 | 6.82 |
| 495 | M | 2C | EUPH | Marg nobi | 13.90 | 0.0151 | | 8.95 | 6.75 |
| 496 | S | 2C | SAPI | Meli biju | 6.20 | 0.0030 | | 7.50 | 9.91 |
| 497 | M | 2C | SAPI | Meli biju | 6.80 | 0.0036 | | 7.00 | 5.89 |
| 498 | M | 2C | SAPI | Meli biju | 6.50 | 0.0033 | | 6.90 | 5.61 |
| 499 | S | 2C | FABA | Andi iner | 11.30 | 0.0100 | 11.5 | 6.30 | 5.38 |
| 500 | S | 2C | SAPI | Meli biju | 11.50 | 0.0103 | | 8.90 | 2.20 |
| 501 | S | 2C | SAPI | Meli biju | 10.50 | 0.0086 | | 5.80 | 9.00 |
| 502 | S | 2C | SAPI | Meli biju | 5.40 | 0.0022 | | 1.75 | 6.21 |
| 503 | S | 2C | SAPI | Meli biju | 5.80 | 0.0026 | | 1.20 | 8.05 |
| 504 | M | 2C | SAPI | Meli biju | 6.60 | 0.0034 | | 0.50 | 9.91 |
| 505 | S | 2C | FABA | Andi iner | 11.60 | 0.0105 | | 1.15 | 5.45 |
| 506 | M | 2C | SAPO | Chry pauc | 10.80 | 0.0091 | | 1.05 | 4.70 |
| 507 | M | 2C | SAPO | Chry pauc | 7.70 | 0.0046 | | 1.35 | 4.28 |
| 508 | M | 2C | SAPI | Meli biju | 14.70 | 0.0169 | | 2.20 | 1.71 |
| 509 | M | 2C | SAPI | Meli biju | 5.90 | 0.0027 | | 1.95 | 1.97 |
| 510 | M | 2C | SAPI | Meli biju | 10.30 | 0.0083 | | 2.35 | 1.91 |
| 511 | M | 2C | SAPI | Meli biju | 7.50 | 0.0044 | | 2.95 | 1.59 |
| 512 | M | 2C | SAPI | Meli biju | 7.80 | 0.0047 | | 2.40 | 1.65 |



234

APPENDIX III. (Continued)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 513 | S | 2C | SAPI | Meli | biju | 5.70 | 0.0025 | | 0.10 | 3.01 |
| 514 | M | 2B | SAPI | Meli | biju | 11.60 | 0.0105 | | 9.20 | 4.11 |
| 515 | M | 2B | SAPI | Meli | biju | 6.30 | 0.0031 | | 9.00 | 4.04 |
| 516 | M | 2B | SAPI | Meli | biju | 11.80 | 0.0109 | | 9.00 | 3.95 |
| 517 | M | 2B | SAPI | Meli | biju | 8.00 | 0.0050 | | 9.15 | 3.94 |
| 518 | M | 2B | SAPI | Meli | biju | 7.80 | 0.0047 | | 9.40 | 3.91 |
| 519 | M | 2B | SAPI | Meli | biju | 7.20 | 0.0040 | | 9.50 | 3.88 |
| 520 | S | 2B | SAPI | Meli | biju | 6.50 | 0.0033 | | 8.90 | 0.45 |
| 521 | M | 2B | SAPI | Meli | biju | 15.40 | 0.0186 | | 6.80 | 1.65 |
| 522 | M | 2B | SAPI | Meli | biju | 9.40 | 0.0069 | | 6.75 | 1.20 |
| 523 | M | 2B | SAPI | Meli | biju | 5.00 | 0.0019 | | 7.00 | 1.35 |
| 524 | S | 2B | NYCT | Guap | frag | 10.10 | 0.0080 | | 5.45 | 2.65 |
| 525 | S | 2B | NYCT | Guap | frag | 36.00 | 0.1017 | 16.1 | 6.00 | 3.85 |
| 526 | S | 2B | MYRT | Euge | mont | 7.80 | 0.0047 | | 6.15 | 4.05 |
| 527 | S | 2B | MYRT | Euge | mont | 9.20 | 0.0066 | | 6.90 | 3.95 |
| 528 | S | 2B | SAPI | Meli | biju | 8.70 | 0.0059 | | 9.80 | 4.65 |
| 529 | S | 2B | MORA | Ficu | citr | 10.90 | 0.0093 | 10.6 | 9.20 | 8.01 |
| 530 | S | 2B | FABA | Andi | iner | 10.10 | 0.0080 | 12.1 | 8.80 | 9.65 |
| 531 | S | 2B | FLAC | Case | deca | 6.00 | 0.0028 | 6.07 | 4.35 | 8.51 |
| 532 | S | 2B | LAUR | Ocot | cori | 11.00 | 0.0095 | | 3.85 | 8.25 |
| 533 | S | 2B | SAPI | Meli | biju | 7.50 | 0.0044 | | 0.08 | 9.55 |
| 534 | S | 2B | LAUR | Ocot | cori | 8.10 | 0.0051 | | 0.21 | 5.29 |
| 535 | S | 2B | SAPI | Meli | biju | 11.80 | 0.0109 | | 2.05 | 2.79 |
| 536 | S | 2B | NYCT | Guap | frag | 12.40 | 0.0120 | | 3.25 | 3.00 |
| 537 | S | 2B | PALM | Cocc | alta | 8.50 | 0.0056 | 7.59 | 3.20 | 2.81 |
| 538 | M | 2B | CAPP | Capp | ampl | 10.10 | 0.0080 | | 4.15 | 0.13 |
| 539 | M | 2B | CAPP | Capp | ampl | 6.80 | 0.0036 | | 4.25 | 0.10 |
| 540 | M | 2B | SAPI | Meli | biju | 7.20 | 0.0040 | | 0.90 | 0.87 |
| 541 | M | 2B | SAPI | Meli | biju | 7.80 | 0.0047 | | 0.70 | 0.81 |
| 542 | S | 2A | FLAC | Case | deca | 5.90 | 0.0027 | | 7.30 | 4.95 |
| 543 | S | 2A | SAPI | Meli | biju | 5.90 | 0.0027 | | 5.80 | 4.12 |
| 544 | S | 2A | VERB | Cith | frut | 6.80 | 0.0036 | | 5.80 | 7.25 |
| 545 | S | 2A | RUBI | Guet | parv | 8.40 | 0.0055 | 5.77 | 4.60 | 9.65 |
| 546 | M | 2A | FABA | Sabi | flor | 10.60 | 0.0088 | 7.90 | 2.10 | 9.10 |
| 547 | M | 2A | FABA | Sabi | flor | 5.20 | 0.0021 | | 2.25 | 9.14 |
| 548 | M | 2A | FABA | Sabi | flor | 5.20 | 0.0021 | | 2.35 | 9.05 |
| 549 | S | 2A | RHAM | Krug | ferr | 7.60 | 0.0045 | 4.25 | 1.45 | 8.20 |
| 550 | M | 2A | NYCT | Piso | subc | 64.10 | 0.3227 | 13.3 | 2.25 | 4.60 |
| 551 | M | 2A | NYCT | Piso | subc | 55.40 | 0.2410 | | 2.75 | 4.00 |
| 552 | M | 2A | NYCT | Piso | subc | 47.50 | 0.1772 | | 3.30 | 3.91 |
| 553 | S | 2A | LAUR | Ocot | cori | 8.00 | 0.0050 | | 4.60 | 7.05 |
| 554 | S | 2A | VERB | Cith | frut | 10.70 | 0.0089 | | 0.60 | 0.50 |
| 555 | S | 3A | NYCT | Guap | frag | 6.40 | 0.0032 | | 2.10 | 2.20 |
| 556 | S | 3A | LAUR | Ocot | cori | 7.10 | 0.0039 | | 2.25 | 3.10 |
| 557 | S | 3A | CAPP | Capp | indi | 5.20 | 0.0021 | 4.55 | 0.61 | 6.20 |
| 558 | S | 3A | NYCT | Guap | frag | 27.80 | 0.0606 | 12.7 | 0.30 | 7.21 |
| 559 | S | 3A | RHAM | Krug | ferr | 8.20 | 0.0052 | 9.42 | 3.40 | 8.15 |
| 560 | S | 3A | CAPP | Capp | cyno | 6.40 | 0.0032 | | 3.30 | 7.61 |

APPENDIX III. (Continued)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 561 | S | 3A | BURS | Burs sima | 34.40 | 0.0929 | 9.72 | 4.10 | 7.64 |
| 562 | M | 3A | CAPP | Capp ampl | 7.80 | 0.0047 | | 4.80 | 6.50 |
| 563 | M | 3A | CAPP | Capp ampl | 9.00 | 0.0063 | | 4.95 | 6.39 |
| 564 | M | 3A | CAPP | Capp ampl | 12.60 | 0.0124 | | 5.20 | 6.36 |
| 565 | M | 3A | CAPP | Capp ampl | 10.50 | 0.0086 | | 5.30 | 6.32 |
| 566 | S | 3A | LAUR | Ocot cori | 5.20 | 0.0021 | | 6.50 | 8.70 |
| 567 | S | 3A | NYCT | Guap frag | 5.50 | 0.0023 | 5.77 | 4.50 | 2.95 |
| 568 | S | 3A | LAUR | Ocot cori | 10.80 | 0.0091 | | 7.65 | 0.40 |
| 569 | S | 3A | MYRT | Euge mont | 8.40 | 0.0055 | 10.9 | 7.95 | 2.00 |
| 570 | S | 3A | CAPP | Capp indi | 5.70 | 0.0025 | | 9.95 | 0.02 |
| 571 | S | 3A | LAUR | Ocot cori | 5.00 | 0.0019 | | 4.90 | 2.99 |
| 572 | M | 3B | SAPI | Meli biju | 12.90 | 0.0130 | 13.6 | 0.19 | 5.09 |
| 573 | M | 3B | SAPI | Meli biju | 5.30 | 0.0022 | | 0.05 | 5.43 |
| 574 | M | 3B | SAPI | Meli biju | 12.20 | 0.0116 | | 1.10 | 4.19 |
| 575 | M | 3B | SAPI | Meli biju | 6.80 | 0.0036 | | 1.30 | 3.94 |
| 576 | M | 3B | SAPI | Meli biju | 7.30 | 0.0041 | | 1.40 | 3.90 |
| 577 | M | 3B | SAPI | Meli biju | 11.30 | 0.0100 | | 1.50 | 4.05 |
| 578 | S | 3B | ANAC | Spon mamb | 9.20 | 0.0066 | | 1.20 | 6.79 |
| 579 | S | 3B | LAUR | Ocot cori | 6.50 | 0.0033 | | 1.80 | 5.51 |
| 580 | S | 3B | SAPI | Meli biju | 17.00 | 0.0226 | | 3.25 | 8.60 |
| 581 | S | 3B | VERB | Cith frut | 21.90 | 0.0376 | 13.0 | 4.15 | 1.65 |
| 582 | M | 3B | SAPI | Meli biju | 11.90 | 0.0111 | | 4.95 | 2.00 |
| 583 | M | 3B | SAPI | Meli biju | 6.70 | 0.0035 | | 5.10 | 2.05 |
| 584 | S | 3B | SAPI | Meli biju | 10.20 | 0.0081 | | 7.65 | 1.10 |
| 585 | M | 3B | SAPI | Meli biju | 5.80 | 0.0026 | | 7.30 | 2.15 |
| 586 | M | 3B | SAPI | Meli biju | 5.90 | 0.0027 | | 7.40 | 2.39 |
| 587 | M | 3B | SAPI | Meli biju | 6.30 | 0.0031 | | 5.70 | 5.85 |
| 588 | M | 3B | SAPI | Meli biju | 5.20 | 0.0021 | | 5.95 | 5.92 |
| 589 | S | 3B | SAPI | Meli biju | 5.10 | 0.0020 | | 5.40 | 5.50 |
| 590 | S | 3B | FABA | Andi iner | 5.90 | 0.0027 | | 8.70 | 7.21 |
| 591 | S | 3B | SAPI | Meli biju | 5.20 | 0.0021 | | 8.30 | 8.99 |
| 592 | S | 3B | LAUR | Ocot cori | 7.50 | 0.0044 | | 9.75 | 9.20 |
| 593 | M | 3C | SAPI | Meli biju | 5.90 | 0.0027 | | 0.30 | 0.98 |
| 594 | M | 3C | SAPI | Meli biju | 11.30 | 0.0100 | | 0.45 | 1.04 |
| 595 | M | 3C | SAPI | Meli biju | 8.60 | 0.0058 | | 0.85 | 1.32 |
| 596 | M | 2C | SAPI | Meli biju | 5.80 | 0.0026 | | 1.15 | 5.45 |
| 597 | S | 3C | SAPI | Meli biju | 6.70 | 0.0035 | | 1.75 | 2.12 |
| 598 | M | 3C | SAPI | Meli biju | 9.10 | 0.0065 | 12.4 | 0.12 | 4.65 |
| 599 | M | 3C | SAPI | Meli biju | 10.00 | 0.0078 | | 0.50 | 4.12 |
| 600 | M | 3C | SAPI | Meli biju | 7.00 | 0.0038 | | 4.25 | 0.95 |
| 601 | M | 3C | SAPI | Meli biju | 9.70 | 0.0073 | | 4.67 | 0.73 |
| 602 | M | 3C | SAPI | Meli biju | 6.30 | 0.0031 | | 4.40 | 1.35 |
| 603 | S | 3C | LAUR | Ocot cori | 8.90 | 0.0062 | 8.81 | 1.30 | 6.10 |
| 604 | S | 3C | FABA | Andi iner | 7.40 | 0.0043 | 7.90 | 1.30 | 6.09 |
| 605 | S | 3C | FLAC | Case guia | 5.50 | 0.0023 | 9.42 | 0.28 | 7.28 |
| 606 | S | 3C | BORA | Cord alli | 18.00 | 0.0254 | 14.2 | 0.65 | 8.25 |
| 607 | S | 3C | SAPI | Meli biju | 6.50 | 0.0033 | | 2.15 | 0.40 |
| 608 | M | 3C | SAPI | Meli biju | 5.60 | 0.0024 | | 5.00 | 1.75 |



236

APPENDIX III. (Continued)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 609 | M | 3C | SAPI | Meli biju | 8.90 | 0.0062 | | 5.00 | 1.52 |
| 610 | S | 3C | FABA | Andi iner | 14.30 | 0.0160 | | 5.60 | 0.65 |
| 611 | S | 3C | SAPI | Meli biju | 11.60 | 0.0105 | | 6.70 | 1.45 |
| 612 | S | 3C | MELA | Tetr elae | 18.10 | 0.0257 | | 5.20 | 2.89 |
| 613 | S | 3C | SAPI | Meli biju | 6.50 | 0.0033 | | 7.80 | 2.80 |
| 614 | S | 3C | LAUR | Ocot cori | 10.90 | 0.0093 | | 1.85 | 9.65 |
| 615 | S | 3C | SAPI | Meli biju | 5.10 | 0.0020 | | 1.85 | 9.95 |
| 616 | M | 3C | SAPI | Meli biju | 12.50 | 0.0122 | | 6.85 | 4.24 |
| 617 | M | 3C | SAPI | Meli biju | 5.80 | 0.0026 | | 6.50 | 4.20 |
| 618 | S | 3C | SAPI | Meli biju | 6.80 | 0.0036 | | 9.10 | 6.29 |
| 619 | S | 3C | BORA | Cord coll | 15.60 | 0.0191 | 13.3 | 9.80 | 6.49 |
| 620 | S | 3C | FLAC | Case sylv | 5.50 | 0.0023 | | 7.10 | 7.65 |
| 621 | S | 3C | MYRT | Euge mont | 7.50 | 0.0044 | | 6.55 | 5.98 |
| 622 | S | 3C | MYRT | Euge mont | 11.80 | 0.0109 | 10.6 | 5.75 | 6.05 |
| 623 | S | 3C | SAPI | Meli biju | 5.30 | 0.0022 | | 5.85 | 6.52 |
| 624 | S | 3C | SAPI | Meli biju | 7.40 | 0.0043 | | 5.40 | 7.15 |
| 625 | S | 3C | SAPI | Meli biju | 9.20 | 0.0066 | | 6.55 | 7.10 |
| 626 | S | 3D | SAPI | Meli biju | 12.20 | 0.0116 | | 0.42 | 3.12 |
| 627 | S | 3D | SAPI | Meli biju | 7.00 | 0.0038 | | 0.95 | 2.90 |
| 628 | S | 3D | SAPI | Meli biju | 8.00 | 0.0050 | | 0.50 | 4.20 |
| 629 | S | 3D | LAUR | Ocot cori | 9.10 | 0.0065 | | 0.12 | 6.15 |
| 630 | S | 3D | SAPI | Meli biju | 5.20 | 0.0021 | | 1.90 | 1.95 |
| 631 | S | 3D | LAUR | Ocot cori | 10.70 | 0.0089 | 10.0 | 4.00 | 1.65 |
| 632 | S | 3D | SAPI | Meli biju | 9.40 | 0.0069 | | 5.00 | 0.20 |
| 633 | S | 3D | LAUR | Ocot cori | 5.50 | 0.0023 | | 6.30 | 0.25 |
| 634 | M | 3D | SAPI | Meli biju | 15.40 | 0.0186 | 14.2 | 6.75 | 2.55 |
| 635 | M | 3D | SAPI | Meli biju | 23.50 | 0.0433 | | 6.65 | 2.65 |
| 636 | S | 3D | LAUR | Ocot cori | 11.50 | 0.0103 | 12.1 | 5.20 | 4.25 |
| 637 | S | 3D | SAPI | Meli biju | 13.10 | 0.0134 | | 3.30 | 5.09 |
| 638 | S | 3D | SAPI | Meli biju | 8.80 | 0.0060 | | 5.05 | 6.85 |
| 639 | S | 3D | SAPI | Meli biju | 7.10 | 0.0039 | 12.4 | 6.05 | 6.85 |
| 640 | S | 3D | NYCT | Guap frag | 11.20 | 0.0098 | 12.7 | 7.25 | 6.31 |
| 641 | M | 3D | SAPI | Meli biju | 10.40 | 0.0084 | | 4.35 | 7.00 |
| 642 | M | 3D | SAPI | Meli biju | 7.20 | 0.0040 | | 4.30 | 7.70 |
| 643 | S | 3D | SAPI | Meli biju | 5.80 | 0.0026 | | 2.40 | 8.08 |
| 644 | S | 3D | FABA | Andi iner | 10.00 | 0.0078 | 10.0 | 2.20 | 9.40 |
| 645 | S | 3D | SAPI | Meli biju | 9.20 | 0.0066 | | 4.00 | 8.80 |
| 646 | M | 3D | SAPI | Meli biju | 6.60 | 0.0034 | | 4.00 | 8.95 |
| 647 | M | 3D | SAPI | Meli biju | 6.00 | 0.0028 | | 4.00 | 9.20 |
| 648 | M | 3D | SAPI | Meli biju | 9.50 | 0.0070 | | 4.45 | 9.55 |
| 649 | M | 3D | SAPI | Meli biju | 6.30 | 0.0031 | | 4.30 | 9.75 |
| 650 | M | 3D | SAPI | Meli biju | 10.90 | 0.0093 | | 5.20 | 9.80 |
| 651 | M | 3D | SAPI | Meli biju | 10.40 | 0.0084 | | 5.10 | 9.75 |
| 652 | M | 3D | SAPI | Meli biju | 6.00 | 0.0028 | | 5.05 | 9.30 |
| 653 | M | 3D | SAPI | Meli biju | 9.00 | 0.0063 | | 5.70 | 9.75 |
| 654 | M | 3D | SAPI | Meli biju | 7.40 | 0.0043 | | 5.60 | 9.00 |
| 655 | M | 3D | FABA | Andi iner | 5.20 | 0.0021 | | 8.00 | 9.85 |
| 656 | M | 3D | FABA | Andi iner | 15.40 | 0.0186 | 13.3 | 8.07 | 9.95 |



257

APPENDIX III. (Continued)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 657 | S | 3D | SAPI | Meli biju | 6.10 | 0.0029 | | 7.45 | 8.00 |
| 658 | S | 3D | SAPI | Meli biju | 11.50 | 0.0103 | | 8.40 | 9.10 |
| 659 | S | 3D | SAPI | Meli biju | 6.00 | 0.0028 | | 9.10 | 9.85 |
| 660 | M | 3D | SAPI | Meli biju | 16.80 | 0.0221 | 12.7 | 9.05 | 9.65 |
| 661 | M | 3D | SAPI | Meli biju | 6.70 | 0.0035 | | 8.80 | 9.40 |
| 662 | S | 3D | SAPI | Meli biju | 10.90 | 0.0093 | 10.3 | 9.40 | 6.65 |
| 663 | S | 3D | NYCT | Guap frag | 24.20 | 0.0459 | | 9.70 | 5.90 |
| 664 | M | 3D | SAPI | Meli biju | 15.30 | 0.0183 | | 8.70 | 4.60 |
| 665 | M | 3D | SAPI | Meli biju | 8.30 | 0.0054 | | 8.60 | 4.55 |
| 666 | M | 3D | SAPI | Meli biju | 6.20 | 0.0030 | | 8.10 | 4.85 |
| 667 | M | 3D | SAPI | Meli biju | 14.50 | 0.0165 | | 9.60 | 2.90 |
| 668 | M | 3D | SAPI | Meli biju | 11.80 | 0.0109 | | 9.70 | 2.95 |
| 669 | M | 3D | SAPI | Meli biju | 6.20 | 0.0030 | | 9.80 | 2.95 |
| 670 | M | 3D | SAPI | Meli biju | 6.90 | 0.0037 | | 9.75 | 2.45 |
| 671 | M | 3D | SAPI | Meli biju | 5.40 | 0.0022 | | 9.65 | 2.50 |
| 672 | M | 3D | SAPI | Meli biju | 7.20 | 0.0040 | | 9.45 | 2.60 |
| 673 | S | 3D | SAPI | Meli biju | 8.00 | 0.0050 | | 9.90 | 1.75 |
| 674 | M | 3D | NYCT | Guap frag | 19.30 | 0.0292 | | 9.75 | 1.60 |
| 675 | M | 3D | NYCT | Guap frag | 18.80 | 0.0277 | | 9.65 | 1.65 |
| 676 | M | 3D | NYCT | Guap frag | 18.90 | 0.0280 | | 9.57 | 1.50 |
| 677 | S | 3E | LAUR | Ocot cori | 10.80 | 0.0091 | | 1.60 | 0.05 |
| 678 | S | 3E | LAUR | Ocot cori | 7.30 | 0.0041 | 10.9 | 2.15 | 2.10 |
| 679 | S | 3E | SAPI | Meli biju | 8.90 | 0.0062 | | 1.60 | 5.51 |
| 680 | S | 3E | LAUR | Ocot cori | 5.40 | 0.0022 | | 2.40 | 7.71 |
| 681 | S | 3E | LAUR | Ocot cori | 8.60 | 0.0058 | | 3.50 | 8.95 |
| 682 | S | 3E | NYCT | Guap frag | 15.40 | 0.0186 | | 4.50 | 9.20 |
| 683 | S | 3E | MYRC | Ardi obov | 6.20 | 0.0030 | 7.29 | 5.10 | 6.25 |
| 684 | S | 3E | FLAC | Case sylv | 6.20 | 0.0030 | 10.3 | 5.20 | 5.60 |
| 685 | S | 3E | SAPI | Meli biju | 9.00 | 0.0063 | 10.6 | 5.85 | 3.55 |
| 686 | S | 3E | NYCT | Piso subc | 35.30 | 0.0978 | 14.5 | 8.00 | 0.25 |
| 687 | S | 3E | MYRC | Ardi obov | 5.10 | 0.0020 | | 9.85 | 2.82 |
| 688 | S | 3E | SAPI | Meli biju | 7.00 | 0.0038 | | 7.50 | 4.50 |
| 689 | S | 3E | SAPI | Meli biju | 5.40 | 0.0022 | | 7.65 | 5.65 |
| 690 | M | 3E | SAPO | Chry pauc | 10.10 | 0.0080 | | 8.35 | 5.85 |
| 691 | M | 3E | SAPO | Chry pauc | 8.10 | 0.0051 | | 8.30 | 6.00 |
| 692 | M | 3E | SAPO | Chry pauc | 14.00 | 0.0153 | 13.0 | 8.65 | 6.15 |
| 693 | M | 3E | SAPI | Meli biju | 10.10 | 0.0080 | | 6.10 | 9.90 |
| 694 | M | 3E | SAPI | Meli biju | 6.50 | 0.0033 | | 6.20 | 9.55 |
| 695 | M | 3E | SAPI | Meli biju | 12.10 | 0.0114 | | 6.60 | 9.85 |
| 696 | M | 3E | SAPI | Meli biju | 13.40 | 0.0141 | 13.0 | 9.65 | 8.95 |
| 697 | M | 3E | SAPI | Meli biju | 6.90 | 0.0037 | | 9.80 | 8.75 |
| 698 | M | 3E | SAPI | Meli biju | 5.90 | 0.0027 | | 9.70 | 8.65 |
| 699 | S | 3F | SAPI | Meli biju | 7.40 | 0.0043 | | 0.41 | 2.63 |
| 700 | M | 3F | SAPI | Meli biju | 8.00 | 0.0050 | | 1.20 | 0.21 |
| 701 | M | 3F | SAPI | Meli biju | 8.30 | 0.0054 | | 1.25 | 0.05 |
| 702 | S | 3F | NYCT | Guap frag | 31.70 | 0.0789 | 14.5 | 2.30 | 0.55 |
| 703 | M | 3F | SAPI | Meli biju | 6.80 | 0.0036 | 8.81 | 3.50 | 2.41 |
| 704 | M | 3F | SAPI | Meli biju | 5.70 | 0.0025 | | 3.80 | 2.35 |

APPENDIX III. (Continued)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 705 | S | 3F | SAPI | Meli | biju | 5.40 | 0.0022 | | 6.10 | 1.55 |
| 706 | S | 3F | NYCT | Guap | frag | 8.20 | 0.0052 | 10.3 | 8.90 | 1.06 |
| 707 | S | 3F | BURS | Burs | sima | 23.90 | 0.0448 | 13.3 | 9.05 | 1.75 |
| 708 | S | 3F | BORA | Bour | succ | 16.80 | 0.0221 | | 6.55 | 2.85 |
| 709 | M | 3F | NYCT | Guap | frag | 23.70 | 0.0441 | | 8.30 | 4.35 |
| 710 | M | 3F | NYCT | Guap | frag | 12.90 | 0.0130 | | 8.00 | 4.30 |
| 711 | S | 3F | SAPI | Meli | biju | 5.60 | 0.0024 | | 6.65 | 6.00 |
| 712 | S | 3F | VERB | Cith | frut | 14.90 | 0.0174 | | 6.10 | 6.35 |
| 713 | M | 3F | SAPI | Meli | biju | 11.00 | 0.0095 | | 4.40 | 8.74 |
| 714 | M | 3F | SAPI | Meli | biju | 12.20 | 0.0116 | | 4.15 | 8.80 |
| 715 | M | 3F | SAPI | Meli | biju | 13.50 | 0.0143 | | 4.25 | 8.95 |
| 716 | M | 3F | BORA | Bour | succ | 8.10 | 0.0051 | | 7.15 | 8.80 |
| 717 | M | 3F | BORA | Bour | succ | 5.10 | 0.0020 | | 7.15 | 8.65 |
| 718 | S | 3F | FABA | Sabi | flor | 6.80 | 0.0036 | | 9.00 | 9.90 |
| 719 | S | 3F | MIMO | Acac | muri | 15.40 | 0.0186 | 10.0 | 8.95 | 7.55 |
| 720 | S | 3F | RHAM | Krug | ferr | 5.30 | 0.0022 | 6.99 | 8.80 | 7.45 |
| 721 | S | 3G | BORA | Bour | succ | 16.10 | 0.0203 | 11.5 | 0.29 | 7.92 |
| 722 | S | 3G | VERB | Cith | frut | 8.80 | 0.0060 | 9.11 | 3.70 | 8.45 |
| 723 | S | 3G | BORA | Bour | succ | 11.10 | 0.0096 | | 4.60 | 9.50 |
| 724 | S | 3G | BIGN | Tabe | hete | 8.90 | 0.0062 | | 5.85 | 6.70 |
| 725 | S | 3G | RHAM | Krug | ferr | 10.20 | 0.0081 | 9.11 | 6.05 | 6.50 |
| 726 | S | 3G | NYCT | Guap | frag | 14.70 | 0.0169 | | 5.90 | 6.45 |
| 727 | S | 3G | NYCT | Guap | frag | 12.50 | 0.0122 | | 6.20 | 5.61 |
| 728 | M | 3G | RUBI | Guet | parv | 7.90 | 0.0049 | | 6.00 | 2.35 |
| 729 | M | 3G | RUBI | Guet | parv | 6.40 | 0.0032 | | 5.85 | 2.41 |
| 730 | M | 3G | RUBI | Guet | parv | 5.20 | 0.0021 | | 5.80 | 2.90 |
| 731 | M | 3G | RUBI | Guet | parv | 8.30 | 0.0054 | 7.59 | 5.80 | 2.60 |
| 732 | M | 3G | RUBI | Guet | parv | 5.00 | 0.0019 | | 5.75 | 2.80 |
| 733 | M | 3G | RUBI | Guet | parv | 7.60 | 0.0045 | | 5.70 | 2.50 |
| 734 | S | 3G | BORA | Bour | succ | 13.50 | 0.0143 | | 4.20 | 2.01 |
| 735 | S | 3G | RHAM | Krug | ferr | 5.50 | 0.0023 | | 4.00 | 1.42 |
| 736 | S | 3G | RHAM | Krug | ferr | 6.20 | 0.0030 | | 2.10 | 0.81 |
| 737 | S | 3G | RHAM | Krug | ferr | 5.10 | 0.0020 | | 8.05 | 0.05 |
| 738 | S | 3G | RHAM | Krug | ferr | 12.40 | 0.0120 | 8.20 | 9.40 | 0.10 |
| 739 | S | 3G | RHAM | Krug | ferr | 10.40 | 0.0084 | | 9.25 | 3.25 |
| 740 | S | 3G | FABA | Sabi | flor | 10.20 | 0.0081 | 9.72 | 9.00 | 3.90 |
| 741 | S | 3G | NYCT | Guap | frag | 6.70 | 0.0035 | 8.51 | 7.90 | 8.65 |
| 742 | M | 3G | BORA | Cord | coll | 12.50 | 0.0122 | 12.7 | 7.60 | 9.45 |
| 743 | M | 3G | BORA | Cord | coll | 8.30 | 0.0054 | | 7.70 | 9.45 |
| 744 | S | 3H | RHAM | Krug | ferr | 7.50 | 0.0044 | | 2.05 | 7.10 |
| 745 | S | 3H | RHAM | Krug | ferr | 7.00 | 0.0038 | | 2.50 | 7.75 |
| 746 | S | 3H | MYRT | Euge | bifl | 5.50 | 0.0023 | | 0.78 | 8.60 |
| 747 | S | 3H | BIGN | Tabe | hete | 12.20 | 0.0116 | 8.81 | 3.00 | 9.10 |
| 748 | S | 3H | NYCT | Guap | frag | 5.70 | 0.0025 | | 3.10 | 8.70 |
| 749 | S | 3H | BURS | Burs | sima | 29.70 | 0.0692 | 9.72 | 2.95 | 6.60 |
| 750 | S | 3H | RHAM | Krug | ferr | 6.20 | 0.0030 | | 2.85 | 6.50 |
| 751 | S | 3H | ERYT | Eryt | rotu | 6.30 | 0.0031 | | 1.60 | 5.31 |
| 752 | S | 3H | BORA | Bour | succ | 8.60 | 0.0058 | 10.3 | 2.90 | 4.45 |

APPENDIX III. (Continued)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 753 | M | 3H | RHAM | Krug | ferr | 10.30 | 0.0083 | | 2.30 | 3.51 |
| 754 | M | 3H | RHAM | Krug | ferr | 5.10 | 0.0020 | | 2.50 | 3.54 |
| 755 | M | 3H | RUBI | Guet | parv | 13.50 | 0.0143 | | 4.25 | 2.45 |
| 756 | M | 3H | RUBI | Guet | parv | 11.30 | 0.0100 | | 4.05 | 2.31 |
| 757 | S | 3H | RHAM | Krug | ferr | 8.50 | 0.0056 | | 3.80 | 7.60 |
| 758 | S | 3H | NYCT | Guap | frag | 11.40 | 0.0102 | 9.11 | 4.00 | 7.50 |
| 759 | M | 3H | RUBI | Guet | parv | 5.10 | 0.0020 | | 7.45 | 3.20 |
| 760 | M | 3H | RUBI | Guet | parv | 5.50 | 0.0023 | | 7.35 | 3.00 |
| 761 | M | 3H | RUBI | Guet | parv | 7.70 | 0.0046 | | 8.10 | 3.10 |
| 762 | M | 3H | RUBI | Guet | parv | 6.20 | 0.0030 | | 8.10 | 3.00 |
| 763 | M | 3H | RUBI | Guet | parv | 10.90 | 0.0093 | | 8.00 | 2.95 |
| 764 | M | 3H | RUBI | Guet | parv | 5.00 | 0.0019 | | 8.25 | 2.65 |
| 765 | M | 3H | RUBI | Guet | parv | 13.70 | 0.0147 | | 8.30 | 2.45 |
| 766 | M | 3H | RUBI | Guet | parv | 8.60 | 0.0058 | | 8.00 | 2.38 |
| 767 | S | 3H | NYCT | Guap | frag | 5.20 | 0.0021 | 8.51 | 7.75 | 1.92 |
| 768 | S | 3H | PALM | Cocc | alta | 7.00 | 0.0038 | 5.16 | 9.00 | 1.85 |
| 769 | S | 3H | SAPI | Meli | biju | 6.00 | 0.0028 | | 9.10 | 2.50 |
| 770 | M | 3H | SAPI | Meli | biju | 15.90 | 0.0198 | 9.11 | 9.00 | 3.00 |
| 771 | M | 3H | SAPI | Meli | biju | 11.00 | 0.0095 | | 9.15 | 3.10 |
| 772 | S | 3H | MYRT | Euge | bifl | 5.70 | 0.0025 | | 9.70 | 4.00 |
| 773 | S | 3H | RHAM | Krug | ferr | 6.80 | 0.0036 | | 8.85 | 5.10 |
| 774 | S | 3H | RUBI | Guet | parv | 6.80 | 0.0036 | 10.3 | 8.00 | 6.95 |
| 775 | S | 3H | BURS | Burs | sima | 21.40 | 0.0359 | | 7.95 | 7.42 |
| 776 | S | 3I | RUTA | Amyr | elem | 7.30 | 0.0041 | | 0.02 | 7.80 |
| 777 | S | 3I | RHAM | Krug | ferr | 10.60 | 0.0088 | 9.11 | 0.50 | 8.45 |
| 778 | S | 3I | RHAM | Krug | ferr | 6.40 | 0.0032 | | 0.71 | 9.20 |
| 779 | S | 3I | BURS | Burs | sima | 27.20 | 0.0581 | | 1.80 | 8.01 |
| 780 | S | 3I | NYCT | Guap | frag | 8.00 | 0.0050 | 8.81 | 1.40 | 7.12 |
| 781 | S | 3I | BURS | Burs | sima | 30.60 | 0.0735 | 12.7 | 1.90 | 5.35 |
| 782 | S | 3I | NYCT | Guap | frag | 16.40 | 0.0211 | | 2.35 | 5.19 |
| 783 | S | 3I | MORA | Ficu | citr | 6.60 | 0.0034 | | 3.20 | 4.60 |
| 784 | S | 3I | ERYT | Eryt | rotu | 5.40 | 0.0022 | 4.55 | 3.10 | 4.10 |
| 785 | S | 3I | MORA | Ficu | citr | 6.20 | 0.0030 | | 3.30 | 4.50 |
| 786 | S | 3I | RHAM | Krug | ferr | 5.60 | 0.0024 | 8.51 | 0.05 | 4.01 |
| 787 | S | 3I | POLY | Cocc | krug | 6.90 | 0.0037 | 8.51 | 2.40 | 2.10 |
| 788 | S | 3I | NYCT | Guap | frag | 9.90 | 0.0076 | | 2.95 | 0.40 |
| 789 | M | 3I | RUBI | Guet | parv | 7.50 | 0.0044 | 10.3 | 3.85 | 1.35 |
| 790 | M | 3I | RUBI | Guet | parv | 8.40 | 0.0055 | | 3.65 | 1.25 |
| 791 | S | 3I | BURS | Burs | sima | 16.70 | 0.0219 | | 4.80 | 1.20 |
| 792 | S | 3I | RUBI | Guet | parv | 5.20 | 0.0021 | | 5.70 | 2.21 |
| 793 | M | 3I | RHAM | Krug | ferr | 8.80 | 0.0060 | | 7.50 | 2.25 |
| 794 | M | 3I | RHAM | Krug | ferr | 11.60 | 0.0105 | | 7.60 | 2.40 |
| 795 | M | 3I | RHAM | Krug | ferr | 5.80 | 0.0026 | | 7.45 | 2.35 |
| 796 | S | 3I | MYRT | Euge | mont | 7.60 | 0.0045 | 8.81 | 8.50 | 3.31 |
| 797 | S | 3I | FLAC | Case | guia | 6.60 | 0.0034 | | 9.45 | 1.92 |
| 798 | S | 3I | BORA | Bour | succ | 12.90 | 0.0130 | | 9.55 | 0.40 |
| 799 | M | 3I | POLY | Cocc | krug | 7.80 | 0.0047 | | 7.85 | 4.31 |
| 800 | M | 3I | POLY | Cocc | krug | 7.40 | 0.0043 | | 7.90 | 4.55 |

APPENDIX III. (Continued)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 801 | M | 3I | POLY | Cocc | krug | 9.90 | 0.0076 | 9.72 | 1.30 | 5.18 |
| 802 | M | 3I | POLY | Cocc | krug | 8.90 | 0.0062 | | 7.70 | 4.43 |
| 803 | S | 3I | NYCT | Guap | frag | 15.00 | 0.0176 | 10.3 | 5.80 | 5.50 |
| 804 | S | 3I | RUBI | Guet | parv | 9.20 | 0.0066 | | 5.80 | 5.60 |
| 805 | S | 3I | BIGN | Tabe | hete | 13.10 | 0.0134 | 12.1 | 5.25 | 6.95 |
| 806 | M | 3I | CELA | Mayt | elli | 15.90 | 0.0198 | | 4.00 | 7.65 |
| 807 | M | 3I | CELA | Mayt | elli | 5.70 | 0.0025 | | 4.70 | 7.60 |
| 808 | M | 3I | CELA | Mayt | elli | 7.60 | 0.0045 | 8.51 | 4.60 | 8.20 |
| 809 | S | 3I | FLAC | Case | guia | 8.00 | 0.0050 | | 4.30 | 8.40 |
| 810 | S | 3I | BORA | Bour | succ | 14.50 | 0.0165 | | 8.00 | 8.25 |
| 811 | M | 3I | VERB | Cith | frut | 6.90 | 0.0037 | | 8.85 | 6.85 |
| 812 | M | 3I | MYRT | Euge | bifl | 6.80 | 0.0036 | | 9.00 | 6.75 |
| 813 | M | 3I | VERB | Cith | frut | 11.60 | 0.0105 | 11.5 | 9.15 | 6.75 |
| 814 | M | 3I | VERB | Cith | frut | 5.30 | 0.0022 | | 9.10 | 6.70 |
| 815 | S | 3J | RHAM | Krug | ferr | 7.70 | 0.0046 | | 1.47 | 5.50 |
| 816 | S | 3J | RUBI | Exos | cari | 9.70 | 0.0073 | 11.2 | 3.35 | 3.40 |
| 817 | S | 3J | RHAM | Krug | ferr | 5.40 | 0.0022 | | 3.20 | 5.13 |
| 818 | S | 3J | RHAM | Krug | ferr | 8.20 | 0.0052 | | 4.30 | 5.12 |
| 819 | M | 3J | POLY | Cocc | krug | 13.60 | 0.0145 | 9.72 | 7.00 | 3.10 |
| 820 | M | 3J | POLY | Cocc | krug | 7.10 | 0.0039 | | 7.05 | 3.00 |
| 821 | S | 3J | POLY | Cocc | krug | 6.90 | 0.0037 | | 3.50 | 6.21 |
| 822 | S | 3J | POLY | Cocc | krug | 10.80 | 0.0091 | | 3.40 | 8.42 |
| 823 | S | 3J | RHAM | Krug | ferr | 10.80 | 0.0091 | 10.0 | 4.90 | 5.18 |
| 824 | S | 3J | RHAM | Krug | ferr | 5.20 | 0.0021 | | 2.55 | 9.01 |
| 825 | S | 3J | RHAM | Krug | ferr | 5.20 | 0.0021 | | 4.05 | 9.25 |
| 826 | M | 3J | POLY | Cocc | krug | 10.50 | 0.0086 | | 6.30 | 7.32 |
| 827 | M | 3J | POLY | Cocc | krug | 11.10 | 0.0096 | 8.20 | 6.40 | 7.25 |
| 828 | S | 3J | RHAM | Krug | ferr | 6.80 | 0.0036 | | 7.20 | 4.92 |
| 829 | S | 3J | RHAM | Krug | ferr | 5.00 | 0.0019 | | 9.00 | 3.29 |
| 830 | M | 4J | RHAM | Krug | ferr | 8.10 | 0.0051 | | 8.30 | 2.09 |
| 831 | M | 4J | RHAM | Krug | ferr | 6.10 | 0.0029 | | 8.60 | 1.90 |
| 832 | S | 4J | RHAM | Krug | ferr | 7.10 | 0.0039 | 7.59 | 7.15 | 1.61 |
| 833 | M | 4J | RHAM | Krug | ferr | 9.80 | 0.0075 | | 9.10 | 3.00 |
| 834 | M | 4J | RHAM | Krug | ferr | 6.20 | 0.0030 | | 9.00 | 3.00 |
| 835 | S | 4J | RUBI | Guet | scab | 8.00 | 0.0050 | 8.20 | 9.05 | 2.80 |
| 836 | S | 4J | CELA | Mayt | elli | 10.20 | 0.0081 | | 8.80 | 5.00 |
| 837 | M | 4J | CELA | Mayt | elli | 7.90 | 0.0049 | | 9.30 | 6.15 |
| 838 | M | 4J | CELA | Mayt | elli | 5.00 | 0.0019 | | 9.00 | 6.50 |
| 839 | S | 4J | MORA | Ficu | citr | 9.30 | 0.0067 | | 8.70 | 7.31 |
| 840 | S | 4J | CELA | Mayt | elli | 11.70 | 0.0107 | 6.99 | 8.45 | 7.15 |
| 841 | S | 4J | BORA | Bour | succ | 11.60 | 0.0105 | 6.99 | 9.30 | 7.95 |
| 842 | S | 4J | BORA | Bour | succ | 6.00 | 0.0028 | | 7.50 | 8.83 |
| 843 | S | 4J | BORA | Bour | succ | 6.90 | 0.0037 | | 7.00 | 8.80 |
| 844 | S | 4J | RHAM | Krug | ferr | 9.20 | 0.0066 | | 6.30 | 9.37 |
| 845 | M | 4J | BIGN | Tabe | hete | 13.40 | 0.0141 | 8.81 | 5.10 | 8.62 |
| 846 | M | 4J | BIGN | Tabe | hete | 9.40 | 0.0069 | | 5.00 | 8.56 |
| 847 | S | 4J | RHAM | Krug | ferr | 5.70 | 0.0025 | | 6.90 | 7.81 |
| 848 | S | 4J | MYRT | Euge | bifl | 6.50 | 0.0033 | 6.99 | 2.20 | 8.91 |

APPENDIX III. (Continued)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 849 | M | 4J | BIGN | Tabe | hete | 11.80 | 0.0109 | 9.72 | 1.15 | 9.82 |
| 850 | M | 4J | BIGN | Tabe | hete | 11.20 | 0.0098 | | 1.00 | 9.85 |
| 851 | S | 4J | FABA | Sabi | flor | 5.30 | 0.0022 | | 0.85 | 8.60 |
| 852 | S | 4J | BURS | Burs | sima | 17.50 | 0.0240 | 9.11 | 0.50 | 6.41 |
| 853 | S | 4J | RUBI | Guet | parv | 5.60 | 0.0024 | | 5.40 | 4.31 |
| 854 | S | 4J | MYRT | Euge | mont | 6.00 | 0.0028 | 6.07 | 6.50 | 3.61 |
| 855 | S | 4J | MORA | Ficu | citr | 7.00 | 0.0038 | 7.59 | 1.20 | 5.01 |
| 856 | S | 4J | RUBI | Pali | domi | 6.90 | 0.0037 | | 0.40 | 5.24 |
| 857 | S | 4J | RHAM | Krug | ferr | 6.50 | 0.0033 | | 2.40 | 3.84 |
| 858 | M | 4J | FABA | Pisc | cart | 7.60 | 0.0045 | 8.51 | 1.05 | 2.69 |
| 859 | M | 4J | FABA | Pisc | cart | 7.20 | 0.0040 | | 1.10 | 2.59 |
| 860 | M | 4J | RHAM | Krug | ferr | 6.90 | 0.0037 | | 5.40 | 1.41 |
| 861 | M | 4J | RHAM | Krug | ferr | 5.10 | 0.0020 | | 5.15 | 1.35 |
| 862 | S | 4J | BURS | Burs | sima | 31.10 | 0.0759 | 10.3 | 4.95 | 1.61 |
| 863 | M | 4J | RUTA | Amyr | elem | 8.90 | 0.0062 | | 1.25 | 0.08 |
| 864 | M | 4J | RUTA | Amyr | elem | 7.10 | 0.0039 | | 1.10 | 0.15 |
| 865 | S | 4I | MORA | Ficu | citr | 7.00 | 0.0038 | | 9.05 | 3.39 |
| 866 | S | 4I | BURS | Burs | sima | 14.30 | 0.0160 | 8.51 | 9.00 | 4.60 |
| 867 | S | 4I | BURS | Burs | sima | 18.80 | 0.0277 | 8.20 | 6.80 | 6.80 |
| 868 | S | 4I | EUPH | Plum | alba | 9.80 | 0.0075 | 6.07 | 6.45 | 6.10 |
| 869 | S | 4I | RUBI | Guet | scab | 6.00 | 0.0028 | | 9.95 | 9.00 |
| 870 | S | 4I | BURS | Burs | sima | 9.50 | 0.0070 | | 7.30 | 9.15 |
| 871 | M | 4I | BIGN | Tabe | hete | 11.90 | 0.0111 | | 3.15 | 8.90 |
| 872 | M | 4I | BIGN | Tabe | hete | 22.70 | 0.0404 | 10.6 | 2.65 | 8.90 |
| 873 | M | 4I | BIGN | Tabe | hete | 7.40 | 0.0043 | | 2.80 | 9.02 |
| 874 | S | 4I | MYRT | Euge | mont | 6.90 | 0.0037 | 6.68 | 2.55 | 8.15 |
| 875 | S | 4I | BIGN | Tabe | hete | 7.90 | 0.0049 | 6.99 | 4.15 | 6.15 |
| 876 | M | 4I | RUBI | Guet | parv | 10.90 | 0.0093 | 6.99 | 4.00 | 5.50 |
| 877 | M | 4I | RUBI | Guet | parv | 8.60 | 0.0058 | | 3.70 | 5.45 |
| 878 | M | 4I | VERB | Cith | frut | 8.10 | 0.0051 | 9.72 | 3.75 | 5.21 |
| 879 | M | 4I | VERB | Cith | frut | 7.90 | 0.0049 | | 3.35 | 4.45 |
| 880 | M | 4I | CELA | Mayt | elli | 7.90 | 0.0049 | | 3.75 | 4.42 |
| 881 | M | 4I | CELA | Mayt | elli | 10.40 | 0.0084 | | 3.60 | 4.35 |
| 882 | S | 4I | RHAM | Krug | ferr | 10.90 | 0.0093 | 8.20 | 6.05 | 2.80 |
| 883 | S | 4I | BIGN | Tabe | hete | 8.50 | 0.0056 | | 6.20 | 2.70 |
| 884 | S | 4I | VERB | Cith | frut | 8.00 | 0.0050 | | 6.30 | 3.00 |
| 885 | S | 4I | CELA | Mayt | elli | 14.10 | 0.0156 | 9.11 | 7.80 | 3.10 |
| 886 | S | 4I | RHAM | Krug | ferr | 6.10 | 0.0029 | | 5.00 | 0.20 |
| 887 | S | 4I | CAPP | Capp | indi | 9.40 | 0.0069 | 3.95 | 2.40 | 3.60 |
| 888 | S | 4H | ERYT | Eryt | rotu | 9.70 | 0.0073 | 4.25 | 9.10 | 8.00 |
| 889 | S | 4H | BURS | Burs | sima | 16.20 | 0.0206 | 9.42 | 9.00 | 4.20 |
| 890 | S | 4H | EUPH | Plum | alba | 7.20 | 0.0040 | 3.95 | 7.50 | 3.85 |
| 891 | S | 4H | RHAM | Krug | ferr | 5.60 | 0.0024 | | 9.20 | 0.05 |
| 892 | S | 4H | MYRT | Euge | mont | 6.30 | 0.0031 | 7.90 | 6.30 | 4.00 |
| 893 | S | 4H | SAPI | Meli | biju | 15.90 | 0.0198 | 10.3 | 5.45 | 4.45 |
| 894 | M | 4H | MYRT | Euge | bifl | 6.60 | 0.0034 | | 4.40 | 9.10 |
| 895 | M | 4H | MYRT | Euge | bifl | 9.10 | 0.0034 | 9.72 | 4.45 | 9.15 |
| 896 | S | 4H | MYRT | Euge | mont | 9.00 | 0.0063 | 9.72 | 3.15 | 9.30 |

APPENDIX III. (Continued)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 897 | M | 4H | BIGN | Tabe | hete | 12.70 | 0.0126 | 9.11 | 1.50 | 6.80 |
| 898 | M | 4H | BIGN | Tabe | hete | 5.40 | 0.0022 | | 1.35 | 6.90 |
| 899 | S | 4H | VERB | Cith | frut | 7.20 | 0.0040 | 5.77 | 4.00 | 4.10 |
| 900 | S | 4H | MYRT | Euge | mont | 5.90 | 0.0027 | 6.38 | 0.32 | 2.15 |
| 901 | S | 4G | BURS | Burs | sima | 25.50 | 0.0510 | | 9.90 | 9.55 |
| 902 | S | 4G | FABA | Sabi | flor | 5.80 | 0.0026 | 4.55 | 9.55 | 7.35 |
| 903 | S | 4G | BIGN | Tabe | hete | 6.10 | 0.0029 | 7.90 | 9.60 | 7.45 |
| 904 | M | 4G | RUBI | Guet | parv | 5.10 | 0.0020 | | 7.25 | 6.25 |
| 905 | M | 4G | RUBI | Guet | parv | 9.60 | 0.0072 | 10.0 | 6.90 | 6.30 |
| 906 | S | 4G | NYCT | Guap | frag | 10.00 | 0.0078 | 10.9 | 8.80 | 4.60 |
| 907 | M | 4G | FABA | Pisc | cart | 8.50 | 0.0056 | | 5.55 | 6.76 |
| 908 | M | 4G | FABA | Pisc | cart | 5.60 | 0.0024 | | 5.40 | 6.85 |
| 909 | S | 4G | BIGN | Tabe | hete | 13.00 | 0.0132 | 10.3 | 5.20 | 6.50 |
| 910 | S | 4G | MYRT | Euge | bifl | 6.30 | 0.0031 | 8.81 | 2.25 | 9.45 |
| 911 | S | 4G | NYCT | Guap | frag | 16.50 | 0.0213 | | 1.95 | 9.21 |
| 912 | M | 4G | NYCT | Guap | frag | 13.00 | 0.0132 | 10.9 | 1.30 | 5.25 |
| 913 | M | 4G | NYCT | Guap | frag | 10.00 | 0.0078 | | 1.20 | 5.10 |
| 914 | S | 4G | BORA | Bour | succ | 11.60 | 0.0105 | 6.68 | 3.30 | 4.65 |
| 915 | M | 4G | POLY | Cocc | krug | 13.30 | 0.0138 | 10.3 | 2.80 | 4.45 |
| 916 | M | 4G | POLY | Cocc | krug | 8.30 | 0.0054 | | 2.60 | 4.4 |
| 917 | S | 4G | LAUR | Lica | sali | 6.00 | 0.0028 | 6.99 | 7.60 | 2.45 |
| 918 | S | 4G | NYCT | Guap | frag | 23.30 | 0.0426 | 10.9 | 8.00 | 2.30 |
| 919 | S | 4G | NYCT | Guap | frag | 13.70 | 0.0147 | 10.3 | 8.60 | 1.05 |
| 920 | S | 4G | BURS | Burs | sima | 32.20 | 0.0814 | 12.4 | 6.90 | 0.85 |
| 921 | S | 4G | BURS | Burs | sima | 18.30 | 0.0263 | 11.2 | 3.85 | 1.25 |
| 922 | S | 4G | BURS | Burs | sima | 24.30 | 0.0463 | | 2.20 | 1.55 |
| 923 | S | 4G | CELA | Mayt | elli | 7.20 | 0.0040 | | 2.30 | 2.31 |
| 924 | S | 4G | BORA | Bour | succ | 7.80 | 0.0047 | 9.42 | 0.54 | 4.65 |
| 925 | S | 4F | SAPI | Meli | biju | 6.40 | 0.0032 | 7.59 | 9.80 | 8.75 |
| 926 | S | 4F | LAUR | Ocot | cori | 5.60 | 0.0024 | 7.29 | 8.45 | 9.15 |
| 927 | S | 4F | RUBI | Guet | parv | 6.90 | 0.0037 | 7.59 | 7.80 | 8.61 |
| 928 | S | 4F | FLAC | Case | guia | 5.50 | 0.0023 | 6.38 | 6.40 | 9.30 |
| 929 | S | 4F | BORA | Bour | succ | 36.70 | 0.1057 | 11.8 | 6.10 | 9.25 |
| 930 | S | 4F | FLAC | Case | guia | 7.50 | 0.0044 | 8.51 | 7.75 | 7.80 |
| 931 | S | 4F | POLY | Cocc | krug | 11.70 | 0.0107 | 9.72 | 7.80 | 5.02 |
| 932 | S | 4F | LAUR | Ocot | cori | 6.60 | 0.0034 | 8.20 | 4.70 | 6.40 |
| 933 | S | 4F | FLAC | Case | guia | 5.80 | 0.0026 | 7.59 | 4.10 | 6.70 |
| 934 | S | 4F | RHAM | Krug | ferr | 6.00 | 0.0028 | | 5.20 | 4.00 |
| 935 | M | 4F | MORA | Ficu | citr | 11.30 | 0.0100 | 9.11 | 2.70 | 4.85 |
| 936 | M | 4F | MORA | Ficu | citr | 8.80 | 0.0060 | | 3.20 | 4.80 |
| 937 | S | 4F | RHAM | Krug | ferr | 10.20 | 0.0081 | 8.20 | 2.80 | 5.25 |
| 938 | S | 4F | FLAC | Case | deca | 6.10 | 0.0029 | 8.51 | 1.10 | 8.85 |
| 939 | S | 4F | RHAM | Krug | ferr | 7.20 | 0.0040 | 7.59 | 3.80 | 1.10 |
| 940 | S | 4F | LAUR | Ocot | cori | 8.10 | 0.0051 | | 1.20 | 2.51 |
| 941 | M | 4E | NYCT | Guap | frag | 16.30 | 0.0208 | 11.8 | 9.75 | 8.50 |
| 942 | M | 4E | NYCT | Guap | frag | 12.40 | 0.0120 | | 9.80 | 8.20 |
| 943 | S | 4E | MYRT | Euge | mont | 9.90 | 0.0076 | 10.9 | 8.40 | 6.50 |
| 944 | M | 4E | SAPI | Meli | biju | 15.10 | 0.0179 | | 8.20 | 7.15 |

APPENDIX III. (Continued)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 945 | M | 4E | SAPI | Meli | biju | 8.90 | 0.0062 | 11.5 | 8.10 | 7.05 |
| 946 | M | 4E | SAPI | Meli | biju | 6.70 | 0.0035 | | 8.65 | 7.21 |
| 947 | S | 4E | LAUR | Ocot | cori | 8.60 | 0.0058 | 7.29 | 4.40 | 8.75 |
| 948 | S | 4E | NYCT | Guap | frag | 43.90 | 0.1513 | 18.2 | 4.20 | 7.95 |
| 949 | S | 4E | MYRC | Ardi | obov | 5.30 | 0.0022 | | 4.15 | 9.05 |
| 950 | S | 4E | FLAC | Case | guia | 6.30 | 0.0031 | 7.29 | 8.70 | 3.45 |
| 951 | S | 4E | SAPI | Meli | biju | 10.20 | 0.0081 | | 6.60 | 4.00 |
| 952 | S | 4E | RHAM | Krug | ferr | 6.40 | 0.0032 | | 7.90 | 0.25 |
| 953 | M | 4E | SAPI | Meli | biju | 8.80 | 0.0060 | | 6.80 | 0.15 |
| 954 | M | 4E | SAPI | Meli | biju | 14.20 | 0.0158 | | 6.55 | 0.15 |
| 955 | S | 4E | NYCT | Guap | frag | 20.60 | 0.0333 | 13.0 | 5.40 | 1.85 |
| 956 | S | 4E | SAPI | Meli | biju | 5.60 | 0.0024 | | 4.10 | 4.35 |
| 957 | S | 4E | NYCT | Guap | frag | 34.40 | 0.0929 | 12.1 | 1.70 | 6.10 |
| 958 | M | 4E | LAUR | Ocot | cori | 6.10 | 0.0029 | | 0.50 | 6.71 |
| 959 | M | 4E | LAUR | Ocot | cori | 11.70 | 0.0107 | 11.5 | 0.25 | 6.40 |
| 960 | S | 4E | LAUR | Ocot | cori | 13.00 | 0.0132 | | 2.60 | 4.95 |
| 961 | M | 4E | SAPI | Meli | biju | 8.00 | 0.0050 | | 3.40 | 1.35 |
| 962 | M | 4E | SAPI | Meli | biju | 5.10 | 0.0020 | | 3.20 | 1.71 |
| 963 | S | 4E | LAUR | Ocot | cori | 5.60 | 0.0024 | | 0.60 | 3.55 |
| 964 | S | 4E | SAPI | Meli | biju | 11.90 | 0.0111 | | 1.75 | 2.35 |
| 965 | S | 4E | NYCT | Guap | frag | 13.40 | 0.0141 | 12.4 | 0.40 | 0.07 |
| 966 | S | 4D | LAUR | Ocot | cori | 8.50 | 0.0056 | | 9.60 | 9.65 |
| 967 | M | 4D | ERYT | Eryt | rotu | 6.60 | 0.0034 | 10.0 | 9.07 | 9.40 |
| 968 | M | 4D | ERYT | Eryt | rotu | 5.80 | 0.0026 | | 9.00 | 9.45 |
| 969 | M | 4D | SAPI | Meli | biju | 11.50 | 0.0103 | 12.4 | 7.55 | 8.95 |
| 970 | M | 4D | SAPI | Meli | biju | 11.20 | 0.0098 | | 7.48 | 9.00 |
| 971 | M | 4D | SAPI | Meli | biju | 5.80 | 0.0026 | | 7.40 | 8.90 |
| 972 | M | 4D | SAPI | Meli | biju | 5.80 | 0.0026 | | 7.42 | 9.05 |
| 973 | S | 4D | NYCT | Guap | frag | 18.60 | 0.0271 | 13.0 | 8.40 | 7.85 |
| 974 | S | 4D | SAPI | Meli | biju | 5.30 | 0.0022 | | 9.15 | 6.70 |
| 975 | S | 4D | BURS | Burs | sima | 18.30 | 0.0263 | | 8.60 | 5.90 |
| 976 | M | 4D | SAPI | Meli | biju | 15.00 | 0.0176 | 12.1 | 4.10 | 8.32 |
| 977 | M | 4D | SAPI | Meli | biju | 7.40 | 0.0043 | | 4.00 | 7.95 |
| 978 | M | 4D | SAPI | Meli | biju | 7.10 | 0.0039 | | 3.20 | 8.80 |
| 979 | M | 4D | SAPI | Meli | biju | 5.50 | 0.0023 | | 3.15 | 8.84 |
| 980 | M | 4D | SAPI | Meli | biju | 13.00 | 0.0132 | | 3.30 | 8.20 |
| 981 | S | 4D | MYRT | Euge | mont | 6.10 | 0.0029 | 8.51 | 7.75 | 4.00 |
| 982 | S | 4D | SAPI | Meli | biju | 10.40 | 0.0084 | | 9.65 | 2.05 |
| 983 | S | 4D | RUBI | Guet | parv | 7.60 | 0.0045 | | 8.45 | 1.40 |
| 984 | S | 4D | SAPI | Meli | biju | 7.50 | 0.0044 | | 9.25 | 0.15 |
| 985 | S | 4D | RUTA | Zant | mart | 19.20 | 0.0289 | 15.5 | 7.60 | 0.75 |
| 986 | M | 4D | MELA | Tetr | elae | 10.20 | 0.0081 | 11.2 | 7.55 | 0.45 |
| 987 | M | 4D | MELA | Tetr | elae | 6.90 | 0.0037 | | 7.80 | 0.55 |
| 988 | S | 4D | LAUR | Ocot | cori | 5.50 | 0.0023 | | 5.90 | 0.80 |
| 989 | S | 4D | BORA | Cord | coll | 7.70 | 0.0046 | 9.11 | 5.75 | 1.45 |
| 990 | S | 4D | BORA | Cord | coll | 9.90 | 0.0076 | 12.7 | 0.65 | 5.15 |
| 991 | S | 4D | SAPI | Meli | biju | 9.20 | 0.0066 | | 1.10 | 7.55 |
| 992 | S | 4D | LAUR | Ocot | cori | 9.40 | 0.0069 | | 0.25 | 3.80 |

APPENDIX III. (Continued)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 993 | M | 4D | SAPI | Meli | biju | 5.00 | 0.0019 | | 2.00 | 2.01 |
| 994 | M | 4D | SAPI | Meli | biju | 5.10 | 0.0020 | | 2.00 | 1.95 |
| 995 | M | 4C | SAPI | Meli | biju | 9.80 | 0.0075 | | 8.75 | 0.40 |
| 996 | M | 4C | SAPI | Meli | biju | 7.20 | 0.0040 | | 8.95 | 0.10 |
| 997 | M | 4C | SAPI | Meli | biju | 9.80 | 0.0075 | 12.4 | 8.80 | 0.05 |
| 998 | M | 4C | SAPI | Meli | biju | 7.60 | 0.0045 | | 8.45 | 0.94 |
| 999 | M | 4C | SAPI | Meli | biju | 7.60 | 0.0045 | | 8.30 | 0.76 |
| 1000 | S | 4C | SAPI | Meli | biju | 9.90 | 0.0076 | | 7.95 | 3.10 |
| 1001 | S | 3D | SAPI | Meli | biju | 9.00 | 0.0063 | | 2.10 | 7.48 |
| 2801 | M | 4C | SAPI | Meli | biju | 11.70 | 0.0107 | | 6.25 | 2.50 |
| 2802 | M | 4C | SAPI | Meli | biju | 8.20 | 0.0052 | | 6.30 | 2.30 |
| 2803 | M | 4C | SAPI | Meli | biju | 5.70 | 0.0025 | | 6.10 | 2.40 |
| 2804 | S | 4C | LAUR | Ocot | cori | 9.10 | 0.0065 | | 7.95 | 2.60 |
| 2805 | S | 4C | SAPI | Meli | biju | 11.20 | 0.0098 | 13.9 | 8.60 | 3.90 |
| 2806 | M | 4C | SAPI | Meli | biju | 8.50 | 0.0056 | | 8.50 | 4.30 |
| 2807 | M | 4C | SAPI | Meli | biju | 9.60 | 0.0072 | | 8.60 | 4.40 |
| 2808 | M | 4C | SAPI | Meli | biju | 5.80 | 0.0026 | | 9.45 | 6.30 |
| 2809 | M | 4C | SAPI | Meli | biju | 5.70 | 0.0025 | | 8.85 | 5.90 |
| 2810 | M | 4C | SAPI | Meli | biju | 5.00 | 0.0019 | | 8.95 | 5.95 |
| 2811 | M | 4C | SAPI | Meli | biju | 8.00 | 0.0050 | | 8.85 | 6.10 |
| 2812 | S | 4C | LAUR | Ocot | cori | 8.80 | 0.0060 | | 8.30 | 6.90 |
| 2813 | S | 4C | SAPI | Meli | biju | 6.70 | 0.0035 | | 8.00 | 7.30 |
| 2814 | S | 4C | RUBI | Guet | scab | 6.70 | 0.0035 | | 7.55 | 7.15 |
| 2815 | S | 4C | SAPI | Meli | biju | 6.00 | 0.0028 | | 6.40 | 9.65 |
| 2816 | M | 4C | SAPI | Meli | biju | 14.30 | 0.0160 | | 5.85 | 8.85 |
| 2817 | M | 4C | SAPI | Meli | biju | 6.00 | 0.0028 | | 5.10 | 8.70 |
| 2818 | S | 4C | LAUR | Ocot | cori | 9.50 | 0.0070 | | 7.50 | 6.40 |
| 2819 | S | 4C | SAPI | Meli | biju | 9.20 | 0.0066 | | 7.80 | 5.65 |
| 2820 | M | 4C | SAPI | Meli | biju | 7.70 | 0.0046 | | 7.00 | 5.50 |
| 2821 | M | 4C | SAPI | Meli | biju | 5.90 | 0.0027 | | 7.05 | 5.40 |
| 2822 | S | 4C | SAPI | Meli | biju | 7.80 | 0.0047 | | 7.45 | 5.45 |
| 2823 | S | 4C | ANAC | Spon | momb | 34.40 | 0.0929 | 15.8 | 7.05 | 5.75 |
| 2824 | S | 4C | SAPI | Meli | biju | 8.50 | 0.0056 | | 5.50 | 5.05 |
| 2825 | M | 4C | SAPI | Meli | biju | 7.40 | 0.0043 | | 4.30 | 6.08 |
| 2826 | M | 4C | SAPI | Meli | biju | 6.50 | 0.0033 | | 4.28 | 5.20 |
| 2827 | M | 4C | SAPI | Meli | biju | 5.00 | 0.0019 | | 4.25 | 5.08 |
| 2828 | M | 4C | SAPI | Meli | biju | 9.10 | 0.0065 | 10.6 | 4.25 | 5.32 |
| 2829 | M | 4C | SAPI | Meli | biju | 5.60 | 0.0024 | | 4.10 | 5.38 |
| 2830 | M | 4C | SAPI | Meli | biju | 6.50 | 0.0033 | | 4.00 | 5.92 |
| 2831 | M | 4C | SAPI | Meli | biju | 6.40 | 0.0032 | | 3.95 | 3.60 |
| 2832 | M | 4C | SAPI | Meli | biju | 5.20 | 0.0021 | | 7.05 | 5.75 |
| 2833 | S | 4C | SAPI | Meli | biju | 16.50 | 0.0213 | 10.4 | 0.41 | 9.80 |
| 2834 | S | 4C | SAPI | Meli | biju | 6.40 | 0.0032 | | 3.75 | 1.00 |
| 2835 | S | 4C | SAPI | Meli | biju | 7.40 | 0.0043 | | 3.80 | 0.05 |
| 2836 | S | 4C | SAPI | Meli | biju | 6.00 | 0.0028 | | 0.25 | 2.89 |
| 2837 | M | 4B | FABA | Andi | iner | 6.00 | 0.0028 | | 9.70 | 7.50 |
| 2838 | M | 4B | FABA | Andi | iner | 10.90 | 0.0093 | 13.0 | 9.00 | 8.60 |
| 2839 | S | 4B | LAUR | Ocot | cori | 6.50 | 0.0033 | 9.72 | 8.90 | 7.30 |

APPENDIX III. (Continued)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 2840 | S | 4B | SAPI | Meli biju | 8.50 | 0.0056 | | 9.75 | 5.75 |
| 2841 | S | 4B | FABA | Andi iner | 11.10 | 0.0096 | 13.6 | 9.40 | 3.69 |
| 2842 | M | 4B | SAPI | Meli biju | 14.00 | 0.0153 | 12.7 | 8.80 | 3.55 |
| 2843 | M | 4B | SAPI | Meli biju | 6.70 | 0.0035 | | 8.70 | 3.20 |
| 2844 | M | 4B | SAPI | Meli biju | 8.30 | 0.0054 | | 8.95 | 3.26 |
| 2845 | M | 4B | SAPI | Meli biju | 10.80 | 0.0091 | | 9.10 | 3.35 |
| 2846 | S | 4B | SAPI | Meli biju | 6.10 | 0.0029 | | 9.05 | 1.45 |
| 2847 | S | 4B | SAPI | Meli biju | 14.30 | 0.0160 | | 8.90 | 5.65 |
| 2848 | S | 4B | MELA | Tetr elae | 12.10 | 0.0114 | 12.1 | 6.10 | 5.95 |
| 2849 | S | 4B | MELA | Tetr elae | 12.10 | 0.0114 | 12.7 | 5.80 | 5.40 |
| 2850 | M | 4B | SAPI | Meli biju | 10.20 | 0.0081 | | 3.50 | 7.40 |
| 2851 | M | 4B | SAPI | Meli biju | 7.60 | 0.0045 | | 3.70 | 7.30 |
| 2852 | M | 4B | SAPI | Meli biju | 10.20 | 0.0081 | | 3.55 | 7.55 |
| 2853 | M | 4B | SAPI | Meli biju | 7.00 | 0.0038 | | 3.65 | 7.50 |
| 2854 | M | 4B | SAPI | Meli biju | 16.30 | 0.0208 | | 3.20 | 9.40 |
| 2855 | M | 4B | SAPI | Meli biju | 11.40 | 0.0102 | | 3.10 | 9.65 |
| 2856 | M | 4B | SAPI | Meli biju | 5.00 | 0.0019 | | 3.15 | 9.80 |
| 2857 | M | 4B | SAPI | Meli biju | 6.10 | 0.0029 | | 3.30 | 9.45 |
| 2858 | M | 4B | SAPI | Meli biju | 8.10 | 0.0051 | | 3.40 | 9.75 |
| 2859 | M | 4B | SAPI | Meli biju | 5.80 | 0.0026 | | 3.55 | 9.48 |
| 2860 | S | 4B | MELA | Tetr elae | 7.80 | 0.0047 | 10.0 | 4.65 | 4.15 |
| 2861 | S | 4B | RUBI | Guet parv | 5.30 | 0.0022 | | 4.35 | 0.03 |
| 2862 | S | 4B | SAPI | Meli biju | 7.20 | 0.0040 | | 2.90 | 2.22 |
| 2863 | M | 4B | SAPI | Meli biju | 5.90 | 0.0027 | | 2.20 | 0.35 |
| 2864 | M | 4B | SAPI | Meli biju | 7.60 | 0.0045 | | 2.15 | 0.25 |
| 2865 | M | 4B | SAPI | Meli biju | 8.80 | 0.0060 | | 1.95 | 0.33 |
| 2866 | M | 4B | SAPI | Meli biju | 15.00 | 0.0176 | | 2.20 | 2.01 |
| 2867 | M | 4B | SAPI | Meli biju | 13.90 | 0.0151 | | 2.00 | 1.81 |
| 2868 | M | 4B | SAPI | Meli biju | 7.70 | 0.0046 | | 1.90 | 1.80 |
| 2869 | M | 4B | SAPI | Meli biju | 5.80 | 0.0026 | | 2.15 | 2.60 |
| 2870 | S | 4B | MELA | Tetr elae | 11.70 | 0.0107 | 9.11 | 0.60 | 6.10 |
| 2871 | M | 4B | SAPI | Meli biju | 16.00 | 0.0201 | | 0.15 | 8.10 |
| 2872 | M | 4B | SAPI | Meli biju | 5.40 | 0.0022 | | 0.45 | 8.15 |
| 2873 | S | 4B | VERB | Citr frut | 15.90 | 0.0198 | 14.5 | 0.55 | 9.70 |
| 2874 | S | 4A | CAPP | Capp cyno | 8.50 | 0.0056 | 6.07 | 9.00 | 9.10 |
| 2875 | S | 4A | RHAM | Krug ferr | 6.10 | 0.0029 | | 3.80 | 5.45 |
| 2876 | S | 4A | NYCT | Guap frag | 26.30 | 0.0543 | 15.8 | 9.05 | 4.20 |
| 2877 | S | 4A | NYCT | Guap frag | 14.00 | 0.0153 | 13.6 | 7.65 | 3.95 |
| 2878 | S | 4A | NYCT | Guap frag | 13.50 | 0.0143 | 10.9 | 8.00 | 3.79 |
| 2879 | S | 4A | NYCT | Guap frag | 19.50 | 0.0298 | | 8.05 | 3.65 |
| 2880 | S | 4A | SAPI | Meli biju | 7.10 | 0.0039 | | 8.70 | 2.95 |
| 2881 | S | 4A | NYCT | Guap frag | 9.40 | 0.0069 | 10.6 | 8.25 | 2.50 |
| 2882 | M | 4A | SAPI | Meli biju | 5.90 | 0.0027 | | 6.50 | 0.60 |
| 2883 | M | 4A | SAPI | Meli biju | 7.60 | 0.0045 | | 6.45 | 0.25 |
| 2884 | M | 4A | SAPI | Meli biju | 14.00 | 0.0153 | | 6.30 | 0.30 |
| 2885 | M | 4A | SAPI | Meli biju | 9.00 | 0.0063 | | 6.10 | 0.38 |
| 2886 | S | 4A | MYRC | Ardi obov | 6.00 | 0.0028 | 4.86 | 5.05 | 2.00 |
| 2887 | S | 4A | SAPI | Meli biju | 10.30 | 0.0083 | | 4.85 | 1.10 |

APPENDIX III. (Continued)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 2888 | S | 4A | BORA | Cord | coll | 8.70 | 0.0059 | 8.81 | 4.00 | 1.61 |
| 2889 | M | 4A | SAPI | Meli | biju | 9.20 | 0.0066 | | 4.10 | 4.32 |
| 2890 | M | 4A | SAPI | Meli | biju | 21.50 | 0.0363 | | 4.20 | 4.40 |
| 2891 | S | 4A | RHAM | Krug | ferr | 6.00 | 0.0028 | 6.38 | 2.00 | 4.35 |
| 2892 | M | 4A | BIGN | Tabe | hete | 12.50 | 0.0122 | | 0.95 | 1.31 |
| 2893 | M | 4A | BIGN | Tabe | hete | 21.20 | 0.0352 | 13.3 | 1.15 | 1.15 |
| 2894 | M | 4A | BIGN | Tabe | hete | 5.90 | 0.0027 | | 1.05 | 1.08 |
| 2895 | S | 4A | BIGN | Tabe | hete | 10.80 | 0.0091 | | 1.45 | 0.55 |
| 2896 | S | 4A | CAPP | Capp | indi | 5.70 | 0.0025 | 3.34 | 0.60 | 7.59 |
| 2897 | S | 4A | BIGN | Tabe | hate | 7.30 | 0.0041 | 6.68 | 0.36 | 7.70 |
| 2898 | M | 5A | FABA | Sabi | flor | 7.60 | 0.0045 | | 0.80 | 2.01 |
| 2899 | M | 5A | FABA | Sabi | flor | 8.00 | 0.0050 | 6.99 | 0.70 | 2.31 |
| 2900 | S | 5A | MIMO | Leuc | leuc | 8.70 | 0.0059 | | 2.80 | 4.12 |
| 2901 | S | 5A | CAPP | Capp | indi | 10.80 | 0.0091 | 6.07 | 3.20 | 1.60 |
| 2902 | S | 5A | MELA | Tetr | elae | 9.20 | 0.0066 | 6.99 | 3.70 | 1.25 |
| 2903 | S | 5A | MYRT | Euge | mont | 6.40 | 0.0032 | | 3.00 | 5.01 |
| 2904 | M | 5A | BIGN | Tabe | hete | 7.50 | 0.0044 | | 3.10 | 6.10 |
| 2905 | M | 5A | BIGN | Tabe | hete | 9.30 | 0.0067 | 8.81 | 3.15 | 6.17 |
| 2906 | S | 5A | CAPP | Capp | indi | 5.10 | 0.0020 | | 0.50 | 7.37 |
| 2907 | S | 5A | BIGN | Tabe | hete | 5.20 | 0.0021 | | 0.25 | 7.30 |
| 2908 | S | 5A | NYCT | Guap | frag | 15.90 | 0.0198 | 9.11 | 4.20 | 9.55 |
| 2909 | S | 5A | NYCT | Guap | frag | 10.70 | 0.0089 | 8.51 | 4.45 | 6.80 |
| 2910 | S | 5A | CAPP | Capp | indi | 7.90 | 0.0049 | 3.64 | 4.70 | 6.80 |
| 2911 | S | 5A | MYRT | Euge | bifl | 5.40 | 0.0022 | 6.38 | 4.80 | 6.30 |
| 2912 | S | 5A | RHAM | Krug | ferr | 6.00 | 0.0028 | | 5.90 | 6.70 |
| 2913 | S | 5A | LAUR | Ocot | cori | 5.00 | 0.0019 | | 5.10 | 7.05 |
| 2914 | M | 5A | LAUR | Ocot | cori | 7.60 | 0.0045 | 8.81 | 6.80 | 7.40 |
| 2915 | M | 5A | LAUR | Ocot | cori | 10.20 | 0.0081 | | 6.95 | 7.32 |
| 2916 | S | 5A | MELA | Tetr | elae | 14.20 | 0.0158 | 10.3 | 7.05 | 7.42 |
| 2917 | S | 5A | RHAM | Krug | ferr | 8.80 | 0.0060 | 10.0 | 3.50 | 6.55 |
| 2918 | S | 5A | NYCT | Guap | frag | 7.10 | 0.0039 | 7.59 | 8.20 | 3.25 |
| 2919 | S | 5A | BORA | Cord | coll | 11.00 | 0.0095 | 12.4 | 8.60 | 2.45 |
| 2920 | S | 5A | VERB | Cith | frut | 8.30 | 0.0054 | 7.29 | 9.25 | 4.25 |
| 2921 | S | 5A | MYRT | Euge | bifl | 8.70 | 0.0059 | 10.0 | 9.00 | 5.55 |
| 2922 | S | 5B | MELA | Tetr | elae | 13.30 | 0.0138 | 12.4 | 0.35 | 9.35 |
| 2923 | S | 5B | BORA | Cord | alli | 8.50 | 0.0056 | 9.72 | 2.90 | 6.90 |
| 2924 | M | 5B | MYRC | Ardi | obov | 7.50 | 0.0044 | | 4.00 | 3.40 |
| 2925 | M | 5B | MYRC | Ardi | obov | 8.20 | 0.0052 | 8.20 | 4.05 | 3.45 |
| 2926 | M | 5B | SAPI | Meli | biju | 20.40 | 0.0326 | 13.0 | 5.95 | 4.00 |
| 2927 | M | 5B | SAPI | Meli | biju | 9.50 | 0.0070 | | 6.50 | 4.05 |
| 2928 | S | 5B | SAPI | Meli | biju | 9.10 | 0.0065 | | 7.60 | 3.70 |
| 2929 | S | 5B | SAPI | Meli | biju | 12.30 | 0.0118 | | 6.90 | 0.75 |
| 2930 | S | 5B | SAPI | Meli | biju | 6.90 | 0.0037 | | 9.00 | 2.60 |
| 2931 | M | 5B | SAPI | Meli | biju | 9.50 | 0.0070 | | 7.65 | 4.70 |
| 2932 | M | 5B | SAPI | Meli | biju | 11.00 | 0.0095 | | 7.60 | 4.90 |
| 2933 | S | 5B | RUTA | Zant | mart | 8.00 | 0.0050 | 13.0 | 8.00 | 5.40 |
| 2934 | S | 5B | BORA | Cord | coll | 20.10 | 0.0317 | 15.5 | 8.35 | 7.00 |
| 2935 | S | 5B | FABA | Andi | iner | 10.90 | 0.0093 | 12.4 | 8.40 | 9.75 |

APPENDIX III. (Continued)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 2936 | M | 5C | SAPI | Meli biju | 8.70 | 0.0059 | | 3.50 | 5.95 |
| 2937 | M | 5C | SAPI | Meli biju | 6.10 | 0.0029 | | 3.40 | 5.80 |
| 2938 | M | 5C | SAPI | Meli biju | 5.60 | 0.0024 | | 3.90 | 5.01 |
| 2939 | M | 5C | SAPI | Meli biju | 9.70 | 0.0073 | | 4.35 | 4.80 |
| 2940 | M | 5C | SAPI | Meli biju | 5.80 | 0.0026 | | 3.70 | 4.30 |
| 2941 | S | 5C | FABA | Andi iner | 21.60 | 0.0366 | 15.5 | 4.20 | 1.20 |
| 2942 | S | 5C | SAPI | Meli biju | 12.90 | 0.0130 | 14.5 | 0.15 | 0.08 |
| 2943 | M | 5C | SAPI | Meli biju | 10.20 | 0.0081 | | 7.00 | 2.81 |
| 2944 | M | 5C | SAPI | Meli biju | 5.50 | 0.0023 | | 6.85 | 2.76 |
| 2945 | M | 5C | SAPI | Meli biju | 6.40 | 0.0032 | | 6.80 | 2.51 |
| 2946 | S | 5C | LAUR | Ocot cori | 6.80 | 0.0036 | | 3.60 | 9.75 |
| 2947 | S | 5C | NYCT | Guap frag | 10.80 | 0.0091 | 10.6 | 8.00 | 4.97 |
| 2948 | M | 5C | SAPI | Meli biju | 7.10 | 0.0039 | | 5.45 | 8.45 |
| 2949 | M | 5C | SAPI | Meli biju | 10.80 | 0.0091 | | 5.70 | 8.95 |
| 2950 | M | 5C | SAPI | Meli biju | 6.00 | 0.0028 | | 5.80 | 9.05 |
| 2951 | M | 5C | SAPI | Meli biju | 6.60 | 0.0034 | | 7.50 | 7.85 |
| 2952 | M | 5C | SAPI | Meli biju | 9.20 | 0.0066 | | 7.30 | 8.20 |
| 2953 | M | 5C | SAPI | Meli biju | 5.30 | 0.0022 | | 7.45 | 8.46 |
| 2954 | M | 5C | SAPI | Meli biju | 18.90 | 0.0280 | 14.5 | 7.55 | 8.51 |
| 2955 | M | 5C | SAPI | Meli biju | 24.70 | 0.0479 | | 9.65 | 5.57 |
| 2956 | M | 5C | SAPI | Meli biju | 38.20 | 0.1146 | | 8.80 | 5.85 |
| 2957 | M | 5C | SAPI | Meli biju | 34.70 | 0.0945 | | 9.10 | 5.35 |
| 2958 | M | 5C | SAPI | Meli biju | 12.80 | 0.0128 | | 8.75 | 5.45 |
| 2959 | M | 5C | SAPI | Meli biju | 5.60 | 0.0024 | | 8.90 | 5.62 |
| 2960 | S | 5C | SAPI | Meli biju | 10.00 | 0.0078 | | 9.20 | 1.00 |
| 2961 | S | 5C | SAPI | Meli biju | 6.20 | 0.0030 | | 9.80 | 2.19 |
| 2962 | S | 5D | LAUR | Ocot cori | 8.70 | 0.0059 | 12.4 | 1.25 | 2.31 |
| 2963 | S | 5D | FLAC | Case guia | 10.90 | 0.0093 | 14.5 | 0.70 | 5.45 |
| 2964 | S | 5D | LAUR | Ocot cori | 5.20 | 0.0021 | | 2.55 | 8.45 |
| 2965 | S | 5D | MELA | Tetr elae | 5.30 | 0.0022 | | 4.70 | 9.00 |
| 2966 | M | 5D | SAPI | Meli biju | 12.70 | 0.0126 | | 5.35 | 8.48 |
| 2967 | M | 5D | SAPI | Meli biju | 7.10 | 0.0039 | | 5.25 | 8.51 |
| 2968 | M | 5D | SAPI | Meli biju | 5.20 | 0.0021 | | 5.15 | 8.42 |
| 2969 | M | 5D | SAPI | Meli biju | 6.00 | 0.0028 | | 4.75 | 8.50 |
| 2970 | S | 5D | LAUR | Ocot cori | 7.10 | 0.0039 | | 3.55 | 5.52 |
| 2971 | M | 5D | SAPI | Meli biju | 10.70 | 0.0089 | | 6.75 | 5.05 |
| 2972 | M | 5D | SAPI | Meli biju | 6.60 | 0.0034 | | 6.85 | 4.95 |
| 2973 | M | 5D | SAPI | Meli biju | 16.30 | 0.0208 | | 6.60 | 4.55 |
| 2974 | M | 5D | SAPI | Meli biju | 14.40 | 0.0162 | | 6.20 | 4.75 |
| 2975 | S | 5D | BORA | Cord alli | 6.00 | 0.0028 | 7.59 | 8.00 | 4.00 |
| 2976 | S | 5D | MYRT | Euge mont | 7.30 | 0.0041 | 11.8 | 9.30 | 6.15 |
| 2977 | S | 5D | FABA | Andi iner | 10.00 | 0.0078 | 12.1 | 9.65 | 6.85 |
| 2978 | S | 5D | NYCT | Guap frag | 14.00 | 0.0153 | | 9.00 | 8.70 |
| 2979 | S | 5D | LAUR | Ocot cori | 9.60 | 0.0072 | 11.5 | 8.50 | 8.70 |
| 2980 | S | 5E | CAPP | Capp cyno | 8.90 | 0.0062 | 8.51 | 2.15 | 6.51 |
| 2981 | S | 5E | LAUR | Ocot cori | 11.60 | 0.0105 | | 0.60 | 5.31 |
| 2982 | S | 5E | LAUR | Ocot cori | 5.90 | 0.0027 | | 0.75 | 3.70 |
| 2983 | M | 5E | RUBI | Guet parv | 8.20 | 0.0052 | 6.68 | 2.55 | 3.05 |

APPENDIX III. (Continued)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 2984 | M | 5E | RUBI | Guet | parv | 5.30 | 0.0022 | | 2.70 | 3.45 |
| 2985 | S | 5E | BORA | Bour | succ | 6.50 | 0.0033 | | 3.85 | 0.55 |
| 2986 | S | 5E | SAPI | Meli | biju | 9.40 | 0.0069 | 12.7 | 7.25 | 4.40 |
| 2987 | S | 5E | BURS | Burs | sima | 20.00 | 0.0314 | 11.2 | 4.30 | 4.75 |
| 2988 | S | 5E | BORA | Bour | succ | 17.90 | 0.0251 | | 6.65 | 0.15 |
| 2989 | S | 5E | SAPI | Meli | biju | 18.40 | 0.0265 | 13.6 | 5.40 | 6.45 |
| 2990 | M | 5E | FABA | Sabi | flor | 9.00 | 0.0063 | 10.3 | 5.80 | 8.10 |
| 2991 | M | 5E | FABA | Sabi | flor | 6.00 | 0.0028 | | 5.70 | 8.20 |
| 2992 | S | 5E | MYRT | Euge | bifl | 6.10 | 0.0029 | | 5.60 | 7.90 |
| 2993 | S | 5E | NYCT | Guap | frag | 18.20 | 0.0260 | 11.8 | 5.75 | 7.10 |
| 2994 | S | 5E | LAUR | Lica | sali | 6.50 | 0.0033 | | 5.60 | 6.15 |
| 2995 | S | 5E | MYRT | Myrc | flor | 16.30 | 0.0208 | 5.47 | 8.85 | 9.60 |
| 2996 | S | 5F | BORA | Cord | alli | 11.00 | 0.0095 | 11.5 | 0.50 | 1.00 |
| 2997 | S | 5F | BURS | Burs | sima | 22.50 | 0.0397 | 10.0 | 2.90 | 3.65 |
| 2998 | S | 5F | SAPO | Mast | foet | 10.00 | 0.0078 | 11.2 | 2.20 | 5.30 |
| 2999 | S | 5F | CAPP | Caly | thom | 6.80 | 0.0036 | | 4.15 | 0.95 |
| 3000 | S | 5F | NYCT | Guap | frag | 16.70 | 0.0219 | | 3.85 | 1.90 |
| 3001 | S | 5F | FABA | Sabi | flor | 7.40 | 0.0043 | 8.81 | 2.20 | 7.40 |
| 3002 | S | 5F | SAPI | Meli | biju | 7.70 | 0.0046 | | 1.70 | 7.69 |
| 3003 | M | 5F | RHAM | Krug | ferr | 9.80 | 0.0075 | 9.72 | 2.05 | 8.90 |
| 3004 | M | 5F | RHAM | Krug | ferr | 9.20 | 0.0066 | | 1.90 | 8.95 |
| 3005 | M | 5F | RHAM | Krug | ferr | 8.00 | 0.0050 | | 2.00 | 8.80 |
| 3006 | M | 5F | RHAM | Krug | ferr | 5.30 | 0.0022 | | 2.10 | 9.10 |
| 3007 | M | 5F | MYRT | Euge | mont | 6.30 | 0.0031 | | 4.10 | 4.95 |
| 3008 | M | 5F | MYRT | Euge | mont | 10.60 | 0.0088 | 9.11 | 4.20 | 4.91 |
| 3009 | M | 5F | MYRT | Euge | mont | 8.10 | 0.0051 | | 4.25 | 4.60 |
| 3010 | S | 5F | BURS | Burs | sima | 17.30 | 0.0235 | 12.1 | 6.35 | 3.70 |
| 3011 | S | 5F | BURS | Burs | sima | 27.30 | 0.0585 | 13.3 | 6.25 | 7.45 |
| 3012 | S | 5F | FLAC | Case | guia | 10.10 | 0.0080 | | 6.50 | 7.70 |
| 3013 | S | 5F | CELA | Mayt | elli | 6.00 | 0.0028 | | 3.25 | 9.45 |
| 3014 | S | 5F | RHAM | Krug | ferr | 6.50 | 0.0033 | | 5.95 | 9.00 |
| 3015 | S | 5F | BIGN | Tabe | hete | 7.60 | 0.0045 | | 6.10 | 8.30 |
| 3016 | S | 5F | RHAM | Krug | ferr | 5.20 | 0.0021 | | 6.20 | 8.50 |
| 3017 | S | 5F | NYCT | Guap | frag | 28.20 | 0.0624 | 12.7 | 9.00 | 9.10 |
| 3018 | S | 5F | BURS | Burs | sima | 14.70 | 0.0169 | 8.81 | 9.80 | 6.40 |
| 3019 | S | 5F | BORA | Cord | coll | 5.20 | 0.0021 | | 7.90 | 5.75 |
| 3020 | M | 5G | POLY | Cocc | krug | 8.70 | 0.0059 | 9.72 | 1.60 | 2.01 |
| 3021 | M | 5G | POLY | Cocc | krug | 8.40 | 0.0055 | | 1.55 | 1.81 |
| 3022 | M | 5G | POLY | Cocc | krug | 5.80 | 0.0026 | | 1.65 | 1.81 |
| 3023 | M | 5G | POLY | Cocc | krug | 8.50 | 0.0056 | | 1.70 | 1.70 |
| 3024 | M | 5G | POLY | Cocc | krug | 7.70 | 0.0046 | | 1.65 | 1.61 |
| 3025 | M | 5G | POLY | Cocc | krug | 7.60 | 0.0045 | | 1.90 | 1.55 |
| 3026 | S | 5G | LAUR | Lica | sali | 5.50 | 0.0023 | | 0.90 | 1.95 |
| 3027 | S | 5G | BIGN | Tabe | hete | 9.70 | 0.0073 | 7.29 | 1.35 | 5.60 |
| 3028 | S | 5G | FABA | Pisc | cart | 8.00 | 0.0050 | 10.0 | 1.10 | 6.00 |
| 3029 | S | 5G | BIGN | Tabe | hete | 8.60 | 0.0058 | | 0.45 | 5.80 |
| 3030 | S | 5G | MYRC | Ardi | obov | 5.10 | 0.0020 | 6.38 | 0.14 | 6.70 |
| 3031 | S | 5G | CAPP | Capp | fron | 5.70 | 0.0025 | | 2.80 | 6.90 |

APPENDIX III. (Continued)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 3032 | M | 5G | RHAM | Krug | ferr | 5.60 | 0.0024 | | 4.25 | 2.09 |
| 3033 | M | 5G | RHAM | Krug | ferr | 6.70 | 0.0035 | | 4.20 | 2.05 |
| 3034 | M | 5G | NYCT | Guap | frag | 7.90 | 0.0049 | 6.07 | 4.60 | 2.14 |
| 3035 | M | 5G | NYCT | Guap | frag | 12.20 | 0.0116 | | 4.70 | 2.00 |
| 3036 | S | 5G | CELA | Mayt | elli | 8.90 | 0.0062 | 7.59 | 3.40 | 6.35 |
| 3037 | S | 5G | NYCT | Guap | frag | 23.80 | 0.0444 | | 3.20 | 7.15 |
| 3038 | S | 5G | RHAM | Krug | ferr | 7.10 | 0.0039 | | 6.80 | 9.15 |
| 3039 | S | 5G | MYRT | Euge | mont | 10.20 | 0.0081 | 8.20 | 9.40 | 9.20 |
| 3040 | S | 5G | BURS | Burs | sima | 43.70 | 0.1499 | 12.7 | 7.90 | 7.80 |
| 3041 | S | 5G | RUBI | Guet | scab | 7.90 | 0.0049 | 6.68 | 7.20 | 7.60 |
| 3042 | S | 5G | CAPP | Capp | ampl | 7.70 | 0.0046 | 6.68 | 7.80 | 0.30 |
| 3043 | M | 5G | RUBI | Guet | parv | 5.70 | 0.0025 | | 8.60 | 2.51 |
| 3044 | M | 5G | RUBI | Guet | parv | 5.90 | 0.0027 | 6.38 | 8.50 | 2.58 |
| 3045 | S | 5G | CELA | Mayt | elli | 5.00 | 0.0019 | 8.51 | 8.30 | 4.75 |
| 3046 | S | 5H | BURS | Burs | sima | 21.30 | 0.0356 | 6.68 | 5.40 | 0.40 |
| 3047 | S | 5H | MYRT | Euge | mont | 6.10 | 0.0029 | 3.95 | 7.80 | 2.30 |
| 3048 | S | 5H | MORA | Ficu | citr | 5.50 | 0.0023 | 6.99 | 9.75 | 2.40 |
| 3049 | S | 5H | NYCT | Guap | frag | 9.50 | 0.0070 | | 9.85 | 3.35 |
| 3050 | S | 5H | NYCT | Guap | frag | 11.40 | 0.0102 | | 2.80 | 8.45 |
| 3051 | S | 5H | MYRT | Euge | bifl | 5.00 | 0.0019 | | 2.90 | 6.00 |
| 3052 | S | 5H | BORA | Cord | alli | 5.20 | 0.0021 | | 2.70 | 6.85 |
| 3053 | S | 5H | BURS | Burs | sima | 18.20 | 0.0260 | | 3.40 | 9.00 |
| 3054 | S | 5H | LAUR | Ocot | cori | 6.60 | 0.0034 | 6.99 | 7.65 | 4.45 |
| 3055 | S | 5H | MIMO | Leuc | leuc | 10.80 | 0.0091 | | 4.00 | 3.15 |
| 3056 | S | 5H | NYCT | Guap | frag | 11.50 | 0.0103 | 8.51 | 9.05 | 8.15 |
| 3057 | S | 5I | FABA | Pisc | cart | 12.00 | 0.0113 | 8.51 | 0.55 | 5.10 |
| 3058 | S | 5I | VERB | Cith | frut | 12.20 | 0.0116 | 10.0 | 2.90 | 0.50 |
| 3059 | S | 5I | MORA | Ficu | citr | 5.40 | 0.0022 | | 2.70 | 1.05 |
| 3060 | M | 5I | NYCT | Guap | frag | 6.80 | 0.0036 | 7.59 | 2.45 | 0.15 |
| 3061 | M | 5I | NYCT | Guap | frag | 9.30 | 0.0067 | | 2.20 | 9.95 |
| 3062 | M | 5I | NYCT | Guap | frag | 8.90 | 0.0062 | | 2.15 | 0.30 |
| 3063 | S | 5I | CAPP | Capp | ampl | 12.40 | 0.0120 | 8.20 | 1.90 | 0.55 |
| 3064 | S | 5I | RHAM | Krug | ferr | 7.70 | 0.0046 | 8.20 | 5.55 | 2.20 |
| 3065 | S | 5I | CELA | Mayt | elli | 9.00 | 0.0063 | 7.29 | 6.15 | 1.91 |
| 3066 | S | 5I | RHAM | Krug | ferr | 5.30 | 0.0022 | 5.77 | 5.85 | 0.05 |
| 3067 | M | 5I | CELA | Mayt | elli | 5.50 | 0.0023 | | 6.75 | 4.10 |
| 3068 | M | 5I | CELA | Mayt | elli | 9.40 | 0.0069 | | 6.60 | 4.00 |
| 3069 | M | 5I | CELA | Mayt | elli | 7.30 | 0.0041 | | 7.50 | 3.30 |
| 3070 | M | 5I | CELA | Mayt | elli | 13.60 | 0.0145 | 9.72 | 7.40 | 3.20 |
| 3071 | S | 5I | CELA | Mayt | elli | 5.20 | 0.0021 | | 7.55 | 3.10 |
| 3072 | S | 5I | BURS | Burs | sima | 16.30 | 0.0208 | | 9.05 | 3.00 |
| 3073 | S | 5I | BURS | Burs | sima | 7.00 | 0.0038 | 4.55 | 9.00 | 2.40 |
| 3074 | S | 5I | ERYT | Eryt | rotu | 5.10 | 0.0020 | 4.55 | 8.70 | 3.40 |
| 3075 | M | 5I | BORA | Bour | succ | 8.40 | 0.0055 | 6.99 | 6.20 | 4.80 |
| 3076 | M | 5I | BORA | Bour | succ | 7.30 | 0.0041 | | 6.10 | 4.85 |
| 3077 | S | 5I | CAPP | Capp | fron | 5.40 | 0.0022 | | 0.35 | 6.45 |
| 3078 | M | 5I | CELA | Mayt | elli | 13.40 | 0.0141 | | 4.05 | 6.90 |
| 3079 | M | 5I | CELA | Mayt | elli | 8.20 | 0.0052 | | 3.90 | 2.20 |

APPENDIX III. (Continued)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 3080 | M | 5I | CELA | Mayt | elli | 7.40 | 0.0043 | | 4.30 | 7.15 |
| 3081 | M | 5I | CELA | Mayt | elli | 5.80 | 0.0026 | | 4.40 | 7.20 |
| 3082 | S | 5I | BURS | Burs | sima | 17.30 | 0.0235 | | 5.90 | 8.80 |
| 3083 | S | 5I | MYRT | Euge | mont | 9.20 | 0.0066 | | 0.45 | 9.10 |
| 3084 | S | 5I | BURS | Burs | sima | 12.10 | 0.0114 | 8.20 | 7.10 | 6.30 |
| 3085 | S | 5I | CAPP | Capp | cyno | 8.00 | 0.0050 | | 7.25 | 8.00 |
| 3086 | S | 5I | MYRT | Euge | bifl | 5.00 | 0.0019 | 5.16 | 8.70 | 7.55 |
| 3087 | M | 5I | BORA | Bour | succ | 9.40 | 0.0069 | | 7.60 | 9.20 |
| 3088 | M | 5I | BORA | Bour | succ | 18.30 | 0.0263 | 10.0 | 7.50 | 9.10 |
| 3089 | S | 5J | FABA | Pisc | cart | 7.90 | 0.0049 | 8.20 | 0.50 | 4.56 |
| 3090 | S | 5J | MYRT | Euge | mont | 6.40 | 0.0032 | | 0.28 | 4.60 |
| 3091 | S | 5J | BURS | Burs | sima | 18.70 | 0.0274 | | 1.80 | 3.95 |
| 3092 | S | 5J | FABA | Sabi | flor | 7.10 | 0.0039 | 6.38 | 2.00 | 4.15 |
| 3093 | M | 5J | MYRT | Euge | bifl | 6.30 | 0.0031 | 7.59 | 2.70 | 3.80 |
| 3094 | M | 5J | MYRT | Euge | bifl | 6.10 | 0.0029 | | 3.20 | 1.60 |
| 3095 | M | 5J | MYRT | Euge | bifl | 10.10 | 0.0080 | | 3.87 | 1.35 |
| 3096 | M | 5J | MYRT | Euge | bifl | 9.90 | 0.0076 | | 3.85 | 1.25 |
| 3097 | M | 5J | MYRT | Euge | bifl | 6.00 | 0.0028 | | 3.90 | 1.20 |
| 3098 | M | 5J | MYRT | Euge | bifl | 6.00 | 0.0028 | | 3.95 | 1.00 |
| 3099 | M | 5J | MYRT | Euge | bifl | 8.30 | 0.0054 | | 4.05 | 0.90 |
| 3100 | M | 5J | MYRT | Euge | bifl | 7.30 | 0.0041 | | 3.95 | 0.90 |
| 3101 | S | 5J | NYCT | Guap | frag | 14.90 | 0.0174 | 10.6 | 4.25 | 0.80 |
| 3102 | S | 5J | MORA | Ficu | citr | 7.80 | 0.0047 | 6.68 | 4.60 | 4.90 |
| 3103 | S | 5J | RUBI | Guet | scab | 7.50 | 0.0044 | 6.68 | 6.45 | 4.15 |
| 3104 | S | 5J | RUBI | Guet | scab | 5.30 | 0.0022 | | 7.00 | 3.84 |
| 3105 | S | 5J | ERYT | Eryt | rotu | 5.70 | 0.0025 | | 7.40 | 3.71 |
| 3106 | S | 5J | BORA | Bour | succ | 10.20 | 0.0081 | 8.20 | 8.60 | 0.90 |
| 3107 | S | 5J | RUBI | Guet | scab | 7.20 | 0.0040 | 7.90 | 9.70 | 1.00 |
| 3108 | S | 5J | RUBI | Guet | scab | 6.90 | 0.0037 | 8.51 | 9.55 | 2.00 |
| 3109 | S | 5J | SAPO | Mast | foet | 5.40 | 0.0022 | | 9.40 | 3.95 |
| 3110 | S | 5J | SAPO | Mast | foet | 14.10 | 0.0156 | 9.72 | 9.10 | 3.60 |
| 3111 | S | 5J | SAPO | Mast | foet | 13.00 | 0.0132 | | 9.70 | 3.82 |
| 3112 | S | 5J | RUBI | Guet | scab | 8.40 | 0.0055 | 6.68 | 7.10 | 7.02 |
| 3113 | S | 5J | BORA | Bour | succ | 9.40 | 0.0069 | 7.29 | 9.30 | 8.75 |
| 3114 | S | 5J | BORA | Bour | succ | 11.50 | 0.0103 | 6.99 | 8.40 | 9.40 |
| 3115 | S | 5J | MYRT | Euge | bifl | 9.40 | 0.0069 | 10.0 | 8.05 | 9.05 |
| 3116 | S | 5J | MYRT | Euge | bifl | 5.40 | 0.0022 | | 7.95 | 9.15 |
| 3117 | S | 5J | RUBI | Guet | parv | 5.90 | 0.0027 | | 3.85 | 9.80 |
| | | | | | | 1327 | 13.269 | | | |



271

XN-ABA-590-E

# VIRGIN ISLANDS RESOURCE MANAGEMENT COOPERATIVE

BIOSPHERE RESERVE
RESEARCH REPORT NO. 28

## GEOCHEMISTRY OF ST. JOHN AND INFLUENCE ON MARINE SYSTEMS

Carlos R. Ramos-Perez and Cindy Gines-Sanchez
Center for Energy and Environment Research
University of Puerto Rico
San Juan, Puerto Rico

U.S. MAN AND THE BIOSPHERE PROGRAM

Virgin Islands National Park

September, 1988

277

XN-ARH-590-E

# GEOCHEMISTRY OF ST. JOHN AND INFLUENCE ON MARINE SYSTEMS

1988

BIOSPHERE RESERVE REPORT NO. 28

CARLOS R. RAMOS-PEREZ and CINDY GINES-SANCHEZ
TERRESTRIAL ECOLOGY DIVISION
CENTER FOR ENERGY AND ENVIRONMENT RESEARCH
UNIVERSITY OF PUERTO RICO
SAN JUAN, PUERTO RICO

U.S. DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

AND

VIRGIN ISLANDS RESOURCE MANAGEMENT COOPERATIVE
VIRGIN ISLANDS NATIONAL PARK
P.O. BOX 7789, ST. THOMAS
U.S. VIRGIN ISLANDS 00801

LOCAL CONTRACTING AGENT
ISLAND RESOURCES FOUNDATION
RED HOOK BOX 33, ST. THOMAS
U.S. VIRGIN ISLANDS 00802
(NPS CONTRACT NO. CX-0001-3-0048)

272

## ABSTRACT

This study was conducted to determine if three geochemical anomalies in St. John, USVI contribute significant amounts of heavy metals to near shore marine ecosystems. Stream water, sea water, marine sediments, and marine organisms from five watersheds were analyzed for Fe, Mg, Mn, Cu, Cr, Ni, and Zn in order to determine the transport of the metals.

Metal concentrations in stream water were typical of small, unpolluted streams, and only iron exceeded the U.S. Environmental Protection Agency (EPA) water quality standard. Magnesium was transported primarily in the dissolved phase, and iron and manganese were transported in the particulate phase. The streams did not appear to have consistently lower or higher concentrations of the metals, but Coral Bay had markedly higher iron and copper than the other streams.

Annual metal export was estimated for Fish Bay Gut. Mg and Fe were exported in quantities greater than 100 kg; the other metals only rarely exceeded this quantity. There was great variability in annual export rates depending primarily on the magnitude and frequency of rain events.

Sea water samples also had low metal concentrations, but iron and manganese exceeded U.S. EPA water quality standards. There was considerable variability in metal concentrations among the sampling sites.

Marine sediments also had low concentrations and high variability among the samples. Intensive sampling conducted in Fish Bay showed that Mn, Ni, and Fe were horizontally zonated with respect to the discharge point of Fish Bay Gut. The high concentrations found in sediments make this sample type the easiest compartment for heavy metal monitoring.

Snails, crabs, and sea urchins from Fish Bay were analyzed. Snails and crabs appear to be good indicator organisms because the levels of heavy metal present in their tissue is well above the detection limit of the standard analytical techniques.

The geochemical anomalies do not pose a serious threat to the marine ecosystems of St. John island.




214

ACKNOWLEDGEMENTS

We would like to express our gratitude to Mr. Gary Owen of the Caribbean Research Institute for his help during the critical moments. Additional field support was provided by Mrs. Kristen Canoy and her assistants, Vincent and George, of the Virgin Island Environmental Research Station at St. John.

We would also like to thank our friends and colleagues at the Center for Energy and Environment Research (CEER), Lourdes Prieto, Iván Rosa, and Ileana Mejía for their valuable help during this project.

Partial funding for this project was provided by the University of Puerto Rico.

TABLE OF CONTENTS

Abstract.....i

Acknowledgements.....ii

Table of Contents.....iii

List of Tables.....iv

List of Figures.....v

Introduction.....1
    Source.....1
    Transport.....4
    Biotoxicity.....5
    Objectives.....6

Materials and Methods.....6
    Analytical.....7
    Stream Water Samples.....8
    Sea Water Samples.....8
    Marine Sediments.....10
    Marine Organisms.....10

Results.....11
    Export from the Terrestrial Environment.....11
    Heavy Metals in Marine Near-Shore Environments.....18

Conclusions.....28
    Research and Management Recommendations.....29

Literature Cited.....31



276

LIST OF TABLES

1a. Heavy metals in St. John streams.....12

1b. Heavy metals in St. John streams.....13

2. Heavy metal export estimate for Fish Bay, St. John.....18

3. Heavy metal concentrations in the coastal waters of St. John.....19

4. Average heavy metal content of surface coastal waters.....20

5. Leachable metals in sediment core samples from St. John island.....21

6. Leachable metals in sediment core samples from Fish Bay, St. John island.....22

7. Heavy metal content of surface near-shore sediments.....23

8. Heavy metal content of some marine invertebrates in Fish Bay, St. John.....27

LIST OF FIGURES

1. Geology of St. John.....2

2. Metal-rich geological anomalies of St. John.....3

3. Sampling stations.....9

4. Heavy metal concentrations in St. John streams.....14

5. Relationship between precipitation and streamflow for Guinea Gut, St. John.....16

6a. Leachable metals in sediment cores from Fish Bay, St. John.....24

6b. Leachable metals in sediment cores from Fish Bay, St. John.....25

6c. Leachable metals in sediment cores from Fish Bay, St. John.....26

## INTRODUCTION

On a geological time scale, bedrock weathering and tectonic activities have been the largest sources of trace metals entering surface waters (Williams, et al. 1974). These natural inputs may lead to environmental concentrations of trace metals comparable to those produced by anthropogenic pollution. Miller et al. (1982) found dissolved copper concentrations of 4100 and 1300 ug/l in streams overlying or peripheral to large copper deposits, whereas concentrations ranged from 0.8 to 2.6 ug/l in nearby control areas.

A recent study by the US Geological Survey identified several metal deposits in St. John, US Virgin Islands (Tucker, et al. 1985). Researchers discovered anomalously high concentrations of copper, lead, iron, barium, bismuth, and tin. These metals were not restricted to the bedrock, but were also detected in high concentrations in the nearby soils and stream sediments. This geochemical data suggests that bedrock-bound metals are entering the aquatic environment, where they may pose a potential threat to the biota. This study was conducted to provide additional information concerning the potential impact of these heavy metals on marine ecosystems.

### Source

St. John's geology was described by Donelly (1957). The Water Island formation, which crops out along the southern slopes, is composed chiefly of keratophyre flows and tuffs (Figure 1). Also of volcanic origin, the Louisenhoj formation overlies the Water Island formation and is composed of augite andesite breccias and tuffs with intercalated conglomerates. The Outer Brass Limestone overlies the Louisenhoj formation and is thin-bedded, silicified limestone. The Tutu formation is coarse volcanic wacke, composed almost entirely of weathered debris from the Louisenhoj formation.

Tucker, et al. (1985) concluded that these formations were not the principal source of the metals. Instead they identified three geological anomalies which they believe to be the source of the metals (Figure 2). They postulate that these anomalies were formed by the emplacement of intrusive bodies of molten lava which flowed through the existing bedrock. The anomalies are metal rich and are characterized by the presence of iron enrichment, copper minerals, alunite, and gossan.



279

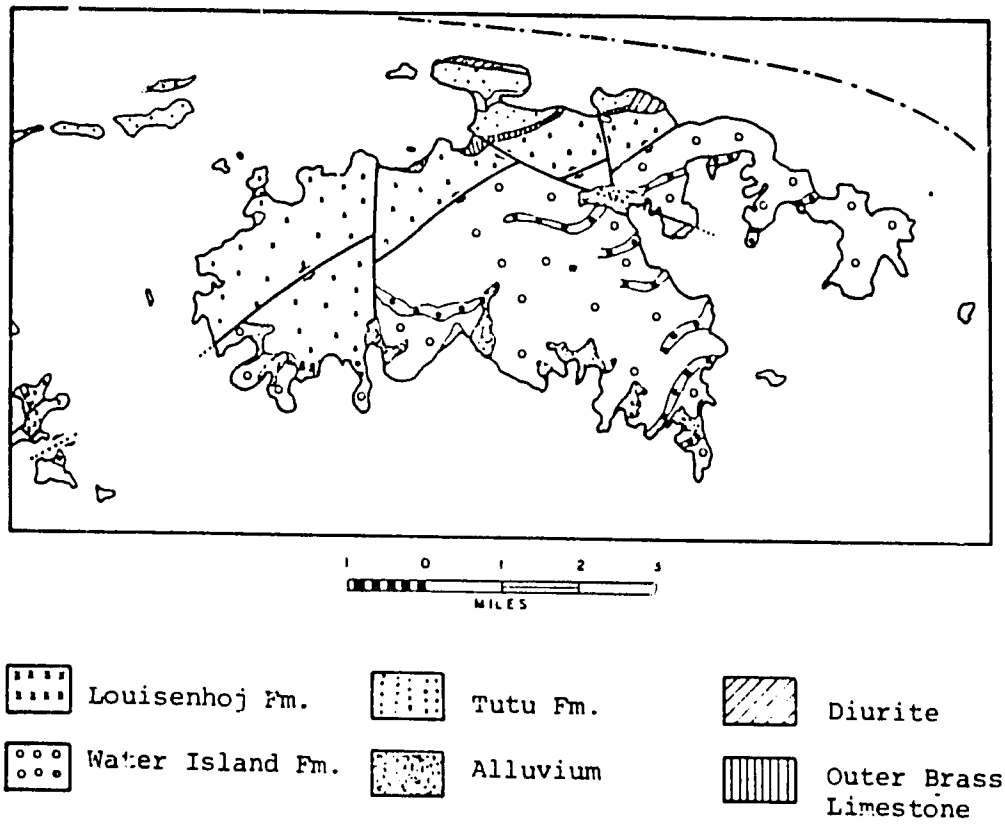



Figure 1. Geology of St. John. Adapted from Donelly (1957).



280

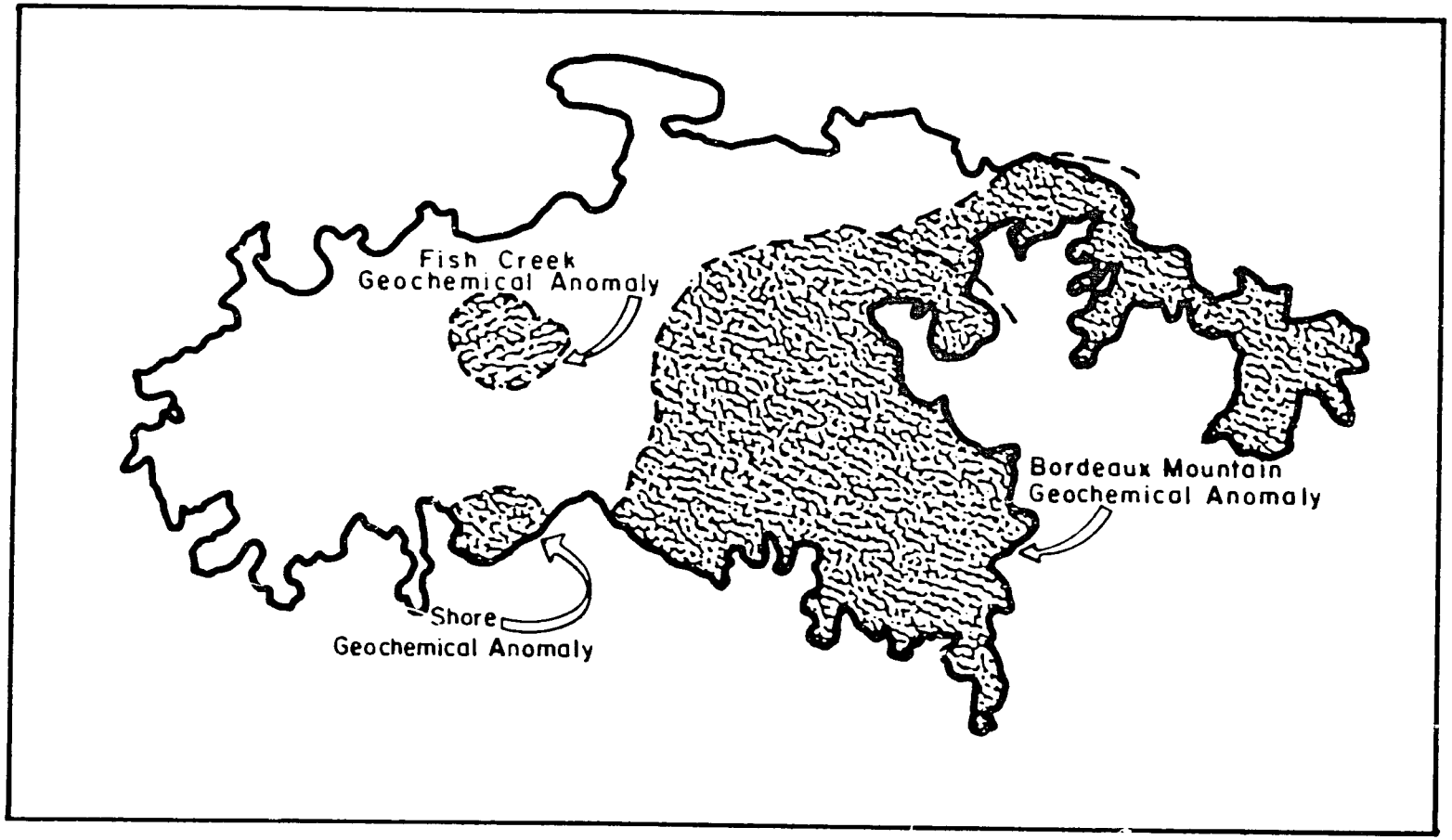



Figure 2. Metal-rich geological anomalies of St. John. Adapted from Tucker, et al. (1985).

The largest anomaly is centered around Bordeaux Mountain and extends from the crest of the mountain to the sea. The authors suggest that a large body of magma flowed through the already deposited bedrock. This anomaly contains intensely argillized areas and nearly vertical iron oxide veins. Many of the streams draining the area contain sediments high in Ag, Bi, Sb, Ba, Cu, and Pb. The second largest anomaly is centered around Fish Bay Creek and is also characterized by high concentrations of Ag, Bi, Sb, Ba, Cu, Pb, and Se in a small area. This anomaly may have been caused by a small metalization zone, possibly related to a geological fault. The third anomaly, the Shore anomaly, is characterized by gossan and intrusive rock containing pyrite.

## Transport

Trace metals are affected by various factors as they are transported through streams, lakes, and estuaries on their way to the sea. Metals in stream or sea water may be either dissolved or associated with suspended solids (generally by adsorption). Equilibrium conditions exist between the two phases depending on parameters such as pH, oxidation reduction potential, salinity, and concentration of suspended solids (Williams, et al. 1974, Salomons 1985, Santschi 1984).

Sediments are by far the largest depository of metals transported by streams and sea water. Santschi, et al. (1984) calculated that 50 to 100% of the cadmium and lead entering Narragansett Bay became incorporated, at least temporarily, into the sediments. This retention of metals makes sediments an ideal indicator of pollution.

Of the trace metals associated with sediments, only a small fraction is released to the water column (Hunt 1983). These metals have been incorporated into the sediments by adsorption or complexation and do not form a part of the chemical lattice of the sediment particles (Chester and Voutsinou 1981, Gupta and Chen 1975). These so-called non-residual metals represent a small fraction of the total metal content of the sediments (Salomons 1985).

Transport in St. John: Of the factors that could potentially affect the transport of the bedrock-bound metals through the environment, St. John's climate and hydrology are most important. St. John receives very little rainfall, and drought conditions exist 66% of the time (BC&E 1979). The highest rainfall occurs from August to November (Cosner 1972), but seasonal cycles of



252

precipitation are hard to establish due to the annual variability (Bowden, et al. 1970).

Although St. John receives an average of 44 inches of rain annually, only 1 inch (2.3%) becomes streamflow (Cosner 1972). The net result is that the island's streams are intermittent, with long periods between flows. Bowden, et al. (1970) reported that in Charlotte Amalie, stream flow occurred in only 14 occasions in a ten-year period (1958 to 1968). These few periods of runoff were generally short lived and characterized by high flows.

The antecedent moisture conditions are very important in determining the amount of stream flow produced by a storm event. Cosner (1972) estimated that only 0.1% of rainfall became runoff when preceded by drought conditions, and 15.1% when preceded by heavy rain.

Several other factors could affect the transport of metals through the environment. Soils are clayey and range from shallow to moderately steep (Rivera, et al. 1970). More than 84% of the island has slopes greater than 30% (BC&E 1979). The combination of easily transported clayey soils and steep topography tends to accelerate soil loss, which also accelerates the loss of soil-bound metals. Fortunately, a land-use survey conducted in 1975 concluded that nearly 88% of the island was forested (BC&E 1979), which diminishes soil loss.

## Biotoxicity

Trace metals are toxic to the marine organism above an availability threshold, but many are essential to metabolism at lower concentrations. The toxicity of heavy metals to marine biota will depend on chemical characteristics and on availability (Rainbow 1985, Louma 1983).

Results from several studies suggest that, for many species, there is a direct relationship between exposure to heavy metals and uptake (Bryan 1976). Uptake from solution is the major source of metals for most organisms since the bulk of the metals ingested passed through unassimilated (Pentreath 1973, Sick and Baptist 1979). The availability of free ions (a very small fraction of the total dissolved concentration) appears to control metal uptake from solution (Sunda and Guillard 1976, Anderson and Morel 1982). However, studies with deposit feeding organisms such as clams (Fowler and Unlu 1978) have found significant bioaccumulation from the ingestion of sediments. These metals are either maintained in a metabolically available

form which may have toxic effects, or they may be detoxified.

The negative effects of elevated concentrations of heavy metals to marine organisms have been well documented by the use of "in vitro" tests (Louma 1983). However, the result of these laboratory toxicity tests may lead to false or misleading conclusions because the conditions of the assay do not necessarily reflect the physiochemical conditions of the natural ("in vivo") environment. Field studies such as the one conducted by Rygg (1986) have shown that elevated metal concentrations can adversely affect marine communities. Rygg found a significant negative relationship between species diversity in benthic communities and sediment concentrations of heavy metals, especially copper.

The consequences of gross heavy metal pollution in estuarine and marine environments have been frequently observed, but the detection of subtle or gradual ecological effects is difficult. Therefore, the environmental consequences of chronic metal contamination have probably gone largely unnoticed.

## Objectives

This study was conducted to provide additional information concerning the potential heavy metal contamination in St. John by accomplishing the following tasks:

1. Measuring heavy metals in stream water, sea water, and marine sediments;

2. Estimating heavy metal export to marine ecosystems; and

3. Measuring heavy metal concentrations in marine organisms and estimating bioaccumulation.

# MATERIALS AND METHODS

Samples were collected from several locations in St. John. Stream water, sea water, and marine sediments were taken in Fish Bay, Reef Bay, Little Lameshur Bay, Great Lameshur Bay, and Coral Bay. All sampling sites were located in watersheds draining the geochemical anomalies, and stream sediments had moderate to high concentrations of

trace metals (Tucker, et al. 1985). Most streams were located in undisturbed watersheds, but the Fish Bay and Coral Bay Guts had significant residential development upstream from the sampling sites.

More intensive sampling was conducted in Fish Bay because of strong development pressures in the area. At the time the samplings were conducted, several houses and roads were being constructed. These activities resulted in considerable soil movement to the stream channel. The location of the stream channel had recently been altered by the developers, thereby changing water movement through the mangroves.

Fish Bay's coastal zone has remained largely unaltered. A fringe of red mangrove borders the eastern half of the bay, and a rock outcrop borders the western half. Until recently, Fish Bay Gut drained into the bay at a small channel cut into the mangrove; the current discharge point is difficult to locate because the stream had not yet formed a well defined channel. The old drainage channel was used as the reference point for sample collection. Bottom sediments were uncompacted and deep. There were few rooted algae covering the bay floor, which made sediments highly susceptible to resuspension. Turbidity in the inner bay was very high, and visibility was often less than 2 feet. Aside from several sharks, there was low observable quantity and diversity of fish in the Bay.

## Analytical

Trace metal concentrations were determined using an atomic absorption spectrophotometer (Perkin Elmer 2380) equipped with a deuterium lamp background corrector. Iron and magnesium were determined by direct aspiration; total chromium, copper, manganese, nickel and zinc were determined using a Perkin Elmer graphite furnace model HGA 400.

Since metal concentrations were expected to be very low, extreme care was taken to avoid contaminating the samples during sampling and processing. All samples for metal analysis were taken in 1 liter polyethylene bottles soaked for 24 hours in 50% nitric acid and rinsed with distilled, deionized water. Furthermore, samples were processed in CEER laboratories in laminar flow hoods. Acids used to digest the samples or to acidify them were either Ultrex$^R$ nitric acid or Intra-analyzed$^R$ hydrochloric acid. Blanks were analyzed for the different digestion techniques.



185

A rigorous quality control program in accordance with US EPA protocol was run with the samples to ensure the reliability of the results (EPA 1979, EPA 1983). This program included the use of blanks, duplicate and replicate analyses, standard additions, and US EPA unknowns.

## Stream Water Samples

Samples from the Fish Bay (2 locations), Little Lameshur Bay, Great Lameshur Bay, Bordeaux, and Coral Bay Guts (Figure 3) were analyzed for dissolved and total metals. All samples were taken 3 meters upstream from the point where the stream intersects a road except for Little Lameshur Bay Gut, where the sample was taken at the intersection with Reef Bay trail. The Great Lameshur Bay Gut samples were taken 50 meters upstream from the Virgin Islands Environmental Research Station field station.

Samples were stored at 4 $^{o}C$ and processed within 48 hours. For the dissolved metal analysis, an aliquot was filtered through a prewashed 0.45 um membrane (Millipore HAWP) and acidified with concentrated nitric acid. The unfiltered portion of the sample was also acidified with concentrated nitric acid for the determination of total metals. Samples for total metals were digested using the hot concentrated nitric acid technique (EPA 1983). Particulate metals were defined as the difference between dissolved and total metals.

Samples for the determination of total suspended solids (TSS) were collected at the same time that samples for heavy metals were taken. TSS were determined gravimetrically using the glass fiber filtration technique (APHA 1980).

## Sea Water Samples

Sea water samples were collected just off shore and 15 meters off shore from the gut outlets in Reef Bay, Little Lameshur Bay, Great Lameshur Bay, and Coral Bay (Figure 3). More intensive sampling was conducted in Fish Bay. When the samples were taken, there was no stream inflow. In order to minimize contamination, samples were collected by hand from a slow-moving fiberglass boat or by diving. Concentrated nitric acid and storage at 4 $^{o}C$ were used to preserve the samples prior to analysis.

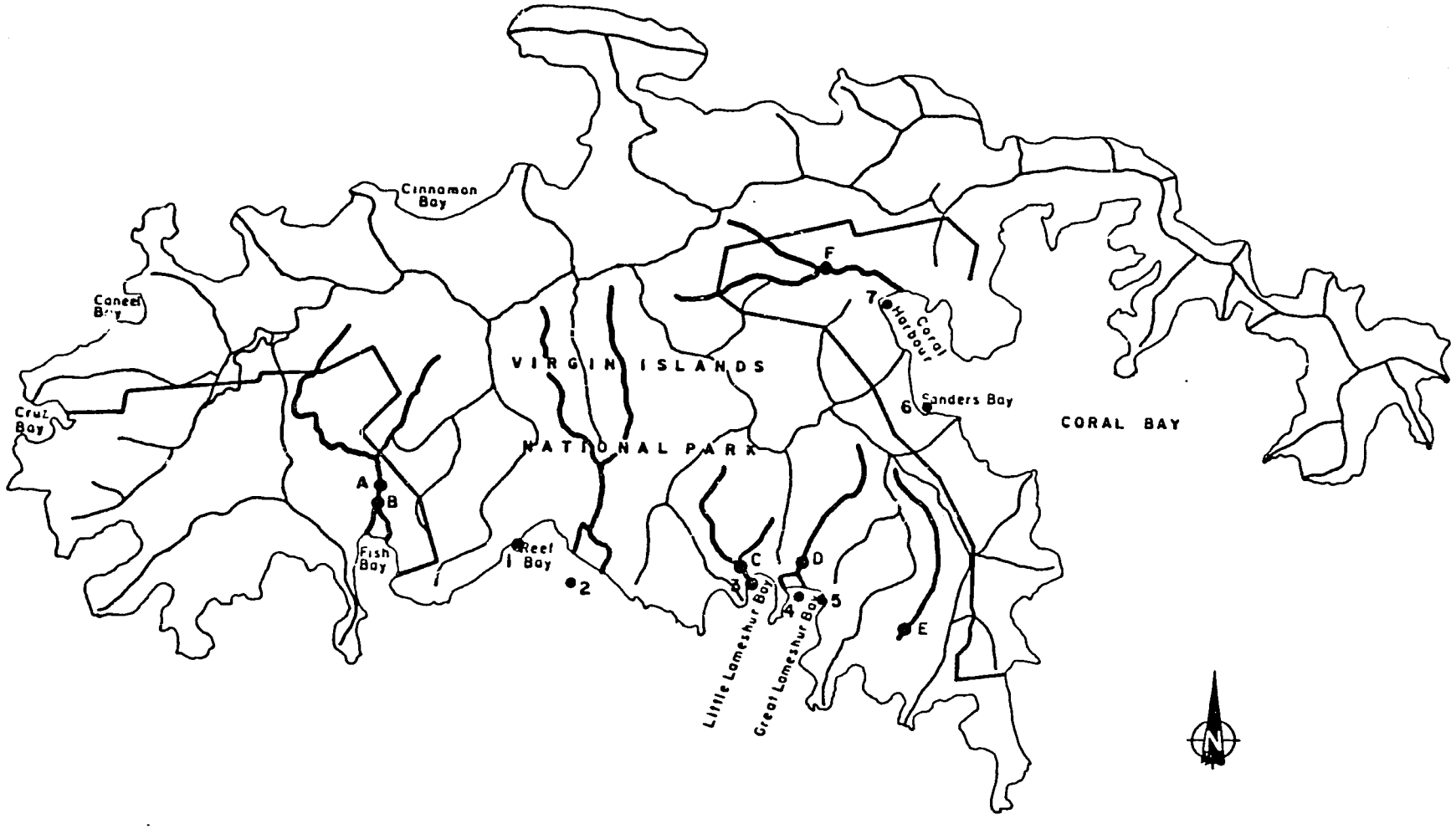



Figure 3. Sampling stations. Letters A to F indicate stream sites. Numbers 1 to 7 indicate sea water and sediment sites.

Samples were digested for the determination of total metals with the addition of 5 ml of 6N hydrochloric acid per 50 ml and heating (Brooks, et al. 1967). Iron, copper, manganese, and zinc were determined by direct aspiration (Sturgeon, et al. 1980).

## Marine Sediments

Surface sediments were collected wherever sea water samples were taken (Figure 3), except in Fish Bay (Figure 6a). Sediments were obtained while diving using acid-washed plastic cores (15.2 cm long x 5.1 cm diameter).

The sediment samples were digested using the hydrochloric acid stripping method described in Wood and Acosta Cintrón (1976). Sediment cores were dried at 120 °C for 7 days. The samples were then sieved and weighed in duplicates. 175 ml of 50% hydrochloric acid was added to each sample, which was allowed to stand for 24 hours. The supernatant was decanted, and another 125 ml of acid was added. After an hour, the supernatant was decanted, and the sample was rinsed 3 times with distilled, deionized water. The digestate was taken to a final volume of 500 ml, and an aliquot was centrifuged at 3000 rpm for 5 minutes. The digestates were diluted for the determination of metals.

## Marine Organisms

Invertebrates (sea urchins, crabs and snails) were caught in Fish Bay by hand and stored frozen. The crabs and snails were associated with mangroves, where they live in the roots and trunks of the trees. The sea urchins were found on a flat at the mouth of the gut. Fish traps using lettuce as bait were set up within the bay, but no fish were captured.

Soft tissues (e.g. liver, kidneys, and heart) were removed by dissection from the crabs and sea urchins; total body tissues were used for the snails. The dry ashing technique described in AOAC (1980) was used to digest the tissues. Tissue samples were oven dried at 120 °C for 24 hours and placed in a muffle furnace for 6 hours at 500 °C. 50% hydrochloric acid was added to the cool, carbon-free residue, which was then warmed for 4 hours or until the sample dissolved. The solution was later transferred to a 50 ml volumetric flask and an aliquot was centrifuged and filtered through a pre-washed 0.45 um membrane.

## RESULTS

### Export from the Terrestrial Environment

Heavy Metals in Stream Water: Dissolved, particulate, and total metal concentrations in stream water appear in Tables 1a and 1b. Only iron and magnesium were found in concentrations higher than 100 ug/l; manganese, copper, zinc, nickel, and total chromium content was low in all samples. Concentrations of dissolved and particulate iron varied considerably among the samples. Particulate iron concentrations, which ranged from <120 to 8,200 ug/l, were higher than dissolved concentrations, which ranged from <120 to 804 ug/l. The highest metal concentrations found in this study were dissolved magnesium, which ranged from 3,130 to 11,320 ug/l. In some cases, all of the magnesium was in the dissolved phase, and particulate concentrations were below the detection limit of 400 ug/l. None of the samples contained measurable dissolved manganese, but most contained detectable particulate manganese, which ranged from <5 to 61 ug/l. Dissolved copper concentrations were lower than 15 ug/l, and only one sample exceeded that value for particulate copper. Concentrations of zinc, nickel, and chromium were generally below the limit of detection for this study.

These values are typical of small, uncontaminated streams. They also agree with previous samplings conducted by the US Geological Survey in St. John (Robison, et al. 1973). From 1962 to 1966, the dissolved metal concentrations for Guinea Gut were: iron <10-100 ug/l, manganese <10 ug/l, and magnesium 48,000-85,000 ug/l. The large discrepancy in the magnesium values might be due to differences in land use or metal content of the bedrock. Most of the metals were below the water quality standards set by US EPA for stream water. Total copper, zinc, and chromium concentrations were much lower than the respective standards of 40, 50, and 50 ug/l. On the other hand, 17 of the 19 samples exceeded the total iron standard of 300 ug/l.

Magnesium was the only metal transported primarily in the dissolved phase (Figure 4). Iron and manganese concentrations were much higher in the particulate phase than in the dissolved phase, suggesting that transport occurred primarily associated with suspended particles. In the case of manganese, all of the detectable metal was exported in the particulate phase. Copper transport was not dominated by one phase.

Table 1a. Heavy metals in St. John streams. All concentrations are expressed in ug/l and are broken down into dissolved (D), particulate (P), and total (T) metals. TSS refers to total suspended solids.

| SITE | DATE 1987 | STREAM DISCHARGE | TSS (mg/L) | Iron D | Iron P | Iron T | Magnesium D | Magnesium P | Magnesium T | Manganese D | Manganese P | Manganese T | Copper D | Copper P | Copper T |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Coral Bay Gut | 5-8 | LOW | 13.70 | <120 | 3,490 | 3,610 | 4,890 | 580 | 5,470 | <5 | 26 | 31 | 8 | 11 | 19 |
| Coral Bay Gut | 5-14 | LOW | 8.54 | 237 | 1,693 | 1,930 | 5,410 | <400 | 5,600 | <5 | 7 | 12 | 8 | 3 | 11 |
| Coral Bay Gut | 5-18 | HIGH | 124.00 | 142 | 8,218 | 8,360 | 3,450 | 1,470 | 4,920 | <5 | 61 | 66 | 11 | 23 | 34 |
| Bordeaux Mtn. Gut | 5-8 | LOW | 5.92 | 124 | <120 | 165 | 7,380 | <400 | 7,380 | <5 | <5 | <5 | 4 | 2 | 6 |
| Bordeaux Mtn. Gut | 5-14 | LOW | 5.73 | 804 | 516 | 1,320 | 7,260 | <400 | 7,260 | <5 | 8 | 13 | 5 | 3 | 8 |
| Bordeaux Mtn. Gut | 5-18 | HIGH | 28.86 | 331 | 709 | 1,040 | 4,910 | <400 | 5,190 | <5 | 16 | 21 | 4 | 3 | 7 |
| Little Lameshur Bay Gut | 5-8 | LOW | 1.07 | 208 | 1,962 | 2,170 | 7,750 | <400 | 7,750 | <5 | <5 | 8 | 6 | <2 | 7 |
| Little Lameshur Bay Gut | 5-14 | LOW | 3.00 | | | 804 | | | 7,600 | | | 7 | | | 4 |
| Little Lameshur Bay Gut | 5-18 | HIGH | 7.35 | 198 | 2,192 | 2,390 | 3,450 | 1,510 | 4,960 | <5 | 34 | 39 | <2 | 8 | 10 |
| Greater Lameshur Bay Gut | 5-19 | HIGH | | 124 | <120 | 236 | 8,370 | <400 | 8,370 | <5 | 48 | 53 | 5 | <2 | 5 |
| Fish Bay Bridge | 5-7 | 0.62 | 37.71 | 149 | 1,121 | 1,270 | 10,680 | 440 | 11,120 | <5 | 24 | 29 | 5 | 3 | 8 |
| Fish Bay Bridge | 5-7 | 0.64 | 3.73 | 124 | 6,206 | 6,330 | 8,540 | 630 | 9,170 | <5 | 44 | 49 | 14 | 3 | 17 |
| Fish Bay Bridge | 5-8 | 0.58 | | 503 | <120 | 552 | 10,490 | <400 | 10,490 | <5 | <5 | 6 | 7 | 15 | 22 |
| Fish Bay Bridge | 5-14 | 0.74 | | <120 | 1,640 | 1,760 | 6,780 | 2,880 | 9,660 | <5 | 40 | 45 | <2 | 5 | 7 |
| Fish Bay Bridge | 5-16 | 0.62 | 7.44 | 198 | 606 | 804 | 6,260 | 3,020 | 9,280 | <5 | <5 | 10 | <2 | 6 | 8 |
| Fish Bay Bridge | 5-18 | 2.28 | 37.80 | <120 | 3,870 | 3,990 | 3,130 | 2,740 | 5,870 | <5 | 45 | 50 | <2 | 10 | 12 |
| Fish Bay Pond | 5-8 | LOW | 2.40 | <120 | 262 | 382 | 11,320 | 430 | 11,750 | <5 | <5 | 7 | 5 | 2 | 7 |
| Fish Bay Pond | 5-14 | LOW | | 124 | 2,786 | 2,910 | 8,010 | 5,830 | 13,840 | <5 | 41 | 46 | <2 | 14 | 16 |
| Fish Bay Pond | 5-16 | LOW | 6.33 | <120 | 660 | 780 | 8,900 | <400 | 9,150 | <5 | 6 | 11 | 5 | 2 | 7 |
| | | | | DETECTION LIMIT=120 | | | DETECTION LIMIT=400 | | | DETECTION LIMIT=5 | | | DETECTION LIMIT=2 | | |

Table 1b. Heavy metals in St. John streams. All concentrations are expressed in ug/l and are broken down into dissolved (D), particulate (P), and total (T) metals.

| SITE | DATE 1987 | STREAM DISCHARGE | Zinc D | Zinc P | Zinc T | Nickel D | Nickel P | Nickel T | Chromium D | Chromium P | Chromium T |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Coral Bay Gut | 5-8 | LOW | <5 | <5 | 9 | <5 | <5 | <5 | <3 | 12 | 15 |
| Coral Bay Gut | 5-14 | LOW | <5 | <5 | <5 | <5 | <5 | <5 | <3 | <3 | <3 |
| Coral Bay Gut | 5-18 | HIGH | 8 | 8 | 16 | <5 | 6 | 11 | <3 | <3 | 6 |
| Bordeaux Mtn. Gut | 5-8 | LOW | <5 | <5 | <5 | <5 | <5 | <5 | <3 | <3 | <3 |
| Bordeaux Mtn. Gut | 5-14 | LOW | <5 | <5 | <5 | <5 | <5 | <5 | <3 | <3 | 4 |
| Bordeaux Mtn. Gut | 5-18 | HIGH | <5 | <5 | <5 | <5 | <5 | <5 | <3 | <3 | 4 |
| Little Lameshur Bay Gut | 5-8 | LOW | <5 | <5 | <5 | <5 | <5 | <5 | <3 | <3 | 6 |
| Little Lameshur Bay Gut | 5-14 | LOW | | | <5 | | | <5 | | | <3 |
| Little Lameshur Bay Gut | 5-18 | HIGH | 6 | 8 | 14 | <5 | <5 | 6 | <3 | <3 | 6 |
| Greater Lameshur Bay Gut | 5-19 | HIGH | <5 | <5 | <5 | <5 | <5 | <5 | <3 | <3 | <3 |
| Fish Bay Bridge | 5-7 | 0.62 | <5 | <5 | <5 | <5 | <5 | <5 | <3 | <3 | 5 |
| Fish Bay Bridge | 5-7 | 0.64 | <5 | <5 | 7 | <5 | <5 | <5 | <3 | 7 | 10 |
| Fish Bay Bridge | 5-8 | 0.58 | <5 | <5 | <5 | <5 | <5 | <5 | <3 | <3 | 4 |
| Fish Bay Bridge | 5-14 | 0.74 | <5 | <5 | <5 | <5 | <5 | <5 | <3 | 4 | 7 |
| Fish Bay Bridge | 5-16 | 0.62 | <5 | <5 | <5 | <5 | <5 | <5 | <3 | <3 | 3 |
| Fish Bay Bridge | 5-18 | 2.28 | <5 | <5 | <5 | <5 | <5 | 6 | <3 | <3 | 6 |
| Fish Bay Pond | 5-8 | LOW | <5 | <5 | <5 | <5 | <5 | <5 | <3 | <3 | 4 |
| Fish Bay Pond | 5-14 | LOW | <5 | <5 | <5 | <5 | <5 | 8 | <3 | 5 | 8 |
| Fish Bay Pond | 5-16 | LOW | <5 | <5 | <5 | <5 | <5 | <5 | <3 | <3 | 6 |
| | | | DETECTION LIMIT=5 | | | DETECTION LIMIT=5 | | | DETECTION LIMIT=3 | | |

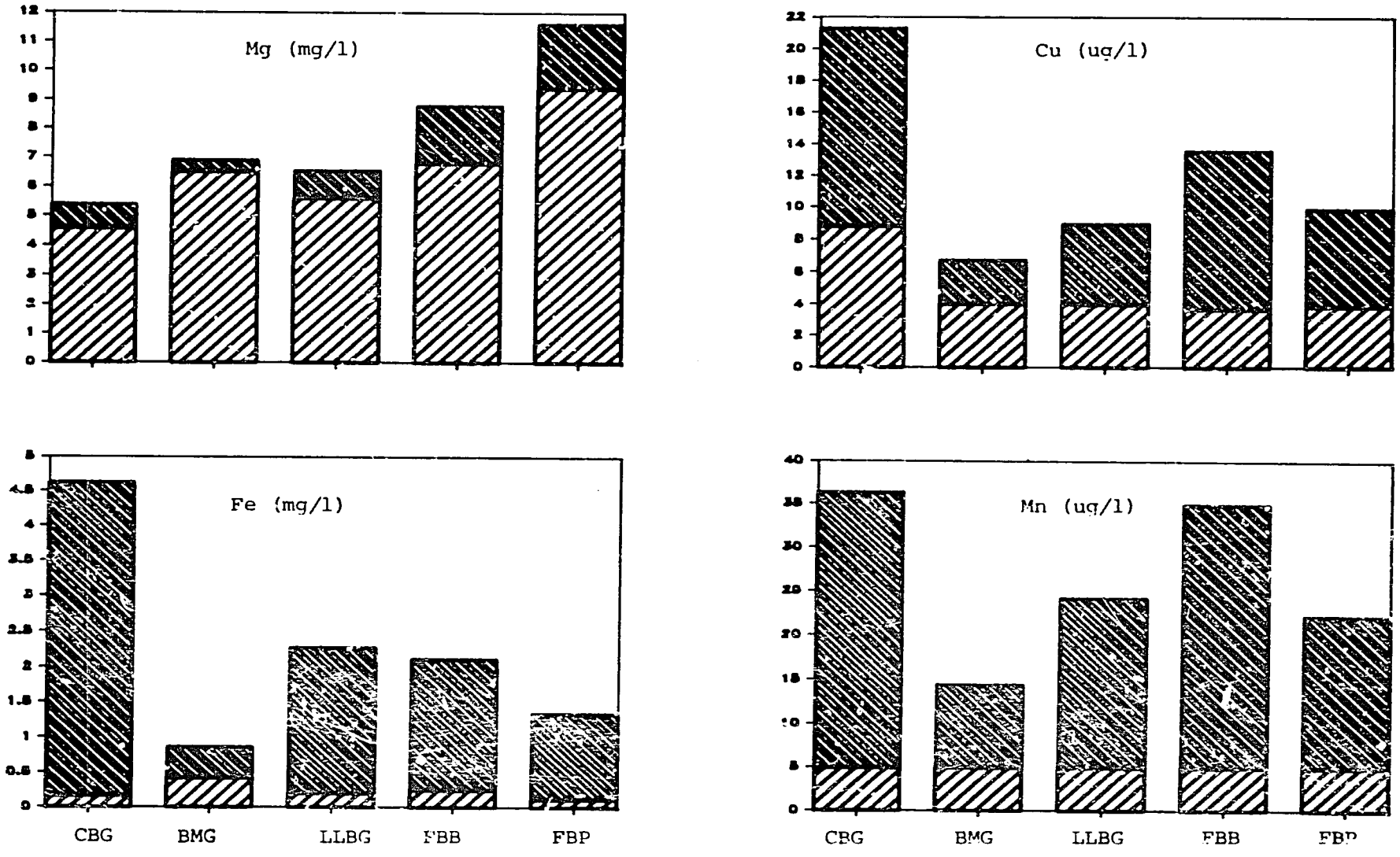



Figure 4. Heavy metal concentrations in St. John streams. Average dissolved (▨) and suspended (▩) concentrations were calculated for common sampling dates (5-8, 5-14, and 5-18). Sampling stations were: Coral Bay Gut (CBG), Bordeaux Mountain Gut (BMG), Little Lameshur Bay Gut (LLBG), and Fish Bay Gut at the bridge (FBB), and at the permanent pond (FBP).

The small number of samples taken in each gut makes it difficult to determine relationships between stream flow, suspended solids, and metal transport, but some generalizations can be made. Magnesium concentrations decreased with increasing discharge, and manganese content increased. The other metals showed no marked relationship between flow rate and metal concentration. Total suspended solids (TSS) were also higher at high flows than at low flows. TSS were positively correlated with particulate copper, manganese, and, to a lesser extent, iron ($r^2$= 0.854, 0.713, and 0.678, respectively). Particulate manganese and copper were also correlated with particulate iron ($r^2$=0.843 and 0.592, respectively).

In order to compare the heavy metal content of the guts, averages were calculated for the three sampling dates on which all guts were sampled (Figure 4). These averages showed considerable variation, which could be due to differences in metal content of the bedrock and in land use within the watershed. None of the guts appeared to have consistently lower or higher concentrations of magnesium, iron, copper, total chromium, or manganese. However, Coral Bay Gut had markedly higher copper and iron content than the other guts.

Export Estimate: In order to estimate heavy metal export from the Fish Bay watershed, the stream water heavy metal results were combined with estimated stream flow values. Since the Fish Bay watershed is ungaged, data from Guinea Gut were used to test the validity of hydrological models. Stream flow data for the Guinea Gut station were obtained from Cosner (1972), Curtis, et al. (1983 and 1984), and US Geological Survey preliminary data. Precipitation data were obtained from two sources: from 1963 to 1966, from the Guinea Gut watershed (Cosner 1972), and from 1983 to 1985, from the Coral Bay watershed (NOAA 1983, 1984, and 1985).

The Guinea Gut watershed data showed that export calculations should be based on annual stream runoff rather than individual storm events. The relationship between precipitation and stream runoff for individual storms was very poor (Figure 5). This great variability in the amount of runoff produced by storms of similar magnitude was probably due to the influence of antecedent weather conditions in the watershed (Cosner 1972). If a storm was preceded by drought conditions, evapotranspiration could account for almost 100% of storm waters, and stream flow would be nearly 0. Therefore, the export estimates were based on annual streamflow and precipitation, which are significantly correlated (Figure 5).



292

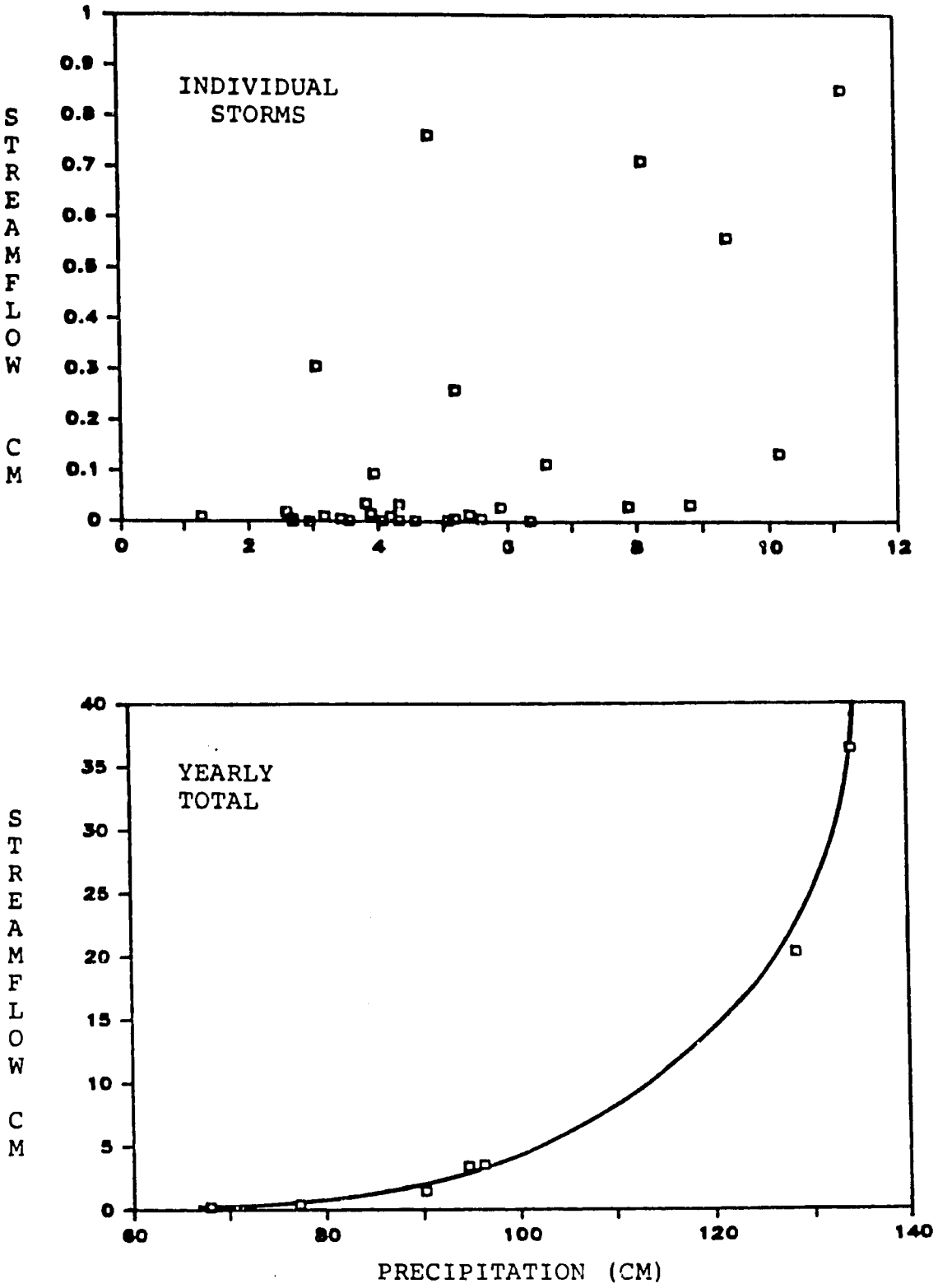



Figure 5. Relationship between precipitation and streamflow for Guinea Gut, St. John.

The next step in the calculation was to extrapolate the precipitation/runoff relationship from Guinea Gut to the Fish Bay watershed by adjusting the runoff data for the drainage area of the two watersheds (0.37 and 1.77 $mi^2$, respectively; Cosner 1972). Due to the sparsity of hydrological information for St. John, this manipulation represents the best estimate of runoff in Fish Bay. However, Jordan (1972) hypothesized that runoff from the major watersheds of St. John was not directly proportional to the drainage area.

The annual runoff data can be subdivided into two groups (Table 2). In some years (1964, 1966, 1983, and 1985), storm events greater than 2.6 cm (approximately 1 inch) accounted for less than 20% of yearly runoff. Most metal export in these years probably occurred over a long period of time and during base flow conditions. However, in other years (1963, 1965, and 1984), storm events greater than 2.6 cm accounted for more than 65% of yearly runoff. Most metal export in these years probably occurred at high stream flows and over a relatively short period of time. Therefore, the runoff data were divided into "base flow" and "storm flow" years, and the estimated annual runoff values for Fish Bay were multiplied by the average total metal concentrations in Fish Bay Gut during low flow conditions (5-7 to 5-16), and high flow conditions (5-18), respectively (Table 1a and 1b). Generally, there was little difference between the high flow and low flow metal concentrations, probably due to the small number of stream water samples analyzed.

There was great variability in the annual metal export (Table 2). Each year, only iron and magnesium were exported in quantities greater than 100 kg and exceeded 1,000 kg several years. The other metals only rarely exceeded 100 kg. Since zinc and nickel concentrations were generally below the detection limit, the values presented in Table 2 represent the greatest possible export (based on the results of this study). These values are comparable to export calculations made by Hart, et al. (1982) for an Australian stream.

It is very probable that only a fraction of the metals exported by a stream find their way to the near shore marine ecosystems. Many of the island's streams do not drain directly into the sea. Mangroves and salt ponds may act as heavy metal sinks by accumulating metal-rich sediments.

Table 2. Heavy metal export estimate for Fish Bay, St. John.

### A. Hydrological data for Guinea Gut:

| Year | Rainfall (cm) | Runoff (cm) | Number of Rain Storms <2.6 cm Per Year | % Yearly Runoff Accounted for by Storms <2.6 cm |
|---|---|---|---|---|
| 1964 | 68.1 | 0.23 | 1 | 1 |
| 1966 | 77.2 | 0.43 | 5 | 17 |
| 1983 | 134.3 | 36.40 | 9 | 12 |
| 1985 | 94.6 | 3.43 | 3 | 2 |
| | | | | |
| 1963 | 90.2 | 1.47 | 5 | 66 |
| 1965 | 96.3 | 3.56 | 7 | 93 |
| 1984 | 128.4 | 20.35 | 6 | 99 |

### B. Metal Export Estimates for Fish Bay Gut:

| Year | Runoff (L X 10^6) | Fe (kg) | Mg (kg) | Mn (kg) | Cu (kg) | Ni (kg) | Cr (kg) |
|---|---|---|---|---|---|---|---|
| 1964 | 72 | 154 | 715 | 2.00 | 0.89 | <0.36 | 0.42 |
| 1966 | 136 | 291 | 1,351 | 3.78 | 1.68 | <0.68 | 0.79 |
| 1983 | 11,456 | 24,552 | 113,918 | 318.91 | 141.21 | <57.28 | 66.44 |
| 1985 | 1,079 | 2,313 | 10,732 | 30.04 | 13.30 | <5.40 | 6.26 |
| | | | | | | | |
| 1963 | 464 | 1,850 | 2,722 | 23.25 | 5.52 | 2.78 | 2.78 |
| 1965 | 1,119 | 4,466 | 6,570 | 56.11 | 13.32 | 6.72 | 6.72 |
| 1984 | 6,404 | 25,550 | 37,589 | 321.04 | 76.20 | 38.42 | 38.42 |

The quantity and chemical partitioning of the trace metals probably varied considerably in the "base flow" and "storm flow" years. Bradley (1984) concluded that the mass flow of metals is greatest during flood peaks. He also concluded that dissolved metal concentrations decrease at high flows, and the quantity of metals bound to particles increases. Therefore, export probably would be greatest during the "storm flow" years, but metals would be relatively unavailable to the environment because they would be tightly bound to suspended particles. During the "base flow" years, there would be less export, but the metals would be in the more bioavailable dissolved state.

## Heavy Metals in Marine Near-Shore Environments

Sea Water: Concentrations of total metals in sea water followed a pattern similar to that observed in stream water (Table 3). Of the metals analyzed, iron had the highest concentration (range: 915 to 71 ug/l), followed by



246

manganese (4 to 387), zinc (10 to 20), and copper (all samples <10). These values were considerably higher than the values obtained in Bermuda, and lower than those obtained in Jobos Bay, Puerto Rico (Table 4). Bermuda, like St. John, is a small island relatively free of anthropogenic contamination, whereas Jobos Bay receives the treated effluents of several industries. The difference in concentrations between Bermuda and St. John is especially interesting since it may be an indication that the metal-rich bedrock in St. John is indeed causing an increase in trace metals in coastal waters. However, the different digestion techniques utilized in the studies should be taken into consideration. The Bermuda samples were not digested, and the samples in this study were digested using 10% HCl.

Several of the samples exceeded the EPA water quality standards for coastal waters. Seven of the fifteen samples had more than 200 ug/l of iron, and four samples had more than 100 ug/l of manganese. All of the zinc and copper samples were below the 50 ug/l standards.

There was considerable variability among the sampling sites. Fish Bay apparently had higher concentrations of iron and manganese, and lower concentrations of zinc than the other bays. However, this fact is probably due to the greater number of samples taken in Fish Bay.

Table 3. Heavy metal concentrations in the coastal waters of St. John. Distance refers to the approximate distance from shore in the north/south (N/S) and east/west (E/W) axis. For ID codes refer to Figure 3.

| ID Code | Site | Distance N/S (m) | Distance E/W (m) | Fe (ug/l) | Mn (ug/l) | Zn (ug/l) | Cu (ug/l) |
|---|---|---|---|---|---|---|---|
| 7 | Coral Bay | 15 | 0 | 276 | 56 | 10 | <10 |
| 6 | Sanders Bay | 15 | 0 | 190 | 9 | 15 | <10 |
| 5 | Greater Lameshur E | 15 | 0 | 86 | 4 | 17 | <10 |
| 4 | Greater Lameshur W | 15 | 0 | 162 | 9 | 10 | <10 |
| 3 | Little Lameshur | 15 | 0 | 71 | 4 | 18 | <10 |
| 2 | Reef Bay E | 15 | 0 | 24 | 12 | 15 | <10 |
| 1 | Reef Bay W | 15 | 0 | 24 | 9 | 10 | <10 |
| | Fish Bay | 0 | 0 | 407 | 387 | 10 | <10 |
| | Fish Bay | 20 | 0 | 762 | 340 | 10 | <10 |
| | Fish Bay | 40 | 0 | 915 | 368 | 10 | <10 |
| | Fish Bay | 60 | 0 | 467 | 104 | 10 | <10 |
| | Fish Bay | 80 | 0 | 484 | 73 | 20 | <10 |
| | Fish Bay | 100 | 0 | 446 | 65 | 10 | <10 |

Marine Sediments: The same concentration pattern that was seen in the stream and sea water samples could also be seen in the marine sediments (Tables 5 and 6). Metals could be arranged in order of decreasing concentration: magnesium (23,800-2,250 ug/g), iron (25,610-1,230 ug/g), manganese (610-4 ug/g), total chromium (388-6 ug/g), copper (33-1 ug/g), nickel (30-1 ug/g), and zinc (<35 ug/g). These values were 2 to 90 times lower than concentrations obtained for Mayaguez Bay, in Puerto Rico, which receives industrial and domestic pollution (Table 7).

Nichols and Towle (1977) studied sediment heavy metal concentrations in Benner Bay, St. Thomas. They obtained the following values: copper 140 to 0.2, and zinc 150 to 0.12 mg/g. These values are not comparable to values obtained in this study because the Benner Bay sediments were digested using hot concentrated nitric acid, which liberates matrix-bound metals in addition to the non-matrix metals liberated by leaching with hydrochloric acid.

There was considerable variation in the metal content of the sediments, possibly due to differences in factors that control adsorption, such as organic matter (Salomons 1985), manganese and iron oxides (Williams, et al. 1974), and percent non-calcareous residue (Jickells and Knap 1984). There was considerable variation in the organic matter content, sand and rock content, and vegetation of the sampling places, which could affect metal concentrations. As was the case in the stream water samples, manganese and copper were positively correlated with iron ($p<0.05$).

Table 4. Average heavy metal content of surface coastal waters. NA means not available.

| | Fe (ug/l) | Mn (ug/l) | Cu (ug/l) | Zn (ug/l) | Ni (ug/l) |
|---|---|---|---|---|---|
| Bermuda[1] | 1.07 | 0.19 | 0.2 | 0.3 | 0.14 |
| St. John[2] | 332 | 111 | <10 | 13 | NA |
| Jobos Bay, Puerto Rico[3] | 541 | 252 | 9.6 | 103 | NA |

1. Total leacnable metals (non-filtered samples without digestion) (Jickells and Knap 1984).
2. Total metals (non-filtered samples with HCl digestion). This study.
3. Dissolved metals (Puerto Rico Environmental Quality Board data for 1984).

Table 5. Leachable metals in sediment core samples from St. John island. Distance refers to the approximate distance from shore. For ID codes refer to Fig. 3.

| ID CODE | SITE | | DISTANCE (m) | Fe (ug/g) | Mg (ug/g) | Mn (ug/g) | Cu (ug/g) | Zn (ug/g) | Ni (ug/g) | Cr (ug/g) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | REEF BAY | W | 15 | 1,230 | 12,660 | 4 | 7 | <35 | 30 | 12 |
| 2 | REEF BAY | E | 15 | 1,440 | 10,630 | 9 | 4 | <35 | 15 | 9 |
| 3 | LT LAMESHUR | | 0 | 1,450 | 4,700 | 25 | 1 | <35 | 6 | 58 |
| 3 | LT LAMESHUR | | 15 | 2,050 | 7,300 | 14 | 1 | <35 | 16 | 60 |
| 4 | GT LAMESHUR | W | 0 | 7,440 | 10,710 | 131 | 5 | <35 | 10 | 49 |
| 4 | GT LAMESHUR | W | 15 | 4,150 | 5,030 | 21 | 9 | <35 | 1 | 6 |
| 5 | GT LAMESHUR | E | 0 | 5,720 | 7,630 | 83 | 6 | <35 | 13 | 10 |
| 5 | GT LAMESHUR | E | 15 | 6,430 | 4,470 | 41 | 4 | <35 | 1 | 8 |
| 6 | SANDERS BAY | | 0 | 3,060 | 2,930 | 18 | 3 | <35 | 5 | 15 |
| 6 | SANDERS BAY | | 15 | 7,020 | 9,430 | 111 | 22 | <35 | 10 | 15 |
| 7 | CORAL BAY | | 0 | 7,780 | 7,110 | 64 | 9 | <35 | 4 | 85 |
| 7 | CORAL BAY | | 15 | 7,220 | 7,090 | 46 | 12 | <35 | 4 | 13 |

Table 6. Leachable metals in sediment core samples from Fish Bay, St. John island. Distance refers to the approximate distances from the point of discharge of Fish Bay Gut in the north/south (N/S) and and east/west (E/W) axis. NA means non-available data.

| DISTANCE N/S (m) | E/W (m) | Fe (ug/g) | Mg (ug/g) | Mn (ug/g) | Cu (ug/g) | Zn (ug/g) | Ni (ug/g) | Cr (ug/g) |
|---|---|---|---|---|---|---|---|---|
| 10 | 0 | 14,590 | 9,930 | 480 | 13 | <35 | 8 | NA |
| 20 | 0 | 9,310 | 8,640 | 222 | 5 | <35 | 8 | 28 |
| 50 | 0 | 17,280 | 10,730 | 186 | 28 | <35 | 11 | 388 |
| 60 | 0 | 11,190 | 23,800 | 135 | 15 | <35 | 6 | 194 |
| 80 | 0 | 2,420 | 2,250 | 40 | 4 | <35 | 1 | 6 |
| 90 | 0 | 11,160 | 6,660 | 362 | 20 | <35 | 2 | NA |
| 100 | -60 | 19,490 | 11,020 | 185 | 33 | <35 | 11 | 33 |
| 100 | -40 | 16,620 | 10,070 | 510 | 27 | <35 | 9 | 32 |
| 100 | -20 | 15,230 | 7,220 | 601 | 21 | <35 | 8 | 20 |
| 100 | 20 | 12,730 | 8,800 | 145 | 14 | <35 | 7 | 25 |
| 100 | 40 | 10,560 | 9,580 | 76 | 13 | <35 | 5 | 29 |
| 100 | 60 | 8,770 | 10,040 | 160 | 15 | <35 | 10 | 21 |
| 150 | 0 | 6,590 | 10,280 | 42 | 7 | <35 | 3 | 23 |
| 200 | -50 | 6,280 | 11,490 | 54 | 7 | <35 | 2 | 17 |
| 200 | 0 | 5,190 | 9,740 | 54 | 5 | <35 | 2 | 16 |
| 200 | 50 | 9,970 | 10,180 | 53 | 17 | <35 | 5 | 33 |
| 200 | 150 | 7,400 | 9,900 | 35 | 16 | <35 | 3 | 23 |
| 300 | -50 | 25,610 | 17,400 | 248 | 28 | <35 | 12 | 365 |
| 300 | 0 | 5,430 | 7,920 | 37 | 7 | <35 | 2 | 18 |
| 300 | 50 | 9,680 | 10,780 | 67 | 15 | <35 | 4 | 30 |
| 300 | 100 | 9,260 | 10,400 | 48 | 12 | <35 | 5 | 31 |
| 300 | 200 | 10,110 | 12,650 | 53 | 16 | <35 | 5 | 35 |



-200

An intensive sampli effort was conducted in Fish Bay to determine if supe sediment-linked metals were stratified in relati w the gut's discharge point. Three of the six metal lied showed a slight horizontal zonification. Manganes nickel, and to a lesser extent, iron had markedly higher concentrations in the samples taken within 100 meters of the gut's discharge area than in more distant samples (Figure 6a and b). There were no discernible horizontal patterns for magnesium, copper, or chromium (Figure 6b and 6c). The lack of a strong pattern is not surprising since the stream runoff events that bear metals to the bay occur only 1 to 7 times per year. Post-depositional mixing of particles by physical and biological mechanisms could then affect the original heavy metal imprint on the sediments (Santschi, et al. 1984, Polprasert 1982). The water circulation pattern within the bay, which is yet unknown, may also affect the deposition pattern of the metals.

Samples taken in other bays had lower concentrations of iron, magnesium, manganese, copper, and total chromium than samples taken in Fish Bay (Tables 5 and 6). This difference is probably due to the unequal sample sizes at each site. The greater number of samples taken in Fish Bay permitted samples with higher concentrations to appear in the study.

Marine Invertebrates: Concentrations of manganese, copper, magnesium, and iron for several species of snails, crabs, and sea urchins are given in Table 8. Metal content varied considerably among the different organisms. The concentrations found in snail and crab tissues were generally higher than those found in sea urchins. However, this observation was not tested statistically due to the small sample size and large standard deviations.

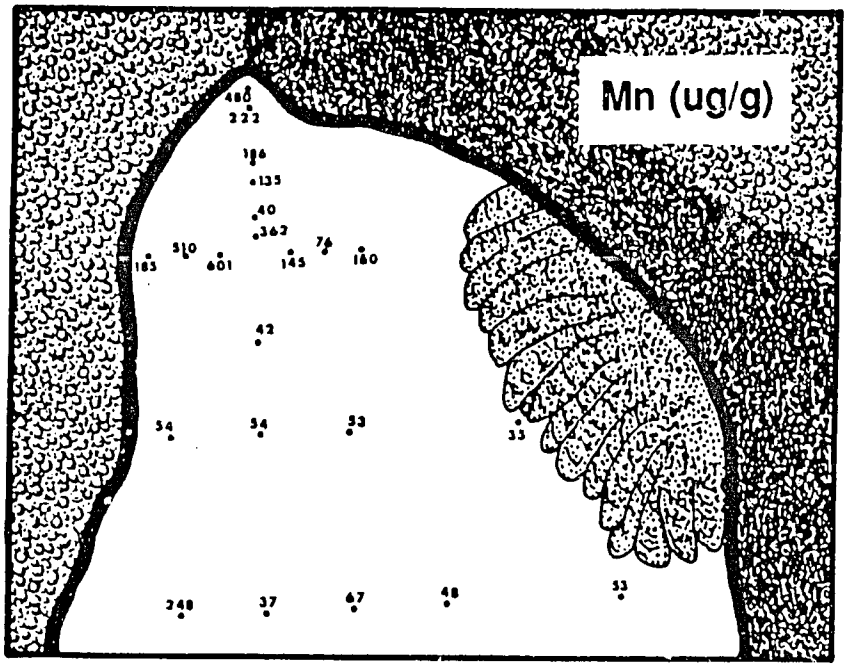
Table 7. Heavy metal content of surface near-shore sediments.

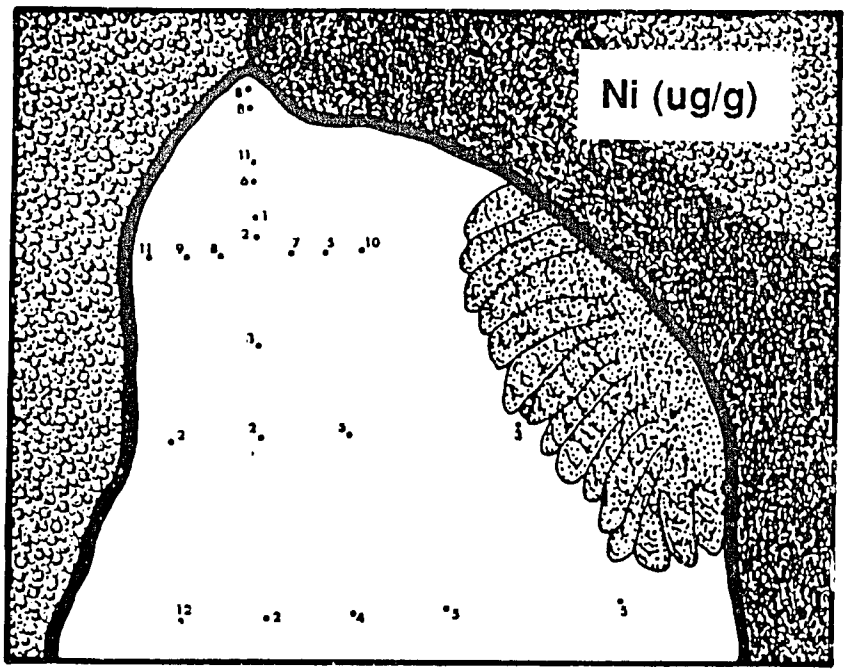
| Site | Cr (ug/g) | Cu (ug/g) | Fe (mg/g) | Mn (ug/g) | Ni (ug/g) | Zn (ug/g) |
|---|---|---|---|---|---|---|
| Mayaguez Bay, Puerto Rico[1] | 690 | 31 | 60 | 827 | 487 | 70 |
| Fish Bay, St. John[2] | 68 | 12 | 9 | 9 | 7 | <35 |

1. Adapted from Wood and Acosta Cintrón (1976).
2. This study.



-301




Corals Mangrove Secondary Forest

Figure 6a. Leachable metals in sediment cores from Fish Bay, St. John.



202

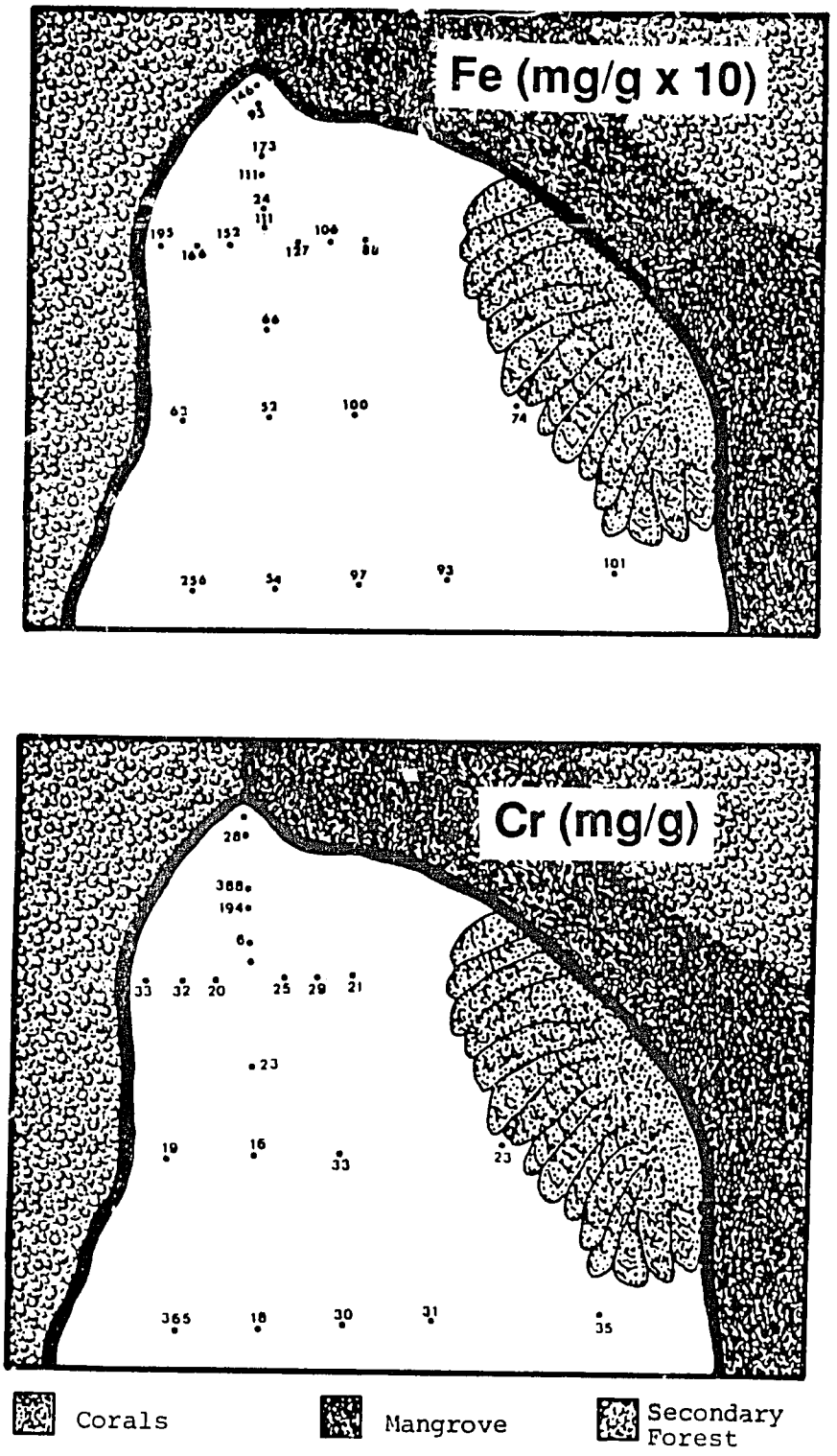
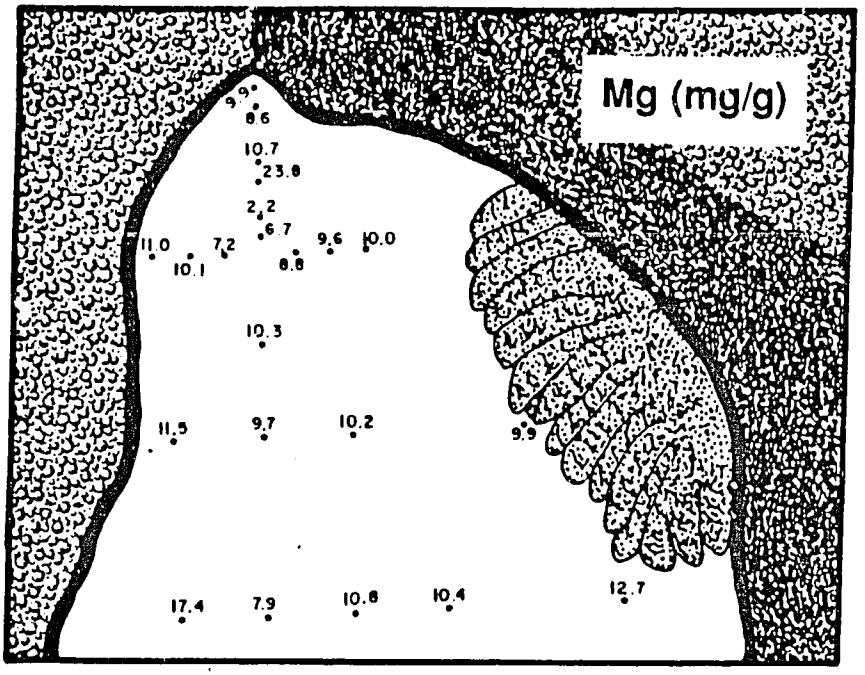
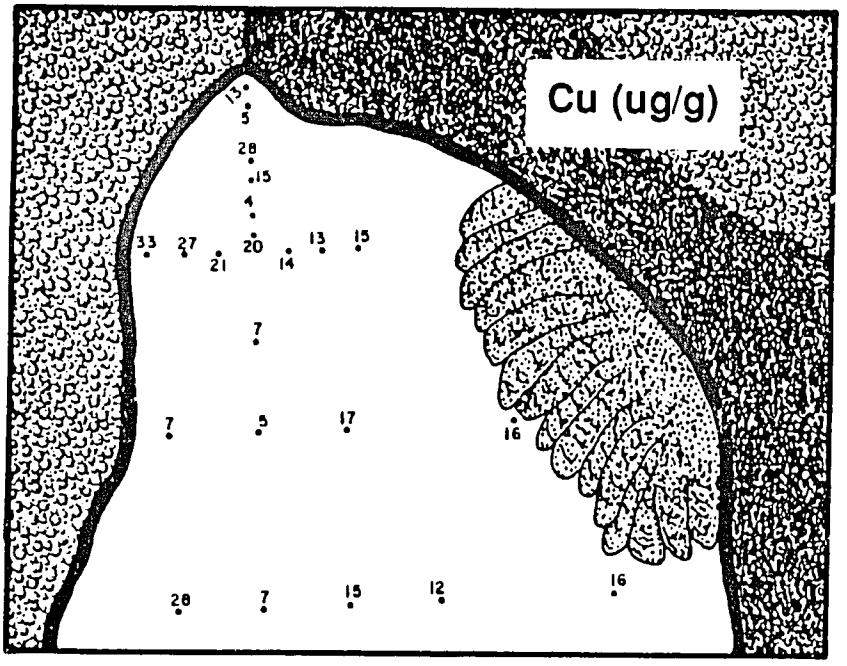



Figure 6b. Leachable metals in sediment cores from Fish Bay, St. John.



303




Corals Mangrove Secondary Forest

Figure 6c. Leachable metals in sediment cores from Fish Bay, St. John.



704

Table 8. Heavy metal content of some marine invertebrates in Fish Bay, St. John. The snail was *Littorina angulifera*, the sea urchin was *Tripneustes esculantus*, and the crabs were *Goniopsis cruentata*, *Plagusia depressa*, and *Aratus pisonni*. N represents the number of individuals analyzed. All values are expressed in terms of dry tissue weight.

**A: AVERAGE ± STANDARD DEVIATION**

| | N | Wet/Dry Ratio | Fe (ug/g) | Mg (ug/g) | Mn (ug/g) | Cu (ug/g) |
|---|---|---|---|---|---|---|
| Snail | 8 | 6.0 ± 1.0 | 1461 ± 1221 | 7510 ± 1900 | 236 ± 121 | 88.2 ± 58.8 |
| Sea Urchin | 4 | 4.8 ± 1.6 | 158 ± 67 | 8387 ± 5674 | 4 ± 1 | 3.1 ± 1.7 |
| Crab | 2 | 2.6 ± 0.1 | 133 ± 11 | 6906 ± 874 | 131 ± 29 | 97.9 ± 9.4 |

**B: RANGE**

| | | | | | | |
|---|---|---|---|---|---|---|
| Snail | 8 | 5.0 - 7.8 | 125 - 3818 | 5491 - 10124 | 147 - 436 | 2.3 - 196.7 |
| Sea Urchin | 4 | 3.4 - 7.0 | 125 - 258 | 5433 - 16897 | 2 - 5 | 1.1 - 5.0 |
| Crab | 2 | 2.5 - 2.7 | 125 - 140 | 6288 - 7524 | 110 - 151 | 91.3 - 104.6 |



305

Manganese concentrations ranged from values as high as 436 ug/g in snails to values as low as <5 ug/g in sea urchins. The same pattern was found to be true for copper and iron, with maximum concentrations of 197 and 3,818 ug/g, respectively. The concentrations of nickel and total chromium were below the analytical detection limit. The large variation in metal content of the species is not surprising since it is well known that some organisms have a significantly higher capacity to bioaccumulate metals than others due to physiological and behavioral differences (Louma 1983).

The levels of copper in crab tissue found in this study (36.4 and 38.9 ug/g wet weight) were higher than those reported by Sanders (1984) for two South Carolina estuaries (7.5 to 9.8 ug/g wet weight). This difference can be attributed to differences in methodology since Sanders analyzed only edible tissue. The tissue analyzed in this study was soft tissue which usually has higher metal concentrations.

Snails and crabs appear to be good indicator organisms since the level of heavy metals present in their tissue is well above the detection limits of the standard analytical techniques. In order to assess their suitability, information about seasonal and intra-sample variability must be generated and studied, and the implications for biomonitoring determined.

## CONCLUSIONS

The geochemical anomalies identified by Tucker, et al. (1985) do not pose a serious threat to the marine ecosystems of St. John island. Heavy metals are transported by the island's streams to the sea, and can be detected in stream water, sea water, and marine sediments. However, these levels were typical of uncontaminated environments and, with the exception of iron and manganese, were mostly below water quality standards set by US EPA.

The concentrations of trace metals in these three sample types followed a similar concentration pattern: Mg > Fe > Mn > Cu > Cr > Ni > Zn. The much higher concentrations found in marine sediments make this sample type the easiest compartment for heavy metal monitoring.

Although samples from several watersheds were analyzed, no conclusions can be made concerning the relative impa of the geochemical anomalies in these watersheds due to the

limited number of samples taken. Samples from Fish Bay had higher concentrations of some of the metals, but this fact can be attributed to the greater number of samples taken in Fish Bay. More intensive sampling, together with a better understanding of the role of metal sinks such as salt ponds and mangroves, are needed to address this question.

The export estimates suggest that large quantities of some metals are transported by the island's streams. More than 100 kg of iron and manganese were consistently exported by Fish Bay, and export of the other metals only rarely exceeded 100 kg. However, two factors must be taken into consideration in order to assess the potential impact of these metals. First, not all of these metals reach coastal waters because salt ponds and mangroves retard or stop metal movement. By slowing down water velocity, these ponds facilitate the incorporation of metals into the sediments. Second, the chemical partitioning of the metals determines the bioavailability to marine organisms. Dissolved ions are potentially more toxic than metals adsorbed onto particles. Only magnesium was transported primarily in the dissolved phase; iron and manganese were exported in the particulate phase.

The levels of trace metals present in the animal tissues analyzed were not dangerously high and should not pose a threat to the organisms. There was considerable difference in the metal content of the different species collected in Fish Bay, with those associated with mangroves having the highest concentrations. Snails and crabs should be considered as indicator organisms because of their abundance and the relatively high concentration of trace metals found in their tissues.

## Research and Management Recommendations

1. Monitor iron and manganese concentrations in stream and sea water to determine how often the EPA standards are exceeded. Since iron is much easier to analyze and is highly correlated with manganese and copper, this metal might be used as an indicator of metal contamination.

2. Determine the transport of lead through the ecosystem. Tucker, et al. (1985) found very high concentrations of lead in the geochemical anomalies.

3. Determine the fraction of stream-transported metals that become incorporated into the sediments of salt ponds and mangroves.

4. Establish a long-term biomonitoring program. In order to assess the suitability of the indicator organisms, the intra-species and seasonal variability in metal content need to be studied.

5. Study the effects on the ecosystem of the high sedimentation and turbidity in Fish Bay; determine the relative importance of natural and anthropogenic factors in causing this sediment load.

## LITERATURE CITED


Anderson, M.A. and F.M.M. Morel. 1982. The influence of aqueous iron on the uptake of iron by the coastal diatom Thalassiosira weissflogii. Limnol. Oceanogr. 27:789-857.

AOAC. 1980. Official methods of analysis of the Association of Official Analytical Chemists. 13th ed.

APHA. 1980. Standard methods for the examination of water and wastewater. American Public Health Association. 1134 pp.

BC&E. 1979. A sediment reduction program. B.C. and E. Inc. Gainesville, Florida, USA.

Bowden, M.J., N. Fischman, P. Cook, J. Wood, and E. Omasta. 1970. Climates, water balance, and climate change in the north west Virgin Islands. Caribbean Research Institute, College of the Virgin Islands, St. Thomas, VI.

Bradley, S.B. 1984. Flood effects on the transport of heavy metals. Inter. J. Environ. Studies 22:225-230.

Brooks, R.R., B.J. Presley, and I.R. Kaplan. 1967. Talanta 14:309.

Bryan, G.W. 1976. p. 185-302 in R. Johnston (ed.) Marine Pollution, Academic Press, London.

Chester, R. and F.G. Voutsinou. 1981. The initial assessment of trace metal pollution in coastal sediments. Mar. Poll. Bull. 12(3):84-91.

Cosner, O.J. 1972. Water in Saint John, U.S. Virgin Islands. US Geological Survey Open-file Report. Available from: USGS Water Resources Div., San Juan, PR.

Curtis, R.E., S. Guzmán-Ríos, and P.L. Díaz. 1984. Water resources data for Puerto Rico and the U.S. Virgin Islands 1984. US Geological Survey Report USGS-WRD-PR-84-1. Available from: USGS Water Resources Div., San Juan, PR.

Curtis, R.E., S. Guzmán-Ríos, and P.L. Díaz. 1983. Water resources data for Puerto Rico and the U.S. Virgin Islands 1983. US Geological Survey Report USGS-WRD-PR-83-1.

Donelly, T.W. 1957. Geology of St. Thomas and St. John, Virgin Islands. Ph.D. thesis, Princeton University, Department of Geology.

EPA. 1983. Methods for chemical analysis of water and wastes. EPA-600/4-79-020.

EPA. 1979. Handbook for analytical quality control in water and wastewater laboratories. EPA-600/4-79-019.

Fowler, S.W. and M.Y. Unlu. 1978. Factors affecting bioaccumulation and elimination of arsenic in the shrimp Lysmata seticaudata. Chemosphere 9:711-720.

Gupta, S.K. and K.Y. Chen. 1975. Partitioning of trace metals in selective chemical fractions of nearshore sediments. Environmen. Letters. 10(2):129-158.

Hart, B.T., S.H.R. Davies, and P.A. Thomas. 1982. Transport of iron, manganese, cadmium, copper and zinc by Magella Creek, Northern Territory, Australia. Water Res. 16:605-612.

Hunt, C.D. 1983. Variability in the benthic Mn flux in coastal marine ecosystems resulting from temperature and primary production. Limnol. Oceanogr. 28(5):913-923.

Jickells, T.D. and A.H. Knap. 1984. The distribution and geochemistry of some trace metals in the Bermuda coastal environment. Estuarine, Coastal and Shelf Sci. 18:245-262.

Jordan, D.G. 1972. Land-use effect on the water regimen of the U.S. Virgin Islands. Geol. Survey Prof. Paper 800-D, pp. D211-D216.

Louma, S.N. 1983. Bioavailability of trace metals to aquatic organisms: A review. The Science of the Total Environment. 28:1-22.

Miller, W.R., W.H. Ficklin, and R.E. Learned. 1982. Hydrochemical prospecting for porphyry copper deposits in the tropical-marine climate of Puerto Rico. J. of Geochem. Exploration. 16:217-233.

Nichols, M. and E.L. Towle. 1977. Water sediment and ecology of the Mangrove Lagoon and Benner Bay, St. Thomas. Island Resources Foundation Technical Report 1, St. Thomas, USVI. 159 pp.

NOAA. 1985. Climatological data annual summary. Puerto Rico and Virgin Islands. Vol. 30, Num. 13. National Climatic Data Center, Asheville, NC.

NOAA. 1984. Climatological data annual summary. Puerto Rico and Virgin Islands. Vol. 29, Num. 13.



210

NOAA. 1983. Climatological data annual summary. Puerto Rico and Virgin Islands. Vol. 28, Num. 13.

Pentreath, R.J. 1973. The accumulation and retention of $^{65}Zn$ and $^{54}Mn$ by the plaice, Pleuronectes platessa L. J. Exp. Mar. Biol. Ecol. 12:1-15.

Polprasert, C. 1982. Heavy metal pollution in the Chao Phraya River estuary, Thailand. Water Res. 16:775-784.

Rainbow, P.S. 1985. The biology of heavy metals in the sea. Intern. J. Environmental Studies. 25:195-211.

Rivera, L.H., W.D. Frederick, C. Farris, E.H. Jensen, L. Davis, C.D. Palmer, L.F. Jackson, and W.E. Mckinzie. 1970. Soil Survey of the Virgin Islands of the United States. US Soil Conservation Service, San Juan, PR.

Robison, T.M., et al. 1973. Water Records of the U.S. Virgin Islands 1962-1969. USGS Water Resources Div., San Juan, PR.

Rygg, B. 1986. Heavy metal pollution and log-normal distribution of individuals among species in benthic communities. Mar. Poll. Bull. 17:31-36.

Salomons, W. 1985. Sediments and water quality. Environ. Technol. Letter. 6:315-376.

Sanders, M. 1984. Metals in crab, oyster and sediment in two South Carolina estuaries. Mar. Poll. Bull. 15(4):159-161.

Santschi, P.H., S. Nixon, M. Pilson, and C. Hunt. 1984. Accumulation of sediments trace metals (Pb, Cu) and total hydrocarbons in Narragansett Bay, Rhode Island. Est. Coastal and Shelf Sci. 19:427-449.

Santschi, P.H. 1984. Particle flux and trace metal residence time in natural waters. Limnol. Oceanogr. 29(5): 1100-1108.

Sick, L.V. and G.J. Baptist. 1979. Cadmium incorporation by the marine copepod Pseudodiaptomus coronatus. Limnol. and Oceanogr. 24:453-462.

Sturgeon, R.E., S.S. Berman, J.A.H. Desaulniers, A.P. Mykytiuk, J.W. McLaren, and D.S. Russell. 1980. Comparison of methods for the determination of trace elements in seawater. Anal. Chem. 52:1585-1588.



311

Sunda, W.G. and R.R.L. Guillard. 1976. The relationship between cupric ion activity and the toxicity of copper to phytoplankton. J. Mar. Res. 34:511-529.

Tucker, R.E., H.V. Alminas, and R.T. Hopkins. 1985. Geochemical evidence for metalization on St. Thomas and St. John, U.S. Virgin Islands. US Geological Survey Open-File Report 85-297.

Williams, S.L., D.B. Aulenbach, and N.C. Clesceri. 1974. Distribution of trace metals in aquatic environment. pp. 77-127 in A.J. Rubin (ed.) Aqueous-environmental chemistry of metals. Ann Arbor Science Publishers, Ann Arbor, Michigan.

Wood, E.D. and N. Acosta Cintrón. 1976. Accuracy in determining trace element concentrations in marine sediments. National Bureau of Standards Special Publication 422.



312