Sultanate of Oman

Ministry of Agriculture and Fisheries

Directorate General of Fisheries

Marine Science and Fisheries Center

Oman Marine Science and Fisheries Center

Annual Report 1988

March 1989

P.O. Box 467
Muscat

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INTRODUCTION

Oman's Marine Science and Fisheries Center was officially opened on 29 December 1986 with the primary objective of providing scientific advice on which to base the careful management of Oman's fishery and other marine resources. The Marine Science and Fishery Center is Oman's primary source of scientific information concerning the management of these important resources.

Secondary objectives of the Center include the provision of 1) an increased understanding of the marine environment, especially as it affects fisheries, and 2) a means of educating Oman's citizens about the marine environment.

More specifically the objectives of the Center are:

1) to provide assessment of the stocks of fish in Omani waters in order to determine the optimum harvest levels,

2) to provide basic biological information as a basis for the management of specific fisheries,

3) to improve the quality and utilization of seafood products,

4) to better understand the ocean environment as it affects fishery resources and their management,

5) to enhance the public's knowledge of marine life and its care.

We expect the Marine Science and Fishery Center to expand its programs and to become one of the region's well known centers of marine and fisheries research. We expect that its primary goals will remain the same: To provide scientific fisheries advice to the government of Oman for use in developing and protecting fishery and other marine biological resources.

Gradually the center's programs will expand to provide information on the hundreds of important fish species found in Omani waters, and to merge this information with data about the fish catches and marine environment to provide up to date, accurate information for fishery planners.

Currently the Center's programs also provide on the job training for Omani staff who arrive from university, or secondary and technical school programs. At present, some staff are on leave for degree training, and several others are receiving technical training.

At present about 100,000 tons of fish and shellfish are harvested from Omani waters. With careful management this total could probably be raised to 200,000 tons. Oman's Marine Science Center will continue to grow, and to work toward the better understanding and management of marine resources. This will allow Oman to use its marine resources wisely to provide food and income for Oman's population for generations to come.

I would sincerely like to thank the staff of the Marine Science and Fisheries Center for their hard work during the past year. Although many of our junior scientists are away on training programs, the hard work of the remaining personnel allowed us to make significant progress during 1988.

I would like to extend special thanks to the Omani American Joint Commission for Economic and Technical Coopreation for funding the positions of six scientists from Oregon State University and University of Michigan.

This annual report provides a summary of our research activities over the past year (1988). Anyone wishing additional information is encouraged to write to us.

Director
Marine Science and Fisheries Center
February 1989

LARGE PELAGIC SECTION

Dr. Richard G. Dudley[1]
Arundhati Prabhaker Aghanashiniker
Juma Al-Mamry
Shar.. Zakiakleen Abdulhaleem
Mohamed Al-Aremy

Preliminary Assessment of Kingfish and Longtail Tuna Stocks Completed

Kingfish (*Scomberomorus commerson*) and longtail tuna (*Thunnus tonggol*) are the two most important species in Oman's catches. In 1988 an estimated 30,000 tons of kingfish and 16,000 tons of longtail tuna were caught in Oman. Until this year virtually no information about these stocks of fish was available. However, analysis recently completed by the Large Pelagics Section gives us our first indications of what is happening with this fishery.

The analysis was based on length data collected over a two year period coupled with other information (Figures 1).

Mortality rates calculated from length frequency data indicate that the stock of kingfish in Oman is being harvested at near its optimum level. Further increases in fishing for kingfish are likely to be detrimental.

Analysis of longtail tuna data gives more approximate results than that for kingfish, but indications are that fishing for longtail tuna is also reaching its optimum level. While continuing data collection and analysis is essential for both species, the information now available is sufficient to determine that significant expansion of catches of these species is unwise.

Both species are probably shared with adjacent countries, so catches in those countries probably affect Oman's catches. Thus careful management of these species on a regional basis is essential.

These data also revealed that kingfish first enter the fishery in September at about 40 cm (approximately one year old). By the end of their second year kingfish have grown to about 80 cm and at age three to about 100 cm. King fish of ages 1,2 and 3 produce most of the catch, though fish as large as 200 cm (perhaps 10 or 15 years old) are sometimes caught.

Longtail tuna first enter the Omani fishery in October at a size of about 25 cm (probably at age 1), but most fish in the catch are between 60 and 80 cm and are two to five years old.

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[1]Oregon State University CIFAD Scientist. Position funded by The Omani American Joint Commission for Economic and Technical Cooperation.

Knowledge of Fishermen Revealed in Interviews

Taped interviews with traditional fishermen in the Sur area of Oman revealed that these fishermen have significant knowledge of importance to fishery managers. The study, carried out by Research Assistant Juma Al-Mamry, utilized open ended, tape recorded interviews with twenty local fishermen.

Among the findings were the local beliefs about migrations of kingfish, *Scomberomorus commerson*. Fishermen define three kingfish seasons, two major and one minor. The "Seera" season starts in late February when kingfish schools move from the eastern Arabian sea and Indian Ocean into the Gulf of Oman and the Arabian Gulf. This season lasts for a period of one to four months. Fishermen noticed this migration long ago, and they believe that the reason for such movement is that the *S. commerson* are looking for temperate, stagnant waters in shores and bays of the Gulf because warm temperatures lead to early maturation of eggs.

The return migration "Rajaiya" which takes place by the end of Summer forms the return of these schools from the Gulf to the Arabian Sea. During this period the fish are emaciated, spent, and moving faster than before. They usually spend about three months near the shores of Sur but they may stay there longer if there is abundance of sardine and cool currents.

Fishermen also believe there is another form of migration, called "Hadfar", in which large *S. commerson* come from offshore and move to nearshore areas, perhaps 500 to 1000 m from shore. These fish are usually of an extra large size and move as individuals rather than in schools. This Hadfar season precedes the Seera season by a short time.

Many other subjects important for the management of these fish stocks were covered in the fishermen's comments.

Oman Longtail Tuna Shown to be Different from those in Gulf of Mannar

The purpose of this study was to investigate possibilities of using gill raker counts as a method of separating stocks of longtail tuna in the Indian Ocean.

Since longtail tuna are somewhat migratory it is important to find some indicators of the extent to which stocks in different regions might mix. With this goal in mind, gill raker counts from longtail tuna (*Thunnus tonggol*) in Oman were compared with those reported in the literature. Significant differences were found in the number of gill rakers in Oman longtail tuna, as compared to those from Gulf of Mannar, between India and Sri Lanka. This is an indication these stocks of longtail tuna from that region do not mix with Omani longtail.

Papers Prepared for Tuna Workshop

Four papers were prepared for presentation at the Indo-Pacific Tuna Program's Workshop on Tunas and Seerfishes in the North Arabian Sea Region.

Oman was honored to be selected as host for this workshop. It is the first of its kind to be held in the region. The workshop permits scientists from countries in the region to exchange information and discuss items of common interest related to these migratory fishes.

The papers prepared are as follows:

Abdulhaleem, Shama Zakiakleen. 1989. Gill raker counts: a possible means of stock separation for longtail tuna (*Thunnus tonggol*) in the Indian Ocean.

Al-Mamry, Juma. 1989. Interviews with traditional fishermen near Sur, Oman.

Arundhati Prabhaker Aghanashiniker and Richard G. Dudley. 1989. Age, growth and mortality rates of longtail tuna *Thunnus tonggol* (Bleeker) in Omani Waters based on length data.

Dudley, Richard G. and Arundhati Prabhaker Aghanashiniker. 1989. Growth of *Scomberomorus commerson* in Oman based on length data.

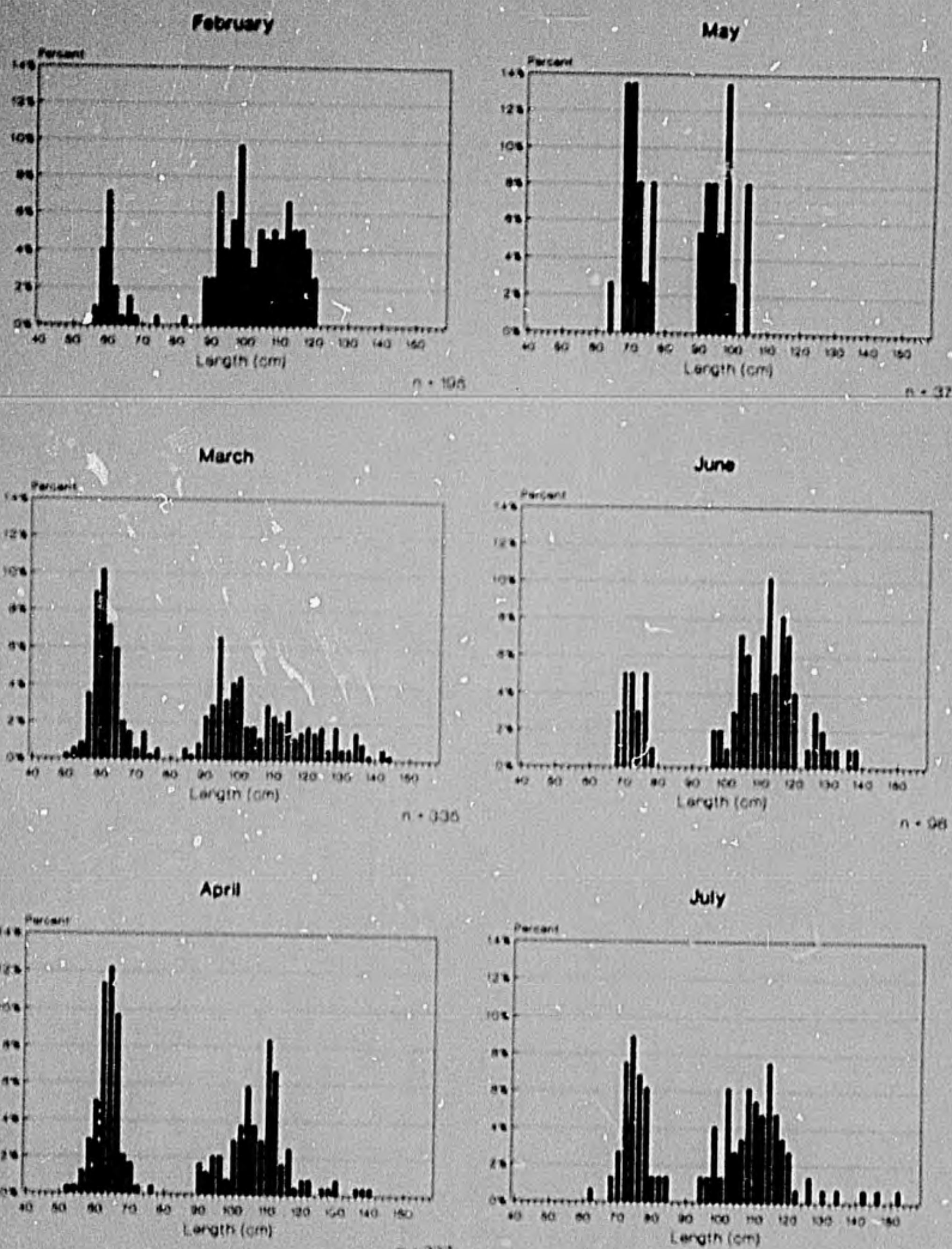

Figure 1. *Somberomorus commerson* length frequency data covering the period February 1987 through January 1989. This page shows data from February 1987 through July 1987.

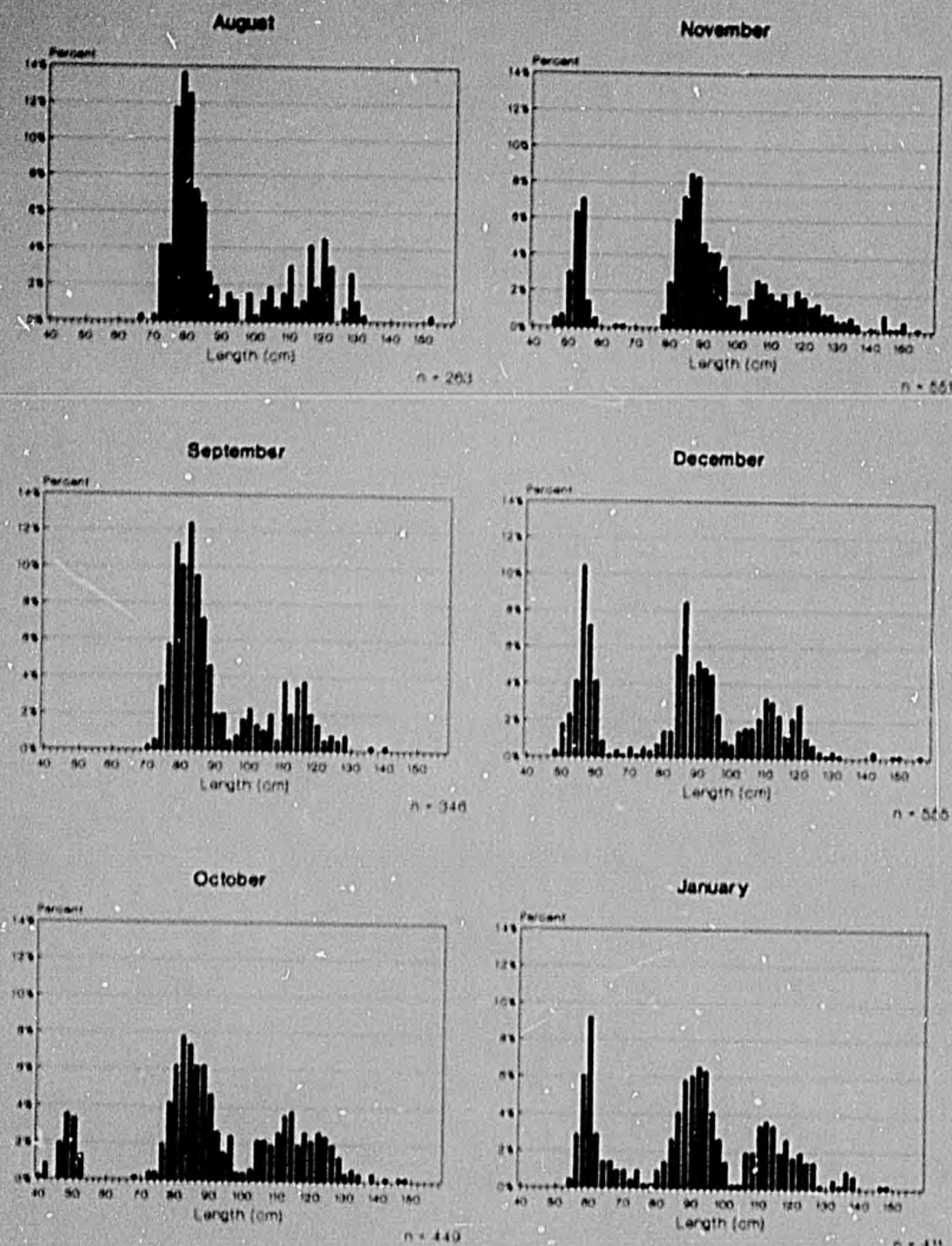

Figure 1. (Continued) August 1987 through January 1988.

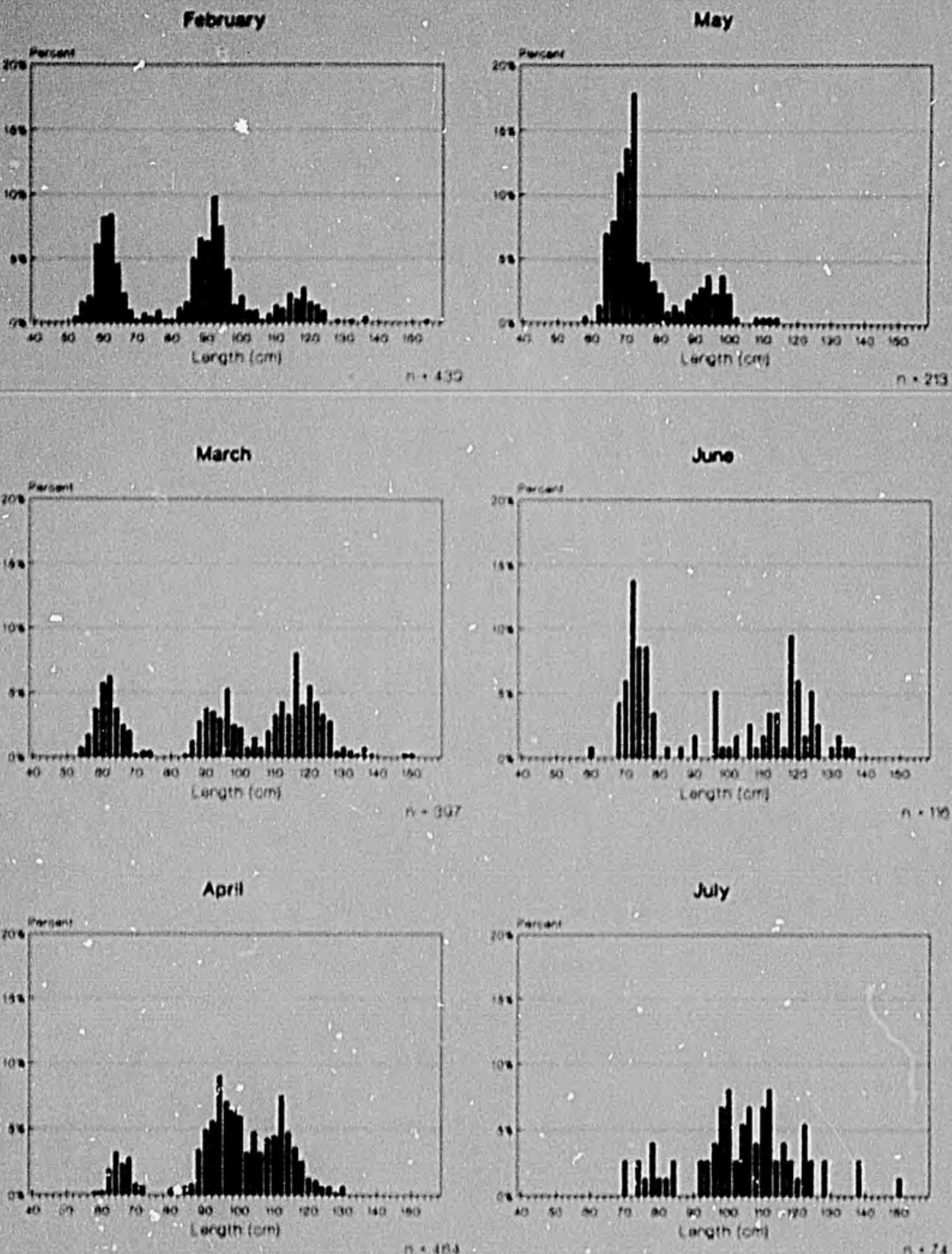

Figure 1. (Continued) February 1988 through July 1988.

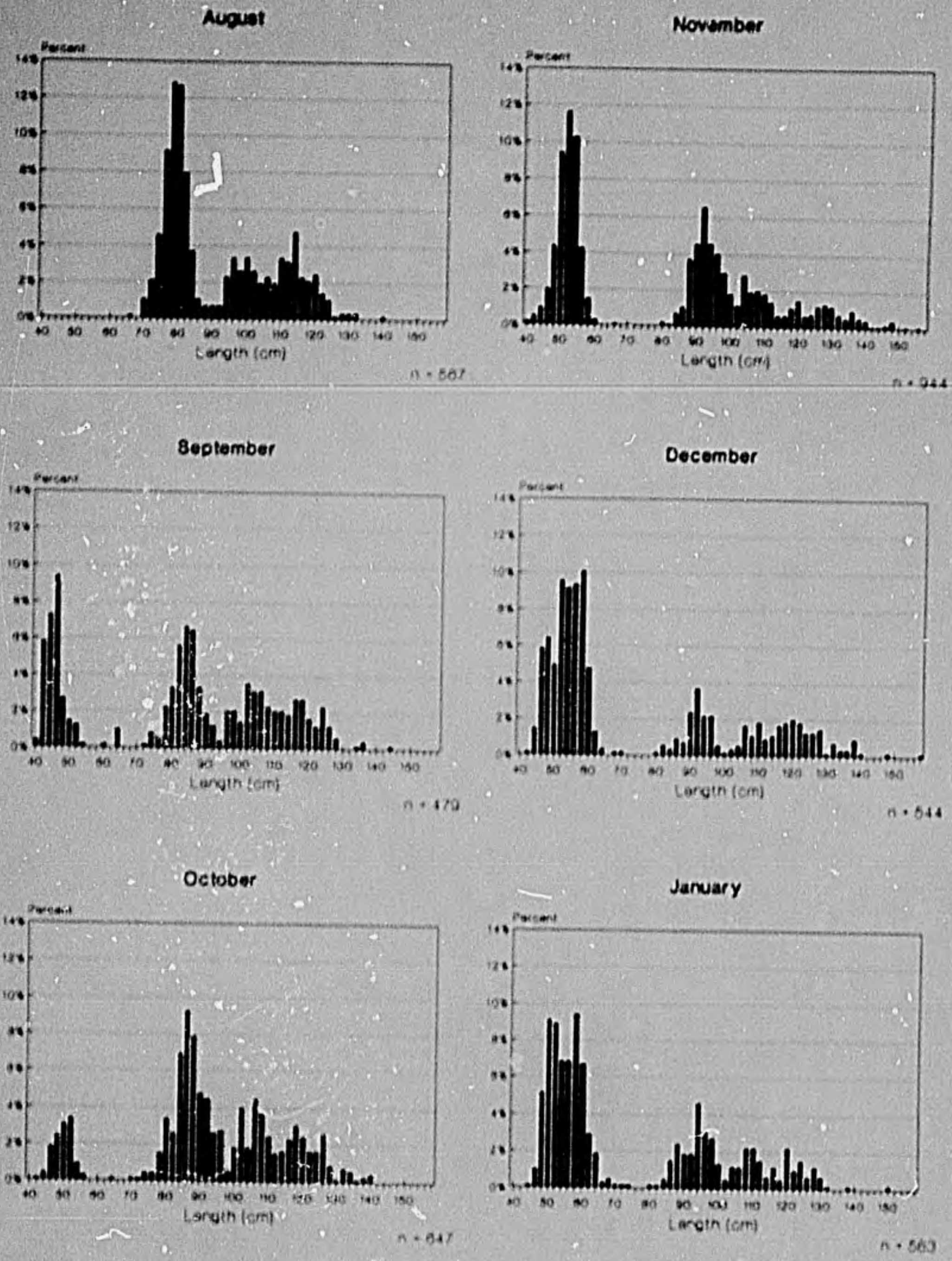

Figure 1. (Continued) August 1988 through January 1989.

SMALL PELAGIC SECTION

Dr. John A. Dorr III[2]
Mariam Al-Bulushi
Mohamed Al-Hidjri
Majda Al-Lawatiya

Sardine Research Program Yielding Results

Studies of the Small pelagic Section have focused on *Sardinella* because these sardines comprise more than 80% of the artisanal landings of small-pelagic fish and also because the annual safe harvest of sardines could be increased considerably.

Sampling of the artisanal fishery landings of sardines was begun in December 1984 and continues. Samples are collected monthly at various locations in the Batinah, Capital, and Dhofar regions, and occasionally in the Northern and Southern Sharkia Regions.

Fish are weighed and measured in the laboratory, the sex and maturity are determined, and the presence of food in the stomach and visible visceral fat is noted. Data over a 50- month period has now been collected and computerized. These data include information from about 20,000 small-pelagic fish (primarily sardines) collected from inshore, Omani waters of the Gulf of Oman and the Arabian Sea. These data will help provide a more fully rounded assessment of this fishery.

Related research programs which will conclude by May of 1989 will provide: a) estimates of the throughput of dried fish in the major Dhofar drying yards based on a 6-day sampling cycle, b) an analysis of the spatial and temporal variation in the chemical composition of Sardinella longiceps collected in the Gulf of Oman and southern Arabian Sea, c) and tables for converting dry to wet biomass estimates of *Sardinella longiceps* based on length and degree of desiccation.

Findings on the Biology of *Sardinella longiceps*

Although 5 species of *Sardinella* are reported to occur in Omani waters only three species, *Sardinella longiceps*, *Sardinella gibbosa* and *Sardinella sindensis*, have been identified in samples taken from artisanal fishery landings.

Sardinella longiceps attains sexual maturity at 110-130 mm (TL). Preliminary analysis of growth rates, length frequency distributions and maturity data indicate that sexual maturity is attained within 18-24 months of hatching.
The sex ratio of adult fish was closely balanced in all regions.

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[2]University of Michigan/CIFAD Scientist. Position funded by The Omani American Joint Commission for Economic and Technical Cooperation.

The major spawning period for *Sardinella longiceps* appears to occur during the early part of the year in the Gulf of Oman and during the late summer in the southern Arabian Sea (Figure 2). Small fish (<100 mm) appeared in artisanal fishery catches shortly after these periods, respectively.

The major maturation, spawning and recruitment cycles of this fish species appear to occur at opposite times of the year for fish stocks in the Gulf of Oman and the southern Arabian Sea.

The longest specimen of *Sardinella longiceps* measured during the 4-year sampling period was 262 mm. This suggests that the maximum length (Lmax or Linfinity) achieved by *Sardinella longiceps* is probably not greater than 280 mm.

Results of ongoing analyses will detail growth, mortality and recruitment rates for stocks of *Sardinella longiceps* in the Gulf of Oman and the Arabian Sea, permit construction of an age length key for these stocks, and provide additional information of the biology and population characteristics of these stocks.

Status of the Existing Small-Pelagic Fishery

The only available estimates of standing stocks of sardines and other small-pelagic fish are those which were produced from vessel-based studies conducted during 1975-1984. These studies estimate that <10,000 mt and 1.1.3 million mt of small-pelagic fish are present in the Gulf of Oman and Arabian Sea, respectively.

The most recent estimates of potential yield of small pelagic fishes is 270 thousand metric tons, including about 70 thousand tons of *Sardinella*. Artisanal fishery landings of small-pelagic fish including sardines during July 1985-June 1986 were estimated at 35,000 mt valued at 3.5 million Rial Omani. The January-December 1987 landings were estimated to be 27,000 mt. There is no industrial fishery for small- pelagic fish in Omani waters.

Most sardines are caught with beach seines, dried, and sold for livestock feed. Some of the dried product is used as fertilizer. A comparatively small amount of sardines is taken with gill nets and casts nets. These fish are usually sold fresh in local or regional markets for human consumption and fishing bait.

In the Batinah and Capital regions, seined fish are dried on the beach for 3-10 days, depending on the weather and available labor, and are usually then bagged in 10-20 kg sacks and trucked to local markets, the Dhofar, or markets in the United Arab Emirates and Quatar. The wholesale price of a sack of dried fish varies from 0.800 to 2.000 rial Omani, depending on the supply of fish.

In the Northern aad Southern Sharkia Regions where catches of small-pelagic fish are relatively small and transportation is difficult, most fish dried and fresh fish are sold within the region.

In the Dhofar Region near Salalah, nearly all of the small- pelagic fishery catch is composed of sardines taken in beach seines. These fish are loaded into trucks, taken to drying yards near Dahariz and Taqah, dried for about 6 days, and sold directly out of the yard to fish buyers. Local buyers general purchase the fish for their own consumption; other purchasers act as agents, transporting the fish to regional markets in the interior and northern Oman and neighboring countries.

The wholesale price of dried fish at the Dahariz drying yard was 0.350-0.750 Rial Omani per square meter, or 29-36 Rial Omani per cubic meter. The exact price depends on the supply of fish and their size, large fish (e.g., > 150 mm) being more highly valued than small fish (e.g., < 100 mm)

Relative to the beach seine fishery, extremely small amounts of sardines are caught in gill nets and cast nets. These fish are sold fresh on the beach or in the Salalah markets for human consumption and bait.

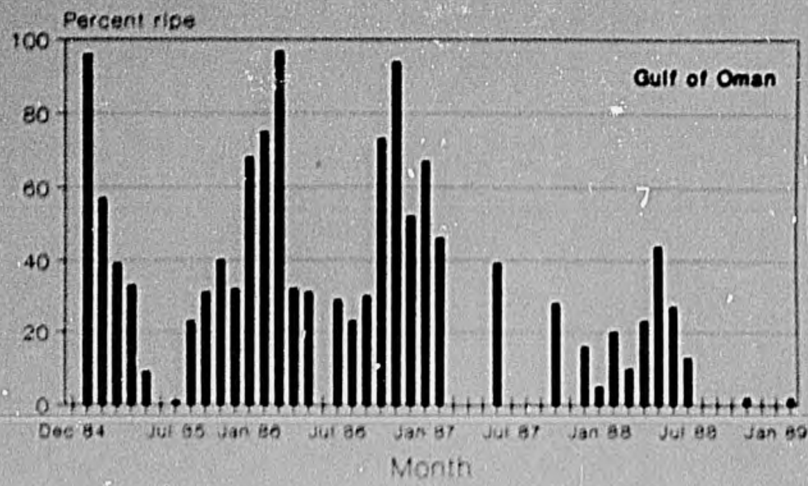

Figure 2. Monthly comparison of percent ripe for *Sardinella longiceps* collected the Gulf of Oman and the Arabian Sea between December 1984 and January 1989.

SHELLFISH SECTION

Dr. Donald W Johnson[1]
Mohamed Al-Harthy
Ali Saleh Al-Harasy
Shama Zakialdeen Adulhaleem

Preliminary Assessment of Scalloped lobster stocks Completed.

The current (1986-88) harvest level of 2500 MT for scalloped lobster (*Panulirus homarus*) may be maintained if existing regulations are enforced. By avoiding harvest of incubating females and small lobster the full reproductive and growth potential of the stocks will be realized. For optimum harvest the extent of the scalloped lobster fishing grounds and limitations on their productivity must be defined and the potential of the three commercially unutilized species of lobster determined.

Some portions of the Oman lobster fishery are in very good condition with growth rates and maximum sizes which equal or surpass those reported for other parts of the world. However, some areas have decreased sizes, reduced numbers of mature females, and greatly reduced productivity. Degradation of the fishery is related to overfishing and a failure to protect immature and egg bearing females. Specific recommendations have been made to enhance the fishery. Stocks cannot be maintained in those areas where most of the catch is composed of undersized lobsters if unregulated harvests continue. If management regulations cannot be enforced there should be no open harvest season.

Most lobster (up to 98%) caught in Dhofar are small and immature. By comparison as little as 4% of the Masira landings are immature. Decreased size and altered sex composition, both of which lead to reduced landings, have been observed in most Dhofar populations. These trends must be reduced for recovery of the fishery. The fishery is threatened. With attention it can 1) be protected from continuing degradation, 2) begin to recover in the most seriously damaged areas, and 3) perhaps be safely expanded in areas presently unexploited.

MSFC research workers have visited 22 lobster landing areas and analyzed 138 samples based on the examination and measurement of 23374 lobster since September 1987 (Figure 3).

Lobster Fishing Gear Recommendations Made

If lobster fishermen are to continue prospering they must use fishing techniques that will allow immature females to remain in the sea, grow to reproductive size, and

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[1]Oregon State University/CIFAD Scientist, Position funded by The Omani American Joint Commission for Economic and Technical Cooperation.

produce seed for future harvests. That is why the Ministry of Agriculture and Fisheries has forbidden harvest by the destructive tanglenets that catch and result in the death of all lobster caught, including egg-bearing and immature females.

Although an 80mm carapace length (CL) minimum size regulation has been established in Oman, only 43% of the processed lobster harvested during the 1988-89 season (and only 50% in 1987-88) were of legal size. Most females (64%) were undersized. The 80mm CL minimum size favors the harvest of males (Figure 4). This regulation and the use of escape vents (55 x 300mm) protects three and four year old lobster and allows them to grow rapidly and mature.

Illegal fishing methods harvest sublegal lobster thus reducing reproductive potential by disproportionately harvesting the number of females since females are most abundant in the smaller size classes. Among the legal sized lobster there are two males for each female.

During the current season 57% of the harvest was below the minimum legal size. With presently legal harvest gear (traps without escape vents) the fishermen should have handled and released 57% of their catch. This would have been additional work for the fishermen and many of the lobster handled would have died. The lobster research program has shown that both of these problems can be eliminated by restricting lobster harvest to traps with escape vents.

Studies of Lobster Maturity Justify Minimum Size Regulation

Female lobsters begin to mature (mate and incubate eggs) early in the third year (2 years after larval settlement) between 50-60mm CL (Figure 5). Of the 2002 egg-bearing females measured 5% were in the third year size class (50-70mm CL). Most (46%) females with eggs were in the fourth year size class (70-85), with 42% 80-90mm. The fifth year (85-95) contained 37% of the egg bearing females and makes the major contribution to the reproductive potential. These individuals have an egg-producing capability (fecundity) 2-3 times that of fourth year females.

During the peak incubation period on the Jazir Coast (September-October) the smallest size class to have 50% females with eggs was the 80-85 group (Figure 6). A standard determination for the size of lobsters at reproductive maturity is the size at which 50% of the females are with eggs. Although individual females as small as 50-55mm CL may breed and incubate eggs their contribution to the fisheries reproductive potential is small. A minimum commercial size of 80mm CL will allow females to grow to maturity and reproduce at least once prior to being harvested.

Peaks in lobster reproduction suggest new harvest seasons

Recommendations have been made to consider adopting multiple management zones. Research has shown clear distinctions between lobster populations in different zones (size, sex ratios, and reproductive seasons differ). Different seasons have been suggested for each zone. Although lobsters in Oman are found incubating eggs during each month, peaks of incubation are seen in specific areas. Sometimes more than 50% of all females captured are bearing eggs but at other times only 0 to 10% have eggs (Figure 7).

The most important breeding season is from August through October, though a second peak from December through February may be critical to the recovery of stocks in South Dhofar. A South Dhofar season of 1 October to 31 December has been recommended, this shorter season may contribute to the recovery of that fishery. The Central Dhofar area may support a season from 1 October to 31 March. Under this proposal the later breeding stocks to the north have seasons from 15 October to 31 March for North Dhofar and 1 November to 31 March for Sharquiya. Enforcement of season regulations requires less effort since lobster processors will not be buying any lobsters when the season is closed.

Species composition of shrimp fishery variable

Eight samples from the Gulf of Masira shrimp fishery confirmed that landings contain 3 species in commercially important quantities. The ratio of those species and their size composition varies with the specific fishing ground and the season (Figure 8). Previous stock assessment effort is limited to a 10 day study by FAO in 1982. They concluded that *Penaeus semisulcatus* was the principal component of the fishery. Our 1987-88 samples show that *P. indicus* was the only species that is consistently a major component of landings, with *P. semisulcatus* and *Metapenaeus monoceros* in lesser amounts. The value of this fishery and the interest of two large processors in becoming involved in its development warrant increased stock assessment effort.

Abalone data points direction for future research

More than 3000 abalone have been examined and measured from 15 samples at three localities (Sudh, Hadbin, and Sharbithat). The average size was 95mm shell width; the smallest was 38mm and the largest 152mm. Examination of the size composition indicated that 51% were from 85 to 110mm shell width, with 28% smaller and 21% larger. Sharbithat, the area receiving the least harvest pressure had the largest abalone (Figure 9).

Great variation in size exists between samples, especially in the Sudh area, where an undefined rotational system of community harvest provides potential for bias in sampling. Diver and community elder interviews must be conducted before an appropriate sampling program can be designed.

A number of possible fishery enhancement techniques should be investigated. They include potential size restrictions and breeding stock refuges, as well as mariculture and planting of seed stock. Abalone culture sites in Japan have been visited and discussions initiated with scientists involved in other regions.

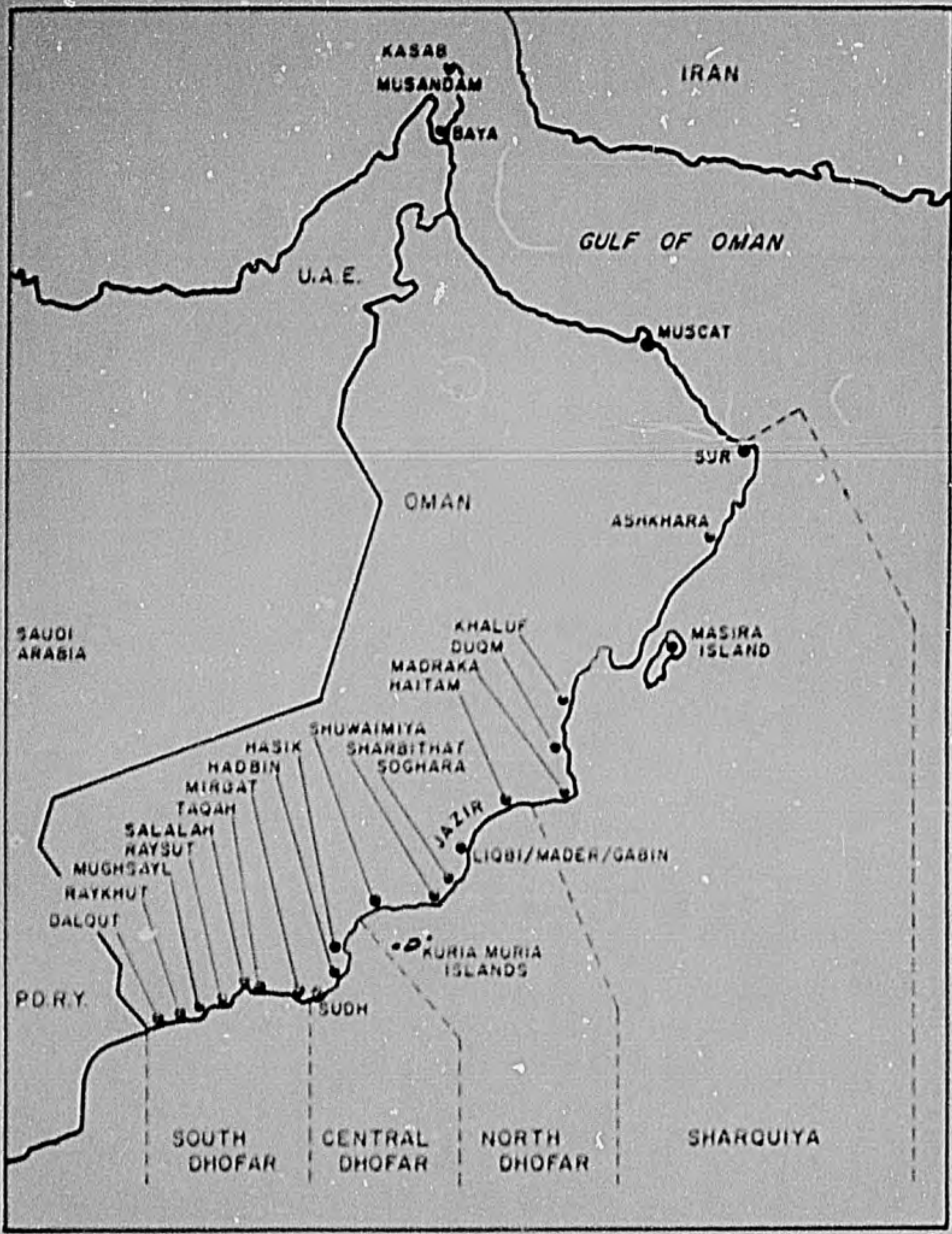


Figure 3. Lobster sampling areas in the Sultanate of Oman.

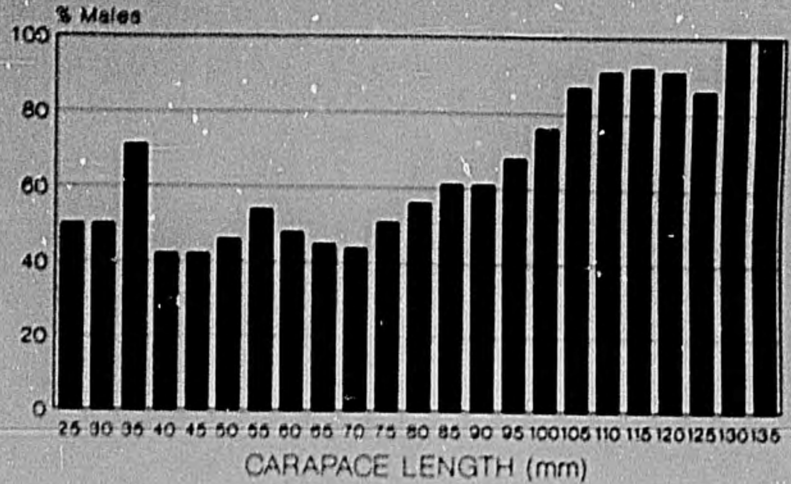


Figure 4. The relative contribution of male lobster in each size class to the commercial landings (1987-89) of scalloped lobster in the Sultanate of Oman.

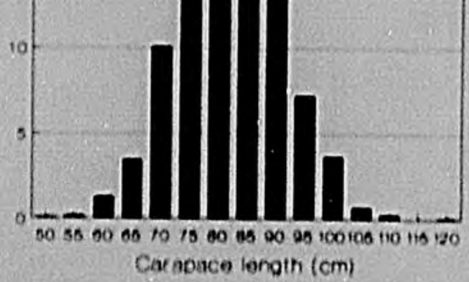


Figure 5. The size composition of commercially harvested egg-bearing scalloped lobster in the Sultanate of Oman (1987-88).

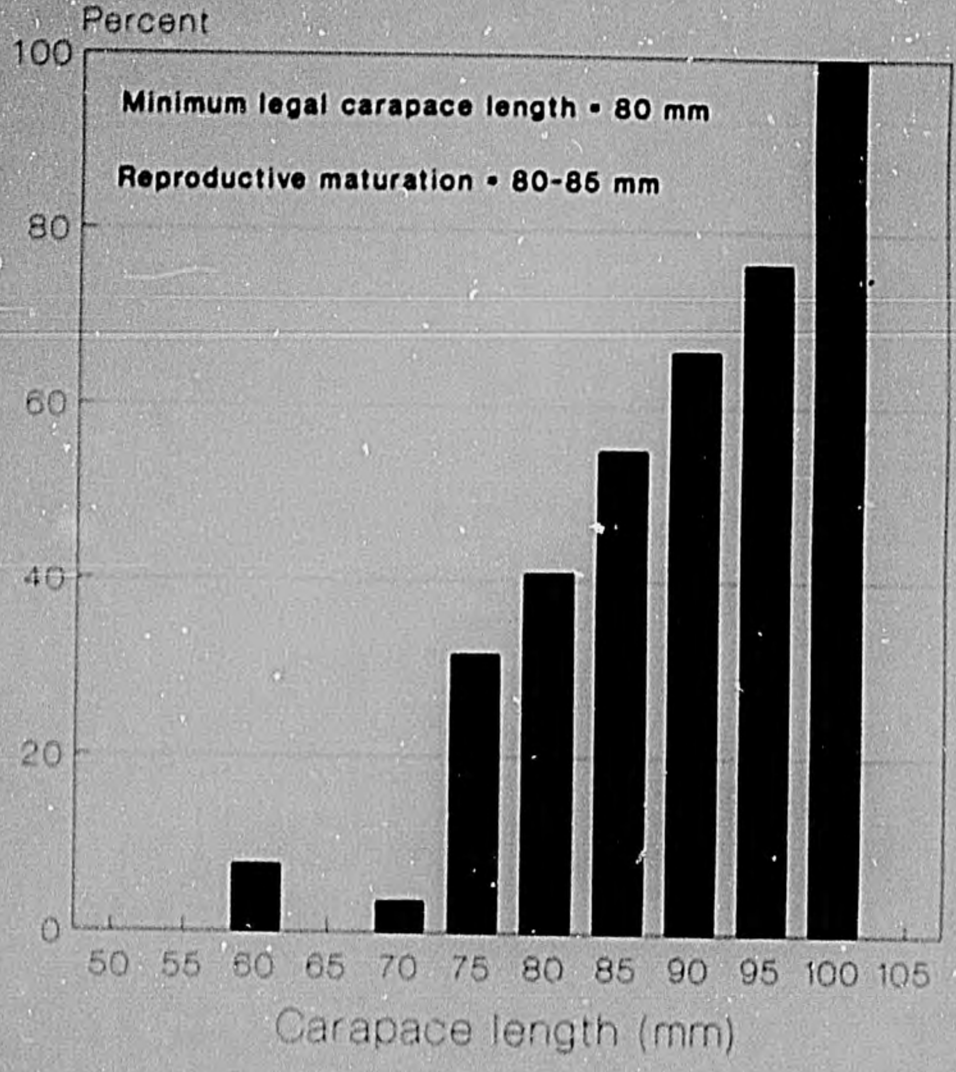


Figure 6. The frequency of female scalloped lobster bearing eggs on the Jazir coast from 13 September to 2 October 1987.

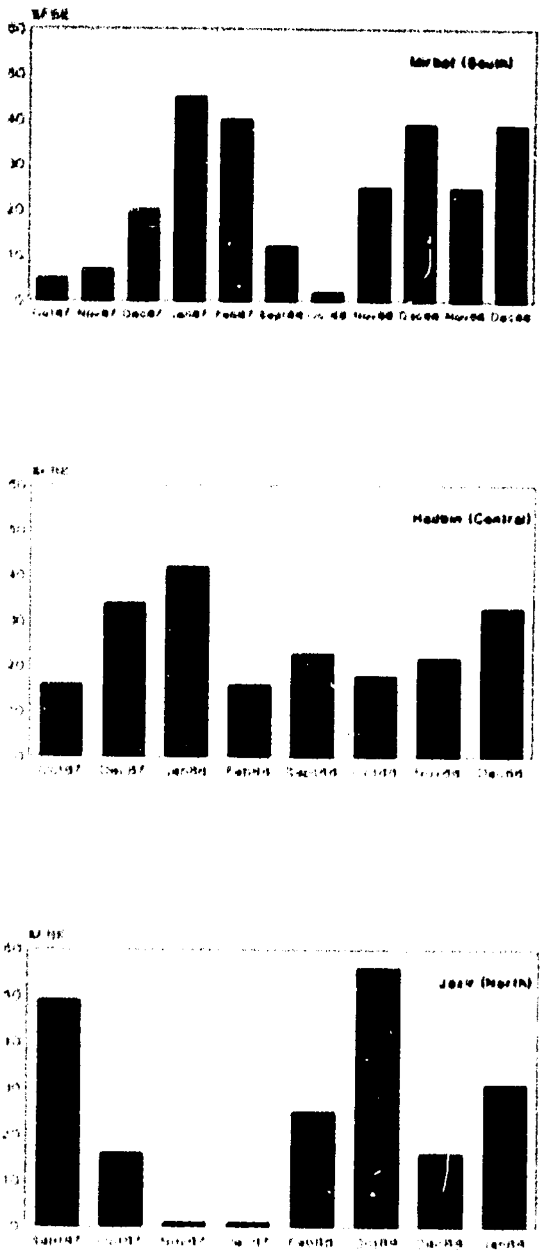


Figure 7. Variation in the incidence of female scalloped lobster bearing eggs from commercial landings in Mirbat (South), Hadbin (Central), and Jazir (North) Dhofar during the 1978-88 and 1988-89 harvest seasons.

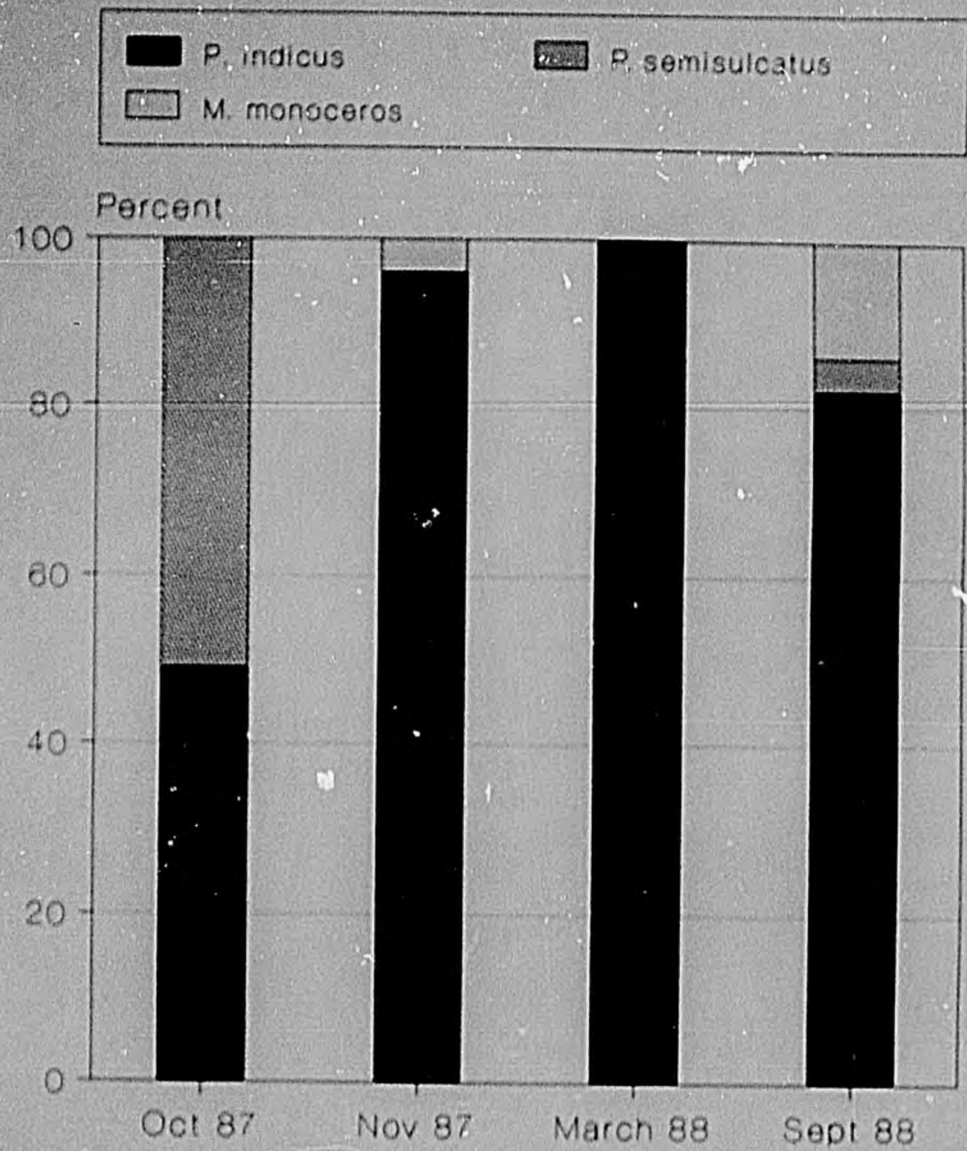
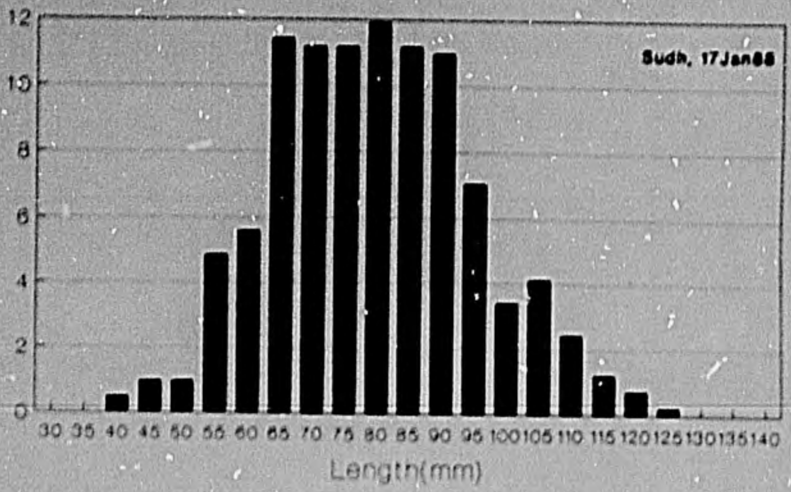


Figure 8. Relative abundance of *Peneaus indicus*, *P. semisulcatus*, and *Metapeneaus monoceros* in commercial landings sampled at Al-Khaluf in 1987-88.



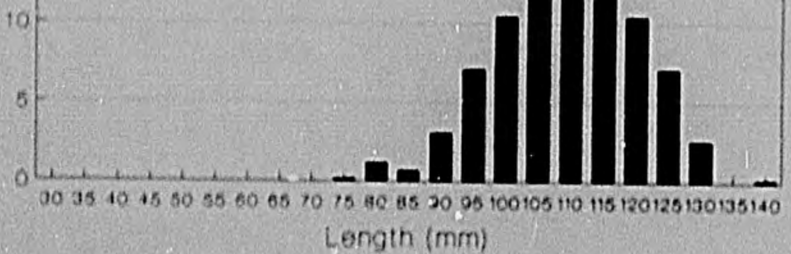


Figure 9. Size composition of abalone commercially harvested at Sudh and Sharbithat in January 1988.

DEMERSAL FINFISH SECTION

Dr. Donald W. Johnson[4] & Steven R. Hare[4]

Improvements in demersal finfish stock assessment needed (Dr. Donald Johnson)

Previous estimates of potential yield are based on substrate mapping, experimental fishing, and commercial trawler data. Although these are the best estimates available they are of limited accuracy. Seasonal and annual fluctuations are probably great, but sampling limitations have prevented the collection of sufficient data to examine them. These estimates assumed a very low fishing mortality when investigators could not get reliable estimates based on commercial trawler activity. Nevertheless, commercial landings can provide trends over time for species composition, relative abundance, size composition and other information. For that information to be meaningful trained observers must be onboard to verify fishing location and catch composition.

The best estimate of potential yield of demersal finfishes has been 77,000 MT. Of that total 5,000 MT were ocean catfish, 4,000 MT were lizardfish, which, together with considerable amounts of other fishes currently discarded add up to over 30,000 MT. The yield estimate after subtraction of discards (based on species and size preference) is close to the 1986 estimated landings of 32,000 MT. Landed catch to commercial trawlers should not exceed 14,000 at present. Future landings might be increased to 20,000 MT increased to 20,000 with the following limitations. Any additional trawlers should be restricted to fish stocks 1) determined to be underutilized, 2) where exploratory fishing efforts are part of a stock assessment program, and 3) where potential conflict with traditional fishermen does not exist.

Future estimates of potential yield should utilize existing substratum surveys, improved catch per unit effort and mortality data compiled by trained Omani data collectors onboard commercial trawlers, as well as seasonal experimental fishing and hydroacoustic surveys when possible.

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[4]Oregon State University/CIFAD Scientist. Position funded by Omani American Joint Commission for Economic and Technical Cooperation.

Training of Data Collectors for Commercial Trawlers[5] (Steven R. Hare)

A preliminary training program for on-board data collectors was conducted between June and August by two OSU consultants, Alain Gelbman and Zlatan Kharalampiev. Three Omani trainees, Ali Saleh Al-Harrassi, Mohammed Hamdan Al-Hijri and Ahmed Khalid Al-Esry, received four weeks of classroom instruction. Two of the trainees subsequently boarded Korean trawlers where they received an additional three weeks of practical training.

The focus of this effort was to characterize fishing and processing methods employed by the Korean vessels. With this knowledge, a sampling regime that represents species composition of the catch and detailed the extent of discards in the catch can be designed. It was further believed that the experience gained by the Omani trainees would prove useful when the more formal Data Collector project was implemented in early 1989. The collected data and cruise reports were reviewed for completeness and filed for future analysis.

A corps of eight Data Collectors were hired in December following interviews of 34 applicants. A new project Senior Scientist (Steven R. Hare) was recruited in the U.S. and arrived in Oman in mid January, 1989. While in the States, Hare prepared an extensive set of training materials including a manual and several videos. While awaiting his arrival, the Data Collectors assisted personnel in other Sections, acquiring experience in activities such as field sampling for lobsters, preparation of seafood for processing and market sampling for kingfish. Training for the Data Collectors in On Board Sampling was initiated January 21, 1989.

Plans for the following year include comprehensive training of at least 10 Data Collectors to allow for 100% coverage of the commercial trawler fleet. In addition, the Data Collectors will learn shoreside sampling techniques for the artisanal demersal fishery, thus providing much needed data on a relatively unsampled portion of the total demersal catch.

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[5]Trainees funded by Oregon State University: Nasser Rashid Al-Azari, Yahya Khalfan Al-Hadidi, Abdulla Rashid Al-Sheedi, Yasir Asood Al-Busaidi, Juma Hameed Al-Kalbani, Bakr Juma Al-Saadi, Salim Abdulla Al-Gazali.

MARINE ECOLOGY SECTION

Dr. M. Thangaraja
Ahmed Alisry
Lubna Al-Kharusi
Ali Shaikhan Salem

Ichthyoplankton Studies Carried Out

Ichthyoplankton studies including taxonomy, distribution and abundance, species diversity and periodicity, were conducted in different parts of the country. Most sampling was carried out in the capital area, and in other areas whenever survey opportunities arose. Samples near Al Bustan were collected weekly between February to January 1989.

Ichthyoplankton was sampled during daylight hours, using a bongo net with 400 um mesh using surface tows of 5 minutes duration. The unidentified eggs from the capital area were stored and counted immediately after collection and were cultured in the laboratory for further development and observation. All other samples of eggs and larvae were preserved.

Twenty seven species of fish eggs were collected from different parts of the country. They were photographed and identified as 4 species of *Stolephorus*, 2 species of *Thryssa*, 3 species of *Sardinella*, 1 species of *Fistularia*, 1 species of *Platycephalus*, 1 species of *Collionymus*, 1 species of *Scuenul*, 1 species of trunkfish, 2 species of flatfish (*Cynoglossus* and *Solea*), 3 species of eel (*Muraena* and 2 species of Ophisthid), 1 species of *Saurida* and 2 species of *Myctophul*.

Although fish larvae very rarely occur at the surface layer of water during the day at high light intensities, some larvae were collected. They belonged to 20 species, identified as *Thunnus* sp., *Chaetodon* sp., *Lethrinus* sp., *Stolephorus* sp., *Hemiramphus* sp., *Collionymus* sp., *Gerres* sp., *Sphyraena* sp., *Scatophagus* sp., Carangid type 1, Carangid type 2, *Mugil* sp., *Theragon* sp., *Cypselurus* sp., *Altherinmonus* sp., Gobei, Belonid, *Cynoglossus* sp., *Fistularia* sp., and *Thryssa* sp.

Embryonic, prolarval and post larval stages of 15 species of fish were studied for the first time by laboratory rearing. They are: *Sardinella* spp. a, b, c, *Saurida* sp., *Fistularia* sp., Trunkfish, Carangid type 1, *Platycephalus* sp., *Callionymus* sp., *Muraena* sp., Ophisthid eel Clupeiform, *Thryssa* sp., *Solea* sp., and *Cynoglossus* sp.

Seasonal occurrence and abundance of fish eggs near Al-Bustan were studied. Fish eggs occurred continuously throughout the year. However, abundance of eggs and species diversity varied from season to season. During February to June, the spawning intensity was at its minimum with a mean of 7 to 217 eggs/10^2m^3 while the fewest eggs were in March (7 eggs/10^2m^3). Egg abundance reached its peak in July (mean of 2991 eggs/10^2m^3) and remained near this level until October. The highest overall abundance and diversity of eggs were observed in the same seasons that the greatest number of species were collected. Among 20 species of eggs that occurred in the Al-Bustan coast, 19 species were present in the peak spawning season July to October (Figure 10). Abundance was significantly lower in November through January with an average minimum and maximum of 134 and $295/10^2m^3$ (Figure 11).

Eggs of *Fistularia* sp. were found in each sample except May, giving a mean abundance of 25 $egg/10^2m^3$. Carangid type d eggs were noted in 10 months with an overall mean abundance of 284 $eggs/10^2m^3$. Lizard fish eggs were absent in March, June and July cruises. All other species were rare or limited in their occurrence. Comparisons were made between egg species composition and abundance in different regions.

The environmental factors such as surface water temperature and salinity of the Al-Bustan coast during September 1987 to October 1988 were studied and their mean monthly values depicted (Figure 12). The mean surface water temperature ranged from 23.1°- 33°C, the minimum in February and the maximum in June. The salinity varied between 35.6° C (January) 37.4°C (September). It appeared that, although fish eggs were available throughout the year in the Al-Bustan coast, they were most abundant when temperature and salinity are fairly high and uniform (Sali. 36 to 36.5%, temp 29 to 30.5°C). Although egg abundance was maximum in the capital area during July through October, information from other areas indicate that egg maxima probably starts in June.

Zooplankton Studies Started

Zooplankton samples from the capital area near Al-Bustan during February 1988 to January 1989 showed that these primary consumers were abundant during 4 months, November through February with a peak in November. A few zooplankton were identified to species level and the others were identified to major groups. The seasonal representation of all these zooplankton at the Al Bustan coast is given in Figure 13. The average number of plankton obtained in November was $42839/10^2m^3$ But on a particular date, the 5th of November 1988, a bloom of zooplankton population was noted ($99022/10^2m^3$) in which copepods made up $87847/10^2m^3$. From March June, the zooplankton population declined sharply with a lowest concentration of $1435/10^2m^3$ in May. July to October was considered to be the recovery period with two minor peaks in July and September (Figure 14)

Copepods occurred throughout the year. Their contribution was above 50% level except June, July and September (Figure 15).

The abundance of fish eggs and other zooplankton were negatively correlated (-0.89) with each other. The ratios of mean number per 10^2m^3 of fish eggs to other zooplankton during each month ranged from 1:9 to 1:1101 in February to June, 1:3 to 1:13 in July to October and 1:117 to 1:319 in November to January.

Fish Kills Investigated

Phytoplankton blooms associated with fish kills were observed twice in the capital area during 1988. These fish kills were investigated by the staff of the Marine Ecology Section with the help of the Small Pelagic section. The first bloom, which occurred in February-March, was identified as that of the dinoflagellate, *Noctiluca mellaris*, which has caused orange red discoloration and killed a few species of fish. In September dark brown discoloration appeared which was caused by two groups of phytoplankton, identified as yellow green algae and some different species of dinoflagelliates. These organisms caused a whole-sale mortality of marine animals.

The occurrence of dinoflagellate, *Noctiluca miliaris* was noted in the plankton samples collected within the capital waters from 1st February to the end of March 1988. During this period, sudden blooms of this species caused patches of orange-red discoloration in the waters. These patches were conspicuous in some places within the capital area from Al Bostan to Qurm on the 1st, 8th and 10th of February and attained a peak on the 19th of March 1988. Following this bloom, a few species of fish kill was observed. The affected species were primarily *Atherinomorus lacunosus* but *Odonus niger* and *Diodon hystrix* were also affected.

In March, large numbers of the hardyhead silverside, *Atherinomorous lacunosus*, were observed floating in the harbors and lying on the beaches near Muscat. Laboratory examination of samples of these fish indicated that their death resulted from a viral or bacterial disease. This infection may have been brought on by the phytoplankton bloom.

In September, discoloration of coastal waters (dark brown) was followed by mass mortality of marine organisms along 30 km of coast from Seeb to Qurm. The phenomenon was first seen on September 7 and peaked on September 14. Mortality completely stopped by 20th of September. The possible causes of the phenomena were yellow green algae and the dinoflagelate *Ceratium* spp and *Peridinium* sp. However, these dinoflagellates were very few in numbers.

Blooms of these organisms first caused discoloration of the water and then mass mortality of marine life. The real cause of death may be due to higher biological oxygen demand on decay of the plankton, or the result of toxins produced by the phytoplankton. Low oxygen levels were recorded as 2.64 ml/L and 1.87 ml/L at water depths of 2 to 3 meters and 8-10 meters respectively, on 14th September 1988 at the Al Ghubra coast. Other parameters recorded were pH 8.13 and TDS 39,574 mg/L. The possibility of marine pollution was ruled out on the basis of water quality tests and the presence of enormous amount of phytoplankton.

A significant finding of these studies is that all three of these mass mortalities were caused by natural phenomenon and were not the result of human activities. Although public health aspects of these phytoplankton blooms were not investigated, consumption of shellfish during such phenomena is not advised.

Detailed reports of these fish kills are available at the Marine Science and Fisheries Center.

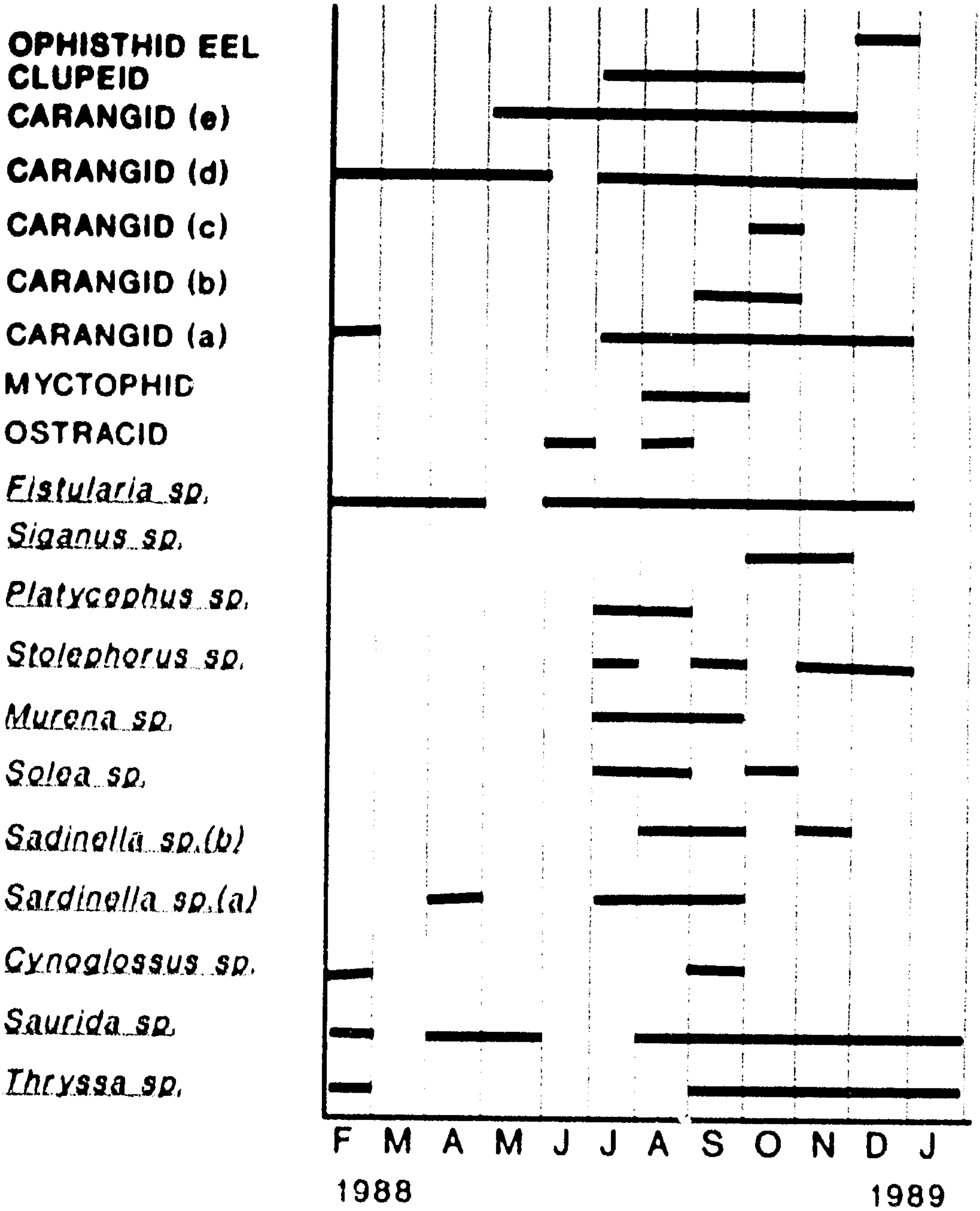


Figure 10. Specieswise monthly representation of fish eggs off Al-Bustan from February to January 1988.

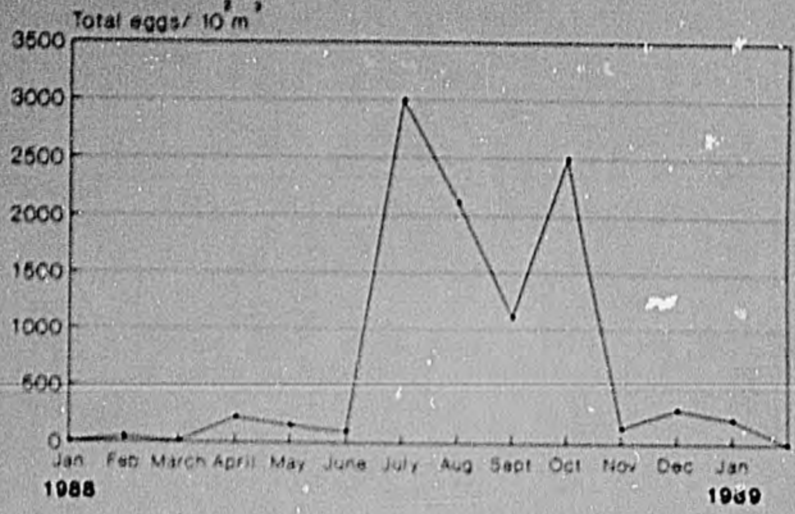


Figure 11. Mean egg abundance off Al-Bustan from January 1988 to January 1989.

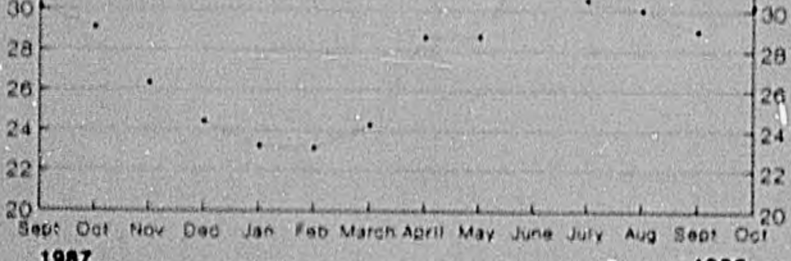


Figure 12. Environmental factors, temperature and salinity off Al-Bustan coast from September 1987 to October 1988.

Figure 11. Specieswise monthly representation of zooplankton off Al-Bustan from February 1988 to January 1989.

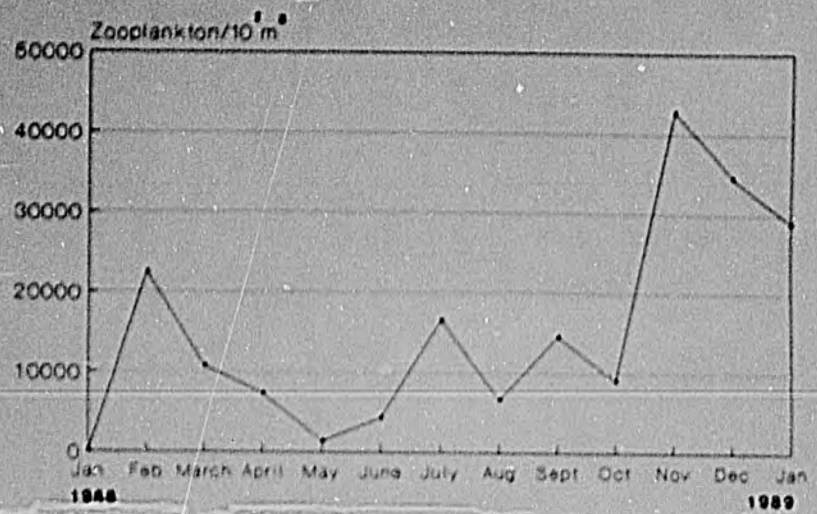


Figure 14. Zooplankton abundance off Al-Bustan from February 1988 to January 1989.

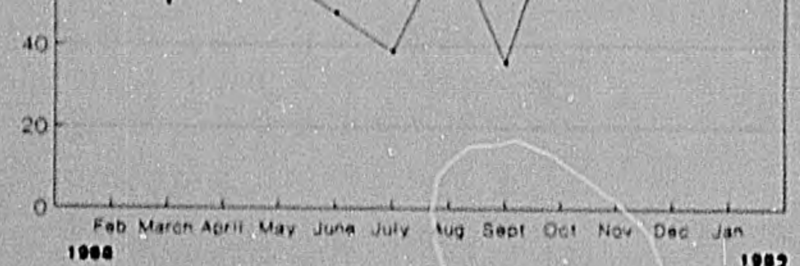


Figure 15. Percentage compostion of copepods off Al-Bustan from February 1988 to January 1988.

OCEANOGRAPHY SECTION

Dr. Sharma
Nashwa Al-Harthy
Hilal Al-Mukheiny

Oceanographic Data Used to Predict Areas of Fishery Potential

The fertility of the ocean controls its productivity. Thus it is important to understand the oceanographic conditions over time and in various regions in order to predict the effects the ocean environment has on fisheries.

Northwestern Arabian Sea oceanographic data obtained from the World Oceanographic Data Center has been used to predict areas of fishery potential in Oman. Available data from this Center was carefully examined and stations which could be used for analysis were selected for further study. In this way oceanographic factors which affect the fertility and thus the fishery potential of Oman's waters could be examined. These factors include temperature, salinity, density, nutrient concentration, and dissolved oxygen content of the waters.

Eleven vertical sections have been worked out for Oman's coast, ten in the Arabian Sea and one in the Gulf of Oman (Figure 16). As far as possible care was taken to select sections from a single year collected by the same research vessel in different months. The data used are mostly from the R. R. S. Discovery (from 1962 and 1963) and allowed the examination of this region throughout the monsoon cycle. An example of a data section is presented in Figure 17.

Analysis of these vertical sections indicate that the area from the Kuria Muria Islands to the northern tip of Masirah Island is the area most strongly influenced by upwelling during the southwest monsoon. This is evident from the cold, dense, homosaline, nutrient rich and oxygen poor water present north of Masirah Island at a time (a fortnight apart) when waters off the southernmost part of Oman were relatively warmer, less dense, more oxygenated and had lower nutrient concentrations.

This same region has a broad continental shelf which results in it having a higher concentration of nutrients even outside the upwelling period. This region is relatively fertile all year while other regions have seasonal peaks in fertility.

A study of areas of divergence and convergence was also used to assist in identifying areas of fishery potential. During January coastal waters mostly converge while divergence is predominant offshore (Figure 18). During July, which is representative of the monsoon season, coastal waters diverge and the horizontal gradients are stronger (Figure 18). In general this information also indicated that the region between the Kuria Muria Islands and the northern tip of Masirah Island is the area of maximum horizontal gradients which indicates that vertical mixing is highest in this region.
A detailed report of these analyses is available from the Center.

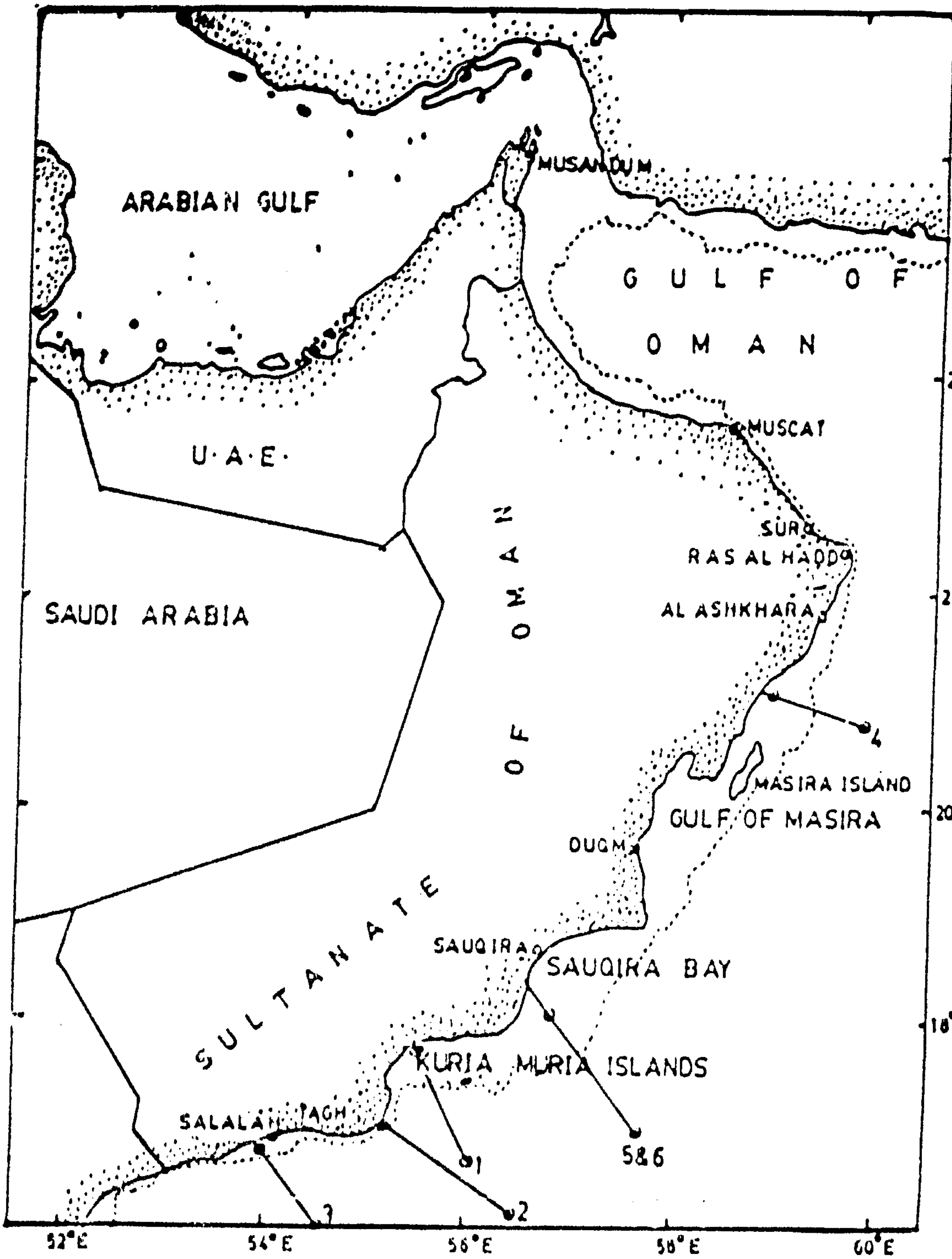


Figure 16. Location of vertical sections along the coast of Oman.

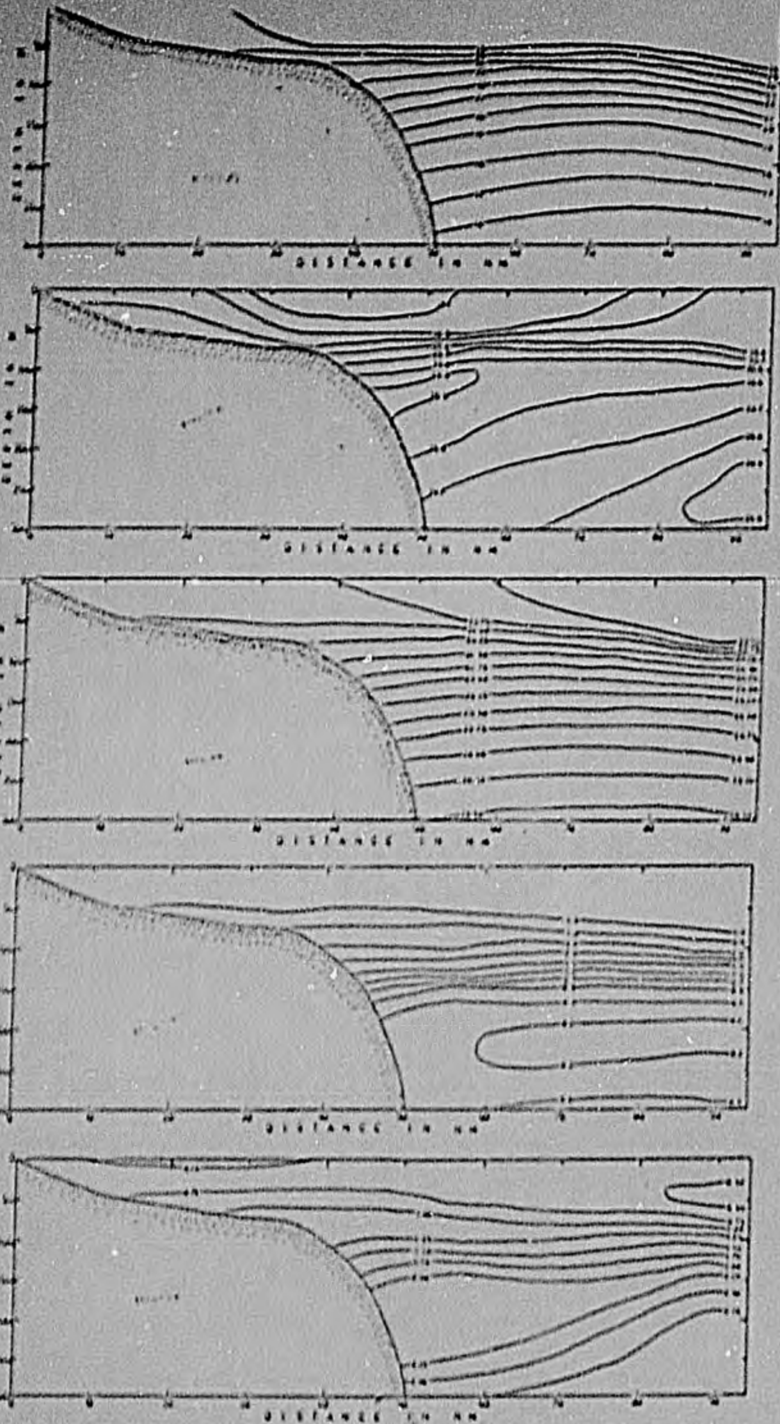
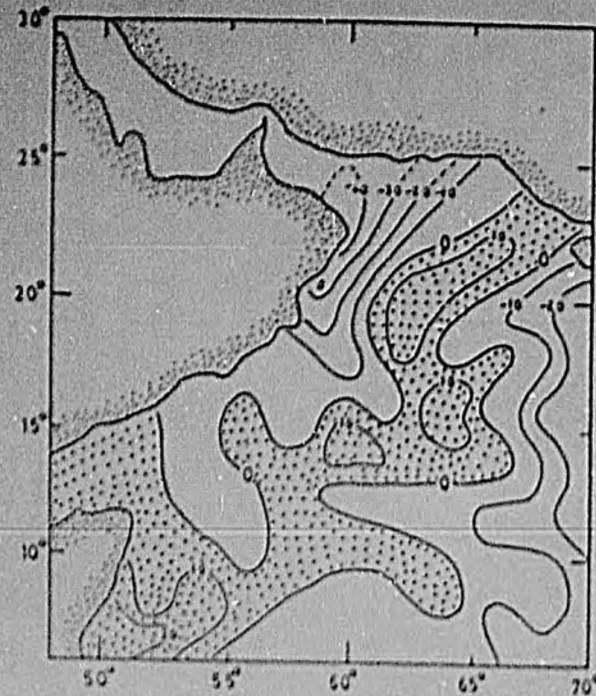


Figure 17. Vertical section of the distribution of Temperature (°C), Salinity (‰), density, oxyty (Ml/l) and Phosphate (Mg-at/l), respectively.



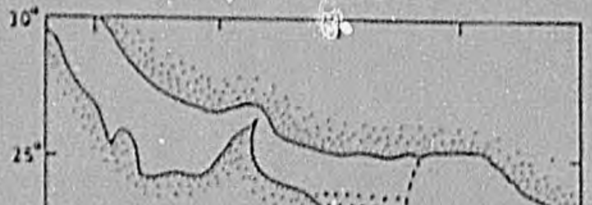


Figure 18. Vergence field of surface currents.

SEAFOOD SECTION

Ken Hilderbrand
Media Al-Zedjali
Adil AL-Kasmi

Seafood Research Laboratories Equipped and Operating

The sections chemistry laboratory is now set up for routine determination of common seafood quality characteristics as well as salt, moisture, protein, ash, and oil content in local seafood. A modern testing kitchen was designed and equipped for the latest techniques of organoleptic analysis. Accurate methods of determining flavor preferences between various species of seafood were developed and tested. Pressure canning equipment imported from the United States was installed and tested.

Wet fish handling facilities were equipped for all types of seafood preparation and yield analysis. A small nearby laboratory was converted into a controlled environment seafood pilot plant and equipped with modern research smoking and drying equipment.

Processing Procedures Established For Canned and Smoked Fish

Seafood Section staff have establish proper time/temperature cycles for hot or cold smoking two of Oman's most important species of seafood, yellowfin tuna and Kingfish. The research program on fish smoking procedures has initially emphasized these two species because it was felt they would present fewer problems while training staff in smoking procedures and because a ready local market probably existed.

Proper preservation of wholesome smoked fish requires that the final product contain 3 ½ percent salt in the water phase and that the flesh be heated to 75 degrees centigrade for at least ½ hour. The section's research showed this could be accomplished by treating 4 cm thick pieces of yellowfin tuna for 45 minutes in 15 percent salt solution followed by smoking 8 to 10 hours using a programed temperature regime. The resulting product met the minimum salt and temperature requirements necessary for safe storage and, at about 60 percent moisture, had color, flavor, and texture well accepted by the local hotel and catering market. Figure 20 shows the result of a salt penetration study on 4 cm thick yellowfin tuna (*Thunnus albacares*). This chart is used by the staff to predict the final water phase salt content of tuna after smoking and drying.

Research to establish proper smoking procedures for other fish species are continuing. Appendix 1, Table 1, shows taste panel results from these preliminary experiments.

The Seafood Section has established that several local seafood species are suitable for raw-pack canning. Unlike commercial tuna canning procedures which require pre baking of the fish to remove natural oils, raw-pack canning uses high quality fish and retains natural oils. The two main advantages of this technique are production simplicity and improved nutritional value of the final product. Appendix 1, Table 1, shows a summary of the taste panel evaluations of this work with Skipjack tuna the highest (7.8) and shark the lowest (1.7). Storage tests to establish shelf life on raw-pack Yellowfin Tuna are now into the 9th month without showing any significant quality deterioration.

Under-utilized Seafood Species shown to have Acceptable Quality

Seafood Section staff have characterized over 100 species of Omani seafood in terms of overall acceptability, yield of edible flesh, and moisture content (a rough indication of fat content). This information is not available from any other source world wide. One under-utilized species, *Arius thalassinus* (Giant Catfish) was shown to score 7.1 out of a possible 9 points. Figure 21 shows the evaluation form used by the section for taste panels conducted using over 60 MSFC staff. To date almost 7000 individual evaluations have been made. Appendix 1, Table 1, contains a summary of this data for samples fried without salt. The highest score was achieved by *Rachycentron canadum* (Cobia) at 8.2 while the lowest score was for *Morbula diabola* (Lesser Devil Ray) at 5.3.

The Seafood Section has gathered valuable information on the edible flesh yield from over 100 Omani fish. This data will be useful for both government and private sectors who are conducting financial feasibility studies. Fillet yields varying from a high of 61.3 for skin-on *Scomberomorus commerson* (Kingfish) to a low of 20.4 for *Arius thalassinus* (Giant Catfish), are summarized in Appendix 1, Table 2, along with data on "gilled & gutted" and "headed and gutted" fish (Appendix 1, Table 3).

Data gathered on the moisture content of fresh seafood is summarized in Appendix 1, Table4). This data is a rough indication of oil content of seafood (an important nutritional consideration) and is also useful data in predicting yield of processed products such as smoked fish.

Seafood Section Staff Enter Training in Seafood Science and Computer Use.

Ken Hilderbrand, Seafood Section Head, in cooperation with other MSFC staff, organized and taught the first computer classes at the Marine Science and Fisheries Center. Oriented toward developing working knowledge of basic computer operations and useful software, 6 classes were held for MSFC staff. As a result, at least 10 MSFC Omani staff can now use computers to write reports and enter research data into computer databases. At least one Omani is proficient in a database programming language. This expanded proficiency in computer use has greatly enhanced the efficiency of MSFC research and library programs.

The Seafood Section continues to send Omani staff for further training in Seafood Science and Technology in a effort to build skills necessary for it's research programs. One research Technician is studing at the University of Rhode Island for two years training in Food Scinece. Research Technician Sabra Al-Mugheiry has finished the first year of a two year Food Science program in the U.K. Research Assistant Lubna Al-Kharusi (Ecology Section) is in the U.S.A. during February and March 1989 to be trained in the procedures for chemical analysis of seafood protein, ash, fat/oil, and moisture.

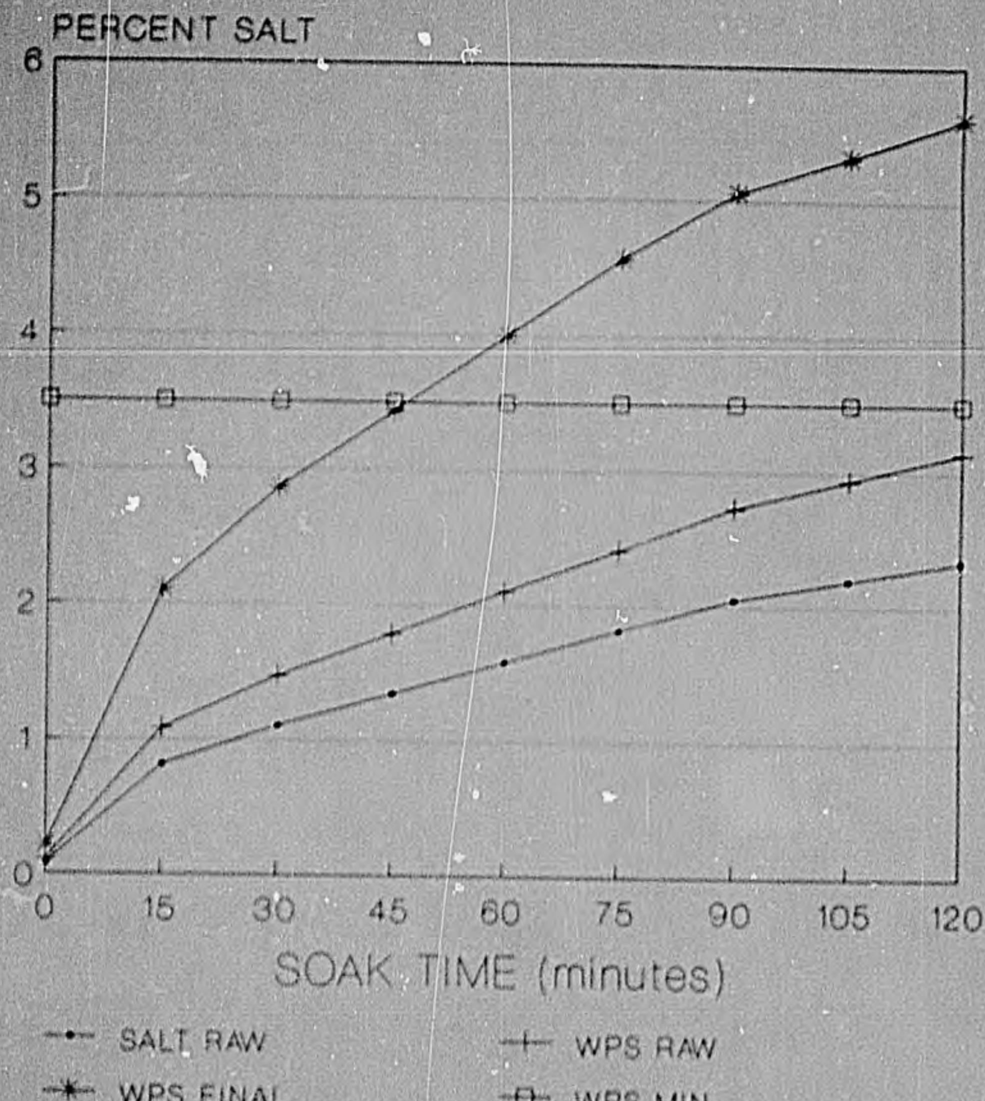


Figure 19. Salt absorption in yellowfin tuna. Soak time in 15% salt versus percent salt (4cm * 4cm blocks).

Taster id. number ________

MINISTRY OF AGRICULTURE & FISHERIES
DIRECTORATE GENERAL OF FISHERIES

وزارة الزراعة والاسماك
المديرية العامة للاسماك

FISHERIES FOOD TECHNOLOGY
SEAFOOD PREFERENCE TEST

تكنولوجيا غذاء الاسماك
اختبار لتقييم الطعام البحري

NATIONALITY الجنسية

تقييم السمكة PREFERENCE SCORE		A	B	C
احبه جدا جدا Like Extremely	9			
احبه جدا Like Very Much	8			
احبه Like Moderately	7			
احبه قليلا Like Slightly	6			
لم احبه ولم اكرهه Neither Like/Dislike	5			
لم احبه قليلا Dislike Slightly	4			
لم احبه Dislike Moderately	3			
لا احبه كثيرا Dislike Very Much	2			
لا احبه اطلاقا Dislike Extremely	1			

TEXTURE تركيب لحم السمك		A	B	C
احبه Like	3			
لم احبه ولم اكرهه Neither Like/Dislike	2			
لا احبه Dislike	1			

الملح SALT		A	B	C
كثيرا جدا Too Much	3			
جيد Just Right	2			
قليل جدا Too Little	1			

Mark with a tick (✓) in the appropriate box to express your evaluation of the sample

ضع علامة (✓) في المربع المناسب
الذي يمثل تقييمك لقطعة السمكة
التي اكلتها .

Figure 20. Evaluation Form.

AQUARIUM SECTION

Jonathan K.L. Mee
Abdulrahman Hajj
Ali Salem Al-Jafary
Facil Al-Akhzami
Hamed Saud Al-Mazrouei

Aquarium Attendance Triples During 1988

Attendance figures for 1988, the Aquarium's second year of operation, have tripled to an estimated 15,000 visitors. This increase is shown in the number of organized tours from school groups as well as visits by individuals and families. Overall visitor makeup is approximately one third Omani, one third Indian, and one third western expatriate.

Zoos and Aquariums around the world have undergone a renaissance during the last thirty years. No longer are they simply a collection of interesting or curious animals, but rather an outstanding forum for educational, management, and conservation issues which focus upon the displays of living creatures.

Oman's first public Aquarium is growing into the above role as both the living displays and their accompanying graphics focus on Oman's bountiful sea life. A mixture of commercially important species as well as colorful reef fishes and invertebrates are displayed to interest and delight the visitor. Visitor response has been positive with the most frequent comments asking the question "when are you going to expand?".

A public Aquarium is of little use unless the public is aware of it. As the attendance increases show, the public of Oman is becoming aware that the Aquarium is open for drop by visitors. During 1988 the Aquarium was highlighted in numerous Arabic and English local publications. These writings continue to spread the word that the government of Oman has made provision for a public aquarium which can be visited without prior arrangement.

Collecting Both the Rare and the New To Science

The collection of display animals is an ongoing process for any Aquarium and the Oman Aquarium is no exception. Only marine life from Oman's waters are displayed. Because the Aquarium is not large by world standards, the Aquarium staff strive to add to or regularly change displays to maintain the public interest. Hopefully a potential visitor could visit the Aquarium as often as once a month and always see something new on display.

During 1988 the Aquarium staff made extensive collections while using SCUBA equipment. Many fishes and invertebrates can only be collected in this manner. For example, Aquarium staff were able to collect and display the rare Arabian Flame Hawkfish, *Cirrhitichthys calliurus*. This fish was known from only a few museum specimens dating to the early part of this century, however, Aquarium divers found them to be abundant in certain habitats around Muscat below 20 meters. These colorful fishes have proven to be a popular display.

Aquarium staff have also collected fishes which are new to science. During 1987, the Aquarium Curator cooperating with the staff of the Coastal Zone Management Team, caught and described a new species of shallow water Butterflyfish. The paper describing this fish will be published in early 1989. Other new species currently under investigation include a new pufferfish and *Pseudochromis* from Salalah, a clownfish from central Oman, and a new stingray from the Capital Area.

The combined collection efforts of the Aquarium staff have thus far yielded over 200 different species of fishes (Appendix 2, Table 1) see accompanying list). Many of these are range extensions not previously reported from Omani waters. The Aquarium staff have kept careful records of these species and many species have been preserved in a permanent fish collection.

Wet Lab Improvements Made

While the Center's seawater system is designed as a flow through system, a closed system recirculating quarantine facility exists in the wet-lab. All new fishes are put into this system which has a low level of therapeutic copper sulfate in the water. Fishes remain here for several weeks while capture injuries heal and they learn to eat aquarium fare.

A series of 28 small all-glass aquariums was completed in 1988. These tanks allow the staff to better observe fishes and also allow the grow-out of small fishes and invertebrates to a size suitable for display. Aquarium staff are currently using these tanks to experiment with different foods and feeding techniques to entice difficult fishes to eat in captivity.

Publications

Salm, R.V. and Jonathan K.L. Mee. 1989. Chaetodon dialeucos sp. nov. A new species of shallow water butterflyfish from the Northwest Indian Ocean. Freshwater Mar. Aquar. (USA). 12(3)8-11.

Mee, Jonathan K.L. 1988. Oman's Deadly Pufferfish. Petroleum Development Oman News, Dept. of Public Affairs and Information, No. 3, 1988.pp 20-24.

Mee, Jonathan K.L. 1988. Secret Affairs: The Sharks of Oman. in A Tribute to Oman, 18th National Day. Apex Publishing, Oman. pp. 62-67.

Mee, Jonathan K.L. 1988. Our Living Sea. A weekly column in Oman Observer newspaper English and Arabic editions.

LIBRARY SECTION

John Hoover
Norjehan Mohamed

Library Acquires Laser Disk Databases

A CD-ROM laser disk reader was bought for the Marine Science and Fisheries Centre by Oregon State University and installed on one of the Library's computers in March 1988. Two databases and software were acquired for use with this system. Records for three million books in the U.S. Library of Congress are stored on one database known as Bibliophile, used primarily by the library staff for cataloging, while many thousands of fisheries, marine biology, and oceanography abstracts are available on ASFA (FAO's Aquatic Sciences and Fisheries Abstracts). In seconds the system can provide references (complete with abstracts) to journal articles, reports, conference proceedings and even book chapters. Operation is simple and many Marine Science and Fisheries Centre staff members have learned to do their own literature searches. The same searches performed manually could take hours or days. In addition to speed and ease of use, an important advantage of computer searching over manual searching is the capability of using Boolean operators for information retrieval. This is impossible with conventional printed indexes.

Orders Placed for 600 Publications

The library acquisitions program got underway at the end of 1988 with the placing of orders for needed books, reports, and other publications to augment the existing collection. These cover the subjects of oceanography, fisheries biology, marine ecology, aquarium maintenance and food science. Publications selected range from introductory textbooks to research-level materials. These publications will be purchased via a contract with Oregon State University.

Card Catalog and MARC Database Being Created

A retrospective project to build a card catalog was started in March to augment the dBase III database which has been in use since the library's beginning. Although the program that accesses this database is quite effective it was written in-house and might be difficult to maintain in future years as personnel and computer technology change. Card catalogs are simple, permanent, and do not break down. Unlike a microcomputers they can be used by several people at once. Many libraries are today are abandoning cards because typing and filing them is extremely labor-intensive. However the job is much easier when cards are printed by computer from records contained on the Bibliophile CD-ROM database.

But printing cards is actually a byproduct of the more important project of building a local fisheries and marine science database in the MARC format. The CD-ROM Bibliophile database uses a standard format called MARC (Machine Readable Cataloging) created by the U.S.A.'s Library of Congress. After cards are printed the records are saved onto our own disks and can eventually be converted to tape format. These MARC records are far superior to our present records for several reasons. The present dBase III records use fixed length fields and are too wasteful of disk space to hold complete bibliographic information. Furthermore, they is not usable by other libraries who lack our custom designed software. The MARC format, by contrast, is an international standard designed for libraries. Libraries with a MARC database can choose from wide variety of commercially available library automation systems when they decide to go on-line. Equally importantly, they can share databases and/or participate in the growing number of regional and international library networks.

SPECIAL PROJECTS: DIRECTOR'S OFFICE

Mohammed Amour Al-Barwani

Research on Oman's Sea Turtles Continues

Research on green, loggerhead, hawksbill and Ridley turtles continued under the direction of the the Director's office and via a short term visit by Dr. Perran Ross[6]. Under this program field teams carry out turtle research while also protecting turtles. Research activities of the teams include measurement and tagging of turtles and making track counts. During 1988 over 1000 green, 652 loggerhead, 21 Ridley and 6 hawksbill turtles were tagged. A brief report prepared by Dr. Ross and Nashua Al-Harthy summarizing the 1987-1988 findings is available from the Center.

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[6]Dr. Ross's work is funded by the United States Fish and Wildlife Service, Office of International Affairs. His U.S. Address is the Caribbean Conservation Corporation, Gainesville, Florida, USA.

APPENDIX 1

Table 1

AVERAGE PREFERENCE SCORES

SPECIES	ENGLISH NAME	ARABIC NAME	total #	fried #	fried score	smoked #	smoked score	canned #	canned score	boiled #	boiled score
Ablennes hians	Flat Needlefish	Kherkhoor	3	0		0		3	6.5	0	
Acanthocybium solandri	Wahoo	Kanaad Zan	2	2	7.8	0		0		0	
Acanthopagrus berda	Picnic Seabream	Khanaph	1	1	8.1	0		0		0	
Acanthopagrus sp.	Bream	Khanaph	3	3	7.9	0		0		0	
Acanthurus bleekeri	Surgeonfish		3	3	7.9	0		0		0	
Argyrops spinifer	King Soldierbream	Coghra	1	1	7.9	0		0		0	
Arius thalassinus	Giant Catfish	Khaan	13	4	7.4	9	7.1	0		0	
Atule mate	Yellowtail Scad	Seal	9	8	7.5	0		0		1	6.8
Auxis thazard	Frigate tuna	Deraiga	3	1	7.9	0		2	7.4	0	
Canthidermis rotundatus	Triggerfish	Gorbobah	1	1	6.8	0		0		0	
Carangoides bajad	Orangespotted Trevally	Hamman	2	2	7.9	0		0		0	
Carangoides chrysophrys	Longnose Trevally	Hamman	1	1	7.3	0		0		0	
Carangoides ferdau	Blue Trevally	Hamman	1	0		0		0		1	7.2
Carangoides gymnostethus	Bludger	Hamman	1	1	7.7	0		0		0	
Caranx sexfasciatus	Bigeye Trevally	Josh	3	2	7.0	0		1	6.0	0	
Carcharhinus Sorrah	Shark	Jerjoor	9	1	7.0	8	7.0	0		0	
Carcharhinus sp.	Shark	Jerjoor	4	3	6.8	0		1	1.7	0	
Chanos chanos	Milkfish	Mumere	1	0		0		0		1	6.5
Coryphaena hippurus	Common Dolphinfish	Abu raas	2	2	7.3	0		0		0	
Diagramma pictum	Painted Sweetlips	Khashom	2	2	7.5	0		0		0	
Drepane longimana		Meshot	1	0		0		0		1	6.3
Elagatis bipinnulata	Rainbow Runner	Ghazaal	6	5	7.6	0		1	6.7	0	
Epinephelus areolatus	Areolated Grouper	Hamour	1	1	7.7	0		0		0	
Epinephelus multinotatus	Hamoor	Hamour	2	1	7.9	0		1	6.5	0	
Epinephelus sp.	Grouper	Hamour	6	6	7.1	0		0		0	
Euthynnus affinis	Kawakawa	Sada	9	2	7.4	0		7	7.5	0	
Euthynnus pelamis		Thogalbah	1	1	7.4	0		0		0	
Gadus morhua	True Cod		1	1	6.6	0		0		0	
Gerres abbreviatus	Deepbody Silverbiddy		1	1	7.3	0		0		0	
Gerres acinaces	Longtail Silver-biddy		1	0		0		0		1	5.9
Istiophorus platypterus	Sailfish	Khail bahr	5	3	7.6	2	8.0	0		0	
Katsuwonus pelamis	Skipjacks		3	0		2	7.0	1	7.8	0	
Lethrinus nebulosus	Spangled Emperor	Shaeery	3	3	7.5	0		0		0	
Loligo duvauceli		Hakarer	1	1	7.4	0		0		0	
Lutjanus ehrenbergii	Ehrenberg's Snapper	Hamra	1	0		0		0		1	6.5
Lutjanus malabaricus	Blood Snapper	Hamra	1	1	7.3	0		0		0	
Megalaspis cordyla	Torpedo Scad	Deyayeh	1	1	7.3	0		0		0	
Mixed species	mixed species	Sahwa	1	1	7.1	0		0		0	
Mobula diabolo	Lesser Devil Ray	Tabaq	1	1	5.3	0		0		0	
Mugil cephalus	Flathead Mullet	Beiah	2	1	7.2	0		1	7.0	0	
Naucrates ductor	Pilotfish		1	1	7.5	0		0		0	
Nematalosa nasus		Sowamee	3	1	7.0	0		2	6.3	0	
Nemipterus japonicus	Japanese Threadfin Bream		5	5	7.9	0		0		0	
Panulirus homarus	Scalloped Spiny Lobster	Sharkha	2	0		0		0		2	7.3
Papilloculiceps sp.	Spiney Flathead	Debaiah	1	1	6.6	0		0		0	
Parastromateus niger	Black Pomfret	Halwaiah	2	2	7.2	0		0		0	
Penaeus monodon	Giant Tiger Prawn		1	0		0		0		1	7.7
Penaeus semisulcatus	Green Tiger Prawn		2	0		0		1	7.2	1	7.8
Platax pinnatus		Amlad	1	1	7.6	0		0		0	
Plectorhinchus chubbi		Khashra	3	3	7.7	0		0		0	
Plectorhinchus schotaf	Minstrel Sweetlips	Khannal	1	1	7.5	0		0		0	
Plectorhinchus sp.	Sweetlips	Khannal	6	6	7.1	0		0		0	

SPECIES	ENGLISH NAME	ARABIC NAME	total #	fried #	fried score	smoked #	smoked score	canned #	canned score	boiled #	boiled score
Pomadasys argenteus	Silver-grunt	Nagarar	8	6	7.6	0		2	5.1	0	
Pomadasys opercularis	Smallspotted Grunter	Nagarar	1	1	7.8	0		0		0	
Pomadasys sp.	Grunt	Nagarar	8	8	7.6	0		0		0	
Pomatomus saltatrix	Blue Fish	Tokowaiah	3	3	6.8	0		0		0	
Priacanthus hamrur	Moontail Bullseye	Hamra	4	4	7.7	0		0		0	
Priacanthus sp.	Bullseye	Hamra	2	2	7.6	0		0		0	
Pristipomoides filamentosus	Blue-spotted Jobfish	Hamra	4	3	7.5	0		0		1	1
Psettodes erumei	Indian Spiny Turbot	Kabiah	1	1	6.9	0		0		0	
Rachycentron canadum	Cobia	Sekel	4	2	8.2	0		2	5.9	0	
Rastrelliger kanagurta	Indian Mackerel	Garfa	2	1	7.0	0		0		1	3
Rhynchobatus djiddensis	Wedgefishes	Hasoom	1	0		0		0		1	6.6
Sarda orientalis	Striped Bonito	Saqotanah	4	1	7.6	0		3	7.2	0	
Sardinella longiceps	Indian Oil-sardinella	Ooma	2	0		0		2	7.1	0	
Saurida tumbil		Hasoom	6	5	7.6	0		1	5.0	0	
Scarus ghobban			1	1	7.8	0		0		0	
Scomber japonicus	Chub Mackerel		3	2	7.4	0		1	7.5	0	
Scomberoides lysan	Doublespotted Queenfish	Thalaah	5	3	7.0	1	6.7	1	4.5	0	
Scomberoides tol	Needlescaled Queenfish	Thalaah	2	2	7.1	0		0		0	
Scomberomorus commerson	Kingfish	Kanaad	47	28	7.4	16	7.7	1	6.3	1	6.2
Scombridae sp.	Mackerel		2	0		0		2	6.3	0	
Selar crumenophthalmus	Bigeye Scad	Seema	2	0		0		2	7.2	0	
Sepia pharaonis	Cuttle Fish	Habara	2	2	7.3	0		0		0	
Siganus argenteus	Streamlined Spinefoot	Saafy	1	0		0		0		1	7.1
Siganus canaliculatus	Whitespotted Spinefoot	Saafy	1	1	8.0	0		0		0	
Siganus javus	Streaked Spinefoot	Saafy	2	1	8.0	0		0		1	6.5
Siganus sp.	Spinefoot	Saafy	1	1	7.8	0		0		0	
Sphyraena acutipinnis	Bigeye Barracuda	Gad	7	7	7.4	0		0		0	
Sphyraena jello	Barracuda	Gad	3	1	7.7	0		1	5.7	1	6.1
Thunnus albacares	Yellowfish Tuna	Gaither	59	16	7.6	26	7.5	16	7.3	0	
Thunnus tonggol	Longtail Tuna	Sahwa	8	1	7.6	2	7.7	5	7.2	0	
Trachinotus baillonii	Smallspotted dart	Leefouh	1	1	8.0	0		0		0	
Trachinotus blochii	Snubnose Pompano	Telaah	1	1	8.1	0		0		0	
Trichiurus lepturus	Largehead Hairtail	Salfah	1	1	6.9	0		0		0	
Tylosurus crocodilus	Hound Needlefish	Khorkhoor	1	1	7.7	0		0		0	
Uraspis secunda	Cottonmouth jack	Seema	1	1	7.3	0		0		0	
Valamugil buchanani	Bluetail Mullet	Belah	1	1	7.5	0		0		0	

Table 2

AVERAGE YIELD OF FILLETED FISH

SPECIES	ENGLISH NAME	ARABIC NAME	average weight (g)	total #	average yield
Acanthocybium solandri	Wahoo	Kanaad Zenjebari	5744.0	1	54.1
Acanthopagrus berda	Picnic Seabream	Khanaph	2320.5	4	36.0
Acanthurus Bleekeri			3128.3	4	38.8
Argyrops spinifer	King Soldierbream	Cophra	2562.0	1	35.0
Arius thalassinus	Giant Catfish	Khaan	979.4	30	20.4
Atule mate	Yellowtail Scad		310.4	65	35.4
Auxis thazard			638.0	3	44.1
Canthidermis rotundatus		Gerbaban	3151.0	2	39.9
Carangoides bajad	Orangespotted Trevally	Hamam	1314.7	3	49.2
Carangoides chrysophrys	Longnose Trevally		2184.0	1	43.8
Carangoides gymnostethus			5048.0	1	44.2
Caranx sexfasciatus	Bigeye Trevally		2922.0	2	46.8
Carcharhinus melanopterus	Blacktipped Reef Shark	Jarjurr	2161.0	1	38.5
Carcharhinus sorrah			12302.	2	53.9
Cephalopholis miniata	Vermilion Seabass	Hamur	3656.0	1	35.5
Chanos chanos	Milkfish		7349.0	1	33.3
Coryphaena hippurus	Common Dolphinfish		5535.6	9	45.6
Diagramma pictum	Painted Sweetlips		2548.0	2	33.0
Elagatis bipinnulata	Rainbow Runner	Ghazaal	4881.4	5	50.8
Epinephelus epistictus	Broken-line Grouper	Hamoor	1429.2	1	33.2
Epinephelus latifasciatus	Banded Grouper	Hamoor	1688.0	1	28.6
Epinephelus multinotatus	Hamoor		4040.0	1	36.6
Epinephelus radiatus	Oblique-Banded Grouper	Hamur	2143.0	1	35.6
Epinephelus sp.		Hamour	2195.1	4	32.3
Euthynnus affinis	Kawakawa		2204.4	6	44.9
Euthynnus pelamis		Thogaibeh	5484.0	1	51.3
Gerres abbreviatus			315.4	7	39.5
Istiophorus platypterus	Sailfish		6863.0	2	40.0
Katsuwonus pelamis		Sada	1562.5	2	53.1
Lethrinus crocineus	Yellowtail Emperor		2026.0	1	37.2
Lethrinus nebulosus	Spangled Emperor	Shari	1362.8	4	35.0
Lutjanus argentimaculatus	Mangrove red snapper		1227.6	5	34.2
Lutjanus malabaricus	Blood Snapper		2943.0	2	34.5
Megalaspis cordyla	Torpedo scad	Deyeyeh	1480.0	1	35.2
Mobula diabola		Tabaq	12240.	1	32.7
Naucrates Ductor	Pilotfish		384.3	6	46.3
Nematalosa nasus			316.3	9	41.6
Nemipterus japonicus	Japanese Threadfin Bream		181.6	87	29.5
Papilloculiceps sp.		Debeiah	2217.0	1	26.8
Parastromateus niger	Black Pomfret		1020.5	2	43.6
Platax orbicularis	Batfish	Amiad	1443.0	1	39.4
Platax pinnatus		Amaid	2258.5	2	35.0
Plectorhinchus chubbi			2368.7	6	32.9
Pomadasys argenteus	Silver-grunt		3486.5	8	30.3
Pomadasys multimaculatum	Cock Grunter		1104.5	1	35.8
Pomadasys sp.		Nagaror	3844.9	8	29.8
Pomadasys sp.		Nagaror	3844.9	8	29.8
Pomatomus saltatrix	Blue Fish		1551.8	5	39.5
Priacanthus sp.	Bullseye	Hamra	522.8	43	31.2
Pristipomoides filamentosus	Blue-spotted Jobfish	Andak sali	5191.6	5	45.5
Psettodes erumei	Indian Spiny Turbot		1709.7	4	36.9
Rachycentron canadum	Cobia	Sekal	9971.0	1	45.8
Rastrelliger kanagurta	Indian Mackerel	Delas	330.8	4	45.5
Sarda orientalis	Striped Bonito		937.2	8	46.5
Saurida tumbil		Hasoom	621.7	15	43.3
Saurida undosquamis	Brushtooth Lizardfish	Hasoom	626.4	16	43.8
Scarus ghobban			3121.0	1	37.4
Scomber japonicus	Chub Mackerel		582.2	16	44.7
Scomberoides lysan	Doublespotted Queenfish		5010.7	3	41.3

SPECIES	ENGLISH NAME	ARABIC NAME	average weight (g)	total #	average yield
Scomberoides sp.			4675.0	2	44.2
Scomberoides tol	Needlescaled Queenfish	Tholaah	371.6	11	47.7
Scomberomorus commerson	Kingfish / Spanish Macker	Kanaad	11621.	11	61.3
Sepia pharaonis	Cuttle Fish		1513.0	3	32.1
Siganus canaliculatus	Whitespotted Spinefoot	Saffy	473.7	8	40.7
Siganus oramin		Safi	1186.0	1	54.2
Sphyraena acutipinnis	Bigeye Barracuda	Gad	734.4	28	43.0
Sphyraena jello		Gadd	3346.0	1	48.3
Thunnus albacares	Yellowfish Tuna	Sehwa	18761.	27	47.5
Thunnus tonggol	Longtail Tuna		5572.0	1	46.1
Trachinotus baillonii	Smallspotted dart		477.7	3	43.6
Trachinotus blochii	Snubnose Pompano	Telaah	1464.0	1	46.0
Trachinotus blochii	Snubnose Pompano	Telsah	1464.0	1	46.0
Trichiurus lepturus	Largehead Hairtail	Sellak	1011.0	2	40.4
Valamugil buchanani	Bluetail Mullet	Beiah	3042.0	1	37.5

Table 3

AVERAGE YIELD FROM WHOLE FISH

SPECIES	ENGLISH NAME	ARABIC NAME	average weight	total #	gutted yield	headed & gutted yield	cooked flesh yield
Ablennes hians	Flat Needlefish		1133.5	3	91.5	70.9	76.7
Atule mate	Yellowtail Scad		177.6	1		74.6	41.2
Carangoides chrysophrys	Longnose Trevally		1236.6	1		87.1	39.0
Carangoides ferdau	Blue Trevally		448.0	2	92.2		56.7
Carangoides gymnostethus			5048.0	1	85.4	75.6	
Cephalopholis miniata	Vermillion Seabass	Hamoor	964.0	1	93.4	77.2	36.8
Chanos chanos	Milkfish		7349.0	1	84.0	75.3	
Clupeidae nematolosa			310.8	1	82.1	74.4	
Coryphaena hippurus	Common Dolphinfish		6166.7	3	82.4	63.2	
Drepane longimana			304.4	1	93.9		43.9
Epinephelus diacanthus	Thorny Cheek Grouper		519.6	1		65.8	34.8
Euthynnus affinis	Kawakawa		3447.1	1	82.2	62.0	
Gerres acinaces	Longtail Silver-biddy		480.4	1	88.7		49.0
Istiophorus platypterus	Sailfish		13699.	1	86.9	78.7	
Lethrinus nebulosus	Spangled Emperor	Sheery	1143.5	2	84.2	66.9	32.6
Lutjanus ehrenbergii	Ehrenberg's Snapper		278.8	3	87.8		46.6
Mobula diabolo		Tabaq	12240.	1	50.0	40.5	32.7
Mugil cephalus	Flathead Mullet	Belah	654.5	4	81.1	66.9	44.0
Nematalosa nasus			180.5	11	80.4	59.1	59.1
Nemipterus japonicus	Japanese Threadfin Bream		354.5	6	89.4	73.0	42.8
Pagellus natalensis	Natal Pandora		394.6	1		77.1	50.2
Parastromateus niger	Black Pomfret		1020.5	2	86.5	70.8	43.4
Parupeneus rubescens	Rosy Goatfish		391.2	4		73.4	45.6
Pomadasys stridens	Stripped Piggy		176.4	2		66.4	35.2
Priacanthus hamrur	Moontail Bullseye		347.7	1		65.0	34.4
Pristipomoides filamentosus	Blue-spotted Jobfish		733.8	3	90.2		47.6
Rastrelliger kanagurta	Indian Mackerel		379.7	3	82.0		47.6
Rhynchobatus djiddensis	Wedgefishes		1748.5	2		57.2	43.6
Saurida tumbil		Hasounr	686.4	5		68.8	30.1
Saurida undosquamis	Brushtooth Lizardfish		162.3	1		76.5	46.1
Scolopsis taeniatus	Banded Monocle Bream		423.2	2		73.5	39.0
Scomberomorus commerson	Kingfish / Spanish Macker	Kanaad	5710.1	14	92.4	84.4	81.1
Siganus argenteus	Streamlined Spinefoot		448.6	3	84.0		42.3
Siganus javus	Streaked Spinefoot		341.4	3	89.8		49.0
Sphyraena acutipinnis	Bigeye Barracuda	Gid, Jid	495.9	1		78.9	54.5
Sphyraena jello		Gid, Jid	956.4	2	89.4		50.0
Sphyraena sp.		Gid, Jid	2166.7	5	87.9	75.2	
Terapon puta	Smallscale Terapon		432.1	1		70.2	34.7
Thunnus albacares	Yellowfish Tuna	Sahwa	9173.7	3	88.0	77.9	53.9
Thunnus tonggol	Longtail Tuna		2853.4	2	88.0	73.7	42.6
Trichiurus sp.			825.4	2	88.4	76.8	
Tylosurus corcodilus		Kherkhoor	2567.0	1	88.3	74.5	
Tylosurus acus melanotus			862.8	1	73.3		49.1
Uraspis secunda	Cottonmouth jack		753.9	1		88.9	43.9

Table 4

AVERAGE MOISTURE CONTENT OF SEAFOOD

SPECIES	ENGLISH NAME	ARABIC NAME	total #	percent moisture
Acanthopagrus berda	Picnic Seabream	Khanaph	3	75.4
Acanthurus bleekeri	Surgeonfish		3	77.5
Argyrops spinifer	King Soldierbream	Cophra	3	77.6
Arius thalassinus	Giant Catfish	Khaan	9	79.5
Atule mate	Yellowtail Scad	Saal	7	73.3
Auxis thazard	Frigate tuna	Deraige	3	73.4
Canthidermis rotundatus	Triggerfish	Gerbobah	3	76.7
Carangoides gymnostethus	Bludger	Hamman	3	66.9
Caranx sexfasciatus	Bigeye Trevally	Josh	9	73.9
Carcharhinus sp.	Shark	Jerjoor	6	75.6
Cephalopholis miniata	Vermilion Seabass		3	82.7
Diagramma pictum	Painted Sweetlips	Khashom	6	75.2
Elagatis bipinnulata	Rainbow Runner	Ghazaal	15	76.3
Epinephelus areolatus	Areolated Grouper	Hamour	3	80.4
Epinephelus sp.	Grouper	Hamour	6	69.9
Euthynnus affinis	Kawakawa	Sada	9	73.3
Gerres abbreviatus	Deepbody Silverbiddy		3	79.2
Istiophorus platypterus	Sailfish	Khail bahr	3	76.5
Katsuwonus pelamis	Skipjack Tuna		3	72.8
Lethrinus nebulosus	Spangled Emperor	Shaeery	9	76.6
Lutjanus malabaricus	Blood Snapper	Hamra	3	76.7
Naucrates ductor	Pilotfish		3	75.3
Nematalosa nasus		Sowamee	6	77.2
Nemipterus japonicus	Japanese Threadfin Bream		3	80.1
Panulirus homarus	Scalloped Spiny Lobster	Sharkha	3	76.4
Papilloculiceps sp.	Spiney Flathead	Debelah	3	79.2
Parastromateus niger	Black Pomfret	Halwaioh	9	71.4
Platax pinnatus		Amiad	3	71.2
Plecto[illegible]chus chubbi		Khashom	3	77.4
Plectorh[illegible]chus schotaf	Minstrel Sweetlips	Kharmal	3	79.9
Plectorhinchus sp.	Sweetlips	Kharmal	3	76.3
Pomadasys operculare	Smallspotted Grunter	Negeror	6	76.8
Pomadasys sp.	Grunt	Negeror	15	75.7
Pomatomus saltatrix	Blue Fish	Tekowaiah	3	75.8
Priacanthus hamrur	Moontail Bullseye	Hamra	3	80.3
Pristipomoides filamentosus	Blue-spotted Jobfish	Hamra	6	76.0
Rachycentron canadum	Cobia	Sekal	3	67.8
Rastrelliger kanagurta	Indian Mackerel	Garfa	3	70.0
Sarda orientalis	Striped Bonito	Seqotanah	3	73.2
Saurida tumbil		Masoom	3	79.2
Scarus ghobban			3	76.5
Scomber japonicus	Chub Mackerel		3	74.7
Scomberoides tol	Needlescaled Queenfish	Thalaah	3	71.1
Scomberomorus commerson	Kingfish	Kanaad	18	64.4
Sepia pharaonis	Cuttle Fish	Habara	3	82.7
Siganus canaliculatus	Whitespotted Spinefoot	Saafy	3	73.8
Siganus oramin	Rabittfish		3	73.5
Sphyraena acutipinnis	Bigeye Barracuda	Qad	3	73.8
Sphyraena jello	Barracuda	Qad	3	74.4
Thunnus albacares	Yellowfish Tuna	Galther	58	74.9
Trachinotus blochii	Snubnose Pompano	Talaah	3	72.5
Trichiurus lepturus	Largehead Hairtail	Salfak	3	76.8
Tylosurus crocodilus	Hound Needlefish	Kherkhoor	3	74.1
Valamugil buchanani	Bluetail Mullet	Balah	3	76.3

APPENDIX 2

Table 1

New records for Oman and/or range extensions

Gymnothorax favagineus	Muraenidae	Honeycomb Moray	Nachooch
Siderea grisea	Muraenidae	Grey Moray Eel	Nachooch
Echidna nebulosa	Muraenidae	Snowflake Moray	
Echidna zebra	Muraenidae	Zebra Moray	
Gymnothorax nudivomer	Muraenidae	Yellowmouth Moray	
Siderea picta	Muraenidae		
Plotosus species	Plotosidae	Catfish	
Doryrhamphus excisus	Syngnathidae	Bluestripe Pipefish	
Corythoichthys flavofasciatus	Syngnathidae	Pipefish	
Trachyrhamphus bicoarctatus	Syngnathidae	Double-end Pipefish	
Scorpaenopsis barbatus	Scorpaenidae	Bearded Scorpionfish	Rahwah
Pterois antennata	Scorpaenidae	Antennata Lionfish	Deech al Bahar
Aethaloperca rogaa	Serranidae	Redmouth Grouper	
Cirrhitus pinnulatus	Cirrhitidae	Stocky Hawkfish	
Pseudochromis linda	Pseudochromidae	Linda's Dottyback	
Pseudochromis leucorhynchus	Pseudochromidae	Leucorhynchus Dottyback	
Psuedochromis nigrovittatus	Pseudochromidae	Blacklined Dottyback	
Pseudochromis persicus	Pseudochromidae	Bluespot Dottyback	
Pseudochromis nov sp.	Pseudochromidae	Dark Dottyback	
Plesiops nigricans	Plesiopidae	Whitespotted Plesiops	
Cheilodipterus quinquelineatus	Apogonidae	Fiveline Cardinalfish	
Narcine nov sp.	Narkidae		
Rhinobatos punctifer	Rhinobatidae	Spotted Guitarfish	
Gymnura japonica	Dasyatidae	Japanese Butterfly Ray	
Anthias conspicuus	Anthiidae	Conspicuous Basslet	
Uropterygius concolor	Muraenidae	Uniform Reef Eel	
Apogon cyanosoma	Apogonidae	Golden Striped Cardinal	
Cheilodipterus bipunctatus	Apogonidae	Two Dot Fiveline Cardinal	
Apogon fraenatus	Apogonidae	Bridled Cardinal	
Apogon taeniatus	Apogonidae	Twobelt Cardinal	
Apogon multitaeniatus	Apogonidae	Smallscale Cardinal	
Siphamia species	Apogonidae		
Myxus capensis	Mugilidae	Cape Mullet	Bia
Amphiprion nov sp.	Pomacentridae	Dhofar Clownfish	Ega'aisse
Dascyllus trimaculatus	Pomacentridae	Domino Damsel	Ega'aisse
Dascyllus marginatus	Pomacentridae	Blackbordered Damsel	Ega'aisse
Chromis species	Pomacentridae	Yellowtail Chromis	Ega'aisse
Pomacentrus aquilus	Pomacentridae	Sombre Damsel	Ega'aisse
Chrysiptera annulata	Pomacentridae	Footballer	Ega'aisse
Stethojulis species	Labridae	Cutribbon Wrasse	
Thalassoma lunare	Labridae	Moon Wrasse	
Scarus ferrugineus	Scaridae	Rusty Parrotfish	Gain
Chaetodon dialeucos	Chaetodontidae	Oman Butterflyfish	Misht
Chaetodon nov sp.	Chaetodontidae	Muscat Butterfly	Misht
Apolemichthys xanthotis	Pomacanthidae	Yellow-ear Angel	Misht

Acanthurus xanthopterus	**Acanthuridae**	**Yellowdot Surgeon**	
Zanclus canescens	**Zanclidae**	**Moorish Idol**	Misht al-aroos
Trichonotus species	**Trichonotidae**	**Sand Diver**	
Istiblennius periophthalmus	**Blenniidae**	**Red-Dotted Blenny**	
Meiacanthus species	**Blenniidae**	**Blenny**	
Plagiotremus rhinorhynchus	**Blenniidae**	**Bluestriped Blenny**	
Istigobius decoratus	**Gobiidae**	**Decorated Goby**	
Bathygobius species	**Gobiidae**	**Goby**	
Sufflamen chrysopterus	**Balistidae**	**Bluethroat Trigger**	Humarah
Odonus niger	**Balistidae**	**Redtooth Trigger**	Humarah
Melichthys indicus	**Balistidae**	**Indian Trigger**	Humarah
Canthidermis maculatus	**Balistidae**	**Leatherjacket Trigger**	Humarah
Sufflamen fraenatus	**Balistidae**	**Bridle Trigger**	Humarah
Stephanolepis diaspros	Monacanthidae	**Reticulated Filefish**	**Bughoomee**
Ostracion cyanurus	Ostraciidae	Bluetail Boxfish	Sandookal Bahar
Ostracion cubicus	Ostraciidae	Bluespot Boxfish	Sandook al Bahar
Tetrosomus gibbosus	Ostraciidae	Thornback Trunkfish	Sandook al Bahar
Arothron meleagris	Tetraodontidae	Guineafowl Puffer	Fugul
Arothron stellatus	Tetraodontidae	Starry Puffer	Fugul
Arothron immaculatus	Tetraodontidae	Immaculate Puffer	Fugul
Arothron sp.nov	Tetraodontidae	Dhofar Puffer	Fugul
Canthigaster solandri	Tetraodontidae	Pearl Sharpnose Puffer	
Canthigaster valentini	Tetraodontidae	Valentine's Puffer	
Diodon holocanthus	Diodontidae	Porcupinefish	
Thalassoma klunzingeri	Labridae	Klunzinger's Wrasse	
Apogon taeniophorus	Apogonidae	Cardinalfish	
Gymnothorax species	Muraenidae	Salalah Moray	Thaban
Abudefduf notatus	Pomacentridae	Yellowtail Sergeant	
Pomacentrus caeruleus	Pomacentridae	Blue Damsel	
Apogon semiornatus	Apogonidae	Ornate Cardinal	
Archamia fucata	Apogonidae	Orangelined Cardinal	