PN-ABT-711
ISN 92389

P-151
94-03

TUVALU BOTTOMFISH PROJECT REPORT ON THE FIRST EXPORT MARKETING TRIAL

Pacific Islands Marine Resource Project
Tuvalu Component

Project No. 879-0020

Prepared by RDA International, Inc.
under Contract No. 879-0020-C-1231-00
with USAID/RDO/SP

Paul K. Bartram

March 1994
RDA International, Inc.
801 Morey Drive
Placerville, CA 95667-4411
Telephone: (916) 622-8800
Facsimile: (916) 626-7391

This report was made possible through support provided by USAID under the terms of Contract No. AID 879-0020-C-00-1231-00. The opinions expressed and conclusions reached here are those of the author and do not necessarily reflect the views of USAID.

2

ABBREVIATIONS

USAID	United States Agency for International Development
FAD	Fish Aggregating Device
PCC	Project Coordination Committee
PIMAR	Pacific Island Marine Resource
RDO	Regional Development Office
GOT	Government of Tuvalu
MRA	Marine Resources Adviser
NAFICOT	National Fishing Company of Tuvalu
SP	South Pacific

3

TABLE OF CONTENTS

1.0	EXECUTIVE SUMMARY	1-1
2.0	INTRODUCTION	2-1
3.0	DESCRIPTION OF SHIPMENT	3-1
3.2	Packing	3-2
3.3	Shipping	3-3
3.4	Detailed Procedures	3-3
4.0	EVALUATION OF FISH QUALITY	4-1
6.0	MARKETING ALTERNATIVES	6-1
6.1	Hawaii	6-1
6.2	Japan	6-1
6.3	U.S. Mainland	6-2
6.4	Europe	6-3
7.0	RECOMMENDATIONS	7-1
7.1	Conduct Additional Export Marketing Trials	7-1
7.3	Target Larger Bottomfish for Export	7-2
7.4	Target Non-Bottomfish Species of High Market Value	7-2
7.5	Increase Net/Gross Weight Ratio in Fish Shipments	7-2
7.6	Improve Sanitation on Fishing Vessels	7-3
7.7	Take Measures to Eliminate Ciguatera Hazard	7-3
8.0	REFERENCES CITED	8-1

APPENDICES

APPENDIX A.	HAWAIIAN, EQUIVALENT NAMES AND MARKETABILITY OF BOTTOMFISH SPECIES	A-1
APPENDIX B.	DETAILED PROCEDURES FOR EXPORTING TUVALU BOTTOMFISH TO HAWAII	B-1
APPENDIX C.	UNDERSTANDING CIGUATERA POISONING	C-1

TABLES

TABLE 3-1	COMPOSITION OF FIRST EXPORT SHIPMENT FROM TUVALU	3-2

FIGURES

FIGURE 4-1	INDICATORS OF HIGH QUALITY IN FRESH ISLAND BOTTOMFISH	4-2

1.0 EXECUTIVE SUMMARY

Tuvalu may have the potential for developing a commercial fisherv which targets deepwater bottomfish for export overseas. To test this potential, a series of export marketing trials was initiated by the RDA Tuvalu Bottomfish Project in January 1994. This report describes and evaluates the results of the first trial. Despite the fragile communications and transportation links to the Hawaii seafood market, 214 kg of fresh bottomfish was shipped from Tuvalu to Honolulu on January 25, 1994.

Product temperature was carefully controlled at sea, during packing, and in transit, and the fish were delivered to market in excellent condition. The marketing results were encouraging even though the first shipment was comprised of a wide mix of species and was dominated by small fish. The average price received for the shipment is considered high (A$ 8.62/kg) for a Tuvaluan supplier with no previous record of selling bottomfish in the Hawaiian market.

Due to economic recession in Hawaii and increasing imports from the Pacific basin, the Hawaii bottomfish market is changing dramatically and should not necessarily be the exclusive market destination for Tuvalu fish. Up to six additional export marketing trials (one every two weeks from February through May 1994) should be conducted to test alternative market niches in Hawaii, and also in Okinawa and the continental U.S., if the Tuvalu project can produce a sufficient quantity of exportable bottomfish for the latter destinations.

It is strongly recommended that the project adopt commercial bottomfishing methods that promote targeting of the species most desirable for export (especially opakapaka and onaga). A master fisherman from Hawaii may be needed to teach some of the more specialized techniques. A plotter should be acquired to interface with the global positioning system on the Tuvalu government vessel *Manaui*, and a sea anchor should be obtained to aid in holding vessel position over productive fishing areas. The purpose of these and other recommendations contained in the report is to increase the income Tuvalu could earn from bottomfish export.

2.0 INTRODUCTION

The purpose of the RDA Tuvalu Bottomfish Project is to evaluate the commercial feasibility of an export fishery based on bottomfish found on offshore seamounts in the Tuvalu Exclusive Economic Zone. The project has completed the initial phase of resource assessment and is entering the second phase--commercial fishing and marketing trials.

This report describes and evaluates the first export shipment of bottomfish from Tuvalu to Hawaii in January 1994. The composition of the shipment (weight, species, sizes) and the procedures used at sea and on shore to produce the export are described in Section 3.0. Fish quality is assessed in Section 4.0 and marketing results are reported in Section 5.0. Section 6.0 considers marketing alternatives in Hawaii and elsewhere. Section 7.0 recommends that up to six additional export marketing trials be conducted during the period February-May 1994. This section contains other recommendations for increasing the income Tuvalu derives from bottomfish export.

In this report, bottomfish species are generally referred to by their Hawaiian names. This is consistent with marketing practice and is the standard usage throughout the Pacific region. Appendix A contains a table of Tuvaluan, scientific, Hawaiian and English common names for the most commonly traded bottomfish species. The marketability of major species is ranked in this appendix.

3.0 DESCRIPTION OF SHIPMENT

A trial shipment of fresh chilled bottomfish was exported from Funafuti, Tuvalu, on January 25, 1994. The shipment contained 214 kg of a diverse mix of species (see Table 3-1). Species of primary market importance (the deepwater snappers opakapaka and onaga, and the pelagic ono) comprised 15% of the total weight delivered to Hawaii. Species of secondary market importance (yelloweye opakapaka, uku, lehi, gindai, ehu) comprised 70% of the exported weight. Three species of grouper unknown to the Hawaii market accounted for about 9% of the total fish weight. One wahoo, one papio and one Randall's snapper were also included in the first trial shipment from Tuvalu. Most of the exported fish were smaller than 2.5 kg (whole weight).

3.1 Fishing

The exported fish were caught over the span of six days of fishing by the Tuvalu government vessels *Manaui* and *Tasu*. Fish were caught on vertical lines wound onto hydraulically-operated reels or hand-operated Samoan reels. Fish taken early in the fishing trip had been dead 8 days when they were marketed in Hawaii, whereas fish taken on the last day of the fishing trip had been dead only three days when marketed. The fish were stored and shipped in whole form, except for large ehu which were gutted immediately after capture.

TABLE 3-1 COMPOSITION OF FIRST EXPORT SHIPMENT FROM TUVALU

SPECIES	WEIGHT DELIVERED (kg)	NUMBER OF FISH	AVERAGE WEIGHT OF FISH (kg)	AVERAGE MARKET PRICE (A$)
Grouper	18.36	17	1.08	6.99
Opakapaka	21.68	10	2.17	11.52
Yelloweye opakapaka	34.36	28	1.23	7.49
Uku	39.09	11	3.55	7.07
Lehi	16.77	7	2.40	7.92
Ehu	61.45	9	6.83	8.33
Gindai	1.86	2	0.93	7.20
Onaga	7.55	2	3.78	13.05
Papio (trevally)	2.00	1	2.00	5.76
Randall's snapper	7.05	1	7.05	14.40
Ono	3.64	1	3.64	10.80

All bottomfish were killed and bled by spiking immediately after capture. Fish of exportable species were placed in an ice-seawater slurry, for 2 to 4 hours, until stiff and straight. To make the slurry, one part ice was mixed with one part seawater in a 160-quart insulated plastic cooler. A small amount of salt was added to the slurry to lower its temperature to about 0°C. A teaspoon of "Taiyo fish preservative" was mixed in to prevent build-up of bacteria and slime on the fish bodies, especially the gills. The slurry water was changed whenever it became noticeably discolored from heavy use. Fish removed from the slurry were wrapped in Japanese "rice paper" and then iced in layers in the refrigerated hold of the fishing vessel where the temperature is maintained at 0 to -1°C. Export fish were kept in the refrigerated hold until the day of packing and shipping.

3.2 Packing

Several hours before scheduled departure of the shipment, the fish were removed from the vessel hold and placed in insulated coolers with ice. The facilities of the National Fishing Corporation of Tuvalu (NAFICOT) were used for receiving, weighing and packing of fish.

8

After being weighed individually, the fish were packed for air freight. The packing material consisted of three layers: an outer carton of wax-impregnated cardboard, fitted with a layer of thermal barrier insulation ("insufoil"), protecting the inner layer of fish enclosed in a plastic liner. The fish were placed inside the plastic so that the head of one fish faced the tail of the adjacent fish. The fish were packed in two layers with bags of frozen coolant covering each layer. For the first shipment, approximately 10 kg of frozen water bags were enclosed in each carton. The outer box was sealed with tape and marked with the name and address of the consignee. The total gross weight of the loaded cartons was recorded and provided to the airline.

3.3 Shipping

The export fish were transshipped through Nadi, Fiji. The first carrier was Air Marshall Islands, which delivers the freight from Funafuti to Nadi Airport. On arrival in Fiji, a freight forwarding agent received the cargo and placed it in chill storage, completed documentation and shipped it out on the Qantas flight from Nadi to Honolulu. The fish spent approximately 18 hours in transit from Funafuti to Hawaii.

The type of aircraft (Hawker Siddeley HS 748) presently used by Air Marshall Islands (AMI) on Funafuti routes has very limited cargo capacity. Nevertheless, AMI has made a commitment to reserve cargo space for approximately 250-300 kg per week (on the Tuesday flight to Nadi). The freight forwarder at Nadi airport responsible for transshipment anticipates little problem as long as bookings are made well in advance for exports to Hawaii.

3.4 Detailed Procedures

Appendix B contains a more detailed description of the procedures that should be followed in the export of Tuvalu bottomfish to Hawaii.

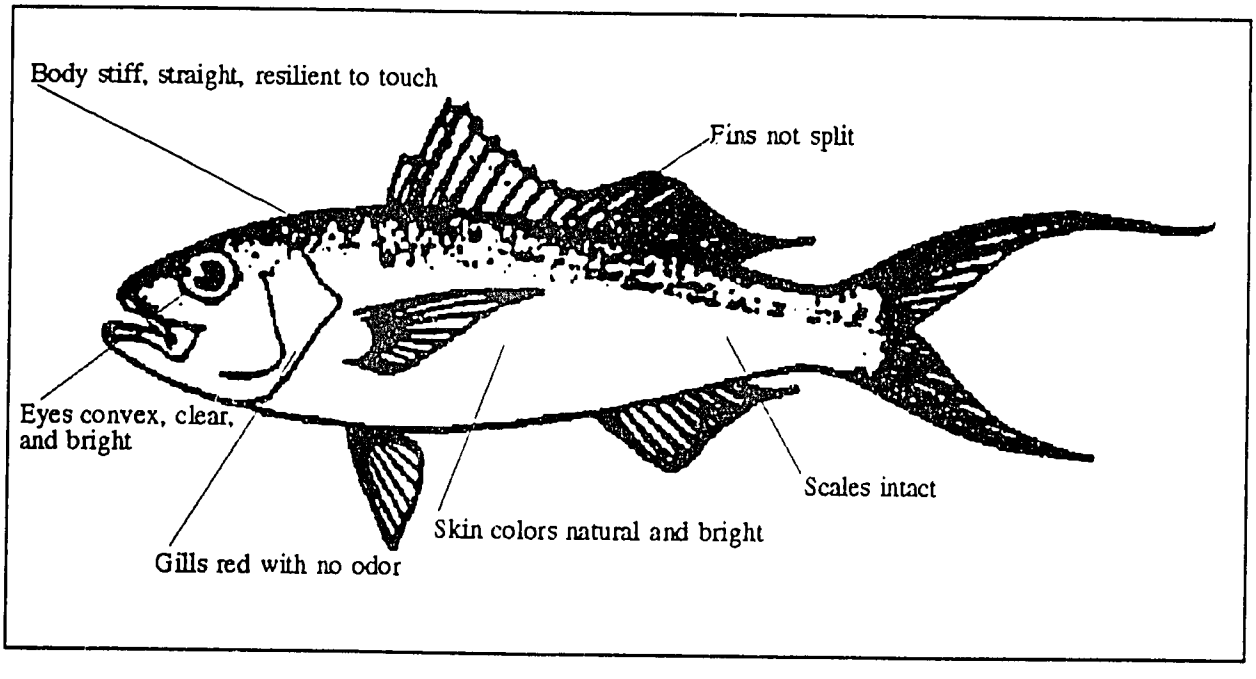
4.0 EVALUATION OF FISH QUALITY

Vessels that fish in the Northwestern Hawaiian Islands regularly land bottomfish after 14-day trips, but 7 to 10 days is considered to be the maximum age for bottomfish to command top prices in the Hawaiian market. For Tuvalu bottomfish, the duration between capture and marketing was as follows:

	Days
On board vessel while fishing	5
Return to Funafuti	1
Pack and transship to Hawaii	1
Marketing in Hawaii	2
TOTAL	9

Figure 4-1 illustrates the primary determinents of good quality in whole bottomfish. In Hawaii, the quality of tuna is evaluated by exposing a flap near the fish tail so that the flesh can be inspected for color and texture prior to sale. Bottomfish are not graded in the same manner. Instead of cutting into the flesh, buyers assess quality by examining the color of the gills, clarity of the eyes and appearance of the body.

FIGURE 4-1 INDICATORS OF HIGH QUALITY IN FRESH ISLAND BOTTOMFISH



Only two major defects in quality were observed: (1) skin damage on some fish caused by contact with the wire leader used in fishing; and (2) discoloration of gills which may be caused by residue on bags in which ice is stored or by contamination of export fish by bacteria originating with bait, non-export fish or provisions stored in the same fish hold.

The price paid for fresh bottomfish varies with their quality and with end use. If the end use is for upscale retail markets or Japanese restaurants, the fish must have an exceptionally fresh appearance. If the end use is for non-Japanese restaurant dinner portions, the shelf life of the fish is the most important consideration. The appearance of the eyes and gills may provide an indication of shelf life, but most seafood processors who supply bottomfish to restaurants are concerned about accumulating an inventory of fish that will hold up until it is processed a few days after purchase. For this segment of the bottomfish market, buyers may overlook some deterioration of gills, eyes and skin colors if the bodies are firm and there are no "off" odors in the gills and bellies of the fish. High quality bottomfish can be sold to all segments of the Hawaii bottomfish market, whereas lower quality fish can only be sold as fillets priced at a discount to generate immediate sale.

In the first shipment of bottomfish from Tuvalu, a generally high quality of fish was maintained from the time of capture through marketing. Temperature control of fish at sea, during packing and transit to market was more than satisfactory. The more recent catch (three days old) had a very fresh appearance, with full eyes and bright red gills. The older catch still had good skin colors, full eyes and firm bodies. The gills of the latter fish were discoloring but there were no odors emanating from the gills. All of the Tuvalu fish proved to have good shelf life.

5.0 MARKETING RESULTS

The first trial export of fresh, chilled Tuvalu bottomfish was shipped to Garden and Valley Isle Seafood (GVI) of Honolulu, Hawaii, for consignment sale (i.e., price was not pre-determined but was based on market conditions at the time of import). GVI is a major processor of bottomfish for Hawaii restaurants. Once reaching market, the Tuvalu fish proved to have a good shelf life, which allowed the marketer to blend it into its normal sales programs without having to discount price. Most of the fish was sold in Hawaii but a small quantity was re-exported as part of a fresh fish shipment to Zurich, Switzerland.

Market prices ranged from a high of A$ 11-13/kg (whole weight) to a low of A$ 6-7/kg. Predictably, primary market species of restaurant size (e.g., opakapaka and onaga > 2.5 kg) received the highest prices, whereas secondary market species (uku, lehi, gindai, yelloweye opakapaka and other species smaller than 2.5 kg) received the lowest prices. Averaged for the entire shipment, the market price was A$ 8.62/kg. The total sales revenue amounted to A$ 1,844.94.

Garden and Valley Isle Seafood charged A$ 1.43/kg for marketing the Tuvalu fish. The remainder of the sales revenue was remitted to the RDA Bottomfish project. Hence, the net return from the trial shipment is A$ 1,533.60, or A$ 7.17/kg.

6.0 MARKETING ALTERNATIVES

The targeted species in the RDA Tuvalu Bottomfish Project are sold in narrow-based, specialized markets, unlike seafood commodities such as tuna and swordfish that are mass-marketed. Such specialized markets exist, principally in Hawaii and Japan, but the market base has declined because of economic recession in those areas.

6.1 Hawaii

A preliminary economic evaluation conducted for the RDA Tuvalu Bottomfish Project identified Hawaii as the most desirable market destination for all export-grade bottomfish (Philipson, 1992). This basic conclusion remains correct, but the Hawaii bottomfish market has become less stable since 1992. Increasing imports from Tonga, Fiji, Western Samoa, Indonesia, the Solomon Islands and Australia frequently saturate the market and create an imbalance between supply and demand. The present trend invalidates one of the assumptions made in the preliminary economic evaluation of the Tuvalu bottomfish project: "...that price levels for imported fish will remain steady or even increase" (Philipson, 1992).

Alternative markets and marketing strategies, not previously considered as attractive as Hawaii, deserve more serious consideration. The preliminary economic evaluation (Philipson, 1992) considered three options for the marketing of Tuvalu bottomfish:

a) Sale under a long-term agreement with a Hawaiian wholesaler at fixed prices.

b) Consignment to the Honolulu fish auction for sale through competitive bidding.

c) Consignment to a Hawaiian wholesaler for sale at spot market prices.

Option a) is not available under the present conditions in the Hawaiian bottomfish market because wholesalers are avoiding long-term commitments involving pre-arranged prices. Option b) is still available but the "windows" when good prices are available for imported bottomfish are fewer than in the past. Imported fish often sell at discounts because of the buyers' unfamiliarity with and suspicion of new suppliers. Option c) is the preferred alternative because good-quality bottomfish from Tuvalu can be blended into normal sales activity without having to discount price or overcome possible biases against imported bottomfish.

6.2 Japan

Japan is not usually considered as a primary market destination for Pacific island bottomfish because of poor prices offered for imported versus domestic product, Japan's preferences for smaller (plate size) bottomfish and high freight rates and marketing costs (Philipson, 1992). Studies of the Japanese market for deepwater snapper have determined that imported deepsea snapper did not usually receive price premiums in urban markets (Crossland, 1985). Test marketing in Japan of the highest

quality onaga caught in Hawaii produced similar disappointing results (D. Leong, Wing Sing Seafood, pers. comm.).

It is difficult to generalize about the Japanese market because of that country's distinct regional preferences for fish. In many areas, the most important determinant of market price for a fish is its familiarity to the buyers. Fish which are well known will normally realize a higher price than the ones which are little known even if their product quality is better than that of the more familiar species.

There is a well-established fishery and market for bottomfish in Okinawa. The value of a fish is much greater in an area where it is known and regularly consumed. Consequently, the Okinawa market offers price premiums for certain species (especially groupers and onaga) not available elsewhere in Japan (Wakugawa, pers. comm.).

The mix of bottomfish species caught in Tuvalu fishing trials includes several species of small grouper. If these can be harvested in sufficient quantity (50-100 kg) to fill one or two boxes, grouper should be targeted as a primary export species and a trial shipment should be arranged to Okinawa for test marketing.

6.3 U.S. Mainland

Relatively few restaurants in the continental U.S. purchase and serve deepwater snapper from the Pacific Islands. Species such as opakapaka and onaga are unknown to most chefs on the U.S. mainland. Their high price relative to mid-water snapper from the Gulf of Mexico and elsewhere has discouraged greater use.

The oversupply of deepwater snapper in the Hawaiian market could be partially relieved by re-exporting surpluses to the U.S. mainland. Such an initiative is beyond the scope of the RDA Tuvalu Bottomfish Project. Tuvalu bottomfish production alone does not provide the consistency of supply that is necessary to open up new markets. In the later stages of export marketing trials, however, it may be feasible to export small quantities of bottomfish to one restaurant chain on the U.S. west coast. Arrangements are being made for this contingency with a Seattle, Washington, chain. The buyer for this chain would prefer a promotion centered around the exotic image and identity of Tuvalu rather than a seafood promotion (D. Pugh, E&E Foods, pers. comm.).

When the Hawaiian bottomfish market is healthy, prices for good quality bottomfish are at the high end of the spectrum. The U.S. mainland should not be thought of as a market which can match Hawaii's sometimes high prices, but as a market for surplus fish that cause precipitous drops in Hawaii bottomfish prices. Without some price discounting in the early stages of product promotion, Pacifc Island bottomfish will never overcome initial resistance and unfamiliarity.

6.4 Europe

Species of Pacific Island deepwater snapper and grouper are unfamiliar to most European fish marketers. There is, however, a small demand for onaga, opakapaka and uku among the more elite seafood processors who supply the best restaurants and steamship cruise lines. A small quantity of Tuvalu bottomfish (uku) included in the first export shipment to Hawaii was re-exported to such a company in Zurich, Switzerland. This company has previously rejected Tongan snapper and even snapper from the Northwestern Hawaiian Islands as unsatisfactory but found the Tuvalu fish to be of acceptable quality. Test marketing of Tuvalu fish should be conducted on a larger scale in Europe to determine if this market could generate a higher market return.

15

7.0 RECOMMENDATIONS

7.1 Conduct Additional Export Marketing Trials

Up to six additional export marketing trials (one every two weeks from February through May 1994) should be conducted to explore alternative market niches in Hawaii, and also in Okinawa, the continental U.S., and Europe, if the Tuvalu project can produce a sufficient quantity of exportable bottomfish for the latter three destinations.

7.2 Target High-Value Species for Export

Additional export marketing trials should be coordinated with the introduction of commercial bottomfishing methods. All fishing by the project to date has been conducted for the primary purpose of resource assessment. Non-commercial fishing methods have been used. With the completion of research and initiation of the marketing phase of the project, it will be necessary to target the bottomfish species which have the greatest export value (especially onaga and opakapaka). These fish are not evenly distributed over the seamount habitat but occur in pockets where their food is concentrated. Special skills are required to locate these pockets, to position the vessel and its fishing gear directly over fish concentrations and to keep fish biting. The following procedures are among those practiced in Hawaii's commercial bottomfish fishery:

- Fish only in the depth range between 120-200 m, where export species are most concentrated. Test fishing should be conducted while drifting over seamount slopes in the proper depth range. Seamounts often have one side that is exposed to nutrient-rich upwelling currents and this is usually the most productive area for bottomfishing. When there are signs of bottomfish (e.g., surface schools of skipjack tuna or a bottomfish bite while the vessel is drifting), the drift of the vessel needs to be slowed to increase time over the fish. Deployment of a sea anchor is a helpful technique, especially when the ocean bottom is too deep for anchoring. The Tuvalu Bottomfish Project should acquire a sea anchor of suitable size for holding vessel position over productive fishing areas.

- Color echo sounders are used to search the profile of a seamount and select the most likely places to fish (based on a combination of depth and bottom topography). Searching is most effective when the color sounder is used in conjunction with a global positioning system and a plotter. The Tuvalu government vessels *Manaui* and *Tasu* have all of the necessary equipment except the plotter. The Tuvalu Bottomfish Project should consider the acquisition of a plotter.

- In some situations, fish images can be detected on color sounders. Because of the steep slopes of the Tuvalu seamounts, the monitor displays a thick "return"

that will probably obscure fish images. It is still possible to locate canyons and pinnacles along the seamount slope which are worth test fishing.

- When fish concentrations are located, the vessel should be anchored so that the wind and current will position it over the preferred site. Helpful for this purpose are using a long length of chain at the end of the anchor line (for greater weight), tying the anchor line at midships to generate a "sailing" effect, or deploying a sea anchor. It is probably not feasible to anchor in deep water on the windward slopes of seamounts which drop precipitously to great depths.

- When fish start to bite at an anchored position, chum should be released at or above the depth where fish are biting to (1) induce bottomfish to feed at shallower depths in the water column to reduce line hauling time; (2) induce bottomfish to move upcurrent if the vessel is not positioned exactly over the preferred site; or (3) to induce reluctant feeding fish to bite. The purpose of chumming is to increase the fish caught per hour of fishing, so that fishing trips are as short as possible and the freshest product is delivered to shore.

The proper use of chum could be taught most efficiently under the guidance of a Hawaiian master fisherman. Joe Marks, one of the Hawaiian fishermen most skilled in this practice, is completing an assignment for RDA on the PIMAR/Tonga project. The Tuvalu Project should request the services of Mr. Marks for a short-term assignment in Tuvalu to train the crews in fishing techniques, vessel positioning, and chumming.

7.3 Target Larger Bottomfish for Export

Bottomfish are often segregated by size class, with large fish inhabiting deeper water than small fish. For most species, fish larger than 2.5 kg are more valuable than smaller fish. This size is the minimum that is filleted for restaurant dinner portions. Small sizes of bottomfish can receive premium prices if they are fresh enough (4-5 days after harvest) for restaurant display or for high-end seafood retailers. The major exception to the size requirement is ehu, which is most valuable in small sizes (< 5 kg). Fillets processed from large ehu (> 5 kg) often have a dull, chalky appearance that detracts greatly from their commercial value.

7.4 Target Non-Bottomfish Species of High Market Value

If bottomfishing is poor, one method of increasing the revenue from Tuvalu fish exports is to target high-value pelagic species, especially wahoo, which sometimes command top market prices in Hawaii. Wahoo larger than 5 kg are the most valuable.

7.5 Increase Net/Gross Weight Ratio in Fish Shipments

Fish exported by air freight from Tuvalu to Honolulu has to be transshipped through Nadi, Fiji. The use of two different carriers (Air Marshall Islands and Qantas) results

in high air freight cost: A$ 2.85/kg of gross weight. The net weight of fish in the first trial shipment accounted for only 60% of gross weight, so air freight was actually A$ 4.75/kg of fish weight. Insulation and frozen coolant contributed an unusually high percentage of gross weight in the first shipment because the transportation system had never been tested and caution was advised to avoid loss of quality in transit. The first shipment arrived in perfect condition with the coolant still completely frozen. It is safe to reduce the amount of insulation and coolant can be reduced in future shipments without risk to fish quality. In future shipments, it should be possible to increase the ratio of fish weight to gross weight to 75%. Air freight cost per unit weight of fish could be reduced by approximately A$ 1.00/kg.

7.6 Improve Sanitation on Fishing Vessels

While fish was being packed in Tuvalu for the first export trial and after delivery to the Hawaiian market, discoloration of gills was observed in some fish. The absence of odors emanating from the gills suggested that the discoloration was a result of contamination from an outside source of bacteria, possibly in ice bags or in the vessel hold.

Cross-contamination of export fish should be avoided. To deliver bottomfish with the freshest possible appearance, one hold or compartment on the fishing vessel should be reserved exclusively for export fish. No storage of bait, crew fish, local market species, stores or other food should be permitted in this area.

In addition, fish holds, brining coolers and bags used for storing ice should be thoroughly cleaned after each fishing trip. The refrigerated holds on *Manaui* are not compartmentalized. Plastic baskets should be obtained so that fish can be stored belly down in ice. (On *Tasu*, fish can already be stored belly down in ice in the compartmentalized hold).

7.7 Take Measures to Eliminate Ciguatera Hazard

Ciguatera fish poisoning is the most common non-bacteria seafood-related disease in the South Pacific. The disease is endemic in Tuvalu. Gastrointestinal, neurological and cardiovascular disorders develop after consumers have ingested shallow-water fish in which ciguatoxin is concentrated. Scientists have determined that these toxins are produced by microscopic, single-celled marine algae, the primary one being *Gambierdiscus toxicus.* Toxins become more concentrated as they pass up the food web from fish herbivores to carnivores and, finally, to human consumers.

Susceptibility to the toxin and the severity of the symptoms vary greatly among individuals. Immunity through previous exposures to ciguatoxin does not develop. On the contrary, individuals who have been previously exposed are more susceptible and react to lower levels of the toxin.

The species of fish which are infected differ from area to area. A fish species is susceptible based on its eating habits and habitat. The freshness of the fish has no bearing on its possible toxicity. The affected fish look, smell and taste normal. To provide an early warning of the ciguatera threat, the Government of Tuvalu Fisheries Division has a program that monitors the lagoons of the populated atolls for the presence and abundance of *G. toxicus.*

All species of bottomfish being harvested at the seamounts are consumed in Tuvalu without fear of ciguatera, including *Lutjanus bohar*, which is ciguatoxic throughout most of its range in the South Pacific. No symptoms of ciguatera poisoning have been reported but a *L. bohar* was shipped to the University of Hawaii Biomedical Laboratory for testing and it did test positive for ciguatera.

The Tuvalu Bottomfish Project has focused on the offshore seamounts and fishing on the submarine slopes offshore of atolls has been limited. An uku *(Aprion virescens)* caught off one of the atolls was shipped to the University of Hawaii Biomedical Laboratory and also tested positive for ciguatera. The testing procedure is known to have a high rate of "false positives," but development of an export fishery for Tuvalu bottomfish should proceed with considerable caution. Even a single case of ciguatera traceable to a bottomfish exported from Tuvalu would be a major setback, probably sufficient to terminate export fishery development. Whenever ciguatera poisoning occurs in Hawaii, the State Department of Health and the seafood industry suspend the marketing of all bottomfish from the source area.

No bottomfish taken from the submarine slopes off the atolls of Tuvalu should ever be exported. Fishing at the seamounts should always be directed at deepwater species (below 60 m). No *L. bohar* or other shallower-water snappers, groupers or emperorfish should ever be exported no matter where they are harvested. Wahoo, a pelagic species, is safe to export.

Appendix C describes a ciguatera test kit being developed by Hawaii Chemtect International. A field testing procedure would greatly reduce the risk of ciguatera poisoning in Tuvalu and would allow the development of an export-based bottomfish fishery with greater confidence in product safety. It is estimated that at least 6-9 months of further work is needed before the test kit is available (Klein, pers. comm.).

8.0 REFERENCES CITED

Crossland, J. The market for Pacific bottomfish in Japan. South Pacific Forum Fisheries Agency, Honiara, Solomon Islands. FFA Rep. 85/29. 1985.

Klein, K. AECOS, Inc. Personal communication.

Philipson, P.W. Preliminary economic evaluation. USAID Pacific Islands Marine Resources Project, Tuvalu Component. RDA International, Inc., Placerville, CA. RDA P-1519201. January 1992.

Wakugawa, S. Y. Maruwa Shokai Co. Personal communication.

20

APPENDIX A. HAWAIIAN, EQUIVALENT NAMES AND MARKETABILITY OF BOTTOMFISH SPECIES

HAWAIIAN	TUVALU	SCIENTIFIC	ENGLISH	MARKETABILITY
Onaga	Palu malau loa	*Etelis coruscans*	Longtail red snapper	Primary market species (> 2.5 kg)
Opakapaka	Palu sega	*Pristipomoides filamentosus*	Ruby snapper	Primary market species (> 2.5 kg)
Ehu	Palu malau	*E. carbunculus*	Shorttail red snapper	Primary market species if < 5 kg and very fresh; larger, older fish are secondary market species
Gindai	Palu savane	*P. zonatus*	Flower snapper	Secondary market species
Uku	Utu	*Aprion virescens*	Green jobfish	Secondary market species
Lehi	Palu sega	*Aphareus rutilans*	Red jobfish	Secondary market species
Hapu'upu'u	N/A	*Epinephelus spp.*	Grouper	Primary market species in Japan; secondary in Hawaii
Yelloweye opakapaka	Palu sega	*P. flavipinnus*	Yelloweye snapper	Secondary market species
Ulua	Various	*Caranx spp.*	Trevally	Secondary market species

APPENDIX B. DETAILED PROCEDURES FOR EXPORTING TUVALU BOTTOMFISH TO HAWAII

I. Before Vessel Leaves Port

A. Clean vessel hold, deck areas where fish is processed, bags used to store ice, and plastic coolers with a disinfecting cleanser ("Ajax"). Rinse thoroughly after cleaning to remove disinfectant residue.

B. Bag ice before loading into the refrigerated hold of the vessel. Bagged ice can be easily broken apart whereas unbagged ice will fuse into a solid mass that is difficult to use. Used rice or flour bags are convenient for storing ice but they should be thoroughly cleaned beforehand so that the ice is not contaminated. The crew uses these bags after a fishing trip to take home their personal catch. This is acceptable as long as they return the bags and they are soaked in a solution of Ajax and water and then thoroughly rinsed before re-use to store ice.

C. Place on board the following supplies:

ice picks
a bag of salt
one jar of fish preservative
green rice paper

D. To avoid delays in packing export shipments (see Section III below), shipping cartons should be made ahead of time. The cardboard cartons are shipped from the point of manufacture to Tuvalu as collapsed sheets which have to be formed into box bottoms and tops. Box bottoms should be fitted with sheets of thermal barrier insulating material (insufoil) pre-cut into box shapes. A plastic liner is placed within the insufoil to contain the fish. (Boxes can be imported from Fiji via Kiribati Shipping Lines; insufoil can be imported from Hawaii via Air Marshall Islands; plastic bags are available locally from NAFICOT.)

E. To make a frozen coolant for shipping, plastic bags (available locally) are filled with fresh water and sealed with a hand-operated heat sealer (available locally). A sufficient number should be made and frozen (in NAFICOT chest freezers) well in advance of need.

F. Air Marshall Islands (AMI) should be notified of the intention to ship fish from Funafuti to Nadi. AMI has committed space on its Tuesday flight for weekly shipments of approximately 300 kg (gross weight). Assuming that the net (fish) weight is 70% of gross weight, it should be possible to ship approximately 210 kg of fish per week. Because of the AMI schedule, fishing trips should be planned so that the vessel returns to port on a Monday night and the catch is available to be packed on a Tuesday morning. The AMI air waybill for the first export shipment can be used

as a model for future shipments, with possible changes in the name and address of the Hawaiian consignee.

G. Tuvalu fish exports to Hawaii have to be transshipped through Nadi, Fiji. A freight forwarder (Williams & Gosling Ltd.) books space for a connecting flight to Hawaii and transships the fish cargo under bond. Williams & Gosling should be notified of the intention to transship a specific quantity of fish from Tuvalu through Nadi to Hawaii on a specific date. The best connection with the AMI flight which arrives at Nadi at 5 pm on Tuesday is Qantas flight #17 which departs for Honolulu the following morning at 2 am. Because of AMI limits on outbound freight from Funafuti, it is reasonable to ask Williams & Gosling to book space for approximately 300 kg. The Qantas air waybill for the first export shipment can be used as a model for future shipments, with possible changes in the name and address of the Hawaiian consignee.

H. Transshipment of fish through Fiji requires an export permit from the Government of Fiji Ministry of Agriculture, Fisheries & Forestry. This permit is issued by the Fisheries Division office in Lautoka, Fiji. The permit is prepared by the licensing officer, Mr. John Ah Tong and is signed by the senior fisheries officer, Mr. Suresh Chand. Mr. Ah Tong should be advised on the intention to make a transshipment of Tuvalu fish through Nadi well ahead of the date of shipment so a permit can be prepared. The export permit prepared for the first transshipment needs to be revised to show the RDA Tuvalu Bottomfish Project as the shipper. The quantity of fish actually transshipped should not be higher than the weight shown on the permit, so it is advisable to use a larger number (such as 500 kg) than is actually transshipped for permit purposes.

II. While Fishing

A. Designate a separate refrigerated hold or compartment exclusively for storing export fish. No other fish (crew fish, bait, non-export fish) or provisions should be stored in this hold or compartment.

B. Fishing should be restricted to deep water (120-200 m) over seamounts where the risk of catching ciguatoxic fish is slight. On the first 3-4 days of fishing, the following primary export species should be targeted:

- Redfinned opakapaka *(Pristipomoides filamentosus)*
- Long-tail red snapper or onaga *(Etelis coruscans)*

If the catch of the latter species is low during the first few days of fishing, the following secondary species can be exported <u>but only if caught in the last 1-2 days of fishing for maximum freshness</u>:

- Short-tail red snapper or ehu *(E. carbunculus)*; only fish smaller than 5 kg should be exported

- Flower snapper *(P. zonatus)*
- Red jobfish *(Aphareus rutilans)*
- Green jobfish *(Aprion virescens)*
- Various species of deepwater grouper (*Epinephelus spp., Cephalopholis spp., Variola spp.*)

If the catch of primary and secondary export species is still too low (less than 200 kg) on the last day of fishing, *ono* or wahoo, a pelagic species, should be targeted for export. Large wahoo will not fit into the slurry cooler and should be cut into two equal-length pieces for brining, storage and packing.

C. All fish destined for export should be handled as follows:

(1) No dropping or throwing of export fish. The fish should be carried under the gills, not by the tail.

(2) Fish need to be killed immediately after capture to minimize movement in the slurry. Do this by opening the gill cover on one side and driving an ice pick into the area where the last gill is attached to the skull. When the right spot is hit, a bloody froth will flow from the spike hole and the fish will quiver and stiffen.

(3) After spiking, the fish should be washed under the seawater pump and placed immediately in an ice-seawater slurry. The slurry should be made in a 160-quart plastic cooler by mixing one part ice and one part seawater, a handful of salt and a teaspoon of Taiyo fish preservative. Fish should be removed from the slurry when they are completely stiff and straight and their gills are fire red, usually after 2 to 4 hours.

(4) After each fish is removed from the slurry, its head and eyes should be wrapped in a piece of green paper. (The tail portion of the body does not need to be wrapped). Fish should be stored <u>belly down</u> and completely covered by ice in the compartment of the refrigerated hold. The hold of the *Manaui* is not compartmentalized, so it is recommended that plastic baskets be obtained for storage and icing of fish in the proper position.

(5) More ice may need to be added periodically to keep the fish completely covered.

(6) All species for Hawaiian export should be stored and shipped as whole fish.

24

III. After Returning to Port

A. Fish for local sale and crew use should be unloaded immediately after returning to port. Fish for export should be left in the hold, with the vessel's generator kept running to maintain refrigeration until the day of shipment.

B. A 10-kg scale for weighing fish and another scale for weighing full-packed boxes should be available at the NAFICOT facility. Shipping cartons should also be ready for packing. They should be numbered (1,2,3, etc.) in two places: the end of the bottom piece facing the scale and the recorder and the top of top piece.

C. Fish should be removed gently from under the ice in the refrigerated hold and placed in 160-quart coolers for trucking from the vessel to the NAFICOT facility. Ice should be added to each cooler for temperature control prior to weighing and packing.

D. Coolers should be positioned near the scale. Fish should be removed and weighed from one cooler at a time. After the species and weight are recorded, the recorder should specify a box number for each fish. Ideally, small fish should be packed in the same boxes with other small fish and larger fish should be packed together in separate boxes. This allocation process should not be rushed or errors could occur on the packing list.

E. Fish should be packed on their bellies, head to tail (i.e., the head of one fish should be next to the tail of the adjacent fish), in the innermost of the plastic bags which lines the box. After the bottom layer of fish accumulates, three large frozen gel bags should be added and the bag should be closed up. The second layer of fish should be formed on top of the lower bag and three frozen gel bags should be placed over this layer before the bag is closed. The insufoil bag should then be sealed and taped tightly so there are no openings. If the insufoil bag cannot be completely closed without gaps, then a second piece of insufoil should be used to form a complete wrap. The purpose of the gel bags is not to cool the fish but to absorb heat entering the fish carton, thereby preventing a rise in temperature of the fish while in transit.

F. The cartons should be closed by working the top pieces over the bottom pieces and taping around both ends. The carton tops should be numbered to correspond to the bottoms (1,2,3, etc.) and addressed to the consignee in Hawaii. The fully loaded boxes should be weighed and the gross weight marked. Air Marshall Islands should be informed of the total number and weight of boxes so the air waybill can be completed.

IV. After Packing

A. After packing, the boxes should be stored at NAFICOT completely enclosed by a layer of tnermal barrier (insufoil) material, as with the first shipment on Jan. 25, 1994. The boxes have to be trucked to the airport about two hours before the AMI flight departs. The insufoil jacket should be taken apart and reformed around the boxes in the bed of the truck. The insufoil jacket must be taken apart once again at the airport but should be reformed a third time to completely enclose the boxes inside the airport terminal while waiting for the AMI aircraft to arrive in Funafuti. By fitting the insufoil jacket around the boxes everywhere they are moved, they can be shielded very effectively from heat and sunlight until cargo is loaded on the outbound AMI flight just a few minutes before takeoff.

B. The person responsible for recording weights and box numbers must prepare a printed packing list and commercial invoice for the shipment. The basic format can follow that used for the first shipment. The commercial invoice must show the total weight and value of the fish (not the gross weight of the boxes) in the shipment. For purposes of U.S. Customs clearance in Hawaii, the value should be calculated by multiplying the weight of fish (kg) by US$ 4.00 per kg. The invoice must also show the RDA Tuvalu Bottomfish Project as the shipper and name the consignee in Hawaii. The packing list lists the boxes by their numbers and the contents of each box (the weight of each fish species). Several copies of the commercial invoice and packing list should be made. One copy is for AMI to send with the shipment. A second copy should be put in an envelope addressed to Williams & Gosling and the envelope should be taped to one of the boxes. A third copy should be retained by the Tuvalu Bottomfish Project. The project should also fax the Hawaiian consignee the commercial invoice and packing list as soon as possible to facilitate pre-sale of fish before delivery to Hawaii.

C. The Government of Tuvalu Customs requires an export entry permit for each shipment of fish leaving the country. The permit should be filled out like the permit for the first shipment and taken to the Customs office for approval prior to the departure of the AMI flight.

V. Before Arrival of AMI Flight in Nadi

A. The export permit (described in Section I.H above) must be delivered to the Williams & Gosling Ltd. export documentation office at Nadi Airport prior to the date of transshipment. One way of accomplishing the delivery is to alert Charles Valentine of Pacific Seafoods in Lautoka. If the governments of Fiji and Tuvalu execute a memorandum of understanding that allows Tuvalu vessels to unload their catch at the port of Lautoka, Mr. Valentine is prepared to serve as port manager for these operations. He has also volunteered his services to

26

expedite transshipment of Tuvalu fish by air through Nadi Airport. If Mr. Valentine is unavailable to deliver the export permit, Mr. Ah Tong himself may be able to assist. In an emergency situation, a taxi could be hired to pick up the permit at the Fiji Fisheries office in Lautoka and to deliver it to W&G at Nadi Airport.

B. A copy of the AMI air waybill, the commercial invoice and packing list should be faxed to Williams & Gosling as soon as possible after the freight leaves Funafuti. In the cover letter to this fax, W&G should be requested to fax a copy of the transshipment air waybill (Qantas) and the commercial invoice and packing list to the Hawaiian consignee.

APPENDIX C. UNDERSTANDING CIGUATERA POISONING

UNDERSTANDING CIGUATERA POISONING

What is Ciguatera Poisoning?

Ciguatera poisoning is not a new disease, it was described as early as 600 B.C by the Chinese and in the 18th century was known to have infected the crew of Captain James Cook during a voyage to Tahiti. The head and organs from the same fish that infected Captain Cook's crew were fed to their pigs, causing their death. In August of 1985, four of Captain Cousteau's camera crew ate barracuda at a hotel in Haiti and six hours later were stricken with ciguatera poisoning. "... they were lucky, they recovered completely in two months." (San Francisco Chronicle, March 1988)

While much more research needs to be done to determine the origin of ciguatoxin, scientists have determined that it is caused by toxins produced by microscopic, single-celled, free-swimming marine organisms, the primary one being *Gambierdiscus toxicus*.

Ciguatoxin is a lipid soluable, heat-resistant, acid-stable toxin. This means that **you can not boil, salt, dry, freeze, marinate or cook the fish to eliminate the toxin.** The fish look, smell and taste normal. The toxin tends to accumulate more in the head, organs and roe of the fish — it may be 100 times more concentrated in these parts than in the flesh. The freshness of the fish has no bearing on its toxicity.

The medical community is just beginning to understand ciguatoxin and although it is the most common food borne condition due to a chemical toxin, it is not a reportable illness, is vastly under-diagnosed and frequently misdiagnosed as salmonella or a persistent flu. Recent discoveries show that there are 27 different ciguatoxins. Fish are known to carry more than one of these toxins at the same time — one moray eel was found to have 9 different ciguatoxins.

Susceptibility to the toxin and severity of the symptoms varies greatly among individuals which may be due to the presence of several different toxins. Immunity through previous exposures to ciguatoxin does **not** develop. On the contrary, evidence suggests that individuals who have been previously exposed are more susceptible and react to lower levels of the toxin. Additionally, the severity of the symptoms increases with subsequent ingestions of toxic fish.

How does a fish get ciguatoxin?

Microscopic organisms called dinoflagellates attach themselves to the surface of marine algae which is eaten by fish that feed on plants. The algae grow on or near coral reefs in tropical and near-tropical regions. The toxin gets passed up the food chain from the small, plant eating fish; to large, carnivorous fish; to larger, predatory fish; and finally to humans.

Ecologic disturbances to the reef cause the toxic organisms, which normally reside under the sand, to swim and spread rapidly. These disturbances to the reef can be either man-made or natural. Underwater earthquakes, typhoons and tidal waves or tsunamis are some of the natural causes for outbreaks of ciguatoxin. Man-made causes include ship wrecks, explosions such as bombs or dynamite fishing and construction (docks and piers or swimming areas) which necessitates disturbing the reef. We know, for instance, that the incidence of ciguatoxin in the South Pacific greatly increased after World War II. Increased nutrients and water salinity have recently been noted as contributing factors.

What symptoms come from eating toxic fish?

Ciguatera poisoning exhibits itself in a variety of ways with as many as 150 reported symptoms ranging from gastrointestinal to neurological and cardiovascular disorders. The symptoms last from an initial duration of 14 to 21 days, to months or even years in protracted cases.

The onset of symptoms usually occurs within three to five hours after eating a toxic fish, but severe cases have been known to be more immediate. Consuming the head, organs or roe of the infected fish causes more severe symptoms.

General symptoms include: weakness; diarrhea; muscle pain; joint aches; numbness and tingling around the mouth, hands and feet; reversal of temperature sensation where cold objects feel hot (a burning or tingling sensation may also be felt) and hot objects feel cold; nausea, vomiting, chills, itching, headache, sweating and dizziness. Prolonged cases may also exhibit depression and the development of various phobias. Low blood pressure, reduced blood volume, coma or death occur occasionally, but varies from region to region. These more severe symptoms are thought to be associated with consumption of the head and/or viscera (internal organs) of toxic fish. **If you experience any of these symptoms after consuming fish, be sure to consult a physician immediately.**

Evidence shows that infected individuals would be wise to avoid consuming fish, shellfish, alcoholic beverages, oily foods and nut or seed products as the

severity or duration of the symptoms may increase. For varying periods of time after initial symptoms subside, consumption of these items can cause symptoms to re-occur. To date there is no definitive treatment, however, some success has been achieved with an infusion of intravenous Mannitol administered during the first 48-72 hours. (Palafox, N.A., Journal of the American Medical Association, May 13, 1988, Vol. 259, No. 18) HawaiiChemtect has a blood test currently being used in research projects, **Ciguatect-H™**, as a diagnostic tool for those who are suspected of having contracted ciguatera poisoning. No known antitoxin exists.

There are also reports that the toxin is present in mother's milk of infected women and in semen. Cases show it can also adversely effect a fetus, therefore, *pregnant and nursing women should exert the highest degree of caution.*

HOW CAN I PREVENT GETTING CIGUATERA POISIONING WHEN TRAVELING?

In general, the disease can be avoided if the following precautions are taken (Craig 1980; Halstead 1968; Grant 1984; Lange 1987; Lee 1980; Rege et al., 1979; Withers 1982):

1. Avoid eating fish caught in endemic regions — check with the local Health or Fishery Department.

2. Avoid eating fish considered harmful by [indigenous people]; do not eat scaleless fish or moray eel.

3. Avoid abnormally large carnivorous fish especially large predacious reef fishes such as groupers, barracudas, snappers and jacks, on the premise that the larger the fish, the more toxin it is likely to have absorbed.

4. Avoid the liver, head, gonads or viscera of any fish.

5. Beware of eating reef fish after any aggression or disturbance to their environment.

6. In most instances, research shows you should choose fish harvested from the leeward side of an oceanic island if possible [the Hawaiian Islands are an exception to this rule].

If ciguatera, or any other type of fish poisoning is suspected, the person should follow these measures (Environmental Epidemiology Program, State of Hawaii, 1987):

1. Call a physician immediately for treatment. If the patient's physician is not available, call the nearest Poison Center.

2. Do not take drugs or medications without the physician's advice.

3. Save the remainder of the fish (including the head and the gut) in the refrigerator or freezer to be given later to the Department of Health or a suitable organization for laboratory analysis. [HawaiiChemtect provides these services.]

. Call the Department of Health, Poison Center or suitable organization to report cases of fish poisoning.

IS CIGUATOXIN FOUND EVERYWHERE?

This toxin is regularly reported in: The Caribbean, Florida, French Polynesia, American Samoa, Hawaii, Papua New Guinea and Australia. Favorable environmental conditions for the growth of these toxin producing organizims exist in a broad circumglobal belt extending from 35 degrees north to 35 degrees south latitude. Since most of the world imports fish from these areas (tropics, semitropics and temperate zones) the regions reporting outbreaks of ciguatera poisoning are all inclusive. The incidence of Ciguatera Fish Poisoning has been increasing throughout all reportable areas.

DOES EVERY FISH GET CIGUATOXIN?

No. The overwhelming majority of fish consumed in the United States are safe to eat. However, in temperate waters more caution is required. While over 400 species worldwide are known to carry the toxin, just as the type and severity of symptoms can vary from person to person; so, too, does the kind of fish which are infected vary from area to area. A fish species is susceptible based on its eating habits and the condition of the area in which it feeds. It is best to check with the local health department or fisheries department for lists of suspect species in the area. The following are a sampling of those that have consistently been reported as having evidenced varying levels of toxicity and are listed by region:

Caribbean:

Several species of Lutjanus, dolphin, snappers, barracuda, dorado, amberjack, and grouper.

Florida:

Groupers, snappers, kingfish, amberjack, dolphin, barracuda, jack, and mullet.

French Polynesia:

Sphyraena barracuda, grouper, snapper (three varieties), wrasse, and surgeon fish.

Hawaii:

Jack, amberjack, eel, flagtail fish, mullet, wrasse, goatfish, surgeon fish, snapper, grouper, and parrotfish.

Australia:

Narrow-barred Spanish mackerel, mackerel, school mackerel, sported mackerel, giant dart, gray mackerel, barracuda, coral trout, flowery cod,spotted cod, cod, grouper, wirenetting cod, red snapper, yellow sweetlip, yellowtail, kingfish, kingfish, trevally, lowly trevally, coral cod, Maori wrasse, venus tusk fish, dart, southern fuselier, and barramundi.

Other fish in varied regions include the moray eel, sea bass, shark, big eye scad fish, flagtail fish and squid. In general we can state that the number of species reported have a direct correlation to the amount of research being conducted in that region.

WHY HAVE I NOT HEARD OF THIS BEFORE?

A few years ago the general public had not heard of ciguatoxin, and with good reason. There was no way to be certain that a fish was contaminated. However, in the 1970's research into the cause and detection of fish bome toxins had significant breakthroughs. The publication of research results and findings from rudimentary tests, began to sensitize doctors, government agencies and disease control centers to the problem. Except for raw shellfish related reports, Ciguatera Fish Poisoning is now the most commonly reported non-bacteria seafood related disease in the United States. Outbreaks of ciguatera have been reported in the mass media throughout the world.

In San Francisco in July of 1989, twenty-four persons were stricken after consuming barracuda bought at a farmers market. Just one mullet with a rather toxic liver felled eight Floridians and a grouper from southern waters infected several people in Kansas. Many cases are reported by tourists who travel to these temperate regions and consume the local fish.

Papua New Guinea, as reported in *Pacific Island Monthly*, has an infection rate of 12,000 cases per 100,000 people with a perceived death rate of 24 cases per 100,000.

In the Marshall Islands, the incidence has become so frequent that symptoms are recognized by all physicians and it is there that the emergency Mannitol treatment was discovered.

IS ALL FISH POISONING CIGUATOXIN?

No. There are several different types of fish poisoning not related to ciguatera. In addition to illnesses which come from high bacteria or virus counts, a partial list includes: Diarrheic Shellfish Poisoning (DSP) caused by okadaic acid and related to poor storage of the product; Scombroid Poisoning caused by spoiling of fish flesh by bacteria or a release of histamine-like compounds; Puffer Fish (fugu) Poisoning; and Paralytic Shellfish Poisoning (PSP) caused by red tide. DSP and PSP appear mostly in shellfish. The initial clinical symptoms in all these poisonings appear similar. The one symptom which may distinguish Ciguatera Poisoning is the hot/cold temperature sensory reversal.

HOW CAN I BE SURE THE FISH I BUY WILL BE FREE OF CIGUATOXIN?

Until the **Ciguatect**™ test kit, which has been developed by HawaiiChemtect International, there was no test available which could be conducted outside of a laboratory. We anticipate this 15-minute simplified test which can be done by anyone, anywhere will be available in the very near future. For the first time fishermen, processors and individuals, at various stages in the food chain, can test for the presence of ciguatoxins. Since the toxin does not leave the fish, it can also be tested again just prior to consumption or even after cooking.

The United States Government is developing regulations which will create a commercial testing procedure to determine infected fishing areas as well as random testing of commercial catches of suspect fish to assure the buying public the finest and safest product available. These regulations will most likely become part of an international equivalency agreement expected to be signed by most countries of the United Nations thus assuring the same level of seafood inspection throughout the world.

Ciguatect™

Ciguatect,™ a single test kit utilizing advanced sciences in a simplified format which rapidly and economically detects, and thus interdicts, toxins/poisons in seafoods and by-products. The test is primarily designed to detect Ciguatoxins (CTX) and Diarrheic Shellfish Poisoning (DSP). Also, **Ciguatect™** identifies associated marine polyethers (additional toxins/poisons). The entire testing process takes only 12-15 minutes and can be performed by virtually anyone, anywhere.

Ciguatect Lab-Pak™

Ciguatect Lab-Pak™ is a bulk configuration of the **Ciguatect™** Kit and features the identical compounds and materials found in the single test format. There are sufficient quantities to perform 50 separate tests and, as with other user-ready bulk formats, further savings below Ciguatect's already modest price are realized.

Ciguatect - H™

Currently Available For Collaborative Studies

Ciguatect-H™ (not shown) is a precise diagnostic tool for the detection of marine polyether infection in humans, subsequent to ingestion of the toxins / poisons.

HawaiiCHEMTECT
INTERNATIONAL

P.O. Box 92015
Pasadena, CA 91109, USA
Telephone (818) 568-8606 • Facsimile (818) 795-6032

FORM 1292

© Hawaii Chemtect International 1992

32

Currency Equivalents

Currency Unit - Australian dollar (A$)

A$ 1.00	=	US$ 0.76
US$ 1.00	=	A$ 1.309
A$ 1.00	=	Fiji$ 1.08
F$ 1.00	=	A$ 0.93