

Appendixes

Appendix A: The Importance of Tuna to the Federated States of Micronesia

Quantity of tuna caught in the country

- From 1991 to 1999, the FSM Exclusive Economic Zone (EEZ) yielded about 1,250,300 metric tons (MT) of tuna catch. Of this amount, 86.3 percent was caught by purse seine, 8.8 percent by longline, and 4.8 percent by pole-and-line vessels (MMA 2000).
- Provisional figures of the Micronesian Maritime Authority (MMA) for 1999 show a total of 188,028 MT caught in the EEZ – 92 percent by purse seine, 7.5 percent by longline, and the rest by pole-and-line vessels. In 1999, the total catch consisted of skipjack (74 percent), yellowfin (20.5 percent), and bigeye (4.6 percent) (T. Park, personal communication).
- From 1991 to 1999, longline vessels caught 38,836 MT of (sashimi-grade) tuna. Of this type of catch, 1,725 MT were exported in 1999 (Sitan 2000).
- Data on artisanal fishing activities are scanty; however, one survey in Pohnpei (OFCF 1995) estimated that 444 kg of pelagic fish, assumed to be mostly tuna, were caught and sold locally each week. Extrapolating this figure to artisanal activities and economic conditions in other states gives an average of 1,100 kg of tuna per week, or 57 MT per year, entering local commerce.
- Given the population distribution and the geography of the islands that also limits access to central markets, the subsistence catch is thought to be much larger. Citing earlier studies, FAO (1997) estimates the annual subsistence catch at 6,243 MT. Tuna is thought to compose around 30 percent of this catch (1,900 MT).
- The foreign catch makes up the bulk of the catch in the FSM tuna fishery. In 1999, foreign vessels accounted for all pole-and-line catch, 92 percent of the longline catch, and 91 percent of the purse seine catch (MMA 2000; T. Park, personal communication).

Value of tuna caught in the country

- Using the available figures cited above and an average price of \$2.75/kg¹ for tuna caught in artisanal fisheries, it is estimated that \$240,000 worth of tuna is sold in local markets annually.
- Although the subsistence catch does not enter commerce, the SPC Coastal Fisheries Program (cited in OFCF 1998) estimated its value at \$1.80 per kg, or \$3.42 million.
- About \$336 million worth of tuna caught by longline vessels was exported from 1991 to 1999. The total value of such exports from the country in 1999 was \$15.6 million (Sitan 2000).
- FSM-based purse seiners caught \$5.22 million worth of fish in 1999 (ADB 2000).
- Local sales and exports of tuna in 1999 fetched an estimated \$15.84 million.
- Sharks compose the largest portion of the by-catch of longline vessels in FSM. About 25 percent of sharks caught by foreign longliners are retained (Heberer 1997). All shark fins are retained for sale by the vessel crew, and such sales can result in bonus income above their regular salaries or shares. McCoy and Ishihara (1999) estimate that each member of the crew of a longline vessel fishing in the western Pacific can expect to receive from \$409 to \$827 per year from shark fin sales alone. At the higher value, this would represent over two months' wages.

Tuna exports

- Tuna is the top export of the country. In 1996, the last year for which total export data are available, the Government recorded total exports of \$10.4 million, of which fish exports were \$9.83 million, or 94.5 percent (FSM 1998). Tuna composed about 95 percent of fish exports (P. Sitan, personal communication) and, hence, accounted for about 90 percent of the value of all exports.
- In addition to exports of tuna landed in FSM, about 90,500 MT of tuna were transhipped through FSM ports by purse seiners in 1999 (MMA 2000). Payments to the private sector for services

¹ All dollar figures, unless otherwise specified, are in US dollars.

and supplies, such as food, accommodation, rental cars, and minor repairs, total an estimated \$4,000 per transshipment port call (McCoy and Gillett 1998). In 1999, transshipping purse seiners in FSM ports made \$2.23 million in such payments to the private sector.

Access fees

- MMA records show that, since 1979, FSM has received over \$170 million in EEZ access fees paid for tuna fishing rights.
- In fiscal year 1999, receipts from access fees totaled \$15.4 million (FSM 1999; MMA records)
- In January 2000, seven bilateral and one multilateral foreign fishing agreements were in place. In addition, there were nine agreements with locally based foreign vessels.
- Besides the revenue from bilateral arrangements, a multilateral treaty with the United States, which is administered by the Forum Fisheries Agency, gives FSM about \$110,000 more annually. This amount is tied to fisheries development projects.
- Japanese associations make an annual payment of goods and services as part of the access agreement. The payment in 1999 was valued by MMA at \$550,000 (E. Pangelinan, personal communication).
- In FY 1999, access fees represented about 39 percent of the nontax revenue and 22 percent of the total domestic revenue of the national Government.

Tuna vessel fines

- Fines levied for illegal fishing and other infractions in the FSM zone have been substantial. According to Department of Justice records, more than 70 cases have been brought at the national level for illegal fishing or other transgressions since 1979. In all, fines or settlements amounting to more than \$3.65 million have been collected, and eight vessels have been forfeited to the Government.
- In 1999, two longliners were convicted of illegal fishing, and four more cases were pending (MMA 2000).

Direct employment in the tuna industry

- Using the most recent estimates of the number of local longliners and purse seiners, about 254 people from FSM, 86 of them FSM citizens, are believed to be working on locally based tuna vessels.
- More recent estimates from Gillett and McCoy (1997) show that 150 FSM citizens are employed aboard foreign tuna vessels.
- Tuna enterprises, including processors and exporters, employ 178 FSM citizens.
- Artisanal tuna fishing provides about 200 jobs.
- It therefore appears that about 614 people from FSM are directly employed in the tuna industry.
- Wage-paying jobs in FSM totaled 18,669 in 1997, including 8,752 jobs in the private sector (FSM Social Security Administration, quoted in Bank of Hawaii 2000). The more than 614 jobs held by those directly employed by the tuna industry represent a substantial portion of the wage-paying jobs in the country.
- Private-sector jobs in FSM account for about \$24 million in wages (Bank of Hawaii 2000). The amount of the tuna industry payroll is not known, but assuming that the average wage in the industry reflects the average wage in the private sector as a whole, direct employment in the tuna industry would account for \$1.14 million in wages, or about 7 percent of all wages in the private sector. The proportion would be significantly larger if indirect employment in tuna-related industries and employment generated by spinoffs were considered.

Indirect and spinoff employment

- A variety of different types of jobs are closely connected to the tuna industry in FSM. Machine shop employees, welders, and others that provide minor vessel and machinery repair hold these types of jobs.
- Professional fees such as those paid for legal and accounting services are also associated with the tuna industry. One fleet

operator based in Pohnpei spends about \$2,500 annually per vessel for such services provided in the country.

- Others whose jobs indirectly relate to the tuna industry are fiberglass boat repairers and outboard engine mechanics who service the artisanal vessels, as well as fishing gear store salesmen, workers in the ice plants, refrigeration specialists, sellers of the tuna by-catch, fuel suppliers, staff of the shipping and air cargo agencies, and providers of groceries and supplies for the tuna vessels. Such jobs are significant in number but are difficult to quantify.
- The 600-plus people directly employed in the tuna industry and the people working in jobs closely associated with the tuna industry create greater demand for consumer goods and services, resulting in greater total employment in the economy.

Other employment considerations

- MMA, the government fisheries management agency, is responsible solely for the management of tuna fisheries. Its staff of 28 comprises 10 full-time office staff, 12 observers, and 6 port samplers.
- About 10 percent of those directly employed in the tuna industry are women.
- A significant amount of nonurban tuna-related employment aboard vessels is due to the outer islanders' reputation as seamen. Given the relatively small population of the outer islands relative to the urban areas, the employment of these outer islanders tends to have a greater impact.
- The availability of air freight services allows the cost-effective export of agricultural and fisheries commodities to Guam and elsewhere.
- Given the Government's stated policy of downsizing the public service, it is recognized that there will be fewer public-sector employees in the future. Jobs directly or indirectly related to the tuna industry (the vast majority of which are in the private sector) will become more important as this transition progresses.

Expenditures of locally based vessels

- The 47 locally based longline vessels in FSM spend about \$6 million per year on supplies, consumables, and services.
- Wages represent about 20 percent to 25 percent of the expenditures of longline vessels; FSM citizens, who make up 22 percent of the crew of longline vessels, earn \$440,000 in personal income from those wages.
- The locally based purse seine fleet appears to be spending about \$970,000 locally.

Government revenue from direct taxation of the tuna industry

- Figures provided in McCoy and Gillett (1998) indicate that Government revenue from both national and state levies and charges placed on purse seine transshipments amounted to \$1.11 million in 1999.
- In 1999, the national revenue from the import duty on diesel fuel used by the marine sector was about \$120,000; almost all of the fuel was used by the tuna fishing industry. This amount was 25 percent of all import duties on diesel fuel in the country (FSM Dept. of Economic Affairs, unpublished data.)
- Significant national revenue is also derived from the import duty on frozen longline bait. From estimates of expenditures by domestic vessels representative of fishing activities in FSM, it is calculated that the 47 locally based longliners generate \$140,000 in tax revenue per year from bait purchases.
- Other national, state, and municipal taxes generate around \$50,000.

Small-scale fishing

- Each year, trolling for tuna produces about 57 MT of tuna, which enters the local market.
- Subsistence fishing yields about 1900 MT per year.
- The ice plants serving the tuna industry allow small-scale fishermen to better preserve their catch and take advantage of export opportunities for reef or demersal fish and other marine products. Because these ice plants are usually operated, maintained, and serviced on a commercial basis, they tend to

be more reliable than refrigeration or ice facilities for small-scale fishing that rely on government or other noncommercial means of operation.

- Subsistence catches of tuna, mainly in the outer islands, are taken by handline and by trolling with outboard-powered motorboats or by canoe. In some islands of the central Carolines, fishing with pole and line by canoe can result in significant catches of over 1 MT per canoe per day during periods of high tuna abundance. This important food source is smoked or preserved in other ways for use later on when the weather inhibits fishing activity and access to tuna or other protein sources (Gillett 1987; Lieber 1994).
- Some atolls are able to close off lagoon passages with large nets to trap large schools of tuna within the lagoons. Such activities can result in substantial quantities of tuna for subsistence use, which are able to feed the entire island for weeks at a time (Bates and Abbott 1954). These and other activities focused on capturing tuna also serve to reduce inshore fishing on some coral reefs.

Nutritional value

- Tuna is important in the diet. Government figures (cited in Bank of Hawaii 2000) show the population of FSM to be 116,268. Annual per capita consumption of tuna is about 18.5 kg.
- No data on locally sold fish, including tuna or by-catch, have been collected. However, one company based in Pohnpei reports local sales averaging 100 MT per year (G. Russo, personal communication). Local sales to restaurants, institutions, and the general public by a large processor based in Pohnpei average 24 MT per year, or 60 MT whole weight. Lesser amounts are sold in the other three states, but the total for the country as a whole is estimated to be 200 MT.
- Thus, more than 257 MT of tuna are sold through domestic markets annually.
- The by-catch landed by locally based longline vessels is offloaded in FSM for local consumption or for processing and export. Among the major by-catch species landed are billfish, barracuda, dolphin fish, and wahoo. For processing and export, the most important species is swordfish. Heberer (1997)

estimates the swordfish catch as 33 percent of all billfish by-catch of longline vessels in FSM. While not producing a major component of vessel revenue, the sale of this by-catch to the public in population centers can be an important contribution to available protein at affordable prices.

- The almost constant availability of tuna sashimi provides an important enticement to diners at restaurants in FSM. When a cholera epidemic in Pohnpei forced the Government to ban sales of sashimi, unhappy customers put pressure on restaurant operators to seek a reconsideration of the ban, which was eventually lifted with new health safeguards in place (Y. Suzuki, personal communication).

Cultural and recreational value

- The Pohnpei Fishing Club has about 60 members. Each year the club conducts eight or nine fishing competitions in which tuna figure prominently. The opportunity to advertise products in FSM draws outside sponsors.
- Hotels in both Pohnpei and Yap offer tuna fishing as a recreational activity for their guests.
- The current and historical importance of tuna fishing activities in the local culture has been documented by ethnographers and is reflected in daily life in Micronesia.
 - Gillett (1987) says: "It would indeed be a clever writer who could adequately express the jubilation caused by a sailing canoe arriving at Satawal [outer islands of Yap] fully laden with over a tonne of tuna. The crew of the canoe pound their paddles with joy while waiting offshore, old women dance and sing on the beach, and the entire population is in a state of delightful anticipation...."
 - According to Lieber (1994), "Ritually and economically, tuna fishing was the single most important fishing activity in the community."
 - Bates and Abbott (1954), on the other hand, write: "The number one food fish in terms of importance to the island is identified as skipjack tuna."
 - Strict taboos surrounded tuna fishing activities and the consumption of tuna on many islands and atolls of the central Carolines, a strong indication of the reverence and

importance attached to the resource. For example, on Satawal island, skipjack tuna brought ashore after a fishing expedition were not treated carelessly and were butchered and divided only by respected senior members of the community (Hijikata 1997).

- The importance of tuna and tuna fishing is evident in the availability of handicraft items available in some stores in Micronesia, especially in the western areas. Traditional tuna fishing lures, tackle boxes, and associated fishing gear are offered for sale to tourists and others as examples of implements important to the culture of the islands.
- Various tuna species have been featured on FSM postage stamps.

Future importance

- Recognizing the importance of tuna to the country, the Plan for the Management of Tuna in the Federated States of Micronesia emphasizes the need for proper management of the country's tuna resources to protect its economic security. The plan identifies these major goals of tuna fisheries management:
 - Obtaining national revenue from fees paid for access to FSM tuna resources
 - Encouraging investment in enterprises related to tuna fisheries that will support development and provide economic and social benefit
 - Promoting employment opportunities that will contribute to the national economy
 - Developing international relationships beneficial to FSM
- FSM has made a large amount of capital available in the form of grants for tuna fisheries infrastructure and development, in recognition of the future importance of tuna. Direct foreign aid grants to the fisheries sector from one donor were valued by FSM Foreign Affairs at \$40 million over the past two decades (Raigutel, personal communication). Of that amount, about 10 percent, or \$4 million, directly supported the acquisition of tuna fishing equipment and supplies, while the remaining \$36 million supported tuna fisheries and other activities at the commercial and artisanal levels.

- The more than \$110 million invested directly in the sector (FFA 1994) is an indication of the importance given by the FSM national and state governments to tuna fishing and related projects.
- The national income from foreign tuna fishing vessels forms a large part of the income of the national Government, and the importance of this contribution is likely to grow as grant aid funds from the US lessen.

References

- Asian Development Bank (ADB). 2000. *Financial review of the FSM public enterprise sector*. 30 pages.
- Bank of Hawaii. 2000. *Federated States of Micronesia economic report*. 23 pages.
- Bates, M., and D. Abbott. 1954. *Ifaluk: Portrait of a coral atoll*. 287 pages.
- Burslem, W.H.G. 1999. *Analysis of the National Fisheries Corporation and its subsidiaries*. Pohnpei. 65 pages.
- Federated States of Micronesia (FSM) Government. 1998. *Trade bulletin no. 9*. Palikir: Statistics Unit, Department of Economic Affairs. 105 pages.
- _____. 1999. *Statistical yearbook 1999*. Palikir: Statistics Unit, Department of Economic Affairs. 124 pages
- Food and Agriculture Organization (FAO). 1997. *Fishery profiles: Papua New Guinea*.
- Forum Fisheries Agency (FFA). 1994. *Pacific tuna industry study*. Honiara. 75 pages.
- Gillett, R. 1987. *Traditional tuna fishing: A study at Satawal, central Caroline Islands*. Bulletin of anthropology 1. Honolulu: Bishop Museum Press. 48 pages.
- Gillett, R., and M. McCoy. 1997. *Employment of Pacific Islanders aboard foreign fishing vessels*. Honiara: Forum Fisheries Agency. 97 pages.
- Heberer, C. 1997. *Estimation of by-catch and discard rates for pelagic fish species captured in the tuna longline fishery of the Federated States of Micronesia*. Unpublished master's thesis. Mayaguez: University of Puerto Rico. 106 pages.

- Hezel, F.X., E. Petteys, and D. Chang. 1997. *Sustainable human development in the Federated States of Micronesia*. Report prepared for the Micronesian seminar of the United Nations Development Programme. Pohnpei.
- Hijikata, H. 1997. *Driftwood: Life on Satawal island, Micronesia*, translated by K. Sudo. Tokyo. 205 pages.
- Lieber, M. 1994. *More than a living: Fishing and social order on a Polynesian atoll*. 235 pages.
- McCoy, M., and R. Gillett. 1998. *Foreign tuna purse seining in the Pacific Islands: The current situation and business opportunities*. Report prepared for the Forum Fisheries Agency. 89 pages.
- McCoy, M., and H. Ishihara. 1999. *The socioeconomic importance of sharks in the US flag areas of the western and central Pacific*. Administrative report AR-SWR-99-01. Honolulu: National Marine Fisheries Service. 119 pages.
- Micronesian Maritime Authority (MMA). 2000. *1999 MMA annual report*. Draft. 12 pages
- Overseas Fishery Cooperation Foundation (OFCF). 1995. *Report on inshore fishery resources and environment in Pohnpei State*.
 _____. 1998(?). *Federated States of Micronesia fishery report*. Suva: Overseas Fishery Cooperation Foundation. 12 pages.
- Pohnpei State Government and Pohnpei Economic Planning Commission. 1997. *Solicitation of investment opportunity: Tuna longline operations, production, processing and marketing*. Pohnpei. 13 pages
- Pollard, S., D. Robb, and M. McCoy. 1994. *Pacific tuna industry study: The Federated States of Micronesia*. Honiara: Forum Fisheries Agency.
- Sitan, P. 1995. *Prospects of the longline fishery in FSM*. Paper presented at the First FSM Economic Summit, Pohnpei. 18 pages
 _____. 2000. "Historical longline landings in FSM ports, 1991–2000." Unpublished data. FSM National Fisheries Corporation. 1 page.

Appendix B: The Importance of Tuna to Samoa

Quantity of tuna caught in the country

- The alia catamaran longline fleet caught 5,747 metric tons (MT) of tuna in 1997, 6,072 MT in 1998, and 5,156 MT in 1999 (Watt and Moala, 2000b). Of the yearly catch, about 70 percent was albacore, 12 percent yellowfin, 5 percent bigeye, and 4.5 percent skipjack (Passfield and Mulipola 1999). Tuna caught through other means added another 100 MT or so to these quantities. Samoa Fisheries Division (1999) reports a total catch of 4,971 MT for the financial year 1998/99, including 4,757 MT of tuna exports and 214 MT sold in the domestic market.
- According to Cusack and Stanley (1999), foreign longline vessels have fished in Samoa's waters since the 1960s. Their total catch has averaged between 200 MT and 500 MT, of which 75 percent has been albacore, 15 percent yellowfin, and 7 percent bigeye tuna. The Samoa area has attracted low to moderate longline vessel fishing relative to other parts of the region. The highest catch by foreign vessels was recorded in 1994 (1,050 MT). Data in Passfield and Mulipola (1999) show that Japanese, Korean, and Taiwanese longliners caught about 11,000 MT of tuna and other pelagic species between 1962 and 1994 in the vicinity of Samoa.
- The annual tuna catch in recent years has been about 25 percent higher than the catch of inshore species in subsistence fisheries.

Value of tuna caught in the country

- An estimated S\$600,000 worth of tuna is sold in the domestic market (Samoa Fisheries Division 1999).
- Tuna exports fetched an estimated S\$33 million for the 1998/99 financial year (Samoa Fisheries Division 1999) and S\$27.5 million for the 1999 calendar year (Watt and Moala 2000b). Boyle (1999) places the tuna exports for 1998 at S\$22.4 million.
- Shark fins valued at about S\$250,000 annually are also taken while tuna fishing.

- Recent local sales and exports of tuna appear to have reached a combined annual value of about \$10 million.¹

Tuna exports

- Tuna is now the most important export of Samoa. Unpublished information from the Samoa Treasury Department shows that fish made up 71.8 percent of the country's exports in 1999, and information in Watt and Moala (2000b) suggests that tuna or fish caught while fishing for tuna made up 82 percent of all fish exports. Hence, the tuna industry was responsible for about 60 percent of all exports from the country in 1999.
- World Bank (2000) reports that the growth of the Samoa economy in 1999 exceeded expectations and that the export of tuna for canning was a key contributor to that growth.

Access fees

- The US purse seine fleet and a foreign longliner based in Pago Pago are the only foreign vessels that are currently licensed to fish in the Samoa Exclusive Economic Zone (EEZ).
- Under the multilateral treaty with the United States that is administered by the Forum Fisheries Agency, Samoa receives \$148,000 yearly as its share in access fees. A further \$110,000 annually is tied to fisheries development projects.
- The lone foreign longline vessel licensed to fish in the Samoa EEZ pays S\$6,000 in access fees.
- According to the fee schedule of the Samoa Fisheries Division, locally based longliners generate about S\$65,000 in fees.
- Access arrangements for foreign and domestic vessels generate about \$281,233 in revenues and associated benefits yearly.

¹ Although there was some variation in exchange rates during the period under consideration, a constant rate of S\$3 = US\$1 is used in this report. Dollar figures, unless otherwise specified, are in US dollars.

Tuna vessel fines

- Fines for illegal fishing in the Samoa zone have been substantial. In the 1980s, a US purse seiner was fined \$100,000 and a Taiwanese longliner, \$125,000 (Fa'asili, personal communication).

Direct employment in the tuna industry

- The most recent estimates of the number of local longliners (Passfield 2000) and the size of the crew on vessels of various size categories (P. Watt, personal communication) indicate that about 455 people work on locally based tuna longliners.
- The tuna processors and exporters in Apia now employ 55 Samoans.
- An indicator of the extent of formal employment in Samoa is the 23,009 people paying into the National Provident Fund in 1999. The more than 510 jobs in Samoa aboard tuna vessels or at the Apia-based processors and exporters therefore represent a substantial portion of the wage-paying employment in the country.
- Gillett and McCoy (1997) report that 53 Samoans were employed aboard US tuna vessels. The number of Samoans working in the US purse seine fleet is likely to have increased in the last few years, says an official of the US National Marine Fisheries Service based in Pago Pago (G. Yamasaki, personal communication).
- About 3,500 people from independent Samoa are employed at the two canneries in Pago Pago, according to ASG (1999) and officials of the canneries.
- Therefore, about 4,070 people in Samoa are directly employed in the tuna industry.

Indirect and spinoff employment

- Various types of jobs are closely connected to the tuna industry in Samoa. These include aluminum boatbuilders/repairers, outboard engine mechanics, fishing gear salesmen, workers in the ice plants, refrigeration specialists, sellers of the tuna by-catch, fuel suppliers, staff of the shipping and air cargo

agencies, and providers of groceries and supplies for the tuna vessels. Such jobs are significant in number but difficult to quantify.

- The third category of tuna-related employment is the indirect spinoff employment resulting from links to other sectors of the economy. The 4,020 people directly employed in the tuna industry and the people working in jobs closely associated with the tuna industry create greater demand for consumer goods and services, resulting in greater total employment in the economy. Although the increase in total employment attributable to the industry is difficult to quantify, Samoa Government (1999) states that the tuna industry has increased the cash earnings of a wide range of households throughout Samoa, creating a direct flow-on effect on the commerce sector and a significant impact on the rest of the economy.

Other employment considerations

- About 58 percent of the Samoans employed at the Pago Pago canneries (2,030 people) are women.
- Because about 40 percent of the longliners in the country are based outside Apia (including 20 percent on Savaii), there is a significant amount of nonurban tuna-related employment aboard the vessels.
- World Bank (2000) indicates that a key issue for the Samoa Government is downsizing the public service. In the future environment of less public-sector employment, jobs directly or indirectly related to the tuna industry (the vast majority of which are in the private sector) will become more important.

Expenditures of locally based vessels

- Stanley and Toloa (1998) report that between 600 and 800 fishing trips are made by the alia fleet in an average week, each trip requiring between S\$200 and S\$500 in expenditures for fuel, bait, food, and crew wages. This information suggests that the annual expenditures of the alia fleet are in the order of S\$10 million.
- More recent analyses (Passfield and King 2000) show that an alia fleet of 121 active vessels, doing 65 trips per year, would

have local expenditures of S\$8.4 million for fuel, bait, ice, food, gear, and wages.

- The 20 locally based tuna longline vessels larger than 10 meters spend about S\$8 million locally per year.
- The entire locally based tuna longline fleet appears to be spending about \$5.5 locally each year.
- Wages paid (about \$2.2 million) represent about 40 percent of the expenditures by the vessels.

Government revenue from direct taxes on the tuna industry

- Most of the direct taxes on the industry take the form of levies on the fuel used by the longline vessels. According to the schedule of tax rates from the Samoa Treasury Department, the 121-vessel alia fleet pays about S\$1.8 million in taxes on fuel each year, including import duties and the value-added goods and services tax (VAGST). The 20 larger vessels in the longline fleet pay about S\$.7 million.
- Expenditures for bait and gear by the entire local longline fleet result in about S\$.6 million in taxes.
- The local longline fleet pays about \$1 million annually in direct import duties and VAGST for fuel, bait, and equipment.

Small-scale fishing

- Trolling for tuna produces about 100 MT of tuna annually (K. Passfield, personal communication). This amount is likely to have increased recently with the deployment of the two fish-aggregating devices (FADs) in 1999.
- A World Bank study (World Bank 1999) showed that at one site sampled in Samoa (Manase, Savaii) alia tuna fishing was actually assisting in the management of small-scale inshore fisheries as the sale of the by-catch in the village reduced the need for inshore fishing.

Nutritional value

- Tuna is important in the diet of Samoans and, with the recent expansion of tuna longline fishing, this importance is growing.

- More than 200 MT of tuna, or about 1.18 kg per capita, is sold in the domestic market (Samoa Fisheries Division 1999). This actual figure is larger because of the informally distributed tuna and leakage from the longline fishery. The 1.18 kg per capita consumption is significant compared with the 19 kg per capita fish consumption estimated by FAO (1993) for urban households.

Cultural and recreational value

- There are three commercial sport fishing operators in Samoa. One of these has about two charters per week and charges \$300 per half-day trip (P. Meredith, personal communication).
- Each year for the past five years an international sport fishing competition has been held in Samoa. The 2000 competition attracted 60 foreign competitors and an equal number of international spectators, who spent about S\$200,000, plus vessel charters and airfare.
- Activities revolving around tuna fishing are quite important in Samoan culture. Hornell (1950), describing traditional tuna fishing in Samoa, states: "The enthusiasm for this madly exciting sport remains as strong as ever. No blood runs so sluggish as not to course wildly with excitement as the fish are whirled aboard in a frenzied fight against time." Buck (1930) describes the elaborate customs associated with the manufacture of tuna fishing gear, the naming of fish, and the distribution of the tuna catch. In their classic reference on Pacific Island canoes, Haddon and Hornell (1936) call the bonito [skipjack] canoe of Samoa "the most graceful of all Polynesian canoes."
- Replicas of traditional Samoan tuna lures sold in handicraft stores in Apia reflect the importance of tuna in Samoan culture. Post Office officials also point out that various tuna species have been featured on postage stamps.

Future importance

- UNDP (1997) examines the employment situation in Samoa from 1986 to 2011 and shows that both the potential labor pool and the economically active population are much larger and

are increasing at a faster rate than the number of wage jobs. Jobs in the tuna industry (almost all of which are wage-paying) will therefore assume greater importance.

- According to officials of Star-Kist Samoa Incorporated, a tuna loining plant might be established at Asau on the western side of Savaii. The plant would provide more than a hundred jobs to start with and about 1,600 jobs eventually (Pacific Magazine 2000).
- Tuna fishing appears to have successfully reversed the fisheries sector's "state of continuous decline over the last decade" (AIDAB 1994), and there are indications that it will continue to do so in the future.

References

- American Samoa Government (ASG). 1999. *American Samoa statistical yearbook 1997*. Statistics Division, Department of Commerce, American Samoa Government. 176 pages.
- Australian International Development Assistance Bureau (AIDAB). 1994. *The Western Samoa economy*. International development issues no. 35. Canberra: Australian International Development Assistance Bureau.
- Boyle, J. 1999. *Samoa tuna market study*. Apia: Pacific Corporate Services.
- Buck, P. 1930. *Samoa material culture*. Bulletin no. 75. Honolulu: Bernice P. Bishop Museum.
- Cusack, P., and J. Stanley. 1999. *Samoa fisheries sector investment study report*. Gillett, Preston and Associates. 29 pages.
- Food and Agriculture Organization (FAO) 1993. *Samoa: Fisheries resources assessment for management*. Project SAM/89/002. Rome: Food and Agriculture Organization.
- Gillett, R., and M. McCoy. 1997. *Employment of Pacific Islanders aboard foreign fishing vessels*. Honiara: Forum Fisheries Agency. 97 pages.
- Haddon, A., and J. Hornell. 1936. *Canoes of Oceania*. Bulletin no. 27. Honolulu: Bernice P. Bishop Museum.
- Hornell, J. 1950. *Fishing in many waters*. Cambridge: University Press.
- Pacific Magazine*. 2000. "Starkist seeks processing plant." July/August 2000, page 19.

- Passfield, K. 2000. *Samoa Fisheries Division daily visual boat census*. AusAID Samoa Fisheries Project.
- Passfield, K. and M. King. 2000. *Costs and returns for a longline tuna fishing vessel*. AusAID Samoa Fisheries Project.
- Passfield, K., and A. Mulipola. 1999. *Profile of the commercial tuna fishery in Samoa*. AusAID Samoa Fisheries Project.
- Samoa Fisheries Division. 1999. *1998/1999 annual report*. Apia: Fisheries Division, Ministry of Agriculture, Forests, Fisheries and Meteorology.
- Samoa Government. 1999. *The Samoa economy: Gross domestic product*. Apia: Treasury Department.
- Stanley, J., and F. Toloa. 1998. *Review of the Samoa longline fishing industry*. Consultancy report prepared for the Samoa Government and the Forum Fisheries Agency.
- United Nations Development Program (UNDP). 1997. *Sustainable livelihoods: Promoting informal sector growth in Pacific Island countries*. Suva: United Nations Development Program. 82 pages.
- Watt, P., and S. Moala. 2000a. *Estimates of rejection in the Samoa tuna fishery*. AusAID Samoa Fisheries Project.
- _____. 2000b. *Samoa's longline newsletter*. No. 1, April 2000.
- World Bank. 1999. *Voices from the village: A comparative study of coastal resource management in the Pacific Islands*. Pacific Islands discussion paper series no. 9. Washington, D.C.: World Bank.
- _____. 2000. *Regional economic review*. Annex A.

Appendix C: The Importance of Tuna to Papua New Guinea

Quantity of tuna caught in the country

- Kumoru and Polon (2000) estimate the total annual PNG tuna catch to be 155,188 metric tons (MT) in 1997, 128,765 MT in 1998, and 72,647 MT in 1999. Using provisional 1999 logsheet data, it is estimated that about 138,000 MT were caught in 1999.
- Sanders (1999) states that the average purse seine tuna catch for the five years since 1993 was 296,000 MT, and the average for the longline fishery since 1991 was 534 MT.
- The Information Register of the PNG National Fisheries Authority (NFA) shows that in the five years from 1995 to 1999, 609,075 MT of tuna were caught in the PNG Exclusive Economic Zone (EEZ). Almost all of this catch (99.8 percent) came from purse seine vessels. Domestic longline vessels accounted for most of the balance.
- In 1998, the purse seine catch comprised skipjack (77.2 percent), yellowfin (22.1 percent), and other species. The longline catch that same year was made up of yellowfin (77.4 percent), albacore (11.7 percent), bigeye (5.7 percent), and other species (NFA Information Register)
- In recent years the nominal annual purse seine catch from the EEZ has exceeded 200,000 MT on three occasions (1989, 1991, and 1995). Allowing for underreporting by some fleets, the annual catch is believed to have reached more than 200,000 MT in 1989–1992 and 1995, and more than 350,000 MT in 1991 (South Pacific Commission 1997).
- Data on the tuna catch in subsistence and artisanal fisheries are scanty.

Value of tuna caught in the country

- According to unpublished NFA data, the total landed value of the tuna catch in 1998 was about \$140 million.¹

¹ Unless otherwise specified, dollar amounts are in US dollars.

Tuna exports

- Tuna exports amounted to \$39.5 million in 1998 and \$29.3 million in 1999 (NFA export receipts). In 1999:
 - The lone tuna cannery operating in PNG (RD Tuna Cannery) exported 5,587 MT of canned tuna to the US, Philippines, and Europe in 1999. This export was valued at \$12.3 million (NFA export receipts).
 - Other tuna products exported in 1999 were frozen tuna (\$14.3 million), fresh chilled tuna (\$2.6 million), and dried tuna (\$0.08 million) (NFA export receipts).
- The tuna fisheries also exported shark fins valued at about \$500,000.
- The tuna industry accounts for between 1 percent and 2 percent of all exports from the country including exports from the major mining and petroleum industries.

Access fees

- For 2000, access arrangements resulted in the payment of \$10,534,495 in fees plus \$706,125 for training levies, observer fees, and technical assistance (NFA and Forum Fisheries Agency data).
- Access fees paid in late 1999 and early 2000 included \$2,808,000 for Korean vessels and \$4,104,000 for vessels from Taipei, China (NFA 2000b). NFA (2000a) shows that these vessels paid an additional \$682,000 for observers, training levies, and fisheries development projects.
- Sanders (1999) states that \$3,067,012 was paid in the 9th (1996–1997) and \$1,382,194 was paid in the 10th (1997–1998) licensing period of the US multilateral treaty, for an average annual payment of \$3.8 million over the 10 periods. In the 11th licensing period PNG received \$1,688,855 (FFA 2000).
- In 1998, \$16.4 million in access fees was collected from vessels of Korean, Philippine, Vanuatu, Taipei, China, and US registry (McCoy 1998).
- PNG has collected about 45 percent of the access fees paid by purse seine fleets of the US, Korea, and Taipei, China in the region (McCoy 1998).

- As of 1 September 2000 (NFA Information Registry), fishing licenses for the EEZ had been granted to 78 purse seine vessels (under foreign access agreements), 19 purse seine vessels (under domestic or charter arrangements), 44 domestic longline vessels, and 120 support, tanker/reefer, or carrier vessels.
- To put the \$11.2 million 2000 access fees/charges into perspective, information from AusAID (2000) shows:
 - The amount represents about 2 percent of all government revenue, or 33 percent of nontax revenue.
 - The income from fees and charges is greater than the amount the Government was expected to spend in 2000 on services relating to law and order (police and prisons).

Tuna vessel fines

- Data on Government income from tuna-related fines and vessel confiscations are not readily available, but the amounts involved are substantial. In 1997, for example, 10 illegal boats were apprehended and prosecuted (NFA 1998).

Direct employment in the tuna industry

- The tuna cannery at Madang employs about 2,500 people (S. Tiller, personal communication).
- The PNG Fishing Industry Association and NFA have jointly estimated that there are a further 515 jobs in the tuna industry, with domestic longline vessel crews making up the largest component (340). Other subsectors providing employment are the local purse seine fishery (75), a loining plant (15), processing and exporting establishments (60), and transshipment operations (25).
- The total number of PNG nationals directly employed in tuna catching, processing, and exporting is about 3,000.

Indirect and spinoff employment

- PNG's growing domestic tuna fishery and onshore processing developments by domestic and foreign interests generate indirect jobs in a wide variety of sectors, including: mechanical engineering and maintenance; vessel maintenance, repair, and

dockyard services; refrigeration installation and repair; land, sea, and air transport services; vessel provisioning; packaging manufacture; accounting, legal, and other business services; insurance services; and fresh and processed fish products wholesale and retail marketing.

- The 3,000 people directly employed in the tuna industry and the people working in jobs associated with the tuna industry create greater demand for consumer goods and services, resulting in increased overall employment and economic activity in the country.

Other employment considerations

- The restructuring of the National Fisheries Authority has reduced the NFA staff from around 136 to 44. Under its new structure NFA expects to contract some tuna fishery monitoring functions to provincial governments and the private sector. Significant employment is expected to result, as exemplified by an anticipated need for 300 trained observers to monitor fishing and transshipping activities.
- Around 85 percent of the employees of the tuna cannery at Madang are women. It is likely that loining and other processing operations now under development or negotiation will employ similar proportions of women (P. Celso, personal communication).
- A current initiative to develop industry-oriented training courses at the National Fisheries College at Kavieng would provide 200 graduates annually for the seagoing and processing sectors in response to anticipated growth in the tuna fishery (National Fisheries College Strengthening Project, 2000).
- On the basis of information in SPC (1998) and AusAID (2000), the 3,000 people directly employed by the tuna industry can be said to represent about 1.5 percent of the total formal employment in the country. This proportion would become significantly larger if the difficult-to-quantify indirect employment in tuna-related industries and employment generated by spinoffs were considered.

Expenditures of locally based vessels

- Each longline vessel spends more than \$590,000 on the average on wages, supplies, and services annually. Of this total amount, airfreight is the single largest cost component, at around 25 percent, although some airfreight costs are paid directly to foreign carriers. The next most important cost component is fuel, which accounts for around 16 percent of the total, while wages and bait account for about 6 percent each. These figures indicate that the 30 or so vessels active in the domestic longline fishery spend \$17.7 million annually (M. Brownjohn, personal communication).
- The annual expenditures of onshore operations maintained by the various domestic tuna longlining companies, including receiving, grading, packing, and refrigerated storage services, are said to amount to at least around \$400,000, inclusive of wages and salaries, irrespective of whether the company operates only a few vessels or 8 to 10 vessels (M. Brownjohn, personal communication).
- McCoy (1998) estimates that the company operating the onshore cannery had direct local expenditures of \$4.8 million during the construction and startup year and currently spends around \$2.5 million annually.
- Purse seine vessels licensed to fish or transship in PNG are required to make minimum levels of local expenditure under the terms of access agreements (vessels operated by the company that has established an onshore cannery are exempted from this requirement). McCoy (1998) points out a distinction between the *payao* (fish aggregating device) – based fishery and the distant water fishery.
 - The minimum required local expenditure of *payao*-based fishing companies during the 1997/98 licensing period was \$1.95 million. Overall, fuel purchases accounted for 86 percent to 95 percent of local expenditure.
 - In the case of the distant water fishery, vessels from Taipei, China and Korea transship in PNG ports and allow PNG to derive benefit through local expenditure. In examining the local expenditure of such vessels in Wewak during 1996, McCoy (1998) estimates that each port call resulted in expenditure of about \$7,400.

- In 1996 there were about 311 transshipments from PNG ports (SPC data), which would have resulted in \$2.3 million in expenditure, very little of which was for fuel.

Government revenue from direct taxation of tuna industry

- An analysis of the value of the tuna fishery to PNG (Lightfoot 1999) indicates that foreign purse seine vessels entering the fishery generate an initial contribution of \$500 in taxes and charges and a further \$53,000 to \$70,000 in taxes and government charges annually (the taxes include the tax on fuel).
- Locally based purse seine vessels, in contrast, are estimated to generate contributions of \$463,000 to \$595,000 in taxes and charges on entering the fishery and a further \$237,000 to \$301,000 in taxes and charges annually.
- A similar analysis of the longline fishery in PNG waters (all domestic) indicates that vessels generate contributions of \$41,464 in taxes and charges on entering the fishery and \$62,224 annually (Lightfoot 1999).

Small-scale fishing

- There are few data on subsistence catches of tuna, but 10 percent of the estimated annual subsistence production of 26,000 MT is thought to comprise pelagic species, including tuna (FAO 1997).
- Troll fishing, which is conducted in only a few areas of PNG, typically includes a much higher proportion of tuna. Dalzell et al. (1996) estimate that more than 84 percent of troll catches in PNG is made up of tunas and other scombrids.
- Trials with fish-aggregating devices (FADs) indicate that the production and productivity of small-scale tuna fisheries can be increased by deploying FADs. A FAD deployed off Daugo Island near Port Moresby in 1992 is reported to have resulted in better than 27 kg per hour of catches of tuna and other species by small-scale fishermen trolling with multiple lines (Beverly and Cusack 1993).
- With the development of the domestic tuna longline fishery to provincial bases and its dispersal from Port Moresby to provincial bases in the New Guinea Islands region and

elsewhere, related infrastructure developments and the establishment of marketing links at such centers is likely to provide new opportunities for small-scale fishermen to better handle and market their tuna catch.

- The economic opportunities created by the development of the domestic longline fleet are also thought likely to increase tuna production by small-scale fishermen (ADB 1995b; Preston 1996; Tutumarem Marine Consultancy Services 1999). At least one infrastructure development project—the construction of a longline vessel wharf at Kavieng in New Ireland—has taken this possibility into account in its design (P. Cusack, NFA Fisheries Development Project, personal communication).

Nutritional value

- The consumption of all fish products in PNG is estimated at 78,000 MT annually, or about 18.0 kg per person per year (FAO 1997). Although tuna is thought to make up only a small portion of this amount at present, the proportion is increasing, primarily because of increased availability from the by-catch of industrial tuna fishing operations.
- Little reliable data are available on the local sale of tuna produced by either small-scale or industrial producers, but retail and wholesale availability of non-export-grade fresh tuna and tuna by-catch through retail outlets, restaurants, and hotels in Port Moresby is increasingly common.
- Canned tuna produced by the lone established tuna cannery at Madang is marketed throughout the country. Daily production and domestic sale of canned tuna has stood at 20 MT per day since January 2000 (P. Celso, pers. comm.).
- In the North Solomons Province, Hulo (1980) reports that “tuna is a highly regarded food fish which is caught in large numbers.”

Cultural and recreational value

- Regular sport fishing activity targeting tunas and other oceanic fish is found in the larger population centers of Lae, Port Moresby, and Madang. Less regular, tourism-associated sport fishing occurs in some resort centers, such as Kavieng and

Rabaul, most often in resorts offering diving and other water sports. Regular sport fishing competitions include an international competition organized by the Port Moresby Game Fishing Club.

- FADs have been deployed by some recreational sportfishing associations off Port Moresby and Lae to increase productivity (M. Penney, personal communication).

Future importance

- Considerable effort was invested in the National Tuna Management Plan, which came into legal force in March 1999. The plan's underlying strategy is to manage the level of fishing at a sustainable level that has been determined scientifically. Where such information is limited, the precautionary approach applies. The plan has two overall objectives:
 - To manage and conserve the tuna stock on a sustainable basis
 - To assist in the growth of the domestic tuna industry
- In 2000, several major tuna fishing or tuna processing projects were under consideration; some of these would provide several thousand job opportunities for PNG citizens. These projects included:
 - An economic cooperation agreement for fisheries with New Caledonia, which might result in the granting of fishing access to French purse seine vessels. Such access, if granted, suggests the possibility of onshore processing operations with market access to countries in the European Union.
 - Spanish interest in a cooperative arrangement with an established onshore processor, which would see Spanish purse seine vessels landing tuna for loining and export to Europe.
 - Discussions with Korean interests regarding the establishment of loining facilities producing products that could enter the Korean market under domestic production duty concessions.
 - Discussions with Taipei, China interests that might result in up to 48 purse seine vessels being based in PNG. The interest of Taipei, China in local basing is thought to stem

- in part from the recent establishment of a large-capacity dockyard and slipway at Port Moresby.
 - Applications for a further 25 longline vessel licenses (S. Tiller, personal communication).
- A PNG Government policy decision in 2000 that offers both local and foreign operators wider access to domestic and international air routes is considered likely to result in increased airfreight services for fresh chilled tuna shipments.
- The opportunities provided by tuna-related activities become even more important given the scarcity of jobs for an expanding population:
 - UNDP (1997) indicates that the PNG labor force is growing at a rate of 3.2 percent per year.
 - AusAID (2000) shows that there was no net growth in formal employment in the PNG private sector in the decade between 1989 and 1997.

References

- Asian Development Bank (ADB). 1995a. *Report on a survey of fish markets in Port Moresby. Supplementary paper no. 3*. Technical assistance no. 2022-PNG. 44 pages.
- _____. 1995b. *Institutional strengthening of the Department of Fisheries and Marine Resources: Report of the Marine Resources Specialist*. Working paper no. 3. Technical assistance no. 2022-PNG.
- Australian Agency for International Development (AusAID). 2000. *The economy of Papua New Guinea: 1999 report*. Canberra: Australian Agency for International Development.
- Beverly, S., and P. Cusack. 1993. *Report of a pilot fish aggregation device (FAD) deployment off Port Moresby, Papua New Guinea*. South Pacific Commission.
- Dalzell, P., T. Adams, and N. Polunin. 1996. "Coastal fisheries in the Pacific Islands." *Oceanography and marine biology: An annual review*. Vol. 34. UCL Press. Pages 395–531.
- Food and Agriculture Organization (FAO). 1997. *Fishery profiles: Papua New Guinea*.

- Forum Fisheries Agency (FFA). 2000. *Allocation of catch and distribution of final shares for the 11th licensing period*. Information paper C. Internal meeting of Pacific Island parties, 12th Treaty Consultation, Niue.
- Hulo, J. 1980. "Fishing practices in Buka Island, North Solomons Province." *Subsistence practices of Papua New Guinea*. Traditional technology series no. 2. Lae: Appropriate Technology Development Institute.
- Kumoru, L., and P. Polon. 2000. *National fisheries report: Papua New Guinea*. 13th meeting of the standing committee for tuna and billfish, National Fisheries Authority, Port Moresby. 6 pages.
- Lightfoot, C. 1999. *A report on the viability and domestication policies for the tuna fisheries of Papua New Guinea*. Fisheries Development Project (PNG 31650) of the PNG National Fisheries Authority and Asian Development Bank. 40 pages.
- McCoy, M. 1998. *Tuna purse seine fishing in Papua New Guinea: An assessment of benefits*. Report prepared for the Forum Fisheries Agency. 85 pages.
- National Fisheries College Strengthening Project. 2000. *Meeting 1 of the Fisheries Training Advisory Committee*. Report to the Fisheries Training Advisory Committee on Sectoral Training Needs Analysis. 10 pages
- National Fisheries Authority (NFA). 1998. *Annual report 1997*. Port Moresby: National Fisheries Authority. 20 pages.
- _____. 2000a. *Annual report 1999*. Draft. Port Moresby: National Fisheries Authority. 42 pages.
- _____. 2000b. *Ministerial statement*. Port Moresby: National Fisheries Authority. 22 pages.
- Preston, G. 1996. *Evaluation of the potential for commercialisation of small-scale fisheries*. Technical report prepared for the Food and Agriculture Organization under the Technical Cooperation Programme for Strengthening Capacity for Fisheries Conservation and Management, Papua New Guinea. 58 pages.
- Sanders, M. 1999. *Report on the bio-economic assessment for the tuna fisheries of Papua New Guinea*. Fisheries Development Project (PNG 31650) of the PNG National Fisheries Authority and the Asian Development Bank. 51 pages.

- Secretariat of the Pacific Community (SPC). 1997. *Scientific inputs into a PNG Tuna Management Plan*. Compiled by the Oceanic Fisheries Programme. Noumea: Secretariat of the Pacific Community. 16 pages
- _____. 1998. *Pacific populations*. Revised edition. Report prepared for the International Conference on Population and Development, Cairo. Noumea: Secretariat of the Pacific Community. 68 pages.
- Tutumarem Marine Consultancy Services. 1999. *Issues for consideration in promoting the development of sustainable commercial fisheries for near-shore resources in New Ireland Province*. Report prepared for the New Ireland Provincial Government. 22 pages.
- United Nations Development Programme (UNDP). 1997. *Sustainable livelihoods: Promoting informal sector growth in Pacific Island countries*. Suva: United Nations Development Programme. 82 pages.
- _____. 1999. Papua New Guinea human development report. United Nations Development Programme. 320 pages.

References

- Anell, B. 1955. Contribution to the History of Fishing in the Southern Seas, *Studia Ethnographica Upsaliensia*, IX.
- Anon (1998). Solomon Taiyo. 21 pages.
- Anon (2000). Republic of Vanuatu Tuna Management Plan.
- Arama (2000). Fiji: Gender Impacts Related to Development of Commercial Tuna Fisheries - A Report to the South Pacific Forum Secretariat. Arama & Associates, July 2000.
- ASG (1999). American Samoa Statistical Yearbook 1997. Statistics Division, Department of Commerce, American Samoa Government, 176 pages.
- Asian Development Bank (ADB). 1995a. Report on a Survey of Fish Markets in Port Moresby, Supplementary Paper No 3, Technical Assistance No. 2022-PNG. 44 pages.
- _____. 1995b. Institutional Strengthening of the Department of Fisheries and Marine Resources: Report of the Marine Resources Specialist, Working Paper No.3. Technical Assistance No. 2022-PNG
- _____. 2000. Asian Development Outlook. Asian Development Bank, Manila.
- _____. 2000. Financial Review of the FSM Public Enterprise Sector. 30 pages.
- Australian Agency for International Development (AusAID). 1994. The Solomon Islands Economy. Australian Agency for International Development.
- _____. 2000. The Economy of Papua New Guinea: 1999 report. Australian Agency for International Development, Canberra.
- Australian International Development Assistance Bureau (AIDAB). 1994. The Western Samoa Economy. International Development Issues No.35, Australian International Development Assistance Bureau, Canberra.
- Bank of Hawaii. 1998. Solomon Islands Economic Report. Pacific Economic Report, 18 pages.
- _____. 2000. Federated States of Micronesia Economic Report. 23 pages.

- Barclay, K., and W. Yoshikazu. 2000. Solomon Taiyo: Tuna Dreams Realised. *Pacific Economic Bulletin*, Volume 15, Number 1, pages 34-47.
- Bates, M., and D. Abbott. 1954. Ifaluk: Portrait of a coral atoll. 287 pages.
- Beverly, S., and P. Cusack. 1993. Report of a pilot fish aggregation device (FAD) deployment off Port Moresby, Papua New Guinea. South Pacific Commission.
- Boyle, J. 1999. Samoa Tuna Market Study. Pacific Corporate Services, Apia.
- Bright, J. 1996. The Development of a National Strategy for the Promotion of Sustainable Sports Fishing in the Solomon Islands. Report 1, TCP/SPO/4553, Food and Agriculture Organization of the United Nations, Rome.
- Buck, P. 1930. Samoan material culture. Bernice P. Bishop Museum, Bulletin No. 75, Honolulu.
- Burslem, W. 1999. Analysis of the National Fisheries Corporation and its subsidiaries. Pohnpei. 65 pages.
- Carter, R. 1995. Managing Purse Seiner Shore-Based Operations. Working Paper, at the 5th Cultural Values in the Age of Technology Conference, Maui Pacific Center, Hawaii.
- Clark, L. 1983. A Study on Fees and other economic Benefits from Foreign Fishing Access to the Fishery or Exclusive Economic Zones of the States Participating in the South Pacific Forum Fisheries Agency. Report 1983/2, FFA, Honiara.
- Cook Islands Ministry of Agriculture and Fisheries (1979). Statistics of Artisanal Fishing in the Southern Group 1979. Statistical Working Paper No. 13, Agriculture Planning Unit, Rarotonga.
- Crossland, J., and R. Grandperrin. 1979. Fisheries Directory of the South Pacific Commission Region. South Pacific Commission, Noumea.
- Crossland, J., and P. Philipson. 1992. The Rural Fishing Enterprise Project in the Solomon Islands: fish market and marketing study. James Crossland and Associates.
- Dalzell, P., and T. Adams. 1994. The Present Status of Coastal Fisheries Production in the South Pacific Islands. Working Paper Number 6, 25th Regional Technical Meeting on Fisheries, South Pacific Commission, Noumea, New Caledonia.

- Dalzell, P., T. Adams, and N. Polunin. 1996. Coastal Fisheries in the Pacific Islands. *Oceanography and Marine Biology: An Annual Review*, Volume 34, UCL Press. Pages 395-531
- Ditton, R., S. Grimes, and L. Finklestein. 1996. A Social and Economic study of the Recreational Billfish Fishery in the Southern Baja Area of Mexico. Billfish Foundation, Ft. Lauderdale.
- Douglas, N. 1994. Pacific Islands Yearbook. Fiji Times Ltd., Suva
- ESCAP (1996). Promoting Exports of Fish and Fishery Products in Selected Pacific Island Developing Countries of the ESCAP Region. *Studies in Trade No.20*, Economic and Social Commission for Asia and the Pacific, Bangkok.
- Fairbairn, T. 1992. The Kiribati Economy. *International Development Issues No.26*, Australian International Development Assistance Bureau, Canberra.
- _____. 1993. Tuvalu: Economic Situation and Development Prospects. *International Development Issues No.29*, Australian International Development Assistance Bureau, Canberra.
- Food and Agriculture Organization (FAO). 1993. Samoa - Fisheries Resources Assessment for Management. Project SAM/89/002, Food and Agriculture Organization, Rome.
- _____. 1995. Demand and Supply of Fish and Fish Products in Selected Areas of the World. *International Conference on Sustainable Contribution of Fisheries to Food Security*, Food and Agriculture Organization of the United Nations, Rome.
- _____. 1995. The Role of Fisheries in Food Security. 21st Session, Committee on Fisheries, Food and Agriculture Organization of the United Nations, Rome.
- _____. 1996. Regional Review of the Fisheries Situation in the South Pacific. *Fisheries Circular No.907*, Food and Agriculture Organization of the United Nations, Rome.
- _____. 1997. Fishery Profiles - Papua New Guinea.
- Forum Fisheries Agency (FFA). 1995. Director's Report 1994 - 1995. Forum Fisheries Agency, Honiara.
- _____. 1995. Tuna Industry Development Study - Regional Report. Report 95/66, Forum Fisheries Agency, Honiara.
- _____. 1996. Director's Report 1995 - 1996 . Forum Fisheries Agency, Honiara.
- _____. 1998. An Economic Appraisal of the Majuro Fishbase. Report 98/11. Forum Fisheries Agency, Honiara, 55 pages.

- _____. 2000. Allocation of catch and distribution of final shares for the 11th Licensing Period. Information Paper C, Internal Meeting of Pacific Island Parties, 12th Treaty Consultation, Niue.
- Fisheries Division (1996). Annual Report 1995. Fisheries Division, Ministry of Agriculture, Fisheries and Forests, Suva.
- Fisheries Division (1999). 1998/1999 Annual Report. Fisheries Division, Ministry of Agriculture Forests, Fisheries and Meteorology, Apia.
- Fisheries Division (1999). Fiji Fisheries Division Annual Report 1998. Ministry of Agriculture, Fisheries and Forests, Suva.
- Forau, P. 1995. A Review of Purse Seine Transshipment in the Solomon Islands. Report 95/56, Forum Fisheries Agency, Honiara.
- Forum Secretariat (2000). Economic Outlook for the Region. Forum Economic Ministers Meeting, Niue.
- FSM Government (1998) Trade Bulletin No. 9. Statistics Unit, Department of Economic Affairs, Palikir, 105 pages.
- FSM Government (1999) Statistical Yearbook, 1999. Statistics Unit, Department of Economic Affairs, Palikir. 124 pages.
- Gillett, R. 1985. Traditional Tuna Fishing in Tokelau. Topic Review Number 27, South Pacific Regional Environment Programme, Noumea, 47 pages.
- _____. 1987. Traditional Tuna Fishing: a study at Satawal, Central Caroline Islands. Bulletin in Anthropology 1. Bishop Museum Press, Honolulu, Hawaii, 48 pages.
- _____. 1994. Canned fish in Fiji: a review of the trade and suggestions for implementing quality control standards. Technical Cooperation Programme, Food and Agriculture Organization of the United Nations, 35 pages.
- _____. 1997. The Importance of Tuna to Pacific Island Countries: a report prepared for the Forum Fisheries Agency. Gillett, Preston and Associates, Suva, 28 pages.
- _____. 1997. Notes on Visits to Vanuatu, Solomon Islands, Kiribati, Marshall Islands, Federated States of Micronesia, Guam, American Samoa, and Fiji to Investigate the Employment of Pacific Islanders Aboard Foreign Fishing Vessels. Gillett, Preston and Associates, 50 pages.

- _____. 1999. The Inter-Relationship Between the Tuna Fishery and Other Key Marine Sectors in Palau - the report of the support consultant for the Palau tuna management plan. Forum Fisheries Agency, Honiara, 22 pages.
- Gillett, R., and M. McCoy. 1997. Employment of Pacific Islanders aboard foreign fishing vessels. Forum Fisheries Agency, Honiara, 97 pages.
- Gillett, R. and F. Toloa (1987). The Importance of Small Scale Tuna Fishing in the Pacific Islands: A Case Study at Fakaofu Atoll, Tokelau. pages 177-190, In: D. Doullman (1987), Tuna Issues and Perspectives in the Pacific Islands Region. Pacific Islands Development Programme, East-West Center, Honolulu.
- Government of PNG (1994). Economic and Development policies. Port Moresby.
- Government of Samoa (1999). The Samoa economy: gross domestic product. Treasury Department, Apia.
- GPA (1997). The sustainable contribution of fisheries to food security in the Oceania sub-region of the Asia-Pacific Region: review of food security issues and challenges in the Asia and Pacific Region. UNDP TSS1 Project - Ras/95/01T, Gillett, Preston and Associates, 50 pages.
- Haddon and Hornell. 1936. Canoes of Oceania. Bernice P. Bishop Museum, Bulletin No. 27, Honolulu.
- Handy, E. 1932. Houses, Boats, and Fishing in the Society Islands. Bernice P. Bishop Museum, Bulletin 90, Honolulu.
- Heberer, C. 1994. Transshipment. Report 95/8, Forum Fisheries Agency, Honiara.
- _____. 1997. Estimation of bycatch and discard rates for pelagic fish species captured in the tuna longline fishery of the Federated States of Micronesia. Unpublished master's thesis, University of Puerto Rico, Mayaguez. 106 pages.
- Hezel, F. X., E. Petteys, and D. Chang. 1997. Sustainable human development in the Federated States of Micronesia: report prepared for the United Nations Development Programme, Micronesian Seminar, Pohnpei.
- Hornell, J. 1950. Fishing in Many Waters. University Press, Cambridge, England.

- Hulo, J. 1980. Fishing Practices in Buka Island, North Solomons Province. In: Subsistence Practices of Papua New Guinea, Traditional Technology Series No. 2, Appropriate Technology Development Institute, Lae.
- Ivens, W. 1972. *Melanesians of the Southwest Pacific*. Benjamin Blom, New York.
- Joseph, G. 2000. Country Statement – Marshall Islands. 13th Meeting of the Standing Committee for Tuna and Billfish, 10 pages.
- Joseph, J. 2000. World Tuna Production: Past, Present and Future. Infofish-Tuna 2000 Bangkok, 18 pages.
- Kennedy, D. 1930. Field Notes on the Culture of Vaitupu, Ellice Islands. Volume 39, Number 1, *Journal of the Polynesian Society*.
- Kildow, J., H. Kite-Powell, C. Colgan, and E. Bruce. 2000. Estimating the Economic Value of the Ocean. *Sea Technology*, January 2000, pages 65-67.
- Kingston, T., T. Maeda, and G. Geen. 1993. An Economic Appraisal of the Benefits from Foreign-Owned, Locally Based Fishing Companies. Report 93/58, Forum Fisheries Agency, Honiara.
- Kiribati Ministry of Commerce and industry (undated). Annual Report of the Fisheries Division, 1981.
- Kumoru, L., and P. Polon. 2000. National Fisheries Report – Papua New Guinea. 13th Meeting of the Standing Committee for Tuna and Billfish, National Fisheries Authority, Port Moresby, 6 pages.
- Leolahi, S. 2000. Niue country Report. Working Paper 15, 13th Meeting of the Standing Committee on Tuna and Billfish, Secretariat of the Pacific Community, 3 pages.
- Lieber, M. 1994. More than a living: fishing and social order on a Polynesian atoll. 235 pages.
- Lightfoot, C. 1999. A Report on the Viability and Domestication Policies for the Tuna Fisheries of Papua New Guinea. PNG National Fisheries Authority/ Asian Development Bank, Fisheries Development Project (PNG 31650) 40 pages.
- Lucas, K., S. Tiller, and J. Swan. 1996. Background Report to the National Fisheries Policy Study, Volume 2. Asian Development Bank, Manila.
- MacGregor, G. 1937. *Ethnology of Tokelau Islands*. Bulletin 146, Bernice P. Bishop Museum, Honolulu.
- Martin, J. 2000. Recent Developments in the Solomon Islands. *Pacific Economic Bulletin*, Volume 15, Number 1, pages 1 to 16.

- Maxwell, J., and A. Owen. 1994. South Pacific Tuna Fisheries Study. Australian Agency for International Development.
- McCoy, M. 1998. Tuna purse seine fishing in Papua New Guinea: An Assessment of Benefits. A Report prepared for the Forum Fisheries Agency. 85 pages.
- McCoy, M., and R. Gillett. 1998. Foreign tuna purse seining in the Pacific Islands: the current situation and business opportunities. Report prepared for the Forum Fisheries Agency. 89 pages.
- McCoy, M., and H. Ishihara. 1999. The socioeconomic importance of sharks in the U.S. flag areas of the western and central Pacific. Administrative Report AR-SWR-99-01 National Marine Fisheries Service, Honolulu. 119 pages.
- Mees, C. (undated). The fisheries of Temana and Arorae. Fisheries Division, Ministry of Natural Resources, Tarawa.
- Meyer Resources (1987). A report on resident fishing in the Hawaiian Islands. Administrative Report H-87-8c, National Marine Fisheries Service.
- MMA (2000a) 1999 MMA Annual Report (Draft). 12 pages.
- _____. 2000b. Plan for the management of tuna in the Federated States of Micronesia. 53 pages.
- National Fisheries College Strengthening Project (2000) Meeting 1 of the Fisheries Training Advisory Committee, Report to Fisheries Training Advisory Committee on Sectoral Training Needs Analysis. 10 pages
- NCDS (1994). Pacific 2010. National Centre for Development Studies Research School for Development Studies, Australian National University, Canberra, Australia.
- National Fisheries Authority (NFA). 1995. Export Tables. National Fisheries Authority, Port Moresby.
- _____. 1998. Annual Report 1997. National Fisheries Authority, Port Moresby, 20 pages.
- _____. 2000a. Draft Annual Report 1999. National Fisheries Authority, Port Moresby, 42 pages.
- _____. 2000b. Ministerial Statement. National Fisheries Authority, 22 pages.
- Nordhoff, C. 1930. Notes on the Offshore Fishing in the Society Islands. Volume 39, Numbers 2 and 3, Journal of the Polynesian Society.
- Overseas Fishery Cooperation Foundation (OFCF). 1995. Report on inshore fishery resources and environment in Pohnpei State.

- _____. 1998. Federated States of Micronesia fishery report. Overseas Fishery Cooperation Foundation, Suva. 12 pages.
- Pacific Magazine. 2000. Starkist seeks processing plant. July/August 2000 edition, page 19.
- Passfield, K. 2000. Samoa fisheries division daily visual boat census. AusAID Samoa Fisheries Project.
- Passfield, K., and M. King. 2000. Costs and returns for a longline tuna fishing vessel. AusAID Samoa Fisheries Project.
- Passfield, K., and A. Mulipola. 1999. Profile of the commercial tuna fishery in Samoa. AusAID Samoa Fisheries Project.
- Palau Conservation Society (PCS). 1999. Palau's locally based foreign tuna fishery: benefits and costs to Palau. Palau Conservation Society, 87 pages.
- Philipson, P. 1998. The fresh sashimi longline fishery. *In*: Development Opportunities in Selected Tuna Fisheries for Pacific Island Countries. Forum Fisheries Agency, Honiara.
- Pohnpei State Government and Pohnpei Economic Planning Commission (1997) Solicitation of investment opportunity: tuna longline operations, production, processing and marketing. Pohnpei. 13 pages.
- Pollard, S., D. Robb, and M. A. McCoy. 1994. Pacific tuna industry study, The Federated States of Micronesia, Forum Fisheries Agency, Honiara, Solomon Islands.
- Preston, G. 1996. Evaluation of the potential for commercialisation of small-scale fisheries: technical report prepared for FAO under the Technical Cooperation Programme for Strengthening Capacity for Fisheries Conservation and Management, Papua New Guinea. 58 pages.
- Rodwell, L. 1999. Issues in the development of the tuna fishery in Nauru. Report 99/24, Forum Fisheries Agency, Honiara.
- Sanders, M. 1999. Report of the bio-economic assessment for the tuna fisheries of Papua New Guinea. PNG National Fisheries Authority/ Asian Development Bank, Fisheries Development Project (PNG 31650), 51 pages.
- Sharma, K., A. Petersen, S. Pooley, S. Nakamoto, and P. Leung. 1999. Economic contributions of Hawaii's fisheries. SOEST 99-08, JIMAR Contribution 99-327, Joint Institute for Marine and Atmospheric Research, Hawaii.
- SIVB (2000) The Solomon Islands – A world you never knew existed. Solomon Islands Visitor Bureau, 22 pages.

- Sitan, P. 1995. Prospects of the longline fishery in FSM. Paper presented to First FSM Economic Summit, Pohnpei. 18 pages.
- _____. Historical longline landing in FSM ports (1991-2000). FSM National Fisheries Corporation. Unpublished data. 1 page.
- Smith, D., and J. Tamate. 1999. Fiji Islands skipjack pole and line fishery. Fisheries Division, Government of Fiji, 26 pages.
- Solomon Islands Government (1999). Solomon Islands national tuna management and development plan. Volume 1, Forum Fisheries Agency, Honiara.
- Secretariat of the Pacific Community. 1984. An Assessment of the Skipjack and 1984 Baitfish Resources of Wallis and Futuna. Skipjack Survey and Assessment Programme, Final Country Report No.19, South Pacific Commission, Noumea, New Caledonia.
- _____. 1993. South Pacific economies. statistical summaries Number 13, South Pacific Commission, Noumea, New Caledonia.
- _____. 1994. The present status of coastal fisheries production in the South Pacific islands. Working Paper 8, 25th Technical Meeting on Fisheries, South Pacific Commission, Noumea.
- _____. 1996. Tuna fishery yearbook. South Pacific Commission, Noumea.
- _____. 1997. Scientific inputs into a PNG tuna management plan, compiled by the Oceanic Fisheries Programme. South Pacific Commission, Noumea, 16 pages.
- _____. 1998. Pacific populations. Report prepared for the International Conference on Population and Development, Cairo. Revised edition, South Pacific Commission, Noumea, 68 pages.
- _____. 1998. Pocket statistical summary. South Pacific Commission, Noumea.
- SPREP (1985). Traditional Tuna Fishing in Tokelau. Topic Review No.27, United Nations Environment Programme - South Pacific Regional Environment Programme. South Pacific Commission, Noumea, New Caledonia.
- Stanley, J., and F. Toloa. 1998. Review of the Samoa longline fishing industry. Consultancy Report Prepared for the Government of Samoa and the FFA.
- Sudo. 1987. *Translation of: Hijikata, H. Driftwood, life on Satawal island, Micronesia.* Tokyo, 205 pages.

- Swerdloff, S., and S. Pooley. 1979. Hawaiian fisheries development plan. Department of Land and Natural Resources, State of Hawaii, Honolulu.
- Tinga, R. 2000. Kiribati national tuna fishery report. Working Paper 10, 13th Meeting of the Standing Committee on Tuna and Billfish, Ministry of Natural Resources, Tarawa.
- Tong, P. and L.Rodwell (1995). A Review of Purse Seine Transshipment in the Federated States of Micronesia. Forum Fisheries Agency, Honiara.
- Tutumarem Marine Consultancy Services. 1999. Issues for consideration in promoting the development of sustainable commercial fisheries for near shore resources in New Ireland Province, report prepared for the New Ireland provincial government. 22 pages.
- Tuwai, I. 2000. National tuna fisheries report of Fiji as of 1999. 13th Meeting of the Standing Committee for Tuna and Billfish, 11 pages.
- United Nations Development Program (UNDP). 1994. Pacific human development report. United Nations Development Programme, Suva.
- _____. 1996. Sustainable human development in Vanuatu. United Nations Development Programme, Suva.
- _____. 1997a. Human development choices for the Cook Islands. United Nations Development Programme, Suva.
- _____. 1997b. Sustainable human development in the Federated States of Micronesia. United Nations Development Programme, Suva.
- _____. 1997c. Sustainable human development in the Marshall Islands. United Nations Development Programme, Suva.
- _____. 1997d. Sustainable human development in the Western Samoa. United Nations Development Programme, Suva.
- _____. 1997e. Sustainable livelihoods: Promoting informal sector growth in Pacific Island countries. United Nations Development Program, Suva, 82 pages.
- _____. 1999. Pacific human development report - creating opportunities. United Nations Development Programme, Suva, 122 pages.
- _____. 1999. Papua New Guinea human development report. United Nations Development Programme, Port Moresby, 320 pages.

- Van Santen, G., and Philipp Muller. 2000. Working apart or together – the case for a common approach to management of the tuna resources in the exclusive economic zones of Pacific island countries. Number 10, Pacific Island Discussion Paper Series, World Bank, Washington.
- Watt, P., and S. Moala. 2000. Estimates of rejection in the Samoa tuna fishery. AusAID Samoa Fisheries Project.
- _____. 2000. Samoa's longline newsletter. Number 1, April 2000
- Weber, P. 1994. Net loss: fish, jobs, and the marine environment. Paper 120, Worldwatch Institute, Washington D.C.
- Western Samoa Department of Statistics (1979). Western Samoa Statistical Summary 1978.
- Wilson, P. 1995. The economic benefits of operating integrated Pacific island tuna industries. Working paper, at the 5th Cultural Values in the Age of Technology Conference, Maui Pacific Center, Hawaii.
- World Bank. 1995. Pacific island economies - sustainable development of fisheries. Report No. 14615-EAP, Country Department III, World Bank, Washington D.C.
- _____. 1999. Voices from the village: a comparative study of coastal resource management in the Pacific islands. Pacific Islands Discussion Paper Series No.9, World Bank, Washington.
- _____. 2000. Regional economic review. Annex A.
- Wright, A. 1994. Regional opportunities in the tuna industry. Working Paper, at the 4th Cultural Values in the Age of Technology Conference, Maui Pacific Center, Hawaii.
- Zann, L. 1980. Tuvalu's subsistence fisheries. Institute of Marine Resources, University of the South Pacific, Suva.
- Zann, L., and S. Aleta. 1984. A preliminary survey of fish consumption in Tokelau. Institute of Marine Resources, University of the South Pacific, Suva.

About the Authors

Robert Gillett

Robert Gillett, a director of Gillett, Preston and Associates (www.gillettpreston.com), has been involved in marine resources development in the Pacific Islands over the past three decades. He has also worked for several regional and international organizations active in the marine sector, including the South Pacific Commission, the Forum Fisheries Agency, and the Food and Agriculture Organization of the United Nations. Mr. Gillett has authored over 150 publications and technical reports on fisheries in the region.

Mike A. McCoy

Having lived and worked in Micronesia, Melanesia, and Polynesia since 1968, Mike McCoy has extensive experience in the use and management of marine resources at all levels of Pacific Islands life, from subsistence and artisanal fisheries to the development of industrial tuna fisheries. He has advised several Pacific Islands governments and authored numerous papers and technical reports on fisheries. Now based in Hawaii, Mr. McCoy is affiliated with Gillett, Preston and Associates.

E-mail: mmc@aloha.net

Josie Tamate

Josie Tamate was born and educated in Niue. After graduating from the Australian National University with a master's degree in the economics of development in 1998, she worked for two years as an agricultural economist with the Department of Agriculture, Forestry and Fisheries of Niue and later as a policy analyst with the Economic, Planning and Development, and Statistics Unit of the Premier's Department. As project economist with the Forum Fisheries Agency since 1999, Ms. Tamate has specialized in the analysis of fisheries access agreements.

E-mail: josie.tamate@ffa.int

Len Rodwell

Len Rodwell has an honors degree in economics from the University of Tasmania and 13 years' experience in fisheries policy in Papua New Guinea. He joined the Forum Fisheries Agency in December 1994 as market adviser and was promoted to the position of manager for economics and marketing in January 1999.

E-mail: len.rodwell@ffa.int