Summary Report: South Pacific Albacore Longline Fisheries Workshop

September 2006

Western Pacific Regional Fishery Management Council
1164 Bishop Street, Suite 1400, Honolulu, HI 96813

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1 Introduction and Overview

Longline fishing expanded across the Pacific Ocean in the 1950s driven primarily by the demands for fresh and frozen tuna from Japan and the expansion of the tuna canning industry worldwide, requiring a supply of albacore. For the past 50 years almost all longline caught albacore from the Pacific was taken by fleets from around the Pacific Rim, especially from Asia, notably, Japan and Taiwan.

For most of this period, the countries and territories of the Pacific Islands did not participate in the Pacific longline fishery, except to grant access rights to fish in their exclusive economic zones (EEZs) following the passage of the United Nations Convention on the Law of the Sea from the early 1980s onwards. However, development of new technologies for longlining in the late 1980s and early 1990s, plus the expansion of air-transshipment opportunities, resulted in expansion of longline fishing by Pacific Island nations, especially those countries in the South Pacific.

Today, many of the nations and territories of the South Pacific, have developed longline fisheries with South Pacific albacore as one of the main components of their catches.

In recent years, however, longline fisheries across the entire Pacific have experienced very low catch rates for South Pacific albacore despite optimistic stock assessments, which suggest catches are well below the maximum sustainable yield (MSY) for this important stock. A frequent question posed at international fishery meetings across the South Pacific was "Where's the fish?"

From September 19 to 21, 2006, the Western Pacific Regional Fishery Management Council (WPRFMC) sponsored the First Workshop on South Pacific Albacore Longline Fisheries to seek answers to this critical question. Pacific Island nation participants included fishery management representatives from American Samoa, Australia, Cook Islands, Fiji, French Polynesia, New Caledonia, New Zealand, Niue, Papua New Guinea (PNG), Samoa, Solomon Islands, Tonga and Vanuatu. In addition, fisheries scientists from the National Marine Fisheries Service–Pacific Islands Fisheries Science Center (NMFS-PIFSC) and the Secretariat of the Pacific Community's Oceanic Fisheries Program (SPC-OFP) also provided the latest scientific reports on albacore data and research studies.

The purposes of the Workshop focused on the following:

- Providing the countries and territories of the South Pacific with greater opportunity to exchange views and perspectives on issues important to the long-term continuity of their fisheries.
- Providing opportunities to review biological and economic research on albacore, albacore stock assessments and trends in domestic longline fisheries targeting albacore in the South Pacific.
- Exploring the potential for a collaborative management arrangement for the region's albacore longline fisheries to minimize the impacts of localized declines in productivity.

The Workshop revealed issues of mutual interest to fisheries in the region, including data collection, observer placement on longline vessels and compliance issues. It also brought to light the significance of developments unique or special to a particular fishery, such as the key importance of the Pago Pago canneries to the long-term continuity of the South Pacific longline fisheries.

Recommendations for future meeting topics included increasing participation by longline operators and processors in the region, continuing scientific investigations and expanding focus on marketing, oceanographic influence and historical data from the Taiwanese longline fleet.

2 Issues and Recommendations

1. The Workshop was convened by the WPRFMC to provide the countries and territories of the South Pacific with domestic longline fisheries catching albacore a greater opportunity to exchange views and perspectives on issues important to the long-term continuity of their fisheries. The meeting also provided more opportunities to review biological and economic research on albacore, albacore stock assessments and trends in domestic longline fisheries targeting albacore in the South Pacific.

2. The Workshop recommends that this forum focusing on South Pacific albacore and issues and other species of mutual interest (e.g., South Pacific swordfish) be reconvened on a regular basis, possibly in conjunction with one of the meetings of the regional fishery organizations.

3. The WPRFMC offers to continue to act as secretariat for this Workshop until such time as meeting members wish to change this arrangement.

4. The Workshop recommends that closer cooperation be sought between relevant Pacific Island Countries and Territories (PICTs) agencies, the NMFS Pacific Island Regional Office (NMFS-PIRO) and National Oceanic and Atmospheric Administration Office for Law Enforcement (NOAA-OLE) in Pago Pago on issues of mutual interest relating to data collection, observer placements on longline vessels and compliance issues.

5. The Workshop recommends that closer cooperation be sought between relevant PICTs agencies and the Fiji Ministry of Fisheries and Forests on issues of mutual interest relating to data collection and observer placements on longline vessels.

6. The Workshop recognizes that, given current costs, the economic viability of South Pacific longline fleets is dependant on maintaining high catch rates of South Pacific albacore. The Workshop, therefore, fully supports the types of economic studies being conducted by the Forum Fisheries Agency (FFA) to establish economic indicators and reference points for management of domestic longline fisheries and hopes that similar studies may also be conducted by non-FFA participants attending the Workshop. The Workshop notes that completion of these studies will be contingent on the availability of funding.

7. The Workshop underscores the key importance of the Pago Pago canneries to the long-term continuity of South Pacific longline fisheries, especially to the countries clustered around the EEZ around American Samoa (Cook Islands, Niue, Samoa and Tonga) and more broadly across the region. The Workshop recommends that the Secretariat convey these sentiments to the appropriate US government agencies and to the American Fishermen's Research Foundation.

8. With respect to the previous recommendation, the Workshop also recognizes the importance of the South Pacific longlining countries and territories as suppliers of fish to the Pago Pago canneries and asks the Workshop Secretariat to communicate the importance of better responsiveness with information requests from these countries.

9. The next meeting of this Workshop should seek to include greater participation by South Pacific longline fishing industries, including both longline operators and processors.

10. The Workshop expresses concern about the apparent expansion of illegal, unreported and unregulated (IUU) driftnet fishing for albacore and other pelagic species in the North Pacific and is further concerned that this may have already spread to the waters of the South Pacific.

11. The Workshop recognizes the need to continue a range of scientific investigations into South Pacific albacore, and a list of the various research priorities is attached. The Workshop will endeavor to promote research activities on South Pacific albacore fisheries among the Pacific regional fishery management organizations, other regional organizations and national fisheries research agencies.

12. The Workshop recommends that future meetings include more focus on issues such as marketing, influence of oceanography on the availability of South Pacific albacore and the importance of a more in-depth analysis of the Taiwanese longline historical catch and effort.

13. The Workshop appreciates the support and participation of the FFA Secretariat, SPC and the Western and Central Pacific Fisheries Commission (WCPFC) Secretariat in this meeting and encourages their continued participation and assistance in facilitating future meetings of this Workshop.

3 Description of National Longline Fisheries

3.1 American Samoa

Albacore dominates recent catch statistics of the American Samoan pelagic fishery, which transitioned into a multimillion dollar albacore longline fishery in the late 1990s. Peak values for nearly all fishery statistics were reached between 2001 and 2003, reports Karl Brookins, PhD, chief of fisheries for American Samoa. Today, the American Samoa pelagic fishery is dominated by mono-hull boats greater than 50 feet, using longline gear and delivering to the canneries in Pago Pago Harbor. Brookins noted that American Samoa's albacore contribution to Pago Pago's cannery industry is small compared to other Pacific fisheries and that all longliner vessels are

US vessels. Declines continued through 2005 with some indicators increasing starting in 2005-2006. Brookins noted that fishery data from 1995 to 2005 were collected by the American Samoa Department of Marine and Wildlife Resources (DMWR) in partnership with the Western Pacific Fishery Information Network (WPacFIN) staff from NMFS-PIFSC in Honolulu.

The value of the American Samoa pelagic fishery topped out during 2002 at nearly US$16 million. Tuna, mostly albacore, dominates the value by one to two orders of magnitude. Other important commercial species include yellowfin, bigeye and skipjack tunas and wahoo, which are all purchased by the Pago Pago canneries.

Average albacore size decreased 1.6 kg (9.6 percent) to 15 kg in 2005, continuing a general trend in the American Samoa fishery since 1999. Yellowfin, bigeye and skipjack tunas as well as dolphinfish also decreased in average size landed in 2005.

Pelagic trolling peaked for American Samoa during the mid-1980s and has been declining since 1984. Longline vessels have been declining since the peak in 2001. The number of longline hooks set has declined since 2003.

For the dominant sector of the American Samoa pelagic fleet, mono-hull vessels greater than 15 meters, catch per unit effort (CPUE) increased 35 percent in 2005, reversing the trend occurring since 2001. However, CPUE is still approximately one-half the peak value of 2001. For other often caught pelagic species, CPUE values are down from 2004.

Management of albacore and other pelagic resources in American Samoa is through co-management involving the territorial government, WPRFMC, NMFS and other federal partners.

Workshop Discussion

Josh Mitchell, director of the Offshore Fisheries Section of the Ministry of Marine Resources for the Cook Islands, asked for information on discards.

Brookins replied that American Samoa has a system of logbooks, observers and creel census to get data from the fishery, including bycatch. He noted that they have or have had in the past a high discard rate for some species including: marlin and swordfish, notably, a situation definitely not optimal.

Paul Dazell, senior scientist with the WPRFMC, noted that the American Samoa fisheries have an additional problem because of a limited domestic market.

Sean Sloan with the Fisheries Management Division of the FFA asked what the total albacore production of the Pago Pago cannery is from the entire Pacific fleet.

Paul Dalzell, senior scientist at the WPRFMC, replied that the information cannot be released under confidentiality rules in the United States.

Mitchell asked if at Pago Pago is getting data from port sampling and observers from all boats that unload at the port.

Keith Bigelow of the Stock Assessment Program at the Hawai‘i-based NMFS-PIFSC replied that through NMFS-PIRO, port sampling includes longline and purse-seine fisheries whether vessels are from Taiwan or American Samoa.

Adam Langley of the SPC-OFP, who is principally involved in stock assessment of tuna species including albacore, asked if the data on the decline in albacore size came from cannery receipts or sampling data.

Brookins replied that it is from cannery sampling, done by NMFS-PIRO, which samples any boat unloading in Pago Pago.

3.2 Samoa

Tuna longline fishing has dominated Samoa's offshore fishery since the mid-1990s, creating opportunities for employment and bringing in foreign monies through the exportation of frozen and fresh chilled fish to overseas markets, according to Savali Time, head of Offshore Fisheries in the Samoa Ministry of Agriculture and Fisheries. Albacore is the target species, while large yellowfin and bigeye tunas also contribute as major catch components of the tuna longline fleet.

While the *alia* constituted the first domestic longline fleet in Samoan waters and dominated the fishery until 2002, over time bigger commercial longliners were introduced into the fishery. Currently, the tuna longline fleet is exclusively domestic.

Albacore accounts for more than 75 percent of catches from this fleet, with yellowfin following at 12 percent and bigeye at 3.8 percent, reported Ueta Fa‘asili, Jr., also with the Offshore Fisheries in Samoa. A variety of other pelagic fishes, including wahoo, dolphinfish and broad bills, contributed much less to the total catch in 2005. About 89 percent of the total domestic longline catch is exported as frozen fish, with the bulk going to markets in American Samoa and other notable exports to the fresh chill markets in the United States, New Zealand and Japan.

The value of longline catches declined from $42.2 million in 2002 based on 5,091.6 metric tons (mt) to $12.6 million from 1,664.2 mt.

The Samoa longline fishery is currently managed by the moratorium on fishing licenses set by the Tuna Management and Development Plan, under which the government of Samoa aims to maximize the long-term economic and social benefits of its tuna resources over the five-year period 2005 to 2009. Smaller fishing vessels are exempted from this moratorium based on the lesser scale of operations as compared to bigger boats.

Workshop Discussion

Langley asked if the increase in the June 2006 catch rates was from the entire fleet.

Fa‘asili replied that it encompasses all vessels and that the catch in general is increasing, especially for the *alia* vessels. Since the number of bigger boats has remained the same, the increase represents an improvement in the catch rate for the *alia* fleet.

Dalzell asked if Samoa has a similar area closure at that implemented in American Samoa, which restricts vessels larger than 50 feet from entering 50-mile area closures.

Savali Time replied that the Samoan government took the American Samoa model and set a similar advisory that boats over 50 meters were not allowed in the 50-mile radius, following incidents of conflict on the fishing grounds and over fishing gear. Partnership arrangements were also discouraged, and shares were raised for such arrangements, 60 percent for locals and 40 percent for foreign partners. Time also noted that a super *alia* has been designed, able to fit all of the necessary equipment for the longline, but, because of the cost, fishermen tend to prefer the mono-hull than the super *alia*.

Len Rodwell, director of fisheries development of the FFA, commented that, given the dramatic fluctuations in *alia* vessel numbers in Pacific fisheries, the agency has recently initiated with the Samoa government a study on the economics of the *alia* fishery with the aim of providing the economic factors that are affecting the fishery and its economic future.

Marco Kienzle of the Stock Assessment Division of NMFS-PIFSC asked if the catch in the American Samoa and Samoa fisheries is comparable in weight, gear, etc.

Dalzell said no one has done a systematic comparison of the two fisheries, but, given the similarity of the *alia* gear, it is likely that *alia* vessel CPUE in both fisheries is similar.

William Naviti of the Fisheries Department in Vanuatu asked the scientists about local depletion.

Bigelow noted that the cause of local depletion or catch composition is essentially too many fishermen in one area at one given time, reducing the CPUE of the other fishing vessels. He noted that a current project in the Pelagic Fisheries Research Program is attempting to scientifically demonstrate local depletion, which has been difficult to statistically demonstrate in most fisheries.

Fa‘asili asked if oceanographic conditions are a factor for Samoa’ s very small fleet and very low catch rates.

Bigelow said yes and noted three different influences on CPUE: 1) status of regional stock, 2) oceanographic influences to reduce fish availability in the EEZ, and 3) local depletion. Langley added that, in the case of Samoa and other eastern EEZs (Cook Islands and French Polynesia), oceanographic influences are by far the major influence on not only the seasonal but also interannual trends in CPUE, with the scale of local depletion, to some extent, overlaying those or exacerbating those trends.

Mitchell added that, in the Cook Islands, recent SPC assessment showed strong correlations with catch to sea surface temperature (SST) and temperature fronts over time.

3.3 Cook Islands

The Cook Islands domestic longline fishery has developed rapidly over a relatively short period of time, reported Mitchell, director of the Offshore Fisheries Section, Ministry of Marine Resources (MMR) in Cook Islands. In 2000, the government discontinued all licensing of foreign

fishing vessels and, following this, introduced policies to establish and develop a domestic commercial fishing fleet. There are two distinct fisheries in Cook Islands: the northern fishery, targeting albacore for the canneries, and the southern fishery, targeting fresh chilled fish for export out of Rarotonga. Currently, the domestic fleet consists of 13 locally owned vessels. Eight are smaller in size (12-16 meters), typically set 800 hooks or less, and conduct short (3- to 5-day) trips at sea. The remainder, much larger vessels, target albacore north of 15 degrees South, and operate at sea for longer periods of time, together with the chartered vessels (15-35 meters), which operate out of Pago Pago. These vessels remain fishing in the northern fishery year round.

Since 2001, annual total catches have been increasing, and 2005 had the highest total catch to date with almost 3,500 mt reported, with the majority of the total catch attributed to the thern fishery. Total hook numbers have been increasing annually, even though vessel numbers have decreased since the peak of licensed vessels in 2003. Hooks being set in the north are driving this increase, as there has been a decrease in vessel numbers operating in the southern fishery.

Overall CPUE for the Cook Islands EEZ has varied significantly in recent years, largely due to the impact of climatic and oceanographic conditions, especially in the southern EEZ—characterizing a "boom and bust" fishery. The 2002 albacore catch rates were the highest recorded in recent times, after which catch rates began to drop for the next two years, before recovering in 2005.

Albacore has always accounted for the majority of total annual catches in recent years (2001-2005). Increasing in recent years, yellowfin is the second largest portion of total catch. Most of the yellowfin and bigeye tuna caught in the southern fishery is exported to markets in Japan, with the remainder sold in the local market. The southern fishery's swordfish accounts for 16 percent of total catch for recent years, with the majority exported to the United States and a small amount sold in the local market.

Average bycatch landed makes up approximately 15 percent of total catch. In the northern fishery, wahoo is the main bycatch species and is usually sold to the canneries in Pago Pago, along with skipjack. Dolphinfish, moonfish and pomfrets are either discarded or retained for crew consumption, and most marlins are discarded. Swordfish makes up less than 1 percent of northern catches but can be sold in Pago Pago's local market.

In the southern fishery, most of the bycatch is made up of billfish species. Black marlin, blue marlin, short-billed spearfish, sailfish, skipjack and wahoo are sold on the local market. Dolphinfish and striped marlin are also occasionally exported to the United States. A small amount of migrating Pacific bluefin tuna is taken annually and exported to Japan, due to the high prices they can fetch.

In 2005, approximately US$6.7 million, with albacore alone accounting for approximately US$6.4 million, was generated from northern fishery catch unloaded in Pago Pago. Swordfish sales in Pago Pago accounted for US$15,000. The canneries in American Samoa are critical to the success of the northern fleet of Cook Islands vessels. Over 450.7 mt of fish was exported out of Rarotonga in 2005 to markets such as the United States, Japan, Taiwan and Hong Kong. Air flight links are critical for the southern fishery.

Fishery management is overseen by the Marine Resources Act (2005) and takes into account all national, regional and international marine resource management issues and obligations under agreements, such as the UN Fish Stocks Agreement, Compliance Agreement and WCPFC Convention. Licensing regulations have yet to be finalized. Policies are aimed at securing more economic benefits to the Cook Islands from those productive northern fishing grounds. Currently, the bulk of the benefit is going to American Samoa.

The Offshore Fisheries Division provides technical and policy support to its industry stakeholders, with the aim of implementing and monitoring sustainable management measures. The MMR is currently developing a tuna management plan and in the final drafting stages of developing an ecosystem-based approach to fisheries management framework to implement and merge with the fishery management plan. MMR also collects and monitors catch data in the form of logsheets, unloading forms and port-sampling forms from all Cook Islands licensed vessels. The MMR is also looking to re-establish its observer program in 2007.

The Cook Islands National Plan of Action on IUU has been completed and work on National Plan of Actions for sharks, seabirds and marine turtles will begin in October. The aim is to have all of these formally endorsed by the government by year end.

Workshop Discussion

Peter Ward of the Bureau of Rural Sciences, Australia, asked if the low catch rates for albacore in 2003 and 2004 were related to some kind of economic threshold to make fishing operable for the fishery.

Mitchell replied that this slump was preceded by a gold rush in 2001 and 2002 with lots of money invested in multi-million dollar processing facilities, followed by the bottom dropping out and many boats returning to New Zealand. Due to huge variation or fluctuation in catches, it is difficult to plan on some economic threshold but instead the focus is on using oceanographic data to forecast the bad times ahead.

Brookins acknowledged the challenges of obtaining data from the canneries and suggested that cross-country agreement to cover Cook Island and Samoa boats may help with equity issues.

Dalzell asked if the charter boats are from American Samoa.

Mitchell said they are a mixture. All are based in Pago Pago but they include Korean, Taiwanese and US boats. Charters are flagged in the Cook Islands and are required to deal with an existing license or local person but they are not charters in the strict sense. Logbook data is collected from charters but proves insufficient, and port sampling is the aim.

Langley asked if observers are on these vessels.

Pamela Maru with the MMR in Cook Islands replied that a program is in development with John Kelly to put observers from the United States and possibly other nations on board hopefully in 2007.

Mitchell stated his hope for better communication, such as a Memorandum of Understanding, as an outcome of this workshop. As a start, Dalzell offered to put together an organizational chart for the Pacific fisheries. He noted Cook Islands as an example of a strong symbiotic, dependent relationship among the Pacific fisheries. Having access to fishing grounds and to canneries keeps fisheries viable.

3.4 French Polynesia

Dominated by distant-water fishing nation (DWFN) fleets until 1992, French Polynesia's longline fishery saw its beginnings in 1979 with the first fishing agreement with Japan and in 1980 with Korea, reported Stephen Yen from the Fisheries Office of French Polynesia. Based on a quota system and a maximum number of vessels authorized to fish in the EEZ, these foreign longliner agreements numbered between 19 and 65 from 1984 to 2000. Until the mid-1970s, the SPC data estimated the average catches of albacore at approximately 4,000 mt annually. More recently, the catches were dominated by bigeye and yellowfin. Albacore catches were no longer the main catch of the longline fishery, while the traditional fishery caught very few albacore tuna.

By the end of 1980s, the local government decided to develop a domestic longline fleet by setting up a fishery policy and incentive subsidies to encourage fishermen to invest in longline vessels. The first domestic longline vessels were built in 1990, and foreign longliner agreements were not renewed.

From 1994 to 2003, active longline vessels averaged 60 in number and rose to 72 by 2005. Currently, the domestic longline fleet comprises 97 vessels but only 50 to 55 are regularly active. Most inactive vessels are freezer vessels targeting albacore. The low catch of albacore is not the only reason for the current slowdown but has contributed to it.

The fleet composition has also switched from mostly small longliners (longline bonitiers) and fresh tuna boats in the early 1990s (1,000-2,000 hooks/set) to a mixed fleet comprised of fresh tuna boats, freezer vessels and a new category called "mixed tuna boats," which are vessels equipped for both fresh and frozen tuna. Most current longliners set between 2,000 and 3,000 hooks/set.

Based on logsheet data and data submitted to SPC in aggregated form from 1954-1984, albacore catches ranged from 2,000 to 7,000 mt before the fleets start to switch to yellowfin and bigeye tunas. When fishing agreements from 1980 to 2000 directed foreign longline fleets to target bigeye and yellowfin, albacore tuna decreased to a level of less than 1,000 mt and went as low as 100 mt.

Since the early 1990s when the domestic longline fishery began, albacore catches represent more than 30 percent of the total catch and has increased to more than 50 percent, reaching 62 percent of the total catch in 2002. In 2004 and 2005, due to the low catch rate, the proportion of albacore dropped down to 42 and 48 percent, respectively, of the total catch. The amount of catches was nearly halved from 2001 and 2002, even while the total effort had increased nearly 30 percent. The most important decline during this period occurred from 2003 to 2004, when the CPUE dropped down to a low of 9 kg/100 hooks (less than 1 fish/100 hooks).

Two studies have been conducted by the fisheries office in conjunction with SPC. One

was on a national tuna fishery report with special interest focused on the albacore tuna. The other, with Marc Labelle, examined the distribution patterns of the three principal tuna species in relation to the sub-surface conditions. The results of the latter are being used to tentatively predict future distribution patterns.

Workshop Discussion

Mitchell noted that French Polynesia's four-year "boom and bust" cycle of peaks and troughs of total albacore catch mirrors that of the Cook Islands and, to some extent, American Samoa. The critical factor does not appear to be local area depletion but rather something on a very large, broad scale.

Ward asked about the change in the size composition in the catches coinciding with large changes in catch rates.

Yen replied that the fishery has no data for size composition for catches and that, perhaps through the observer program, SPC may have some albacore size data.

Langley replied that observer data collecting in French Polynesia has been good and gone on for some time. Size composition has been remarkably consistent throughout and with other albacore longline fisheries as well, principally catching large adult fish. He believed fluctuations are linked to oceanographic conditions rather than pulse fishing on recruitment.

Dalzell asked what is French Polynesia's main market for albacore, including catch processed at-sea on the frozen vessels.

Yen replied that frozen fish usually goes to Europe and fresh fish to the United States. He added that the current catch rate has improved but 30 to 40 boats have not returned to fishing.

3.5 Niue

The Niue government views Fisheries as a priority and key sector for economic development, according to Brendon Pasisi, director of fisheries in Niue. A joint venture fish processing plant and partnership between the government and Reef Group Ltd. to develop Niue's tuna fisheries were established in 2003. Over the last two years, the longline industry development and fishing activity have progressed considerably. With a processing capacity of up to 6,000 mt annually, Niue Fish Processors is expected to comfortably service the needs of an appropriate-sized fleet of fishing vessels for Niue.

Up to 2003, when the joint processing venture was established, Niue had licensed longline vessels, limited to 48 at one time, to fish in the EEZ. These vessels were mainly Taiwanese and some Korean vessels out of American Samoa. In 2002, 21 licensed vessels (Taiwanese and American Samoan flag) caught approximately 50-100 mt of tuna in Niue's EEZ. Catch and effort data under the latter arrangements are considerably poor. In 2003 and 2004, there were no catches in Niue's EEZ by commercial fisheries, due to the joint venture and discontinuation of licensing of foreign vessels under access arrangements. Ten vessels are currently licensed to fish and significant increases in fish volumes are expected over the next 6-12 months as a number of larger vessels join those currently operating.

Benefits are being realized through direct employment and goods and services required by the industry. Among the issues currently being addressed by both partners are airfreight capacity, wharf infrastructure and human resources. A new dedicated air service (Reef Air) is expected to recommence flights to Niue shortly to cater to increasing airfreight demands. The importance of ensuring resource sustainability is also a key consideration of the govern ment, which is reflected in the management plans and policies governing these initiatives in Niue's tuna fisheries.

With no vessel registry program and, therefore, no fleet operating under its flag, Niue is currently exploring development of such a registry or other arrangement to give greater recognition to Niue's participation in the highly migratory fisheries of the region. Since early 2005, it has licensed 13 longline vessels under special charter arrangement to fish as locally-owned, local-based foreign vessels.

At the time of writing this report, catch data for the first six months of 2006 had just been provided to SPC but preliminary estimates of total catch based on logsheet data indicate a total catch around 130-150 mt for the January–June 2006 period. Catch composition appears to be consistent with 2005 catches, except for a noticeable increase in yellowfin catch.

More than 95 percent of albacore and all skipjack are currently exported to the two canneries in Pago Pago, American Samoa, with very small quantities exported recently as chilled product to the United States or consumed locally. About 90 percent of bigeye and yellowfin (headed and gutted) is exported fresh to the United States and New Zealand, with the remaining sold/consumed locally.

Some bigeye and 90 percent of billfish are being exported fresh (trunks and loins), with the remainder exported as frozen product to the same markets due to limited airfreight capacity. Among byproduct species, dolphinfish is exported frozen and chilled to New Zealand and moonfish is exported chilled to the United States and frozen to New Zealand markets. Wahoo and other less common species are all sold locally. Bycatch, estimated at 16 percent of catch or about 4 mt, is principally being consumed locally or exported for fishmeal to New Zealand, wiht a small quantity used for livestock feed supplements.

Actual direct value of the catch to date is not currently available, but it is estimated at NZ$1 million to NZ$2 million for the first half of 2006, with only two large vessels operating.

The offshore tuna fishery is managed under national legislation, government policy and the Tuna and Billfish Management Plan, a tuna management and development plan. The number of licenses issued is calculated against an initial sustainable catch limit based on the national fisheries assessment and tuna management advice. The fishery development envisioned is incremental increases in the fishery up to the initial limits set, an approach anticipated to provide for close monitoring of the fishery to ensure sustainability.

Niue is operating two vessel monitoring systems (VMSs): the FFA VMS, which is required on all foreign vessels, and ARGOS, a national system for smaller size classes of vessels fishing inside Niue waters. The latter system provides not only a compliance role but also a safety role for small vessels. Port sampling is currently carried out, and observers are available within fisheries.

Workshop Discussion

Dalzell asked what air services are available to get fish out of Niue now.

Pasisi replied that there is one Air New Zealand flight in and out of Niue on Fridays. Reef Air is expected to come online now that five vessels from French Polynesia are expected to arrive to fish.

Ward asked whether the industry is expected to develop as a fishery for sashimi-grade yellowfin and bigeye tuna with a bycatch of albacore as a dedicated albacore fishery.

Pasisi said currently boats are targeting the higher valued fish, which is why the partnership is looking at airline service, as the one weekly flight is limiting its ability to get fresh fish out. However, the albacore is a considerably lower than expected component of total catch. The current situation may reflect the start-up nature of the fishery. What the fishery will ultimately be is still to be determined.

Mitchell asked how the frozen albacore is being exported.

Pasisi replied that fresh fish coming off the boats are flash-frozen at the plant and then shipped via containers. Loining is just starting and a very small amount of fresh albacore is sent to the United States.

Mitchell asked about the proportion of catch going to New Zealand, the United States and elsewhere.

Pasisi said it depends on the species but it is probably around 50/50, with a little more going to New Zealand. He noted that he is unable to give any specific numbers.

Mitchell inquired if skippers are beginning to target swordfish in Niue.

Pasisi replied that only a small amount of swordfish is currently being caught. It does not appear than any fisher is specifically targeting swordfish.

3.6 Tonga

Historically, albacore dominates Tonga's annual catches of tuna, accounting for 70 percent of the total, with yellowfin at less than 20 percent and bigeye at 10 percent, reported Aulunga Faanunu of the Tonga Fisheries Department. As surface species, skipjack and yellowfin are known to occur more seasonally and are believed not to be fully exploited in Tonga's fisheries.

Following the development of the domestic longlining in late 1990s, the tuna fleet increased, peaked in 2002 and 2003 and subsequently declined due to poor catch rate and high operations cost. During the second half of 2004 and all of 2005 about 12 and 9 of the licensed vessels were actively fishing respectively. By the end of 2004, most of the locally based foreign fishing vessels had relocated to other countries.

Tonga's total annual catch has been fluctuating independent of total number of licensed vessels. An increase in total number of licensed vessels did result in total annual catch increase

from late 1990s to 2001. However, 2002 and 2003 saw a steady decline when compared to the number of licensed vessels. This is explained by a decline in CPUE from 2001 to 2003. Due to low CPUE and high operation costs, only some of the licensed vessels were fishing, and others were tied at wharf or went fishing once a month or two, especially during 2003 and 2004. Despite the significant decrease in number of fishing vessels from 28 in 2004 to 15 in 2005 and then to 12 in 2006, the total annual catch increased in 2005 and is expected to be higher in 2006.

Tonga's albacore is mainly exported to the cannery in Pago Pago. The chilled sashimi-grade fish are mainly exported to Japan, Los Angeles and Hawai'i. Bycatch species and small tuna (albacore, yellowfin and bigeye) are sold locally.

Currently, no research program is being undertaken or planned for the future. Statistical data are collected using three different methods: port sampling (70 percent of landing vessels), logsheet (for remainder) and observer. The observer program formerly covered the locally based foreign fishing vessels. When these vessels relocated to other countries, domestic vessel operators did not welcome their observers, mainly due to the additional costs involved, at a time when fishers were experiencing financial problems due to low catch rate and high operation costs. With financial assistance from the observer program of SPC, observers on the domestic vessels were covered.

Tonga has five tuna packing facilities, which all operate under Hazard Analysis and Critical Control Points-certified conditions. Two companies are exporting loins and fresh-cut sashimi packets. Poor management of the fisheries wharf has been a major concern and the major constraint to most fishing vessel operators. Tonga hopes for some kind of bilateral agreement with neighbor countries to allow a free movement of domestic fleets among their EEZs.

Workshop Discussion

There were no discussion questions for Tonga.

3.7 Fiji

Good catches of albacore and other pelagic species have been a consistent part of Fiji's fisheries, reported Jone Amoe of the Offshore Fisheries Section, Fiji Department of Fisheries. Since the early 1950s, Fiji has attracted foreign fishing activity, and, with the inception of Taiwanese and Korean longline activity in the 1980s, longlining has become the predominant fishing method, while pole and line fishing is conducted in a very small scale with few artisanal trolling fishers targeting fish aggregating devices (FADs) for the local market. In the mid-1970s, Fijian participation in the commercial tuna fishing picked up, focusing mainly on pole-and-lining.

The Fiji longline fleet is composed of licensed longline vessels, plus other unlicensed longline vessels based in its ports. Fiji-based vessels, stationed at Suva, fish outside Fiji waters but unload their catch in Suva and Levuka ports. In 2005, licensed longline vessels decreased from 103, due to enforcement of a more stringent vetting process and enhanced monitoring of fishing vessels. In 2005, the majority of the catch was within Fijian waters, with some activity in the high seas and in the neighboring EEZs, where several vessels are licensed to fish.

The total catch of the Fiji fleet in waters outside the EEZ has increased considerably, from 10 percent in 2001 to 55 percent in 2004. In 2005, the opposite happened with catch from waters outside the EEZ reduced to 31 percent.

In 2005, total catch by the domestic longline fleet (catches inside and outside the EEZ) was 13,010 mt (11,313 mt for tuna species). A drop in tuna catch levels from 2004 to 2005 was due to the substantial reduction in albacore and bigeye.

The Department of Fisheries has increased its observer coverage levels to more than 6 percent in order to make use of this data to accurately estimate non-target species catch. The Department plans to reach its target of 20 percent observer coverage. In 2005, catches of the non-target species totalled 1,697 mt, a 40 percent reduction in catch from 2004.

Fluctuations in albacore CPUE have occurred over the past decade. From a consistent rate below 1.0 per 100 hooks, CPUE for albacore increased in 1996 to 1.5 per 100 hooks, returned to 1.0 in 2003 and increased to 1.7 in 2005. Yellowfin CPUE has remained stable over the time series, with peaks in 2000 and 2004, likely due to greater availability. Bigeye CPUE was consistent at 0.2 level earlier in the time series, and then dropped to 0.1 levels from 1999.

Tuna catch is usually made up of 60 percent albacore, followed by yellowfin and bigeye. The period of April–September sees the highest catches of tuna by the Fijian longline fleet. Albacore is highest in the third quarter and lowest in the first; yellowfin and bigeye catches are highest in the second quarter (corresponding to the period with the highest SST) and lowest in the fourth.

In the early 1990s, when fishing activity was relatively low, albacore accounted for about 50 percent of the tuna catch, increasing to 70–80 percent from 1995 on, with 68 percent recorded in 2005. Trends of yellowfin have remained at 15-25 percent of total tuna catch with a high in 2004. Bigeye increased from 2001, peaking in 2003, and then declined slowly in 2004 and 2005.

In 2005, Fiji exported 66 percent of its sashimi-grade tuna to Japan and the United States, with the remaining 34 percent exported to China and other countries. The United States received 43 percent of the total billfish exported. Non-target species are exported to the United States, China, Thailand, New Zealand and Japan.

Albacore and skipjack are processed at the local cannery, the Pacific Fishing Company (PAFCO), or exported to Pago Pago. PAFCO receives fish directly from domestic and foreign vessels unloading at the Levuka port or indirectly through freezer containers from the local fishing companies. PAFCO processed fish is exported as three products: canned fish (65 percent to US and Canadian markets), packed tuna loins (to Bumble Bee in Santa Fe, New Mexico), and fishmeal (to the Philippines and Japan). The rest of the catch and damaged fish are sold locally at supermarkets, restaurants or directly to consumers.

Tuna fisheries are managed by the Fisheries Department under the guidelines of the national Tuna Development and Management Plan (TDMP). Plans are underway to incorporate ecosystem-approach management regimes into the TDMP. As a precautionary approach in managing the tuna fishery, the Fiji government settled on an EEZ total allowable catch (TAC). Based on previous history of catches, available information on the productivity of the EEZ, the

present mix of gears and existing regional assessments of the stocks, the TAC was set at 15,000 mt (albacore, bigeye and yellowfin). The number of longline vessels that are permitted to fish (those that meet the licensing criteria) in Fiji waters is limited to 60.

Workshop Discussion

Vidar Wespestad, scientific consultant with Western Fishboat Owners Association (WFOA), was surprised by the sashimi sales to China and asked if this is a growing market for Fiji's product.

Amoe replied that Fiji's Chinese market began just two or three years ago but is growing slowly.

Wespestad then asked if mainly Chinese-flagged vessels or a range of boats are shipping their catch to China.

Amoe said the majority are Chinese vessels but a range of boats participates in the China market.

Langley asked what makes Pago Pago more attractive for boats unloading albacore.

Amoe said fish price is why some processing companies prefer to ship to Pago Pago. He believed that in 2004 the price was $1.80 in PAFCO (Levuka) and $2.48 in Pago Pago.

Mitchell asked if fuel is a factor in unloading.

Amoe said fuel cost is approximately the same in both locations; for foreign vessels, Fiji provides a special rate for fuel.

Mitchell asked how much fish is being exported to the European Union (EU).

Amoe said he did not have those figures.

Dalzell asked for clarification on foreign boats licensed to land in Fiji but not licensed to fish.

Amoe concurred that such boats are based in Fiji, where they unload their catch and also tranship in Fiji but they are not licensed by Fiji to fish. He added that some of them are licensed in Vanuatu and in the Solomon Islands.

Mitchell asked what the value of Fiji's fresh fish industry is.

Amoe replied that a conservative estimate would be about $200 million.

Colin Brown of the Cook Islands added this observation from a trip to Fiji earlier this year. He noticed about 150 vessels licensed or based there. He felt other countries in the region should know what is happening to vessels that fish in their zones and operate in Fiji, to unload, tranship or refuel. In the larger picture, he stressed, it is important to know what these boats are catching and more knowledge is needed from ports like Fiji and American Samoa.

Mitchell said this concern refers to some of the issues with port state responsibilities,

obligations and cooperation. He agreed that they have similar issues at Pago Pago.

3.8 Vanuatu

Vanuatu has experienced longline fishing with the Japanese fleet since the early 1950s, the Korean fleet since 1957 and the Chinese Taipei fleet since the late 1960s. In the 1970s, Chinese Taipei fleet became the dominant fleet. Vanuatu domestic activity was restricted to the operation of a transshipment base, which ceased in 1986. Since 1983, access to the commercial tuna fishery is only by licensing, and foreign fishing vessels must operate under a bilateral access agreement. DWFN fleets continued to dominate the fishery until the mid-1990s, when the domestic fleet began rapid expansion. In 2005, Vanuatu licensed over 120 vessels to fish in its EEZ.

The Vanuatu longline fleet numbers 55. Only 11 actively fish in the vicinity of the EEZ; the rest fish mainly in high seas areas. Major players in the foreign fleet currently are China, Fiji, Korea and Chinese Taipei. Currently, the Chinese fleet dominates the number of fishing vessels and total gross registered tonnage. However, in terms of catch and effort, the Fiji fleet is dominant.

From 2001 to 2005, the Vanuatu fleet's annual catch estimates have generally increased, as did the fishing effort (number of hooks). The unraised and provisional estimate for the longline fleet in 2005 was over 11,000 mt. Albacore accounted for 9,339 mt (60 percent of the total tuna catch), which was caught in the high seas enclaves. Within the Vanuatu EEZ, the estimated 2005 albacore catch caught by the Vanuatu fleet was just over 1,000 mt.

In the period 2001 to 2005, the estimated total annual catch for all the fleets had increased four-fold from 1,933 mt to 8,842 mt (unraised logsheet data). The tuna catch was dominated by albacore (73 percent), yellowfin (19 percent) and bigeye (3 percent). Although catch and effort have increased significantly, the nominal CPUE (number of fish/100 hooks) has continued to be well below the 1992 levels. For 2005, the CPUEs were albacore ~1.6, yellowfin ~0.1 and bigeye ~0.04.

Vanuatu fish are mainly landed or transshipped in foreign ports, principally in American Samoa and Fiji, and their value is unknown. The only value that Vanuatu can put to its fishery is based on the resource rent, worth more than US$1 million annually.

Logsheets are the only source of bycatch data information. Small quantities of other species, such as billfish, sharks, dolphinfish, moonfish, etc., are caught. Vanuatu does not have observer coverage and cannot verify quantitatively or qualitatively the accuracy of the actual catch and the bycatch levels.

Oceanographic factors undoubtedly have a major influence on the distribution and availability of albacore. Albacore is mainly caught in the second and fourth quarters of the year, towards the eastern part of the EEZ, and throughout the year, show a south to north/west movement and the opposite as the range contracted.

The management of albacore has yet to be fully implemented as required by the 2005

Fisheries Act No. 55 and the Tuna Management Plan (TMP). The TMP is currently being reviewed to ensure that ecosystem approaches to fisheries management concerns are fully addressed. At a minimum, all licensed operators are currently required to report their catch, exit and entry on weekly reports and automatically report their vessel positions via satellite while operating in the Vanuatu EEZ.

Workshop Discussion

Dalzell asked how many domestic vessels homeport in Vanuatu and what is the problem with logsheet coverage.

Naviti said Vanuatu had domestic vessels in 1997 but currently has none. He added that most logsheets do not get to them. When boats arrive in Fiji, an observer or whoever goes to port collects the logsheets and sends them to SPC.

Dalzell asked about raised and unraised catches.

Langley offered to help answer that question, saying they receive logsheets from a fair proportion of the vessels in the Vanuatu fleet but are not sure of the actual proportion of the vessels and logsheets received. For that reason, they are unsure of what the coverage rate of logsheets might be. The unraised refers to catches from the logsheets. The raised is if you assume a level of coverage, which is a best guess. Vanuatu has made good progress in improving the level of coverage of the data in the fishery compared to ten years ago when it had less confidence in the levels of logsheet coverage received.

Ward asked what are the main obstacles in getting observers on the vessels.

Naviti said that Vanuatu doesn't have the resources, but an observer program is being considered in the development plan.

Mitchell asked how many vessels are on the ARGOS system for tracking and what kinds of actions have had to be taken to exercise control over those vessels.

Naviti explained that ARGOS is used to record catch, other catch documentation, transshipment, etc. As for controlling the fleet, vessels now must come under management as a requirement for registry and are required to operate VMS in the FFA area or on the high seas. Vanuatu works closely with the registry to enforce compliance with these vessels.

3.9 New Caledonia

New Caledonia is a French territory with conservation and management rights of living resources within its EEZ as well as in the territorial sea, reported Vincent Denamur, head of fisheries for New Caledonia. In 2005, 27 domestic tuna longliners were licensed to fish in the EEZ but only 23 of them were active. New Caledonia's tuna fleet is managed 100 percent by local companies, with only French flag-owned ships. With the exception of eight active vessels with a gross registered tonnage of less than 50 mt, the vessels are large enough to be capable of staying at sea for more than two weeks. No fishing license for the EEZ has been issued to foreign vessels since early 2001.

Total annual catch from the longline fleet has remained around 2,500 mt over the last three years. Denamur noted that the catch for both yellowfin and bigeye tuna was decreased, while the albacore catch increased over the same period of time, accounting for 64 percent of the annual catch.

The tuna fleet faces seasonal patterns in the abundance of the resources, with yellowfin having the high proportion of fish caught from February to May, while albacore dominates from May to September. Bigeye represents a very low proportion of catch, with a peak in the second quarter of the year.

Regarding bycatch, 124 mt of marlin were caught in 2005 of which 74 mt were of striped marlin and 50 mt blue and black marlins. The fleet targets tuna and does not use squid as bait. A scientific observer program in place since 2002 has reported no interaction with seabirds or sea turtles. A series of workshops about turtle handling and mitigation techniques on tropical tuna vessels is planned for 2007.

In 2005, the annual catch was worth about US$10 million, with 43 percent of the catch exported to Japan (92 mt of fresh entire bigeye and yellowfin), Europe (126 mt of fresh or frozen loins) and American Samoa and Fiji canning (959 mt of albacore). The local market is provided in whole fish and fresh vacuum loins.

As for sea processing, there is only one frozen-fish ship fitted with a loining display. All the other ships are fresh-fish providers. Four small loining factories are located in Nouméa and Koumac.

With the 2003 establishment of an economic tuna fishery observatory, collection of statistics has gradually improved and the coverage rate is now nearing 100 percent. Observatory staff members visit the fishing companies in Noumea daily to collect the latest logsheets. As required by fisheries policy, the only company not located in Noumea sends its logsheets to the observatory on a regular basis.

Since early 2005, a VMS has been in place in New Caledonia to track both Inmarsat-C and CLS-ARGOS, with a 4-hour positioning frequency; 15,000 positions were loaded in 2005. VMS is used to check the logsheets coverage from the domestic fleet. The New Caledonia fisheries department has also entered into a cooperative program with the French Navy to use the VMS data on a daily basis. The information on the region's fishing by the domestic fleet helps improve the efficiency of the surveillance in the EEZ against illegal foreign vessels.

Workshop Discussion

Ward noted that throughout the reports so far there is a consistent seasonality pattern in the availability of albacore. He asked if New Caledonia vessels change positions or are they fishing in the same locations year-round.

Denamur replied that they do not fish in the same locations because their EEZ at 1.4 million square miles is not as large as those of other countries.

Dalzell noted that New Caledonia is on the migrating route of satellite-tagged endangered leatherback turtles and was pleased to know New Caledonia has a low catch of turtles.

Denamur explained that the main area for fishing is northwest of New Caledonia, not south, and that leatherback is a big taboo in the country.

Mitchell asked what are the criteria for a local company for licensing.

Denamur said that French interest has to be more than 50 percent.

Ward asked what is the level of observer coverage on the fleet.

Denamur replied that they have the support of the European program for the last five years and have about 5 percent coverage.

3.10 Solomon Islands

The tuna fishery in the Solomon Islands is comprised mainly of longlines, pole-and-line and purse seine, both from domestic and DWFN. Vessels are mainly from Solomon Islands, Fiji and Taiwan. Longliners from Korea, Japan, Taiwan, China, Fiji, Vanuatu, Cook Islands and Solomon Islands range from 23 meters to 67 meters. Shark longliners from Taiwan and Australia have operated in the Solomon Islands EEZ, with vessels of 10 to more than 20 meters in length.

In 2005, the purse-seine fleet included 101 foreign-owned vessels operating under bilateral agreements, 10 foreign chartered vessels and three locally owned National Fisheries Development vessels. Of the longliners, 38 vessels operated under bilateral agreement and 59 vessels under foreign charter. Ten shark longliners operated under foreign charter. Two pole-and-line vessels fished under foreign charter and seven Soltai Company Limited vessels were locally owned. Sixty longliners operated under bilateral agreement, and six shark longliners under foreign charter.

Before 1996, the longline fleet in the Solomon Islands was dominated by Japanese vessels, whose presence declined in late 1990s. Only two Solomon Islands vessels operated between 1981 and 1985 and then stopped their operations in 1986 to 1994. With longlining recommencing in 1995, only vessels from line Solomon Islands operated. Fiji longline vessels have rapidly increased operations in the Solomon Islands EEZ in recent years. Between one and 19 Taiwanese longliners have operated since 1980.

Albacore, bigeye and yellowfin tuna were the main target species of the longline fishery. Longline effort exceeded more than 20 million hooks in 1997 but then rapidly decreased in the year 2000 due to ethnic tension. Longline effort has remained between 3 and 10 million hooks per year since 2001, after the ethnic tension dissipated.

Solomon Islands vessels reported an average of 78 days fishing per year since 1995, but no effort was reported since 2002. Many fleets suffered a major decline in effort or zero effort during 1999 and 2000, but, by 2002, Fiji and Vanuatu fleets have increased their total number of days fishing. The Solomon Islands fleet saw an increase in the number of hooks from around 1,800 hooks per set in early 1980s to between 2,375 to 2,946 hooks per set in the mid-1990s and early 2000s.

The highest CPUEs were recorded during the third quarter from 1990 to 1995 and from 1995 to 1998, the second quarter reported the highest CPUE for albacore. Since 1999, the highest

CPUE was recorded in the fourth quarter, reflecting some oceanographic changes in the EEZ as a result of changes in spatial distribution of effort and hooks between floats through time. All the highest albacore CPUEs were recorded 12 degrees South of the equator.

Since 2000, tuna catches ranged between 1,000 mt to 4,000 mt per year [with yellowfin and albacore accounting for 1,200 mt per year and a lower catch for bigeye tuna of 500 mt.] Skipjack tuna dominated the total catch, about 95 percent and yellowfin about 5 percent.

Albacore catch peaked in 1995 with 1,785 mt by pole-and-line, longline and purse-seine methods combined. From 1990 to 2005, total catch for all gear types was 8,521 mt. Other species catch from 1990 to 2005 yielded 860,675 mt for all methods combined. Since 1992, catches expanded rapidly to more than 20,000 mt in 2003, as domestic longline fleets expanded into other EEZs within the northwest sub-region. Most albacore captured by the longline fishery in the western central Pacific Ocean are usually between 5 to 10 years of age, due to the time-lag between recruitment and the contribution of recruits to estimates of adult biomass.

With the exception of blue marlin and blue shark, stock assessments of other species exploited by the commercial fisheries have not been done; therefore, their status is uncertain and relatively minor from a regional perspective. Purse-seine bycatch has been documented, with 40 percent of total weight being rainbow runner. Other species identified were oceanic triggerfish, mackerels, mackerel scads and sharks, which are sometimes discarded. Turtles and dolphins if accidentally captured are usually released.

In 2005, all tuna products, including albacore, were exported by the local fishing companies as frozen fish to Thailand, Australia and New Zealand (14,202 mt at a value of SI$80.96 million); as canned fish to Fiji, Vanuatu, PNG and Japan (348 mt valued at SI$4.93 million); smoked fish and fishmeal to Japan only (318.5 mt valued at SI$8.15 million and 80 mt valued at SI$221,067, respectively); and loin tuna to Italy (1,200 mt valued at SI$24.59 million).

Tuna catches (frozen, canned, smoked, loined or fishmeal) from the Solomon Islands EEZ usually are exported to several countries such as Japan, Korea, Taiwan, China, Thailand, Australia, New Zealand, Fiji, Vanuatu, PNG and EU member countries. Some go back to domestic markets. Tuna caught by longliners were usually given special icing treatment, especially if destined for the sashimi markets in Japan. Tuna caught by pole-and-line and purse-seine vessels are immediately frozen and later processed into canned, smoked, loined or turned into fishmeal for both domestic and overseas markets from shore-based factories. Only one cannery operating in the country processes mainly skipjack from domestic vessels.

Since the late 1990s, logsheet coverage from longline vessels usually has been very low. The Department of Fisheries and Marine Resources has been recommended to identify and recover missing logsheet data and try to recover them from fishing vessel masters, companies or landing records. Without these data, the true extent of the fishery and the trends of the longline fishery are unclear. Catches of all species are to be recorded on logsheets for future assessment. Other recommendations request increasing the observer coverage rates to assist in catch estimation of shark and other species and limiting access to the region to DWFN longliners.

Workshop Discussion

Dalzell asked what were the issues about incomplete coverage of the longline fishery in the Solomons.

Langley replied that the problem dates back to the ethnic tension period when a lot of logsheets were not returned or got lost. He believed the system was being brought up to speed and there was pretty good coverage of much of the fleet. The Fijian vessels, likely the most significant component of the albacore fleet, were largely reporting logsheets back to PNG.

Dalzell asked if a lot of albacore is caught by vessels other than longline boats. John Leqata of the Research Section of the Solomon Islands Fisheries Department affirmed that.

Ward asked if the Solomon Islands fishermen have any explanations for the fluctuations in albacore CPUE.

Simon Alekera of the licensing section of the Solomon Islands Fisheries Department believed one of the main reasons is the increase of foreign vessels licensed to operate in the area in recent years, thus increasing the fishing fleets around the Islands.

3.11 Papua New Guinea

Luanah Koren from the PNG National Fisheries Authority reported that tuna is the most important economic component for the PNG fishery, where the dominant commercial fishing method is purse-seine with longlining following next. There is no specific targeting of tuna species in the longline fishery. The fishery is currently entirely domesticated with small vessels, ventures limited to citizens and national companies operating out of Port Moresby. Over the last four years, the fishery has been stable with 41 tuna (currently 27 active) and nine shark longline vessels. The boats are mostly secondhand Taiwanese or Japanese longline vessels, ranging from 14.8 to 33.6 meters; and there are a few modern longliners. Only dry charters are permitted, and there are currently no arrangements for chartered vessels.

Most vessel gear is imported, resulting in a variety of engines and gear, as well as fishing techniques from boat-to-boat and skipper-to-skipper. In 2005, albacore accounted for 58 percent of total tuna catch, overtaking yellowfin, continuing a five-year increase trend. This may be due to high costs causing fishing effort to be concentrated near Port Moresby, where albacore is drawn to good environmental conditions.

Logsheets from the observer program show a bycatch rate of about 10 to 15 percent made up of sharks, rays and billfish.

As for processing, no company has a truly modern processing unit. PNG's principal exports of yellowfin and bigeye are sent to Japan, Australia and the United States. In recent years, with the shift to albacore, the tuna is sold to American Samoa, Thailand and Vietnam for canning at a value of about US$8 million.

PNG's tuna fishery is under the guidance of a National Tuna Fishing Management Plan, which sets a management structure and an application framework for longline, purse-seine and pole-and-line fisheries.

Workshop Discussion

Dalzell asked why PNG sends its tuna to Pago Pago for canning when it has canneries.

Leka Pitoi with the PNG National Fisheries Authority explained that artisanal fisheries, using small vessels under 10 meters, are the ones that supply the local processing facilities. The larger longline companies stick to traditional processing markets.

Dalzell asked what a dry charter is.

Rodwell replied that it can also be termed a "bareboat charter," which is an arrangement to hire or charter a ship or boat, whereby no crew or provisions are included as part of the agreement; instead, the people who rent the vessel from the owner are required to outfit and pay the crew. It's seen as a charter with greater control over the vessel, which is the aim of the PNG policy. It's often applied to foreign boats to generate benefits for the local economy by the hiring of local crew, for example. And it only applies to the longline fishery. In the management plan, 51 percent is local and 49 percent is foreign interest.

3.12 Australia

Edward Ho-Shon from Australia Fisheries Management Authority reported in place of Wes Norris, manager of the Eastern Tuna and Billfish Fishery (ETBF), who could not attend the workshop. The ETBF is a multispecies, multimethod fishery with export product that extends from Camp York to Tasmania, down the east coast of Australia. Fishing primarily occurs within the Australian fishing zone, with some outside fishing. Targeted species are yellowfin, bigeye, striped marlin, albacore and broadbill. Since the cessation of Japanese bilateral arrangements in 1997, catches of these five primary species have increased significantly. Stock assessments indicate that yellowfin, bigeye and swordfish are fully fished in the western and central Pacific Ocean; South Pacific albacore is biologically underfished; and striped marlin is data-lacking.

Australia has about 280 fishing permits in the ETBF, with about 170 vessels nominated to those permits. The country currently has no active charter or joint venture arrangements. In 2006, only about 80 vessels were actively fishing under the fishing nomination system, representing a range of vessel sizes, mostly in the 15- to 25-meter range. A newly announced structural adjustment package for the fisheries is expected to remove about 100 permits from the ETBF.

Albacore catch peaked in the 1980s and 1990s, with generally declining effort in the ETBF fishery, primarily due to economic reasons. The strong Australian dollar has created unfavorable exchange rates and high fuel and transport costs. Thus, increases in the catches are primarily due to increasing operator knowledge of deep-setting techniques, which has led to increased catch rates for albacore this year. This is in the face of a declining number of boats targeting albacore, reflecting a decreasing pattern of effort in the ETBF.

In response to the increased catches, the Australian Fisheries Management Authority created an albacore fishing area in August 2006, which accounted for 79 percent of the total albacore catch in 2006, and is open only to vessels that have actively fished during the year in the ETBF. These vessels are able to target any of the species and bycatch species allowed under the permit system. The closed area was to prevent further expansion of the fishery by latent vessels and to comply with the WCPFC resolution to not increase the number of boats targeting albacore south of the 23rd parallel.

Workshop Discussion

Wespestad noted that Australia plans to increase its current observer coverage of 7 percent to 8.5 percent and asked if any analysis had been done to determine the optimum level.

Ho-Shon said he was not qualified to answer that question and offered to find the information.

Langley asked if the albacore area extends outside of the EEZ or does the fleet also operate outside the EEZ while actively fishing for albacore.

Ho-Shon replied that all fishing was within the EEZ.

Ward added that if they extended beyond the EEZ, they would be fishing in the waters of New Caldeonia, which was not allowed.

Yen asked what is meant by deep-setting and if the increase of such catch rates is for all species.

Ward replied it means setting over 20 hooks and up to 40 hooks per float. Occasionally weights are used on the main line and hooks descend to 400 to 500 meters. The result appears to be good catches of bigeye and yellowfin in very good condition.

Langley asked how many vessels qualify for fishing in the albacore area. Ho-Shon replied about 80. Ward added that that is presuming that many of those boats have been bought back by the Australian government, which has spent about AU$40 million in the buy-back program.

Dalzell asked if fishing for albacore is done outside the albacore area.

Ho-Shon said the general plan is to allow fishing for albacore anywhere in the ETBF.

Ward added that there is some activity outside of the area but most of it is currently as bycatch.

Mitchell asked how effective putting in a TAC would be in controlling those catches.

Ho-Shon replied there is an overall cap on effort in the entire fishery. The management plan also categorizes certain areas and designates different rates for hook-setting in different parts of the fishery.

3.13 New Zealand

The New Zealand longline fleet is dominated by small domestically owned and operated vessels, reported Sarah Omundsen of the New Zealand Ministry of Fisheries. There has been a significant reduction in the fleet since 2001, mostly of vessels smaller than 50 gross registered tons. In 2001, there were 132 vessels, which dropped to 57 by 2005. This is likely due to the introduction of significant tuna species into the quota management in 2004.

With no foreign licensed access for tuna longline fishing in New Zealand waters since 1995, only vessels operated by New Zealand companies can fish in its fisheries' waters. A small fleet of foreign-owned longline vessels on charter to New Zealand fishing companies has

operated in New Zealand fisheries waters since the late 1980s. These longliners have almost exclusively targeted southern bluefin tuna; although, on one occasion two were chartered to target albacore tuna. Only two of these charter vessels fished in 2005.

Although albacore catches by longline are largely a bycatch of the bigeye fishery off the east coast of the North Island and the fishery targeting southern bluefin tuna off the west coast of the South Island, they represent the largest component of the longline catch. Pacific bluefin and yellowfin tunas are taken in small numbers in longline sets, and skipjack is a very occasional catch.

The principal albacore fishery is the troll fishery. Catches by the fleet have declined in recent years from 2,500 mt to 634 mt in 2005, with an estimate of about 500 mt in 2006. The economics of the fishery are currently difficult with high fuel prices and the decline in the international market. With the decline in the fleet, fishing effort has also declined from ten million hooks in recent history to about four million in 2005.

Principal bycatch are blue mako, portbeagle sharks, moonfish and Ray's bream. Eleven sea turtles were captured and released alive since 2001. Regulations are currently being examined for sea turtle catches as well as potential guidelines for fishermen. As part of an agreement reached by the Commission for the Conservation of Southern Bluefin Tuna, New Zealand longline vessels fishing south of 30 degrees S are required to use tori lines to reduce catches of seabirds, about 24 percent of which are taken alive, during the setting process.

Albacore catch in New Zealand waters is generally all exported, with destination varying depending on whether catches have been taken by longline or troll. The most significant market in recent years has been Spain, with smaller volumes exported to Samoa, Japan and the United States. Albacore are mostly exported whole and frozen, although some fish are also exported whole and chilled or headed, gutted and frozen.

The export value of the New Zealand albacore fishery is an estimated NZ$10 to NZ$20 million per annum, depending on volume of catches. Value of the longline component of export also varies and is estimated to be between NZ$2 and NZ$11 million per annum.

The main fish species associated with New Zealand's longline fishery are managed under the New Zealand Quota Management System. All fishers are required to furnish monthly returns of catch, which are then matched to individual holdings of quota entitlement. The total fishery catches are assessed annually, and adjustments to future catch limits are made to account for any annual over-catch as required.

All trips on charter vessels are covered by at least one observer, while the target coverage level for the domestic fleet is 10 percent of the effort to reflect 10 percent of the catch. In 2004, 12 observers were briefed and deployed (four charter vessel and 10 domestic vessel deployments); in 2005, 10 observers were deployed (two charter vessel and nine domestic vessel deployments).

Since 1994, the industry has implemented voluntary measures with respect to longline fishing that are detailed in a "Code of Practice." Specific measures include gear specifications, environmental standards, operational practices and closed areas.

Workshop Discussion

Dalzell asked if the drop in the longline fleet was an objective of the quota management system.

Omundsen said no but they were aware that it would happen.

Ward asked what has happened to the trolling fleet.

Omundsen said most are down on the west coast participating in the seasonal rock lobster fishery but one is still fishing for other species. They use albacore as part of their overall fishing effort.

Mitchell asked what happens to bycatch sharks. Omundsen said it depends on the species, but most blue sharks are released.

Time asked if other fisheries have experiences with cetacean interactions, which are reported by fishermen in Samoa but which have not been mentioned in the presentations.

Dalzell noted the Council has a Marine Mammal Advisory Committee to deal with cetacean interactions in longline fisheries, which is probably lower than turtles in hookings or tanglings. High interaction rates occur in depredation of longlines by false killer whales and pilot whales.

Mitchell added that depredation by the same types of whales also occurs quite often in the Cook Islands. He said it's frustrating to fishermen because fishery legislation prevents shooting or harming mammals.

Dalzell noted a symposium on depredation by whales in Seattle or British Columbia possibly in October.

In summary for the day, Dalzell noted the importance of the American Samoa canneries to the region and data issues.

4 Research on South Pacific Albacore

4.1 Stock Assessment

Langley began his report with a summary of the fishery. Over the last 10 or 15 years, there has been a steady increase in the catch of longline-caught albacore, principally through the development of the domestic longline fisheries in and around the PICTs.

In the southern regions, troll-caught albacore is prevalent around New Zealand. Operating in the Subtropical Convergence Zone, fleets from the United States, Canada and New Zealand principally catch juvenile albacore during the summer months. Another component is the short period of relatively high catches of juvenile albacore by the driftnet fishery operating in the Tasman Sea.

Recent catch trends from the Pacific fleets show these fisheries have developed rapidly from the early 1990s, especially in American Samoa, Cook Islands, Fiji, French Polynesia, New Caledonia and Samoa accounting for 25,000 mt, which is about half of the total longline-

caught albacore catch. This catch is on a par with the take from longline DWFNs, principally the Taiwanese fleet, the historical catcher of albacore in the region.

It is currently believed that albacore reach maturity around age 5. The southern catches are principally catching fish at 2 to 3 years of age, while the northern longline fishery catches subadult fish aged 3 to 4 years. In the more northern waters, the most striking part of albacore catch is the very large fish (i.e., more than 90 centimeters) taken by the Pacific Island fleets, which are estimated to be at least 7-year-old large, mature adults.

Consistent seasonal patterns in CPUE are seen year-in and year-out by region. Early in the year, high catch is restricted to the more northern part of the range. By late summer, the high CPUE is taken in waters south of 20 degrees latitude. By the third quarter, the numbers retreat back into the north and by the fourth quarter, the cycle begins again. The seasonality is in part an increase in juvenile availability in the summer as well as a movement of large fish from the north to the south.

Stock Assessment

Langley noted that the SPC-OFP undertook a fairly detailed assessment in 2005, which was updated in 2006 and presented at the Scientific Committee meeting. Data is based on the Taiwanese DWFN fishery for the main index of stock abundance, as it represents the most consistent long-term fleet operating in the region. It is important to recognize the contribution from a lot of countries now providing information through various observer and port sampling programs. Tagging data has so far yielded little information.

With a fair amount of uncertainty associated with assessment in terms of biological parameters, estimates of natural mortality, age of mortality, etc. are less than desirable. However, despite such uncertainty, some key conclusions strongly emerge from the assessment.

Data indicate that we are taking about 60,000 mt from the fishery. Stock assessments show that we can take a lot more in terms of the MSY, which is approaching 200,000 mt. While Langley cautioned that this estimate is very uncertain, to take that level of yield would mean increasing fishing effort almost 20 times.

In terms of trends in exploitable abundance for a group of fisheries included in the model, the tendency appears to be a decline in the overall longline biomass, which is partly due to the impacts from the fishery as well as an estimate of decline in recruitment over the last 20 years. In the case of Fiji, for example, data indicate that the fishery is reducing the biomass available to the fleet by approximately 25 percent. On the other hand, the New Zealand troll fishery, which fishes juvenile albacore and has very low mortality rates, has had no substantive impact on the juvenile component.

Langley noted that even in unexploited conditions, stock decline is estimated to be due to recruitment decline through a given period. There is no concern about the status of the stock in terms of the standard biological reference points. Fishing mortality rate is well below the FMSY, (level of fishing effort that will generate MSY) while the biomass levels are well in excess of the biomass which can produce MSY level.

Despite the uncertainty associated with MSY, achieving yields would result in CPUE decline, which would be evident in the Pacific longline fleets, as they are most susceptible to any substantial increase in fishing mortality rates.

Looking at the albacore population through age-class provides another insight at what might happen at higher levels of fishing mortality rates and at rates approaching MSY. Data show that up to age 3, growth in population is rapid and natural mortality rates are lower than growth rates. Over age 3, cohort abundance declines steadily because of natural mortality, while growth rates slow. This is where the cohort is most abundant and will begin to decline with increasing age. Age 5 to 6 is an albacore's age of maturity.

Longline fisheries catch very few fish younger than 6 or 7, with most catch at age 9 and older. Because of that selectivity, fishing mortality rates are targeting older fish over age 10, so essentially there are very, very few fish that are vulnerable to longline fisheries in domestic waters. That is a key conclusion coming out of stock assessment.

Based on a Scientific Committee-1 resolution to restrict any increase in fishing effort south of 20 degrees, which is designed to prevent an influx of foreign, largely Taiwanese, vessels coming south, Langley reported on two scenarios in the context of the assessment. One was a baseline scenario making a projection based on the current level of fishing effort for all fleets. The second scenario was based on an increase of fishing in the south by a factor of five for the Taiwanese fleet.

The result was that, in spite of a fivefold increase, essentially there was very little impact on the exploitable biomass that might be available to the Pacific Island fleets due to selectivity of that fishery directed at younger fish and to the natural mortality of non-caught fish. Increasing Pacific fleet efforts by a factor of two, an extreme scenario, is predicted to have a much larger impact on exploitable biomass. This illustrates that the current measure does not provide any security for the future of the Pacific Island fleet. Potentially, the risk for those fisheries lies within those countries themselves.

Therefore, to maintain a high level of biomass and a higher level of CPUE, measures are needed to maintain and manage that component of the fishery specifically.

Stock Assessment Discussion

Wespestad asked what estimate of natural mortality is being used.

Langley said an estimate within the range of 0.2 and 0.4 is used, and, allowing the model to estimate an age-constant natural mortality through that range, it is currently estimated at 0.3.

Tom Graham from NOAA Fisheries Service asked if any work has been done to explore what other potential MSYs would be if the selectivity would change.

Langley said no such research has been done.

Brown asked about the state of the Taiwan logbooks.

Langley said the SPC is very reliant on the Taiwanese for data but not as much on

logsheet data. Reports are done each month at a five-by-five spatial resolution. He was unsure about the accuracy of the Taiwanese data or how to resolve the issues.

Samasoni Sauni of the Fisheries Management Division of the FFA asked if there was any point to producing several MSYs for the north and the south or even producing MSY for each of the countries.

Langley clarified that his information did not include northern albacore and was an assessment of southern albacore. He added that it was not appropriate to derive any MSY on anything less than overall stock because one has to apply an assumption about stock recruitment relationship in the yield analysis and that it's an overall stock and recruitment relationship that feeds into the MSY calculation. Selectivity also differs among the fisheries. What is produced is an amalgam of all fisheries and a yield as a function of that overall selectivity. Without any management directive or need, no further exploration of alternative scenarios has been done. Regarding country-specific MSYs, there would be a need to start balancing the overall level of the catch that can be taken from these fisheries and find an equitable mechanism for sharing that out among the countries. That would become the point of how to start to make in-country assessments.

Graham asked if the main source of uncertainty in MSY is the uncertainty in the stock assessment recruitment relationship and if that level of uncertainty is typical of tuna stocks in general.

Langley agreed that the statistical estimates of uncertainty are broad, with stock recruitment relationship as one source and an attempt to estimate natural mortality within the model as another. He believes improving the estimate of natural mortality for albacore would be a big step in improving assessment. Little focus has been made on the standard MSY-based reference points, but, Langley said he felt they are obligated to use those reference points by default to the various agencies.

Sloan asked what the recent trends are in the Taiwanese data and do they correspond to observations in other Pacific Island EEZs.

Langley said the trends in the Pacific Islands tend to be more extreme because of the largely static distribution of where these fleets operate and their greater susceptibility to trends driven by oceanographic conditions. Given that albacore is a very mobile species, a fleet index is needed based on accessibility to fish on a fairly consistent basis, such as the far-ranging Taiwanese fleet.

Ray Clarke of the Pacific Islands Research Office (NMFS-PIRO) asked about the lack of other sources of estimates of natural mortality for two key assessments, bigeye and yellowfin.

Langley replied that, for these two species, it is believed that there is a strong age-specific trend in natural mortality based on external results from tagging data. The model has delivered contrary trends, so they have gone back to fixing age-specific patterns of natural mortality for yellowfin and bigeye. Because of the selectivity of the fishery with the taking of larger fish, even with low end or high end scenarios, the fishery is still taking just the cream off the top and a component not vulnerable to the fishery still exists that is able to replenish the stock.

Dalzell asked if tagging might aid in getting better estimates of natural mortality.

Langley said tagging data does provide some information on natural mortality, and, if the underlying age composition were better known, it would provide a better indication of what the natural mortality might be.

Oceanography

Langley pointed out that the overall level of stock abundance and the location of the EEZ relative to record areas of albacore abundance are going to impact the relative abundance of albacore. Strong seasonal fluctuations driven by oceanographic conditions have been observed. Fairly strong and consistent seasonal trends in a lot of the fisheries have also been observed and reported by individual nation representatives.

Inter-annual trends are also seen across the board, the most striking being the decline in CPUE in late 2002 and 2003, followed by a resurgence in the catch rates, particularly in the western part of the South Pacific albacore distribution. Further east, however, is a long period of very low catch rates, particularly in French Polynesia and Tonga. This decline is not due to population dynamics, low recruitment or sudden removal of fish in the fishery, which is based on large, old fish. Add to that the quick recovery in the fishery suggest that is not driven by population.

A more reasonable explanation is some persistent oceanographic conditions affecting broad-scale availability. When oceanographic conditions—SST, isotherms, warmer water in the north, colder water in the south, etc.—are overlaid with best catch and effort data in the region, some descriptive statistics of trends and oceanographic conditions are seen. Essentially, there is a warming southward during the summer, then a retreat of isotherms north in winter. As they retreat in the winter, there is a sudden resurgence of catch rates. As a result, CPUE typically spikes during the middle of the year as the isotherms move north, and then drops again as the isotherms settle further north. Seemingly more important, the distance between these isotherms is where the core distribution of albacore is believed to occur and when the distance is narrow, the habitat is compressed, yielding a higher CPUE. A broader distance yields a lower CPUE.

During 2003, when the pattern fell apart, the distance lacked what is called environmental forcing or compression, which may provide some explanation for the low CPUE in 2003. These trends appear to be consistent in other areas of the fishery including a fairly broad regional-scale effect in oceanographic conditions, largely dictated by the extension of the warm pool during the summer months and then the retreat.

How frequently and for how long these low CPUE events are likely to occur was then examined. Data from French Polynesia, which is on the eastern fringe and may be more susceptible to these perturbations, suggest low CPUE events there occur on a three- to five-year cycle and persist for a two- to three-year period. More stable oceanographic conditions in the west appear to diminish these long, protracted periods of low CPUE. Langley reiterated that these trends tend to be country-specific and difficult to generalize across the region.

Local impacts that these fisheries are having on subsequent fishery performance,

particularly those with high fishing effort, were also examined. Data from the Fiji EEZ, a fairly intensively fished area, showed a decline in CPUE with increasing levels of catch in the preceding period beyond a certain threshold. One explanation is that the infusion rates into this area may be exceeded by the removal rates, with the resulting reasonable decline in CPUE. This trend appears to be consistent across a number of fisheries, particularly those with high effort, which was incorporated into a statistical model approach.

When oceanographic conditions are added to a highly fished fishery vulnerable to long periods of low CPUE, the management issues emerge of how to be more profitable and economic during the high catch periods to sustain one's fleet during the ensuing low periods. In light of this situation, in Fiji, a simple economic model was developed in conjunction with FFA to make recommendations for its licensing regime. Once an economic reference point is developed, which might be the break-even CPUE for the fleet as a whole or a part of the fleet, then a more detailed analysis of various management options about levels of catch can be taken from various regions but still maintain that economic reference point.

Oceanography Discussion

Mitchell asked how much value can be placed on the oceanographic data's effect on CPUE.

Langley replied that they were not in the position yet to use the catch and effort data from the Pacific Island fleets and they will continue to rely on a broader-scale regional CPUE as a regional index. He did not believe they are able to remove the oceanographic effects and then use that as an abundance trend of a stock.

Ward asked if, as Pacific Island fleets upgrade to larger vessels and gain knowledge on tracking oceanography, they can expect to maintain high catch rates and experience fewer large fluctuations in catch rates.

Langley replied that the key factor in these fleets is that they are essentially locked into a small EEZ with little flexibility in terms of their operation to maximize overall efficiency, given that there are strong and consistent trends in seasonality. Improvement with greater efficiency and knowledge would be minimal in this context, and there would not likely be substantial change in levels of CPUE.

Dalzell asked if it was possible to develop an optimum density of hooks per unit area with regard to the economic reference point.

Langley said he believed it would be possible on average but a large degree of inter-annual variability and seasonal variability still has to be dealt with. Management concerns would also extend to being overly directive to fishermen as to how to fish.

Sloan asked how realistic the unfished biomass estimate to have over a 20-year period is.

Langley replied that it is essentially driven by recruitment. Information used in the model comes from size distribution and the population as a long-term recruitment index, as well as integrating the catch and effort data. Since the model is trying to provide a lot, a trend that emerges in declining abundance, as in the index by the CPUE trend, can be interpreted in

two ways as increasing fishing mortality or decreasing recruitment. The model's information is statistically providing the best interpretation by estimating the recruitment to have declined in the stock.

4.2 Oceanography, Catch and Relative Abundance

American Samoa Albacore Study

Kienzle shared the results of a NMFS-PIFSC Stock Assessment Division statistical analysis on the trends of albacore in American Samoa. The aim of the analysis was to determine the relationship among the variables collected in the American Samoa fishery and determine if any oceanographic conditions influence the catch, with the objective of improving the stock assessment.

The American Samoa fishery, as defined by the total landings of albacore by year, begins with a very small number in 1996 and increases to approximately 100 times that by 2002. After 2002, carches decrease. Other changes include a dramatic 14-times increase in the number of hooks used by fishermen from before 2000 and after 2003. The study analyzed 17 variables from longline logbooks and oceanographic information.

Logbook data included longline sets, positions, vessel type (three types were studied—*alia*, monohull <50 feet and monohull >50 feet), boat identification by permit number, number of hooks set, timing of sets and number of albacore caught.

Oceanographic descriptors included SST, depth of isotherm (using 15 degree isotherm and 27 degree isotherm), sea surface height and, from that, surface current velocity and compass direction.

Logbook and oceanographic data were matched based on the timing and positioning of the sets. Every set in the logbook was attributed with the value of the oceanographic feature normally given by either satellite imagery or output from models. The aim was to develop a generalized linear model (GLM) to explain the variability of the albacore catch. With a dataset of 17 variables, it was not clear from the beginning which one was influencing the variation of catch. So, a table was developed to rank the variables (most explanatory effects from top to bottom) and to detail which variable is most relevant to this kind of catch.

The six most important variables turned out to be permit number, boat category, number of hooks set, set year, set time and latitude of set deployment. The first oceanographic feature, depth of 15 degree thermocline, appears in seventh position, followed by depth of 27 degree thermocline and SST. The researchers also found that the first six variables are correlated. Researchers concluded the importance of investigating the variability of the fisheries information.

This model was then compared to other models. The best model they found to explain the variation of catch was one that incorporates the effect of the number of hooks in each longline set, the boat used and the oceanographic effect on the catch. Taking the oceanography into account provides a better model than when not used. The oceanographic feature most important to understand catch is the depths of the isotherm.

Kienzle focused on model number 10 to explain the variation of catch as a function of the number of hooks used in each year. The conclusions, thus far, are 1) the discovery of a linear relationship between the mean catch of albacore and the number of hooks that are used; 2) the inability to explain with certainty why the CPUE has decreased during the last decade; and 3) the influence of both the fishery and the oceanography on the number of albacore caught by a longline fishery.

In the future, the researchers would like to determine what is the relative influence of the oceanography compared to the fishery. Is the oceanography playing an important role in a decrease in CPUE? They also hope to improve the methodology, using different statistical methods, use catch data and models to determine if decrease is linear or cyclical and study biological indicators for possible same trends as the CPUE.

Oceanography, Catch and Relative Abundance Discussion

Ward asked if researchers looked at competition (i.e., increasing number of hooks set) resulting in a lower CPUE and if any interaction effect occurs between number of hooks and vessel category.

Kienzle replied that the data showed that the smaller the boat, the smaller the number of albacore caught. A larger boat will on average catch eight to ten times more than an *alia*. Clearly, the more hooks set, the more fish will get caught.

Eric Gilman, director of the Fisheries Bycatch Program with Blue Ocean Institute, asked if fishers were simply adding more baskets to the gear or more hooks per basket because with more hooks per basket, gear-setting is likely deeper.

Kienzle replied that since a monohull sets ten times more hooks than an *alia*, setting is probably related to depth. He pointed out, however, the prominent oceanographic influence on total catch is how deep the thermocline is—essentially, the deeper the thermocline, the less available the fish are to the hooks. So, there is a relationship between depths of hooks and how much warm water is available for the fish to stay in.

Sauni asked if research was still ongoing on oceanographic influences, even if this study concluded that logbook data are more important than oceanographic variables.

Kienzle said their research is still ongoing.

Langley asked if the analysis is providing information as to the abundance of albacore or is it the model's ability to explain the oceanographic trend by using the year effect.

Kienzle concurred that the CPUE must provide a picture of the biomass available to fishermen. But it also did not work out to show the oceanographic effect. So, basically the model is capable of capturing the trend in average catch but not at explaining why sometimes fishermen are going out and throwing a very large longline set without capturing albacore. The study cannot explain this very well.

Clarke commented that for other albacore fisheries, variables such as ex-vessel price and fuel prices may tend to explain some of the variability in catch rates.

North Pacific Albacore Workshop

Bigelow with the PIFSC Stock Assessment Program, which deals with tuna, marlin and swordfish assessments, reported on research presented at the North Pacific Albacore Workshop in December 2004. Recently incorporated into the International Scientific Committee on Tuna and Tuna-like Species (ISC), the Workshop presents scientific advice of member nations, which include China, Japan, Korea, Mexico, the United States and Taiwan.

From 1950 to 2005, there were a large variation in catch trends in this area with the largest recorded in the mid-1970s of about 120,000 mt. Fisheries in Japan account for 71 percent of the catch for the past five years, with the United States at 15 percent; Chinese Taipei, 6 percent; Canada, 6 percent, followed by minor players such as the Cook Islands, Ecuador, Mexico and a few others.

The North Pacific catches are about twice as large as those caught in the South Pacific. The fleet also differs, with the troll fishery (or pole-and-line) at 62 percent, largely from Japan. Only 10 percent are caught in the surface fisheries. The majority comes from the longline fisheries. As a result, the North Pacific albacore stock appears to be a better fishery in yield per recruit than its southern counterpart. Another major difference is the low number of EEZs in the area, with a lot of the fishing occurring on the high seas.

A number of assessments have been applied to the North Pacific albacore, including single or two-region model virtual population analyses (VPAs), a Multi-FANC1 and a Coleraine.

Recruitment from 1975 to 2000 show trends similar to the South Pacific albacore, perhaps environmentally-driven but no specific relatively low period of productivity from the mid-1970s to mid-1980s. In the North Pacific, the mixed layer was deeper, with more nutrients in the upper part of the water column, thus, increasing recruitment thereafter. Stock biomass is estimated at 430,000 mt with fairly large confidence intervals and fluctuations throughout time. The North Pacific Albacore Group is reluctant to express reference points in MSY-based criteria. Debate is ongoing as to what they actually prefer.

Management has been formulated into six-year projections from 2005 to 2010 using four different simulations: 1) high productivity in the ocean at low fishing mortality, 2) high productivity at high fishing mortality, 3) low productivity and low mortality and 4) low productivity at high mortality.

High productivity with low fishing mortality could be expected to result in a moderate stock increase. High productivity and high fishing mortality would produce a decline in spawning biomass. Low productivity at low fishing mortality would maintain a constant in spawning stock. Low productivity and high mortality would see stock decline substantially.

These scenarios led to a December 2005 resolution by WCPFC that suggests the level of fishing effort for North Pacific albacore not increase.

North Pacific Albacore Workshop Discussion

Clarke asked, in light of the differences in models applied in the South Pacific and the North, how common MSY-based approach reference points are to be gotten.

Bigelow replied that stock assessments are conducted by NMFS in LaJolla, Calif. and groups from Japan and Taiwan who have chosen to use the ADAPT VPA. Some preliminary work has been done with Multi-FANC1. Bigelow suggested a discussion with the stock assessment staff would be most appropriate.

4.3 Forecasting Albacore Distribution Patterns in French Polynesia

Labelle, a fisheries scientist working on the albacore fishery in French Polynesia, reported on preliminary results and ongoing work done with the Service de la Pêche in Tahiti during the past 18 months. He had access to a rich dataset for his investigations including detailed catch and effort statistics for all longline fishing activities in the French Polynesian EEZ, logbook records, hook-timer records, temperature depth profiles, observer records and the results of test fishing cruises sponsored by the government to explore new areas, the local university's oceanographic research results, the Ocean Global Simulation Models data, published information on archival tagging programs and the results of sonic tracking of tuna from ECOTAP (a research program on biology, ecology and habitat of deep swimming tuna in the Polynesian EEZ).

The French Polynesia EEZ, a large area of 5.2 million square kilometers, has experienced a drop in CPUE for the domestic longline fleet for all species combined including albacore. The prevailing two hypotheses are 1) stock abundance levels have diminished or 2) changes in ocean conditions have caused stock distribution patterns to change inducing a reduction in catch rates on the traditional fishing grounds.

The main objective was to try to identify areas that might have high tuna densities based on oceanographic conditions and provide guidance to fishermen. A secondary objective was to explore possible evidence for a limit on the amount of effort deployable in the high-use areas and around the Society Archipelago in the northwest Tuamotu Islands, and help to prevent excessive exploitation on a localized basis.

Based on the various data sources, the conditions under which albacore are found were determined in terms of the regional productivity; the concentration of dissolved oxygen and the temperature they occupy day and night. Based on that information, habitat preference indices were produced to reflect the amount of time tuna spend at a certain depth in each region. This was correlated with CPUE in areas where longline fishing activity occurs.

The result is a weighted index that accounts for the subsurface conditions and how gear is deployed that provides a probability of encountering fish. So, for example, at 13 degrees south by 145 west, use of the indices suggest that the best place to fish for albacore would be at about 200 meters. Labelle emphasized that while the results only suggest suitable habitat conditions, there is no guarantee tuna are present.

Labelle acknowledged that habitat preference models have been criticized lately as being inadequate for effort standardization or as forecasting tools. Several reasons have been proposed. The indices do not account for changes in stock levels, and if the stock level changes, the CPUE will change, even though the habitat might be the same. They also do not account for levels of fishing effort, which can vary considerably among individual fishermen and between fleets. The relatively low abundance archival tagging results also limit what can be concluded for albacore, as well as other species. Also, even when information is available on the time spent under

certain conditions of temperature and O2 concentrations, there is no widely accepted procedure to combine and weigh various indices. Labelle also noted that it is difficult to reconcile the differences between the results of various studies conducted in different regions, and ideally, it would be preferable to use results from archival tagging programs conducted within the French Polynesia EEZ.

His next investigation involved the use of GLMs to determine trends in distribution patterns from the analysis of fishery statistics. Data from the Korean fleet, which had access to the EEZ and the French Polynesia domestic fleet, were used to determine the depth distribution of hooks, the relation between the hooks set and the deployment, and slack and retrieval periods, so as to obtain an overall distribution of fishing effort patterns in terms of hook-hours per area, period and depth.

The model attempts to predict the logarithm of catches by 1x1 per month, not the CPUE per se. The effects of a large set of environmental factors were also tested by the model to explain observed catch patterns. The results suggest that the ocean conditions that are suitable for albacore have not deteriorated in the area where the French Polynesia domestic longline fishery deploys a lot of effort. This suggests that albacore are less abundant in that area, but it does not imply the stock is depressed as they may have gone to areas where conditions are better. The graph suggested the best areas in some periods were simply outside the French Polynesia EEZ. Perhaps stocks can detect this and that is where high abundance levels exist.

Labelle noted that the extent of future investigations would depend on what kind of forecast is desired by the industry. Fishermen could be provided very general advice such as the habitat preference of each species, the ideal fishing depths by region and average trends over the year. More detailed advice could include seasonal forecasts, regional trends based on average productivity or even very detailed maps of relative densities of each species by year, period and depth for the current month. Labelle noted that "near real-time forecasts" will probably be possible by 2007, but at this stage, the advice provided to fishermen is largely based on historical observations (1995-2005). The current objective is to improve this situation so as to provide more up-to-date advice to industry.

Forecasting Albacore Distribution Patterns in French Polynesia Discussion

Bigelow asked how hook depth is incorporated into the model and whether there is a change in the hooks between floats in any of these fisheries.

Labelle noted that for the French Polynesian fleet, the number remains pretty stable. Hook depth and soaking time distribution might eventually be used to do a fine-scale analysis of catch composition.

Wespestad asked if species composition has some predictive power.

Labelle said it may, but the model was not structured to assess that effect. Areas with a high yellowfin CPUE often have high albacore CPUE as well, but it is hard to test this hypothesis because the French Polynesia's fleet targets albacore, and yellowfin are mainly caught incidentally.

Langley asked if this GLM, which is able to explain an impressive 70 to 80 percent of the historical variation in catch patterns, is more tied up in the year effect and not in the oceanographic conditions.

Labelle replied that one has to look at the table of parameters to assess the relative importance of each. Effort was the most important factor, and several other environmental variables had large influences. Some years had substantial influences as well but not all years, and the effects were not consistently greater than those of other factors.

Dalzell asked what kind of product ultimately is to be provided to fishermen from this modeling. Labelle replied that this is a work in progress but some preliminary results have already been proven helpful to fishermen (e.g., the results of archival tagging and optimum fishing depth maps). It is still undetermined if detailed maps in "near real-time" would eventually be provided because this would depend on demand, needs, funding and other resources.

4.4 Future Research

Langley reported that some work is underway on albacore aging from collected samples. Australia's Commonwealth Scientific and Industrial Research Organisation has also received funding to create a small sampling and aging program, and they hope to collaborate over the next few years to develop a broader Pacific analysis of age and growth. They are hoping to undertake this work through the SCIFISH project, an EU-funded science project for the African, Caribbean and Pacific Group of States' countries with Overseas Countries and Territories components, hopefully to commence in early 2007.

A critical input and component of current analysis is the size frequency data, which is continuing through various country and observer programs. It is hoped SCIFISH will also continue to support that as well.

With regard to CPUE, there has been improvement in standardization of the Taiwanese CPUE data incorporating oceanographic data into those standardizations. Also explored is the potential of using CPUE data from PICT countries' developing fleets.

A tagging project is hopefully being readied within the SCIFISH project given the number of issues associated with tagging albacore. The scope of this project has not yet been determined. It has been demonstrated that juvenile albacore can be tagged in large numbers because the catch of juveniles is small compared to what is believed to be the size of the juvenile population. Recovery rates are low, followed by a long period of following tagging and a subsequent large loss of tags through natural mortality. But a large-scale tagging program would incur large expenses.

The other alternative is to tag large adult albacore, but that has not met with much success due to susceptibility to ruptures of the swim bladder for both archival and spaghetti tags. Further work is still needed on this.

In the works is a revisit to the 2007 stock assessment. But with the absence of much additional data, it is unlikely that that assessment would significantly change. Nevertheless, an update and staying on top of some issues are important.

There is also an ongoing need for the SPC to continue to monitor performance of the domestic fleets at the country and regional levels, and incorporate their information into understanding the dynamic between oceanographic conditions and fishery performance.

Future Research Discussion

Wespestad noted a 5 percent recovery rate on the North Pacific juvenile albacore archival tagging program. A key factor is the selection of the fish tagged and working with seasoned fishermen who are accomplished at the process and who take care in the selection of fish. From the data collected, they have gained a different view of the migration route and behavior.

Langley added that tagging in the core area of the fishery (large adult fish) is still problematic. Attempts have included vertical handlines on FADs and catching in shallower waters (i.e., between 50 and 100 meters).

Time said Samoa has tried tagging for three years but the timing may not be optimal. When tagging 200- to 300-pound fish, the major problem seemed to be that most of the fish being caught for tagging died or were too weak to be tagged.

Sloan noted that the research plan is focused on biological information gaps in the albacore fishery and asked if it should include economic information gaps as well. This would offer reporting with some level of structure on the economic performance of the fishery from a management point of view.

Mitchell noted that albacore catch rates are affected when the price for the fish is low because fishermen will go after swordfish or other tuna, which may help explain fluctuations.

Rodwell added that the development of economic reference points would require cooperation from industry and suggested being prepared to deal with management issues that may arise should the fishery need to be cut back. In Fiji, a lot of ground work had to be established with industry before getting relevant information on both cost and revenue.

Langley added that moving into economic issues is beyond SPC's mandate in some respects and caution has to be exercised so as to not tread on the concerns of other agencies.

Ward noted the importance of the Taiwanese CPUE time series and suggested that verification of that data, particularly the areas of uncertainty, may be useful. He also suggested looking at the Japanese longline time series, which was responsible for initiating the fishery in the 1950s and 1960s, even if albacore is now a bycatch for that fleet, .

Langley said that they have generally discounted the Japanese data as not being necessarily representative of the albacore stock as a whole. As for the Pacific fleets, longer time series of data are needed before adding data from other countries. But he agrees that the information should rely solely on the Taiwanese data. He added that good observer programs among some of the Pacific fleets are being developed and that he has been receiving some good information on the technical configuration of gear and fishery operations. Tagging is the major role the Pacific fisheries can play, and it needs to be realistic and carefully planned.

5 Management

5.1 Overview

Dalzell reported that there are current resolutions for the North and South Pacific stocks in the WCPO and a North Pacific Albacore Resolution from the Inter-American Tropical Tuna Commission (IATTC).

In the WCPFC, the measure currently focuses on not increasing the number of fishing vessels by commission members, cooperating non-members, and participating Territories (CCMs) actively fishing for South Pacific albacore south of 20 degrees south above current 2005 levels or historically recent (2000 to 2004) levels. This reflects a concern about the North Pacific stock or DWFN vessels entering the region to target albacore on the high seas. This measure will be reviewed in 2006 and likely on the agenda at Apia when WCPFC meets again.

In the North Pacific in the WCPFC, the total level of effort for North Pacific albacore in the convention area north of the equator shall not be increased beyond current levels, which is a much broader application than in the south.

For the IATTC, the total level of fishing effort for North Pacific albacore in the EPO will not be increased beyond current levels. When using CCMs as opposed to CPCs (contracting parties, cooperating non-parties, fishing entities and regional economic integration organizations), all necessary measures must be taken to ensure level of fishing effort by their vessels is not increased. Reporting requirements are included.

Dalzell noted that the North Atlantic albacore stock is fished beyond the minimum sustainable stock threshold and that South Atlantic albacore is close to full exploitation. He added that fishing fleets are mobile so limitations on albacore elsewhere can have implications for the Pacific region.

5.2 Economic Reference Points

Rodwell addressed the principles and issues associated with economic reference points. From an economic view, one can end up with a situation where the maximum economic yield is significantly below that which the biological MSY or the level of effort that equates to where revenue equals cost can support. Using Fiji as an example, from a management standpoint, to maximize the economic rent from the fishery, about 50 vessels were deemed allowable. Taking into account increasing or maximizing other benefits from the fishery, the level was thought to be up to 60 vessels, which is how Fiji settled on that number for any one licensing year, subject to

annual review. Regarding possible reference points, Rodwell's presentation suggested focusing on the break-even point, which would include a return on investment in the fishery that would be equal to the opportunity cost of capital so that fishermen would at least be getting enough to say they are engaged in this activity, rather than leaving or doing something else.

As an alterative, aiming for maximum economic yield would follow Fiji's model, which targeted some modifications to account for additional economic benefits received, mainly crewing on boats. Clearly, a link back to economic indicators in the fishery is important, such as

the contribution to the gross domestic product in the economy for the fishery. It is essential to work with the true costs involved, even though that might prove difficult to get cooperation from fishing participants. Otherwise, one will end up with some very misleading reference points.

Each individual fishery for each country, for each EEZ, should be treated as a discreet unit and have a separate economic reference point. This is because the cost structures are likely to be different and affect the economic reference points for each fishery in turn. High seas should be treated as a separate unit with different reference points for individual DWFN fleets.

The issue of funding to do an economic reference point analysis is important, given the length and breadth of its reach. The FFA has limited capacity and is recruiting additional economists; but it is likely looking for some technical assistance and additional funding. The Agency's annual meeting provided authorization to initiate a major project on the collection of economic indicators and had a consultancy on the methodology for doing that. Rodwell hopes to issue an interim report to the membership on the procedure to be adopted.

Economic Reference Points Discussion

Dalzell asked if indicators of health for each of the fisheries are being undertaken and if that would be included in a study to generate individual economic reference points for each of the individual fisheries.

Rodwell replied that while there is no doubt the economic indicator work will begin to provide needed data, there would need to be followup at the national level in terms of developing each of these economic reference points to ensure a link between these two projects. Links already exist with work done on other models for economic viability of different fisheries. In the Cook Islands, work has been done on economic models from which data could be used in developing economic reference points. So, it's not all starting from scratch.

Mitchell noted the challenge of getting current prices at the cannery at Pago Pago for such purposes. Pamela Maru of the Offshore Fisheries Division for the MMR in Cook Islands reported that the confidentiality contract between the vessel operators and the canneries prevents the cannery from providing price information.

Clarke noted that one can call the cannery to get the current price, the challenge is the broader issue of obtaining a published price from the canneries. Research is constrained, in terms of the US government, by internal confidentiality rules.

Dalzell noted that one of the conclusions emerging from the meeting is that biological reference points for managing the Pacific fisheries and the fishery as a whole are perhaps less important than economic reference points.

Rodwell added that his project is aimed at responding to national requests and they are looking to respond to requests to develop economic reference points.

Pasisi commented that while he can see the benefit of looking at economic reference points if there is a general recommendation for each of the different countries to do so, but he could not ensure that they could subscribe to it being applied across the board.

Langley noted that in the Fiji situation, what enabled the analysis was that the fishery had gone beyond the point of the maximum economic return. So, unless a fishery is pushed beyond the economically-viable level, that relationship cannot be well defined unless parallels to other fisheries where it has occurred are being drawn. He added that to make the output from stock assessment meaningful, they have converted biomass trends to actual trends in CPUE for each of the fisheries. This provides a framework that fishermen can relate to and, therefore, can make their own judgment calls about the economic level of CPUE.

Dalzell asked if the Fiji study was available to the public. Rodwell said he believes the report is currently confidential and only accessible by the government of Fiji.

5.3 Management Strategies

Based on experiences as chairman of PolyMelan from 1994 to 1995, Colin Brown of the Cook Islands explored several management strategies. As a subregional agreement of Polynesia and Melanesia, which included Cook Islands, Fiji, Niue, Samoa, Solomons, Tokelau and Tonga, PolyMelan, which operated from 1994 to 1997, was aimed at establishing multilateral access arrangements, initially with the Taiwan Deep Sea Tuna Boat and Exporters Association.

Brown noted that current management issues are not very different from the concerns facing PolyMelan back in the mid-1990s. He notes that there is heightened concern about port-stay enforcement, particularly at Suva and Pago Pago, which are major bases for offloading and transshipment. Current issues include resupply and refueling.

Brown sees a potential opportunity for a relationship to be established with boats from countries like the Cook Islands, which unload in American Samoa and do not land at all in their home country. Perhaps some kind of formal arrangement is in order for countries with vessels that unload in those ports to consider and coordinate an information transfer as well as possibly inspection and observer coordination.

A country like Tuvalu, which has 20 trained observers but no boats to go on, could have these observers stationed in Fiji, for example. The Solomon Islands also have a large pool of observers, so Cook Islands would be trying to utilize that resource.

Other issues raised include catch reporting, cooperation in marketing and North Pacific drift-netting moving to the south—all of which could use more cooperation and investigation.

Management Strategies Discussion

Dalzell inquired as to what happened with PolyMelan.

Brown said it was initially an attempt to establish a multilateral arrangement, which Taiwan did not pursue. Moving beyond that initial purpose, the concern shifted to possible cooperation in the management of albacore, which brings us to today. Perhaps this meeting could steer participants in the direction of creating a formal arrangement for the development and conservation of albacore resources.

Langley asked about the FFA initiative for albacore. Mitchell replied that the FFA group is currently in the organization stage and determining its focus areas. He added his support of further discussion on the issues raised in this workshop.

Dalzell noted that one of the outcomes of this meeting was to determine areas to more closely focus on in the future. Issues include data and observers, particularly among neighboring fisheries. Despite the work involved in organizing such meetings, he believes there is value in bringing in not only FFA nations but also colleagues from American Samoa and the French Territories.

Mitchell commented that it is desirable to have the French territories involved and be able to contribute in a meaningful way, which raises the question of what legal issues might need to be addressed.

Dalzell said if those involved would like to meet again at a similarly informal level to exchange updates on fisheries and concerns, the group could just be called an informal association of the longlining nations of the South Pacific with a focus on albacore.

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Component		Comment	Proposed research
Biological parameters	Natural mortality (M)	Uncertainty regarding longevity (M assumed to be within 0.2–0.4).	Preliminary work currently being undertaken by OFP. Proposed additional research 2007–09 (CSIRO and SCIFISH).
	Growth parameters	Initial growth derived from otoliths (daily increments). Other growth studies using vertebrae, otoliths, and length data.	
	Maturity	Age-at-maturity based on current understanding of growth.	
Size monitoring		Fish size (length and weight) data provides information on growth and, in the framework of a stock assessment, information on recruitment, selectivity, and fishing mortality.	Ongoing port sampling and observer countries operating in most PICTs. Length frequency data provided by some DWFNs.
Relative abundance	CPUE indices	Catch and effort data from the Taiwanese DWLL fleet provides a key input to the current stock assessment.	Ongoing improvement to standardisation of CPUE data with the inclusion of oceanographic data. CPUE indices to be updated before the next stock assessment (2007). Explore methods to validate recent and historical catch and effort data from the Taiwanese longline fleet. In the future, there is potential to derive a relative abundance index from PICT CPUE data.
Tagging programme		Potential to provide information on growth, movement, age composition, exploitation rates and stock size. Many logistical and biological constraints associated with tagging of albacore.	Previous successful tagging projects have been limited to juvenile albacore. There is a need to develop a method to tag older, adult albacore. Potential for implementation of a tagging programme under the SCIFISH project (commencing 2007?).
Stock assessment		Last assessment undertaken in 2005 using MULTIFAN-CL.	Proposed to update current stock assessment in 2007. The assessment will include the updated CPUE indices and the addition of the most recent catch, effort, and size data (2004–06). Subsequently, the assessment would be updated as required.
Oceanography		Recent trends in albacore longline CPUE have been linked to seasonal and interannual variation in oceanographic conditions.	Continued analysis of oceanographic data to improve understanding of the dynamics of the domestic longline fisheries in the SP.
Fishery monitoring		Ongoing analysis of the performance of domestic LL fisheries and interaction with prevailing oceanographic conditions.	Ongoing, in the framework of the OFP National Tuna Fishery Status Reports to PICTs, principally those in the subequatorial waters of the South Pacific.
Fishery economics		There is a need to ensure economic viability of the domestic longline fisheries.	Formulation of potential economic reference points for domestic SP longline fisheries. This may include national and regional reference points.

Appendix 3 List of Acronyms (in alphabetical order)

CPUE – catch per unit effort

DMWR – (American Samoa) Department of Marine and Wildlife Resources

DWFN – distant-water fishing nation

EEZ – exclusive economic zone

EU – European Union

ETBF – Eastern Tuna and Billfish Fishery

FAD – fish aggregating device

FFA – Forum Fisheries Agency

FMSY – level of fishing effort that will generate maximum sustainable yield

GLM – generalized linear model

IATTC – Inter-American Tropical Tuna Commission

ISC – International Scientific Committee on Tuna and Tuna-like Species

IUU – illegal, unreported and unregulated (fishing)

MMR – Ministry of Marine Resources (Cook Islands)

MSY – maximum sustainable yield

MT – metric tons

NMFS-PIFG – National Marine Fisheries Service-Pacific Islands Fisheries Group

NMFS-PIFSC – National Marine Fisheries Service–Pacific Islands Fisheries Science Center

NMFS-PIRO – National Marine Fisheries Service-Pacific Island Regional Office

NOAA-OLE – National Oceanic and Atmospheric Administration-Office for Law Enforcement

PAFCO – Pacific Fishing Company

PICTs – Pacific Island Countries and Territories

PNG – Papua New Guinea

SPC-OFP – Secretariat of the Pacific Community's Oceanic Fisheries Program

SST – sea surface temperature

TAC – total allowable catch

TDMP – Tuna Development and Management Plan

TMP – Tuna Management Plan

VMS – vessel monitoring system

VPA – virtual population analysis

WCPFC – Western and Central Pacific Fisheries Commission

WFOA – Western Fishboat Owners Association

WPacFIN – Western Pacific Fishery Information Network

WPRFMC –Western Pacific Regional Fishery Management Council