

Fisheries and Aquaculture Reviews and Studies

MARINE FISHERY RESOURCES IN THE PACIFIC ISLANDS

by **Robert Gillett**

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ABBREVIATIONS AND ACRONYMS

ADB	Asian Development Bank
CMM	conservation and management measure
EEZ	exclusive economic zone
FAO	Food and Agriculture Organization of the United Nations
FFA	Forum Fisheries Agency
FSM	Federated States of Micronesia
MPA	marine protected areas
PNG	Papua New Guinea
SPC	Secretariat of the Pacific Community (formerly South Pacific Commission)
SPREP	South Pacific Regional Environment Programme
TMP	tuna management plan
WCPO	western and central Pacific Ocean
WCPFC	Western and Central Pacific Fisheries Commission

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catches of non-target species, the compilation of operational (logsheet) catch and effort data, data processing on behalf of member countries and territories, and the provision of technical support for port sampling programmes and observer programmes in member countries and territories.

The situation of coastal fisheries statistics is considerably different. For coastal fisheries, the quality of fisheries statistics furnished to the Food and Agriculture Organization of the United Nations (FAO) by national governments is generally not very good. In fact, the estimation of the production from coastal fisheries by government fishery officers in about half of the Pacific Island countries is largely guesswork. Typically, government fisheries agencies give low priority to estimating the amount of coastal catches. In general, the smaller the scale of the fishing, the less is known about the production levels, with quantitative information being especially scarce for the subsistence fisheries in most countries.

Main categories of fisheries in the region

Fishing activity in the Pacific Islands can be classified both by area in which the fishing is undertaken and by scale.

Coastal fishing is of fundamental importance in the Pacific Islands. Much of the region's nutrition, welfare, culture, employment and recreation are based on the living resources in the zone between the shoreline and the outer reefs. The continuation of current lifestyles, the opportunities for future development and food security are all highly dependent on coastal fisheries resources. Although dwarfed in both volume and value by the offshore tuna fisheries, the Pacific Island fisheries that are based on coastal resources provide most of the non-imported fish supplies to the region. Coastal fisheries harvest a very diverse range of finfish, invertebrates and algae. Unlike the tuna fishery, virtually all the coastal catch is taken by Pacific Islanders themselves, with very little access by foreign fishing vessels. Coastal fishing in the region can be placed mostly in three categories:

- Small-scale commercial fishing (also referred to as “artisanal”), which can be further broadly subdivided into those supplying domestic markets and those producing export commodities.
- Subsistence fisheries, which support rural economies and are extremely important to the region's nutrition and food security.
- The industrial-scale shrimp fisheries, which in the region only occur in Papua New Guinea.

Offshore fishing is undertaken mainly by large industrial-scale fishing vessels. Approximately 1 500 of these vessels operate in the exclusive economic zones (EEZs) of Pacific Island countries, mainly using purse seine, longline and pole-and-line gear to catch tuna. A fourth type of tuna fishing, trolling, is not undertaken on an industrial scale in the Pacific Islands, but some industrial tuna trollers are based in the region and troll in temperate waters to the south. The amount of tuna captured by offshore vessels in the region is many times greater than the catch from coastal fisheries. Offshore fishing in the region can be further subdivided into two categories:

- *Locally-based offshore fishing.* A survey carried out in 2008 (Gillett, 2008) showed that 269 longline vessels, 56 purse seine vessels and 2 pole-and-line vessels were based in the region. About 1 169 people from the Pacific Islands are employed on these tuna vessels.
- *Foreign-based offshore fishing.* Approximately 1 200 foreign-based vessels operate in the waters of Pacific Island countries. Although about 65 percent of the vessels are longliners, about three-quarters of the tuna catch is taken by purse seiners. Most foreign fishing vessels are based in Asia, while some United States-flagged purse seine vessels are based in American Samoa. The licence fees paid to Pacific Island countries by these foreign-based vessels is substantial and, in some cases, the major source of government revenue for some countries.

In 2009, the Asian Development Bank (ADB) estimated the fishery production in each Pacific Island country. All readily available sources of production information for each country were scrutinized to come up with a best estimate of national catches in the four fishery categories (Table 1).

Table 1: Marine fishery production in Pacific Island countries, 2007

	Coastal commercial	Coastal subsistence	Offshore locally-based	Offshore foreign-based	Total
Papua New Guinea	5 700	30 000	256 397	327 471	619 568
Kiribati	7 000	13 700	0	163 215	183 915
Federated States of Micronesia	2 800	9 800	16 222	143 315	172 137
Solomon Islands	3 250	15 000	23 619	98 023	139 892
Marshall Islands	950	2 800	63 569	12 727	80 046
Nauru	200	450	0	69 236	69 886
Fiji	9 500	17 400	13 744	492	41 136
Tuvalu	226	989	0	35 541	36 756
Vanuatu	538	2 830	0	12 858	16 226
Samoa	4 129	4 495	3 755	25	12 404
Tonga	3 700	2 800	1 119	0	7 619
Palau	865	1 250	3 030	1 464	6 609
Cook Islands	133	267	3 939	0	4 339
Niue	10	140	640	0	790

Source: ADB, 2009. Note: units = metric tonnes.

The six countries that have the most production have large tuna fisheries and, with the exception of Papua New Guinea, most of the tuna catch in those countries is taken by foreign-based vessels. Other notable features of the information in Table 1 are:

- there is a general pattern of decreasing total national catches going from west to east across the region, and from equatorial to higher latitudes;
- the relatively large contribution of offshore locally-based production in the Marshall Islands and, to a lesser extent, Fiji; and
- the relatively large contribution of non-tuna production in Fiji.

Figure 2 below shows that the production from the offshore fisheries is about nine times greater than the coastal fisheries (commercial and subsistence). It is easy to conclude that offshore fishing and the tuna resources upon which they are based are very important to the region.

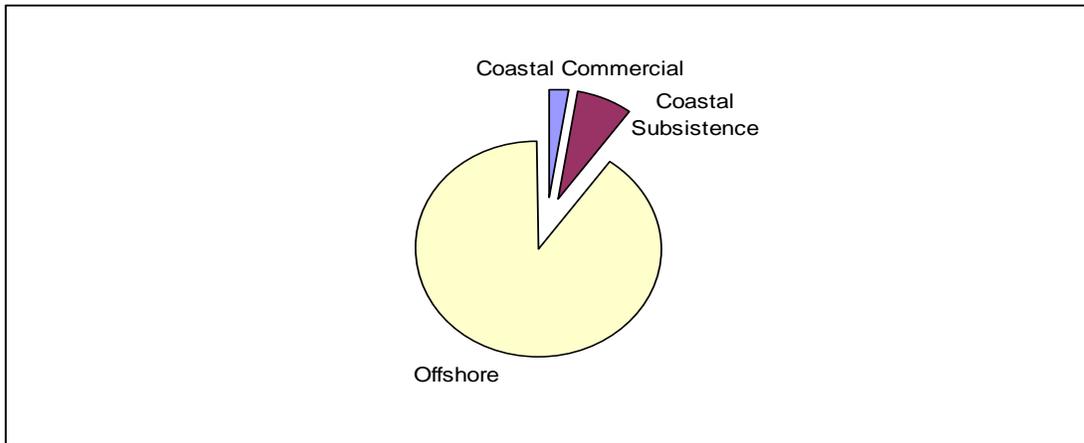


Figure 2: Marine fishery production by volume and by fishery category, 2007
 Source: Modified from Table 1 above

The region’s marine fishery resources can be broadly split into two main categories: coastal (or inshore) and offshore (or oceanic). Coastal resources include a wide range of finfish and invertebrates, while offshore resources are mainly tunas, billfish and allied species.

Coastal fishery resources

Profile of catches

There are considerable differences between coastal subsistence fisheries and the coastal commercial fisheries of the region. Table 1 above gives estimates of fisheries production for each Pacific Island country for 2007. Figure 3 takes the coastal fishing data from the table and shows the annual production by country graphically.

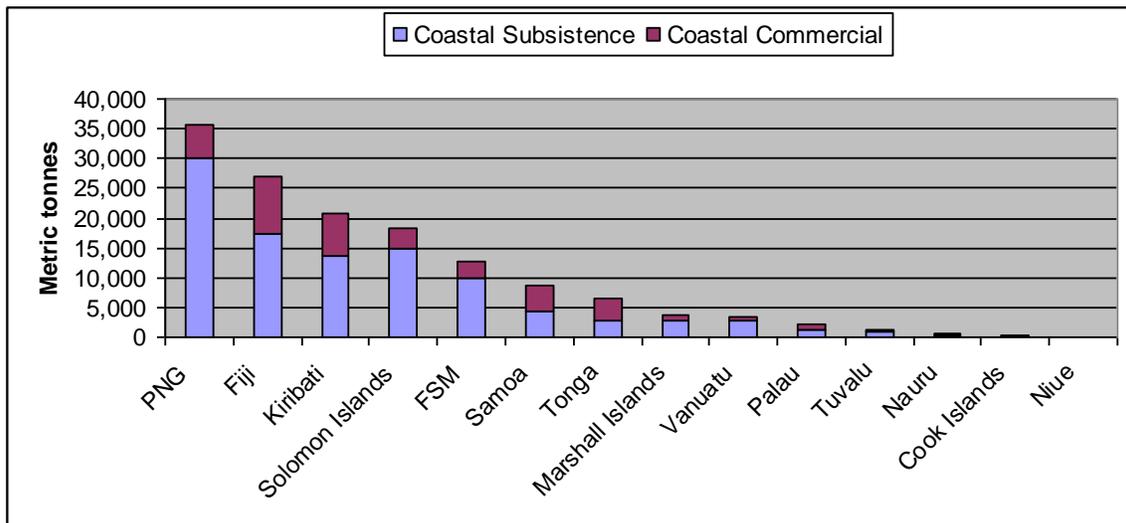


Figure 3: Coastal fishing production, 2007

About 70 percent of the overall fisheries production from coastal areas of the Pacific Islands is produced by subsistence fishing. In several countries, well over 80 percent of the coastal catch is from the subsistence sector: Niue, Papua New Guinea, Solomon Islands, Tuvalu and Vanuatu.

Subsistence fisheries generally involve a large variety of species, including fish, molluscs, crustaceans, algae and other groups. For example, Zann (1992) reports that in Western Samoa the subsistence fisheries make use of 500 species. In a study of coastal resources management in the Pacific Islands (World Bank, 2000), residents in coastal villages in five countries identified what they considered were their major coastal resources (Table 2).

Table 2: Resources that support subsistence fishing

Country	Groups of fishery resources (descending order of importance)
Fiji	Finfish, beche-de-mer, octopus, seaweed, lobster, mud crab and various bivalve molluscs
Tonga	Finfish, octopus, lobster, beche-de-mer, turbo, giant clams, seaweed and Anadara
Samoa	Finfish (especially surgeonfish, grouper, mullet, carangids, rabbitfish), octopus, giant clams, beche-de-mer, turbo, and crab
Solomon Islands	Finfish, beche-de-mer, trochus, giant clam, lobster, turbo and mangroves
Palau	Finfish, giant clams, mangrove crab, lobster, turtle and beche-de-mer

Source: World Bank, 2000

Dalzell and Schug (2002) review finfish that are important in small-scale Pacific Island coastal fisheries. They state that a typical fishery may harvest between 200 and 300 finfish species, although it is likely that only a few species will dominate landings. Approximately one-third of the coastal catch total is comprised of emperors (Lethrinidae), surgeonfish (Acanthuridae) and snappers (Lutjanidae).

Compared with the subsistence fisheries of the region, the coastal commercial fisheries are smaller and take a more restricted range of species, although it may still be substantial. For example, over 100 species of finfish and 50 species of invertebrates are included in Fiji's fish market statistics. Total commercial fishery products from the region include reef and deep-slope fish (about 43 percent of total weight), coastal pelagic fish (18 percent), shell products (trochus, green snail and pearl shell, 9 percent), crustaceans (8 percent), beche-de-mer (7 percent) and estuarine fish (6 percent).

It may not be appropriate to place the various types of coastal commercial fishing into discrete "fisheries", especially for the smaller-scale fishing. A single fishing trip often involves the use of several types of gear to make a range of catches. For example, Gillett and Moy (2006) state that during a multi-day fishing trip, spearfishers in Fiji characteristically collect beche-de-mer, trochus and lobster, and do some handlining in addition to the main effort of spearing finfish. Therefore, it is more suitable to discuss the various types of coastal commercial fishing in the region by primary target.

Shallow-water reef fish. In most of the Pacific Islands finfish found in relatively shallow water (< 50 m) are the basis of much commercial fishing. About 300 species representing 30 to 50 fish families comprise the majority of the catch. The main gears are handlines, spears and gillnets.

Beche-de-mer. About 20 species are currently exploited in the region, primarily for export to Asia. Recent annual production from Pacific Island countries is about 1 500 tonnes (dried, equivalent to 15 000 tonnes live weight). Villagers can process beche-de-mer into a non-perishable product which can be stored for extended periods awaiting opportunistic transport to markets. "Pulse fishing" is often used to describe the fishery – long cycles in which a period of intense exploitation is followed by a sharp fall in the abundance of the resource with associated difficulty in maintaining commercial exploitation and then a dormant period in which the resource is able to recover.

Aquarium fish and invertebrates. Aquarium fish collectors target a large number of species, with the major families being butterflyfish (Chaetodontidae), damselfish (Pomacentridae), surgeonfish (Acanthuridae) and angelfish (Pomacanthidae). Most aquarium species have the characteristics of relatively small size, bright coloration and good survival in captivity. Many operations also harvest and export invertebrates and

“live rock”. An appealing aspect is that aquarium fish are rarely taken for food in the Pacific Islands and therefore this fishery does not interfere with subsistence fishing activities.

Trochus. The topshell, *Trochus niloticus*, is commercially one of the most important shellfish in the Pacific Islands. Although the natural range of trochus is limited to the western part of the region, the gastropod has been transplanted to almost all Pacific Island countries. It is valued for the inner nacreous layer of the shell which, along with that of the pearl oysters and some other shells, is used for the manufacture of “mother-of-pearl” buttons. The annual harvest of trochus in the Pacific Islands in recent years has been about 2 300 metric tonnes, with five Pacific Island countries providing most of the harvest.

Live reef food fish. The live reef food fish fisheries typically harvest certain groups of fish in the tropical Indo-Pacific region and ship them by air or sea to Chinese communities in east Asia. Sadovy *et al.* (2003) indicate that in the main destination markets, the bulk of the trade consists of the groupers (Serranidae). Also taken are snappers (Lutjanidae), wrasses (Labridae), small numbers of emperors (Lethrinidae), sweetlips (Haemulidae), seabream (Sparidae) and members of a few other families. A variety of techniques and gears are used in live reef food fish fishing.

Lobsters. The commercial lobster fishery in the region is based on three species in the genus *Panulirus*. The largest fishery occurs in the Torres Strait of Papua New Guinea and targets the ornate spiny lobster (*Panulirus ornatus*). Smaller lobster fisheries, based mainly on the double-spined lobster (*P. penicillatus*), take place in many Pacific Island countries. The most common fishing method is by walking on reef flats and catching by hand at night.

Nearshore pelagics. Trolling for tuna and other large pelagics just outside the reef is practiced in most Pacific Island countries. Fiji, Kiribati and Papua New Guinea are likely to have the largest production from coastal trolling. The use of fish aggregation devices increases catches and reduces operating costs.

Deep-water bottom fish. The target of deep-water bottom fishing in the Pacific Islands is actually a number of fish species (mainly in the families Lutjanidae and Seranidae) which inhabit reef slopes and shallow seamounts between 100 and 400 metres. The most active export-oriented deep-water bottom fish fisheries in the Pacific Islands are presently in Fiji and Tonga.

Coastal fishery resource status and fishery management

In general, the coastal fishery resources are heavily fished and often show signs of overexploitation, especially in areas close to population centres and for fishery products in demand by the rapidly growing Asian economies. The coastal fisheries are also negatively affected by habitat degradation, which occurs from destructive fishing practices, urbanization, siltation from mining and logging, and competing uses of the coastal zone.

On a more detailed level, the degree of exploitation of coastal finfish is generally related to the distance from urban markets. The perishable nature of finfish has a limiting effect on fishing pressure in rural areas. By contrast, the products of commercial invertebrate fishing are mostly non-perishable. SPC (2008) states that most sites surveyed in the Pacific Islands are “seriously depleted of commercial invertebrate resources”. Another aspect of the status of invertebrate fisheries in the region is variability. Dalzell and Schug (2002) state that commercial harvests of invertebrates are characterized by boom and bust cycles, and in some cases the bust part of the cycle has persisted with no indication of recovery.

The management of coastal fishery resources in many Pacific Island countries is a mixture of several systems:

- *Traditional management.* This is most prevalent in rural areas and characteristically involves village leaders restricting the fishing by those outside the community and by various controls on fishing by community members.
- *Central government management.* All Pacific Island countries have a fisheries law giving wide powers to the government fisheries agency in controlling fishing activity. For various reasons, the system is mostly ineffective. There is some degree of success, however, in central governments applying point of export restrictions on those coastal resources which are exported.
- *The use of marine protected areas (MPAs) and similar arrangements,* whereby communities, with varying degrees of outside assistance, establish an area which is closed to fishing or is subjected to reduced fishing pressure.

Current coastal fishery management measures (both centrally administered and community driven) tend to be non-quantitative and are intended to protect stocks in a generalized way (Preston, 2008). These include MPAs, size limits (both minimum and maximum), gear restrictions (minimum mesh sizes for nets, bans on torch fishing at night), prohibitions on the use of destructive fishing methods (blast fishing, poisons), prohibitions on the taking of berried females, and seasonal or area closures.

Quantitative stock assessments have been carried out for only a few of the coastal fish stocks in the region, with deep-water bottom fish in Tonga being an example. Some fisheries are managed on the basis of trends in catch per unit effort or, more precisely, perceptions of such trends.

Many current management measures are in support of biological objectives. This is most often stock sustainability, i.e. prevention of resource collapses (rather than catch optimization). There is also management for purely economic objectives, such as encouraging in-country trochus processing. Cultural objectives, such as the closure of a reef to fishing after the death of a traditional leader to show respect, are also common.

Offshore fishery resources

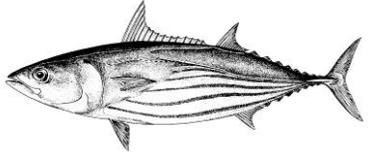
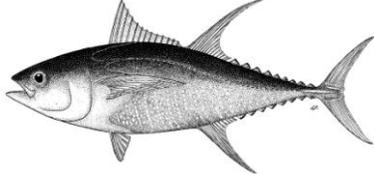
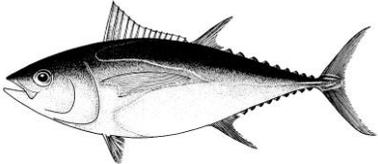
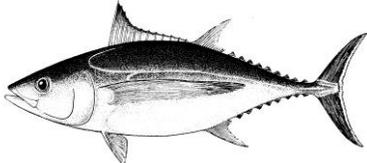
Profile of catches

Although several species of scombrids are found in the Pacific Islands area, four species of tuna are of major commercial importance: skipjack tuna (*Katsuwonus pelamis*), yellowfin tuna (*Thunnus albacares*), bigeye tuna (*T. obesus*) and albacore tuna (*T. alalunga*). Table 3 gives information on these fish in the WCPO.

Another important target of offshore fishing is swordfish (*Xiphias gladius*). This is caught by relatively shallow longline gear mainly in the subtropical parts of the WCPO. A few billfish species and some sharks are targeted by specific fisheries, but the usual situation is that they are bycatch in tuna longlining and, to a lesser extent, tuna purse seining. The common billfish are black marlin (*Makaira indica*), blue marlin (*M. mazara*), sailfish (*Istiophorus platypterus*), shortbill spearfish (*Tetrapturus angustirostris*) and striped marlin (*T. audax*). The most common shark caught is the blue shark (*Prionace glauca*).

In 2007, about 1.1 million tonnes of tuna was captured in the Pacific Islands region. Figure 4 gives the catch composition by species. Approximately 72 percent of the tuna catch in the region is taken by purse seining gear, with the remainder by longline, pole-and-line and troll gear. Almost 70 percent of the tuna catch in the EEZs of Pacific Island countries was made by vessels based outside the region. All Pacific Island countries received fees for foreign tuna fishing activity in their waters – the total access fee payments for the countries of the region for 2007 were about US\$77 million (ADB, 2009).

Table 3: The tuna species of major commercial importance in the region

Tuna species		Typical size captured	Important aspects
Skipjack		40 to 70 cm	Skipjack are caught mainly on the surface by purse seine and pole-and-line gear and used for producing canned tuna. Most fish caught are from one to three years old. In the WCPO, the skipjack biomass is greater than that of the other three main tuna species combined.
Yellowfin		40 to 70 cm and 90 to 160 cm	Small yellowfin are caught on the surface by purse seine and pole-and-line gear, while larger/older fish are caught in deeper water using longline gear. Small fish are used mainly for canning while high-quality larger fish are often shipped fresh to overseas markets. Most fish caught are from one to six years old.
Bigeye		40 to 70 cm and 90 to 160 cm	Small bigeye are caught on the surface by purse seine and pole-and-line gear, while larger/older fish are caught in deeper water using longline gear. Small fish are used mainly for canning while high-quality larger fish are especially valuable as fresh fish in the Japanese market. Most fish caught are from one to ten years old. Bigeye tuna account for a relatively small proportion of the total tuna catch in the region, but these tuna are extremely valuable.
Albacore		60 to 110 cm	Small albacore are caught by trolling at the surface in cool water outside the tropics, while larger fish are caught in deeper water and mainly at lower latitudes using longline gear. Most of the catch is used for producing "white meat" canned tuna. Fish caught are typically from one and a half to ten years old.

Drawings courtesy of SPC

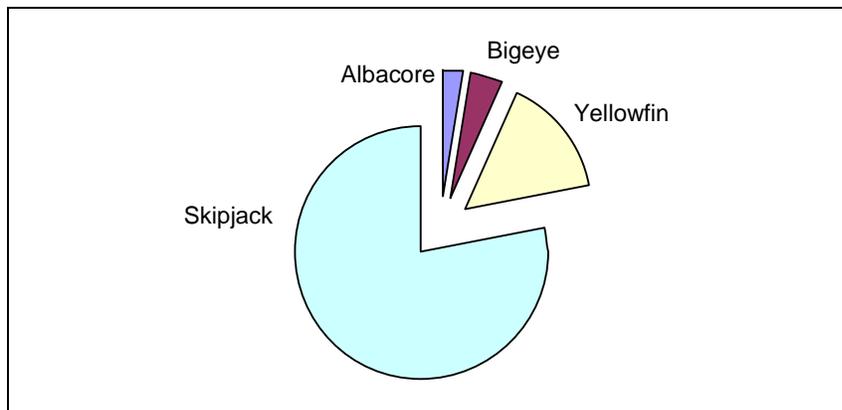


Figure 4: Composition of the tuna catch in the EEZs of Pacific Island countries

Source: FFA/SPC unpublished data

Offshore fishery resource status and fishery management

The management of the tuna resources in the Pacific Islands area is complex and involves political, resource and historical considerations. Current management occurs on the national, regional and international levels.

A general feature of *national level* tuna management in the region is the use of tuna management plans (TMPs). In 1998, the Canada-South Pacific Ocean Development Programme cooperated with the Forum Fisheries Agency (FFA) to produce a detailed TMP for the Solomon Islands. The Forum Fisheries Agency and Canada have subsequently prepared plans, on country request, for Fiji, Kiribati, Palau and Vanuatu. The ADB and Australia have also assisted in the formulation of TMPs for the Federated States of Micronesia (FSM) and Samoa, respectively. FFA has continued with this process using its own staff and has prepared TMPs for Niue, the Marshall Islands, Tokelau and Tonga. Recently, New Zealand has provided fisheries assistance that includes support for TMPs in the Cook Islands and in the Solomon Islands.

Currently, all Pacific Island countries have prepared national TMPs, and most have been formally adopted. Characteristically, the TMPs give a description of the current national tuna fisheries, the status of the tuna resources, overall government goals in the fisheries sector, specific objectives for the management of the fishery, and the interventions used to obtain the objectives. Tuna resource sustainability is often given as the priority objective in the TMPs. Other objectives are related to increasing employment, increasing access fees, and creating and/or enhancing domestic tuna fisheries.

At the *regional level*, there are a number of tuna fishery management arrangements in the Pacific Islands. All are promoted and coordinated by the FFA. The first measures, introduced in the 1980s and early 1990s, were:

- In licensing foreign fishing vessels, countries agreed to insist on the Harmonised Minimum Terms and Conditions for Foreign Fishing Vessel Access (e.g. use of a common regional licence form, requirement to carry observers if requested). These have been progressively added to over the years – and now encompass several types of measures, such as the use of vessel monitoring systems.
- Reciprocal fisheries law enforcement as per the Niue Treaty on Cooperation in Fisheries Surveillance and Law Enforcement in the South Pacific Region.
- Incentives to locally based industrial tuna vessels as per the Federated States of Micronesia Arrangement for Regional Fisheries Access.

The region's first conservation-oriented management move in the tuna fisheries was the Palau Arrangement for the Management of the Western Pacific Purse Seine Fishery, which entered into force in November 1995. The arrangement places a ceiling on the number of purse seine licences that can be issued by the seven Pacific Island countries party to the agreement. The limit was originally set at 164 vessels and has been progressively increased. For several years there has been discussion of modifying the Palau Arrangement so that purse seine vessel fishing days (rather than vessel numbers) are used as the basis for management. In May 2004 a subset of FFA member countries decided to adopt such a scheme and it has subsequently been progressively implemented.

In a general sense, the original thrust of regional tuna fishery management in the 1980s and 1990s was to increase foreign fishing access fees. This has been broadened in recent years to include domestic tuna industry development and resource sustainability. The latter objective overlaps somewhat with international fishery management efforts in the western and central Pacific Ocean.

At the *international level*, a management convention came into force in June 2004 establishing the Western and Central Pacific Fisheries Commission (WCPFC). The Commission adopts “resolutions” which are non-binding statements and “conservation and management measures” (CMMs) which are binding. As of mid-2009, a total of 26 CMMs have come into force.

In the December 2008 Commission meeting, a crucial CMM was adopted – which may increase the effectiveness of the WCPFC in its tuna management efforts. The objectives of that measure (CMM 2008–06) are:

- the implementation of a package of measures which, over a three-year period commencing in 2009, results in a minimum of 30 percent reduction in bigeye tuna fishing mortality from the annual average during the period 2001–2004 or 2004;
- ensuring that there is no increase in fishing mortality for yellowfin tuna beyond the annual average during the period 2001–2004 average or 2004; and
- adoption of a package of measures that shall be reviewed annually and adjusted as necessary by the Commission, taking account of the scientific advice available at the time as well as the implementation of the measures.

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