OVERVIEW OF PACIFIC FISHERIES AGENCIES AND INSTITUTIONS COLLECTING SHARK CATCH DATA

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Executive Summary

This report was prepared for the Western Pacific Fishery Management Council with the objective of providing a comprehensive directory of fisheries agencies and institutions around the Pacific Rim that are collecting information on shark catches from domestic and foreign fleets. The main focus of the report is on shark taken as bycatch in the major tuna fisheries operating in the Pacific region, principally pelagic longliners, but also includes information from those fisheries that target sharks.

A shark research and data holdings questionnaire was drawn up and distributed to corresponding Fisheries Departments and Institutions throughout the Pacific, with emphasis on the South Pacific and Southeast and East Asia. The questionnaire requested descriptions of their data holdings and some background information on the commercial fisheries operating under their respective jurisdictions for which there are significant shark catches (including distant-water fisheries). The requested information included:

- Principal species captured (target and bycatch)
- Fishing methods/gear used
- Seasonality
- Location of the fisheries
- Overview of fisheries statistics collected (logbook, port sampling, observer program, etc.)
- Spatial and temporal resolution of data
- Time series available
- Biological data being collected
- Processing fate of sharks (fins removed and carcass discarded; fins and trunk retained, etc.)
- Contact information for personnel working on shark research and data collection

The questionnaire was then followed up with extensive personal contacts which included in-country visits (e.g. Taiwan, Japan) and interviews with key personnel via phone, fax, and email communications. A total of 29 questionnaires were sent out to 16 different countries representing the major distant-water fishing nations (e.g. Japan, Taiwan and China) as well as key Pacific Island nations which have developed substantial commercial fisheries and/or rent out the fisheries resources in their respective EEZ's (e.g. Federated States of Micronesia and the Republic of the Marshall Islands). Assistance was also sought, and received, from the main data collection, research and management agencies operating in the western Pacific Ocean: the South Pacific Commission - Oceanic Fisheries Program and the South Pacific Forum Fisheries Agency.

Excellent cooperation was received from scientists and managers of the Fisheries Departments of Australia, New Zealand, Taiwan, the United States, the Federated States of Micronesia, the Republic of Marshall Islands, the Republic of Palau, Fiji and Papua New Guinea. Negative responses, in the sense of returning our messages and queries but declining to offer the requested information for a variety of reasons, were received from

Japan and Korea. In the case of Japan, shark catch has been a particularly sensitive issue recently and it is our belief that a more formal approach will be needed to seek their cooperation and assistance. It was also our belief that the type of approach was beyond the scope and mandate of the present contract. There was, however, indications from key personnel with the Japanese government, that cooperation could be extended given the proper assurances are in place.

In the case of Korea, follow-up contacts provided hints that cooperation was forthcoming but ultimately that cooperation never materialized. Other countries, China for example, were information 'black-holes' given the logistical (and language) constraints, and the limited scope of the contract in terms of travel funds and time to track down the pertinent contacts. Information, nonetheless, was obtained for these countries by accessing secondary and tertiary sources of information via our extensive network of contacts throughout the Pacific, many of whom were very knowledgeable of the basic fisheries infrastructure's for the countries in question.

It became apparent, both from the information we gathered, and from the recently completed works of TRAFFIC-International and the CITES-IUCN Shark Specialist Group Investigations, that reliable fisheries statistics on a species-specific level for sharks is a rare commodity throughout the Pacific Rim. In addition, many developing nations (e.g. China, Indonesia) have substantial layers of complexity and diversity in their domestic fisheries which makes adequate coverage and collection of shark catch, effort and landings data a difficult, and in some cases, unrealistic task.

In the case of shark bycatch taken by the major industrial tuna fisheries operating in the Pacific region, the majority of fishery-dependent catch records (logbooks) have been grossly inadequate in terms of reporting the actual levels of interactions. As such, 'logbook-independent' sources of information, such as dedicated Fisheries Observer Programs, have proven invaluable in the estimation of species composition, catch rates, mortality levels and various biological parameters for the principal species of sharks under exploitation.

Extensive information was gathered and summarized from the National Fisheries Observer Programs of Australia, New Zealand, the US, and the Federated States of Micronesia, as well as data collected by the SPC-OFP and FFA US Multilateral Treaty Observer Programs. Future research programs directed towards gathering the necessary data for shark stock assessment work can potentially be gathered, utilizing existing Observer Programs. In our extensive research of literature and data holdings it became apparent that there is a lack of priority for shark research in the region versus the effort exerted for target species such as the principal species of tunas.

There are some exceptions, however. Australia and New Zealand have the best documented and most intensively managed domestic shark fisheries in the Pacific region, with some of the best examples of species-specific shark stock assessments. For this reason, many countries, in particular developing Pacific Island Nations, that have

substantial catches of sharks within fisheries operating in their respective EEZ's, will do well to take a good look at the Australian 'experience' as an effective blueprint for future management.

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General Introduction

Recent investigations into the International Trade in Sharks conducted by TRAFFIC International (Rose, 1996) coupled with an Overview on the Impacts on the Biological Status of Sharks, pursuant to CITES Resolution Conf. 9.17 (Anon., 1997), have provided individuals and organizations interested in shark fisheries and research with detailed and up to date background information. The TRAFFIC report is comprehensive in the areas of domestic shark fisheries by country of origin and trade information, with particular reference to the global shark fin industry. The CITES report, on the other hand, focuses on the biological aspects (e.g. reproduction, migration) of the most commonly exploited shark species as well as providing excellent coverage of past and present resource assessment techniques and management strategies put in place to conserve over-exploited and depleted shark stocks.

Neither of these studies, however, is particularly comprehensive in terms of providing background information on one of the largest and expanding components of global shark catches, that is, shark bycatch from the industrial tuna fishing fleets. The present report attempts to synthesize available information, by country, for fisheries agencies and institutions in the South Pacific and Southeast and East Asia that are collecting information on incidental catches of tropical sharks caught by the principal gear types operating in Pacific tuna fisheries. Particular attention will be paid to sharks captured by pelagic longline vessels but information is provided for other gears as well (e.g. purse seine, gillnet), in addition to some ancillary data on domestic shark catches (both targeted and bycatch) within the countries mentioned.

Methodology

A Shark Data and Research Holdings Questionnaire (see Appendices) was drawn up and distributed to fisheries institutions and scientists throughout the Pacific Rim. The Questionnaire was accompanied, in most cases, by a Letter of Introduction (see Appendices) which detailed the nature of the information request and some background information on how the data will be used. The Questionnaire was then followed up with extensive personal contacts which included, among other things, in-country visits (e.g. Taiwan, Japan) and interviews with key personnel via phone, fax, and email communications. An extensive review of available literature, both published and gray literature, was conducted and pertinent information condensed and summarized for inclusion in the report. As such, the report benefitted greatly from the recent TRAFFIC and CITES publications as well as a global review of shark fisheries previously conducted by Bonfil (1994). Another invaluable source that was utilized for the report was the recently completed SPC Internal Document on Bycatch and Discards in Western Pacific Tuna Fisheries (Bailey et al., 1996) for which one of us (C. Heberer) was a collaborator and data contributor.

Before presenting the specific country by country summaries, an overview of the major tuna fisheries operating in the Pacific ocean is presented along with an outline on the fisheries management regimes operating in the area as well as the institutional arrangements currently in place for cooperative scientific research. It is important to have a clear understanding of these regimes and arrangements since any future regional shark research and/or management regulations will no doubt be undertaken within the current frameworks. Since the majority of the shark catch is taken as bycatch within the industrial tuna fisheries of the central and western Pacific, emphasis on the extent of these fisheries, on a country by country basis, will be provided. With this in mind, present and future data concerning species composition and catch rates for the principal shark species being exploited can be put into context of the overall catch and effort being exerted by these tuna fisheries.

Tuna Fisheries of the Pacific Islands Region

Fisheries in the Pacific region relevant to this report are dominated by the industrial harvesting of tuna, the value and volume of which far exceeds those of other fisheries. The majority of the tuna effort is concentrated in the highly productive west-central Pacific Ocean area that encompasses the EEZs of (from west to east) Indonesia, Palau, Federated States of Micronesia, Papua New Guinea, Solomon Islands, Nauru, Marshall Islands, and Kiribati, as well as the high seas areas adjacent to these zones.

The regional tuna fishery in the area of the South Pacific Commission, the "SPC Statistical Area" (see Appendices) targets the principal market species of tuna (skipjack, yellowfin, albacore and bigeye) whose catches have more than doubled between the years 1976 and 1986, from about 302,000 metric tons to over 624,000 metric tons. The following decade saw a further increase to over 1 million metric tons in 1991 with catches slightly below that level ever since. The total catch for 1995 has been estimated at 958,000 metric tons (Lawson, 1996). In addition to these figures, the domestic tuna fisheries of the major fishing nations of Asia contributed over 633,000 metric tons: Japan, 279,000 mt , Philippines 56,000 mt, Indonesia 270,000 mt (Nambiar and Krishnasamy 1996)[1] and Taiwan 28,000 mt (TFB 1996).

The major fishing gear type in terms of catch weight is purse seine. In addition to domestic fisheries in the Philippines and Indonesia which are mainly involved in fishing on "payao" or anchored rafts, the purse seine fleets of the major DWFN's and those Pacific Island nations that have domestic fisheries in place (e.g. FSM, PNG, Kiribati) catch from 700,000 to 800,000 metric tons per year in the SPC Statistical Area. The main catch consists roughly of 70-80% skipjack and 20-25% yellowfin, with a smaller component of immature bigeye.

Longline fishing targets mainly deep swimming tunas, bigeye and yellowfin for sashimi, and albacore for primarily canning markets. It accounts for annual catches of 110,000 to 150,000 mt

[1]Figures are for 1994

in the region. In addition to the more traditional distant water fleets of Japan, Taiwan and Korea have been added locally-based fleets in Pacific island countries using both domestic and foreign vessels. The shark bycatch in longline fisheries is a significant component of the overall bycatch captured by Pacific tuna fisheries and as such, the present report will focus primarily on this gear type.

Pole and line fishing has declined over the years, and is now limited to domestic Japanese, Indonesian, Fijian and Solomon Islands fisheries, with the Japanese possessing the only long range fleet. The major target species is skipjack, with catches on the order of 60,000 to 100,000 tons per year. Pole and line fisheries are one of the 'cleanest' fisheries in operation in terms of bycatch, and in particular, shark bycatch. For this reason, the present report will deal mainly with purse seine and longline gear types when discussing shark bycatch.

The only significant trolling fleet operating in the region is the albacore fleet which operates in the southern convergence zone around 40°S. This is mainly a high seas fishery, with highly fluctuating production from 3,000 to around 10,000 tons annually. As with the pole and line fishery, there is insignificant amounts of bycatch and hence almost no published records for shark bycatch.

Fishery Management Regimes

Distant water fishing nations active in the region all license and control their own flag vessels to some extent. At one end of the spectrum is the highly regulated Japanese distant water fishery where licenses specify, among other things, vessel size, areas of operation allowed, and numbers of vessels permitted. Requirements include an obligation to report catches and activity back to the home country. At the other end are the mainland Chinese, and perhaps one or two others who are encouraging deployment of their vessels to overseas bases for economic reasons and minimize regulatory measures that might otherwise govern the activities of those vessels in their own coastal waters or EEZ.

Commercial interests in several countries continue to operate vessels under open (i.e. flag of convenience) registries, although the practice seems to have diminished in recent years. A few Korean and Taiwanese controlled longliners and purse seiners continue to operate under these conditions however the trend is more towards flagging in their true home countries.

All foreign fishing vessels operating in the region of the Forum Fisheries Agency (FFA) member states must register with that organization and be placed on the Regional Register. Domestic vessels registered in FFA countries which seek permits to operate in other FFA countries must also register. All FFA countries have agreed not to license vessels which do not appear on the Register. The mechanism of maintaining "good standing" on the Register assists management and enforcement by ensuring compliance by such vessels. A vessel can be withdrawn in situations such as the commission of a serious fishery offense, even if the vessel is not apprehended. Such an action would effectively prohibit the vessel from being licensed by any other member FFA country, and prevent its legal fishing anywhere in the region.

The most institutionalized of all coastal states' resource management regimes occurs in the FFA region where agreed "Harmonized Minimum Terms and Conditions for Foreign Fishing Vessel Access" (MTCs) exist. The MTCs, last revised in April, 1990, are supposed to be incorporated into all access agreements and gradually incorporated into national legislation. They include the subjects of:

uniform vessel identification
catch and position reporting
specific transshipment requirements
standard catch and effort logsheets
carriage of observers
appointment of agents
foreign fishing vessels in transit
flag state or fishermen's association responsibility.

The FFA countries most affected by DWFN tuna fisheries banded together in 1982 under the Nauru Agreement Concerning Cooperation in the Management of Fisheries of Common Interest to further their goals in managing fisheries under their jurisdiction[2]. Subsequently, in 1992 these same countries enacted an "Arrangement for the Management of the Western Pacific Purse Seine Fishery" (the Palau Arrangement) which gives preference to vessels from member countries and sets out a specified, but movable, ceiling on the number of tuna purse seiners which may be licensed to operate in the region, allocating such license numbers among DWFNs.

Later, in 1995 the same countries enacted an Arrangement for Regional Fisheries Access (the Federated States of Micronesia Arrangement) which sets forth the requirements of member countries to gain preferential access to each others' zones and further promotes cooperation among the parties.

Institutional arrangements for scientific research

The monitoring of the regional tuna fishery is done mainly through the auspices of the Oceanic Fisheries Program (OFP) of the South Pacific Commission, headquartered in Noumea. The Program has been made the major depository for catch and effort data provided by both domestic and DWFN vessels which provide required catch and effort data to licensing authorities as part of their licensing conditions. This logsheet data is in addition to other data collected through port samplers stationed at key transshipment ports or canneries in the region which serve to collect offloading data as well as help verify logsheet data provided by vessels.

The SPC-OFP has been running an observer program since 1995 (earlier trips were through existing observer programs) that places OFP observers onboard the major DWFN's as well as

[2]Parties to the Nauru Agreement (PNA) are Palau, Federated States of Micronesia, Marshall Islands, Kiribati, Solomon Islands, Tuvalu, Nauru, and Papua New Guinea

providing training and institutional support for National Observer Programs of SPC member countries (Kiribati, Palau, PNG, FSM, RMI and the Solomon Islands). The SPC and the FSM observer programs provide the majority of the 'logbook-independent' bycatch records for the major DWFN's operating in the western Tropical Pacific Ocean. Information concerning the FSM Observer Program will be covered under the country section for FSM. A list of tuna longline observer trips carried out by the SPC Observer Program is presented in Table 1.

Table 1. Longline Observer Trips - SPC Observer Program for the period 1993-1996

Country Where Vessel Based	Flag of Vessel	No. of Trips
Cook Islands	Cook Islands	2
Fiji	Fiji	4
Fiji	Taiwan	1
Fiji	United States	1
French Polynesia	French Polynesia	1
Marshall Islands	Chinese	8
New Caledonia	New Caledonia	9
New Caledonia	Japan	3
Palau	Taiwan	2
Solomon Islands	Japan	2
Tonga	Tonga	2
Total		**35**

Source: Peter Williams, SPC-OFP Database Manager

It is important to realize that the OFP operates as a non-political body dedicated to research within SPC. Data is provided in confidence and, unless authorized by the provider of that data, it may not be released in its raw form to any third party[3] (e.g. logbook and observer data pertaining to shark catches in member nation EEZ's).

The OFP also manages the Standing Committee on Tuna and Billfish, and assists others such as the Yellowfin Research Group and the South Pacific Albacore Research Group. The members of these groups participate as individuals and meet on an ad hoc basis as required. Their basic function is to examine current research being undertaken, and to make recommendations on the

[3]FFA may obtain access to the data, however it is in condensed form and omits critical features that might allow analysis of an individual vessel's data.

direction of tuna research or management requirements to SPC and FFA. These scientific committees have their own aggregated databases which may be restricted. The SPC, FFA and other regional institutions and fishery management bodies are well placed to institute and carry out any future regulations and management actions in regards to shark bycatch.

Shark Bycatch in Tuna Longline Fisheries of the Pacific

The issue of shark bycatch in longline fishing has become a particularly sensitive subject in both the scientific and commercial fishing communities at this point in time due to various factors. On the surface is the vulnerability of the majority of shark stocks to over-exploitation and their slow recovery to sustainable levels given their unique life history traits. These traits include a k-selected life history (i.e. low birth rates, high survival rates among offspring, and prolonged development), apparent sexual segregation in their distribution and abundance, the potential negative effects of a decreasing food supply and wide spread nursery destruction (Holden, 1977; Nakano et al. 1985; Stevens, 1992). Catches of sharks in the Pacific has shown a continual upward trend over the past few decades mainly as a result of the increased effort (including expansion of fishing areas) and catches by the industrial tuna fleets, development of markets and target shark fisheries, improved logbook reporting, and the increased demand and higher prices being paid for shark fins.

In addition to concerns over their long term sustainability, there has been concern expressed from many sectors, both public and private, regarding the practice of shark finning and the subsequent discards of the carcasses back to the ocean. There are very few fishery-independent records demonstrating the levels of shark finning in the tuna longline fishery but what is available suggests that a high percentage of the shark bycatch is finned (>75%) with industry sources placing the amount of fins shipped to the principal market in Hong Kong at 50 million pounds annually (*Nat. Fish. Sept. 1996*).

After target tuna catches, shark catches are the predominant component of the mixed species catch for many tuna longline fisheries throughout the Pacific. In the western Pacific Ocean, for example, shark species account for the highest category of bycatch observed in both the tropical fisheries, where they comprise about 27.2% of the total bycatch, and in the subtropical fisheries where their numbers represent 17.9% of the total bycatch (Heberer, 1997; Bailey et al., 1996).

Shark Bycatch: Observer Data vs. Logbook Data

The quantity of sharks taken as by-catch by tuna fisheries in general is not known. However it is thought to be considerable, particularly in longline and some purse seine fisheries. Several reasons for the poor data available on both by-catch and discards in tuna fisheries are evident to those familiar with management of the fisheries concerned. Vessel logsheet data usually doesn't provide good detail because the main priority in the past has been to obtain data needed for stock assessment of the major target species.

It is generally recognized that filling out logsheets by captains or others is usually an unwelcome chore. With getting any good data from logsheets often difficult, it is not surprising that

authorities have concentrated on improving data collection which reflects the main scientific and management priorities. A further, perhaps more recently developed reason has been that vessel operators who are already reluctant to report details of their operations are even more reluctant to report or discuss events and practices which may have negative repercussions on them and their livelihood.

Logsheet reporting of bycatch and discards from vessels engaging in purse seine fisheries is generally considered very poor. Less than 1% of the more than 70,000 purse seine sets carried out between 1975 and 1991, and for which logsheet data is held by SPC, report any bycatch, whereas observer data indicates that most sets have some level of bycatch (Bailey et al., 1996). It is felt that logsheet reporting of bycatch and discards in general is worse for longline than for purse seiners. As a result, Fisheries Observer Programs are viewed as one of the primary vehicles for independently assessing the levels of bycatch in Pacific tuna fisheries.

The available Fisheries Observer data sets, which highlight shark catch in selected tuna longline fisheries are presented below in Table 2. It should be noted that the observer coverage rate, for both the domestic and foreign distant water fleets operating in the Western Tropical Pacific Ocean, is very low (~0.3% of all trips for 1994-1996, Williams, pers. comm.) which makes fleet-wide extrapolation of bycatch levels based on current data holdings very tenuous at best. The information presented below is given primarily to provide a comparative view of aggregated shark catch composition in various tuna longline fisheries.

Blue sharks, *Prionace glauca*, comprise by far the most abundant and ubiquitous component of the shark catch in the Pacific-wide tuna longline fishery. Markets for blue shark meat are virtually non-existent but a strong market does exist for the fins and as a result almost all blue sharks are finned and the trunks discarded. Bonfil (1994), provides a figure of 6.2 million to 6.5 million blue sharks taken annually by high-seas fleets of all types (not just longline) from around the world. Using extrapolated logbook data on total hook-effort in the Pacific-wide longline fishery, coupled with fishery independent catch rates converted from numbers to weights, Stevens (pers. comm.) suggests that the 1994 catch of blue sharks may have exceeded 137,000 metric tons.

Table 2. Observer and logbook records of shark catch and percent composition of total catch in various tuna longline fisheries

Author	Effort	Area	Total Catch No.	Shark Catch No. (%)
Anon. 1996	n/a	Central Pacific - Hawaii	n/a	101,773 (n/a)
Williams, P.G. 1996	97 sets JP & domestic LL	Western Sub-Trop. Pacific Ocean	11016	1,970 (17.9%)
Williams, P.G. 1996	465 sets TW, JP, CH & domestic LL	Western Trop. Pacific Ocean	11611	3,158 (27.2%)
Francis, 1996	355 sets domestic LL	New Zealand EEZ	20467	8,602 (42.0%)

Hoey, 1995	5,000 sets JP LL & 1,500 US LL	Western Atlantic, Gulf of Mexico & Caribbean	432904	87,691 (20.3%)
Lopez, et al., 1978	167 sets JP LL	Gulf of Mexico	8237	638 (7.8%)
Ward, P.J. 1996	n/a	Australian Fishery Zone	2926679	~4,800 (16.2%)
Ward, P.J. 1996	171 sets JP LL	NE Australian Fishery Zone	17990	898 (5%)

Legend: Total catch = catch, in numbers of individuals, of all species (i.e. target and bycatch).

Shark catch (%) = catch of all sharks and their percentage of total catch.

Western Tropical Pacific Ocean refers to a fishing zone in the Western Pacific Ocean bounded by 10 North and 10° South Latitude and by 125° East and 120° West Longitude.

Western Subtropical Pacific covers an area 10°South to 35° South and the area north of 15° North (same longitudes).

Western Temperate Pacific covers an area 35°-45° South (same longitudes).

The Hawaii tuna and swordfish longline fishery has a large bycatch of blue sharks with logbook records for 1995 showing catches of 95,312 blue sharks (M. Laurs, pers. comm.). Observer records from the Australian tuna longline fishery for 1994 demonstrate an AFZ-wide blue shark catch of 7,363 animals based on roughly 1.2 million hooks observed of the 7.3 million hooks of total effort in the fishery for 1994 (Ward, pers. comm.). Observer records from the New Zealand tuna longline fishery indicate a substantial bycatch of blue sharks with a raised effort of 2,455 sets (observed effort of 335 sets) from the NZ domestic fleet (50-60 vessels) producing a raised catch of 45,082 animals in 1995 of which nearly all were finned and discarded (Francis, 1996). A summary of some recent reports presenting quantitative data concerning blue shark catch in tuna longline fisheries is given below in Table 3.

Table 3. Estimates of blue shark catch composition, catch-per-unit-effort and survival and discard percentages from selected tuna longline fisheries in the Pacific

Reference	Effort sets/hooks	No. Caught	Percent of Total	CPUE	Percent discard	Percent alive
Anon. 1995	13,538 sets	95312	n/a	7.04	68.1	n/a
Williams, P.G. 1996 (WTP)	577,143 hk (465 sets)	808	7.0%	1.40 (1.74)	77	87
Williams, P.G. 1996 (WSP)	135,575 hk (97 sets)	1532	13.9%	11.3 (15.79)	83	91
Francis, M.P. 1995	335 sets	6152	30.1%	18.36	71(a)	62(b)
Hoey, 1995	170 sets	4955	44.7	29.15	64(c)	34(d)
Nakano, et al. 1985	436 sets	12504	n/a	28.68	n/a	n/a
Ward, P.J. 1996a	1.2 mil. hk	7373	2.9%	6.14	90	82

Legend: Effort in sets and/or hooks (hk) with cpue in numbers per set and/or numbers per 1,000 hooks.
a = includes sharks finned and the trunks discarded as well as whole shark discards.
b = does not include 29% of landed sharks that were classified as condition unknown.
c = includes discards for all species pooled.
d = does not include those animals landed alive and retained for sale and/or personal use.

Shark Bycatch Reduction and Mitigation Efforts

In response to concerns of over-exploitation of coastal and pelagic shark resources, and to address the practice of shark finning, there have been several management and/or regulatory measures instituted in various tuna longline fisheries. A complete prohibition of shark finning, without utilization of the whole carcass, was instituted in the Australian tuna longline fishery in 1991 (Ward, 1996). The western Atlantic US longline fishery has been under a shark management plan since 1993 (Anon., 1993) that puts a 2,570 ton cap on the commercial take of sharks and limits the practice of shark finning to a quantity not to exceed 5% of the landed carcass weight (Branstetter, pers. comm.). There has also been considerable discussion about the extent of movement and the magnitude of foreign captures for stocks of US Atlantic large coastal sharks (e.g. sandbar sharks, *Carcharhinus plumbeus,* between the US and Mexico fisheries, and what effect that has on population recovery efforts and unilateral quotas placed on US fishermen (Branstetter, pers. comm.).

In the Pacific there is currently no management plan in effect for any shark species and no ban on shark finning in the longline fishery (excluding regulations in place in Australia). A few major US Conservation Organizations (e.g. Defenders of Wildlife, the National Audubon Society) are lobbying to have selected shark species placed on the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) list for protection. There are no shark species currently listed on any of the Appendices to CITES (J. Perrine, pers. comm.)

In the following chapters, information on domestic and foreign shark fisheries (both directed and as bycatch in tuna fisheries), along with data collection procedures, pertinent management and research activities, contact personnel and selected references are presented on a country by country basis. References pertaining to given fisheries are placed, for convenience, at the end of the section for the fishery in question and then again in the General Reference section at the end of the report.

AUSTRALIA

Introduction

Australia has a 36,000 km coastline covering a broad range of climates from equatorial zones at about 10°S to cool temperate zones at about 45°S. The 200 nautical mile Australian Fishing Zone, which includes some offshore reefs, banks and seamounts, as well as Lord Howe and Norfolk Islands covers some 9 million km². The Australian continent is bordered by three oceans: The Pacific, the Indian, and the Southern Ocean. The marine fauna is influenced by two major warm currents and one cold current, the West Australian Current. The warm currents seasonally bring tropical species into more southerly latitudes. Sharks and rays are widely distributed throughout most habitats of the region (Peter and Last, 1994).

The Australian chondrichthian fauna is extremely rich with approximately 296 species, of which, 54% are endemic to Australia. Of the shark fauna, 48% of the species are endemic, 29% are widespread, 21% are Indo-Pacific or Pacific, and 2% have Australasian distribution. Almost a half of Australian sharks are demersal on the continental slope; of the rest, 20% are demersal on the continental shelf, 15% are pelagic on the continental shelf, and 8% are oceanic (Peter and Last, 1994).

Domestic Fisheries

Southern Australia

In the Australia region, sharks are used principally for food with an estimated 7,000 tons of shark landed annually (Stevens and Last, 1994). Almost all shark landed in Australia is used for domestic consumption, much of it sold in Victoria under the marketing name of 'flake' and used primarily in the 'fish and chips' trade. The largest in terms of catch is the southern shark fishery which traces it's root back to the early 1920's and targets mainly school shark, *Galeorhinus galeus*, and the gummy shark, *Mustelus antarcticus*. Current yearly catches average about 3,000 tons (carcass weight) with fishing taking place off of Victoria, Tasmania and South Australia.

Up until the 1960's, shark fishers used longlines up to 10 km. long and took mainly school sharks. In 1964 gillnets were introduced in the fishery and by the early 1970's, most of the catch was taken by this method. This step, coupled with the 1972 banning of the sale of large school sharks in Victoria because of their mercury content, led to gummy shark replacing school shark as the dominant species in the Southern Shark Fishery catch. Today, gummy sharks and school sharks are of equal importance in the catch, most of which is taken by specialist shark fishers. The gear consists mainly of 6-7 inch monofilament gillnets with some sharks taken in the Tasmanian fishery using longlines.

Small quantities of school sharks are taken in southern Australia as a bycatch of fish trawling. For example, in 1989-90, 10 tons were recorded as landed catch from the South East Fishery. Significant bycatches in the Southern Shark Fishery are centered around 2 species of saw sharks, *Prisitophorus cirratus* and *P. nudipinnis*, and the elephant fish, *Callorhynchus milii*. Over the past 20 years the annual catch of saw sharks has fluctuated between 44 tons and 325 tons, and that of the elephant fish between 4 tons and 119 tons.

Management of the Southern Shark Fishery is shared by both the Commonwealth and the governments of Victoria, Tasmania and South Australia. It is directed towards the total shark stock and no distinction is made between species. Management controls have been based on several strategies: a closed fishing season during October or November, the months prior to sharks giving birth; legal maximum and minimum lengths of marketed shark (the former to reduce the average mercury concentration in the catch and the latter to protect young sharks); a legal minimum gillnet mesh size; reductions in the amount of gillnet used; and the closure to fishing of inshore areas around Tasmania (to protect new-born and young sharks).

Type of Data Collected: The domestic shark fisheries all have a very general compulsory logbook with the data entered into the Shark Monitoring Fishery Database's which records weight and days fished but doesn't give detailed effort data. There is also a research logbook which provides more detail - but this is voluntary. Port Sampling data is collected opportunistically and may be available by State of landing to include dressed weights (carcasses) by species.

There is no observer program or port sampling is carried out on a regular basis, however, there is onboard coverage by fisheries staff on an ad hoc basis for research purposes.

Time Series Available: Catch and Effort Statistics as well as periodic research cruise data compiled and summarized from period 1964 till the present.

Publications: Not published but available upon request (e.g. data used by Southern Shark Fishery Assessment Group).

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Western and south-western Australia

Commercial exploitation of sharks in Western Australia commenced in 1941 and by 1949 the catch was beginning to be significant. Fishing activities expanded considerably between 1950 and the early 1970's. Concern about mercury levels in sharks caused a drop in fishing effort and catch between 1972 and 1976. Shark fishing resumed its expansion from then into the early 1980's. Western Australian vessels currently land about 1,200 tons of whiskery sharks, *Furgaleus macki*, gummy sharks, and dusky sharks, *Carcharhinus obscurus*. Whiskery sharks are also taken as an incidental catch on demersal otter trawlers on the continental shelf off South Australia where they are caught in waters deeper than 100 m. Bottom set longlines were the main gear used to catch sharks in Western Australia until the early 1960's, when monofilament gillnets were introduced. Bottom set gillnets, longlines, handlines and droplines are the main methods used in the fishery today. Gillnets take most of the catch and individual gillnets can vary in length from about 100 m to nearly 3 km.

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Northern and eastern Australia

Currently in the tropical Queensland and Northern Territories area, domestic fishermen utilize drifting longline and gillnet gear to catch up to 500 tons of sharks consisting mainly of Australian blacktip, *Carcharhinus tilstoni*, and spot-tail sharks, *C. sorrah.* A development plan is in place to encourage Australian participation in the Northern Shark Fishery which is managed by the Commonwealth of Australia. Restrictions on net length, mesh size and areas also apply.

A domestic longline fishery for tunas has existed off south-eastern Australia since 1954. It expanded rapidly during the 1980's when professional longline fishers successfully airfreighted fresh yellowfin to sashimi markets in Japan. Longlining occurs in coastal waters (generally within 60 nautical miles of the continental shelf) of New South Wales and southern Queensland. Domestic longliners catch variable quantities (300-800 tons per year) of yellowfin off the east coast. Other commercially important species include bigeye tuna, *Thunnus obesus*, and broadbill swordfish, *Xiphias gladius*. While there exists anecdotal information concerning the catch of non-target species associated with the domestic longline fishing operations, there is very little quantitative data available for use in management decisions. Domestic tuna longline vessels reportedly catch primarily mako and requiem sharks and hammerheads, with smaller bycatches of tiger and thresher sharks.

As with other longline fisheries throughout the Pacific, fisheries observer records appear to provide the only reliable means of documenting the catch rate and composition for non-target species captured by the domestic longline fishery. Table 4 provides a summary of target and non-target catches from observer records gathered during 11 separate trips onboard Australian domestic longline vessels operating off of Northeastern Queensland during October - December, 1995. A total of 44 fishing days were observed during which time 73 sets and 22,712 hooks

were deployed. Sharks comprised approximately 14% (199 out 1,468 records) of all fish captured during the surveys.

The survey was limited to vessels fishing within a region known as Area E off the northern Queensland coast - outside the Great Barrier Reef Park. Longliners in this area are restricted to deploying a maximum of 500 hooks. This restriction is to help reduce effort and minimize the bycatch and kill of billfish - particularly black marlin as there is an internationally recognized game fishery for black marlin in the Cairns region.

Table 4. Total species catch composition and life status (sharks) from domestic longline survey off north-eastern Queensland October-December, 1996

Species	Count	Alive	Dead
Yellowfin Tuna	538		
Bigeye Tuna	246		
Black Marlin	216		
Sharks (Unid. commercial)	60	56	3
Thresher Shark	38	18	21
Oceanic White Tip shark	37	34	2
Dusky Shark	26	3	23
Blue Whaler Shark	16	1	15
Silky Shark	9	4	3
Sandbar shark	3	3	--
Crocodile Shark	2	2	--
Tiger shark	2	2	--
Shortfinned Mako	2	1	1
Longfinned Mako	2	--	--
Hammerhead Shark	1	--	1
Unknown Fish	6		
Others	263		
Total	1467		

Source: (Campbell et al., 1996)

Table 5 provides a summary of target and non-target catches from observer records gathered during 4 trips onboard Australian domestic longline vessels operating off of Northeastern Queensland during May - August, 1996. A total of 34 fishing days were observed during which time 36 sets and 20,493 hooks were deployed. Sharks comprised approximately 6% (79 out 1,229 records) of all fish captured during the surveys.

Table 5.Total Species Catch Composition and Life Status (Sharks) from domestic longline survey off north-eastern Queensland, May - August, 1996

Species	Count	Alive	Dead
Yellowfin Tuna	451		
Albacore	140		
Bigeye Tuna	85		
Dusky Shark	39	28	11
Broadbill Swordfish	37		
Silky Shark	11	9	2
Blue Whaler Shark	9	9	0
Unknown Fish	8		
Tiger shark	6	6	0
Thresher Shark	4	2	2
Oceanic White Tip shark	3	3	0
Shortfinned Mako	3	2	1
Sharks (Unid. commercial)	2		
Hammerhead Shark	1	1	0
Dog Shark	1	1	0
Black Marlin	0		
Sandbar shark	0		
Crocodile Shark	0		
Longfinned Mako	0		
Others	800		
Total	1600		

Source: (Campbell et al., 1996)

Type of Data Collected: The vessels keep logbooks which are sent to the Australian Fisheries Management Authority (AFMA). The logbook requests fishers to record information for the following shark species: Bronze Whaler, Blue Whaler, Mako, Blacktop, Tiger, Hammerhead. Information includes the number of fish kept (and estimated weight) along with the number of fish discarded. However, the quality of this data is unverified and most likely not good (B. Campbell, pers. comm.).

How Stored: All logbook data is punched by AFMA and used for management and scientific purposes. CSIRO gets a copy of all tuna and longline data for research purposes. The data is not generally available due to confidentially requirements. Summary data is given in reports etc.

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Foreign Fisheries

Taiwanese gillnetters and longliners

Directed commercial fishing for sharks by foreign fishing vessels began in northern Australian waters in 1974, when Taiwanese gillnetters began operations. Between 1975 and 1977, average catches were over 7,500 tons, with sharks representing 65-76 % of the total weight (Walter, 1981), with the catch landed primarily in Taiwan. Australian black-tip and spot-tail sharks accounted for 90% of the shark catch by weight (Stevens, 1990). More than 20 species made up the remaining shark catch, including several species of whaler sharks (e.g. *C. macloti, C. amboinensis*), milk sharks, *Rhizoprionodon acutus*, and hammerhead sharks, *Sphyrna* spp.

With the declaration of the Australian Fishing Zone in November 1979, the Australian Government imposed management measures on the northern shark fishery, including restriction of Taiwanese gillnetting to specific offshore areas with the AFZ, closure of the area within 15 miles of the coast, and a catch quota of 7,000 tons of processed weight (Branford, 1984). This was further reduced to 6,000 tons in 1985, due to concern over a dropping catch per unit of effort for sharks in the fishery, and increasing involvement of Australian vessels in the fishery (Lyle, 1987).

During the mid-1980's, further management measures for the Taiwanese gillnet fishery included a ban in 1986 on pelagic gillnets over 2.5 km. length, a measure which resulted in many Taiwanese vessels leaving the northern shark fishery. For those vessels that continued to fish it became apparent that the restriction on short nets rendered the fishing operations unprofitable and the fishery closed for good less than a year later. The Taiwanese gillnet fishery was followed by a Taiwanese longline fishery which targeted many of the same species that the aborted gillnet fishery had targeted. The longline access agreement terminated in 1991 and that fishery has now also ceased.

Type of Data Collected: The Taiwanese fishery (gillnet and longline) had radio report and logbook data as well as observer coverage. The Taiwanese published some of the logbook data in their annual reports. Archiving of radio report and observer data is poor. CSIRO did an analysis of this fishery (catch) in the 1980s and have some of the original data on tape but it is not very accessible. Effort data is virtually non-existent (John Stevens, pers. comm.).

Time Series Available: 1979-1986.

How Stored: Hard copy, computer files, and tape.

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Japanese longliners

Japanese longliners have fished in waters near Australia since the 1950's. The AFZ east of 140° E includes portions of Japanese global fisheries for southern bluefin tuna, *Thunnus maccoyii*, in southern waters and tropical tunas and billfishes in warmer waters, primarily in north-eastern Australian. Prior to 1978, the year in which the Australian government declared a 200-mile

Exclusive Economic Zone, the Japanese longliners fished to within 12 miles of the Australian coast. Early in 1979, Australia and Japan negotiated access to fish resources in the AFZ. Subsequently, Australia and Japan signed an agreement that permitted continued fishing by Japanese vessels in specific areas of the AFZ, subject to Australian law and terms and conditions specified by Australia. Part of the terms and conditions included acceptance of Australian government fisheries observers onboard the vessels and procedures for reporting positions and catches in the AFZ. Prior to this agreement, the Australian government had very little data concerning the catches by Japanese longliners operating near Australia. What information they did obtain was based on catches of commercially important 'target' species such as tuna and billfish while the incidental catch of non-target species, such as sharks and miscellaneous finfish, went virtually unreported.

Initially, Australia licensed Japanese vessels to use longline in the AFZ to take all species of fish, including tunas, billfishes and sharks. The maximum number of licensed Japanese longliners which Australia permitted to fish in the AFZ had ranged from 350 in 1979/80 to 250 in 1989/90, however, these maximum numbers were not reached in any one year and this restriction did not actively limit effort. Beginning with the 1991/92 Access Arrangements, the Japanese longliners were not permitted to retain the fins of shark unless they also retained the carcass. During November 1995, Australia introduced to the Japanese longliners a logbook supplement for reporting the number and weight of each of the four main shark species retained, and the number discarded. The four species are blue whaler, short finned mako, bronze whaler and porbeagle, plus a column for "other shark species" (P. Ward, pers. comm.).

With the implementation of catch and effort reporting procedures as part of the access agreement for foreign vessels licensed to fish in the AFZ, the Australian Fisheries Management Authority has compiled a large database of fisheries statistics under the umbrella of the Australian Zone Fishing Information System (AFZIS). The data extend from November 1979 to the present and can be manipulated in various scales and degrees of resolution (e.g. using MapInfo or any similar GIS-based software systems).

Prior to the implementation of mandatory shark catch reporting in 1991/92, many of the vessel masters tended to limit logbook entries to species landed and retained for commercial sale. As a result, much of what is known about the catch composition for shark species taken in the commercial longline fisheries comes from Australian Fisheries Observer data reports. The Australian Fishing Zone (AFZ) Observer Program was implemented in 1978 with the overall aim of providing reliable and accurate information on fishing catch, effort and operational characteristics of a wide range of vessels operating in the AFZ. The Program is managed by the Commonwealth, through the Australian Fisheries Management Authority, with the main headquarters located in Canberra, and regional observer units located in Hobart, Brisbane and Perth. Development of a dedicated database by the Program began in 1990 with AFMA, BRS, and CSIRO the major clients of the Program, although data is supplied to various other organizations by request for analysis of target species catch and effort, bycatch and interaction with seabirds or marine mammals.

The longline database is organized on a cruise basis, as repeated cruises on the same vessel occur rarely, and individual fish records comprise its primary data component. Data describing the vessel's daily operations is linked to the biological files. Ancillary data describing the vessel, its fishing gear, processing techniques and fishing campaign is linked to each cruise. Information collected by Australian Fisheries Observers pertaining to shark catch includes species, life status (dead, alive, injured), lengths, processing fate code (retained, discarded) and processed weight (P. Ward, pers. comm.).

For the period 1979 - May 1995, the AFZ Observer database lists 20 species of sharks captured by Japanese longline vessels fishing in the AFZ with blue sharks, *Prionace glauca*, the predominant species in the catch comprising approximately 56% of the total shark catch, followed by mako sharks (~16%), and oceanic white-tips (~10%) (Ward, 1996).

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Type of Data Collected:

1) From 1950's to 1980 - summarized catch, effort, and location data by 5 degree square based on logbook data that Japanese based longliners submitted to the Fisheries Agency of Japan, Far Seas Fisheries Research Laboratory or the Federation of Japan Tuna Fishermen's Cooperative Associations. AFZ Observers report that logbooks usually included only the species retained for commercial sale and they rarely included fish that were discarded or retained for consumption by the crew. Crew members also retained shark fins, and, on return to their home port, sold these for 'pocket money'. A 1991 ban on removing fins from sharks and discarding the carcass reduced this activity.

2) From 1980 - present Australia has issued Japanese longliners logbooks for reporting catch and effort while fishing in the AFZ. The logbook details, among other things, the vessel's position, number of hooks set, bait and number of each species caught each day. In addition, a radio reporting system has also operated since the establishment of the AFZ in 1979 which requires Japanese longliners to make radio reports to the Australian Coastal Surveillance Center. Once each six days the Japanese provide details of their current position, as well as the catch and effort recorded since the previous radio report. The catch details include numbers and weights for the principal target tunas and billfishes as well as the total number and weight of all species caught in the AFZ (e.g. sharks). As of November 1991, the radio reporting requirement was upgraded to daily reporting. A more sophisticated Satellite Monitoring System is slated to replace the radio reporting system sometime in 1996/97.

Time Series Available:

1) Japanese Summarized Logbook Data from 1950's - 1980.
2) AFZIS database from 1980 - present.

Publications: 1) The Fisheries Agency of Japan published annual summaries of longline catch and effort in Annual Report of Effort and Catch Statistics by Area on the Japanese Longline Fishery from 1962 to 1980 (which includes historic fishing data in what would become the AFZ). Catch (number of each species) and effort (hooks) are aggregated by five-degree square and month.

How Stored: The Australian Fisheries Management Authority (AFMA) are the "custodians" of the AFZIS and observer databases. They run under Ingres. The Bureau of Resource Sciences holds database copies, which are stored in a Microsoft Access format. AFMA technicians are currently developing a web page but no information was available as to content or expected start-up date (P. Ward, pers. comm.).

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Summary

Although the direct and non-direct commercial shark fisheries of Australia are regarded as being of minor importance to the overall world catch of elasmobranchs (Bonfil, 1994), they are of considerable importance given the fact that they may be the best documented and most intensively managed elasmobranch fisheries in the world. For this reason, many countries, in particular developing Pacific Island Nations, that have substantial catches of sharks within fisheries operating in their respective EEZ's, will no doubt rely heavily on the Australian 'experience' as an effective blueprint for future management. The use of the AFZ Fisheries Observer Program as a vital platform for logbook-independent assessment purposes demonstrates the need for 'at-sea' monitoring of the fishing operations if one hopes to get a handle on the catch rates and species composition for sharks and other non-target components of the fishery in question.

CHINA

Introduction

The People's Republic of China, has a coastline that extends some 18,000 km along with a large EEZ covering some 3,000,000 km². China includes more than 3400 offshore islands, of which Hainan, in the South China Sea, is by far the largest.

About 110 species of shark have been recorded in Chinese waters covering adjacent coastal waters as well as the South China, East China, Yellow and Bohai seas (Cheng and Zheng, 1987). Shark catches comprise a minor component of the overall harvest of marine organisms in China. The country, has however, become a major world player in the lucrative multi-million dollar shark fin industry mainly due to it's large and cheap labor force which supplies numerous factories set up to process raw shark fins into finished product for re-export to nearby Southeast Asian markets.

Although China does not report its fish landings to FAO and various estimates are not verified, a figure of around 9.5 million tons, or 12% of the world total marine fish production, has been claimed.[4] This is reportedly produced by a fishing fleet of more than 380,000 vessels with an estimated 3.46 million people employed in fisheries, not including an estimated 5.63 million part-time fishermen (Anon, 1992).

Information on the institutional and legal basis of Chinese fisheries is difficult to obtain. A State Fishing License system for commercial fishermen was established in 1980 (Anon, 1992). Domestic fisheries are subject to "Regulations for the Propagation and Protection of Fishery Resources", established in 1979 which include fish size limits on capture fisheries, prohibited fishing areas, closed seasons for fishing, and the prohibition of certain fishing gears and methods (Anon, 1992).

Anecdotal information based on interviews with key figures involved with China's domestic fisheries indicate that shark catches may have decreased over the past 40 years. Analysis of what little quantitative data exists, however, suggests that overall catches have increased (Parry-Jones et al., 1996). This is probably due to an expansion of the fisheries industry and catching capacity versus any intrinsic factors associated with the population dynamics of China's shark resources.

Domestic Fisheries

[4]China Fisheries and Seafood Expo 96.

According to officials within the Fisheries Agency of the People's Republic of China very limited information exists on shark fisheries within Chinese waters as the artisanal/subsistence types of fisheries that prevail along the Chinese coast do not routinely supply records of fishing activities (Bonfil, 1994). There are more than 1,000 types of fishing gear in use in Chinese fisheries which add to the difficulty of quantitatively monitoring the domestic fisheries in general, let alone for specific groups and/or species of organisms (Feng et al., 1989). The recently completed TRAFFIC Report on Shark Fisheries and Trade in China (1996) states that some limited information does exist on Chinese directed shark fisheries, but this information was regarded as classified by the government and thus not available for release. Based on field data collected during the period of April-May, 1995 by TRAFFIC port samplers based in the major off-loading sites in China, a total of 38 species of sharks were recorded in the landing sites and/or fish markets. The most common species encountered in the census were the Spadenose shark, *Scoliodon laticaudus*, Scalloped hammerhead, *Sphyrna lewini*, White-spotted bamboo shark, *Chiloscyllium palgiosum*, Japanese topeshark, *Hemitriakis japonica*, and the Spottail shark, *Carcharhinus sorrah*, (Parry-Jones, 1996). China does not supply fisheries statistics on catch and effort and landings of sharks to FAO which, as a result, requires FAO to base their catch and landing estimates for China on secondary and tertiary information (Stoessell, 1993).

Although certain fisheries in China have been regulated to some extent since 1979 (Ji, 1990), which includes, among other things, size limits, closed areas and seasons, there is currently no management system in place to monitor shark fisheries. As a member of the CITES Convention, China was asked to provide the best available estimates on elasmobranch catches landed in the country, for which the Chinese Ministry of Agriculture, Bureau of Fisheries provided an estimate of 4,000-7,000 tons per annum (Parry-Jones et al., 1996). Based on dockside interviews (of limited scope and duration) with fishermen and fishing industry personnel in China, TRAFFIC-Southeast Asia puts unofficial estimates of total annual shark landings in China in the neighborhood of 22,500 tons using a raising factor based on estimated catch and effort (Zhou et al., 1996; Parry-Jones et al., 1996).

Previous estimates of Chinese shark catches made by converting shark fin export data from China to whole weight tonnage (conversion factor unknown) were made by Bonfil (1994) using information obtained from the Southeast Asian Fisheries Development Center (SEAFDEC). These estimates, ranging from less that 100 tons whole weight in 1981 to between 17,000 and 28,000 tons in 1991, have now been shown to be partially erroneous due to constraints on China's external trade in previous years and the fact that a significant proportion of these exports consisted of raw product sent to China for processing and subsequently re-exported to wholesale/retail outlets in various Southeast Asian markets (e.g. Hong Kong) for final sale (Parry-Jones et al., 1996).

Distant Water Fishing Fleet

Of greater interest, however, in terms of the catch of pelagic shark species, are the rapidly expanding Chinese distant water fishing fleets which now have reached formidable numbers

especially with respect to pelagic tuna longline vessels fishing in the western Tropical Pacific Ocean and industrial stern trawlers, mostly targeting groundfish in the North Pacific Ocean (Wildman, 1993). The first large scale deployment of a distant water fishing fleet to venture overseas consisted of trawlers sent to West Africa from Fuzhou in 1985. At that stage in Chinese development, overseas ventures were arranged through the China National Fisheries Corporation (CNFC)[5]. Subsequent joint venture arrangements sent 12 vessels to Guinea Bissau, 4 vessels to Nigeria, 6 to Senegal and Morocco, and 4 to Argentina. The contribution of the overseas distant water fisheries sector is very small compared to overall fisheries production.

In overseas tuna fisheries, Guangdong province seems to have been a leader in China's involvement, bringing two used (48 meter) Japanese longliners to the South China sea for experimental fishing in the early 1970's. During the early 1980's a joint venture operation, which included an ex-Japanese low temperature sashimi longliner, was attempted, but little further information is available. To date the only known sustained involvement in overseas tuna fisheries has been the longline vessels contracted to Taiwan and Hong Kong-based fishing and trading companies which began operations in Palau and FSM (Yap) in the early 1990's[6]. By 1995 Guangdong province had about 150 vessels in the longline fishery in those areas. Unlike many of the vessels connected to CNFC-sponsored operations which are reported to operate under the umbrella of parastatal bodies, vessels from Guangdong province are reportedly mostly operated by groups or family ventures[7]. The number of Chinese longliners licensed to operate in the western Pacific Ocean (SPC Statistical Area) for 1995 was 435 (Lawson, 1995).

Although in comparison to the fleets of Japan and Korea, the China distant-water fleet is still in its infancy, it is the only major Asian distant-water fleet which is still growing significantly. Chinese officials have also stated that Chinese fisheries policies will emphasize the expansion of distant-water fishery operations in order to reach a stated goal of 20 million tons of fishery production for the country by the year 2,000 (Wildman, 1993). Information on shark catches from the distant water vessels are not available at this time from the Fishery Agency of China although it is believed that some form of data does exist but at what resolution and to what degree of accuracy is currently unknown.

In it's recent report on the World Trade in Sharks, TRAFFIC International states that information on the volume and species composition of sharks caught by distant-water longline vessels is not available (Rose, 1996). Fortunately, there are some limited data sets that do present some

[5]Names of and relationships between parastatal organizations referenced in the literature are unclear, partly because of variations in translations from Chinese and other news sources

[6]One reference cited a domestic longline fleet composed "...to a considerable extent second-hand boats that were purchased from Japan" which produces about 15,000 tons per year. Nothing is known of this fleet; one can only surmise it operates in the South China Sea for the domestic market, as no known Chinese exports of tuna to Japan or elsewhere are known.

[7]Ownership of the vessels is another matter. One source reports that all vessels are either owned by the national government or "group enterprises".

quantitative information on species composition and catch rates for Chinese longliners operating in the Federated States of Micronesia (Heberer, 1997) and in other parts of the western Tropical Pacific (Bailey et al., 1996). Both of the above mentioned sources have been compiled from Fisheries Observer Programs operated by the FSM's Micronesian Maritime Authority and the SPC-OFP, respectively. Specific information relating to these data sets will be given in the appropriate country section's for which the Chinese vessels have been operating under bilateral licensing agreements (e.g. FSM, Republic of Marshall Islands).

The majority of the distant water Chinese longline vessels fishing in the western Tropical Pacific Ocean where brought to the region to operate under the umbrella of large Taiwanese and Hong Kong fishing and trading companies, in particular, Ting Hong Oceanic Enterprises Inc., of Taiwan. Ting Hong negotiates the licensing agreements with the respective Pacific Island nation's and then recruits selected Chinese Provincial Fishing Associations to fish for them under the agreement (e.g. Guangdong Provincial Fisheries Cooperative). The Chinese vessels, which are then based in the respective Pacific Island ports, receive logistic support and supplies from Ting Hong and in turn agree to sell most of their target catch (yellowfin and bigeye tuna) to them for export to the sashimi market in Japan. Non-target catches, such as sharks and billfish, are either purchased by Ting Hong or various Pacific Island fisheries concerns and stored on-island, or kept frozen onboard the vessels and off-loaded back in Taiwan/China when the vessels return to home-port.

Mandatory logbook records are submitted by the Chinese vessel captains to Ting Hong company officials who in turn translate them from Chinese into English and then submit the records, as part of the licensing agreement, to officials from the Fishery Department's in the Pacific Islands where they operate. These records are then submitted by the Pacific Island Fisheries Departments to personnel of the SPC-OFP who then handle the arduous task of error checking and entering the data into a Windows driven Fox-Pro database. Copies of the 'clean' data are then sent back to the various Pacific Island Fisheries Departments whose personnel can then generate specific Windows-driven outputs (reports) based on the parameters of the database which include spatial (1° square or finer), temporal (daily), and catch and effort variables for both target and non-target (e.g. sharks) species. Intensive computer training and software/hardware technical assistance is provided to the Pacific Island countries by both the SPC-OFP and the South Pacific Forum Fisheries Agency (FFA) personnel.

As with most mandatory logbook programs in place throughout the world, information on non-target species is usually severely under-reported or not reported at all. For this reason, the existence of scientific monitoring Fisheries Observer Program's give us the only reliable estimates of non-target catch rates which can then be used to extrapolate upwards for fleet-wide estimates and annual shark catches by area and by fleet. The confidence of these estimates, however, are a direct reflection of the percent coverage and in general can be positively biased (bycatch overestimated) if coverage is under 10% (Hilborn and Walters, 1992). Due to the large number of Chinese longline vessels operating in the western Tropical Pacific (~350 in 1995), and given the short duration of trip lengths (~ 7-10 days), both the MMA and the SPC Fisheries

Observer Programs have coverage rates of less than 1% of the total trips in any give year for the fleets in question. Any data requests made by outside organizations (e.g. if the Council wishes to obtain bycatch data from the MMA or SPC Observer Program's) would need to seek the approval of the Pacific Island Fishery Department(s) in question who would then authorize SPC-OFP personnel to summarize and release the data requested.

Type of Data Collected: Chinese Government: International Trade Data for Shark Products.

Time Series Available: 1990-1994.

Publications: China Customs Statistics Yearbook

How Stored: unknown.

Type of Data Collected: Ministry of Agriculture, Bureau of Fisheries: Catch and Landings of Elasmobranchs, format unknown.

Time Series Available: unknown.

Publications: Report to CITES Committee, China CITES Management Authority, 1995 (Notification Number 884 from the Secretariat of CITES)

How Stored: unknown.

Type of Data Collected: TRAFFIC International: Port Sampling Data for Sharks from 14 fishing ports in China. Species composition, size, sex, and meristic data collected.

Time Series Available: April - September, 1995. (Rotated between ports, not continuous in one port).

Publications: TRAFFIC-International Publications (raw data contained in unpublished reports)

How Stored: unknown.

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FIJI

Introduction

Fiji is an independent republic in the southern Pacific Ocean, part of Melanesia. It comprises more than 300 islands and islets, 100 of which are inhabited. Fiji has a total land area of 18,274 km^2 and an EEZ which extends for roughly 1.3 million km^2.

The Fiji fishing industry (excluding aquaculture) is generally divided into three primary sectors, all of which capture appreciable quantities of sharks:

1. The industrial fishery which delivers to the only commercial tuna cannery in Fiji (PAFCO), located in Levuka on the island of Ovalau. The cannery is supplied by the catch from three fleets. The first consists of freezer longliners targeting albacore: about 16 to 20 Taiwanese vessels which are not licensed to fish in Fiji's EEZ, but deliver fish taken in other jurisdictions and on the high seas, and two Korean and one Honduran vessel on charter to PAFCO which operate mainly in the EEZ. The second are pole and line vessels (6 domestic and 2 foreign in 1997) which catch predominantly skipjack. The third, a fleet of fresh sashimi longliners is actually a separate fishery, however they do catch quantities of albacore while targeting yellowfin and bigeye and occasionally may sell these to the cannery when not of export quality.

2. The fresh sashimi longline fishery which in recent years has consisted of up to 50 vessels landing up to 180 tons per week. The catch is exported by air to markets in Japan and the US (Southwick, 1995).

3. The artisanal/subsistence fisheries which includes most small-scale commercial production for domestic sale. It is a significant source of domestic fish-supply and employment.

The only directed fishery occurs within the third category. Utilizing primarily small scale gillnet and drop-line gear (fishing on FADs) it occurs year-round, primarily in the nearshore waters adjacent to the main islands of Viti Levu and Vanua Levu, and to a lesser extent in the inhabited smaller islands. In dropline surveys carried out by the South Pacific Commission, the oceanic whitetip, *Carcharhinus longimanus*, and the gray reef shark, *C. amblyrhynchos*, were the most common sharks captured. Other species recorded included the black tip shark, *C. melanopterus*, the white tip reef shark, *Triaenodon obesus*, the lemon shark, *Negaprion brevirostris*, the tiger shark, *Galeocerdo cuvier*, and the bull shark, *C. leucas* (Anon. 1994).

The artisanal/subsistence fisheries land fresh shark for local consumption but is of minor importance in terms of the overall marine harvest in Fiji. This may be due in part to traditional Fijian taboos on consuming shark meat. The shark meat is sold through a series of municipal

markets and road-side outlets with annual production figures published by the Fiji Fisheries Division based on market surveys (at least six days per month) and outlet surveys (twice a week for large outlets and quarterly for smaller operations). Unfortunately, the estimates are frequently aggregated with other 'fresh fish' products or if listed, grouped as generic 'shark' sales.

In terms of numbers, the greatest increase in vessels has come with the fresh sashimi longliners. Numbers have grown in the past few years to where there are now over 50 such vessels, with some locally owned but the majority operating under joint ventures. The fishing captains on these vessels are required to turn in catch report forms and landings records to the Fiji Fisheries Division who in turn forward the information to SPC-OFP personnel. Catch, in tons, is recorded for the target species (yellowfin, bigeye and albacore tuna) with all other species (including sharks) recorded as 'others' on the catch report forms.

Fiji is a significant exporter of dried and frozen shark fins taken as bycatch by both the domestic and foreign tuna longline fleets. Dried shark fin from the cannery-associated vessels composes an important part of the fishing crew's "bonus" in addition to their usual compensation. Sales are usually handled by the crew directly to buyers in Levuka. It is said by fishermen that prices offered by several competing buyers in Levuka are higher than those paid in Pago Pago. Export statistics for Fijian shark fins sold to foreign markets (mainly Hong Kong) are kept by the Fijian Bureau of Census and Statistics as well as summarized in FAO Annual Fisheries Statistics by Country. Thirty tons of shark fins were exported from Fiji in 1994 which was slightly lower than previous years (Anon.,1994). The relative contribution of the sashimi fleet and albacore longliners within these totals is not known.

Longline vessels are licensed to fish in the EEZ or offshore waters. Almost all are involved in the fresh sashimi fishery. In 1997, 28 vessels were licensed for offshore waters, with 18 being wholly-owned Fijian vessels. The remainder were foreign-flag longliners with at least 30% Fijian ownership. Of the 10, five were flagged in the United States, 3 were of Honduran registry and 2 were Japanese. There were an additional 25 foreign flag vessels licensed to fish in the EEZ in 1997. These vessels either came from or were flagged in China (8), US (3), Taiwan (3), Australia (3), Japan (2), Panama (2), Korea (3) and Honduras (1) (Gillett, pers. comm.). The last two categories were actually all Korean vessels, contracted to PAFCO and targeting albacore.

A substantial amount of shark is taken as bycatch by the tuna longline fleet but quantitative data on species composition and catch rates are sparse. Blue shark, *Prionace glauca*, appears to be the most abundant species taken in the longline fishery, which is consistent with data from other sources throughout the tropical Western Pacific (Heberer, 1997; Bailey, et al., 1996). A total of 15.8 tons of blue shark, equal to about 0.4% of the total longline catch, was reported captured by the foreign and domestic longliners for the 1994 fishing season (Anon., 1994a).

Type of Data Collected: Fiji Fisheries Division - Port Samplers collecting unloading data for target species and bycatch group (e.g. weights collected for generic 'shark' category with no attempt to breakdown by species) only weights, no effort data.

Type of Data Collected: Fiji Fisheries Division - Mandatory Catch Report Forms and Landing Records for both domestic and foreign tuna longline vessels. Includes aggregate shark catches under 'others' category. This data is subsequently forwarded to the SPC-OFP for entry into the Regional Tuna Fisheries Database (RTFD) as mentioned in the section covering China's fisheries.

Time Series Available: Published about 8 months after completion of calendar year. Annual Report Series begin in the late 1970's/early 1980's (exact date uncertain).

How Stored: Excel files.

Publications: Fiji Fisheries Division Annual Reports.

Type of Data Collected: Fiji Fisheries Division - Fisheries Observer Data collected during 4 observer trips onboard domestic tuna longline vessels and 2 observer trips onboard foreign tuna longline vessels (1 US flag and 1 Taiwanese flag).

Time Series Available: February 1994 - February 1997. By individual trip, usually a quarter or two after trip completion. Data request must be made through Fiji Fisheries Division and if approved will then be forwarded from the SPC-OFP Fox Pro Windows driven database.

Publications: Fiji Fisheries Division Annual Reports and SPC-OFP Observer Newsletter (planned).

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THE FEDERATED STATES OF MICRONESIA

Introduction

The Federated States of Micronesia (FSM) is a sovereign nation consisting of more than 600 islands lying in the tropical western Pacific Ocean. The FSM is composed of four states: Kosrae, Chuuk, Yap, and Pohnpei, the latter of which serves as the capital of the National Government. The States manage fishing activities within 12 mile territorial waters and the National government manages fishing activities in the waters of the 200 mile Exclusive Economic Zone (EEZ). The FSM EEZ encompasses close to 3 million km^2 of ocean, which includes some of the worlds richest tuna fishing grounds. The FSM has had a long involvement in commercial tuna fishing, with income derived from foreign fishing access agreements with the major distant water fishing nations (DWFN's) representing a major source of revenue for the nation.

A diverse range of sharks are present in FSM waters. Sharks are used as a subsistence resource in Kosrae, by Kapingamarangi fishermen living in Pohnpei, and on Fais Island in Yap State. In March 1989, a private joint venture Japan-Yap fishing company was licensed to conduct trial fishing in Yap waters for sharks utilizing drift gillnet gear. The low catch, combined with political pressure from both governments resulted in the licenses being suspended and the operation ceased (Smith, 1992). There is currently no research conducted on shark stock assessment in FSM waters nor are there any management plans in place.

The majority of shark catches in FSM waters are taken, however, as bycatch in the domestic and foreign tuna fisheries operating in the 200-mile EEZ. Total tuna catches in FSM waters have increased substantially from the late 1980's and have continued into the 1990's (mainly as a result of increased purse seine effort) and are now among the highest of any Pacific Island Nation. Since the declaration of the FSM EEZ in 1979, most of the fishing by the DWFN's in FSM has taken place under access agreements. At various times, bi-lateral agreements have been in force between FSM and governments or commercial interests from Japan, Taiwan, Korea, the United States (the only multi-lateral agreement to date), Mexico, Philippines, Australia, Indonesia and the People's Republic of China. The principal gear types operating in the FSM tuna fishery are purse-seine, longline, and pole and line.

The bycatch of sharks forms a major component of the overall catch for the domestic and foreign tuna longline fleets with substantial, but poorly documented, shark catches suspected for the purse seine fleets as well. As is the case in most of the logbook data submitted by commercial fishing fleets in other parts of the Pacific, the species composition and catch rates for sharks captured by the longline and purse-seine fleets fishing in FSM waters is grossly under-reported or not reported at all.

The FSM has been administering one of the only Pacific-Island run Fisheries Observer Programs (FOP) since 1979. For the period 1979-1991, the FOP was primarily managed as a technology

transfer program with the main objectives being to document fishing operations, validate fishing logbook data and to provide a 'presence' on the foreign vessels thereby giving the FSM Fisheries Managers some feedback on what was taking place on the fishing grounds. As a result, there is no species specific shark data during the early years of the FOP. An average of 8 trips per year were carried out during the period, mainly on Japanese fishing vessels based in Japan and licensed to fish in the FSM EEZ.

For the period 1992-present, the FOP has been expanded and the objectives modified to include a more scientific based monitoring program with coverage expanded in scope and magnitude to cater for the arrival of Taiwanese and Mainland Chinese longline vessels based in the FSM. The Taiwanese and Mainland Chinese vessels are small (19-120 grt) in comparison to the long-range Japanese longliners (~200 grt), and are used for shorter trips (few days to two weeks in duration), basing themselves in proximity to the fishing grounds. These vessels fish yellowfin and bigeye tuna for the fresh sashimi market utilizing flake ice or refrigerated sea water cooling systems. They typically set between 650-1,200 hooks, utilizing monofilament mainline and branchline gear designed for use in clear tropical waters, and with storage capacity to hold up to 25 metric tons of fish product between unloadings.

It has been estimated that in recent years over 25% of Japan's fresh tuna imports have come from the western Tropical Pacific Ocean (anon. 1995). A large part of this production stems from the basing of Chinese and Taiwanese longliners in FSM, with their catch air freighted to Japan.

In recent years there was first a dramatic increase in the number of these small longline vessels targeting tunas with over 600 vessels (435 in FSM) participating in the western tropical Pacific fishery (Lawson, 1995). However by 1997 the number of these vessels licensed in FSM had dropped to 60 as adverse business conditions forced the major trader and base operator, Ting Hong, to cease operations (R. Gillett, pers. comm). Ting Hong had provided management services in terms of regulatory and logistical support, as well as the set up and operation of onshore transshipment bases. They operated three of their own 727 cargo jets and transshipped air freight for Japan to regularly scheduled carriers at Guam and Saipan.

Although the demise of Ting Hong in late 1996 has lessened overall effort, the significant fleet of vessels which still remains in Pohnpei (60 boats) as well as 8 locally-owned vessels means that effort will not totally cease in this fishery. Air freight services have been taken over by the National Fisheries Corporation (NFC) who, in conjunction with Okinawan interests also provides air freight services to about 10 under 20 gt Okinawan sashimi longliners operating in FSM. NFC intends on attracting additional fleets of Chinese vessels to FSM which could operate under different business arrangements than those under Ting Hong.

The general decline in the numbers of large distant-water vessels and the increase in activities involving the smaller vessels out of the western tropical Pacific in the past 5-10 years is seen

primarily as a development to capitalize on the higher sashimi price for fresh/chilled fish and related improvements in air freight availability (Bailey et al., 1996).

Ting Hong used a barge with a large freezing capacity to store the shark and billfish bycatch purchased from the Taiwanese and Chinese longline vessels. This bycatch was shipped back to Taiwan aboard supply vessels which brought bait and other supplies to FSM. Reportedly, sharks and other bycatch are used in Taiwan to produce "fish balls", manufactured from a fish cake or surimi-like product. Limited data exists on the extent of the shark and billfish bycatch trade since the off-loadings take place after the target species were offloaded and when port samplers are no longer on duty.

An average of over 40 trips per year (range 19-58 trips) have been carried out on Japanese, Taiwanese, Mainland Chinese, and FSM domestic fishing vessels during the FSM FOP expansion period with the quantitative estimation of bycatch and discard rates a top priority within the data collection routines. For the period 1993-1995, a total of 51 observer trips were carried out on foreign and domestic longline vessels licensed to fish in the FSM EEZ with the overall aim of documenting the rates of bycatch and discard for these fleets (Heberer, 1997). A breakdown of the total observed effort monitored during these 51 trips is provided in Table 6.

Table 6. Trip Statistics for Observer Trips on Foreign and Domestic Longline Vessels, 1993-1995

Flag	No. trips	No. sets	Sets per trip		Hooks per set		Hooks per trip		Tot. no. hooks
			Avg	s.d	Avg	s.d	Avg	s.d	
China	11	82	7.5	1.6	755	130	5,643	1,426	62080
Taiwan	24	205	8.5	2.2	.993	189	8,430	2,460	202326
Japan	10	159	15.9	4.0	2,280	318	36,283	11,231	362831
Others*	6	50	8.3	4..3	1,179	802	12,158	11,725	72946
Total	51	496							700183

Legend: Others includes trips made on vessels from FSM (n=3), KR (n=1), and US (n=2)

The low observer coverage, approximately 0.44 % of all sets carried out in the three year span of the study, reflects the difficulty, both financially and logistically, of administrating a comprehensive Fisheries Observer Program when dealing with such a large scale, multi-national fishery. As such, care must be exercised in using the data to extrapolate for fleet-wide estimates of bycatch and discards.

Table 7. Comparison of observed effort values (MMA observer records) versus total logged effort (mandatory logbooks) for longline vessels operating in the FSM EEZ, 1993-1995. *Logbook data provided by Micronesian Maritime Authority.*

Flag	Observed sets	Logged sets	Per cent coverage	Observed hooks	Logged hooks	Per cent coverage
China	79	61,820	0.13	60,339	44,390,600	0.14
Taiwan	202	18,457	1.09	196,756	19,605,600	1.00
Japan	159	29,072	0.55	362,831	65,449,400	0.55
Others	50	2,260	2.21	72,946	2231600	3.27
Total	490	111,609	3.98	692,872	131,677,200	4.96
Wt. avg.			0.44			0.53

Legend: Others includes trips made on vessels from FSM (n=3), KR (n=1), and US (n=2). Wt. avg. = weighted average based on number of sets and hooks observed by flag.

The species composition and catch-per-unit-effort values for elasmobranch catches observed by MMA Fisheries Observers during the period 1993-1995 are presented below. Species specific data is also recorded for sharks and all other bycatch for discards (retained, discarded), processing fate (finned, filleted, etc.), life status (dead, alive, injured), lengths, and sex.

Table 8. Species composition and CPUE values for target tunas and shark bycatch collected by MMA Fisheries Observers on foreign longline vessels, 1993-1995

Common Name	Scientific Name	Number	CPUE (no/1000 hooks)	Per cent of total catch
Yellowfin tuna	*Thunnus albacares*	3767	5.38	25.28
Bigeye tuna	*Thunnus obesus*	2902	4.14	19.47
Blue shark	*Prionace glauca*	1105	1.58	7.42
Requiem Sharks (unid.)	Carcharhinidae	779	1.11	5.23
Tunas (unid.)	Scombridae	711	1.02	4.77
Pelagic stingray	*Dasyatis sp.*	584	0.83	3.92
Silky shark	*Carcharhinus falciformis*	469	0.67	3.15
Thresher shark	*Alopias spp.*	336	0.48	2.25
Oceanic white tip	*Carcharhinus longimanus*	198	0.28	1.33
Grey reef shark	*Carcharhinus amblyrhynchos*	145	0.21	0.97
Crocodile shark	*Pseudocarcharais kamoharai*	84	0.12	0.56

Mako shark	*Isurus spp.*	48	0.07	0.32
White-tip reef shark	*Triaenodon obesus*	19	0.03	0.13
Silvertip shark	*Carcharhinus albimarginatus*	10	0.01	0.07
Black-tip shark	*Carcharhinus limbatus*	7	0.01	0.05
Hammerhead shark	*Sphyrna spp.*	7	0.01	0.05
Tiger shark	*Galeocerdo cuvier*	7	0.01	0.05
Manta rays	Mobulidae	1	0.00	0.01

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INDONESIA

Introduction

The Republic of Indonesia which stretches across some 5150 km² of sea in the region of the equator, encompasses a portion of the Malay Archipelago and includes more than 13,600 islands, almost half of which are inhabited. The republic shares the island of Borneo with Malaysia and Brunei. Indonesia also shares the island of New Guinea: The western half, known as Irian Jaya is under Indonesian administration, and the eastern half is part of the independant state of Papua New Guinea. Marine frontiers of Indonesia include the South China Sea, the Celebes Sea, and the Pacific Ocean on the north, and the Indian Ocean on the south and west. Indonesia has a land area of 1,919,443 km², territorial waters that cover 3.1 million km.² and a 200-EEZ of approximately 2.5 million km².

Indonesia's marine environment is extremely complex with a great deal of physical diversity, with extensive continental shelves in the western half of the archipelago giving way to great oceanic depths in eastern waters. Polunin (1983) reviewed the pertinent literature and noted many groups of marine organisms reach the peak of speciation in Indonesian waters. Sidarto (1979) reported some 2,500 species of fish to be present, however, very little research has been conducted on the fish, sharks and other marine organisms of Indonesia.

Indonesian Marine Fisheries

The bulk of Indonesia's total marine fisheries landings is caught in coastal waters by small-scale fishers. The Directorate General of Fisheries (DGF) reports landings by quantity and value for 45 finfish species with no species specific data available for sharks which are reported under the generic category of 'sharks'. Between 1987 and 1991, sharks and rays accounted for only 2.4% of fisheries production (Bonfil, 1994). Given the immense size of the fisheries and number of vessels and units of gear employed, Indonesia has the largest elasmobranch fishery in the world estimated in 1993 to be over 87,000 mt (Bonfil, 1994). The DGF publishes landing statistics for 29 of the most common gear types, ranging from simple 'traditional' hand lines to more complex 'modern' gear such as purse seine and trawl gear.

Indonesia's marine fisheries sector is divided for planning purposes into small, medium, and large-scale subsectors. Small-scale fisheries, by far the most important in terms of employment, numbers of fishing units (~270,000 in 1982) and quantity of landings, are distinguished from the other subsectors by type (or absence) of boat employed (C. Bailey et al., 1987). All fishing units which do not employ boats, use boats without engines or use boats powered by outboard engines are defined as small-scale. The small-scale sector accounts for about 55% of Indonesia's total marine production. Both medium- and large-scale fisheries use boats powered by inboard engines (~29,000 vessels combined in 1982).

Indonesian Marine Fisheries Information System

The Central Fisheries Research and Development Institute (CFRDI) is responsible for coordinating the activities of research institutes focusing on marine fisheries, coastal aquaculture and freshwater fisheries. Each of the institutes publishes research findings in its own regular journals or in special reports which are widely circulated within Indonesia. The separation of functions from the DFG, which retains responsibility for fisheries management and development, is not in all cases clearly defined (C. Bailey et al., 1987). Statistical reports for marine fisheries landings are summarized and published in the Annual Fisheries Statistics of Indonesia prepared by the DFG headquarters staff in Jakarta. The annual reports contain information, by province, on the numbers of fishermen, boats, types of gear in use and volume, value and species composition of the catch. Data is supplied by the provinces in hard copies of tabulated summaries which is then entered and stored at DGF headquarters in Lotus 1-2-3 software on IBM-compatible PC's. The reports are published about 1.5 years after completion of the calendar year (R. Gillette, pers. comm.).

Sharks are reported under the demersal fisheries category which includes rays, red snappers, groupers, and other finfish. The current system of fisheries statistics collection was initiated in 1976 (Dudley and Harries, 1987) and reportedly contains many inaccuracies which casts doubt on its reliability and usefulness (R. Gillette, pers. comm.).

Other agencies involved in fisheries research and data collection in Indonesia include the Marine Fisheries Research Institute and the National Oceanographic Institute which has prepared several bibliographies related to marine resources and the environment (e.g. Ongkosongo and Seogiarto, 1980).

Indonesian Shark Catches

Small-scale operations employ gillnets, purse seine and trolling lines to catch various species, including Indian mackerels *(Rastrelliger* spp) and other scombrids such as *Euthynnus* and *Auxis.* Sharks are taken as bycatch in these fisheries with most of the activities occurring in coastal waters. TRAFFIC consultants noted blacktip reef sharks, and assorted rays in the fresh fish markets during visits in 1996.

Directed shark fisheries exist in many areas of Indonesia with species from the family Carcharhinidae as the target species (white and black tip reef shark). Historically, specialist fishermen from southeast Sulawesi fished for sharks using handlines and employing shark rattles made from coconut shells and a bamboo pole to attract the sharks (Wallner and McLoughlin, 1995 as cited in Hin-Keong, 1996). There has been an increase in the fishing pressure with a shift to using pelagic longline gear and expanded effort due to fishing farther from home bases as a result of the acquisition of motorized vessels. There has also been an increase in illegal fishing activities within Australian waters with fishermen from Indonesia

settling on Roti and Timor in order to have easier access to the shark fishing grounds (Hin-Keong, 1996). Prior to 1988 less than 10% of the vessels boarded by Australian fisheries officers had shark onboard whereas between the period 1989-present, over 80% of the vessels had shark onboard.

Indonesia's large-scale fishery operates in relative isolation from the medium- and small-scale subsectors due to a strong export orientation which limits competition in local markets and to the location of fishing operations. Significant amounts of shark are caught as bycatch from tuna fisheries within Indonesia. The tuna fisheries are of three types: pole and line requiring live bait and targeting skipjack, longline for sashimi quality yellowfin and bigeye tuna, and purse seine fisheries based mainly on "payaos" and catching both skipjack and yellowfin, a large portion of which are immature. The total estimated catch in 1994 for all species was about 270,000 metric tonnes, with about 100,000 tons defined as "tuna" and the remainder skipjack (Soepanto, 1995).

The commercial tuna longline fishery began in 1962, though experimental fishing with this gear began as early as 1954 (P.T. Samodra Besar, 1981 as reported in C. Bailey et al., 1987). A local company, P.T. Samodra Besar was established in 1973 with aid from the Japanese Overseas Technical Cooperation Agency. By 1980, the fleet of Besar consisted of 17 boats of 111 grt each. The lines were several kilometers in length and targeted tunas with a significant bycatch of billfish and sharks.

The biggest growth in tuna fisheries within the Indonesian EEZ this decade has been experienced in tuna longline fisheries, which grew from about 60 boats under 100 gt in 1989 to about 350 in 1993 (DGF quoted in Soepanto, 1995). Exports of longline-caught sashimi grade tuna by air originate from offloading points in Manado, Bali, Jakarta and possibly elsewhere. The port of Benoa in Bali has become a major transshipment point, with over 300 Taiwanese and domestic vessels basing there in late 1995. Fresh tuna exports to Japan for sashimi increased during the period from around 1,700 metric tons in 1987 to over 20,000 tons in 1993. By 1995 Indonesia had become one of the largest exporter of fresh sashimi to Japan. However partly because of poor handling and grading, the value received was not as high as other countries in the Pacific region (Ting Hong, pers. comm.).

A TRAFFIC consultant observed in May, 1995 that 18 Taiwanese longliners were docked in Bitung, Northern Sulawesi and that one vessel was seen loading frozen shark carcasses onto a Taiwanese mothership. This mothership may be bringing bait and supplies to the fishing vessels and then carrying bycatch species back to Taiwan as is done with Ting Hong operations in the FSM and RMI transhipment bases. Official Indonesian Export figures list 9,231 mt of shark products exported from Bitung in 1993.

Purse seine fishing techniques were introduced in 1968 by the MFRI to fishermen in the area along Java's north coast. Current areas of major purse seine activity are the provinces of North Sulawesi (Bitung), the Moluccas and South Sulawesi where vessels operate in payao fisheries,

occasionally delivering to numerous small canneries there. Indonesia's developing purse seine fishery and canning industry is hampered by a lack of cold storage, so foreign vessels (mainly from the Philippines) that are active in the region return much of the catch to canneries in that country (Gillett, pers. comm.).

A significant but poorly documented shark bycatch occurs in the commercial shrimp and bottomfish trawl fisheries. Trawlers were banned from use in Indonesian waters in 1983, with close to 2,000 trawlers active prior to the ban (DGF, 1984). Trawling is allowed, however, in waters east of 130° east and a substantial fleet is currently operating in those waters. No quantitative data exists on shark bycatch from these vessels but observations by fishermen in the area and reports of dead sharks and fish washing up on island shores indicates that the catches may be significant (Hin-Keong, 1996).

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JAPAN

Introduction

Japan is constitutional monarchy in eastern Asia comprising four large islands, as well as the Ryukyu Islands and more than 1000 lesser adjacent islands. It is bounded on the north by the Sea of Okhotsk, on the east by the Pacific Ocean, on the south by the Pacific Ocean and the East China Sea, and on the west by the Korea Strait and the Sea of Japan.

The Japanese islands extend in an irregular crescent from the island of Sakhalin (Russia) to the island of Taiwan (Republic of China). Japan proper consists of the large islands of Hokkaido, the northernmost; Honshu, the largest, called the mainland; Shikoku; and Kyushu, the southernmost. The combined area of these islands is about 362,000 km^2. The total area of Japan is 377,727 km^2 with an EEZ covering 4.4 million km^2.

Fisheries Overview

Japan's elasmobranch production is mainly from bycatch in other fisheries. Some directed fisheries exist, such as a salmon shark, *Lamna ditropis*, fishery off northeast Japan, a winter fishery for skates near Hokkaido and another in the East China Sea.

However, all of Japan's pelagic fisheries, particularly those relating to shark by-catch, have declined significantly since the introduction of 200 mile EEZs which limited access to important fishing grounds beginning in the late 1970's. Further decline has been attributed to cessation of several major fisheries such as pelagic drift net fishing for squid and albacore because of environmental pressure, and reductions in other fisheries such as distant water skipjack pole and line which could not compete with changes in technology and world markets. As a result of a combination of these and other factors, a shift in industrial focus has seen major fishing companies gradually divest themselves of their former fleets and processing capacities to become trading companies operating mainly in the fisheries sector.

The catch of sharks in Japan's various fisheries is reported to have declined steadily in the period 1983-1990. From highs of 90,000-100,000 tons per year in the early 1950's, the figure has steadily declined to where it was about 25,000 tons in 1991-1993.[8] From 1982-1991, over half to three-quarters of Japan's total elasmobranch catch originated from FAO area 61 (roughly west of the dateline, above 20 deg. N.). This area, which includes Japan and all of East Asia as well as a large area of international waters of the north central Pacific, is closest to Japan and could be expected to experience a high amount of effort. The second most important area, with

[8]TRAFFIC, 1996, P. 13.

almost 10% to 18% of catches is FAO area 77: the eastern and central Pacific ocean, including Hawaii and the important tuna fisheries areas of the eastern tropical Pacific.[9]

The number of Japanese fishing vessels has also declined steadily, particularly in the largest size classes. For example, from 1988 to 1992 the number of vessels over 1,000 gross tons declined from 166 to just 56; while vessels in the 200-499 gross ton class went down from 1,646 to 1,570.

The number of vessels in the tuna longline fleet has also declined overall, however it has been the middle-size classes between 40 and 120 gross tons rather than the larger longline fleet that has experienced the greatest decline in terms of numbers of vessels. Generally, these smaller vessels fish in international (near seas or *kinkai*) waters offshore of Japan and in the offshore areas which include the EEZs of Forum member countries such as Palau, FSM, Marshalls and Kiribati.

Tuna vessels are usually defined in Japanese statistical summaries by size class, with those operating in distant water fisheries being over 120 gt, those in offshore fisheries ranging from 20-120 gt, and those in coastal fisheries under 20 gt. The latter category includes not only coastal vessels which fish within Japan's 200 mile EEZ, but also some vessels which measure just under 20 gt who fish in the EEZs of Palau and FSM and are based there as well as Guam.

In contrast with other Japanese fisheries, the tuna industry's larger distant-water (*enyo*) longline vessel numbers have been reduced more slowly over the past 5 years. In order to remain viable however, this fleet has undergone great changes with increased employment of foreigners, and extended trips now routinely lasting up to 18 months, utilizing mainly overseas ports as well as the high seas for re-supply and refueling. Full-time commercial agents are employed with Japanese staff at ports such as Callao and Las Palmas to assist in vessel management and administration.

The coastal vessel situation is somewhat more complicated. Smaller coastal vessels can participate in other fisheries, but must always deliver their catch back to Japan. The only longline vessels allowed to deliver at foreign ports are the under 20 gross ton tuna longliners, which have been able to land their catch in Guam and ports of the FSM since the early 1990's.

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[9]It should be pointed out that FAO data do not match those of JFA quoted by Kiyono. FAO (quoted in Bonfil, 1994) shows an overall catch of about 33,000 mt in 1991; however Kiyono ascribes this to the use of different time frames with Japan using the fiscal year which begins April 1, and "different estimating systems employed".

In the table below, those longliners are presumed to be included in the "coastal" category[10], with "offshore" representing 40-120 gross ton vessels in the *kinkai* fishery.

Table 9. Number of Licensed Japanese Tuna Longline Vessels, 1983-1993

YEAR	DISTANT WATER	OFFSHORE	COASTAL	TOTAL
1983	747	523	561	1831
1984	810	478	523	1811
1985	823	476	620	1919
1986	818	442	536	1796
1987	819	398	661	1878
1988	807	385	586	1778
1989	806	353	650	1809
1990	791	362	685	1838
1991	790	332	768	1890
1992	768	302	793	1863
1993	767	272	790	1829

Source: Ministry of Agriculture, Forestry and Fisheries, 1994

As of August, 1996, there were 216 offshore longliners under 120 gt[11] and 674 active distant water longliners. Many of the former are from the southern parts of Japan, returning to regional markets to offload every 60-75 days or so. The larger distant water vessels are home ported in various regions of Japan but are mainly from Misaki, Yaizu and Shimizu. They spend long periods overseas, obtaining supplies and exchanging crews in foreign ports as well as the high seas, and are said to return to home port only about once every 18 months or so.

There are also approximately 40 under 20 ton boats, most all from Okinawa, which operate out of Guam, Palau and FSM, air freighting fish back to Japan. At last report 7 of these were based in Pohnpei, with most of the others calling at Guam, Palau, and Yap depending upon fishing conditions.

[10]It is unknown if the increases since 1989 in this category reflect shifts in license holding from the offshore category. This is doubtful however, since even the number of under 20 gross ton longliners delivering to Guam and FSM ports has decreased steadily since 1991 in the face of increased competition from Taiwan and mainland Chinese vessels in those areas.

[11]There are an additional 33 permits issued by the government of Japan for this size class which are currently not active

In Japan there are about 55 primary landing ports for all major species of fish. Of these, eight ports have shark landings significant enough to support specific businesses associated with sharks: Hachinohe, Kesennuma, Shiogama, Choshi, Misaki, Shimizu, Katsuura, and Nagasaki.

Fisheries Management and Administration

The basic management system is embodied in the Fisheries Law, first enacted in 1950. The Law's primary intentions have been described as increasing fishery productivity and at the same time "democratize" a system that evidently was almost feudal in nature.

In general, the overall aim of management in Japan can be described as the maintenance (as near as possible) of a state of equilibrium within the various sectors of the fishing industry, to avoid cataclysmic change and to smooth out as much as possible the potential conflicts within those sectors. Eventual change is acknowledged, however the approach to its implementation can be a tortuous process by which all sides must give and take in reaching an acceptable solution.

Sixteen designated fisheries have historically required licensing and are determined by Cabinet order. Of the sixteen, those relevant to shark by-catch are the trawl fisheries including those in the Yellow and East China seas, North Pacific Ocean longline (and formerly the gillnet) fishery, medium and large purse seine fisheries, all pelagic (*enyo* or far seas) skipjack and tuna fisheries as well as near shore (*kinkai*) skipjack and tuna fisheries[12].

The mechanisms which operate under the Fishery Law to adjust and develop domestic regulatory measures in domestic, inshore fisheries are described as "adjustment commissions" made up of fishery operators and fishery employees. In practice these are vested in fisheries cooperative associations, which remain the backbone of the domestic fishery system.

High seas or pelagic fisheries such as those in the North Pacific or distant-water tuna longline are regulated by the Japan Fishery Agency, JFA (*Suisan-cho*), an agency within the Ministry of Agriculture, Forests and Fisheries. JFA is headed by a Director-General and includes an Oceanic Fisheries Department, under which is a Far Seas Fisheries Division.

JFA is also the parent body which oversees research institutions and their activities. The major one relevant to shark research and data collection being the National Research Institute of Far Seas Fisheries (NRIFSF), located in Shimizu.

[12]The others, many of which no longer exist, are mothership and other fisheries; large-scale, small-scale and mothership whaling, medium-scale salmon drift-netting and salmon mothership fisheries, mothership crab fisheries and gold-lip pearl and other shell fisheries.

Longline Tuna Fisheries Statistical Collection System Overview

Longline landing data are collected at the local level at actual landing sites by either fishery cooperative associations or the local government. It is usually the responsibility of the home port officials, rather than those at the landing port, to obtain and forward on actual log sheets. Some city administrations are also involved in the collection of landing information in this manner.

While landing and even price information can be fairly complete, there are strict regulations regarding access to such data. For example, certain price information on an individual vessel basis is expressly exempt from scrutiny by tax authorities. Landing weight data consists of actual landed, dressed weight and conversion factors are applied to obtain live weight. These conversion factors originate mainly with the information supplied by the activities research and training vessels.

Thus, "catches and landings from adjacent and distant-water fisheries do not include discarded catch. With the exception of 1951-1967 when landings of Salmon Shark, *Lamna ditropis*, Blue Shark *Prionace glauca* and Piked Dogfish *Squalus acanthias* (also known as Spiny Dogfish) were recorded, Japan data do not record shark landings at the species level."[13]

Data is forwarded to JFA and used at institutions such as NRIFSF for research purposes.

Catch data for the tuna longline fleet was previously collected on a worldwide basis and published for many years by the Ministry of Agriculture, Forestry and Fisheries (MAFF). The data were reported in 5 degree squares and consisted of numbers of fish of all major target species. While sharks were recorded, there was no breakdown by either genus or species. The estimated weights of fish from each species (in the case of tuna) was estimated from research vessel and training ship activity as well as occasional sampling programs in the relevant areas.

However this information was sometimes used against the Japanese industry in fishery access negotiations during the early 1980's, and partly as a result they ceased to publish the information. The Japanese steadfastly claimed that such information was used for scientific purposes only and was not applicable to estimating catch for the purpose of access negotiations.

As late as the mid-1980's annual reports for the activities of research vessels were published by NRIFSF but "recently the institute makes efforts to collect more precise and detailed data for these vessels" and has ceased their publication.[14]

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[13]TRAFFIC, 1996

[14]Dr. Toru Taniuchi, pers. comm. March, 1997

Aggregate data is published annually by the Department of Statistics Information (DSI) of the Ministry of Agriculture, Forestry and Fishery (MAFF) as "Annual Report of Production Statistics for Fisheries and Aquaculture." These data show total catches in metric tons caught by the Japanese tuna longline fishery in each of the 3 fishing areas, high seas, offshore and coastal seas.[15]

Scientific Activities Overview

JFA actively participates in international fora and research, the former sometimes including scientists and bureaucrats from the main office in Tokyo and the latter usually through the participation of scientists from one of the regional research laboratories. One of the most important laboratories for such research and data collection is the National Research Institute of Far Seas Fisheries (NRISF) in Shimizu, Shizuoka prefecture. It is situated in a port city, close by to Tokai University, and conducts work using data and biological samples from both commercial fisheries as well as research vessels. The Institute publishes the "Bulletin of the Far Seas Research Laboratory" on a periodic basis[16]. Organizationally the laboratory consists of four major divisions: North Pacific, Pelagic, Oceanic and Oceanography. The Pelagic Pelagic Fish Resources Division, has four separate sections.

1. Temperate Tuna Section which focuses on northern and southern bluefin, and size statistics for tuna and billfish collected from Japanese tuna fisheries

2. Tropical Tuna Section involved in stock assessment of tropical tunas, stock discrimination, and which also compiles catch statistics of Japanese tuna fisheries

3. Tuna Ecology Section which conducts biological and ecological studies on tunas, as well as some non-target species including sharks
4. Tuna Fisheries Section which works out of an office in Yaizu (another major tuna port nearby) and with the commercial fleet in the collection and analysis of biological samples and fisheries data[17].

JFA has researched shark catch by tuna longline fisheries since 1992. The aim of their research is said to be "resource assessment for appropriate preservation and management of sharks". JFA has been collecting data on catch, investigating biological aspects, and assessing trade

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[15]T. Taniuchi, "The Role of Elasmobranchs in Japanese Fisheries", in NOAA Technical Report NMFS 90, 1990

[16]Numbers 16 and 31 are said to have some information, however raw data is never published

[17]D. Itano, pers. comm.

information. It has also collected data on sharks as bycatch while conducting research on other species, such as bluefin tuna. However these research data have not been published and are not currently available to the public[18].

The Japan Marine Fishery Resource Center (JAMARC) is charged with actively investigating potential new fishing grounds and developing new fisheries. They utilize both their own research vessels and sometimes chartered commercial vessels for this purpose. They reportedly have undertaken research into shark fisheries in the past, and are said to have or have access to a database containing a listing of all recent and ongoing research in Japan pertaining to sharks.

Attitudes towards "the shark issue"

The Japanese fishing industry is keenly aware of the potential adverse affects which could accompany any deepening of the controversy surrounding shark by-catch and utilization. They have seen their commercial whaling industry banned in 1988 and later high seas squid drift-nets in 1992. Although each of these major fisheries were the targets of environmental concern, with investigations by outsiders first took the form of requests for data and information from ostensibly neutral or scientific purposes. It is thus not surprising that even the mere mention of shark by-catch can bring conversations to an abrupt halt between outsiders and Japanese industry representatives.

Likewise, the Japanese government and some research institutions are also hesitant to discuss data holdings or ongoing research. To date these investigations have failed to elicit any positive response from the Japanese government's scientific community regarding details of data held by research institutions. Likewise, attempts to engage institutions such as JAMARC in discussion regarding their activities and possible data holdings have been unsuccessful.

Identified Data Holdings

"The Japan Fishery Agency has been collecting data on sharks by some species since 1992. Those data will be published by the Japanese government" (TRAFFIC, 1996)

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[18]TRAFFIC, 1996

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KIRIBATI

Introduction

Kiribati is an independent state in the west central Pacific Ocean. It consists of 33 coral islands and atolls, about 20 of which are permanently inhabited. The total land area is 886 km² with an EEZ covering 3.6 million km². The islands of Kiribati include Banaba (Ocean Island); the 16 Gilbert Islands, including Tarawa, on which the capital is located; Rawaki; and 8 of the Line Islands, including Christmas Island (Kiritimati), the nation's largest.

Although sharks form an abundant and important component of the nearshore marine resources inhabiting the waters of Kiribati, very little quantitative information exists concerning species compositions and catch and effort rates. Elasmobranchs currently make up only 3.4% of the total artisanal fisheries landings in Kiribati with catches recorded from Onotoa and Aranuka (Anon., 1995b as cited in Hayes, 1996). Shark catches composing 9.4% and 12.3% of total fish catches were recorded during artisanal fishing surveys made in the islands of Aranuika and Arorae, respectively (Anon., 1989a).

In addition to supporting it's own budding domestic fleet, with 1 pole and line vessel and 1 purse seine vessel operating in 1995, Kiribati has licensed several DWFN fleets over the years to operate in it's EEZ. Historically the most important has been the Japanese pole and line fleet, however during El Nino periods, purse seiners of the United States, Taiwan and elsewhere are known to fish as far east as the Phoenix and northern Line islands. The Japanese distant water sashimi longline fleet also fishes in areas of all three island groups, and Korean longliners have been licensed to fish there as well. The US purse seine fleet has access to Kiribati waters through the multi-lateral treaty with 44 vessels licensed to fish in 1995. The Japanese pole and line fleet, which numbered 42 vessels in 1995, fished in the southern part of the Kiribati EEZ with the Japanese distant water tuna longline fleet fishing heavily throughout the Kiribati EEZ. Korean longliners, totaling 154 in 1995, had some limited fishing effort in Kiribati but for the most part worked farther to the east in search of bigeye and yellowfin tuna. The Korean fleet, however, has had a greater presence in Kiribati waters in past years with some Kiribati crew working on the Korean vessels fishing within the EEZ.

To our knowledge, there is no quantitative data available on shark catches by the domestic or DWFN longline fleets operating in the Kiribati EEZ (i.e. there are no records in SPC Observer Trip database). The Kiribati Fisheries Division has operated an Observer Program for many years, however, there focus is on enforcement and compliance rather than data gathering for research and assessment purposes. As such, historic data on shark catches does not exist in any adequate detail (J. Kirata, pers. comm.).

It has been reported that shark fins are purchased from the longline fleets and exported to Asian markets with annual quantities exported between 1980 and 1989 in the range of 900 kg.-3,000 kg. (Anon., 1989a).

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KOREA

Introduction

South Korea, officially known as the Republic of Korea, has a coastline of 11,542 km. occupying the southern portion of the Korean Peninsula. South Korea is bounded on the north by North Korea; on the east by the Sea of Japan; on the southeast and south by the Korea Strait, which separates it from Japan; and on the west by the Yellow Sea. It has a total area of 99,300 km² including numerous off-lying islands in the south and west, the largest of which is Cheju (area, 1829 km²). The 200-mile maritime zone of Korea covers 447,000 km.². Korea is divided into nine provinces and six cities (Seoul, Pusan, Taegu, Taejôn, Kwangju, and Inch'ôn) with provincial status.

Domestic Fisheries

The Council is directed to the TRAFFIC report on *Shark Fisheries and Trade in the East Asia Region - South Korea* section (Parry-Jones, 1996) for a detailed overview of the domestic shark fisheries, past and present, in the waters of South Korea. In general, the quality of data for both domestic and distant water fishing fleets of Korea is quite poor and unreliable. Information for domestic catches of sharks is recorded in the *Statistical Yearbook of Agriculture, Forestry and Fisheries* (SYAFF) but species-specific data are not recorded and under-reporting and non-reporting of catches are common and problematic. The SYAFF historic domestic catch data has been produced from landing records compiled by the National Fisheries Administration (NFA).

Government oversight of the fishing industry is now provided by the Ministry of Maritime and Fisheries Affairs which superseded the NFA in 1996. With respect to fisheries, its main functions include fisheries planning and policy development, promotion and development of both near shore and distant water fisheries, and management of fishery facilities and infrastructure.

Data records for shark landings were also collected during 1995 by TRAFFIC personnel stationed at the Pusan Marine Center, the largest fish market in Korea, which handles about 35% of the total Korean landings (Parry-Jones, 1996). The landings data from Pusan include distant water fisheries as well as coastal and offshore catches from Korean waters. The only truly directed fishery landing shark in Pusan is a small-scale shark gillnet fishery with the remainder of the landings coming from incidental catches (both domestic and distant water fisheries) by other gear types.

The principal gear types used by Korean fishermen, for which domestic shark catches have been recorded, include: gillnet, bottom trawl, and longlines. Landings by shark gillnet peaked in 1970 at 5,734 tons with 1995 estimates placed at 325 tons based on data from four boats operating in Korean waters and 2 boats in the distant water category (Parry-Jones, 1996). Principal species

of sharks encountered in the Pusan market by TRAFFIC personnel (1995) include: gummy shark, *Mustelus antarcticus,* hammerheads, cow sharks, F. Hexanchidae, blackspotted dogfish, *Mustelus punctulatus*, great white sharks, mako sharks, blue sharks, thresher sharks, and salmon sharks, *Lamna dioptris*.

As mentioned, Korean catch and effort statistics are generally recognized as being unreliable and this is reflected in FAO records as well which show tremendous fluctuations for the years 1947- 1992 (Anon., 1994). General trends, however, demonstrate increasing distant water shark catches and decreasing domestic catches from Korean waters, which may or may not be the actual case. FAO elasmobranch data show a peak catch for Korean fisheries (domestic and distant water) in 1985 at 22,888 mt and a low in 1992 at 12, 221 mt with an average catch of elasmobranchs for 1982-1992 of 19,182 mt. (Anon., 1994 as cited in Parry-Jones, 1996).

Distant Water Fisheries

Data for distant water shark landings has been compiled by NAF and reported in SYAFF data. Shark catches for the gillnet and longline fisheries are not representative of the actual catches due to under-reporting and non-reporting for both target and non-target species and only target catch trends realistically extractable from the data.

Korean distant water purse seiners have had, over the years, various access agreements to fish in the EEZ of Pacific Island nations (FSM, Kiribati, PNG, New Zealand and some French Pacific Island territories). Mandatory logbook records for trips made by the Korean purse fleet within the EEZ's of the countries in question have been submitted to the SPC-OFP for inclusion in the Regional Tuna Fisheries Database (RTFD). Shark catches by the Korean purse seine fleet are theoretically included in the RTFD but as previously noted are virtually non-existent.

Total landings of fish from all distant water fisheries has grown steadily in Korea from about 475,000 tons in 1980 to almost 900,000 tons in 1994, with the Pacific contributing about 80% of the total in that year. As of 1994, tuna and skipjack catches represented about 23% of all distant water catches by volume, and ranked third behind pollack (30%) and squid (26%).

With the closure of the high seas driftnet fishery for squids, which previously captured significant quantities of pelagic sharks (Park et al, 1992), the remaining Korean distant water fisheries for which shark bycatch is significant, are the tuna fisheries. The Korean tuna longline fishery began in the late 1950's with tuna longliners based out of Samoa targeting albacore for cannery grade product. By the 1960's there was a UN-sponsored training school in operation at Pusan, and tuna longlining was well established in the south and central Pacific by the early-1970's. By the mid-1970's this fleet had grown to 589 vessels worldwide. However increased operational costs encouraged operators to follow the Japanese into low temperature sashimi operations. By 1995 there were only 31 foreign-based (i.e. albacore) longliners worldwide, with 18 operating in the Pacific (see Table 10 below).

In contrast, the number of low temperature sashimi vessels grew gradually and reached a maximum of 276 by 1990. However the following five years saw continued attrition to where there were just under 200 vessels by 1995. Reasons given for the decline included high operating costs, poor catches and fluctuating fish prices.

During the period of the early to mid 1980's Korean purse seine operations began based in Guam and the numbers of purse seiners quickly increased to where there were 39 seiners owned by 12 companies in 1990. As financial and political difficulties in the purse seine industry worldwide began to exert negative pressure on fleet operations, the fleet began to gradually downsize and in 1995 the Korean fleet consisted of 29 vessels operated by 7 companies. Down sizing of the fleet will most likely continue in the near future due to regional restrictions on the number of licenses available to the foreign purse seine fleets seeking access to the western Tropical Pacific tuna fishery (South Pacific Forum Fisheries Agency: Arrangement for the Management of the Western Pacific Purse Seine Fishery (a.k.a. the "Palau Agreement").

By 1995 the number of vessels in the Korean distant water fleet were reported as follows:

Table 10. Vessels in Korean Distant Water Fisheries, 1995

Vessel type	Total	Pacific	Atlantic	Indian
Foreign-based tuna longliners	31	18	1	12
Korea-based tuna sashimi longliners	196	53	3	40
Purse seiners	30	30	0	0
Squid vessels	125	43	82	0
North Pacific trawlers	25	25	-	-
Hokkaido area trawlers	11	11	-	-
Foreign based trawlers	157	79	65	13
Shrimp trawlers	35	0	34	1
Saury driftnet	12	12	0	0
TOTAL	642	387	189	66

Source: Korea National Fisheries Administration, quoted by R. Perry-Jones, TRAFFIC, 1996

Catch records for the now defunct North Pacific squid driftnet fishery give some idea of species composition for the most common sharks captured, which included: blue sharks, salmon sharks,

thresher sharks, F. Alopiidae, shortfin mako shark, *Isurus oxyrhinchus*, the cookie cutter shark, *Isistius spp.*, great white shark and numerous unidentified sharks.

Observer records for shark catches made by Korean purse seine vessels operating in the western Tropical Pacific have been made by Micronesian Maritime Authority Observers for the years 1993 to the present and SPC Observers for the years 1995 to the present. To date, coverage percentages have been very low (<< 1%) and extrapolations of the data to arrive at fleetwide estimates will not provide statistically reliable figures.

No observer records trips have been carried out on the Korean albacore longliners operating in the western Pacific Ocean due to shrinking fleet size and the longevity of cruises which makes it difficult for Regional Organizations to justify the placement of observers. Shark catches are not reported by these vessels on the mandatory logbook sheets and as such no information is available in the RTFD.

The Korean fresh tuna longliners operating in the western Pacific ocean also do not report shark catches on a consistent basis and there are no observer records to draw upon for species composition and catch rate data.

Availability of Korean Shark Data:

Dr. Dae-Yeon Moon's response to our official request to Dr. Lee for a description of Korean shark data:

"On behalf of Dr. Lee, I would like to inform you that the Distant Water Fisheries Division of the NFRDA collects sharks data caught incidentally by Korean tuna purse seiners and longliners. However, we only collect catch data by gear rather than detailed data such as those by statistical block, by species, or biological data. Our policy to distribute the fisheries statistics is that under a domestic regulation the data can be released to international fisheries organizations upon request for stock assessment purposes only under the permission of Director-General of the NFRDA."

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NEW ZEALAND

Introduction

New Zealand is a self-governing country in the South Pacific Ocean, situated southeast of Australia. It comprises the two principal islands of North Island and South Island along with numerous smaller islands, including Stewart Island to the south of South Island. The land area of New Zealand is 270,534 km² with an EEZ covering 1.2 million nm² extending from latitudes 25° S to 55° S. Associated with New Zealand are Ross Dependency (in Antarctica), Niue, Tokelau, and the Cook Islands. The capital of the country is Wellington. Auckland is the largest city.

New Zealand is divided into 14 local government regions. On North Island are Auckland, Bay of Plenty, Hawke's Bay, Northland, Taranaki, Gisborne, Waikato, Manawatu, Wanganui, and Wellington; on South Island are Canterbury, Otago, Nelson-Marlborough, Southland, and West Coast.

The amount of productive shelf area surrounding New Zealand is limited in comparison with continental shelf areas in other parts of the world which support large fisheries, and although New Zealand has substantial and productive deepwater fisheries, the coastal fisheries are relatively minor in terms of the country's overall marine fishery production. Chondrichthyian fisheries comprise about 2.2% by weight of the total marine fishery production (Bonfil, 1994).

New Zealand has about 65 species of sharks with the rig shark, *Mustelus lenticulatus*, being one of the few endemic sharks important in the commercial shark catches (Paulin et al., 1989). Sharks commonly encountered and commercially fished in New Zealand waters include the school shark, *Galeorhinus galeus*, elephantfish, *Callorhinchus milii*, spiny dogfish, *Squalus acanthias*, mako shark, *Isurus oxyrinchus*, blue shark, *Prionace glauca*, Porbeagle, *Lamna nasus*, bronze whaler, *Carcharhinus brachyurus*, and the Tiger Shark, *Galeocerdo cuvieri* (Paul, 1993).

An excellent historical overview, along with copious background information covering New Zealand's domestic shark fisheries, is given by Hayes (1996-TRAFFIC). As such, the Council should refer to this paper for more specific details on domestic shark fisheries which will not be extensively covered in this section whose primary focus will be on pelagic shark bycatch in the industrial-offshore fisheries, primarily the tuna fisheries.

Inshore Fisheries

During the early to mid twentieth century, New Zealand shark fisheries were quite active based on the demand for shark livers for vitamin A extract as well as providing food for local

consumption and export markets. Initial catches were centered on the longlining of school sharks which preceded the emergence of the spiny dogfish as a primary target species for the vitamin A liver market in the late 1940's (Palmer, 1994). The fishery sustained catches of over 2,500 tons per year at it's peak and then collapsed in the mid 1950's with the development of synthetic vitamin A.

A second pulse of concentrated shark fishing occurred in the early 1970's when new markets were created for shark fillets, both domestically and in Australia, with some 3,000 tons of school shark, rig, and elephantfish supplying the annual demand (Annala, 1995). As in other parts of the world, the concern over high levels of mercury content in the flesh of large oceanic predators lead to the decline of this market in 1972. From the 1970's up until 1986, shark fisheries and catches expanded rapidly in New Zealand as the domestic and export market's for sharks began to pick up steam. In response to warning signs that the major stocks were being over-exploited, the New Zealand government implemented in 1986 a Quota Management System which included Individual Transferable Quotas (ITQ's) for many of the more commercially important fisheries, including the domestic shark fisheries (Francis, 1996).

Commercial fishing in New Zealand waters is administrated by the Ministry of Fisheries under the Fisheries Act of 1996 which divides the EEZ into ten Fisheries Management Areas (FMA) with the major fish stocks managed at a finer scale within Quota Management Areas (a particular fish stock may overlap several FMA's, hence the need for Quota Management Areas). The Ministry of Fisheries collects data from all commercial fishing operations in the New Zealand EEZ. All commercial fishermen are required to fill out a logbook that contains catch, effort and landing data which details, among other things: trip dates, catch of target and the 5 most prominent shark species caught (after 5 listed as others), effort, landing date and point of landing.

The three main directed domestic shark fisheries (school, rig and elephantfish) are allocated Total Allowable Commercial Catches (TACC) which are assigned each year based on the base available scientific evidence concerning the status of the stocks as well as any relevant political, social and economic factors that come into play. The TACC is then distributed to the commercial fishermen as ITQ's .

A significant shark bycatch has been recorded for the commercial trawl fisheries in New Zealand with Bonfil (1994) stating that 40% of the overall shark bycatch comes from this fishery, with dogfish being the primary component of bottom trawl shark bycatch (Palmer, 1994). Other commercial fisheries that capture shark as bycatch include the jack mackerel (*Trachurus declivis*) and barracouta (*Thyrsites atun*) fisheries, both taking poorly documented amounts of school sharks, and the hoki (*Macruronus novaezelandiae*) and warehou (Seriolella punctata) fisheries which capture the dark ghost shark, *Hydrolagus novazelandiae*, in moderate quantities.

Offshore (Tuna) Fisheries

The largest bycatch of sharks in any NZ commercial fishery, however, have been taken by the domestic and foreign tuna longline fleets which target bigeye and bluefin tuna. Historically, Japan was the predominant fleet fishing for tunas in New Zealand but a recent emphasis on maximizing the potential of the domestic fishery has reduced the number of licenses available to Japan and has resulted in the growth of the domestic fleet and a concurrent decline in the Japanese fleet.

Table 11. New Zealand Tuna Longline Vessel Composition Summary

Fleet	Year	No. vessels	No. sets	Fleet	Year	No. vessels	No. sets
Domestic	1991	6	84	Japan	1991	49	4465
Domestic	1992	11	359	Japan	1992	35	3148
Domestic	1993	22	984	Japan	1993	24	1501
Domestic	1994	39	1651	Japan	1994	6	320
Domestic	1995	51	2006	Japan	1995	7	463

Source: NZ Ministry of Fisheries catch and effort database

Observer records from the New Zealand domestic tuna longline fishery indicate a substantial bycatch of sharks (≈ 42% by number of total catch) with a raised effort of 2,455 sets from the NZ domestic fleet producing a raised catch of 45,082 animals in 1995 of which nearly all were finned and discarded (Francis, 1996).

Table 12. Fisheries Observer Records for shark bycatch taken in tuna longliners operating in the NZ EEZ in 1995.

Species	Observed	Scaled
Blue shark	6,152	45,082
Mako shark	209	1,532
Porbeagle shark	1,086	7,958
School shark	416	3,048

Other sharks	739	5,415
Total sharks	8,602	63,035
Tunas	4,748	34,793
Billfish	75	550
Other finfish	7,042	51,604
Grand total	20,467	149,982

Source: Malcolm P. Francis, NIWA, 13 November 1996 Total sets: 2455 (3.18 million hooks),
Observed sets: 335, Scaling ratio: 7.328

A poorly documented amount of shark bycatch is taken by the New Zealand purse seine tuna fishery targeting skipjack tuna in the NZ EEZ during the southern hemisphere summer with fishing the best from December to March (Itano, pers. comm.). A total of 5 domestic seiners (159 to 544 gt) operated in 1995 producing a total catch of 10,398 mt. (Lawson, 1995).

Shark bycatch taken by US and NZ purse seiners operating in the NZ EEZ is available for the years 1976-1982 from observer data supplied by the NZ Ministry of Agriculture and Fisheries (Bailey et al., 1996). Six species of sharks are recorded including blue sharks, bronze-whalers, *Carcharhinus brachyurus*, smooth hammerhead, *Sphyrna zygaena*, mako, thresher, and spiny dogfish, *Squalis acanthias*.

Fisheries Data Collection and Management

The National Institute of Water and Atmospheric Research (NIWA) manages the tuna longline database with the overall NZ commercial catch and effort information system and the Observer logbooks handled by the Ministry of Fisheries (K. Sullivan, pers. comm.). The commercial logbook database has complete records of the fishing operations, but less details on the shark species involved. There is, however, port sampling data recorded from the off-loading and processing operations. Very little biological data is collected as the shark species are not generally high priority for stock assessment (none are included in the Quota Management System, except the smaller elasmobranchs, elephant fish, rig and school shark, which are inshore species). It is possible ghost sharks and spiny dogfish may be added to the System in the near future.

Commercial logbook catch data from 1983 is available by species. Prior to that the non-target species records were kept and reported as generic 'others' in the logbooks (K. Sullivan, pers. comm.). The MAF Observer program on deep water vessels started in 1986, and in 1990 for the tuna longline vessels more. Catch records for the tuna longline database (managed by NIWA) are from at least mid-1980s.

The various databases utilize the Empress System (relational databases) and is readily accessible by various government and industry personnel for management and research purposes. The Observer data is in a separate database whose format we were not able to track down.

There currently is no direct access of the databases for outside sourcing (i.e. no web pages or interactive terminal downloads), but data would be made available on request (some minor costs may be involved) on a case by case basis (K. Sullivan, pers. comm.).

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PALAU

Introduction

The Republic of Palau consists of approximately 200 islands situated in the western Pacific Ocean with a land area of 500 km and an EEZ extending to 600,900 km² of ocean. The Republic includes the islands of Koror (the administrative center and capital), Babelthuap (the largest island in terms of land mass), Angaur, Peleliu and several coral outer islands including Sonsorol, Tobi, Pulu Anna, Helen's Reef and Merir to the southwest, and Kayangel to the north.

The Palauan people have a rich fishing heritage with domestic and subsistence fisheries contributing over 1,500 tons per year of marine organisms, including some sharks (Anon. 1993). Palau has an abundant and diverse population of tropical sharks inhabiting the coral reefs and atolls but apparently no commercial fishery targeting sharks has ever developed. The only known research survey investigating the possibility of a commercial shark fishery was carried out by a Korean research vessel in 1975. Reportedly, that survey "found hammerheads, milk sharks, white tip reef sharks and sand sharks (no species names provided) to be the most abundant".[19]

Currently, the country is experiencing an economic boom that is partially fueled by an ever-increasing tourism sector. Tourists, mainly from the US, Japan, Korea, Taiwan and elsewhere in Asia are visiting Palau in record numbers to view its rich marine habitat and participate in such activities as scuba diving and snorkeling. A heightened awareness of the value of the environment is evident, with two well-respected Non-governmental organizations (NGO's), The Nature Conservancy and the Palau Conservation Society maintaining offices and conducting programs and research in Palau. The latter organization is about to undertake a large scale review and survey of pelagic fisheries in the country under the auspices of the World Resources Institute (Graham, pers. comm).

Beginning in the mid 1960's a skipjack fishing base was set up in Palau's Malakal harbor by Van Camp Seafood Company of California. First Okinawan and then later Korean pole and line vessels produced from 4,000 to around 8,000 tons per year, with an average of about 20-25 vessels operating from the on day trips. All catch was brine frozen and stored in a large shoreside cold storage until loaded onto refrigerated carriers and shipped to markets worldwide. The base was closed in the late 1970's when purse seine fishing for skipjack and yellowfin tuna developed in the region. Van Camp maintained the facilities for several years, however later

[19]Although Hayes makes this statement (TRAFFIC, 1996), no reference for the shark survey document is available. One of the authors of this report was present in Palau when the survey vessel arrived in 1975 and recalls meeting the captain and chief scientist. Their published report was provided later to the then Trust Territory of the Pacific Islands Marine Resources Department, but has not been located to date

they were used for a variety of purposes until eventually taken over by Palau International Trade Corporation (PITI) in for use as a tuna longline transhipment base (Maeda, 1992).

A substantial fresh sashimi longline industry has developed in Palau since 1990 with Chinese and Taiwanese vessels targeting bigeye and yellowfin tuna for the Japanese market. The industry was set up by Taiwanese traders (PITI and Palau Marine Industry Corporation, PMIC) in the early 1990's who brought in dedicated air freight aircraft and provided logistical support as well as supplies and marketing expertise. The first groups of Chinese vessels to arrive were those operating under the umbrella of the China National Fisheries Corporation (CNFC) a parastatal body that formed the Zhong Yuan Fisheries Company Ltd. as a joint venture with provincial groups from Fujian, Shantou, Hainan and other locations in China. They outfitted vessels from other fisheries from China and contracted their vessels and crews to fish for the foreign sashimi trading companies which had set up operations in Palau. Early results were not very encouraging in terms of either effort or production, however Zhong Yuan Fisheries believed these to be trial operations and did not seem overly concerned with these problems[20].

At the present time, three companies operate in the fresh sashimi industry: PITI and PMIC are the two largest with a third and smaller company, Kuniyoshi Fishing Company (KFC), also involved. The Palau Maritime Authority currently licenses about 200 locally-based longliners in this fishery, roughly equally divided between Chinese and Taiwanese vessels. It is thought that vessels of one major company use predominantly steel leaders and thus tend to land more sharks than vessels associated with the other which use monofilament (Graham, pers. comm.).

Port sampling under the local direction of the Palau Maritime Authority (PMA) began including non-tuna species in 1994. As with other Pacific island countries where port sampling occurs in longline landings of Asian longliners it is not clear how many sharks are either hidden or overlooked by the time the sampling is completed. In 1994, PMA's port sampling summary shows that by number of fish approximately 8% of the Taiwan longline catch and about 3% of the Chinese catch were sharks. PMA now says that

current Chinese longliners do not write down shark catches on the madatory log sheets,

and they are "looking into it". (T. Graham, pers. comm.).Those Japanese vessels sampled, both the under 20 gross ton vessels as well as a few distant water vessels which called at Palau, had no sharks retained on board. (T. Graham, pers. comm.).

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[20]Personal conversation of one of the authors with Li Xiang Xiu, Manager/Engineer, Zhong Yuan Fisheries Co. Ltd, of Palau, during a visit to Majuro, 1992

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PAPUA NEW GUINEA

Introduction

Papua New Guinea, is an independent nation in the southwestern Pacific made up of the eastern half of the island of New Guinea, called the mainland; the Bismarck Archipelago; the Louisiade Archipelago; the Trobriand Islands, and the D'Entrecasteaux Islands; Woodlark Island; and other nearby islands, including Bougainville and Buka. Papua New Guinea is bounded on the north by the Bismarck Sea; on the east by the Solomon Sea; on the south by the Coral Sea, the Gulf of Papua, and the Torres Strait; and on the west by the Indonesian province of Irian Jaya. The nation has a land area of 462,840 km^2 and an EEZ of 2.3 million km^2.

Relatively small quantities of shark were caught incidentally by artisanal fisheries prior to 1980, and either consumed locally or exchanged for garden products (Chapau and Opnai, 1983). Taiwanese gillnetters (five 150 grt vessels with 1.6 km long nets of 160 mm mesh) began fishing in the Gulf of Papua in 1982. Data for this fishery are poor, due to incomplete or non-existent reporting of catches to the Papua New Guinea fisheries authorities (Nichols, 1993). Catch figures are only available for 1981 and 1982 when 810 tons (1.01 ton per day) and 405 tons (0.80 ton per day) were caught respectively (Chapau and Opnai, 1983; Anon. 1982). Catches were dominated by sharks, which were reported to make up 80-90 per cent of the catch by weight. The scalloped hammerhead shark, *Sphyrna lewini*, accounted for 40% by weight of the shark component of the catch.

Commercial tuna longlining was first begun by Japanese distant water vessels in the 1950's. They were followed by Taiwanese and Koreans during the succeeding decades. The first licensing of distant water fleets was instituted with the Japanese in 1978. However in 1987 the Japanese and PNG could not reach agreement, and no permitted longlining by Japanese vessels has been undertaken since that time (Preston, 1995).

By the early 1990's a small fleet of Taiwanese and Japanese boats based in Guam also entered the fishery. Taiwanese longliners have also been allowed to fish for tuna and shark. A directed fishery for sharks took place in the 1990's, however it is unclear how many vessels out of an estimated 40 or so were involved in directed shark fishing because there was some cross licensing with tuna fisheries (Len Rodwell, pers. comm.).

As of 1995 PNG has banned all foreign longlining in it's EEZ and has instituted a policy aimed at developing a domestic fleet. By the end of 1995 there were 12 domestic longliners, about half of which were actively exporting their catch (Preston, 1995).

Based on data from a single observer trip on board a 59 grt Japanese longliner, sharks (no species breakdown, catches listed under generic 'shark' category) comprised 10% of the overall catch by weight (Wright, 1980).

During 1993 and 1994 a test longline fishing project was carried out by SPC in East New Britain province. It was reported that "sharks were not excessively numerous or troublesome and did not cause gear damage or bait loss to the extent reported in other longline fisheries" (Preston, 1995) .

Note: this may have been unique to the fishing ground, as while yellowfin were captured in historically consistent rates, "several species normally encountered in longline catches...were rare in or absent from the ...trial catches (Preston, 1995).

Japanese purse seine vessels operated in the PNG EEZ from 1979 to 1986 and no doubt captured a significant number of pelagic sharks given the importance of log fishing to the overall catches made in PNG waters. A developing PNG PS fleet also fished in the PNG EEZ in 1995 with 3 vessels taking over 15,056 mt of fish (Lawson, 1995). The US PS fleet has access to PNG waters via the multi-lateral fishing treaty and there are some limited FFA PS Observer records for shark catches from these trips but these have been, in the past, more qualitative than quantitative (Karl Staisch, FFA Observer Program Coordinator, pers. comm.).

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THE REPUBLIC OF THE MARSHALL ISLANDS

Introduction

The Republic of the Marshall Islands (RMI) is an archipelagic nation located in the central North Pacific Ocean consisting of 34 islands in two groups: the southeastern Ratak Chain and the northwestern Ralik Chain. The islands are atolls and coral reefs (~870) and the inhabitants are of Micronesian descent. Kwajalein is the largest atoll with Majuro serving as the capital island. The total land area equals 181 km^2 with an EEZ of approximately 2.13 million km^2. Population is currently 45,600 (1990 estimate).

The RMI became a trusteeship of the United States in 1947 and self-governing in 1979. A Compact of Free Association, delegating to the U.S. the responsibility for defense, was approved by plebiscite in 1983 and came into effect in 1986. The trusteeship was formally dissolved by the UN Security Council in 1990, and the country was admitted to the United Nations in 1991.

Reef sharks (F. Carcharhinidae) are common and widely distributed throughout the atolls and lagoons. Sharks are used as a minor subsistence resource but are not a preferred item in the diet and are not targeted specifically. There currently is a U.S. funded Outer Islands Shark Project, however, underway in the RMI which focuses on incorporating a value-added component to the shark portion of the artisanal fish catch by selling shark fins for export (Ray Clarke, pers. comm.). The initial effort of the project is centered around one atoll (Ailingalaplap) with production at 15 kg. (or less) of shark fins every few months. Sharks are caught both tangled in lagoon-set gill-nets as well as during pelagic fishing. and killed (not eaten) because they damage the nets. The project coordinator has instituted a minimum size requirement for shark fins but it appears that small sharks that do damage to the gillnets are killed (Kevin Hart, pers. comm.). No relevant fisheries data for this project is being collected at this time.

The majority of the shark catch in the RMI is taken by the domestic and foreign (Japanese, Taiwanese, Chinese and US) tuna longline fleets as well as the foreign purse-seine fleet (Japan and US multi-lateral). There are currently 4 domestic longliners and 20 Taiwanese longliners licensed to fish in the RMI EEZ (Lawson, 1995; Simon Tiller, pers. comm.). The Taiwanese longliners are part of the Ting Hong group that set up an onshore transhipment base in late 1993 with 30 Taiwanese and 30 Chinese longliners originally licensed to fish. Due to adverse business conditions, the Ting Hong operation is now supporting only about 20 Taiwanese longliners and may not continue in the near future (Tiller, pers. comm.).

Ting Hong purchased whole shark from both the domestic and foreign longliners and shipped them frozen, in containers, back to Taiwan although no data exists to verify the species captured or amounts shipped. This was initially carried out as backhaul cargo on their supply ship which

brought bait and other supplies to Majuro. However with the reduction in vessel numbers at the base, such activities now utilize containerized shipping on commercial carriers.

Some newer Taiwanese longliners above the 40 grt class have a freezer hold located in the focsle area of the vessel where high value sharks are stored after finning. The catch may be held on board until return of the vessel to Taiwan, or transshipped at the fishery base.

No data exists in Majuro to verify the species captured or amounts shipped. The Marshall Islands Marine Resources Authority (MIMRA) has not received good cooperation from Ting Hong in terms of submitting mandatory longline catch records (including shark catches) and the termination of there operations in the RMI may be due, in part, to there lack of compliance to the minimum terms and conditions of the licensing agreement (Tiller, pers. comm.).

Species composition and cpue data for shark catches are available from SPC Observer trips made on 8 Chinese longliners based in the RMI for the period July-December, 1995. There has previously been no observer activity in RMI waters, where a considerable amount of longline activity by distant water Japanese longline and pole and line vessels has taken place for more than 15 years. In addition, SPC Port Samplers collect biological data for target and bycatch species offloaded to the transhipment base in the RMI but as can be expected, there are very few opportunities to collect data on the shark catches as they are offloaded (as in the FSM) apart from the target catches.

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SOLOMON ISLANDS

Introduction

The Solomon Islands consists of about 30 principal islands and numerous atolls in the South Pacific Ocean, east of Papua New Guinea. The country includes most of the Solomon Islands group, notably Guadalcanal, New Georgia, Santa Isabel, Malaita, Choiseul, San Cristobal, and Vella Lavella, as well as Ontong Java (Lord Howe Island), Rennell, and the Santa Cruz Islands. The total land area is 27,556 km² with an EEZ of 1.3 million km.². The population (1990 estimate) was 328,000. The capital and principal port is Honiara (population 35,288), on Guadalcanal. Melanesians make up about 94 percent of the population, with a small minority of indigenous Polynesians. Micronesians were brought to live in the Country during the first half of the century, mostly from the overcrowded Gilbert Islands. English is the official language, although Pidgin is more widely spoken; some 80 local languages are also used.

Sharks are caught by subsistence and small scale artisanal fishers in many areas of the Solomons, generally as a bycatch of fishing for deep water bottom fish. Some villages, in particular the Micronesian populace, consume the flesh of certain high quality species but more commonly the fins are removed and sold to local buyers in Honiara. Shark landings are comprised mainly of Carcharhinid sharks, the inspection of the catch from a shark longliner in 1984 found that 62% of the catch was made up of *Carcharhinus spallanzani* (Skewes, 1990).

During 1984-85, a commercial shark fishing operation was in place to catch sharks (primarily reef sharks) for the production of hides for tanning into shark leather and export to the US leather market. Catch rates were reported by Nichols (1993) in the range of 60-126 sharks per set with between 340-380 hooks set per night. Sharks caught were generally 1-2 meters in length (15-62 kg. weight range), with an average of 1.3 m. The species composition taken in this fishery included the gray reef shark, *C. amblyrhynchos*, spot-tail shark, *C. sorrah*, black-tip reef shark, *C. melanopterus*, white-tip reef shark, *Triaenodon obesus*, silver tip shark, *C. albimarginatus*, hammerheads, *G. Sphyrna*, and Tiger sharks, *Galeocerdo cuvieri.* For the period 1984-85, a total of 190 tons of shark were landed with 2,000 skins and 2 tons of shark fins exported. The company ceased operations in 1985.

An exploratory fishery for deep-water sharks commenced in Solomon Islands in 1987 using deep water droplines and longlines. Fishing occured overa period of 2 weeks either side of the new moon in the vicinity of Guadalcanal (Nichols, 1993). Catch rates were reported to be around 250 sharks per day, mainly *Centrophorus spp*. The carcasses were discarded at sea and the livers retained with subsequent production of squalene oil for export to Japan (1989-92) ranging from 2,890 kg. to 7,650 kg. per year (TRAFFIC, 1996). The SI possess a small domestic tuna longline fishery that has remained steady at 2 vessels since 1976 (Lawson, 1995). Logbook data is submitted to the Fisheries Division of the SI Ministry of Natural Resources but shark catch data is usually not recorded.

Industrial DWFN purse seine and longline vessels are licensed to fish in the SI EEZ mainly vessels from Japan (only longline vessels), Taiwan, Korea and the US. Again, quantitative data for shark bycatch from the DWFN fleet is virtually non-existent save for the occasional FFA US PS observer trip (K. Staisch, pers. comm.).

A domestic purse seine fishery has existed in the Solomons for almost a decade, and comprises two 500 gt purse seiners. Most purse seine fishing is undertaken in association with anchored or drifting fads and payaos. A group purse seiner was also operated under domestic license by the Solomon Taiyo Enterprise, delivering to the tuna delivering to the cannery at Noro that cans almost exclusively skipjack from the domestic pole and line fleet (~ 30 vessels in 1995). No information on shark bycatch from either of these operations is known.

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TAIWAN

Introduction

Taiwan is an island province of China and, since the Communist victory in 1949 on the Chinese mainland, the seat of the government of the Republic of China. It is separated from the Chinese mainland by the Taiwan Strait and is bordered on the north by the East China Sea, on the east by the Pacific Ocean, and on the south by the South China Sea. In addition to the island of Taiwan, the country includes the P'enghu Islands, or Pescadores, the small Quemoy Islands off the mainland city of Amoy (Xiamen), and the Matsu group off Fuzhou (Foochow). The People's Republic of China also claims Taiwan as one of its provinces. The land area of Taiwan is about 36,000 km^2. Taiwan is divided into 16 counties (hsien), five municipalities, and two special municipalities (T'aipei, the capital, and Kaohsiung). Each county is subdivided into townships (chen), rural districts or groups of villages (hsiang), and precincts.

Fisheries Overview

For administrative and statistical purposes, the Taiwanese fisheries are divided in to four categories:

--Aquaculture

--Coastal fisheries: sampans and small craft, including motorized rafts, which fish within 12 miles

--Offshore fisheries: vessels fishing in Taiwan's 200 mile EEZ

--Deep sea fisheries: fishing beyond Taiwan's 200 mile EEZ, including international waters and EEZs of other countries (also referred to as distant water fisheries)

In 1994, distant water fisheries were the principal source of production volume (683,000 tons) and value (US$1.4 billion). Tuna longline produced over 200,000 tons and squid jigging about 150,000 tons.

Tuna fisheries, both ports and markets, are located in the southern ports. Kaohsiung is the main harbor in country but Tung Kang, about 20 miles south is a major secondary landing port for fresh tuna. Landings of high quality tuna are air freighted to Japan via Kaohsiung. Smaller offshore and some distant water vessels land fresh fish to Tung Kang, with sashimi tuna being the major export species. From 30-100+ tons per day are landed at Tung Kang.

All commercial fishing is supposed to take place within the umbrella of fisheries associations. There are 38 associations in the country.

There are two directed shark fisheries in the country. Both take place in offshore waters within Taiwan's EEZ. Combined these two fisheries landed a total of about 85% of the country's total coastal and offshore shark landings of 5,300 mt in 1994. One is based in Nanfang Ao and consists of about 20 vessels that employ bottom longline in depths of from 80 to 200 meters to catch mainly thresher, shortfin mako, hammerhead, tiger and other species. The other fishery is based in Chengkung and uses three different types of gear: shark longline, large mesh drift gill-net and set-net. Major species caught by drift net are two species of thresher; mid-water longline targets requiem sharks, hammerhead, shortfin mako and others.

The numbers of tuna longline vessels which might either fish or be based overseas, including offshore vessels, are noted below (Table 13).

Table 13. Taiwan Tuna Longline Fishing Vessels

Tonnage Class	Fishery	Total number
20-49	Coastal, offshore tuna	950
50-99	Offshore tuna, foreign based albacore	485
100-199	Far seas tuna, foreign based albacore	66
200-499	Foreign based albacore, deep freeze sashimi	413
500-999	Deep freeze sashimi	220
Total		2134

Source: Fisheries Yearbook, Taiwan Area, 1995 and industry contacts.

Longline Tuna Fisheries Statistical Collection System Overview

Taiwan fisheries are regulated under the Fisheries Act. This legislation has existed in the Republic of China since 1929, but was revised and put in its current form in 1991. The objectives, as stated in Article 1 are "to conserve and rationally utilize aquatic living resources; to enhance fisheries productivity; to guide the complete development for fisheries; to foster the development of recreational fisheries; to maintain fisheries discipline; and to improve the standard of living of fishermen" (unofficial translation).

Chapter 5 of the Act deals with conservation and management, and includes the requirement for fishermen to cooperate in providing needed information, including fishery catch data.

In actual practice, it can be said that government administration of fisheries has lagged behind commercial development to a large degree, and still has a long way to go to catch up. External pressures, particularly the realities of operating in foreign EEZs have accelerated the pace of governmental control and subsequent data collection, however there is still a long way to go.

The Fisheries Department of the Council of Agriculture is the national organization responsible for fishery planning, policy and administration. Although it is at the highest level of government, the number of senior staff is quite small and reliance is still placed on lower administrations or other bodies for data collection and compilation.

The Taiwan Fisheries Bureau (TFB) is a provincial level bureaucracy (keeping in mind the claim of the Republic of China to the mainland) within the Department of Agriculture and

Forestry. The TFB has a division responsible for the collection of statistics on fisheries, and publishes the annual *Fisheries Yearbook, Taiwan Area.*

The Kaohsiung Fisheries Administration is similar to the Taiwan Fisheries Bureau, but is responsible for all vessels registered in that locality. Since many of the tuna longline, purse seine and squid boats are from Kaohsiung, it handles the majority of these vessels. It also has a division responsible for the collection of statistics on fisheries. About 90% of the distant water shark catch taken by large vessels, including trawlers as well as longliners, is landed in Kaohsiung (Chengchen harbor).

The Tuna Research Center of the Institute of Oceanography, National Taiwan University had published the Annual Catch Statistics of Taiwan's tuna longline fishery since about 1978. However the system has reportedly changed, with the data now being sent to the Overseas Fisheries Development Council for preparation and publication (P. Ho, pers. comm). The data shows target catch by major species by 5 degree squares, with sharks not identified as to species. The role of the Tuna Research Center in data collection and publication is now not clear.

The Taiwan Fisheries Bureau publishes annual landings and landed value of tunas by species by prefecture (Hsien) as well as overseas landings in the *Fisheries Yearbook, Taiwan Area.*

Recently there has been a shift in responsibilities for the compilation of catch statistics from distant water vessels; this collection has been made the responsibility of the Overseas Fisheries Development Council. The Council was created in 1989 as a non-profit corporation to mainly work in cooperation with Taiwanese interests involved in overseas fisheries. They are in close contact with the three major Associations involved in such fisheries: the Kaohsiung Fishing Boats Commercial Guild, the Taiwan Deep Sea Tuna Boatowners and Exporter's Association, and the Taiwan Squid Fishery Association.

Data is collected at the Provincial level by the Taiwan Fisheries Bureau, Kaohsiung Fisheries Administration, and the smaller Fu-kien Provincial government administration where applicable, and forwarded to the Council in Taipei.

Compilation of the data is accomplished by keying in directly from log sheets provided by the above collecting agencies. Reportedly, these data are put on CD ROM, however they are still working the bugs out of this system (1/97). Publication is said to be by 5 deg. square.

Scientific Activities Overview

Scientific research which makes use of fishery statistics must request such data from the relevant organization in charge of the data. It should be understood that universities thus request access to such data, and do not own the data.

The main national university involved in research and graduate teaching is the National Taiwan University in Taipei. The National Taiwan Ocean University in Keelung is concerned mainly with undergraduate studies.

Taiwan universities and research institutions operate several research vessels. However to date there have been no cruises or research programs aboard such vessels directed specifically at sharks. The Taiwan Fisheries Research Institute operates from five to seven vessels, the National Taiwan Ocean University in Keelung has one vessel, with others operated by the National Taiwan University in Taipei and Sun Yat Sen University in Kaohsiung.

Dr. George C.T. Chen of the National Taiwan Ocean University is one of the foremost shark researchers in Taiwan. Dr. Chen is a graduate of the Tokyo University School of Fisheries, and has spent time in universities in the United States, most recently at the University of Washington. He has instituted a voluntary program of shark data collection among captains of distant water tuna vessels, using the cooperation of the Taiwan Deepsea Tuna Boatowners and Exporters Association. Captains have been asked to identify sharks when captured by using a combination of photographs and profile drawings. They have also been supplied with some instant cameras and have been asked to retain specimens from those individuals they cannot identify. Dr. Chen does not expect to get species identified, however hopes to at least successfully name the genus. He is thus hoping to more precisely define what is caught beyond the officially required large/small descriptions within the catch data.

Identified Data Holdings

There has been no separate collection of statistical data for shark from any offshore or distant water fishery. There are two directed coastal shark fisheries in Taiwan (see above). Data for these two fisheries exists, but it is mostly landing data taken from the ports and markets.

The major source of published information on shark by-catch is the *Fisheries Yearbook, Taiwan Area.* Shark bycatch has been compiled by the Taiwan Fisheries Bureau since at least 1981 in aggregate form and is published in the *Fisheries Yearbook, Taiwan Area*. Codes for shark within the published data however are limited to "sharks" (5201) and "young sharks" (5202). Data can also be extrapolated for total landings by year for types of fisheries (distant water, offshore and coastal) and gear employed (trawl, tuna longline, gill net, spear/harpoon and others).

Annual landings of Taiwan's distant water tuna vessels began to be published in the *Fisheries Yearbook, Taiwan Area*, (1989d). This information is aggregated by operational area, i.e. Pacific, Atlantic or Indian Ocean.

Tuna catch statistics contain shark by-catch information. It is the opinion of many that this catch information reflects retained sharks only. In the case of Taiwan's fisheries this may or may not represent a large percentage of landings. For offshore vessels landing fresh fish to Taiwan ports, most sharks are retained for sale and thus landing data might reflect overall catch. Distant-water fisheries, such as deep-freezer longliners operating in the Indian Ocean or elsewhere, land to transshipment ports or on the high seas. The destination of such transshipment is always Japan, and onboard handling and transportation costs do reportedly justify the retention of sharks for such transshipment (there may be exceptions for such more desirable species as shortfin mako).

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A note on Email in Taiwan: Email is fairly new to many government bureaucrats and business people. While they are making efforts to utilize this convenient and inexpensive method of correspondence, the equipment in Taiwan has been woefully inadequate to handle the demand. Thus many who initially tried using Email are discouraged and have reverted back to telephone and fax communications. Also, in many offices individuals do not have their own computers, or if they do the system is not a network so Email access, even if available, is difficult and messages are not confidential.

UNITED STATES

Introduction

A US distant water purse seine fishery is conducted in the central and western Pacific oceans with the majority of the vessels based in Guam or American Samoa. The carrying capacities of these vessels, which numbered 44 in 1995, are 1,000 mt or more. The fishery targets the principal market species of tuna (skipjack, yellowfin, and bigeye) but also has a significant, but poorly documented bycatch of sharks, particularly when fishing on logs (drifting objects).

Catch and Effort Data

The US distant water purse seine logbook data have been collected by the US tuna industry for the period 1976 to 1988. Landings and logbook data for 1976 to 1978 are estimates from exploratory fishing of vessels chartered by the Pacific Tuna Development Foundation (Anon., 1977, Anon., 1979, Souter and Broadhead, 1978). It is not known if shark catches were recorded during these exploratory trips.

Data for 1987 to 1990, for operations of this fleet within the EEZ's of Pacific Island countries, have been published in the SPC's Regional Tuna bulletin which is circulated on a quarterly basis. Landings for 1979 to 1990 are from cannery receipts of landings and transhippments to USA canneries in American Samoa, Puerto Rico and California (Schug and Galea'I, 1987). Some vessels transship their catch directly to foreign ports such as Thailand, Japan, Indonesia, Philippines, Italy, and Australia and data are gathered from canneries in those countries whenever possible (Coan Jr., 1994).

Since 1989, landings and logbook data for the distant-water fishery are more complete, due to reporting requirements of the South Pacific Regional Tuna Treaty (SPRTT) between the US and 16 island nations that started in June, 1988 (Coan et al., 1988). There has been 100% coverage of landings and full compliance of logbook reporting since June 15, 1988. The data are collected, computerized and submitted by the National Marine Fisheries Service to the Forum Fisheries Agency (FFA), the managing agency for the treaty.

The SPRTT mandates an observer program for the US PS fleet with a minimum coverage of 20% of all trips. The observer program is managed by the FFA, based in Honiara, Solomon Islands. For the last reporting period June 95-96, a total of 32 observer trips were completed (~20%, K. Staisch, pers. comm.).

Table 14. The following Observer Program figures are for the last three SPRTT licensing periods

Summary Information FFA SPRTT Observer Program	June 93/94	June 94/95	June 95/96

Number of trips made by US fleet	199	206	158
Number of trips by observers	31	38	32
Percentage observer trip coverage	15.6	18.4	20.5
Fleet sea days available for observer placement	8,985	9,301	9,345
Total fleet sea days with observer coverage	1,768	2,113	1864
Percentage observer sea day coverage	19.7	22.7	20
Average observer sea days per trip	57	56	58

Source: Karl Staisch, FFA Observer Program Coordinator.

No quantitative summaries have been prepared concerning shark bycatch (based on observer data) but a rough estimate of 128 sharks reported as retained, probably the fins only were retained, and 1,553 discarded (no reports whether fins were retained) was recently reported by K. Staisch, the Observer Program manager (time frame unknown).

Until recently the only observer data collected on shark catch was whether they were present or absent in a given set and in most cases the observers recorded them as unidentified. Although no published, species-specific data currently exist, it appears from descriptive reports that Ocean White Tip and Silky Sharks are recorded regularly. The observer's do not generally record length, weight, sex or condition of sharks (K. Staisch, pers. comm.). They are instructed, however, to record whether the sharks are being finned, but this is only a recent task (i.e. shark data collection has not been a major emphasis of the data collection routines carried out by the observers).

The data is stored using MS Access database software and has been made available to the SPC-OFP on a periodic basis (e.g. submitted for inclusion in the SPC Bycatch document, Baiely et al., 1996).

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Within the USA EEZ, or 200 miles of the coasts of Hawaii, American Samoa, Northern Marianas and Guam, the US has domestic and artisanal fisheries for large pelagics (e.g. tuna, billfish and sharks) using tuna longline, pole and line, handline and troll gears. Data for these fisheries are gathered by local island fisheries agencies. Various techniques are used to gather and process the data. Hamm (1993) and Hamm et al. (1992), provide detailed background on fisheries statistics and data collection for these local island fisheries agencies in the western Pacific. The data are placed in most instances on the Western Pacific Fishery Information Network. For fisheries operating in Guam, Meyers (1993) and Hensley and Sherwood (1993) provide background information, as does Craig et al. (1993) for American Samoa.

For the fisheries operating in Hawaii, the main agency collecting information is the National Marine Fisheries Service, which collects information through the following sources:

1. Observer data. Observers are deployed on Hawaii-based longliners (coverage is about 5% of fleet activities). The observer deployment and reporting are coordinated from the Southwest Fisheries Center Office in Long Beach California, while the data observer data is sent for analysis to the Southwest Fisheries Center Laboratory in Honolulu.

Observer data is primarily directed at turtle-longline interactions so any recording of shark data is opportunistic and ceases when turtles are spotted near the line or caught in the gear. Observer coverage of the fishery extends from 1993 to the present.

2. Longline log book data. The logbook data collected from the Hawaii-based longline fishery is the responsibility of the SWFC Honolulu laboratory. The captain of each fishing vessel is obliged to complete the daily log sheets as part of the licensing conditions for the Hawaii-based fishery. The information collected on shark catches

includes navigational position, effort, date, main target species, bait used, ratio of hooks to float, number of light sticks, wind speed, wind direction, wave height, sea surface temperature, time and position of beginning and end of sets and beginning and end of haul, species caught including: blue, mako, thresher and other shark species, number of sharks finned, number of sharks kept whole, and number of sharks released/discarded. Logbook data for the longline fishery extend from 1991 to the present.

3. Both logbook and observer data are stored in computer files in ASCII format and accessed by the Honolulu Lab using the statistical program, S Plus. The data is stored on disks and on backup tapes. The Lab is developing a relational database in ORACLE which should be ready in 1997. Some of the information on shark incidental catch may be posted on the Honolulu Lab Web Page.

4. US Dept. of Commerce and NOAA confidentiality regulations apply to both logbook and observer data (National Administrative Order 216 - 100).

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Before the 1970's various species of shark were used commercially in the United States for food and assorted high value products (e.g. liver oil, shark skin leather). Shark demand as a food fish began to increase on the west coast during the middle 1970's (Holts, 1988). Most sharks are taken as bycatch in other fisheries; drift gillnet, set gillnet, hook and line, and drift longline

(only allowed outside 200 miles offshore). Small sharks and skates are also taken in trawl fisheries

The principal shark species taken include: the common thresher, bigeye thresher, shortfin mako, soupfin shark, leopard shark, angel shark, spiny dogfish, shovelnose guitarfish, and skates. The large sharks are generally headed, gutted and fins and tail removed. However, if fishers want to keep the fins, they must remain attached to the shark (except for threshers). Very small sharks and skates are brought in whole.

Captures occur in both coastal and offshore areas while most shark landings occur in southern California (Pt. Conception to Mexican Border). The fishery is year round, however, landing of large pelagic's drops off in the spring and early summer when the drift gillnet season is closed. Large pelagic sharks are more abundant in late summer and fall.

Data collection includes: Landing data (pounds, areas, ports, fishing area) collected via landing receipts; specific summaries are available from Marine Fisheries Statistics Unit. Individual port units along the coast collect biological data (length/weight frequencies, species composition) of species based on set priorities. The Long Beach Monitoring and Management Unit also conducts a shark tagging program to study pelagic shark migration, and keeps data from research cruises each year tagging shark caught on longline gear. CPUE data from these cruises is kept by NMFS. Logs are required for the Drift gillnet fishery, Offshore Longline fishery, and Commercial Passenger Fishing Vessel (sport) fishery.

Landings Data dates back to the 1920's. Unit biological data is variable. Shark biological data begins in the early 1980's. Data is stored by individual units in computer files, although original data forms are also kept. Commercial fish landings are kept on a mainframe at Cal. Fish and Game headquarters in Sacramento. Commercial Fish Landings (summaries) are published annually, individual units submit internal reports summarizing sampling effort and other unit activities (SFRA reports) annually. There is a charge involved for summaries from the Marine Fisheries Statistics Unit.

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Notes: There are quite a few people spread all over the state who work with shark fisheries; Rick Klingbeil can direct the Council to the appropriate contacts based on future data needs.

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OCEANIA SMALL ISLAND COUNTRIES OVERVIEW

Introduction

Aside from the countries specifically described in this report there are several countries in the South Pacific which, while shark catches may not be of major commercial importance or significant to local fisheries, should nonetheless not be overlooked.

Tonga, Cook Islands, Vanuatu, Nauru, New Caledonia, Niue, Tuvalu, Tokelau and Western Samoa are all members of the Forum Fisheries Agency and the South Pacific Commission and as such all participate fully in fisheries discussions, meetings and programs of regional interest. Beginning in 1978 the Commission's program of introducing and testing new fishing gear evolved into training in fishing and boat-handling techniques for small scale fishermen (Preston 1987). Most of these countries have at least some history of traditional shark fishing, including techniques fairly widespread in the Pacific such as noose fishing and shark attracting. Initially, most of the activities focused on the deep or outer reef slope (and seamounts in a few localities), and was known at different times as the Deep Sea Fishery Development Project and the Outer Reef Slope Project. All the countries mentioned were visited by SPC master fishermen employed in these projects. Several countries had three or more visits over the course of the projects' lifetime. One master fisherman reported that sharks were very difficult to retain and identify during fishing operations, with various species of F. S*qualidae* and larger sixgill shark, *Hexanchus griseus,* dominating the shark by-catch, particularly at night (Mead, pers. comm.).

The master fishermen and other SPC staff produced country reports, fishing manuals and summary reports describing the fishing techniques used, resources encountered and prospects for future activities (Dalzell and Preston, 1992). One short report was specifically aimed to assist artisanal fishermen market shark products (Preston, 1984). Partly as a result of these projects, sporadic interest in marketing shark fins from the by-catch continued throughout the decade. In 1990 the a simple manual for rural fishermen addressing this subject was prepared and published (Trachet, Pelasio and Gillett, 1990).

Of the eight countries mentioned, New Caledonia and Tonga have the most well developed commercial fishing sector and has had the greatest experience in fisheries where shark by-catch is present. The SPC Deep Sea Development Project and others resulted in an extensive artisanal deepwater snapper fishery, first focused on areas close to the main islands and later on offshore seamounts. During that period the country was provided with one longline "training" vessel, as foreign aid from Japan in the 1982. They have operated it in the longline fishery for albacore with deliveries to Pago Pago and sometimes offloading by-catch in the Nuku'alofa market for local sale (Farman, 1986).

More recently the commercial longline fleet has expanded, with currently 6 vessels operating including the former training vessel. These boats reportedly deliver exclusively to the local

market, although in the past some albacore had been delivered to Pago Pago canneries by the training vessel. However the demand and price for fish is high in the capital, Nuku'alofa, and all catch is currently landed there. Generally, these vessels do not land sharks, however shark fin is retained and sold to traders in the capital where current prices are reported to be T$60/kg. The country is currently instituting a fisheries licensing scheme, and mandatory catch reporting will be required to maintain licenses (Mead, pers. comm.).

Western Samoa's artisanal fishing sector supplies a fish market in Apia and smaller markets around the main island, fishing mainly from 7 to 9 meter outboard powered aluminum double-hulled "alias". Fishermen always attempt to land sharks caught while bottomfishing, and they are brought to the Apia market where they are butchered and offered for sale. Landing data consists of market surveys carried out by the Fisheries Division in the mid and late 1980's. More recently a small scale longline fishery has developed around FADs in Western Samoa which seasonally targets mainly albacore and yellowfin. No published information could be found on this fairly new development.

Niue and Tokelau are closely aligned politically with New Zealand and emigration has meant limited fishing activities are undertaken in both places. Niue's fishery resources are limited, and the difficulty in launching boats from the rocky coast limits activities. Tokelau consists of three separate atolls, but it too has experienced a net population loss to New Zealand and artisanal activities are essentially for subsistence purposes. Foreign access to the EEZ around Tokelau is controlled by New Zealand, and any DWFN information should be available there. Niue has participated in talks with Taiwan regarding joint licensing of albacore longliners operating in the S. Pacific, however to date they have not concluded any such arrangement.

Nauru's local fishing activity is mostly carried out by Kiribati and Tuvaluan workers on the island, and consists of handlining for small pelagics close inshore. Nauruans fish from shore-launched aluminum boats that are outboard powered, and mostly engage in trolling around the island.

Cook Islands and Vanuatu have perhaps greater fishery resources than the four previously mentioned countries. Both have licensed albacore longliners from Taiwan in the past, and Vanuatu at one time served as a base for the South Pacific Fishing Company which operated a fleet of vessels in the albacore longline fishery from Santo. Two domestic longline vessels were reported active in the Cook Islands in 1995, while none were reported from Vanuatu.

Tuvalu is a country consisting of eight coral atolls and characterized by mostly subsistence fishing. The country has operated one domestic pole and line vessel since 1982 given as aid from Japan. It fished in the Fiji skipjack fishery during the late 1980's, and was chartered by the South Pacific Commission for three years during the tagging phase of the Tuna and Billfish Assessment Program.

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GENERAL SUMMARY

Although bycatch has always been an integral part of fishing with non-discriminatory gear, efforts to manage bycatch effectively have intensified due to the changing public perception of fishing and an increased awareness of the global declines in marine fish stocks and the need for conservation measures to ensure their long-term sustainability (Murawski, 1992). The documentation of bycatch levels for many tuna longline fisheries are far from complete, but the implied levels of mortalities and associated fishing related impacts on population declines, may be large, and significant in certain regions.

In the Pacific, we know very little about the basic stock structure and population dynamics for many of the exploited shark species. A dedicated shark tagging project, such as the Virginia Institute of Marine Science's on-going shark tagging project, is lacking in the tropical Pacific where large quantities of sharks are being caught but very little information is being received on mortality levels, catch-per-unit-effort, and yearly trends in species composition and abundance. Observer Programs have proven to be the most reliable method for obtaining accurate and timely bycatch records from tuna longline fisheries and enhancement of regional efforts to provide coverage for those sectors of the fishery from which data lacks should be supported whenever possible. The main problem with the implementation and continuation of observer programs will be the huge amount of human and financial resources required to cover the fishing activities in the region. Once in place, however, observer programs can be utilized as a platform to initiate some much needed directed research on sharks. Since many of the foreign longline fleets are now basing in ports of Pacific Island nations, research projects can be coordinated through the various Pacific Island Fisheries Departments, with samples collected and stored on-site. Samples could be collected for age and growth work, reproduction (age at female maturity, average fecundity), feeding habits (energetic requirements, predator-prey relationships), and basic morphometric data. The observers could engage in shark tagging activities which are sorely needed to learn more about migration and size (sex) segregation.

Future direction for bycatch monitoring

There is currently not enough information available to review the population dynamics of individual shark species (as there is with target tuna species), and as such, it would be difficult to suggest where management measures are required at this stage, without the baseline data to support those measures. There is some obligation by coastal and flag states, with appropriate assistance from sub-regional or regional fisheries management organizations or arrangements, to address this issue in the future. Due to the low priority traditionally placed on shark research, the current state of knowledge about shark biology has been characterized as 'fragmentary' (Anon.,1997). Large gaps exist in our understanding of such life-history and biological parameters as growth rate, life span, sexual maturity, fecundity and stock-recruitment relationships (Anderson, 1990). Size of shark populations or stocks have not been estimated in most countries. Most nations do not record shark catch or landings statistics and when data are available, the reliability may be questionable due to various factors such as, the lack of adequate coverage within the fishery in question, and

non-existent validation procedures to assure accurate information is being compiled. Some countries are also reluctant to release available data due to increasing 'sensitivities' concerning the way the data have, and will be, interpreted resulting in what the countries perceive, as negative consequences for their commercial fisheries and associated industries. These issues will have to be addressed if international efforts to conserve depleted shark stocks are to succeed.

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Appendices

Map of the SPC Statistical Area
AFZ Catch Record & Shark Supplement
Shark Data Questionnaire
WPFMC Letter of Introduction
Fax Contact (Sample)