DATA REQUIREMENTS OF THE SPC OCEANIC FISHERIES PROGRAMME AND STATUS OF DATA

Tim Lawson, Peter Williams, Colin Millar and Emmanuel Schneiter

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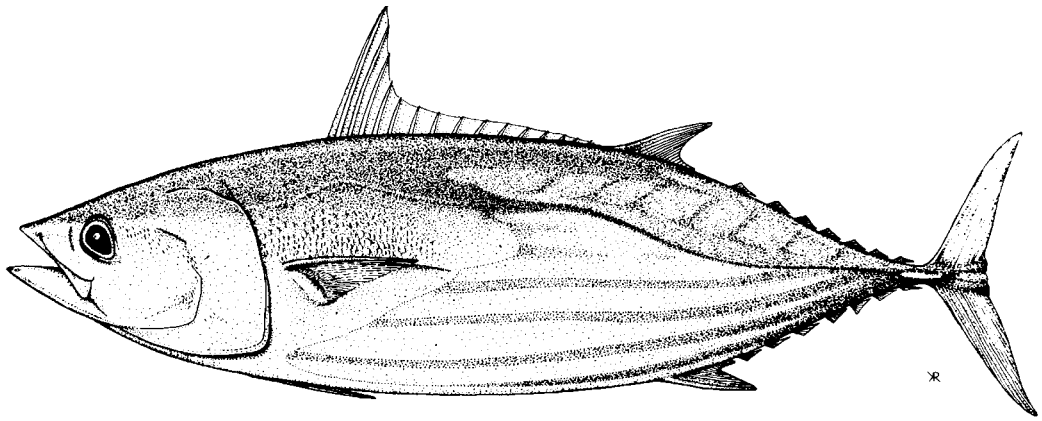

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1. INTRODUCTION

The Statistics and Monitoring Section of the SPC Oceanic Fisheries Programme (OFP) is responsible for compiling and disseminating tuna fisheries data for the western and central Pacific Ocean (WCPO, Figure 1). These data include annual catch estimates for each of the fleets, catch and effort data, species composition data, length data, and several other types of data that will be described below. The data compiled by the Statistics Section are used in OFP statistical bulletins and for research conducted by OFP scientists and scientists outside SPC.

This document presents the status of data held by the OFP in July 2002. First, the requirements of data for monitoring and research by the OFP are discussed. Then the status of each type of data held by the OFP is presented in regard to coverage, data quality and other issues specific to each type of data. Then the dissemination of data by the OFP is discussed. Information concerning data management by the OFP is presented in Appendix 1; tables of data coverage, by gear type, are given in Appendix 2; and a comparison of logsheet catch data to unloadings data is presented in Appendix 3.

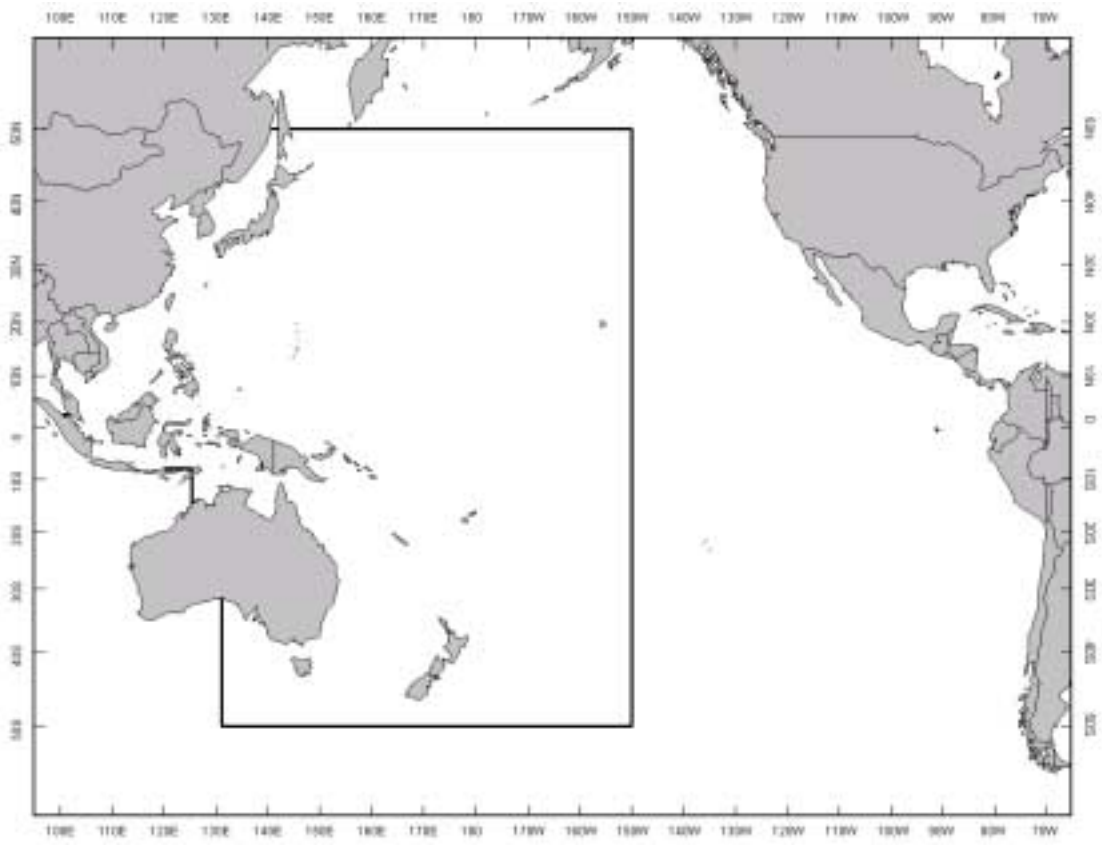

Figure 1. Western and Central Pacific Ocean (WCPO) Area. The WCPO Area was established for statistical purposes at the twelfth meeting of the Standing Committee on Tuna and Billfish, 16–23 June 1999, Papeete, Tahiti, French Polynesia (Anon., 1999a).

1.1 Background

Since the inception of the Skipjack Survey and Assessment Programme (SSAP) in 1977, SPC has been involved in the collection, compilation and dissemination[1] of tuna fisheries data for the WCPO. During the SSAP, from 1977 to 1981, tagging data and biological data were collected throughout the tropical WCPO. The SSAP also compiled catch and effort data aggregated by time-area strata that were required in addition to the tagging data for the assessment of skipjack in the WCPO.

The Tuna and Billfish Assessment Programme (TBAP) followed the SSAP in October 1981 and had, as its priority activity, the establishment of a regional tuna fisheries database, which consisted primarily of logsheet catch and effort data provided by SPC member countries and territories, and aggregated catch and effort data provided by distant-water fishing nations. In 1987, two projects were defined within the TBAP: the Statistics and Monitoring Section and the Stock Assessment and Modelling Section. A third section, the Tuna Ecology and Biology Section, was introduced in 1999.

The TBAP conducted a second large-scale tagging programe, the Regional Tuna Tagging Project, from 1989 to 1992, covering the tropical WCPO, including Indonesia and the Philippines.

The TBAP (and then the OFP, after the name of the programme was changed in early 1994 to better reflect the division of responsibility with the SPC Coastal Fisheries Programme) has compiled data in support of the South Pacific Albacore Research Group (SPAR) since 1986. SPAR and the Western Pacific Yellowfin Research Group (WPYRG), which also covered bigeye tuna, were incorporated into the Standing Committee on Tuna and Billfish in 1998. Since then, the OFP has provided statistical support to the five SCTB species research groups (albacore, bigeye, skipjack, yellowfin, and billfish and bycatch).

In the early 1990s, the OFP began providing technical and financial support for port sampling programmes and observer programmes in SPC member countries and territories. The technical support included training port samplers and observers, and compiling and processing port sampling and observer data. This activity grew in importance with the establishment of the European Community-funded South Pacific Regional Tuna Resource Assessment and Monitoring Project (SPRTRAMP), which ran from 1994 to 2001. OFP involvement in port sampling and observer programmes in SPC member countries and territories, including data compilation and processing, will continue with the Pacific Regional Oceanic and Coastal Fisheries Project (PROCFISH), which began in March 2002, with European Community funding.

1.2 OFP Tuna Fishery Data Catalogue

The present document discusses the status of the various types of data held by the OFP, but does not present detailed information regarding data holdings. Detailed information — such as the annual number of logsheet records, species covered by catch data, information on tag releases and recaptures, size composition data, unloading data, observer data and oceanographic data — can be found in the OFP Tuna Fishery Data Catalogue, which is available on the OFP website at:

http://www.spc.int/oceanfish

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[1] In the present context, "collection" of data refers to the use of forms to record various types of data (e.g. logsheets to record catch and effort data for individual vessels, observer data collection forms, port sampling forms). "Compilation" of data refers to the provision of these forms to national or international agencies, such as SPC. "Dissemination" refers to the release of data to OFP scientists and scientists outside SPC.

2. DATA REQUIREMENTS

The data requirements for research on WCPO tuna fisheries are presented below in reference to the activities of the three sections within the OFP. Among the various types of data that are required are 'logsheet' catch and effort data and 'aggregated' catch and effort data; the relationship between these two types of data is discussed below.

'Logsheet' catch and effort data and 'aggregated' catch and effort data

Catch and effort data are provided to the OFP by flag states and coastal states in two formats. 'Logsheet' catch and effort data cover individual fishing operations (e.g. a longline set or a purse-seine set) and include operational details, such as the name of the fishing vessel, the location, the catch by species, and information concerning fishing effort (e.g. number of longline hooks that were set or the association of the purse-seine school with logs, fish aggregating devices, etc.). The logsheet data are provided to the OFP by SPC member countries and territories. They are verified with unloadings data, which are also provided by SPC member countries and territories, when such data are available.

'Aggregated' or 'grouped' catch and effort data cover a time-area stratum (e.g. 5° longitude by 5° latitude by month for longline and 1° longitude by 1° latitude by month for pole-and-line and purse seine) and data for individual vessels are combined. Aggregated catch and effort data have been provided to the OFP for the Japanese distant-water longline, pole-and-line and purse-seine fleets, the Korean distant-water longline fleet, the Taiwanese distant-water longline fleet, and the United States purse-seine fleet prior to the entry into force of the treaty between the United States and certain Pacific island states in 1988 (after which complete logsheet data have been provided for this fleet).

The aggregated catch and effort data are generated from logsheet data; however, the logsheet data do not usually represent complete coverage, so they are usually raised on the basis of estimates of either the total annual effort or the total annual catch, such that the resulting aggregated data represent total catch and effort.

For those fleets for which aggregated catch and effort data have not been provided to the OFP by the flag state, the OFP generates aggregated data based on logsheet data that are held by the OFP and estimates of annual catches. Hence, when discussed below, the requirement for aggregated catch and effort data implies that logsheet catch and effort data are required by the OFP to generate the aggregated data, for those fleets for which the flag state does not provide aggregated data.

2.1 Data Requirements for Statistics and Monitoring

2.1.1 Monitoring of annual catches

Trends in annual catches are basic indicators of long-term changes in the fisheries. The data required for monitoring of annual catches are as follows:

- Estimates of annual catches of the four main species of tuna (albacore, bigeye, skipjack and yellowfin) are required for each fleet (i.e. fishing nation and gear type, such as United States purse seiners). For albacore, bigeye, skipjack and yellowfin, estimates are required for monitoring purposes for the WCPO and the Eastern Pacific Ocean. For albacore, estimates are also required for the South Pacific Ocean, since albacore in the South Pacific are considered to

be a separate stock from North Pacific albacore. The annual catch estimates for tuna are published in the SPC Tuna Fishery Yearbook and are available on the SPC/OFP website.

- For certain fleets for which annual catch estimates have not been provided by the flag state, the annual catch estimates have been determined by the OFP based on catch data and unloadings data for trips by individual vessels. The catch data for trips by individual vessels are, in turn, determined from logsheet catch data held by the OFP. The logsheet data held by the OFP do not cover all trips; hence, the unloadings data, which may cover trips that are not covered by logsheet data, are also used.

- Bigeye are usually mis-identified as yellowfin on purse-seine logsheets and unloadings forms; hence, observer and port sampling species composition data are used by the OFP to adjust estimates of annual catches of bigeye and yellowfin for those purse-seine fleets for which annual catch estimates are not adjusted by the flag state.

- Aggregated catch and effort data have also been used to estimate annual catches of tuna for certain fleets and years for which annual catch estimates have not been provided by the flag state. These include estimates for Japanese distant-water longline, 1962–1969 and 2000, Japanese pole-and-line, 1999–2000, Japanese purse seine, 2000–2001, and Taiwanese distant-water longline, 1967–1995.

- Estimates of annual catches of the four main species of billfish (blue marlin, black marlin, striped marlin, swordfish) are required for each fleet. The annual catch estimates for billfish are presented in a background paper prepared for annual meetings of the Standing Committee on Tuna and Billfish, which is made available on the SPC/OFP website.

- Observer catch data are required to estimate annual catches of non-target species, including species of special interest (such as sharks, marine reptiles, marine mammals and sea birds); however, current observer coverage of the WCPO is considered to be too low to enable reliable estimates of annual catches of most non-target species to be determined.

- Mapping of the geographic distribution of catch, effort and catch rates requires aggregated catch and effort data.

2.1.2 Monitoring of annual numbers of vessels active

Trends in the annual numbers of vessels active are also basic indicators of long-term changes in the fisheries.

- Estimates of the annual number of vessels active are required for each fleet. These estimates are published in the Tuna Fishery Yearbook.

- Estimates of the number of vessels active by size-class are required for each fleet. These data have been compiled in response to a directive made by the Standing Committee on Tuna and Billfish.

2.1.3 Monitoring of annual catch rates

Estimates of annual catch rates are indicators of long-term changes in the fisheries.

- Annual catch rates are estimated by the OFP using aggregated catch and effort data. The annual catch rates are published in the Tuna Fishery Yearbook.

2.1.4 Monitoring of monthly catch rates

Estimates of recent monthly catch rates are indicators of short-term changes in the fisheries.

- Recent monthly catch rates are estimated by the OFP using logsheet catch and effort data. For fleets for which aggregate data have been provided to the OFP, logsheet data are still used because the aggregated data are provided with a much longer time lag, up to 25 months (see section 3.3.3), compared to three months to a year for logsheet data (see section 3.2.13). The tables of monthly catch rates are published semi-annually in the Regional Tuna Bulletin, which is available on the OFP/SPC website.

2.2 Data Requirements for Stock Assessment and Modelling

Stock assessment and modelling have been applied primarily to the four main tuna species, i.e. albacore, bigeye, skipjack and yellowfin.

2.2.1 Indices of abundance based on CPUE

Abundance indices based on nominal or standardised catch per unit of effort (CPUE) are regularly applied to the four tuna species. Standardised CPUE time series can provide valuable information on variations in stock abundance. The data requirements for standardised CPUE methods depend on the factors that are incorporated into the statistical model. Factors such as season, geographic area, vessel attributes, gear attributes and environmental factors are usually tested for statistical significance. In most cases, such models require logsheet catch and effort data and vessel and gear attributes.

2.2.2 Habitat models

The OFP also uses habitat models to estimate effective effort and standardised CPUE for longliners targeting bigeye and yellowfin tunas. These models integrate information on the habitat preferences of the tuna (e.g. temperature and oxygen concentration at depth), the spatial and temporal variation of habitat variables and estimates of the depth distribution of longline gear. These models require biological information on habitat preferences of the species concerned, oceanographic data for the habitat variables considered, logsheet catch and effort data, including the set configuration, or fine-scale (1° longitude by 1° latitude by month) aggregated catch and effort data.

2.2.3 Surplus production models

Surplus production models have been applied to albacore, bigeye and yellowfin. The data requirements include standardised CPUE, which, in turn, require logsheet catch and effort data, vessel and gear attributes, and estimates of the total catch, including discards, stratified by time period. The total catch estimates require either logsheet catch data of high coverage together with estimates of annual catches or aggregated catch and effort data that have been raised to represent the total catch. If discards are significant, then estimates of discard rates determined from observer catch data are required.

2.2.4 MULTIFAN-CL models

MULTIFAN-CL models are length-based, age-structured, spatially-disaggregated population models and have been applied to albacore, bigeye, skipjack and yellowfin. They are considered to be the most reliable stock assessment method currently applied to WCPO tuna, but also the most data intensive. The data requirements include total catch, nominal or standardised or effective effort,

length frequency samples, and tag release and recapture data, all of which must be stratified by time period (usually quarter or month) and fishery (defined by gear type and geographic area). The catch and effort data that are used by MULTIFAN-CL models are determined from aggregated catch and effort data. If discards are significant, then estimates of discard rates determined from observer catch data are required. Standardised effort is determined from logsheet data and information on vessel attributes and gear attributes. Effective longline effort is determined from habitat models (see section 2.2.2). Length frequencies are determined from port sampling length data and observer length data.

2.2.5 Assessment of billfish, other major non-target species and species of special interest

The assessment of billfish, other major non-target species and species of special interest depend on the availability of observer catch data, since catch data for most non-target species are not usually available from other sources, such as logsheet catch and effort data.

2.3 Data Requirements for Tuna Ecology and Biology

2.3.1 Age and growth of tropical tunas and other species

Studies on growth require otolith ring counts, tag release and recapture data, and port sampling length data and observer length data.

2.3.2 Stock structure of tuna in the Pacific Ocean

Studies of stock structure primarily require tag release and recapture data and genetic data.

2.3.3 Environmental determinants of tuna fishery production

Studies on the environmental determinants of tuna production examine the relationships between oceanographic and meteorological conditions, primary production, tuna forage, tuna population dynamics and tuna-fishing fleet dynamics. The data requirements include oceanographic and meteorological data, including oxygen, salinity, temperature, chlorophyll, the Southern Oscillation Index, winds and currents; aggregated catch and effort data; and estimates of tuna biomass generated by the MULTIFAN-CL models.

2.3.4 Tuna ecology

Studies on tuna ecology examine the community dynamics and trophic relationships in the marine ecosystem and require stomach contents data, which are usually determined from samples collected by observers, and observer catch data. The food-web structure of the pelagic ecosystem is also investigated through analyses of isotopic N15/C14 data requiring muscle and liver samples of prey and predator species, as well as plankton reference samples collected on an opportunistic basis in collaboration with regional research organisations.

2.4 Summary of Research Data Requirements

(i) Estimates of annual catches of tuna, billfish, other major non-target species and species of special interest (such as sharks, marine reptiles, marine mammals and sea birds), by gear type and fishing nation, are required for monitoring.

(ii) Logsheet catch and effort data are required:

- to estimate (with unloadings data and observer and port sampler species composition data) annual catches taken by fleets for which annual catch estimates are not provided by the flag state, for monitoring;
- to generate (with annual catch estimates) aggregated catch and effort data for fleets for which aggregated data are not provided by the flag state;
- to estimate recent monthly catch rates, for monitoring;
- to standardise CPUE for indices of abundance and surplus production models; and
- to standardise effort and determine effective longline effort for MULTIFAN-CL models.

(iii) Aggregated catch and effort data are required:

- to estimate annual catches of tuna for those fleets for which other sources of annual catch estimates are unavailable, for monitoring;
- to estimate annual catch rates, for monitoring;
- to map the geographic distribution of catch, effort and catch rates, for monitoring;
- to estimate annual catches and CPUE for surplus production models; and
- to estimate the catch and effort by geographic area and time period, for MULTIFAN-CL models.

(iv) Unloadings data are required to verify logsheet catch data and to estimate (with logsheet catch data and observer and port sampler species composition data) annual catches taken by fleets for which annual catch estimates are not provided by the flag state, for monitoring;

(v) Observer and port sampling species composition data are required:

- to estimate (with logsheet catch data and unloadings data) annual catches of bigeye and yellowfin taken by purse-seine fleets for which annual purse-seine catch estimates are not adjusted by the flag state, for monitoring; and
- to verify the species composition of logsheet catch data and aggregated catch data for longliners.

(vi) The total annual number of vessels active or the annual number of vessel active by size class are required for monitoring.

(vii) Observer catch data for non-target species and discards of tuna are required:

- to estimate annual catches of non-target species, including species of special interest (such as sharks, marine reptiles, marine mammals and sea birds), for monitoring and studies of tuna ecology;
- to estimate tuna discard rates, for use in surplus production models and MULTIFAN-CL models; and
- for stock assessment of non-target species.

(viii) Port sampling length data and observer length data are required for MULTIFAN-CL models and growth studies.

(ix) Vessel and gear attributes are required to standardise effort data, which, in turn, are used in indices of abundance, surplus production models and MULTIFAN-CL models.

(x) Tag release and recapture data are required for MULTIFAN-CL models and growth studies.

(xi) Oceanographic and meteorological data are required to determine effective longline effort and to study the environmental determinants of tuna fishery production.

(xii) Genetic data are required for studies of stock structure.

(xiii) Otolith ring counts are required for studies of growth.

(xiv) Stomach contents data are required for studies of tuna ecology.

(xv) Isotopic N15/C14 data of all functional groups of the pelagic ecosystem are required for pelagic food-web structure analysis and modelling.

3. STATUS OF DATA HELD BY THE OFP

3.1 Annual Catch Estimates

3.1.1 Estimation of annual catches of tuna taken by distant-water fleets

The OFP has compiled estimates of annual catches of albacore, bigeye, skipjack and yellowfin taken in the WCPO since 1950. Estimates of annual catches and seasonal troll catches of albacore in the South Pacific Ocean have also been compiled.

The following table lists the tuna-fishing fleets that have been active in the WCPO since 1950 and the source of estimates of their annual catches:

GEAR TYPE	COUNTRY OR TERRITORY	FLEET ACTIVE		SOURCE OF CATCH ESTIMATES
		FROM	TO	
Driftnet	Japan	1983	1990	Japan
	Korea	1989	1989	Korea
	Taiwan	1988	1991	Taiwan
Longline	American Samoa	1995	present	United States
	Australia	1985	present	Australia
	China	1988	present	China
	Cook Islands	1994	present	None
	Federated States of Micronesia	1991	present	SPC/OFP
	Fiji Islands	1989	present	SPC/OFP
	French Polynesia	1990	present	French Polynesia
	Japan	1950	present	Japan (see text)
	Kiribati	1995	1996	SPC/OFP
	Korea	1958	present	Korea
	Marshall Islands	1992	1995	SPC/OFP
	New Caledonia	1983	present	New Caledonia
	New Zealand	1989	present	New Zealand
	Papua New Guinea	1983	present	SPC/OFP
	Samoa	1983	present	Samoa
	Solomon Islands	1973	present	Solomon Islands
	Taiwan	1954?	present	Taiwan
	Tonga	1982	present	None
	United States of America	1950	present	United States
	Vanuatu	1995	1998	SPC/OFP
Pole-and-Line	Australia	1970	present	Australia
	Fiji Islands	1974	present	Fiji Islands
	French Polynesia	1975	present	French Polynesia
	Japan	1950	present	Japan (see text)
	Kiribati	1979	1997	Kiribati
	New Caledonia	1981	1983	SPC/OFP
	New Zealand	1990	present	None
	Palau	1964	present	SPC/OFP
	Papua New Guinea	1970	1985	SPC/OFP
	Solomon Islands	1971	present	SPC/OFP
	Tuvalu	1982	1992	Tuvalu
	United States of America	1995?	present	United States
Purse Seine	Australia, inside the AFZ	1970	present	Australia
	Australia, distant-water	1988	1993	SPC/OFP
	Federated States of Micronesia	1991	present	SPC/OFP
	Indonesia, distant-water	1984	1990	SPC/OFP
	Japan	1969?	present	Japan (see text)
	Kiribati	1994	present	SPC/OFP
	Korea	1980	present	Korea
	Marshall Islands	2000	present	SPC/OFP
	Mexico	1984	1985	SPC/OFP
	New Zealand	1975	present	New Zealand
	Papua New Guinea	1994	present	SPC/OFP
	Philippines, distant-water	1983	present	SPC/OFP
	Russia	1985	1994?	Russia
	Solomon Islands	1980	present	SPC/OFP
	Spain	1999	present	SPC/OFP
	Taiwan	1983	present	Taiwan
	United States of America	1976	present	United States
	Vanuatu	1994	present	SPC/OFP
Troll	American Samoa	1982	present	United States
	Australia	1992	present	Australia
	Canada	1988	present	Canada
	Fiji Islands	1983?	present?	None
	French Polynesia	1989	1997	French Polynesia
	Guam	1980	present	United States
	New Zealand	1967	present	New Zealand
	Northern Marianas	1983	present	United States
	United States of America	1987	present	United States
Various	Indonesia	1950	present	Indonesia
	Philippines	1950	present	Philippines

The sources listed in the table above are the primary sources; estimates for some years may be from other sources. The annual catch estimates and detailed information regarding their sources are published in the SPC Tuna Fishery Yearbook (Lawson, 2001a). The sources of annual catch estimates for distant-water fleets are the flag state. The estimates are usually published in working papers presented at the annual meeting of the Standing Committee on Tuna and Billfish (SCTB).

Estimates of annual catches of bigeye by the Japanese longline fleet are missing for 1950–1961; hence, it has not been possible to estimate the total catch of bigeye in the WCPO, nor the combined catch of the four main tuna species in the WCPO, for those years.

The methods used to estimate annual catches are not usually discussed in the SCTB working papers that contain the annual catch estimates; hence, it is not usually possible to determine the quality of the estimates.

3.1.2 Estimation of annual catches of tuna taken by fleets of SPC member countries and territories

The sources of annual catch estimates for fleets of SPC member countries and territories are either the flag state or the OFP. The OFP has estimated annual catches for certain fleets either because estimates have not been provided by the flag state or they are considered to be unreliable. The use of logsheet catch and effort data and unloadings data by the OFP to estimate annual catches is discussed in section 2.1.1 above. The fleets for which the OFP has estimated annual catches in this manner include Federated States of Micronesia longline and purse seine, Fiji Islands longline, Kiribati longline and purse seine, Marshall Islands purse seine, Papua New Guinea longline and purse seine, Taiwan offshore longline (based in Micronesia, i.e. east of 130°E), United States longline (excluding American Samoa and Hawaii), and Vanuatu longline and purse seine.

Annual catch estimates for the Solomon Islands pole-and-line and purse-seine fleets are estimated by the OFP from logsheet data provided by Solomon Islands; these logsheet data represent full coverage.

The OFP estimated the catch of the longline fleets of Fiji Islands and Tonga during 2001 using logsheet data and landings data; these estimates were raised using the ratio of the number of vessel-months active to the number of vessel-months covered by the logsheet data and landings data. The OFP estimated the catch of the longline fleet of Papua New Guinea during 2001 from export statistics.

3.1.3 Estimation of annual catches of tuna taken in other ocean areas

Estimates of annual catches of the four main tuna species in other ocean areas have been compiled in order to determine the relative importance of WCPO catches globally. Estimates for the Eastern Pacific Ocean have been provided by the Inter-American Tropical Tuna Commission. Estimates for the Atlantic Ocean have been taken from the FISHSTAT_ICCAT database, which is available on the website of the International Commission for the Conservation of Atlantic Tunas. Estimates for the Indian Ocean have been provided by the Indian Ocean Tuna Commission.

Estimates of annual catches by ocean area are published in the SPC Tuna Fishery Yearbook. Figure 2 shows the annual catches by ocean area since 1970. The WCPO accounted for about 49 percent of the global catch of the four main tuna species during 2001.

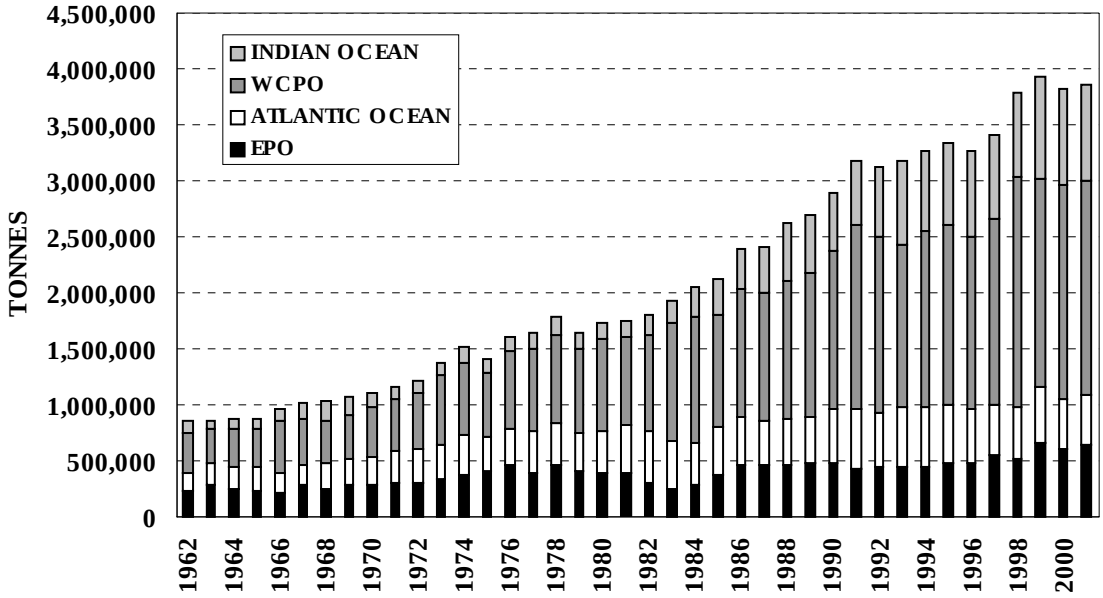


Figure 2. Catches (tonnes) of albacore, bigeye, skipjack and yellowfin in the Atlantic Ocean, Indian Ocean, Eastern Pacific Ocean (EPO) and Western and Central Pacific Ocean (WCPO), including preliminary estimates for 2000 and 2001

3.1.4 Estimation of annual catches of tuna in Indonesia, the Philippines and elsewhere in the South China Sea

The diverse domestic fisheries of Indonesia (including pole-and-line, handline, longline, purse seine and unclassified gear types) and the Philippines (including gillnet, hook-and-line, longline, purse seine, pole-and-line, ringnet and unclassified gear types) together accounted for about 30 percent of the total WCPO tuna catch in 2001. The following is a brief description of what is currently known regarding the sources of annual catch estimates that have been provided to the OFP:

- In the Philippines, the Bureau of Agricultural Statistics (BAS) has been responsible for compiling estimates since the late 1980s. The estimates are based on surveys of landing centres, but these do not cover all landing centres and, where surveys are conducted, only a few days per month are sampled. A precise estimate of the level of coverage by the BAS sampling is not available. The most recent annual catch estimates, which cover 1995–2001, have not been broken down by gear type. The National Stock Assessment Project (NSAP), recently established by Bureau of Fisheries and Aquatic Resources (BFAR), should, in the future, provide data that will allow the estimation of catches by gear type, by time period and by species.

- In Indonesia, the Directorate General of Capture Fisheries (DGCF) has been responsible for the collection of landings data through the provincial offices throughout Indonesia. Each provincial office relies on their district offices to collect unloadings data and estimate the catches at the landing centres. The DGCF headquarters in Jakarta is responsible for compiling the estimates provided by the provincial offices. The level of coverage and the quality of the data collected are not available. Estimates for 1992–2000 have not been broken down by gear type. Catches by unclassified gear types represented 38 percent of the catch in 2000.

For both countries, bigeye have been included in catch estimates for ‘yellowfin’. The OFP has estimated the catches of bigeye and adjusted the yellowfin catch estimates, based on species

composition data collected through port sampling in the Philippines, i.e. the Landed Catch and Effort Monitoring Programme.

A domestic Vietnamese longline fleet operates in the South China Sea and has taken several thousand tonnes of yellowfin and bigeye in recent years, based on export figures provided by the Vietnam Ministry of Fisheries. There are currently no other details available on catches by this fleet.

3.1.5 Nationality of the catch

For statistical purposes, the OFP assigns a nationality to a vessel for certain joint-venture or chartered vessels and vessels on open registries, in addition to the nationality of registration. The OFP is therefore able to determine annual catch estimates and catch and effort data either for the nationality of registration or the nationality assigned by the OFP.

The criteria used by the OFP to assign the nationality of joint-venture or chartered vessels, in addition to the nationality of registration, are consistent with the revised formulation for determining the nationality of catch data established by the Coordinating Working Party on Fishery Statistics (Anon., 1999b):

"Where a foreign flag vessel is fishing in waters under national jurisdiction of another state, the flag state of the vessel shall have at all times the responsibility to provide relevant catch and landings data. The only exceptions to this shall be:

> *"(a) where the vessel undertakes fishing under a charter agreement or arrangement to augment the local fishing fleet, and the vessel has become for all practical purposes a local fishing vessel of the host country;*
>
> *"(b) where the vessel undertakes fishing pursuant to a joint venture or similar arrangement in waters under national jurisdiction of another state and the vessel is operating for all practical purposes as a local vessel, or its operation has become, or is intended to become, an integral part of the economy of the host country."*

For vessels on open registries, the OFP assigns a nationality, in addition to the nationality of registration, that reflects the state whose nationals effectively control the fishing vessel. The following are instances in which the OFP has assigned a nationality in addition to the nationality of registration, for vessels on open registries:

- Five ex-Taiwanese vessels registered in Vanuatu and chartered and managed by a company in Papua New Guinea have been assigned to Papua New Guinea.
- One ex-Philippines vessel registered in St. Vincent and the Grenadines and chartered and managed by a company in Papua New Guinea has been assigned to Papua New Guinea.
- Two vessels registered in Panama and managed by a company in the Federated States of Micronesia has been assigned to the Federated States of Micronesia.
- Two vessels registered in Guatemala and managed by a company in Spain have been assigned to Spain.
- Five vessels registered in Belize and owned by Taiwanese nationals have been assigned to Taiwan.

3.1.6 Unreported catches of tuna in the WCPO

The extent of catches of tuna in the WCPO that are not reported to national or regional agencies is unknown, although it is considered to be low. This issue has been discussed at meetings of the Standing Committee on Tuna and Billfish and the SCTB Statistics Working Group was directed at the fourteenth meeting of the SCTB to evaluate methods to determine the extent of unreported catches in the WCPO, including trade statistics and catch certification schemes (Anon., 2002).

The OFP subsequently determined that trade statistics held in the merchandise trade database of the United Nations and in the fisheries trade database of the Food and Agriculture Organization were not adequate for determining the extent of unreported catches in the WCPO.

A catch certification scheme for bigeye and swordfish may soon be implemented in the WCPO in response to recommendations proposed by the International Commission for the Conservation of Atlantic Tunas (Lima, pers. comm., April 2002). The recommendations propose that all ICCAT contracting parties require that all bigeye and swordfish, when imported into the territory of a contracting party, be accompanied by an ICCAT statistical document, regardless of the ocean area in which the fish were caught.

3.1.7 Estimation of annual catches of tuna within EEZs

Estimates of annual catches within EEZs are requested of the OFP by SPC member countries and territories for monitoring and management purposes. Catch estimates for EEZs are usually determined by the OFP from logsheet catch and effort data, since this is the only source of data which provides the detailed position of the catch at the fishing operation level.

Three categories of availability of data to determine annual catch estimates for EEZs and enclaves have been identified:

(i) logsheet data are readily available to determine catches within the EEZ;

(ii) logsheet data are not readily available, but catches within the EEZ can be estimated using other types of data, such as aggregate catch and effort data; and

(iii) there are insufficient data of any type to estimate catches within EEZs.

Concerning (iii), it is not considered possible, using data held by the OFP, to estimate the annual catches taken within the EEZs of SPC member countries and territories by the following fleets:

GEAR TYPE	FLAG	PERIOD	COMMENT
Longline	Japan	1962–1980	Aggregated catch data are available, but by 5°x5° and hence are too coarse to be able to determine catch by EEZ/enclave.
	Korea	1975–1980	Aggregated catch data are available, but by 5°x5° and hence are too coarse to be able to determine catch by EEZ/enclave.
	Korea	1995–2000	Logsheet data are available for EEZs where this fleet operates under bilateral access arrangements (e.g. Kiribati). However, the coverage for activities within enclaves is considered inadequate and there are no aggregate data available to estimate this catch.
	Taiwan, distant-water	1967–2000	Both aggregate and logsheet data are available, but the coverage is considered inadequate for estimating annual catches by EEZ and enclave.
	Vanuatu	1995–2000	Logsheet data are available, but the coverage is unknown.
Purse seine	Kiribati	1994–2000	Logsheet data are available, but the coverage is unknown.
	Russia	1985–1994	Logsheet data are available, but the coverage is unknown.
	Taiwan	198?–1993	Logsheet data are available, but the coverage is considered inadequate for estimating annual catches in EEZs and enclaves.
	Vanuatu	1994–2000	Logsheet data are available, but the coverage is unknown.

3.1.8 Estimation of annual catches of tuna in the SPC Statistical Area

Annual catch estimates are currently compiled for the WCPO (Figure 1), but estimates of annual catches within the SPC Statistical Area (Figure 3) are sometimes requested of the OFP. The procedures for the estimation of annual catches for the SPC Statistical Area is as follows:

- For fleets that are known to fish exclusively within the SPC Statistical Area, the annual catch estimates compiled for the WCPO are equivalent to the annual catch estimates for the SPC Statistical Area.

- For fleets where fishing activities extend beyond the SPC Statistical Area, the proportion of the WCPO catch that was taken in the SPC Statistical Area is determined from logsheet or aggregated catch data, if catch data are available and the coverage is adequate.

- For fleets where fishing activities extend beyond the SPC Statistical Area, but recent logsheet or aggregated catch data are not available or the coverage is not adequate, the annual catch estimates for the SPC Statistical Area are determined by calculating the average proportion of the WCPO catch that was taken in the SPC Statistical Area during the most recent years for which catch data are available and applying the proportion to the annual catch estimate for the WCPO.

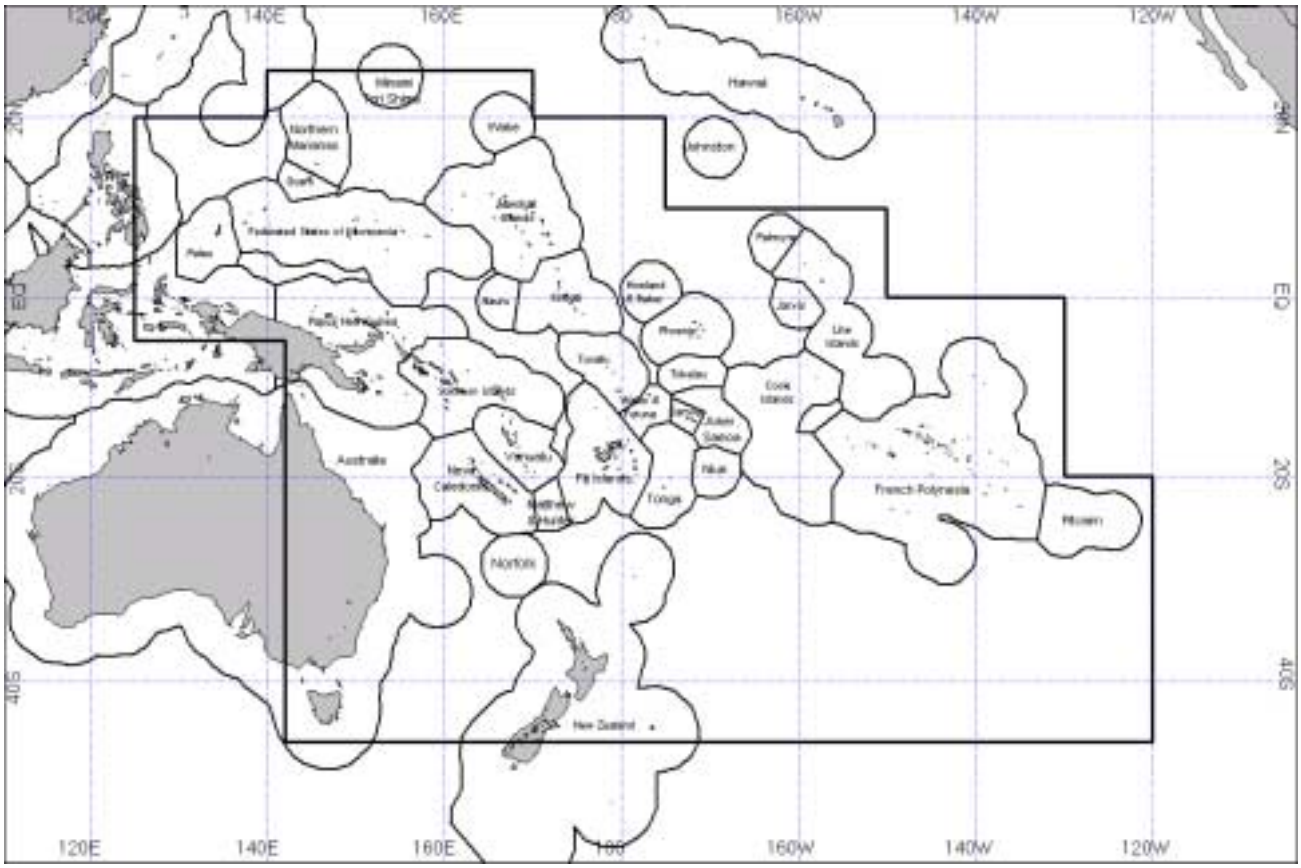


Figure 3. SPC Statistical Area

The most recent estimates of annual catches within the SPC Statistical Area for the distant-water fleets of Japan, Korea and Taiwan are usually provisional, since the logsheet or aggregated catch data, which are used to estimate the proportion of the WCPO catch taken in the SPC Statistical Area, are usually available only after a relatively long delay (see section 3.3.3).

3.1.9 Estimation of annual catches of billfish

After tuna, billfish are the most important species caught by longliners in the WCPO. They are sometimes target species for some vessels. Most of the billfish caught in the WCPO are taken by commercial longliners, though billfish may be caught by a variety of other gears (e.g. handline, purse seine, coastal gillnet and recreational gamefishing).

The OFP has compiled estimates of annual catches of the four main billfish species — blue marlin, black marlin, striped marlin and swordfish — in response to a directive made by the Standing Committee on Tuna and Billfish in 1999 (Anon., 1999a). When estimates of billfish catches have not been provided by the flag state, the OFP has estimated billfish catches using the available information. For example, billfish catches in the large domestic fisheries of Indonesia and the Philippines have been estimated by applying species composition data, collected through port sampling, to estimates of catches of tuna taken by these fleets.

The quality of data available to estimate billfish catches in WCPO longline fisheries has been considered in Williams et al. (1999). This work highlighted problems in using logsheet data to estimate billfish catches for certain fleets, specifically (i) discarding and under-reporting; (ii) inaccuracies in statistical extrapolation; and (iii) billfish species mis-identification. This report

further showed how observer data could be used to identify problems with logsheet data, by comparing the species composition of billfish reported on logsheets to that reported by observers.

3.1.10 Estimation of annual catches of species of special interest

The estimation of catches of species of special interest (such as sharks, marine reptiles, marine mammals and sea birds) depends on the availability of observer catch data, since catches of species of special interest are only rarely recorded on logsheets. However, the annual coverage of WCPO catches by observer data has been less than one percent for longliners and less than 2–4 percent for purse-seine fleets, except for the United States purse-seine fleet, for which coverage has been about 20 percent (Lawson, 2001b). The estimation of annual catches of species of special interest has therefore not been carried out by the OFP on a regular basis. On the other hand, certain flag states have estimated catches of species of special interest taken by their fleets (e.g. Francis et al., 2000; McCracken, 2000).

3.1.11 Estimation of annual catches by small-scale fisheries

Small-scale fisheries (i.e. subsistence or artisanal or small-scale commercial fisheries) account for only a small proportion of catches of tuna in the WCPO. Nevertheless, the OFP has begun compiling catch estimates for those fisheries for which estimates are available. These currently include Australian recreational fisheries, the French Polynesia poti marara fleet, small-scale fisheries in the Gilbert group in Kiribati, and troll and handline fisheries in American Samoa, Guam and the Northern Marianas.

Statistics for small-scale fisheries were considered at the FAO Pacific Islands Regional Workshop on Fishery Statistics, which was held during 16-18 July 2001 in Noumea, New Caledonia, with 40 participants, including 17 from Pacific island countries. The current status of fishery and aquaculture statistical systems in the participating countries was presented, which ranged from systems covering only exports and industrial tuna fisheries to systems covering all production, including subsistence catches. However, most small-scale fisheries are not monitored; hence, it is currently not possible to estimate annual catches for most small-scale fisheries in the WCPO.

3.2 Catch and Effort Logsheets

3.2.1 Coverage of logsheet data for fleets of SPC member countries and territories

The coverage of the fleets of SPC member countries and territories by logsheet data held by the OFP, for recent years, varies considerably among the fleets. It should be noted that the logsheet coverage for certain fleets (e.g. Fiji longline, Papua New Guinea longline, Tonga longline) is over-estimated for some years, due to annual catch estimates that have been under-estimated due to low coverage of logsheet data and unloadings data held by the OFP (Lawson, 2002a).

Logsheet data are provided to the OFP by both the flag state and by coastal states with which the fleet has access agreements. Several flag states do not systematically compile logsheets for their vessels. For these fleets, the coastal states with which the fleet has access agreements are the more important source of logsheet data.

Complete or nearly complete logsheet data are currently provided by the flag state for the fleets of Australia, New Zealand, Solomon Islands and the United States of America. Logsheet data of moderate coverage are provided by the flag state for the fleets of the Federated States of Micronesia, Fiji Islands, French Polynesia and New Zealand.

No logsheet data or logsheet data of low coverage are provided by the flag state for the fleets of Kiribati, Marshall Islands, Palau, Papua New Guinea, Samoa, Tonga and Vanuatu. For several of these fleets — Kiribati, Marshall Islands, Papua New Guinea (purse seine) and Vanuatu — the logsheet data held by the OFP have been provided primarily by coastal states with which the fleet has access agreements, rather than the flag state.

3.2.2 Coverage of logsheet data for distant-water fleets

Logsheet data covering the distant-water fleets of China, Japan, Korea, Philippines, Spain and Taiwan have been provided to the OFP by the SPC member countries and territories with which the fleets have access agreements. The coverage varies considerably among the fleets (Lawson, 2002a).

The coverage of the purse-seine fleets of Korea, Taiwan and Spain is high, since these fleets provide logsheet data covering the high seas, in addition to the EEZs of the coastal states. The coverage of the distant-water purse-seine fleet of the Philippines is high, since these vessels fish almost entirely within the EEZs of the coastal states with which they have access agreements.

The coverage of the distant-water longline fleets of Korea and Taiwan is low, since these fleets do not usually provide logsheet data covering the high seas and coverage of catches taken within the EEZs of coastal states is low.

The coverage of the offshore longline fleet of China was high until 1998, since most catches were taken within the EEZs of coastal states. However, since 1999, Chinese longliners have targeted albacore on the high seas. No logsheet data covering the high seas have been provided to the OFP, so the overall level of coverage for Chinese longliners has declined.

The coverage of the offshore longline fleet of Taiwan has been relatively high to the east of 130°E, which includes the EEZs of SPC member countries and territories. However, these vessels also fish to the west of 130°E and no logsheet data covering this area have been provided to the OFP, so the overall level of coverage is currently low.

The coverage of the Japanese distant-water longline, pole-and-line and purse-seine fleets by logsheet data held by the OFP is low, since these fleets provide data only for the EEZs of the coastal states and not for the high seas. No logsheet data are held by the OFP for the coastal fleets of Japan, which fish in the EEZ of Japan and adjacent waters.

3.2.3 Coverage of domestic fisheries of Indonesia and the Philippines

No logsheet data covering the domestic fleets of Indonesia and the Philippines are held by the OFP. Logsheet data for domestic vessels are not required in those countries; however, Indonesia is considering implementing logsheets for longliners.

3.2.4 Coverage of the WCPO

Table A8 presents the coverage by logsheet data held by the OFP of the total catch in the WCPO of the four main tuna species. Coverage has increased consistently since 1970 and in recent years has been about half of the total catch, including catches by the coastal fleets of Japan and the domestically-based fleets of Indonesia and the Philippines. The coverage for 2001 given in Table A8 will increase as more logsheets are provided to the OFP. If the domestic fleets of Indonesia and the Philippines are ignored, logsheet coverage in recent years has been about 68 percent.

3.2.5 Verification of catches of tuna reported on logsheets with unloadings

The quality of logsheet data can be evaluated by comparing the total catch for a trip to the total amount unloaded for the trip. The catches recorded on logsheets for purse seiners are estimated by a crewmember, whereas the unloadings are weighed and, hence, more accurate. Appendix 3 presents comparisons of logsheet data to unloadings. Whereas serious problems have existed in the past with the reporting of catches on logsheets for certain fleets, the reporting of catches on logsheets in recent years appears, on average, to be unbiased.

3.2.6 Mis-identification of bigeye as yellowfin

Bigeye are usually mis-identified as yellowfin on purse-seine logsheets and unloadings forms, both because smaller fish are difficult to identify and because the value of the two species, when caught by purse seine, is the same, so buyers do not distinguish between them. Hence, observer and port sampling species composition data are used by the OFP to adjust estimates of annual catches of bigeye and yellowfin for those purse-seine fleets for which annual catch estimates are not adjusted by the flag state and to adjust aggregated catch data.

Much of the observer and port sampling data that are used by the OFP for this purpose have been collected by the observer and port sampling programmes covering United States purse seiners under the treaty between the United States and certain Pacific island states.

Discrepancies between the species composition data collected by observers and those collected by port samplers have recently been identified. The OFP is currently investigating the reasons for these discrepancies through a detailed examination of the port sampling and observer species composition data held by the OFP.

3.2.7 Conversion factors

Bigeye, yellowfin and billfish caught by longliners are usually processed onboard the vessel, by removing the gills and the guts of the tuna and also by cutting off the head and the tail of billfish. The weight of the fish recorded on unloading forms is therefore the processed weight and not the live weight. Therefore, when estimating catches from unloadings data, the weights must be converted from processed weights to whole weights.

The OFP and various flag states use different conversion factors. Hence, the Standing Committee on Tuna and Billfish formulated a directive to compile information on factors for converting processed weights to whole weights (Anon., 2001). Australia uses conversion factors of 1.131 for bigeye and 1.166 for yellowfin, while Japan uses single conversion factors for each species (although the factors have not been provided). New Caledonia suggests that bigeye and yellowfin estimates be raised by 1.120. The conversion factors currently used by the OFP are given below:

Species processed to whole weight formulae (Whole weight = Processed weight * σ)

Species	Processed weight	Parameter σ	Sample size	R^2	Source
Albacore	Gilled and gutted	N/A			
Bigeye	Gilled and gutted	1.1018	92	0.9948	Regional Observer data
Yellowfin	Gilled and gutted	1.0896	116	0.9940	Regional Observer data
Black marlin	Headed, Tailed and gutted	1.2005	19	0.7357	Regional Observer data
Blue marlin	Headed, Tailed and gutted	1.2605	103	0.9855	Regional Observer data
Striped marlin	Headed, Tailed and gutted	1.2314	12	0.9378	Regional Observer data
Swordfish	Headed, Tailed and gutted	1.2551	10	0.9834	Regional Observer data
Swordfish	Filleted	1.5269	682	0.9650	Regional Observer data

A request for information concerning conversion factors was sent to fishing nations prior to the fourteenth meeting of the Standing Committee on Tuna and Billfish; however, no new information was received (Anon., 2002).

3.2.8 Reporting of discards

Estimates of the total removals from the population, including discards, are required for stock assessment. The logsheets used in the region have been designed to record discards of tuna. However, discards are only rarely recorded on logsheets. The OFP therefore uses observer data to estimate discard rates for tuna.

3.2.9 Reporting of depredation

At the thirteenth meeting of the Standing Committee on Tuna and Billfish, a directive was made to compile information concerning the depredation of longline-caught fish by whales, as this issue was perceived to be gaining in importance in the region (Anon., 2000). An analysis of observer data indicated that whale depredation is 0.8 percent of all tuna caught on longlines, while shark depredation is 2.1 percent (Lawson, 2001c). However, the level of depredation varies among areas and more extensive observer data are required to study this issue in greater detail.

3.2.10 Reporting of catches of billfish on logsheets

With the exception of a few directed fisheries that specifically target swordfish, billfish are usually considered by-catch in longline fisheries. Billfish are also taken in the purse-seine fishery, but to a lesser extent. Problems that have been identified concerning the reporting of billfish catches on logsheets comprise three broad categories: discard and non- or under-reporting; inaccuracies in the conversion of numbers of fish to weight; and species mid-identification.

Discarding and non- or under-reporting: At the both the vessel and fleet level, bycatch estimation may be potentially biased downwards due to discarding and non- or under-reporting. The extent of non- or under-reporting of billfish in the absence of observer data has been generally difficult to determine. Discard rates tend to vary according to vessel category and marketability (Bailey et al., 1996). Billfish discard rates varies among the three distant-water longline fleets of Japan, Korea and Taiwan due to the marketability of the species. For example, striped marlin command a higher price in Japanese markets than the other billfish species. Discard rates may also vary by vessel size among vessels in a fishing fleet. Larger distant-water vessels catching fish for the frozen market have adequate freezer storage for most of their catch and billfish would probably only be discarded due to low marketability. In contrast, smaller vessels that have only a limited supply of ice to chill their catch for the sashimi market would probably have higher billfish discard rates, since space is allocated for more economically valuable species.

Inaccuracies in conversion of numbers of fish to weight: Catches of billfish on logsheets are usually reported in numbers of fish only and not in weight. Bias may be introduced when converting billfish numbers to weight using estimates of average weight. The conversion may take into account temporal variation in average weight, but billfish size also varies with latitude (Bailey et al. 1996); hence, the use of average weights determined from fish sampled across the entire latitudinal range may not be appropriate.

Species mis-identification: Several accounts of mis-identification of billfish species have been reported. For example, the Taiwanese offshore longline fleet has probably mis-identified blue marlin as black marlin (Bailey et al., 1996). This fleet has shown some improvement in this regard, as recent logsheet data show that the ratio of black marlin to tuna now appear to be consistent with other longline fleets operating in similar areas. Nevertheless, this problem probably continues to exist for individual vessels.

In recent years, the OFP has attempted to resolve these problems through the use of observer data and comparisons of the species composition reported on logsheets among longline fleets.

3.2.11 Reporting of catches of other non-target species on logsheets

Non-target species are usually taken in most longline and, to a lesser extent, purse-seine sets. The reporting of catches of non-target species (other than billfish) on logsheets largely depends on the commercial value of the catch, even though most logsheets are designed to record catches of all non-target species (although longline logsheets are not designed to record catches of shark to the species level, except for those used by the Japanese fleet). Species that are typically discarded are rarely recorded on logsheets. Non-target species that are retained because of their commercial value (e.g. wahoo and mahi mahi) are often reported on logsheets by fleets that have a ready market for those catches (e.g. the offshore fleets of the SPC member countries and territories), but these species are only rarely reported by distant-water fleets.

The following table presents the number of sets for which the catches of non-target species (other than billfish) have been recorded on logsheets:

YEAR	PURSE SEINE			LONGLINE		
	TOTAL SETS	SETS WITH NON-TARGET SPECIES	%	TOTAL SETS	SETS WITH NON-TARGET SPECIES	%
1975	30	30	100.0	-	-	-
1976	7	7	100.0	-	-	-
1977	23	23	100.0	-	-	-
1978	62	62	100.0	368	210	57.1
1979	377	19	5.0	18,546	8,473	45.7
1980	854	29	3.4	46,231	28,346	61.3
1981	1,703	155	9.1	56,041	27,765	49.5
1982	3,901	192	4.9	52,181	19,306	37.0
1983	4,543	104	2.3	36,512	13,032	35.7
1984	7,701	19	0.2	46,143	13,540	29.3
1985	7,115	50	0.7	46,845	15,668	33.4
1986	6,996	93	1.3	28,394	10,147	35.7
1987	8,066	98	1.2	35,593	15,379	43.2
1988	12,482	98	0.8	46,598	17,679	37.9
1989	17,243	210	1.2	51,926	20,822	40.1
1990	17,394	122	0.7	51,690	18,221	35.3
1991	19,355	144	0.7	47,665	16,630	34.9
1992	19,779	372	1.9	56,301	19,576	34.8
1993	25,196	90	0.4	83,102	24,822	29.9
1994	30,566	38	0.1	105,674	27,475	26.0
1995	25,182	63	0.3	115,724	28,865	24.9
1996	30,011	52	0.2	83,064	19,361	23.3
1997	33,980	300	0.9	73,413	24,373	33.2
1998	40,323	344	0.9	70,376	26,076	37.1
1999	40,807	799	2.0	92,680	27,402	29.6
2000	44,966	550	1.2	89,045	29,583	33.2
2001	30,801	246	0.8	34,706	13,461	38.8
2002	214	0	0.0	93	19	20.4

3.2.12 Standardisation of catch and effort logsheets

The OFP has been involved in the standardisation of catch and effort logsheets through the SPC/FFA Tuna Fishery Data Collection Committee and through the Standing Committee on Tuna and Billfish. At the time of the first meeting of the Data Collection Committee, in December 1995, many different logsheets were used in the region, which considerably complicated the task of data processing done by the OFP and the Forum Fisheries Agency. Standard logsheets were therefore designed and introduced to both the domestic fleets of SPC and FFA member countries and the foreign fleets with which they have access agreements. The Data Collection Committee has since met three more times — in December 1996, December 1998 and December 2000 — in order to review the standardised logsheets and to design standard observer forms, port sampling forms and forms to record unloadings. The current versions of the forms are available in Anon. (2000) and on the SPC/OFP website, together with translated versions of the logsheets (French, Japanese, Korean, Mandarin and Spanish).

The OFP has been involved in the establishment of minimum standards for catch and effort logsheets through the Statistics Working Group of the Standing Committee on Tuna and Billfish. The minimum standards were established at a special session of the Statistics Working Group that was held prior to the twelfth meeting of the SCTB (Anon., 1999a). Since then, the OFP has been involved in reviews of logsheets that are used in the region in order to ensure that they conform to the minimum standards.

3.2.13 Timeliness of provision of catch and effort logsheets

The timeliness of the provision of catch and effort logsheets to the OFP varies considerably among the sources of the logsheets. Some SPC member countries and territories provide the logsheets regularly, while others provide them on an opportunistic basis (e.g. when staff are attending technical meetings at SPC headquarters or other meetings also attended by OFP staff or when OFP staff visit the country or territory). The logsheets that are provided to the OFP are first compiled by the SPC members from either domestic vessels or from foreign vessels with which they have access agreements. The logsheets are usually compiled by SPC members with delays that can vary from several weeks to several months after the fishing trip has ended. The delay in the compilation of the logsheets by SPC members and the delay in their provision to the OFP result in the OFP usually receiving logsheets with a delay of three months to a year.

The following tables present the average number of days between the return to port at the end of the fishing trip and the receipt of the logsheets by the OFP, from 1997 to March 2002; the number of trips that was used to determine the average number of days is also given.

LONGLINE		
FLAG	**TRIPS**	**DAYS**
New Caledonia	861	71
United States	163	100
Papua New Guinea	263	129
FSM	741	130
Tonga	481	132
Palau	17	147
Fiji Islands	1,661	153
Vanuatu	6	160
Taiwan	2,945	170
China	7,000	203
Japan	3,024	269
Philippines	11	319
Korea	268	323

PURSE SEINE		
FLAG	**TRIPS**	**DAYS**
United States	720	101
Marshall Islands	46	112
Spain	31	120
Vanuatu	423	132
Kiribati	64	136
Japan	2,061	146
FSM	133	146
Korea	1,884	159
Philippines	113	160
Papua New Guinea	168	162
Taiwan	3,234	233

In order to increase the timeliness in the provision of logsheets by SPC members to the OFP, the OFP has designed a system in which logsheets are scanned electronically by the SPC member and then transferred to the OFP via email. The system is currently being tested at the National Oceanic Resource Management Authority of the Federated States of Micronesia and, in the future, will be implemented in several other SPC member countries and territories.

3.3 Catch and Effort Data Aggregated by Time-Area

3.3.1 Coverage of aggregated data for distant-water fleets

Aggregated catch and effort data have been provided by flag states for the Japanese offshore and distant-water longline (1962–2000), pole-and-line (1972–2000) and purse-seine (1967–2001) fleets, the Korean distant-water longline fleet (1975–1997) and the Taiwanese distant-water longline fleet (1967–2000). In all cases, except Japanese purse seine, aggregated data are missing for the early years of the fleet's activities. For example, the Japanese offshore and distant-water longline and

pole-and-line fleets have been active since 1952; the Korean distant-water longline fleet has been active since 1958; and the Taiwanese distant-water longline fleet has been active since about 1956.

Korea has also provided aggregated catch and effort data covering purse seiners during 1980–1995. However, the units of effort are 'days on which a set was made', rather than 'days fished or searched'; hence, these data cannot be used for stock assessment. They have therefore not been incorporated into the OFP aggregated catch and effort database.

In general, the coverage of aggregated data is greater than for logsheet data held by the OFP, since logsheet data covering the high seas are not usually provided by the flag states to the SPC member countries and territories, whereas the aggregated data cover the entire WCPO, including the high seas.

3.3.2 Quality of aggregated data for distant-water fleets

The following problems have reduced the usefulness of the aggregated catch and effort data that have been provided to or prepared by the OFP:

- Aggregated longline data are usually grouped by 5° latitude and 5° longitude and month; however, the Korean longline data for 1989–1993 are grouped by 5° by 5° by year. These data have been broken down by month by the OFP, based on historical distributions of monthly effort.

- The aggregated Korean longline catch data for 1994–1997 are in units of kilograms only, rather than kilograms and numbers of fish. The catches in numbers of fish have been estimated by the OFP using average weights estimated by the OFP; however, the accuracy of the estimates of average weights is considered to be poor.

- The aggregated Korean longline data are unraised. The OFP has raised these data on the basis of estimates of annual coverage provided by Korea.

- Aggregated Korean longline data for 1962–1974 have been estimated by the OFP using the spatial information available in size composition data for these years, in conjunction with annual catch estimates. The annual catch estimates for the period 1962–1974 are available only from unloadings in Pago Pago, American Samoa, and therefore they do not reflect the Korean longline catch for the entire WCPO. Effort (in hundreds of hooks) has been estimated from annual Japanese longline catch rates.

- Aggregated Japanese longline catch data are in units of numbers of fish only, rather than numbers of fish and kilograms. The catches in kilograms have been estimated by the OFP using average weights estimated by the OFP; however, the accuracy of the estimates of average weights is considered to be poor. More accurate average weights, stratified by time and area, are held by Japan, but these have not been provided to the OFP.

- The aggregated Japanese pole-and-line data are unraised, although coverage is high.

- The aggregated Taiwanese longline data for 1967–1993 that were provided to the OFP were raised on the basis of the total number of trips, rather than on total landings. These data were subsequently raised on the basis of total landings, which is more reliable, by the OFP (Lawson, 1997). Aggregated data provided by Taiwan for 1994–2000 have been raised on the basis of total landings by Taiwan.

3.3.3 Timeliness of provision of aggregated data for distant-water fleets

The timeliness of recent provisions of aggregated data for distant-water fleets is as follows:

- The most recent Japanese longline data, covering 1998–2000, were received on 28 May 2002, 17 months after the end of fishing in 2000.
- The most recent Japanese pole-and-line data, covering 1998–2000, were received on 28 May 2002, 17 months after the end of fishing in 2000.
- The most recent Japanese purse-seine data, covering 2000–2001, were received on 28 May 2002, five months after the end of fishing in 2001.
- The most recent Korean longline data, for 1994–1997, were provided on 15 February 2000, 25 months after the end of fishing in 1997.
- The most recent Taiwanese longline data, for 1999–2000, were provided on 14 June 2002, 18 months after the end of fishing in 2000.

The delay between the end of the fishing year and the recent provision of aggregated data to the OFP has ranged from five to 25 months. In this regard, the Standing Committee on Tuna and Billfish made a recommendation in 2000 to develop a strategy for improving the timeliness of the provision of longline catch and effort data (Anon., 2001). The only response to this recommendation has been the OFP project to provide logsheets by email (see section 3.2.13 above) (Anon., 2002).

3.4 Unloadings Data

3.4.1 Coverage of unloadings in ports of SPC member countries and territories

The OFP holds unloadings data for individual trips for vessels unloadings in the ports of SPC member countries and territories. The coverage of the unloadings data is presented in Lawson (2002) and Appendix 2. Coverage varies considerably; complete coverage is rare.

3.4.2 Coverage of unloadings in ports outside SPC member countries and territories

Several distant-water and domestically-based tuna fleets operating in the WCPO unload their catches in ports outside SPC member countries and territories. The following table lists what is currently known by the OFP regarding the existence of data covering these unloadings:

FLAG	GEAR TYPE	COMMENTS
Japan	Distant-water, domestic and coastal longline, purse seine and pole-and-line fleets	Unloading data are known to be collected for these fleets. The coverage is unknown.
Korea	Distant-water longline and purse seine	Unloading data are collected for these fleets. The coverage is unknown.
Taiwan	Distant-water, offshore and coastal longline and distant-water purse seine	Unloading data are collected for these fleets. The coverage of distant-water and offshore fleets is high, according to summaries available in the Annual Taiwanese Tuna Bulletin.
Indonesia	Domestically-based fleets	Unloading data are collected at ports covered by the DGCF sampling programme. DGCF has information that could be used to determine the coverage of this sampling, but this information has not been provided to the OFP.
Philippines	Domestically-based fleets	Unloading data are collected in ports covered by BAS and BFAR sampling. Data for some years have been provided to the OFP. BAS and BFAR have information that could be used to determine the coverage, but this information has not been provided to the OFP.
Vietnam	Domestically-based longline	There is currently no indication that unloading data are collected for this fleet.

3.4.3 Unloadings data quality

Unloadings are weighed; hence the data are generally considered to be reliable. However, no information is available regarding the calibration and accuracy of the scales used to weigh unloadings.

For purse-seine unloadings, bigeye are usually mis-identified as yellowfin (see also section 3.2.6).

3.5. Port Sampling Data

3.5.1 Coverage in ports of SPC member countries and territories

The OFP holds length and species composition samples for individual trips for vessels unloadings in the ports of SPC member countries and territories. The coverage of the port sampling data is presented in Lawson (2002) and Appendix 2. Coverage for the longline fleets of China, Federated States of Micronesia, New Caledonia, Solomon Islands, Taiwan (offshore, east of 150°E) is greater than 10 percent; coverage for all other fleets is below 10 percent.

The National Marine Fisheries Service samples United States purse seiners, primarily in Pago Pago, American Samoa, with coverage of about 20 percent; these data are provided to the OFP in summary format.

3.5.2 Coverage in ports outside SPC member countries and territories

The following table lists what is known by the OFP concerning sampling in ports outside SPC member countries and territories:

COUNTRY	GEAR TYPE	COMMENTS
Japan	Distant-water domestic and coastal longline, purse seine and pole-and-line fleets	Length data are collected for these fleets, and data for distant-water fleets have been provided to the OFP in aggregate form.
Korea	Longline and purse seine	Length data may be collected for distant-water longline and purse-seine fleets.
Taiwan	Longline and purse seine	Length data may be collected for both offshore and distant-water fleets, but these data have not been provided to the OFP.
Indonesia	Domestically-based fleets	In the 1980s, length data were collected by the FAO Indo-Pacific Tuna Programme and RIMF. Some IPTP data have being provided to the OFP. It is not known whether sampling has occurred in recent years.
Philippines	Domestically-based fleets	During the past two decades, length data have been collected from certain ports by BFAR and LCEM. Some LCEM data have being provided to the OFP for the period 1981–1987 and 1993–1994. Coverage is very low for all other years. Coverage by the NSAP project, which was established in 1998, has increased in recent years, but these data have not been provided to the OFP.
Vietnam	Domestically-based longline and artisanal fleets	It is not known whether these fleets have been sampled.

3.5.3 Port sampling data quality

The port sampling data provided to the OFP are checked for data quality both manually before data entry and by the data entry software. For example, missing information are flagged; length histograms are generated for each sample to identify falsified data; and floating object sets by purse seiners are checked for the presence of bigeye tuna.

The quality of port sampling data varies among the national programmes. An examination of port samples of the proportion of bigeye in the catch taken by purse seiners revealed serious problems with data quality (Lawson, 2002b). Supervisors evaluated the reliability of port samplers, other than those of the National Marine Fisheries Service and Japan, and the results indicate that only 19 out of 129 port samplers (15 percent) were considered to be reliable.

3.6 Observer Data

3.6.1 Coverage of observer programmes of SPC member countries and territories

The following information concerning observer coverage has been taken from Lawson (2001b), which also contains detailed information regarding the species covered, species identification, school association, discards, geographic coverage and temporal coverage.

Longline

The longline observer data held by the OFP in 2001 were obtained from eight observer programmes, i.e. the national programmes of Australia (1987–1997), Federated States of Micronesia (1992–

1999), Marshall Islands (1995, 1997), New Zealand (1987–1999), Palau (1999), Papua New Guinea (1999) and Solomon Islands (1996, 1998–1999), and the SPC regional programme (1992–2000). The SPC programme covered longliners operating in the waters of American Samoa, Cook Islands, Fiji, Federated States of Micronesia, French Polynesia, Kiribati, Marshall Islands, New Caledonia, Papua New Guinea, Palau, Samoa, Solomon Islands and Tonga. The Australian and New Zealand data account for 42.6 and 38.2 percent of the data respectively, while the other national programmes account for 9.9 percent and the SPC programme accounts for 9.3 percent. Observer data covering United States longliners based in Hawaii have recently been received from the National Marine Fisheries Service.

Total coverage of the catch of target species in the WCPO from 1987, the first year for which observer data are available, to 2000 is 0.18 percent. The level of observer coverage is consistently low among fleets and years. There are only 15 fleet–years out of 223 for which coverage is greater than 1 percent and only one fleet–year for which coverage is greater than 5 percent.

The largest proportion of the observer data held by the OFP (in terms of the observed catch) is for the Japanese fleet (67.2 percent), followed by the fleets of Taiwan (12.8 percent), China (3.6 percent), Korea (2.8 percent), Solomon Islands (2.6 percent), Papua New Guinea (2.1 percent), French Polynesia (2.0 percent), Tonga (1.6 percent), New Caledonia (1.4 percent) and Fiji Islands (1.1 percent).

Pole-and-Line

The pole-and-line observer data held by the OFP were obtained from the observer programme of Solomon Islands and cover 1998 only. Total coverage of the pole-and-line catch of skipjack, yellowfin and bigeye in the WCPO during 1998 is 0.2 percent. Coverage for the Solomon Islands fleet is 2.1 percent, while the coverage for all other fleets is zero.

Purse Seine

The purse-seine observer data held by the OFP were obtained from seven observer programmes, i.e. the national programmes of the Federated States of Micronesia (1994–1999), Nauru (1996), Papua New Guinea (1996–1999) and Solomon Islands (1998–1999), and the regional programmes of the FSM Arrangement (1998–2000), SPC (1995–2000) and the US treaty (1994–2000). The US Treaty data account for 66.6 percent of the data, while the national programmes account for 24.6 percent and the other regional programmes account for 8.8 percent.

Total coverage of the catch of target species in the WCPO from 1994, the first year for which purse-seine observer data are available, to 2000 is 3.9 percent. The level of observer coverage is variable among fleets and years, although coverage is usually less than 5 percent, except for the United States fleet, for which coverage has ranged from 7.4 percent (1994) to 20.5 percent (1997). Excluding the United States fleet, the coverage of the catch of target species in the WCPO from 1994 to 2000 is 1.4 percent.

The largest proportion of the observer data held by the OFP (in terms of the observed catch) is for the United States fleet (71.6 percent), followed by the fleets of Taiwan (11.6 percent), Korea (7.7 percent), Japan (3.5 percent), Philippines (1.4 percent), Federated States of Micronesia (1.0 percent) and Papua New Guinea (1.0 percent).

3.6.2 Coverage of observer programmes of distant-water fishing nations

No observer data are held by the OFP for the domestically-based fleets of Indonesia or the Philippines.

Small amounts of observer data may have been collected by Japan, Korea and Taiwan, but these data are not held by the OFP.

Taiwan recently reported that it will undertake a pilot observer programme, with a small number of observer trips aboard longliners and purse seiners (Anon., 2002). The objective of the programme is primarily to collect biological data.

3.6.3 Observer data quality

The observer data provided to the OFP are checked for data quality both manually prior to data entry and by the data entry and data importing software. In observer programmes for which technical support is provided by the OFP, a purse-seine and longline debriefing form allows the national observer coordinator (or a senior observer) to check each data field systematically and to query the observer as to whether they have followed the correct sampling protocol. The observer database software also screens the data in order to set a number of data quality flags that indicate whether the data can be used for various analyses, such as the estimation of catches of non-target species.

However, an examination of observer samples of the proportion of bigeye in the catch taken by purse seiners revealed serious problems with data quality (Lawson, 2002b). Supervisors evaluated the reliability of observers and the results indicate that only 83 out of 151 observers (55 percent) were considered to be reliable.

3.7 Tagging Data

Tag release and recapture data from two large-scale tagging projects have been compiled by the OFP. During the Skipjack Survey and Assessment Programme, 1977–1981, 152,166 fish (141,986 skipjack, 9,346 yellowfin and 834 fish of other species) were tagged. During the Regional Tuna Tagging Project, 1989–1992, 116,448 fish (78,658 skipjack, 30,960 yellowfin and 6,830 others) were tagged. An additional 48,798 fish were tagged during eight small-scale tagging programmes. The total number of fish for which tag release data have been compiled is therefore 317,412.

The total number of recaptures has been 25,670 (19,163 skipjack, 5,252 yellowfin and 1,255 others). The overall recapture rate has therefore been 8.1 percent.

The OFP has recently conducted archival tagging of bigeye in the Coral Sea off Australia's north-east coast, in conjunction with the Marine Research Laboratory of the Commonwealth Scientific and Industrial Research Organisation of Australia. As of 15 March 2002, 161 tags have been placed out of a planned total of 200 and 7 tagged fish have been recaptured, 6 off the east coast of Australia and one off the north coast of New Caledonia.

Conventional tagging has also been conducted by Japan, primarily in the north Pacific Ocean. These data have been provided to the OFP for use in the MULTIFAN-CL analysis of skipjack.

3.8 Other Biological Data

3.8.1 Morphometric data

The OFP has compiled morphometric samples collected during the Regional Tuna Tagging Project from 1989 to 1992. These data allow morphometric characteristics of tuna species to be compared over various time and area strata. The specific measurements include fork length; snout to first dorsal fin; snout to second dorsal; snout to anal fin; head length; first dorsal to second dorsal; first dorsal to anal fin; second dorsal to anal fin; first dorsal to pelvic fin; second dorsal to pelvic fin; second dorsal fin length; pectoral fin length; anal fin length; number of upper gillraker limbs; and number of lower gillraker limbs.

3.8.2 Stomach contents

The OFP has compiled stomach content data that were collected during the Skipjack Survey and Assessment Programme from 1977 to 1981 and the Regional Tuna Tagging Project from 1989 to 1992. In addition, a database has been developed to store information on stomach contents of tuna and bycatch species collected by observers in 2002 and examined by the OFP. Information stored in this database include the identification of the prey ingested, their number, weight, length and state of digestion, as well as pictures of the prey and references to the specimens stored in collection. The OFP has so far compiled data for 50 stomachs of various species.

3.8.3 Gonad indices

The OFP has compiled gonad indices that were collected during the Skipjack Survey and Assessment Programme and the Regional Tuna Tagging Project. Gonad indices have been collected by the observer programmes of Australia and the United States; however, these data have not been compiled by the OFP.

3.8.4 Otolith ring counts

The analysis of otoliths using microscopy provides a means of estimating the growth of tuna through the counting of rings laid down over discrete periods of time. The OFP has developed a database that stores scanned versions of each otolith sample as a picture file. Other attributes stored in this database include the species of the sampled fish, fork length, sex, area and time captured. The OFP has compiled data for more than 800 otoliths of tuna and billfish species.

3.9 Oceanographic and Meteorological Data

The OFP has compiled oceanographic and meteorological data, including oxygen by depth, salinity by depth, temperature by depth, the Southern Oscillation Index (SOI), chlorophyll pigment, winds and currents. These data have been provided by the National Oceanic and Atmospheric Administration (NOAA) and the National Center for Atmospheric Research (NCAR) of the United States and the *Institut de recherche pour le développement* (IRD) and the *Institut français de recherche pour l'exploitation de la mer* (IFREMER) of France.

3.10 Gear and Vessel Attributes

3.10.1 Gear and vessel attribute data held by the OFP

The OFP compiles gear attributes from catch and effort logsheets, including:

- longline: the number of hooks between floats and the number of hooks set;

- pole-and-line: the presence of bait onboard; and
- purse seine: the number of fish aggregating devices (FADs) used and whether tender vessels were used.

The attributes for purse seine were introduced on logsheets that were revised by the SPC/FFA Tuna Fishery Data Collection Committee in December 2000.

The OFP has compiled gear and vessel attributes recorded by observers, including:

- longline: make and model of electronics (radar, depth sounder, sonar, GPS, track plotter, radio beacon direction finder, radio buoys, Doppler current meter, bathythermograph, sea surface temperature gauge, wind speed and direction finder, and weather facsimile); presence of mainline hauler, branchline hauler, line shooter, automatic bait thrower, automatic branchline attacher and weighing scales; composition of mainline and branchlines; number of hooks per basket; number of baskets; number of hooks; length of floatline and branchline; length between branchlines; number of shark lines; presence of time-depth recorder; and amount of bait and hook numbers used for bait, by bait species;
- pole-and-line: make and model of electronics (see 'longline' above); number of binoculars; bait species and number of buckets onboard; and
- purse seine: numbers of speed boats; number of tow boats; number of light boats; net skiff make and engine power; vessel cruising speed; helicopter make, model, effective range and colour; make and model of power block and purse winch; maximum net depth and length; number of net strips; net mesh size of main section; purse cable length and diameter; brailer type and capacity; and electronics make and model (see 'longline' above).

However, observer coverage, except for United States purse seiners, has been low (see section 3.6).

3.10.2 Gear and vessel attributes on the FFA Regional Register

Various gear and vessel attributes are collected on the application form for the Regional Register of Foreign Fishing Vessels that is maintained by the Forum Fisheries Agency. The quality of these gear and vessel attribute data have been reviewed by the OFP (Anon., 2002). Certain problems were identified, including duplicate vessels, high percentages of missing data, different spellings of the same item in text descriptions, a mixture of units used for some numeric fields, no unique value with the meaning 'no information', and some possible entry errors. FFA is currently resolving these problems and also retrieving historical gear and vessel attribute data.

3.10.3 SCTB Fishing Technology Working Group

The Fishing Technology Working Group formulated the following research task at the fourteenth meeting of the Standing Committee on Tuna and Billfish in August 2001 (Anon., 2002): "*Evaluate the data that needs to be collected by the Regional Register on vessel and gear attributes with a view to identifying data that are 'essential' and data that are 'desirable'. Request the Statistics Working Group and OFP to encourage the provision of these data from flag states not required to report on the Regional Register.*" Hence, the OFP will be responsible for compiling data on gear and vessel attributes from domestically-based fleets in the WCPO, while gear and vessel attributes for foreign vessels will continue to be collected on the Regional Register application form and compiled by FFA.

4. DISSEMINATION OF DATA HELD BY THE OFP

4.1 Security and Confidentiality of Data Held by the OFP

The data held by the OFP are kept secure and strictly confidential. All hardcopy data are stored in locked file cabinets in a secure area of SPC. Access to data stored on the SPC computer network is restricted to OFP staff through firewall protection. Data are only released to users outside the OFP in accordance with the OFP policy on the dissemination of data (see below).

4.2 OFP Policy on Dissemination of Data

The OFP policy on the dissemination of data is identical to the policy that was established by the Standing Committee on Tuna and Billfish at its eleventh meeting in July 1998 (Anon., 1998).

4.2.1 Annual catch estimates

Annual catch estimates, by gear type, flag state and year, are considered to be in the public domain.

4.2.2 Catch and effort data

The policy for the dissemination of catch and effort data is as follows:

- Catch and effort data grouped by 5° longitude by 5° latitude by month for longline and 1° longitude by 1° latitude by month for surface fisheries, for all fishing nations combined, are considered to be in the public domain.

- Catch and effort data grouped by 5° longitude by 5° latitude by month for longline and 1° longitude by 1° latitude by month for surface fisheries, stratified by fishing nation, are available for release at the discretion of the Coordinator of the SCTB Statistics Working Group, for those sources of data which have so authorised the SWG Coordinator. For those sources of data that have not authorised the SWG Coordinator to release data at his discretion, authorisation for the release of data must be obtained from the sources of the data.

- Catch and effort data grouped at a finer level of time-area stratification may be released with authorisation from the sources of the data.

- Catch and effort data are released for research purposes only and to individuals who can be trusted to use the data responsibly. The person requesting the data is required to provide a description of the research project. The data are released only for use in the specified research project and the data must be destroyed upon completion of the research project. However, catch and effort data may be released for long-term usage for research purposes, such that the data need not be destroyed, with authorisation from the sources of the data.

- The person requesting the data will be asked to provide a report of the results of the research project to the SWG Coordinator, for subsequent forwarding to the sources of the data.

The above policy was drafted with the understanding that the OFP Fisheries Statistician would be the Coordinator of the SCTB Statistics Working Group. All SPC member countries and territories, except New Zealand, have authorised the OFP Fisheries Statistician to release data at his discretion. Of the non-SPC sources of data held by the OFP, the Forum Fisheries Agency, Japan and Korea require authorisation before their data can be released.

It should be noted that the policy above states that catch and effort data, stratified by time and area, but not by flag state, are in the public domain, whereas catch and effort data stratified by time and area and also flag state are not in the public domain. In contrast, the International Commission for the Conservation of Atlantic Tunas and the Indian Ocean Tuna Commission both consider that data stratified by time and area and flag state are in the public domain.

4.2.3 Length data

The policy for the dissemination of length data is similar to that for catch and effort data.

4.2.4 Observer data

The SCTB has not formulated a policy concerning the dissemination of other types of data. With regard to observer data, the OFP only releases observer reports to the agency that arranged the placement of the observer (when the agency does not already have a copy of the report) or to the captain and owner of the vessel (if a request is received by the OFP). Otherwise, only summary information for research purposes is released by the OFP.

4.3 Statistical Bulletins

4.3.1 Regional Tuna Bulletin

From the first quarter of 1988 to the second quarter of 2001, the OFP published monthly catch rates for certain fleets in the Regional Tuna Bulletin on a quarterly basis and made the Bulletin available in print and on the SPC/OFP website. Editions of the Bulletin are now published semi-annually and are only available on the SPC/OFP website; the Bulletin is no longer available in print.

The monthly catch rates published in the Bulletin are determined from catch and effort logsheet data provided to the OFP. The fleets currently covered by the Bulletin include the longline fleets of China, Federated States of Micronesia, Fiji Islands, Japan (between 15°N and 10°S), Korea, New Caledonia and Taiwan (between 15°N and 10°S and south of 10°S); the pole-and-line fleets of Japan and Solomon Islands; and the purse-seine fleets of Federated States of Micronesia, Japan, Korea, Taiwan and the United States of America.

4.3.2 Tuna Fishery Yearbook

In response to a directive made at the third meeting of the Standing Committee on Tuna and Billfish in June 1990, estimates of annual catches in the SPC Statistical Area during 1952–1992 were published in a technical report in 1991, together with information on the historical development of the fleets (Lawson, 1991). A similar technical report was published in 1992. Then, from 1993 onwards, the annual catch estimates were published in the Tuna Fishery Yearbook.

The area covered by the Yearbook was changed in the edition published in 1999 from the SPC Statistical Area to the WCPO and the time period was extended from 1952 back to 1950. The most recent edition, for 1950–2000, covers 53 fleets, plus the domestic fisheries of Indonesia and the Philippines and several small-scale fisheries.

The Yearbook is usually available on the SPC/OFP website within eleven months following the end of the most recent year covered and it is usually available in print within fourteen months. French editions of the Yearbook are published after the English version has been translated.

4.4 Releases of Public Domain Data on the SPC/OFP Website

Since May 1999, public domain catch and effort data, grouped by 5° latitude and 5° longitude and month, for all fishing nations combined, have been available on the SPC/OFP website. The following data are available in zip files containing FoxPro Professional Edition Version 5.0 DBF files:

- Driftnet data, grouped by 5x5 and month, for all fishing nations combined, for 1983 to 1990, covering the Pacific Ocean south of the equator.

- Longline data, grouped by 5x5 and month, for all fishing nations combined, for 1958 to 2000, covering the whole Pacific Ocean.

- Pole-and-line data, grouped by 5x5 and month, for all fishing nations combined, for 1972 to 2000, covering the WCPO.

- Purse-seine data, grouped by 5x5 and month, for all fishing nations combined, for 1967 to 2000, covering the WCPO.

Downloads of public domain data from the SPC/OFP website have been monitored since October 1999. Since then, the public domain data have been downloaded on 40 occasions, including three in 1999, three in 2000, 42 in 2001 and 52 in January–June 2002.

4.5 Releases of Non-Public Domain Data to Researchers Outside the OFP

Releases of non-public domain catch and effort data and length data to researchers outside the OFP have been monitored since October 1994. Since then, non-public domain data have been released in response to 76 requests, including one request in 1994, seven in 1995, five in 1996, 12 in 1997, 12 in 1998, 13 in 1999, 11 in 2000, 13 in 2001 and 7 in January–June 2002.

4.6 Releases of Other Information

The OFP receives numerous requests for a wide variety of information other than catch and effort data and length data. These releases have been monitored since August 1996. Since then, other information have been released in response to 262 requests, including 22 in 1996, 45 in 1997, 26 in 1998, 75 in 1999, 46 in 2000, 42 in 2001 and 15 in January–June 2002.

5. REFERENCES

Anonymous. 1998. Report of the Eleventh Meeting of the Standing Committee on Tuna and Billfish, 28 May – 6 June 1998, Honolulu, Hawaii, United States of America. Secretariat of the Pacific Community, Noumea, New Caledonia. 108 pp.

Anonymous. 1999a. Report of the Twelfth Meeting of the Standing Committee on Tuna and Billfish, 16–23 June 1999, Papeete, Tahiti, French Polynesia. Secretariat of the Pacific Community, Noumea, New Caledonia. 126 pp.

Anonymous. 1999b. Report of the eighteenth session of the Coordinating Working Party on Fishery Statistics, Luxembourg, Grand Duchy, 6–9 July 1999. FAO Fisheries Report No. 608. Food and Agriculture Organization of the United Nations, Rome, Italy. 62 pp.

Anonymous. 2000. Report of the Fourth Meeting of the SPC/FFA Tuna Fishery Data Collection Committee, 6–8 December 2000, Brisbane, Queensland, Australia. Secretariat of the Pacific Community, Noumea, New Caledonia. 101 pp.

Anonymous. 2001. Report of the Thirteenth Meeting of the Standing Committee on Tuna and Billfish, 5–12 July 2000, Noumea, New Caledonia. Secretariat of the Pacific Community, Noumea, New Caledonia. 124 pp.

Anonymous. 2002. Report of the Fourteenth Meeting of the Standing Committee on Tuna and Billfish, 9–16 August 2001, Noumea, New Caledonia. Secretariat of the Pacific Community, Noumea, New Caledonia. 134 pp.

Bailey, K., P. Williams & D. Itano. By-catch and discards in western Pacific tuna fisheries: a review of SPC data holdings and literature. Oceanic Fisheries Programme Technical Report No. 34. South Pacific Commission, Noumea, New Caledonia.

Francis, M.P., L.H. Griggs, S.J. Baird, T.E. Murray & H.A. Dean. 2000. Fish bycatch in New Zealand tuna longline fisheries, 1988–89 to 1997–98. NIWA Technical Report 76. National Institute of Water and Atmospheric Research, Wellington, New Zealand. 44 pp.

Lawson, T.A. 1991. Status of tuna fisheries in the SPC area during 1990, with annual catches since 1952. Tuna and Billfish Assessment Programme Technical Report No. 29. South Pacific Commission, Noumea, New Caledonia. 73 pp.

Lawson, T.A. 1994. Coverage and accuracy of catches reported on logbooks provided to coastal states by distant-water purse seine fleets in the tropical western Pacific Ocean. Oceanic Fisheries Programme Internal Report No. 26, Revised October 1994. Secretariat of the Pacific Community, Noumea, New Caledonia. 19 pp.

Lawson, T.A. 1997. Review of catch estimates for Taiwanese distant-water longliners. Oceanic Fisheries Programme Internal Report No. 31, Revised May 1997. Secretariat of the Pacific Community, Noumea, New Caledonia. 19 pp.

Lawson, T.A. [editor] 2001a. Tuna Fishery Yearbook, 2000. Secretariat of the Pacific Community, Noumea, New Caledonia. 162 pp.

Lawson, T.A. 2001b. Observer data held by the Oceanic Fisheries Programme covering tuna fishery bycatches in the western and central Pacific Ocean. Internal Report N° 45. Oceanic Fisheries Programme, Secretariat of the Pacific Community, Noumea, New Caledonia. 40 pp.

Lawson, T.A. 2001c. Predation of tuna by whales and sharks in the western and central Pacific Ocean. Working Paper SWG–6. Fourteenth Meeting of the Standing Committee on Tuna and Billfish, 9–16 August 2001, Nouméa, New Caledonia. Oceanic Fisheries Programme, Secretariat of the Pacific Community, Noumea, New Caledonia. 7 pp.

Lawson, T.A. 2002a. Status of data collection, compilation and dissemination. Working Paper SWG–2. Fifteenth Meeting of the Standing Committee on Tuna and Billfish, 22–27 July 2002, Honolulu, Hawaii, United States of America. Oceanic Fisheries Programme, Secretariat of the Pacific Community, Noumea, New Caledonia. 12 pp.

Lawson, T.A. 2002b. Sampling the proportion of bigeye caught by purse seiners in the western and central pacific Ocean. Working Paper SWG–5. Fifteenth Meeting of the Standing Committee on Tuna and Billfish, 22–27 July 2002, Honolulu, Hawaii, United States of America. Oceanic Fisheries Programme, Secretariat of the Pacific Community, Noumea, New Caledonia. 25 pp.

McCracken, M.L. 2000. Estimation of sea turtle take and mortality in the Hawaiian longline fisheries. Administrative Report H–00–06. Honolulu Laboratory, Southwest Fisheries Science Center, National Marine Fisheries Service, Honolulu, Hawaii, United States of America. 29 pp.

Williams, P.G., K.A. Bigelow & A.W. Whitelaw. 1999. Estimates of longline billfish catch in the western and central Pacific Ocean, 1980–1997. Working Paper BBRG–2. Twelfth Meeting of the Standing Committee on Tuna and Billfish, 16–23 June 1999, Papeete, Tahiti, French Polynesia. Secretariat of the Pacific Community, Noumea, New Caledonia.

Williams, P.G. & E. Schneiter. 2000. Processing catch logsheets. Oceanic Fisheries Programme Internal Report No. 38 (Revised January 2000). Secretariat of the Pacific Community, Noumea, New Caledonia.

APPENDIX 1. MANAGEMENT OF DATA HELD BY THE OFP

A1.1 Data Processing

A1.1.1 Data entry and importing

The OFP employs three full-time data entry technicians to process several types of hardcopy data. Catch and effort logsheets are the most important and time-consuming type of data processed by the OFP. Williams & Schneiter (2000) provide a detailed description of the procedures involved in processing catch and effort logsheets. All catch and effort logsheets are entered twice, by different data entry technicians, in order to reduce the possibility of data entry errors. On average, data for more than 1,200 fishing operations are entered daily by the three data entry technicians. In addition to catch logsheets, the data entry technicians are enter unloadings data, length data, observer data, tagging data and other types of data.

Various types of data in computer-readable formats are also provided to the OFP. These data are imported into the OFP master databases using a suite of customised importing programmes.

A1.1.2 Quarterly transfer of entered data

Once every quarter, newly-entered catch and effort logsheet data are transferred to the master catch and effort database. This process usually coincides with the distribution of updated catch and effort data to member countries. The quarterly transfer is undertaken in several steps: (i) the physical transfer of data from the entry/verification catch and effort database to the master catch and effort database tables; (ii) a comprehensive error-checking process prior to allowing access by OFP staff and member country users; (iii) the manual cross-check of hardcopy logsheets with a report generated from the newly-entered and transferred catch and effort data; and (iv) final processing in order to set key fields accessed in the Catch and Effort Query System (CES) and other analytical procedures conducted by OFP staff.

A1.1.3 Determination of 'Best' catch and effort data grouped by time-area

Stock assessment requires the most accurate representation of catch and effort possible. However, the coverage of catch and effort logsheet data is not complete. The logsheet data provided by SPC member countries and territories are therefore raised to represent the total catch and effort or aggregated data provided by distant-water flag states are used. The process of producing the 'Best' catch and effort data for each fleet involves several steps:

- An aggregated version of the logsheet data, grouped by 5° by 5° by month for longline or 1° by 1° by month for surface gear types, is generated.

- Average weights grouped by flag, time and area are estimated to enable missing catch (in weight or numbers) to be estimated for certain fleets that report longline catch in either weight only or numbers only.

- Aggregated data provided by distant-water fishing nations are included.

- When aggregated data for a fleet are not available for recent years and the logsheet coverage is very low, data are generated to represent the best estimate of catch and effort. This is done by calculating the average catch, effort and catch rate for the target species, by time-area, for the previous five years and raising the data by the estimate of the annual catch by the fleet. If annual

catch estimates are not available, the most recent aggregated data are carried over to the following year.

- Catch and effort data for some fleets — e.g. the Taiwanese domestically-based offshore longline fleet and the domestic fleets of Indonesia and the Philippines — either do not exist or are unavailable. In these cases, it is necessary to use ancillary information from other sources, such as port sampling data and other information in the literature, to estimate the spatial and temporal stratification of the catch and effort. Effort is determined by applying estimates of catch rates derived from port sampling data or, if this information is inaccurate or missing, effort is calculated by applying the catch rate from fleets operating in similar times and areas.

- All catch and effort data are then raised by the annual catch estimate for each fleet. Threshold values for the raising factor have been set in this process to ensure data with very low coverage are not raised.

- Effective effort is determined for the longline and purse-seine aggregate data and stored in the "BEST" database, in addition to nominal measures of effort. For longline, effective effort has been determined for bigeye and yellowfin from algorithms developed in a study on the habitat of these tuna species. For purse seine, effective effort represents the total number of days fishing and searching stratified by school association or set type.

- For each data record, fields are set to indicate whether the catch and effort were in the SPC Statistical area, and the quadrant of the WCPO (i.e. southwest, northwest, southeast and northeast, bounded by the Equator and 180°).

- Purse-seine catch and effort data with missing set type information are stratified using set type information for neighbouring time-area strata.

- A field is set in the purse-seine database to indicate the approximate EEZ or high seas area where the catch and effort occurred. The data are stratified by 1° by 1°; hence, the EEZ field is only approximate.

A1.1.4 Inputs to MULTIFAN-CL analyses and SEPODYM

The OFP Statistics Section provides data to the OFP Stock Assessment and Modelling Section for MULTIFAN-CL analyses, which require three types of data: catch and effort data, size data and tagging data, all aggregated by time-area strata. The catch and effort data used in the analyses are the 'Best' catch and effort data discussed above, with the addition of certain data that are incomplete and, hence, inappropriate to include in the 'Best' data. For example, the inclusion of data with missing effort (e.g. data covering the Eastern Pacific Ocean) and data where the spatial reference is restricted to broad areas only (e.g. some troll and drift net data) is inappropriate. However, the MULTIFAN-CL analysis accounts for missing data and, hence, they are included in the MULTIFAN-CL input data.

The generation of text files that are used as input files by MULTIFAN-CL is facilitated by a data generation system. MULTIFAN-CL requires the input data to be stratified by 'fisheries', which are defined using selections of gear, groups of fleets, school associations, nominal or effective effort, and species-specific sub-areas. These definitions must be assigned to the catch and effort data, the size data and the tagging data, and they are handled by a dedicated procedure built into the data generation system.

Similar data are also provided to the OFP Tuna Ecology and Biology Section for use in applications of the Spatial Environmental Population Dynamics Model (SEPODYM).

A1.1.5 Tuna databases in SPC member countries and territories

Logsheet catch and effort data and other types of data that have been provided on hardcopy to the OFP by SPC member countries and territories are processed by the OFP and then sent back to the SPC member for incorporation into national tuna database systems. The OFP has installed tuna database systems in 15 member countries and territories, including Cook Islands, Federated States of Micronesia, Fiji, French Polynesia, Guam, Kiribati, Marshall Islands, New Caledonia, Northern Marianas, Palau, Papua New Guinea, Solomon Islands, Tonga, Tuvalu and Vanuatu, Technical support for the tuna database systems in Guam and the Northern Marianas is currently provided by the United States National Marine Fisheries Service.

The following table describes the types of information that is sent back to SPC members, the method by which information is sent and the frequency with which the information is sent:

TYPE OF INFORMATION	METHOD	FREQUENCY
Ad hoc summaries of tuna fishery data	Email / FAX	On request from member country or territory.
Catch and effort data grouped by time area / Annual catch estimates / CES query system	OFP FTP site	Full, historic set of data provided on request, or every quarter if new data have been added.
"	CD ROM	Full, historic set of data provided every quarter, if new data have been added recently.
"	Email attachment	Subset of recently entered data are provided on request.
Summaries of tuna fishery statistics	OFP web site (with secure login)	Users can access the OFP in-country web pages remotely through the internet. These pages are updated at least once every quarter.
Port sampling data and associated database systems	CD / OFP staff visits / Email attachments / OFP FTP site	Installed during in-country visits or on request via the OFP FTP site.
Observer database systems	CD / OFP staff visits / Email attachments / OFP FTP site	Installed during in-country visits or on request via the OFP FTP site.
Licensing database systems	CD / OFP staff visits / Email attachments / OFP FTP site	Installed during in-country visits or on request via the OFP FTP site.

A1.2 Query Interfaces

A1.2.1 CES — Catch and Effort Query System

The Catch and Effort Query System allows the user to build simple queries concerning catch and effort data. Since the mid-1990s, CES has evolved considerably in order to answer the needs of SPC member countries and territories for a robust, functional and user-friendly interface. It now allows the user to query several types of data and to produce maps of catch, effort and catch rates.

A1.2.2 PORT — Port Query System

The Port Query System is a user-friendly interface for querying length and unloadings data. It includes a charting component that allows the user to create customised Excel charts for all length data. Queries and charts can be formulated based on port name, species, flag state, time period and other factors.

A1.2.3 ORSE — Observer Query System

The Observer Query System provides a simple interface to query data collected by scientific observers onboard fishing vessels. Queries can be formulated based on gear type, flag state, observer programme, time period, geographic area, fate code, condition code and species. A mapping component is also included.

A1.3 SPC/OFP Website

With the availability of Internet access throughout the region, the OFP has taken a proactive approach in dealing with the dissemination of tuna fishery information to member countries and territories, and other agencies concerned with tuna fisheries. Several projects revolving around developing data dissemination on the SPC/OFP website have been completed. These include:

- establishing password-protected member country and territory web pages that allow users to login and retrieve tuna fishery information based on data provided to the OFP by the member country and territory, such as catch statistics, port sampling statistics, maps of catch and effort, etc.;

- establishing a system that enables member countries to track the progress of the processing of tuna fishery data they have provided to the OFP; and

- making the public-domain aggregated catch and effort data and the public-domain version of the Catch and Effort Query System available for downloading.

A1.4 Staffing of the OFP Statistics and Monitoring Section

The OFP Statistics and Monitoring Section currently consists of nine staff members:

- The Fisheries Statistician is responsible for overall management of the section, liaison with users external to SPC, editing and publication of statistical bulletins, and conducting statistical analyses.

- The Fisheries Database Supervisor is responsible for supervising the processing of data, maintaining data processing software, and compiling data summaries.

- The Programmer / Research Officer is responsible for maintaining data processing and query interface software, providing technical support for tuna fishery database systems in SPC member countries and territories, and compiling data summaries.

- The Research Officer / Analyst is responsible for maintaining data processing and query interface software, providing technical support for tuna fishery database systems in SPC member countries and territories, and maintaining the SPC/OFP website.

- The Fisheries Monitoring Supervisor is responsible for providing technical support for port sampling and observer programmes in SPC member country and territories.

- The Port Sampling and Observer Trainer is responsible for training port samplers and observers in SPC member country and territories.

- Three Data Entry Technicians are responsible for data entry and other secretarial duties, as required.

One additional staff — the Port Sampler and Observer Supervisor — is currently being recruited to provide technical support for port sampling and observer programmes in SPC member countries and territories.

APPENDIX 2. COVERAGE OF WCPO TUNA FISHERIES BY DATA HELD BY THE OFP

The tables below present the coverage of total catches of the four main tuna species (albacore, bigeye, skipjack and yellowfin) by logsheet catch and effort data, unloadings data, length samples taken by port samplers and catches recorded by observers.

The coverage rates for logsheet catch and effort data represent the coverage by raw logsheets, i.e. catch and effort data for individual fishing operations (longline sets, pole-and-line days fished or searched, purse-seine sets and troll days fished), and do not represent the coverage by catch and effort data aggregated by time-area strata that have been provided to the OFP by distant-water fishing nations.

Table A1. Drift net

Year	Total	Logsheet	%	Landings	%	Port	%	Observer	%
1983	32	-	-	-	-	-	-	-	-
1984	1,581	-	-	-	-	-	-	-	-
1985	1,928	-	-	-	-	-	-	-	-
1986	1,936	-	-	-	-	-	-	-	-
1987	919	-	-	-	-	-	-	-	-
1988	5,271	-	-	-	-	-	-	-	-
1989	21,955	-	-	-	-	-	-	-	-
1990	7,426	-	-	-	-	-	-	-	-
1991	1,394	-	-	-	-	-	-	-	-

Table A2. Longline

Year	Total	Logsheet	%	Landings	%	Port	%	Observer	%
1950	1,111	-	-	-	-	-	-	-	-
1951	1,245	-	-	-	-	-	-	-	-
1952	24,710	-	-	-	-	-	-	-	-
1953	35,570	-	-	-	-	-	-	-	-
1954	46,906	-	-	-	-	-	-	-	-
1955	41,150	-	-	-	-	-	-	-	-
1956	31,945	-	-	-	-	-	-	-	-
1957	64,043	-	-	-	-	-	-	-	-
1958	74,477	-	-	-	-	-	-	-	-
1959	71,612	-	-	-	-	-	-	-	-
1960	85,708	-	-	-	-	-	-	-	-
1961	95,506	-	-	-	-	-	-	-	-
1962	121,278	-	-	-	-	-	-	-	-
1963	117,072	-	-	-	-	-	-	-	-
1964	95,056	-	-	-	-	-	-	-	-
1965	101,549	-	-	-	-	-	-	-	-
1966	134,003	-	-	-	-	-	-	-	-
1967	103,625	-	-	-	-	-	-	-	-
1968	93,943	-	-	-	-	-	-	-	-
1969	102,118	-	-	-	-	-	-	-	-
1970	115,105	-	-	-	-	-	-	-	-
1971	113,564	-	-	-	-	-	-	-	-
1972	125,657	-	-	-	-	-	-	-	-
1973	123,751	-	-	-	-	-	-	-	-
1974	116,735	-	-	-	-	-	-	-	-
1975	133,492	-	-	-	-	-	-	-	-
1976	155,535	-	-	-	-	-	-	-	-
1977	175,821	-	-	-	-	-	-	-	-
1978	182,169	429	0.2	-	-	-	-	-	-
1979	182,783	17,387	9.5	-	-	-	-	-	-
1980	193,839	34,790	17.9	-	-	-	-	-	-
1981	153,433	39,133	25.5	-	-	-	-	-	-
1982	143,324	40,253	28.1	-	-	-	-	1	0.0
1983	139,726	37,667	27.0	-	-	-	-	-	-
1984	128,393	39,056	30.4	-	-	-	-	1	0.0
1985	138,674	46,972	33.9	-	-	-	-	-	-
1986	128,984	27,245	21.1	-	-	-	-	-	-
1987	140,582	27,772	19.8	287	0.2	-	-	15	0.0
1988	141,704	34,847	24.6	1,142	0.8	-	-	21	0.0
1989	125,770	35,371	28.1	2,608	2.1	-	-	12	0.0
1990	150,638	36,108	24.0	16,589	11.0	-	-	47	0.0
1991	123,353	25,804	20.9	18,952	15.4	93	0.1	215	0.2
1992	142,420	37,850	26.6	22,481	15.8	1,822	1.3	280	0.2
1993	134,039	41,710	31.1	30,423	22.7	4,134	3.1	395	0.3
1994	159,865	55,958	35.0	35,086	21.9	5,860	3.7	378	0.2
1995	150,735	55,676	36.9	31,864	21.1	5,253	3.5	477	0.3
1996	138,627	40,633	29.3	24,487	17.7	4,872	3.5	643	0.5
1997	147,789	40,849	27.6	18,418	12.5	5,672	3.8	729	0.5
1998	150,426	37,084	24.7	18,710	12.4	6,422	4.3	566	0.4
1999	148,353	38,828	26.2	14,421	9.7	4,879	3.3	326	0.2
2000	162,540	42,588	26.2	28,353	17.4	4,967	3.1	547	0.3
2001	182,722	30,741	16.8	32,948	18.0	2,967	1.6	739	0.4

Table A3. Pole-and-line

Year	Total	Logsheet	%	Landings	%	Port	%	Observer	%
1951	96,214	-	-	-	-	-	-	-	-
1952	83,213	-	-	-	-	-	-	-	-
1953	73,174	-	-	-	-	-	-	-	-
1954	94,441	-	-	-	-	-	-	-	-
1955	100,507	-	-	-	-	-	-	-	-
1956	100,749	-	-	-	-	-	-	-	-
1957	99,025	-	-	-	-	-	-	-	-
1958	138,575	-	-	-	-	-	-	-	-
1959	151,266	-	-	-	-	-	-	-	-
1960	73,845	-	-	-	-	-	-	-	-
1961	132,070	-	-	-	-	-	-	-	-
1962	157,412	-	-	-	-	-	-	-	-
1963	98,644	-	-	-	-	-	-	-	-
1964	143,279	-	-	1,414	1.0	-	-	-	-
1965	134,667	-	-	2,488	1.8	-	-	-	-
1966	218,892	-	-	2,829	1.3	-	-	-	-
1967	174,771	-	-	3,408	2.0	-	-	-	-
1968	167,385	-	-	4,849	2.9	-	-	-	-
1969	172,498	-	-	5,010	2.9	-	-	-	-
1970	201,598	2,429	1.2	8,043	4.0	-	-	-	-
1971	184,612	16,975	9.2	2,031	1.1	-	-	-	-
1972	182,176	13,195	7.2	1,428	0.8	-	-	-	-
1973	261,921	28,241	10.8	2,404	0.9	-	-	-	-
1974	297,632	41,630	14.0	7,262	2.4	-	-	-	-
1975	227,506	17,368	7.6	6,946	3.1	-	-	-	-
1976	296,783	33,601	11.3	5,656	1.9	-	-	-	-
1977	312,732	25,806	8.3	3,921	1.3	-	-	-	-
1978	346,445	51,512	14.9	9,747	2.8	-	-	-	-
1979	295,569	56,094	19.0	5,649	1.9	-	-	-	-
1980	325,996	80,996	24.8	7,226	2.2	-	-	-	-
1981	293,170	89,817	30.6	9,447	3.2	-	-	-	-
1982	256,169	38,913	15.2	4,371	1.7	-	-	-	-
1983	286,574	74,294	25.9	-	-	-	-	-	-
1984	351,307	65,226	18.6	-	-	-	-	-	-
1985	226,149	48,089	21.3	-	-	-	-	-	-
1986	302,050	94,688	31.3	-	-	-	-	-	-
1987	227,259	48,488	21.3	-	-	-	-	-	-
1988	258,129	98,276	38.1	-	-	-	-	-	-
1989	235,559	76,120	32.3	-	-	-	-	-	-
1990	166,335	42,939	25.8	-	-	-	-	-	-
1991	209,589	68,326	32.6	-	-	-	-	-	-
1992	161,006	38,857	24.1	-	-	-	-	-	-
1993	202,346	35,691	17.6	-	-	-	-	-	-
1994	149,489	40,077	26.8	3,487	2.3	-	-	-	-
1995	180,835	63,601	35.2	5,558	3.1	-	-	-	-
1996	132,688	32,097	24.2	3,913	2.9	-	-	-	-
1997	153,491	30,736	20.0	875	0.6	46	0.0	-	-
1998	159,956	43,023	26.9	21,337	13.3	83	0.1	554	0.3
1999	137,046	27,168	19.8	14,555	10.6	54	0.0	192	0.1
2000	139,626	14,783	10.6	-	-	-	-	1	0.0
2001	141,895	17,395	12.3	-	-	-	-	-	-

Table A4. Purse seine

Year	Total	Logsheet	%	Landings	%	Port	%	Observer	%
1951	3,781	-	-	-	-	-	-	-	-
1952	7,320	-	-	-	-	-	-	-	-
1953	5,250	-	-	-	-	-	-	-	-
1954	8,895	-	-	-	-	-	-	-	-
1955	6,135	-	-	-	-	-	-	-	-
1956	3,777	-	-	-	-	-	-	-	-
1957	4,358	-	-	-	-	-	-	-	-
1958	14,084	-	-	-	-	-	-	-	-
1959	21,293	-	-	-	-	-	-	-	-
1960	5,224	-	-	-	-	-	-	-	-
1961	14,533	-	-	-	-	-	-	-	-
1962	18,822	-	-	-	-	-	-	-	-
1963	11,875	-	-	-	-	-	-	-	-
1964	28,942	-	-	-	-	-	-	-	-
1965	8,623	-	-	-	-	-	-	-	-
1966	16,821	-	-	-	-	-	-	-	-
1967	14,409	-	-	-	-	-	-	-	-
1968	14,556	-	-	-	-	-	-	-	-
1969	8,305	-	-	-	-	-	-	-	-
1970	8,320	-	-	-	-	-	-	-	-
1971	13,247	-	-	-	-	-	-	-	-
1972	17,959	-	-	-	-	-	-	-	-
1973	22,846	-	-	-	-	-	-	-	-
1974	16,677	-	-	-	-	-	-	-	-
1975	14,889	-	-	-	-	-	-	-	-
1976	28,014	-	-	-	-	-	-	-	-
1977	27,137	-	-	-	-	-	-	-	-
1978	37,480	-	-	-	-	-	-	-	-
1979	58,090	5,784	10.0	-	-	-	-	-	-
1980	83,567	18,397	22.0	-	-	-	-	-	-
1981	117,087	30,404	26.0	-	-	-	-	-	-
1982	197,394	74,265	37.6	-	-	-	-	-	-
1983	368,898	103,532	28.1	-	-	-	-	-	-
1984	384,393	153,851	40.0	-	-	-	-	-	-
1985	338,882	134,859	39.8	-	-	-	-	-	-
1986	397,958	168,382	42.3	-	-	-	-	-	-
1987	463,146	167,005	36.1	-	-	-	-	-	-
1988	529,493	239,273	45.2	79,024	14.9	-	-	-	-
1989	579,852	317,908	54.8	144,183	24.9	-	-	-	-
1990	688,072	360,008	52.3	171,232	24.9	-	-	-	-
1991	885,089	432,088	48.8	223,920	25.3	-	-	-	-
1992	876,902	475,019	54.2	273,626	31.2	-	-	-	-
1993	764,471	547,677	71.6	405,055	53.0	84	0.0	5,653	0.7
1994	856,206	623,875	72.9	556,022	64.9	119	0.0	27,132	3.2
1995	795,682	641,454	80.6	412,181	51.8	144	0.0	30,993	3.9
1996	743,753	626,570	84.2	390,080	52.4	79	0.0	45,943	6.2
1997	809,530	656,076	81.0	438,630	54.2	199	0.0	47,434	5.9
1998	1,092,580	914,201	83.7	455,564	41.7	3,025	0.3	74,503	6.8
1999	898,354	800,783	89.1	319,105	35.5	1,719	0.2	53,601	6.0
2000	948,242	790,871	83.4	201,545	21.3	469	0.0	46,482	4.9
2001	922,246	681,792	73.9	219,896	23.8	61	0.0	32,628	3.5

Table A5. Troll

Year	Total	Logsheet	%	Landings	%	Port	%	Observer	%
1967	5	-	-	-	-	-	-	-	-
1968	14	-	-	-	-	-	-	-	-
1969	-	-	-	-	-	-	-	-	-
1970	50	-	-	-	-	-	-	-	-
1971	-	-	-	-	-	-	-	-	-
1972	268	-	-	-	-	-	-	-	-
1973	484	-	-	-	-	-	-	-	-
1974	898	-	-	-	-	-	-	-	-
1975	646	-	-	-	-	-	-	-	-
1976	25	-	-	-	-	-	-	-	-
1977	621	-	-	-	-	-	-	-	-
1978	1,686	-	-	-	-	-	-	-	-
1979	814	-	-	-	-	-	-	-	-
1980	1,468	-	-	-	-	-	-	-	-
1981	2,085	-	-	-	-	-	-	-	-
1982	2,434	-	-	-	-	-	-	-	-
1983	744	-	-	-	-	-	-	-	-
1984	2,773	-	-	-	-	-	-	-	-
1985	3,253	-	-	-	-	-	-	-	-
1986	2,003	-	-	-	-	-	-	-	-
1987	1,881	-	-	-	-	-	-	-	-
1988	2,945	-	-	-	-	-	-	-	-
1989	7,682	-	-	-	-	-	-	-	-
1990	5,575	-	-	-	-	-	-	-	-
1991	6,890	-	-	-	-	-	-	-	-
1992	5,427	-	-	-	-	-	-	-	-
1993	4,292	-	-	-	-	-	-	-	-
1994	7,258	-	-	-	-	-	-	-	-
1995	7,691	-	-	-	-	-	-	-	-
1996	7,531	-	-	-	-	-	-	-	-
1997	4,296	-	-	-	-	-	-	-	-
1998	6,133	-	-	-	-	-	-	-	-
1999	3,317	-	-	-	-	-	-	-	-
2000	3,435	-	-	-	-	-	-	-	-
2001	3,468	-	-	-	-	-	-	-	-

Table A6. Others

Year	Total	Logsheet	%	Landings	%	Port	%	Observer	%
1950	37,361	-	-	-	-	-	-	-	-
1951	37,108	-	-	-	-	-	-	-	-
1952	74,140	-	-	-	-	-	-	-	-
1953	66,906	-	-	-	-	-	-	-	-
1954	54,893	-	-	-	-	-	-	-	-
1955	47,247	-	-	-	-	-	-	-	-
1956	63,153	-	-	-	-	-	-	-	-
1957	74,882	-	-	-	-	-	-	-	-
1958	47,932	-	-	-	-	-	-	-	-
1959	36,489	-	-	-	-	-	-	-	-
1960	48,403	-	-	-	-	-	-	-	-
1961	43,603	-	-	-	-	-	-	-	-
1962	30,641	-	-	-	-	-	-	-	-
1963	45,337	-	-	-	-	-	-	-	-
1964	46,687	-	-	-	-	-	-	-	-
1965	60,797	-	-	-	-	-	-	-	-
1966	56,260	-	-	-	-	-	-	-	-
1967	70,216	-	-	-	-	-	-	-	-
1968	49,884	-	-	-	-	-	-	-	-
1969	61,975	-	-	-	-	-	-	-	-
1970	53,534	-	-	-	-	-	-	-	-
1971	74,265	-	-	-	-	-	-	-	-
1972	91,275	-	-	-	-	-	-	-	-
1973	102,113	-	-	-	-	-	-	-	-
1974	99,732	-	-	-	-	-	-	-	-
1975	77,081	-	-	-	-	-	-	-	-
1976	117,931	-	-	-	-	-	-	-	-
1977	61,523	-	-	-	-	-	-	-	-
1978	96,381	-	-	-	-	-	-	-	-
1979	79,461	-	-	-	-	-	-	-	-
1980	81,599	-	-	-	-	-	-	-	-
1981	66,856	-	-	-	-	-	-	-	-
1982	77,269	-	-	-	-	-	-	-	-
1983	62,607	-	-	-	-	-	-	-	-
1984	73,388	-	-	-	-	-	-	-	-
1985	63,313	-	-	-	-	-	-	-	-
1986	60,720	-	-	-	-	-	-	-	-
1987	64,978	-	-	-	-	-	-	-	-
1988	66,637	-	-	-	-	-	-	-	-
1989	61,432	-	-	-	-	-	-	-	-
1990	74,399	-	-	-	-	-	-	-	-
1991	59,025	-	-	-	-	-	-	-	-
1992	70,245	-	-	-	-	-	-	-	-
1993	64,845	-	-	-	-	-	-	-	-
1994	73,145	-	-	-	-	-	-	-	-
1995	78,969	-	-	-	-	-	-	-	-
1996	89,089	-	-	-	-	-	-	-	-
1997	110,197	-	-	-	-	-	-	-	-
1998	98,613	-	-	-	-	-	-	-	-
1999	124,512	-	-	-	-	-	-	-	-
2000	90,367	-	-	-	-	-	-	-	-
2001	90,795	-	-	-	-	-	-	-	-

Table A7. Domestic fleets of Indonesia. The estimate of the total catch for 2000 has been carried over to 2001.

Year	Total	Logsheet	%	Landings	%	Port	%	Observer	%
1950	3,270	-	-	-	-	-	-	-	-
1951	3,547	-	-	-	-	-	-	-	-
1952	3,847	-	-	-	-	-	-	-	-
1953	4,174	-	-	-	-	-	-	-	-
1954	4,529	-	-	-	-	-	-	-	-
1955	4,915	-	-	-	-	-	-	-	-
1956	5,335	-	-	-	-	-	-	-	-
1957	5,792	-	-	-	-	-	-	-	-
1958	6,288	-	-	-	-	-	-	-	-
1959	6,828	-	-	-	-	-	-	-	-
1960	7,415	-	-	-	-	-	-	-	-
1961	8,054	-	-	-	-	-	-	-	-
1962	8,749	-	-	-	-	-	-	-	-
1963	9,505	-	-	-	-	-	-	-	-
1964	10,327	-	-	-	-	-	-	-	-
1965	11,223	-	-	-	-	-	-	-	-
1966	12,198	-	-	-	-	-	-	-	-
1967	13,260	-	-	-	-	-	-	-	-
1968	14,417	-	-	-	-	-	-	-	-
1969	15,677	-	-	-	-	-	-	-	-
1970	17,600	-	-	-	-	-	-	-	-
1971	18,100	-	-	-	-	-	-	-	-
1972	28,600	-	-	-	-	-	-	-	-
1973	32,500	-	-	-	-	-	-	-	-
1974	33,779	-	-	-	-	-	-	-	-
1975	34,378	-	-	-	-	-	-	-	-
1976	33,375	-	-	-	-	-	-	-	-
1977	37,235	-	-	-	-	-	-	-	-
1978	40,024	-	-	-	-	-	-	-	-
1979	50,973	-	-	-	-	-	-	-	-
1980	61,795	-	-	-	-	-	-	-	-
1981	68,809	-	-	-	-	-	-	-	-
1982	74,056	-	-	-	-	-	-	-	-
1983	84,532	-	-	-	-	-	-	-	-
1984	96,662	-	-	-	-	-	-	-	-
1985	101,905	-	-	-	-	-	-	-	-
1986	103,171	-	-	-	-	-	-	-	-
1987	111,005	-	-	-	-	-	-	-	-
1988	116,922	-	-	-	-	-	-	-	-
1989	132,464	-	-	-	-	-	-	-	-
1990	142,237	-	-	-	-	-	-	-	-
1991	169,046	-	-	-	-	-	-	-	-
1992	218,353	-	-	-	-	-	-	-	-
1993	196,325	-	-	-	-	-	-	-	-
1994	215,951	-	-	280	0.1	-	-	-	-
1995	229,432	-	-	315	0.1	-	-	-	-
1996	256,975	-	-	96	0.0	-	-	-	-
1997	252,598	-	-	-	-	-	-	-	-
1998	335,016	-	-	-	-	-	-	-	-
1999	332,253	-	-	-	-	-	-	-	-
2000	361,384	-	-	-	-	-	-	-	-
2001	361,384	-	-	-	-	-	-	-	-

Table A8. Domestic fleets of the Philippines

Year	Total	Logsheet	%	Landings	%	Port	%	Observer	%
1950	12,132	-	-	-	-	-	-	-	-
1951	12,774	-	-	-	-	-	-	-	-
1952	13,454	-	-	-	-	-	-	-	-
1953	14,174	-	-	-	-	-	-	-	-
1954	14,937	-	-	-	-	-	-	-	-
1955	15,747	-	-	-	-	-	-	-	-
1956	16,605	-	-	-	-	-	-	-	-
1957	17,514	-	-	-	-	-	-	-	-
1958	18,477	-	-	-	-	-	-	-	-
1959	19,501	-	-	-	-	-	-	-	-
1960	20,585	-	-	-	-	-	-	-	-
1961	21,735	-	-	-	-	-	-	-	-
1962	22,957	-	-	-	-	-	-	-	-
1963	24,252	-	-	-	-	-	-	-	-
1964	25,626	-	-	-	-	-	-	-	-
1965	27,084	-	-	-	-	-	-	-	-
1966	28,632	-	-	-	-	-	-	-	-
1967	30,275	-	-	-	-	-	-	-	-
1968	32,021	-	-	-	-	-	-	-	-
1969	33,875	-	-	-	-	-	-	-	-
1970	52,000	-	-	-	-	-	-	-	-
1971	57,200	-	-	-	-	-	-	-	-
1972	60,700	-	-	-	-	-	-	-	-
1973	70,900	-	-	-	-	-	-	-	-
1974	81,188	-	-	-	-	-	-	-	-
1975	84,450	-	-	-	-	-	-	-	-
1976	73,653	-	-	-	-	-	-	-	-
1977	118,149	-	-	-	-	-	-	-	-
1978	87,319	-	-	-	-	-	-	-	-
1979	94,308	-	-	-	-	-	-	-	-
1980	77,505	-	-	-	-	-	-	-	-
1981	94,616	-	-	-	-	-	-	-	-
1982	102,806	-	-	-	-	-	-	-	-
1983	118,529	-	-	-	-	-	-	-	-
1984	103,596	-	-	-	-	-	-	-	-
1985	124,829	-	-	-	-	-	-	-	-
1986	136,478	-	-	-	-	-	-	-	-
1987	125,559	-	-	-	-	-	-	-	-
1988	113,002	-	-	-	-	-	-	-	-
1989	126,800	-	-	-	-	-	-	-	-
1990	180,807	-	-	-	-	-	-	-	-
1991	197,988	-	-	-	-	-	-	-	-
1992	128,206	-	-	-	-	-	-	-	-
1993	106,280	-	-	-	-	-	-	-	-
1994	148,640	-	-	-	-	-	-	-	-
1995	171,068	-	-	-	-	-	-	-	-
1996	171,284	-	-	-	-	-	-	-	-
1997	177,439	13	0.0	18	0.0	14	0.0	-	-
1998	195,888	1	0.0	1	0.0	2	0.0	-	-
1999	199,131	-	-	-	-	14	0.0	-	-
2000	203,339	-	-	-	-	8	0.0	-	-
2001	211,651	-	-	867	0.4	10	0.0	-	-

Table A9. All gears

Year	Total	Logsheet	%	Landings	%	Port	%	Observer	%
1950	53,874	-	-	-	-	-	-	-	-
1951	154,669	-	-	-	-	-	-	-	-
1952	206,684	-	-	-	-	-	-	-	-
1953	199,248	-	-	-	-	-	-	-	-
1954	224,601	-	-	-	-	-	-	-	-
1955	215,701	-	-	-	-	-	-	-	-
1956	221,564	-	-	-	-	-	-	-	-
1957	265,614	-	-	-	-	-	-	-	-
1958	299,833	-	-	-	-	-	-	-	-
1959	306,989	-	-	-	-	-	-	-	-
1960	241,180	-	-	-	-	-	-	-	-
1961	315,501	-	-	-	-	-	-	-	-
1962	359,859	-	-	-	-	-	-	-	-
1963	306,685	-	-	-	-	-	-	-	-
1964	349,917	-	-	1,414	0.4	-	-	-	-
1965	343,943	-	-	2,488	0.7	-	-	-	-
1966	466,806	-	-	2,829	0.6	-	-	-	-
1967	406,561	-	-	3,408	0.8	-	-	-	-
1968	372,220	-	-	4,849	1.3	-	-	-	-
1969	394,448	-	-	5,010	1.3	-	-	-	-
1970	448,207	2,429	0.5	8,043	1.8	-	-	-	-
1971	460,988	16,975	3.7	2,031	0.4	-	-	-	-
1972	506,635	13,195	2.6	1,428	0.3	-	-	-	-
1973	614,515	28,241	4.6	2,404	0.4	-	-	-	-
1974	646,641	41,630	6.4	7,262	1.1	-	-	-	-
1975	572,442	17,368	3.0	6,946	1.2	-	-	-	-
1976	705,316	33,601	4.8	5,656	0.8	-	-	-	-
1977	733,218	25,806	3.5	3,921	0.5	-	-	-	-
1978	791,504	51,941	6.6	9,747	1.2	-	-	-	-
1979	761,998	79,265	10.4	5,649	0.7	-	-	-	-
1980	825,769	134,183	16.2	7,226	0.9	-	-	-	-
1981	796,056	159,354	20.0	9,447	1.2	-	-	-	-
1982	853,452	153,431	18.0	4,371	0.5	-	-	1	0.0
1983	1,061,642	215,493	20.3	-	-	-	-	-	-
1984	1,142,093	258,133	22.6	-	-	-	-	1	0.0
1985	998,933	229,920	23.0	-	-	-	-	-	-
1986	1,133,300	290,315	25.6	-	-	-	-	-	-
1987	1,135,329	243,265	21.4	287	0.0	-	-	15	0.0
1988	1,234,103	372,396	30.2	80,166	6.5	-	-	21	0.0
1989	1,291,514	429,399	33.2	146,791	11.4	-	-	12	0.0
1990	1,415,489	439,055	31.0	187,821	13.3	-	-	47	0.0
1991	1,652,374	526,218	31.8	242,872	14.7	93	0.0	215	0.0
1992	1,602,559	551,726	34.4	296,107	18.5	1,822	0.1	280	0.0
1993	1,472,598	625,078	42.4	435,478	29.6	4,218	0.3	6,048	0.4
1994	1,610,554	719,910	44.7	594,875	36.9	5,979	0.4	27,510	1.7
1995	1,614,412	760,731	47.1	449,918	27.9	5,397	0.3	31,470	1.9
1996	1,539,947	699,300	45.4	418,576	27.2	4,951	0.3	46,586	3.0
1997	1,655,340	727,674	44.0	457,941	27.7	5,931	0.4	48,163	2.9
1998	2,038,612	994,309	48.8	495,612	24.3	9,532	0.5	75,623	3.7
1999	1,842,966	866,779	47.0	348,081	18.9	6,666	0.4	54,119	2.9
2000	1,908,933	848,242	44.4	229,898	12.0	5,444	0.3	47,030	2.5
2001	1,914,161	729,928	38.1	253,711	13.3	3,038	0.2	33,367	1.7

APPENDIX 3. COMPARISON OF LOGSHEET CATCH DATA TO UNLOADINGS DATA

Sources of Data

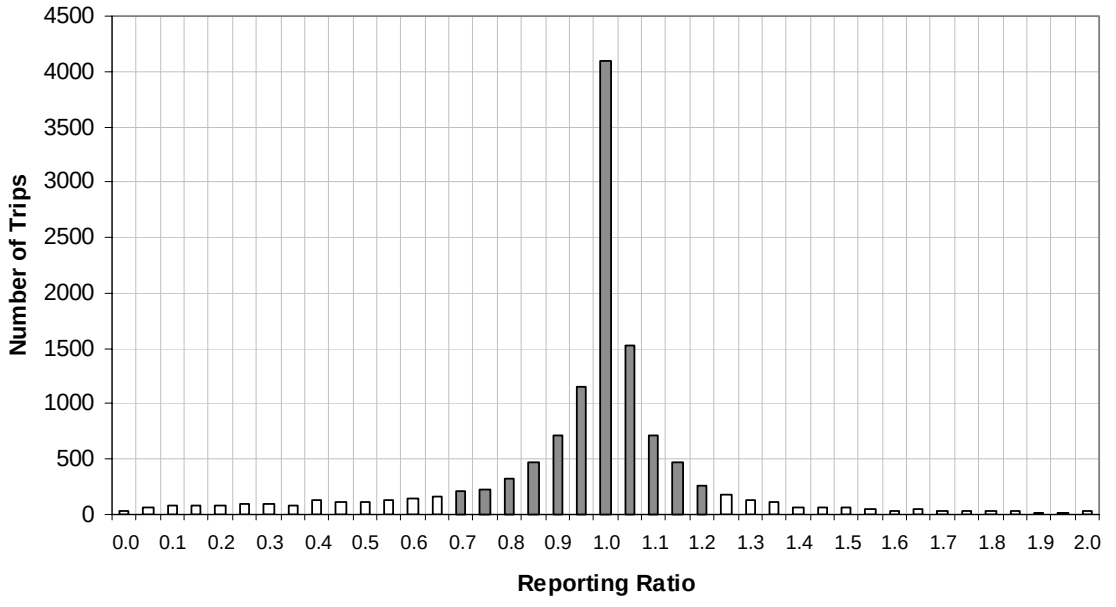
Two sources of data were used in the analysis: logsheet data and unloadings data provided to the OFP by SPC member countries and territories. The analysis was restricted albacore, bigeye, skipjack, and yellowfin.

The data were matched as closely as possible such that the logsheets for a particular trip corresponded to the appropriate unloadings data. The data were screened to eliminate outliers, which were almost certainly due to the inappropriate matching of the logsheet and unloadings data. Eliminating trips for which the reporting ratio (i.e. the ratio of the catch reported on logsheets to the amount unloaded) were beyond the 10^{th} and 90^{th} percentiles still resulted in unreasonable data. Therefore, the minimum and maximum accepted values for the screened data were based on the histogram intervals of the reporting ratio, such that data were eliminated from intervals beyond the interval in which the number of values first drops below 1.5 percent of the total number of trips. The intervals had a width of 0.05, such that the interval containing the ratio of 1.0 was bounded by 0.975 to 1.025.

Catch by numbers was used for longline since the catch in units of kilograms is often not recorded on longline logsheets. The catch in tonnes was used for purse-seine.

Longline

The histogram below presents the distribution of the reporting ratio for longline. The dark bars were included in the analysis, while the light bars were excluded.



The table below presents the average reporting ratio for longliners, by flag state. The overall average ratio is 0.99 (i.e. catches reported on logsheets are 99 percent of the amount unloaded), which implies that longline catches reported on logsheets are generally unbiased. The average ratio varies among flag states, ranging from 0.93 for Fiji and the United States to 1.04 for Korea, but these values can still be considered relatively unbiased. The overall standard deviation is 0.10, which implies that the reporting ratio for 95 percent of trips lies between about 0.8 and 1.2. This, together with the minimum and maximum values of the reporting ratio for each fleet, suggest that, for some

trips, either the catches reported on logsheets or the unloadings data are considerably under- or over-estimated.

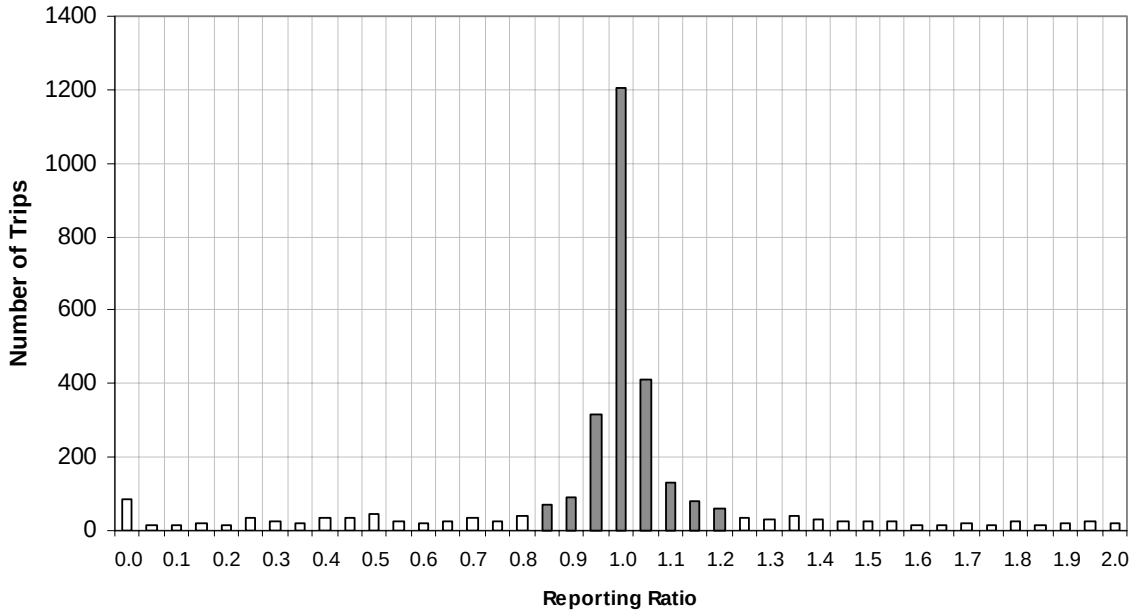
Flag	CN	FJ	FM	JP	KR	MH	NC	PF	PH	PW	TO	TW	US	Total
Average	1.00	0.96	0.99	0.93	1.04	0.97	1.01	0.98	1.01	0.96	1.02	0.96	0.93	**0.99**
Min	0.68	0.69	0.69	0.68	0.94	0.97	0.69	0.93	1.00	0.93	0.91	0.68	0.74	**0.68**
Max	1.23	1.22	1.22	1.20	1.15	0.97	1.22	1.00	1.13	1.00	1.19	1.22	1.04	**1.23**
StdDev	0.09	0.13	0.11	0.11	0.08	0.00	0.07	0.04	0.04	0.05	0.08	0.11	0.12	**0.10**
n	7055	138	334	389	9	2	400	3	10	2	10	1798	5	**10155**

The following table presents the average reporting ratio by year. The average reporting ratio has varied about 1.0 without trends and the standard deviations and minimum and maximum values have remained relatively constant.

Year	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	Total
Average	0.96	1.03	0.95	1.00	0.99	1.00	0.99	0.99	0.99	0.97	0.95	**0.99**
Min	0.68	1.03	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.68	**0.68**
Max	1.22	1.03	1.22	1.23	1.22	1.21	1.22	1.23	1.22	1.22	1.21	**1.23**
StdDev	0.15	-	0.12	0.10	0.10	0.09	0.09	0.09	0.09	0.11	0.10	**0.10**
n	73	1	561	2602	2061	1352	1005	782	748	840	130	**10155**

Purse seine

The histogram below presents the distribution of the reporting ratio for purse seine. The dark bars were included in the analysis, while the light bars were excluded.



The table below presents the average reporting ratio for purse seiners, by flag state. The overall average ratio is 1.01, which implies that purse-seine catches reported on logsheets are generally unbiased. The average ratio varies only slightly among flag states, ranging from 0.97 for Russia to 1.03 for Kiribati. The overall standard deviation is 0.06, which implies that the reporting ratio for 95 percent of trips lies between about 0.88 and 1.12. This implies that the catches reported on logsheets for most trips is relatively unbiased; however, the minimum and maximum values of the reporting ratio for each fleet suggest that, for some trips, the catches reported on logsheets or the unloadings data are considerably under- or over-estimated.

Flag	FM	KI	KR	MH	PG	PH	SB	SU	TW	US	VU	Total
Average	1.01	1.03	1.01	0.99	0.99	1.01	1.00	0.97	1.00	1.02	1.02	**1.01**
Min	0.85	1.00	0.83	0.97	0.90	0.83	0.83	0.86	0.83	0.83	0.92	**0.83**
Max	1.13	1.19	1.22	1.00	1.01	1.22	1.11	1.16	1.22	1.22	1.22	**1.22**
StdDev	0.05	0.07	0.07	0.02	0.03	0.09	0.06	0.14	0.07	0.05	0.09	**0.06**
n	52	14	429	2	22	72	16	4	602	1128	18	**2359**

The following table presents the average reporting ratio by year. The average reporting ratio has varied about 1.0 without trends and the standard deviations and minimum and maximum values have remained relatively constant.

Year	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	Total
Average	1.00	1.02	1.02	1.02	1.00	1.00	1.00	1.01	1.01	1.01	1.01	1.01	1.01	1.00	**1.01**
Min	0.87	0.83	0.83	0.92	0.83	0.83	0.83	0.83	0.85	0.83	0.83	0.83	0.88	0.94	**0.83**
Max	1.21	1.20	1.19	1.19	1.21	1.20	1.20	1.21	1.22	1.21	1.22	1.21	1.20	1.07	**1.22**
StdDev	0.05	0.06	0.07	0.07	0.06	0.07	0.06	0.06	0.06	0.06	0.07	0.06	0.06	0.03	**0.06**
n	53	86	69	69	76	194	258	250	307	357	334	202	64	41	**2360**

Conclusions

On average, the catches reported on both longline and purse-seine logsheets in recent years appear to be unbiased, although considerable errors can occur for some trips.

These results are consistent for all fleets and years; however, the data were not sufficient to examine time trends for all fleets individually. For those fleets for which the data were sufficient, only minor trends were observed. On the other hand, it is known that, prior to 1992, catches were reported on logsheets by Korean and Taiwanese purse seiners with a strong negative bias (Lawson, 1994). Reporting of catches on logsheets for both fleets improved considerably following the ban on transhipment at sea that was implemented by the member countries of the Forum Fisheries Agency in June 1993. The ban on transhipment enabled the collection of unloadings data by coastal states that could be used to verify the catches reported on logsheets.

The manner in which the data were screened for outliers may have resulted in under-estimating the extent to which major errors occur in catches reported on logsheets. Many outliers are probably the result of inappropriately matching the logsheet catch totals to the unloadings data. Therefore, a screening process was used wherein the only trips examined were those for which the start and end dates of the trip were recorded on the unloadings form, such that no errors would be introduced by inappropriately matching the logsheet totals to the unloadings data. The results were almost identical to the results presented above, except that the number of trips was reduced by more than 75 percent.