

**Interim Advice to the Preparatory Conference for the
Western and Central Pacific Fisheries Commission
(WCPFC)**

**Review of Data Standards for the Western
and Central Pacific Region**

Prepared for

**The Preparatory Conference
For the Western and Central Pacific
Fisheries Commission (WCPFC)**

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List of Acronyms

BAS	Bureau of Agricultural Statistics (Philippines)
BFAR	Bureau of Fisheries and Aquatic Resources (Philippines)
CCAMLR	Commission for the Conservation of Antarctic Marine Living Resources
CCSBT	Commission for the Conservation of Southern Bluefin Tuna
CECAF	Commission for the Eastern Central Atlantic Fisheries
CES	Catch and Effort Statistics
CPUE	Catch Per Unit Effort
CSIRO	Commonwealth Scientific and Industrial Research Organisation (Australia)
CWP	Co-ordinating Working Party on Fishery Statistics
DCC	Data Collection Committee
DGCF-Stat	Directorate General Capture Fisheries sub-Directorate of Data and Statistics (Indonesia)
EEZ	Exclusive Economic Zone
EU	European Union
Eurostat	Statistical Office of the European Community (European Commission)
FAO	United Nations Food and Agriculture Organisation
FFA	Forum Fisheries Agency
FIDI	Fishery Information Data and Statistics Unit
FIGIS	Fisheries Global Information System
FTP	File Transfer Protocol
GAM	Generalised Additive Model
GFCM	General Fisheries Commission for the Mediterranean
GLM	Generalised Linear Model
HMS	Highly Migratory Species
IATTC	Inter-American Tropical Tuna Commission
ICCAT	International Commission for the Conservation of Atlantic Tunas
ICES	International Council for the Exploration of the Sea
IOTC	Indian Ocean Tuna Commission
IPTP	Indo-Pacific Tuna Programme
ISC	Interim Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean
ISCAAP	International Standard Statistical Classification of Aquatic Animals and Plants
IWC	International Whaling Commission
LIPI	Indonesian Institute of Sciences
M & E	Monitoring and Evaluation
MCS	Monitoring Control and Surveillance
MHLC	Multilateral High Level Conference
NADS	Non-target, Associated and Dependent Species
NAFO	Northwest Atlantic Fisheries Organisation
NASCO	North Atlantic Salmon Conservation Organisation
OECD	Organisation for Economic Cooperation and Development
OFCF	Overseas Fisheries Cooperation Fund (Japan)
OFF	Oceanic Fisheries Programme
PICT	Pacific Island Countries and Territories
PrepCon	Preparatory Conference
RFMO	Regional Fisheries Management Organisation
RIMF	Research Institute of Marine (Indonesia)

SCG	Scientific Coordinating Group
SCTB	Standing Committee on Tuna and Billfish
SPC	Secretariat of the Pacific Community
STATWG	Statistics Working Group of the ISC
TAC	Total Allowable Catch
UNFSA	United Nations Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks
VMS	Vessel Monitoring System
VPA	Virtual Population Analysis
WCPO	Western Central Pacific Ocean
WCPFC	Western Central Pacific Fishery Commission
WG	Working Group

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1 Introduction

The Convention on the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean (WCPO) was concluded in July 2000. The Convention was opened for signature at Honolulu on 5 September 2000. The Conference that negotiated the Convention passed a resolution establishing a Preparatory Conference (PrepCon), which met for the first time in April 2001 in Christchurch, NZ. The Conference recognized that PrepCon would function during an interim phase prior to ratification of the Convention. After ratification, a transition phase of up to two years would lead to the establishment of a fully functioning Commission.

During the meeting, the PrepCon established two open-ended working groups:

- Working Group I (WGI) on issues relating to the organisational structure of the Commission, its budget and financial contributions.
- Working Group II (WGII) on the scientific structure of the Commission and the provision of interim scientific advice.

During the second session of the Preparatory Conference (PrepCon2), WGII reviewed and gave preliminary consideration to the Commission's needs with respect to:

1. Data requirements, including current gaps in data coverage and standards for data collection and management;
2. Science, and in particular stock assessment and advice on stock status in the short term and ongoing;
3. Research priorities and research planning and co-ordination;
4. Review of assessments, analyses and other scientific work.

WGII established an ad-hoc task group to consider the future information needs to support discussions and progress on matters related to the scientific activities of the Commission. Drawing upon the material from the ad-hoc task group the working group agreed that the following matters, amongst others, should be addressed, as far as possible, prior to the next meeting of the working group:

1. An investigation of the technical capabilities, and security and data-sharing policies of existing organisations, including those of participants in the Preparatory Conference, with the view of possibly contracting out interim data services.
2. A compilation and review of standards for collection, verification and for the timely exchange and reporting of data on fisheries currently practised by existing arrangements (e.g. the Standing Committee on Tuna and Billfish (SCTB), the Interim Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean (ISC), the Inter American Tropical Tuna Commission (IATTC), the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR), the Commission for the Conservation of Southern Bluefin Tuna (CCSBT) and the International Commission for the Conservation of Atlantic Tuna (ICCAT)) and an assessment of their suitability for use by the Commission.

During the third session of the Preparatory Conference (PrepCon3), held in Manila, a paper (WCPFC/PrepCon/WP.10) addressing these matters was presented at a meeting of WGII. It was agreed that a number of revisions and updates, to the paper, would be undertaken prior to the next meeting of the Scientific Coordinating Group (SCG). Furthermore, it was decided that issues treated in WCPFC/PrepCon/WP.10 would best be addressed in two distinct papers; the first devoted to data standards and the second addressing issues of technical capacity.

The matter of data standards is addressed in this paper. In addition to matters discussed in the original draft, the revised document considers explicitly the obligations associated with data related standards and implications for developing states and territories, including consideration of the kinds of technical assistance (under Article 30 (4) of the Convention text) that would facilitate implementation of data standards.

1.1 The requirement for fishery data

The quality of fishery data required for fishery management cannot be determined in isolation. The purpose for which data are needed dictates the required resolution. For example, to close a fishery that reaches an overall total allowable catch TAC requires data of lower resolution than that for a fishery where quota is allocated to individual vessels. Similarly, the time scale on which data are needed also varies depending on their intended use. For example, catch and effort data collected for use in an annual stock assessment analysis may be reported with several months delay between the catch event and the time of recording in the database. However, catch data that are used to monitor progress during the season towards a catch limit must be reported with minimal delay to ensure that the fishery is closed when the limit is reached.

Fishery collection programs often develop during the initial phases of a fishery, and continue even as the fishery and exploitation patterns change. Periodic review of the fishery, its management objectives, and the data collection program assures that the data collection program remains compatible with current data needs.

The data requirements for the types of scientific analyses needed to manage WCPO tuna fisheries in accordance with the Convention text are essentially those specified by other tuna commissions. The most basic data are catch (by weight and numbers), effort, and length frequency data. If the fish can be aged, which in the case of tuna is very rare, then age subsamples, along with other biological data are needed to develop estimates of the various biological relationships (growth, mortality, length-weight, etc.). All these data should be collected on an ongoing routine basis. Ideally, they would be supplemented by other targeted data collection (surveys, tagging, etc.). Regarding fishing effort, it is important to collect vessel specific information, for example through a vessel register and observer programme.

One of the keys to reliable tuna assessments is the collection of representative data across the full range of the species being caught. First and foremost this provides good estimates of total removals. But, given the distribution of highly migratory species (HMS) is affected strongly by the environment, it is vital to cover the full geographical area, especially when developing abundance indices. Unlike most other ocean areas with tuna fisheries, the WCPO contains many small islands, which affect oceanic processes and make interpretation and extrapolation of data much more difficult. Finally, many longline vessels work preferentially on the high seas, rather than within an exclusive economic zone (EEZ), and data from them is vital. Longline effort data are usually considered easier to interpret than purse seine effort data.

Regarding the scale of data required for stock assessment, the characteristics of HMS and their fisheries make it very important to collect data at the finest scale possible. This points essentially to haul-by-haul data.

For most tuna species, especially tropical tunas, ageing is extremely difficult, and currently not possible for some species. In those species, good quality, comprehensive length frequency data (at as fine a geographical scale as possible) and growth curves are needed, with large enough sampling fractions and full area coverage. This is true whether one is using simple production models, age-structured production models, virtual population analysis (VPA) like assessments or integrated assessment methods.

The other vital element is catch per unit effort (CPUE) data. In many cases, these are the only data that might produce an index of abundance. It is routine now to analyse these data with complex statistical analytical tools such as generalised linear models (GLMs) and generalised additive models (GAMs). These models try to account for targeting changes over time, vessel changes, and spatial distribution. Commonly in these analyses every factor is significant, as usually is every interaction term. For these reasons, these analyses are most effective when undertaken on detailed haul-by-haul data (e.g. from logbooks) with exact positions, supplemented by observer data. However, this ideal is rarely met. Most tuna commissions do not have mandatory submission of data at such a fine scale. More commonly, catch and effort data are provided on a scale of 1-degree squares by month, while length data may be required on a scale of 5-degree squares by month or quarter. It is sometimes possible to get access to more detailed haul-by-haul data, but the problem is that collection of data at this scale impinges on issues of commercial confidentiality, and unless fishers and flag states are convinced that confidentiality will be preserved, there may be a reluctance to submit the necessary information.

1.2 Data standards in the context of the Commission

The Convention calls for the Commission to:

- adopt standards for collection, verification and for the timely exchange and reporting of data on fisheries for highly migratory fish stocks in the Convention Area in accordance with Annex I of the Agreement, which shall form an integral part of this Convention (Article 10(1d)); and
- compile and disseminate accurate and complete statistical data to ensure that the best scientific information is available, while maintaining confidentiality, where appropriate (Article 10(1e)).

With regard to data collection, Annex I of the United Nations Fish Stocks Agreement (UNFSA) explicitly requires fishery data collection at an operational level. Conversely, obligations relating to specifications for data reporting are not clearly defined. Nevertheless, given reference to the need for data collection and compilation enabling – *statistically meaningful analysis for the purposes of fishery resource conservation and management* – this too points to the need for catch and effort reporting at the finest stratum possible, at the operational level.

States should ensure from vessels flying their flag that data are collected on fishing activities according to the operational characteristics of each fishing method (e.g., each individual tow for trawl, each set for long-line and purse-seine, each school fished for pole-and-line and each day fished for troll) and in sufficient detail to facilitate effective stock assessment (Article (2a))

States should agree, within the framework of subregional or regional fisheries management organisations or arrangements, or otherwise, on the specification of data and the format in which they are to be provided, in accordance with this Annex and taking into account the nature of the stocks and the fisheries for those stocks in the region (Article (2d))

The management of HMS requires regional co-ordination through the development of common standards¹ influencing collection, verification and reporting of data. Criteria need to be established which, when applied, permit data collected at a national level to be used as the source of regional data. The primary objective of standardisation, in this context, is therefore to facilitate the integration of data collected under different data collection systems through the application of common standards and classification codes. The application of common standards and codes has a particular influence on the extent to which data can be integrated

¹ 'A Standard is a documented agreement containing technical specifications or other precise criteria to be used consistently as rules, guidelines or definitions of characteristics, to ensure that materials, products, processes and services are fit for their purpose.' - Source: International Organization for Standards (ISO)

within a central data repository. Significant benefits can be obtained in both the quality and value of data where standards are applied.

The use of data exchange standards, in addition to offering a framework of guidelines defining the format of submissions, provides ready means of integrating data from disparate sources, and in so doing enables Regional Fisheries Management Organisations (RFMO) to offer information and services in improved ways.

Timely exchange (reporting) of data will rely to a large extent on the structure of national data collection systems. Significant benefits in timeliness of data reporting can result through ensuring that standard (compatible) exchange formats are generated; recent information technology (IT) advances have been made in the development of methods of data exchange that are independent of proprietary software or hardware.

In the development of standards applicable within the region, the Commission will need to consider the particular situations of developing countries as these countries may not be able readily to implement standards designed in the context of more developed fisheries. Specific regional examples include the Philippines and Indonesia where the capacity to monitor domestic fleets is limited.² On the other hand the national capabilities of the Island Nations in the Convention Area are substantially augmented through their membership of the Forum Fisheries Agency (FFA) and the Secretariat of the Pacific Community (SPC)³.

Finally, it is essential that any framework of standards and classifications is not only capable of meeting immediate requirements but that it is flexible enough to meet those needs and priorities which might evolve over time.

1.3 Recommendations of the 1996 MHLC Technical Consultation

The Multilateral High Level Conference (MHLC) Technical Consultation of 1996 agreed several outline standards for collection, verification, and exchange and reporting of data. During the Technical Consultation, a drafting group, consisting of Representatives of Japan, Korea, New Zealand, Papua New Guinea and the United States, assisted by SPC and FFA staff drafted recommendations for co-operation in data collection and exchange and research co-operation under some future regional fisheries management organisation or arrangement. The resulting recommendations were as follows:

In recognition of the need to progress the development of scientific support for future conservation and management of highly migratory species in the WCPO, the Consultation affirmed its support for:

² As noted in Williams (2002), Indonesia and the Philippines represent two of the largest domestic tuna fisheries in the world. The estimated tuna catch from the Indonesian and Philippine fisheries contribute 17% and 13% of the WCPO total catch, respectively, and 13% and 9% of the Pacific Ocean total catch, respectively. Appropriate data from these fisheries are therefore fundamental to regional tuna stock assessments.

³ Commencing in 1988, tuna fishery databases have been developed and installed on computers in fisheries departments of fourteen SPC member countries. The systems are customised according to the needs of the member country, but typically allow the production of data summaries and maps of fishing activity within their EEZ. Some systems also include a logsheet data entry component and components for landings data, observer data and length-frequency data. In cases where data entry is carried out at SPC, regular data updates are sent via email or on CD-ROM with the CES data retrieval system. Countries that have received support for their fisheries databases include Federated States of Micronesia, Fiji, French Polynesia, Kiribati, Marshall Islands, Nauru, New Caledonia, Palau, Papua New Guinea, Samoa, Solomon Islands, Tonga and Tuvalu. In the past, the OFP has also provided support to Guam and the Northern Marianas; however, support for these systems has since been provided by the National Marine Fisheries Service (<http://www.spc.org.nc/OceanFish/Html/Statistics/StatSysSCTB.htm>).

- *collection by flag states of catch (target and non-target species), effort and other data at a vessel operation level, i.e. logbook data;*
- *provision of such data for both waters under national jurisdiction and the high seas at a degree of detail and at a level of resolution to be agreed upon to enable effective stock assessment; and*
- *cooperation in scientific programmes to generate other data required for effective stock assessment.*

Regarding the future data needs of WCPO fisheries, the Consultation recommended that any future co-operative scientific data collection in the WCPO be consistent with the guidelines and requirements of the UN Implementing Agreement, especially as set out in Annex I of that agreement, and be established pursuant to a regional fisheries management organisation or arrangement, taking into account the nature of the stocks and the fisheries involved. Regarding the specification of agreed minimum requirements of any future scientific data collection programme, the Consultation also recommended that the following elements be included in any such future programme:

- 1. Flag states should compile annual catch statistics by species, covering all fishing activities for each fleet.*
- 2. Flag states fishing for tuna in the WCPO should collect catch, effort and other data at the fishing operation level (i.e. logbook data in a format to be agreed upon) for all commercial tuna fishing activity, regardless of whether such activity takes place in waters under flag state jurisdiction, other national jurisdiction or on the high seas. The logbook data should be validated with landings or other information.*
- 3. Annual catch statistics should be made available as soon as possible to all parties involved in the arrangement. Agreement should be reached on how to consolidate logbook and other data for all fleets in a confidential database. Access to such data should be under conditions determined by international agreement.*
- 4. A data repository system for length-frequency and associated data should be established so that such data can be used under agreed conditions for stock assessment and other tuna research projects. A co-ordinated sampling plan for all major species should be developed and implemented through the co-operation of the parties involved in the arrangement.*
- 5. A scientific observer programme, based on a regionally co-ordinated sampling design, should be developed and implemented through an agreement among the parties involved in the arrangement. Observers should collect data on fishing operations, including bycatch and discards; they should also conduct biological sampling of both the target and non-target catch, and collect other operational data as appropriate.*
- 6. All parties involved in the arrangement should co-operate in developing and implementing scientific research programmes of relevance to stock assessment of target and non-target species caught by tuna fisheries in the WCPO.*

1.4 Organization of the report

The paper opens in Section 2 with a discussion of international standardisation initiatives deemed appropriate for PrepCon consideration. Section 3 presents a brief review of data types required by international regional fisheries organisations, such as the WCPFC, to meet their obligations of fishery management advice based on the best scientific evidence available. Points (1) and (2) of the Technical Consultation list (Section 1.3) refer specifically to data types that are required for stock assessment analyses and should be collected by flag states. Point (4) also refers to another important data type - length frequency data - although in the context of data storage rather than data collection. Nevertheless this is another data type that is important for stock assessment. Options available for collecting these data (e.g. observer programs

mentioned in Point (5), the sampling plan mentioned in point (4) and the scientific research programs mentioned in Point (6) of the Technical Consultation list are discussed in Section 4. This section also discusses regional capabilities for collecting and handling various types of data. The importance of data quality and issues relating to the promotion of data quality and of validation of data resulting from several types of data collection (e.g. logbooks, observer programs) is stressed in Section 5. Expectations regarding timely data reporting to the organisation and standards for data exchange (point (3) of the Technical Consultation list) are discussed in Section 6.

Section 7 presents a discussion of the potential implications of defined Commission data standards for member States, specifically developing States and Territories. Consideration is placed on the types of assistance that might be appropriate under Article 30(4) of the Convention text to ensure that Commission standards are implemented.

The paper concludes with recommendations for the development and implementation of standards for collection, verification, reporting and timely exchange of fishery data. Recommendations are presented in the context of the Commission development process. Given the extent of uncertainty surrounding this process, rather than define explicit actions against a fixed timeframe, we felt that a more useful approach would be to present a sequence of recommendations against the backdrop of the Commission development process. We have treated Commission development as a phased process comprising: (1) an interim period leading up to entry into force of the Convention; (2) a transitional period immediately following entry into force of the Convention and establishment of a Secretariat; and (3) a fully developed phase.

The data repository system, mentioned in Point (4) of the Technical Consultation list, relates specifically to technical capabilities required by organisations to process and store data. These issues are discussed in detail in a separate paper (WCPFC/PrepCon/WP.16), where some of the specific hardware and software needs of organisations undertaking this type of data storage and processing are presented.

2 Initiatives towards standardisation

2.1 Co-ordinating Working Party on Fishery Statistics

The United Nations Food and Agriculture Organisation (FAO) promotes various instruments, which present overarching guidelines for collection and exchange of fisheries data, including: the UNFSA (discussed earlier), the FAO Compliance Agreement, and the FAO Code of Conduct for Responsible Fisheries. Given clear reference to the UNFSA in the recommendations of the MHLC consultation of 1996 and subsequent Convention text, it is important for the Commission to be aware of FAO standards developed in support of statistical systems guided by these instruments. This includes internationally recognised definitions, classifications and codes, which the FAO recommends be used where possible and appropriate.

The FAO co-operates with regional fisheries bodies, particularly through the Co-ordinating Working Party on Fishery Statistics (CWP), to standardise reporting forms, procedures, definitions, classifications, and other related documentation.

The CWP has as its purpose to:

- keep under continuous review the requirements for fishery statistics for research, policy-making and management,
- agree standard concepts, definitions, classifications and methodologies for the collection and collation of fishery statistics, and
- make proposals for the co-ordination and streamlining of statistical activities amongst relevant intergovernmental organisations.

Current Membership of the CWP includes CCAMLR, CCSBT, FAO, IATTC, ICCAT, the International Council for the Exploration of the Sea (ICES), the Indian Ocean Tuna Commission (IOTC), the North Atlantic Salmon Conservation Organisation (NASCO), the Northwest Atlantic Fisheries Organisation (NAFO), the Organisation for Economic Cooperation and Development (OECD), the European Unions (EU) Eurostat, SPC, and the International Whaling Commission (IWC). The SPC Oceanic Fisheries Programme (OFP) Fisheries Statistician is currently chairman of the CWP.

The CWP is an advisory body and as such application of CWP defined standards is not a legal obligation. Nevertheless, it is reasonable to assume that if recommendations are made by the CWP, then working party participants will, where appropriate, endeavour to implement them.

2.1.1 Review of statistical requirements

To ensure that appropriate standards are maintained, whilst reflecting the changing needs and priorities of scientists, statisticians and fisheries managers, requires ongoing review and adaptation. Recent initiatives of the CWP, relevant to the Commission, include the recognition that a more integrated approach to fisheries management is needed. A consequence of this process is recognition that data outside the realm of traditional fishery statistics, including data relating to biological, environmental, ecosystem, social and economic aspects of fisheries is required. Concepts and definitions for the parameters necessary to address these additional aspects are under constant review, particularly with respect to mechanisms for their assimilation into existing data collection programmes. For example, although CWP was not mandated to define social and economic indicators, the CWP recognises that it has a role to play in addressing the data requirements necessary to quantify them (Inter-Sessional Meeting of the CWP, 2002).

2.1.2 Standard classification codes and definitions

The use of internationally agreed codes is an important element facilitating the collation of fishery statistics from disparate sources, at national, regional and at international levels. International classification codes agreed by the CWP include:

- International Standard Statistical Classification on Aquatic Animals and Plants (ISSCAAP)
- International Standard Statistical Classification of Fishing Vessels (ISSCFV)
- International Standard Statistical Classification of Fishing Gears (ISSCFG)

Standard classification codes drawn-up by the CWP have been widely accepted. Periodic reviews are undertaken in an effort to reflect changes in fisheries and the needs of scientists, statisticians and managers. Issues recently addressed by the CWP have included proposed revisions to ISSCAAP and ISSCFV (FAO, 2001).

Also with regard to standard classifications, a recommendation has recently been put forward by the SPC and IATTC proposing that once the Commission becomes operational, statistical areas be modified to reflect areas used for statistical purposes by the Commission, IATTC, and other RFMOs in the region.

In addition, the CWP has recommended improvements to standard definitions. A recommendation was made by the CWP for an amendment to the definition relating to attribution of catch nationality; specifically with regard to flag state reporting obligations (FAO, 1999c). The recommendation was made in recognition of the complex situation surrounding distant water fishing nation (DWFN) vessel reporting, particularly when fishing in territorial waters under access or joint venture arrangements. The updated definition has been implemented by the SPC-OFP when determining catch and effort reporting obligations (Lawson et al., 2002); this matter is discussed in more detail in Section 6.1.

2.1.3 Reporting methods

Recognising the importance of harmonised data reporting, the CWP has also addressed the issue of standard formats for data reporting. Traditionally, focus has orientated towards the standardisation of paper reporting formats such as the STATLANT questionnaires, to which the CWP made a major contribution with regard to the specification of measures of fishing effort by gear type. The name itself betrays the origins of the CWP as a co-ordinating body for Atlantic statistics. STATLANT forms are dispatched (together with instructions for completion) by the FAO on behalf of RFMOs to the relevant national authorities.

- STATLANT A questionnaires are used for reporting annual nominal catch by species and by statistical sub-area, division or sub-division.
- STATLANT B questionnaires are used for reporting fishing effort by month, vessel size class, gear and statistical sub-area, division or subdivision and together with associated catch by species.

STATLANT A and B questionnaires have been used by CCAMLR to collate statistics for major fishing areas 48, 58 and 88 (Southern Oceans), by NAFO for area 21 (Northwest Atlantic), by ICES for area 27 (Northeast Atlantic), by CECAF for area 34 (Eastern Central Atlantic), and by GFCM for area 37 (Mediterranean and Black Sea).

With the specification of finer and finer detail in catch reports (many organisations now require that haul by haul data are reported from defined fisheries), STATLANT data are probably of less use to individual RFMOs than they were previously. If they are the only form of reporting on some fisheries, they are obviously essential, but in the case where there are better data available to the organisation, STATLANT data still have a use in being public domain summaries of data on catch and effort.

FAO only collates the STATLANT A questionnaires into its publication of global fisheries statistics, and the organisations listed above have generally found the STATLANT B information to be more useful for their purposes. Thus, if the Commission wishes data similar in scope to the STATLANT B data to be available publicly it will have to publish them itself. This should, however, be relatively inexpensive especially if web-based publication is envisaged.

More recent attention of the CWP has focused on the need for standards to be defined for reporting using electronic media. An example is the recognition of the CWP of the widespread implementation of vessel monitoring system (VMS) technology and the need for international reporting standards. The CWP agreed that there is an urgent need for an international standard format which accommodates the reporting of position, fishing activity, catch and other data through VMS. The CWP recommended that an international standard be developed and promoted, and that FAO consider facilitating this process as a matter of urgency (FAO, 1999c).

2.2 Fisheries Global Information System

The Fishery Global Information System (FIGIS) is a global information system on fisheries developed by FAO aimed at providing policy makers with timely, reliable strategic information on fishery status and trends on a global scale. Designed as a policy-based information system, it provides a single entry point to strategic data, information, analyses and reviews of fisheries issues and trends. A key principle of FIGIS is that of ensuring that information is quality-controlled and maintained up-to-date. FIGIS' maintenance will rely upon a network of partners (initially RFMOs and National Centres of Excellence) contributing to the system according to their own mandate. As a corollary, the system's control is decentralised: contribution and maintenance rights are assigned to FIGIS partners who are the data owners, these partners having to share certain standards and adhere to certain rules aimed at ensuring the best possible quality of data and information. Being a distributed information system, FIGIS will allow states to fulfil their reporting obligations according to international requirements. In that respect, FAO has already agreed with SPC, ICCAT, ICES, and NAFO on the development of case studies.

For effective fisheries information management, FIGIS needs to promote and agree on standards: thesauri with agreed vocabularies and classifications for indexing, glossaries to ensure definitions of terms, and shared concepts. Norms for data sets content management are under development, including documentation of information quality assurance processes. FIGIS refers to the Dublin core XML Metadata standard (dublincore.org) to set up its own proposal for Fisheries XML information standards.

2.3 International Standards Organisation

The International Organisation for Standards (ISO – www.iso.org) produces internationally agreed standards for quality management systems (ISO9000) and for environmental management systems (ISO14000). Under the ISO format, standards developed must:

- Consider and organise the purpose of the standards,
- Define the problem areas that the standards must solve,
- Determine the “best practices” available, and
- Select the actual measures to assure that the standards are met.

The main attributes of best practice are based on the standards established by ISO 14000. In environmental management these standards require consensus planning and comprehensive stakeholder involvement, based on full information and equal empowerment. The ISO 14000 standards for environmental management are scale-independent: they apply to environmental management of regions, sectors, specific projects and individual operational activities.

The rigorous and time-consuming process to achieve full ISO certification for data collection management standards will not likely serve the purpose of the Commission. However, a less

rigorous procedure that follows the ISO format will provide an opportunity for the PrepCon to fully evaluate the details of sampling requirements in the context of data quality needs, e.g. see Figure 2.1.

3 Data types

As discussed in the previous section, a number of recommendations were presented in the 1996 MHLC Technical Consultation, specifically relating to data collection, reporting and associated standards; including a discussion of the overarching data types needed. These and the bodies charged with their collection are summarised below:

Data type	Responsibility for collection
Annual catch statistics	Flag state
Catch and effort data	Flag state
Logbook validation data	Flag state
Length data and associated biological information	All parties to the Commission through a co-ordinated sampling plan
Operational data, data on bycatch and discards, biological sampling of target and non-target species	All parties to the Commission through a regionally co-ordinated observer or port sampling programme
Research programmes of relevance to stock assessment which could broadly be interpreted as collection of biological, environmental and ecological data	All parties to the Commission through co-operative research

In discussing the data usually required to undertake stock assessment and other related scientific analyses that underpin management advice, we consider four principal categories of data:

- Commercial fishery data including catch and effort statistics, landings and transshipment records (both aggregated and fine-scale) collected on the basis of flag state submissions;
- Biological and ecological data, including by-catch information, length frequency data, sex, maturity, age data, environmental data etc.;
- Environmental data, including meteorological and oceanographic information;
- Economic data, including market information, trade data, commodity, consumption, fisher information etc.

In addition to the above data categories, we also recognise the category of technical data. This comprises the type of data collected on vessel characteristics and operational history that would be collected as part of a vessel registration process for use in standardising fishing effort data (see Section 3.1) and for other Commission purposes.

3.1 Commercial fishery data

Commercial fishery data represent the most fundamental data type required to monitor a fishery. It can also contribute, once a sufficient time series has been collected, to the assessment of stock status and potential. Annual catch estimates and annual catch rates offer a baseline for monitoring long-term trends in a fishery, whilst for stock assessment and other population modelling, finer scale data are usually needed. Catch and discard data are required for both target and non-target species, although direct commercial sources are usually limited with respect to the latter.

Regarding standardised terminology for catch statistics, the following terms are suggested from the US National Marine Fisheries Service (NMFS) National Bycatch Strategy (1998)⁴.

- Target Catch Catch of a species, a particular size or sex, or an assemblage of species that is primarily sought in a fishery, such as shrimp in a

⁴ US NMFS National Bycatch Strategy <http://www.nmfs.noaa.gov/bycatch.htm>

shrimp fishery or mature female fish in a roe fishery. The definition of targeted catch within a fishery is not static, for example in a multispecies fishery, the mix of species targeted and caught may be quite variable and may change over time.

- Incidental Catch Catch that is not part of the targeted catch. This includes retained nontargeted catch and discarded catch. Examples are finfish catch in shrimp fishery that may be sold or kept for personal use, juvenile pollock catch that now must be retained in the Alaska pollock fishery, and seabird catch in the Pacific longline tuna/swordfish fishery that must be discarded.
- Discarded Catch Living marine resources discarded whole at sea or elsewhere, including those released alive.
- Bycatch Discarded catch of any living marine resource plus retained incidental catch and unobserved mortality due to a direct encounter with fishing gear.

Landings and transshipment records comprise an important source of information with which reported catch data can be verified and validated; both in terms of absolute volume of catch and reported species composition. Additional sources of data used to verify reported catches, include observer programmes and port sampling programmes. Observer programmes are a particularly important source of data with which catches can be adjusted to reflect actual catch (all species landed on deck) rather than the proportion of catch that is retained.

Basic effort data, such as number of vessels and days fished must be supported with detailed information regarding vessel and gear attributes to allow standardisation of effort indices; this may be critical for estimating indices of abundance and for use in stock assessment models (e.g. surplus production models and MULTIFAN-CL models). Commercial sources of effort data, including details of vessel and gear attributes include operational logsheet reporting, vessel registers and vessel activity reports.

The following list identifies some of the key commercial fishery data types in the context of scientific research and the monitoring of catch and effort:

Commercial fishery data collection	
Data type	Description/Source
Annual catch estimates	Estimates of annual catch by gear and species Catch is defined as all species landed on deck; discard as all species caught and subsequently discarded Based on verifiable logsheet, unloading, or other commercial catch data sources (trade statistics etc.)
Catch data	Landings /unloading data Data on volumes by species, origin of catch (e.g. statistical area) Mechanism for confirmation of reported landed-catch volume and composition. Catch data are whole (green) weight only. If fish are processed on board, independent collection of data on conversion factors is highly recommended

Commercial fishery data collection	
Data type	Description/Source
	Port sampling Landed catch composition – volume by species
	Transshipment data Data on volumes by species, origin of catch (e.g. statistical area)
	Scientific observer data Detailed records maintained of catch composition (catch and by-catch species) Recorded on a haul-by-haul basis / by statistical area / as trip summary information
	Trade statistics Including catch documentation and trade documentation schemes Mechanism to verify legality and identify unreported catches (respectively).
Effort data	Vessel registers and activity reports Catalogue of operator, vessel and gear attributes (standardising effort) Trends in vessel activity
	Observer data Operational data recorded on a haul-by-haul basis Gear and vessel attributes, including any modifications to gear and setting practices Recording of other vessels sighted
	Surveillance reports Patrol reports used to verify licensed vessel activity and a means of identifying and recording Illegal, Unregulated and Unreported (IUU) fishing activity
	VMS data Mechanism for verifying licensed vessel activity and can act as a monitoring and evaluation (M & E) mechanism ensuring complete catch and effort enumeration (means of identifying missing data sets and intelligence prompting requests for data)
Catch and effort data	Flag state reporting based on vessel records – catch and effort logsheets <ul style="list-style-type: none"> • Haul by haul • Fine-scale (by vessel per fishing operation) • Aggregated catch and effort data by time, area and gear strata (e.g. monthly 5° x 5° for longline and 1° x 1° for surface gears) In some cases individual vessel catch and effort records transcribed at port in a prescribed format (IATTC).
	Observer data Usually detailed records of catch and bycatch recorded at an operational level (haul-by-haul).

3.2 Biological and ecological data

Biological and ecological data types supplement commercial fishery data and are collected either through targeted research initiatives or through monitoring programmes such as port sampling and observer programmes. Regular monitoring programmes, particularly observer programmes, provide a valuable source of supplementary data, which are not usually available from commercial catch and effort data. These include: catch composition, discards of target species, incidental catch and discard of non-target species, details of fishery interactions with species of special interest (e.g. marine mammals, seabirds and turtles) and changes in operational factors or gear. Of particular importance for observer programs in tuna fisheries is the recording of bycatch, especially in view of the increased emphasis on ecosystem approaches in modern fisheries management policy.

Data collected in support of age and growth studies include length data, otolith samples and tag recapture data. Tag recapture data together with genetic data also constitute an important source of information on stock structure. Tuna ecology studies are reliant on detailed ecosystem information with which food web structures may be modelled; data sources include samples of stomach contents and muscle / tissue biopsy samples.

Biological and ecological data collection	
Data type	Description/Source
Bycatch, discard and other data	Observer data Number and/or weight of discarded catch (target and non-target catch) Incidental mortality data of species of scientific interest (e.g. marine mammals, seabirds, turtles)
Length data	Observer sampling Information relating to unsorted catch according to defined sampling protocols (protocols differ based on scientific objectives (e.g. development of age length keys etc.).
	Port sampling Collect length frequency information based on samples of landed catch.
	In some cases crew record length frequency information of target species
Movement and growth data	Tagging programmes Supported by observer and crew records of recapture and sampling for ageing material
	Fishery independent research – aerial surveys (ICCAT/IOTC)
Morphometric data	Observer sampling Morphometric information, conversion factor information etc.
	Port sampling Additional information to length data collected on occasions
	Fishery independent research
Ecological data	Observer sampling Stomach contents, genetic data, etc Anecdotal information may provide qualitative data to inform future research.
	Fishery independent research Details of species interactions including predator prey relationships etc. Direct effects on non-target species and habitat. Details of species interactions including predator prey relationships etc. Direct effects on non-target species and habitat.

3.3 Environmental data

Tuna distribution and abundance have been shown to be sensitive to environmental variability. In particular, the El Niño Southern Oscillation (ENSO) appears to have important consequences both for spatial distributions and migrations of the tuna populations and for their level of recruitment and biomass. Environmental data are therefore important for the determination of effective effort, in longline and surface fisheries, and in monitoring the extent and the influence of, oceanographic and meteorological processes on tuna fishery stock dynamics, migrations and production.

3.4 Economic and sociological data

Fisheries managers and policy makers increasingly recognise the importance of social and economic information in fisheries management. The collection and evaluation of social and economic data, when integrated with fishery and biological data, can provide an important source of advice relating to optimal levels of fishing, from a bio-economic point of view. This is particularly important for Small Island Developing States (SIDS), where the fishing industry is often regarded as the cornerstone of the economy contributing socially through employment and protein and directly to the economy through contribution to Gross Domestic Product (GDP) and generation of foreign exchange.

The Convention is very clear regarding the consideration of sociological and economic criteria in the application of management measures. This stems primarily from the need to take into account the special requirements of developing States in the Convention Area, particularly small

island developing States (Article 5(b)), both in terms of the allocation of allowable levels of catch and effort (Article 10(3)), and inclusion in the scientific process (Article 30(3)).

In terms of scientific activities in support of these objectives, however, the Convention mentions only the collection and evaluation of economic and other fisheries-related data and information relevant to the work of the Commission (Article 10(1j)). To give effect to these objectives, the Commission will need to consider what specific information will be needed to support the application of the type of criteria listed in Article 10(3).

An increasing trend in the demand for economic data has resulted in a number of organisations, most notably the CWP, stressing the need for collaboration between fishery statisticians, economists and managers towards determining the types of data necessary to quantify the social and economic contribution of fisheries.

3.5 Technical data

The concept of a vessel register is now widely accepted as a valuable means of collecting vital information on vessels technical details and capacities (important for analysis of catch per unit effort data) and also for tracking vessel ownership and standing in terms of compliance with national and international management regulations. Fishing operators seeking to access resources managed under a regional fisheries arrangement should be required to register with the regional organisation and provide the required information on their vessel, company, master and catches. In Part V, Article 24 of the Convention text, vessel register information and procedures are discussed. Information requirements set out in Annex IV of the Convention are as follows:

1. *Name of fishing vessel, registration number, previous names (if known), and port of registry;*
2. *Name and address of owner or owners;*
3. *Name and nationality of master;*
4. *Previous flag (if any);*
5. *International Radio Call Sign;*
6. *Vessel communication types and numbers (INMARSAT A, B and C numbers and satellite telephone number);*
7. *Colour photograph of vessel;*
8. *Where and when built;*
9. *Type of vessel;*
10. *Normal crew complement;*
11. *Type of fishing method or methods;*
12. *Length;*
13. *Moulded depth; Beam;*
14. *Gross register tonnage;*
15. *Power of main engine or engines;*
16. *The nature of the authorisation to fish granted by the flag State;*
17. *Carrying capacity, including freezer type, capacity and number and fish hold capacity.*

These data surpass FAO standards, but represent an agreed framework upon which more specific information requirements can be established. It is crucial that standard units of measurement are agreed to facilitate harmonisation of data from different sources. This is particularly important, for example, with metrics that may be important for assessing fishing effort, such as Gross Registered Tonnage, which should be standardised to the international convention, not based on national conventions, which vary. Standard codes for potentially ambiguous data types are also an important component of vessel registers. These are particularly applicable with regard to vessel type and where operational details are required describing gear, processing facilities etc.

In addition to the information included in the list above detailed information is commonly submitted regarding: fishing gear attributes, including details of power blocks, winches, net type and configuration, hook size etc.; vessel technology in addition to communications equipment such as navigational equipment, fish finding equipment, Electronic Position Relay Beacons (EPRB), transceivers (VMS) etc.; and fishing vessel support, which may take the form of support vessels, helicopters etc.

3.6 Summary

Steps have already been taken, through the PrepCon process, to prioritise data types for scientific purposes. A meeting of the SCG in Hawaii in July 2002 made recommendations concerning priority data types, which were subsequently endorsed by WGII at PrepCon3 in Manila. These data include: annual estimates of catch; catch and effort data (the scale and resolution are yet to be established, although data at the finest scale possible are recommended); and size composition data (length frequency).

The specifics of longer-term Commission data requirements for scientific purposes have yet to be agreed. Nevertheless, priority fishery data in the context of the PrepCon have been established (see above) and these same priority data types are likely to be reflected in Commission data needs and associated standards, at least in the short term.

4 Data Collection

In this section we review some of the mechanisms commonly used to collect fishery data. The accepted mechanism to ensure both harmonised and consistent data collection is through the use of standardised data collection forms and/or formats (e.g. logsheets). These are usually supported by detailed instructions or manuals, which define data collection procedures / sampling protocols and standard classification codes to ensure compatibility, consistency and quality of reported data.

4.1 General fishery data collection techniques

4.1.1 Logbooks and data forms

The logbook or logsheet is the accepted data collection form used to record catch and effort data. Vessel logsheets and logbooks can also offer a means of collecting additional information in a standardised manner, including information concerning vessel and gear attributes, discards etc. Other commonly used data collection forms include: unloading forms, transshipment forms, port sampling forms, observer forms and data transcription forms.

Standard approaches to the design of data collection forms are discussed in the Guidelines for the Routine Collection of Capture Fishery Data (FAO 1999a). Effective data collection form layout relies upon the relative simplicity with which forms can be completed and the extent to which data processing methods are reflected in design and layout. Some additional considerations for the design and implementation of data collection forms include:

- the identification of essential and desirable data types through prioritisation of essential data against those data types which can be collected and *de facto*, the extent to which it is practical for additional information to be collected;
- evaluation of the scale and precision of required data;
- the use of standard terms / classification codes / standard measurements / units etc. which facilitate harmonised data collection and data recording (where appropriate these standards must be defined with international reporting requirements in mind);
- the parallel development of detailed instructions, including statistically valid sampling protocols where appropriate;
- linguistic requirements of both collection forms and instructions should reflect the needs of those tasked with data collection; and,
- the effective implementation of an appropriate and regular mechanism for review.

With regard to the medium used, data collection forms are designed both in hardcopy format and in electronic form, either as printable copies or as data entry forms which can be uploaded directly into a data management system (database or spreadsheet files). It is becoming increasingly common to record data electronically rather than on paper. For instance, almost all research surveys and observer data are now collected on computers at sea, although there may be an intermediate paper stage if the data are being collected in a wet environment such as on the deck or in the factory. It is still probably the case that most fishing masters will prefer to use paper to collect their data, but the time is fast approaching when we can envisage the use of VMS data to collect some fisheries data.

4.1.2 Observer programmes

At the micro-level it is usually extremely useful to have observers on at least some vessels. Observers provide feedback on fishing practices, processing practices and the level and species composition of discards. Care must be taken to try to identify changes in fisher behaviour when an observer is on board. This is very difficult to do (for obvious reasons) but some experimental designs are available, especially from fisheries with good levels of observer coverage.

International observer programmes (e.g. the CCAMLR Observer Scheme) offer some advantages over national observer programmes. The quality of the observations from such programmes may be higher, standards are consistently applied across the entire fleet, and the added transparency increases the confidence that all parties have in the data.

Observer responsibilities have components of collecting scientific information and assuring compliance with regulations. The distribution of tasks among these components affects the observers' relationship with the fishing industry. Some national and international programmes, such as CCAMLR, use observers only to collect data. The Australian programme uses observers to collect scientific data and compliance data related to permits and marine pollution.

In point (e) of Article 28 the Convention text states that:

the activities of observers shall include collecting catch data and other scientific data, monitoring the implementation of conservation and management measures adopted by the Commission and reporting of their findings in accordance with procedures to be developed by the Commission;

Careful consideration will be required when decisions are taken regarding observer responsibilities to ensure that the quality of scientific data is not compromised when the inevitable balance is struck between scientific data collection responsibilities and compliance (MCS) data collection.

4.1.3 Port sampling programmes

Port sampling programmes offer a means of identifying volume and species composition of landed catch. These data are critical given that the majority of logbook data is based on estimates made under difficult working conditions at sea. In addition size (length/weight) frequency data can also be collected. As with observer programmes the use of standard nomenclature, methodology, sampling protocols and recording forms maximises the value of data.

4.2 Data collection programmes

We have identified a number of international programmes responsible for the collection, compilation and dissemination of fishery data both within and outside the WCPO region, listed in Table 4.1. A discussion follows outlining the data types handled and the mechanisms employed in collation and collection of fishery data. The summary information was compiled on the basis of available literature, supplemented by information collected through telephone interviews and a structured pro-forma. In addition to the information presented here, Lawson (2002) provides the most recent and complete inventory of tuna fishery data collection, compilation and dissemination for nations in the WCPO currently available.⁵

⁵ The Statistics Working Group (SWG) of the SCTB has the objective of coordinating the collection, compilation and dissemination of tuna fishery data for the WCPO. At its inaugural meeting in June 1998, the SWG agreed to (a) coordinate data collection by reviewing data collection forms currently in use in the region; (b) coordinate data compilation by reviewing the compilation of annual catch statistics, catch and effort data, and length data, on an annual basis; and (c) coordinate data dissemination by reviewing the instances of the dissemination of data on an annual basis. A paper was prepared by the Coordinator of the SWG (Lawson 2002) in order to report on progress with the coordination of the collection, compilation and dissemination of data. We have made no attempt to specifically summarize the content of that paper, although matters relating to WCPO region developing state data collection, verification and reporting capabilities are addressed in Section 7 of this report.

Table 4.1 Details of WCPO and International organisations responsible for fishery data collection and compilation considered

Organisation	Description
SCTB	The Standing Committee on Tuna and Billfish. The SCTB provides a forum for scientists and others with an interest in the tuna stocks of the western and central Pacific region to meet to discuss scientific issues related to data, research and stock assessment. It was established in 1988, as an advisory body to the Tuna and Billfish Assessment Programme (TBAP), the predecessor to the OFP. Its role was to be purely advisory and consultative, to assist in the conduct of pelagic fisheries research through the provision of expertise, information and technical advice. In 1997 the terms of reference and participation guidelines of the SCTB changed to promote a wider sense of ownership and enhanced scientific collaboration. The SCTB no longer advises SPC's Regional Technical Meeting on Fisheries.
ISC	Interim Scientific Committee. A scientific forum to exchange views on a full range of biological and other scientific issues relating to tunas and tuna-like species in the North Pacific Ocean, including status of stocks, data collection, research, and the consideration of future work programmes.
OFP (SPC)	Oceanic Fisheries Programme. A unit of the Secretariat of the Pacific Community, with a mission to provide member countries with the scientific information and advice necessary to rationally manage fisheries exploiting the region's resources of tuna, billfish and related species.
FFA	South Pacific Forum Fisheries Agency. Collects, analyses, evaluates and disseminates information to member countries. The Agency also provides legal, economic and technical advice, information and assistance in the formulation and implementation of the fisheries policies and access agreements.
IATTC	Inter-American Tropical Tuna Commission. An intergovernmental organisation with full scientific secretariat that studies the biology of the tunas and related species of the eastern Pacific Ocean to estimate the effects that fishing and natural factors have on their abundance, recommends appropriate conservation measures to maintain the stocks of fish at levels which will afford maximum sustainable catches, and collects information on compliance with Commission resolutions.
CCSBT	Convention for the Conservation of Southern Bluefin Tuna. An intergovernmental organisation established to ensure, through appropriate management, the conservation and optimum utilisation of southern bluefin tuna.
ICCAT	International Commission for the Conservation of Atlantic Tuna. An intergovernmental organisation established to recommend on the basis of scientific evidence, management measures and resolutions aimed carrying out its objective of maintaining the populations of tuna and tuna-like fishes at levels that will permit maximum sustainable catch.
IOTC	Indian Ocean Tuna Commission. An intergovernmental organisation established under Article XIV of the FAO constitution. It is mandated to manage tuna and tuna-like species in the Indian Ocean and adjacent seas.
CCAMLR	Commission for the Conservation of Antarctic Marine Living Resources. An intergovernmental organisation with a mission for the conservation of Antarctic marine living resources with conservation defined to include rational use.

4.2.1 Reported catch and effort data

Relevant to the WCPO region, the SPC-OFP, CCSBT, ISC and IATTC are regional fisheries bodies that maintain commercial fisheries data for tuna fisheries. In all cases, member states provide catch effort and landings data to the regional organisation. While the SPC-OFP and IATTC have long-established fisheries database capabilities, the CCSBT has recently developed a Commission database of catch, effort, landings and length composition data, and ISC is in the process of developing comprehensive database and data management systems. Of these groups, only

IATTC has staff members in the field to collect supplemental catch data. All four organisations collect or receive logbook data but the data do not include all fisheries from some nations or gear types. For example, the SPC-OFP collects logbook data on standard forms from both domestic and foreign fisheries. The logsheet data held by OFP for 1999 cover 47% of the catch of tuna in the WCPO. Excluding the domestic fisheries of Indonesia and the Philippines, which account for 33% of the catch of tuna in the WCPO, logsheet coverage is 68% (Lawson et al. 2002). A notable characteristic of the data held by SPC-OFP is that the majority originates from coastal state submissions inclusive of data relating to PICT national fisheries and DWFNs fishing under access arrangements in PICT territorial waters.

In the case of the international organisations reviewed, ICCAT, IOTC and CCAMLR receive catch and effort data from flag states according to standardised reporting formats. In the case of IOTC and CCAMLR, contracting parties are obliged to submit data in a standard format using standard codes in either paper or electronic form. In the case of CCAMLR, a comprehensive *Fishery Data Submission Manual*, produced in English, French, Russian and Spanish, provides guidelines for data submission including: deadlines for submission, data forms, explanatory guidelines, and standard definitions and codes.

Several WCPO organisations provide co-ordination and review of data-oriented activities. The SCTB co-ordinates data collection, compilation and dissemination according to agreed principles and procedures. While membership in SCTB is open to all interested parties, not all nations fishing in the WCPO are able to participate (for example, in past years, financial difficulties have curtailed full participation by Indonesia, Philippines and some Pacific Island States). The ISC has a primary task to regularly assess and analyse fishery and other relevant information concerning tuna and tuna-like species. Its membership consists largely of distant water fishing nations.

4.2.2 VMS in the region

The potential crosscutting benefits of Vessel Monitoring System (VMS) data for the purposes of fishery data verification should not be overlooked. The issue of VMS data compatibility is also of increasing concern to RFMOs (see Section 2.1.3). VMS data can be used both as a means of verifying reported effort data and as a means of monitoring the completeness of data submissions. It is in this context that existing VMS capacity within the WCPO region is discussed.

The FFA has taken a leading role in the development and application of VMS in the WCPO region. The FFA has convened a series of technical consultations for member states and DWFNs to review and discuss VMS (e.g. FFA 1996). Several nations (including: New Zealand, the People's Republic of China, Papua New Guinea, the USA, Korea, French Polynesia, New Caledonia, Australia, and Japan) have implemented or are evaluating VMS technology.

Under the existing programme any DWFN vessel that wishes to apply for a licence to fish in the waters of an FFA Member Country must first be registered on the VMS Register of Foreign Fishing Vessels maintained by FFA. The VMS Register is distinct from the regional register, also maintained by the FFA. Information required includes basic vessel details (name, call sign, type, operator / charter) and specific information relevant to the transceiver (Automatic Location Communicator, ALC) installed on the vessel (including communication information, certification and installation details).

The FFA system is based on the Inmarsat-C service, which offers comprehensive coverage of the entire WCPO region. In addition, Inmarsat-C offers two-way communications and messaging capabilities, which ensures flexibility with regards potential extensions to VMS (e.g. electronic logbook reporting). A type approval process has been implemented to ensure compatibility of hardware.

FFA maintains VMS information centrally and distributes data to member countries when fishing activity occurs within their respective EEZ. Actual data collected includes: vessel identity,

position (latitude and longitude) and a time stamp; course and speed are determined on the basis of this information. The frequency at which data are transmitted is standardised at 6 transmissions per day, although the frequency can be increased and decreased if and when it is deemed necessary. No VMS transmission is currently required in high seas waters.

4.2.3 Biological and ecological data

Observer programmes offer an opportunity to obtain scientific data directly from fishing operations. Observer programmes provide important scientific information on target catch, non-target catch (including incidental catch of seabirds, marine mammals and turtles), and the mortality of discards. In the WCPO, both FFA and IATTC operate regional observer programmes. The OFP supports and co-ordinates national observer programmes, and has employed full-time observers in the past for deployment in priority fisheries (3 full time staff provide technical support both for observer programmes and port sampling programmes to SPC member States). In addition OFP provides limited financial assistance in support of member state observer programmes. The FFA programme operates under a US purse seine fleet treaty and achieves some 20% coverage in terms of vessel days; there is no coverage of longline or pole and line fleets. The IATTC operates a regional observer programme and co-ordinates with member nations to obtain 100% coverage of purse seine vessels larger than 363-mt capacity. The CCSBT has begun planning for observer coverage.

It is important to note that the design of observer sampling programs is far from simple. The statistical qualities of the required parameters are often very poorly defined, and rarely lend themselves to that body of statistical theory that deals with normal distributions. Sampling is typically a three-stage process, with three levels that need to be considered – the vessel (i.e. how many vessels to sample), the haul (how many hauls to sample on a vessel) and within-haul (how many samples to take from any sampled haul). Solutions that have been adopted in other international forums may help to provide guidance, but observer programmes will have to be tailored specifically to the species in question and the particular operating characteristics of the various fleets. Furthermore, the ideal statistical sampling method will only rarely be practical to implement within budgetary and logistical constraints. Therefore we would caution at this stage against any decision being made about the correct level of coverage in terms of vessels to be covered, % of fishing days to be covered, etc.

Effects of fishing on non-target, associated and dependent species (NADs), typically known as bycatch, has assumed increasing importance in international forums. Analysis of fishing impacts on bycatch of finfish, porpoise (dolphins), sea turtles, and sea birds requires objective and scientifically collected data such as obtained by observers. Increasing fishing for tuna near Fish Attracting Devices (FADs) has increased the incidence of bycatch of many species, including some that are threatened or endangered. The “Agreement for the Conservation of Albatrosses and Petrels of the Southern Hemisphere” provides an example of the international attention given to means of reducing impacts of bycatch.

The following summary information is available on observer programmes on vessels fishing for HMS in the Pacific

Organisation	Function
FFA	Develops and co-ordinates regional observer programmes and assists in the development of national observer programmes. Data collected combines operational information including vessel and gear attributes, biological data collected according to defined sampling protocols and environmental data. Compliance information is also collected, although there are no defined formats for compliance data collection.
OFP	Obtains species composition, catch data for non-target species, and length data from national programmes; OFP observer programme co-ordinates with member nations to expand coverage; provides training and processes observer data.
IATTC	IATTC regional programme co-ordinates with national programmes for 100% coverage of vessels with > 363-mt capacity. Detailed observer manual and log sheets ensure

Organisation	Function
	standard protocols and collection procedures are followed.

Quality control of observer data is essential. Data provided to the OFP are checked both manually prior to data entry and by the data entry and data importing software (Lawson et al. 2002). In observer programmes for which technical support is provided by the OFP, a purse seine and longline debriefing form allows the national observer co-ordinator (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.

An examination of observer samples of the proportion of bigeye in the catch taken by purse seine vessels has however revealed serious problems with data quality (Lawson, 2002b). Supervisors evaluated the reliability of observers and the results indicate that only 83 of 151 observers (55 percent) were considered to be reliable. Observer training programmes have since been conducted by the OFP and it is considered that the reliability of samplers has as a result improved considerably (Tim Lawson, OFP, pers. comm.).

Port sampling programmes offer a means of identifying both species size composition and length / weight of landed catches. The IATTC operates an extensive port sampling programme through its field offices; employing standard sampling formats supported by detailed instruction manuals.

The OFP supports member country and territory port sampling initiatives through encouraging the use of standard sampling protocols and reporting formats. In its supporting capacity port sampling data provided to the OFP are checked for data quality both manually before data entry and by the data entry software (Lawson et al. 2002). For example, missing information is 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 obtained varies among existing 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 of 129 port samplers (15 percent) were considered to reliably identify bigeye tuna.

Significant steps have since been taken by OFP to address this problem; several training programmes have been conducted and as a result the capacity of samplers to identify juvenile bigeye tuna in purse seine catches is judged to have improved considerably (Tim Lawson, OFP, personal comment).

The ISC Statistics Working Group has recently addressed the issue of size data collection by member countries, encouraging the use of standard protocols; species-specific measurement standards are currently being defined by the ISC's Species Working Groups.

Outside the region, size data collection is mandatory for IOTC and ICCAT contracting parties. In the case of CCAMLR biological data are not collected through port sampling programmes, although length data are reported to CCAMLR on the basis of crew samples, undertaken in the absence of International Scientific Observers.

No regional fishery bodies in the WCPO area conduct operations to obtain fishery-independent data. Some member nations conduct surveys to collect fishery-independent data, which are generally for local use.

Environmental data collection is in the most part restricted to data collected at sea through observer programmes. A range of public domain environmental data are however used, for

example the SPC-OFP has access to public domain data which it uses for assessment purposes and shares with member countries / territories.

4.2.4 Social and economic data

The Convention makes reference to the need for sociological and economic criteria to be taken into account in the design of management measures. Underlying these provisions is recognition of the special requirements of developing States in the Convention Area, particularly small island developing States (Article 5(b)), both in terms of the allocation of allowable levels of catch and effort (Article 10(3)), and inclusion in the scientific process (Article 30(3)).

In terms of data collection activities in support of these sociological and economic objectives, however, the Convention mentions only the collection and evaluation of economic and other fisheries-related data and information relevant to the work of the Commission (Article 10(1j)). To give effect to these objectives, the Commission will need to consider what specific information will be needed to support the application of the type of criteria listed in Article 10(3).

The decisions made on the basis of fishery and biological data, stock assessment results, and management policies have direct economic and social ramifications for fishers. Yet the difficulties in obtaining data to assess these effects generally cause economic and social analyses to lag far behind other aspects of fishery science. In the WCPO region, FFA and OFP have made significant progress in obtaining and using social and economic data. The issue of the optimal level of fishing is receiving increasing attention. The OFP has begun a project to integrate the available economic information for the fisheries and markets with the population biology of major tuna species in the western Pacific to provide advice to FFA member countries on optimal (from a bio-economic point of view) levels of fishing effort.

The following summary information is available on the status of the incorporation of economic information into management scenario modelling of fisheries for HMS in the Pacific:

Organisation	Summary of activities
OFP	Integrates the available information on the population biology of major tuna species in the western Pacific with economic information on the fisheries and markets; develops bio-economic model to assess economic rent and economic benefits to FFA countries
FFA	Collects and disseminates economic and marketing information to the government and private sector in member countries

The CWP noted the trend for social and economic data to be increasingly requested for use in fisheries management and has recognised the need for the improved availability of such data. The CWP recognises the need for collaboration between fishery statisticians, economists and managers in determining the data required and the concepts and definitions to be applied to these data (CWP-18, Appendix 6).

5 Data quality

Data quality control is applied at two points in the data capture and handling process. Firstly there is verification of data submissions prior to insertion into the database. Secondly there are internal mechanisms to ensure the integrity of data in the database is maintained.

5.1 Data verification

The verification of data is essential to ensure that data are accurate, complete and give a true indication of the state or value of the factors under consideration. The problems associated with the collection of fisheries data mean that the risks of collecting erroneous or inappropriate data are very high without careful and statistically valid design and monitoring.

Standard data import routines can facilitate traditional manual crosschecks of reported data with independent sources and ensure data integrity during data entry. Different types of data will need to be verified in different ways. Some examples of methods to verify data include:

- Checking logbooks against landings data (e.g. sales notes);
- Sampling catches for species or grade composition;
- Comparing landings statistics with certificates of origin, trade and commodity production statistics (e.g. processed fish) and similar sources of information;
- Inspecting data collection methods by statistical staff;
- Interviews with fishers;
- Observer schemes or inspections;
- Reporting from sea on retained catch on entering and leaving the fishing zones;
- Using vessel monitoring systems, such as transponders, to monitor the position, catch and activities of vessels;
- Instituting airborne and shipboard surveillance, together with the boarding of vessels.

In cases where fishery-independent data, such as stock abundance indices from research surveys, are available, it is possible to use these as an independent check on CPUE indices based on commercial fishery catch and effort data. In cases of suspected serious misreporting of catches, it is even possible to use such fishery-independent data to obtain estimates of the commercial catches.

At the macro-level (typically national), food balance sheets can be used as an overall check of the consistency between production, utilisation, trade and consumption statistics. For such an exercise, it is necessary to convert all figures into live-weight equivalent units using appropriate conversion factors. Total fish production from capture fisheries and aquaculture, less quantities used for non-food purposes (e.g. fishmeal production) plus imports minus exports should correspond to the domestic food fish supply. It is usually expressed in per capita terms by dividing by the population size. The average per capita fish supply can then be compared with fish consumption estimates derived from food surveys. Large deviations from food survey results or large fluctuations from year to year suggest that there are problems with some of the statistics used in the calculations (FAO, 1998).

5.2 Data Quality Control

5.2.1 Overview

Data quality control is a key element of ensuring adherence to data quality standards. In this context, we consider data quality control in terms of its utility to managers, scientists and other interested parties. The data collected must be rational in order to form the basis of standard report summaries (weight of catch, location of catch, CPUE, etc.) against which progress of the fisheries is monitored or managed (output control, stock assessment, etc.).

The main issue to be addressed in data quality control is the identification of 'outliers' in the input data. For example, one can ask the question, are catches / effort reported by each vessel consistent with other reports coming in from other vessels operating within the same fishery, at the same time, general location, and with the same gear? How consistent are these data with historical pictures of how data have accumulated within the fishery? (See also discussion of error types in Section 5.2.2). This requires some detailed level of understanding about 'average' expected conditions within any one particular fishery, under a given set of circumstances. For example, distributions of previous years' catch and effort data may be used to establish 'thresholds' above or below which input data are flagged (say, 95th and 5th percentiles - effectively, 'zero tolerance') as possibly suspect. Alternatively, depending on how data are assembled, individual input data sheets can be compared against current data accumulating from the fishery. 'Outliers' may also appear on position reports associated with catch records compared with detailed management measures, including conditions of licence, gear restrictions, area restrictions etc. which may be in force. These can be identified at the time of data entry in the same way as the genuine outliers described above.

It is also important to consider the 'completeness' of the data. On the assumption that any one vessel must submit a fishing report or a non-fishing report, the time series of accumulated data should be checked at the level of the individual vessel in order to identify any unaccounted gaps in the date sequence. This requires, for example, information on fishing plans and license periods for individual vessels.

The primary tool of monitoring data quality within a database is through database integrity constraints. Three mechanisms exist for implementing database integrity constraints dependent on the volume of data being processed. These are real-time, transaction and batch.

Real-time error trapping has become much easier in the last few years with the increase in speed of PC-based applications and their increased complexity. Single fields can now be checked within the data entry application against a set of possible values or that an entered value is within a defined range. Fields can also be checked relatively simply against each other as they are entered. For example take the latitude and longitude entered for the start and end of a haul. It is now quite a simple process to take the two positions, calculate the distance between the two (using the Great Circle functions) and check that this is within an appropriate range. For a wide variety of fields, pull-down menus of appropriate values can be added, e.g. only "N" or "S" can be entered for the latitude hemisphere field of a position.

Transaction processing occurs at the end of a single unit of data entry, i.e. a logsheet. Here error trapping can be implemented for a wide variety of fields. For instance, it is common to run a quick check to see that the values entered for a particular entry add up correctly to match an entered total. If they don't, the row is not submitted to the database and the user is prompted to check the data before proceeding to the next row. Another mechanism used for transaction processing is that of double entry or double keying of data. Normal practice for the double entry of data is to enter the data twice, i.e. a set of logbooks will be entered once by the first data entry person and then the entire set will be re-entered by a second independent data entry person. The two datasets will then be compared at the end of the entry of the second data record and any inconsistencies resolved by reference to the original paper record. This has been

found to reduce substantially simple errors caused by e.g., operator's inability to read data on a data sheet, transposition of numbers, missing decimal points etc.

The double entry method is expensive, however, and requires a number of personnel to be available to enter one single dataset, it also doubles the size of the database. The compromise solution is double typing where each field in a data set is typed twice during entry before the user is passed onto the next record. The previous typing is obscured and any differences are highlighted at the end of the second row and resolved against the paper record. Only one correct set of data is retained in the database and one data entry clerk is needed. Probably the simplest mechanism at this level of data checking is to make the data entry clerk do a simple visual check of the data entered at the end of each record. Batch processing is similar to transaction processing, but occurs after a number of rows have been entered into the database. During batch error processing a series of complex analytical routines are run automatically, usually overnight or at weekends when data are not being entered. Data are then flagged as having passed or failed the checks. Data having passed the test are available for analysis immediately. Data having failed one or more of the error checks are flagged and will need to be checked by the user. It is possible to implement a system of data flags that allow a number of flags to be applied to a particular data record, to track where in the record errors have occurred. For example, data can be checked for a large array of potential problems including CPUE within a particular range, species average weights within ranges, and species composition not skewed towards by-catch species that may in fact be targeted against regulations. Each of these is allocated a unique flag, which is applied to the data error flag field for the record. In this way multiple errors can be traced for each record. It is quite common for errors to cascade through a record; once one field is wrong, the user continues to enter data incorrectly until the row is completed. This mechanism easily highlights these occurrences.

5.2.2 Types of errors

There are four types of data errors that commonly occur in database systems. These are completeness, consistency, currency, and accuracy. Completeness is a simple Boolean description of whether a datum has been filled or not. A datum is consistent if its value satisfies a set of constraints such as formal rules, logical requirements, or relational requirements, vis-à-vis other variables. A datum is non-current or out-of-date if its recorded value was true in the past but no longer agrees with the present true value. Finally a datum is accurate if its recorded value agrees with its true value.

In the case of the majority of fisheries data being collected, currency is not an issue as these are single entries recorded and stored that are not modified after storing (unless other types of errors are found). Completeness and consistency can both be trapped very easily by the mechanisms described above. Accuracy in many cases will be trapped but is the most likely of all errors to go undetected.

5.2.3 Numbers of errors allowable per unit

The number of allowable errors, depends heavily on the context - for example what is considered to be a unit, the type of error, and how sensitive the subsequent analyses are to errors in the data. In a perfect world, there would be time to resolve all issues relating to anomalous or spurious data. In practice, this is not the case in most fisheries departments.

The number (and types) of errors that may be tolerated varies between users in terms of the effect they have in any subsequent use. Under a policy of zero tolerance of errors, no data that have failed a quantitative range test can be loaded into the live system. This extreme level of quality control might be implemented, for example due to the potential impact of erroneous data on a statistical model used to monitor and manage the fisheries in real time (e.g. for within season TAC monitoring). Range testing eliminates most quantitative errors in the data. Obvious outliers (e.g., orders of magnitude) should not be allowed, but see note above concerning

concept of 'flagging.' Redman (1992) estimated that in the US a typical payroll record has a 1% chance of having one or more errors and a typical US billing record as high as 2% - 7% of having errors. These are in many cases regarded as being within acceptable bounds. Primary errors in fisheries data have been set previously at levels in the region of 85% of all records are 95% or more correct. With modern data systems it should be possible to attain a much better level than this.

For the most part error trapping is only capable of detecting and fixing errors made during data entry. There will be a number of errors that are made during the recording phase that it may not be possible to fix, although a proportion of these errors can be flagged and excluded from the data analysis, if appropriate (see methods above).

There are a number of statistical procedures (using the hypergeometric distribution) that, given the sample size (i.e. total number of records) and the probability of errors (taken from a subset of data visually checked against the entered data), can estimate the confidence limits for a particular dataset.

5.2.4 Methods used to rectify errors

After potential errors have been flagged in the database, the most common and best recourse for sorting out data problems is to check the entered data against the original hardcopy paper record. If this is not available or an error in the paper record is the source of the problem, a number of options are still open to rectify the error. Values can be compared against past and future values collected for the same data field. It may show that the same value has been entered each day for the field and on one occasion a different value was entered but it was more likely to be the same as previous values. Erroneous or data that have been modified after looking at possible sources of error can also be easily excluded or partially excluded from analysis datasets by using the same set of data flags described earlier.

Flagged data can be held in a temporary 'pending' database while source documents are checked usually using an index system such as pre-numbered log-book sheets, which could be an index generated by a document management system. This means that at any one time, the live database holds only those data that pass range checking and input control. The source of error must be investigated before the data can be transferred into the live database, if necessary, by recourse to the originators of the document. An alternative solution that is commonly used throughout large database systems is that records may be flagged with a code whose value indicates at which particular level any one record failed range checking. Data will be recorded in the 'live' database but it is then the responsibility of the administrators and users of that database to make some rational decision concerning its usage and applicability for each analysis conducted, e.g. records where the catch data is flagged as erroneous would not be used for estimating total catch.

5.2.5 Policies for reviewing data

The data management section of an RFMO must be tasked with continually checking the validity of data, and must correspond with data originators to answer any discrepancies that appear in the data. This can be a costly and time-consuming task, but its importance cannot be understated. One important consideration is that the origin of official data is often known to only a few national officers. Requests for clarification several years later, when those individuals have moved on, is much less likely to lead to a resolution of the problem than questions raised immediately following submission of the data. If investment in a data management section of an RFMO is not high, a large number of historical records are likely to have low quality reliability, because of the legacy effect of delayed checking.

An essential element to an effective reviewing mechanism is the identification of data correspondents. The STATWG of the ISC recently recommended that data correspondents be

identified for each Member. Data correspondents will be responsible for ensuring the quality of data collection and submissions by Members. Data correspondents will constitute the primary contact with which the ISC will communicate in the event of data related queries.

6 Data exchange and reporting

Timely reporting of fishery data directly influences the capacity of an RFMO to provide appropriate and timely management advice and disseminate information on the status of the fishery in question. Three contributing factors influence the timely exchange and reporting of fishery information, these include:

- agreement on the criteria used to allocate responsibility for data reporting;
- agreement on a framework for data reporting, including reporting schedules and defined lines of communication; and,
- agreement on a common format for data reporting and information exchange.

6.1 Fishery data reporting responsibilities

Although international instruments such as the UNFSA allocate responsibility for fishery data reporting to the flag State, areas of uncertainty remain particularly with regards the scale and resolution of data to be reported. Additional uncertainty exists in the case of DWFN activity (under access agreements and joint venture and charter arrangements). At its Eighteenth Session, the CWP revised its existing criteria in an effort to address these uncertainties, as detailed below:

The flag State of the vessel performing the essential part of the fishing operation shall be responsible for the provision of catch and landing data.

Where a foreign flag vessel is fishing in the waters under the national jurisdiction of another State, the flag State of the vessel shall have at all times the responsibility to provide relevant catch and landing 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 the 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.

In any situation where there is uncertainty as to the application of these criteria, any agreement, charter, joint venture or other similar arrangement shall contain a provision setting out clearly the responsibility for reporting catch and landing data, which shall be reported to the flag State, and, where relevant, to any coastal State in whose waters fishing operations are to take place or competent sub-regional, regional or global fisheries organisation or arrangement.

Agreement will need to be reached regarding the allocation of Flag state status and associated data reporting obligations, particularly under circumstances where DWFN operations are undertaken on the basis of JV operations or under access arrangements. To this end, it is strongly suggested that the PrepCon consider the above definition.

The question of data reporting obligations is of particular relevance given the current status of data reporting by certain fleets in the WCPO. Coastal states, rather than flag states, are in some cases the best or only source of catch and effort logsheet data. For example, flag state holdings of logsheet data for the Korean purse seine fleet constituted less than 40% in 1999 (Koh et al., 2002), Whereas, SPC-OFN logsheet data holdings, provided by SPC member countries, suggest a significantly higher level of coverage, some 98% (Lawson, 2002). This situation is attributed to the unique nature of the WCPO region, where the majority of catches are taken in territorial waters and where logsheet submissions are an explicit requirement of access arrangements.

Although the situation of Korean purse seine vessels and other DWFNs can be compensated for in the short term with coastal state data, given the reporting obligations outlined in Annex I of the UNFSA, coastal state reporting should be viewed as a short-term solution. For the mid to long-term, commitment to improved flag state data reporting should be sought.

6.2 Schedules for data submission

An important measure to ensure timely data submissions is agreement on a framework for data reporting, which might include data specific schedules and reporting protocols. The nature of data collected and its importance with respect to the formulation of management advice and associated measures will generally dictate the regularity with which reporting should take place. The development of a clearly defined reporting schedule with associated mechanisms to monitor and enforce data submissions should be considered.

Closely associated with the development of a data-reporting schedule should be the allocation of a point of contact responsible for data submissions (See Section 5.2.5). The identification of an individual responsible for data reporting is crucial not only for monitoring purposes but also for feedback and review, particularly where discrepancies in reported data are identified.

As discussed in Section 5.2.5, the ISC has recently endorsed the use of data correspondents, whilst the OFP have established a system whereby designated contacts are assigned for all countries / territories reporting data. Data handling is monitored using a *Data Registry* database; data submissions are logged and receipt of information is automatically generated and sent to the designated contact by email. The system is reciprocal in that designated contacts are able to access secure pages of the OFP website and obtain information on the status of data processing, specific to their submissions. A similar system has also been established by the CCSBT.

Given the number of States likely to report to the Commission, it will be critical that a reporting framework be established including provision for an appropriate response if discrepancies in data are identified or in the case of delays in data reporting.

6.3 Data reporting formats

The range of mechanisms available for data reporting has developed significantly from traditional hard copy formats (e.g. STATLANT forms) to electronic solutions. Considerable emphasis has been recently placed on the use of electronic media for data submission. Electronic reporting formats that are independent of proprietary software have been developed and their use is encouraged by the FAO. The use of file transfer protocols (FTP) offers a fast and secure mechanism for exchange of large data sets. These solutions are fast becoming the norm and it will be important for the Commission to consider defining reporting formats which maximise developments in the IT environment whilst acknowledging member State capabilities.

An approach similar to that taken by CCAMLR may offer an effective solution; standard reporting formats are clearly defined both for hardcopy and electronic data submissions. Whilst electronic data reporting is encouraged, mechanisms are in place for hardcopy data reporting and subsequent data entry and processing. In this way, standard formats are ensured whilst sufficient flexibility is maintained in line with different levels of member states' data handling capacity⁶.

⁶ The CCAMLR *Fishery Data Manual* is published in English, French, Russian and Spanish. This manual describes CCAMLR procedures for collecting, submitting and disseminating catch, effort and biological data for fisheries in the CCAMLR Convention Area. Information is provided on deadlines for data submissions, data requirements for each fishery, data forms and guidelines for their completion, and definitions of data fields and codes. Procedures for collecting and submitting fishery observer data and reports are described in the CCAMLR *Scientific Observers Manual* (<http://www.ccamlr.org/pu/e/sc/fish/intro.htm>).

This approach is reflected informally by the CCSBT, where it is felt that too prescribed a format for data reporting may exert a negative influence on the timeliness and completeness of data submissions. As long as standards are consistent through time and sufficient information ("metadata") accompanies data describing them, in the short term, the benefits of rigidly enforcing standard data reporting formats may be outweighed by the need for timely delivery of data (Bob Kennedy, pers. com., CCSBT). Nevertheless, a more prescribed format than that applied by CCSBT may be appropriate in the case of the Commission, not least given that the likely volume of Member data submissions will be significantly higher than is the case for the CCSBT.

Alongside the growth in the use of electronic media, significant emphasis has been placed on the development of international standards for describing data. Metadata are "*information about data*" and can include characteristics about the data such as the content, accuracy, reliability and the source. Metadata provide the mechanism to describe data in a consistent form that allows users to gain a uniform understanding of the content and fitness for purpose of datasets. Metadata can accompany a dataset when it is transferred to another computer so that the dataset can be fully understood, and be used effectively. The FAO, through FIDI, are currently developing a global standard for fishery metadata, which will offer a baseline of common terms and definitions that describe fishery data. Within the WCPO region, the OFP routinely includes metadata when disseminating information; equivalent use of metadata by the Commission would increase the sustainability of electronic data and should therefore be considered by the Commission.

6.4 Standardisation of data collection and reporting in the WCPO region

6.4.1 Catch and effort logsheets

Significant steps have been taken towards the development of common standards for catch and effort logsheets within the WCPO region. This includes the following initiatives:

- SPC/FFA cooperation in the Tuna Fishery Data Collection Committee (DCC); and,
- the work of the Statistics Working Group of the SCTB.

The first meeting of the DCC was held in December 1995. At the time, an array of logsheets was used throughout the region. The OFP and FFA recognised the extent to which the situation complicated the task of data processing. In response, standard logsheets were designed and introduced to both domestic fleets of SPC and FFA member countries and the DWFN fleets with which they have access agreements. Subsequent DCC meetings have followed (December 1996, December 1998 and December 2000) where an ongoing process of review has continued and standard observer forms, port sampling forms and unloading forms have resulted; translated versions of logsheets have been made available on the SPC-OFP website in French, Japanese, Korean, Mandarin and Spanish.

A special session of the SCTB Statistics Working Group was held prior to the twelfth meeting of the SCTB in 1998 (Anon. 1999a) where minimum logsheet standards were established. The minimum standards reflect the need to differentiate between data that are essential and data that are desirable. Reviews of logsheets used in the region continue to ensure conformity with the agreed minimum standards.

The DCC logsheets include:

Logsheets	Languages	Instructions
Longline	English, French, Japanese, Korean,	English, French, Japanese,

	Mandarin	Mandarin
Pole and line	English, French, Japanese	English, French
Purse seine	English, French, Spanish	English, French, Spanish
Shark longline	English	English

A summary of the status of South Pacific Regional logsheet implementation is included in Anon. (2001). Although implementation amongst FFA and SPC flagged vessels has in the majority of cases been successful, adoption by DWFNs has been limited.

6.4.2 Observer data

Observer data collected for research purposes include primarily species composition of target species, catch data for non-target species, and length data.

A series of forms have been developed for observers aboard longline, pole and line and purse seine vessels. In addition there are a number of general forms completed by observers aboard all vessel types. Each form is accompanied by detailed instructions defining data format and codes as required. All forms include instructions that guide observers through the collection and sampling process with the exception of the longline forms, which provide detailed instructions for form filling only. The DCC observer data collection forms are listed below:

General Forms	Field data collection instructions
	GEN-1 - Vessel and aircraft sightings and fish transfer log
	GEN-3 - Vessel trip compliance record
	GEN-6 - Pacific regional pollution report
Longline forms	LL-1 - Longline general information
	LL-2 - Longline set information
	LL-3 - Longline haul information
	LL-4 - Longline catch monitoring
	LL-5 - Longline conversion factors
Pole and line forms	PL-1 - Pole and line general information
	PL-2 - Pole and line daily log
	PL-3 - Pole and line catch details
Purse seine forms	PS-1 - Purse seine general information
	PS-2 - Purse seine daily log
	PS-3 - Purse seine set details
	PS-4 - Purse seine length frequency
	PS-5 - Purse seine well loading

No regional manual has been developed combining instructions for collection and form filling with roles and duties of observers, statistical sampling techniques, standard classification codes, conduct of observers, safety at sea etc.

6.4.3 Unloading and port sampling data

Logsheets and associated guidelines have been developed to harmonise data collection and data recording protocols throughout the region. Similarly, SPC member agencies are encouraged to use the regional logsheets and guidelines when collecting port-sampling data. This ensures standard sampling practices, data collection procedures, and a standardised format for reporting. All forms are accompanied by instructions, with the exception of the *Monthly summary forms for longliners*, as detailed below.

Fishery	Types of forms	Language
Longline	Unloading Form	English, French (no instructions)
	Port sampling form	English, French (no instructions)

	Monthly summary form	English (no instructions), French (no instructions)
Pole and line	Unloading Form	English
	Port sampling form	English
Purse seine	Unloading Form	English
	Port sampling form	English
	Well unloading form	English
Troll	Port sampling form	English

A detailed port-sampling manual has been developed by SPC-OFP, which provides background information for port samplers explaining why data are collected, how samplers should comport themselves, standard measurements, sampling protocols and data collection procedures and how data should be recorded. The manual places particular focus on purse seine, pole and line and longline vessel port inspection.

The concerted actions of the DCC and the SCTB represent significant steps towards the standardisation of data collection and reporting within the WCPO region. It is important that these achievements are both acknowledged and taken advantage of by the PrepCon. DCC logsheets and forms, although not comprehensively implemented, have been endorsed through their application by both Pacific Island Countries and Territories (PICT) and to a lesser extent DWFNs.

7 Capacity to implement standards

When considering the question of data standards, in addition to considering the science and management needs, it is also important to consider member State data handling capabilities. An appreciation of member State capabilities will ensure that standards are agreed that can realistically be achieved. Equally, a clear understanding of weaknesses in member State data collection and data handling programmes will help the Commission to identify where assistance, whether financial or technical, could be applied towards achieving data standardisation goals. The provision of technical and financial assistance towards this end is emphasised in the Convention text, which states:

The Commission shall establish a fund to facilitate the effective participation of developing States Parties, particularly small island developing States, and, where appropriate, territories and possessions, in the work of the Commission, including its meetings and those of its subsidiary bodies. The financial regulations of the Commission shall include guidelines for the administration of the fund and criteria for eligibility for assistance.

Cooperation with developing States, and territories and possessions, for the purpose set out in this article may include the provision of financial assistance, assistance relating to human resources development, technical assistance, transfer of technology, including through joint venture arrangement, and advisory and consultative service. Such assistance shall, inter alia, be directed towards:

- (a) improved conservation and management of highly migratory fish stocks through, collection, reporting, verification, exchange and analysis of fisheries data and related information;*
- (b) stock assessment and scientific research;*
- (c) monitoring, control, surveillance, compliance and enforcement, including training and capacity-building at the local level, development and funding of national and regional observer programmes and access to technology and equipment. Article 30 (3 & 4)*

Given significant concern expressed during the PrepCon process with regard to the quality and completeness of fishery information from Indonesia and the Philippines, this section presents a brief review of existing data handling arrangements in Indonesia and the Philippines and relates these to likely Commission data related obligations.

A paper prepared by the SPC-OFP (WCPFC/PrepCon/WP.15/Add.1), entitled "Current capacity of Pacific Island Countries and Territories to collect tuna fishery data," addresses these issues for PICTs in the WCPO region.

7.1 Indonesia

Comparatively little substantive information was available to describe Indonesia's capacity to collect and handle fishery data. Fisheries targeting HMS in the Pacific are prosecuted by both industrial and artisanal (small scale) domestic fleets. No joint venture or access arrangements exist although Indonesia does maintain a small distant water fleet presence in the WCPFC region.

As a flag state, Indonesia will be required to report data for both its domestic and distant water fleets. Logbook use is not currently enforced for domestic fleets. Catch and effort statistics are compiled on the basis of three data sources: surveys at village level (for artisanal data); survey data from selected landing sites; and, reports provided by large fishing companies (landing data). No indication of the extent of sample coverage was available. Given that these statistics have historically been reported in an aggregated form (by species, gear, and area), the current system of fishery data collection is unlikely to meet with the needs of the Commission.

Mechanisms for data verification are limited to survey data collected at selected sampling sites, for which no details of coverage were available and a limited supply of industry sourced landings statistics.

Biological data collection (length and species composition) is currently limited to a programme of data collection at selected sampling sites, although no length data has been supplied to SCTB since 1999. There is no active observer programme and as a result information regarding gear specifications, catch composition or discards is not available. Table 7.1 presents a review of available information concerning Indonesian capabilities to collect and handle fishery data for HMS in the WCPO region.

Table 7.1 Indonesia

<p>Background</p> <p>Indonesian catches contribute some 17% of total tuna catches for the WCPO region. Tuna fisheries prosecuted by Indonesia in Pacific Ocean include domestic artisanal and industrial fleets (purse seine, pole and line, longline, handline, troll). No access arrangements exist, no DWFNs licensed to operate in the Indonesian EEZ. Indonesia has historically maintained a distant water industrial fleet.</p>
<p>Institutional structures</p> <p>The Directorate General for Capture Fisheries sub-directorate of data and statistics (DGCF-stat) is responsible for compiling fishery statistics. DGCF-stat is supported by a network of offices at provincial and district levels. Eight provinces and some 70-80 districts include landing sites served by vessels active in the WCPO region. Fishery data are collected and compiled for all fisheries prosecuted, not just tuna fisheries. Details of specific structures responsible, timelines and sampling protocols and procedures applied were not available. Management decisions also supported with additional information contributed by: the Indonesian Institute of Sciences (LIPI); the Indonesian Research Institute for Marine Fisheries (RIMF); and various universities. RIMF conducts research on biology, stock assessment, ecology, fishing gear, vessels, socio-economics and post-harvest technology. Fisheries control and surveillance activities are currently under the control of the navy.</p>
<p>Fishery statistics</p> <p><u>Data collection:</u> Three primary data sources – (1) sample surveys at village level (artisanal data); (2) sample surveys from selected landing centres; (3) reports provided by large fishing companies (landing data). Enumerators collect data at district level. Details of actual sampling protocols are unclear although information indicates that there is inadequate species identification. Species of interest to the Commission are aggregated under 3 categories: <i>tuna</i>, <i>skipjack tuna</i>, and <i>Eastern little tuna</i>. The category '<i>tuna</i>' aggregates bigeye, yellowfin tuna and billfish. Size and species composition data were formerly collected under the Indo-Pacific Tuna Programme (IPTP). Funding constraints have limited capabilities to continue sampling since IPTP dissolved in 1992, although protocols are still maintained where funding permits. No observer programme.</p> <p><u>Data verification:</u> No information on processes in place to verify catch reporting aside from limited sampling exercises detailed above and export information.</p> <p><u>Data reporting:</u> Undertaken by DGCF statistics department. Statistics reported at SCTB 15 (SCTB15/NFR-9) include annual catch estimates, licensing and export data. Significant limitations observed in reported data. Highly aggregated statistics - large proportion of estimated catch unclassified by gear, catch information for two or more species aggregated under the category '<i>tuna</i>', limited information accompanying data to explain sampling protocols applied, no useful effort data. Historical use of logsheets (industrial fleets) unclear. Fishing company reports based on unloading data, therefore no spatial component. No size / species composition data reported since 1999.</p>
<p>Measures to strengthen capacity</p> <ol style="list-style-type: none"> 1. RIMF-IPTP programme (early 1980's - 1992). Sampling protocols devised, collection of tuna catch and effort data, and size composition data at selected ports. 2. IOTC catch monitoring programme (report due in June discussing Indonesian data collection and compilation capabilities). A collaborative programme between IOTC / RIMF / Japan's Overseas Fisheries Cooperation Fund (OCFC) / Australia's CSIRO – the sampling scheme, as a whole, includes Indonesia, Thailand, Malaysia and Sri Lanka. In Indonesia data are collected from longline landings in three key ports (Jakarta, Benoa, Cilacap). The programme also aims to strengthen capacity for the collection and compilation of information for artisanal catches.

3. Recommendation made in SCG report Annex III - to produce a status report for Indonesian fisheries in the Pacific Ocean, to develop an interim port sampling programme for Banda Sea and Pacific Ocean ports and to build capacity towards developing an integrated catch monitoring system for the Indonesian Pacific Ocean tuna fishery. Recommendation that this should be undertaken in collaboration with Indian Ocean monitoring programme.

Given the limited information available, recommendations presented in Annex III to the SCG report appear to offer a practical way forward towards strengthening Indonesian data collection and handling capabilities. The recommendations suggest a phased approach commencing with a comprehensive review of existing capabilities and data holdings. The second phase would involve the establishment of an interim solution towards the collection of priority data, likely focusing on strengthening the existing port sampling programme. The final phase would constitute a long-term initiative to develop capacity towards the establishment of an integrated system of monitoring for the Indonesian Pacific Ocean fisheries. The ongoing Indian Ocean joint Catch Monitoring Programme offers an opportunity for lessons to be learned that could be transferred to the programme design.

There are significant threats to the success of such a large-scale programme in Indonesia, not least the extent of political will invested in achieving Commission standards. Current initiatives in Indonesia appear to indicate a greater emphasis on fleet enlargement and post harvest improvements over the need to develop capacity to monitor fishing activity. If the programme is to be successful, participation will need to be sought not only from the monitoring authority, but also from the national fishing industry.

7.2 Philippines

As is the case in Indonesia, the Philippines maintains both a domestic artisanal and industrial fishing fleet. Significant efforts are currently underway to strengthen the national industrial fishing sector both directly through fleet improvements (gear and technology), improved processing facilities, and indirectly through the encouragement of joint venture arrangements. As a flag state, the Philippines will likely be obliged to supply the Commission with both annual estimates of catch and more detailed catch and effort data. Table 7.2 presents a summary of available information concerning the capacity to collect and handle fishery data in the Philippines.

Table 7.2 Philippines

<p>Background</p> <p>Philippine catches contribute some 13% of total tuna catches for the WCPO region. Diverse fisheries prosecuted by domestic artisanal and industrial fleets. Gears used: (ring net, purse seine, longline, handline, troll). The Philippines maintains a distant water fleet although there are no access arrangements permitting DWFNs to operate in the Philippine EEZ; joint venture (JV) agreements are, however, encouraged (no existing JVs).</p>
<p>Institutional structures</p> <p>Philippine Bureau of Agricultural Statistics (BAS) has been responsible for compiling fishery statistics since 1987; the Bureau of Fisheries and Aquatic Resources (BFAR) was responsible before 1987. Collection and compilation of fishery statistics acknowledged as a secondary task of BAS in favour of the agricultural sector. Philippine port authorities support BAS through supply of commercial catch statistics. Recent executive order for closer cooperation between BAS/BFAR. Research arm of BFAR a separate entity – National Fisheries Research and Development Institute.</p>
<p>Fishery statistics</p> <p><u>Data collection</u>: Three primary data sources – (1) sample surveys of municipal (artisanal) fisheries; (2) sample surveys of selected major landing centres; (3) reports provided by fishing companies (landing data). Details of actual sampling protocols used are unclear. Catch and effort data – DWF vessels complete logsheets when fishing in PICT EEZs, no details of domestic fleet logsheet requirements. Catch and effort data compiled on the basis of annual fishing company reports without spatial component. Port sampling data is also collected which</p>

includes catch effort information although only disaggregated by broad fishing area. Size and species composition data formerly collected under the Landed Catch and Effort Monitoring (LCEM) programme (1993-1994). No sampling in 1995. Funding received by BFAR for the National Stock Assessment Project (NSAP) – large component being a substantial port sampling programme (1998 onwards). There is, however, a backlog in data processing. No observer programme.

Data verification: no information on processes in place to verify catch reporting aside from limited sampling exercises detailed above and export statistics. Reliability of some data in question (municipality versus commercial catch reporting, level of coverage, sampling protocols used etc.)

Data reporting: undertaken by BAS. Data have been collected although there is a backlog in processing. Catch effort data are reported, but coverage is low and only disaggregated by broad fishing area and unclassified gears remain. Species composition / length data also suffer from backlog in processing.

Measures to strengthen capacity

1. NSAP & LCEM (see above)
2. OFP has provided technical support to strengthen database capabilities under NSAP - critical to overcome backlog in data processing.
3. Uncertainty remains regarding port sampling coverage although financial support has been sighted as essential if the existing programme is to continue.

It appears that a particular weakness of the Philippine system lies at the data processing stage. There are also indications that the system of data collection may not be sufficient in the short to mid-term to meet likely data standards, particularly with to the scale and resolution of required data. Deficiencies are particularly apparent when catch and effort data are considered; reporting currently relies on unloading information, from which spatial information is not discernable.

In the short term, it appears that financial support is required to support existing port sampling activities and additional technical support may be required to process the existing data backlog. Once this has been achieved, specific data handling needs will become more apparent.

Williams (2002) indicates that, as with Indonesia, a long-term programme of capacity building will be necessary if monitoring capabilities are to be strengthened to a level required for scientific purposes. In the long-term a challenge particular in the Philippines is the devolved nature of fisheries management and data collection responsibilities. Limited information was available describing specific data flows, although forthcoming projects, such as the USAID-funded Fisheries Improved for Sustainable Harvest (FISH) Project, include components aimed at strengthening both local and national fisheries monitoring capabilities and associated legislation. However, as is the case in Indonesia, significant uncertainty exists with regards the level of long-term commitment towards strengthening fisheries monitoring.

7.3 A way forward

Given the interim data needs identified by the SCG, likely data standards in the short to mid term will require flag states to collect and report commercial fishery data including annual catch estimates and catch and effort data to an agreed scale and resolution. These data standards should be formulated to reflect member State capacity, whilst not compromising the quality or completeness of required data. The CCSBT recommended that care be taken not to establish hurdles which might limit the level / quality of data submitted. In the short term, timely submission of accurate data should have a higher priority than having the data delayed to conform to a designated reporting format.

The information submitted alongside reported data (methodologies and processes used to collect and to collate data) will be essential particularly in instances where standards are not fully adopted or deviation from standards has been unavoidable as is likely in the case of both the Philippines and Indonesia.

Standards currently beyond the capacity of some members could nevertheless be established. These could represent target towards which member States should aim. Commission assistance, as envisaged in Article 30, could then be formulated in support of members achieving these targets and as such could be identified as a criterion to evaluate any subsequent application for assistance.

8 Recommendations

The objective of this paper was primarily to present a review of standards applied by bodies charged with the collection, verification and reporting of fisheries data both within and outside the WCPO region with the aim of informing the PrepCon decision making process. Discussions at PrepCon3 indicated that significant value could be obtained from a document that not only presented these findings, but also placed them in the context of the Commission development process.

Given the extent of uncertainty surrounding this process, rather than define explicit actions against a fixed timeframe, we felt that a more useful approach would be to present a sequence of recommendations against the backdrop of the Commission development process characterised in three phases: (1) an interim period leading up to entry into force of the Convention; (2) a transitional period immediately following entry into force of the Convention and establishment of a Secretariat; and (3) a fully developed Commission.

Underpinning this approach is the recognition that specific data requirements, and the need for associated data standards, will grow as Commission capacity increases, and that a pivotal point in the implementation process of data associated standards will occur with ratification of the Convention.

In addition to presenting an indicative time-line we have also identified a number of overarching issues for PrepCon consideration. We regard these as essential for the successful establishment of Commission data related standards. These overarching issues represent a target for establishing standards for the WCPFC.

The Commission Secretariat will work with these standards for a considerable time, and should have a significant role in finalizing them. In some cases, the final standards will build on work in progress during PrepCon. In other cases, work during the transition period will lead to finalized standards when the Commission is fully staffed and operating. The following sections present recommendations for a process of developing the target standards and the interim standards.

8.1 Overarching issues to consider

The Convention text and the MHLC consultation report present overarching guidelines for data collection, verification and timely exchange and reporting. In addition, clear reference is made to associated standards and obligations presented in Annex I of the UNFSA. In support of this guiding instrument and others, the FAO co-operates with RFMOs, particularly through the CWP, to standardise reporting forms, procedures, definitions, classifications, and other related documentation.

The following measures are recommended as targets for development of standards during the transition phase and during the fully functioning phase:

1. Agreement on Commission participation in international initiatives promoting the implementation of data standards, particularly those of the FAO's CWP and FIGIS programmes
2. Consideration of the CWP definition regarding vessel flag, nationality of catch and associated reporting obligations
3. Agreement on scale and resolution for data collection and data reporting
4. Agreement on schedules for data reporting
5. Identification of appropriate member State data correspondents

6. Establishment of a mechanism for regular review of adopted standards
7. Consideration of the particular situations of developing countries and their capacity to implement standards designed in the context of more developed fisheries

The points listed above are regarded as essential elements to ensure a responsive and effective framework of Commission data standards, drawing from collective experience and lessons learned both internationally and within the WCPO region.

It is strongly recommended that the Commission adopt standard codes and co-ordinate with FAO and the CWP in their development. Where it is necessary to adopt unstandardised codes in the short term, databases can easily be configured to accept temporary codes for later replacement with standard codes.

Commission participation in the FIGIS programme is recommended as this will offer member States a conduit for meeting international reporting obligations, according to commonly shared data standards.

In the development of standards applicable within the region, the Commission will need to consider the particular situations of developing countries as these countries may not be readily able to implement standards designed in the context of more developed fisheries.

8.2 Interim period

The interim period constitutes PrepCon activity leading up to entry into force of the Convention. This is an important phase since decisions taken during this period will define the framework for the future data-related structures and systems of the Commission. The objective will be to create a responsive system of standards rather than a rigid and definitive structure. Initial decisions taken regarding data collection, data verification, and data dissemination standards will need to reflect perceived priority data needs.

Significantly, agreement has already been reached, through the PrepCon process, regarding priority data types for scientific purposes. These priority data types include: annual estimates of catch; catch effort data (the scale and resolution are yet to be established, although data at the level of individual fishing operations are recommended); and size composition data (length frequency).

Agreement concerning priority data types infers that efforts during the interim period should focus on the adoption of standards to meet perceived priority data requirements. In practical terms, this implies that the onus be placed on reaching agreement over appropriate standards applicable to the collection, verification and dissemination of annual catch estimates, catch and effort data and observer port sampling data.

In addition, the SCG also recommended that existing regional arrangements for the compilation and dissemination of data, coordinated by SCTB, are suitable in the interim. These arrangements include:

1. the provision of fisheries data by flag states and coastal states to the OFP;
2. processing and management of these and other data by the OFP; and
3. the dissemination of data according to established procedures by the OFP

Endorsement of existing arrangements underlines the important point that Commission data standards will not be developed in a vacuum and that significant steps have already been taken in the region.

8.2.1 Data collection

In acknowledgement of the significant progress already achieved, it is strongly recommended that the PrepCon consider DCC logsheets and forms as a baseline (template) from which Commission data collection forms can be developed. The forms, and associated manuals and instructions, have undergone regular review and have been widely implemented by SPC and FFA members and, to a lesser extent, DWFNs active in their respective waters.

An interim solution for the establishment of a vessel register will be addressed by WGIII. Existing capacity within the region should again be considered and cooperation is encouraged between WGII and WGIII, so that a balance is struck between scientific data needs and data needs associated with compliance and enforcement. Similarly, consultation between working groups to discuss observer data collection will be essential. Decisions taken in these areas will strongly influence the nature of appropriate standards.

8.2.2 Verification

The verification of data is essential to ensure that data are accurate, complete, and give a true indication of the state or value of factors under consideration. Landings and transshipment records comprise an important source of information with which reported catch data can be verified and validated. Additional sources of data used to verify reported catches include observer programmes, port sampling programmes, and VMS. In the absence of such data in the short term, adoption of existing standardised data collection forms will facilitate the collection of such data and the capacity for verification and quality control significantly.

8.2.3 Reporting

Although international instruments such as the UNFSA allocate responsibility for fishery data reporting to the flag State, areas of uncertainty remain. In the context of Commission needs, consensus will need to be reached regarding data reporting responsibilities, particularly those relating to DWFN operations. It is strongly suggested that the Preparatory Conference consider the definition agreed by the CWP.

It is also important to recall the *status quo*, in which OFP currently plays an essential role in supporting PICTs in data collection and processing. The data resulting from the work of OFP have proved to be of higher quality than those held by flag states. It would likely be counterproductive to disassemble the effective OFP-PICT *data pipeline* in favour of a flag-state reporting requirement that is known to be deficient, certainly in the short term.

When in place, the Commission should consider establishing a framework for data submissions including the identification of data correspondents and the definition of schedules for data reporting. The identification of an individual responsible for data reporting is crucial not only for monitoring purposes but also for feedback and review, particularly where discrepancies in reported data are identified. Adoption of such a framework at an early stage will enhance the Commission's capability to verify and validate data submissions and disseminate accurate and complete data in a timely fashion.

Considerable emphasis has recently been placed on the use of electronic media for data submission. Electronic solutions to data exchange are fast becoming the norm and it will be important for the Commission to consider, at the earliest stage possible, the definition of reporting formats which maximise developments in the IT environment whilst acknowledging member State capabilities.

An approach similar to that taken by CCAMLR may offer an effective solution. Whilst electronic data reporting is encouraged, mechanisms are in place for hardcopy data reporting and

subsequent data entry and processing. In this way, standard formats are ensured whilst sufficient flexibility is maintained in line with different levels of member States' data handling capacity.

The Commission should also consider the inclusion of metadata relating to the exchange of electronic fishery data, which will not only facilitate compatibility with international standards but may also influence the sustainability of data compiled by the Commission.

8.3 Transitional period

The transitional period represents the point at which Commission capacity will develop and interim measures will be modified and/or replaced. In reality, groundwork achieved during the interim phase will likely overlap with the transitional period. The PrepCon is recommended to consider the establishment of a system of review and evaluation of data quality and needs. The rigorous and time-consuming process to achieve full ISO certification for data collection management standards will not likely serve the purpose of the Commission. However, a less rigorous procedure that follows the ISO format will provide an opportunity for the PrepCon to fully evaluate the details of existing and future sampling requirements in the context of data quality needs.

The specifics of longer-term Commission data requirements for scientific purposes have yet to be agreed. Nevertheless, priority fishery data in the context of the PrepCon have been established (see above) and these same priority data types are likely to be reflected in Commission data needs and associated standards, at least in the mid-term. Nevertheless, the Convention text does make clear reference to data types, in addition to those identified as being of a high priority.

Where the Commission requires information in addition to fishery data (e.g. economic and sociological data), it should seek to identify appropriate data to quantify indicators in cooperation with the CWP, which has already taken steps to address these issues. The development of associated standards will then be possible, ensuring that benefits are maximised in terms of utility.

With regards Commission data processing, standard data quality control approaches are now commonplace in data handling; it is recommended that quality control standards be adopted which incorporate these mechanisms, including: the double entry method of data capture (where hardcopy data are processed); real time error trapping; and transaction processing.

8.4 The fully-functioning Commission

The term "fully-functioning" refers explicitly to the institutional structures and technical capacity of the Commission. This is not to say that a fixed framework of standards is envisaged. To ensure that Commission objectives are met both efficiently and effectively, it is strongly recommended that the system of review be ongoing. In this way it will aim to ensure that standards adopted during earlier stages of Commission development continue to meet Commission needs whilst taking into account the particular circumstances of member States.

8.5 Data handling capacity considerations

Interim data standards agreed by PrepCon for WCPFC should be formulated to reflect member State data handling capabilities. Nevertheless, neither the quality nor completeness of data should be compromised. Care should be taken to ensure that '*hurdles*' are not established which might limit the level / quality of data submitted.

In the short term, timely submission of accurate data should be given a higher priority than having the data delayed to conform to a designated reporting standard. Information submitted

alongside reported data documenting methodologies and processes used to collect and to collate data will be essential, particularly in instances where standards are not fully adopted or deviation from standards has been necessary.

Standards for the longer-term, currently beyond the capacity of some member States, could be established which members should strive to achieve. A schedule for all members to reach the final data standards would depend on the financial and technical assistance available for those states that are unable to meet them without such assistance.

Objective	Action	Interim		Transition		Developed		Remarks
Overarching issues								
Adopt scale and resolution of data needs (collection and reporting)	Priority data types: annual catch data, catch and effort data and length/weight data							Priority data types agreed although consensus not reached regarding scale and resolution or schedules for reporting.
	Additional data needs: biological and ecological, environmental, sociological and economic and technical							Data needs will be dictated by stock assessment requirements and Commission capacity
Establish process for review of standards	Agree on TOR, representation and meeting schedules							Essential process to evaluate existing standards and to ensure that change (data needs, fleet activity, technical innovation etc.) is accounted for. On ratification schedules for the review process will need to be established as the transitional period will likely need regular monitoring
Commission participation in international standardisation initiatives e.g. CWP and FIGIS	Agreement sought and appropriate representatives identified							May have implications for all aspects of data standards. SPC currently active in both CWP and with the FIGIS programme
Data Collection								
Adoption of standard data collection formats and protocols	Standards for priority data types: catch and effort logbooks/logsheets & length/weight data)							Consider formats developed by the DCC
	Standards for observer data collection							Consider formats and protocols developed by the DCC. Consultation with WGIII will be necessary to formalise scientific and other objectives
	Standards for port sampling/unloading data collection							Consider formats and protocols developed by the DCC
	Technical data – vessel registers							Consultation with WGIII will be necessary
	VMS							Start with FFA standards in interim phase, then consider modification in transition/developed phases.

Objective	Action	Interim			Transition			Developed			Remarks
	Standards for collection of additional data types: biological and ecological, environmental, sociological and economic and technical										Reflect ongoing data needs prioritisation process. Changing requirements captured on the basis of the evaluation process discussed above
Data verification											
Improve data verification	Adopt member State data verification standards (flag state)										Heavily dependent on member State data collection and processing capacity
Assure quality of Commission data	Develop in-house quality control system										Specifics will need to be considered when the Secretariat is established
Data Reporting											
Adopt data reporting obligations (Flag state and Coastal state)	Consider existing arrangements & CWP definition and adopt Commission standards										In the short term important to recognise the importance of coastal state reporting and associated capacity to meet reporting obligations
Adoption of framework for data reporting	Seek agreement on reporting schedule										Essential aspect of M & E ensuring timely submission and completeness (an aspect of data verification/quality control). Interim arrangements could be formulated; to be reviewed once the Secretariat is established.
	Identify member State data correspondents										
	Sanctions for non-compliance should be considered.										
Adoption of common reporting standards	Initially consider using formats developed by the DCC for annual catch data and catch and effort data										
	Adopt outline (preferred and acceptable) formats both in electronic and hardcopy form										Will need to encompass the lowest common denominator in terms of technical capacity and also reflect current and future innovations

9 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. 108p.
<http://www.spc.org.nc/oceanfish/Docs/SCTB11.pdf>
- Anonymous. 1999. Report of the Third Meeting of the Tuna Fishery Data Collection Forms Committee, 9–10 December 1998, Brisbane, Queensland, Australia. Secretariat of the Pacific Community, Noumea, New Caledonia, and Forum Fisheries Agency, Honiara, Solomon Islands. 84p. http://www.spc.org.nc/oceanfish/Docs/FC_1998.pdf
- Anonymous. 2001. Report of the Fourth Meeting of the Tuna Fishery Data Collection Committee, 6–8 December 2000, Brisbane, Queensland, Australia. Secretariat of the Pacific Community, Noumea, New Caledonia, and Forum Fisheries Agency, Honiara, Solomon Islands.
- CCAMLR. 1999. Fishery Data Manual. CCAMLR, Hobart, Australia.
- Everett, E., M.G. Hinton & W.H. Bayliff. 1991. Procedures for Collection and Handling of Tuna Fishery Data by Field Station Personnel. Revision C, January 1991. Inter-American Tropical Tuna Commission, La Jolla, California, United States of America. 46p.
- FAO. 1999a. Guidelines for the Routine Collection of Capture Fishery Data. Prepared at the FAO/DANIDA Expert Consultation, Bangkok, Thailand, 18-30 May 1998. FAO Fisheries Technical Paper. No. 382. Rome, FAO.
- FAO. 1999b. Legal Aspects of the Collection of Fisheries Data, FAO Fisheries Circular No. 953. Rome, FAO.
- FAO. 1999c. 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. Rome, FAO. 1999. 62p.
- FAO. 2000. Satellite-based vessel monitoring systems international legal aspects & developments in state practice. FAO Legal Papers Online #7. <http://www.fao.org/legal/Prs-OL/vms7.pdf>
- FAO. 2001. Report of the nineteenth session of the Coordinating Working Party on Fishery Statistics. FAO Fisheries Report No. 656. Rome, 10-13 July 2001. 91p.
- FFA. 1996. 6th Technical Consultation on Fishing Monitoring Systems. FFA Report #96/31.
- Koh, J., D. Moon & D. An. 2002. National tuna fisheries report in 2002, Republic of Korea. Working Paper NFR-10. Fifteenth Meeting of the Standing Committee on Tuna and Billfish, 22–27 July 2002, Honolulu, Hawaii, United States of America. National Fisheries Research and Development Institute, Busan, Korea. 4p.
- ISC. 2002. Report of Statistics Working Group. Third Meeting of the Interim Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean. Nagasaki, Japan, January 2002.
- ICCAT. 2002. Report of the Sub-committee on Statistics, Standing Committee on Research and Statistics (SCRS). ICCAT Report 2002-2003, Appendix 10

Lawson, T. A. 2001. Observer data held by the Oceanic Fisheries Programme covering tuna fishery bycatches in the western and central Pacific Ocean. Internal Report No. 45. Oceanic Fisheries Programme, Secretariat of the Pacific Community, Noumea, New Caledonia. 40p.

Lawson T. 2002. Status of data collection, compilation and dissemination. SCTB15 Working Paper SWG-1. Hawaii, July 2002.

Lawson, T., P. Williams, C. Millar and E. Schneiter. 2002. Data requirements of the SPC Oceanic Fisheries Programme and status of data. Oceanic Fisheries Programme Internal Report No. 47.

Miyake, M. 1990. Field Manual for Statistics and Sampling of Atlantic Tunas and Tuna-Like Fishes. Third Edition. International Commission for the Conservation of Atlantic Tunas, Madrid, Spain. 184p.

Williams P.G. 2002. Current status of data available from the Indonesian and Philippines domestic tuna fisheries. SCTB15 Working Paper SWG-7. Hawaii, July 2002.

10 Figures

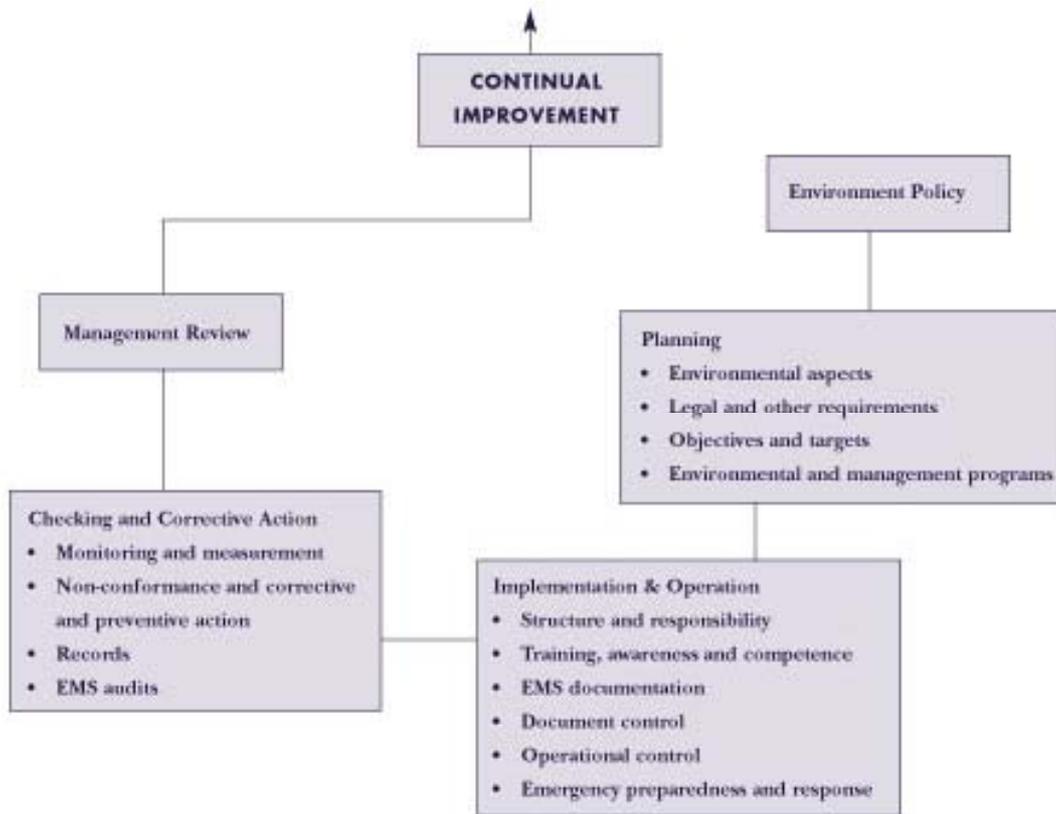


Figure 2.1 Best Practice Management. From: AS/NZS ISO 14001 (Int). (1995). Environmental management systems; Specifications with guidance for use.

11 Contacts

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