

SOUTH WEST INDIAN OCEAN FISHERIES COMMISSION

Report of the

FIRST WORKING PARTY ON FISHERIES DATA AND STATISTICS

Mombasa, Kenya, 24–27 April 2007



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PREPARATION OF THIS DOCUMENT

This is the final version of the report of the first Working Party on Fisheries Data and Statistics held in collaboration with the Kenya Marine Fisheries Research Institute, Mombasa, Kenya, 24–27 April 2007. The country reports appear as presented by the authors/participants.

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Other interested nations and international
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ABSTRACT

The first Working Party on Fisheries Data and Statistics was attended by participants from Comoros, France, Kenya, Madagascar, Maldives, Mauritius, Mozambique, Seychelles, South Africa, the United Republic of Tanzania and Yemen.

The Working Party received national reports of each of the countries and examined the status of fisheries catch and effort data and statistics. Several countries do not produce annual fisheries statistical reports. In most cases countries attributed weaknesses in data collection to lack of funds and insufficient numbers of enumerators.

The Working Party discussed minimum data requirements for effective fisheries management in five generic fisheries types: industrial shrimp, artisanal shrimp, trap fisheries, demersal line and beach seine fisheries. Each country provided the existing availability of data for these requirements. Major issues of data collection (structural data, operational data and biological data), data processing, data analyses, data dissemination and other related matters were identified.

A list of metadata fields was presented to assist member countries provide data to the regional data coordinator of the South West Indian Ocean Fisheries Project (SWIOFP) in order to set up a regional metadatabase. The availability of relevant regional and global information systems was discussed. WioFish, a fisheries metadata management system, was initiated to collate available information from small-scale fisheries of the Western Indian Ocean countries. The FishCode-STF (Strategy for improving information on status and Trends of capture Fisheries) project and the Fishery Resources Monitoring System (FIRMS) are two initiatives towards a global strategy to improve information on status and trends of capture fisheries. StatBase software has already been adopted by the SWIOFP project for regional data management and would be available for South West Indian Ocean Fisheries Commission (SWIOFC) member countries for reporting, disseminating, gathering and sharing data. A schematic representation of the relationship between organizations, institutions, projects and information systems was produced. The Working Party was appraised on the development of a SWIOFP Web site and provided with a demonstration on applications of Geographical Information Systems (GIS) in fisheries management.

The Working Party made recommendations on improving the situation of fisheries data and statistics for the consideration of the Scientific Committee of the SWIOFC.

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OPENING

1. The first Working Party on Fisheries Data and Statistics (WPFS) was held at the Soleil Beach Club Mombasa from 24 to 27 April 2007 and organized by the Kenya Marine Fisheries Research Institute (KMFRI).

2. The Working Party was attended by 27 participants from Comoros, France, Kenya, Madagascar, Maldives, Mauritius, Mozambique, Seychelles, South Africa, the United Republic of Tanzania and Yemen. The list of participants is given in Appendix B.

3. Mr Micheni J. Ntiba, Professor of Biological Sciences at the University of Nairobi and Chairman of the Scientific and Technical Committee of the Board of Management of KMFRI opened the work of the WPFS. The full statement of Prof. Ntiba is attached as Appendix D to this report.

4. Prof. Ntiba pointed out the need to have a common approach in solving regional issues. He said that fisheries resource management can only be effectively done based on scientific information. While giving his comments on monitoring, control and surveillance of fisheries, he said that these efforts are still hampered by lack of adequate investments further compromising the management of crucial fish stocks including straddling and transboundary fisheries. He concluded by advising that fisheries data and statistics underpins the management of fisheries in the region.

5. The Director of KMFRI, Dr Johnson Kazungu, the Secretary of the South West Indian Ocean Fisheries Commission, Mr Aubrey Harris, the recently-appointed Executive Secretary of the South West Indian Ocean Fisheries Project, Mr Kaitira Katonda, also made introductory remarks and welcomed the participants. They recalled the background to the Working Party and welcomed the collaboration between SWIOFC and SWIOFP.

ADOPTION OF THE AGENDA

6. Dr Renison Ruwa chaired the Working Party on behalf of KMFRI. A time-table for the WPFS was presented and discussed. The Working Party agreed to keep the timing flexible to allow all participants to make their country contributions whilst covering all the proposed items of the Agenda. The Agenda of the Working Party is given in Appendix A.

STATUS OF THE COLLECTION OF FISHERIES LANDINGS (CATCH AND EFFORT) AND OF FISHERIES DATA MANAGEMENT

7. The participants presented the status of collection of fisheries landings information and fisheries data management in their respective countries.

Comoros

8. The fisheries of Comoros are entirely artisanal and consist of boats of 3 to 9 m in length. The last estimates made together with the fisher associations in 2002 indicated that there were about 7 550 fishers and 3 200 boats (900 of which are motorized). Drop lining (with disposable rock sinkers) is undertaken by small canoes (pirogues), while trolling is undertaken by motorized boats. Small pelagics (*Tylosorus* spp. et *Ablennes* spp.) that come close to the coast are fished with circling seines. The estimated catch of 13 300 tonnes (65 percent tunas and the remainder of other species) is still derived from 1995 statistics.

9. A statistical system of monitoring of landings based on a regular sampling was established in 1994 by the Association Thonier of the Commission de l'océan Indien. The system defined 12 strata within three islands with five primary sites in Grande Comoros, four primary sites in Anjouan and three primary sites in Moheli. Detailed information was randomly collected directly from the boats by fish recorders. The landings monitoring system continued until the end of the project in June 1996. Fish landings have not been monitored since.

10. The Ministry of Fisheries intends to set up a monitoring system this year keeping much the same structure as system that was in place from 1994 – 1996. The problem involved in setting up a landings monitoring system in Comoros include lack of funds, numerous landing sites (104), insufficient recorders, lack of computer support for processing and analysis and reluctance of some fishers to have their catch monitored or handled. There have not been any biological studies undertaken of species at the level of the artisanal fishery. Scientific studies to examine if there are different stocks and their interactions between countries would be useful.

11. The Working Party noted that, without basic landings information, Comoros is severely limited in its capacity to contribute to subsequent SWIOFP working parties or in the Scientific Committee of SWIOFC. Possibilities for assisting Comoros set up a catch monitoring system to obtain information for a national database and used in assessments of the status of its fisheries resources were discussed. The ability of the Comoros to support and manage a monitoring system over the long term is a critical factor for determining the technical assistance that could be provided and type of system that should be developed. It was noted that there will be some support in SWIOFP for capacity building which would improve the data management capacity.

France

12. The Reunion fishery sector consists of a small coastal fishery with a catch of 800 tonnes of mixed fish and a longline fishery that caught 3400 tonnes of tunas and billfishes in 2005. The entire fishing fleet consist of 279 vessels. An elaborate system for the monitoring these fisheries was set up in 2006 by the French Research Institute for Exploitation of the Sea (IFREMER) with similar fishing concepts and statistical processes as exist elsewhere in the European Union (Appendix G). The monitoring system seeks to capture the totality of fishing activity including seasonal, spatial as well as economic and social aspects. It consists of two levels: an administrative/management/reporting level done by Direction des pêches maritime et de l'aquaculture – DPMA and an analytical/operational level which is variously undertaken by different agencies depending on their competences (such as IFREMER, the Institut de Recherche pour le Développement (IRD), Muséum national d'Histoire naturelle (MNHN), University of Caen) while still under the administrative mandate of DPMA.

13. Details of the information collected for the small coastal fishery were presented. Monitoring is based partly from information collected when the vessels are registered or from frame surveys as well as subsequent verification and enquiries on the actual fishing trips. A team of a coordinator and two investigators are responsible for the data collection and preliminary data preparation in Reunion. The data are sent to France and entered into a national system for the monitoring of marine resources (Système d'information halieutique français) managed by another team responsible to ensure standardized methods, appropriate reference systems, data management, processing and distribution. The statistical analysis is undertaken by IFREMER, Brest, through a HARMONIE front – end to an ORACLE database. Effectively only one person of the team in France manages the data from Reunion. In June 2007, IFREMER will be releasing a statistical bulletin of the 2006 fishing results for Reunion. A national dynamic SiG-based Web site is under construction that will allow interrogation of all French fisheries statistics and fishery regulations.

14. Difficulties encountered in Reunion related to night fishing which was difficult to monitor and estimate, and over-reporting of catches in questionnaires and logbooks to take advantage of fuel subsidies. The participants from France noted that fisheries statistical monitoring systems are grounded on a combination of general needs (regulation of fishing licences, monitoring of landings or transshipment, respect of international agreements) as well as specific needs based on the context or history of the fishery. This context which is especially evident in artisanal fisheries providing for richness as well as complexity which should, to the extent possible, be captured by the monitoring system. Within SWIOFC, it is important that countries can adequately monitor their various fisheries and resources with all their national specificities. However for regional purposes, the national data needs to be available in a standardized

form that can be exchanged and analysed to allow regional monitoring at appropriate spatial and temporal scales.

15. The working party reflected on the difficulty of monitoring artisanal fisheries particularly in with regard to seasonal or even daily changes of fishing method by a fishing vessel. It noted that the monitoring system used did not require much manpower but it was technically demanding and costly. It also noted that, in time, the monitoring system that had been set up would enable very detailed analysis of the small coastal fishery, its impact upon coastal fishery resources, and of the economic and social contribution of the sector. It was noted that all vessels were registered and licensed but that the fisheries are not as yet closed to entry.

Kenya

16. The collection of fisheries landings data in Kenya is mainly undertaken by Fisheries Department staff and recently by Beach Management Units (BMUs). Other organizations such as Kenya Marine and Fisheries Research Institute (KMFRI) and Coral Reef Degradation in the Indian Ocean (CORDIO) as well as recreational fisher associations have also collected fish landing statistics for variable periods in particular areas to address specific ecological or socio-economic issues. The data resides with the original organization or association usually as hardcopies of responses to forms, questionnaires or logbooks. Administratively landings data is first reported at the District level. The data are aggregated at species level into fish groups and then summed at district level and finally into a simple statistical report showing total national landings by fishery sub-sector. Constraints include insufficient capacity, dependence on untrained BMU members, absence of a central repository and insufficient processing and analysis of the data collected. Without adequate monitoring control and surveillance (MCS) and vessel monitoring systems (VMS) requirements, the resultant illegal, unreported and unregulated (IUU) fishing is likely to seriously undermine Kenya's ability to know how much fish is caught in its exclusive economic zone (EEZ) (Appendix G).

17. In the discussions that followed, the working party (WP) examined in more detail the method by which the operational effort was obtained from frame surveys, as well as the collection of logbook information from licensed vessels fishing in the EEZ. A lack of manpower to monitor the artisanal catch could be resolved by employing more staff or by collaboration with other institutions and non – governmental organizations (NGOs). With regard to an apparent lack of a national centralized marine fisheries database in Kenya, it was noted that there were scattered institutional databases available which included KMFRI, and other NGOs (CORDIO, Coral Reef Conservation Project CRCP) who conducted catch assessment surveys. They are in varied formats but mainly in Excel (80 percent). There is also available a long term sport fishery database. It was perceived that there was a need to develop a national fisheries database coordinated between Fisheries Department (FiD) and KMFRI to harmonize their marine fisheries data sets (i.e. similar to Lake Victoria). This would assist in providing more comprehensive information for management as well as facilitate the provision of information to other regional and international organizations such as Indian Ocean Tuna Commission (IOTC), the Oceanographic Research Institute ORI (West Indian Ocean fish database WIOFISH) and FAO.

Madagascar

18. Fish production statistics are derived from logbooks (in the shrimp fishery), from reports, from sporadic surveys and from projecting past data (Appendix G). The total catch is estimated at 120 000 tonnes to 130 000 tonnes per year. Increase of total production is due to the development of shrimps culture and artisanal fishing. Statistics on the export of fish products is collected by the Administrative declaration (Health certificate and customs declaration). Exports of fish products from capture fisheries are important as a source of foreign currencies, and contribute 2.3 to 3.0 percent of gross domestic product (GDP). The consumption of fish, which is an important source of protein for the population, is estimated every 10 years by sampling. It is estimated that about 20 percent of the artisanal catch is consumed by fishers and their families and do not appear in official statistics. The

contribution of fisheries to employment is obtained by census and frame surveys. Subsistence and part-time fishers are grossly underestimated in frame surveys.

19. Shrimps are the most studied fisheries resource. The stock units have been identified and key biological parameters estimated with assessments made using the Thompson and Bell model. A logbook system established in 1993 and standardized in 1995 is used to monitor the catches of the shrimp fishery and the data store within the "BANACREM" database which has been managed since 1998 by Fisheries Administration. There have been instances when difficulties in the transmission of information and the capture of data have introduced errors into the database.

20. Previous monitoring of artisanal fisheries incorporated both frame and catch assessment surveys. Frame surveys in particular are considered essential for collecting statistical information from the artisanal fisheries. These have taken place roughly every 10 years and the last general census took place in 1990. A census (with World Bank support) is expected this year (2007). Catch assessment surveys set up using FAO Approaches, Rules and Techniques for Fisheries Statistical Monitoring (ARTFISH) software were undertaken in Toliara (South-West) in 1995, in Toamasina (East) in 1996 and in another region in 2000. The system that was in place has not been operational since 2003 because of a lack of funds.

21. Madagascar participates actively in the data collection activities of the Indian Ocean Tuna Commission (IOTC). Scientists from Institut de recherche pour le développement (IRD) and Spanish Oceanographical Institute (IEO) in collaboration with Antsiranana Tuna Statistical Unit (USTA) routinely monitor purse-seiner catches. The data are entered and archived in AVDTH (an application to acquire and validate data on tunas).

22. Estimates of the total capture of tunas depend largely on declarations of the captains of foreign vessels fishing in the Malagasy EEZ. Logbooks are not systematically returned and viewed more as administrative documents.

23. In discussions following the presentation by the Malagasy participants, the enormity of the task of assessing the catch of artisanal fisheries over the 5 000 km of coastline was noted. Madagascar was clearly the major country in the region where this posed the greatest logistical and technical difficulty as it was a continental island with eastern, western, northern and southern coastlines. It was noted that present day catch statistics for the artisanal fishery are still largely extrapolations made from a frame survey undertaken in 1990. The working party was aware that a workshop on vessel registration had been held last year. Discussions examined the benefits and limitations of a good registration system as compared to occasional frame surveys to know how many boats are involved in a fishery. The WP was requested to look into possibilities of improving the collection of fisheries statistics in Madagascar.

Maldives

24. A well-established artisanal tuna fishery existed well before the 14th century and a data collection system for fisheries was established in 1959. Possibly the earliest quantitative estimates of Maldives fish production was reported in FAO yearbook of Fisheries Statistics 1947 (FAO, 1948). Fishing has constituted around 6.6 and 8.9 percent of GDP in the past ten years.

25. Today, the live bait pole-and-line fishing fleet produces around 180 000 tonnes/year mainly of skipjack and yellowfin tuna and these two species constitute the main local consumption. Reef fisheries started in Maldives in the early 1970s. Some of the species of reef fish are targeted mainly for export such as groupers, aquarium fish and sea cucumbers. Giant clams have been over fished to commercial extinction and their export is now banned; sea cucumbers have restrictions on the method of harvest and there are concerns that the grouper fisheries which are approaching maximum sustainable yield become overexploited.

26. Data in Maldives are obtained from each vessel by the island offices and reported on a daily and monthly basis to Ministry of Fisheries, Agriculture and Marine Resources (MoFAMR) via the Atoll office (Appendix G). Because of the predominant volume and importance of tuna and tuna related species, the highest priority during data collection is to obtain this information. Reef fish and other marine fish catch are reported by vessels and resorts in separate forms to the MoFAMR as well. Biological data including length and weight frequencies are collected by the Marine Research Centre (MRC) as sample surveys and through various stations in selected locations.

27. Concerns exist over the quality of some of the data been collected. However it is believed that the statistics provide an accurate reflection of the general trend in the catch of various species. Pilot surveys are being conducted to test new mechanisms of data collection.

28. Difficulties in data collection and analysis include: insufficient trained staff in the statistics section; low-level of awareness among the fisherfolk about the importance of providing fisheries data; lack of information on geographical position of fish catch; under-reporting and over-reporting of fisheries data; and inadequate information of the recreational and sports fisheries.

29. In follow up discussions, the Maldivian participants emphasized that any regional attempt to standardize catch assessment systems should carefully consider the specific geographical situations. It was noted that the fishing method (handlining, pole-lining) largely determined the species of tuna that was recorded in the landings (yellowfin and skipjack tuna respectively). Catches of both tuna and reef fish are provided in annual fisheries bulletins. Decreases in the catches of grouper evident from the statistic were more likely a result decreasing abundance which also coincided with a movement of fishing effort from reef fish to tunas. This could benefit from further scientific examination.

Mauritius

30. The participants from Mauritius emphasized the importance of the fisheries sector which provided direct employment to about six thousand people and significant source of foreign exchange earner. The main fisheries within the sector are: coastal artisanal; banks; semi-industrial chilled fish; fish-aggregating-device; sports; tuna and swordfish.

31. They provided statistics on the total catch, fishing gear, main species caught, numbers of boats and numbers of fishers for each fishery. They also explained how each fishery was monitored, the software used, and the processing and analysis undertaken. The status of exploitation of these fisheries was presented and their available assessments (Appendix G).

32. Mauritius considered that good catch and effort statistics are fundamental in the evolvement of management measures. These are analysed and published in Statistical Bulletins and in an Annual Report. Based on the statistics and recommendations by the scientists, the Ministry issues licences to local and foreign vessels and decides upon the imposition of limited entry or catch quota in some subsectors like the bank fishery. Tuna fishery statistics are also of great help during the negotiations of fishing agreements. Processed statistics are regularly transmitted to FAO, IOTC, Common Market for Eastern and Southern Africa (COMESA) and Southern African Development Community (SADC). Locally these are used by the Central Statistics Office in deriving economic parameters.

33. Much emphasis is placed on the collection and processing of good standard data as this assists the country in assuming its responsibilities both as an flag and port state. It also assists in cooperating with regional and international fisheries bodies for proper management of fisheries resources.

34. In follow up discussion, the Working Party noted that the catch assessment system also included the island of Rodrigues. The system of managing the banks fishery using a quota system was based on occasional monitoring at sea, the use of logbooks and the record of landings when the motherships returned to Port Louis. Logbooks used could be made available to the Working Party.

Mozambique

35. Mozambique has a coastline of about 2 750 km and three main fishery subsectors: artisanal, semi-industrial and industrial. The total fisheries catch in 2006 was about 90 500 tonnes, an increase of 7 percent over 2005. About 70 percent of the total catch came from artisanal fisheries. The most caught resources were two species of shrimp and deep sea prawns mainly off the south coast and a freshwater sardine from inland waters. Tuna are taken offshore along the entire coast mainly by licensed EU and Japanese vessels.

36. The data on the catch of the industrial and semi-industrial fisheries subsectors are collected using a logbook system while a systematic and functional landings monitoring system is used for artisanal fisheries.

37. The artisanal fisheries monitoring system is based on stratified random sampling with landing sites having similar features grouped into strata (Appendix G). Catch recorders are residents of the fishing community that are trained for the purpose and act in teams of one sampler and one assistant. The system now covers almost the entire coastline (all coastal districts) as well as some inland areas. Catch, effort, CPUE, species composition and length frequencies of the most important species are collected. The analysed results are provided to public as well as private entities, and used for stock assessment and advice for management measures.

38. The main constraints of the system are related to expense, limited financial resources, difficulty in covering all the required landing sites, and limited stock assessment experience.

39. In follow up discussions, it was noted that while the data is reliable it does not adequately include some fisheries (such as the crab fishery). However, currently all coastal provinces are being covered whilst in 1996 only two districts were covered. Mozambique has significant fisheries for short-lived, abundant species (eg small pelagic) that have very variable and sometimes large catches. These present particular technical difficulties to the level of enumerator coverage in a stratified sampling scheme. Enumerators are residents of coastal villages that are identified, trained and paid allowances by the Institute primarily responsible for catch assessment (IIP). The monitoring system is costly and ways are being examined to ensure continued funding. The system includes monitoring of the price of the fish (by family groups) though this needs improvement.

Seychelles

40. The Seychelles participants presented information predominately focusing on the major artisanal fisheries in Seychelles and their associated monitoring systems. Artisanal fisheries, which are multispecies, multigear, typically catch between 4 000 and 5 000 tonnes annually. Three main monitoring systems are employed (Appendix G):

- a) The catch assessment survey (CAS) is a catch, effort and species composition sampling system that is stratified geographically and by boat/gear type.
- b) Boat surveys, four types within the CAS aiming at a wide range of trap, line, net, and foot fisheries.
- c) Logbook-based monitoring programmes in the sport (recreational), the lobster and the sea cucumber fisheries.

41. The various monitoring programmes provide adequate coverage of the fisheries and data that are reliable and of good quality. They have been in place continuously since the early 1980s. Some smaller scale fisheries and the recreational sub-sector are not monitored, leading to underestimation of total catch and other parameters. Problems with the sampling strategy were identified, and the data management approaches and software require revision and modernization to provide better utilization of data for management. The latter issue is being addressed through the development of centralized data repository system at Fisheries Information and Statistical Systems (SFA), although the modules for artisanal fisheries have not yet been designed.

42. Fisheries data have been well utilized for stock assessment, for ecological research and for fisheries policy and development, but the lack of management plans inhibits further utilization of the data. Most fisheries remain open access with no harvest strategies, reducing the utility of stock assessment. Demographic parameters exist for many of the key species, but other parameters for analytical stock assessment are estimated or sourced from other areas.

43. In terms of the regional issues, Seychelles noted that regional standardization of monitoring was not appropriate and that monitoring should be implemented according to local circumstances. Particularly in the case of transboundary stocks, regional approaches to minimum data requirements was advocated, and it was noted that stock assessments should be conducted at as fine a spatial scale as possible to account for local fishing effects.

44. In the discussions that followed, the WP noted the importance of spatial scale and availability of data on the recreational fisheries for decision making. The WP also noted the efforts being made to have an operational, centralized information system.

South Africa

45. Most of South Africa's important commercial fisheries occur outside of the SWIOFC area. The two South African fisheries (excluding tuna and billfish) with connection to the SWIOFC region are the line and crustacean trawl fisheries.

46. The line fishery is one of the oldest fishing activities in South Africa and has recreational, commercial and subsistence components. Although many of the species are endemic to South Africa, several important target species are shared stocks with other South Western Indian Ocean countries. The crustacean trawl fishery is a small multispecies fishery that operates off the KwaZulu-Natal coast and targets various commercial prawn species and occasionally crabs and lobsters.

47. The participants from South Africa presented the history and changes that had taken place in the monitoring of these two fisheries since the 1970s (Appendix G). They covered collection of catch and effort data, other standard biological sample data (lengths, weights, sex, maturity and gonad condition), submission of mandatory as well as voluntary returns depending on the recreational or commercial nature of the fishery, the use of trained land-based and at-sea observers, and the utility of hand-held electronic systems for the collection of landings and bycatch data. They drew attention to issues of data quality, the complexity of explaining CPUE trends from a multispecies fishery, and the difficulties of standardizing CPUE across different gear types.

48. The linefish data are stored in the National Marine Linefish System (NMLS) with a customized Delphi front-end to a Sybase database structure. The crustacean fishery data is in an Access database. The NMLS produces comprehensive as well as specific reports on the catch, catch-per-unit-effort (CPUE) and size frequencies that can be further processed in Excel spreadsheets by end users for their own particular analyses. From the Access database, standard reports on trends in catch, effort and CPUE of the major species are compiled annually. These systems or databases are compatible with and in due course will form a part of a centralized Marine Administrative System (MAST) which links all facets of Marine and Coastal Management (MCM) functions to allow for an integrated analysis of fishery performance and tracking of total allowable catches.

49. Owing to the large number of species, and the difficulty of having them all quantitatively assessed, other interim indicators of stock status (such as historical trends in catch and effort) are being developed to respond to the needs of a protocol that requires management plans to be eventually set up for all the major species. Ongoing studies in South Africa recognize three methods as potentially suitable for quantitative assessment of linefish stocks using existing data or data collected from these fisheries over the longer term: per recruit analysis; dynamic, age-structured production modelling and ad hoc tuned Virtual Population Analysis (VPA).

50. The crustacean fishery is currently managed in terms of Total Allowable Effort (TAE) measured by the number of vessels. A surplus production stock assessment is being undertaken this year, using subsets of the crustacean trawl system data.

51. The participants from South Africa considered that given the complexities highlighted, it would be difficult, but not impossible to establish a regional data system. A clear understanding of the information required and how it would be analysed was required. Also a basic understanding of the life history strategy of a species or group of species was a prerequisite for any successful management intervention. As there is little information on connectivity between South African stocks and those of other parts of the southwest Indian Ocean, genetic studies (most likely at micro satellite level) were required for stock identification.

52. In follow up discussions the Working Party noted the significant long term datasets that were available in South Africa. Also that even when good data was available, the use of less quantitative assessment indicators such as catch and effort trends was still important. Standardization of CPUE could be difficult but had been possible between South Africa and Mozambique for lobsters. It was important to understand the connectivity between some of the fish species for which there is long term data in South Africa, and the same species elsewhere, as further analysis of these datasets could shed insights into changes that may have taken place elsewhere in the region. The WP also noted that the cost of catch data collection is financed by licences and revenue from the fishery. South Africa has established databases for most fisheries, mostly using volunteers to assist in data collection. The fluctuation in landings of swordfish was in part due to a significant drop in catch rates and shifting to other areas.

United Republic of Tanzania

53. The Tanzanian marine fishery is mainly artisanal with a small industrial fleet which targets commercially important species like prawns and tunas. Fisheries statistics have been collected since 1960s and various systems have been used. The Tanzanian participants traced the history of catch monitoring from a Tanzanian Fisheries Information System (TANFIS) between 1989–1996, subsequent years of difficulty following decentralization when regional/district fisheries officers ceased to be answerable to a central Fisheries Division, a catch assessment system produced under the SADC Regional Fisheries Information Systems (RFIS) program 2002–2005 which produced a database but was incomplete, more recent programming initiatives was through the Fisheries Training Programme (FTP) of the United Nations University (UNU) and supported from the IOTC (Appendix G). Frame surveys describing the fishing, landing, processing and marketing patterns were undertaken in 1995, 1998, 2001 and 2005. Currently catch assessment of the marine landings is based on 22 of 259 coastal sites identified in the 2005 frame survey. Data input is from five districts that are in five different administrative regions.

54. The data collected has generally been inadequate, inaccurate and unreliable apart from a few years such as in 2006. The catch is mostly aggregated into family groups. At least for major stocks species-level data are required for stock-assessment. There is therefore a need to improve the national capacity in terms of the quality and availability of fisheries data and the ability to collect fisheries statistics. The major constraints on the evaluation and analysis of fisheries data in artisanal fisheries is a lack of answerability of data recorders employed by respective districts to the Ministry responsible for fisheries, a lack of fisheries data recorders employed by the Fisheries Division itself, insufficient logistical facilities such as bicycles, motorbikes, insufficient data processing equipment, and use of local names which differ between places. In the industrial fisheries constraints include absence of an observer program, insufficient monitoring (Vessel Monitoring System [VMS] is being established but is not yet operational), lack of fishing port facilities so that most of the tuna catch leaves the EEZ unrecorded, and vessel returns that were summaries of catches and insufficiently detailed to be useful. There was inadequate and insufficient reporting in the artisanal and the tuna industrial (EEZ) fisheries.

55. Information on fish population biology is old, limited and scattered. The last comprehensive stock assessment was conducted in 1983, though there have been intermittent surveys on crustacean resources.

56. There was need for an improved ability to use landings and effort information to assess the state of fish stocks and provide appropriate management advice on sustainable yields and recommended total allowable catches within the context of clearly articulated stock harvesting strategies.

57. The Tanzanian participants considered that there was need for a collective approach to deal with shared fishery resources in the South West Indian Ocean, to harmonize datasets, collection procedures and data analysis so that management strategies can be implemented harmoniously. They considered that this required the establishment of a regional data system, to be fed by the national systems. There was also need to develop the capacity for stock identification and separation.

58. In the discussions that followed the Working Party examined the situation with regard to management of artisanal fisheries and existing data that may help. Presently the artisanal fishery is open access, and very scanty data exists to study the fishery. Fisheries data and statistics are aggregated to gross estimates of weight, effort and value of fish. The WP was informed that no boat census data exists. No fisheries bulletin has been produced to date but the first will be produced later this year. The WP suggested that Tanzania should seek to have a standardized data collection method including vessel descriptions defined by the CWS handbook from the International Fisheries Commission.

Yemen

59. Yemen has a coastline of about 2 500 km and some 70 000 fishers mostly organized into 130 cooperatives with 17 000 boats. The artisanal fisheries produced 98 percent of the total catch of 230 000 tonnes in 2006. The country has many islands one of which (Socotra) is located within the zone of competence of the SWIOFC. The fisheries sector includes artisanal industrial, aquaculture and tuna-processing subsectors. Aquaculture represents a new investment in fourteen locations along the coast (Appendix G).

60. Whilst monitoring of landings started before 1990 it was only in 1996 that data of good quality data was collected. In all the landing centres, there are cooperatives and data collectors from the Ministry of Fisheries who collect information on the catch and effort. In any case all fishery products have to be registered before sale. Data are collected by data collectors in each coastal region and sent to the Ministry of Fisheries. Data is stored in Excel and results are produced every third months of the catch, fishing effort, price, export, species composition, aquaculture production, and tuna canning output.

61. Yemen's constraints include lack of a database, biological information and technical capacity for stock assessment.

DATA GAPS ANALYSIS (IDENTIFICATION OF PARAMETERS)

62. Five working groups were set up to examine the minimum data of requirements for effective fisheries management in five generic fisheries types: industrial shrimp, artisanal shrimp, trap fisheries, demersal line and beach seine fisheries. The requirements and the status of data for each of the countries are in Appendix H. The following observations were made with respect to each of the fisheries:

Industrial shrimp trawling

63. Information is generally well documented and port-based. There was concern about the level of precision. There was a need identified for observer programmes to validate the data that was

provided by fishing companies. There was also an urgent need to standardize the species, gears, and vessels regionally according to FAO accepted codes and criteria.

Artisanal shrimp fishing

64. The artisanal shrimp fishery is more dispersed and thus more difficult to monitor than industrial fishery. Boats are mostly unregistered and data can best be obtained through surveys or sampling. Frame surveys should be conducted every two years. There are requirements for biological data more especially growth parameters. Environmental data such as river discharge and socio-economic data would also be necessary.

Trap fishery

65. The primary data needs for this fishery are size at first maturity, spawning periods/grounds, trap/ gear efficiency and, saturation soak time.

Demersal line fisheries

Species composition

66. Recognizing that these fisheries are multi-specific, dominant (key, indicator) or critical (overexploited) species should not be aggregated. Other species may be aggregated to family or other level. A regional study is required to identify critical and key transboundary species in the fishery so as to list species and groupings for reporting.

Effort

67. Fishing effort, in fisher days as a minimum, should be available by sector, year and region. Better measures may be appropriate, at least at the sector level. A SWIOFP project should look at gear efficiency and standardization of effort. Problems with CPUE calculated from commercial catch and effort data were discussed, and an alternative approach to assessing status was considered important.

Frame (fleet structure) survey

68. Should be periodic (every five years) according to standard (FAO) criteria. A regional frame survey could be undertaken as a SWIOFP project.

Length frequency

69. Given that CPUE is often not a reliable indicator in multi-species line fisheries, it is important to have an alternative approach. Depending on data quality, maximum size, size at capture, minimum size, etc. could all be used as indicators in addition to utility of the data for analytical stock assessment. Routine collection of these data will be simple in some countries and not others. Key species for sampling (e.g. transboundary) require identification. Difficulties with obtaining random, representative samples were identified.

Mean weight

70. Where length frequency data collection is not feasible or catches are relatively uniform, mean weight data could also be collected.

Beach seines

71. There is variability in the unit of effort used e.g. number of hauls/day/net, number of days fished/month. These need to be standardized. Currently the following information is available:

- Kenya (data for 4 years up to 2006): total catch; total effort (by net);
- Tanzania (data is available but not processed);
- Mozambique (data for 6 years for all areas up to 2006; in database): total catch and total effort (by nets); catch composition by size and by species (most important species);
- Yemen (data for 7 years for all areas up to 2006): total catch only.

Major data issues in selected fisheries

72. Six areas of data management were considered in relation to selected fisheries in respective countries. These were data collection (structural data, operational data and biological data), data processing, data analyses, data dissemination and any other general matter. The selected fisheries were: industrial shrimps, artisanal shrimps, industrial line, artisanal line, recreational line, subsistence line, artisanal trap, beach seine and industrial trap. The matrix below provides the fisheries for which each country reported.

	Comoros	France	Kenya	Madagascar	Maldives	Mauritius	Mozambique	Seychelles	S. Africa	Tanzania
Industrial shrimps			√	√		√			√	√
Artisanal shrimps			√	√						
Industrial line			√		√	√	√		√	√
Artisanal line		√	√		√	√	√	√		
Recreational line		√	√				√	√	√	
Subsistence line									√	
Artisanal trap			√				√	√		
Beach seine			√				√	√		
Industrial trap								√		

Industrial shrimps

73. Structural data was sufficiently available. The operational data was however all aggregated and lacked geospatial information except for Mozambique. Biological data on target species and bycatch was insufficient or altogether missing except for Mozambique.

74. Madagascar and Kenya reported minimal data processing including lack of specialized software and no quality checks on their data sets. All the countries had limited capacity on data analysis including modelling work. South Africa, Madagascar and Kenya reported the need for improvement on dissemination including production of statistical year books

75. Other general issues included environmental assessment of the prawn trawl fisheries, stock separation, and cross boundary connectivity. There was also lack of staff and limited funding to carry out observer programs for data collection.

Artisanal shrimps

76. Structural data was either out of date as in the case of Madagascar where frame survey was lastly carried out in 1998, or non existent. In Kenya operational data is aggregated and limited, whereas in Madagascar the data is of poor quality due to inaccessibility to the landing beaches, high gear variability and multispecies nature of the fishery. Biological data does not exist. There was no activity on data processing, data analysis and data dissemination due to limited capacity.

Industrial line

77. Structural was widely available. In Kenya illegal fishing hooks exist but were not well documented. Operational data was generally not reliable except for South Africa who reported the use of VMS. Mozambique has sufficient biological data. There was lack of quality checks in most of the countries except South Africa. Other issues included lack of MCS systems, delays in data dissemination as well as lack of observer programme.

Artisanal line

78. Number of fishers and hooks are unknown for both Kenya and Mozambique. Seychelles have data up to 2004. Except for Mozambique and Mauritius, the countries reported problems with operational data including inaccurate reporting and highly aggregated data sets. Biological data was available for only Mozambique and Mauritius.

79. Mozambique, Mauritius and France reported no problems with data processing. It was generally reported that there was limited capacity in carrying out data analysis as well insufficient funding.

Recreational line

80. There was no problem with structural data except for Mozambique and Seychelles who reported unreliable reporting in log books. All the countries had none or insufficient biological and operational data. Data processing, data analysis and dissemination are insufficient or non-existent in most of the countries.

Subsistence line

81. Data collection on the structures, operations and biology was sufficiently done. Data processing, analysis and dissemination needed improvement.

Artisanal trap

82. Data collection on structures, operations and biology is insufficient. Number of traps per vessel is not known and also the operational data is aggregated and unreliable. Trap fisheries are multispecies, mainly for demersal species and difficult to monitor. The only information disseminated has been through scientific studies.

Beach seine

83. Out of the information reported for the three countries, most of the issues are in the Kenya and Seychelles data and include aggregation and unreliability of data. Operational and structural data is poor in the countries while the biological data is poor in all the three countries. There is no data dissemination in Kenya. Seychelles also reported diminished catches through changes in fleet structure.

Industrial trap

84. The last major boat survey was done in 2004. Operational data is species aggregated. There is no routine stock assessment programme. There are no problems in data analysis, however dissemination experiences a 8-month delay.

METADATA REPORTING

85. A list of metadata fields was presented to help the member countries report statistical data to the regional coordinator to make a combined regional meta-database. The comprehensive table is available as Appendix G. It is expected that the data reported will form part of the regional but the schema may also be useful for national databases.

86. In the discussions that followed it was agreed that in-country data should be reported to the SWIOFP Data Coordinator in the next few weeks up to August 2007. The data held outside the region will be handled at the onset of the SWIOFP project since resources are already set aside in the project.

FISHERIES DATABASES

WioFish database

87. WioFish is a form of a fisheries metadata management system. Development of the database to collate all available information from small-scale fisheries of the WIO was initiated as a component of a Norwegian International Development Agency (NORAD) funded programme to assist WIO countries in implementing the Jakarta Mandate of the Convention on Biological Diversity. The ultimate goal of this component is to ensure that the coastal fisheries of the WIO are sustainable based on a cohesive and scientific management approach. Furthermore, since the focus is on regional collaboration, it is hoped that there will be an associated increase in institutional capacity.

88. Objectives were:

- improved understanding of biological and socio-economic aspects of fisheries;
- regional overview of inshore fisheries including problems and management needs;
- enable comparisons of policy and management strategies among fisheries;
- provide semi-quantifiable indicators of status of, and progress in, management of fisheries;
- increase understanding of threats to biodiversity by fishing.

89. Inception meeting was held in Mombasa, February 2000 which formulated the WIO Marine Biodiversity Project and established a Task Force. The ORI was appointed as the lead for the project and developed, in partnership with other institutes in the region, the project approach and data collecting strategies

90. The project commenced with the creation of a data gathering template (see table).

Fishery description	The catch
Sector classification	Target species
Geographic change	Species composition
Habitat/ecosystem	Catch rates
Depth range	Total catch
Socio-economic aspects	Bycatch
Markets and processing	Seasonality
Impacts on biodiversity	Management
Sustainability	Management system
Threatened species	Access
Habitat impacts	Monitoring
	Programme linkages
	Conflicts
	Management problems
	Research status
Other issues	References

91. As a first step, each country node was asked to identify all the possible fishing activities that could be described from that country. A total of seven broad fishery sectors were defined and a total of 213 different fishery types were identified. A review workshop was held in December 2002 in Mombasa which reached the consensus that a lot of interesting information and data has been gathered in the first stage.

92. A follow-up Technical Review Workshop in Durban, March 2004 was held to review and finalize the structure and format of the database, develop a web-based interface with the database, resolve issues regarding access and access permissions to the database and Web site and provide a platform for the expression of any objections by the participants to the database. The outcome of the workshop was a training session in November 2004 in Nairobi which was attended by representatives from South Africa, Tanzania, Seychelles and Kenya

93. The online version of Wiofish is available at www.wiofish.org. At present data has been entered for the small-scale fisheries of Kenya, Mozambique, Seychelles, South Africa and Tanzania. It is hoped in the future to extend this network of collaboration to include Madagascar, Mauritius, Comoros, Somalia and Reunion (France). The national nodes are IIP (Mozambique), KMFRI (Kenya), UDM (Tanzania), ORO (RSA) and SFA (Seychelles). Further funding has been confirmed by TFESSD Fund (World Bank).

94. In the discussions that followed, members felt that efforts to use WioFish database can be linked with the development of StatBase database. It was noted that the information structure of WioFish is useful describing various fisheries in the region.

StatBase database

95. The participant from France gave an overview of StatBase software. Participants were reminded that the software is intended for use by the SWIOFP project once the project activities begin. He said that there would be need for training of the users during its implementation. It is an open source software, so there will be no further maintenance.

96. He said that implementation of the StatBase activities is scheduled to begin in September 2007 assuming that SWIOFP project is to begin then (see tables below). Although SWIOFP only targets specific fisheries, it gives an opportunity to expand to the wider fisheries as well.

97. In the discussions that followed, it emerged that most countries do not have a national fisheries database. The software can be available for SWIOFC member countries to be used for reporting, disseminating, gathering and sharing data but it is not conceived to manage daily or routine information. In addition the software is not designed to manage scientific data. Since each country will have specific needs and ways of collecting data, StatBase simply accommodates national databases which should be structured around their own needs.

98. The software would be available to manage the SWIOFP regional database. Each country can present all the data sets that they want to include on the regional database. Anyone interested can access the data and make their own checks since the system could be installed in a regional (internet) platform.

The strategy for improving information on status and trends of capture fisheries (FAO – STF Project)

99. The participant from FAO explained how FAO implements the Strategy-STF, improving information on status and trends of capture fisheries through two actions:

- the FishCode-STF project;
- the Fishery Resources Monitoring System (FIRMS).

The Fisheries Resources Monitoring System (FIRMS): Status and prospects

100. The Fisheries Resources Monitoring System (FIRMS) is a partnership of international organizations and regional fishery bodies. The aim is to provide decision-makers with information in order to develop effective fisheries policies in accordance with the Code of Conduct for Responsible Fisheries. It was established in 2004, and functions under the framework of the 2003 FAO Strategy for Improving Information on Status and Trends of Capture Fisheries which has been endorsed by the United Nations General Assembly. Each partner agrees to regularly provide relevant information on the exploitation, assessment, management and status and trends for species and fishing areas for which they have primary responsibility. SWIOFC is among the 14 partner organizations.

101. Information is presented in synthesized fact sheets and State of Resources Summaries. These include images, maps of geographical distribution, general biological and habitat characteristics, scientific assessment results, management considerations and status and trends statements. For each collection of fact sheets, the FIRMS Data Quality Assurance statements describe the set of criteria applied, enabling users to evaluate FIRMS information content.

Status of FIRMS Marine module database – inventory and fact sheets

Partner	Stocks – Marine resources in the inventory	Fact sheets published
CCAMLR	3	
CCSBT	1	1
FAO	22	22
CECAF	220	86
GFCM	36	8
SWIOFC	264	41
IATTC	37	21
ICCAT	22	16
ICES	148	148
IOTC	15	5
NAFO	18	18
TOTAL	786	366

102. FIRMS data sharing occurs under the agreed FIRMS Information Management Policy (IMP) using a list of standard terms for Marine resources status descriptors (e.g. abundance level = "low abundance", or exploitation rate = "high fishing mortality"). This will enable users for example to search stocks with similar status across all information contributed to the system. FIRMS Web site is www.firms.fao.org.

103. Presently regular inventories of marine resources and Fisheries in the SWIOFC region have not been initiated. Two sources for the development of these inventories were identified by the FIRMS Secretariat:

- the list of Marine resources or fisheries on which some Status and Trends knowledge is available can be compiled from the SWIOFC Scientific (SC) meeting report;
- the inventory of small scale fisheries sponsored by IUCN known as the WIOFISH initiative provides a comprehensive list from which the SWIOFC inventory can be elaborated.

104. Further the inventories can be updated online or submitted as XML format subsequently loaded and published in FIRMS.

105. FIRMS will hold Technical Working Group meeting between September and November 2007 which will: i) train partners in using the final version of the workflow management system; and ii) validate the draft fisheries modules and its underlying data model, and welcomed the attendance of SWIOFC experts.

The FishCode – STF project

106. The FishCode – STF project started in November 2004, to support the implementation of "The STF – Strategy" world wide, with special emphasis on developing countries. The project aims at improvement of information at national or regional level to be used for strengthening of national or regional policy-making and sustainable management of fisheries.

107. Operationally the project looks at the following inventories:

Complete description of how information on fisheries is collected, with analyses on strengths and weaknesses by reporting on the following:

- Institution in charge
- Scope (e.g. fisheries monitored)
- Type of monitoring system
- Spatial and time coverage
- Data source
- Data unit
- Strategy (sampling, full enumeration)
- Population size
- Collection method
- Data management
- Data analysis-reporting (including indicators)
- Finance

Information on how the different fisheries are monitored reporting on the following topics:

- Overview
- Fishing area
- Fishing ground
- Species
- Fishing gear
- Fishing vessels
- Exploitation indicators
- Socio-economic indicators
- Post-harvest use
- Management
- Bibliographic references

108. Regional workshops focusing on coastal fisheries are organized to discuss the following:

- review of the fisheries and data collection systems inventories;
- seek for practical solutions (data collection in a budget and manpower limited situation);
- partnership with regional initiatives.

109. The Project has been involved in the following field activities:

- study on the impact of IUU fisheries on statistics in the Arafura Sea (Indonesia);
- establishment and support to regional working group on fisheries statistics of OSPESCA;
- standardization and preparation of guidelines on Queen conch monitoring in Caribbean and Central America;
- support to information collection on small-scale fisheries in Nicaragua;
- support to the development of sample based fisheries survey systems in China;
- support to the improvement of fisheries monitoring in Brazil and Yemen;
- support to improvement of inland fisheries monitoring in SE Asia.

110. The project can work in collaboration with the Working Party on the following areas provided that funding is identified:

- standardized inventories on fisheries monitoring systems and fisheries inventories (FIRMS);
- technical support to the working group on statistics;
- development of regional training programs on sample based surveys or GIS;
- support to development and implementation of national/regional pilot programs for improvement on monitoring;
- technical assistance.

111. In the discussions that followed, there was unanimous agreement that FIRMS and FishCode-STF represented potentially excellent systems for use by both SWIOFC and SWIOFP and that its

adoption and inclusion would be progressively considered as activities of SWIOFC and SWIOFP intensified.

112. A schematic representation of these databases was presented (see figure next page) to guide the regional data management activities. Relevant database systems and suitable institutional structures are shown.

FISHERIES AND INFORMATION TECHNOLOGY

SWIOFP Web site being developed through the IW:LEARN project

113. Participant from KMFRI Mrs Edna Onkundi presented SWIOFP Web site presently being developed by her with technical assistance of the International Waters: Learning Exchange and Resource Network (IW:LEARN). The Web site is currently being hosted by IW-LEARN at the UNDP (United Nations Development Programme) offices in Nairobi –Kenya, and can be reached through <http://plone25.iwlearn.org/sites/swiofp/about>.

114. IW:LEARN works with GEF International Waters projects to improve online sharing of data and information relevant to managing international waters, including marine, coastal and freshwater ecosystems. An important activity of IW:LEARN is to implement its Web site Toolkit, Plone 2.5 using Zope 2.8 which provides support for developing a dynamic content management system.

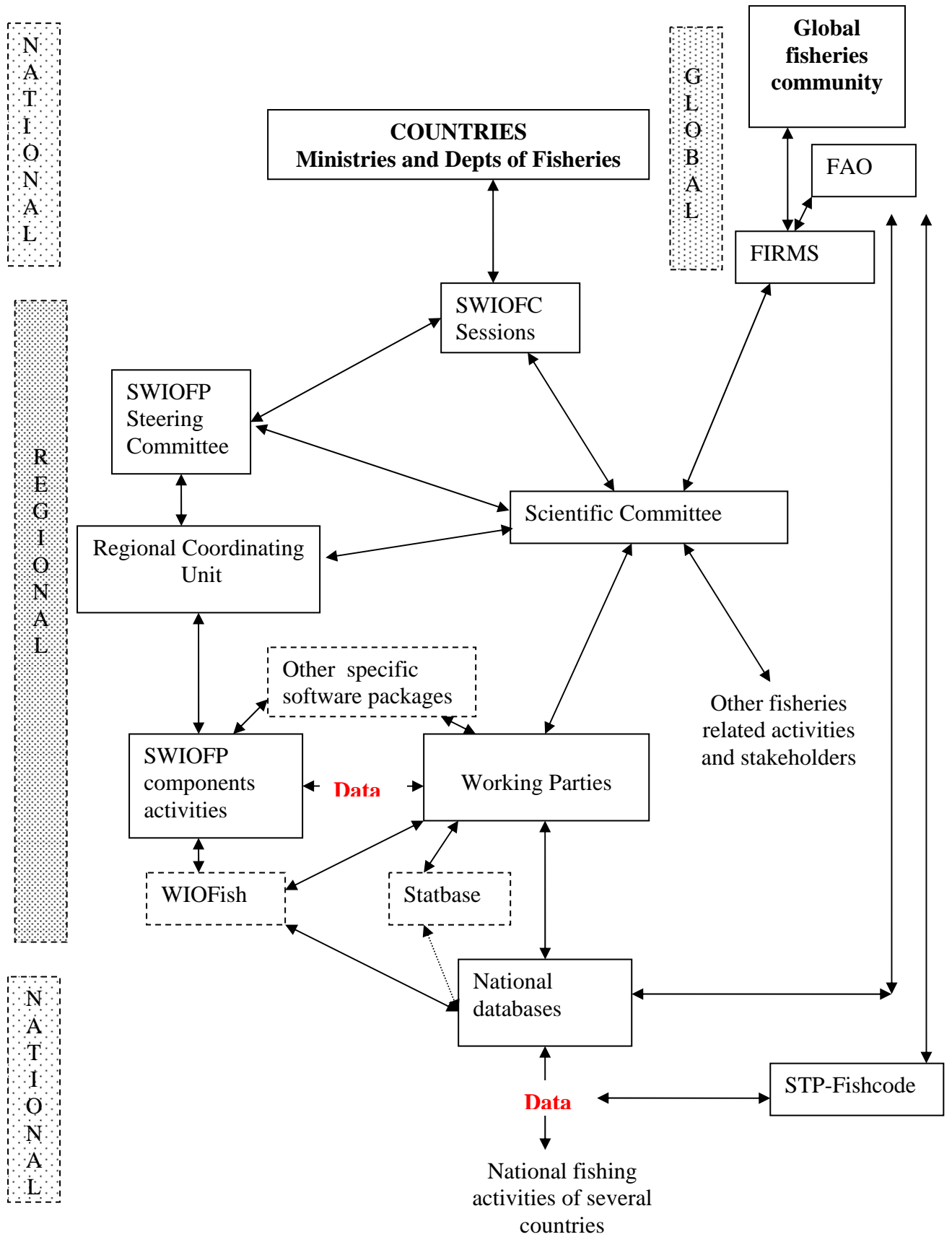
115. The presenter also attended training workshop organized by IW-LEARN for Web development late last year (2006) in Mombasa –Kenya where she participated and acquired the knowledge of web development using the IW:LEARN newly launched toolkit.

116. In the discussions that followed, participants commended the good work being carried out on the Web site development. The participants asked for more information including the likely implications of hosting large databases and interactive updating of information. The meeting was informed that so far the IW:LEARN project provides technical assistance at no cost. Members proposed that SWIOFC Web site be developed with this arrangement after seeking commitment during the next session of the commission.

Use of GIS in fisheries and fish stocks management

117. Participant from KMFRI, Miss Jane Ndung'u made a demonstration of how Geographic Information System (GIS) can be applied in fisheries and stock management. The demonstration involved identification of fish spawning areas, migratory corridors, main fishing areas, geodistribution of their abundance, and suitable seasonal habitats. She demonstrated with an aid of a management problem, how the water depth, water temperatures, Secchi depth, chlorophyll, larval abundance, clupeids, larval abundance, adult carp were combined together in GIS overlays to support a decision making process in a fisheries, in this case the creation of a fish sanctuary and determination of MSY to curb problem of overexploitation.

118. In the discussions that followed, Mr Gertjan, FAO, informed the working group that he was closely involved in developing this particular GIS application module which has now been released as a technical FAO guideline on geospatial fisheries management. This is free licence software and it is available and can be requested by email. Several other sets of software are similarly available on request.



RECOMMENDATIONS OF THE WORKING PARTY

119 The working party recommended the following:

- Countries that have not already established integrated information gathering systems are urged to establish such systems relating to their fisheries, in particular the minimum requirements such as catch and effort. FAO through partnership with FishCode seek to assist with the catch and effort information on request by the countries.
- Countries that have not put the minimum requirements such as catch and effort in their national databases are encouraged to set up national databases capable of generating various sets of information and statistics, and optionally feed onto the designated regional database (i.e. StatBase). Countries are encouraged to collaborate with different agencies that collect fisheries (relevant) data so that these should become available to the Working Party. Other stakeholders are encouraged to contribute to this Working Party.
- National centres may hold a national workshop for metadata based on regionally agreed minimum parameters, if required.
- The Working Party recognized the usefulness of contributing to the FIRMS database through the SC of SWIOFC to facilitate or highlight fisheries issues of the region.
- The Working Party recognized the difference in availability of information between the artisanal and industrial fisheries. Further in recognition of global initiatives to recognize the importance of artisanal fisheries and its technical and resource difficulties, member countries and the project are encouraged to contribute and participate in these initiatives.
- Focal institutions should report the current descriptions of relevant data held in the format agreed on during this Working Party, by August 2007 to the RMU. Support on the schema will be available from IRD (e-mail: Pierre.Chavance@ird.fr).
- Countries are encouraged to participate in WioFish project as a useful information system.
- The Working Party recognized the capability of GIS in fisheries information management and recommended that future national datasets should incorporate geospatial information as much as possible, to facilitate the use of GIS analytical tools.
- The SWIOFP regional Web site being developed at the RMU, should provide an additional Web platform for SWIOFC information dissemination.
- Recommends that the Project assist countries strengthening the capacity in ICT especially GIS.
- The next Working Party should consider increasing focus on ecosystem approach and climate issues.
- The value of a regional framework survey was recognized as a useful tool in information gathering and should be investigated further.
- Recognize the importance of harmonized registration of vessels and seek guidance on studies already undertaken.
- Importance of discriminating fish stocks was highlighted and accordingly countries are encouraged to initiate studies on connectivity of stocks.

- The meeting agreed that FishCode-SDF, FIRMS, StatBase presented a range of opportunities that could enhance the development of several aspects of the SWIOFC and SWIOFP in particular information management, data integration, resource monitoring and improving the quality of national data sets, and that their adoption and inclusion would be progressively considered as activities of SWIOFC and SWIOFP intensified.
- Recommend that SWIOFP/C experts attend the forth coming FIRMS workshop on standardization of resource data. The meeting recommended that SWIOFP manager appoint the project nominee to attend.
- The Working Party requests FAO and SWIOFP and other partners to investigate the possibility of supporting the Comoros and Madagascar in revitalizing their artisanal fisheries monitoring systems.
- The meeting considered further meta-database options and recommended that a table of available systems to be made available by ORI.

CLOSING OF THE WORKING PARTY

120. The closing remarks were delivered by the new acting Executive Secretary for the SWIOFP, Dr Kaitira Katonda. In his remarks he recognized the contribution that WP has made towards fisheries statistics and data management as seen in the deliberations and the set of recommendations. He thanked the participants for dedicating their time in attending and for KMFRI in organizing the WP meeting in short notice. Noting that activities of the WP and SWIOFP are complementary, he said that the WP meeting was timely as the SWIOFP is almost set to begin in another three months after signing of the major documents with the World Bank, the MoU and the PAD. Finally he thanked all those who have contributed in one way or other to make the WP meeting a success (see full text, Appendix E).

APPENDIX A

Agenda

1. Opening
2. Adoption of the Agenda
3. Status of the collection of fisheries landings (catch and effort) and of fisheries data
4. Data gaps analysis (identification of parameters)
5. Metadata reporting
6. Fisheries databases
7. Fisheries and information technology
8. Other matters
9. Recommendations of the Working Party
10. Closing of the Working Party

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Stenographers:	Miss Grace Chagonda, FAO Mrs Pamela Ochieng', KMFRI
Documentalist:	Miss Florence Ayoo, KMFRI
Driver:	Mr Peter Chiteri, KMFRI
Liaison Officer:	Mr Maurice Munene, KMFRI

APPENDIX C**List of documents****Working documents**

- Report of the First Session of the Scientific Committee, Dar es Salaam, United Republic of Tanzania, 31 May–3 June 2006
- Fishery Resources Monitoring System (FIRMS)
- The FISHCODE-STF Project
- Meeting timetable
- Fish catches in the Western Indian Ocean by SWIOFC members
- Statistics on SWIO fish catches over 10 years
- Catch of all SWIOFC members aggregated by species over 10 years

Information documents

- List of SWIOFP National Coordinators
- Report of development of a data management plan framework based on the information and data management workshop held at Reef hotel, Mombasa, Kenya, 8–9 October 2003
- Resolutions of the Second Session of the South West Indian Ocean Fisheries Commission, Maputo, Mozambique, 22–25 August 2006
- National Report for Fisheries in Mauritius

APPENDIX D

Speech by Prof. Micheni Ntiba, Chairman of the Scientific and Technical Committee of the Board of Management of the Kenya Marine Fisheries Research Institute

Distinguished guests, participants from SWIOFC member countries, FAO, NGOs, ladies and gentlemen,

I take this exceptional opportunity, on behalf of Kenya Marine and Fisheries Research Institute, to welcome you in Kenya. Indeed **KMFRI** feels very much privileged to be honoured by their international colleagues to host the first working party of the commission. I note with pride that we will also be hosting the new GEF-World Bank project – SWIOFP for the next five years.

I feel greatly honoured to share a few words with you as you get set to deliberate on matters of fisheries management in the Western Indian Ocean region.

Ladies and gentlemen, this gathering here is a very clear indication to me that indeed the ideals of the commission are being fulfilled. This is much more so considering that among us here are representatives of the entire membership of the commission. Therefore we can carry back a message of inspiration and hope back to our national governments on the practical achievements based on an agreed road map. I can be sure that by the end of the workshop, there will be consensus both on common issues as well on how to address them as a region.

Needless to say, fisheries is increasingly becoming a major pre-occupation for our national governments as major source of food and trade commodity, both at regional and global levels. I am sure it is clear to most of us here that fisheries management can only make an impact on the fisheries resource if they it is supported by scientific information that includes, monitoring for sustainable exploitation, fish biology and stock assessments. The region is now looking up to this working party to once again provide a firm basis on which a number of these analyses will inform the management of the fisheries resources.

Ladies and gentlemen, some of the management issues on our fisheries are well known. In many of our countries monitoring, control and surveillance is still hampered by inadequate legislation, resources and, information on the stocks. A move towards holistic management practice need to be more emphasized in fisheries policies to integrate issues dealing with economic, social, biological and environment. Transboundary stocks are still often not well understood and in any case there may be inadequate institutional arrangements for their management, as well, a number of countries are still not taking into consideration the multispecies nature of most fisheries.

Ladies and gentlemen, we may continue to enumerate a few other areas. However I wish to urge you once again to come up with the clearest illustration on the significance of data and relevant statistics that may address the above issues. It is only then that the other issues may be resolved objectively.

Ladies and gentlemen, it is my pleasure to declare the first Working Party on Fisheries data and Statistics also known as ‘WPFS’ of the South West Indian Ocean Fisheries Commission open.

APPENDIX E**Closing remarks by Mr Kaitira Ibrahim Katonda, Interim Regional Manager of the South West Indian Ocean Fisheries Project**

Hon. Chairman,
The SWIOFC Secretary,
Representatives from the Food and Agriculture Organization (FAO) of the United Nations,
Representatives from National Organizations (ORI, IRD, Coast Development Authority);
SWIOFP Regional Component Coordinator for Component 1,
Distinguished Participants from SWIOFC Member States,
Invited Guests,
Ladies and Gentlemen

It gives me great pleasure to officiate the Closing of this very important First Working Party on Fisheries Data and Statistics. I thank the Working Party Organizers for giving me this honour.

Hon. Chairman, during the last three days, the Working Party has discussed various issues, including the status of the collection of fisheries landings and fisheries data management; identification of minimum parameters for effective fisheries management; and various fisheries databases and their requirements on implementing the database systems. I am glad to note that the Working Party had fruitful deliberations on the above issues and have come up with a set of recommendations which will be presented to the SWIOFC Scientific Committee.

Hon. Chairman, you will recall that the South West Indian Ocean Fisheries Project (SWIOFP) has been approved by the Chief Executive Officer of the GEF, which means that funds from the GEF will be availed to the project. The Project documents (PAD & MoU) are now expected to be presented to the World Bank Board of Directors in May 2007 for approval and thereafter the SWIOFP participating countries will be given three months to fulfil the conditions of effectiveness. The project is, therefore, expected to start in September 2007. This First Working Party has been held at a prime time for the outcome of the Party will assist the SWIOFP Component 1 greatly.

Hon. Chairman, Distinguished Participants, Ladies and Gentlemen, allow me to thank the following: First, the South West Indian Ocean Fisheries Commission (SWIOFC) for their financial support; secondly, our hosts, the Kenya Marine & Fisheries Research Institute (KMFRI), for organising this First Working Party at a short notice bearing in mind the number of countries involved; thirdly, you the Participants for finding time in your busy schedules to attend this Working Party; and last but not least, the Hotel Management for their good services.

Hon. Chairman, Distinguished Participants, Ladies and Gentlemen, I now have the pleasure of declaring the First Working Party on Fisheries Data and Statistics officially closed. I wish you all *bon voyage*.

Thank you for your attention.

ASANTE SANA.

APPENDIX F

StatBase – SWIOFP: Preliminary inventory of the data on fisheries

Objective: To lay out a documented list of the quantitative statistical information likely to be included in the national/regional database

DATA ITEM DESCRIPTION	EXAMPLE
Data set: A set of quantitative information which can be considered as homogeneous in terms of origin, nature, type, coverage, etc. It is a pragmatic concept aiming to facilitate the inventory process. As an example, it is perfectly possible to consider as two different data sets for a single series of census, if it is considered that significant changes have taken place in the methods of acquisition, management, treatment.	
JDD Identifier: Key made up of the country name and a sequential number.	xxxxx123
Data file name: Name allowing clear identification of the dataset.	
Information channels: It is a sentence allowing a coherent identification procedure of data acquisition (example: artisanal fisheries catch and effort, onboard observers).	<ul style="list-style-type: none"> – Fishing logbook – Industrial fishing register – Onboard observers – Industrial fishing sampling – Artisanal fishing sampling – Artisanal fishing census – Synthesis – Modelling – Working group – Other
Scale: Defines the range of the statistical system.	Local, National, Subregional, Regional, World.
Data file type: Specifies level of compilation and processing of the data.	Raw data, Compiled data, Processed data.
Source: Characterizes the data collected according to a pre-established typology. To be noted, a database can contain several data files; in this case, one will identify here separately the data files which on the other hand will be associated in the database form.	Census, Fleet, Effort, Effort and yield, Catch, Yield, Cpue, Biometry, Biology.
Responsible agency: Institution or legal entity for which data are collected.	
Agency collecting data: Institution responsible for the effective collection of the data.	
Support: Physical medium on which are the data.	Paper, Computerized, Paper and computerized.
Computerized support: Numerical type of medium.	Hard disk, Floppy disk 3p1/2, Floppy disk 5p1/4, cd-rom, disk zip, Magnetic tape, Other.
Temporal coverage: Dates of the beginning and the ending of the data file, with indication of the interruptions if necessary.	
Temporal resolution: Time unit used for the	Hour, Day, Week, Fortnight, Month, Quarter,

DATA ITEM DESCRIPTION	EXAMPLE
statistical data.	Semester, Year, Trip, Specified period.
Spatial coverage: Defines the extension of the area covered by the data file.	EEZ, National coast, FAO area, Ocean.
Spatial resolution: Space units used for the statistical data.	Fishing spot, FAO statistical area, Statistical area, EEZ, Sampling strata, Survey site, Unloading site/Landing site.
Where: Precise localization of the statistical data.	
Computerized format: txt, dbf, xls, access, etc.	Text, Excel, dBase, Access, Binary (to be precised), ASCII.
Operating system: OS used by the processing system managing the statistical data.	Macintosh, PC-DOS, WINDOWS 3.1, WINDOWS FW, WINDOWS 95, WINDOWS 98, WINDOWS 2000, Windows NT, LINUX, UNIX.
Data base software: Software(s) used to manage and process the data.	
Data to be stored in StatBase: yes or no, possibly with comments.	
Quality standard: To classify according to three terms.	<ul style="list-style-type: none"> – Data to be checked. – Data checked non published. – Data checked and published.
Observations: Any additional information considered to be useful for the definition of the data file.	
Nomenclature: One uses here the concept of nomenclature to define the list of terms allowing to classify the elementary objects of the statistics (example: species, statistical categories, commercial categories, fishing gears, licences ...). These nomenclatures are significant as they determine the compatibilities between data files.	Nomenclature code: Key made up of the country, N (nomenclature) and a sequential number, Nomenclature label: Name allowing to identify the nomenclature used, Origin: local, FAO, international, FishBase, other? ", Date of validity: (beginning), Date of validity: (ending), Data file concerned: internal code of the data file.
Bibliography: One will note here the references of the documents relating to the information channels or a particular data file.	Author(s), Year, Title, References.

Country availability of minimum data for selected fisheries

- This table reflects the minimum data requirements for distinct fisheries in order to ensure that there can be assessment and management for sustainable use at a regional level. These minimum requirements were generated by working groups and are reflected in Column 1 per fishery.
- The scoring in this table indicates current national ability to deliver these minimum data needs. The rating is as follows:

0 = nil; 1 = very little; 2 = medium; 3 = Excellent

INDUSTRIAL SHRIMP TRAWLING	KENYA	MOZAMBIQUE	TANZANIA	SOUTH AFRICA	MALDIVES	MAURITIUS	YEMEN	SEYCHELLES	MADAGASCAR
Effort - accurate Vessel Registration. (including length, HP and gear).	2	3	3	3		0	2		3
Effort - actual number vessels operational.	2	2	3	3			3		3
Effort – defined, such as number of days, hours trawled, number of sets/trawls. (indicate units).	1	3	3	3			2		3
Location of operations (including GPS, depth)	0	2	2	2			3		3
Catch – total weight	2	3	3	2			3		3
Catch – composition of major species	2	3	1	2			2		2
Catch – weight of bycatch and discards by major groups/species.	2	1	1	2			2		1
Catch – details of standardized sorting categories.	1	3	2	2			3		1
Day/night fishing details	0	3	3	2			1		2
Mechanisms to validate accuracy.	1	3	1	2			0		2
Socio-economic data	1	1	2	2			3		2
Others – specify Biological data		3							

ARTISANAL SHRIMP FISHERY	KENYA	MOZAMBIQUE	TANZANIA	SOUTH AFRICA	MALDIVES	MAURITIUS	YEMEN	SEYCHELLES	MADAGASCAR
Effort – accurate Vessel Registration (including type of vessel, length, HP and gear; DC, Boat, Dhow, etc).	2	1	1			0	1		2
Effort - actual number vessels operational.	2	2	1				0		2
Effort – defined, such as number of days, hours trawled, number of sets/trawls (indicate units).	1	2	Days						1
			1				1		2
Effort- seasonal distribution	1	0	1				2		1
Catch – total weight	2	2	1				1		2
Catch – composition of major species	2	3	1				1		2
Catch – weight of bycatch and discards by major groups/species.	1	3	0				1		2
Catch – size composition of main species.	2	3	0						1
Socio-economic data	1	2	2				1		3
Day/night fishing details	1	0	2				2		
Frame survey for structural information.	2	1	2				1		2
Other?		2					0		

DEMERSAL LINEFISH	KENYA	MOZAMBIQUE	TANZANIA	SOUTH AFRICA	MALDIVES	MAURITIUS	YEMEN	SEYCHELLES	MADAGASCAR
Catch: species composition of key transboundary and critical species.	1	1	0	3	3	2	2	2	1
Catch: total annual by species/species group, stratified by sector (industrial, artisanal, subsistence, recreational) and region (bank, atoll group, etc.).	1	3	0	3	3	2	1	2	0
Effort: annual fisher days by sector, year and region.	0	3	0	2	3	2	2	2	0
Effort: periodic (5-year) frame fleet structure survey.	0	0	1	2	2	2		3	1
Fisheries profile: annual profile describing aspects for major linefisheries including changes in management, fishing gear/strategy, socio-economics and trade.	0	1	0	2	2	2	1	1	0
Biological: length frequency (or mean, max, etc).	0	3	0	3	1	2	0	2	1
Biological: mean weight	0	3	0	3	1	2	0	1	1

APPENDIX G

Country reports

FRANCE (REUNION)

KENYA

MADAGASCAR

MALDIVES

MAURITIUS

MOZAMBIQUE

SEYCHELLES

SOUTH AFRICA

THE UNITED REPUBLIC OF TANZANIA

YEMEN

Rapport National – France

CPSOOI/WPFS

WORKING PARTY ON FISHERIES STATISTICS

Zones FAO 51 relevant de la France et sources d'information

La zone statistique FAO 51 couvre les régions suivantes : La Réunion, Mayotte, les Terres australes et antarctiques françaises. Les TAAF assurent la gestion des Îles Éparses (Bassas da India, Glorieuses, Tromelin, Juan de Nova, Europa), Saint-Vincent, St-Paul et Amsterdam, et Crozet.

Les informations présentées ici concerne principalement l'île de la Réunion. Elles ont été communiqués par le programme Sidepêche de l'Ifremer (resp. P. Berthou) qui est chargé du suivi statistiques des pêches de la Réunion. Le suivi des pêches de l'île de Mayotte est réalisé par le service des pêches désormais sous la responsabilité de la Marine Marchande (des informations détaillées sont en cours d'acquisition).

Qualité et disponibilité des données de statistiques de pêche (débarquements, rejets, composition spécifiques, effort de pêche)

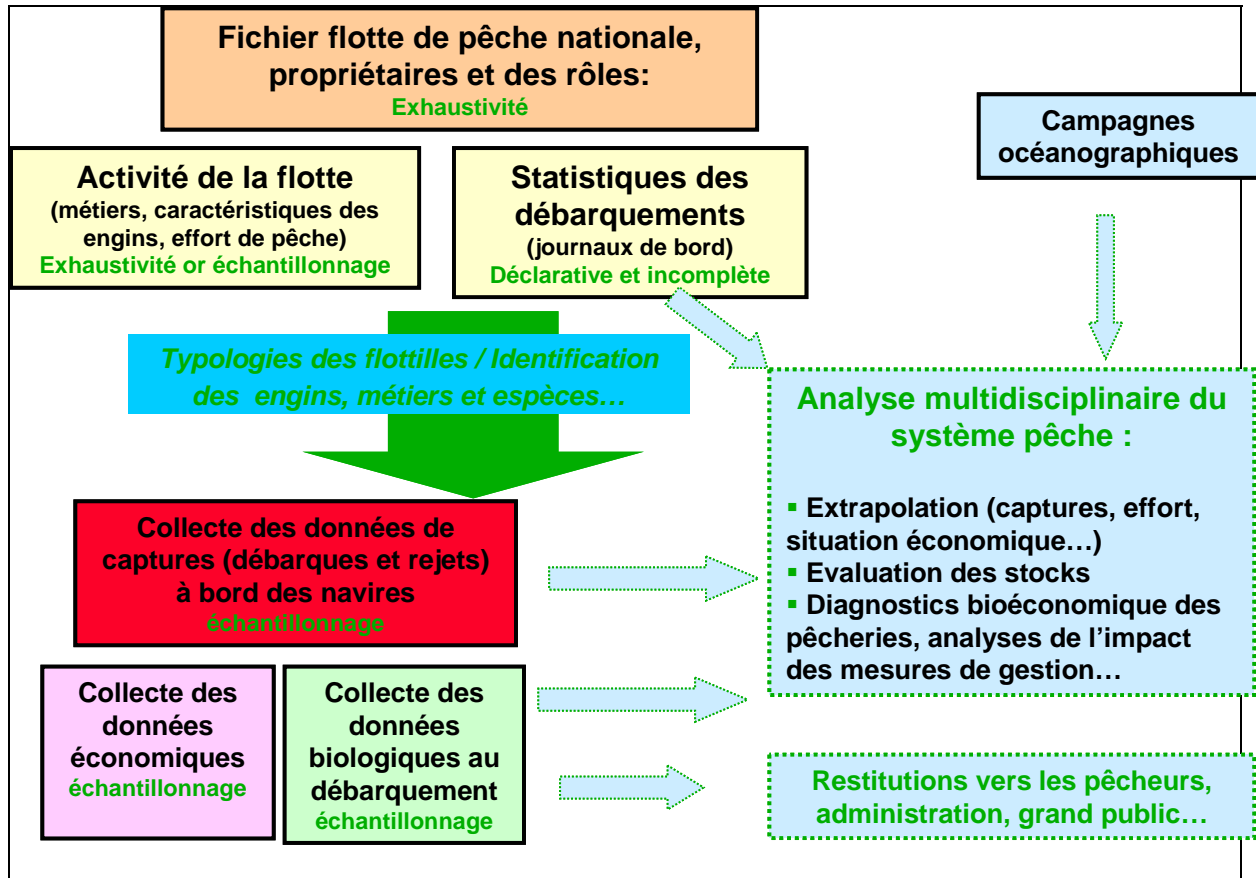
Le système de suivi statistique français

Le système de suivi statistique français vise à appréhender la totalité de l'activité des navires et d'apprécier les dimensions économiques et sociales de la pêche. Il comprend deux niveaux : - le niveau administratif et déclaratif et - le niveau statistique proprement dit pris en charge, sous mandat de l'administration, par différents instituts de recherche selon leurs compétences (Ifremer, IRD, MNHN, Université de Caen).

Quand il est complet le dispositif comprend 8 modules :

- √ Le suivi des caractéristiques techniques et géographiques des navires (avec le code armateur) : fichier Flotte nationale
- √ Le suivi des caractéristiques des armateurs et des rôles (jours d'armement, nombre d'hommes enrôlés) : fichier Armateur et Rôle
- √ Le suivi déclaratif des captures par espèce et d'effort par navire/marée/engin/zone : Logbook (pour les navires de 10 m et plus) et fiche de pêche (pour les navires de moins de 10 m).
- √ Une enquête dite « Activité » (exhaustive ou échantillonnage) visant à la reconstitution des calendriers d'activité des navires inscrits au fichier Flotte. Elle repose sur les données du flux déclaratif et sur des enquêtes directes auprès des armateurs
- √ Une enquête socioéconomique (échantillonnage)
- √ Des embarquements d'observateurs scientifiques (échantillonnage)
- √ Des enquête biologiques au port de débarquement
- √ Des campagnes de navires scientifiques

Ce dispositif permet une analyse multi disciplinaire du système pêche avec : - Extrapolation (captures, effort, situation économique), - Evaluation des stocks, diagnostic bio-économique des pêcheries, Analyse de l'impact des mesures de gestion. Il prévoit en outre une restitution vers l'administration, la profession et le grand public, à travers un bulletin statistique et un site web (en cours de développement).



(source : Sidepêche/Ifremer)

Quelques notions clés du suivi statistique :

La polyvalence et la mobilité des activités de pêche ont conduit à développer un système statistique reposant sur des nouvelles notions :

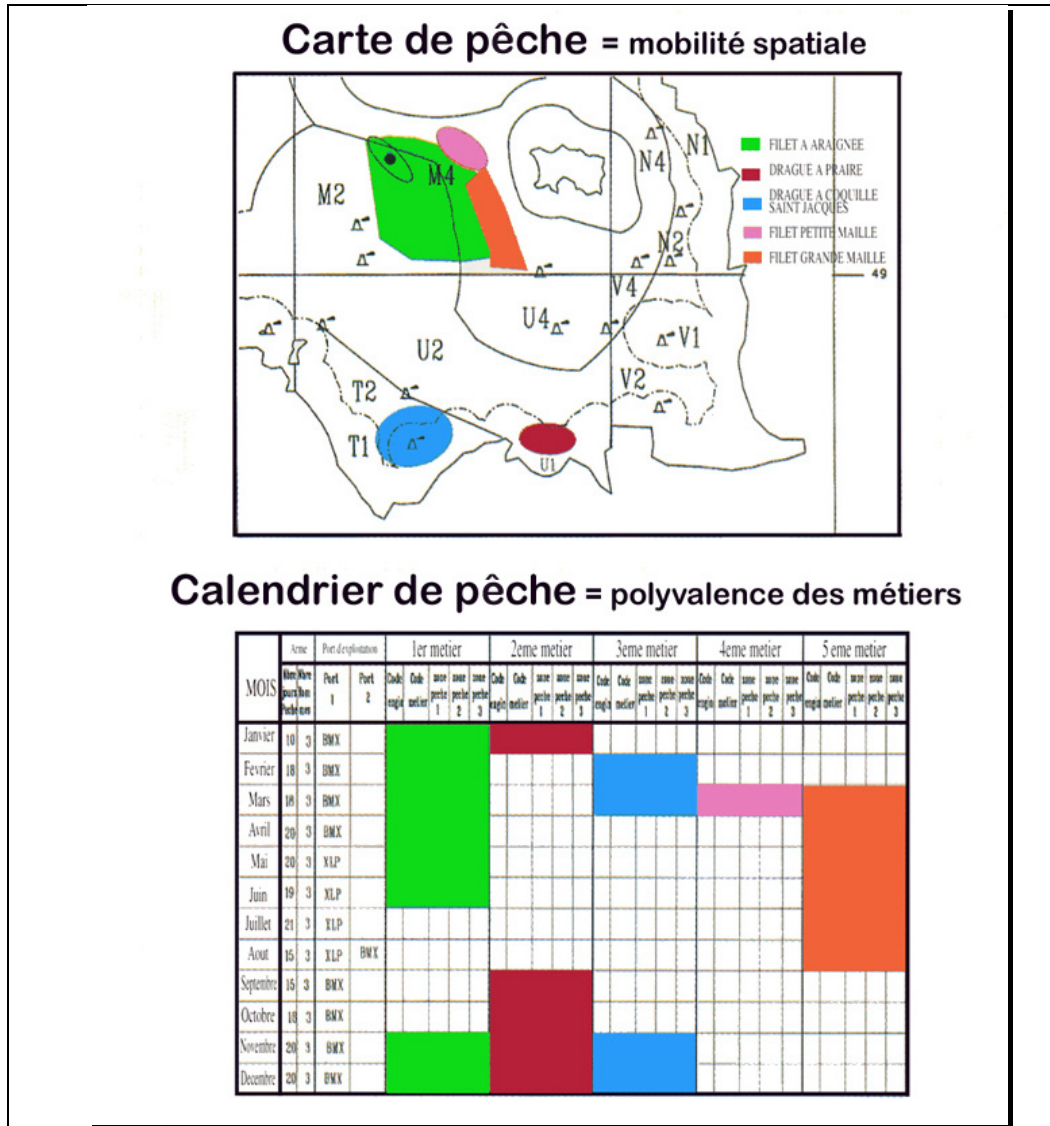
- √ Le métier (ou la tactique) : mise en œuvre d'un engin de pêche pour capturer une espèce ou plusieurs espèces cibles dans une zone de pêche donnée
- √ La stratégie : ensemble de métiers pratiqué par un navire.
- √ La flottille : ensemble de navires ayant une stratégie commune (combinaison de métier)
- √ Le rayon d'action : zone de fréquentation géographique définissant des navires côtier, mixte ou large

Ces notions permettent de construire deux produits importants du dispositif.

- Le calendrier d'activité reconstituant par mois et pour chaque navire la liste des métiers pratiqués, les zones fréquentées par métier, les efforts (j de mer, de pêche, d'hommes).

- La carte de pêche (mobilité spatiale)

On note que la polyvalence est d'autant plus faible qu'un navire dispose d'un rayon d'action élevé.



Ce système de suivi se met en place progressivement à la Réunion. Il s'étendra progressivement à tous les territoires d'outre mer français de l'Océan Indien.

Le suivi de la pêche réunionnaise

La pêche réunionnaise peut être classifiée en - une petite pêche côtière et - une pêche palangrière. Cette dernière pêche ciblant les espèces hauturières (thons et poissons porte épées), l'examen de son suivi statistique relève de la CTOI et ne sera pas considéré dans ce rapport.

Suivi de la petite pêche

Le suivi de la petite pêche relève de deux composantes, le suivi administratif et déclaratif et le suivi statistique proprement dit.

Le suivi administratif et déclaratif comprend trois types de données

- √ Les caractéristiques techniques et géographiques des navires (avec le code armateur) : fichier Flotte nationale
- √ Les caractéristiques des armateurs et des rôles (jours d'armement, nombre d'hommes enrôlés) : fichier Armateur et Rôle

- √ Les données de capture par espèce et d'effort par navire/marée/engin/zone : Logbook (pour les navires de 10 m et plus) et fiche de pêche (pour les navires de moins de 10 m).

Le suivi statistique proprement dit comprend :

- √ Une enquête dite « Activité » (exhaustive) visant à la reconstitution des calendriers d'activité des navires inscrits au fichier Flotte. Elle repose sur les données du flux déclaratif et sur des enquêtes directes auprès des armateurs

Les calendriers de pêche issus de l'enquête statistique sont ensuite traités pour élaborer une typologie des flottilles soit des ensembles de navires pratiquant une combinaison de métiers similaires. Sur cette base, la production déclarée est ensuite extrapolée à l'ensemble des activités de la pêche.

Moyens en personnel

Le système déclaratif et administratif est supporté par l'administration. Le système de suivi statistique quant à lui est composé d'une équipe locale chargée essentiellement de la collecte et première mise en forme des données et d'une équipe basée en France coordonnant l'ensemble du Système d'Information Halieutique Français (méthodes, référentiel, gestion des données, traitement, transmission, diffusion) pour le compte de la Direction des Pêches Maritimes et de l'Aquaculture (DPMA). L'équipe locale comprend environ 3 personnes, un coordinateur et deux enquêteurs. L'équipe basée en France et concernée par le SIHR représente environ 1 homme.an.

Données disponibles :

Les données administratives et déclaratives sont communiquées par la DPMA à la FAO. Le nouveau système de suivi produira quant à lui ses premiers chiffres très prochainement en 2007 pour l'année 2006. Pour mémoire, la pêche réunionnaise représente au total en 2004, 279 navires et une production (déclarées) de 3 400 tonnes

Système utilisé pour traiter, analyser et diffusés ces données

Les données administratives et déclarative sont gérés par l'administration. Les données fines issues du système de suivi statistique sont quant à elles gérées au niveau national sous Oracle (base Harmonie) au Centre Ifremer de Brest, France.

En matière de diffusion, pour la Réunion, un bulletin statistique de synthèse sera produit en juin 2007 portant sur l'année 2006, première année de suivi (déclaratif et par enquête). Signalons un projet en cours de la DPMA visant à construire une interface SIG accessible sur internet permettant la diffusion de l'ensemble des statistiques des flottilles ainsi que des textes réglementaires. La DPMA communique tous les ans à la FAO les données déclaratives et à la CTOI les statistiques concernant les pêches thonières de surface et palangrières.

Capacité d'utiliser cette information pour la gestion des stocks et avis sur la gestion durable

Les stocks exploités par la pêche côtière réunionnaise sont considérés comme des stocks nationaux. Le système en place permet de fournir des informations sur les rendements, les efforts et sur les données socio économiques.

Souligner les difficultés des Systèmes de suivi et de la disponibilité des données (en particulier pour la pêche artisanale)

Plusieurs difficultés sont rencontrées dans la mise en œuvre du système général à la Réunion. D'une part il est constaté un phénomène de sur déclaration dans les fiches de pêche du fait d'un avantage économique associé (aide en carburant). La pêche de nuit et la pêche récréative sont mal suivies. Le système complet incluant en particulier les enquêtes économiques sera mis en place progressivement.

Point de vue pour la standardisation des collectes de données et voies pour établir un système d'information régional

Les systèmes de suivis statistiques nationaux répondent à une combinaison de besoins. Certains sont relativement génériques (suivi des navires, des autorisations, des débarquements, des flux commerciaux, respect des engagements internationaux). D'autres en revanche sont plus spécifiques et peuvent être le fruit de l'histoire, des contextes, des contraintes et de besoins locaux ou nationaux. Cette diversité est une richesse qu'une approche normative ne doit pas négliger en particulier lorsque l'on s'adresse aux pêcheries artisanales.

La gestion des ressources et des pêcheries partagées entre les différents pays de la région SWIOFC, nécessitent de veiller à suivre de façon adéquate les différentes pêcheries et ressources concernées et aussi de mieux échanger les données pour permettre un suivi aux bonnes échelles de temps et d'espace.

Dans cette perspective de meilleure qualité des données et de meilleures collaborations, il est donc recommandé les étapes suivantes :

- √ Faire un état des lieux approfondi de la situation (contexte, historique, règlements) et des pratiques dans les différents pays de SWIOFC en matière de suivi des pêcheries. Etablir un échange d'expérience (benchmarking) sur la base de cet inventaire.
- √ Harmoniser les référentiels entre systèmes de suivi de façon à rendre leurs produits statistiques (actuels) compatibles entre eux (classification des engins de pêche, des espèces) et avec les standards internationaux (FAO en particulier)
- √ Rechercher pour chaque situation des solutions et des moyens d'amélioration des systèmes eux mêmes afin qu'ils répondent mieux aux besoins identifiés et aussi qu'ils soient dotés de meilleures capacités d'échanges

Gestion des stocks partagés

Les stocks exploités par la pêche côtière réunionnaise sont considérés et gérés comme des stocks nationaux.

P. CHAVANCE et R. PIANET (IRD)

FISHERIES DATA MANAGEMENT IN KENYA

	Prepared by
P. M. Nzungi	– Fisheries Department, Nairobi
E. N. Kimani	– KMFRI, Mombasa
G. Okemwa	– KMFRI, Mombasa

Landings

Landings are well documented in Kenya and to some extent the quality is good; 15 percent of the landings sites have permanent fisheries staff collecting data while over 70 percent are covered by Beach Management Units (BMUs);

Landings

With 15 percent of the landing site unmanned, there is a possibility of unreported landings; A sampling program has been developed by the Fisheries Department to address this problem so as to assist in the estimation of the catches using Frame survey results.

Species composition

Marine species composition data captured is usually on pelagic species, demersal species, crustaceans and mollusks;

Fishing effort

- Fishing effort data is usually obtained by either direct observation or interviewing fishers as the fishers land their catches;
- For the artisanal fisheries of the marine waters, Frame surveys are conducted bi-annually from where fishing effort data is determined;
- The overall objective of the Frame Surveys has been to provide information on the composition, magnitude and distribution of fishing effort; and the facilities and services at landing sites to guide development and management of the fisheries resources.

Processing, analysing and reporting of data

- Kenya has field staff that are employed and stationed at landing sites for data collection;
- Data collected from the landing sites is submitted to the district offices where it is summed up on monthly basis then submitted to the Regional offices;
- Data handling at some districts has not been done effectively due to lack of basic computer knowledge by the staff or even lack of the computers;
- Provision of computers to the data handlers at the district level would improve on the quality of data and the time it takes to compile the data;
- The regional statistics officers enter the data submitted from the district offices into an Excel program;
- Data from the landing sites which are not manned is factored in by a raising factor obtained from the frame survey results;
- The regional statistics officers compile an annual statistical report for their respective areas and submit the same to the Director of Fisheries (DoF);
- The officers in charge of statistics at the DoF office compile all the data from regions, analyses it and writes an annual fisheries statistical bulletin for the whole fisheries sub-sector which is disseminated to stakeholders.

State of fish stocks assessment

- Use of many production models needs a lot of data and continuous monitoring so as to lead to a good estimation;
- Data collected in most of our cases does not detail on the sizes of fish being harvested;
- The data gives the total catch which doesn't tell us whether the fish caught were juveniles or adults;

- The information is also aggregated and doesn't get to the species level.

Data collection from artisanal fisheries

- Weighing scales used in most of the landing sites are owned by fish dealers. Some landing sites do not have weighing scales and the landings are only estimated;
- It is recommended that all major landing sites should have a fisheries departmental weighing scales;
- Weight of fish from same landing sites is only available in processed (dry) form;
- The dry weights are converted back to nominal weight using conversion factors;
- Data collection for locally consumed fish by the fishers and their dependants has not been effective in some areas, especially where there are no fisheries staffs on the ground;
- There are very many landing sites compared with the available number of data collectors from fisheries department. Mainly we do rely on Beach Management Units for data collection in many of the landing sites.

Standardization of data collection methods

- Where fisheries resources are shared one state cannot effectively manage the resources alone. Standardized data collection methods if developed for the whole SWIO region will assist the managers and decision makers to come up with regional policies on the exploitation of the shared stocks.
- Where fisheries resources are shared, all states should be involved in the management if the resources were to be sustainably managed and exploited;
- This calls for establishment of a regional data system.

Fish population biology

- The principles of theoretical fisheries management (Fish population dynamics) which give the production models are in most cases hypothetical, and are tailored to give MSY, MEY and come up with the TAC or the Allowable Biological Catch (ABC);
- All these models are geared towards evaluating the resource abundance. These models although they seem appealing should be looked into in the context of availability of data;
- Data collection is a costly and a time consuming task that needs a lot of financial and human resource that is lacking in many of the developing countries.

Transboundary stock management

- A lot of fish are known to be highly migratory especially Tuna like species and hence need a transboundary stock management;
- To manage such a stock, there is need to have information of the stock status, migratory habits and presence of residential stocks;
- Information on transboundary stock can only be realized if we have a transborder management plan;
- In Kenya no stock assessment has been carried out of late, and that means species identification still remains undone.

MADAGASCAR REPORT

MADAGASCAR – FISHERIES DATA MANAGEMENT

Total production statistics have various sources, particularly from logbook, from activities report, from evaluations and projections. It is 120 000 tons to 130 000 tons per year. Increase of Total production is due to the development of shrimps culture and traditional fishing. Statistics of the fishing product Exports is collected by the Administrative declaration (Certificate of healthiness and customs declaration). The exports of Fishing products and Fish farming have an important income of foreign currencies, and occupy important place in the constitution of the GDP: 2.3 - 3.0 percent. Consumption of Fishes products is evaluated every 10 years by sampling. Since the quantities of bovine meat became insufficient, Fish constitute an important source of animal protein of the population. A part of the capture of the traditional Fishing is auto consumed and does not appear in the official statistics (# 20 percent). Creation of Employments is evaluated by Census and Frame Survey. As there is no status of Traditional Fishermen, the Occasional Fishermen, as well as the informal Activities, are not taken into account during Frame survey.

Shrimps resource is the most study. Stock unit is identified and Biological parameter is allowed. The stock assessment is made currently from the model of Thompson and Bell. Shrimps fisheries survey is implemented with a Logbook system. Data archived systematically on the database called ‘‘BANACREM’’. Logbook is set up since 1993. Standardization of the Logbook was introduced in 1995. Database BANACREM (National Base on Statistics of Malagasy Shrimps Fishing) was operational since 1998, and managed by Fisheries Administration. Transmission procedures of the information and Seizure of the data are not well and some errors are introduced into the database.

Two complementary methods are implemented in the traditional fisheries: Frame Survey and Catch Assessment Survey. Frame survey is complete census or count of the main units (Fishermen, Boat, Fishing Gear,...) is essential for statistical collection from Traditional fisheries. The pattern of rotation of the frame survey would have 10 years the last census goes back to 1990. It is expected that this operation will be led this year (2007). In addition, Catch assessment survey is used by sampling in space and in time for data collection using ARTFISH software of the FAO. It is implemented in Toliara (South-West) in 1995, in Toamasina (East) in 1996 and in the other region in 2000. The system is not operational any more since 2003 for lack of budget.

The Malagasy State participates actively in the Indian Ocean Tuna Commission (IOTC) data collection activities. Routine survey for purse seine are conducted by Europeans Scientists Institute (IRD & IEO), in collaboration with USTA (Unité statistique thonière d’Antsiranana) in Madagascar. Data are entry and archived in AVDTH (Acquisition and Validation of Tunas Data application).

Knowledge on the total captures of tunas depends mainly on the declaration of the captain of the foreign vessel fishing in the Malagasy EEZ. The return of logbooks is not systematic and it constitutes only as administrative document.

For standardization needs of the statistical system at the regional level the following data are necessary: time series of catch and effort statistics by fishery and fleet, total catch in number and nominal weight by species and discard statistics. With those global data the following data is added to support stock assessment: fishing location; date and time fished; composition of the catch according to length, weight and sex; biological information like age, growth, recruitment, distribution, abundance and stock identity.

Fisheries Data Management (Power Point presentation)

OBJECTIVES OF DATA COLLECTION

- What are the Net Earnings of Foreign Exchange from Fisheries ?
- What are the Fishermen's Earning ?
- What do Fisheries Contribute to the Economy ?
- What do Fisheries Contribute to the national Food Supply ?
- What is the present State of the Resources ?

WHAT ?

Objectives 1, 2, 3, 4

	Fisheries				Aquaculture	
	Inland	Marine			Freshwater	Mariculture
	Small scale	Coastal		>EEZs	"Tilapias, Carps"	"Shrimps"
		Small scale	Industrial	"Tunas"		
Fisherman's Earning	X	X	X		X	X
Contribution to the Economy	X	X	X		X	X
Contribution to National Food Supply	XXX	XXX	X		XXX	
Net Earnings of Foreign Exchange			XXX	XXX		XXX

Total production data

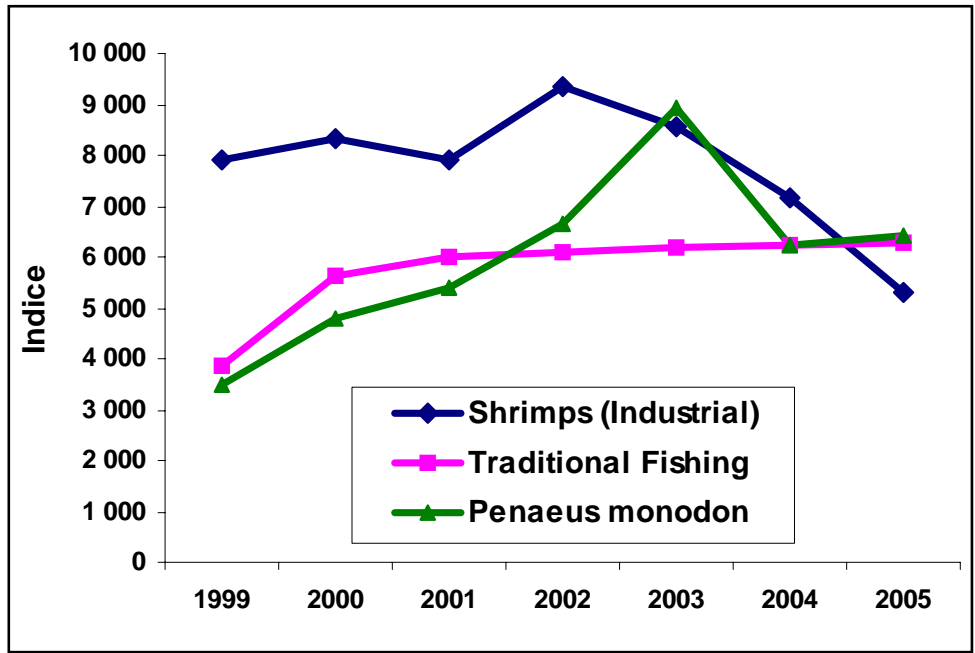
Total production Data

Logbook, Reports, Estimations, Projections, ...

			1999	2000	2001	2002	2003	2004	2005
Marine Production	Agreement of Fishing	Tuna	12 000	10 000	10 000	10 000	10 000	10 000	10 000
		Shrimps	7 888	8 303	7 889	9 328	8 545	7 155	5 312
	Industrial Fisheries	By-catch	2 586	4 268	4 517	3 050	3 105	4 089	3 273
		Deep shrimps			130	99		30	
		Deep Fish			2 127	2 200	2 270	2 300	2 350
	Artisanal Fisheries	Shrimps	480	412	437	490	726	580	572
		Fish	150	175	183	200	38	9	67
	Traditional Fisheries	Shrimps	2 139	3 412	3 450	3 450	3 450	3 450	3 450
		Crab	868	1 030	1 347	1 400	1 450	1 500	1 525
		Lobster	338	329	359	400	450	450	500
		See Cucumber	512	838	851	830	850	850	820
		Fish	55 000	55 000	55 000	55 000	55 000	55 000	55 000
		Other	4 117	4 100	4 500	4 500	5 500	5 500	5 500
		Alga	1 933	5 792	5 045	5 100	5 170	5 200	5 225
	Shrimps Culture	<i>Penaeus monodon</i>	3 486	4 800	5 389	6 628	8 920	6 243	6 404
Freshwater Production	Inland Fisheries	<i>Tilapia, Carpes, Macrobrachium, ...</i>	30 000	30 000	30 000	30 000	30 000	30 000	30 000
	in Ponds	<i>Tilapia, Carpes</i>	560	800	850	900	950	1 000	1 000
	in Rice Field	<i>Tilapia, Carpes</i>	1 000	1 500	1 500	1 500	1 500	1 550	1 600
Total Production			123 057	130 759	133 583	135 075	137 925	134 916	132 598

120 000 to 130 000tons/Year

Production trend



Increase of total production due to the development of shrimps culture and traditional fishing.

Evolution of exports

Evolution of the Exports

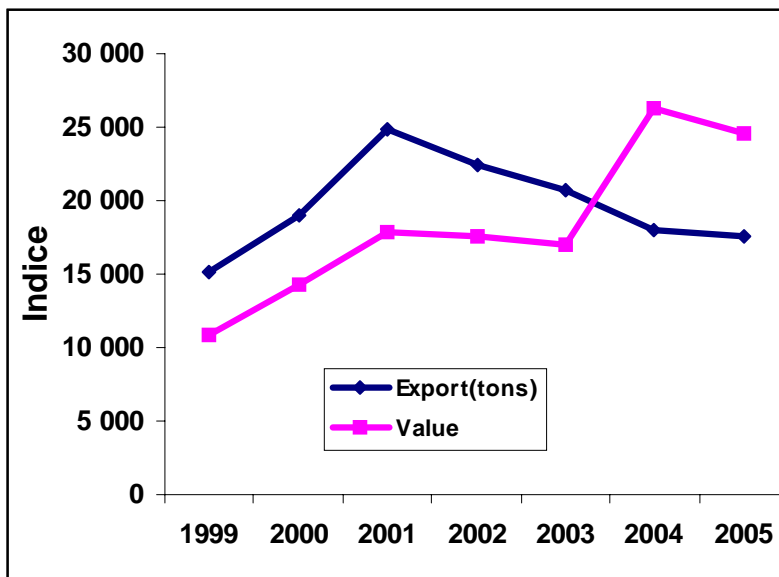
Administrative declaration (Certificate of healthiness, customs declaration)

	1999		2000		2001		2002		2003		2004		2005	
	t	Billions d'Ar	t	Billions d'Ar	t	Billions d'Ar	t	Billions d'Ar	t	Billions d'Ar	t	Billions d'Ar	t	Billions d'Ar
Shrimps (*)	12 250	99,3	12 666	125,2	15 274	155,5	15 139	156,8	15 256	155,1	13 651	231,7	11 716	187,7
Crab	261	0,7	578	1,3	522	1,4	488	1,5	492	1,6	852	4,3	1 228	8,0
Lobster	199	2,6	258	3,8	257	3,9	309	5,6	383	6,2	555	11,3	565	11,3
Sea cucumber	327	2,0	390	2,7	355	2,0	987	3,9	205	1,2	300	3,3	223	2,4
Cephalopod	757	1,0	1 114	2,0	1 093	2,2	1 753	3,7	999	2,5	1 668	6,4	1 606	13,6
Shark fin	10	0,3	14	0,1	15	0,4	20	0,2	18	0,2	43	0,8	58	2,5
Fishes	746	1,3	2 756	6,5	6 332	11,8	2 882	2,5	2 796	2,7	891	3,5	1 900	17,4
Ewers	0	0,0	6	0,1	7	0,1	6	0,1	12	0,4	8	0,6	7	0,0
Other product (**)	550	0,9	1 249	1,1	1 011	1,6	780	2,0	565	0,7	31	0,7	258	3,5
TOTAL	15 101	108,0	19 030	142,8	24 865	178,9	22 364	176,3	20 726	170,5	17 999	262,5	17 561	246,4

(*) Shrimps of Fishing and of Aquaculture
 (**) Tuna canned excluid

The exports of Fishing products and Fish farming are an important income of foreign currencies, and occupy important place in the constitution of the GDP : 2.3 % a 3.0 %

Export trend



Consumption of fish products

Consumption of Fishes products

Sampling

kg/Person/Year	1960/70	1980	1990	2000
Bovine meat	+	15,0	-	-
Fish	4,9	5,2	7,4	7,6

Since the quantities of bovine meat became insufficient, Fish constitute an important source of animal protein of the population.

A part of the capture of the traditional Fishing is autoconsumed and does not appear in the statistics (# 20%)

Employments

Employments

Census, Frame Survey

ACTIVITIES	1990	2000
Maritime Traditional Fishing	42 600	80 000
Inland Traditional Fishing	17 800	
Industrial Fishing	1 300	
Artisanal Fishing	450	
Global Direct Employment	62 150	
Commerce, Processing, ...	4 700	
Embarcation construction, Fishing gear confection, ...	1 500	
Administration, ...	500	
Global Indirect Employment	6 700	
TOTAL Fishing Activities	68 850	96 000
% Active population	(1,2%)	
Creation of employment (in 10years)		37 400

As there is no status of Traditional Fishermen, the Occasional Fishermen, as well as the informal Activities, are not taken into account during Census.

WHAT ? (For research need)

WHAT ? (For research need)

		Tuna	Penaeus	"By-catch"	Panulirus	Scylla serrata	Octopus	Small pelagics	Multispecific demersal
Data	Catches	X	X	X	X	X	X		
	Efforts	X	X		X	X			
	Length frequency	X	X		X	X			
	Stage of maturity		X		X	X			
	"Scientific survey"		X					?	?
Parameters	recruitment		X						
	growth		X						
	natural mortality		X						
	age of first capture		X		X	X			
	age at maturity		X		X	X			
	longevity		X						
Assesment	fishng mortality		X						
	total biomass		X					X	X
	MSY		X		X	X			
	Yield per recruit (Y/R)		X						
Institutions		USTA IOTC	DPRH PNRC IRD	CSP PNRC	DPRH FAO	DPRH JICA	DPRH JICA

VPA → Estimation of the Fishing mortality

→ Explanation and predict modelling of Thomson and Bell

Foreign Vessel fishing in the Malagasy EEZ

Foreign Vessel fishing in the Malagasy EEZ

Number of vessels

with License	2002	2003	2004	2005	2006	2007
European seiner	40	40	33	37	39	39
European Longliners	40	40	39	33	40	33
Asiatic longliners	65	65	6	19	47	24

Licenses fees of tunas fishing allowed a recipe in foreign currencies to the Country :

Reference of capture	11 000 t
License fees	65 Euros /t
Financial Contrepart :	
Access in Malagasy ZEEs	715 000 Euros/year
Promotion of Responsible Fishing	275 000 Euros/year

-Income resulting from operations of supply (Salt, ...), from naval repair (SECREN) and from the other Services (transshipment, ...)

- Existing of the Canning factory of tuna - Antsiranana (PFOI)

Indian Ocean Tuna Commission

Asiatic Longline fleets do not supply logbook data.

AVDTH

Acquisition and Validation of Tunas Data purposes standardized grids by seizure of fishing statistics to the tropical tuna and Tools to their validation and to their export.

AVDTH is an ACCESS application.

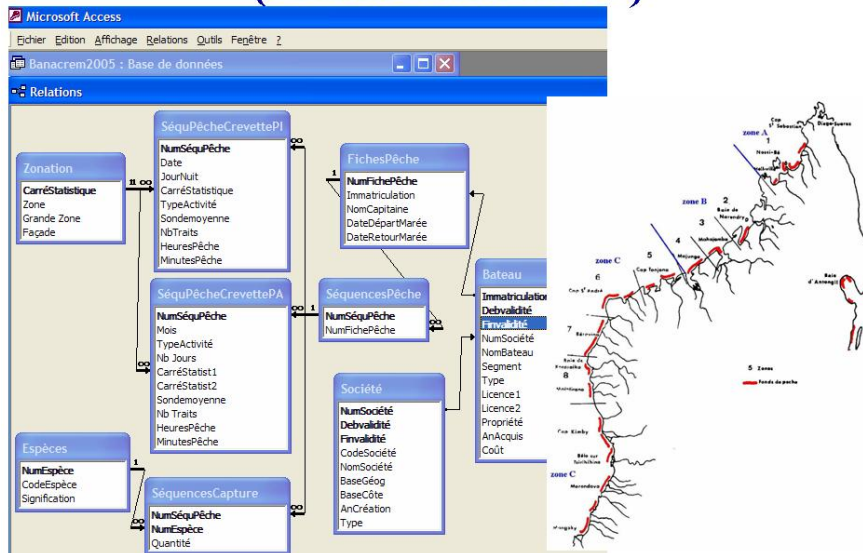
Catch survey for artisanal and industrial prawn fisheries

- Logbook is set up since 1993
- Standardization of the Logbook was introduced in 1995
- Database BANACREM (*National Base on Statistics of Malagasy Shrimps Fishing*) was operational since 1998, and managed by Fisheries Administration

Databases BANACREM

(Table and Link)

Databases BANACREM (Table and Link)



Statistics of traditional fisheries

- **Frame Survey**: Complete census or count of the main units (Fishermen, Boat, Fishing Gear, ...) is essential for statistical collection from Traditional fisheries

WHAT is ARTFISH

Definition of ARTFISH

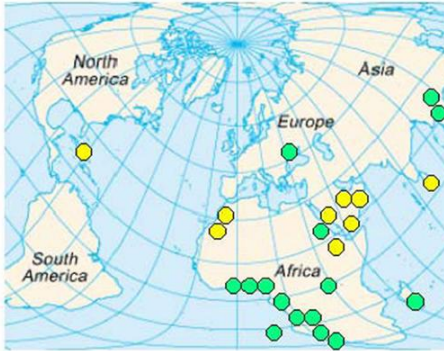
Approaches

Rules

Techniques

FISHeries surveys

ARTFISH is a suite of standardized statistical approaches and computer software developed by FIGIS for sample-based fishery surveys

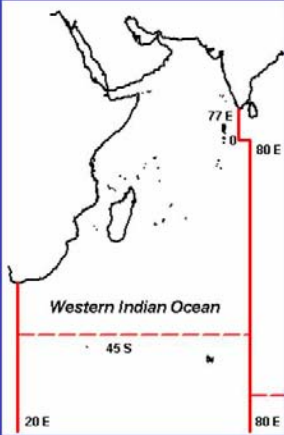


FIGIS - ARTFISH as at March 2005

● Implemented ● Pipeline

“Issues for Regional Databases”

“Issues for Regional Databases”



South West Indian Ocean Fisheries

Basic Fishery Data need to Fisheries management

GLOBAL :

- Time series of catch and effort statistics by fishery and fleet
- Total catch in number and nominal weight by species
- Discard statistics

Designing the Programme

WHY ? :

- Identify problems in the Fisheries

- **Identify Policy, Research and Management Objectives**

WHAT ? :

- **Identify types of indicators witch will be required (simple trends, MSY/MEY, ...)**
- **Biological, Economic, Socio-cultural indicators to guide management decision?**
- **What data (variables) are possible to collect, What data are essential, and What data are only desirable.**

HOW ? :

- **Standardization**

Issues for standardization

Apply international Classifications and Codes :

- **International Standard Statistical Classification of Fishery Vessels (ISSCFV)**
- **International Standard Statistical Classification of Fishing Gear (ISSCFG)**

Thanks

MALDIVES

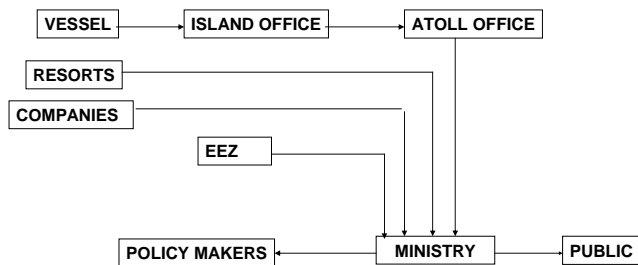
PRESENTATION AT THE FIRST MEETING OF THE WORKING PARTY ON FISHERIES STATISTICS

By: Hussain Sinan
 Research Officer,
 Ministry of Fisheries, Agriculture and Marine Resources
 Maldives

INTRODUCTION

Republic of Maldives is an archipelago of 26 natural atolls consisting of 1190 coral reef islands. There are 200 inhabited islands of which 87 are resorts and the rest is utilized for industrial purposes. Fishing industry is a major contributor in the Maldives economy, accounting for between 6.6 percent and 8.9 percent of the GDP during the past ten years.

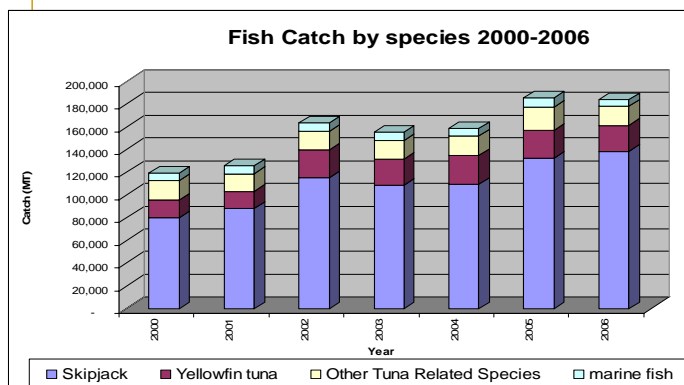
DATA COLLECTION IN MALDIVES



QUALITY OF DATA

Quality of data is questionable, however the general trend of fisheries statistics of various species is intact.

Fisheries data are published annually through statistics yearly book and other various publications.



EFFORT DATA

No. of trips, Poles, No. of Hooks are collected on daily basis

Reported monthly to the Ministry by islands by vessel.

Effort data is analysed with catch data annually and is reported.

DATA ANALYSIS

The available data is analysed by scientists in Marine Research Center and Economists in the Statistics Section.

Constant Monitoring of selected species like grouper, shark and sea cucumber.

Reports are prepared and advised to the policy makers when the need arises.

It is believed that grouper fisheries is almost at Maximum sustainable yield level and constructive measures are been taken place.

Research work is ongoing on aquaculture of grouper fisheries.

ISSUES

Lack of trained staff

Lack of information on fisheries statistics

No information on position of fish catch.

Under reporting and Over Reporting of fisheries data.

STANDARDIZATION

Issues

- Geographical distribution

- Fishing methodologies

Advantages

- Easier to analyse from a regional point of view

- Better stock management capability

TUNA FISHERY

Same data collection methodology used for Tuna Fishery

Close monitoring of stocks, catch, exports of fisheries products

Data are sent annually to various regional bodies including FAO.

INFORMATION ON FISH POPULATION BIOLOGY

Size data and stock analytical data are collected through various officers in selected points.

Survey data are also gathered.

Day to Day data on length, weight are collected in main fisheries harbors across the nation for all species.

Data is analysed by various scientists to advise policy makers of any threats to stock.

MAURITIUS COUNTRY REPORT

1. The fisheries sector in the Mauritian economy

From the economic, nutritional and social stand points, the fisheries are an important sector in Mauritius. Although local production does not suffice to cover market needs, it provides direct employment to about six thousand people and is quite an important foreign exchange earner.

2. Important Marine Fisheries in Mauritius

2.1 Coastal (artisanal) fishery

Coastal fishery involves fishing in the lagoon and outer reef areas. This fishery is the main source of fresh fish supply to the local market. About 2 174 fishermen are involved in the coastal fishery using about 1 474 boats. The different type of gears used is hooks and lines, basket traps, large net, gill net and harpoons. The annual production is around 1000 tonnes and includes mainly Mullidae, Scaridae, Seranidae, Siganidae, Lethrinidae, Acanthuridae and Octopodidae.

Catch and effort data of the artisanal fishery are collected by a team of enumerators covering the 61 fish landing stations. A computer package was designed with assistance from FAO for the data entry and processing.

Besides the monthly estimates of the fish catch, the following information are also obtained:

- Catch per fisherman day (CPFD)
- Total fishing efforts
- Value of fish catch
- Average catch per boat
- Catch by gear and ground of fishing

2.2 Bank Fishery

The banks (St Brandon, Nazareth, Saya de Malha and Chagos) are exploited by the Mauritian vessels. Except for the Chagos bank, the hand line fisheries resources are fully exploited on these banks. Fish produced from the banks constitutes a major source of frozen fish to the population. The catch from the Saya de Malha and Nazareth is about 3000 tonnes annually and comprises mainly of *Lethrinus* species. A licensing system was introduced in 1992 to manage the fishing activities in the banks. The licences are valid for one year.”

Length frequency data for the major species of fish, *Lethrinus mahsena* from the banks are collected during unloading of catch by the fishing vessels. Data collected are the number of fish sampled and the length range. The length frequency distributions of fish from the bank are calculated using the LFDA software

An assessment of the fish stocks on the two banks was carried out using the Surplus Production Model. Catch and effort data for the period 1995 to 2003 were used to estimate the Maximum Sustainable Yield (MSY). The MSY obtained for the Saya de Malha and Nazareth Bank were 2 350 and 1 800 tonnes respectively. In 2003, the total catch from the two banks amounted to 2 822 tonnes; the level of fishing efforts was below F_{MSY} , the effort required to achieve MSY.

2.3 Semi-industrial chilled fish fishery

Fifteen semi-industrial vessels operated in the chilled fish fishery for a duration of 12 days. This fishery has been developed to tap the demersal resources of the banks, namely: Sudan, Albatros, Hawkins and St. Brandon. The catch amounts to about 356 tonnes in 2005 and the species compositions of the catch include lethrinids, snappers, Groupers, Tuna and others.

Sampling for length and weight of the two major species: *lethrinus mahsena* and *lethrinus nebulosus* is carried out on the arrival of vessels.

Data collection methodology for banks and Semi-Industrial fishery

On the arrival of each fishing vessel at Port Louis, the skipper has to submit a logbook and landing data. The recorded data on the logbook are mainly the position of the fishing vessels, number of dories and number of fishermen on board. The depth of the fishing grounds and catch by species are also recorded. These data are fed into the Microsoft excel software from where the catch by fishing vessels, by fishing grounds, fisherman days, catch per fisherman day (CPFD) and species composition are obtained.

2.4 Fish Aggregating Device fishery

In this fishery the catch amounts to 214 tonnes of pelagics annually. Data recorded include catch, species composition, gear and effort. The species compositions are, Germon-*Thunnus alalunga*, Thon jaune- *Thunnus albacares*, Dorade- *Coryphaena hippurus*, Becune- *Acanthocybium solandri*, Sharks- *Carcharhinus* sp and others. Since recently a data collection system has been set up. Enumerators are posted at landing sites to collect catch and effort data on a daily basis.

2.5 Sport Fishery

The sport fishery supplies the local market with an additional estimated amount of 350 tonnes of fish which include marlin, tuna, dorados and sharks. Daily catch statistics and boat characteristics on a monthly basis are submitted. Data collection forms have been designed and distributed to the concerned organizations.

2.6 Tuna Fishery

Each year there are about 500 calls of longliners. The catch of these longliners is composed mainly of albacore which constitutes more than 75 percent of their total catch. Fishing logbooks are regularly distributed to local vessels and licensed longliners. Daily catch statistics are recorded by skippers on fishing logbooks. These catch statistics include fishing positions, catch by species (in tonnes), effort, (hours at sea, fishing hours, number of hooks), sea temperature, association of tuna schools, and wind and current direction in degrees and knots. The fishing logbooks are collected on the arrival of the licensed purse seiners and longliners at the port or from the representatives of the vessels in Mauritius. Landing statistics (or total catch landed) are collected from the tuna canning factory and fishing companies representing longliners in Mauritius. These companies have the responsibility to record the weighed quantity landed by their vessels. Information obtained from the companies also includes total catch landed by species and effort (in terms of days at sea, fishing hours, and number of hooks).

Length frequency data

Length frequency sampling is conducted on the catches of licensed longliners during each landing. During the sampling, 150 - 200 fish are measured irrespective of species and size of the fish at three different intervals. Length frequency data are also collected during the landing of a licensed purse seiner.

Data entry and processing

Data is entered directly from the paper forms without pre-coding being needed. The programme contains different modules which allow the entry of logbook, transshipment figures, length frequency, vessel registry and other biological data. The 'Wintuna' is designed to generate statistical bulletins, reports and catch made in the EEZ of a country. Presently the software EXCEL is utilized to process the data and to generate charts and tables.

2.7 Swordfish fishery

Each licensed local boat is provided with a logbook. The skipper on board has to provide information like daily catch by species, number of hooks used, fishing positions and environmental parameters. Logbooks returns are submitted after each trip. Landing weight per species and duration of trips are provided by the fishing companies. This data is used to correct estimated catch provided by the logbook. Length frequency data are collected during each landing of the vessels. Length as well as

the species of the fish measured is noted. As the fish is already headed and gutted on board of the vessels, different types of measurements are taken at the landing sites. For swordfish, the pectoral-anal length is collected. The data collected are entered using the Wintuna. For processing of the data the software EXCEL is used.

2.8 Use of fisheries statistics

It is a fact that good standard statistics are fundamental in the evolvement of management measures. All data collected relating to various sectors of fisheries are analysed and published in the Annual Report.

Based on the statistics and recommendations by the scientists, the Ministry issues licences to local and foreign vessels and decide upon the imposition of limited entry or catch quota in some sectors like the bank fishery. The tuna statistics are also of great help during the negotiations of fishing agreements. Processed statistics are regularly transmitted to FAO, IOTC, COMESA and SADC. Locally these statistics are also used by the Central Statistic Office in its calculation of different economic parameters. Statistical bulletin on all the different fisheries are prepared annually.

3. Conclusion

The Ministry of Fisheries is giving much emphasis to the collection and processing of good standard data. Good management practices are essential for sustainability of fisheries. In these respect Mauritius is assuming its responsibilities both as a flag and Port State and is cooperating with regional and international fisheries bodies for proper management of fisheries resources.

MOZAMBIQUE COUNTRY REPORT

Fishery Ministry and the Mozambican National Fisheries Research Institute

National statistics system

Catch and effort data

1. Introduction

Mozambique is a developing country in southeast Africa with extensive fisheries resources. It has 800 000 km² of area of which 100 000 km² is covered by marine water, 13 000 km² covered by Inland water and the coastal line is about 2 750 Km. The population number was estimated in 18 million in 1994 census.

The fishery sector provides animal protein and employment. The fishing activity is regulated through management measures which include Fishing License, TAC / quota allocation, mesh size regulation, closed seasons, catch limits, restrictions on gears and sizes, Closed Fishery and Limited Entry and VMS Monitoring.

In industrial and semi-industrial fisheries, shrimp stock has been assessed and managed since late 1970s. The fishery itself has historically undergone many phases and stock assessment and management have evolved along the years. A national management plan for the fishery exists where the major management measure is a closed season for shrimp of 3.5 – 4 months each year. No new entries are allowed in the fishery which is also managed on the basis of total allowable catches (TACs) and a vessel logbook programme. The fishery is currently fully exploited.

There is ongoing activity in producing management plan for Shrimp and as this resource is caught by all the fisheries sector this plan will take into account all the fisheries. And is all ongoing job for fish line management. A management plan exists that prevents entry and has a zero TAC (for lobster for example).

There are two main shrimp fishing grounds: the Maputo Bay grounds in the south where most of the catches come from artisanal and semi-industrial fisheries and the Sofala Bank in the central part of the coast. Much of the industrial marine fishing activity is on Sofala Bank. The Sofala Bank is one of the largest penaeid shrimp fisheries in Africa.

The main fisheries resources caught in the fishing activity are:

- CRUSTACEANS**: Shallow water shrimp, deep sea prawns, crayfish, crabs, lobsters - represent 77 percent of the total production value;
- FIN FISH**: Demersal and pelagic species - representing 22 percent of the total production value;
- MOLLUSCS**: Squids, octopus, sea-cucumbers and bivalves.

2. Summary of the data collection system

The production of reliable data is one of the priorities of the fisheries sector in Mozambique. This data is crucial for the implementation of resources management measures which guarantee the sustainable use of fishery resources.

2.1 Industrial and semi-industrial data collection

In the Industrial and Semi-industrial sector, the data collection process is the responsibility of the fisheries company providing the information of their fishing productivity to the Fisheries sector. Also, the Fishery Research Institute make research cruise and often send data collectors on board to register biological information. The information is recorded in logbooks. It includes name and code vessel, name and code of enterprise, capture of target and bycatch species and days of fishing

2.2 Artisanal fisheries data collection

The Data Collecting System was created and first implemented in 1996 where it was tested simultaneously in Inhambane (Southern) and Nampula (Northern) Provinces. Gradually the system was expanded, covering nowadays most of the Mozambican Coastal Provinces and Inland areas. The aims of the system was the creation of data system on artisanal fisheries, which shall provide information to public and private entities; production of secure data of catch rates and fishing effort for stock assessment; to advice for management measures for sustainable use of fisheries resources if necessary.

This system was drawn by the National Institute of Fishing Investigation (IIP) involving in informatics programmers, biologists and statistics. The applied methodology is based in sampling and out of the traditional method of census or average statistics.

The reasons that took the implementation of the sampling method were:

- Great dispersion of the landing sites and some being temporary;
- Extensive coastline (2 780 Km);
- High diversity of fishing gear;
- High species Diversity;
- Great seasonality in the craft fishing activity.

The sampling design is random stratified from which we obtain data of the catch per unit effort (CPUE), total catches and fishing effort for fishing gear in a considered geographical area.

A team of data collectors (One Sampler plus an assistant) must speak local language and live in the community. At the Province level the system foresees at least one biologist and one technician with Secondary School Level.

Staff involved in Data Collection in the Artisanal Fisheries		
	N ^o	total annual cost in USD
Samplers	130	125042
Assistants	41	29862
total	171	154904
Technicians involved	25	

The system has different levels of quality control to verify how the system is working. Some levels of quality control are listed below:

1. Data inspection before recording in the Database;
2. Automatic control of mistakes - Database;
3. Provincial supervisions;
4. National meetings for system uniformization.

Main constraints of the system

Data collection of artisanal fisheries is not done in all fishing centers because of:

- Extensive Mozambican coastline (2780 Km);
- Insufficient human resources;
- Limited accessibility;
- Incomplete data and not reliable;
- High Diversity of fishing gear and species;
- Seasonality of fishing activity;
- Fishermen migration;
- Limited technical

Perspectives of the system

- Improvement of the economic data collection;
- Additional biological data (e.g., stage of maturity, individual weight, stomachs, otoliths);
- Urgent to use all available data information to achieve knowledge as soon as possible about the current stock conditions.

3 Statistics of catch and effort, 2006

3.1 Statistics of total catches

Global 2006 catches was around 90 460 tonnes excluding tuna catch which around 6 690 tonnes (Table 1). Comparing these catches with the 2005 catches, there was an increase of 7 percent in general (Table 1).

Table1. Global Catches for the Fishing Sector in 2005 and 2006 and the growth rate

Resources	catch in tonnes		
	2005	2006	growth rate
shallow water Lobster	13	5	-62
Crabs	319	282	-12
Deep shrimp	1774	1803	2
Fish	50687	56878	12
Shallow water shrimp	11346	9660	-15
deep water Lobster	149	95	-36
Cephalopods	165	115	-30
Lymnotrissa miodon	12991	15378	18
bycatch	1830	1724	-6
Shark	893	789	-12
Other (Artisanal fisheries)	4660	3730	-20
Total	84827	90459	7
Tuna	5396	6691	24

The most caught resources was shrimps *Fenneropenaeus (Penaeus) indicus* and *Metapenaeus monoceros*, Deep sea prawn of the species *Haliporoides triarthrus* and *Aristaomorpha foliacea* mainly off the south coast of Mozambique and *Limnothrissa miodon*.

The Tuna (*T. albacares*, *T. obesus* and *T. alalunga*) are exploited offshore along the entire coast mainly by licensed European Union (EU) and Japanese vessels. The 2006 catches was 6 961 tonnes what's means an increase of 24 percent of the 2005 catches (5 396 tonnes).

Of the total catches (70 percent) comes from the artisanal fisheries (Table 2). The most fish species caught in artisanal fisheries are mainly composed by the genera: *Pellona*, *Thryssa*, *Hilsa*, *Trachurus sp*, *Sphyraena spp*, *Carangoides spp*, *Caranx spp*.

Table 2. Catches for artisanal fisheries in 2005 and 2006 and the growth rate

Resources	catch in tonnes		
	2005	2006	growth rate
shallow water Lobster	12	5	-58
Crabs	161	175	9
Fish	50024	57457	15
Shallow water shrimp	1759	1367	-22
cephalopods	239	247	3
Shark	893	776	-13
Other (Artisanal fisheries)	4660	3946	-15
total	57748	63973	11

SEYCHELLES NATIONAL REPORT

J. Robinson & R. Azemia
Seychelles Fishing Authority (SFA)

Artisanal fisheries

Fishery	Species	Vessel	Gear	Catch (mt)
<i>Demersal handline fisheries</i>	<i>Lutjanidae, Lethrinidae, Serranidae</i>	<i>Whaler, schooner</i>	<i>Handline, dropline, electric reels</i>	1642
<i>Semi-pelagic handline fisheries</i>	<i>Carangidae, Scombridae</i>	<i>Whaler, schooner</i>	<i>Handline</i>	1434
<i>Net fisheries</i>	<i>Rastrelliger kanagurta, Selar crumenophthalmus</i>	<i>Mini-Mahe</i>	<i>Encircling gillnet, Beach seine</i>	683
<i>Trap fisheries</i>	<i>Siganidae, Scaridae, Mullidae</i>	<i>Mini-Mahe, whaler</i>	<i>Traps (active and static)i</i>	358
<i>Sea cucumber fishery</i>	<i>Holothuridae, Actinopyga spp.</i>	<i>Schooner whaler</i>	<i>SCUBA</i>	<i>c.75ii</i>
<i>Octopus fishery</i>	<i>Octopus vulgaris</i>	<i>On foot</i>	<i>Harpoon</i>	34
<i>Crab giraffe fishery</i>	<i>Ranina ranina</i>	<i>Schooner</i>	<i>Hoop-tangle net</i>	18
<i>Spiny lobster fisheries</i>	<i>Panulirus spp.</i>	<i>Mini-Mahe</i>	<i>Snorkelling Traps</i>	4

Artisanal fishery fleets

- Traditional wooden pirogue
- Traditional whaler
- Mini-Mahe
- Lekonomie (whaler)
- Lavenir
- Schooner

Monitoring systems

Monitoring system	Fisheries	Survey type	Frequency	Start year	Data frame
Catch Assessment Survey (CAS)	Mixed*	Creel-type, except SFS	All year (6-days/week)	1985	Foxbase/Art!fish
Lobster Monitoring Programme (LMP)	Spiny lobster	Logbook/ Creel-type	Seasonal (3-months/year)	1992	MS Access
Sea Cucumber Monitoring Programme (SCMP)	Sea cucumber	Logbook	All year	2001	MS Access

Monitoring systems: CAS (1)

Catch, effort, species composition data for main artisanal fisheries

Demersal handline, dropline, semi-pelagic handline, trap, net, harpoon, foot fisheries

CAS stratified by area and boat/gear combination

CAS = 4 surveys (creel survey, except sport)

Operates on 3 main populated islands

54 landing sites (1° & 2 °), 7 main strata

9 full time staff, 7 part time

US\$ 100,000 (salaries & other expenses)

Monitoring systems: CAS (2)

Small boat survey:

- Multispecies (18 species/groups, high aggregation)
- Multi-gear (18 boat/gear types monitored)
- Monthly data entry/analysis ART! FISH (FoxBase)
- 9 step routine
- Monthly estimates, by stratum, of:
 - total catch by species-group by boat/gear type total effort by boat/gear type
 - number of fishing units per site
- Monthly and annual statistical reports
- Sample and output data stored in MS Excel

Monitoring systems: CAS (3)

Whaler Handline Survey:

- Multispecies (32 species/groups, low aggregation)
- Handlines - semi-pelagics/demersal spp
- Monthly data entry/analysis 'WHALER' (FoxBase)
- 14 step routine
- Monthly estimates, by stratum, of:
 - total catch by species-group
 - total effort, mean effort & CPUE
 - number of fishing units per site
 - Plus descriptive statistics
- Monthly and annual statistical reports

Monitoring systems: CAS (4)

Schooner Handline Survey:

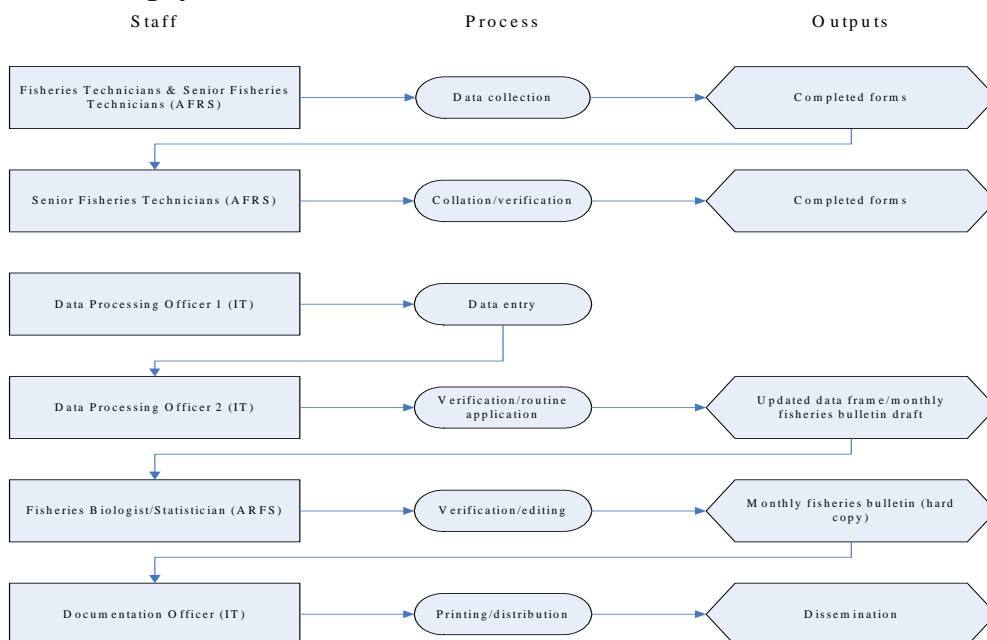
- Multispecies (31 species/groups, low aggregation)
- Handlines (drop lines, reels) - demersal/semi-pelagic spp.
- Monthly data entry/analysis 'SCHOONER' (FoxBase)
- 5 step routine
- Monthly estimates, of:
 - total catch by species-group
 - total effort, mean effort & CPUE
 - number of fishing units per site
 - Plus descriptive statistics
- Monthly and annual statistical reports

Monitoring systems: CAS (5)

Sport Fishery Survey:

- Multispecies (13 species/groups, low aggregation)
- Range of vessels, trolling, handline, low catch and release (demersal catches increasing)
- Logbook system – poor returns, system not functioning
- Monthly data entry – 'SPORT' (FoxBase)
- step routine
- Monthly estimates, of:
 - total catch & effort
 - Species composition
- Monthly and annual statistical reports

Monitoring systems: CAS (6)



Monitoring systems: LMP (1)

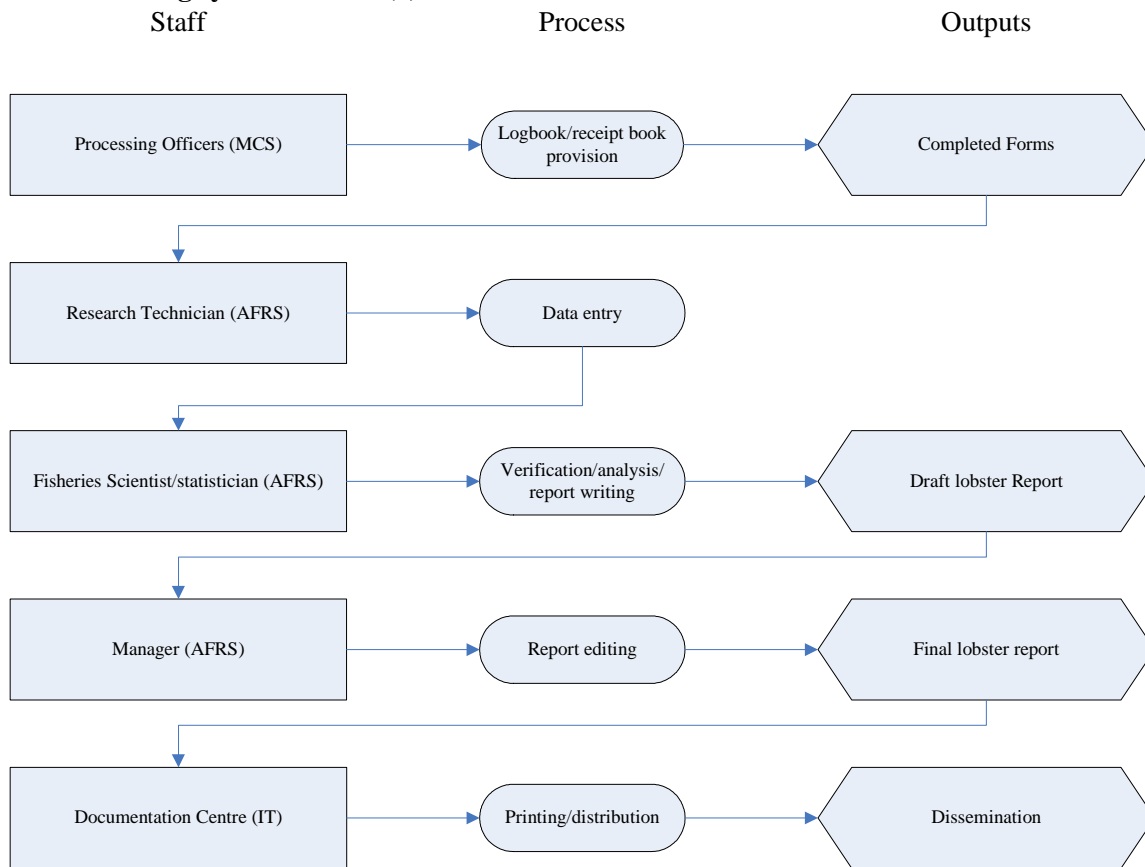
- Established 1992 to collect catch, effort, species composition & biological data for stock assessment
- Logbook
- Creel-type survey (verification & biological data)
- Economic data (receipt books)

- Data management in MS Access
- main species (Palinuridae)
- Data entry/analysis after season
- Spiny lobster report after each fishing season

Monitoring systems: LMP (2)

- Total catch: mean site CPUE x site effort (no. trips), summation across sites
- Outputs: Total catch/effort by site, gear, month, species
- Low annual catch (< 5 mt), closures common (CPUE)
- Cost: US\$ 15,000 (salaries and allowances)
- 13 staff (part-time basis, c.10 percent)

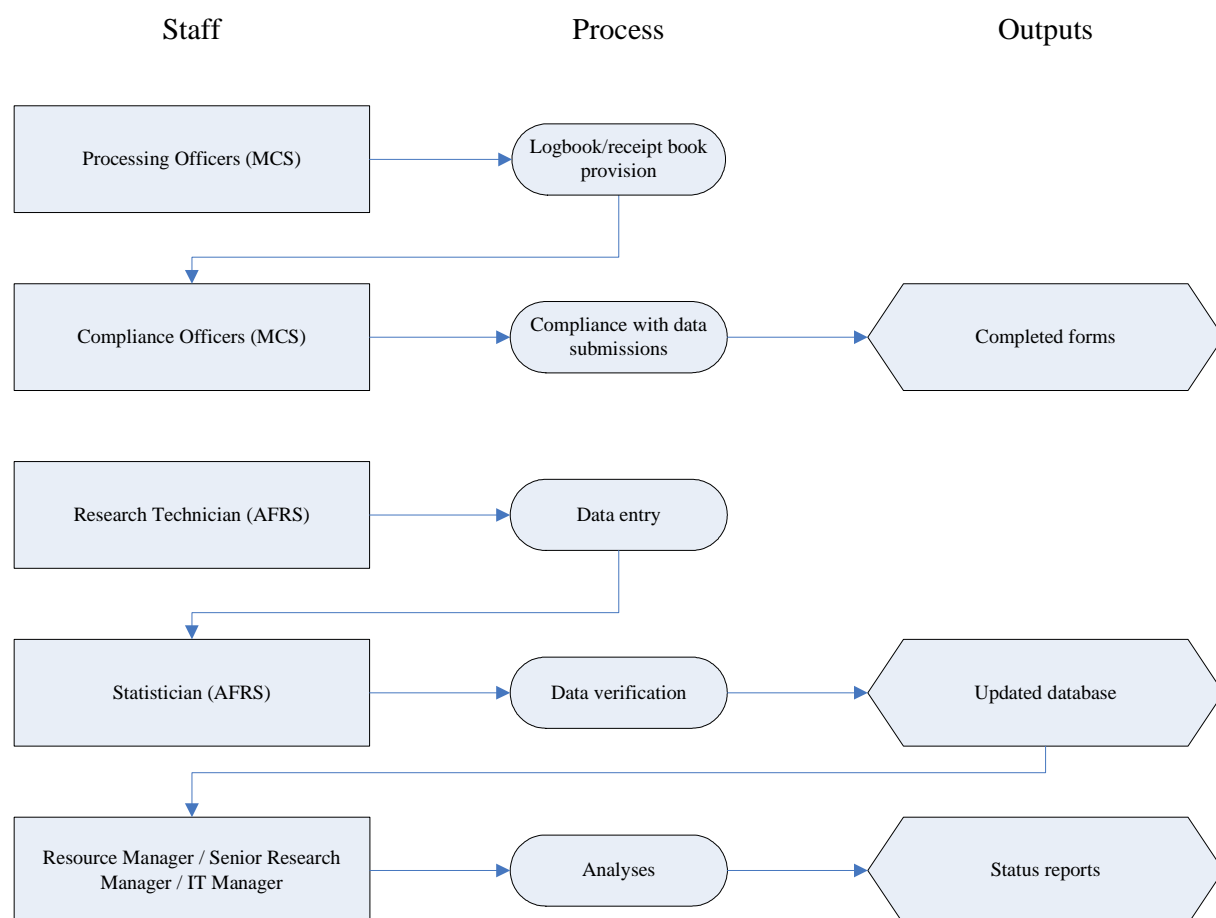
Monitoring systems: LMP (3)



Monitoring systems: SCMP

- Established 2001 to collect catch, effort, species composition and trade data
- Targets *Holothuria* spp., *Actinopyga* spp.)
- Logbook survey (incl. fishing location maps)
- Receipt books
- Data managed in MS Access
- Outputs: Total effort and catch by species/fishing ground
- Limited entry (25 licenses)
- Management plan (plan, incl. TAC, not legislated)
- No specific report (SFA Annual Report)

Monitoring systems: SCMP (2)



Reporting & dissemination

Report	Frequency	Time-lag	Format	No. printed
Seychelles Fisheries Bulletin	Monthly	3 months	Hard copy	12
Seychelles Artisanal Fisheries Statistics	Annually	6-12 months	Hard copy, electronic	75
Spiny lobster fishery report	Annually*	2-12 months	Hard copy, electronic	100
SFA Annual Report	Annually	6-10 months	Hard copy, electronic	200

Utilization of data

- Fisheries monitoring (CPUE, yield)
- Stock assessment
 - Biomass dynamic models (CEDA)
 - YPR (FiSAT/YIELD)
- Ecological research
 - e.g. Impacts of coral bleaching, tsunami
- Socio-economic studies
 - Linked to fisheries management
- Fisheries development, planning & policy
 - e.g. FDP, Strategy 2017, Fishing capacity policy
- National and international statistical reporting
 - e.g. NSB, FAO, IOTC, SWIOFC, INFOPECHE

Data quality & constraints

- Species aggregation
 - Lack of contrast for surplus production models, species declines masked, underestimation of higher value species (SBS), low ecological resolution
- Spatial & temporal resolution
 - Low reliability of fisher information, sequential fishing, patchiness, VMS needs integration
- Effort resolution
 - Demersal vs. semi-pelagic, trap vs. handline
- Effort standardization
 - Wide range of fishing power with fleet categories

Data quality & constraints (2)

- Parameterization (YPR)
 - Age-derived growth parameters - few indicator species
 - Length-based growth parameters – > 20 key species
 - SRR largely unknown
 - Recruitment variability largely unknown
 - Few reliable estimates of SSB0
- *L. sebae*, *L. bohar*, *P. filamentosus*, *A. virescens*, *A. rutilans*, *E. chlorostigma*, *E. multinotatus*, *E. fuscoguttatus*, *E. tukula*, *P. laevis*, *V. louti*, *L. mahsena*, *L. lentjan*, *L. nebulosus*, *L. variegatus*, *S. ghobban*, *S. rubroviolaceus*, *S. sutor*, *R. kanagurta*, *P. penicillatus*

Fisheries management

Fisheries	Management/regulatory measure (s)	Management Plan
Demersal handline fisheries	Vessel licensing	No
Semi-pelagic handline fishery	Vessel licensing	No
Net fisheries	Vessel licensing, time restriction, mesh size restriction	No
Trap fisheries	Vessel licensing, minimum mesh size	No
Sea cucumber fishery	Vessel licensing, limited entry, gear control, TAC control	Yes, awaiting approval
Octopus fishery	None	No
Spanner crab fishery	Vessel licensing	No
Spiny lobster fishery	Vessel licensing, limited entry, seasonal closures, minimum size restriction, berried female restriction	No

Improved utilization

- Management plans required
 - Cultural barriers, i.e. open access
- Human & technical limitation
 - Few graduate fisheries scientists
- Funding
 - Linkage of fisheries revenue to research
- Collaboration
 - Proactive approach to collaboration with academia & regional programmes
- Improved sampling methodology
 - e.g. increased use of logbooks
- New data management system (FINNS)

Major limitations

- Recreational, subsistence, gleaning and outer island (IDC) fisheries not monitored
- Adaptability poor: New fisheries, boat/gear combinations not incorporated
- Systems not integrated, links to vessel registry and other management systems also needed
- Biological datasets not integrated
- Socio-economic data collection lacking – ad-hoc surveys
- FINNS will address many of these issues

Fisheries information and statistical system (FINNS)

- Software developed by IOTC (from WinTuna)
- Designed modularly
- Central data repository at SFA
- Trip & logbook registries, plus landing, sampling, tagging, licensing, inspection, and infraction modules for the industrial fisheries
- Artisanal vessel registry module complete

- Other artisanal fisheries modules to follow

Regional standardization

- Fisheries data collection:
 - Standardization more important for trans-boundary/migratory stocks & larger fisheries
 - Survey types related to type of fishery/local conditions
 - Metadata standardized
 - Linkages with WIOFISH explored
- Research data (SWIOFP):
 - Standardization important
 - Parameters for analytical stock assessment a priority
 - Standard stock assessment approaches (age vs. length based, otolith-weight relationships useful)
 - Project database & meta-database needed
 - Regional database on demographics & model parameters needed

Transboundary stocks (Demersal/Shelf)

- Continental vs. Island states
- Stock differentiation data needed for certain species & areas
- Meta-populations defined, assessed and managed
- Emphasis on localized stock assessment to account for fine-scale spatial structure & effects
- Ecosystem based management appropriate at population level

Summary

- Data satisfactory for management
- Revision and modernization needed in terms of data collection, management and analysis
- Management plans urgently needed
- Institutionalization of stock assessment
- Enhanced recruitment and retention of fisheries scientists
- Monitoring systems expensive but necessary

NATIONAL REPORT: SOUTH AFRICA

Introduction

Most of South Africa's important commercial fisheries occur outside of the SWIOFC area (see Table1) and are therefore not included in this report. The two South African fisheries (excluding tuna and billfish) that have some connection to the rest of the SWIOFC region include those for linefish and a small multispecies crustacean trawl operation based off the KwaZulu-Natal coast.

South African Linefishery

The South African linefishery is one of the oldest fishing activities in South Africa and is a multi-user, multi-species fishery targeting approximately 200 species of which 95 still contribute significantly to catches. The current fishery may be broadly divided into recreational, commercial and subsistence components. Although many of the species are endemic to South Africa, on the East Coast several important target species are shared stocks with other eastern seaboard countries.

The recreational activity can be split into a number of distinct and definable facets with participants divided into organized anglers affiliated to club structures and a larger component of non affiliated anglers. The majority of recreational activity is angling from the shore or from boats in the marine environment and to a lesser extent in estuaries.

Commercial activity is boat based and operates on the continental shelf between the 2 and 100 m contours and is undertaken by holders of commercial fishing rights. The subsistence component operates in the estuarine and marine environment but is limited to traditional community areas along the eastern seaboard of the country and is predominantly shore angling with a limited component of fishing activity from non motorized small boats.

Quality and availability of fisheries data

Fishery Dependent Data

In the 1970s efforts to develop scientifically based linefish management led to the establishment of a monitoring system by the Oceanographic Research Institute (ORI) for the KwaZulu-Natal recreational linefisheries. Similarly, the then Sea Fisheries Research Institute (now MCM) was collecting catch and effort data from commercial linefishers. These data systems were subsequently merged to form the National Marine Linefish System (NMLS) in the early 1980s, which has since served as the database for all linefish related catch and effort, length frequency and biological data (Penney, 1993).

The NMLS attempts to collate indices of catch and effort from all major sectors in the fishery, across all species and fishing areas. From the commercial fishery, where submission of returns is mandatory, daily catch and effort are reported on a monthly basis from every registered vessel in the fishery. Wherever possible, these data are supplemented by, and validated against, other voluntary submitted data from harbour activity or dealer purchase records.

Recreational data sources comprise voluntary daily catch cards generally issued, controlled and returned via angling clubs necessitating substantial public relations efforts to introduce and maintain data flow. Recreational catch returns are received from the various angling disciplines and cover marine skiboat and light tackle estuarine boating outings and shore angling and spearfishing activities. Angling competition returns are the oldest regular source of recreational data on the NMLS.

The NMLS data have been shown to closely track species targeting by a sector and annual species availability trends. As a result of the multi-user, multi-species nature of the fishery and its national

distribution the quantity and quality of data varies substantially between sectors and regions. Several directed species specific studies have highlight problems with the quality of compulsory and voluntarily submitted catch and effort data returns across all components.

Observer Data

The use of the observer data has developed into an important data source and have proven a viable alternative to voluntary data submission particularly where the cooperation by fishers has declined in response to implementation of ever more restrictive management measures.

Observer data have been collected in KwaZulu-Natal from the 1980s by the then Natal Parks Board (NPB) as a cooperative effort between ORI and NPB, in order to provide a system for monitoring non club affiliated shore angling effort. The shore angling monitoring system by NPB observers has proved successful and was extended to monitor the boat based recreational fishery in the early 1990s (Penney *et al.*, 1997).

Problems with data quality (Sauer *et al.*, 1997) and the added complexity of trying to decipher CPUE trends from a multi-species fishery led to a unanimously endorsement for the development of a national land based observer programme (Penney *et al.* 1997). This programme should make it possible to collect accurate indices of catch and effort necessary to monitor the South African linefishery, and to provide suitable data on size and species distribution and the selectivity of different components for use in linefish stock assessments. The national observer system is currently being developed by MCM and could be implemented during 2007 to address the monitoring of catches from the commercial sector in all regions.

All length-frequency data together with information on catch method, sector, catch area, data and sample weight can be captured on the NMLS. These data can be summarized to provide size composition summaries, but can also be used to convert catch weight data into catch-per-size-class and together with the morphological species data, catch-per-age-class summaries. The NMLS also provides a facility for the capture of standard biological sample data (lengths, weights, sex, maturity and gonad data) per species.

Gaps

Owing to biases associated with voluntary returns and competition data the existing recreational data have many limitations for use in stock assessments. This in conjunction with the limitations associated with the compulsory returns collected from the commercial component (Penney, 1997; Sauer *et al.*, 1997) have restricted the use of the data to evaluating species targets and coarse comparison of total catches between components. Owing to the lack of long-term data suitable for more sophisticated modelling it is probable that most linefish stocks will be assessed using per-recruit analyses (Griffiths *et al.*, 1999).

System used to process, analyse and report on these data

The National Marine Linefish System (NMLS) is a custom developed database written in Delphi and supported by a Sybase database structure. Data are currently recorded by various sectors and data sources. Specific reports have been developed to address the analysis of the data to provide summaries of catches by species and catch-per-unit-effort (CPUE) reporting by sector by species. Furthermore, specific reports address the summarization of size frequency data per species.

The reports can be generated in an Excel spreadsheet format for further processing by end users. The NMLS is earmarked to be rewritten to be compatible with a centralized Marine Administrative System (MAST) which is a relational database linking all facets of Marine and Coastal Managements functions to allow for integrated analysis for management needs of fishery performance and total allowable catch tracking. The scientific databases will provide the information on the catches but

should retain their current capabilities for scientific analysis. The MAST is an Oracle database with web enabled applications.

Ability to use this information to assess the state of fish stocks and provide appropriate management advice

In accordance with the Marine Living Resources Act (No. 18 of 1998), a Linefish Management Protocol (LMP) was developed for the linefishery in 1999 (Griffiths *et al.* 1999); in which regulations are based on clearly defined objectives and quantifiable biological reference points. Due to the many species targeted by the linefishery it will take many years before stock assessments on all species have been completed.

Owing to the large number of species caught in the linefishery, it will take many years for all to be quantitatively assessed. Provision is therefore made for the use of other, less reliable, stock status indicators to develop management recommendations. Rigorous guidelines for the use of indicators are difficult to establish. However, in the absence of defensible assessments, some guidelines are set as a starting point for developing regulatory action. For each indicator there is a condition that can be determined *a priori* that flags stock rebuilding (or a reduction in effort) as the correct option to follow. Stock status indicators must not be used as replacements for assessments, but should be used only in cases where stock assessments have not been performed.

The protocol therefore requires management plans for all linefish species with the development of management measures through stock status evaluated using biologically based stock assessments and interim “stock status indicators” such as historical trends in catch and effort. The relative importance of a species to each of the components and the multi species nature of the fishery has resulted in the determination of research priorities using a Multiple Criteria Decision Analysis (MCDA) approach. The methodology incorporates a number of criteria including catches, existing indications of stock depletion, biological knowledge and endemism (Lambert and Joubert 1999).

Three main assessment methods are recognized as being suitable or potentially suitable for the assessment of linefish stocks:

- (i) Per-recruit analyses;
- (ii) Dynamic, age-structured production modelling;
- (iii) *Ad hoc* tuned Virtual Population Analyses (VPA).

Each of the above assessment methods has specific data requirements; increasing in quantity and complexity along the progression from per-recruit methods, to age-structured production models and VPA analyses. Considering the range of life-history strategies used by linefish species (including adaptations such as sex-change, slow growth, residency, spawning aggregations, multiple stocks), the large number of species involved and the paucity of quality fishery data, sophisticated stock assessment methods are currently impracticable for most linefish resources. Without long time-series of accurate catch and effort data or information on the spawning-stock recruitment relationship, yield per-recruit (Y/R) and spawner-biomass per-recruit (SB/R) models are the most appropriate stock-assessment methods available.

These methods incorporate the interplay between somatic growth and mortality in order to project the lifetime yield and spawner biomass of a single recruit, under various combinations of instantaneous fishing mortality (F) and age-at-first-capture (t_c). Although per-recruit models do not incorporate stochastic variation in recruitment strength, they do allow for the quantitative assessment of the desired level of exploitation, on a relative basis, and for the comparison of different management options. Per-recruit methods are also flexible and can be tailored to accommodate complex life-history strategies and fisheries that target different stages of the life-cycle.

View on standardization of data collection methods and establishing regional data systems

Given the complexities highlighted above it will be difficult, but not impossible to establish a regional data system for linefish. What is required is a clear understanding of what information is required and how it will be analysed (see above discussion on per-recruit analyses; dynamic, age-structured production modelling and *ad hoc* tuned Virtual Population Analyses). The use of trained observers and hand-held electronic data storage/collection systems may be of importance here.

Comment on information on fish population biology used to parameterize fishery management models

Linefish have a wide range of life-history strategies including adaptations such as sex-change, slow growth, residency, spawning aggregations and multiple stocks. A basic understanding of the life history strategy of a species/group of species is therefore an absolute prerequisite for any successful management intervention.

Information needs for transboundary stock management issues –stock identification and separation

There is little information on connectivity between South African stocks and those to the north. Genetic studies (most likely at micro satellite level) are required for stock identification.

Multispecies Crustacean Trawl Fishery

A small multi-species crustacean trawl fishery operates off the KwaZulu-Natal coast. While various prawn species are the most important commercial targets, both crab and lobster catches are important on occasions.

Quality and availability of fisheries data

There is good, continuous crustacean data on landings, catch composition of landings and effort from 1990 onwards. The bycatch/discard information is however discontinuous. Bycatch information for the shallow water component of the fishery is available from 1989-1992. Bycatch information for both the shallow and deep-water components (based on 60-100 trawl days per year) is available from 2003-2007. The use of observers to collect bycatch information has proved to be most valuable.

System used to process, analyse and report on these data

The prawn data base is an excel (Access data base). Standard reports on trends in catch, effort and CPUE for the major target species are compiled annually.

Ability to use this information to assess the state of fish stocks and provide appropriate management advice

The fishery is currently managed in terms of TAE (number of vessels). A surplus production stock assessment is being undertaken this year, using subsets of the crustacean trawl system data.

View on standardization of data collection methods and establishing regional data systems

One of the major obstacles to standardization in the prawn trawl fisheries is the use of various gear types and the units used for measuring CPUE. Although cross calibration of gear types may provide a solution it may prove an expensive option. The use of trained observers and hand-held electronic data

storage/collection systems to collect landing and bycatch data may assist in the standardization of data collection.

Comment on information on fish population biology used to parameterize fishery management models

A basic understanding of the life history strategy of a species/group of species is essential for any successful management intervention. In South Africa biological data for the target species were collected in the 1970s and from 1995-1997 although some important aspects still remain unknown. Biological data on the main fish bycatch species were collected from 1989-1992.

Information needs for transboundary stock management issues –stock identification and separation

There is little information on connectivity between South African stocks and those to the north; some target species occur all the way up to Tanzania as well as around Madagascar, but there is little understanding of the degree of stock separation, particularly for the deep-water target species. Genetic studies (most likely at micro satellite level) are required to shed light on these relationships.

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Table 1. Databases in South Africa

DEMERSAL TRAWL	5
Hake deepsea trawl	
Hake inshore trawl	
Horse mackerel	
Shallow water shrimp	
Deep water shrimp	
SMALL PELAGIC (sardine & anchovies)	1
ROCK LOBSTER	3
South Coast	
West Coast (nearshore + offshore)	
Natal (Experimental)	
ABALONE	1
NETFISH	1
SUBSISTENCE FISHERIES	VARIOUS
LINEFISH	5
Traditional	
Commercial	
Hake handline	
Tuna Pole	
Recreational	
Squid	
LONGLINE	3
Hake	
Shark	
Large Pelagics	
PATAGONIAN TOOTHFISH	1
OTHER	5
Invertebrate shore based harvesting	
Subsistence database	
Commercial oyster	
Seabird diet	
Turtles nesting	
Physical oceanography	
SPECIFIC BIOLOGICAL DATABASES	
Numerous	

TANZANIA NATIONAL REPORT ON FISHERIES DATA MANAGEMENT

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Background information:

The United Republic of Tanzania is a coastal state located in Eastern Africa lying between 29° and 49° East longitude and 1° and 12° Latitude South of the Equator. The country borders Kenya and Uganda to the north, Rwanda, Burundi and the Democratic Republic of Congo (former Zaire) to the west and Mozambique, Zambia and Malawi to the south, while the Indian Ocean occupies the Eastern side of the country (particularly the South Western Indian Ocean).

The Country is well endowed with both marine and inland water resources. The marine territorial water area is 64 000 km² with a total coastline of 1 450 km. The Exclusive Economic Zone (EEZ) has a total area of 223 000 km². The marine coast is occupied by about 9 million people (Census, 2002) who depend very much on fisheries and other coastal activities.

The fishery of Tanzania is mainly artisanal with very few commercial/industrial targeted specific species e.g. prawns fishery and tuna like species for the territorial sea and deep sea fishery respectively. Both artisanal fishermen and industrial trawlers are harvesting the marine fishes which includes crustaceans (prawns and lobsters), cephalopods (squids and octopus), bony fishes (flat fishes, snappers, groupers, sardines, mackerels, tunas and tuna like species), rays, sharks among others. The artisanal fishermen can only operate in the shallow waters because of poor fishing craft.

The artisanal fisheries lands almost all the freshwater and most of the marine catches (Table 1) and is consequently much more important. Apart from the data collected in the Exclusive Economic Zone (EEZ), the artisanal fisheries accounts for more than 99 percent of the country's total catch (Table 1).

Table 1: Total Fish Production 1999–2006

Years	FRESH WATER Weight in metric tons	MARINE WATERS Weight in metric tons	INDUSTRIAL (Trawlers)		
			Prawns	Fish (bycatch)	EEZ
			Weight in metric tons		
1999	260 000.0	50 000.0	613.4	592.8	-
2000	271 000.0	49 900.0	909.7	958.1	-
2001	283 354.0	52 934.9	1 193.7	1 010.3	2 506.0
2002	273 856.0	49 674.5	926.1	295.1	4 456.0
2003	301 855.0	49 270.0	1 320.1	931.2	14 916.5
2004	312 040.0	50 470.0	661.2	862.4	48 833.5
2005	320 566.0	54 968.6	467.0	869.0	12 984.4
2006	292 518.7	48 590.5	312.1	792.6	6 346.0

Fisheries statistics:

The fishery resources of Tanzania have been monitored before 1960s (Sobo and Mgaya 2005), and the estimated fish productions have been used in planning and management of fishery resources. Fisheries Division is the custodian of fisheries statistics in Tanzania and also deals with all matters related to fisheries sector. TAFIRI as a fisheries research institution, collaborate with Fisheries Division to make sure that, fisheries statistics are assembled in an accurate way and on timely fashion. Unfortunately, the manpower and capacity for data collection and analysis is lacking in the Fisheries Division.

During the centralized administration system (1980s), there was a strong formal link between Fisheries Division and regional/district administrations. Regional/district fisheries officers and their subordinates were answerable to Fisheries Division. Therefore in every landing site field officers were employed at the district level (during that time) as data enumerators. Apart from other fishery related activities, data collection was the main/core activity of the field officers.

The artisanal fisheries data are collected on a sampling basis. The primary sampling unit is the landing site. From a list of landing sites obtained from the frame surveys, a number of landing sites are randomly selected (22 are sampled in marine waters). The secondary sampling unit is the day. The data are collected for 16 days per month, which are selected randomly.

In 1995, the formal link between Fisheries division and regional/district administration was broken, following the implementation of a decentralized administration system, whereby regional/district fisheries officers (and their subordinates) were no longer answerable to Fisheries Division. In 1996, many of the district field officers were laid off at the district level, leaving the data collection activity unperformed. The remaining officers cover all of the many functions coming under the heading of "fisheries"; e.g., registration of fishermen, fisheries regulations and their surveillance, fishermen's affairs, advice on resources and their assessment, marketing, aquaculture (seaweed farming) and tax collection at the landing beaches for the district administrations. As a result, limited amount of data (from sampling sites) have been collected and in some sampling sites where data enumerators have been laid off the data are simply not collected.

Fisheries Division of the Ministry of Natural Resources and Tourism has been working with other stakeholders like FAO (Strengthening fisheries statistics unit), SADCC (Regional Fisheries Information Systems (RFIS)) since 1989 to 2001 in an attempt to re-establish a functioning national fisheries information system and produce annual reports on national fisheries statistics.

The National Fisheries Policy and Strategy Statement (1997) also spell out the need to improve the knowledge of the fisheries resource base and on proper information management. Due to this, proper, accurate and up to date information on the resource base is of vital importance. The policy put emphasis on information collection and processing for fisheries management purposes. Currently, the fisheries data collection and processing system is based on sampling in time and space i.e. Sampling days and selected landing sites. The system is updated from time to time depending on necessity and availability of funds.

Type of data collection

1. Frame survey data

Frame survey is an inventory of fish producing factors such as number of landing sites, number of fishermen, number of fishing vessels and gears by type and size. It is also a description of fishing and landing activity patterns, processing and marketing patterns, as well as describing supply centre for goods and services (FAO, 1998). The frame survey also refers to a fisheries census which is mainly the fishing effort obtained by complete total enumeration. Frame Survey data is always used to raise estimates of catch data obtained from sampling at selected landing sites to estimate the total catch.

Frame survey is conducted on biannual basis. However, sometimes the survey is delayed due to logistic problems, as was the case in 1995, 1998, 2001 and 2005 in marine waters (Table 2).

The overall objectives of conducting fisheries frame survey are:

- To secure data on the current number of fishermen, number of fishing vessels, number of fishing gears by type and size and some socio-economic information (available facilities) at the landing beaches on the composition, magnitude and distribution of fishing effort to guide development and management of the fishery.
- To provide a "raising factor" for estimation of the country total artisanal fish catch production from the sampling data.
- To provide sampling frames (comparison) for various surveys being conducted and those to be conducted in the future.
- To provide data that can be used for estimation of fish stock (stock assessment).

Table 2: Fishing effort 1995 – 2005

Items	Years			
	1995	1998	2001	2005
Number of fishermen	13 822	20 625	19 071	29 754
Number of fishing vessels	3 768	5 157	4 927	7 190
No. of Outboard engines	272	463	336	507
Number of Inboard engines	34	55	51	53
Gears by type:				
Gill nets:	4 120	9 125	5 136	18 802
Shark nets	3 357	3 463	2 852	8 820
Traps	3 390	5 299	5 557	5 907
Hand lines	7 839	9 383	13 382	14 980
Long lines	1 575	11 734	5 272	53 549
Beach seines	350	319	485	453
Cast nets	49	0	173	73
Ring nets	221	128	224	370
Scoop nets	75	256	252	710
Purse seine	350	15	68	0
Fixed fences	25	254	72	14
Spears	134	0	496	350
Industrial trawlers		17	20	20

2. Catch assessment survey data:

Another type of data collected from artisanal fisheries is the catch assessment survey. These are landing surveys which are conducted at selected/chosen landing sites. The collected information include data on catch, species composition, associated effort, and other secondary data such as prices, weight of fish and number of fish caught for big size fishes (Appendix 1). The main objectives of the catch assessment survey data are:

- To provide total fish production (by all species, all boats and all gears) by weight and value per district, region, water body and for the whole country.
- To provide total fish production by species (caught by specific boat/gear type) in terms of weight and value.
- To provide Catch per unit effort (CPUE) i.e. average catch per fishing boat or fishing gear and even average per fishing hours.
- To provide biological parameters, this will give out yield per recruitment and value per recruitment analysis for the most important commercial species. However, this parameter is not yet being collected.

Catch and effort data are collected on sampling basis. The primary sampling unit is the landing site where by few landing sites were randomly selected from a list obtained during the frame survey (The first selection was done in 1991 when TANFIS was introduced). Sometimes, the selection is not random due to accessibility, conditions of the landing sites; permanent or temporary sites and size and type of fishing activities. In marine waters, up to now, there is a total of 22 landing sites where data is collected on a daily basis out of 259 landing sites observed during 2005 Frame survey. The secondary sampling unit is the day. The data are collected for 16 days per month, which are selected randomly.

With the collected catch data and frame survey, which is used as a raising factor, the two are used to estimate the total fish production obtained from artisanal fishing. Previously, the data were analyzed at Fisheries Division through Dbase II program called Tanzania Fishery Information Systems (TANFIS) which was introduced by FAO during the implementation of UNDP/FAO funded project "Strengthening Fisheries Statistical Unit" (URT/016/89). The project came to an end in 1994 but the program was used up to 1996. From early 1997 the program was unable to analyze any data due to the following constraints; the program (TANFIS) was incompatible with new MS Windows versions and the computers used were broken. In addition there was no repair due to lack of funds at the Fisheries Division. Part of the problem is lack of programmers at Fisheries Division as most of staff from statistics unit is marine biologist by profession.

Before 1996, the Fisheries Division had been looking for means to improve the reliability of artisanal fisheries statistics. The shift to decentralized administration structure in 1996 discussed above has made this work very difficult. In 2000 a Regional Fisheries Information System (RFIS) under SADC project, was established (SADC, 2002). The purpose of the project is to provide timely, relevant, accessible, useable and cost effective information to improve the management of marine fisheries resources in the Southern African region (Kenya, Tanzania, Seychelles, Madagascar, Mozambique, South Africa, Angola and Namibia). A Catch Assessment Survey (CAS) database in MS Access was developed. The database was based on the same main principles employed in Tanzania i.e. intermittent frame survey and collection of catch data from selected landing sites on selected days. It replaces the TANFIS program that was originally designed by FAO.

Before the completion of the database, the consultant left the project, and therefore the system failed to work properly. The system (CAS database) was modified and finalized by expert consultants from UNU – FTP with request from the Fisheries Division. However, the system worked for 2006 only and in 2007 the New CAS was introduced.

The New CAS system introduced in 2007 is based on the same FAO, SADCC and UNU-FTP foundations but the programmer simplified the system and made it user friendly. Since the New CAS is the modification and simplification of the old system, there is nothing new in the system. The database is housed at the Fisheries Division where the data will be analysed centrally, backed up for privacy, easy storing, recovering and security of the data. A tailor made training course was conducted for 10 days in April 2007 and 10 data entry personnel were trained from 5 coastal districts.

The data are collected on sampling basis and data input is done in five coastal districts which belong to five administrative regions. The five computers were obtained from IOTC/OFCF (Indian Ocean Tuna Commission/Overseas Fisheries Cooperation Foundation) project with its headquarters in Seychelles. The project has an overall objective of improving the quality of fisheries statistics especially tuna statistics in the Indian Ocean.

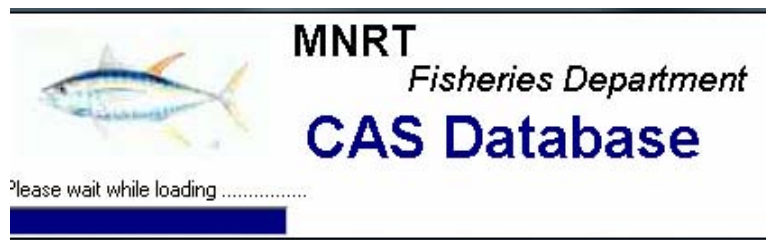


Figure 1: New CAS database

The data for marine waters are entered in the districts to simplify heavy workload for Fisheries Division headquarters. The data are entered into two forms i.e. Catch details and Fishery inventory forms (Fig. 2 and 3) whereby Catch Assessment Survey and frame survey data are entered respectively. In each month, the districts have an option to validate the data locally, and there is also a flexibility for district analysis to cater for their needs eg. for the purpose of co-management.

Figure 2: Catch detail form

Figure 3: Fishery inventory form

3. Tuna data collection:

For the EEZ data where all tuna fisheries are licensed, the data are collected through logbooks. Each month the licensed vessels are supposed to report tuna catches to the Fisheries Division based on a special logbook provided. Unfortunately, most of the vessels do not bring back the given logbook to the Fisheries Division instead they present summary catch forms which are difficult to analyse. However, the reported data are analysed at Fisheries Division by total enumeration according to species (Figure 4).

The government is in the process of establishing a Deep Sea Fishing Authority under Division of Fisheries. This effort is being facilitated by the MACEMP project. The main responsibility of a deep sea fishing authority will be to monitoring of the deep sea fishery.

Issues in data collection and analysis

- a) Lack of data enumerators – The major constraints on the evaluation and analysis of fisheries data in artisanal fisheries is that the Fisheries Division does not have capacity to employ data recorders, i.e. lack of fisheries data enumerators. This has resulted in data not being collected in some areas due to lack of staff. Currently fisheries data enumerators are employed by respective district authorities and not the Ministry responsible for fisheries, which makes them answerable to their employer and not the Fisheries Division. As a result they are assigned other duties such as revenue collection and fisheries data collection is not given priority. This has resulted into inaccurate, inadequate and unreliable information hence leading to poor management of the resources.
- b) In the EEZ, there is no observer program due to financial constraints. There is lack/insufficient monitoring equipment - Vessel Monitoring System was installed but not yet operational
- c) Lack of EEZ fish landing port and facilities thus all catches are landed outside the country thus no landing data available
- d) Inadequate and insufficient data reporting both in artisanal and in the EEZ
- e) Lack of data collecting facilities e.g. bicycles for enumerators and motorbikes for District Fisheries Officers who pick the data from distant areas (sampled landing sites) to the office where data are analysed. There is also lack of data processing equipment e.g. Computers.

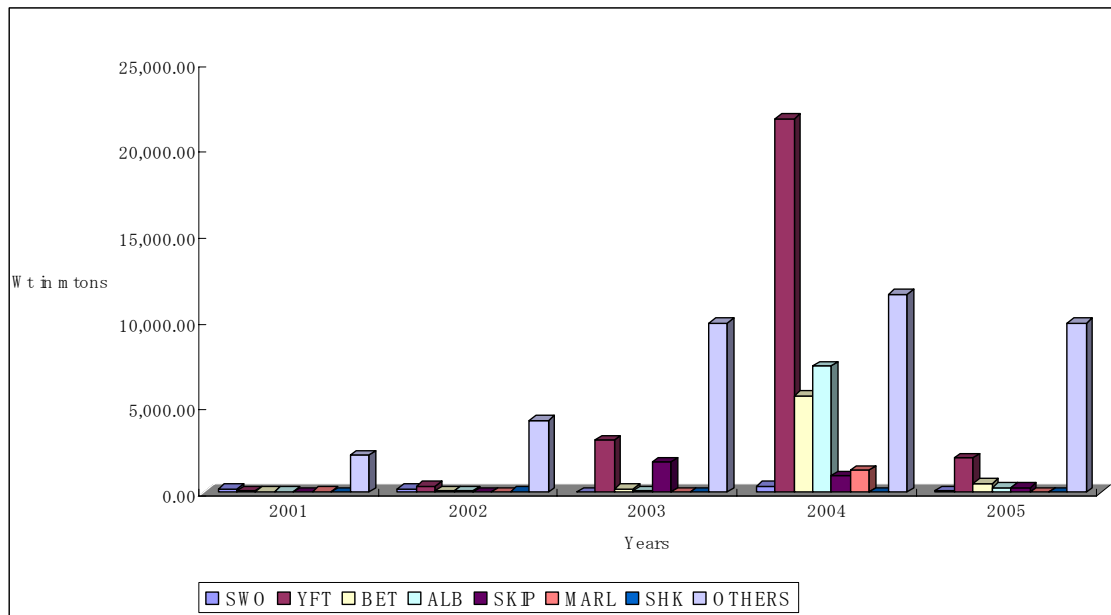


Figure 4: Tuna catches 2001– 2005

- f) It has recently being realized that, species local names differ from one place to another thus making it difficult during data analysis. Efforts are being made to identify site specific species names and harmonized at the national level.

Uses of fisheries data:

Since 1996, fisheries statistical reports have ceased to be published and hence not disseminated to various stakeholders. As a result, the provisional information being used, does not really represent the actual situation which can be used in planning, development and management of the fisheries sector. For instance fisheries statistics for 2006 in Dar es salaam region were under estimated because only one district out of three submitted data to fisheries division, the other two districts did not collect any data due to lack of enumerators. To make matters worse, the resource base (stock assessment) is not well known as the last stock assessment survey was carried out during 1980s. Currently, TAFIRI is carrying out stock assessment survey on three pilot districts falling under the Marine and Coastal Environment Management Project (MACEMP).

The analysed fisheries information cannot be used to assess the state of fish stocks. This is due to the fact that, the collected information is insufficient as a basis for proper management of the fishery resource. For proper management of the fishery, economical and biological monitoring should be gathered together. Economical data will give clear picture to industry fishery while biological data are useful in estimating specific biological parameters that are useful in fish stock estimation. Together, they both provide basis for suggesting fisheries management strategies.

Recommendations:

1. The South Western Indian Ocean being a shared ecosystem requires a collective approach to deal with its shared fishery resources. There is therefore a need to harmonize datasets, collection procedures and data analysis methods so that management strategies can be implemented harmoniously.
2. The idea to introduce standardization of data collection methods and establishing regional data system, is good provided all concerning countries should agree on modalities and

logistics be set for all nations to follow. For instance, the Lake Victoria riparian states of Tanzania, Kenya and Uganda have standardized collection of fishing effort and have come up with one standard system.

3. During collection of fisheries statistics, various species are grouped into family groups. There is a need to classify further into species level. Hence making it difficult to assess the stock according to species and to make any decision on total allowable catches.

Conclusion:

The existing management regime is based on open access and community management. Government should take steps to eliminate this common property right. The government should establish a license control mechanism. It is important to find out the total number of fishing vessels operating in the fishery. Then, entry into the fishery can be closed for the new comers at least up to 2008, but existing licenses should be tradable. Those who need fish for home consumption only should be given limited permits. This might be the start of the introduction of total allowable catch (TAC). With accurate and reliable data it will be easier to know exactly how much should be taken out from the stock. By making use of TAC and property rights such as licenses, policy makers may be able to maintain a desired fishing effort so that the fishery operates at the reasonably efficient point from the social perspective.

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DATA COLLECTION IN YEMEN

General information

- The Republic of Yemen is located in South Arabia, between the Arabian Sea and Aden River in the south and the Red Sea and Indian Ocean in the West.
- The coastline is about 2 500 km².
- The area covered by water is 600 000 km².
- The population is about 20 million and 70 000 of these are fishers. In the coastal area there live 9 million people.
- There are 10 coastal regions
- The fishers work exclusively in the fishery activity and they are organized into 130 cooperatives. All the cooperatives work together in helping the fishers.
- Within the fishing area these cooperatives have 17 000 boats in all.
- In Yemen there are more than 360 fish species plus other fisheries resources.

Fisheries areas

- The coastal zone borders to the Aden Gulf, Arabian Sea and Red Sea, among many islands lays one in the Indian Ocean, the Great Socotra.

Fisheries sector

- Artisanal fisheries
- Industrial Fisheries
- Aquaculture Fisheries
- Factories (three) for Tuna processing

Aquaculture since 2005

The Ministry of Fish Wealth have invested in Aquaculture and established 14 new places along the coast. In the future aquaculture represents a new economical potential for Yemen fisheries.

Data collection

- The data collection in Yemen before 1990 produced only scarce data, after 1996 the data becomes better.
- The artisanal fishery is responsible for 98 percent of the total catch. In all the landing centres there are cooperatives and data collectors from the Ministry of Fishery who registry the catch and effort (nobody can sell the fish before they register the catch), the data collected is e.g. engine power, fishing site, fish species and consumption.
- There is one office in each coastal region were the data collectors are based and after collecting the information they send it to the Ministry of Fisheries.
- At every landing centre there is a system for fridge-transport (cars/trucks) that can take the fish to the market.
- There is no database, the information is recorded in Excel programme
- The results are produced every third month and are organized in :
 - Catch
 - Fishing effort
 - Price
 - Export
 - Species composition
 - Aquaculture productions

- Record from the three Tuna manufacture companies (these companies produce 30 million tuna cans per year).

Needs

- Database creation
- Record of biological information
- Stock assessment (creating technical capacity)
- Improving aquaculture

Total catch (in tonnes) in 2005 and 2006

Groups/Sectors	2005	2006
Demersal	216 263	184 623
Deep Sea	1 547	26 382
Other (includes cephalopods)	21 035	18 655
Aquaculture		400
Total	238 845	230 060

Artisanal catch (in tonnes) by coastal region in 2006

Sucatra	Haja	Hodida	Taiz	Lahaz	Adin	Abian	Shabwa	Hadromot	Almahra	Total
2 488	1 426	22 341	3 954	9 166	13 790	13 618	9 479	47 895	100 003	224 160

The first Working Party on Fisheries Data and Statistics was organized by the Kenya Marine Fisheries Research Institute. It was attended by participants from Comoros, France, Kenya, Madagascar, Maldives, Mauritius, Mozambique, Seychelles, South Africa, Tanzania and Yemen. The Working Party received national reports of each of the countries and examined the status of fisheries catch and effort data and statistics. It discussed minimum data requirements for effective fisheries management in five generic fisheries types: industrial shrimp, artisanal shrimp, trap fisheries, demersal line and beach seine fisheries.

A list of meta data fields was presented to assist member countries provide data to the regional data coordinator of the South West Indian Ocean Fisheries Project in order to set up a regional meta-database. The availability of relevant regional and global information systems was discussed. The Working Party made recommendations on improving the situation of fisheries data and statistics for the consideration of the Scientific Committee of the South West Indian Ocean Fisheries Commission.

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