**MALDIVES**

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

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INTRODUCTION

Republic of Maldives is an archipelago of 26 natural atolls consisting of 1190 coral reef islands. There are 200 in habited 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.
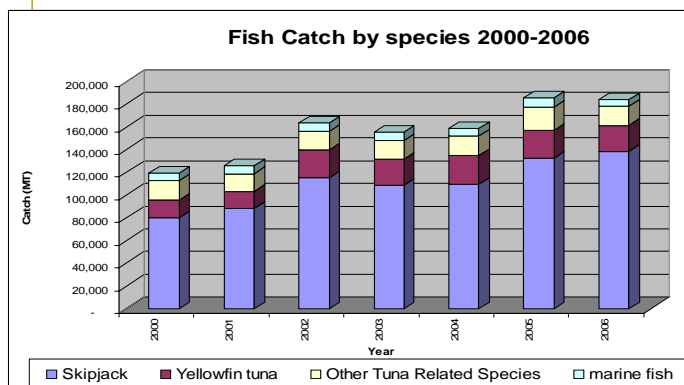
DATA COLLECTION IN MALDIVES
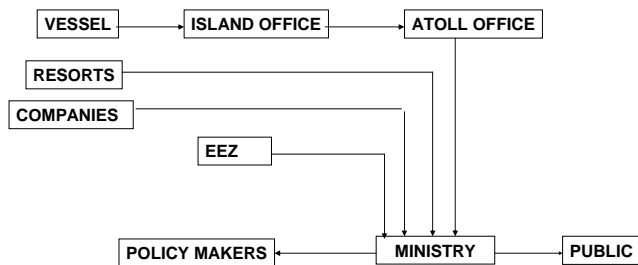
QUALITY OF DATA

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 km^2 of area of which 100 000 km^2 is covered by marine water, 13 000 km^2 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 in 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 in 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 send 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 envolved in Data Collection in the Artisanal Fisheries

	N^o	total annual cost in USD
Samplers	130	125042
Assistants	41	29862
total	171	154904
Technicians envolved	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 acessibility;
- 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 *Aristaemorpha 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)
Demersal handline fisheries	*Lutjanidae, Lethrinidae, Serranidae*	*Whaler, schooner*	*Handline, dropline, electric reels*	*1642*
Semi-pelagic handline fisheries	*Carangidae, Scombridae*	*Whaler, schooner*	*Handline*	*1434*
Net fisheries	*Rastrelliger kanagurta, Selar crumenophthalmus*	*Mini-Mahe*	*Encircling gillnet, Beach seine*	*683*
Trap fisheries	*Siganidae, Scaridae, Mullidae*	*Mini-Mahe, whaler*	*Traps (active and static)i*	*358*
Sea cucumber fishery	*Holothuridae, Actinopyga* spp.	*Schooner whaler*	*SCUBA*	*c.75ii*
Octopus fishery	*Octopus vulgaris*	*On foot*	*Harpoon*	*34*
Crab giraffe fishery	*Ranina ranina*	*Schooner*	*Hoop-tangle net*	*18*
Spiny lobster fisheries	*Panulirus* spp.	*Mini-Mahe*	*Snorkelling Traps*	*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 (1º & 2 º), 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)
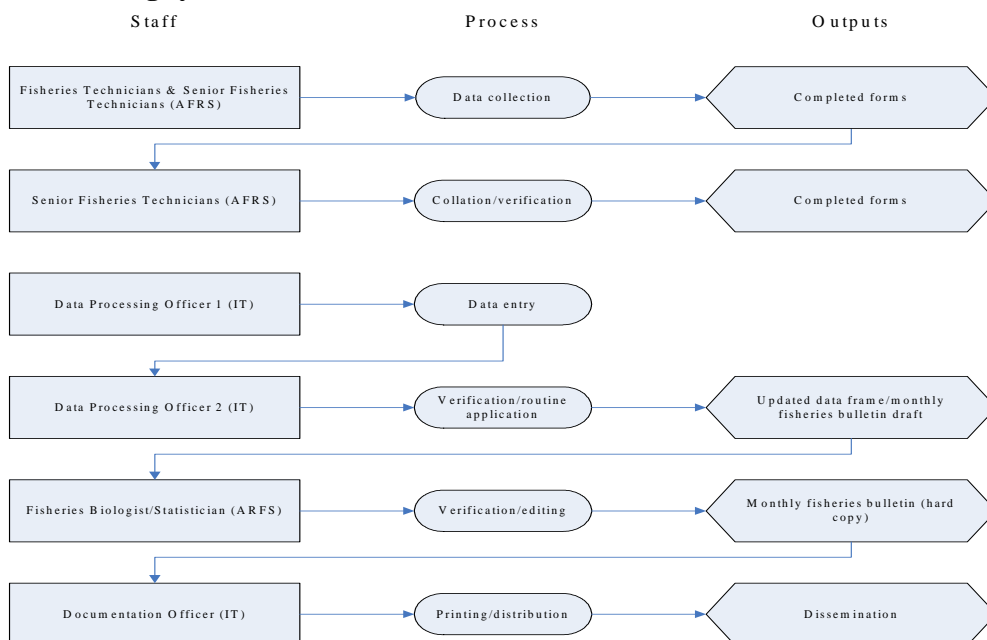
Schooner Handline Survey:
- Multispecies (31 species/groups, low aggregation)
- Handlines (drop lines, reels) - demersal/semi-pelagic spp.
- Monthly data entry/analysis 'SCHOONER' (FoxBase)
- 5 step routine
- Monthly estimates, of:
    - total catch by species-group
    - total effort, mean effort & 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)

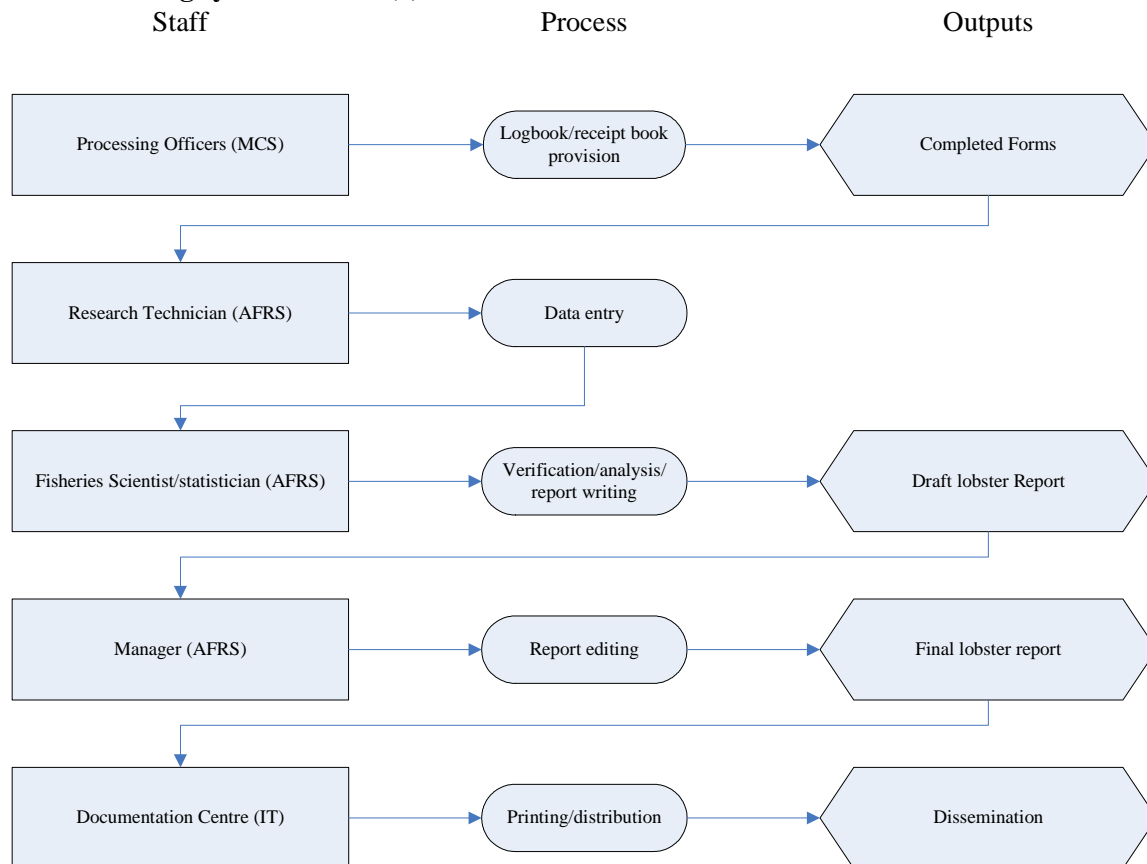| Staff	Process	Outputs
Fisheries Technicians & Senior Fisheries Technicians (AFRS)	Data collection	Completed forms
Senior Fisheries Technicians (AFRS)	Collation/verification	Completed forms
Data Processing Officer 1 (IT)	Data entry	
Data Processing Officer 2 (IT)	Verification/routine application	Updated data frame/monthly fisheries bulletin draft
Fisheries Biologist/Statistician (ARFS)	Verification/editing	Monthly fisheries bulletin (hard copy)
Documentation Officer (IT)	Printing/distribution	Dissemination

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)

Staff	Process	Outputs
Processing Officers (MCS)	Logbook/receipt book provision	Completed Forms
Research Technician (AFRS)	Data entry	
Fisheries Scientist/statistician (AFRS)	Verification/analysis/ report writing	Draft lobster Report
Manager (AFRS)	Report editing	Final lobster report
Documentation Centre (IT)	Printing/distribution	Dissemination

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)

Staff	Process	Outputs
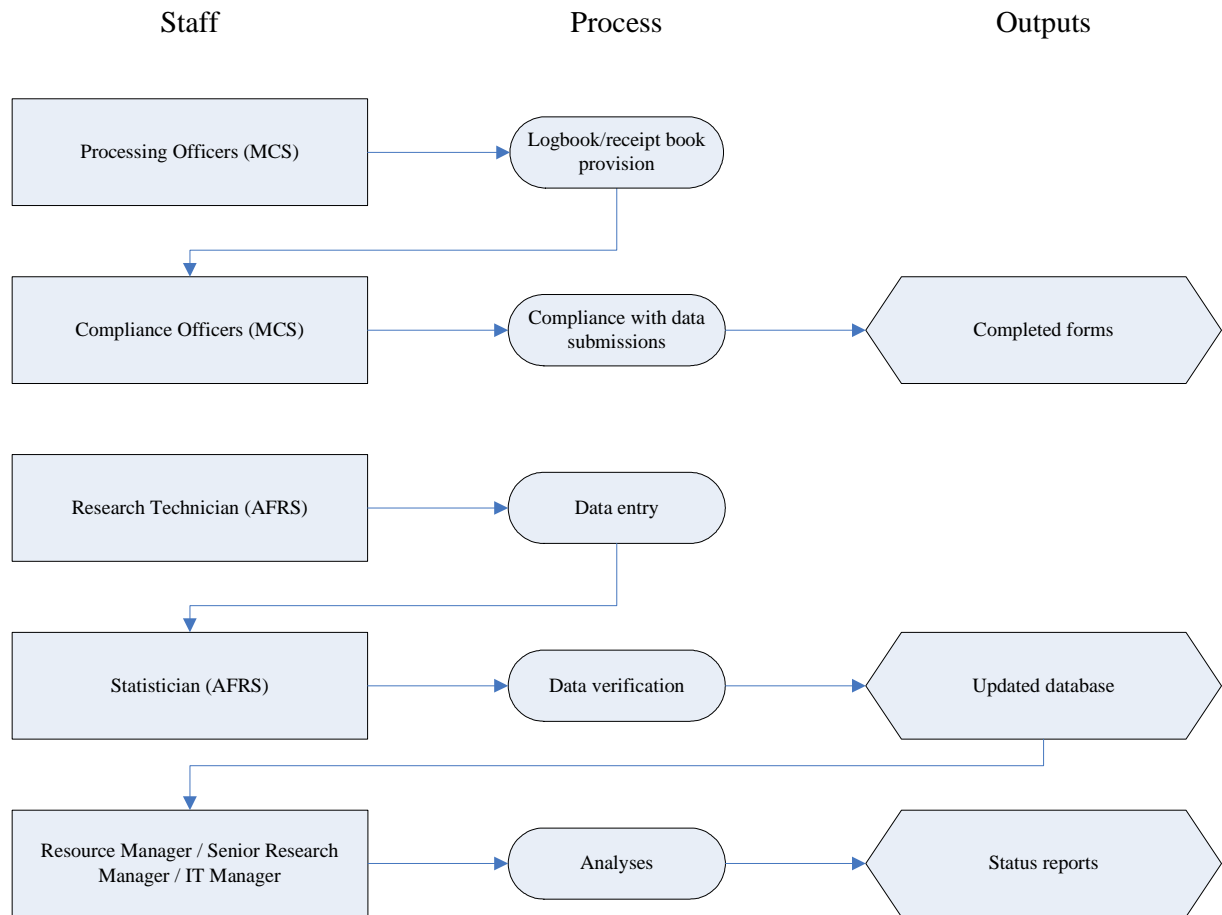
Reporting & dissemination

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. rubrovioloceus, 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 <u>not</u> 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 a*d 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	MARINE WATERS	INDUSTRIAL (Trawlers)		
			Prawns	Fish (bycatch)	EEZ
	Weight in metric tons		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 form 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 sytem (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.
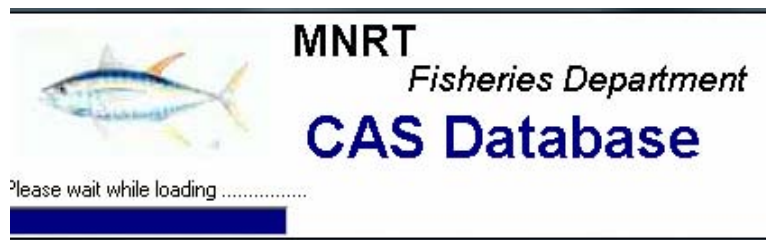

Figure 1: New CAS database

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 inventroy forms (Fig. 2 and 3) whereby Catch Assessment Survey and frame survey data are entered respectively. In each month, the districs 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.
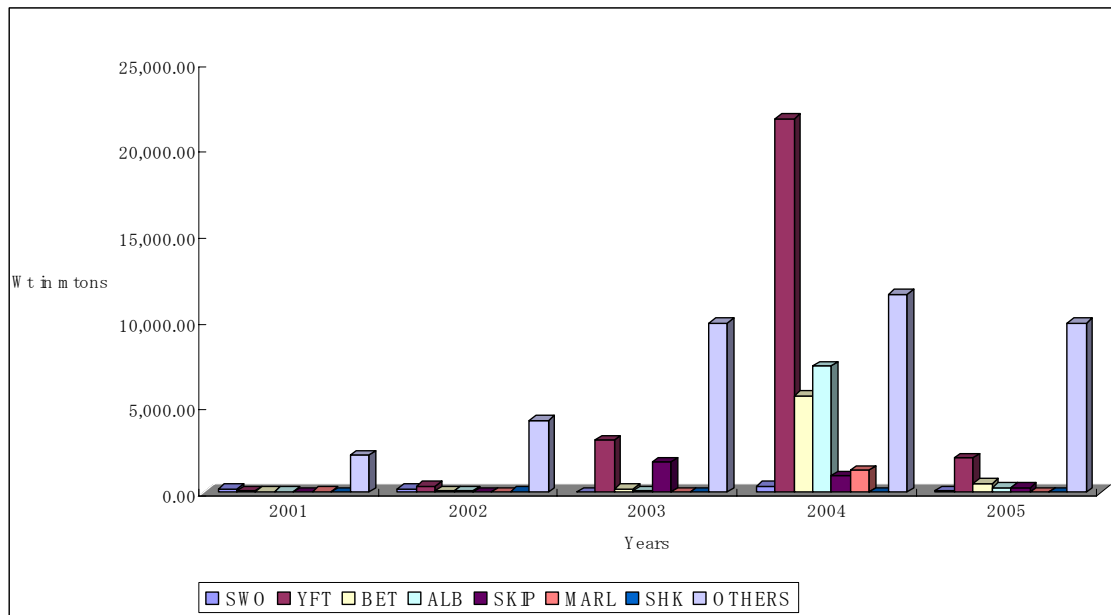
Figure 4: Tuna catches 2001– 2005

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 establishing 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 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-transports (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.