

TECHNICAL PAPER 2.

AN OUTLINE OVERVIEW OF ISSUES OF CONCERN TO FISHERIES MONITORING, CONTROL AND SURVEILLANCE IN THE NORTHWEST INDIAN OCEAN

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MANAGEMENT ISSUES

Although the objectives of fisheries management are often perceived differently by the many persons involved in the activity, it is generally recognized that long-term sustainable use of fisheries resources is the overriding objective of conservation and management, and that appropriate management measures should be adopted on the basis of the best scientific evidence available, taking into account relevant ecosystem, environmental, economic and social factors. In practice, governments often give less emphasis to biological considerations or economic performance, or both, in favour of considerations of reducing conflicts in the fishery. Nevertheless, a number of governments and authorities now perceive the advantages of formulating a fishery management plan for each fishery, which may be amended either annually or at appropriate times to take into account the changing resources and fishery situation.

Authorities are gradually learning about the precautionary approach to management and exploitation of living aquatic resources (as set out in the FAO Code of Conduct for Responsible Fisheries), which could provide a basis for setting the framework in which stocks are protected and the aquatic environment is preserved. The absence of adequate scientific information should not be used as a reason for postponing or failing to take conservation and management measures. In operating the precautionary approach, States should take into account such reference points as levels and distribution of fishing mortality and the impact of fishing activities, including discards, on non-target and associated or dependent species, as well as environmental (including biodiversity) and socio-economic factors.

The adoption of conservation measures that regulate fishing activity (e.g., closed seasons and areas, restrictions on types and use of gear, etc.) may be used in conjunction with effort reduction programmes, to avoid overexploitation. However, used alone, they fail to address causes of the management problem, which often includes excess capacity. In the absence of effort reduction (or, at the very minimum, freezing it at present levels, associated with controls) the long-term prospect is often poor for improvement in the status of stocks and associated sustained welfare gains for fisherfolk.

Management approaches for artisanal and industrial fisheries will be different, but the principles upon which management arrangements are based will be similar. Moreover, the implementation of arrangements for artisanal fisheries will be more difficult to achieve than in the industrial fishery, principally because of the larger number of fishers and fishing units involved. Where industrial fisheries are unmanaged, or poorly managed, overcapitalization could occur and

capital may not receive an economic return, with the result that subsidies will often be paid to financially support their operations. Subsidizing fleets can exacerbate fisheries management problems.

The implementation of management arrangements or plans often poses difficult decisions about access arrangements and resource allocations, and in most instances the need to exclude individuals already operating, or intending to operate, in a fishery. Moreover, it is not possible to concurrently satisfy the interest of all groups involved in the sector, and for this reason opposition to the introduction of management measures often results; however, in many countries it has been shown that when fisherfolk are closely involved in formulating management measures and implementing the whole process, then fishery management can be better than when civil servants alone take decisions. It hardly needs to be said that without a strong political commitment to fisheries management, the structure of management plans may well fail at the implementation stage.

Monitoring, control and surveillance (MCS) programmes are required for fisheries both under national jurisdiction and on the high seas, as an integral component of management, and these programmes are required to ensure that management arrangements, once in place, are observed and not undermined by non-compliance (i.e., failure of fishers to abide by local and national laws, sub-regional or regional conventions, licensing terms and conditions, management requirements, etc.). However, it should be clearly understood that there is a need to build consensus among external and local resource users to increase compliance, rather than rely exclusively on the repressive side of enforcement of sector policies.

Countries may decide to undertake MCS in their territorial seas and adjacent EEZs with specific regard to (i) fisheries (to ensure that information necessary for fisheries management is collected, and that such programmes are implemented and observed), or (ii) as part of an integrated or multi-task national administration and security activity (concerning exercise of sovereignty and law enforcement, customs and immigration duties, etc.). The approach adopted by a country is likely to reflect the economic importance of its fisheries sector, because there is little sense in having an elaborate MCS activity if its "maintenance" costs exceed national revenue from the sector.

This paper does not describe in detail the background to MCS in every country of the region, but it does attempt to highlight the principal issues that need to be addressed by fishery managers when using MCS to assist them in their task.

SOME MCS COUNTRY ISSUES OF INTEREST TO THE REGION

In the northwest Indian Ocean, there are similar concerns about fish resources and the need to ensure their sustainability as in other parts of the world. Fisheries involve not only exploitation of resources in inshore waters with simple craft and gear, but also within the EEZ waters by industrial vessels. In addition, the countries are particularly concerned with the high seas fishery for tuna. Reef fisheries are of concern both as a basis for fishing, and also, along with the coastal area, for tourism values.

Marine parks and reserves also have a role to play in a number of fisheries, and here again the MCS procedures will need to be adapted to the management priorities.

The overall fish catch (some 3.3 million t) in this region is dominated by the catch of India (some 2 million t).

Parts of the area are considered of high productivity, mainly in the Arabian Sea, which is characterized by the influence of the Southwest monsoon, with an impact generally from June to November, and the Northeast monsoon in December to April. The months of May and November are generally calm inter-monsoonal months. There is upwelling in several areas, such as off Somalia, Yemen, Oman and southwestern India.

The Gulf is characterized by very warm, highly saline water. Colder water enters from the Gulf of Oman, forming a counterclockwise current, then exiting as a submerged denser, warmer and highly saline water mass moving towards the centre of the Indian Ocean. The Gulf is shallow, deeper on the Iranian side, and fringed with extensive coral areas on the Arabian side. Around the Gulf of Oman and the Gulf of Aden, the continental shelf is narrow, and fisheries concentrate on pelagic species. Studies indicate that mesopelagics may be the basis for a commercially viable fishery.

The Red Sea is characterized by considerable areas of great depth and extensive coral reefs. There are only a small number of trawlable areas. Many areas are now becoming targets for setting up reserves and marine parks. Their uses will not only be for tourism, but more specifically for promoting an appreciation of the environment.

The area is characterized by the presence of inshore fishing vessels, which use handlines, gillnets or traps. Relatively few trawlers are present in the Gulf and Red Sea, but many are found in territorial waters and the EEZ of India and Pakistan. Small purse seine netters are frequently found in the area. Large trawlers and tuna longliners operate in deeper waters of the Arabian Sea, and the Gulfs of Oman and Aden.

The abundance of certain migrating stocks, such as tuna and kingfish, may be monitored by the Indian Ocean Tuna Commission (IOTC). Many other stocks that are shared between countries could also be the subject of cooperation in monitoring.

This is not an area where foreign fishing is common, although it does exist. This could be assessed through Vessel Monitoring Systems (VMS), but such systems need to be linked to effective management units for their performance to approach an optimal level.

Crucial to effective management is the work of a legal unit, and the ability of magistrates to be in a situation to deal with fishery offences. Frequently there is a need to reduce conflict between inshore and offshore fishermen. Such problems can be mitigated when there is commitment by national institutions to address such issues.

Bahrain

Three trawlers are authorized to fish in waters deeper than 20 m. Five shrimpers can trawl in certain authorized areas, in depths less than 20 m, but the three-month closed season must be respected. Staff of the Department of Fisheries are permitted to embark on vessels of the Coastguard engaged in fisheries patrols at sea. The Department of Fisheries has its own craft for

Table 1. NW Indian Ocean; nominal catches by country

Country	T
Bahrain	10 000
Djibouti	340
Egypt	51 670
Eritrea	978
India	2 028 989
Iran	238 476
Iraq	10 783
Israel	225
Jordan	2
Kuwait	7 825
Maldives	107 676
Oman	117 049
Pakistan	422 137
Qatar	5 032
Saudi Arabia	49 395
Sudan	5 000
UAE	114 358
Yemen	112 834
TOTAL	3 298 169

Source: FAO Yearbook of Fishery Statistics, Vol. 84, 1997 (data for Western Indian Ocean, Statistical Area 51)

control, and to ensure there is no unauthorized dredging of sand in coastal waters. The annual catch is about 10 000 t.

Egypt

There have been 82 purse seiners operating in the Gulf of Suez. The vessels used are about 20-25 m LOA and powered by a 200 hp engine (sometimes up to 425 hp). Nets are generally 200-300 m long and 50-80 m deep. On each vessel, about 25 to 30 persons haul the net manually, as there is no power block. The fleet operates by night during the period of little or no moon, using kerosene lamps placed in two 6 m dinghies; with about 10 lamps on each dinghy. At times, the vessels may trawl or handline.

In the Gulf of Suez, 78 trawlers have been permitted to operate. The Mediterranean-type trawlers operate in depths not usually exceeding 40 m. The duration of each trawl haul is about 2.5 to 3 hours. Fishing usually commences in early September and finishes at the end of May. Each trawl trip is about 7 days in the Gulf of Suez and about 20 to 30 days when working in distant waters. Vessels range in length from 11.5 to 30 m with engines up to 800 hp (sometimes up to 1 000 hp). Crews usually consists of 10 to 15 persons.

Most vessels are based in Ataqa fishing port near Suez. The General Authority for Fish Resources Development (GAFRD) of the Ministry of Agriculture is the primary agency for conservation, management and development. Enforcement of regulations in the marine water bodies is the responsibility of GAFRD in cooperation with the Frontier Corps (Ministry of Defence).

There was an initial three-year agreement between Egypt and Yemen to allow 15 Egyptian vessels to fish in Yemeni waters and it is understood that this agreement was recently renewed to allow 20 vessels to fish for one year. These trawlers operate normally within a Yemeni joint venture (some reports mention that 30 Egyptian vessels fish in Yemeni waters). One part of the agreement covers operations of vessels, and a second part covers aspects of research. Cuttlefish form an important part of the catch. The Institute of Oceanography and Fisheries at Suez has been assisting with stock assessment.

Official statistics for the Red Sea fishery show a steady increase in catch, from 39 900 t in 1990 to 57 400 t in 1997. There are 239 trawlers, 83 purse seiners and 286 longliners. For the nation as a whole, imports of fish increased to 207 356 t in 1997; only 2 233 t of high-value fish were exported.

The annual trawl catch is about 3 500 t in the Gulf of Suez. Purse seine catch can vary, but recently was 11 000 t, a decline from a maximum of 26 000 t in the 1980s. GAFRD officials record the composition of catch landed from each vessel. Another form records the weight of fish sent to Cairo or Suez. There appears to be no vessel logbook for daily catch records. The number of days absent per trip is not recorded, but this information could be found from the Coastguard station.

The Ministry of Marine Affairs and Transportation assigns a registration number to each vessel. GAFRD issues a fishing permit. A replacement licence can only be issued if the applicant scraps his first boat and applies for another licence within a three-month period.

For the Gulf of Suez, there is a closed season for trawlers, extending from 1 May to end August. Purse seining is closed from 10 May to 10 October. It would appear that fishing can take place up to the shore both in the Gulf of Aqaba and the Gulf of Suez. The codend stretch mesh size for trawlers in the Gulf of Suez is generally 30 mm, with some parts being 25 mm. It is not clear what is the minimum legal mesh size.

Some Egyptian trawlers fishing off Yemen can be identified by relatively large letters, e.g., S 134, on the side structure, presumably in an attempt by Yemeni authorities to improve vessel identification.

The Coastguard has a station at Ataq port, Suez. At departure and entry to the port each vessel must report. Apparently, some officials of the Coastguard were given some training in the fisheries training centre in Alexandria, but then were transferred to other duties.

The Egyptian Red Sea Coastal and Marine Resources Management Project was conceived following a request for funding from the Global Environment Facility (GEF) of the World Bank from the three main institutions involved in the development of the Red Sea coast – the Tourism Development Authority (TDA), the Egyptian Environmental Affairs Agency (EEAA) and the Red Sea Governorate (RSG). The result is an innovative tourism and environmental project which aims to strengthen the institutions' capacity in multi-sectoral coastal zone management activities, and also to encourage public and private partnerships to ensure that economic development is consistent with environmental management.

Eritrea

The coastline is about 1 200 km, with about 350 islands off the coast. Artisanal fisheries is carried out by the *hourri*, an 8 – 11 m open boat with shallow draft for beaching, with an outboard engine, and the *sambuq*, a 12 – 15 m traditional Red Sea vessel, partly decked, with inboard engine. *Sambuqs* can also be used for trading. Much of the fish used to be dried and then sold in Yemen and Saudi Arabia. Now the Government of Eritrea is attempting to promote local activities and sales. Local annual landings have reached about 3 200 t. A training course for staff involved in MCS was organized by FAO in the framework of a UNDP/FAO project in 1997/98.

The Ministry of Fisheries employs fisheries inspectors. Some foreign-flag vessels have been arrested when found fishing illegally in Eritrean waters. At present, the Eritrean Navy is undertaking the task of enforcing regulatory measures at sea. It is understood that a Fisheries Law was introduced in 1995. In the framework of the Law “the Minister shall prepare and keep under review plans for the management and development of fisheries in Eritrea waters, and shall base the fisheries development programmes on such plans.” For the purpose of enforcing the Law, any authorized officer may stop, board and search any fishing vessel in the Eritrean EEZ.

A fisheries agreement has recently been signed with Egypt, and Egyptian vessels will be authorized to fish in Eritrean waters at the end of 1999.

India

This is by far the biggest fishing nation in the region, with an annual catch of about two million ts from the west coast (1994 State catches recorded as Gujarat 645 261 t; Maharashtra 374 260 t; Goa 102 113 t; Karnataka 173 750 t; Kerala 568 042 t; Lakshadweep 9 845 t).

The number of mechanized craft in each State are Gujarat – 8 365 (of which there were 4 360 trawlers in 1994/95); Maharashtra – 7 930; Karnataka – 3 243; Goa – 850 approximately; Kerala – 4 206; and Lakshadweep – 443. The majority of vessels operate inside the 50-m depth contour. Fisheries management responsibility is split between the States for the territorial sea (an area up to 12 n.mi. from the coast), and the Government of India for all foreign fisheries and for the area outside the territorial waters. In a recent report by FAO on fisheries in India, it was noted that general assistance for strengthening fisheries management was required, and this could include a limited entry licensing system.

The Commissioner for Fisheries Development is answerable to the Joint Secretary Fisheries within the Secretariat for Animal Husbandry and Dairying of the Ministry of Agriculture. The Fisheries Survey of India (FSI) at Mumbai reports to the Commissioner. The main institute

concerned with fisheries research is the Central Marine Fisheries Research Institute (CMFRI) at Cochin (attached to the Indian Council of Agriculture Research (ICAR)). Both institutions have several bases throughout the country.

Legislation was enacted to extend the EEZ to 200 n.mi. in 1976 (The Territorial Waters, Continental Shelf, EEZ and Other Maritime Zones Act, 1976), and to address foreign fishing in 1981 and 1982 (The Maritime Zones of India, Regulation of Fishing by Foreign Vessels, Act 1981 and its Rules of 1982). Fisheries regulations for Indian-registered fishing vessels fishing in the area outside the territorial seas and on the high seas could be drawn up in the framework of the 1976 Act, and conditions for fishing could be attached to a licence. More preferably, a specific Act to cover fisheries within the EEZ, linked to fishery management plans, could be drawn up.

Karnataka, as an example of one State, has 1 964 shrimpers, 884 gillnetters and 395 purse seiners. Mechanized craft in this and other States are normally accepted as exceeding 70-90 hp power (for trawling and gillnetting). Motorized craft are powered by outboard engines and engines of 20 hp or below. Non-motorized craft are numerous. The Karnataka Marine Fishing Regulations Act 1986 allows for licensing of fishing boats. Fishing by mechanized boat is banned from 1 July to 31 August. To have control over mechanized boats, and help the traditional fishery, a zone of 10 km from the coast is reserved for traditional fishing boats.

For Gujarat State, there has been a recommendation that the trawl codend mesh size be 35 mm.

Offshore patrols come under the authority of the Indian Coastguard under the Ministry of Defence of Central Government, and the Navy, to enforce the two Acts of 1976 and 1981 dealing with fisheries. There appears to be fairly close coordination between different fisheries authorities and the Indian Coastguard for assistance in the offshore control of foreign vessels operations (although it is not clear what number is involved). Coastguard officers receive a week-long fisheries familiarization course at the Central Institute of Fisheries, Nautical and Engineering Training (CIFNET) in the areas of fisheries enforcement for which their services are required, covering topics such as fishing materials, fishing gear for the deep sea, fishing licences, logbooks, endangered species, etc. There may be a need for further training when legislation is promulgated for Indian vessels fishing outside the territorial waters. For the initial implementation of MCS activities for this new sector, it might be advisable for the Coastguard to carry fisheries officials on board the vessels for assistance with the enforcement scheme on this fleet.

The Coastguard requires all foreign fishing vessels to call to the Coastguard with position and catch data each morning. This information is to assist the Coastguard in its patrol planning by knowing where vessels are expected. The information and catch data could be of assistance to fisheries and research personnel in fisheries management.

There are certain areas of special environmental interest such as the Lakshadweep coral reef. The Environmental Protection Act of 1986 provides the framework for coastal regulations.

The Central Government has pledged to assist all coastal States in the implementation of State fisheries laws by providing 100% capital cost of 30 coastal patrol vessels for their MCS activities. A total of 26 of these vessels are in final construction or already delivered and in operation in the States.

Islamic Republic of Iran

The law of protection and exploitation of the fisheries resources of the Islamic Republic of Iran (4286, date 1337/7/3 (1993)) states that the fisheries resources of the waters within jurisdiction and authority of Iran are the national property of the country and that protection and exploitation of these resources are among the responsibilities of the government, and, specifically, the Iranian Fisheries Company (Shilat). Shilat is part of the Ministry of Jihad-e-Sazandegi.

The fisheries along the coast of the Gulf of Oman and the Persian Gulf in 1991 had 54 662 fishermen, using 5 861 boats from 246 centres in the provinces of Sistan va Baluchistan, Hormuzgan, Busheir, and Khuzestan. There are some 120 trawlers, and five vessels fishing tuna. The traditional fisheries constitute most of the fleet, with 3 176 fibreglass boats less than 9 m in length, with outboards, and 2 567 large and medium wooden dhows of 12-20 m length with inboard engines. They use gillnets, longlines, fish and lobster traps and target demersals and small and large pelagic species; some of the dhows can trawl. Finfish but not shrimp trawling is apparently banned in the Persian Gulf. There is a closed season on trawling to catch shrimp. As the result of a buy-back programme, there has been a reduction in the number of trawlers operating in recent years.

The fishery in the Caspian Sea is relatively smaller and less complex, but valuable in view of the catch of three sturgeon species. About 14 000 fishermen fish with large mesh gillnet for the sturgeon. The sturgeon fisheries are a monopoly of Shilat, well controlled, with a programme of stock enhancement with hatchery-bred fingerlings.

A number of other species of fish are caught by beach seine and gillnet. The anchovy-like fish *killka*, consumed locally as well as reduced to fish meal, is fished with lift nets and lights. An international cooperative project to study the ecosystem of the whole Caspian is currently being funded through UNDP/GEF.

At Bandar Abbas, a five-storey building is the headquarters of a vessel tracking and monitoring system, provided through a company called Kafa, based on a system developed by Racal. The system will cover the Strait of Hormuz, with stations located at regular distances of 20 km. After being properly established, it may be extended to cover the whole coast of the Persian Gulf and Gulf of Oman. It is based on radio communication linked to a radar network for inshore waters, which can be connected to satellite communication to cover more distant waters. There would still be a need for vessels to be properly marked, as required under Article 22.c.8 of the 1993 Law.

It is understood that management plans are set for each main fishery on an annual basis.

A number of trawlers based on Bandar Abbas are authorized to trawl 7 miles offshore along the Iranian coast in the Gulf of Oman.

Enforcement of fisheries regulation is by the Disciplinary Forces of the Ministry of Jihad-e-Sazandegi. On the Caspian, the Disciplinary Forces commonly confiscate monofilament gillnets, the use of which, along with trammel nets, is forbidden. Shilat pays staff costs.

A number of open glassfibre speedboats of approx. 8 m length, with 2 Δ 200 hp outboards, are used to patrol waters subject to fishing. These craft are paid for and maintained by Shilat. On each patrol there are 3 or 4 staff, and it is the staff of the Disciplinary Forces that actually undertake arrest or prosecute for violation of the fisheries law. Common offences are fishing without a permit (although free), fishing in a closed area or season, and trawling at an unauthorized time.

Kuwait

The shrimp landings are highly variable: 1 793 t in 1995 compared to 4 999 t in 1988. There are 24 dhows and 35 steel trawlers which are licensed to take shrimp. The three industrial companies are the United Fisheries of Kuwait, the National Fishing Company and the Bubiyan Fishing Company. Average power of engine ranges from 320 to 540 hp. The industrial sector uses trawl nets with a 50-mm stretched mesh, and the artisanal fleet employs 38 mm stretched-mesh-size nets.

With the introduction of fishing closures in Kuwait Bay and the 3-mile coastal zone, artisanal boats increased in size to fish in more offshore areas without a change in mesh size. Fishing grounds were similar in recent years, but dhows operated in more northern waters because their nets of smaller mesh size allow them to catch, simultaneously, two smaller-sized species (*Metapenaeus affinis* and *Parapenaeopsis stylifera*), and industrial trawlers fished somewhat more southern waters. The fishing season lasts for three to six months, with an opening on 1 September.

The major part of Kuwait's fisheries MCS is carried out by the Directorate of Fisheries (DOF) in the Public Authority for Agriculture and Fisheries Resources (PAAFR). The Directorate issues fishing licences for artisanal and industrial sectors, and issues regulations for fisheries management. The DOF cooperates closely with Kuwait Institute for Scientific Research (KISR) in getting recommendations for fisheries management based on up-to-date catch and effort and other information. The Fisheries Directorate has its own patrol boats. They go on routine (24 hours a day) inspection cruises covering fishing areas, gears, and size of catch. Illegal fishing boats are stopped immediately and their case is forwarded to the court. The Coastguard, and sometimes the Navy, help the DOF in their work. A committee called The Shrimp Ban Committee was formed about 20 years ago to supervise the implementation of KISR recommendations on the annual shrimp ban season. The committee was headed by the Director General of PAAFR and included representatives from KISR, Coastguard, Kuwait Municipality, Ministry of Commerce and Kuwait Fishermen Association. The DOF ensures that no illegal unlicensed fishing takes place or that vessels registered elsewhere fish in Kuwait waters. Inspection of vessels in port also takes place.

Oman

The total value of the catch in 1996 was RO 53 819 000 (some US\$ 200 million) made up of landings from longliners (RO 3 835 000), from trawlers (RO 10 132 000) and from traditional craft (RO 39 852 000), much of which was exported.

Landings from the traditional fishery have fluctuated between 81 000 and 148 000 t since 1985. In 1996, landings reached 88 513 t, made up of large pelagics (32 798 t), small pelagics (32 983 t), demersals (14 271 t), sharks and rays (5 352 t) and crustacea (3 109 t). The regional landings in 1996 were 2 847 t at Musandam, 26 017 t at Al-Batinah, 20 009 t at Muscat, 21 858 t at Shargiah, 7 257 t at Al-Wusta, and 10 526 t at Dhofar.

Trawlers are only permitted to fish beyond 10 n.mi. from the coast in depths exceeding 50 m, along the coastline named Al-Wusta (to the south of which is Dhofar, and to the north of which is Shargiah, Muscat, Al-Batinah, and Musandam). The particular trawling zone is some 3.5 days steaming time from the port of Muttrah. Eighteen trawlers are permitted to operate; they normally carry the Korean flag, of which the Oman Fishing Company charts twelve. Government holds a 25% shareholding in this company, and the remaining shares are in private hands. Four other companies charter five further vessels. The trawlers are not permitted to catch crustacea, such as shrimp and lobster, or kingfish. It is reported that the allowable stretched mesh is 120 mm in the codend. In 1998, from 17 July to 17 November, there was the first closed trawling season. A ban on discards, which previously made up about 40 to 60% of the catch, was also introduced at this time. If the ban is enforced, so that all the fish has to be landed for sale for human consumption or the fishmeal plant, the viability of trawling may well be in doubt. A trawler normally makes a catch in excess of 5 t per day, with up to about 250 t landed per (35 day) trip. Ribbonfish, threadfins, brems and cuttlefish are main components of the catch.

The catch of foreign-registered trawlers, licensed to fish in Oman waters, is reported to have increased from 13 368 t in 1985 to 23 366 t in 1996. Ribbonfish (8 000 t) and cuttlefish (2 737 t) are amongst the most important species.

The number of licences for traditional boats has been fixed since 1982, with no new entry. The overall quota for trawled fish is 25 000 t per year, but there seems to be no continuous review of the quota, or of the number of vessels authorized, or of the codend stretched mesh permitted.

Foreign-registered tuna longliners fishing with permits catch approximately 9 000 t of tuna, mainly yellowfin, in Omani waters. Two companies act as agents for about 100 – mainly Taiwanese – longliners that normally target tuna off the Al-Batinah coast during March and April. Besides yellowfin, substantial catches of sharks are also taken.

The shrimp fishery, dominated by catches of *Penaeus indicus* and *Penaeus semisulcatus*, around Mahout Island in the Gulf of Masirah, is not controlled either by closed season or closed area, although the annual monsoon season enforces a closed season between May and August, when no fishing takes place. The fishery, for some 200 to 500 t per year, by 200 to 300 fibreglass boats with outboard motors, is based on the use of cast nets.

The spiny lobster (*Panulirus homarus*) is one of the principal shellfish species traditionally fished by tangle nets and traps. The annual production during the 1994 fishery season was estimated at 623 t. The present minimum capture size regulation specifies an 80 mm carapace length. It is understood that there has been a steady decline in catch over the years.

Divers take abalone off Dhofar, in relatively small quantities, using snorkel, but not scuba. The most serious decline has been in landings of a migratory species, kingfish (*Scomberomorus commerson*) which have stabilized at a relatively low level of about 4 000 t compared with landings in 1988 estimated at 28 000 t. Certain parts of the coast have been designated as marine reserves.

A Ministerial Decree (3/82) and 1983 amendment (59/93) followed the 1981 first Royal Decree on Fisheries (53/81). New bylaws were issued in 1994 (4/94). There is a reference to permitting 16 species to be discarded at sea. In theory crustacea and cuttlefish should not be caught, but since they are caught in a zone where trawling is permitted, no prosecutions are brought. The 1998 ban on discards will have changed the situation.

At least twelve small patrol boats for the police are based at Muttrah and carry out normal work of a Coastguard. There is liaison of the Fisheries Department with this section of the police, and with the Navy and Air Force. The Fisheries Department has been assessing possible use of a vessel monitoring system. The large trawlers fishing in the Omani EEZ normally carry observers.

Pakistan

There are two coastal provinces (Balochistan and Sindh) which cover the 990-km coastline of the country. Each province has its own fishery law and access arrangements. The Exclusive Fishery Zone (Regulation of Fishing) Act, 1975, extends to waters within the exclusive fishery zone of Pakistan. Regulations pertain to (a) size of meshes and type of net, (b) size and quantity of fish which may be caught, (c) conditions to which licences may be subject, (d) registration of craft and gear, (e) fees, and (g) area, etc. Further, more detailed, directives were issued as Exclusive Fishery Zone (Regulation of Fishing) Rules, 1990. By notification in 1992, certain officers of the Pakistan Navy and Maritime Security Agency, along with Fishery Officers, were given powers to enforce the 1975 Act. The Sindh Fisheries Ordinance 1980 and the Balochistan Sea Fisheries (Amendment) Act 1986 regulate fisheries in the two provinces.

The Balochistan Provincial Fisheries Administration has offices at nine points along a 750-km coast, for monitoring fishing activity, and collecting statistics. There are six (approx. 14 m length) patrol craft (of which three are operational) involved in fisheries inspection, and mainly checking the licences of fishing craft coming in from Sindh. The patrol craft operate up to 12 n.mi. from shore, with craft of the Maritime Security Agency working further offshore. The 1986 Law prohibits shrimp trawling, or purse seining for sardines, but, in spite of this, such

operations do occur. When a vessel is arrested at sea, it is first brought to a port and then the catch is auctioned. Funds from the sale are kept on deposit in case the fishermen wins the court case, which is usually heard within 6 to 7 days. Within the period August 1997 to October 1998, there were 238 arrests; the total value of fines exceeded US\$ 400 000 and value of confiscated catch exceeded \$ 300 000. There is no minimum legal mesh size, but normally the gillnets are of 10-12.5 cm (4 $\bar{\exists}$ to 5 $\bar{\exists}$) stretched mesh. It is understood that a number of communities practise community-based fisheries management. There is a need for protection of areas where turtles lay eggs. Areas of mangrove also need protection.

Although the Sindh authorities prohibit trawling in creeks and in an area up to one mile from the shore, there is in reality a situation where trawling appears to continue. The codend of these trawls is normally of 25 mm with an inner pocket of 10 mm. There is no regulation pertaining to mesh size. Set bag nets and purse seine nets are also prohibited but are known to be used. There is no limit to the number of vessels that may fish, and no effort is made to freeze or reduce entry into the fishery. Some twenty years ago, FAO recommended that only 450 to 600 trawlers be authorized, but numbers are now about 2 000. A closed season for shrimp trawling, in June and July (agreed by processors) does, however, appear to function. It appears that shrimp fishing using gear other than the trawl operates throughout the year. Other regulations prohibit dynamiting and the landing of small carp and lobster.

Personnel of the Navy staff the Maritime Security Agency (MSA). There are some 800 personnel. Their objective is to implement the MSA Act of 1994 with regard to fisheries, as well as search and rescue and anti-pollution activities. There are 4 vessels of 58 m and a number of smaller craft for this work. There are also two Britten-Norman *Islander* aircraft. Any foreign unlicensed vessels or large trawlers caught in the 35-n.mi. zone are immediately brought to port. The 35-n.mi. limit that regulates foreign trawlers operations apparently does not take into consideration the availability of trawling grounds. The location of trawling grounds accessible to these trawlers could be located on a chart.

Ten tuna longliners gain authorization to fish in the EEZ for about six months in the first half of each year. Previously, the vessels carried observers, but this practice has now been discontinued.

Staff of the Marine Fisheries Department do not accompany MSA patrols. Boarding of fishing vessels for inspection takes place after transfer, by an inflatable craft, of the boarding party to the vessel inspected. There is no clear procedure for checking fishing location, catch composition, log book, gear, etc., which can be fed back into fishery management processes. The control room of the MSA is operational continuously.

Qatar

Only artisanal craft are authorized to fish in the waters under jurisdiction of Qatar. The catch in 1997 was estimated to have been 5 032 t. No trawling is permitted. Patrols are undertaken by the Coastguard. Gillnets, handlines and traps are the predominant fishing gear.

Saudi Arabia

The coastline in the Gulf is 600 km and in the Red Sea it is 1 800 km. There are 17 landing sites in the Gulf, and 88 in the Red Sea. The Directorate General of Fisheries, Ministry of Agriculture and Water, was created in 1986, with departments for marine fisheries, aquaculture, and marine ecology. There is a Deputy Minister for Fisheries Affairs in the Ministry, who can issue licences for industrial vessels over 9 m. There is a Coastguard Authority (Ministry of the Interior), which also cooperates in the collection of statistics.

In the Gulf there are 1 931 traditional craft and 45 industrial vessels. No new fishing licences have been issued since 1981. The codend stretch mesh size is 38 mm. In 1995, the shrimp season in the Gulf extended from 10 July to 9 December, when 4 216 t of shrimp were caught. The date of opening and closing the shrimp season can vary from year to year. In the Red Sea, there are 5 055 traditional craft and 126 industrial vessels. About 85% of crews are of non-Saudi origin, being mainly from Bangladesh, Egypt, India, the Philippines and Yemen.

Total catch in the Gulf is estimated at 2 056 t from industrial trawl fishing, mainly for shrimp, and 20 089 t from artisanal fishing, of which 18 499 t is taken with traps, gillnets and trawls. Species caught include emperors, kingfish, rabbitfish, scads, seabreams, groupers, tunas, snappers and crabs.

Total catch in the Red Sea is estimated at 6 012 t, taken by industrial vessels, mainly purse seines, and 15 405 t by artisanal vessels, of which handlines take 14 614 t. The main Red Sea fishing area is off the Farasen Islands, Al-Quafotha, and Al-Khariebah. Species caught include scads, groupers, emperors, kingfish, shrimp, Indian mackerel, rabbitfish, snappers, barracudas and parrotfish.

IUCN has classified the Red Sea as a “key environment.” In the Gulf, there is the Jubail Marine Wildlife Sanctuary. There are extensive coral reefs along the whole Saudi Arabian coastline.

Somalia

Civil disturbances have affected the country for quite some time, but the relative stability of the northwestern region, Somaliland, has allowed for the development of fishing as well as fish processing in that region as well as in the northeastern region.

Berbera is the main fishing base. It is reported that a number of fishermen from Sri Lanka have been permitted to fish in waters off and process their fish in Somaliland.

Along the northern Somalia coast, the sea border from Djibouti in the east has a gradual slope of 15 to 250 m and forms a shelf generally less than 5 km in width running parallel to the shoreline. Beyond this shelf, bottom depth increases rapidly to about 1 000 m. Near shore, the bottom is primarily sandy, but changes to fine sediment with increasing distance from shore to the shelf edge. The edge of the shelf extends out to and surrounds the island of Socotra (Yemen). This part of the coastline has many rocky cliff areas that extend 1-10 m below sea level at the shoreline. Many turtles congregate for breeding at points along the north coast. The northeast of Somalia is in the process of establishing an administrative authority relatively independent from the remainder of the country, with a base at Boosaso. The authority is understood to issue fishing licences, most notably to fishermen from foreign countries that have traditionally fished in the area. Some communities have been able to arrest and then prosecute vessels fishing without a licence.

The exploitation of the lobster appears to be one of the mainstays of the economy, with one report estimating some 1 200 t landed annually. The lobsters are bought by middlemen using a truck or collector vessel moving along the coast between coastal communities. Many consignments of lobster are sent by plane to Dubai for onward export.

Sudan

The long coast of Sudan is an area of relatively low fish production. Marine production is estimated to have been 5 000 t in 1997. There are a number of areas of scientific interest, most particularly in the coral reefs.

The Department of Fisheries has an office at Port Sudan. Incursions of foreign-registered vessels fishing in Sudanese waters are monitored when possible. A relatively large loan for development of marine fisheries has recently been agreed with the Government of the Republic of China, and this could lead to the intensification of fishing activity along the Sudan coast.

United Arab Emirates

Total catch of fish was 107 000 t in 1996, which increased from 95 048 t in 1992 and 64 000 t in 1976. In 1996, landings were 63 879 t of pelagics, 42 791 t of demersals and 330 t of crustacea. Landings by Emirate were Abu Dhabi, 27 157 t; Dubai, 15 247 t; Sharjah, 24 899 t; Ajman, 3 959 t; Umm Al Quwain, 4 516 t; Ras Al Khaimah, 18 682 t; Fajairah, 12 540 t. Subsidized loans were offered to fishermen for purchase of diesel engines (40 in 1996) and petrol engines (391 in 1996).

The municipalities are responsible for enforcement of the fisheries regulations. Joint meetings of staff from the Fisheries Department of the Ministry of Agriculture and Fisheries (MAF), Coastguard (Ministry of the Interior), Navy and Air Force occur from time to time. The Coastguard has vessels at sea throughout the 24 hours, involved in routine searches of small craft. Vessels caught using undersized mesh, prohibited monofilament nets, or fishing in prohibited zones, have gear and craft confiscated. The nearest municipality is charged with taking a set fine, and on presentation of the receipt the Coastguard will release the vessel and gear. There are some 20 fast patrol craft with the Dubai Coastguard. Repeat prosecutions may lead to permanent withdrawal of licence. The level of fine for first offence is about Dh 1 000 (about US\$ 300).

The functions of the Coastguard in relation to the fisheries relate to (1) safety certification of fishing vessels, e.g., ensuring that the required equipment is on board; (2) emergency search-and-rescue operations; and (3) certification of the size (e.g., GRT) of fishing vessels for registration purposes. Some of these activities overlap or require coordination with MAF.

Since 1980, the use of trawlers has been prohibited in waters up to 24 n.mi. from the coast. Shrimp are not caught in UAE waters due to the ban on trawling. At certain times, tuna fleets operate off the coast of Fajairah.

Fishing is mainly from locally manufactured glassfibre dhows of up to 20 m (65 feet) using traps, lines and gillnets. Both traps and gillnets must have a stretched mesh of at least 50 mm (2 inches). Some effort is being made to stop ghost fishing, through use of material that decays after three days, thus allowing fish to escape from traps that go adrift. The vessels should be registered in the name of UAE nationals. Often the crews come from Pakistan, India and Bangladesh. There are about 14 000 registered fishermen.

The number of fishing boats has increased from 1 065 in 1976 to 3 536 in 1992, to 4 303 in 1994 and 4 464 in 1996. Fishermen's numbers increased from 4 000 in 1976 to 14 143 in 1994, with landings increasing from 64 000 to 109 600 t over the same period. There is concern over a possible decline in abundance of fish as vessels carry more and more traps (often over 100), fish for longer periods, including the hot season (with air conditioning now installed in the wheelhouse) and with winches so the traps can be more quickly hauled for checking.

Yemen

The coastline is 2 200 km, with some 1 500 km along the Arabian Sea/Gulf of Aden and some 700 km in the Red Sea. The coastline has extensive seagrass beds, as well as mangrove stands, and coral reef areas. Vessels of the private sector, joint ventures, the public sector, and foreign vessels with a licence conduct fishing. From 1969 to 1989, Soviet Union vessels fished with bottom and pelagic trawls, while the Japanese targeted cuttlefish. From 1989 to 1992, during a transitional period and after unification of the country in 1990, no data exist on catches, and since

then the reporting system is considered unreliable. The fisheries sector, however, is estimated to represent about 10% of GDP and employ 20 000 persons; more than 70% of fishermen are reported to be members of Fisheries Cooperative Societies. More than 90% of the catch comes from the artisanal sector. There is evidence that there is overfishing for rock lobster, shrimp, cuttlefish and sharks, while small pelagics (mackerel, scads, anchovies) are considered to be underexploited.

In 1996, the country imported 2 842 t of canned fish and exported 1 119 t of fresh/frozen fish, 88 t of dried fish, and 1 353 t of crustacea/molluscs. The 1996 nominal landings were reported as 112 834 t.

The Ministry of Fish Wealth (MFW) has overall responsibility for the sector. Within the MFW, the General Department of Control and Surveillance (GDCS) is the department responsible for the control of fishing activities and the protection of the marine environment and aquatic resources. It is understood that five patrol boats were donated by Japan and delivered in July 1999 for use by GDCS. GDCS activities include issue of licences, control and monitoring of fishing operations, catches, and local landings of foreign or Yemeni industrial trawlers. Two inspectors are placed on foreign vessels fishing under licence.

Law No. 42 of 1991 "Organization, Exploitation and Protection of Fishing and Aquatic Resources" deals with the protection of fishery resources and gives authority to the MFW to regulate fishing, issue licences, supervise the marketing and processing of fish, etc. The Marine Science and Resources Research Centre (MSRRC) is the national institution responsible for fisheries research. Its responsibilities cover oceanography, fisheries, mariculture and environmental protection.

The largest project is the Fourth Fisheries Development Project, jointly financed by the EU, World Bank and IFAD, which started in 1992 and which was to terminate in 1999. The objectives have been to increase fish catches, improve processing and marketing, improve assessment and management of resources, and enhance the position of women in fishing activities. Earlier projects financed by the World Bank since the 1970s attempted to establish a fleet of industrial trawlers, fishing port, workshop and handling/processing facilities. A Fisheries Institute was established to provide training, and organizations were established to promote marketing as well as coastal fisheries. In order to develop the relatively high potential of the fisheries around the island of Socotra, near Somalia, a Socotra Fisheries and Marine Products Co. Ltd. was established. There were many initiatives to establish cooperatives, which rarely worked well, and which have been overtaken by private-sector activity.

On the Gulf of Aden coast in particular, shark is targeted, as little infrastructure is required, and the fish can be caught with handlines. Apart from the small vessels used in coastal fisheries, there are foreign-flag trawlers, coming from Egypt, China, Korea and elsewhere, fishing with licences offshore. Some of the laws pertaining to fisheries need to be clarified, as exports of fish are liable to restrictions.

There had been hopes of promoting fishmeal production through use of the Indian oil sardinella (*Sardinella longiceps*) in the 1970s off Mukalla, but the results were never positive. Cuttlefish are taken by trawler towards the eastern boundary. Lobsters are taken in variable quantities along the whole coast. Off Hodeidah, there is a small trawl fishery for shrimp (with an MSY of 800 to 1 500 t). Along the Arabian Sea and Gulf of Aden, the MSY of small pelagics has been estimated at 75 000 to 275 000 t.

Currently, it is known that Egyptian vessels have licences to fish in Yemeni waters. In 1998, the joint venture company YFIC operated 14 vessels, and the company CHNC operated 16 vessels in the Gulf of Aden and Arabian Sea. In June 1999, 41 vessels were authorized to operate in the Red Sea. The number of vessels fishing illegally is difficult to assess.

FURTHER OBSERVATIONS

The northwest Indian Ocean region has a number of different fishery management situations; these range from the local, specific stock and specific fishery of perhaps a few ts, through to a number of different trawl fisheries, and then an unexploited, mesopelagic, fishery with a potential exceeding a million ts. In addition, there is the situation of coral reef fisheries, where areas need to be conserved for objectives not related to fisheries.

In all situations, there is a need to examine the best way of collecting information so as to aid managers to set targets and improve approaches towards meeting those targets. Information gathering includes data on catches, landings and species composition, as well as components of the catch in detail. Important data on the economics for the operation also need to be collected.

Once information is available and assessed, the management regime can be established, and regulations introduced. Enforcement of these regulations is a requirement that is necessary not only for adhering to the legal requirements but also as an aid to improving the management regime and modified regulations that can perhaps be more easily enforced.

Certainly there is a need to have regulations at a national level to assist with fisheries management. In addition, there is the need to have close cooperation with neighbouring countries' technical staff to ensure that regional information is exchanged and joint assessments carried out. There must also be an element of flexibility, allowing regulations to be improved as knowledge become available.

In many countries there has been an attempt to involve fishermen in the process of rights-based management, in a number of forms, which involve the fishermen in decision making. Quite often, the community management aspect can be facilitated at the start by a simple recognition of the advantages of such management through a bylaw or law that can be applied at the local level. In some countries where co-management has been attempted, there appears to have been a greater degree of success where the fishery resource is exploited optimally, where fishermen earn reasonable incomes, and where returns on investment are substantial enough to ensure that management (including research) costs can be covered substantially by the fishermen themselves (and this has been found to be unusual in many canoe/artisan fisheries).

A difficulty faced by a number of fisheries administrations is the lack of firm advice on what management decisions to apply in the case of a fishery. There should be improved stock assessment based on long-term monitoring. Certainly, MCS can provide information of use to scientists as well as to fishery managers in their assessment of what is happening to a fishery, and on what problems need to be faced so that decisions can be taken. Where management decisions are being enforced, there must be a feedback from MCS personnel to decision-makers so that reasonable measures can be taken that are indeed applicable. The application of measures to reduce fishing conflicts must be taken both with sensitivity and firmness, and this calls for considerable judgement on the part of the authorities.