

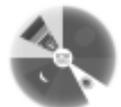
Report of the Regional Workshop on Monitoring, Control and Surveillance in Marine Fisheries

16 - 18 January, 2008
Chittagong, Bangladesh



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and Surveillance in Marine Fisheries**

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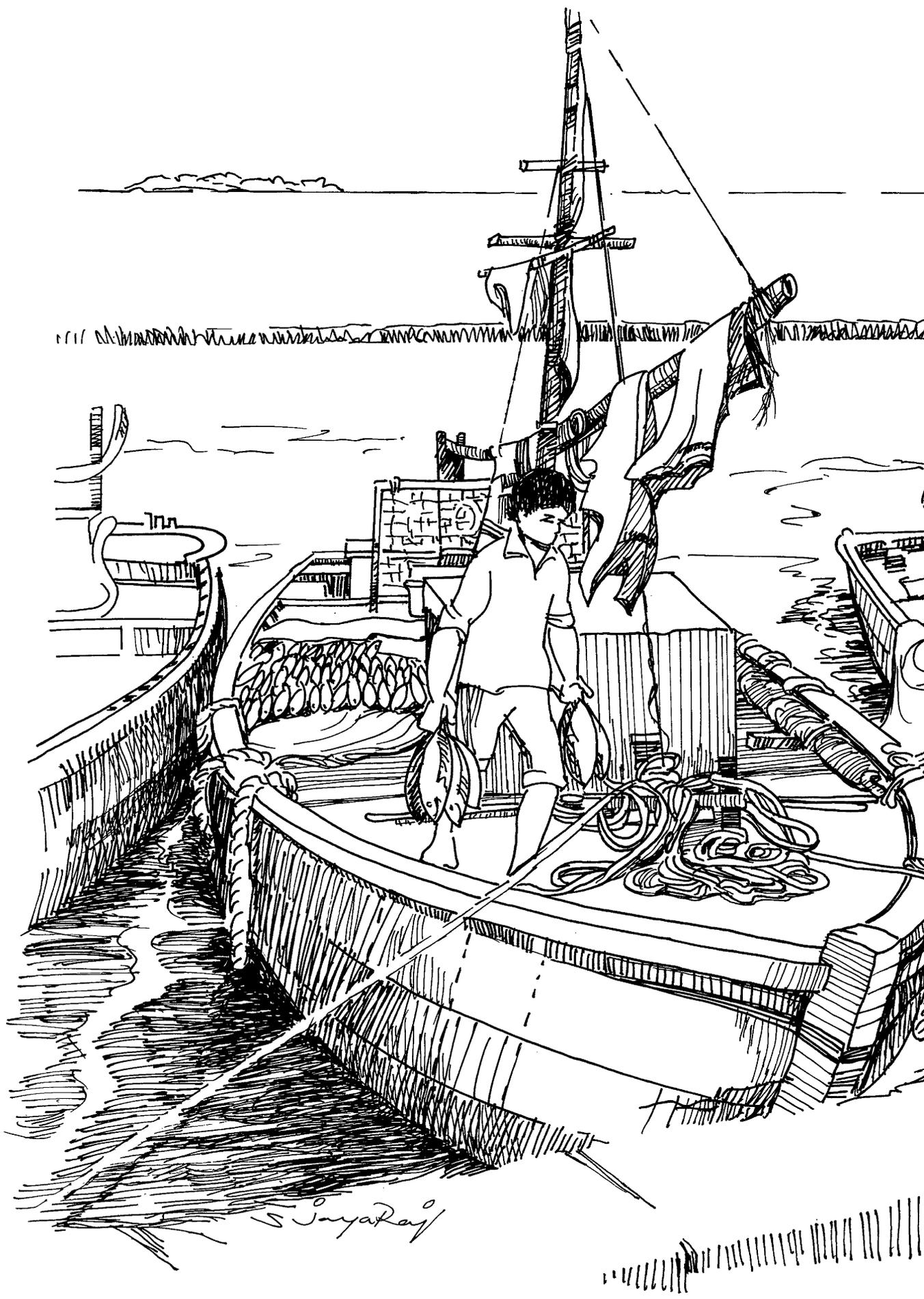
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S. Jayaraj

Prospectus

1.0 Background and rationale

Fisheries have substantial social and economic importance in the member-countries of the Bay of Bengal Programme Inter-Governmental Organisation (BOBP-IGO). However, with the rapid increase in fisher population, fishing in coastal areas has become difficult with low catches and fishing rights conflicts. Often, the entire community may rely on fishing as its chief source of livelihood, lacking alternative means of livelihood. Almost the entire small-scale/artisanal fishery operates in free access regime and a large proportion of marine fish stocks is fully exploited or over-exploited and is in need of recovery.

Fishing communities in the Bay of Bengal region constitute a large population, which is mostly illiterate and poor. As they are remotely located, access to electronic media and other channels of information is limited. In view of their ignorance, illiteracy, lack of access to mass media, etc, making them aware about the significance of responsible fishing and implementation of other management measures and conservation related issues is an enormous task. Provisions of the existing Fisheries Acts and Regulations are also not known to most of the fishing communities and as such compliance level is very poor.

An effective and implementable legal framework is pre-requisite to management and conservation of fisheries resources. It also forms a major component of the control aspect in programmes related to monitoring, control and surveillance (MCS).

2.0 The proposed programme and its justification

The main constraints, which impede practical application of MCS in the BOBP-IGO member-countries have been identified as follows:

- Lack of accurate statistics in the small-scale/artisanal sector, which contributes about 96 percent of the total marine fish production.
- Lack of a scientific information system.
- Inadequate trained manpower at both management and operational levels.
- Lack of awareness at the community-level of the need for MCS.
- A large number of remote landing places along the coast.
- Lack of supporting legislation to implement MCS.
- Inadequate funding for MCS.

In the given situation, some of the main controls and instruments that could be used in implementing MCS are:

- (i) determining the level of sustainable exploitation and other relevant information by data collection, assessment and analysis;
- (ii) fishing effort control (through licensing);
- (iii) selecting appropriate management instruments – fishing areas/locations/duration of fishing (zonation);
- (iv) development of fisheries management plans based on the principles of conservation of fish stocks in a sustainable manner;

- (v) controls in ports and at sea;
- (vi) use of Vessel Monitoring System, wherever applicable;
- (vii) educating the community by dissemination of information;
- (viii) promoting co-management strategies;
- (ix) legal support for the fishery management plans and ensuring equitable allocation of resources; and
- (x) implementation of regulations through licensing, reporting and enforcement.

Another critical requirement for effective MCS is the establishment of a coordinating mechanism, with well-defined objectives and a clear work plan. The government cannot practice MCS in isolation and, therefore, coordination among stakeholders is essential. In this regard, an important approach to MCS in such fisheries is, where possible, to foster a strong local awareness on the need for conservation and management. The setting up of MCS can also assist in establishment of multiple channels of communication, which can provide information to the fisher community on weather, commodity and market prices, safety aspects, hygiene, etc.

3.0 Objectives of the Regional Workshop

The main objective of implementing MCS is to secure an ecologically safe and economically profitable exploitation of living marine resources in the interest not only of today's population but also for posterity. It is also expected to bring in a paradigm shift in the marine fisheries from *de facto* open access to limited and controlled access regime. In essence, the proposed MCS will be the Government's response to challenges posed by the issues that confront the fishery.

The objectives of the Regional Workshop are as follows:

- (i) Review of existing marine fisheries management programmes and analysis of the fisheries in the coastal waters and the EEZ (this will *inter alia* include the registration/licensing of fishing vessels, number and category of fishing craft and gear, fishing harbours/ fish landing sites, boat building yards, etc).
- (ii) Review of the existing procedures and practices, and fisheries legislations of other concerned Ministries/Departments (*e.g.* Mercantile Marine Department(MMD)).
- (iii) Assessment of the MCS capacity and identification of institutional development requirements within the Ministry/Department of Fisheries and, if necessary, other concerned Departments (*e.g.* MMD).
- (iv) Assessment of needs and requirements of regional cooperation in MCS.
- (v) Preparation of an outline of procedures for practical application of fisheries MCS programme and its implementation on pilot basis (in one or two manageable sites).
- (vi) Preparation of training and extension material including development of manual/guidelines essential for the implementation of MCS.

4.0 Regional Workshop

The Regional Workshop will be organized in coordination with the Ministry of Fisheries and Livestock (MoFL), Government of the People's Republic of Bangladesh. The Agenda and Timetable for the Workshop is attached as Annexure 1.

Date and venue

The Regional Workshop will be organized from **16–18 January 2008** at The Peninsula Hotel, Bulbul Center, 486/B, O R Nizam Road, CDA Avenue, Chittagong 4000, Bangladesh (Tel: + 88 031 285 0860 9 (10 lines), 616722, 619850; Fax: +88 031 624385, 613520; Website: www.peninsulactg.com).

Conduct of the Workshop

The Regional Workshop will be conducted in English.

Participation

Participants of the Workshop shall include representatives from the (i) Ministries/Departments of Fisheries, (ii) Navy/Coast Guard, (iii) Mercantile Marine Department of the BOBP-IGO member-countries, (iv) Food and Agriculture Organization of the United Nations, (v) Experts, (vi) and the BOBP-IGO. The List of Participants is placed as ***Annexure 2***.

Format of the Workshop

The Regional Workshop shall include six (6) presentations followed by Group Discussions and finalisation of a set of activities to be implemented in the member-countries. Copies of the presentations shall be distributed to the participants prior to the Workshop.

Coordination of Workshop

The BOBP-IGO will coordinate the Workshop arrangements with assistance from Mr Md Moniruzzaman, Deputy Secretary, MoFL, Government of Bangladesh.

For any further information, please contact:

Mr Md Moniruzzaman

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*Regional Workshop on
Monitoring, Control and Surveillance
Chittagong, Bangladesh, 16-18 January 2008*

Annexure 1

Agenda and Timetable

Date & Time	Programme
<i>15 January 2008 (Tuesday)</i>	<i>Arrival of the Participants</i>
<i>16 January 2008 (Wednesday)</i>	<i>Day 1</i>
0900 - 0930	Registration
<i>0930 - 1000</i>	<i>Session I: Opening Session</i>
0930 - 0935	Recitation from the Holy Quran
0935 - 0945	Welcome and Introductory Remarks– BOBP-IGO
0945 - 0950	Welcome and Introductory Remarks– Ministry of Fisheries and Livestock, Government of Bangladesh
0950 - 1000	Inaugural Address– Joint Secretary, Ministry of Fisheries and Livestock, Government of Bangladesh
<i>1000 - 1030</i>	<i>Group Photograph; Tea/Coffee</i>
<i>1030 - 1300</i>	<i>Session II: Technical Presentations</i>
1030 - 1100	Application of Monitoring, Control and Surveillance in Small-scale Fisheries– Y S Yadava
1100 - 1140	Application of MCS in Small-scale Fisheries– Arne C I Andreasson
1140 - 1220	Country Report on the Status of MCS in the Marine Fisheries Sector in Bangladesh– Afazur Rahman Chowdhury
1220 - 1300	Country Report on the Status of MCS in the Marine Fisheries Sector in India– V S Somvanshi
<i>1300 - 1400</i>	<i>Lunch</i>
1400 - 1440	Country Report on the Status of MCS in the Marine Fisheries Sector in Maldives– Mohamed Shameem
1440 - 1520	Country Report on the Status of MCS in the Marine Fisheries Sector in Sri Lanka– Nimal Abeywickrama
1520 - 1530	Formation of Groups
<i>1530 - 1545</i>	<i>Tea/Coffee</i>
1545 - 1700	<i>Session III: Group Discussion</i>
1545 - 1700	Group discussion
<i>1900 - 2130</i>	<i>Workshop Dinner</i>



Date & Time	Programme
17 January 2008 (Thursday)	Day 2
<i>0930 - 1100</i>	Session III: Group Discussion contd...
0930 - 1100	Group discussion contd...
<i>1100 - 1115</i>	<i>Tea/Coffee</i>
1115 - 1300	Preparation of Group Reports
<i>1300 - 1400</i>	<i>Lunch</i>
<i>1400 - 1800</i>	<i>Field Visit</i>
18 January 2008 (Friday)	Day 3
<i>0930 - 1100</i>	Session IV: Group Presentations
0930 - 1100	Group presentations and discussions
<i>1100 - 1115</i>	<i>Tea/Coffee</i>
<i>1115 - 1300</i>	Session V: Concluding Session
1115 - 1230	Adoption of Recommendations
1230 - 1240	Concluding Remarks– Chairperson
1240 - 1300	Vote of Thanks– BOBP-IGO
<i>1300 - 1400</i>	<i>Lunch</i>
1400 -	Participants Departure



**Regional Workshop on
Monitoring, Control and Surveillance
Chittagong, Bangladesh, 16-18 January 2008**

Annexure 2

List of Participants

Sl. No	Name	Address	Tel/ Fax/ Mobile/ Email
A. Bangladesh			
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Sl. No	Name	Address	Tel/ Fax/ Mobile/ Email
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E. Expert			
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Participants at the Regional Workshop on MCS

Report

Opening of the Workshop

1.0 The first Regional Workshop on Monitoring, Control and Surveillance (RW-MCS) for Marine Fisheries in the Bay of Bengal was held at Hotel Peninsula, Chittagong, Bangladesh, on 16-18 January 2008. Taking part in the Workshop were officials from the Ministry/Department of Fisheries, the Coast Guard and the Navy of the Bay of Bengal Programme Inter-Governmental Organisation (BOBP-IGO) member-countries (Bangladesh, India, Maldives, and Sri Lanka); plus experts and representatives of the Food and Agriculture Organization (FAO) of the United Nations and the BOBP-IGO.

2.0 The inaugural session of the Workshop was chaired by Mr Parikshit Datta Chowdhury, Joint Secretary, Ministry of Fisheries and Livestock (MoFL), Government of the People's Republic of Bangladesh. The Workshop began with the recitation of the Holy Quran.

3.0 Dr Y S Yadava, Director, BOBP-IGO, welcomed participants and thanked the MoFL for having agreed to host the first RW-MCS. He highlighted MCS measures as the missing link in sustainable fisheries management and expressed the hope that the Workshop would identify critical issues and the means to address them.

4.0 Mr Chowdhury welcomed participants and asserted that the fisheries sector is a keystone in the economy and society of all the BOBP-IGO member-countries. He pointed out that in Bangladesh, marine fisheries is often the sole source of livelihood for the coastal population. However, the increasing fishing effort on marine resources may turn out to be disastrous for both the community and the country. He hoped the Workshop would pave the way for effective policy formulation on MCS in the member-countries.

5.0 The Director, BOBP-IGO, presented the Agenda (see Annexure 1 on pages 5-7). The Workshop was divided into technical presentations and discussions; a field trip; and group discussions to analyze issues brought out in the technical presentations and suggest recommendations. Six papers were presented and discussed in the RW-MCS and they are presented in the subsequent sections.

Technical Presentations

6.0 Dr Yadava initiated the technical session with an overview of MCS measures as relevant to the BOBP-IGO member-countries. He said that the rapid increase in the fisher population that operates in a *de facto* open-access regime has made fishing in coastal areas difficult, leading to low catches and fishing rights conflicts. Since the concern for sustainable fishing operations is relatively recent, member-countries are not ready for a paradigm shift in policy emphasis from production to management. The legal framework is insufficient, policies and programmes for fisheries management are inadequate and compliance levels are low. Citing FAO data, he said that in the Bay of Bengal region, of 46 commonly exploited species, 11 species are fully exploited and four are fully or over-exploited.

Dr Yadava expressed the view that globally, emphasis has switched from higher production to sustainable production. The 1995 FAO Code of Conduct for Responsible Fisheries (CCRF), the accepted management philosophy in member-countries, also proposes the same.

He emphasized that MCS is not a new idea in fisheries management. Member-countries have policies incorporating MCS tools. However, the MCS in the present context goes beyond its traditional definition of policing. It is rather a tool to develop and implement sustainable fisheries exploitation. In this context, he explained the array of tools for MCS — an enforceable legislation, data collection, improved communication and overall support from political, social and business interests.

Dr Yadava highlighted the significance of a vessel monitoring system (VMS) as a tool of MCS. VMS can be either a simple or advanced-level tool, he said, citing the example of the Maldives.

Discussing MCS in small-scale fisheries, Dr Yadava said that paucity of data, a large number of landing sites, dearth of manpower and lack of community awareness were major constraints to implementation of MCS in small-scale fisheries. Community participation through awareness-building and benefit-sharing through co-management – these two principles could be effective in this context.

Dr Yadava suggested that member-countries could seek cooperation from advanced countries on MCS, as proposed by the CCRF. Data and technology could be the areas where such cooperation could be generated, he said.

7.0 Mr Arne Andreasson, an independent consultant, made a presentation on ‘Application of MCS in Small-scale Fisheries’. He further stressed the importance of MCS, particularly its effective implementation, in member-countries.

He said that unsustainable use of fish resources and overexploitation of major fisheries has made MCS critical. International agreements – such as the United Nations Law of the Sea, the United Nations Conference on Environment and Development, and the CCRF — have acknowledged the increasing role of MCS and stressed the obligations of States to establish effective control systems.

Sharing with participants his experiences in the Swedish fishing industry, Mr Andreasson said that MCS systems have mainly been designed for the industrial fisheries of developed countries, and need to be adapted to the requirements of small-scale fisheries. Small-scale fisheries are scattered and consist of a large number of small units. They usually operate close to the shore, employing a wide range of gear. Their operating patterns are complex, and may include seasonal migration. Landings take place in numerous small and often remote landing centres.

He said that the characteristics of small-scale fisheries called for special MCS systems. These would include monitoring through random sampling and the use of modern communications technology by the enforcing authority. Management measures such as limits on effort through access regulations (licensing of fishing vessels, for example), closed seasons, closed areas and gear restrictions, may be enforceable in a cost-effective manner in small-scale fisheries.

He said that all MCS systems are costly - but not in relation to the cost of not managing the resource at all. Acceptance of management measures by stakeholders would ensure effective

enforcement. He concluded that efforts to decentralize management decisions and move towards co-management and community management would lead to cost-effective MCS systems, with elements of self control.

8.0 Commander Afazur Rahman Chowdhury from Bangladesh Coast Guard presented a paper on the 'Status of MCS in the marine fisheries sector of Bangladesh'. He said that the total fish production in Bangladesh is 2.1 million tonnes, of which about 93 percent is supplied by small-scale fishers. The fishery sector accounts for 4.86 percent of the GDP and 5.9 percent of the export earnings of the country. It ensures food security by supplying about 80 percent of the animal protein intake of its population.

The marine fishing fleet of Bangladesh comprises industrial trawlers, gill netters, set bag netters, long lines and trammel nets, etc. The total fishing fleet has increased from 17 385 to 44 082 between 1997 and 2006. About 41 percent of the boats are non-mechanized. The country has 0.9 million fishers, concentrated mostly in Cox's Bazaar - Chittagong (46 %) and Bhola (20 %).

Functionally, marine capture fisheries are sub-divided into subsistence, artisanal, commercial and industrial fisheries. Marine fishing in Bangladesh occurs within the 100 m isobaths; deep-water pelagic and demersal resources remain wholly unexplored and untapped by Bangladesh fishers. The only industrial fishing developed in Bangladesh generally operates out of Chittagong on the east coast.

Analyzing the MCS situation in Bangladesh, Mr Chowdhury said that the declining growth rate of fisheries and the increasing incidence of idle boats indicated over-capacity. This might lead to stock depletion and collapse. On a positive note, Bangladesh has already implemented various control measures, including limits to fishing days, control of mesh size, restricting trawling to within the 40 m depth zone, formulation of marine fish exploitation guidelines, declaration of a sanctuary for hilsa, etc. The government is also encouraging alternative livelihoods to siphon off excess fishing effort. The government is carrying out registration of boats through the Marine Mercantile Department (MMD).

Despite these measures, Mr Chowdhury said, MCS on small-scale fisheries is very inadequate. Only 15 to 20 percent of the country's fishing vessels are registered. Registration and licensing are multi-window processes that discourage fishers. A fisher must first register his boat with MMD and then seek a fishing license from the Department of Fisheries. A separate license is needed from the Forest Department for a fisher operating in the Sundarban Reserve Forest. Mr Chowdhury said that the licensing fee (which is perceived as high), the formality of annual renewal, harassment by the authorities, and lack of awareness, are major reasons for fisher apathy in the matter of registration and license.

The newly constituted Bangladesh Coast Guard and the Bangladesh Navy are responsible for enforcement as well as search and rescue (SAR) operations in the country. But enforcement is severely constrained by manpower shortage and the lack of air support. The Navy's experience suggests widespread illegal fishing by the home fleet as well as poaching by foreign vessels.

According to Mr Chowdhury, Bangladesh can seek cooperation from donor agencies to meet the shortage of funds for MCS. It can learn from the experience of countries like Malaysia in designing a cost-effective MCS regime. He suggested that a successful MCS regime needed a separate Marine Fisheries Directorate and awareness-building among

small-scale fishers. There should be strict control on mesh size and a crash programme for registration of all mechanised boats. Stock assessment ought to be done at the earliest to obtain a precise idea on the sustainability of resources. The country's surveillance system needed to be upgraded. In this context, introducing VMS, installing over-the-horizon radar and strengthening the Coast Guard were essential.

The paper concluded that coordinated research by the Bangladesh Fisheries Research Institute, universities, NGOs and others could help advance the MCS regime.

9.0 Dr V S Somvanshi, Director General, Fisheries Survey of India, presented the report from India on the status of MCS in its marine fisheries. He said that India is endowed with 8 118 km of coastline, 0.53 million sq. km of continental shelf and 2.02 million sq. km of Exclusive Economic Zone (EEZ). The fishery sector contributes 1.07 percent to the total GDP and 5.84 percent of the GDP toward agriculture. India's fish biodiversity is considered rich and diverse and represents nearly 10 percent of the world's fish biodiversity. The fisheries sector in India is complex because of its multi-species, multi-gear, multi-craft and multi-stakeholder character.

The Ministry of Agriculture, Government of India (2001) estimated the potential yield from marine sources as 3.92 million tonnes. The present exploitation level is about 76 percent of the potential. The country has about four million marine fishers. The fishing fleet of about 0.3 million comprises mechanised, motorised and non-motorised boats. The fisheries sector in India is regulated by both the Central and State Governments. The administration of fisheries at the national level lies within the Ministry of Agriculture and at the State-level with the Department of Fisheries. However, in practice, the open-access system prevailing in the country leads to the uncontrolled exploitation. Illegal, Unreported and Unregulated (IUU) fishing in the area further aggravates the issue.

The paper proposed that in order to strengthen the MCS system and its implementation, it is essential to make effective changes in the ground-level system. Standardization of craft and gear; zonation of sea fishing areas; introducing a colour code for fishing boats; a uniform system of registration; sea safety regulations, installation of VMS; strengthening of the fisheries database; information networking for fisheries – these are some of the priority areas. Awareness-raising among fishermen and other stakeholders on the need for conservation and management of fishery resources is also essential for management.

Registration of fishing vessels in India follows stipulations in the provisions of the Marine Fishing Regulation Acts of the coastal States/Union Territories, for vessels below 20m Over All Length (OAL) and as per the Merchant Shipping Act, 1958, of the national Government (for vessels larger than 20m OAL). However, there is no uniformity either within a State or between States. Hence, the adoption of a standard system throughout the country requires priority.

Dr Somvanshi suggested that to curb IUU fishing, regional cooperation can play an effective role. The paper concluded that reduction of over-capacity in the mechanised sector and diversion of excess capacity to deep sea/oceanic fishing are essential for sustainability of the sector. A national body with adequate powers is needed to coordinate various agencies for effective implementation of fishery regulations and conservation measures.

10.0. Mr Mohamed Shameem, Chief Boat Builder, Ministry of Fisheries, Agriculture & Marine Resources (MoFAMR), Maldives, and Capt. Ahmed Jihad of the Maldives Coast

Guard, presented the country report on ‘Status of Monitoring, Control and Surveillance in the Marine Fisheries Sector in Maldives’.

The Maldives is an island nation whose territory comprises more water than land. With an EEZ of more than 900 000 km², a population of just over 300 000 scattered over 200 odd small coral islands, and with marine fisheries being the strongest traditional sector in the Island economy, the Maldives faces tremendous constraints in organizing an effective system of MCS on its marine fisheries.

The major fisheries is pole and line tuna fishing for skipjack tuna, followed by hand lining and long lining for yellowfin and bigeye tuna. Reef fisheries targeting different species takes place at an artisanal and semi-industrial level. A small yet profitable aquarium fishery exists, primarily targeted at export markets.

The major governing regulation is the Fisheries Act (Act No: 5/87). It empowers the MoFAMR to establish and administer regulations for sustainable utilization and conservation of fisheries stocks and living marine resources, including threatened species. In addition, it lays out conditions for licensing of foreign vessels or joint ventures in the EEZ, provides for apprehension of vessels, arrests and penalties, and describes the Coastal Fishery Zone (CFZ).

The Act is presently being revised to take into account changes in fisheries management requirements and international obligations. Other applicable laws and decrees include the Ocean Territories Act (Act No. 6/96) and the Environment Protection and Preservation Act (Act No. 4/93).

MoFAMR is the lead agency tasked with fisheries management and development in the country. It is supported in the execution of its mandate by the Fisheries Advisory Board (FAB). The FAB comprises Ministers from the Ministry of Trade and Industry, Ministry of Tourism, Ministry of Defence and National Security Service, Ministry of Atoll and Island Administration, Ministry of Transport and Shipping, Maldives Customs Service, Ministry of Health and Ministry of Environment, Energy and Water.

However, compliance is an important issue in fisheries management. The reasons for non-compliance are manifold: lack of awareness, inconsistencies in regulations issued by different ministries, inadequate enforcement capacities, the socio-cultural environment of small island communities that rely firmly on community cohesion and solidarity.

To strengthen its MCS capacity, Maldives has implemented a Vessel Tracking System (VTS) for all vessels licensed to operate in the outer EEZ (the zone between 75 and 200 nm). Established in 1995, the VTS is monitored by the Maldivian Coast Guard by installing necessary vessel-tracking transponder equipment on board the vessel. It is mandatory for fishing vessels as per the license issued by the Ministry of Economic Development and Trade. However, this system can identify only vessels with the programmed transponder. Frequent power failure and absence of written rules and regulations in operating the vessel transponder impair the efficacy of the system.

A review under the FAO FishCode Programme on all aspects of MCS, done in October 2000, found that there is a need to update the current Fisheries Act of 1987 to address, *inter alia*: (i) protection of the interests of fishers *vis-à-vis* competing interests in reef/coastal waters; (ii) aquarium fisheries; (iii) institutional mandates; (iv) foreign fishing; (v) VMS; (vi) improvement in the enforcement framework, *e.g.* measures with respect to registration and marking of vessels and (vii) a legal framework for the control of aquaculture.

The paper argued that in order to foster greater operational coordination, a MCS Operational Coordinating Committee of all relevant ministries is needed. There should also be scope to encourage private sector participation. Further, international and regional cooperation opportunities need to be integrated to reduce MCS costs and to promote collective pressure to combat IUU fishing.

Maldives is planning to experiment on the use of fisheries intelligence to motivate fishers to regulate themselves. MoFAMR will provide fishing forecast information exclusively to registered fishing vessels free of charge. They are expected to get relatively better catches than unregistered boats that lack such information. The MoFAMR will use this as an incentive to encourage fishers to install VMS system onboard. If this strategy is successful, fishermen will improve their catches while MoFAMR will get vessel information and fish catch reports. This should encourage all fishers to register with MoFAMR. It should enhance sea safety as well.

11.0 Mr Nimalsiri Abeywickrama, Director (Planning), Ministry of Fisheries & Aquatic Resources (MFAR), Sri Lanka, presented his country's paper on 'Status of Monitoring, Control and Surveillance in the Marine Fisheries Sector in Sri Lanka'.

Sri Lanka has a coastline of 1 700 km, a shelf area (up to 120 m depth) of 30 000 sq. km and an EEZ of 5 17 000 sq. km. The country has a fishing fleet 43 123 in the marine sector, of which, about 39 351 fishing vessels operate in coastal fisheries. A growing population of about 0.6 million depends on the coastal fishery. A number of small-scale fishing crafts, about 90 percent of the fishing fleet, engage in coastal fisheries. They contribute about two-thirds of the domestic fish production.

The December 2004 tsunami created a unique situation in the country. Due to uncoordinated and un-monitored restoration efforts by NGOs (both local and international) the number of fishing boats after the tsunami has gone up significantly. Resultantly, there has been a reduction in catch per unit effort, and a decrease in income from coastal fisheries. The incidence of harmful IUU fishing, driven by a desire for higher catches, has also gone up.

The Department of Fisheries and Aquatic Resources (DFAR) is the government institution authorized to implement enforcement under the provisions of the Fisheries & Aquatic Resources Act and Regulation of Foreign Fishing Boats Act to prevent such activities. The other key agencies for fisheries management in Sri Lanka are the MFAR, the National Aquatic Resources Research & Development Agency (NARA) and the National Aquaculture Development Authority (NAQDA).

The paper said that coastal fisheries in Sri Lanka have now reached the maximum sustainable yield or close to it, according to information available. Therefore it is very important to implement a management programme to avoid over-exploitation in coastal fisheries. To meet this requirement, the DFAR has launched a management programme for coastal fisheries, and introduced a number of management measures.

The paper also informed that seven hundred management areas have so far been declared under the Act for management of fisheries resources through community participation. As a majority of the coastal fisher community are below the poverty level, alternative income-generating opportunities are to be created by implementing poverty alleviation programmes as per the Ten-Year Plan (2007-2016) to reduce fishing pressure.

Strengthening of MCS and introducing VMS will be other priority areas. Assistance from regional and global management organisations, and cooperation with them, will also be important. Steps will be taken to strengthen relations with such agencies.

Summary of group discussions

12.0 Three groups were constituted for in-depth discussion on different aspects of MCS – physical environment requirements (Group 1); governance and policy environment requirements (Group 2) and the role of CBOs/NGOs in setting up MCS regime (Group 3). Appendix 1 to Appendix 3 contains the recommendations of the groups.

13.0 According to Group 1, comprehensive stock assessment is necessary to determine the optimum size of fleet for sustainable exploitation. The right fleet size and gear can be then worked out, and category-wise operational area of fleets defined. This will also help reduce inter-category conflict. Registration of vessels should be mandatory. Awareness should be built to foster a culture of registration.

The group said that VMS should be mandatory for the large capital/length/hp class of vessels. The government should enact enabling legislation for the purpose. For small vessels, measures like colour-coding and display of flags and registration numbers could be considered as part of the VMS, as traditional tools might not be effective.

Encouraging community participation both in MCS and SAR operations is urgently necessary, the group said. NGOs can play an effective role in this context. For harbour-based vessels, governments can introduce a smart card embedded with necessary details and a harbour pass. Two-way communication (VHF and cell phone) could be promoted to enable both MCS and distress communication. Local communities equipped with Internet access through fishery information centres could be tapped to provide needed information.

14.0 Group 2 reviewed existing MCS legislation in member-countries and concluded that it is inadequate to meet present needs and should be revised. The group found that member-countries lacked an information base for implementing MCS. Existing mechanisms for collecting, collating and disseminating national statistics are grossly inadequate. The group recommended that all stakeholders should be involved to make data collection effective. The group lauded the MCS regime in Maldives and recommended that stakeholder consultation should be the stepping stone for developing any MCS regime.

The group advised that steady budget support should be made available to implement MCS. Citing the example of Maldives, the group said that MCS can be used commercially to make it popular. The group found that given the shared stock of member-countries, regional cooperation is must for a successful MCS. There is also scope for sharing information to curb IUU fishing, the group recommended.

15.0 According to Group 3, even if dedicated legal and administrative instruments exist for MCS, one needed to go the extra mile to ensure connectivity. Community-based organisations (CBOs) can help in this context. The government should promote a management regime whereby fishers, through their CBOs, can help enforce MCS. NGOs can act as facilitators. The group suggested that the government chalk out terms of reference for fisheries management and implement them after discussing with fishers and incorporating their concerns.



Participants engaged in Group Discussion

The group found that co-management will not work without legal empowerment of CBOs. On the other hand, there is a risk of power misuse by CBOs. The practical solution at present was therefore that CBOs could work with the government.

The group recommended a micro-level exercise by government to determine the norms for scientific and environment-friendly MCS, depending on the type of craft, fish species, time of the year and gear type. This should be carried out and published. Accordingly, an area-specific management plan could be set out.

The group concluded that a CBO network, if properly conceived and designed, with an accompanying legal, management and financial framework, could ensure a sound MCS in fisheries. Such a network would also serve as a field watchdog to help government agencies.

Concluding Session

16.0 On, the final day of the regional workshop, participants adopted the ‘Chittagong Resolution’, which was based on the recommendations of the three groups. The Resolution is presented in the following chapter.

17.0 In his concluding remarks the chairperson said that the RW-MCS was a very useful and productive meeting and it is now for the member-countries to implement the ‘Chittagong Resolution’ in a time bound manner. He thanked the BOBP-IGO for its contributions to make the RW-MCS successful and to the participants for their active involvement in the proceedings of the Workshop.

18.0 The director, BOBP-IGO proposed the vote of thanks. He said that the implementation of the ‘Chittagong Resolution’ would contribute to sustainable development of the marine fisheries sector in the BOBP-IGO member-countries and also set an example for other countries within and outside the region.

19.0 The Report of the RW-MCS was adopted on 18 January 2008.



SENOARA 1

Chittagong Resolution on Monitoring, Control and Surveillance for Small-scale Fisheries

Conscious that the marine fisheries sector is highly important for the economies of member-countries of the Bay of Bengal Programme Inter-Governmental Organisation (BOBP-IGO);

Recognizing that the marine fisheries sector is a major contributor to the livelihoods, food and nutritional security and foreign exchange earnings of member-countries;

Realizing that a high percentage of the world's artisanal fisheries and small-scale fisheries are concentrated in South Asia, where many of the coastal stocks are almost fully exploited;

Recognizing that the marine fisheries sector largely operates in an open-access regime, and that the present condition of fisheries is largely attributable to weaknesses in the institutional and regulatory environment, a declining resource base and poor socio-economic conditions;

Realizing that monitoring, control and surveillance (MCS) regimes are weak in the marine fisheries sector of member-countries;

Concerned about the social and political constraints to regulating access to marine fisheries and to optimizing the fishing fleet;

Concerned that the current fisheries management regime for coastal fisheries in the region may lead to further unsustainable levels of exploitation of fisheries resources, and thereby impact the livelihoods of small-scale fishermen;

Concerned that the supporting regulations and policy framework relevant to the needs of MCS for small-scale fisheries, remain inadequately addressed by fisheries and maritime administrations in the sector;

Recognizing the limitations in institutional capacity of fisheries and maritime administrations in the region to undertake all responsibilities associated with the mandate;

Recognizing that the 1995 FAO Code of Conduct for Responsible Fisheries (CCRF) does not adequately address the need and requirements of MCS in marine fisheries;

Emphasizing the urgent need to address the multi-dimensional issue of MCS for small-scale fishermen in a holistic manner; and

Recognizing that the problem is not insurmountable;

We, the representatives of Fisheries and Maritime Administrations, Coast Guard and Fishermen's Associations, nominated by the Governments of Bangladesh, India, the Maldives and Sri Lanka, having participated in the BOBP -IGO Regional Workshop on Monitoring, Control and Surveillance for Small-scale Fisheries held in Chittagong, People's Republic of Bangladesh, from 16 -18 January 2008, now therefore:

Resolve to address, as a matter of urgency, the issue of MCS for small-scale fisheries;



Recommend that MCS requirements be comprehensively integrated into every member-country's fisheries policy and regulatory and managerial frameworks. This would include associated commitments under the CCRF and other regional, inter-regional or global instruments and initiatives;

Emphasize the need to rationalize institutional mandates and inter-sectoral cooperation at the national level, in order to enhance implementation of MCS in small-scale fisheries;

Recommend that fisheries and maritime administrations enhance their knowledge and database on the health of the fish stocks and on commensurate efforts required to harvest resources in a sustainable manner;

Recommend the development and implementation of education, training and awareness programmes which satisfy and promote MCS requirements;

Recommend that mandatory requirements for improving implementation of MCS be supplemented by other strategies which involve the participation of fisher communities, families, the media and other stakeholders in order to promote the adoption of a wide range of MCS measures;

Recommend that member-countries, while implementing MCS, also undertake measures to enhance the economic viability of small-scale fishing enterprises, as an essential element of the marine fisheries sector;

Recommend that member-countries make full use of the available technologies, including Vessel Monitoring System wherever feasible, in support of MCS;

Recommend that member-countries employ innovative measures such as co-management. This will be an effective cost-sharing measure for MCS and enhance the participation of fishers and other stakeholders in the management of marine fisheries resources;

Recommend that member-countries undertake measures to formulate time-bound action plans for successful implementation of MCS and for strengthening the national agencies responsible for MCS;

Recommend that member-countries undertake measures directed towards regional cooperation in ensuring successful implementation of MCS; and

Strongly recommend the formation and implementation of a regional MCS programme, employing a consultative and participatory approach, building upon institutionally derived data and the operational experience of small-scale fishermen.

Adopted on Friday, 18th January 2008 in Chittagong, Bangladesh.

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Appendix I

Group Members:

Mr Md Shafiqul Islam, Bangladesh; Mr Mohamed Shameem, Maldives; Mr Md Sanullah, Bangladesh; Mr Ali Rasheed, Maldives; Mr Nimalsiri Abeywickrama, Sri Lanka; Dr V S Somvanshi, India (**Group Leader**); Commandant Anil Sharma, India (**Rapporteur**); Mr R Ravikumar, FAO (**Facilitator**).

Issues	Considerations	Requirements
Optimization of fishing fleet	<p>Small-scale fishery is defined differently in various countries.</p> <p>Need to quantify fish resources in operational area.</p> <p>If the landings indicate a pressure on resources, it calls for immediate action.</p> <p>Stock assessment in areas beyond present area of operation.</p>	<p>Area of operation to be defined.</p> <p>Comprehensive stock assessment to be established by using govt. agencies, fisher community and NGOs.</p> <p>Data collection to be comprehensive.</p> <p>Freeze the size of fleet pending confirmation.</p> <p>Exploratory survey adopting uniform methodology and regional cooperation for data collection.</p>
Restrictions on operation	<p>Spatial.</p> <p>Temporal.</p> <p>Gear restriction.</p>	<p>To avoid conflict between artisanal and mechanised sectors.</p> <p>To protect target species during spawning period.</p> <p>Regulation of mesh size through monitoring of landings.</p> <p>Ban on destructive gear.</p>
Demarcation of fishing fleet	<p>Classification and registration of boats to be made mandatory.</p> <p>Classification of zones.</p>	<p>All fishing boats should be registered.</p> <p>Colour coding to indicate permitted zone(s) of operation.</p> <p>Flag/registration number to determine the origin/port of registration.</p>

Issues	Considerations	Requirements
<p>Use of VMS and other innovative measures</p>	<p>VMS for artisanal boats. Mandatory VMS for high capital/BHP boats. Smart cards. Setting up of Village Information Centres.</p>	<p>To promote awareness on benefits of registration and as a proof of ownership. Fishing zones to be defined to enable effective monitoring. May not be feasible for small boats. Other monitoring systems like use of patrol boats or self regulation/monitoring by community should be promoted. Boat operators reporting to local authority before and after voyage to be encouraged. System of vessel pass should be explored. Where VMS is not feasible, a two way communication [VHF/cell phone] should facilitate monitoring as well as distress communication. Legal instrument to be developed. Use of smart cards for monitoring departure arrival and landings. Use of village information centres as fishery information centres for weather warnings, catch and effort details, price, etc.</p>

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Appendix 2

Group Members:

Mr Parikshit Datta Chaudhury, Bangladesh; Mr Ahmed Jihad, Maldives; Mr Don Simanage, Sri Lanka; Mr Nandasena, Sri Lanka; Mr Md Moniruzzaman, Bangladesh; Mr M A Khaleque, Bangladesh; Mr Sirisena Wettum Pathirana, Sri Lanka (**Group leader**); Cdr Afazur Rahman Chawdhury, Bangladesh (**Rapporteur**); Mr Sanjay Pandey, India (**Rapporteur**); Dr Y S Yadava, BOBP-IGO (**Facilitator**).

Issues	Suggestions	Requirements
<p>1. Legislative support to MCS</p> <p>Legislation in many respects is inadequate to meet the requirements of MCS in the member-countries.</p>	<p>a. The existing legislations of the member-countries should be thoroughly reviewed. If necessary, provisions that meet the requirements for effective implementation of MCS be considered for incorporation into the legislation.</p> <p>b. If considered appropriate in the interest of speedy implementation of MCS, member-countries may also consider formulating stand alone legislation for one or many aspects of MCS.</p>	<p>Necessary action to be taken in consultation with the concerned stakeholders/Ministry/Department.</p>
2. Data collection and database strengthening		
<p>a. Member-countries are lacking in the required information base essential for successful implementation of MCS. The existing mechanisms for collection, collation, dissemination of national statistics on fisheries and related activities is grossly inadequate.</p> <p>b. There are qualitative and quantitative shortcomings in the statistics, which need to be considered.</p>	<p>a. It is desired to conduct a thorough review of the present mechanisms and methodologies deployed for collection, collation and dissemination.</p> <p>b. To also consider various options to make collection and collation of national statistics cost effective through active involvement of the stakeholders. This would ensure the participation of stakeholders and in the longer run the stakeholders might provide the complete information themselves.</p>	<p>a. The Ministry/Departments to conduct review of the existing mechanisms/methodologies in consultation with the concerned sister Ministries/Departments (Statistics/Planning Commission), etc.</p> <p>b. To create a platform for discussions with the stakeholders, especially the boat owners/operators, on the need for accurate and timely collection of statistics concerning activities in relation to fish harvest, effort deployed, discards, etc.</p>

Issues	Suggestions	Requirements
<p>3. Policy support to MCS</p> <p>a. The fisheries sector of all the member-countries operate under a framework of policy, which is determined by the national government on a periodical basis (e.g., in case of Bangladesh, 20 year perspective plan sets the policy framework. In India, the 5 year plan provides the policy options, etc).</p> <p>b. However, these policies do not adequately reflect the requirements for establishing a MCS regime. (It was also recognised that Maldives has a well established MCS programme for the long line fishery, while further improvement may be necessary for the pole & line and reef fisheries).</p>	<p>a. To ensure that the requirement of an effective MCS regime is set up in the member- countries, it may be necessary to introduce the requirements of MCS in the national policies and programmes.</p> <p>b. Such incorporations may be preceded by detailed stakeholder consultations enabling political support.</p>	<p>a. To review the existing policy framework in consultation with the concerned Ministries/ Departments and further consultation with the stakeholders.</p> <p>b. To conduct national level meeting and obtain the endorsement of various groups of stakeholders in strengthening the policy framework to meet the ultimate objective of an efficient and implementable MCS programme.</p>
<p>4. Budgeting MCS in planned development</p> <p>a. An effective implementation of MCS would need adequate support in terms of budget. While budgetary support is available for the marine fishery sector as a whole, the requirements to fulfill the needs of MCS are grossly inadequate.</p> <p>b. The budgetary support for MCS should also be on a continuous basis.</p>	<p>a. Dedicated budgetary support for implementation of MCS.</p> <p>b. The budgetary support should come from internal sources.</p> <p>c. External budgetary support, as and when available, can be used for supplementing/complementing such activities.</p>	<p>a. To review the budgetary support for marine fishery sector as a whole and identify areas/activities for which additional budgetary support (from internal sources) can be allocated/provided for. This might also need extensive consultations with the concerned Ministry/ Departments/Commissions to bring in convergence and optimize the use of scarce budgetary/funding resources.</p> <p>b. To generate revenue from MCS activities, which can be plowed back to MCS programmes.</p>
<p>5. Regulating access to fishing</p> <p>a. Open access to fishing is the bane of most of the problem in the marine fisheries sector.</p> <p>b. As a pre-requisite to bringing an environment of responsible and sustainable fishing in</p>	<p>a. Any attempt to regulate access to fishing would be based on the following requisites:</p> <ul style="list-style-type: none"> • <u>Estimates of the fleet size and the effort deployed for fishing</u>: the existing fishing fleet needs to be 	<p>a. To conduct the census in consultation with the concerned Ministry/Department/agencies.</p> <p>b. To engage in consultation with the concerned Ministry/Department/Stakeholders for setting up of</p>

Issues	Suggestions	Requirements
<p>the marine sector, access needs to be regulated.</p>	<p>thoroughly reviewed, preferably through a census to estimate the exact size of the fishing fleet in terms of category-wise numbers and capacity (length, tonnage, power). In addition, the census should also take into account the geographical distribution of the fleet and all other infrastructure associated with the marine fishing sector (<i>i.e.</i>, fishing harbours, landing sites, processing plants, etc.).</p> <ul style="list-style-type: none"> • <u>Estimation of the harvestable potential</u>: a sound scientific data base on the estimated harvested potential from the national EEZ is a pre-requisite for matching the fishing effort deployed to harvest such resources. It may also be borne in mind that estimation of fish stocks is a costly and time consuming exercise, which may not be easy for the member-countries to accomplish within limited time-frame. However, as a precautionary approach it may be appropriate to begin with the available scientific information on the subject and gradually aim towards more reliable and approximate data on fish stock. b. It may also be necessary to regulate access to the fishery in both space (zonation, marine protected area) and time (seasonal closure, fishing ban, etc.). 	<p>marine protected areas and also enforcing seasonal closure and ban for rejuvenation of fish stocks.</p>
<p>6. Innovative tools in governance and policy for small -scale fishers</p>		
<p>Conventional practices of the Governments are proving to be cost intensive and also at time ineffective.</p>	<p>a. Traditional practices in governance may also be considered besides introduction of innovative tools in governance and policy that could make the process more participatory, transparent and cost-effective.</p> <p>b. Co-management appears to be the most viable approach. In this regard, the steps already initiated by Sri Lanka in setting up of a number of co-management sites should be taken into account.</p>	<p>a. To engage in extensive consultation/dialogue with the concerned Ministries/Departments/Stakeholders on ways and means of implementing co-management approach in the marine fisheries sector.</p> <p>b. Initially such approaches could be tried on pilot-scale basis and later replicated in wider geographical areas.</p>

Issues	Suggestions	Requirements
	<p>c. Co-management approach would require the involvement of all possible stakeholders of the sector and ensure that the process is carried forward with active participation of all. While involvement of the government would be primarily aimed at facilitating the process, it would also be essential for the government to ensure that a level playing field is created and no stakeholder uses his might and strength to dominate the process and/or obtain extra leverage.</p>	
<p>7. Regional co-operation in MCS</p>		
<p>The Bay of Bengal has many fish stocks that are not restricted to the national EEZ, but also are highly migratory or straddling in nature (<i>e.g.</i> Tuna, etc).</p>	<p>The Bay of Bengal being common property of the nations surrounding the Bay would require a collective approach for managing fish stocks in most sustainable and responsible manner. Therefore, this also calls for a regional cooperation in the implementations of the MCS.</p>	<p>a. To enable better understanding of the fish stocks, their migratory behavior and other aspects of the population dynamics, it is essential to establish a mechanism for a regular sharing of information on fish stock assessment, harvesting and trade.</p> <p>b. The member-countries would also benefit through cooperation and collaboration in conducting stock assessment and assisting each other in developing the capacity and skills in the field.</p> <p>c. To ensure that IUU fishing is minimized in the Bay of Bengal, member-countries may share information on licensing of fishing vessels operating in the respective EEZs.</p>



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Appendix 3

Group Members:

Mr Zafar Ahmed, Bangladesh; Mr Roshan Fernando, Sri Lanka; Mr Roger Kullberg, FAO; Mr Ibrahim Fikree, Maldives; Mr Arvind Kumar, India (**Rapporteur**); Mr Arne C I Andreasson, Expert (**Facilitator**).

Issues	Suggestions	Requirements
1. What is meant by co-management?		
How do we define co-management and community management? -Should it be 100% fishermen community owned/managed or at the other extreme, government driven and thrust from top? Or it should be a mix of both?	It should be from the community and by them but co-managed under the overall mutually accepted norms and rules of the government.	The government in consultation with the stakeholders should clearly define the fisherfolk's CBO, its structure, role, functions, legal framework and dos & don'ts.
2. Institutional framework		
<ul style="list-style-type: none"> • Government to define the framework; • Mobilization of CBOs from the community; • Facilitating role of NGOs and the private sector; • Entrusting/enabling CBOs with related mutually beneficial role – non- formal education, etc. 	<ul style="list-style-type: none"> • Awareness building among the government officials/NGOs who would then mobilize CBOs. • Co-partnering with CBOs to negotiate TORs. • Finalizing sets of curriculum & testing them. • Finalizing a curriculum and its uniform application for MCS. 	<ul style="list-style-type: none"> • Government to shortlist/finalize TORs for MCS, in consultation with the CBOs. • Govt. should try and include associated community based programmes such as delegating the responsibility of non-formal education to CBO- this will build trust and make CBOs responsible.
3. Legal framework		
<ul style="list-style-type: none"> • Legal basis for CBO establishment; • Legal issues in decentralizing management decisions; 	<ul style="list-style-type: none"> • Any involvement of CBOs in MCS will never work without accompanying legal authorization/sanctity. 	<ul style="list-style-type: none"> • Defining legal framework of CBOs constitution – election, management, financial management, account keeping, auditing and statutory obligations to put up audited accounts to government.

Issues	Suggestions	Requirements
<ul style="list-style-type: none"> • Legal issues in devolving property rights; • Fisheries- state vs federal government matters? • Issues in legal authorization. <ul style="list-style-type: none"> – What can be legally vested with CBOs? – To what extent? – What can be delegated? – Modalities in follow-up. – Can CBOs be quasi-judicial authority? – How to monitor and prevent misuse. What should be the verifying mechanism? 	<ul style="list-style-type: none"> – Monitoring- can be delegated 100% to CBOs – to be reported at agreed intervals. – Control- setting out rules for CBO management. – Surveillance- defining clearly what can be and what cannot be done by CBOs. <ul style="list-style-type: none"> • Allocation of fishing rights. • Sanctions against members/outsideers – CBO should not have the power. 	
<p>4. Management framework of CBOs</p>		
<ul style="list-style-type: none"> • Is there a scientific management plan defining the norms for MCS – based on type of fleet, fish species, time of the year, etc? • What are the management norms for co-management? <ul style="list-style-type: none"> – Management of output (catch restrictions?) – Management of inputs (boat & gear) – Area management? – Management of the ban period and its implementation? 	<ul style="list-style-type: none"> • A micro-level exercise by the government to determine the norms for scientifically and environment-friendly MCS depending upon the type of craft, fish species, time of the year and gear type should be carried out. <ul style="list-style-type: none"> • There should not be any output/catch restrictions – it should only be for information sake. • Management of inputs, area and ban period must be done by CBOs on accepted norms. • There should be a verifying mechanism by the government to cross verify CBO's MCS reporting and operations. 	<ul style="list-style-type: none"> • Government authorities to: <ul style="list-style-type: none"> – set out area specific management plan. – Define the reporting proforma. – Define the cross verifying mechanism to cross check the self regulation mechanism of CBOs.

Issues	Suggestions	Requirements
<p>5. Financial/Funding mechanisms</p> <ul style="list-style-type: none"> • How should the CBOs be funded? <ul style="list-style-type: none"> – Member’s contributions for MCS? – Role of government – to what extent? On what basis? – Any cost sharing mechanism? – cross subsidization. – Funding CBOs through associated schemes like non-formal education? – modalities? – How will the government agencies take the increasing role of CBOs in managing fisheries activities over & above MCS? – Mechanism for need based redressal of CBOs needs? 	<ul style="list-style-type: none"> • CBOs cannot be left to fund for themselves. This may not work. • Government has to get involved in partial funding either directly or indirectly by routing government subsidy based schemes through CBOs and letting them collect user charges- issue of whether CBO should be MCS specialist or could be more fisheries based generalized one? • Schemes based on cost sharing would be welcome. 	<ul style="list-style-type: none"> • Government has to get involved in partial funding of CBO either directly or indirectly – possibility of routing government schemes through CBO. This should be tried and best models could be worked out. • CBO should levy and collect contribution fee from its members, depending upon the extent of activities undertaken – MCS/MCS +welfare/MCS +welfare+ fisherfolk management, etc.
<p>6. Conclusion</p>		
<p>The need to have a CBO for MCS arises due to acute shortage of government’s field level staff and failure of its machinery in most places. The CBO network if properly conceived and designed with accompanying legal, management and financial framework can ensure a proper MCS in fisheries sector. It can also be a useful arm to the government agencies in the field and serve as a watchdog.</p>		



Application of Monitoring, Control and Surveillance in Small-scale Fisheries¹

1.0 Introduction

Historically, fisheries have often been the basis for human settlements and coastal development in many parts of the world. Populations living in the remotest corners of the coastal nations and islands are vivid example of how fisheries can sustain livelihoods. It is also well recognised that the indirect multiplier effects of the fisheries sector far out weigh its direct contributions to the economy. However, fisheries have often remained an unsung sector in the national accounts statistics.

The fisheries sector not only employs millions but also creates billions in the trade accounts of a large number of countries. The backward linkages to fisheries, such as boat and net manufacturing, ice making, processing, etc. create a large number of livelihood options. More significantly, in coastal areas where livelihood options are limited fisheries provides a viable source of living with scope for surplus generation, which subsequently can foster economic development through promotion of several primary and ancillary activities within and outside the area.

Fisheries have substantial social and economic importance in the Bay of Bengal Programme Inter-Governmental Organisation (BOBP-IGO) member-countries (Bangladesh, India, Maldives, Sri Lanka). However, with the rapid increase in fisher population, fishing in coastal areas has become difficult with low catches and fishing rights conflicts. Often, the entire community may rely on fishing as its chief source of livelihood, lacking alternative means of livelihood. Due to increased pressure on the resources, a large proportion of marine fish stocks is either fully exploited or over-exploited and is in need of recovery. Almost the entire small-scale/artisanal fishery operates in free access regime in the region.

Fishing communities constitute a large population, which is mostly illiterate, poor and has limited access to electronic media and other channels of information. In view of their highly dispersed and remote location, ignorance, illiteracy, lack of access to mass media, etc. making them aware about the significance of responsible fishing and implementation of other management measures and conservation related issues is an enormous task. Also, concern for sustainable fishing operations is of relatively recent origin and the countries lack necessary preparations for such a paradigm shift. As a result, in most cases, the legal framework is insufficient, policies and programmes for fisheries management are inadequate and the compliance levels are also low.

Among the member-countries, the importance of fishing in the national account statistics varies from significant to moderate in the Maldives, Bangladesh, Sri Lanka and India. Therefore, sustainability of the fisheries sector is of utmost importance for the economic stability of all the member-countries.

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2.0 Global and regional status of fisheries

During the last six decades the global capture fisheries sector has flourished. Fish landings, from both inland and marine sources have increased from about 20 million tonnes in 1950 to about 94 million tonnes in 2005. Fish trade has reached a record value of US\$ 71.5 billion in 2004, a growth of 143 percent in real terms during the period 1984-2004. More and more developing countries have joined the global fish trade and as a whole, the value of net export of fisheries from developing countries has way surpassed the value of net export of other agricultural commodities.

Fisheries has emerged as a viable and enabling livelihood not only in developed but also in developing countries. However, the increase in the number of fishers and fishing effort, expanding consumer base and the concomitant demand coupled with unscientific and wasteful fishing techniques has also adversely impacted the natural base of the fishery resources. The Food and Agriculture Organization (FAO) of the United Nations in 2006 estimated that among the species and group of species for which information was available (*e.g.* commercially important species), the proportion of over exploited and depleted stocks increased from about 10 percent in 1974 to about 25 percent at the present, while that of fully exploited stocks stood at 52 percent. On the other hand, the proportion of under exploited and moderately exploited stocks (which hold the possibility of further expansion) declined from about 40 percent in 1974 to about 23 percent in 2005.

The Bay of Bengal (BoB) is a tropical ecosystem in a monsoon belt, bounded on the south by the Indian Ocean and surrounded to the north by the Asian continent, with India to the west, Bangladesh to the north, and Myanmar to the east. Sri Lanka is at the southwestern corner, and Malaysia is at the southeastern. The ecosystem is home to 693 identified fish species. The BOBP-IGO member-countries; constitute a major claim in the resource base of BoB owing to their large fisher population base and rich marine waters. These countries are also among the poor countries in the World with low resource base (Table 1).

During the period, 1950 to 2005, fish landing in the BoB region increased from 0.91 million tonnes in 1950 to 5.16 million tonnes in 2005, recording a CAGR (Cumulative Annual Growth Rate) of 3.18 percent. However, the growth trend on decadal basis recorded a slowdown since 1970s. Among the countries there is considerable variation in the development of capture fishery (Figure 1 and Table 2). Overall, for the period 1950 - 2007, the Maldives has recorded highest rate of growth (5.30%) among the BOBP -IGO countries followed by Sri Lanka (4.38%), India (3.21%) and Bangladesh (2.76%). The decade-wise break up shows that there is a slowdown in production in India and Sri Lanka. Maldives passed through a slowdown in 1970s but since then the capture fishery in the country is growing above the long-term growth rate for the period 1950 - 2005. Almost the same pattern can be seen in Bangladesh also. However, in India and Sri Lanka there is a slowdown in production since the 1980s. As regards contributions to the total fish landings in the region, India (67%) and Bangladesh (25%) provide the larger shares.

As per the FAO information² on western and Indian Ocean, of about 46 species for which statistics is available and commonly exploited by the member-countries, 11 species are fully exploited and 4 are fully or over-exploited. That is for about 33 percent of species there is no further scope of increasing fishing activities; rather they are at risk. These include

² *Review of the State of World Marine Fishery Resources, FAO Fisheries Technical Paper No. 457, Rome, FAO, 2005, 235p.*

Table 1: Socio-economic status of BOBP countries³

Parameter/Country	Bangladesh	India	Maldives	Sri Lanka
HDI Rank	137	126	98	93
Human development index (HDI) value, 2004	0.53	0.611	0.739	0.755
GDP index	0.49	0.58	0.65	0.63
Human poverty index (HPI-1) Rank	85	55	36	38
Total population (millions), 2004	139.2	1 087.10	0.3	20.6
Annual population growth rate (%), 2004-15	1.7	1.3	2.4	0.7
Contribution of fisheries to GDP (%)	4.00	1.07	11.00	2.00
Livelihood (Year)	907 268 (2000)	3 519 116 (2005)	14 241 (2006)	715 160 (2007)
Area	143 998 km ²	3.29 million km ²	90 000 km ²	65 610 km ²
Shelf area (to 200 m)	66 400 km ² approximately	0.53 million km ²	-	27 800 km ²
Exclusive Economic Zone	41 040 sq. nautical miles	2.02 million km ²	1 000 000 km ²	517 000 km ²
Length of coastline	710 km	8 118 km	an archipelago of approx. 1200 islands	1 770 km

Source: Information on fisheries are from corresponding websites of the Ministry/Department of Fisheries of the BOBP-IGO member-countries.

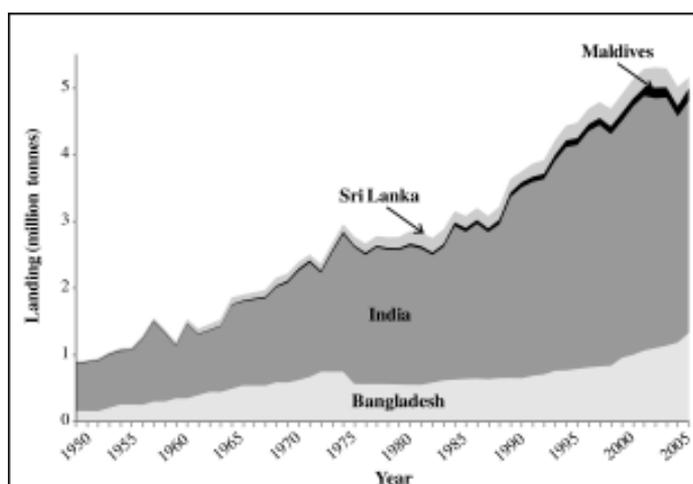


Figure 1: Growth in fish landings in BOBP-IGO member countries 1950-2005⁴

³ World Development Indicators Database, April 2007

⁴ Source: FAO Fisheries Department, Fishery Information, Data and Statistics Unit. FISHSTAT Plus: Universal software for fishery statistical time series. Version 2.3.2000).

Table 2: Growth pattern in fisheries sector in the BOBP-IGO member-countries

Year	Bangladesh	India	Maldives	Sri Lanka	BOBP
1950-59	8.07	0.95	2.26	9.72	2.84
1960-69	5.30	2.97	9.53	6.20	3.74
1970-79	-1.10	2.10	-1.77	5.39	1.46
1980-89	1.68	2.69	6.31	0.83	2.45
1990-99	3.91	2.18	4.66	5.57	2.72
2000-05	4.84	-1.13	7.73	-8.96	0.09
1950-2005	2.76	3.21	5.30	4.38	3.18

Source: Estimated from FAO FISH STAT PLUE Universal Software for Fishery Statistical time series

commercially important species like bombay duck, Indian white prawn, hilsa shad, kelee shad, ponyfishes, sea catfishes, anchovies, Indian oil sardine, kawakawa, butterfishes, pomfrets, jacks, crevalles, narrow-barred spanish mackerel, croakers, drums, giant tiger prawn, natantian decapods, etc. (Figure 2 and Table 3).

There could be variation between these macro trends and the micro situation in BOBP-IGO member-countries. However, if the data could speak for themselves probably they would have sounded the warning bells long back. Although the last six decades have witnessed philosophical change in fisheries governance in the region – first extensive reviews of the status of the resources and second, based on the experience the designing of improved policies and the tools to implement them. However, this process has been slow in the region and needs to be not only strengthened but also expedited.

3.0 The global concern and changing dynamics of fisheries governance

Fisheries governance can be defined as the sum of legal, social, economic and political arrangements that are used to manage fisheries. It includes legally binding rules and regulations, such as national legislation or international treaties, and it relies on customary social

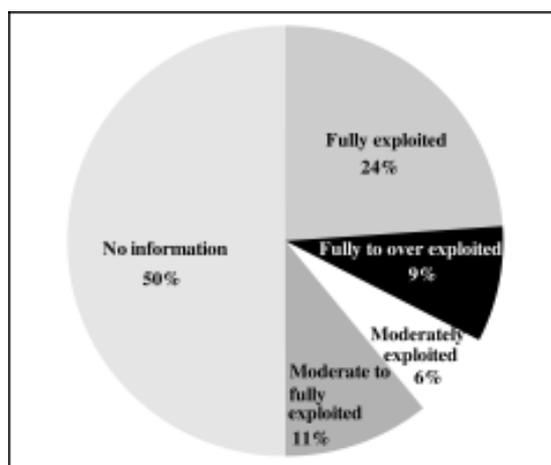


Figure 2: Status of fishery resources in the BOBP-IGO member-countries

Table 3: State of exploitation of selected species and ISSCAAP groups fished in the Indian Ocean (FAO Statistical Area 51 and 57) 1950–2002 for BOBP-IGO countries

SI No	Stock or species group	Scientific name	Concerned BOBP-IGO country	Landing (thousand tonnes in 2002)	State of exploitation
Western Indian Ocean					
1	Bombay-duck	<i>Harpadon nehereus</i>	India	100	F
2	Croakers, drums <i>nei</i>	Sciaenidae	India	265	?
3	Lizardfishes <i>nei</i>	Synodontidae	India	12	?
4	Mulletts <i>nei</i>	Mugilidae	India	22	?
5	Sea catfishes <i>nei</i>	Ariidae	India	87	?
6	Hairtails, scabbardfishes <i>nei</i>	Trichiuridae	India	129	
7	Anchovies, etc. <i>nei</i>	Engraulidae	India	81	?
8	Clupeoids <i>nei</i>	Clupeoidei	India	71	?
9	Indian oil sardine	<i>Sardinella longiceps</i>	India	390	?
10	Wolf-herrings <i>nei</i>	<i>Chirocentrus</i> spp	India	12	?
11	Kawakawa	<i>Euthynnus affinis</i>	India	26	?
12	Narrow-barred Spanish mackerel	<i>Scomberomorus commerson</i>	India	79	F-O
13	Skipjack tuna	<i>Katsuwonus pelamis</i>	Maldives	396	M?
14	Tuna-like fishes <i>nei</i>	Scombroidei	India	13	
15	Barracudas <i>nei</i>	<i>Sphyaena</i> spp	India	15	?
16	Butterfishes, pomfrets <i>nei</i>	Stromateidae	India	23	?
17	Carangids <i>nei</i>	Carangidae	India	59	?
18	Indian mackerel	<i>Rastrelliger kanagurta</i>	India	55	?
19	Jacks, crevalles <i>nei</i>	<i>Caranx</i> spp	India	34	?
20	Pompanos <i>nei</i>	<i>Trachinotus</i> spp	India	0	?
21	Indian white prawn	<i>Penaeus indicus</i>	India	NA	F
22	Natantian decapods <i>nei</i>	Natantia	India	128	F-O
Eastern Indian Ocean					
23	Hilsa shad	<i>Tenualosa ilisha</i>	Bangladesh	152	F
24	Kelee shad	<i>Hilsa kelee</i>	India	44	F
25	Croakers, drums <i>nei</i>	Sciaenidae	India	83	F-O
26	Mulletts <i>nei</i>	Mugilidae	India	26	?
27	Percoids <i>nei</i>	Percoidei	India	29	?
28	Ponyfishes (=Slipmouths) <i>nei</i>	Leiognathidae	India	63	F-O
29	Sea catfishes <i>nei</i>	Ariidae	India	61	F

SI No	Stock or species group	Scientific name	Concerned BOBP Country	Landing (thousand tonnes in 2002)	State of exploitation
30	Hairtails, scabbardfishes <i>nei</i>	Trichiuridae	India	31	M-F
31	Anchovies, etc. <i>nei</i>	Engraulidae	India	39	F
32	Clupeoids <i>nei</i>	Clupeoidei	Sri Lanka, India	102	?
33	Indian oil sardine	<i>Sardinella longiceps</i>	India	20	F
34	Kawakawa	<i>Euthynnus affinis</i>	India, Sri Lanka	27	F
35	Narrow-barred Spanish mackerel	<i>Scomberomorus commerson</i>	India	54	M
36	Skipjack tuna	<i>Katsuwonus pelamis</i>	Sri Lanka	102	M-F
37	Yellowfin tuna	<i>Thunnus albacares</i>	Sri Lanka	57	M
38	Butterfishes, pomfrets <i>nei</i>	Stromateidae	India	17	F
39	Carangids <i>nei</i>	Carangidae	Sri Lanka, India	60	
40	Indian mackerel	<i>Rastrelliger kanagurta</i>	India	34	M-F
41	Jacks, crevalles <i>nei</i>	<i>Caranx spp</i>	India	33	F
42	Silky shark	<i>Carcharhinus falciformis</i>	Sri Lanka	19	M-F
43	Marine fishes <i>nei</i>	Osteichthyes	India, Bangladesh	2 231	M-F
44	Giant tiger prawn	<i>Penaeus monodon</i>	India	56	F-O
45	Natantian decapods <i>nei</i>	Natantia	India	105	?
46	Cephalopods <i>nei</i>	Cephalopoda	India	11	?

nei = not elsewhere included.

(U) Under-exploited; (M) Moderately exploited; (F) Fully exploited; (O) Over-exploited; (D) Depleted; (R) Recovering. Review of the State of World Marine Fishery Resources, FAO Fisheries Technical Paper No. 457, Rome, FAO, 2005, 235p.

arrangements as well as on the respective national framework provided for all economic activities (FAO, 2006). Fisheries governance include two parties: the management authority, who is *de jure*, mandated and designed to perform specific management functions like serving the interest of the state, resource and the stakeholders and the participants, which include the fishers, fish traders, etc. In practice, it is the ministry/department of fisheries and the concerned state agencies that are designed and mandated to govern fishery resources in the region.

In the international arena, the 1995 FAO Code of Conduct for Responsible Fisheries (CCRF) recognises the state of world fisheries and proposes actions that would help achieve long-term sustainability. The FAO member- countries unanimously adopted the Code on 31 October 1995, against a background of profound concern for serious and growing threats affecting the diversity of the aquatic ecosystem. Though voluntary in nature (*i.e.* it does not have to be formally accepted by governments), the Code and its related instruments have been widely recognised by governments and civil society organisations as the global standard for setting out the aims and objectives of sustainable fisheries and aquaculture.

The Code clearly states that the general principle of fisheries is:

“States and users of living aquatic resources should conserve aquatic ecosystems. The right to fish carries with it the obligation to do so in a responsible manner so as to ensure effective conservation and management of the living aquatic resources.”

It further emphasises that:

“Fisheries management should promote the maintenance of the quality, diversity and availability of fishery resources in sufficient quantities for present and future generations in the context of food security, poverty alleviation and sustainable development. Management measures should not only ensure the conservation of target species but also of species belonging to the same ecosystem or associated with or dependent upon the target species.”

Quite in tune with the global trend, fisheries governance in BOBP-IGO member-countries during the early stages (till 1980s) focussed on increasing production through public sector investments in infrastructure, technology and subsidising fishing operations. Later in the 1980s, the governments recognised the problems associated with the growth-centric approach and the concepts of responsible fishing started becoming visible in the fisheries governance. However, the multiplicity of stakes in fisheries resource appropriation coupled with the resource limitations of the government has impeded this process.

‘Sustainability’ is the buzzword in today’s fisheries governance irrespective of a country’s eco-political coordinates. While it can be debated and researched what institutional environment and arrangements will ensure sustainable fisheries, the bottom line is that sustainability rests on the efficacy of information to be used for framing rules and regulations, designing policies and programmes and monitoring compliance and feed backs.

In other words, besides optimising the growth levels to meet the needs of the growing population, much of the success of future fisheries governance regime will depend upon a suitable and effective monitoring, control and surveillance (MCS) mechanism. For the fisheries governance in BOBP-IGO member-countries, the challenge of building a sustainable fisheries sector is daunting, but not impossible!

4.0 Understanding MCS

The task of MCS is as old as fisheries activity itself. However, the contemporary emphasis on MCS differs much from the past applications of MCS. The need for a perspective change of MCS mechanism stems from two facts:

To begin with, fisheries management was initially with the community and fishing operations were largely village/community-based. Technology levels were low and commensurate with the needs of the society. In its domain, it was easy for a fishing community/village to form its own fishing rules and implement them effectively. Since the community *de facto* owns the resources, it has high stakes in protecting them. As technology developed and the sector opened to ‘outsiders’, the traditional community institutions became ineffective resulting in increased involvement of the government to regulate the situation. In the early fisheries managers’ guidebook, MCS was simply policing the opportunistic fishers and implementing policies that government had developed to improve the fisheries sector.

Contemporary definitions of MCS go beyond the traditional idea of MCS as simple policing. MCS is the key to the successful implementation of any planning strategy. The absence of

MCS operations renders a fisheries management scheme incomplete and ineffective (see Figure 3). A comprehensive suite of MCS activities, as FAO manuals have explained, includes:

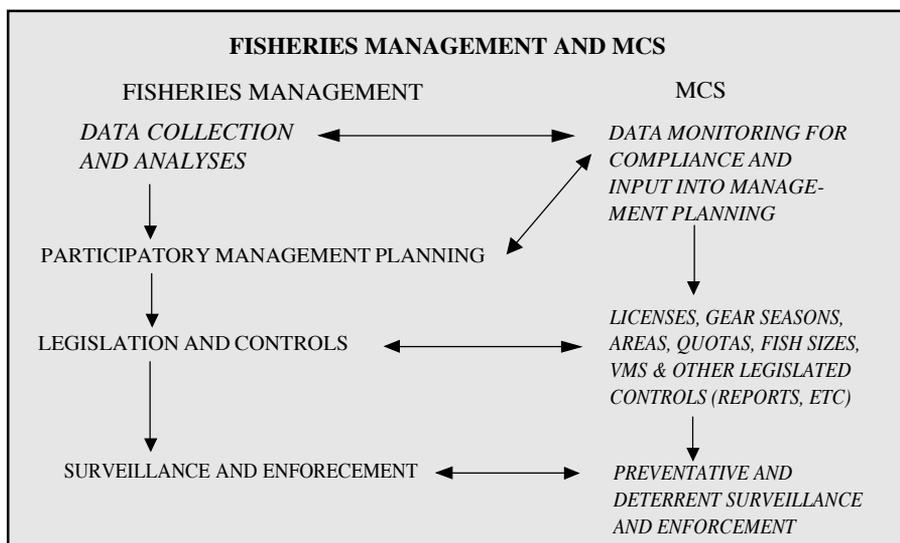


Figure 3: Relationship between fisheries management and MCS⁵

Monitoring: the collection, measurement and analysis of fishing activity including, but not limited to: catch, species composition, fishing effort, by-catch, discards, area of operations, etc. This information is primary data that fisheries managers use to arrive at management decisions. If this information is unavailable, inaccurate or incomplete, managers will be handicapped in developing and implementing management measures. These activities are normally performed by a fishery department. Where community management has been adopted, the fishers will be directly involved in the monitoring and evaluation process.

Control: the implementation of appropriate management instruments in order to regulate the fishery and the resource. Appropriate management instruments may be regulatory measures applied directly to a fishery, such as licensing, or may be fiscal and economic measures to either stimulate or check development of the fishery. Control requires inputs from a number of institutions such as the legislature, licensing departments, the fisheries department, and the department of finance. Communication and education are also important in effecting control, particularly for domestic fisheries. The responsibility for control may be devolved to community institutions.

Surveillance: the observing, policing and enforcement of the implementation of management instruments. In addition to involving the authorities (fishery department, police, coast guard or navy) surveillance, especially of artisanal fisheries, may also involve local fishing communities. This activity is critical to ensure that resources are not over-exploited, poaching is minimised and management arrangements are implemented.

The CCRF documents primarily hold the state responsible to implement MCS system. Paragraph 7.7.3 of Clause 7.7 of Article 7 (Fisheries Management) states that:

⁵ Flewelling, P., *Fisheries Management and MCS in South Asia. FAO/FISHCODE Project, GCP/INT/648/NOR: Field Report C-6 (En), Rome, FAO, 2001:56p.*

States, in conformity with their national laws, should implement effective fisheries monitoring, control, surveillance and law enforcement measures including, where appropriate, observer programmes, inspection schemes and vessel monitoring systems. Such measures should be promoted and, where appropriate, implemented by sub- regional or regional fisheries management organizations and arrangements in accordance with procedures agreed by such organizations or arrangements.

Towards this the FAO⁶ has suggested several indicators, which are helpful in implementing successful MCS system.

There are three main spatial components to MCS: land, sea and air. The proper configuration varies by situation and will depend on such factors as cost, commitment, and organizational structure (national, sub-regional or regional).

The land component of an MCS system serves as the base of operations, the coordinating centre for all MCS activities and entails port inspections, dockside monitoring, and the monitoring of transshipments and trade in fish products. MCS at sea includes activities undertaken in marine areas under the jurisdiction of a state and may also cover high seas areas. Technology can include radar, sonar and vessel platforms. Physical presence through at-sea patrols is a fundamental MCS component as it is necessary for arresting violators and securing evidence. The air component covers the air and space equipment (aircraft, satellites, etc.).

Key tools for MCS can include:

- An appropriate participatory management plan developed with stakeholder input;
- Enforceable legislation and control mechanisms (licenses, etc.);
- Data collection systems - dockside monitoring, observers, sea and port inspections, etc.;
- Supporting communications systems;
- Patrol vessels capable of extended operations to remain at sea with the fishing fleets;
- Aircraft available for rapid deployment to efficiently search large areas;
- Use, where appropriate, of new technology (VMS, satellite, video, infra-red tracking, etc.);
- Linked, land-based monitoring;
- Support of the industry and fishers;
- Bilateral, sub-regional and regional cooperation with other MCS components; and,
- Professional staff.

The Vessel Monitoring System

Recent developments in MCS have seen the growing influence of Vessel Monitoring Systems (VMS). The introduction of very reliable satellite communications systems and the complementary development of Global Positioning Systems (GPS) has enabled fishing vessels to automatically report their positions to management authorities at predetermined intervals or when requested.

⁶ *World Fisheries and Aquaculture Atlas, 2006, 4th edition, Rome, FAO.*

A fishing VMS is a cost-effective tool for the successful MCS of fisheries activities. VMS provides a fishery management agency with accurate and timely information about the location and activity of regulated fishing vessels. The essential components of VMS are tracking vessel locations, identifying possible fishing activity and providing means of communication. For effective application of VMS to a fisheries management objective, it is obvious that the management rules to achieve that objective must relate to VMS capabilities. Examples of management rules where VMS could be effective will probably include restrictions related to geographic areas. These might include but not be limited to:

- An area which is closed for either fishing or navigation or other activity (e.g. transshipment of fish at sea);
- An area which is closed at particular times;
- An area which is restricted for fishing or other activity, to certain vessels on the basis of nationality, type, size, license status, etc;
- An area for which the amount of access is to be timed or counted; and
- An area which is subject to quota or other catch restrictions.

At its simplest form, VMS can be colour coding of fishing fleets as per their base, area of operation, etc and land-based monitoring. In advance forms, it can use mobile and satellite technology, radar system, etc. Currently the most popular VMS systems use INMARSAT-C (and more recently D) and ARGOS. Others such as POLESTAR and EULTRACS are also making an appearance. FAO has prepared detailed guidelines as part of the CCRF series for Fisheries Administrators contemplating the introduction and use of such technology.

At the current state of the art, VMS is a “co-operative” system because each participating vessel must carry an operating transmitter or transceiver⁷. The transmitter or transceiver must have an integrated means of fixing a position and hence calculating speed and course and then reporting it. The GPS used so successfully by the fishing industry, is the method generally preferred because of its high level of accuracy, availability and relatively low equipment cost. The communications system moves data between the transmitter/transceiver on the vessels and the monitoring agency. This may or may not involve the use of a satellite. Many tracking applications for land-based vehicles use cellular phone and high frequency radio.

The combined VMS and Satellite Imagery System under implementation in the Maldives is one of the most sophisticated of MCS tracking systems in that it permits rapid identification of all licensed vessels and also presents a picture of other vessels. This facilitates a focused investigation and cost-effective deployment of expensive patrol resources⁸.

5.0 State of fisheries management in the BOBP-IGO member-countries

(i) Bangladesh

Presently, about 22 percent of the total fish production (2.1 mt) comes from marine waters. The artisanal small-scale fisheries contribute about 93 percent and the industrial (trawlers) contributes about 7 percent of the total marine landings. Gillnets, set-bag nets, long lines,

⁷ FAO Fishing Technology Service., *Fishing operations. I. Vessel monitoring systems. FAO Technical Guidelines for Responsible Fisheries. No. 1, Suppl. 1. Rome, FAO. 1998. 58p.*

⁸ Flewelling, P.; Cullinan, C.; Balton, D.; Sautter, R.P.; Reynolds, J.E. *Recent trends in monitoring, control and surveillance systems for capture fisheries. FAO Fisheries Technical Paper. No. 415. Rome, FAO. 2002. 200p.*

seine nets and trammel nets are the main gear used in the artisanal sector. The main target species for industrial trawlers are shrimp. Many trawlers target live mother shrimp for the shrimp hatcheries, which fetches them high price.

The Ministry of Fisheries and Livestock (MoFL) is primarily responsible for administration and management of fisheries resources. The MoFL has three specialized institutions *viz.* (i) The Department of Fisheries (DoF), (ii) The Bangladesh Fisheries Development Corporation (BFDC) and (iii) The Bangladesh Fisheries Research Institute (BFRI), working on different aspects. The DoF is mainly responsible for implementation of laws and regulations concerning the fisheries sector. The BFDC is primarily responsible for promoting fishing industry, landing, preservation and processing facilities while the BFRI is the prime research and development institution providing valuable inputs towards development of technology and management suggestions.

(ii) India

The BoB region in the country comprises four maritime states - Tamil Nadu, Andhra Pradesh, Orissa and West Bengal and two Union Territories (UTs) – Pondicherry and the Andaman & Nicobar Islands. The total fishing crafts in the region have been estimated at 1 43 872, comprising 22 515 mechanised, 45 551 motorised and 76 806 traditional fishing vessels. The marine fish landing in India during 2004-2005 was 2.960 million tonnes against a potential of 3.934 million tonnes. The BoB contributes about 37 to 40 percent to the total marine fish landings in the country.

As provided under the Indian constitution, both the Central and the State Governments are mandated to manage fisheries activities. While the inland fisheries and coastal areas up to 12 nautical miles are under the jurisdiction of the States, the fisheries beyond 12 nautical miles and up to the Exclusive Economic Zone (EEZ) is within the purview of the Central Government. The Department of Animal Husbandry, Dairying and Fisheries of the Ministry of Agriculture formulates the strategy for the development of the fisheries sector and issues policy guidelines and the DoF in the State government/UTs is responsible for fisheries development and management in their respective jurisdictions. The principal objectives of the DoF are planning and development of infrastructure facilities for landing and berthing of fishing craft, creating suitable marketing facilities, implementation of various fisheries development programmes *viz.*, channelising financial facilities for purchase of fishing implements, implementation of socio-economic programmes and interaction with the Government of India for technical and financial assistance.

(iii) Maldives

The total fishing fleet in the Maldives in 2002 was estimated at 4 356 vessels, of which 1 687 comprised motorised pole and line crafts (*masdhoani*) for tuna fishing in the coastal waters, 111 sailing *masdhoani*, 367 mechanised *vadhudhoani*, 1 168 sailing *vadhudhoani* and 169 mechanised row boats and 854 row boats used for trolling in reef waters. Maldives is traditionally a tuna fishing nation. The main characteristics of tuna fishing are live bait and pole and line fishing. While over the years, tuna fishing has evolved as an industrial activity in the Maldives; reef fishery has remained mostly as a subsistence and small-scale activity.

The Fisheries Law of Maldives, 1987 is the governing law in the fisheries sector. As per the law, the EEZ of the country is specified. The law also empowers the Ministry of Fisheries,

Agriculture and Marine Resources (MoFAMR) to regulate and develop the fisheries sector. The MoFAMR has separated the country into four different fishing zones. Ten-year licenses are issued to the companies, who have invested in the sector.

(iv) Sri Lanka

The fisheries sector of Sri Lanka employs around 1 50 000 active fishers and another 500 000 in support and value chain services⁹. The marine fishing fleet consists mainly of small to medium-sized crafts, owned and operated by individuals. The total fishing fleet in 2004 consisted of 30 024 boats of diverse types, broadly classifiable into: non-motorised traditional craft; motorised traditional craft; fiberglass hulled boats of 6-7 m LOA; larger boats of about 3.5 tonnes; offshore multi-day boats; and beach seine craft.

The Ministry of Fisheries and Aquatic Resources (MoFAR) is the key log in the institutional framework managing the fisheries sector. The Ministry is helped by other agencies engaged in research, planning, input supply and production and marketing. In 1996 a new legislation was introduced in Sri Lanka: the Fisheries and Aquatic Resources Act, No. 2 of 1996, to deal with the modern complexities of the fisheries sector. The main objectives of the Act are management, conservation, regulation and development of the fisheries and aquatic resources of Sri Lanka. Under the Act, seven management areas were declared for the management of fisheries resources through community participation. In addition to the declaration of management areas and management authorities, resource conservation and regulatory functions were also identified and regulations introduced.

Summing up, fisheries have substantial social and economic importance in the BOBP-IGO member-countries. However, with the rapid increase in fisher population, fishing in coastal areas has become difficult with low catches and fishing rights conflicts. A large proportion of marine fish stocks is fully exploited or over-exploited and is in need of recovery. Although, all the member-countries have centralized fisheries management system, almost the entire small-scale/artisanal fishery operates in free access regime. Table 4 gives a snapshot of the MCS situation in member-countries.

6.0 Application of MCS in small-scale fisheries: constraints and scope

Following the FAO terminology, small-scale fisheries can be defined as:

“Traditional fisheries involving fishing households (as opposed to commercial companies), using relatively small amount of capital and energy, relatively small fishing vessels (if any), making short fishing trips, close to shore, mainly for local consumption. In practice, definition varies between countries, e.g. from gleaning or a one-man canoe in poor developing countries, to more than 20-m. trawlers, seiners, or long-liners in developed ones. Artisanal fisheries can be subsistence or commercial fisheries, providing for local consumption or export. They are sometimes referred to as small-scale fisheries”.

Over the years, with the increase in fisher population, number of artisanal boats has increased considerably. On one hand, these increasing numbers of artisanal boats are creating concentration near the coastline escalating rights conflicts and resource depletion. On the other hand, catch per boat is declining leading to pauperization of the fishers and the growing poverty is leading to increasing number of ventures into the sea. The situation is analogous to a spiraling trap and has the potentiality to go out of hand if not controlled.

⁹ Department of Fisheries and Aquatic Resources <http://www.fisheriesdept.gov.lk/divisions/satistics.htm>

Table 4: Snapshot of MCS situation in the BOBP-IGO member-countries

Parameters	Bangladesh	India	Maldives	Sri Lanka
Fishing fleet size	43 254	2 38 772	4 356	30 024
Thrust areas	Fulfilling the requirement of animal protein, Preserving fisheries resources, Improving the socio-economic conditions of fishers, and Exporting fish and fishery products. ¹⁰	Optimizing production and productivity, Augmenting export of fishery products, and Improving welfare of fishermen. ¹¹	Undertaking policies for the sustainable development of fisheries, Developing human resources to promote the fisheries sectors. Undertaking policies to maximize the fisheries sector's contributions, and Undertaking policies to maintain and enhance the natural marine resources. ¹²	Managing fisheries in a sustainable manner, Promoting investment in the fishing sector, Uplifting the socio-economic status of the fishers, Ensuring quality and safety of fish and fishery product exports, and Minimizing post-harvest losses and improving quality of local fish products. ¹³
Key legal instrument	<ul style="list-style-type: none"> The Conservation and Protection of Fish Act, 1950. The Marine Fisheries Ordinance, 1983. The Bangladesh Fisheries Research Institute Ordinance. The Fish Products Inspection and Quality Control Ordinance, 1983. The Bangladesh Fisheries Development Corporation Act, 1973. 	<ul style="list-style-type: none"> The Marine Fishing Regulation Act of States/UTs. Maritime Zone of India (Regulation of Foreign Fishing Vessels) Act, 1981. Indian Fisheries Act, 1897. The Indian Coast Guard Act, 1978. 	<ul style="list-style-type: none"> The Fisheries Law of Maldives, 1987 	<ul style="list-style-type: none"> The Fisheries and Aquatic Resources Act, No. 2 of 1996.

¹⁰ <http://www.moefl.gov.bd/index.aspx>

¹¹ <http://www.dahd.nic.in/>

¹² <http://www.fishagri.gov.mv/home.php?cat=a>

¹³ <http://www.fisheriesdept.gov.lk/pages/objectives.htm>

Parameters	Bangladesh	India	Maldives	Sri Lanka
<i>Key management agency</i>	Ministry of Fisheries and Livestock.	The Ministry of Agriculture, Department of Animal Husbandry, Dairying & Fisheries at the Central Government level and the Department of Fisheries at the State/UT Government level.	Ministry of Fisheries, Agriculture and Marine Resources.	Ministry of Fisheries and Aquatic Resources.
<i>Access</i> ¹⁴	Open 41%	Open in territorial water 56%	Open for locals 62%	Open for locals 46%
<i>MCS readiness, 2001 (highest in South Asia is Malaysia 74%)</i> ¹⁵				

¹⁴ *Op cit*

¹⁵ *Approximated from Flewelling, P., Fisheries Management and MCS in South Asia. FAO/FISHCODE Project, GCP/INT/648/NOR: Field Report C-6 (En), Rome, FAO, 2001:56p.*

The Monitoring Control and Surveillance Division of the Department of Fisheries and Aquatic Resources, Government of Sri Lanka

The main functions of this Division is to ensure the protection of fish resources through MCS programmes and rescue fisherman stranded at sea.

Activities:

1. *Surveillance and rescue operations.*
2. *Monitoring and controlling of illegal unauthorized fishing.*
3. *Provide fishing ground information to fishermen.*
4. *Provisions of weather forecast for fishermen.*
5. *Coordinate Sri Lanka Navy, Air Force and Colombo Radio to rescue the fishermen and crafts stranded at sea.*
6. *Maintenance of signal systems located at Radio centers.*

Source: <http://www.fisheriesdept.gov.lk>

MCS in small-scale fisheries presents a range of unique problems, which relate to large numbers of widely dispersed fishers operating within a fishery, mixed gear/species and landing points. The fisheries sector in the BOBP-IGO member-countries largely comprises small-scale fisheries (including the artisanal fisheries) and the main constraints, which impede practical application of MCS in these countries have been identified as follows:

- Lack of accurate statistics in the small-scale/artisanal sector.
- Lack of scientific information system.
- Inadequate trained manpower at both management and operational levels.
- Lack of awareness at the community-level of the need for MCS.
- A large number of inaccessible landing places along the coast.
- Lack of supporting legislation to implement MCS.
- Inadequate funding for MCS.

In the given situation, some of the main controls and instruments that could be used in implementing MCS in the region are:

- (i) determining the level of sustainable exploitation and other relevant information by data gathering, assessment and analysis;
- (ii) fishing effort control (*e.g.* through licensing);
- (iii) selecting appropriate management instruments – fishing areas/locations/duration of fishing (*e.g.* zonation);
- (iv) development of fisheries management plans based on the principles of conservation of fish stocks in a sustainable manner;
- (v) controls in ports and at sea;
- (vi) educating the community by dissemination of information;
- (vii) promoting co-management strategies;

- (viii) legal support for fishery management plans and regulations to ensure equitable allocation of resource; and
- (ix) implementation of regulations through licensing, reporting and enforcement of fishery laws.

Legislative measures may be appropriate for sophisticated commercial fisheries, but generally in case of small-scale and artisanal fisheries it may be important to reduce the need for conventional surveillance. Alternative methods need to be used to encourage compliance and thus reduce the need for confrontational enforcement, particularly in the light of the costs of management and limited resources generally available. An important approach to MCS in such fisheries is, where possible, to foster a strong local awareness on the need for conservation and management.

Another critical requirement for effective MCS is the establishment of a coordinating mechanism, with well-defined objectives and a clear work plan. The Government cannot practice MCS in isolation and, therefore, coordination among stakeholders is essential. The setting up of MCS can also assist in establishment of multiple channels of communication, which can provide information to the fisher community on weather, commodity and market prices, safety aspects, hygiene, etc.

Although, the MCS tools as per their present definition are well accepted in fisheries management, their implementation in the developing countries is still low. The reasons are assumed prohibitive cost and downgraded benefits. A sound MCS system is costly and also difficult to implement in developing countries. However, through balancing different component of MCS, the fisheries department can achieve some viable degree of MCS.

To aim for a cost-effective solution may appear to be an obvious conclusion, but it's surprising how often this is overlooked. In the 1990's the United States spent approximately \$ 80 million on the surveillance of foreign fishing operations while collecting only \$41.5 million annually from the same fishing fleet. In contrast, in the small coastal state of Costa Rica, the cost of a modest enforcement programme for the tuna fishery was calculated to be about 50% of the expected revenue from this fishery. Another example is Namibia, which collected N\$120 million (US\$15 million) from the fishing industry in 1999 while the cost of the MCS organisation was estimated to be N\$66 million (US\$8 million). This indicates a sound and sustainable organisation well proportioned to the financial income of the sector.

- *A fishery manager's guidebook* (Cochrane, K.L. (ed), 2002)

For small-scale fisheries, the task is still more complicated in terms of number of observation points; however, since their area of operation is limited to inshore waters, low capital MCS technologies can be applied. Regarding funding and technological support, the CCRF has called for funding and technical support to developing countries to develop MCS system. The member-countries have the option to use such calls to approach international donor agencies for funding and technological support. Table 5 presents key tools for an effective MCS, present status and possibility of implementing in the medium run (5 years).

Table 5: Preparedness of the BOBP-IGO member-countries in implementation of MCS

Tool	Efficiency			Preparedness					Implementation ≤ 5 Years			
	Info	Control	Compliance	B	I	M	S	B	I	M	S	
Development of participatory management plan with stakeholder inputs.	High	Medium	Medium	Experiential	Experiential	Initiated	Initiated	No	No	Probably	Probably	
Enforceable legislation and control mechanisms (licenses, etc.).	High	High	High	No			Partially					
Data collection systems - dockside monitoring, observers, sea and port inspections, etc.	High	No	No	Poor		Moderate	Poor	Partial improvement				
Supporting communications systems.	Medium	Medium	Medium	Poor	Better	Improving	Improving	Marginal improvement				
Patrol vessels capable of extended operations and endurance to remain at sea with the fishing fleets	Low	High	High	Poor			No					
Aircraft available for rapid deployment to efficiently search large areas.	Low	High	High	Poor	Better	Improving	Improving	No				
New technology (VMS, satellite, video, infra-red tracking, etc.).	High	High	High	Poor	Initiated	Poor	Better	Yes	Partially	Yes	Yes	
Linked, land-based monitoring.	High	Low	No	Poor	Poor	Poor	Poor	Can be largely improved.				
Support of the industry and fishers.	High	High	High	Poor	Poor	Poor	Poor	Can be largely improved.				
Bilateral, sub-regional and regional cooperation with other MCS components.	High	High	High	Adhering to relevant regional and international arrangements. However, no binding regulations are applicable.			Declarations of regional arrangements can be made binding.					
Professional staff.	High	High	High	Poor	Better	Poor	Poor	Can be largely improved.				

Note 1: B: Bangladesh; I: India; M: Maldives; S: Sri Lanka

Note 2: Efficiency = Efficiency of the corresponding tool in information collection, control and compliance. Preparedness = Preparedness of the country in using corresponding tool. Implementation ≤ 5 Years = Chance of effective implementation in next five years.

7.0 Scope of regional cooperation in MCS

The regional cooperation in respect of the MCS measures is of two types: (1) cooperation with advanced countries and (2) cooperation with neighbours. The CCRF documents (Para 2 of Article 5) states that:

“In order to achieve the objectives of this Code and to support its effective implementation, countries, relevant international organizations, whether governmental or non-governmental, and financial institutions should give full recognition to the special circumstances and requirements of developing countries, including in particular the least-developed among them, and small island developing countries. States, relevant inter-governmental and non-governmental organizations and financial institutions should work for the adoption of measures to address the needs of developing countries, especially in the areas of financial and technical assistance, technology transfer, training and scientific cooperation and in enhancing their ability to develop their own fisheries as well as to participate in high seas fisheries, including access to such fisheries.”

However, it has been noted that at present there is lack of cooperation regarding data exchange, enforceable fisheries management plans and vision. There is collaboration only in case of SAR operations as per international convention. For example, fishing boat of any nationality within the Indian Search and Rescue Region (which includes Indian marine water touching waters of Bangladesh, Sri Lanka and the Maldives).

The international community places high importance on sub-regional and regional fisheries cooperation in the conservation and management of fisheries. This is because many fish stocks (like hilsa, sharks, tuna, etc.) are transboundary in character and cannot be managed by a single country¹⁶.



¹⁶ Towards this, the BOBP-IGO is working on two regional fisheries management plans: the plan on hilsa involves Bangladesh and India (with possibility of joining of Myanmar) and the plan on sharks, involving Bangladesh, India, Maldives and Sri Lanka.

The FAO has singled out the following issues hindering effective regional cooperation:

- Scientific weakness and lack of sound advice/policy.
- Failure of members to address difficult issues such as the management of fleet capacity because of the consequences that reduction may have for their fishers or for their national share (allocation issue).
- Lack of cooperation among members, particularly in relation to shared stocks and practicing exploitation without considering the associate nations.
- Reluctance by members to adopt standard methodologies for scientific assessments, to share information regarding the activity of foreign fleets or to comply with port States responsibility.
- Lack of political will and political differences.
- Lack of technical and financial capacity, which may act a break on cooperation.

Identifying areas for regional cooperation

While lack of capital may be a constraint for all the BOBP-IGO member-countries, but there is still unexplored scope for regional cooperation to strengthen MCS. The following matrix shows potential areas of regional cooperation among the member-countries:

Scope for regional co-operation in MCS

	Bangladesh	India	Maldives	Sri Lanka
Bangladesh	–	Data on shared fish stock.	Sharing experience on shared fish stock.	Sharing experience on shared fish stock.
India	HR Training, Surveillance- aerial and satellite imagery.	–	HR Training, Surveillance, Aerial and satellite imagery.	HR Training, Surveillance, Aerial and satellite imagery.
Maldives	Sharing VMS experience.	Sharing experience on VMS.	–	Sharing experience on VMS.
Sri Lanka	Sharing experience on inter-agency alignment.	Sharing experience on inter-agency alignment.	Sharing experience on inter-agency alignment.	–

8.0 Conclusion

The reality is that fishers are a set of entrepreneurs engaged in one of the riskiest occupations of the world and creating livelihoods for millions of people, both upstream and downstream. Therefore, the ultimate objective of MCS tools for small-scale and artisanal fisheries is not just to protect the resource but to stabilize the sector, minimize occupational hazard and optimize policy benefits. The small-scale fisheries sector can get immediate benefits from successful MCS measures through (i) effective demarcation of fishing areas, (ii) better insurance deal from data strengthening, (iii) target fishing through resource mapping, (iv) sea-safety,





(v) reflecting their stakes in fishing policy, (vi) stabilization of catch per boat and hence income and (vii) possible jobs in land and sea-based monitoring systems.

Community motivation is the most important step for successful implementation of a MCS policy for small-scale fisheries. Sustainability or availability of fish for generations to come offers little or no incentive to artisanal fishers as they earn and live by the day. Promoting MCS as a business-strengthening package, for that matter is more appealing and can be effective in community mobilization to present-day MCS mechanisms.

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Application of Monitoring, Control and Surveillance in Small-Scale Fisheries¹

1.0 Introduction and background

Fisheries monitoring, control and surveillance (MCS) has increasingly been acknowledged as a crucial and integral part of all fisheries management and administration. Its role is to ensure that intentions by fisheries managers and lawmakers are implemented and monitored as to their impact. The recognition of the role of MCS has been linked to major failures in implementing policies and management plans to curb overfishing. FAO (1) states that 75 percent of the fish stocks world wide has remained overexploited or fully exploited over the last 10 - 15 years in spite of national, regional and international efforts. Of these, 25 percent are overexploited, depleted or recovering from depletion.

The recognition of the role of MCS in fisheries management has been highlighted in a few key international developments. The 1982 United Nations Convention on the Law of the Sea (which came into force in 1994) stresses in Article 73.1 the role of MCS. The article states that States may "... take such measures... as may be necessary to ensure compliance with the laws and regulations adopted in conformity with this Convention". In 1992, the United Nations Conference on Environment and Development also lent credibility to MCS and the obligation of States to introduce efficient means of control. In 1995 FAO Code of Conduct for Responsible Fisheries (2) it is stressed, in Article 7.7.3. that "States... should implement effective monitoring, control and surveillance including where appropriate, observer programmes, inspection schemes and vessel monitoring systems".

These international instruments have transferred MCS from being a luxury of developed countries to an obligation for all to work together for the conservation of fish stocks (3). The obligations have been reflected by developed as well as developing countries in their efforts to build effective MCS structures, either on a national, regional or international level. Important instruments in this regard have been the regional fisheries management organisations.

The major threatened resources seem to be the straddling stocks and highly migratory species, but also more local stocks are often showing signs of too high fishing effort, not least in the Bay of Bengal. Many fisheries in the Bay experience declining catch per unit effort, smaller sizes and changes in catch composition (catching down the food chain), all warning signs for the status of the stocks (4).

More efforts are needed to bring fisheries under comprehensive regulation to control and, when needed, limit fishing effort, catches and landings. In case of developing countries with predominantly small-scale fisheries this poses special problems, in terms of regulation, management and control measures. Calls for reduction in fishing effort and bans on destructive fishing methods must also be balanced with the role fisheries play as an economic buffer and the impact of management measures on livelihoods of millions of poor people.

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The paper discusses fisheries MCS, with emphasis on management and control measures, which are applicable to small-scale fisheries.

2.0 Definitions

FAO defines the concepts of monitoring, control and surveillance as follows:

Monitoring: the collection, measurement and analysis of fishing activity, including, but not limited to: catch, species composition, fishing effort, by catch, discards, area of operation, etc. This information is primary data that fisheries managers use to arrive at management decisions. If this information is unavailable, inaccurate or incomplete, managers will be handicapped in developing and implementing management measures.

Control involves the specification of the terms and conditions under which resources can be harvested. These specifications are normally contained in national fisheries legislation and other arrangements which may be nationally, sub-regionally or regionally agreed. The legislation provides the basis for which fisheries management arrangements, via MCS are implemented.

Surveillance involves the regulation and supervision of fishing activity to ensure that national legislation and terms, conditions of access and management measures are observed. This activity is critical to ensure that resources are not over exploited, poaching is minimized and management arrangements are implemented.

3.0 Small-scale fisheries – characteristics

There is no single comprehensive definition of small-scale fisheries. This is partly because small-scale is interpreted differently in different parts of the world. In some areas canoe fishing out of a creek is small-scale, while in some countries also smaller trawlers are considered small-scale. In general, however, small-scale (artisanal) fisheries may be used as a term to describe fisheries involving households operating small amounts of capital and energy, having relatively small fishing vessels, or no vessels, with operational pattern characterized by short trips close to shore, and producing mainly for local consumption. This description does not exclude, however, that fishing trips can be extensive (2 weeks or more for example in the winter fishery for dried fish in Bangladesh) and be oriented towards an international market (tuna fishing in the Maldives).

The table in Annex 1, adapted from Berkes *et.al.* (5), illustrates characteristics of small-scale fisheries operations with regard to the fishing unit (the table also includes subsistence fisheries). In addition to these characteristics, there are other attributes of significance for designing MCS systems. These are the open access nature of many small-scale fisheries, and the complex nature of these fisheries with many small units operating from a large number of scattered, often remote locations and landing their catches in an equal large number of small landing places, employing a wide range of gear, targeting a variety of species, often with seasonal variation, and often migrating between areas during different seasons. A serious problem for MCS systems is that fishers are mostly illiterate, which has posed problems for the introduction of reporting obligations.

More and more sophisticated MCS systems have been established in developed countries responding to needs to monitor and control an increasingly industrialized fleet. The industrialization has often led to a decreasing number of fishing units catching and landing

larger amounts. Systems thus have been designed to cater for few, large units, not the scattered nature of small-scale fisheries with large numbers of units. The obligations to strengthen MCS systems also in developing countries where small-scale fisheries contribute the major part of landings create specific problems and require new innovative approaches.

4.0 From open to regulated access to fisheries resources

Fisheries resources utilized by small-scale fisheries have largely remained open access resources. This regime has evolved from traditional management regimes, which often had unwritten regulations for access. Following demographic and technological changes, these traditional systems have largely broken down and a *de facto* open access has been established.

The open access nature has resulted in small-scale fisheries functioning as an economic buffer for poorer groups in the society. Rapid population increase, marginalization, landlessness and unemployment are forcing increasing numbers to take up fishing, either as a permanent or temporary occupation. Also in areas where traditional mechanisms exist for regulation of entries into the sector, an increasing number has been accommodated because of a culture of mutual assistance.

The ever increasing fishing effort has resulted in overfishing and declining catches per unit effort and Governments have increasingly included regulations of access in their policies and strategies. Such attempts can include the introduction of licensing systems for fishing vessels and registration of fishers, setting criteria for awarding a license. The criteria may then increasingly be made more limiting for entries into the sector. The ultimate regulation may be the allocation of user or property rights for resources to individuals or groups, by introduction of different forms of individual quotas.

Shotton (6) discusses property rights in fisheries and defines four characteristics, which are important for their description:

- *Transferability, which requires proper ownership registers;*
- *Exclusivity, which requires monitoring and enforceable systems;*
- *Security, which depends on honest and effective legal systems; and*
- *Durability, which relates to security.*

He also discusses in detail differences within a so called Individual Transferable Quota (ITQ) system, clarifying that such quotas can be held by a person, a fishing vessel, a community, an enterprise or any form of a collective (co-operative or similar). Further, the term quota does not only refer to output, that is the right to catch and land a certain amount of fish during a defined period. It can also refer to inputs, like fishing effort defined in terms of days fishing, amount of gear or similar. In addition to ITQ's, property rights can be granted as community quotas, which may constrain ownership and transferability. Examples of such quotas are found in Iceland, where municipalities can buy quotas, which are then leased to fishers belonging to the municipality. A third option are territorial user rights (TURF's), which allows an individual or a group to fish in a defined geographic area, but not related to a specific amount of catches. Finally, property rights can be in the form of rights to operate a specific gear. Example of this is lobster fishery with traps in Australia. The latter can be suitable for the operation of large fixed gear or fishing on a fish aggregating device (FAD).

Experiences with group and community-based fisheries rights are limited, which are discussed, for example, by Willmann (7). Group Rights in Fisheries have been more successful

when related to territorial than catch-based rights, which can be attributed to the difficulties in monitoring and enforcing catch limits. There are however examples which indicate that group or community management can be successful and result in a responsible utilization of the resources.

It can be concluded that the trend is towards regulation of fisheries, also in small-scale fisheries, in terms of access to the resources. The final system or detailed model a country chooses will define the MCS needs. Considering the cost of MCS systems all forms of community management and self regulation should be promoted in this process. It is important to recognize the need to integrate MCS with management systems and allow them to develop together.

5.0 MCS tools and small-scale fisheries

5.1 *Framework for monitoring, control and surveillance*

The 1995 FAO Code of Conduct for Responsible Fisheries has been followed up with technical guidelines and action plans. Of specific relevance for MCS are the technical guidelines for fishing operations (8) and the International Plan of Action to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated fishing (IPOA-IUU) (9). These documents provide a comprehensive framework for the establishment of effective MCS systems and can be adapted also to small-scale fisheries operations. Chapter 5 of the technical guidelines states a proper mandate for fisheries protection vessels and fisheries protection officers. Proper marking of fishing vessels and gear is an initial important measure to regulate fisheries and the guidelines have useful Annexes on this. It also gives provisions for “no force” strategies to improve efficiency and effectiveness of MCS. No force strategies can relate to a permit to fish based on catching capacity more than actual catches, which reduces the costs for information gathering and verification. Reporting is then by the vessel itself. Enforcement of such strategies relies on the threat of becoming black listed if regulations are ignored and the need for a vessel to maintain its reputation of “good standing” (10).

The IPOA-IUU prescribes in detail steps to be taken by States in setting up their MCS systems, and covers international instruments, national legislation, MCS systems and sets out a road map for the preparation of national action plans.

5.2 *Legislative framework and management plans*

MCS serves to ensure implementation of fisheries laws and regulations. A pre-requisite for effective MCS is therefore an adequate legislative framework, clearly defining management objectives, means and penalties. It is of utmost importance for all MCS managers that laws and regulations are enforceable, which is not always the case. The ability to enforce a regulation depends on its content and resources available for the enforcement authority. Unenforceable regulations drain credibility from MCS systems and affect the overall effectiveness. It is thus important that MCS managers are consulted when laws and regulations are formulated. It is advisable that the development of management regimes and the continuous elaboration of rules and regulations are done on close collaboration between resource and MCS managers. It is also important that laws and regulations are accepted by major stakeholders. Stakeholder consultations, co-management and community management approaches improve the acceptability (10). The ultimate goal with community management is that the groups decide on management measures within a broad framework established by the authority.

Management plans should likewise be clear, concise and understood by stakeholders. Rohan (7) describes a management strategy evaluation approach, which is based on clearly defined management objectives, clear performance criteria directly linked to objectives, management options which can be considered and means of calculating the performance criteria for each strategy. An evaluation of management plans following this approach would serve the design of MCS systems for monitoring and enforcement.

Management plans for small-scale fisheries should focus on effort control and other measures as gear restrictions, minimum sizes, closed areas and closed seasons. Catch quotas are largely unenforceable in small-scale fisheries, except when sustainable co-management has been introduced. Management plans can and should also include elements of decentralization, whenever possible, towards co-management and community management to be effective.

5.3 *Monitoring*

The role of monitoring has often been underestimated when designing MCS systems and monitoring is often under funded. The Fisheries Information System (FIS) has several tasks, ranging from general statistical information to data for stock assessment (7). FIS can also serve to detect illegal fishing, such as for example landing of species for which there is a seasonal ban, fishing in closed areas, etc. The requirement on FIS is to be as close to real time as possible. It can then assist to direct other MCS tools making them more cost-effective, for example the deployment of patrol vessels, aircraft surveillance and landing inspections.

An efficient use of FIS for MCS purposes relies on timely gathering, quick compilation and analysis of data, much of which can be done automatically. In industrial large-scale fisheries, FIS relies to a large extent on logbooks, sales notes and similar documents, provided by stakeholders in the industry. In small-scale fisheries these systems are largely ineffective and impossible to implement. Data gathering has to be based on random samples and carried out by enumerators, which can be part-time. The design of such systems must build on a proper framework that is a database covering number of fishers and their location and number of fishing vessels (this is required whether it is open or regulated access).

Electronic logbooks are being introduced in industrial fisheries. While digital technologies may seem far from reality for small-scale fisheries, the communications revolution indicates possible innovations in data gathering. One example is the increased literacy among fishers and the rapidly increasing use of mobile phones. Message functions could be used for data gathering from randomly selected fishers. This would be a cost-effective and simple monitoring system.

The basic data, which is required, should assist in determining fishing effort, gear used, areas, catches and catch composition.

5.4 *Inspections of landings*

Inspections of landings lend themselves to checks of catches, catch composition, adherence to minimum sizes, mesh sizes, etc. They thus serve as a deterrent to illegal fishing as well as verification of data gathered by the monitoring system.

The advantages with landing controls are that they are relatively cheap and that measurement, for example weighing of catches, can be made more accurate than inspections at sea. Also gear inspections are easier to carry out at the landing place than at sea. The gear can be taken ashore and inspected in detail.

In industrial fisheries the authorities often prescribe designated landing places and landing times, to allow inspections to take place. Again in small-scale fisheries this is an impossible approach, with all small scattered landing places. While the authority may be able to maintain regular inspections in larger landing centers, inspections at other places must be random. The difficulties and costs involved may prevent the establishment of proper inspections at landing centers. Also in this case, forms of co-management and community management with self control can be a way forward.

5.5 *Inspections at sea and surveillance*

Patrol vessels are efficient in combination with air surveillance in determining fishing patterns, areas of concentration and to detect fishing in closed areas and during closed seasons. Boarding of fishing vessels at sea allows a timely check that regulations for gear and catches are followed. Disadvantages with boarding at sea are inaccurate measurement of catches on board and difficulties to inspect fishing gear properly. In case of suspicion of illegal gear and catches, the patrol vessel can however, order the fishing vessel to the nearest harbour for more in depth inspection.

The cost of patrols by vessels and aircraft is often prohibitive for the MCS authority. In this case a multipurpose Coast Guard can reduce the costs.

Modern technology has been introduced to improve surveillance methods and to complement vessel and airborne surveillance. Vessel Monitoring Systems (VMS) using satellite communication has shown to be effective. VMS allows a control room to follow the fishing fleet in real time as to its movements. It can detect fishing, or at least indicate fishing in closed seasons and areas, and can be used to cross-check other information from the MCS system. The costs for VMS may still be prohibitive for many small-scale fisheries, but costs are coming down and equipment is becoming more affordable. To make VMS more attractive to fishers, its use also to enhance safety at sea is important. It could be foreseen that GPS and VMS could be made available at affordable prices for small-scale fishers in the near future. Table 1 gives a snapshot of applicability of various management measures in small-scale fisheries.

6.0 Institutional arrangements, operating procedures and training

6.1 *Institutional set up*

Under the international legal framework, agreements for regional management organisations, and the national legislation, each country chooses its institutional set up for fisheries management and MCS. The importance of integration of management and MCS has been stressed in the paper. The institutional arrangements must therefore ensure close collaboration between agencies or between different units in an agency. The department of fisheries (integrated in a ministry or as an autonomous government agency) is normally responsible for fisheries management under policy guidelines from the parliament and the ministry. The department usually is responsible for the fisheries information system and thus the monitoring part of MCS. In many countries the department is also setting up landing controls as well as the



Table 1: Management measures and applicability in small-scale fisheries

Management measures	Relevant MCS tool	Applicability in small-scale fisheries
Access regulation	Monitoring system and surveillance at sea and by air.	Adequate data base and transparent processes for licensing a requirement. Provided clear markings of licensed fishing vessels, surveillance can detect illegal fishing. Cost is a factor.
Closed seasons	Surveillance	Same as above.
Closed areas	Surveillance	Same as above.
Quota regulations	Monitoring systems and landing inspections. Self control in community management.	Has to depend on random data and an adequate framework in terms of a database over fishers and fishing gear. The scattered nature indicates that quota control is not a relevant management measure for small-scale fisheries. Sustainable community management can rely on quota regulations.
Fishing effort	Monitoring system and surveillance.	Relevant in terms of regulation of number of vessels in an area (licensing system). Regulation of days at sea ineffective.
Gear restrictions, mesh sizes, etc	Inspections at landing places and boarding at sea.	Necessary measure and applicable but limited effectiveness because of the scattered nature of small-scale fisheries and costs.
Minimum sizes of fish	Same as above.	Same as above.

VMS. Surveillance at sea with aircraft and patrol vessels are the most expensive parts of MCS. Countries therefore seek synergy between multiple uses of the assets. Surveillance are in some countries (for example Ireland) the responsibility of the navy, in others (for example Sweden) the Coast Guard carries out surveillance tasks on behalf of the department of fisheries, and in some countries there are surveillance assets dedicated to fisheries only (example Scotland). In Bangladesh at present both the Navy and the Coast Guard are responsible for fisheries surveillance. The obvious advantage of multi-purpose surveillance agencies is cost. However, the negative side is that priorities for geographical coverage may differ for different tasks. Smuggling is not always concentrated in areas of major concerns for fisheries surveillance. There has also been a debate internationally whether the navy, being part of defence forces, should be involved in civilian tasks. Different countries have arrived at different answers to these questions.

To achieve an optimal effectiveness in MCS, the administrative set up should be clear, and with one lead agency appointed in cooperation with which other agencies carry out specific and well defined tasks.

6.2 Standard operating procedures

Under the overall institutional arrangements there are details, which have to be addressed carefully in order to establish functioning MCS systems. Laws, rules and regulations shall be applied in an equitable and uniform manner and the guiding principle is that all fishers, irrespective of where they fish or land their catches, shall be treated in the same way by inspectors. Training of inspectors is a key element. The FAO Technical Paper 338 (3) has useful Annexes on core competences for fisheries officers and observers, which the basic training and refresher training should strengthen. One area which is often neglected is preparation and use of standard operating procedures (SOPS). Detailed SOPS and uniform training in their use ensures that laws and regulations are applied in a uniform and just way.

It is justified to discuss SOPS in some details since their preparation and systematic use often are neglected. All MCS managers and inspectors should understand the process of SOP preparation, revision and approval, and all should receive training in their use. In small-scale fisheries, which are scattered and subject to random inspections, the use of clear and understood SOPS is essential – the central administration cannot control the inspectors with a high frequency to ensure quality in their work. Thus standardization and systematic reporting are essential.

Different formats can be used for SOPS depending on the nature of their application. However, fisheries MCS always contains a series of decision points. The inspector has to decide whether what she/he observes is compliant or non-compliant with current regulations and what action to take. The SOP should therefore be prepared in a way which facilitates the decision-making and reporting by the inspector. A flow chart is usually the most effective format to satisfy these needs. The flow chart describes all steps to be taken and clearly indicates decision points and the way forward after each decision. Useful guidelines for the preparation of SOPS can be found for example in references 12 and 13.

The preparation process of SOPS in an institution should in itself follow standard procedures. Seven important steps can be identified:

- 1) The first step is to decide on the need for a SOP (revision of an old or a new). Such need arises when new regulations are introduced and when technical developments make an old process obsolete. Also at this stage preliminary aims and objectives and benchmarks for the use of the SOP shall be stated. The SOP shall have a limited scope and not be too general. A “fisheries control SOP” is too wide. Instead the scope should be narrowed down to, for example “landing controls of Hilsa fisheries during September to March”, which is directly linked to a management plan and regulations.
- 2) The second step is the formulation of the first draft. An effective method to do this is that the person or team charged with the drafting are observing a real control, taking notes on each step and use these notes for the preparation of the draft.
- 3) Internal review is the third step. The draft is discussed and commented upon by selected inspectors and MCS managers.
- 4) An external review can also help in discovering inconsistencies and give useful inputs to the finalization of the SOP. External reviewers could be industry representatives and other branches of the fisheries administration.
- 5) Test of the SOP is the next logic step in the preparation. Selected inspectors should be informed/trained in the use of the SOP and apply it for a specified period. They then comment on the draft in terms of how logic the sequences of actions are, and also on undoable inspections, etc.
- 6) Approval of the final draft. The administration should have a defined process for the approval of the final draft and instructions on its use. The SOP should be clearly “marked” in a sequence and easy to retrieve. It should be possible to trace all changes and approvals, who initiated changes and who approved.
- 7) The final step is training. This step is usually the most neglected part of the SOP preparation. It is not sufficient with a letter to “instruct” inspectors to use a specific SOP. This inevitably leads to misinterpretations and non-uniform use. Training of

inspectors in the form of workshops, review sessions, etc will help. Systematic approach to the preparation of SOPS, proper training and monitoring and evaluation of implementation are key elements in effective MCS systems. SOPS should also be made available to and discussed by industry representatives to improve understanding of control points and needs.

7.0 Gender dimension of MCS

A quick internet search reveals that research on women in fisheries focus on their roles either as catchers or workers in trade and processing (14), not on any gender dimension of MCS. However, there is evidence that in some countries, considerable numbers of women taking up fishing, often together with their husbands. This can be a way to reduce labour costs and increase the family income (15, 16). In Bangladesh 150 000 – 200 000 households are engaged in the seasonal catching of fry for the shrimp farming industry (4). The majority of these are women and children. There are examples also from other countries in the region where women are involved in actual fishing operations. These women are directly affected by management decisions and enforcement of regulations. One example is the introduction of property rights (boat quotas) in fisheries in Norway, which in practice guaranteed men the right to fish, largely excluding women, who traditionally had been involved (16). The ban of catching of wild fry in Bangladesh has created severe problems for women. During the season the activity has been an important contribution to the family subsistence and there are no obvious alternatives for women (17).

Although women are affected, as well as men by management decisions and MCS, their voice in management decisions has been negligible. Jentoft (18) argues that fisheries management systematically overlooks the role of women and community in decisions and advocates that resource rights should be vested with communities not individual fishers. This would allow fisheries management decisions as well as MCS to more holistically consider livelihoods impacts of decision. Moves towards co-management and community management could address these issues, by regulating that women must be represented in management committees.



Another gender aspect of MCS is that there are few women in fisheries management institutions and especially in MCS units. However, many countries, such as Ireland have successfully employed women in MCS and this should be encouraged also in the countries around the Bay of Bengal. Participation of women in management decisions as well as implementation of MCS is likely to highlight gender issues and make the administrations more aware of problems arising from management and enforcement.

8.0 Cost

There have been references to the costs for MCS throughout the paper. For example it is stated in section 5.2. that monitoring often is underfunded. This paper does not set out to do a comparative cost analysis. However, the overall considerations must be an analysis of the cost of ill managed fish stocks. This is a cost for the society as a whole and for individual operators in the industry, by not allowing optimal catches. On the other hand one has to avoid a situation where the cost is higher than the benefits generated by the fishery. There are such examples (10).

MCS systems have, as stated earlier, been developed for industrial fisheries, not taking into account the specific characteristics of small-scale fisheries and limitations of developing countries. It would result in unacceptable costs to copy MCS systems for industrial fisheries and apply them for a situation with mainly small-scale operations. Ways have to be sought to reach an acceptable level of enforcement at reasonable costs. To this end the management system should focus on measures which can be controlled with reasonable resources. Effort limitations are thus the entry point to enforceable management regimes. Other cost-effective regulations are gear restrictions (mesh sizes) and minimum sizes of fish. These can be controlled randomly at landing places. Reporting systems should be established built on self-reporting on effort and/or catches which is verified by random sampling using enumerators.

The most cost-effective management regime would be to decentralize management and devolve powers to communities, through co-management. Functioning co-management and community management have mainly been demonstrated in closed systems without migrating fish stocks. However, management regimes based on effort control and allocation of “property rights” in terms of number of vessels or specific gear to a community or a group of fishers has a potential to work also in more open systems. Cost-effective self regulation can be effectively introduced in such systems.

9.0 Conclusions

Overexploitation of fish resources has become a critical factor also in developing countries with predominantly small-scale fisheries and regulation of largely unregulated fisheries has become an urgent issue. There is a trend to move from unregulated, open access fisheries to some form of access limitations. However, few countries have finalized the moves towards regulated access in the small-scale sector.

The small-scale sector serves as an economic buffer and is essential for the livelihoods of millions of poor people. Regulations limiting access therefore have to consider short and long-term livelihoods impact.

There is an increasing recognition of the role of MCS as an integrated part of fisheries management. However, MCS systems have been designed in developed countries, mainly with industrial fisheries operating limited numbers of vessels and often landing in designated

harbours, rendering the systems largely inappropriate for fisheries in developing countries, where the major part of landings are from small-scale fisheries.

Developing countries need to design MCS systems, which are affordable and applicable in small-scale fisheries. Effort limits, by regulating access, closed seasons and closed areas are management measures, which are most likely to be effective and enforceable at a reasonable cost.

An adequate database over fishers and fishing vessels (either access is regulated or not) is crucial for any monitoring system to be effective. Monitoring systems are often neglected in the design of MCS systems and should be given due consideration. The timely gathering of data must rely on random sampling using enumerators, which can be employed part-time. Also modern technologies as message functions in mobile phones should be considered in the design of monitoring systems.

Governments must understand and accept that the obligations under international agreements to effectively control fisheries have a cost tag attached. Underfunded MCS systems will eventually lead to overexploitation of natural resources, which will imply a cost to the society. Different means of funding MCS can be considered. These could include levying fees on the sector. A move towards co-management and community management would assist in keeping costs for MCS low.

An enforceable legal framework and regulations are essential, as well as properly understood and accepted management measures, for MCS systems to be effective. Decentralization of control over management and moves toward co-management and community management employing self control may complement MCS systems and result in more effective enforcement of agreed measures for the protection of fish stocks and sustainable small-scale fisheries.

The institutional set up is critical for effective MCS. Different countries may choose different models. In all models it is essential that a lead agency with overall responsibility is appointed. The lead agency should then cooperate with other relevant agencies within the framework of clear memoranda of understanding.

The smaller details are often decisive for effective MCS. One often neglected detail is the preparation of and training of inspectors in the use of standard operating procedures to ensure that all fisheries are subject to equitable, just, uniform and transparent controls.

Literature reveals that women are often subject to management decisions and MCS enforcement, although they have little influence on management and control decisions. Co-management and community management arrangements therefore should ensure an adequate representation of women in decision making bodies.

The paper does not set out to analyze in detail the cost-effectiveness of MCS systems. However, it is evident that elaborate systems, designed for industrial fisheries can be prohibitively expensive in a situation with predominantly small-scale fisheries. Cost effective monitoring and control methods are essential. The use of modern IT technology should be tried in monitoring systems. Moves towards co-management and community management with elements of self regulation serve to reduce the cost for the government for MCS.

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Annex 1: Characteristics of small-scale and subsistence fisheries.

Characteristic	Small-scale	Subsistence
<i>Fishing unit</i>	Stable, small, specialized with some division of labour.	Lone operators, or family or community group.
<i>Ownership</i>	Usually owned by senior operator, or operators jointly, absentee owner.	Owner-operated.
<i>Time commitment</i>	Either full-time or part-time.	Most often part-time.
<i>Boat</i>	Small, inboard motor (or small outboard).	None, or small, usually non-motorised.
<i>Equipment types</i>	Partly or wholly machine-made materials, often operator-assembled.	Often hand-made materials, operator-assembled.
<i>Gear sophistication</i>	Mechanised and manual.	Mainly non-mechanised.
<i>Investment</i>	Medium to low; entirely by operator.	Low.
<i>Catches (per fishing unit)</i>	Medium to low.	Low to very low.
<i>Disposal of catch</i>	Organised local sale, significant consumption by operators.	Primarily consumed by operator, his family and friends; exchange by barter; occasional sale.
<i>Processing of catch</i>	Some drying, smoking, salting; primarily human consumption.	Little or none; all for human consumption.
<i>Operator's income level</i>	Middle to lowest brackets.	Minimal.
<i>Integration into economy</i>	Partially integrated.	Informal; not integrated.
<i>Occupationality</i>	Often multi-occupational.	Multi-occupational.
<i>Extent of marketing</i>	Often national and local.	Local or district-level only.
<i>Management capacity of fisheries authority</i>	Minimal to moderate, with few scientists/managers.	Often not managed except by the resource users.
<i>Management units</i>	Usually many small units.	Very many small units.
<i>Fisheries data collection</i>	Difficult due to fisheries and authority's features.	Often no data may be collected.

Adapted from Berkes et al, 2001



Status of Monitoring, Control and Surveillance in the Marine Fisheries Sector in Bangladesh¹

1.0 Introduction

Fisheries form a vital source of food, employment, trade and economic well-being for people throughout the world. While Bangladeshis have traditionally been identified with fish and rice, which constitute the major items of their daily diet, practically it has always been more than a mere food source for Bangladeshis. The marine catch in Bangladesh was only 95 000 tonnes in 1975-1976 and has increased to about 500 000 tonnes in 2005-2006. The number of people engaged in fishing has also multiplied since then. At present, the fishery sector accounts for 4.86 percent of GDP, 5.9 percent of the export earnings, 6 percent of the supply of protein and about 80 percent of the animal protein intake of its population. Although, the coastal and marine fisheries historically offer livelihoods to millions of Bangladeshis, the poorest of the poor and the most uneducated lots are involved in artisanal fishing in Bangladesh. Over 167 400 fishermen and estimated 185 000 shrimp fry collectors are directly involved in this sector as per the currently available data.

The total fish production in Bangladesh is 2.1 million tonnes of which marine fisheries contributes around 21.66 percent from an EEZ of 164 000 km². Artisanal fishers contribute about 93 percent of the marine catch. They employ about 43 900 mechanised and non-mechanised fishing vessels, which are small and less efficient and target mainly post larve (PL) and juveniles of marine fishes and shrimps. The marine fish production of certain species is however low considering the perceivably great potential of the resources in the EEZ. Past studies identified high rate of overfishing in the shallow water areas that greatly restricts the recruitment of fish and shrimp. Overexploitation of marine fisheries has resulted in drop in fish catches by the artisanal fishermen affecting the coastal community as well as the entire nation and its economy. It is, therefore, imperative for Bangladesh to review the current status of Monitoring, Control and Surveillance (MCS) for the marine fishery in general and artisanal fishery in particular to determine the required measures to improve the current situation.

2.0 Understanding Monitoring, Control and Surveillance

The rapid depletion of key fish stocks in the 1980s and 1990s has made it imperative that governments achieve greater control over fishing activities. Under this backdrop, MCS was first defined by FAO in 1981, which is discussed elsewhere in this publication. The indicator for MCS is the level of compliance. Compliance is governed by many factors, *e.g.*, number of fishers; the number of vessels; effort and area against hours and area coverage of patrols; number of patrols over a period of time, etc. Mere arrest is not the only relevant indication of the effectiveness of the MCS efforts.

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3.0 Existing management programme/measures

The people of Bangladesh generally prefer to eat freshwater fish rather than marine fish. Therefore, the policy makers traditionally paid more attention to inland fisheries. However, with the increase in population, and more awareness on the benefits of seafood, the demand for marine fish started to increase. At the same time, fish production from freshwater sources has declined for many reasons including pollution. The need for marine fishery management in Bangladesh is reflected in the framing of the Marine Fisheries Ordinance, 1983 and in the provisions of management and notifications of the rules in the official Gazettes published time to time. However, few management interventions have been made so far for the artisanal sector which account for about 93 percent of the marine fish landings. Some of the management measures and important provisions in the Marine Fishery Ordinance, 1983 and in the subsequent amendments are enumerated below:

Limiting fishing days for industrial trawlers

The shrimp trawlers are permitted to fish for 30 days and the catch for each trip must have at least 30 percent fish in the total catch. This measure was enforced in order to limit the discard of by-catch.

Control of mesh size

Mandatory 45 mm mesh size at the codend for the shrimp trawl nets has been enforced to facilitate the escape of small size fish, shrimp and the juveniles of larger fish. Since 2003, high profile drive against catching of *jatka* (hilsa fry) by small mesh nets called “*Current Jaal*” is ongoing during the period February to May every year. Bangladesh Navy and Coast Guard are deployed to enforce the ban routinely. The use of a prescribed mesh size is also being ensured by random inspection of the industrial trawlers before and after every fishing trip.

Depth zone restriction of 40 m

There are provisions for restricting shrimp and fish trawling within the 40 m depth zone to protect the nursery grounds of marine fish and shrimp and preserve the interests of artisanal fishers.

Formulation of marine fish exploration guidance

Guidelines for the industrial fishing fleet have been formulated and published to ensure proper exploitation of the fishery resources.

Declaration of hilsa sanctuary

Four sites in the coastal areas have been established as hilsa sanctuaries, where fishing is banned from 15 to 24 October every year during peak hilsa spawning period.

Restrictions on industrial trawler license

The Government has restricted the issue of fresh license for any industrial trawler till proper survey of the EEZ is carried out.

Encouragement to fish beyond 500 m isobaths of EEZ

The Government has decided to encourage industrial fishing fleet to fish outside 500 m isobaths within the EEZ, in order to reduce pressure on the coastal fish population.

Restriction on PL collection

The Government had restricted post larvae collection in coastal area in 2000, which was later reinforced in 2002.

Ban on throwing any fish into the sea

The Government has imposed restrictions on throwing any catch of fish or aquatic resource, except turtle in the sea.

Survey project and research vessel

A project has been undertaken to procure a survey vessel for full-scale survey in Bangladesh marine waters with external funding support.

Bangladesh Code of Conduct for Responsible Fishing

In line with the FAO CCRF, a Code of Conduct for Responsible Fishing has already been prepared for Bangladesh. The same is in the final stage of approval by the appropriate authority.

Rehabilitation and alternative income generating activities

This programme started from 2005-06 to ensure rehabilitation and alternate source of income during “no catch period”. The activities *inter alia* included, animal husbandry, rickshaw and van pulling, boat making, etc. However it was not adequate to cover all *jatka* fishers. The Government also initiated a project with the assistance of UNDP/FAO, entitled “Empowering Coastal Fishing Communities”. This was a small-scale project, aimed at changing attitudes, empowering and encouraging direct participation of the coastal community in Cox’s Bazaar district. It was viewed partially successful and had several limitations. Such research programmes need to be extended across the coastal region, making some adjustments to incorporate capacity building to strengthen and streamline the institutions and to facilitate community-based management of the coastal fishery resources.

Key marine fisheries rules and regulations

The Government of Bangladesh promulgated the Marine Fisheries Ordinance, 1983 for the management and conservation of marine fisheries resources. Coastal waters are also covered by the Protection and Conservation of Fish Rules (1985). The key marine fisheries rules published since 1989 are shown below:

Year	Key marine fisheries rules published since 1989
1993	Shrimp trawlers must land finfish, which must exceed 30% of the total catch. Licensed vessels must land fishing in designated ports and in the presence of a Department of Fisheries officer.
2000	Non-mechanised boats exempted from license from 1 June – 31 December 2000.
2000	No collection of wild post larvae of fish, shrimp or prawns.
2000	Declaration of marine reserve in the Middle Ground and South Patches of the Bay of Bengal.
2004	No catch can be discarded (except marine turtles). Set bag net minimum mesh size increased from 30 mm to 45 mm.
2006	All trawlers must use a Turtle Excluder Device (TED) during trawling.
2007	Suspension of trawler ban in waters <40 m from 10 April 2007 to 21 August 2007.

4.0 Present state of MCS in Bangladesh

4.1 *Catch and Gear Monitoring*

Currently, the monitoring is done by the limited resources of the Marine Fisheries Office of the Department of Fisheries (DoF) based in Chittagong. The management is highly focused on the activities of industrial trawl sector. There is weaker management and monitoring of artisanal sector which operates from Barisal, Bhola, Patuakhali, Barguna and other areas where fishing pressure is increasing alarmingly. The DoF staff stationed in these areas is generally with aquaculture and inland fishery background. Further studies and research are needed to facilitate the sustainable exploitation of resources in a socially responsible manner in line with the FAO CCRF.

The last comprehensive fish and gear census was undertaken by the DoF during 1995-2000 (Md. Harunur Rashid, 2001). In terms of catch assessment, Fisheries Research Survey System (FRSS) under the DoF is responsible for monitoring coastal artisanal catches. The large number of landing points,² their wide geographic spread and the poor communication in many coastal districts, combined with the limited human resources allocated to catch monitoring, suggest that considerable improvements are needed before these figures can be considered as a management tool. Tables 1 and 2 show the trends in the marine catch and key marine fishery gear respectively. As can be seen from Table 2, a total of 907 268 fishers have been reported to operate in the coastal areas, with the greatest concentrations in Cox's Bazaar and Bhola districts (356 601 and 188 018 fishers respectively).

4.2 *Industrial trawler logbook*

Since the mid-eighties a system has been developed in which trawler skippers regularly produce log books to the DoF marine wing, reporting on the catches of shrimp and fish from commercial shrimp trawlers as well as finfish trawlers. This has been done to monitor and facilitate analysis of the changes in the stock abundance, which can be used to provide suggestions to authorities about the need for fishing effort controls in order to maintain the fish stocks at sustainable level. However, these data logs contain only minimal information concerning details of only those species that have a commercial value; therefore, a full picture of the fishery cannot be established.

4.3 *Fish stock assessment and monitoring*

A number of surveys have been conducted since 1958 in the marine waters of Bangladesh. Most of these surveys were exploratory in nature and oriented to studies for fisheries feasibility. Some surveys were conducted to assess the standing stock of the marine resources, particularly the demersal part of it. However, hardly any objective assessment or survey work has been done for a reasonable assessment for the pelagic resources. The Fridtjof Nansen survey reported 90 000 to 120 000 tonnes of pelagic fish in the continental shelf area (Saetre, 1981), but it is believed that the acoustic survey method used for survey in 1979 resulted in a serious underestimate of pelagic stock. The total stock and annual harvestable stock of marine fisheries (shrimp, demersal and pelagic) resources as estimated in 1979-80 is shown in Table 3.

² There are 192 landing stations for the commercial gillnet fisheries alone (Banks, 2003)

Table 1: Summary of fishing, vessels and catch in 1997-1998 and 2005-2006

Type of fishing	Number of vessels	Catch landed (tonnes)	Average catch per vessel	Number of vessels	Catch landed (tonnes)	Average catch per vessel
	1997-1998			2005-2006		
Industrial						
Shrimp trawl	41	8 133	198	42	6 921	164.8
Fish trawl	13	7 140	549	80	27 163	399.5
Total	54	15 273	283	122	34 084	279.1
Gill net						
Mechanised	2 880	118 911	41	18 922	218 851	11.6
Non-mechanised	3 509	36 747	10	6 377	45 776	7.2
Total	6 389	155 658	24	25 369	264 627	10.4
Set Bag net						
Seasonal (MB)	182	47 665	261	1,091	29 329	26.9
Seasonal (NMB)	2 680	-	-	4 664	100 957	21.6
All season (NMB)	4 590	25 394	6	7 010	23 401	3.3
Total	7 452	73 059	10	12 765	153 687	12.0
Long line fishing						
Mechanised	255	10 394	8	1 350	11 856	8.8
Non mechanised	1 127	-	0	222	2 630	11.8
Other long line	-	-	-	1 069	1 738	1.6
Total	1 382	-	-	2 641	16 224	6.1
Trammel net	500	3 863	8	1 103	7 399	6.7
Other gear	1 608	6 007	4	2 082	3 789	3.6
Total vessels	17 385	264 254	15	44 082	479 810	10.9

Source: DoF (1997-1998 figures quoted in Banks, 2003)

4.4 Licensing and registration procedure

At present it is believed that only half of the commercial fleet and 15-20 percent of the fishing fleet is registered and licensed. All categories of mechanised boat certifications (registrations and fitness) are done by the Mercantile Marine Department (MMD) in Bangladesh. But the fishing license is given by the Marine Fisheries Office (MFO). The MMD registration is a prerequisite for the fishing license provided by MFO. The MMD has so far registered 6 892 mechanised vessels while MFD has given license to only 4 352 fishing vessels till January 2008. It is estimated that the total vessels in the artisanal fleet is about 43 900. However, it has been learned from Cox's Bazaar Fishing Boat Owner's Association in January 2008 that around 6 000 mechanised boats are operated by the fishers of Cox's Bazaar area alone. It is also learned that about 15-20 percent of the boats of Cox's Bazaar area are registered with MMD. The fishers admit that although they are periodically

Table 2: Number of fishermen and fishing gear in coastal districts (2001)

Name of the District	Fishermen	ESBN	Gill net (Ilish Jal)	Push Net	SMD (Bhasan Jal)	Other nets
Chittagong	63 138	14 114	20 118	4 779	117	6 985
Cox's Bazaar	356 601	21 372	28 018	-	-	13 002
Noakhali	72 474	3 093	3 752	-	1 819	3 693
Barisal	84 350	7 179	32 166	-	-	11 060
Jalkhati	1 570	-	-	-	-	-
Pirojpur	10 662	-	-	-	-	-
Bhola	188 018	-	-	-	-	-
Patuakhali	49 112	2 800	8 289	-	-	20 019
Borguna	15 284	-	-	-	-	-
Khulna	50 871	4 982	3 228	1 889	76	6 752
Bagerhat	5 923	-	-	-	-	-
Satkhira	9 265	-	-	-	-	-
	907 268	53 540	95 571	6 668	2 012	61 511

Source: Report of the Marine Fisheries Strengthening Project (Rashid, 2001) DoF/GoB implemented during 1995-2000.

Table 3: The marine fishery stock and MSY

Resource	Stock (tonnes)	MSY (tonnes)
Shrimp	2 000 – 4 000	7 000 – 8 000
Demersal Fish	150 000 – 160 000	40 000 – 55 000
Pelagic	90 000 – 160 000	Not determined

checked by MMD and MFO officials, most of them are not interested in registration. While asking the leaders of a number of Fishing Boat Associations in Cox's Bazaar, Kolapara and Teknaaf, the following reasons were generally given:

(i) Higher licensing fee; (ii) Annual renewal; (iii) Harassment and (iv) Lack of awareness.

The Forest Department controls fishing in the Sunderban Reserve Forest (SRF) area. No boats (mechanised and non-mechanised) are permitted to fish in the reserve forest area without having permit from the Forest Department. In the year 2000 about 5 000 fishing boats of all kinds were licensed to enter the SRF (Sundarban Forest Office, 2000). Records of license maintained by MMD and MFO Chittagong are shown in Table 4.

4.5 Location of main landing sites

Marine fish landing sites in Bangladesh are either developed by the Bangladesh Fisheries Development Corporation (BFDC) or the wholesale merchants themselves. However, there are 192 landing sites for commercial gillnet fisheries alone (Banks, 2003). The BFDC Fish Landing Centers are available at Chittagong, Cox's Bazaar, Khulna, Patharghata, Khepupara, and Barishal. Only Cox's Bazaar and Patharghata were in operation until recently, but now all the landing sites, except Chittagong are in operation. The Fishing Harbour in Chittagong remains unsuitable due to siltation. The trawlers are thereby worst affected with no port

Table 4: State of artisanal boat registration and fishing license

Authority	Number of Vessels			
	2005-2006	2006-2007	2007-2008	Total
MMD (Boat Registration)	138	112	300	6 892
MFO (Fishing License)	134	103	-	4 352

Source: MMD and MFO, Chittagong.

facilities in Bangladesh. Dredging works of the basin of the Chittagong Fish Harbour is in progress and is expected to be completed by February 2008. Many unauthorized landing sites are developed by the merchants in other places, which are poor with regard to hygiene and sanitation aspects.

4.6 Enforcement by Navy and Coast Guard

Both Navy and Coast Guard are routinely involved in checking the enforcement of mesh size and ban of fishing in certain areas during peak spawning period and other specified periods. The presence of Navy and Coast Guard plays a vital role in the security of fishers in coastal area and at sea. Both Navy and Coast Guard are also entrusted with SAR duties in the coastal area and at sea. While Bangladesh Navy is committed to other primary duties, Bangladesh Coast Guard is still in the development phase. Hence, the Coast Guard is presently lacking proper infrastructure and resources. Yet, the presence of both law enforcing agencies, especially of Coast Guard is felt all along the coast, as a good number of Coast Guard Stations/Outposts are operating in the coastal area, although undermanned. The Coast Guard's potential can best be used only if it is properly equipped with adequate resources and manpower.

The Bangladesh Navy (BN) has apprehended a total of 80 foreign fishing trawlers poaching in Bangladesh waters since 1974. However, it is undeniable that many such boats could have escaped undetected due to lack of adequate monitoring and surveillance at sea. To fulfill this challenging task of continuous surveillance and monitoring the vast sea area, neither the Ministry of Fisheries and Livestock (MoFL) nor the Bangladesh Navy or Coast Guard has adequate number of suitable platforms/vessels or manpower. Without suitable air assets for EEZ patrol and suitable fast moving ships/boats capable of operating in the rough sea and in shallow waters respectively, it is extremely difficult to keep the coastal areas and the EEZ under surveillance and control. While a number of Offshore Vessels have been added in the BN fleet over the years, it is still inadequate to cover the vast EEZ. Neither BN nor Bangladesh Air Force is in possession of any Maritime Patrol Aircraft (MPA) yet. On the other hand, the Coast Guard as a paramilitary force under the Ministry of Home Affairs overwhelmingly depends on hired mechanised boats for operations in the coastal area till now. This issue of resource constraints of Bangladesh Coast Guard needs immediate attention.

5.0 Institutional structure and capabilities

5.1 The Department of Fisheries (DoF)

The DoF is the key agency/line agency responsible for fisheries conservation, development and management. Currently there is no information base in the DoF to determine the optimum fishing effort in relation to space and time and in terms of the types of fishing gear and

fishermen. There is need for fishery economist, socio-economist, environmental engineers specialized in hydrodynamics, ecologists, etc. The DoF has rules and regulations promulgated for protection and management of the marine fisheries resources, but the capability of DoF in enforcement of such laws is weak. The Marine Fisheries Ordinance was formulated long back, although some amendments were carried out in the rules. Further amendments should address the growing requirements of the sector.

5.2 *Bangladesh Fisheries Research Institute (BFRI)*

The BFRI, established in 1985 is entrusted with all types of fisheries research to support fisheries information base for management, conservation and development of the fisheries resources, both marine and fresh water. It has four stations: (i) Riverine Fisheries Station at Chandpur (mainly for Hilsa); (ii) Aquaculture Station at Mymensingh (for inland aquaculture); (iii) Brackishwater Research Station at Pikegacha, Khulna (for brackishwater fisheries and aquaculture); and (iv) Marine Fisheries and Technological Station (MFTS) at Cox's Bazaar (for marine fisheries research).

Generally, the MFTS has not been able to undertake open water research in an effective way so far. However, in 2006-2007, the institute implemented 6 marine related projects including improvement of the traditional marine set bag net (MSBN) to make them more fish friendly. The MFTS currently has only 4 scientists.

5.3 *Universities*

The universities located in the coastal areas like Marine Science Institute of Chittagong University has the capacity to undertake research in this sector but at present, their role is generally limited to basic biological research. The DFID, through its SUFER (Support for University Fisheries Education and Research) Project provided support to the universities to introduce field oriented and demand led research. To strengthen the potential for this kind of research, the DoF and BFRI need to formally associate with the universities to create management structures that have an advanced research capacity from which policies can be formulated.

5.4 *Bangladesh Fisheries Development Corporation (BFDC)*

The BFDC has the mandate of exploitation, marketing and infrastructural development. It is a semi-government profit oriented organization and has created facilities in different areas of the country, particularly in the coastal areas in landing, boat building, net making, preservation, processing, marketing and transportation of fish and fisheries products. However, over time many of these facilities have suffered from neglect and the institution is relatively weaker now. The BFDC owned Chittagong Fish Harbour is under renovation and would be opened in February 2008. Once opened it will be able to accommodate up to 68 industrial fishing trawlers inside. BFDC's fish processing plant at Chittagong has reportedly broken the production record of last 20 years recently. It produced 1 800 tonnes of processed fish this year as opposed to usual production of 600 to 700 tonnes in the past years. In terms of research vessels, the BFDC initiated the marine fisheries and oceanographic survey in the past, which contributed significantly to the development of the off-shore fishing fleet. However, the BFDC is no longer responsible for such work.

5.5 National Oceanographic Research Centre

A National Oceanographic Research Centre (NORI) is planned to be established near Cox's Bazaar. Once established, the centre is expected to be an excellent platform for research on marine fishery related subjects.

6.0 Marine fisheries situation

The marine fisheries sector is a source of employment and income for a large section of the population, particularly in coastal areas. According to the MoFL, employment in this sector has increased from 123 562 in 1984 to 916 539 in 1999, implying that the annual growth of employment was 14.3 percent during 1984-1999 (GOB, 2001). This growth rate is faster than that of marine fisheries production, which was 3.9 percent annually between 1984-1999, and indicates that an increasing number of people have found their livelihoods in the sector. The fast employment growth in the sector potentially results from limited employment opportunities in other sectors.

Functionally, marine capture fisheries are sub-divided into subsistence, artisanal, commercial and industrial fisheries. In Bangladesh, marine fishing occurs within the 100 m isobath and as such the deep-water pelagic and demersal resources are either remaining wholly unexplored and untapped by Bangladesh fishers. The only industrial fishing developed in Bangladesh is generally operating out of Chittagong. Currently, the only knowledge of the artisanal resource is unreliable as it is taken from fishermen and some records kept by merchants. Catch data from the industrial fleet are recorded, but these give little information other than the reported total catch.

6.1 Overcapacity and fishing effort in artisanal sector

The country's marine fish production has increased from 95 000 tonnes in 1975-76 to 294 000 tonnes in 1996-97. During 2001-2002 period, the total catch amounted to 415 420 tonnes, up 52 percent from five years earlier. The figure reached to 479 810 tonnes in



2005-2006 showing a much slower growth and resulting a much lower catch per unit effort (CPUE) due to growth in the coastal population and fishing effort. Table 5 shows marine fish production trends in the recent years. The growth in fish production is not due to improvement in base resource; rather it is due to growth in fishing effort caused by overcapacity. On the other hand, as fishing effort has substantially increased since 1975-1976 (over 250%), a large percentage of boats currently remain idle, a clear indication of overcapacity and growing unemployment.

Table 5: Comparison of annual total marine catch 2001-2002 to 2005-2006

Marine Fisheries	Annual Total Catch (Tonnes)						
	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
Industrial Fisheries	16 304	23 901	25 165	27 954	32 606	34 114	34 084
Artisanal Fisheries	317 495	355 596	390 255	403 954	422 601	440 483	445 726
Total	333 799	379 497	415 420	431 908	455 207	474 597	479 810

Source: Fishery Statistical Year Book of Bangladesh, 2005-2006

6.2 Stock depletion

The standing stock data is old and not supportive to formulate a scientific management of the fisheries resource base. Recently the WorldFish Center undertook a short study to identify the trend in fisheries exploitation process and made a preliminary analysis of the present state. It has identified the process of depletion of the resource that was reported earlier to worsen and decline at a faster rate and recommended immediate management actions to be initiated in area of most concern. It also suggested a stock assessment study to be done simultaneously.

The comparative CPUE analysis prepared by the WorldFish Center (Figures 1-3) shows CPUE of artisanal catches by different types of nets along the Chittagong – Cox’s Bazaar coastline. It reveals an alarming fall of CPUE in the artisanal sector in the year 2005-2006. It may eventually mean an imminent collapse of fish stock from Bangladeshi coastal waters.



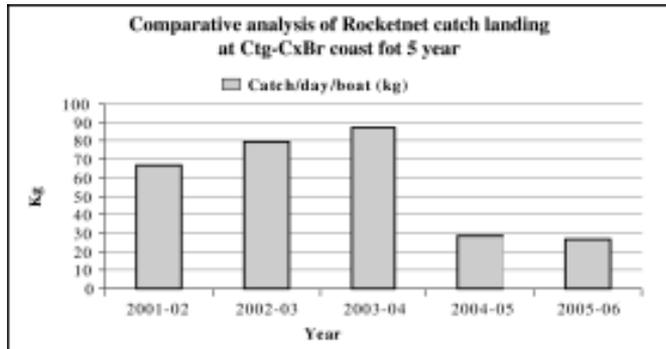


Figure 1: CPUE of artisanal catches by different types of nets

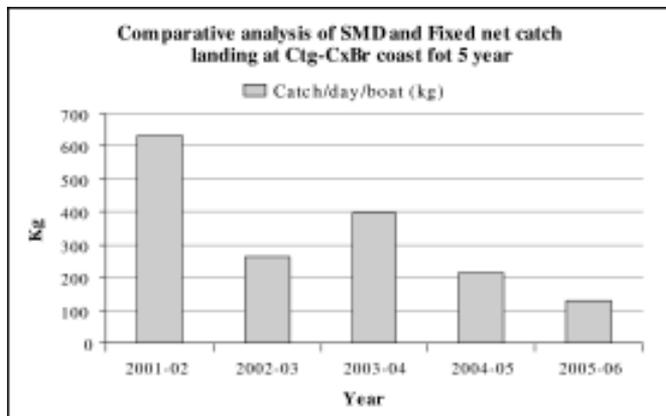


Figure 2: Comparative CPUE analysis of SMD and fixed net catches

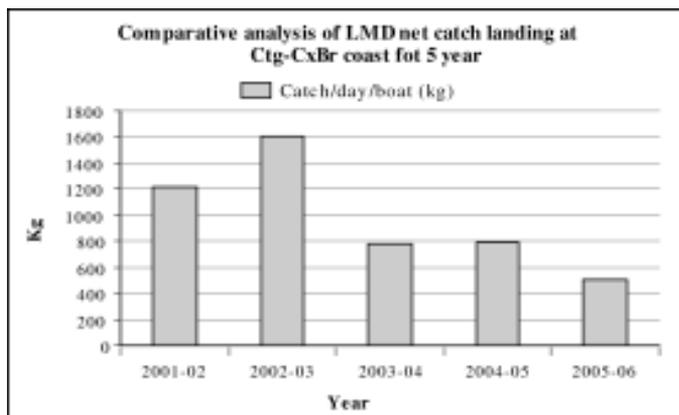


Figure 3: Comparative CPUE analysis of LMD catches

6.3 Situation of hilsa fishery

Hilsa is the national fish of Bangladesh. It is also the largest single species fishery in Bangladesh. It alone makes up about 60 percent of the total catch from the sea while it contributes to about 13 percent of the total national fish production. A good number of Bangladesh Navy ships and Coast Guard vessels are operated in the *jatka* prone area around the clock during *jatka* protection drive (February to May) since 2002-2003. Substantial achievements have been made by both organisations in catching unauthorised boats, nets and defaulters. The hilsa catch is also showing distinct upward trend since 2004 as shown in Figure 4. The trend also continued in 2007. However, it appears that the fishers are coming back with banned nets/gear even by taking the risk of getting the expensive nets confiscated. The reason here is purely socio-economic. Unless alternative livelihood opportunities are found, or participatory management is implemented, fishers will continue to use illegal nets/fishing gear. The confiscation of nets by Navy and Coast Guard is shown in Table 6. It indicates that despite huge confiscations, illegal fishing is going unabated due to socio-economic reason.

6.4 State of sharks

In February 2006, the Marine Fisheries Resource Survey Unit of Chittagong and Cox's Bazaar has taken some steps on data collection of shark fisheries. From primary survey report it was found that 50 000 to 70 000 tonnes of sharks are exploited from Bangladesh EEZ. Some 24 species of sharks are found in the marine waters of Bangladesh. Shark fisheries play an important role in the marine biodiversity balance.

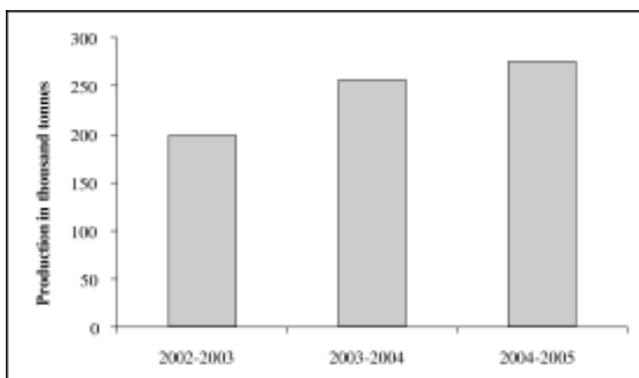


Figure 4: Growth in production of hilsa in recent years

Table 6: State of confiscated nets by Navy & Coast Guard

Year	Navy (in kg) (approx)	Coast Guard (in kg) (approx)
2002	461	2 099
2003	4 066	5 655
2004	31 950	7 825
2005	32 734	3 445
2006	80 412	6 389
2007	58 623	20 653

6.5 By catch

In the past, the industrial fishing fleet, particularly the shrimp trawlers were known to catch more than 35 000 tonnes of by-catch species (White and Khan, 1985). Presently, this by-catch is reported to have reduced, most possibly due to the prevailing lower catches of shrimps and the ban on discard of by catch since 2004.

6.6 Effect of cyclone SIDR

The Sundarbans supports nearly 400 species of fishes in its varied aquatic habitats. These include both the pelagic and demersal fishes. Many species use these habitats as nursery grounds (Banglapedia). As a part of the Sundarbans has been devastated during cyclone SIDR in late 2007, its effect on marine fisheries needs to be studied. SIDR's effect on the other demersal and pelagic marine fisheries in the Bay of Bengal should also be studied at the same time.



7.0 Need for regional cooperation

The UN Convention on the Law of the Sea (UNCLOS) and the FAO CCRF enjoin neighboring States to cooperate and collaborate efforts in the management of the resources that they all exploit. MCS is an expensive venture and collaboration between States in this management measure ensures efficiency of resource use and minimizes costs of operations.

Regional organizations and agencies like South Asian Association for Regional Cooperation (SAARC), Bay of Bengal Initiative for Multisectoral Technical and Economic Cooperation (BIMSTEC), BOBP-IGO, WorldFish Centre should come forward for assistance in technical aspects. They should also make an assessment of the needs for MCS in line with the implementation of the FAO CCRF and translate the global Code in to a local Code to accommodate the national/local technical requirements of Bangladesh. Sharing of Malaysia's experience in achieving one of the best MCS capabilities and considered as a model in Asia may also be of great benefit for Bangladesh.

Most donors active in Bangladesh do not show interest in marine fisheries. They need to be motivated. External interventions may be helpful. Considering the limitations of DoF, exchange of information and experience and intensive cooperation, training assistance, etc by regional partners are essential.

New emerging technology has allowed States to link the land components of their MCS system to those of other States on a regional or sub-regional basis, which can greatly foster coordinated and responsible management. On a regional basis, VMS would be an excellent tool for a regional fisheries organization to encourage and enhance co-operation and information sharing between regional countries. Bangladesh, India, Myanmar and Srilanka can cooperate in his field.

8.0 Recommendations

Action	Details
<i>Separate Marine Fisheries Directorate</i>	Formation of a separate and independent Marine Fisheries Directorate under the MoFL may be considered on a top priority. This will ensure more efficiency in the marine fisheries sector.
<i>Awareness building</i>	Further steps may be taken to create general awareness among the fishing community on the need for conservation of marine fisheries and importance of mesh size.
<i>Alternative employment during closed season</i>	UN and donor agencies may be requested to assist in the alternative employment/compensation of the artisanal fishers for the “no catch period”.
<i>Mesh size restrictions</i>	Strict control of mesh size in artisanal and industrial fishing sector to be enforced with the assistance of Navy and Coast Guard.
<i>Registration/control of all mechanised boats</i>	Projects may be undertaken to register all mechanised boats engaged in artisanal fishing in the coastal area. The project should start with registering boats of Cox’s Bazaar or Bhola district initially, as highest number of fishing boats are operated from these two districts.
<i>Assistance/cooperation from Malaysia</i>	Experience of Malaysia may be thoroughly studied to identify specific field(s) of possible assistance and cooperation needed with a view to improve/strengthen own capacity building measures for enhancing the MCS capability.
<i>Stock assessment</i>	Immediate steps may be taken to determine standing stock and MSY for both pelagic and demersal fishes in the Bangladesh marine waters, including EEZ and coastal waters.
<i>Introduction of VMS</i>	Feasibility of introduction of VMS for the industrial trawlers may be studied immediately.
<i>Over the horizon radar</i>	Feasibility of procurement and installation of a suitable ‘Over the Horizon Radar System’ in Cox’s Bazaar coast (for “no force” monitoring) may be studied.
<i>Strengthening Coast Guard</i>	Steps may be taken to equip Bangladesh Coast Guard with suitable ships, fast moving boats and air assets (fixed wing and rotary wing) to ensure effective patrol and surveillance of the coastal area and EEZ.
<i>Effect of cyclone SIDR</i>	Cyclone <i>SIDR</i> ’s possible effect in the marine fisheries may be studied.
<i>Coordinated research</i>	Steps may be taken to coordinate marine fisheries related research conducted by BFRI, Universities, NGOs and other organisations.



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Commodore Moqsumul Quader (DG, Bangladesh Coast Guard).



Status of Monitoring, Control and Surveillance in the Marine Fisheries Sector in India¹

1.0 Introduction

India is endowed with 8 118 km of coastline, 0.53 million sq. km of continental shelf and 2.02 million km² of Exclusive Economic Zone (EEZ). In India, fishery sector plays an important role, besides providing protein-rich food and employment to more than 6 million fishermen and contributes to export earnings of more than INR 8 000 crore. The contributions to the Gross Domestic Product (GDP) by the fisheries sector during 2005-06 was INR 34 758 crore. Fish and fisheries contributed 1.07 percent to the total GDP and 5.84 percent of the GDP for agricultural sector. The fish biodiversity in the Indian waters is considered as one of the richest and diverse in the world. About 2 200 fish and shellfish species reported from the marine, brackish, fresh water and cold water environment represent nearly 10 percent of the total fish biodiversity of the world. Anthropogenic pressure and climatic changes pose serious problems to the diversity and sustainability of fish stocks. Hence, the biodiversity and fish stocks should be protected for sustainable fisheries using Monitoring, Control and Surveillance (MCS) tools. Considering the importance of MCS, India conducted a workshop on the subject jointly with the Food and Agricultural Organization (FAO) during February, 2001 at Goa. This paper describes progress in implementation of MCS tools for sustainable development of marine fisheries in the Indian EEZ.

2.0 Marine fisheries - status and potential

Indian fisheries has witnessed a steady growth since 1951. From 0.53 million tonnes in 1950-51, the catch has increased to 2.958 million tonnes during 2006 (Figure 1). However, the rate of increase during the past is not proportional to the increase in effort. Most of our

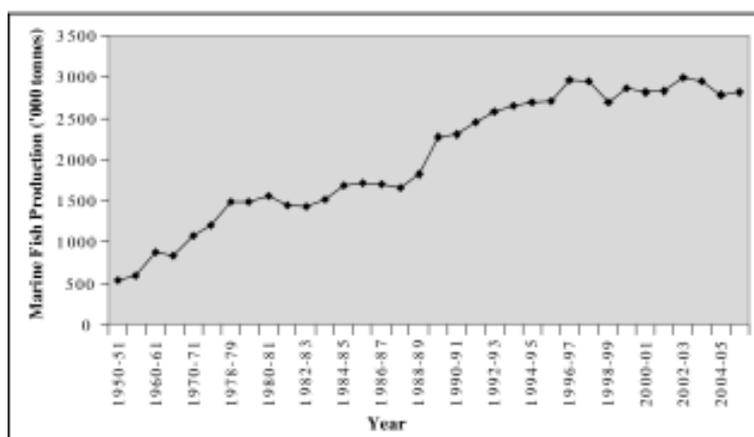


Figure 1: Fish production in India for the period 1950-51 to 2005-06

¹ V S Somvanshi, Director General, Fisheries Survey of India, Botawala Chambers, Sir P M Road, Fort Mumbai - 400 001, India. Email: dg-fsi-mah@nic.in.

fishing effort is directed towards economically important resources and hence restricted to the coastal areas. This has resulted in over-exploitation/full exploitation of certain resources. Regulated fishing, conservation of fishery resources, exploitation of the non-conventional fishery resources, diversified fisheries in deepsea and oceanic resources are the areas that need to be considered for meeting the growing demand of fish and fish products.

The Ministry of Agriculture (2001) estimated the potential yield to be 3.92 million tonnes. Depth-wise potential and level of exploitation are furnished in Table 1. As the table shows, the major share of resources lies within 0-50m depth and the rate of exploitation is also more in this depth zone. The concentration of fishing effort in the coastal zone and the prevailing open access system in India are the major challenges for fishery managers. Popularization of far sea fishing can definitely reduce the fishing pressure in the shallow waters (0-50m depth zone).

Table 1: Potential of fishery resources in the Indian EEZ

Depth range (m)	0 - 50	50 - 200	200 - 500	Oceanic	Total
Demersal	1.28	0.63	0.03	-	1.93
Neretic Pelagic	1.00	0.74	-	-	1.74
Oceanic Pelagic	2.28	1.37	0.03	0.25	0.25
Total	2.28	1.37	0.03	0.25	3.92
Percent to Total	58.15	34.86	0.71	6.27	100.00

3.0 Infrastructure and fishing capacity

According to the marine census, 2005, 35.7 lakh fishermen are engaged in fishing activities. The break up details of fishermen engaged in different activities of fisheries are furnished in Figure 2. The marine fishery resources available in coastal States and Union Territories (UTs) are furnished in Table 2. To exploit the fishery resources, the country has 2.80 lakh fishing fleet and the details of state-wise fishing crafts are furnished in Table 3. As shown in the Table, Andhra Pradesh and Tamil Nadu lead in the total number of traditional fishing craft. Tamil Nadu and Kerala lead in total number of motorised boats and Maharashtra and Gujarat lead in mechanised boats. The motorisation and mechanisation is more prominent along the west coast than in the east coast.

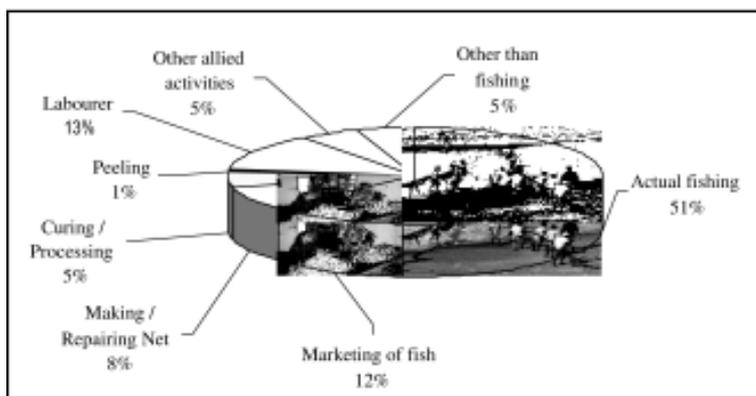


Figure 2: Occupation status of fisherfolk in India

Table 2: Marine fisheries resources –Coastal States and Union Territories of India

Sl. No.	State/union territory	Coast Line (kms)	Continental Shelf ('000 Sq.kms)	Landing Centres (Nos)	Fishing Villages (Nos)	Fishermen families (Nos)	Fisherfolk population
1	Andhra Pradesh	974	33	271	498	1 29 246	5 09 991
2	Goa	104	10	34	39	1 963	10 668
3	Gujarat	1 600	184	123	263	59 889	3 23 215
4	Karnataka	300	27	88	156	30 176	1 70 914
5	Kerala	590	40	178	222	1 20 486	6 02 234
6	Maharashtra	720	112	152	406	65 313	3 19 397
7	Orissa	480	26	57	641	86 352	4 50 391
8	Tamil Nadu	1 076	41	352	581	1 92 152	7 90 408
9	West Bengal	158	17	44	346	53 816	2 69 565
10	A & N Islands	1 912	35	25	100	3 275	15 266
11	Daman & Diu	27	-	7	22	5 278	29 305
12	Lakshadweep	132	4	19	20	5 381	40 322
13	Pondicherry	45	1	26	28	11 541	43 028
	Total	8 118	530	1 376	3 322	7 64 868	3 55 74 704

Table 3: Fishing fleet State-wise

State/UT	Trawlers	Purse seiners	Gill netters	Dol netters	Liners	Others	Total mechanised	Moto-rised	Non-motorised	Total
West Bengal	610	0	4 355	16 922	66	106	6 829	1 776	10 041	18 646
Orissa	1 340	22	1 760	254	28	173	3 577	4719	15 444	23 740
Andhra Pradesh	1 802	0	424	0	20	295	2 541	14 112	24 386	41 039
Tamil Nadu	5 300	46	655	11	781	918	7 711	22 478	24 231	54 420
Pondicherry	326	0	177	0	0	124	627	2 306	1 524	4 457
Kerala	3 982	54	428	0	10	1 030	5 504	14 151	9 522	29 177
Karnataka	2 515	505	1 254	0	28	71	4 373	3 705	7 577	15 655
Goa	830	196	47	0	0	14	1 087	932	532	2 551
Maharashtra	4 219	156	2 550	4 409	253	1 466	13 053	33 82	7 073	23 508
Gujarat	8 002	0	2 363	2 425	4	253	13 047	7 376	3 729	24 152
Daman&Diu	315	4	170	71	0	2	562	654	211	1 427
Total	29 241	983	14 183	8 862	1 190	4 452	58 911	75 591	1 04 270	2 38 772

The post-harvest infrastructure facilities in India are furnished in Table 4. All the west coast States like Gujarat, Maharashtra and Kerala have better harvest and post-harvest infrastructure facilities as compared to the east coast States.

4.0 Legislation, procedure and practices

The fisheries in India are regulated by both central and State Governments. The role of the central Government is explicitly stated in the Constitution of India, Part XII, Chapter 3, Article 297, Schedule VII. As per Article 246, Entry 21 of List 11 specifies fisheries as the responsibility of the States. The administration of fisheries at the national level lies within the Ministry of Agriculture. At the international level, India is participating in several global legal voluntary and advisory instruments.

At the national level, the Indian Fisheries Act, 1897, enacted by the British Government is considered as the first of its kind. It is still in force with some modification by various State Governments. After independence, the Marine Products Export Development Authority Act, 1972; The Territorial Waters, Continental Shelf, Exclusive Economic Zone and other Maritime Zones Act, 1976; the Indian Coast Guard Act, 1977; The Maritime Zones of India (Regulation by Foreign Fishing Vessel) Act, 1981, etc. are the important legislations. The coastal States and the UTs have introduced fishery legislations encompassing the provisions of national level regulations. Most of the regulations are intended to prevent and minimize disputes and conflicts among different sectors of the industry.

The Marine Fishing Regulation Acts (MFRAs) by the coastal States and UTs were enacted in response to various local issues. The demarcation of zones for the non-mechanised and mechanised fishing vessels under the MFRA's varies from State to State (Table 5).

5.0 Monitoring, Control and Surveillance (MCS) assessment

The fisheries sector in India is rather complex due to multi-species, multi-gear, multi-craft and multi-interests of the stakeholders. The open access system prevailing in the country leads to uncontrolled exploitation. Illegal, Unreported and Unregulated (IUU) fishing is further aggravating the issue. Creating awareness among fishermen and other stakeholders

Table 4: Present post-harvest infrastructure in India, 2005

State	Freezing plant		Canning plant		Ice plant		Fish meal plants		Cold storage	
	No	Cap/Day	No	Cap/Day	No	Cap/Day	No	Cap/Day	No	Cap/Day
Kerala	105	2 042	2	1.5	58	147	–	–	167	30 697.1
Tamil Nadu	44	812	–	–	30	511	4	73	93	11 735
Karnataka	12	308.4	–	–	26	549.5	3	259	28	5 080
Andhra Pradesh	56	1 159.4	–	–	9	91	–	–	56	14 050
Goa	5	269.0	2	13	7	278.5	–	–	6	2 300
Gujarat	59	2 981.6	2	4	49	1 628.3	2	23	63	38 075
Orissa	19	359	–	–	16	406.0	–	–	19	4 195
Maharashtra	34	1 940	–	–	11	423	4	73	39	26 263
West Bengal	32	488.1	–	–	4	81.5	–	–	31	7 014

Table 5: The Marine Fishing Regulation Act of maritime States of India and area of operation of fishing vessels

Sl. No.	State	Regulation Act & Year	Category eligible for exclusive fishing right	Area of limitation
1.	Maharashtra	MFRA, 1981	Traditional fishermen	Upto 5-10 Fathoms depth
2.	Goa	MFRA, 1980	Traditional fishermen Mechanised boats	Upto 5 km from shore
3.	Karnataka	MFRA, 1986	Traditional fishermen Vessels upto 50 ft. OAL Vessels above 50 ft. OAL	Upto 6 km Beyond 6 km Beyond 20 km
4.	Kerala	MFRA, 1980	Traditional fishermen Mechanised boats below 25 GRT Mechanised boats above 25 GRT	Upto 10 km Beyond 10 km Beyond 23 km
5.	Tamil Nadu	MFRA, 1983	Traditional fishermen Mechanised boats	Upto 3 nm (1NM = 1.8 km) Beyond 3 NM
6.	Andhra Pradesh	Executive Order, 1983	Traditional fishermen Mechanised boats Vessels of 20m OAL and above	Upto 10 km Beyond 5 km Beyond 10 km
7.	Orissa	MFRA, 1982	Traditional fishermen Mechanised boats upto 15m OAL Mechanised boats above 15m OAL	Upto 5 km Beyond 5 km Beyond 10 km
8.	West Bengal	MFRA, 1993	Non-mechanised vessels upto 9 m OAL Non-mechanised vessels above 9m OAL Mechanised vessels upto 15m OAL Mechanised vessels above 15m OAL	Upto 8 km Beyond 8 km Beyond 20 km Beyond 50 km

on the need for conservation and management of the fishery resources will be a sound management option. In this context, the 1995 FAO Code of Conduct for Responsible Fisheries, assumes great significance. The Code provides necessary framework for national and international efforts to ensure sustainable exploitation of aquatic living resources in harmony with the environment. The policies, programme and legislations enacted by the centre and the maritime states, contain provisions to regulate/restrict or prohibit fishing activities within specified areas, licensing of fishing vessels, cancellations and amendment of licences, regulation of fishing, etc.

The assessment of fish stocks, periodical reallocation of potential resources, implementation of uniform ban on fishing during monsoon periods, overall assessment of the fishing effort, conservation of endangered species, popularisation of Fish Aggregating Devices (FAD), sea ranching and other programmes are initiated with the target of achieving successful MCS. Various schemes to popularise deepsea fishing and diversification of existing trawlers for oceanic fishing, etc. are important steps that would lead to reduction in fishing pressure in the coastal region.

6.0 Implementation of the CCRF in India

A national level committee was constituted during 1999 under the chairmanship of the Secretary, Ministry of Agriculture to implement the CCRF. To initiate action plans for different sub-sectors, three sub-groups were also constituted under the Committee. Those sub-groups are:

- (i) Marine fisheries development, infrastructure development, safety at sea and pollution control.
- (ii) Responsible aquaculture development and application of fisheries research.
- (iii) Post-harvest practices and trade in fisheries.

The Agencies/Institutes responsible for the implementation of various activities under the CCRF are furnished in Table 6.

Table 6: Agencies/Institutes responsible for implementation of CCRF in India

Implementing Agency/ Institutes	Responsibility
Ministry of Agriculture	Implementation of resource specific deep-sea vessels, VMS system.
Central Institute of Coastal Engineering for Fishery (CICEF)	Preparation of techno-economic feasibility report for the development of fishing harbours.
Central Institute of Fisheries Nautical & Engineering Training (CIFNET)	Training to the State/UTs Government officials and fishermen on manning of vessel.
Indian Coast Guard	Prevent IUU fishing.
Department of Ocean Development (DOD)	Environmental monitoring by implementing the coastal ocean maintaining and prediction system (COMPAS).
Fishery Survey of India	Act as interface between the State and Central Government in fishery conservation and management for sustainable fisheries.
Integrated Fisheries Project	Provide training in fish handling and fish processing.

7.0 Implementation of MCS

The MFRAs of the coastal States and UTs have enough provisions for fishery resource management in the country. Still we are far behind in their effective implementation. Presently, MCS in the sector is being implemented with varying degree of success. In order to revamp and strengthen the MCS system and its implementation, it is essential to make effective



changes at the ground level. Standardization of craft and gear, zonation of sea fishing areas, colour code for fishing boats, uniform system of registration, sea safety regulations, installation of VMS, strengthening of database and information network for fisheries sector are some of the priority areas that need to be taken into account.

8.0 Standardization of craft and gear

The craft and gear used for single fishery or multiple-fisheries vary from State to State and even within the States. This non-uniformity results in wastage of effort, investment and catching of juveniles and non-target species. Standardized fishing craft and gear throughout the range of the distribution of targeted fish stock will make the fishery more sustainable. Uniformity in effort is essential for better fishery management, hence, standardization of craft and gear has to be implemented with immediate effect.

9.0 Vessel marking and registration of fishing vessels

The fishing crafts in India have evolved over centuries and depend on the sea-shore contour and sea conditions. Variation in size and shape of the craft are prominent along the east and west coasts and also in the two archipelagoes of Lakshadweep and Andaman and Nicobar. At present, there is no uniform standard for the marking and identification of fishing vessels (Table 7). The adoption of uniform marking system and registration procedures will be highly useful for fisheries management and will help to evolve better safety measures for fishermen at sea. The standard system of identifying fishing vessels, endorsed by the FAO Committee on Fisheries (FAO, 1989) need to be implemented throughout the country. This will help the controlling authority for easy identification of the fishing unit and hence effectively monitor the fishing activities. Some of the maritime States have acquired patrol boats to implement these measures with full assistance from Central Government for surveillance within their territorial waters. These patrol boats should be deployed for conducting surveillance in the coastal waters.

The registration of fishing vessels in India is followed as per the stipulations in the provisions of MFRA (for vessel below 20m Over All Length (OAL)) and as per the Merchant Shipping Act, 1958 for vessels larger than 20m OAL. No uniformity is followed between the States (Table 5) and, therefore, the adoption of standard system throughout the country requires priority.



10.0 Sea safety regulations

The risks of human life at sea are higher than on land. Fishing at sea is reported to be the most hazardous and the hardest job known to mankind. In other words, the risk to marine fishers is 20 times greater than any other industrial risk in the world (Robinson, 1996). The hazardous nature of sea fishing often results in loss of life and property. The ill-equipped vessels, non-availability of early warning system, lack of training and knowledge of navigation are some of the major reasons for the calamities. The strict implementation of the provisions of the MFRA and the Merchant Shipping Act, 1958, will provide the Life Saving Appliances (LSA) and Fire Fighting Apparatus (FFA) on board the vessel. The Government of India provides subsidy for procuring LSA and Global Positioning System (Ministry of Agriculture 2006), under a Centrally Sponsored Scheme. This scheme should be implemented more effectively to ensure that all the fishing vessels are well equipped for meeting any calamity at sea.

11.0 Vessel Monitoring System in India

The Vessel Monitoring System (VMS) is essential for better fisheries management. The VMS provides information on real time position, course & speed of fishing vessels and codified information on catch and effort. This also provides information on the vessels, which conduct fishing in unauthorized areas, undertake fish transshipment and fuel transfer. Presently, in India, the VMS has been developed by Government of India in collaboration with the Indian Space Research Organization (ISRO), Ahmedabad. The INSAT Mobile Satellite Services (MSS) reporting system provides one way transmission of short messages or positions from reporting terminals to the pre-defined central location. The VMS meets basic functions for better management of fisheries and fish stocks and will be helpful in limiting access of fishing vessels to a particular area and restriction of gear; providing accurate location of fishing vessels within the Indian EEZ; and if required also in providing information on fish catch and effort data, geographic positions of shooting and hauling, fishing depth, course, total catch with major components and distress code (which includes sinking, engine failure, fire, explosion, hole in the hull, man over board, accident on board, dislocation in cyclone, serious injury, heart attack of a crew, collision, etc.).

The VMS allows transmission of catch and effort data from fishing vessels to the monitoring agencies in near real time. A preliminary attempt has been made by providing VMS to eleven vessels, which is being monitored through the communication system using the hub of the Department of Space and a few terminals mounted on the vessels. In India, VMS is still to be made operational by the Government of India and there is a proposal to provide the VMS facility, on regular basis, to all the vessels above 20m OAL fishing in Indian EEZ and beyond.

12.0 Strengthening of database and information networking for fisheries sector

The Government of India is implementing schemes for strengthening of database and information networking to meet the following objectives:

- (i) Catch assessment survey of marine and inland fisheries;
- (ii) Information technology networking;
- (iii) Development of GIS using satellite data; and
- (iv) Census on important attributes of marine fisheries.

The Fishery Survey of India (FSI) acts as an interface between the Ministry and the State Fisheries Departments for the catch assessment survey of marine fisheries. The FSI is entrusted to collect data with emphasis on biological aspects of species, gear and market and reconcile the data received from the State Governments and the Central Marine Fisheries Research Institute (CMFRI). The census on marine fisheries was launched in 2005 by the FSI and the CMFRI and a report was published during 2006. The development of GIS and catch assessment of inland fisheries was entrusted to the Central Inland Fisheries Research Institute (CIFRI).

13.0 Regional co-operation in MCS

Regional co-operation among the neighbouring countries is highly essential for the proper implementation of MCS and also to curb IUU fishing. Co-operative MCS arrangement should be contemplated and implemented. There should be common approach and harmony in policy and strategy. Regional co-operation to promote responsible fishing and combat IUU fishing is essential. Information exchange between the countries on details of fishing vessels, trade information on fish and fishery products, etc. are required for the effective implementation of MCS.

14.0 Future strategies

The coastal fisheries is under pressure from excess fleet capacity, over-exploitation, open access fisheries, indiscriminate capture of juveniles, non-regulation of mesh size, discard at capture, environmental degradation, biodiversity loss and ineffective regulatory measures.

In this context, reducing over-capacity in the mechanised sector and diverting excess capacity to deepsea/oceanic fishing merits attention. The change-over from open access to regulated access will definitely increase the efficiency of fisheries management and conservation. The review of MFRA's and necessary amendment for bringing in uniformity is another important step that needs consideration. The FSI, the nodal agency of the Government of India for fishery resource assessment, has to be strengthened and empowered to review and implement conservation measures in various sectors of marine fisheries. The creation of fishery resource assessment division in each maritime State is another step, which can be done on a regional level. A strong network within the Bay of Bengal region will be helpful in bringing in a change in the present scenario and contribute to the development of a sustainable fishery in the region.



Table 7: Marking of name, registration number, etc. on fishing boats in the coastal States in India

State	Registration of boats	Display of boat registration	Size of display	Abbreviations used on boat
Gujarat	The Port Officer, Gujarat Maritime Board, Porbandar acts as the registering authority on behalf of Mercantile Marine Department (MMD), Mumbai.	Small, medium sized wooden trawlers/gill netters (9 to 17 m OAL) display name, code and registration number on both side of the super structure <i>i.e.</i> wheel house cabin as well as in front of wheel house. In FRP boats the display is on both the sides of the hull.	No norms and guidelines to the fishing boat owners regarding size of letters or language. Writing should be large enough to be visible from distance. Use of English is common.	MFB – Mechanised Fishing Boat PBR – Porbandar MFB/Name/PBR/Regt.No.
Maharashtra	Registration of mechanised boats at respective group of Port and Hqs. is at Ballard Pier, Mumbai. There are five groups of Ports (1) Bandra (2) Mora (3) Rajapur (4) Ramagiri and (5) Vengurla. The registration of mechanised boats is done by the Port Officer since 1994 as per Maharashtra Act No. LIV of 1981. Registration of large fishing vessels by DG Shipping.	On both the sides of the fishing boat <i>i.e.</i> on the stern and front of the cabin. Generally name of the boat and registration number is written on a plate fixed in front of the wheel house cabin and registration number on middle of the stern portion of the boat.	As per rule, all letters and figures should not be less than 1 decimeter in height and 2 cm in width and printed in English and local language with white paint with black background.	F/Registration of Port/Port code No./Sl.No. F – Fishing Boat BDR – Bandra; MOR – Mora; RAJ – Rajapur; RTN – Ramagiri; VGL – Vengurla
Goa	Director of Fisheries, Government of Goa under the Marine Fishing Regulation Act, 1980.	Registration number on both sides of the bow and aft.	No specific provision in the Act on the size of letter to be used on board the boat.	MFR – No. allotted – DF (Goa) MFR – Marine Fishing Regulation Act and DF – Director of Fisheries
Karnataka	Assistant Director of Fisheries of the area is the registration authority	Front and back side of the vessel, Registration number are written on cabin and side portion of boat.	Letter size maximum of 6 cm height and 2 cm width. To be written in black on white background.	KDT – K- Karnataka D- District Dakshina T - Trawler KDP – KD – State / District P – Purse seining

State	Registration of boats	Display of boat registration	Size of display	Abbreviations used on boat
Kerala	<p>Registration – As per MPEDA Act all vessels should register with MPEDA. MPEDA document insists for displaying registration number. However, some boats display their registration number on hull or upper structure of the vessel.</p> <p>At Kochi many vessels display the license number issued by Cochin Fishing Authority. This is displayed in front on wheels house or sides of the wheel house as CPH 210. The vessels registered with CFA can use facility/jetty available at fishing harbour for unloading and loading.</p>	<p>As per rule, registration number is to be displayed on the fore bow of the fishing vessels. All fishing vessels should display license by painting the mark in white on yellow background on the fore bow of the vessel.</p>	<p>No specific size indicated in order. The registration number is written only in small letters mostly in front of the wheel house. There is no uniformity/size.</p>	<p>ALP / Registration No. ALP – Vessel belongs to Alleppey district and registration number follows district code.</p>
Tamil Nadu	<p>Mechanised fishing boats registered with the Assistant Director, Department of Fisheries, Government of Tamilnadu.</p>	<p>Recently, as instructed by the Coast Guard, top of the super-structured wheel house should be painted in orange colour (4' x 4') and registration number written in black colour with 1 ½' bold size. In case of large vessels, name and registration number written on the aft on both sides of hull with black letter in Hindi and English.</p>	<p>Letter size varies from 10" to 12" for registration number on both side of the hull. Registration number also written in the side hull and super structure and letter size varies from 5" to 6".</p>	<p>MDS – Registration number MDS - Madras</p>
Andhra Pradesh	<p>Since 1994, mechanised fishing boats are being registered with the State Fisheries Department and prior to 1994 with the Visakhapatnam Port Trust. The deep sea fishing vessels of size beyond 20 m OAL are registered with MPEDA.</p>	<p>No prescribed guidelines. However, in small boats the name is written on the hull near aft and the registration number on the superstructure. In large vessels, name is written in bilingual (Hindi and English) on the hull and the registration number is written in some cases.</p>	<p>No uniform procedure is followed while writing letters.</p>	<p>VPT – Visakhapatnam Port Trust FVSM – Fishing Visakhapatnam KKD – Kakinada FKKD – Fishing Kakinada NZM – Nizampatnam FNZM – Fishing Nizampatnam MPM – Machilipatnam FMPPM – Fishing Machilipatnam FKPT - Krishnapatnam FKPT – Fishing Krishnapatnam</p>
A & N Islands	<p>Director of Fisheries is the licensing authority for fishing in the territorial waters surrounding A & N Islands.</p>	<p>As per licensing authority the registration number must be painted on each side of the bow of the boat.</p>	<p>No standard size of letter used to display name and license number issued.</p>	<p>ANF – Andaman and Nicobar Fishing License ANB – Andaman and Nicobar Boat License</p>



Status of Monitoring, Control and Surveillance in the Marine Fisheries Sector in Maldives¹

1.0 Introduction

The Maldives is an island nation whose territory comprises more water than land. With an Exclusive Economic Zone (EEZ) of more than 900 000 km², a population of just over 300 000 scattered over 200 odd small coralline islands, and with marine fisheries the strongest traditional sector in the island economy, the Maldives faces immense constraints in implementing an effective system for monitoring, control and surveillance (MCS) of its marine fisheries.

More than 20 percent of the Maldivian active labor force is engaged in marine fisheries. More are engaged in small-scale and industrial fish processing and production. The major fisheries is pole and line tuna fishing for skipjack tuna, followed by hand lining and long lining for yellowfin and bigeye tuna. Reef fisheries targeting different species takes place at an artisanal and semi-industrial level. A small yet profitable aquarium fishery exists, primarily targeted towards export markets. Mariculture is very new, with one or two semi-industrial mariculture investments and no small-scale mariculture.

This paper reviews existing institutional arrangements in the Maldives for MCS of its marine fisheries and assesses the strengths and weaknesses of these arrangements. It reviews existing marine fisheries management programmes, the regulatory framework and implementation arrangements, while assessing requirements for institutional strengthening and capacity building. Maldivian experience in the use of Vessel Monitoring System (VMS) to support MCS in the outer EEZ is highlighted. A pilot MCS programme for trial in a Maldivian atoll is proposed. Recommendations are made for promoting regional cooperation in MCS.

2.0 Regulatory framework, legislation, procedures and practices

The legal framework for the present fisheries management system in the Maldives is constituted by:

- (i) the Constitution of the Republic of Maldives;
- (ii) official mandates of relevant government agencies, and
- (iii) relevant laws, regulations, decrees and guidelines,

The major governing regulation is the Fisheries Act (No. 5/87), which empowers the Ministry of Fisheries, Agriculture and Marine Resources (MoFAMR) to establish and administer regulations for sustainable utilisation and conservation of fisheries stocks and living marine resources, including protecting threatened species and establishing conservation areas.

Other applicable laws include the Ocean Territories Act (No. 6/96), Environment Protection and Preservation Act (No. 4/93) and other laws, decrees and regulations relating to the use of the EEZ, fisheries, environment, business, foreign investment and so on.

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The Fisheries Act (No. 5/87) is primarily an enabling act that unequivocally provides that the MoFAMR shall oversee all fisheries activities in the country. It gives MoFAMR and the Government certain rights in relation to management of fisheries. In addition, it describes the conditions for licensing of foreign vessels or joint ventures in the EEZ, provides for apprehension of vessels, arrest and penalties, and describes the Coastal Fishery Zone (CFZ). The Act is presently being revised to take into account changes in fisheries management requirements and international obligations. It is anticipated that the amendments will pass through the parliamentary approval process in 2008.

The Fisheries Act is supplemented by regulations, rules and presidential decrees. Various MoFAMR regulations include provisions on: fishing in lagoons; prohibitions in fishing; banned fishing gear and methods; protected marine life; protection of certain species from harvest; prior permission required for non-traditional gear; reporting violations of Fisheries Act and regulations; reporting of all fish catch and effort; issuing of licenses to fish in the Maldivian EEZ; describes license issuance by the Ministry of Trade and Industry (MTI) and requirements for vessels licensed to fish in the EEZ; marine scientific research in Maldivian waters; sets out requirements for vessel-based research operations and a required application form; catch and export of yellowfin/bigeye tuna; installation of fish cages and culture in fishing lagoons; and installation of Fish Aggregating Devices (FADs) on fishing grounds.

Other relevant regulations under the Maldivian laws and decrees include: protection of species by banning export; declaration of marine protected areas and export quotas of selected species.

The Environment Protection and Preservation Act of the Maldives (No. 4/93) and its supporting regulations provide a second tier in marine resources management. The Act recognizes that protection and preservation of land and water resources, flora and fauna and all natural habitats are important for the country's sustainable development.

International conventions and obligations

The Maldives is party to the UN Convention on the Law of the Sea (UNCLOS, 1982) and the UN Agreement relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks (1993). National obligations under the UNCLOS are reflected in the Fisheries Law and its subsidiary regulations. It is also party to the UN Framework Convention on Climate Change (UNFCCC, 1992) and the Convention on Biological Diversity (CBD). Maldives was the first country to sign the Kyoto Protocol to the UNFCCC (1997). National obligations under the CBD are reflected in the National Environment Action Plan (NEAP) and other national plans and strategies.

Other fisheries and environmental related conventions signed and ratified by the Maldives include: Vienna Convention for the Protection of the Ozone Layer (1985); Montreal Protocol on Substances that Deplete the Ozone Layer (1987) and amendments to it; Basel Convention on the Transboundary Movement of Hazardous Waste and their Disposal (1989); and the International Convention for the Prevention of Pollution of the Sea by Oil (1954). The Maldives is party to the South Asian Regional Seas Programme and resolutions on its implementation (1994); and the Washington Declaration on Protection of the Marine Environment from Land-Based Activities (1995).

It should be noted in this context that the Government is committed to implement the Code of Conduct for Responsible Fisheries and other soft laws relevant to fisheries management.

Administrative arrangements

The MoFAMR is the lead agency tasked with fisheries management and development. The mandate of MoFAMR is to:

- Formulate and enforce laws, regulations and policies required for sustainable development of fisheries and marine resources, including those relating to Maldivian faros, reefs and lagoons;
- Formulate and implement policies and strategies required for sustainable development of fisheries, agriculture and marine resources of the nation;
- Protect and conserve the marine and terrestrial biodiversity of the nation;
- Collect, process and publish fisheries and marine resources data and statistics;
- Protect endangered species;
- Develop and install FADs;
- Formulate and implement development projects which enhance the socio-economic standard of the people;
- Resources monitoring and conduct of multi-disciplinary research;
- Collect, catalogue and maintain samples of the marine and terrestrial biodiversity of the nation; and
- Formulate and implement regulations on scientific exploration and research relating to Maldivian waters, seas, seabed, subsoil and soil

With regard to high level policy advice and coordination with other ministries, MoFAMR is supported in the execution of its mandate by the Fisheries Advisory Board (FAB) whose membership includes the Ministers of most of the ministries, which have concurrent or complementary responsibilities over certain aspects of fisheries and marine resources management. The FAB is chaired by the Minister of MoFAMR and reports to the President of Maldives.



Ministry of Trade and Industry– responsible for the licensing of all commercial fishing vessels including foreign fishing vessels, the determination of numbers of licenses to be issued and the negotiations and other dealings with licensees. The Ministry also issues export permits for the local tuna and reef fish trade

Ministry of Tourism– for ensuring that the marine-related interests of the tourism industry are addressed.

Ministry of Defence and National Security Service– Coast Guard – for monitoring of vessel positions and enforcement of EEZ laws and regulations.

Ministry of Atoll and Island Administration– for collection of fisheries related data and to ensure compliance with the regulations and fisheries laws at island and atoll levels.

Ministry of Transport and Shipping– for registration of fishing vessels and for safety checks and training of officers and crew.

Maldives Customs Service– for monitoring of export fish trade and quality as well as transshipments by foreign fishing vessels.

Ministry of Health– for inspection of food safety and meeting export quality standards.

Ministry of Environment, Energy and Water– for enforcement of the Environment Act of 4/93 and for establishing marine protected areas and reserved diving sites.

Overview of existing marine fisheries management programmes

The key aspects of the current fisheries management regime are:

- Common property resource regime;
- Management, exclusion and alienation rights vested in government;
- Access, withdrawal and other use rights held by citizens;
- Boundary rules and government defined restricted areas, species, gear and methods; and
- Monitoring, control and surveillance by government.

Fisheries management goals are:

- Maximize benefits to Maldivians from sustainable use of marine resources;
- Assist fishing communities in rational and sustainable use of fisheries resources;
- Strengthen resource management through participatory governance; and
- Promote voluntary compliance based system.

Key management issues that need to be addressed include:

- Lack of a licensing regime in the coastal fisheries zone to complement the fishing vessel registration system;
- Use of destructive fishing gear and methods;
- Misreporting of catch data;
- Harvesting of banned species and use of illegal fishing gear;
- Illegal fishing in prohibited areas;
- Poaching in the outer EEZ by foreign fishing vessels;
- Illegal, Unreported and Unregulated Fishing;

- Concern about potential over-exploitation of some reef fish stocks;
- Monitoring, control and surveillance of coastal fisheries; and
- Inadequate human resources and assets for MCS.

The reef fishery resources that have been either depleted, heavily or fully exploited or are under threat of becoming so include sea cucumber, grouper, lobster, reef sharks, turtles, giant clam, various bait fish resources and other types of fin fish reef species. The immediate consequence of overharvesting is a loss in future income and food availability. A long-term consequence of a severe depletion or collapse of critical species (*e.g.* reef shark) could be the degradation of the entire reef ecosystem. The principal reef resources management issues can be classified into three categories: (1) overharvesting of stocks, (2) interactions and use conflicts and (3) physical removal, alteration and damage to the coral reef ecosystem.

In addition to the above management issues, there is the cross-cutting problem of inadequate compliance by the users of marine and reef resources with existing laws and regulations. The reasons for non-compliance are manifold and cannot be exclusively attributed to weaknesses in the current procedures of MCS.

Reasons for low levels of compliance indicate that users are not aware of existing rules and regulations and inconsistencies in regulations issued by different ministries. There is also a lack of reporting of rule offenders and the meting out of punishments. Reasons for this situation include inadequate enforcement capacities as well as the socio-cultural environment of small island communities that rely firmly on community cohesion and solidarity.

While apprehension and punishment of law-breakers is an indispensable enforcement measure, a powerful motivation for people to voluntarily adhere to rules and regulations is when they have had a direct and active involvement in the drafting of these regulations. Such an involvement would allow proper understanding of their objectives as well as the benefits that accrue to all users of the reef ecosystem in the long-term by complying with the rules and regulations. Active and wide-ranging participation in rule-making is also a means of awareness creation about management issues and helps in the formation of peer pressure among users.

The ongoing activities to strengthen fisheries management include:

- Revision of Fisheries Law and regulations to establish appropriate regime for sustainable use;
- Pilot initiatives to develop participatory management arrangements for reef resources;
- Strengthening institutional arrangements and building human resource capacity;
- Programme to promote fishers awareness, capacity and support for sustainable management; and
- Strengthening of reporting, monitoring and surveillance arrangements for enforcement.

3.0 Current MCS capacity and institutional strengthening requirements

In October 2000, as part of the FAO FishCode Programme, a mission by a fisheries expert to the Maldives was carried out to review all aspects of MCS. The MCS review evidenced the need to update the current Fisheries Act of 1987 to address, *inter alia*: (i) protection of the interests of fishers *vis-à-vis* competing interests in the reef/coastal waters; (ii) aquarium

fisheries; (iii) institutional mandates; (iv) foreign fishing; (v) VMS; (vi) improvement in the enforcement framework, *e.g.* measures with respect to registration and marking of vessels and (vii) legal framework for the control of aquaculture.

As outlined earlier, MCS in the Maldives is carried out by many institutions. The MoFAMR has the overall mandate to manage marine resources, while Coast Guard of the Ministry of Defense and National Security carries out the monitoring of EEZ vessels and the surveillance of the EEZ. The MoFAMR monitors and control the fishing fleet with close collaboration with the Ministry of Atolls Development, who facilitate all the reporting (fish catch, fishing activities, fishing vessel registration, infringements, etc). Given the widely spread geographical nature of the islands, a central MCS is a hurdle to fisheries management. Careful devolution of authority and responsibility for MCS is one of the options on which Maldives is currently working on.

The scope of authority in the maritime sector with respect to the enhanced authority of the Atoll Administration has not yet been resolved. However, there are differing views as to whether such a scheme of providing a specific zone for Atoll management should be considered with tourism, economic development and trade believing such a scheme would run counter to the culture of the Maldives for sharing. The devolution of local governance will undoubtedly have considerable impact on the design and development of the MCS scheme to ensure it is cost effective, participatory and results in local, and joint resource management responsibility at the local level between stakeholders and the government.



In order to foster greater operational coordination, it is, therefore, required to establish a MCS Operational Coordinating Committee of all relevant ministries, to provide a mechanism for operational planning, prioritization and possible joint patrolling for enhanced cost-effectiveness. Linked with this, there is also a need to promote private sector participation. Furthermore, international and regional cooperation opportunities need to be integrated to reduce MCS costs and to promote collective measures to combat IUU fishing.



Recommendations for institutional strengthening

The regulatory framework for fisheries management can be strengthened and made more effective by:

- Improved coverage of fisheries management issues;
- Deterrence through increased severity of sanctions;
- Strengthening surveillance and enforcement;
- Enforcing compulsory reporting to MoFAMR; and
- Clearer definition of management and regulatory objectives and principles.

The monitoring system can be strengthened through:

- Timeliness, coordination and human resource development.
- Non-conflict or resource collapse stimulated monitoring of resource use change and intensity.

Options for strengthening surveillance and enforcement could include:

- Fisheries dedicated patrol system;
- Fisher network;
- Improved fishing community reporting system;
- Observer programme; and
- Capacity building and institutional strengthening.

4.0 Use of VMS in Maldives

The Maldives uses a Vessel Tracking System (VTS) for all vessels licensed to operate in the outer EEZ (the zone between 75 and 200 nm). The VTS, established in 1995, is monitored by the Maldivian Coast Guard on a regular basis. The Coast Guard monitors the movement of licensed fishing vessels in the EEZ of Maldives. This is done by installing necessary vessel tracking transponder equipment on board the vessel, which is mandatory under the Fishing License Agreement between the Licensee and the Ministry of Economic Development and Trade. Clause 6 of the agreement states that the Licensee's fishing vessel shall install the necessary transceiver equipment approved by the government for communication links with the Vessel Tracking System in Male', before embarking on any fishing operation in the Licensed Fishing Zone of the Republic of Maldives. This rule applies to all licensed fishing vessels with the permitted fishing methods (pole and line fishing, long line fishing or trolling) in the Maldives. The same is applied to all licensed fishing vessels where both types of royalties (yearly/per catch) are imposed.

Application procedure

After issuing license for fishing in the EEZ, the Coast Guard gives each licensed party the necessary information regarding the required transponder unit which in this case is Inmarsat - C terminals. The most common VTS compatible ones are Galaxy Trimble, Thrane and Thrane, Sailor, etc. Following the registration of these terminals from Dhiraagu and Telecommunication Authority of Maldives (TAM), TAM issues an Inmarsat terminal operating license to the vessel. This license contains the Inmarsat Mobile Number (IMN) which later is used in adding the transponder to the VTS.

How the system works

The Vessel Tracking System works with Xantic Company of Australia, where Land Earth Station (LES) is in Perth, Australia. Upon obtaining the Inmarsat Terminal Operating License (ITOL) from TAM, the local agents bring the C – terminals to Coast Guard for programming and adding it to the VTS. The Coast Guard then sends the terminal information via fax/e-mail to Xantic Australia, where they have a special DNID for the Ministry of Defense of the Maldives. After adding it to the DNID, the terminal which is powered on starts sending data to the LES in Australia. This data include; the present position-Latitude/Longitude, time, speed, bearing, etc. This data is stored in a mail box for the specified DNID. After every one hour, the VTS of Coast Guard receives the aforementioned data through internet. The VTS automatically updates every one hour, provided that there is internet connection.

Note: Stratos and Xantic are now one company after Stratos' acquisition of Xantic on 14th February 2006. As part of this integration, the LES code has been rationalized. The previous LES code now has been changed from Perth LES x22 to Burun LES x12. This transfer was completed in October 2006.

The Vessel Tracking System Software

The terravision software used in VTS is designed in Oracle. It contains five modules, namely the server module, event manager, Inmarsat module, the display module and the setup module.

- **The server module:** connects VTS to Xantic main server.
- **Event manager:** displays most recently received data in a tabular form for easy viewing. This data include date, name of the vessel, time, position, Latitude/Longitude, speed, bearing, etc.
- **Inmarsat module:** Input commands like polling, messaging, etc. are executed in this module.
- **Display module:** Contains Maldives EEZ chart and shows the vessel's position on the chart at that hour according to the data received from Xantic main server.
- **Setup module:** Adding of the specific vessels C- terminal to the VTS is done in this module.



Limitations

The current VTS has some limitations which pose problems to the Coast Guard in its MCS activities. These limitations include:

- This system can only identify vessels with the programmed transponder; vessels without the programmed transponder cannot be identified under this VTS.
- Power failure is frequently reported. Most of the vessels do not have a separate power supply for the transponder unit.
- The main disadvantage is seen as there is no written rule and regulation in operating the vessel transponder.

5.0 Proposed pilot MCS programme

A full-fledged MCS programme for a country with some 200 islands spread over 800 km will be very expensive. Therefore, implementing a cost-effective VMS to effectively combat IUU fishing remains a hurdle for SIDS such as the Maldives. Therefore, Maldives is exploring alternative strategies that incorporate VMS with other systems, such as Iceland's initiative to incorporate MCS with search and rescue. Using a similar strategy, Maldives is working on adopting a system that integrates VMS and PFZ (potential fishing zone) information into one system. The objective is to make the system cost-effective and also provide incentives for vessel owners, thereby promoting greater utilization and hence improved compliance. Such cost-effective and win-win systems could be promoted to developing states and could facilitate the global implementation of VMS.

In order to establish a win-win system, Maldives has now acquired exclusive rights for the fishing forecast information of its EEZ. This information has been broadcasted for the past 3 months. Fishermen have accepted this service and are learning to use the information in finding fish schools. Therefore, MoFAMR is now planning to provide the fishing forecast information system to each registered fishing vessel free of charge. In return, MoFAMR will ask the fishermen to install VMS systems onboard. If this strategy is successful, fishermen will be able to acquire good catch while MoFAMR will get the vessel information and fish catch reports. Furthermore, this will encourage all fishing vessels to be registered with the MoFAMR and enhance the sea safety as well.

6.0 Assessment of needs and requirements for regional cooperation in MCS

Invariably, without regional cooperation, IUU cannot be dealt with. If one country in the region has a good MCS programme with VMS installed in all its fleet, and if the neighboring countries do not have such a system, poaching cannot be stopped. This is especially true for a country like the Maldives, where the human and financial resources are scarce and the area to patrol is enormous. Therefore, regional cooperation in MCS is paramount. Regional black lists, white lists and information sharing amongst the regional fishing authorities will enable the port states to successfully implement port state measures. As such, Maldives is trying to join regional forums to combat IUU fishing. Maldives is already a member of BOBP-IGO and has been actively participating in SWIOFC activities. While fully supporting BOBP's work in combating IUU fishing, in the last SWIOFC session held in Seychelles, Maldives has given its support to SWIOFC in formulating a network of heads of MCS operations and also supported the idea of creating a black and a white list of fishing vessels.



Status of Monitoring, Control and Surveillance in the Marine Fisheries Sector in Sri Lanka¹

1.0 Introduction

Situated in the Indian Ocean, southeast of India, Sri Lanka is a small country having a land area of 65 510 sq. km lying within the latitude from 6^o north to 10^o north and longitude from 79^o east to 82^o east. Sri Lanka has a 1 700 km long coastline of which 1 150 km comprise sandy beaches. Possessing a shelf area (up to 120 m depth) of 30 000 sq. km, Sri Lanka has sovereign rights over an area of about 5 17 000 sq. km of the sea. With the declaration of the Exclusive Economic Zone (EEZ) in 1976, the area up to 12 nautical miles has been designated as the territorial sea and a further stretch of 12 nautical miles as the contiguous zone. In the territorial sea, Sri Lanka has the exclusive rights to all living and non-living resources of the water column, the seabed and subsoil; while in the rest of the EEZ, the country has exclusive rights to all living and non-living resources in the water column, seabed and subsoil, but not over the air space. Under the UN Law of the Sea Convention, Sri Lanka can claim an additional seabed area (1 000 000 sq. km) that has a sediment layer of 1 km in thickness and is contiguous to the EEZ. In addition, it has 4 89 000 ha of inland waters comprising brackish water lagoons and estuaries and freshwater reservoirs.



Figure 1: EEZ of Sri Lanka

2.0 The marine fisheries sector

The marine fishery sector comprises the coastal fishery sector and off-shore/deep sea fishery sector. Comparatively, the coastal fishery sector is much more important as it contributes about 2/3rd of the total fish production from the marine fishery sector. This sector is also important since most of the commercially important fish species have their breeding areas located in the coastal waters. Out of the total marine fishing fleet of 43 123, about 39 351 fishing vessels engage in fishing in coastal waters. Fishers engaged in coastal fishing have been estimated at about 1 50 000. The total population depending on coastal fishery is about 6 00 000 and it is also on gradual increase.

3.0 Fish production and consumption

While majority of the catch comes from the coastal waters, the contribution of deep-sea fishery sector is gradually increasing. The per capita supply of fish comprises both locally harvested and imported fish.

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Table 1: Types of fishing boats operating in Sri Lanka

Year	Total fishing crafts	Multi-day (IB)	Day boats (IB)	FRP (OBM)	Traditional (OBM)	Traditional (NM)
1990	27 675	2 364	**	9 758	973	14 580
1995	27 269	1 639	1 357	8 564	1 060	14 649
1999	27 491	1 419	1 275	8 623	1 274	14 900
2000	27 595	1 430	1 170	8 690	1 205	15 100
2001	27 149	1 572	993	8 744	640	15 200
2002	28 135	1 614	1 112	9 033	776	15 600
2003	29 694	1 530	1 486	11 020	618	15 040
2004	30 567	1 581	1 493	11 559	674	15 260
2007	43 123	2 613	1 159	17 851	1 853	18 590

Table 2: Annual fish production by fishing sub-sectors*Unit = tonnes*

Year	Marine fish catch			Inland fisheries & Aquaculture	Total fish catch	Fish for dried & processing
	Coastal	Off shore	Total			
1980	1 65 264	2 148	67 412	20 266	1 87 678	38 000
1985	1 40 270	2 400	1 42 670	32 740	1 75 410	24 000
1990	1 34 130	11 670	1 45 800	38 190	1 83 990	22 000
1995	1 57 500	60 000	2 17 500	18 250	2 35 750	36 000
2000	1 75 280	84 400	2 59 680	36 700	2 96 380	60 900
2001	1 67 530	87 360	2 54 890	29 870	2 84 760	43 650
2002	1 76 250	98 510	2 74 760	28 130	3 02 890	61 720
2003	1 63 850	90 830	2 54 680	30 280	2 84 960	54 340
2004(1)	1 54 470	98 720	2 53 190	33 180	2 86 370	63 470
2006	1 21 360	94 620	2 15 980	35 290	2 51 270	71 740

Table 3: Utilization of resources*Unit = tonnes*

Sector	Estimated Potential	Current Production
Coastal	2 50 000	1 64 000
Offshore Deep Sea	1 50 000	91 000
Inland & Aquaculture	1 00 000	30 000

4.0 Fishing Ports

The fisheries infrastructure facilities in Sri Lanka comprise 12 Fishing Harbours, 37 Anchorages and 700 Fish Landing Centers for providing landing and berthing facilities for the fishing fleet.

5.0 Utilization of resources

As Sri Lanka is a tropical country, the bio-diversity of coastal waters is also high and they support a large number of fish species. This rich biodiversity also contributes to the deployment of a variety of fishing gear in the coastal waters. However, with the increasing pressure on resources, the fishers are using more efficient but harmful fishing methods. Such methods are destroying fish habitats, fish juveniles, and also impacting on the environment. The increase in such harmful and illegal, unregulated and unreported (IUU) fishing practices more in the Southern and North East areas. Further, the increasing trend on the use of explosives like dynamite for fishing is becoming a threat to the resources and this development is also creating conflict among fishing community as it has become a critical issue for the fishing industry. In addition, there is an increasing trend in unauthorized foreign fishing vessels poaching in the Sri Lanka waters.

In the post 2004 Asian Tsunami scenario in Sri Lanka, many NGOs, both national and international contributed to the rehabilitation of the fishing community in the country without proper coordination with the government. This resulted in the rapid increase in the fishing fleet size creating a number of issues such as:

- (i) Reduction in catch per unit effort from coastal fisheries and thereby reduced income;
- (ii) Deployment of extra fishing effort to catch fish;
- (iii) Increasing use of harmful, and IUU fishing for better income; and
- (iv) Conflicts amongst fishers for coastal fish resources.

To address the issues that are impacting the sustainability of fisheries in the country, the Department of Fisheries and Aquatic Resources (DFAR), which is the authorized government agency, is now intervening by enforcing the provisions of the Fisheries & Aquatic Resources



Act and under Regulations of the Foreign Fishing Boats Act. In particular, the following illegal fishing methods are targeted:

- (i) Small mesh seine nets;
- (ii) Small mesh surrounding nets;
- (iii) Small mesh bottom gill net cast on rocks and reefs; and
- (iv) Dynamite fishing.

6.0 Introduction of fisheries management

In view of the increasing fishing fleet and the over exploitation of coastal fisheries resources, there is an apparent reduction in the income of the fishers. This scenario has also led to increasing conflicts among fishermen and, therefore, an urgent need to better manage the coastal fisheries resources in the country.

Coastal communities in Sri Lanka traditionally depend on coastal fisheries as they do not have alternative sources of income. It has been experienced that most of the coastal fishers lack awareness on resource management and also the possible sources of alternative livelihoods. Therefore, it is essential to make the coastal fishing communities aware of the consequences of bad fisheries management and also about the alternative/additional livelihood opportunities to diversify their income sources. To manage the fishing capacity successfully, it is necessary to reduce the fleet size and diversify coastal fishers to other livelihoods through skill development and financial assistance.

About 90 percent of the 43 123 fishing fleet in the country engages in coastal fisheries, contributing to about two third of the domestic fish production. As stated earlier, the coastal fisheries in Sri Lanka have almost reached the maximum sustainable yield making sound management of the resources imperative to sustain the fisheries. In this regard, the DFAR has already launched a management programme for the coastal fisheries sector introducing number of management measures, which *inter alia* include removal of the excess fishing fleet and regulating the newcomers. While doing so, it is also essential to make available alternative livelihood opportunities available to the fishers so that it does not become a



social issue. Since majority of the coastal fishers are below the poverty level, alternative income generating opportunities need to be created under the Poverty Alleviation Programmes of the 10 Year Plan (2007-2016) of the government. This would also help in reducing fishing pressure.

7.0 State of fisheries management in Sri Lanka

Sri Lanka has the required legal framework to ensure sustainable utilization of fisheries resources. The following two approaches are generally used for the management of the resources:

- (i) Limiting the number of boats, fishermen, fishing gear (nets, hooks, etc.) in a fishery to ensure that the resource is not depleted through excessive fishing (limiting effort to avoid over exploitation).
- (ii) Prohibiting the use of harmful fishing gear and methods.

The key fisheries management institutions are the following;

- **Ministry of Fisheries & Aquatic Resources (MoFAR):** This is the line Ministry responsible for planning and monitoring and also controls the budget for fisheries development in the country.
- **Department of Fisheries & Aquatic Resources (DFAR):** The Department functions under the MFAR and is responsible for management, regulation, conservation and development of fisheries and aquatic resources in Sri Lanka.
- **National Aquatic Resources Research & Development Agency (NARA):** This agency is responsible for promoting and conducting research activities directed towards identification, assessment, management, conservation and development of aquatic resources.
- **National Aquaculture Development Authority (NAQDA):** The Authority is mandated to develop and manage aquaculture and inland fisheries resources.

8.0 Role of DFAR

The DFAR with its mandate to manage the fisheries resources has a network of field staff located in different parts of the country for implementing fisheries management programmes as stipulated under the following:

- (i) Fisheries & Aquatic Resources Act No.2 of 1996 and regulations introduced therein;
- (ii) Fisheries Operation License Regulations, 1997;
- (iii) Fish Landing Regulations, 1997; and
- (iv) Foreign Fishing Boats Regulations, 1979.

The management measures introduced under the legal framework include:

- Registration of fishing crafts (s.15 &16)- Regulations published in Gazette No.109(03.10.1980), No.1055/13(26.11.1998), and No.948/24 (07.11.1996).
- Fishing operation license (s.6 -14) Regulation 948/25 (07.11.1996).
- Prohibition of dynamite or poisonous fishing (s.27).
- Prohibited fishing gear and fishing nets (s.28-29).
- Prohibition or regulation of export and import of fish (s.30).
- Declaration of closed or open seasons for fishing (s.34).

- Declaration of fisheries reserves (s.36-37).
- Aquaculture management license (s.39-43).

The following major activities are implemented by DFAR in respect of fisheries resources management:

- (i) Participation in making fisheries management policy and plans.
- (ii) Implementation of fisheries management programmes, especially in coastal fisheries.
- (iii) Registration of fishing vessels.
- (iv) Issue of fishing operation licenses.
- (v) Issue of fish import and export licenses.
- (vi) Issue of fish landing permits for foreign fishing vessels.
- (vii) Declaration of fisheries management areas.
- (viii) Establishment of fisher's organisations.
- (ix) Issue of fisherman identity cards.
- (x) Organization and coordination of field officers in enforcement activities.
- (xi) Settlement of fisheries disputes.
- (xii) Other activities related to fisheries managements.

9.0 Action suggested for better management of resources

The following actions are proposed for better management of fisheries resources in Sri Lanka.

Issue	Strategic Action
1. Over fishing	<ol style="list-style-type: none"> a) Participatory action. b) Setting up of Marine Protected Areas (MPAs). c) Reduction of fishing efforts. d) Provision of alternate livelihoods.
2. Conflict among fishers	<ol style="list-style-type: none"> a) Integration of coastal fisheries into zonation plans.
3. Poverty - Lack of alternate livelihoods - Marketing failure	<ol style="list-style-type: none"> a) Education/training (capacity building). b) Revival of traditional fish processing. c) Improved marketing system. d) Income diversification.
4. Environment degradation - Coral reef - Mangrove - Sea grass beds	<ol style="list-style-type: none"> a) Public awareness programme-intensive education campaign. b) Pollutant Pays Principle. c) Creation of community watch groups. d) Rehabilitation & restoration programmes. e) Resource enhancement. f) Resource monitoring.
5. Weakness in management system and legal frame-work	<ol style="list-style-type: none"> a) Providing legal framework for fishery management. b) Stakeholder consultation & participation. c) Promotion of the Code of Conduct for Responsible Fisheries. d) Providing training & manpower development to implement coastal fisheries management. e) Strengthening inspection system for fisheries resource protection- MCS

In Sri Lanka 700 management areas have so far been declared under the Act for management of fisheries resources through community participation. In some management areas, fisheries management authorities comprising fishers have also been established. Within the provisions of this Act, the co-management concept has been ensured allowing for fisher community participation. However, the legal frame is inadequate to address high sea fishing and to meet the requirements of international conventions and treaties. The proposed Fisheries and Aquatic Resources Management and Development Act, which is ready for approval, will address these issues.

The DFAR conducts regular monitoring and enforcement through its field offices situated around the Island to prevent and to take deterrent action against unauthorized and IUU fishing. In this regard, strengthening of MCS and introducing vessel monitoring system need to be given priority. Assistance and cooperation of regional and global fisheries management organisations are also considered important and necessary steps should be taken in this regard.

**BAY OF BENGAL PROGRAMME
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