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Monitoring Control and Surveillance for Managers

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Preamble

This document is designed as a practical guide to assist senior fisheries managers to assess the fisheries monitoring, control and surveillance requirements of their organisations, and to provide guidance in the development and execution of MCS plans. The document presents eight discrete modules that contextualises the role of MCS within the wider fisheries management paradigm, the legal and fisheries management frameworks that apply to MCS, design components, information management systems, human resource requirements, and financial, budgetary, and strategic considerations that need to be taken cognisance of when developing MCS programmes.

Module 1: Defining the Relationship – IUU, MCS and fisheries management

1 Introduction – Defining Monitoring, Control and Surveillance in fisheries management

Illegal, Unreported and Unregulated (IUU) fishing (Box 1) has been identified as a major contributing factor to the worldwide collapse of fish stocks (Le Gallic and Cox, 2006; Pitcher *et al*., 2002). In Africa, it has been estimated that one out of every four fish caught is illegally captured, and while the true extent of the problem remains unknown, it has been estimated that the activity is costing the continent over US$1 billion per annum in lost revenues[1]. The activity undermines management interventions, threatens resource sustainability and the conservation of resources for future generations, and undermines the economic and social wellbeing of those individuals that are legally employed in the continent's fisheries.

Box 1

Definition of Illegal, Unreported and Unregulated Fishing

FAO International Plan of Action to prevent, deter and eliminate Illegal, Unreported and Unregulated Fishing

(IPOA-IUU, 2001)

Illegal fishing refers to fishing activities:

- Conducted by national or foreign vessels in waters under the jurisdiction of a State, without the permission of that State, or in contravention of its laws and regulations;
- Conducted by vessels flying the flag of States that are parties to a relevant regional fisheries management organization but operate in contravention of the conservation and management measures adopted by that organization and by which the States are bound, or relevant provisions of the applicable international law; or
- In violation of national laws or international obligations, including those undertaken by cooperating States to a relevant regional fisheries management organization.

Unreported fishing refers to fishing activities:

- Which have not been reported, or have been misreported, to the relevant national authority, in contravention of national laws and regulations; or
- Undertaken in the area of competence of a relevant regional fisheries management organization which have not been reported or have been misreported, in contravention of the reporting procedures of that organization.

Unregulated fishing refers to fishing activities:

- In the area of application of a relevant regional fisheries management organization that are conducted by vessels without nationality, or by those flying the flag of a State not party to that organization, or by a fishing entity, in a manner that is not consistent with or contravenes the conservation and management measures of that organization; or
- In areas or for fish stocks in relation to which there are no applicable conservation or management measures and where such fishing activities are conducted in a manner inconsistent with State responsibilities for the conservation of living marine resources under international law.

[1] http://www.stopillegalfishing.com

Economically, IUU fishing causes the direct loss of revenue to a State through unlicensed foreign vessels catching fish in a State's waters and landing the fish in another country, thereby depriving the country of origin of all revenues associated with the licensing of the vessel / quota allocation. In addition, downstream economic benefits are also lost to the state as the economic activities accruing to the landing of the fish in the country of origin are also lost. Downstream benefits could accrue to a number of activities including the provision of support services to the vessels, port fees, transhipment and fish handling costs, chandlery, fish processing and value addition, and export revenues. Indirect economic losses would accrue to domestic offences in which the fish are landed and traded in the country of origin, but the country does not receive the appropriate remuneration for the use of the resource (e.g. licence and quota fees).

From a biological perspective, IUU fishing will inevitably cause reductions in stock biomass, and possibly stock spawner biomass. This will certainly be the case in situations in which excessive fishing pressure is placed on a resource. There may also be increases in by-catch rates that may have long-term ecosystems effects. IUU fishing is often associated with the use of illegal gears (e.g. small gear meshes, dynamite fishing etc.) which are harmful or destructive to the ecosystem. At a social level, IUU fishing can negatively impact food security and increase conflicts within the fishery as legal and illegal fishers vie for resources.

Monitoring, Control and Surveillance (MCS) is one of the key fisheries management tools that can be applied to reduce the levels of IUU fishing. In its most simplistic form, MCS is an implementation mechanism that fisheries managers use to implement fisheries policies and management plans. In the past, MCS was widely viewed as an enforcement or compliance activity with which to ensure that agreed fishery control measures were adhered to and enforced. However, in more recent years, MCS is increasingly being viewed as an integral component of fisheries management processes that not only encompasses the traditional views of enforcement, but also incorporates the establishment of data collection systems, the enactment of legislative instruments, and the implementation of management plans through participatory techniques and strategies (Flewwelling *et al.* 2002). As discussed in Section 1.1, the core components of MCS are integral components of the fisheries manager's toolbox, the outcomes of which directly feed back into management decision-making and planning processes.

In terms of defining the elements that make up MCS, the FAO defines them as:

a) ***Monitoring*** includes the collection, measurement and analysis of fishing activity including, but not

limited to: catch, species composition, fishing effort, by-catch, discards, and areas of operation. This information is primary data that fisheries managers use to derive management decisions. If this information is unavailable, inaccurate or incomplete, managers will be handicapped in terms of developing and implementing management measures.

b) ***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 that might be nationally, subregionally, or regionally agreed. The legislation provides the basis for which fisheries management arrangements, via MCS, are implemented. For maximum effect, framework legislation should clearly state the management measures being implemented, and define the requirements and prohibitions that will be enforced.

c) ***Surveillance*** involves the regulation and supervision of fishing activities 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.

1.1 The role of MCS in fisheries management

Traditional fisheries management regimes placed scientific assessments and resource modelling at the centre of the fisheries management decision-making processes and the setting of the objectives for a fishery. This approach focused on resource conservation and made little provision for the MCS measures that were required to reach the stated conservation objectives, or whether they could be realistically achieved. This approach has led to the failure of many management interventions, and to the realisation that, as opposed to simply being a mechanism for enforcement, MCS needs to be an integral component of the fisheries management planning process. Modern fisheries management therefore places MCS strategy, planning and activities as a key component in fisheries management, planning and implementation processes (Figure 1).

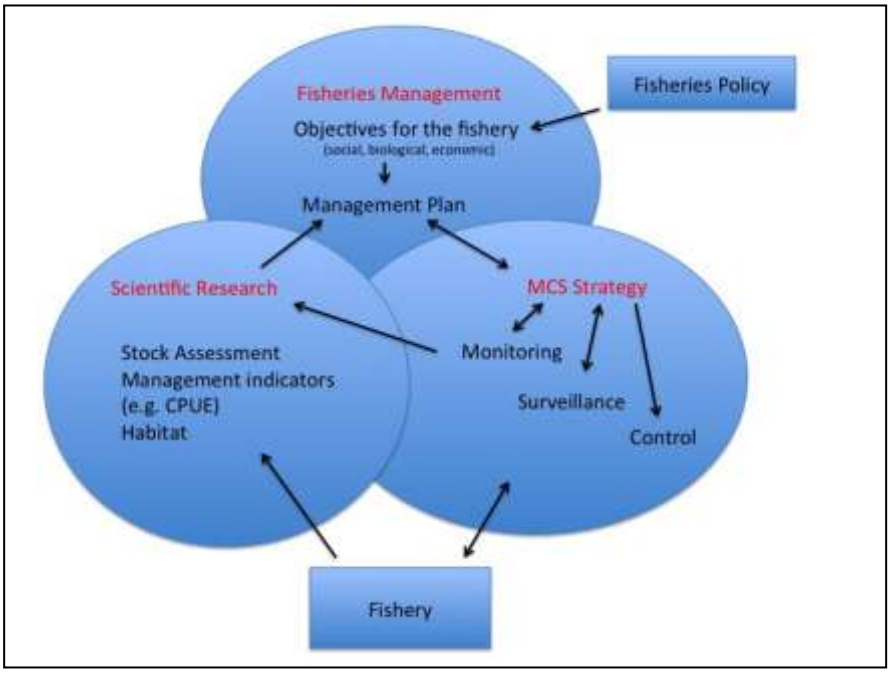

Figure 1: The relationship between fisheries management and MCS (Source: Bergh and Davies, 2002)

In order to be effective, the MCS strategy needs to inform the fisheries management plan and *vice versa*. For example, data collection and monitoring are not only required to monitor the efficacy on MCS interventions; stock data that may be collected during the MCS activities may need to be passed on to the scientists for stock assessment purposes – this may include both biological data (e.g. size frequency data) and data outlining the estimated levels of compliance - the results of which are then fed back to the fisheries managers to assess the level of success of management frameworks, and if necessary, make appropriate changes; likewise, MCS monitoring may be used to establish the efficacy of a given management intervention, and feeding this information back to the fisheries managers would be useful in adapting the management framework and improving future interventions. For example, while the introduction of a simple effort control such as a closed season may appear to be a sensible and viable management intervention, monitoring and surveillance during the closed season may reveal that fishers are not complying with the rules, and thus the fisheries managers would need to reassess the management plan. While the monitoring and surveillance data may not provide the answer as to why the intervention failed, it remains an important link in the adaptive management process.

Integrating MCS into effective fishery management planning therefore needs to be seen as an integral component of the fishery management planning process. While government policy will set the agenda in terms of the societal (biological, ecological and socio-economic) objectives of the fishery, the MCS managers need to be included at the planning level when the design of the interventions that are required to reach those objectives are discussed. As the management planning process is dynamic, adaptive, and needs to address a great diversity of issues that are often fishery specific, there are no specific rules or formulae

that can be applied to the MCS planning component, and how MCS processes should integrate with the proposed management measures. Nevertheless, as a starting point, Bergh and Davies (2002) outlined some of the considerations that need to taken into account during these processes, these include focusing on:

a) the practical requirements needed to implement the management measures and their availability.

b) an analysis of previous records of success and failure of existing management measures, and an evaluation of how this analysis can inform proposed interventions.

c) the factors that will encourage compliance rather than demanding enforcement, and what the requirements to develop interventions that will encourage compliance are, and their feasibility.

d) establishing the consequences for non-compliance; these consequences need to be considered in light of the viability of the fishery, and the level of compliance that is required to support the management plan.

e) the costs of the management measures and / or non-compliance from both a financial and a resource perspective. From a financial perspective, consideration needs to be given to who should cover these costs.

1.2 Value of MCS as a management tool

The value of deploying MCS systems can be viewed in terms of the societal (economic and social) and the biological benefits accruing to their use. While the economic costs associated with deploying an MCS system are relatively easy to quantify, the social and biological aspects are more difficult to assess. To demonstrate how the deployment of MCS systems or a lack thereof, can impact a fishery's economic, social and biological functioning, a series of case studies are presented.

1. The South Africa South Coast Rock lobster fishery

In June 2001, compliance officials from The Department of Environmental Affairs and Tourism - Marine and Coastal Management (DEAT-MCM) discovered a container in Cape Town harbour belonging to Hout Bay Fishing Industries. The container, bound for the USA, was found to contain 1 661kg of west coast rock lobster tails, 16 189kg of south coast rock lobster tails, and 2 844kg of Patagonian toothfish. The discovery lead to the intensification of on-going investigations into Hout Bay Fishing Industries which at the time was already under suspicion of exporting illegally caught rock lobster tails from South Africa. In order to investigate the company, a multi-disciplinary task team, comprising officials from the Scorpions (Directorate of Special Operations), DEAT-MCM (fisheries compliance), the South African Revenue

Service (SARS) and the Asset Forfeiture Unit was set up. After a 10 month investigation, Hout Bay Fishing Industries (Pty) Ltd pleaded guilty to 28 charges of contravening the Marine Living Resources Act (Act 18 of 1998). The company admitted that between 1999 and 2001, it had knowingly and intentionally participated in the over-fishing of south and west coast rock lobster and hake. One of the directors of the company, Colin van Schalkwyk, pleaded guilty to 301 charges of corruption relating to the bribing of 11 fisheries inspectors, and received a fine of R1 million or five years' imprisonment, and a five-year suspended sentence. In terms of a plea bargain, Hout Bay Fishing Industries (Pty) Ltd was fined approximately R40million, including the forfeiture of the fishing vessel Sandalene. Under the Lacey Act in the United States, the former chairman of the company, Mr Arnold Bengis, and two other defendants were charged and found guilty of conspiracy, smuggling and importing wildlife into the US in violation of South African and International law. They received prison sentences that ranged between one and four years, and fines of approximately US$7.5 million. In addition, in 2007, restitution proceedings to compensate the South African Sate for the economic losses associated with the overfishing resulted in a ruling by a US District Court that restitution not exceeding US$41 million be paid to the South African Government. As of January 2011, this ruling remains under appeal[2].

2. Illegal shark fishing in Mozambique and the seizure and confiscation of the Antillas Reefer

Historically, weak monitoring, control and surveillance capacity in Mozambique has left the country's 2 780km coastline and EEZ vulnerable to IUU fishing. Horsh (2008) reported that illegal shark fishing in the EEZ has become particularly problematic at the edge of the continental shelf, and more recently in the inshore areas where Chinese traders reportedly buy shark fins from the artisanal fishers. In recent years, Mozambique has strengthened their MCS capacity. This is a development that has been facilitated by a number of donor programmes and the development of joint operations with South African patrol vessels.

One of the most recent successes in the fight against IUU fishing in the Mozambique shark fishery is the capture and confiscation of the Antillas Reefer. The Antillas Reefer was a long-line vessel that was owned by Ompala Fishing (Pty) Ltd, a Namibian company based in Walvis Bay. In April 2008, the company applied for a tuna fishing licence through a Mozambican company, Sabpal Pescas SA. While the application was being processed, it was reported to the Fisheries Department that an unknown vessel, the Antilles Reefer, had been seen fishing within Mozambican waters. At the time the Fisheries Department had limited capacity to apprehend the vessel at sea, and so asked the Namibian vessel owners to bring the vessel into port for a pre-licence briefing. After some delays, the vessel entered Maputo Harbour on 5th July 2008. At the time, fisheries inspectors boarded the vessel to undertake an inspection. A review of the vessel log book revealed that it had been fishing in Mozambican waters for 50 days. In addition, 43 tonnes of shark meat, 4 tonnes of shark fin, 1.8 tonnes of shark tail, 11.3 tonnes of shark liver, 20 tonnes of shark oil

[2] http://www.leagle.com/xmlResult.aspx?page=1&xmldoc=In%20FCO%2020110104064.xml&docbase=CsLwAr3-2007-Curr&SizeDisp=7

and 65 tonnes of bait and illegal fishing gear was found in the holds. A further investigation of the electronic navigation records indicated that they had been tampered with, and telephone records to the company owners had been deleted.

The master of the vessel admitted to targeting sharks without a licence, and on 18th August 2008, the master and vessel owners were fined US$4.5 million and the vessel and all its contents confiscated. In August 2010, an appeal of the fine imposed and the seizure of the vessel proved unsuccessful. While the vessel is now being converted to a patrol vessel for use by the Mozambican fisheries department, the fine is as yet unpaid. As the Master of the vessel was a Spanish national who has now been repatriated, the Mozambican authorities are now forced to rely on diplomatic channels to ensure that the fine is paid.

The success of the case was attributed to a number of factors. These included the successful application of international legal instruments such as the United Nations Convention on the Law of the Sea (UNCLOS), and the FAO Compliance and Fish Stocks Agreements. The cooperation with the flag state proved important in terms of securing vessel movement information and ultimately having the vessel deregistered. The establishment of an inter-agency cooperation group that ensured a high level of cooperation between the various government agencies that were involved in the case was also key to ensuring the conviction. The agencies that were involved in the cooperation group included the Fisheries Department, which was tasked with inspecting the vessel and the collection / collation of evidence, applying the sanctions and coordinating the process; the Judiciary which was tasked with undertaking the legal trial and appeals process; the Ministry of Foreign Affairs which was tasked with notifying the flag state of the infraction; the Immigration Department which was tasked with repatriating the crew; and the Ministry of Defence which, through the Navy, took custody of the vessel.

3. South African abalone resources - a failure in compliance

The emergence of widespread illegal abalone fishing in South Africa in the 1990s has been attributed to a number of governance, socio-economic and market factors (Tarr, 2000; Steinberg, 2005). Principal amongst these was the abolition of restrictive Apartheid laws in the early 1990s, the transition to democracy in 1994, and a trans-formation of state structures responsible for fisheries management (Marine and Coastal Management - MCM) and law enforcement (South African Police Service – SAPS). Amongst others, these changes resulted in structural changes to fisheries governance in the country, and a policy change in resource allocation from one that favoured the white minority to a more inclusive dispensation. These structural changes in fisheries governance came at a time when the South African Rand (ZAR)

weakened against the U.S. dollar (USD) resulting in a significant increase in the export price for abalone. The increase in abalone prices was a primary driver that stimulated the illegal trade in the product which, due to poor border control systems, could be easily exported illegally. In 2005, an individual diver could make in the region of US$6 000 from 100kg of abalone in a single trip, with minimal capital investment and risk (Raemaekers and Britz, 2009). Finally, the presence of an established and highly efficient Chinese organized crime network in South Africa, promoted the bartering of drugs for abalone, and provided an ideal mechanism for organized crime syndicates to move their product.

By 2005, the Eastern Cape city of Port Elizabeth was home to an illegal fleet of 30 purpose-built vessels with a capital investment of US$4 million, employing at least 300 full time crew, and harvesting 1 000–2 000 tons of abalone per annum with an export value of US$35–70 million. The government enforcement's response to the problem reveals that while considerable resources were deployed to combat the various criminal activities associated with the problem, enforcement agencies lacked a coordinated strategy. Most 'anti-poaching' operations were short-term, and the resources dedicated to combating illegal fishing were no match for the well equipped and highly organized illegal syndicates with their sophisticated intelligence networks (Raemaekers and Britz, 2009). Arguably, by focusing on the confiscation of poached abalone and breaking up the syndicates, the SAPS played the most substantial role in combating illegal abalone fishing. In 2004, 99% of the abalone confiscated was seized by the SAPS with the remaining 1% being seized by MCM. At the outset, MCM failed to grasp the scale of the illegal abalone fishing problem, and was ill-equipped to deal with the organized criminal nature of the enterprise. The organisation's principal response to the illegal activity was to partner with the SAPS to develop an Abalone Task Team (ATT). However, after some initial successes, the task team was disbanded, only to be reinstated at least three times. Furthermore, the compliance unit that was based at Port Elizabeth was underfunded, and equipment that was required to undertake sea patrols was inadequate to combat the well equipped poachers. For example, the vessel that was supplied to combat the poachers was not as agile and manoeuvrable as the poachers' semi-rigid vessels, and could therefore not be used at speed in rough weather, nor move into the estuaries / surf zone where the poachers could effectively evade capture. Clearly, this lack of a coherent compliance response was a primary reason why the illegal fishers were able to act with impunity and plunder the resource. In time, additional resources were allocated to the problem and a more coordinated approach was developed. For example in January 2008, combined operations involving patrol vessels, helicopter air support and shore-based teams to intercept the fleeing fishers resulted in a number of successful arrests.

To conclude, the lack of compliance capability to combat boat-based illegal abalone fishing has enabled illegal fishers to plunder the Eastern Cape abalone stocks with impunity. While substantive resources have been expended by a number of state actors, there has been a lack of coherent coordination by the fisheries management authorities. Efforts to control the fishery have often been poorly coordinated, with little long-term consistency. The failure to mount an effective and coherent compliance response to highly organize IUU fishers and crime syndicates has lost the State in the region of US$35–70 million a year.

Module 2: Legal frameworks

Law is central to MCS as it defines the roles, responsibilities and powers which States and fisheries management organisations have in the management of their fisheries resources. They also assign powers of enforcement to government officials and provide the rules and regulations by which fishers must abide, as well as the judicial process for non-compliance. International law regulates the relationships between States, while National or Domestic law regulates the relationships between people within a State.

2.1 International legislation and agreements

2.1.1 United Nations Convention on the Law of the Sea (UNCLOS)

The United Nations Convention on the Law of the Sea (UNCLOS, 1982) provides the fundamental legal framework within which international arrangements and agreements applying to the oceans and seas are based. It came into force in November 1994 and provides universally agreed limits for the territorial sea, the contiguous zone, the exclusive economic zone and the continental shelf, and establishes a comprehensive legal regime for these areas. It further outlines the rights and duties of coastal, port and flag states with respect to these areas, and provides a framework for conservation and utilization of the living marine resources. It also deals with issues of international navigation and the rights of innocent passage and transit through territorial seas.

In terms of fisheries management, the Convention divides the oceans into two basic areas, *viz.*

1) Areas under the jurisdiction of coastal States in which the coastal State has exclusive authority to manage their fisheries.
2) The high seas, in which all States have qualified resource rights.

States are required to conserve and manage the living marine resources in the areas that are within their jurisdiction, and in those areas over which they exercise sovereign rights. The Convention further establishes a regime for the conservation and management of fisheries resources on the basis of the area that they occupy (internal waters, archipelagic waters, territorial seas, exclusive economic zones, continental shelf areas and high seas), or the types of fish stocks that occur in these areas (e.g. straddling stocks, highly migratory species, marine mammals, anadromous stocks and catadromous species). States are also required to cooperate to conserve and manage specific stocks, particularly straddling fish stocks and highly migratory species without prejudice to the rights of the coastal state where such stocks occur.

2.1.2 FAO Compliance Agreement (1993)

The FAO Compliance Agreement (1993) is designed to strengthen the provisions of UNCLOS, and in particular those that relate to high seas fishing. One of the problems associated with the UNCLOS convention was that it did not adequately address the issue of the flagging (or reflagging) of vessels that were fishing in the high seas to non-signatory nations. The practice of flagging effectively meant that vessels could fish with impunity on the high seas, and circumvented international and regional attempts to manage and conserve the high seas fish stocks.

The Agreement therefore has two overarching objectives: firstly, to require all States whose vessels fish on the high seas to take a range of steps to ensure that their vessels do not undermine fish conservation and management measures; and secondly, to increase the transparency of high seas fishing operations through the collection and dissemination of data. Bearing these objectives in mind, the main obligations of a country accepting the Compliance Agreement is to exercise its responsibility over vessels flying its flag, establish a record of fishing vessels, and to provide the information required under the Agreement with respect to those vessels. The principal benefits to participants arise from the availability of information regarding vessels authorized to fish on the high seas, and an enhanced ability to identify those vessels fishing without permission.

In terms of the responsibilities that member states have in terms of MCS, the most significant provisions in the agreement relate to Article III, *viz.*

1) Flag States should ensure that their vessels do not undermine fishery conservation and management measures that apply in any high seas area.
2) Vessels should not fish on the high seas except pursuant to express authorization to do so by the flag State.
3) Flag States should not grant such authorization to a vessel unless it can ensure that the vessel will not undermine fishery conservation and management measures that apply in the high seas area in which the vessel will operate.

Importantly Article III also requires flag States to ensure that its fishing vessels are marked and readily identifiable in accordance with generally accepted vessel marking standards, that information on the operations of their vessels is collected, and that where necessary, appropriate sanctions that are designed to deter future non-compliance are imposed for fishing offences.

2.1.3 UN Fish Stocks Agreement (1995)

The UN Fish Stocks Agreement (1995) came into force on 11th December 2001. The agreement is designed to implement the provisions of UNCLOS that relate to the conservation and management of straddling fish stocks and highly migratory species. In terms of the agreement, "straddling" fish stocks are those resources whose natural ranges straddle the line dividing areas under the fisheries jurisdiction of one or more coastal States (EEZ) and the adjacent high seas areas. "Highly migratory" fish stocks are those stocks that migrate extensively across the high seas and through areas under the fisheries jurisdiction of coastal States (e.g. tuna resources in the Western Indian Ocean). The agreement places Regional Fisheries Management Organizations (RFMOs) in a central position in terms of stock management, and designates them as the primary mechanism through which States should cooperate to achieve enhanced resource conservation and management. With respect to Flag States responsibilities, the Agreement also contains similar provisions to those outlined in the FAO Compliance Agreement (1993). The Agreement includes specified mechanisms with which to achieve cooperation between States, and calls for strict enforcement and the collection and exchange of fisheries data. Disputes between parties are settled through the procedures established under UNCLOS.

In terms of Flag State responsibilities, the Agreement calls for the state to:

1) Ensure that its vessels comply with applicable conservation measures and do not undermine their effectiveness;
2) Grant an authorization to fish on the high seas only "where it is able to exercise effectively its responsibilities in respect of such fishing vessels";
3) Develop regulations "to ensure that vessels flying its flag do not conduct unauthorized fishing within areas under the national jurisdiction of other States";
4) Wherever violations occur by a vessel flying its flag, enforce compliance using the appropriate sub-regional and regional conservation and management measures.

With respect to other provisions that relate directly to enforcement, the Agreement includes rules under which States other than the Flag States may board and inspect fishing vessels on the high seas, these include:

a) Under certain circumstances, States other than the flag State may board and inspect vessels fishing on

the high seas to ensure compliance with conservation and management measures established by regional fishery bodies;

b) In cases of serious violations by vessels whose flag State either cannot or will not exercise proper control over them, enforcement action, including ordering a fishing vessel to port, may be taken;

c) Serious violations include fishing without a licence; failing to maintain accurate records; fishing in a closed area or for stocks subject to a moratorium; using prohibited gear; falsifying markings or other identification; concealing, hampering with, or disposing of evidence; and multiple violations which together constitute a serious disregard for conservation and management measures;

d) States should act through regional fishery bodies to establish procedures for boarding and inspection and to implement the other provisions involving cooperative enforcement. If they have not done so by now, or have not established an alternative enforcement mechanism, then boarding and inspections may occur in accordance with procedures found in the Agreement.

2.1.4 FAO Code of Conduct for Responsible Fisheries (CCRF)

The FAO Code of Conduct for Responsible Fisheries (CCRF) prescribes principles and standards for the conservation and management of fisheries, fishing operations, fish trade and processing, fisheries research and the integration of fisheries into coastal zone management and aquaculture. The code is designed as a resource that can be used by fisheries managers, policy makers, regulators, researchers and the private sector to guide their decision-making processes. While the code is not legally binding, certain parts of the code are based on international law, including UNCLOS, and contain provisions that may be or have already been given binding effect by means of other obligatory legal instruments. The code is designed as a component of a suite of international agreements. In terms of MCS, these include the FAO Compliance Agreement, the UN Fish Stocks Agreement and the IPOA-IUU.

Implementation of the Code is primarily the responsibility of States. However, the FAO encourages and facilitates the implementation of the Code and provides technical support to national and regional initiatives. In this regard, the FAO develops technical guidelines that can be used to implement the code (www.fao.org).

2.1.5 The International Plan of Action for IUU fishing (IPOA-IUU – FAO, 2001)

The International Plan of Action for IUU fishing (IPOA-IUU - FAO, 2001) is a voluntary instrument that was developed within the framework of the Code of Conduct for Responsible Fisheries. The objective of the IPOA is to provide States with a "toolbox" of comprehensive, effective and transparent measures with which to reduce or eliminate IUU fishing. The IPOA-IUU calls upon all States to develop and adopt National Plans of Action (NPOAs) to combat IUU fishing. Components of the IPOA-IUU are based on international law, including the UNCLOS (1982), the FAO Compliance Agreement and the UN Fish Stocks agreement (1995). As a "toolbox," the IPOA-IUU attempts to embrace all existing measures that have been shown to be useful in combating IUU fishing, and while many of these tools are already in use by some States, acting alone or in cooperation with other States, including through regional fisheries management organizations (RFMOs), it is recognized that not all tools work in all situations. While some of the measures are designed for use by all States, others are tailored for use by Flag States, Coastal States and Port States. Nevertheless, the IPOA is designed to provide appropriate tools, or combinations thereof, to fit every circumstance and, in so doing, reduce the incidence of IUU fishing.

With respect to regional fisheries management, the IPOA-IUU recognizes that many fisheries, particularly those of straddling fish stocks and highly migratory fish stocks, are managed under the auspices of RFMOs. The IPOA-IUU therefore provides States, acting through RFMOs, with a series of tools that are designed for use at a regional level, building on measures that RFMOs have already developed and implemented. The IPOA-IUU, while recognizing that States are only directly bound by measures adopted by RFMOs of which they are members, also reaffirms that States that are not members of RFMOs have a responsibility to ensure that their nationals and vessels do not undermine fishery conservation and management measures adopted by RFMOs.

While the IPOA-IUU is designed to be implemented by individual countries through the development of their own NPOAs, the IPOA recognizes that developing States, and most notably Small Island States and other developing coastal States are among those that suffer the most from the adverse effects of IUU fishing, and in many cases, have the most limited resources to develop and implement their own NPOAs. In response, the plan calls upon States, with the support of the FAO and relevant international financial institutions / mechanisms, to support training and capacity building and to consider providing financial, technical and other assistance to developing States to meet their IPOA-IUU commitments.

2.1.6 Port State Measures Agreement (2009)

The Port State Measures Agreement (PSMA) to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing was approved by the FAO on 22nd November 2009. The Agreement is a legally binding international agreement that is designed to prevent illegally caught fish from entering the market through the closure of all ports to IUU fishing and support vessels. Effectively, the agreement is designed to eliminate "ports of convenience" that have inadequate or lax port control systems and are thus favoured by IUU fishing vessels.

Port State Measures (PSM) are requirements or interventions that are undertaken by Port States to regulate the use of their port facilities by foreign fishing vessels. Foreign vessels are forced to comply with these measures, or are subjected to them as a condition of use of the ports facilities within the port state. National PSM would typically include requirements related to prior notification of port entry, the use of designated ports, restrictions on port entry and landing / transhipment of fish, restrictions on supplies and services, documentation requirements and port inspections, as well as related measures, such as IUU vessel listing, trade-related measures and sanctions.

Crucially, the Port Sate Measures Agreement provides an opportunity to harmonise and strengthen global port state measures. The Agreement outlines the duty of Port States to designate specific ports for use by foreign flagged vessels, inspect foreign flagged fishing and support vessels, and deny port entry and the use of port facilities to IUU fishing vessels and their service vessels. The agreement is designed to promote coordination with other coastal states, flag states and RFMOs to ensure that fishing is conducted in accordance with agreed conservation and management measures.

In terms of implementing the Agreement, a central tenet of the PSMA is that countries can deny entry or port use of IUU fishing vessels, or their supply and transhipment vessels, and inspect vessels that voluntarily enter their ports.

2.2 Regional instruments and initiatives

2.2.1 Southern African Development Community (SADC)

1. SADC Protocol on Fisheries (2001)[3]

[3] http://www.sadc.int/index/browse/page/150

The stated objective of the SADC Protocol on Fisheries is to promote the responsible and sustainable use of the living aquatic resources in the region in a manner that:

(i) enhances food security and human health
(ii) safeguards the livelihoods of fishing communities
(iii) generates economic opportunities for nationals in the region
(iv) ensures that future generations benefit from these renewable resources, and
(v) alleviates poverty with the ultimate objective being its eradication.

In terms of MCS, the primary issues that the protocol outlines include national and cooperative responsibilities of member states in terms of the management of shared resources, the harmonization of legislation, and the development of cooperative mechanisms to undertake MCS activities and reduce IUU fishing. Specifically, the protocol calls for the adoption of regional-wide penalties for IUU fishing, extradition arrangements, joint actions to identify IUU vessels, the establishment of regional vessel registers, and the promotion of cooperative law enforcement and MCS activities. Subject to their respective national laws, the protocol calls for co-operation in the establishment of harmonized minimum terms and conditions for access by non-SADC-flag fishing vessels, and calls for regional or sub-regional negotiations in terms of negotiating foreign access rights to highly migratory species. The protocol affirms the member States' rights to fish in the high seas, and calls member states to support the activities of international organisations that conserve and manage high seas resources, and further, to collaborate in the establishment of common positions and policies with respect to their management.

2. SADC Statement of Commitment to combat IUU fishing (2008)[4]

The SADC statement of commitment to combat IUU fishing is designed to highlight the need for improved regional and inter-regional cooperation to eradicate IUU fishing, the need to strengthen fisheries governance, MCS capacity and legal frameworks, and the need to develop a regional plan of action to combat IUU fishing.
The statement makes a number of resolutions. Principal amongst these is a commitment to ensure that SADC members participate in the FAO IPOA-IUU fishing and Port State Measures initiatives, promote the use of VMS in coastal states and commit to the exchange of IUU information between states, develop appropriate exchange protocols, support regional training and capacity building, and improve coordinated MCS activities between member states by establishing a regional MCS Coordination centre. In 2010, a SADC Action Plan to implement the SADC Statement of Commitment to combat IUU fishing was adopted at a Ministerial level, and it was agreed that the regional centre outlined in the SADC statement would be located in Maputo. A feasibility study has been

[4] http://www.commonwealthfisheries.org/admin/downloads/docs/SADC%20Statement%20of%20Commitment%20on%20IUU%20Fishing%20040708.pdf

undertaken for the centre, and a start-up project proposal was approved by SADC Ministers in May 2011. With respect to the establishment of a regional task force to address IUU fishing issues at a regional level, the first meeting of this taskforce was held in Maputo in September 2011.

2.2.2 Regional Fisheries Management Organisations (RFMOs)

1. Indian Ocean Tuna Commission

The Indian Ocean Tuna Commission (IOTC) is an intergovernmental organization that was established under Article 14 of the FAO constitution. The organisation is mandated to manage the tuna and tuna-like resources in the Indian Ocean and adjacent seas. It is guided by UNCLOS and promotes fisheries management, and the conservation and optimum utilization of the tuna resources. The Commission is tasked with a number of functions and responsibilities. Principally these include, the collection, analysis and dissemination of stock assessment data (e.g. fleet, catch and effort statistics), and on the basis of scientific evidence, the development of conservation and management measures to ensure the conservation of the stocks. It is also tasked with the promotion and coordination of research and technology transfers, and from an economic and social perspective, it is tasked with ensuring that the interests of member states, and in particular the developing coastal states are upheld. The Commission has a compliance committee that is responsible for MCS and IUU fishing issues. The Commission has instituted a number of resolutions to deter IUU fishing and to develop comprehensive MCS systems, amongst others, these resolutions focus on adopting VMS and reporting systems, regional and transhipment observers, and establishing vessel records and IUU vessel listings.

2. Southwest Indian Ocean Fisheries Commission (SWIOFC)

The Southwest Indian Ocean Fisheries Commission (SWIOFC) was established to promote the sustainable use of the living marine resources in the south western Indian Ocean region. In order to achieve this it aims to develop effective actions to address the common fisheries management problems experienced by member States. SWIOFC was established in 2004 under article VI 1 of the FAO Constitution, and its rules and procedures were adopted in 2005. One of the key goals SWIOFC aims to achieve is the establishment of institutional arrangements that will allow for improved coordination between member States thereby contributing to improved governance in the region. The Commission is also responsible for ensuring the on-going review of the state of the fishery resources in the region as well as the industries which are based on the use of these resources. Additional responsibilities include improving the collection, exchange, dissemination and analysis of biological, environmental and socio-economic data and other marine fishery information, as well as promoting research through the development and coordination of research programmes. Through the provision of sound scientific information, SWIOFC aims to assist member States in making management decisions, provide management advice and promote co-ordinated

MCS on a regional and sub-regional level. Training and the promotion of appropriate fishing gears, techniques and post-harvest processes are also key areas of activities.

3. South Indian Ocean Fisheries Agreement (SIOFA)

The South Indian Ocean Fisheries Agreement (SIOFA) is a regional 'arrangement' and not a regional fisheries 'body' as it does not have a permanent secretariat. The main objective of the Agreement is to ensure the long-term sustainable use and conservation of all fishery resources other than tunas and tuna-like species which fall outside the national jurisdictions. Through the agreement, SIOFA aims to establish mechanisms to monitor fishing activities, report on annual fishing activities, harvests and discards, undertake ship inspections to ensure compliance of parties, and to deny landing and discharging privileges to non-compliant parties.

4. International Commission for the Conservation of Atlantic Tunas (ICCAT)

The International Commission for the Conservation of Atlantic Tunas (ICCAT) is responsible for the management and conservation of tunas and tuna-like species in the Atlantic Ocean. Its core area of competence includes the high seas and the national waters of the Atlantic Ocean. The Commission was first established in 1966 and entered into force in 1969, with amendments to the Convention in 1984 and 1992. ICCAT is responsible for compiling fishery statistics for tunas and tuna-like species, coordinating research activities, developing scientific-based management advice, and producing relevant publications. Furthermore, it provides a platform from which agreement on management issues between parties can be reached.

5. South East Atlantic Fisheries Organisation (SEAFO)

The South East Atlantic Fisheries Organisation (SEAFO) was established as a regional fisheries management organisation to meet the provisions of UNCLOS and the UN Fish Stocks Agreement. Its primary objective is to ensure the long-term sustainable use and conservation of all living marine resources in the high seas of the south east Atlantic and to safeguard the marine ecosystems in which they occur. The Convention on the Conservation and Management of Fisheries Resources in the South East Atlantic Ocean was signed in April 2001. Economically important sedentary / discrete and

straddling species occurring within the Convention area include alfonsino, orange roughy, oreo dories, armourheads, sharks, deepwater hake and red crabs.

6. Lake Victoria Fisheries Organisation (LVFO)

The Lake Victoria Fisheries Organisation (LVFO) is a regional organization operating under the East African community (EAC). The LVFO is responsible for coordinating fisheries activities and managing fisheries resources on Lake Victoria and was formed through a Convention signed on 30th June 1994 by the three East African Community partner States of Kenya, Uganda and the United Republic of Tanzania which border Lake Victoria. The LVFO aims to foster cooperation among contracting parties, and to adopt conservation and management measures which will contribute to the sustainable utilisation of the living resources of Lake Victoria. It is responsible for ensuring appropriate management to promote the optimal utilization of the resources of the lake, coordinating research relevant to maintaining a healthy and sustainable ecosystem, storage and dissemination of data relevant to the lake, and enhancing the capacity for future management and cooperation between parties.

7. Lake Tanganyika Authority (LTA)

The Lake Tanganyika Authority (LTA) was established by the governments of Burundi, The Democratic Republic of Congo, Tanzania, and Zambia in December 2008 with the mandate to safeguard the lake and its natural resources. The LTA promotes regional cooperation required for socio-economic development and the sustainable management of the natural resources in the Lake Tanganyika basin through the implementation of the Convention on the Sustainable Management of Lake Tanganyika.

8. Committee for Inland fisheries and Aquaculture of Africa (CIFAA)

The Committee for Inland fisheries and Aquaculture of Africa's (CIFAA) main role is to promote the development of inland fisheries and aquaculture in Africa. The Committee was established by the FAO Council in 1971 under Article VI-2 of the FAO Constitution. Its functions include promoting and coordinating research programmes to provide scientific information to facilitate management and decision-making, coordinating national and regional management to promote a healthy aquatic environment, to assist in the development of culture techniques, training and education, and to assist in the collection, storage and dissemination of ecological, biological and fishery related information.

2.3 National legislative, policy and regulatory frameworks

National laws provide the rules and regulations for people and activities within the land or sea under the jurisdiction of a particular State. This usually pertains to areas of ocean over which the State exercises sovereign rights such as the EEZ, but may also apply to the activities of nationals or vessels of that State outside of its area of jurisdiction. The definitions below are based on UNCLOS.

2.3.1 Internal waters, the territorial sea and archipelagic waters

International law assigns coastal or archipelagic states sovereignty over their internal waters, territorial seas and archipelagic waters. This affords them the power to make and enforce fisheries laws. Internal waters comprise of water bodies on the landward side of the baseline which is defined as the mean low-water mark for coastal states. The baseline for archipelagic waters differs from that above due to the fragmented nature of the State, being more complex and is defined in detail in Article 47 of UNCLOS, yet similar rules apply for these waters. The territorial sea is a belt of coastal waters extending for a maximum of 12 nautical miles seaward of the baseline. Although States have sovereign rights over these waters they must grant foreign vessels, including vessels registered for fishing, innocent passage provided that they are not engaged in fishing activities.

2.3.2 The exclusive economic zone (EEZ)

The exclusive economic zone (EEZ) is an area of coastal water beyond but adjacent to the territorial sea which extends out to 200 nautical miles seaward of the baseline. Coastal States have sovereign rights for exploring, exploiting, conserving and managing natural resources within the EEZ, and are responsible for determining the allowable catch of living resources within this area. They must also promote optimal utilisation of the living resources and where they have insufficient capacity to harvest the total allowable catch they should grant foreign vessels access to the surplus. However, they may enforce laws and regulations on foreign vessels to meet conservation measures and facilitate the monitoring and management of these activities. UNCLOS also provides additional guidance for the management of species that occur in waters under the jurisdiction of more than one State, that migrate between areas under national jurisdiction and the high seas, and that occur exclusively on the high seas.

2.3.3 The continental shelf

The continental shelf of coastal States extends to the end of the natural prolongation of the land territory, or to 200 nautical miles from the baseline (where this is greater), and may therefore exceed the limits of the EEZ. Coastal States have exclusive rights for exploring and exploiting the natural resources on their continental shelf. No other person may undertake these activities without the express consent of the coastal State.

2.3.4 The high seas

All areas of the seas which are not under the jurisdiction of coastal States as defined above form the high seas. The high seas are open to all States. This allows fishing by nationals from any state subject to an obligation to cooperate with other States and ensure the conservation of the living resources, as well as to respect the rights and interests of coastal states. As the high seas are beyond the limits of national jurisdiction, no coastal State fisheries regulations apply to other States' vessels, however, all fishing vessels are subject to jurisdiction of their flag State. Coastal States may, however, take additional action in order to prevent IUU through the UN Fish Stocks Agreement and the International Plan of Action for IUU (IPOA-IUU).

2.4 Actors and their legal roles

Depending on the country and the fishery, a number of national, regional and international actors may be involved in MCS operations.

2.4.1 Government Ministries and Departments

1. Fisheries

The Ministry of Fisheries / Fisheries Agency is usually the lead agency for the implementation of an MCS system. It assesses and allocates fishing licences and is responsible for the overall management of the fishery resources and fishery activities within territorial waters. The development and implementation of a robust MCS system is one of its core duties.

2. Foreign affairs

Foreign Affairs has interests in developing partnerships with foreign fishers and plays a lead role in negotiating agreements between the Fisheries Department and these foreign fishing partners. It is also usually responsible for liaising with foreign governments whose nationals may be in breach of local fishing regulations.

3. Judiciary

The Judiciary plays the central role in prosecuting transgressions of the fisheries laws within the State. They therefore need to understand the fisheries objectives and policies, and the importance of the fishery resources to the livelihoods of the fishers and the State as a whole. They must also have a clear understanding of the intent of fisheries management plans, and thus ensure that these objectives are adequately reflected in the fisheries legislation of the State.

4. Home Affairs - Immigration Services

Home Affairs or Immigration Services is responsible for the immigration status of foreign nationals. Under the Vienna Convention on Consular Relations of 1963 (Article 36), foreign nationals who are arrested or detained are to be given notice "without delay" of their right to have their embassy or consulate notified of that arrest. If the detained foreign national so requests, the police must fax that notice to the embassy or consulate, which can then check up on the person. The notice to the consulate can be as simple as a fax, giving the person's name, the place of arrest, and, if possible, something about the reason for the arrest or detention.

5. Customs Services

Customs agencies can play a surveillance role in fisheries MCS and undertaking joint patrols with fisheries agencies can reduce costs considerably. However, differing priorities between the customs (drugs etc.) and fisheries management agencies may reduce the applicability of joint surveillance efforts in some areas.

6. Port Authority

The Port Authorities provide assistance in both monitoring and surveillance through facilitating port inspections and monitoring transhipments.

7. Police service / National Defence

In many States, the police services play an important role in the implementation of the MCS system, acting as the main operational branch for executing surveillance and enforcement where fisheries officers are lacking. Similarly, where capacity in fisheries organisations is limited, the marine police of the navy can contribute considerably to enforcement through undertaking surveillance patrols and conducting inspections.

8. Flag states

Flag States are responsible for ensuring that their vessels do not undermine fishery conservation and management measures which have been implemented in high seas areas. They must also ensure that vessels that fish the high seas are limited to those authorised by the State. However, a number of flag States do not have the capacity or expertise to regulate the activities of their vessels, thus limiting the effectiveness of their powers.

9. Vessel Owners

Vessel owners have an important role to play in fisheries MCS through ensuring compliance with safety-at-sea regulations, port state controls and compliance with the licensing agreements.

10. RFMOs

In terms of the FAO Code of Conduct for Responsible Fisheries and UN Fish Stocks Agreement, Regional Fisheries Management Organisations (RFMOs) are responsible for managing the fish stocks and fisheries activities on the high seas, particularly migratory species which are targeted over large regions. They also provide the platform for fostering collaboration between neighbouring states, and contribute to coordinating MCS activities along territorial boundaries.

2.5 Fisheries offences

Almost all fisheries are subject to some form of IUU activities which undermine the management actions implemented to ensure the long-term sustainability of the stocks. Implementing a robust MCS system can effectively counter most common fisheries offences. The following section provides an indication of the major fisheries offences that MCS managers need to take cognizance of.

2.5.1 Misreporting / non-reporting

Many fisheries management agencies rely on catch return data submitted by the fishery rights holder or vessel captain for the management of the fishery resources. Misreporting or under-reporting of fisheries activities provides false information to the management authorities and undermines management efforts. Unreported or misreported fishing refers to fishing activities which have purposely not been reported, or have been incorrectly reported to the relevant management authority in contravention of national laws, regulations or reporting procedures (FAO 2001). Unreported fishing may result in gross underestimations of the total harvest, contributes to the overexploitation of the resources above recommended levels and can lead to the collapse of the fishery. Misreporting or non-reporting is usually done to avoid or reduce fishing levies or to increase the harvest over and above that allocated in permit conditions.

2.5.2 Gear violations

Management authorities use regulations to implement gear restrictions in a fishery in order to manage harvest levels sustainably, and prevent excessive by-catch of undersized or non-target species. Gear violations occur when fishing activities contravene these gear restrictions in order to enhance their harvest, and in doing so contravene national laws and regulations. Examples may include using finer mesh on trawl, drift of gill nets to capture smaller fish, and using more traps/pots or hooks than allocated to the rights holder.

2.5.3 Closed season violations

Closed seasons are implemented to protect fishery resources when they are particularly vulnerable to capture. This often occurs over spawning periods when stocks form dense aggregations. Management authorities implement regulations to restrict fishing activity during these periods, and thus award greater protection to the stocks when they are susceptible to capture. Violations of closed season regulations occur when fisheries activities target specific species during these periods. Unregulated fishing activities during these periods when stocks are densely aggregated can lead to the rapid over-exploitation of the resources.

2.5.4 Closed area violations

Closed areas, such as marine protected areas or marine reserves, are areas in which all or some fisheries activities are prohibited through national laws and regulations. Closed areas are usually designated in

sensitive areas, or in areas in which targeted species are known to aggregate (e.g. nursery areas; spawning areas) making them susceptible to capture and overfishing. Closed areas may also be designated to protect breeding populations of resident non-migratory species which contribute to the re-seeding of adjacent fished areas. Fishing within these closed areas is in contravention of the regulations of the management authorities.

2.5.5 Size and species violations

Fishing rights within a particular sector often have size and species restrictions to prevent capture of juvenile, sensitive or protected fish. However many gear types are unselective and by-catch of undersized or non-target species occurs. Limits on the amount and composition of the by-catch in a fishery are imposed by the management authority to restrict selective targeting of non-target species. However, due to the high value of some non-target species and the co-habitation in similar habitats to the targeted species, selective targeting of by-catch species often occurs. This is in contravention of the licence conditions.

2.5.6 Prohibited and destructive fishing methods

Destructive fishing methods are those which have an indiscriminate effect on non-target species and the environment in which they occur. This may result from the use of inappropriate fishing methods in unsuitable habitats (e.g. bottom trawling over sea grass or coral reefs) which can be managed through restrictions on these gears in particular habitats. Alternatively, fishing techniques may be highly destructive and indiscriminate to the species upon which they impact, and prohibition is the only means of preventing ecosystem degradation. Examples include the use of poisons (e.g. the use of cyanide for the collection of ornamental fish) or explosives, which have been used in coral reef areas resulting in the devastation to the local fish populations and surrounding ecosystems. Careful monitoring is required to ensure these activities are managed correctly or prohibited.

2.5.7 Fishing without licences

Fishing without a licence is regarded as an illegal fishing activity as it contravenes the laws and regulations of the national management authorities. This contributes to the overharvesting of the stocks above the allocated quotas within national waters and can contribute to stock depletion or collapse. Furthermore unlicensed vessels contribute to mis- or under-reporting making the quantification of total harvests by the management authority problematical.

2.5.8 Dumping and high grading

Dumping and high grading is of particular concern in larger industrial fisheries regulated by total allowable catches. It occurs due to the rights-holders discarding lower value catches in favour of high value fish. Clearly this is done to maximise profits. Discards may include non-target by-catch species or juveniles of commercially important species which are of little value due to their small size, or are below the minimum legal size for the species. Dumping and high grading of juvenile commercial species is of major concern as it places additional pressures on the stocks by reducing the number of fish which will attain maturity and enter the fishery at a later stage.

2.5.9 Illegal transhipping at sea

Fishing vessels may tranship their catch at sea to another vessel to avoid reporting the full catch to the flag or port state. This enables them to continue fishing beyond the limits of their allocated quota, and exacerbates the problem of mis- and under-reporting of catches.

Module 3: MCS Management Measures under different fisheries management paradigms

3.1 User Rights

User rights are assigned by an appropriate management authority, and represent the rights that are held by fishermen or communities to *use* a fishery resource. In general, user rights can be categorised into two major types:

1. Access rights that grant individuals or communities entry into a fishery or fishing ground;
2. Withdrawal or harvest rights that usually involve a right to catch a specific species, or to expend a given amount of fishing effort (e.g. use a given amount of fishing gear, or fish for a given period).

Open access and rights-based fisheries

Open access fisheries are fisheries in which there is no regulation and anyone can access the resources. In the most extreme form, there are no regulations on fisher numbers, fishing practices or the amount of the fish that can be taken. Examples of truly open access fisheries would be fishing on the high seas in areas that are beyond the jurisdiction of any one country. Other examples would include some of the artisanal inshore fisheries and inland lake systems in Africa, such as Lake Malawi, where although there is some regulation in terms of the gear / fishing practices that can be applied, anyone can access the resources. Likewise, some open access fisheries regulate the volume of the overall catch that can be fished, but have no regulations in terms of the numbers of fishers that are allowed to enter the fishery. In such cases, while the effective application of regulations may result in the sustainable use of resources, it is often the case that in the race to harvest the resource, there is over capitalisation in the fleet to compete for the limited resources. This results in economic inefficiencies in the fishery. It is generally accepted that in the long term, open access fisheries are unsustainable both biologically and economically, and are likely to lead to the collapse of the resources.

In contrast, rights-based fisheries promote the sustainable use of resources by providing the fishers (fishers, fisher organisations, fishing companies or communities) with clearly defined rights and rules in terms of who can fish in an area, and what input and output controls are applied. In terms of MCS and managing a fishery, a rights-based fishery has a number of intrinsic advantages over open access fisheries, these include:

1. The use of a rights-based system eliminates or reduces management demands as number of users are limited and easily defined.
2. Clear user rights enable fishers to economically optimise their activities, conserve the resources and change fishing behaviour according to the resource changes. The system can also assist in reducing conflicts in the fishery by discriminating between those that have legal rights to a resource and those that do not.
3. Rights enable fisheries managers to easily identify rights holders, and to promote sustainable fishing practices / gears to these rights holders.
4. Long term rights endow the rights holders with an incentive to manage the resource in a sustainable manner. This encourages fishers to adhere to the rules that that have been set up to manage the fishery, making MCS activities easier to implement.

3.2 Types of rights

3.2.1 Limited entry

Limited entry rights are designed to restrict the amount of effort that is expended in a fishery by restricting the number of fishers that are licensed to enter the fishery. If successful, this form of right assists in conserving the resource and increases the income of those that have entry rights. However, potential increases in income come at the exclusion of those that were not granted rights. In terms of MCS, this can result in increased IUU fishing as individuals that were not granted rights continue to fish illegally. As a result limited entry rights may only be an effective tool in limiting effort where there are stringent enforcement measures in place, and they may not limit effort *per se* due to increased IUU. Although limited entry rights prevent outsiders from accessing the resource, their sole use can encourage fishers to increase fishing effort such that they catch the available fish before other rights holders. Clearly this results in increased incentive for individual fishers to increase the efficiency of their operations by increasing vessel sizes or investing in technology to catch fish more efficiently. As a result limited entry rights are usually associated with other management measures that are designed to restrict catches such as total allowable catches, and gear and effort controls.

3.2.2 Effort rights

Regulating the amount of effort that can be expended in a fishery is a mechanism that can be used to control fishing pressure at sustainable levels. Limiting entry (see above) is a simple mechanism with which to regulate effort as it limits the number of participants in the fishery. However, other mechanisms (input controls) may also be used. These can be particularly useful in cases in which there is a social need to include large numbers of

participants in a fishery. Under such circumstances, limiting effort may include limiting vessel sizes, the number and/or types of fishing gear, the number of fishers per vessel or the time fished. Rights can either be based at the fishery or individual fisher level. The use of effort rights has implications on MSC activities in that effort controls need to be enforced and monitored.

3.2.3 Harvest quotas

Harvest quotas (Total Allowable Catches - TACs) are quantitative control measures that are used to limit the amount of fish that can be fished, and as such are not in themselves harvest rights, but rather harvest limits. However, often a TAC is divided into individual quotas that fishers, communities or companies are permitted to fish. There are a number of ways the TAC can be divided between communities; for example, the TAC may be allocated to individual fishers as a trip limit in which a certain quantity of fish may be caught per trip, and the number of fishing trips limited. Alternatively individual quotas may be allocated to individuals or companies on an annual basis and can either be transferable harvest rights or non-transferable rights. However, it is important to note that under all these scenarios, the quotas effectively become quantitative output rights.

In terms of MCS, the use of TACs has implications as it creates increased incentives for fishers to under-report their catches, thus prolonging their quota of uncaught fish. Furthermore, depending on the fishery, there may also be an incentive to discard small low value fish and only land higher value, larger fish, and thus increase the value of their landed quota and overall profits. In addition to compliance issues, there is also a need for intensive monitoring of these fisheries, and this has cost and logistical implications. Potentially expensive monitoring systems must be developed and implemented to monitor the fishers, and ensure that they adhere to their quotas. There is also a need to monitor stocks closely over time and undertake regular stock assessments in order to set evidence based and scientifically justifiable TACs.

3.2.4 Territorial User Right Fisheries (TURFs) or Customary Marine Tenure

Territorial User Right Fisheries or Customary Marine Tenure provides for rights to be allocated to individuals or groups (communities) to utilize resources in a given location. In many cases their adoption follows “traditional” tenure systems in which those communities that are based close to the resource and have historically used the resource are afforded legal rights; in others, individuals or syndicates may be afforded rights. The rationale behind territorial user rights is based on a common

property approach, which proposes that a well-established rights-based system provides access, withdrawal and management security for individuals and groups of individuals (Ostrom and Schlager, 1996). With such assurances, fishers would be expected to make credible commitments to one another and develop long-term plans for investing in, and harvesting from, a common-pool resource in a sustainable manner. With respect to designing MCS activities within a TURF system, the implied custodianship of the resource suggests that it is in the best interests of the rights holders to ensure that the resource is protected from unscrupulous exploitation, and thus the concept lends itself to a relatively cost effective MCS solution in which the community has a significant role in monitoring the resource, surveillance and controlling access.

Box 2

Territorial User Rights Fisheries in Chile

In Chile the adoption of co-management as a component of the 1991 Fisheries and Aquaculture Law (FAL) provides a good opportunity to understand fishers' financial decisions under a TURFs framework. Territorial user rights related to artisanal fishers in the FAL take the form of Management and Exploitation Areas for Benthic (bottom dwelling) Resources (MEABR). Through the FAL the Chilean Undersecretary of Fisheries assigns community territorial user rights to artisanal fisher syndicates in defined geographical coastal areas (Gelcich *et al*., 2007). In Chile the gastropod *Concholepas concholepas*, known locally as 'loco', is the most economically important shellfish, hence 90% of existing MEABRs have loco as their main target species. The importance of loco means that management practices specific to loco have become the focus of policy developments towards an MEABR approach and currently all the loco gathered in Chile come exclusively from MEABRs. During the last 5 years, around 3 000 tonnes of loco have been sustainably harvested per year.

3.3 Input, output and technical controls

Input, output and technical controls are management mechanisms that can be applied to control fishing pressure. The choice of controls that are applied will be dependent on the type of fishery and the management paradigm.

3.3.1 Input controls

Input controls regulate the level of fishing intensity or effort in a fishery. Depending on the fishery, there are a large number of different controls that fit into this category. Most common are capacity control restrictions, vessel usage controls or a combination of the two. Capacity control restrictions comprise fleet restrictions such as limitations to vessel numbers, vessel and engine size, limitations to the number of gears that are deployed (e.g. trap fisheries), or the number of fishers allowed on each vessel (e.g. squid jigging fishery – total allowable effort - TAE). Vessel usage controls would include the amount of time (e.g. sea days) that a vessel is allowed to fish.

3.3.2 Output controls

Output controls place limits on the amount of fish or fish products that can be caught. Typical output controls include the imposition of a total allowable catch (TAC) or total allowable landings. These specify the amount of fish or fish products that can be fished and landed over a given period. Furthermore bag limits on the number of fish, or size limits dictating the minimum size of fish that can be caught over a given time frame, can be implemented to control harvest. Limiting the amount of by-catch that can be caught or landed would be another example of an output control.

3.3.3 Technical controls

Technical controls regulate the types and specifications of the fishing gears that are allowed in a fishery, and may also include fishing area and time restrictions. These controls can be used to regulate the amount of effort that is expended in a fishery, and in this regard they can also be viewed as input controls. Examples of technical controls would include minimum net mesh sizes, regulating the use to monofilament nets, and the number of panels (length) allowed in gill nets. Area restrictions relate to areas that are closed to fishing. Typically, these are imposed to protect vulnerable habitats, provide areas

of refuge for fish, or protect recruitment into the fishery (e.g. nursery habitats). Depending upon the rationale that was used to designate a closed area, it may be closed permanently, or seasonally for a particular period in the year in which the target species are abundant. Time restrictions may even be placed on a daily basis, for example a ban on night fishing.

The choice of control measures has implications on MCS costs, operations and the compliance strategies that are adopted. In general, input and technical controls are easier to manage than output controls. Input and technical controls require MCS personnel to monitor compliance to effort limitations such as the vessels, gear limitations and area restrictions. Depending on the resources available, inspection programmes to monitor these controls can be relatively easy to design and deploy. In contrast, output controls require catches and quotas to be accurately monitored. This usually involves the deployment of inspection programmes, supported by the interrogation of log books, catch landings and processing data. Typically, these systems tend to be relatively complex and expensive to deploy, and require significant human resources to maintain catch statistics for multiple rights holders that have been allocated catch quotas. Thus, where MCS resources are limited, it is often easier to develop MCS strategies based on compliance to input controls as opposed to output controls.

3.4 Fishery types

The type and characteristics of the fishery play a major role in determining the requirements, design and associated costs of MCS interventions.

3.4.1 Small scale and Artisanal fisheries

Small scale and artisanal fisheries are often characterised as having large numbers of fishers and itinerant or migrant fishers, multiple gear types that are often used to target a multitude of species, and many landing sites. For example, the marine artisanal fishery along Tanzania's coastal belt comprises at least 210 coastal villages, over 20 000 fisher folk, and approximately 6 000 fishing boats of various sizes and classifications. Multiple fishing gears including handlines, gillnets, seine nets, ring nets, cast nets, fish traps and spears. It is a multi-species fishery with approximately 33% of the catch comprising the shallow water reef fishes (e.g. emperor, rabbit, and parrot fish), a further 33% comprising small pelagics (e.g. sardines and anchovy), and the remaining 33% comprising large pelagics (e.g. kingfish and tuna). Due to the scale of the fishery in terms of the number of fishers and fishing units, the broad geographic

distribution of activities, and the diversity of vessel types, gears and targeted species, designing and implementing MSC interventions is complex. Budgetary constraints often limit the resources and capacity available, and restrict the deployment of complex monitoring and surveillance systems. Low cost MCS solutions are therefore often required in these situations. Such approaches include the development of community based co-management structures (e.g. beach management units / committees, community monitors) to monitor the fishery and promote compliance. Government assistance could be provided to assist the co-management structures, and provide limited enforcement, data collection, and monitoring.

3.4.2 Industrial fisheries

In comparison with the artisanal fisheries, industrial fisheries typically have fewer participants and often target a limited number of species. The comparatively high value of these fisheries, the revenues that they create, and the potential loss of revenues associated with IUU fishing often provide the rationale for developing sophisticated MSC solutions that tend to focus on enforcement of the regulations. Typically, these types of solutions would involve the deployment of VMS systems to track vessel movements, vessel registers, log book and catch reporting systems, on-board observer systems, and sea and air patrols. The incentive to develop these systems is particularly pertinent in those fisheries that are primarily fished by foreign vessels where voluntary compliance may be difficult to promote (Bergh and Davies, 2002). For example, at present only foreign registered industrial vessels target tuna in Mozambican waters and the entire catch is processed at sea, trans-shipped, and exported. None of the tuna is landed in Mozambique, and despite long term fisheries agreements between the Mozambican government, the EU and other countries such as Japan and China, there is little incentive for the foreign vessels to conserve the stocks. Indeed, while the fleet's annual total allowable catch (TAC) for tuna and related species is 24 000 tons, only around 3 000 tons / year are reported. Clearly compliance is a major issue in the fishery, and in the absence of strong MCS enforcement systems, there is significant scope for foreign vessels to undertake IUU fishing activities.

3.4.3 Multi-user fisheries

Several fishery resources are often harvested by multiple user groups (e.g. artisanal, recreational and commercial/industrial sectors). The larger industrial fishers may present the greatest biological threat to the resources due to capital invested and the scale of the operations, however, and in comparison, the number of participants is far fewer than artisanal or recreational sectors and the cumulative levels of

effort and harvest from these latter sectors can also be significant, particularly if compliance is poor. MCS efforts are often focussed on the larger industrial scale fishers due to the potential damage they may cause and economic loss which will occur if activities are not closely regulated. However, a cross-sectoral MCS approach is often necessary to ensure the cumulative impacts of large numbers of low impact fishers are also taken into consideration.

Examples of such multi-user fisheries include the Namibian and South African line fisheries, where a range of species are targeted by commercial and recreational skiboats, and shore-based recreational and subsistence anglers. The responsible authorities target greatest MCS effort at the commercial sectors due to the catch volumes and threat that they pose to the resource base. Effort in the commercial sector is regulated through a licence system, closed areas and closed seasons for some species. Monitoring is conducted through catch returns from the rights holders and through observers based at the commercial landing sites. Effort in the subsistence and recreational sectors is not limited, but regulated through permit systems, with output controls being species and size and daily bag limits, and overall daily bag limits. Despite the high levels of participation, these sectors are monitored less formally due to the dispersed nature of the fishery which makes MCS difficult, as well as the perceived lower threat they pose to the resources. MCS takes the form of patrols conducted primarily during high use periods.

3.4.4 Single and multi-species fisheries

Multi- and single-species fisheries have differing MCS requirements. Due to the variety of fishing methods and vessels participating in the fishery, multi-species fisheries typically have less complex controls, but require considerable effort to obtain accurate catch and effort data. Single-species fisheries, however, are simpler to monitor and typically, have more complex MCS control measures.

3.5 Gear types

Fishing techniques make use of either active or passive gears. Active fishing gears are used to actively pursue and target the fishery resources. These gears range from handheld spears and harpoons to large netting techniques, such as towed/dragged trawling gears, and encircling seine nets. Passive fishing gears are typically deployed for longer periods of time after which the fishers return to retrieve the gear and catch. These include fishing techniques such as gill, drift and trammel nets, hook and line hand fishing, demersal or pelagic long-lining, and pots or traps. IUU fishing activities are more common with active

gears as detection and capture is more easily achieved by regulatory authorities when illegal fishers must return to an area to retrieve their gear and catch. As a result MCS for active fishing techniques is more complicated than that for passive gears as greater mobility and more complex detection systems and equipment are required in order to be effective.

Module 4: Design Components

4.1 Factors to take into consideration when designing an MCS system

Due to differing cultural, geographic, political and legal frameworks no universal MCS system is applicable to all countries. In order for an MCS system to be effective it must take the following factors into consideration:

1. The size of the fishing grounds

The size of the fishing grounds will have implications of MCS solutions and costs. For example, the costs of monitoring operations in Indonesia, which comprises 17 000 islands, a coastline of 81 000 km and 6 million km^2 of EEZ and territorial seas, are likely to be far greater than those of a small island state such as Mauritius that has an EEZ of approximately 1.9 million km^2.

2. The physical geography of the country

The physical geography, isolation and the availability of logistical support will affect the costs and resources that are required to effectively set up MCS operations. Setting up MCS operations in isolated countries or territories (e.g. Vanuatu, Tristan da Cunha, The Falklands (UK)) have logistical and cost implications. Likewise, there are cost implications setting up systems in archipelagos and areas that do not have contiguous coastlines (e.g. Angola) as they require greater patrol capacity than contiguous uniform coastlines.

3. Demographics and the type of fishing industry

The condition, size, gear type and the number of fishers in the fishery has implications in terms of the types of MCS solutions that are required and their costs. Artisanal fisheries often have more participants than semi-industrial or industrial fisheries, and although vessels are smaller and individual catches may be lower, they often operate from a wider range of landing sites. If the full range of access points is to be monitored, artisanal fisheries therefore requires a greater effort in terms of the number of observers required.

4. Number of landing sites / fishing ports

The number of landing sites affects the need for MCS coverage and deployment. This is particularly the case when output controls such as quota controls and total allowable catches are being used - as continuous monitoring at the landing sites / ports is required.

5. Regulatory frameworks

The regulatory framework under which fisheries are managed dictates the MCS requirements in any given situation. The types of control mechanisms in place for each sector influences the type and level of MCS activities required. Input controls (e.g. access, closed seasons/areas; gear restrictions) are typically easier to monitor than output (e.g. quotas; size limits) controls, and hence fisheries based on these management regimes would require less installed MCS capacity. The type of regulatory frameworks in place within a country therefore determines the type and level of MCS required.

6. Involvement of the military / navy

In many countries the military can play a major role in supporting the implementation of a stringent MCS system. However, military / naval involvement is generally more costly than other means and military / naval departments generally assign a low priority to MCS tasks as they are not viewed as their key functions. In order to maximise the benefits of military / naval involvement while minimising costs, inter-agency agreements need to be established to allow fisheries managers to request military support as and when required. Mechanisms need to be established to allow rapid deployment of military / naval resources when illegal activities are known to be occurring and additional support for enforcement is required - this will result in the most cost effective use of military / naval resources in MCS operations.

7. Economic importance of the fishery

The economic value of a fishery plays a major role in determining the importance to the national economy. High value fisheries are usually afforded greater importance in terms of fisheries management as they foster greater political support due to the revenue generated through licensing fees and revenues to the fiscus. This creates greater incentives to ensure the sustainable management of the targeted resources, and this often leads to the development of more comprehensive MCS strategies than those developed for less valuable fisheries. However, less valuable fisheries (artisanal fisheries) also place

considerable pressure on the resources due to the high levels of participation, and therefore they also need to be afforded sufficient priority and MCS resources.

8. Economic and political dispensation

Political will and financial commitment is critical to the implementation of any MCS system. Fisheries managers may gain government support through the development of systems to maximise revenues through licensing, and through MCS activities, increasing the income of legitimate fishers. Financial resources allocated to fisheries management and MCS dictate the extent of the MCS system which can be implemented on the ground. This is a crucial factor in determining the type and extent of monitoring and surveillance activities which will be possible.

9. Other users and enforcement priorities

Other uses of the marine environment such as trade, shipping, and port activities influence the management of fisheries activities, and hence the design of MCS strategies. Careful consideration of all other marine activities needs to be taken into consideration when developing MCS strategies.

4.2 Components of an MCS system and their use in MCS systems

Bergh and Davies (2002) reports that information gathering of these data can be undertaken over four periods:

- Prior to fishing
- During fishing
- During landing operations
- Post landing operations

Prior to fishing

Data gathering activities undertaken before fishing include census data collection (Section 5.1), and this can be complemented by data collected during annual licensing processes. This will enable data on fisher demographics and vessels and gear type used in each fishery to be regularly updated. Spot checks at the port can be used to check and gather data on gear, horse power, crew number, safety equipment, and basic seaworthiness amongst others.

During fishing

The simplest approach to gathering data during fishing is through the use of log book data. Types of data recorded in the log books include catch, effort, gear and location data, as well as environmental parameters. This information is highly valuable to fisheries managers, inexpensive to obtain and can be used aboard any ship. Major limitations regarding logbook data are that the quality of the reported data is dependent on the types of management measures imposed on the fishery (catch controls may influence reported catch data), the periodicity of the control measures, and fishers' perceptions of how important the logbook data is to manage the fishery.

Patrol vessels can be used during fishing to collect legally acceptable evidence of legal and illegal fishing activities. The personnel aboard these types of vessels can verify gear types, catch, logbook entries, discards and dumping. Patrol vessels are considered to be the most important tool in managing offshore and foreign fleets. However vessels are costly to operate, and can only cover relatively small areas.

Patrol aircraft (planes and helicopters) can gather accurate vessel location and identification data over large fishing zones, and over short periods of time. This information is useful for the accurate deployment of compliance vessels. They can also gather information on the location of schools of fish and large marine mammals, and gather data on reef habitat integrity. However, patrol aircraft cannot verify gear or catch, and are relatively expensive to deploy.

Observer programmes, whereby a fisheries official is on-board a fishing vessel throughout the fishing activity, can be used to obtain species specific biological data, by-catch, discard and dumping data, and fisher independent time, date and position information. Observer programmes are a relatively low cost option for obtaining good quality data on a fishery, and act as a deterrent to illegal activities whilst the observer is on-board the fishing vessel. Limitations associated with observer programmes include that the observers require significant training, and that this option is only really suitable for larger vessels as the observers need to be accommodated on the boat.

Vessel Monitoring Systems (VMS), in which an on-board transponder relays position, date, speed and directional information to (shore-based) fishing authorities in real time, can be used to assist with area control, border control, and provide accurate locations for patrol boats to intercept vessels. They can be used to indicate the trans-shipment of fish and the transfer of fuel between vessels. These systems are

highly effective for large vessels. However they only work on vessels that have been fitted with the VMS equipment. They also produce large quantities of data that must be analysed, and are relatively expensive to install on smaller vessels. While gathering evidence of an IUU fishing offence remains a difficult task, electronic data has in recent times gained greater acceptance as reliable evidence in court proceedings.

Satellite imagery provides accurate spatial information on the location of fishing vessels across large areas, and when used in conjunction with VMS data, can assist in the detection of illegal fishing activities. However it is an expensive technique to use if used frequently, and it is difficult to identify individual vessels from the images.

Beach patrols can be used to monitor fishing activities through the checking of licenses, bag limits, size limits and gear restrictions. It is also possible to conduct surveys with the fishers while undertaking patrols which can provide a wealth of information on the near shore and shore artisanal and recreational fisheries and their participants. In some cases, beach patrols may be limited as certain areas cannot be reached by vehicle. Furthermore, their visibility can be a disadvantage as illegal fishers may see the patrol and take evasive action.

During landing operations

Landing points offer an opportunity to fisheries authorities to ensure that fishers are complying with the input and output controls that have been put in place for a particular fishery. At the point of landing, fisheries officers can inspect catches, obtain log book information and undertake weighing and measuring of the catch per species. The major limitation with collecting data at landing points is that no data on locations, gear types used, fish trans-shipments, discards, by-catch, or dumping, can be obtained or verified.

Obtaining independent catch estimates

Often it is necessary to obtain independent catch data to that presented by the fishers. There are several methods to obtain fisher-independent catch estimates. These are dependent on the type of fishing gear in use, and in some cases the species caught.

Trawl fisheries

Weighing the total catch is usually not possible; therefore Flewwelling (1995) proposes three approaches to estimating catch weights:

- Observation of catch in the cod end
- Volumetric calculation of fish pre-processing bin holding capacity
- Volumetric calculation of fish holds and use of production figures

Long-line and Purse Seines Fisheries

The following methods can be applied:

- Wet or salt fish: To be accurate, estimates of wet and salted fish must take into consideration the species, salt, density and fish holding capacities of the vessels.
- Long-line fisheries: A subsample of the fish that were caught can be measured on deck before processing and this can be extrapolated to the rest of the catch where individual fish caught are counted, or if possible, the weight of all the fish caught should be obtained. In worst case scenarios, frozen weights can be obtained and cross-checked with fishing and storage logs.
- Purse seines: The most practical method for estimating the weight of the catch is to obtain a pre-season calibration of the fish hold and vessel. Using this information an estimate of the amount of fish in the hold at sea or in port can be calculated by measuring the volume of space above the fish.

Regarding the estimation of catch composition, Flewwelling (1995) proposes the four approaches:

- Actual weighing of the catch per species
- Extrapolation of species by percentage cover on the surface of the fish hold to the whole of the catch (low accuracy)
- Extrapolation of species percentage contribution to a catch from a subsample and applying that to the whole catch
- Monitoring the fish that exit the fish holding bin to provide an accurate estimate of by-catch which can be subtracted from the estimated total catch to provide an estimate of the retained catch.

Post landing operations

Post landing data sources include data collected from wholesalers, national and export markets and transport companies. Data from these sources can be used to check that the volume of product is similar

to that reported at landing. This also provides market information and price data. The limitation of post landing data is that it is often difficult to trace from where the fishery products originated.

4.3 Designing an MCS system

As discussed in the previous section, there are a wide array of MCS measures that can be implemented, and it is often difficult for managers to decide which measures are the most appropriate to apply to a particular fishery. Ideally, at the biological level there should be a relationship between the controls applied and reductions in fish mortality. However, in practice, such relationships are often difficult to establish. In addition, MCS operations are inevitably constrained by finance and resource considerations, and thus some form of cost benefit analysis is usually required to determine whether interventions are cost effective, and are having the desired impact on the resource (Section 7.2). In terms of determining how to develop an MCS system, Kelleher (2002) designed a decision-making tree that provides a step-by-step approach to identifying how MCS systems should be designed. The decision framework is generic in nature and requires the managers to have an understanding of the pros and cons of the different MCS measures, and how to assess them in terms of the efficacy (e.g. cost benefit analysis / indicators of efficiency, Section 7.2).

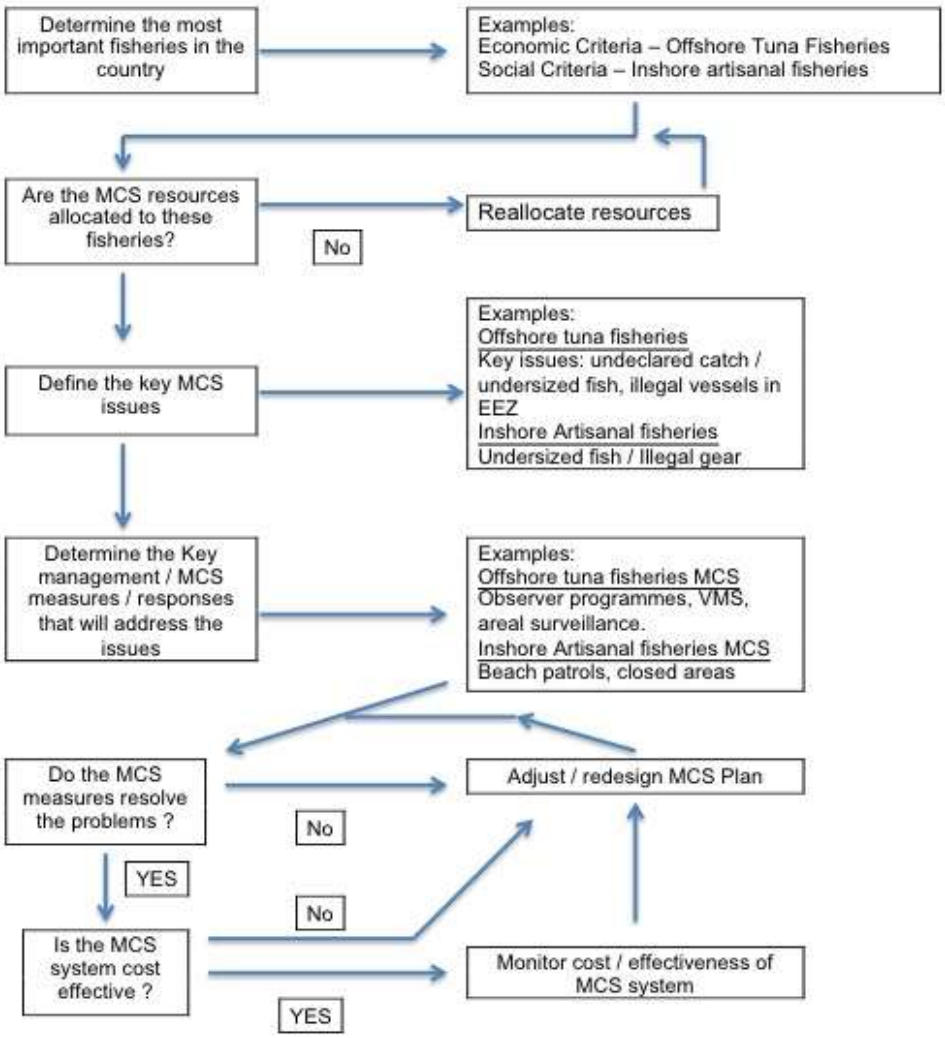

Figure 2: MCS design / decision making tree (modified from Kelleher, 2002)

Module 5: Information management and systems

The objectives of this module are to provide an explanation of the role of information and information flows in MCS operations. The module will detail with the types of information that need to be collected and how this information should be used.

5.1 Monitoring / Data in MCS

All MCS systems require and generate large amounts of data as monitoring and surveillance plans are implemented. In order to ensure that this information is useful to the MCS system, the right type of data must be collected, recorded, analysed and stored in a manner that it can be easily interrogated by the administration and their fisheries specialists, and disseminated to stakeholders (Cochrane 2002).

The data management system will differ depending on the MCS system, and more complex MCS systems will require a broader range of data than more simplistic ones. Due to these disparities associated with scale, a 'one size fits all' solution for data management does not exist. Considerations around the type of data management system to use include:

- Human resources - Are the staff computer literate? If not how long will the training take?
- Infrastructural capacity - What is the storage capacity? Are there existing networks and servers to share the information between various users? What backup capacities exist? How will sensitive or confidential data be protected?
- The cost implications for each option need to be considered

Generally digital systems present the optimal solution for data management because of the ease with which data can be stored, shared and interrogated (Cochrane 2002).

It is important to ensure that overlaps in the types of information collected for the various components of the MCS system are minimised. For example, while compliance surveillance data will be used by the compliance personnel, it may in addition be used by the fisheries scientists for input into fisheries models to more accurately predict the impacts of illegal or unreported fishing on the target population. To ensure cost effective data collection and management, it is important that such information is collected only once, and in a format that both the MCS personnel and the fisheries scientists can use. Such issues should be addressed during the planning and design stages of the management plans, and should involve representatives from scientific, economic and enforcement sectors.

An initial census describing the individual attributes of the fishers involved in a fishery or fisheries is usually sought and used to form the basis of an MCS data system. This census should include detailed information about the people involved in a fishery (e.g. name, age, address, income, role in the fishery, dependency on the fishery). In parallel with the fisher census, vessel registration data is required to obtain information such as the description and size of the vessel, flag, home port, registration details, the amount of fish it can hold, what if any sort of processing facilities are on board, what type of fishing gear it carries, and where it lands its fish. This data should be updated regularly during licensing procedures. Following this initial data gathering phase, follow-up data through monitoring and surveillance activities can be used to cross-check the data obtained during the census, and additional vessel movement and catch data (e.g. species, species composition, size, catch levels etc.) recorded (Flewwelling 1995).

Once agreement pertaining to the data requirements has been reached between the various fisheries management authorities, scientists and stakeholders, appropriate mechanisms to disseminate the information to the various parties, and in appropriate timeframes, need to be devised. For example, the information should be made available as quickly as possible for compliance and MCS purposes, but should also be stored for use in long-term fisheries modelling exercises. Co-ordination will be required between the various locations where data is collected, and where the data is analysed. This should be designed to ensure that data is quickly entered and sent for analysis, and that the results of the analysis can be rapidly distributed to the relevant stakeholders. It may be that different levels / types of information are required and distributed to different stakeholders. For example, the data requirements of customs and revenue collection agencies will be different to those of a local fisheries administration. An efficient data dissemination plan should be developed to ensure all stakeholders receive the information that they require (Flewwelling 2002).

5.2 Information types and collection systems

Types of information

There are four types of data that are required for MCS systems:

- Biological
- Ecological
- Economic

- Social

These four types of data are further broken down in Table 1. The types of data available and suitable for collection will be dependent on the fishery, available resources, and management needs, and thus, for a given fishery, not all the data requirements outlined below will be collected.

Table 1: Types of data required for MCS systems

Objectives	Data requirements
Biological	Total landings by major species per fleet per year Total effort by fleet per year Length and/or age composition of landings for major species Discards of major species per fleet per year Length and/or age composition of discards per species per fleet per year Areas fished by each fleet
Ecological	Total catches of by-catch species (including discarded species), or selected indicator species, per fleet per year Length and/or age composition of catches of by-catch species or selected indicator species Impact of fishing gear and activities on the physical habitat Changes in critical habitats brought about by non-fishing activities
Economic	Average income per fishing unit per year for all fleets Costs per fishing unit per year Profitability of each fleet (in the absence of detailed economic data this could be based on interviews or similar information) Destination of landings from each fleet, and a measure of the dependence on the fishery of other sectors of the community (e.g. processors, wholesalers etc
Social	Total number of fishers employed within each fleet Total number of people employed in fishing or shore-based activities per fleet, by gender and age group where appropriate Dependence of fishers and shore-based workers for their livelihoods for each fleet

Source: Cochrane, 2002.

5.3 Data collection and monitoring systems

Data collection, monitoring and management systems are guided by the MCS strategies and plans that are implemented. As such there are no set approaches to data collection and information management that can be applied across all MCS operations. Nevertheless, Halls *et al*. (2005) recommends that where possible, a collaborative approach to data gathering and sharing should be adopted. Such an approach helps to avoid the duplication of effort, and helps to strengthen relationships between stakeholders in the fishery. Halls *et al.* (2005) proposed the following eight stage process that can be completed with key stakeholders to design a data and information sharing system:

- Stage 1: Identify the key stakeholders, their interests and abilities
- Stage 2: Formulate, formalize, or review and revise local management plans
- Stage 3: Identify common data needs and data specifications
- Stage 4: Review existing data and identify gaps

- Stage 5: Agree data collection and data sharing strategy
- Stage 6: Identify or develop a data and information sharing system
- Stage 7: Design data recording and management systems
- Stage 8: Implement, evaluate and refine the system

The outcome of this approach produces a data gathering and information sharing system that ensures that duplications of effort are avoided, thereby making it efficient. Importantly, government and other key stakeholders are involved in the process, enhancing transparency and trust between parties. Finally, as a needs-driven process that involves the key stakeholders in the fishery, the approach ensures that the information gathered is necessary and relevant to the management processes.

Module 6: Human Resources

6.1 Expertise, staffing and roles and responsibilities

To be effective, MCS programmes should be operated by a lead organization that assumes overall responsibility for all implementation and coordination of activities. One of the key initial actions to be undertaken by the lead organization is the establishment of a coordinating committee that ensures representation of all participating organizations, and provides a mechanism to set priorities and deploy resources. In most instances, the National Fisheries Department would assume the lead role – as they are mandated to manage the living resources and fishing activities occurring within the territorial waters.

Effective MCS systems depend on acquiring quality personnel, and training them to the levels required to perform their duties effectively. All organizations participating in the MCS system must have sufficient resources and expertise to fulfil the roles assigned to them under each of the MCS components outlined in the operational plan. The number of personnel and the skills required will depend on the complexity and the scale of the MCS system being implemented. Human resource issues extend beyond the respective fisheries departments and extend to other MCS role players such as the navy, coastguard, ports authorities, customs and immigration. In this regard, it is important that these additional departments also have sufficient resources and trained manpower to effectively implement the MCS plans.

The level of expertise that is required by MCS staff ranges from basic literacy, interpersonal skills and general knowledge of the fishery, to higher level expertise such as those required for management, data analysis, and addressing policy and legal aspects. These latter components usually require higher level skills that are obtained through tertiary education.

6.2 Capacity building and training

Capacity building and training is an essential component to any MCS system, and should be viewed as a continuous process. Training programmes have to take into consideration staff turnover rates, personnel development, and additional training that may be required for new equipment or procedures that are incorporated into the MCS system. A well-designed training program should be viewed as an essential component of an MCS system, and it must be designed to accommodate the training needs at all staff levels. It is critical that all MCS staff receive the appropriate levels of training to perform their duties competently. Staff training levels should correspond to the level of responsibility and duties required,

and should be matched to the general educational level of the recipient (Flewwelling 2002). For example, fisheries observers who are only required to observe, record and report catch data, and have no enforcement duties will not need to be trained in the legal implications of vessel boarding procedures and inspections at sea for enforcement purposes. However, they will require an understanding of the fishery and fisheries regulations as one of their core functions is to monitor and report on compliance in the fishery. Amongst others, appropriate observer training would therefore include modules relating to data collection and collation, licensing requirements, authorized fishing gears and areas, assessing and monitoring catches, illegal activities or gears, and species specific fisheries regulations.

MCS training requires specialist training in a number of diverse fields of expertise, and requirements will vary according to the responsibilities and range of activities that the personnel are assigned. For example, while the judiciary and police may require training to familiarise themselves with fisheries offences and how to collect fisheries related evidence, observers would require observer training, and fisheries inspectors based at ports will require training on how to implement Port State Measures, while inspectors based on patrol vessels will require training on boarding and assessing compliance. Thus a range of training courses are usually required. Typically training modules would include the following:

1. Introduction and basic principles of MCS
2. Observer training
3. Port State Measures
4. MCS for patrol vessels
5. Investigation of fisheries offences
6. Prosecution of fisheries offences
7. Management of MCS

The most effective method to train lower level personnel is through vocational modular training based on adult learning principles (Cochrane 2002). These training sessions can generally be taught by more senior personnel in the lead MCS or fisheries organization, however, in many instances there may be insufficient expertise or capacity to develop the training materials and implement the courses. In such cases, these tasks are better outsourced to companies specializing in fisheries monitoring and training. Regular refresher training is also recommended.

6.3 Corruption

Corruption undermines the efficiency of the MCS system and may occur at any level in the fisheries management hierarchy. Often, these staffs that are most susceptible to corruption are those that operate independently, or in locations where there is limited control or oversight of their activities. In those countries where wages are low, the incentive to accept bribes may be higher than in those countries that can afford high wages.

Corruption can impact operations at all levels of the MCS operation – from administration (licensing) to inspections, to reporting. While mechanisms to reduce corruption need to be considered on a case by case basis, it can often be promoted by increasing operational transparency such that decisions can be reviewed and assessed by third parties. For example, a common form of corruption in fisheries management pertains to the issuing of fishing licences - these decisions are often made by one person or from within one Department with little transparency in the process through which they are awarded. Recent trends to reduce this form of corruption have seen an increase in transparency in the process with information being made publically available, and through improved accountability of those responsible for awarding licences.

Other forms of corruption occur when transgressions are overlooked by MCS staff, observers, or other enforcement personnel (e.g. the police). For example, while observers are a critical aspect of monitoring, some may be susceptible to bribery as they operate independently and generally receive low salaries. In order to minimise the levels of corruption, staff should receive appropriate salaries for the duties they perform and the conditions under which they work. Regular staff rotations can also limit familiarity between the fishery rights holder and the staff member, further reducing the opportunity for corruption. Independent audits are also a proven method to investigate and reduce the occurrence of corruption. Finally, performance related incentives to staff can be considered. For example if staff are paid a bonus / part of a fine for every transgression they report the incentive to solicit bribes can be reduced. In this regard, there is also a need to monitor such programmes closely to ensure that the system is not abused and that all transgressions are legitimate.

Module 7: Finance and Budgeting

The costs associated with developing and operating an MCS system will be dependent upon how the MSC system is designed, and what it is supposed to achieve. While the design components will vary between countries, it is usually determined by four primary factors:

1. The physical and biological characteristics of the fishery

The scale of a country's fishing grounds varies markedly, and will impact the types of MCS system adopted, and the scale of the resources required. For example, Indonesia comprises 17,000 islands, has an 81,000 km coastline, and an EEZ/territorial seas spanning 6 million km^2. In contrast, The Democratic Republic of Congo has a coastline of 41km and an EEZ in the region of only 8,200 km^2. Clearly, the resources required to monitor these areas will be vastly different. The physical geography will impact MCS costs and solutions. For example, countries such as Indonesia and the Philippines have numerous islands and landing sites that may require monitoring. Fishing grounds that are geographically located far from the mainland, for example, the UK territories of the Falkland Islands provide logistical and cost challenges to the UK. The nature of the fishing industry will further impact design and costs. For example, countries that have artisanal, industrial or mixtures of industrial and artisanal fisheries will all require different MCS solutions

2. The regulatory frameworks and the management objectives

The regulatory framework and the use of input, output or technical controls will impact MCS design and operational costs. For example, input controls (e.g. limiting access to a fishery), and technical controls (e.g. mesh size), are often cheaper to monitor and enforce than output controls (e.g. setting total allowable catches and instituting catch monitoring systems). Shared stocks often provide an opportunity to promote regional management and cooperation, pool resources and reduce the MCS costs for individual countries.

3. The responsibilities of the various government agencies in fishery protection

Depending upon the roles and responsibilities of the various government agencies, the costs of setting up and operating MCS systems are often shared between government agencies. For example, the navy or the military may be mandated to assist in patrolling, while the customs and excise department may be enrolled to assist the fisheries personnel in search and seizure operations at ports. Cooperation with other government agencies that are mandated to other enforcement activities such as combating drug

smuggling, piracy, immigration control, protecting offshore resources (oil installations etc.) can significantly reduce MCS operational costs.

4. The relative importance of the fishery within the country, both economically and socially

The economic and social importance of the fishery will provide an indication of the amount of resources that should be allocated to MCS. In this regard, the level of financing of an MCS programme must be commensurate with the size and value of the fishery, and its importance to the country's population. There is little point in allocating resources to a fishery that is of minimal financial or social importance. An example of an appropriately funded MCS programme would be that of the Falkland Islands. In 2011, the Falkland Islands exported 200,000 MT squid, hake, Patagonian toothfish and southern blue whiting. The value of the catch was £200 million, representing 60% of the Islands' GDP. From a socio-economic perspective, the fisheries are central to the well-being of the island community. The costs associated with running the Fisheries Department and operating an effective MCS programme is £5 million per annum, equating to 2.5% of the value of the fishery.

7.1 MCS budgets

MCS activities can be divided into a number of cost types, including capital, operational, direct and indirect costs. However, in the interests of clarity, these costs accruing to the development of an MCS system can broadly be discussed as the capital costs of the components of the system, and the recurrent or operational costs required in maintaining and operating the system.

7.1.1 Primary capital costs of MCS systems

Buildings and basic infrastructure – The buildings and field office requirements will vary according to operational requirements and budgets. A basic office is likely to include an operations room fitted with desks, chart table, wall charts, and situation (state) boards, whiteboards, or blackboards; a radio room; a computer room to log MCS data, several offices for key staff, a storage area, and emergency generator. Depending upon the country, offices are typically located at the country's Fisheries Departments, naval or coastguard bases or major ports. The requirements for field offices will vary according to the nature of the fishery. Field offices for artisanal fisheries are likely to be simple low cost buildings that are used as stores, to house a radio, and are suitable for storing basic records. For commercial fisheries, the requirements may be for larger more established field offices that depending on the type of MCS activities (e.g. inshore or offshore vessel patrols), may have a requirement for electrical connections, control rooms, secure storage and maintenance areas for vessels, computers and

data collection and collation etc. Often these stations can be based at the Provincial Fisheries Department sites. Vehicles and communication systems are also required, and again will be based on logistical requirements, the type and size of the fishery.

Data management Systems - the cost of data management systems will depend on how data is managed and the complexity of the system developed. Integrated database systems that are designed to store all the data related to the fishery, including licensing information, catch and effort, surveillance, observer and research data are expensive to install and operate. They usually require dedicated and permanent IT staff to operate and update the systems as required. In contrast, "stand alone" systems that use separate databases for the various record types (licences, vessel registration etc.), can usually use off the shelf programmes, and are cheaper to install and operate as they do not need permanent IT staff. In addition to fisheries data management, consideration needs to be given to developing capacity for surveillance information monitoring. At its simplest and cheapest, this would include maintaining manual records of vessel sightings, logging boarding and inspection, catch and position information that are manually uploaded onto conventional databases / spreadsheets. Significantly more costly and complex to install and operate are the integrated systems that monitor vessel movements in real or near real time by integrating radar and VMS data. These types of installation usually use technology that was designed for the military, and are used as a component of larger patrol platforms (e.g. vessels, aircraft).

Patrol platforms – patrol platforms for air or sea-based patrols vary considerably in terms of their capabilities, functionality and costs.

Offshore patrol vessels that are capable of patrolling a country's EEZ are normally at least 30m and have a capability to stay at sea for a minimum of 20 days. Offshore patrol vessels are usually of three types, *viz.*, high speed naval vessels that are armed and can take on a military role if required, high speed offshore patrol vessels that do not have an armour / arms, and slower moving, converted fishing vessels. Clearly the latter is the cheapest option, and the former the most expensive. Kheller (2002) estimated that in 2002, a new high speed patrol vessel that was designed for MCS activities cost in the region of US$25 million, in contrast a smaller 28 year old vessel in good operational condition sold for as little as US$75,000 at auction, and the repair and conversion of an old trawler for MCS deployment was in the region of US$1.5 million. Confiscation of illegal fishing vessels and their refit as patrol platforms provides an additional cost effective way of developing patrol capacity.

Inshore Patrol Vessels are usually 20-30m with an ability to stay at sea for three to ten days at a time. Capital costs will vary according to the requirements, and are usually in the region of US$500,000 - 2 million. In near-shore areas and lakes, smaller open patrol boats may be used, these typically cost in the region of US$5,000 – 70,000.

Aircraft may be used for maritime patrols and helicopters for boarding operations. The most cost effective aircraft to use are the small short range planes that may be fitted with extended fuel tanks and used for low level surveillance operations - normally up to about six hours in duration; depending on the specifications, these cost in the region of US$2 – 6 million. Longer range aircraft can be deployed to monitor extensive EEZ areas in isolated areas (e.g. the Southern Ocean). These aircraft are usually designed to military specifications, possibly deployed by a country's air force, and are often used for multipurpose patrols. Typically, operational and maintenance costs accruing to aircraft are high, and in this regard, it is often more cost effective to simply charter aircraft for a given MSC operation.

7.1.2 Primary operating costs

Administration costs are difficult to define as there are so many permutations in terms of organisational arrangements and MCS activities. For example the use of output controls such as quotas will increase the administrative burden as landings will need to be monitored and recorded. In contrast, input controls such as limiting vessel numbers will be easier to monitor, resulting in reduced administration costs. The decentralisation of fisheries management systems, for example the introduction of co-management may reduce staffing costs at the head office, but incur higher provincial administrative costs in terms of maintaining co-management arrangements and outreach programmes with fishermen and stakeholders. The introduction of Port State Measures is likely to increase administration costs, as will the increasing trend for traceability / sanitary control of fisheries products which necessitates coordination activities between product inspection and fisheries control.

Personnel costs will vary between countries and depend on the standard of living in individual countries, the type of MCS operations that are undertaken, and the skills levels required. In general, personnel costs in the developed world represent a higher percentage of the MCS budget than they do in the developing world. For example, Kelleher (2002) estimated that the US coastguard spend 14% of their operational budget on personnel, while in Mauritania, personnel costs for their MCS operations cost only 7% of the country's operational MCS budget. Where personnel budgets are limited, some fisheries administrations have adopted incentive schemes in which inspection staff are paid a portion of the fines imposed on non-

compliant fishers. Savings to personnel budgets can also be made by appointing honorary fisheries inspectors such as retired officers, respected fishermen or community members. Observer programmes – both scientific and monitoring – can be an effective and cost effective manner in which to monitor catches and obtain biological (resource) information. Typically such programmes can be funded by the government agencies, RFMOs or donors. In some cases (Namibia), the vessel operators pay an observer levy, and thus the industry pays for the observer programme.

Vessel Monitoring Systems can be used to significantly reduce operational costs as vessel and air patrols are expensive, and their use can be significantly reduced by adopting VMS systems. For example, by introducing a VMS into the Hawaiian long line tuna and swordfish fishery, MCS costs were reduced from US$ 5.6 million to US$ 370,000 per annum. The principal cost savings were attributed to a reduction in patrol vessel hours from 3,000 hr / yr to 110 hrs / yr, and a reduction in air patrols from 350 hr / yr to 8 hr / yr. The total cost to operate the VMS system was US$200,000 / yr (Herman and McKinney, 1997)

Patrol vessels and aircraft are expensive to operate, particularly in the offshore environment where patrol vessels usually account for the largest single cost item in an MCS budget. As the operational costs vary according to the size and types of the vessels / aircraft, it is difficult to provide accurate costs associated with offshore patrolling. The cost of mounting sea patrols in offshore waters can be significantly reduced by instituting a number of simple interventions. These include deploying VMS systems and instituting a checkpoint system in which fishing vessels, and vessels wishing to pass through the fishing grounds have to enter and leave a fishing area at a proscribed geographical point, thus reducing the time it takes for the compliance vessels to reach the fishing boats and monitor them. In a similar fashion, support vessels that are used to supply fuel / supplies to the fishing vessels and tranship catches (reefers, bunkers, fish collection vessels) can also be required to locate in a given area, making monitoring more cost effective. In addition, to increase boarding rates, multiple ribs can be deployed in areas where the fleet is concentrated, or where conditions permit, boardings can be undertaken at night as well as during the day. Patrols can be reduced in bad weather when boardings become problematical, and rather than expending time and resources escorting offenders to port, skippers can be provided with the opportunity to sign an admission of violations at sea, and where necessary, have illegal gears confiscated at sea – these types of intervention are suitable for the national fleets, but are unsuitable for the international fleets that will simply sign the admissions and move out of the EEZ. Finally, the option to charter patrol vessels / aircraft should be considered, particularly during periods in which additional enforcement activities may be required (e.g. closed seasons). Aircraft are usually hired on an hourly basis

or supplied by the national air forces. Chartering vessels avoids the need for capital investment, servicing and staffing the vessel full time - this is particularly important when the platform is only required part-time. Experience has shown that often private companies operate patrol platforms more cost effectively than state operations. However, chartering reduces the scope for "in-house" training, and as there is a limited market for patrol vessels, suitable vessels can be difficult to source.

7.2 Measurements of MCS efficiency

Cognisance needs to be taken of the available financial resources when calculating the costs accruing to the setting up and operating of an MCS system. Cost-effective interventions need to be selected, and cost benefit analyses undertaken to ensure that the costs of a given MCS solution do not exceed the benefits accruing to that solution – be they financial, ecological, or social in nature. While there are a large number of different MCS interventions that can be incorporated into MSC plans, the most appropriate MCS solution will be dictated by the availability of resources, and the key determinants of the fishery (e.g. types of fishery, physical size, number of ports, fleet characteristics etc.), and how it is managed (e.g. regulatory frameworks, input, output and technical controls). In practical terms, it is sometimes difficult for managers to allocate resources on a purely rational basis and in response to the biological needs of the resource. Often managers have to respond to priorities that are set in accordance with the current political dispensation, for example resource conflicts, or as responses to the public perceptions of the issues of immediate concern – inherently this makes undertaking a cost / benefit analysis of the interventions problematic, and in such cases, it is better to focus on the cost effectiveness of the interventions.

Cost effectiveness analyses results in the implementation of the least cost option to the provision of a given level of MCS. The technique can be used to provide a least cost solution to a given policy or set of operational goals. The approach requires the MCS authorities to set conservation goals for the fishery, determine an "acceptable level of violations", and develop a series of indicators of effectiveness. As the number of violations is always unknown (some violations will inevitably evade detection), the indicators of effectiveness must be based on common sense targets that are developed by the compliance authorities. Kelleher (2002) developed a series of indicators that could be used to measure the cost effectiveness / efficiencies of MCS interventions, these indicators were classified as offences / violations, patrol efficiency, data efficiency, cost efficiency, administrative and casework efficiency (Table 2).

Table 2: Indicators that can be used to measure the efficacy of MCS interventions

Efficiency measure	Measure
Patrolling	
Time Patrolling	Hours / days patrolling Ratio of air : sea patrolling time
Boarding	Total number of boardings Number per patrol / hr / day
Sightings	Total number of sightings Number per patrol / hr / day
Inspections	Number of gear inspections Number of catch inspections
Time	Hours taken per boarding
Offences / Violations	
Offences	Number of offences detected at sea Number of offences detected on land
Industrial Offences	Number detected / month
Artisanal Offences	Number detected / month
Major Offences	Number detected / month
Cost Efficiency	
Cost	MCS cost per volume / value of fish landed
	Cost per log sheet checked
	Cost per boarding
	Cost per sighting
	Cost per shore inspection
	Cost per VMS poll
Data Efficiency	
Data	Number of logbooks checked
	Percentage of aerial position sightings checked against logbooks
	Landings physically checked against export declarations and linked to dealer purchases
Administrative Efficiency	
Violations	Percentage reported violations within 48 hrs of incident
	Percentage reported violations within 60 days of incident
	Percentage sanctions for violations within 30 days of incident
Casework Efficiency	
Cautions / Warnings / Prosecutions	Percentage of violations resulting in cautions or warnings
	Percentage of violations resulting in prosecutions
	Success rate of prosecutions

Source: Kelleher, 2002.

Module 8: Factors affecting MCS operations - strategic considerations

8.1 Targeted MCS

Operational MCS budgets and the resources (personnel, vessels etc.) that are available to MCS managers are often insufficient to undertake the full suite of MCS operations that are required to operate a comprehensive MCS programme. Budgetary considerations are often compounded when a fishery extends over a large area or the fishery comprises a large number of fishers, and possibly sectors (industrial, artisanal, recreational) or multiple species. Under budgetary constraints, effective monitoring components of the MCS strategies can usually be developed by applying some form of random monitoring which provides data that can be reliably extrapolated to the fishery as a whole. However, random control and surveillance operations are unlikely to yield the best compliance results, and in this regard, it is often better to target the MCS activities towards those members of the fisher communities that are the most likely to be in contravention of the regulations. Intelligence based on "adaptive" MCS operations usually require some form of participation from the fisher community or the general public, and thus forms a component of co-operative management paradigms. Soliciting intelligence from the community requires good communication and trust between the fishers and the fishery authorities, easy reporting systems (telephone / internet hotlines), possible rewards for information, clear legal and administration channels, and the fishers to understand their role in the management system (Bergh and Davies, 2002).

Box 3

An example of targeted MCS in the illegal abalone fishery in South Africa

Innovative MCS methods were developed to combat the illegal abalone fishery that developed in the Eastern Cape of South Africa. Illegal abalone diving activity was monitored using a network of informants and divers were confronted when launching their boats or returning from sea in the Port Alfred harbour. At every opportunity, divers were stopped and searched and repeatedly fined for non-compliance with traffic (roadworthiness and annual licences) and South African Marine Safety Authority (SAMSA) regulations (mandatory life jackets and other safety equipment). In addition, under the resolutions of the Prevention of Organised Crime Act (No. 121 of 1998) and the Marine Living Resources Act (No. 18 of 1998), empty dive waist bags and flat-bladed tools used for abalone harvesting were confiscated if found in the vehicles or boats of the suspected illegal fishers. These actions served a dual purpose of disrupting the illegal fishers' activities, and most importantly, creating a profile of the illegal fishers that could be used in subsequent targeted MCS activities. Despite the limited manpower, support and capacity, targeted MCS operations resulted in shore-based as well as boat-based diving activities being significantly disrupted.

Source: Raemaekers and Britz (2009)

8.2 Compliance and enforcement

MCS activities require a balance between compliance and enforcement. It is inevitable that compliance personnel cannot monitor all the fishing activities that take place in a fishery, and at all times. Thus, much of the time, fishers will be fishing in the absence of fisheries compliance personnel, and many will naturally be tempted to violate the rules. The reasons why fishers choose to comply or disregard fishing regulations are complex, and often include issues such as the perceived legitimacy and transparency of the management paradigm, knowledge of the rules, social influences and opportunistic behaviour, deterrence factors (e.g. fines, impoundment of equipment, prison), and the likelihood of getting caught. Maximizing compliance is more complex than simply introducing regimes that focus on monitoring fishing activities, and enforcement activities that emphasize penalties and deterrence. Encouraging voluntary compliance through the development of trust between the fishing authorities and the fishers is an important consideration that needs to be considered during the development of an MCS programme. In this regard, co-management systems can have a positive effect that can improve the rates of compliance.

Sverker *et al.* (2012) noted that the legitimacy of a fisheries management system is increased when the fishers are provided direct involvement and participation in regulatory decision-making processes, and are delegated management functions from fisheries management agencies. These processes generate support for the management / MCS systems. Rather than rules being imposed on them, co-management arrangements allow rules to be made by the fishers themselves. This in itself tends to result in higher compliance rates. Co-management arrangements also tend to improve the fisher's knowledge of the management regulations and the status of the resource, and they have the potential of creating group solidarity and a sense of ownership of the management systems among the fishers. All these factors create trust in the compliance system, and as a consequence reduce opportunistic behaviour and thus encourage compliance.

8.3 Deterrence

The use of criminal sanctions and heavy penalties as a deterrent against involvement in IUU fishing operations has gained widespread acceptance. Penalties not only determine the deterrent effect of legislation and encourage compliance, but also often serve to specify the seriousness with which offences are pursued by enforcement agencies. In this regard, states need to recognize the full implications of IUU fishing and establish laws that target

not only the act of illegal fishing, but also the processing, possession, import, export and sale of illegal fish products (Erceg, 2006).

It is well recognized that in many countries and RFMOs, there are often insufficient resources allocated to MCS operations. This inevitably leads to a lack of deterrence capability by the authorities, a low probability of being apprehended, and for the IUU fisher, a reduction in the operational cost of their illegal activities as they need not be concerned with the costs associated with avoiding the fisheries inspectorate. A lack of deterrence in terms of capture is often compounded by an insufficient level of sanction (fine, or non-monetary sanction such as vessel / gear impoundment or confiscation). Sumaila et al., (2006) identified three penalty drivers that affect fishers' decisions whether to engage in IUU fishing, *viz:*

Detection likelihood driver: The higher the probability of getting caught the lower the incentive to cheat. The major factors that contribute to the detection likelihood driver are: (i) the effectiveness and efficiency of the enforcement system; (ii) social acceptance of cheating in society; (iii) awareness of the regulations; and (iv) the level of non-governmental or private involvement in detecting infringements.

The avoidance driver: A rational fisher engaging in IUU fishing in a situation where there is some degree of enforcement will take measures to reduce the chances of being detected. Such measures will incur costs, and would typically include vessel movements to avoid detection by compliance personnel, and the trans-shipment of catches. If these costs are high, there will be a concomitant reduction in the incentive to cheat.

The penalty driver: The severity of the penalty when caught is an important driver that determines whether a fisher will engage in IUU fishing; the more severe the penalty the lower the likelihood of cheating. This driver is related to the detection likelihood driver in that if there is no enforcement, the severity of the penalty becomes meaningless. The types of penalties that are usually applied include: (i) monetary fines; (ii) confiscation of the boat / gears; (iii) confiscation of the catch; and (iv) exclusion from the fishery. In many cases, previous prosecutions are taken into consideration during the application of the penalty. For example, in the State of Victoria in Australia, first time offenders are served with a Penalty Infringement Notice (PIN), however, the penalty for repeat offenders is increased and can include seizure of the catch and vessel, imprisonment and other penalties[5]. A review of national penalty levels in OECD countries (OECD, 2005), suggests that while countries apply a very wide range of penalties and fines, very few countries seem to have levels of fines that are effective deterrents to IUU activities. Indeed, in 2004, Sumaila ***et al.*** (2004) suggested in order to work as effective deterrents, the maximum penalties that are imposed in OECD countries for IUU activities should be increased by as much as 24 times over their existing levels.

It should be noted that increasing enforcement, the probability of getting caught, and the penalty dispensation is unlikely in itself to completely eradicate IUU fishing. In a given fisher population, there will always be chronic

[5] www.parliament.vic.gov.au/enrc/fisheries/discussion_paper.htm

violators, moderate violators and non-violators. While the chronic and non-violators usually represent a small percentage of the fisher population, the chronic violators will characteristically undertake illegal fishing activities regardless of the sanctions imposed. For example, Gauvin (1998) estimated that while 10% of the fishers in the Massachusetts lobster fishery regularly violated the regulations, the remaining 90% of the fisher population normally complied with the regulations. Poverty and the socio-economic condition of the fisher community may also play a role in reducing the impact that imposed deterrents have on IUU fishing, as fisher folk see no viable livelihood alternatives. For example, the poaching of trochus in Australian waters in the early 1990s was primarily driven by the extreme poverty of Indonesian fishermen, who undertook the activity despite the potential of facing heavy penalties and imprisonment (Peachey, 1990).

Additional approaches to improving deterrence are to identify and prosecute all the beneficiaries of the IUU actions. Many vessels are owned or operated by foreign nationals, and while different countries have different attitudes to the extra-territorial application of their laws to their citizens, there is increasingly a consensus that deterrents can go further than simply applying the national regulations applicable to the country in which the contraventions took place. These so-called "long-arm approaches", allow for prosecution by a government of a national who acted in contravention of a foreign law. Such mechanisms are often referred to as the "Lacey Act" provision or contraventions. The Lacey Act, passed in the US to outlaw interstate traffic in birds and other animals illegally killed in their State of origin, can apply to the acts of landing, importing, exporting, transporting, selling, receiving, acquiring, possessing or purchasing any fish taken, possessed, transported or sold contrary to the law of another state, and provides a credible deterrence to US nationals contravening fishing regulations in other countries. Related to this, a mechanism to enlarge the scope of possible sanctions in any country would be to make the trade of IUU fish an offence, and in particular the enlargement of sanctions to downstream operators, including final consumers.

8.4 Participatory management

Developing participatory or co-management partnerships with the fishing industry, the fishers and their communities, organizations, cooperatives, unions, and fisher companies is increasingly being recognised as an important component for developing effective MCS policy, strategies and implementation frameworks. Failure to align fishers with MCS priorities and strategies often results in strategies focusing too heavily on enforcement, possibly resulting in a "heavy-handed" approach that in itself often results in

management efforts becoming frustrated. A participatory approach in which communities and organisations are included in the planning design and implementation of the MCS strategies instils legitimacy into the process and the regulatory frameworks developed, and often results in improved fisher compliance.

Partnerships with the fishers, their representatives and organisations, can be developed to provide cost effective monitoring of the fish stocks, and significantly improve the monitoring component of the MSC programme. Fishers have a considerable amount of local knowledge, and thus they are often in a good position to assist managers in the interpretation of fishing habits and patterns, comment on the efficacy of regulations, and assist in the formulation of appropriate MCS management interventions. To be successful, there needs to be a high level of trust developed between the fishing communities and the authorities such that the fishing authorities move away from the traditional regulatory or "top-down approach" to management, and the fishers come to view their role as partners in the management of the fishery. If the fishers see that they will benefit from becoming involved in the monitoring processes by improved management or the benefits associated with improved management frameworks, they are more likely to assist with, and comply with, the management framework.

Promoting partnerships with fishing communities also instils the concepts of ownership and custodianship of the resources. These concepts can be used to promote compliance and for the enforcement of the regulations. In many cases this can extend to the fishers themselves monitoring compliance in their fishing communities / sector, and informing the authorities of contraventions. This enables the authorities to focus on intelligence based enforcement and to target their limited enforcement resources on offenders as opposed to the fishing community as a whole. Thus, by adopting a participatory approach to the development and implementation of MCS systems, the effectiveness of the systems can be substantially increased at no additional cost. In some cases, the cost of MCS activities may even be reduced.

8.5 Legitimacy

Creating a sense of legitimacy for MCS interventions is an important factor in determining whether fishers will adopt and comply with the legal and regulatory aspects of the MCS strategy, and thus, compliance is influenced by the extent to which individuals accord legitimacy to the law enforcement authorities, the management strategy, and the control systems that have been put in place to manage the fishery. In many respects, legitimacy can be viewed as a "reservoir of loyalty" on which the fisheries managers can draw, giving them the discretionary authority of loyalty they require to govern effectively. However, legitimacy is not static, and it will change over time, depending on the relationship between the fishers and the management authorities. Legitimacy is also influenced by changes in societal values, and in the event that a management paradigm is seen to be legitimate, fishers will create

internal obligations for compliance which will also extend to situations in which they would personally gain by non-compliant behaviour. Factors determining and changing the legitimacy of a system are closely linked to procedural fairness, personal experiences, and transparency. Jentoft (1989) noted that ‘‘the more directly involved the fishermen are in installing and enforcing the regulations, the more the regulations will be accepted as legitimate’’. In this regard, he ascribed four basic requirements that govern the legitimacy of a system, *viz.*

(1) The content of the regulations;
(2) The distributional effects;
(3) The making of the regulations; and
(4) The implementation of the regulations.

Tyler (1990) argues that compliance with a law or regulation is influenced by the extent to which an individual accords legitimacy to law enforcement authorities, and that personal morals and experiences are important factors determining compliance. Further, he states that personally recognised obligations to comply with regulations is the single most important element in relation to legitimacy and compliance, whereas support to the MCS institutions seems to be less important. Experience with the authorities and the way one has been treated (procedural fairness) is also an important factor for maintaining, or respectively undermining, legitimacy. The perception of the management authorities is also an important consideration – if fishers view the management authorities as corrupt, inept or arrogant in their dealings with the fishing community, it is likely that the authorities will lose legitimacy, and the levels of non-compliance will increase.

Notwithstanding these factors, it is clearly evident that transparency and fairness promote legitimacy. Regulations need to be transparent, fair and equitably distributed across all the stakeholders in the fishery, including the commercial, artisanal, and recreational sectors, and non-fishing actors such as the fish traders and processors. Legitimacy will be enhanced in those cases in which the fishers have been involved in the development of the regulations and the formulation of the control systems, and where they feel that they have a stake in the management, the sustainability of the management systems, and the fishery as a whole.

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La bonne gouvernance et de la gestion des pêches et de l'aquaculture permettent d'améliorer la contribution du secteur à la sécurité alimentaire, au développement social, à la croissance économique et au commerce régional ; ceci en assurant par ailleurs une protection renforcée des ressources halieutiques et de leurs écosystèmes.

La Commission de l'Océan Indien (COI) ainsi que la COMESA (Common Market for Eastern and Southern Africa), l'EAC (East African Community) et l'IGAD (Inter-Governmental Authority on Development) ont développé des stratégies à cette fin et se sont engagés à promouvoir la pêche et l'aquaculture responsable.

SmartFish supporte la mise en œuvre de ces stratégies régionales en mettant l'accent sur le renforcement des capacités et des interventions connexes visant à :

- la mise en œuvre d'un développement et d'une gestion durables des pêcheries ;
- le lancement d'un cadre de gouvernance pour les pêcheries durables dans la région;
- le développment d'un suivi-contrôle-surveillance efficace pour les ressources halieutiques transfrontalières ;
- le development de stratégies commerciales regionals et la mise en œuvre d'initiatives commerciales;
- l'amélioration de la sécurité alimentaire à travers la réduction des pertes post-capture et la diversification.

SmartFish est financé par l'Union Européenne dans le cadre du 10ème Fond Européen de Développement.

SmartFish est mis en œuvre par la COI en partenariat avec la COMESA, l'EAC et l'IGAD et en collaboration avec la SADC. Une collaboration étroite a également été développée avec les organisations régionales de pêche de la région. L'assistance technique est fournie par la FAO et le consortium Agrotec SpA.

By improving the governance and management of our fisheries and aquaculture development, we can also improve food security, social benefits, regional trade and increase economic growth, while also ensuring that we protect our fisheries resources and their ecosystems.

The Indian Ocean Commission (IOC), the Common Market for Eastern and Southern Africa (COMESA), the East African Community (EAC) and the Inter-Governmental Authority on Development (IGAD) have developed strategies to that effect and committed to regional approaches to the promotion of responsible fisheries and aquaculture.

SmartFish is supporting the implementation of these regional fisheries strategies, through capacity building and related interventions aimed specifically at:

- implementing sustainable regional fisheries management and development;
- initiating a governance framework for sustainable regional fisheries;
- developing effective monitoring, control and surveillance for trans boundary fisheries resources;
- developing regional trade strategies and implementing regional trade initiatives;
- contributing to food security through the reduction of post-harvest losses and diversification.

SmartFish is financed by the European Union under the 10th European Development Fund. SmartFish is implemented by the IOC in partnership with the COMESA, EAC, and IGAD and in collaboration with SADC. An effective collaboration with all relevant regional fisheries organisations has also been established. Technical support is provided by Food and Agriculture Organization (FAO) and the Agrotec SpA consortium.

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