

15 AGAINST ALL ODDS: TAKING CONTROL OF THE NAMIBIAN FISHERIES

*Per Erik Bergh and Sandy Davies**

Abstract

Monitoring, Control and Surveillance (MCS) is concerned with compliance of fishers to the rules and regulations that support the fishery. Over recent years Namibia has gained a solid reputation in MCS: a reputation that is supported by the findings of this chapter. The dramatic initial enforcement of the EEZ; the personnel and resource constraints that faced the Ministry; the national level policies; the positive and negative aspects of a complex legal framework; the influence of the geographical location and the impact of a strong reliance on donor support are identified as important factors in the shaping of the Namibian MCS system. The MCS system is evaluated relative to the stated objectives for three fisheries; the demersal, pelagic and midwater. Conclusions were drawn in relation to compliance levels, deterrence value, impact of the economic viability of fishery, legitimacy and norms and morals. The overall results indicate that the demersal fishery maintains a high level of compliance, the pelagic is variable but within acceptable levels, while the midwater fishery is unacceptably non-compliant. In relating these results back to the objectives it is concluded that the first objective, to restrict fishing activity to those entitled to do so, has been fully achieved; the second objective, to ensure that fishing activity is conducted within legal and administrative guidelines, has been partially achieved; and the third objective, of ensuring that revenues from landings are correctly calculated, has not been achieved. The cost of MCS is calculated and found to be at an acceptable level (around 42% of the income to Government), but concern is raised over the future cost implications with two new patrol vessels and possibly a new plane and helicopter on the horizon, at the same time as withdrawal of substantial donor support. Careful planning and streamlining will be required if the MCS organisation is to continue to develop a successful and sustainable operation; options for this are identified.

* The authors would like to thank the staff of the MFMR for assistance in compiling data and information. They would like to thank Mr S. Ambabi, Mr M. Block, Mr M. Koopman, Dr B. Oelofsen and Dr V. Wiium for their continued assistance during the preparation of the chapter.

INTRODUCTION

Namibia is a significant player in the international fishing industry, and this is reflected in the importance that is placed on ensuring healthy fisheries. Monitoring, Control and Surveillance (MCS) is concerned with compliance of fishers to the rules and regulations that support the fishery. The MCS organisation can therefore be seen as the official overseer of fishing operations and related activities. Over recent years Namibia has gained the reputation of having one of the few functioning and effective MCS systems in Africa.

This chapter aims to describe the events that have led to this achievement and the current structure and components of the MCS system. The system is analysed from three approaches in order to ascertain its underlying strengths and weaknesses and to view these in relation to its success and sustainability. The approaches used are: a critical analysis of the factors that have influenced the system; an evaluation of the stated objectives and the levels of compliance achieved; and an assessment of the cost of the system compared to the revenue and value of the fishery. Future challenges that the MCS organisation will face nationally, regionally and internationally are discussed and options for tackling these considered.

THE MCS SYSTEM

Historical perspective

Following independence, Namibia inherited the marine zones implemented by the South African administration; these included a fishing zone, but no 200 nautical mile exclusive economic zone (EEZ). An attempt had been made in 1983 to claim the EEZ, covering 560 000 km², by the United Nations Council for Namibia, but this claim was rejected by South West Africa Peoples Organisation (the exiled government) and the former Soviet Union. In 1990, the new Namibia ratified the United Nations Convention on the Law of the Sea and made full claim to the Namibian EEZ (Walvis Bay remained South African territory until 1994). Resources to enforce national jurisdiction in the zone were almost non-existent and the country had virtually no experienced personnel to carry out the required operations. At this time the offshore fishing was thriving, with many vessels illegally catching large amounts of demersal and midwater species: a situation that required immediate action by the Government.

When it became clear that diplomatic efforts had failed, Namibia turned to tough practical action. A helicopter was launched to locate and arrest the poachers. Twelve Spanish and one Congolese trawler were arrested and se-

vere sanctions issued. These actions stated Namibia's will and ability: actions that generated remarkable international attention and set the scene for future MCS.

MCS structure and objectives

Having addressed the immediate concern of illegal fishing the next step was to develop an MCS organisation. The Ministry of Fisheries and Marine Resources (MFMR), established in 1991, was tasked with the management of living marine resources within Namibian waters. Two directorates covering resource management and operations were created: the directorate of operations was allocated the responsibility for MCS.

The principal objective of MCS is the regulation of fishery sector activities. For operational purposes this is divided into three objectives: the restriction of fishing activities to those entitled to do so; ensuring that fishing activities are conducted within legal and administrative guidelines; and ensuring that the revenue from landings is correctly calculated. In order to meet these objectives, an integrated system (with the senior management in the national capital of Windhoek and the operational bases in the fishing ports of Walvis Bay and Lüderitz and at the aerial surveillance base of Arandis) was formed. The operational stations are tasked with roles such as the deployment of fishery officers to air, sea or land operations; the deployment of fishery observers onto fishing vessels; the compiling of fishery statistics; the calculating of revenues; and the analysing and planning of operations.

Spatial dimensions

Spatially there are four possible dimensions to an MCS system: sea, air, land and remote sensing. Validating information across these dimensions is a strength. Namibia has a complex system with elements in each spatial dimension. The sea dimension, where the fishing operations take place, offers opportunities for monitoring fishing events and catches, ensuring that these are within legal guidelines and for face-to-face contact with the fishers. Random inspections at sea, the patrolling of boundary and closed areas, hot pursuit of poachers and the arrest of vessels all form elements of this dimension. These activities are facilitated through a fleet of two MFMR-operated patrol vessels, currently the P/V *Tobias Hainyeko* and P/V *Nathaniel Maxwili* (for a comparison of their specifications see Table 1). A third patrol vessel with similar specifications to P/V "*Nathaniel Maxwili*" will supplement and strengthen this fleet in the near future. The patrol activities are supported by a cadre of 200 fishery observers who are deployed onto the larger fishing vessels of the demersal, midwater, crustacean and large pelagic fleets to observe, record and report. Observers provide a unique opportunity to make *in situ* observations of compliance to regulations (such as dumping or discar-

ding, fishing in closed areas, pollution, misreporting of catches, retention of prohibited catch, or the use of illegal gear) and to collect scientific information on catches. Fishing activity logbooks that captains complete on a daily basis also form part of the at-sea dimension.

Aerial surveillance is the principal method used to monitor, locate and track fishing vessels and thus provide a complete overview of activities in the EEZ. Aerial operations can photographically record violations such as fishing in closed areas and poaching, but arrests of vessels are impossible, unless helicopters are used. In the last two years operational difficulties have been experienced with the Cessna F406, Namibia's fixed wing aircraft, but prior to these difficulties an annual average of 500 hours was flown. The plane itself, although 14 years old, has been reliable and flexible, offering a cruising speed of 240 knots, a flight range of 1,600 n.m. and an endurance of more than 8 hours.

MCS activities on land vary considerably from fishery to fishery. All fishing vessels are required to undergo a port inspection in order to receive a clearance certificate at the start of each fishing season. At the end of a fishing trip, fishery inspectors monitor the unloading of fish as the catch is brought ashore or transhipped in the limits of the harbour (transshipping at sea is not permitted). This provides information on catches, which can be cross-checked against the logbook data and the data provided by the vessel operators, in order to facilitate the calculation of levies, quota control and scientific assessment. Coastal and inland patrol operations are carried out throughout the year in an attempt to control trade in seafood and to monitor and regulate the coastal recreational fishery.

Remote satellite tracking of vessels through vessel monitoring systems offers a modern and cost-effective way to provide a baseline of movements and activities of licensed vessels. A system is currently under implementation that will ensure that fishing fleets operate only in authorised areas, and

Table 1. A comparison of Namibian MCS patrol vessel specifications.

Specification	<i>P/V Tobias Hainyeko</i>	<i>P/V Nathaniel Maxwili</i>
Gross tonnage (t)	652	1 400
Length over all (m)	50.0	57.6
Breadth, moulded (m)	10.5	12.5
Maximum draught (m)	3.7	4.2
Maximum speed (knot)	17	17
Range at 11 knot (n.m.)*	5 500	6 600
Other		Helicopter deck

*1 nautical mile (n.m.) = 1.852 km

will provide regular information on the location of all licensed fishing vessels. This overview is important to assist with the deployment of MCS platforms (such as patrol vessels, observers and plane) and to gain a better understanding of the fleet dynamics.

Coordination and system links

Coordinating such a complex mix of MCS platforms and activities is a challenging task for the MCS organisation, a task made no easier by the geographical spread of operational centres. Coordination and information links take the form of: quarterly and annual reports; briefing and debriefing sessions; mission reports; the compilation of statistical summaries, compliance registers, a vessel register; and a wide area computer network that links Windhoek, Walvis Bay and Lüderitz. It is envisaged that the vessel monitoring system, once implemented will provide the framework to electronically monitor the operational activities of the MCS system and to link these directly to the fleet activities. This will provide an electronic planning, management and analysis tool that is currently not available.

Human resources and training

Early in the development of the MCS organisation, training was identified as the key factor required to build up essential knowledge and experience. This approach has been implemented with the assistance of co-operating partners and in 2002 it has resulted in a total MCS workforce, including fishery observers, of 353 (Table 2). The training itself has taken many forms, but three programmes stand out as having been particularly important: the fishery inspector and observer course, a nine month course (that has now trained 64% of the inspectors and observers); the training of observers in catch and scientific monitoring through the commercial sampling programme; and the

Table 2. Human resources of the Namibian MCS organisation in October 2002.

Location	Profession	Number
Walvis Bay	Inspectors	68
	Patrol vessel crew	52
	Air crew	9
	Observers	122
	Others	15
Lüderitz	Inspectors	15
	Observers	65
	Others	5
Windhoek	Management	2
Total		353

training of ships officers and crew for the patrol vessels. The last of these is an example of an eleven year progressive training programme that, with the assistance of foreign (Norwegian and Danish) officers and crew, enabled patrol vessel operations to start in 1993 while training was under way and to then slowly instate with qualified Namibians.

ANALYSIS OF THE NAMIBIAN MCS SYSTEM

How to analyse MCS systems has fuelled much debate from MCS and fisheries managers alike. With even a brief glance at the literature, it is clear that assessing the benefits, effectiveness and cost efficiency of MCS systems is still an issue that has yet to be successfully addressed (Furlong, 1991; Bergh and Davies, 2001; Kelleher, 2002). It is therefore not surprising that there has been little effort made to analyse the Namibian MCS system. However, this type of assessment, even if imprecise, is required if the future of the system is to develop in line with the real needs and demands of the fishery and in support of the management system in place. In the following sections an attempt is made to analyse the system, giving consideration to factors that influence the system, achievement of the stated objectives and the costs of the system.

Key factors that have influenced the MCS system

Both internal and external factors have played a role in shaping the development of the system: an assessment of these factors is presented below.

Historical inheritance and national policy. - The MCS organisation is not only a link in the fisheries management chain, it is also part of a more complex picture related to national policy and transformation. Therefore, the objective of fisheries management has to contribute to these higher social and political priorities of Namibianisation, employment creation and capacity building. In the short term these policies left managers, who themselves were new to MCS, faced with a team of unskilled and untrained personnel. The size of the team was also large, with a hierarchal structure that put seven ranks between an inspector and the director, thus making the delegation of responsibility and associated decision-making a cumbersome task. In the short term, it was evident that these policies accrued limited benefits to fisheries management. However, in the longer term, it is evident that these policies will lead to the provision of a large trained and dedicated national fisheries workforce.

Legal framework. - A supporting legal framework for MCS systems is the first

element required to ensure that management measures are enforced. Namibia has always benefited from a strong fisheries legal framework and this was recently enhanced further by the enactment of the Marine Resource Act of 2000. The negative aspect of such a relatively complex legal system is that at times it is not fully understood by MFMR staff or fishers. This can result in various interpretations of the rules and regulations, and ultimately differing penalties being awarded for similar violations. This factor is a common symptom of legislation that covers more than one fishery: a symptom best addressed through awareness campaigns and training, backed up by guidelines interpreting legal instruments into simple everyday language. Namibia also benefits from a fair and just judicial system that ensures transparency to any fisheries offences that proceed to court. However, a lack of understanding by legal personnel of the potential gains made by illegal fishing has meant that very low fines have been given for serious violations, resulting in high gains for the companies (Table 3).

Geographical and physical factors. - Namibia is an extraordinary country in terms of its long, harsh, desert coastline punctuated by only two ports. These physical characteristics have been ideal in terms of designing an MCS organisation: the two ports allow for monitoring of all landings, the coastline offers no havens for illegal transshipment or landings, and the harshness of the environment and the nature of the fish stocks have discouraged the development of artisanal fisheries. These factors combined with good infrastructure have all contributed to the success of the MCS system. A limitation to the system has been the physical distance between the different operational sections of MCS and other sections of the fisheries organisation, including management that is placed 400 km away from the coastline. Modern trends in fisheries management are to link components together in order to support checks and balances across the system. It is therefore important that the links between the inspectorates, management and research are strengthened at every opportunity.

MCS information and the fisheries information management system. - Internal information related to MCS operations is generated by all the MCS platforms and activities. The aim is that this operational information is compiled, analysed and distributed via the operation centre in Walvis Bay. However, recent reviews (EBCD and GOPA, 1996) noted that there is little compilation and analysis of this information and it is not readily available in a form useful for operational control or planning. The MFMR also utilises a fishery information management system that is an integrated database system developed for Namibia. However, it is reported that not all fishery data is incorporated into the system and this includes the MCS data (Blondal, 2000; Iversen and Gilja,

2001). Due to complications in the main fishery database the MCS organisation has been reluctant to develop its own database tool. Such a system would provide the opportunity to analyse information and to plan more cost effective and efficient operations, as well as contributing to the overall knowledge of the fisheries.

Donor support - Donor support has been instrumental in the development and financing of the MCS system. The most critical period was from independence until 1997, but the support continues to play an important role today. It is a known fact that donor support rarely comes with no ties attached: this point was stated by the Honourable Minister for Fisheries and-

Table 3. Convictions for fishery offences in Namibia since 1996 with level of sanction given.

Year	Name of vessel	Infringement	Fine (N\$)
1996	F/V <i>Juno Warrior</i>	Fishing inside 200 m depth contour. Use of undersized codend.	50 000
1996	F/V <i>Alsu</i>	Failed to comply with the order of a fisheries control officer. Use of illegal attachment to the codend. Attached bottom chaffer wrongly.	30 000
1996	F/V <i>Nivensikoe</i>	Failed to comply with the order of a fisheries control officer by destroying the fishing gear.	3 000
1996	F/V <i>Marshall Novickov</i>	Fishing inside 200.m depth contour. Submission of false information to a fisheries control officer.	3 000
1996	F/V <i>Alsu</i>	Use of restricting construction on the net.	30 000
1996	F/V <i>Ofelia</i>	Fishing inside 200 m depth contour. Submission of false information to a fisheries control officer.	22 534
1997	F/V <i>Marshall Yakobovski</i>	Use of undersized codend. Use of undersized round straps.	10 000
1997	F/V <i>Rosendo da Villa</i>	Use of undersized codend.	50 480
1999	F/V <i>Roselyn</i>	Use of foreign fishing vessel without a permit or license.	Escaped
2000	F/V <i>Juno Warrior</i>	Fishing inside 200 m depth contour.	127 154
2001	F/V <i>Weskus 7</i>	Illegal use of vessel as a fishing vessel.	1 800
2001	F/V <i>Weskus 5</i>	Illegal use of vessel as a fishing vessel.	1 800
2001	F/V <i>Weskus 4</i>	Illegal use of vessel as a fishing vessel.	1 800
2001	F/V <i>Sonia</i>	Illegal use of vessel as a fishing vessel.	1 800
Average fine for the period			25 644

Marine Resources, Dr Abraham Iyambo in a press statement in September 2002: “Aid should be given with an open heart. It should take into account the history of Africans. Those providing aid, even to beggars should listen to the recipients’ needs and aspirations. Pre-conditions should not be imposed by the powerful nations on the economically weak nations. Aid should not be given with strings dangling. Aid should be aid”. Although the donor-funded activities within MCS have been sensitive to the cultural, political and social needs, it is evident that the donating country’s preconceived ideas and expectations have at times played a driving force. For example, one could question the appropriateness of acquiring two new patrol vessels at the same time as implementing a vessel monitoring system, or whether the development of the fisheries information management system has improved the accessibility of information or if the objectives of the Southern African Development Communities MCS programme really addressed the regional concerns of Namibia. These questions and others are often politically sensitive and not easy to answer.

Evaluation of the success of the Namibian MCS system

An evaluation of the success of the MCS organisation must be made against the operational objectives as defined in the MFMR strategic plan (MFMR, 1999).

Restrict fishing activity to those entitled to do so - This objective deals with poaching by non-licensed vessels within the EEZ. Since the initial dramatic arrest of 13 vessels in the early 1990s (described in the section: the MCS system, historical perspective), only one unlicensed large pelagic vessel has been caught fishing within the EEZ (Table 3). A significant benefit was gained from the international exposure that followed these arrests, and the reputation that Namibia takes poaching very seriously has helped to deter potential poachers. The plane and patrol vessels are the means to regularly patrol the edge of the EEZ in the areas where transboundary fisheries occur. In order to ensure that levels of poaching do not increase, a deterrence presence is required and the reputation of the country’s capacity and capability must remain high.

Ensure that fishing activity is conducted within legal and administrative guidelines. - This objective aims to ensure that licensed fishers comply with the regulations. The issue of compliance is vital: non-compliance is the principal reason for the failure of fishery management regimes. Therefore assessing the level of compliance is extremely important both as an indicator of the effectiveness of the regulatory element of the management regime and ultimately as an indicator of the success of the overall system.

To estimate compliance an assessment of the total violations is required. This, for various reasons, is a very complex task (Furlong, 1991). Difficulties are faced in areas such as defining the type of offence (e.g. from a minor mistake in reporting to a deliberate misuse of gear), in assessing the level of sampling, or in determining if all violations are detected during one inspection. As a result of this, all assessment methods show weaknesses (Kelleher, 2002). Two principal methods exist: one is to compare the number of detected infringements in relation to the percentage of the population being sampled (vessels, fishers, gears, etc.), the second is to use surveys. This chapter presents results of the first formal assessment of compliance within the Namibian fishery. Both methods for assessment of violations have been used, with data being sourced from MFMR records of violations detected by patrol vessels and observers on the demersal, midwater and small pelagic fleets and results from a written questionnaire survey, specifically designed for this assessment. Eighty-four completed survey responses were obtained in the survey: 78% of these were from MFMR staff and 22% from the companies in the fishing industry.

A general look at the average number of violations per inspection from the patrol vessels for the three fleets provides a range of figures with the maximum average number of detected violations per inspection being 4.67 in the midwater fleet in 1993 to a minimum figure of 0.08 in 2001 for the demersal fleet (Figure 1). The midwater fleet has continuously been caught with at least one violation per inspection over the last 10 years and frequently over two. These high levels of violations are also reflected in the observer

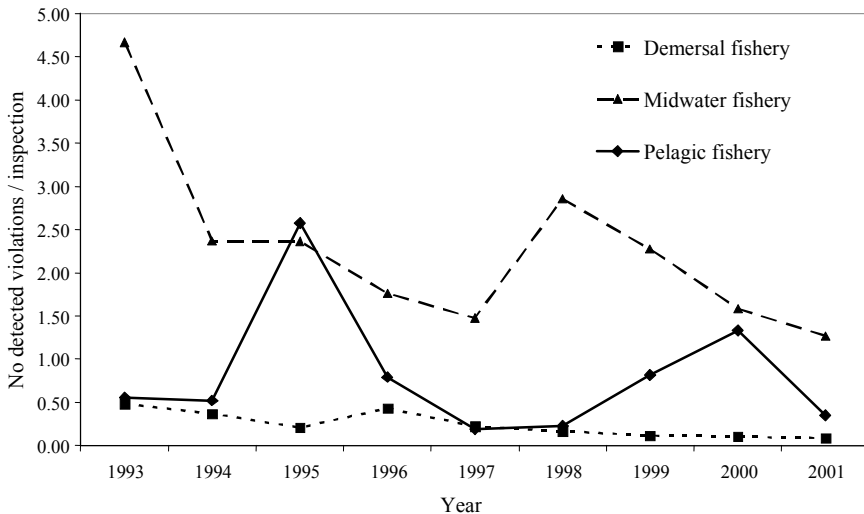


Figure 1. The average number of violations detected per inspection from the patrol vessels for 3 fisheries in Namibia.

data (Table 4), where between 31 and 74 violations per 100 observer days have been reported for this fleet between 1999 and 2001. The most common violations recorded are for the use of short roundstraps, fishing within the 200 m restricted zone, inaccurate or missing diagrams depicting vessel storage areas, or illegal stowing of gear. The pelagic fleet has generally had less than one violation per inspection in all years, except for 1995 and 2000 when peaks in the violations occurred; no observer data are available to validate these figures. The demersal fleet (the largest and most financially important of the Namibian fleets) produced a profile with much lower levels of violations than the other two fleets: from 1993 to 2001 a range from 0.48 to 0.08 average violations per inspection were detected. The 2001 figure of 0.08 reflects a generally compliant fleet. Observer data confirm this trend, with only 3 violations detected per 100 observer days in 2001. It has already been stated that accessing compliance is not a precise science: therefore the consideration of trends over time is very important. For the midwater and demersal fisheries the trend over the last 10 years is of an overall reduction in violations, while for the pelagic fishery no clear trend emerges.

The survey addressed the issue of perceived compliance by fleet and management measure. The estimate of compliance from the survey (where no significant difference was detected between industry and MFMR results) supports the earlier conclusion that the demersal fleet is perceived to be the most compliant fleet with an estimate of non-compliance at 26%, the midwater fleet is perceived to be the most non-compliant with an estimation of non-compliance at 42%, and the small pelagic fleet was perceived to be 32% compliant (Figure 2). It is of interest to note that the survey results, in comparison with the patrol vessel and observer data, appear to have overestimated compliance on the non-compliant fleets and underestimated compliance on the more compliant fleets. In relation to management measures, the industry perceived compliance to be higher than the MFMR staff (Figure 3). This possibly reflects concern by the industry in presenting themselves as a non-complaint body. However, the results show that the perception of compliance to management measures is higher than that found from analysis of actual inspections and observer observations.

Table 4. Number of violations detected by observers by fishery per 100 observer days in Namibia.

Fishery	1999	2000	2001
Demersal	8	5	3
Midwater	74	48	31
Other fishery	27	12	6

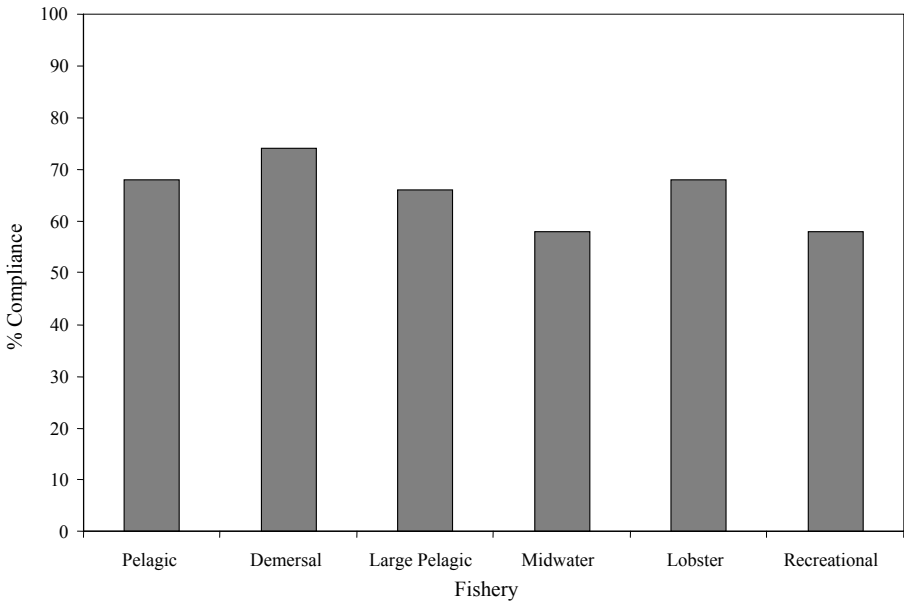


Figure 2. Compliance by fishery in Namibia, as perceived by MFMR and industry survey respondents

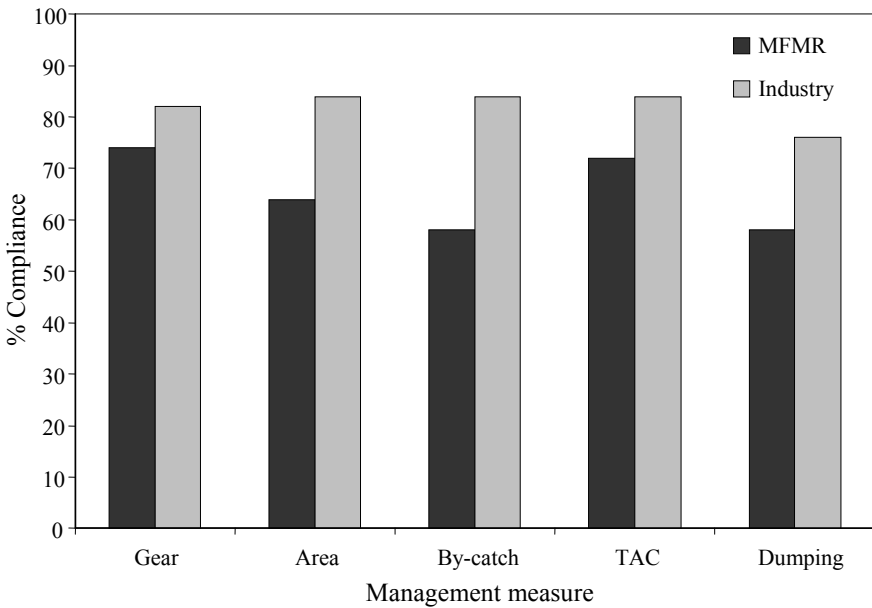


Figure 3. Compliance by management measure in Namibia, as perceived by MFMR and industry survey respondents.

The survey yielded two further results that contribute to the understanding of overall compliance levels. The first related to the effectiveness of different MCS elements and platforms for the purpose of enforcement. The results indicated that all platforms were perceived as above average in their effectiveness. Aerial surveillance and the issuing of sanctions were perceived to be the least effective elements for enforcement; this is a correct reflection of the practical situation. Finally, in considering where violations take place, the survey indicated that 88% occur while fishing, 7% during transshipments and 5% during landings. This result, if correct, supports the use of the data from patrol vessels and observers as an indicator of the compliance levels in the fishery.

The theoretical basis for compliance. - Having evaluated the general level and trend of compliance in the main fisheries, it is now necessary to identify which factors are playing an influential role in causing non-compliant behaviour. Becker (1968) produced the first theoretical framework for a deterrence model (based on explanations of criminal activities). This laid the basis for the development of simple models combining deterrence and bio-economics (e.g. Sutinen and Anderson, 1985). Sutinen *et al.* (1990) made the first real attempt at structurally analysing fishers' compliance behaviour; this was later followed and built on by others (e.g. Kuperan and Sutinen, 1998; Høneland, 1999; Raakjær Nielsen and Vedsmand, 1999). In summary, fishers can be classified as either chronic or moderate violators. Chronic violators, who generally constitute 2-5% of the population, will always violate regulations if there is a gain to be made, while moderate violators will only bypass regulations if the economic gain is high enough (relative to the economic situation of the fishery and the potential sanctions) and the chance of detection low enough. For moderate violators there are two secondary influences that may affect their decision to violate or not: these are the legitimacy of the regulation (and fishery management organisation) and the norms of behaviour, including both the general behaviour of the fishers and the moral code of the individual fisher. In recent literature the trend has been to place an increasing importance on the aspects of legitimacy and norms as major factors affecting the level of compliance in fisheries (Raakjær Nielsen, 2000).

The influence of economic factors on compliance - Individual fishers are more likely to violate regulations if the financial situation relating to fishing is bad. Calculating financial indicators over time is a complex task that at best can only be indicative of the general economic situation of the fishery. Economic indicators were evaluated for the three fisheries by considering the landed value per vessel and the total landed value. For the midwater fishery a correlation was found for both measures (Figure 4) when a substantial increase in

landed value of the horse mackerel (over the last 4 years) did correlate with a decrease in the number of violations recorded. The pelagic fishery showed an erratic pattern for both measures with no clear trends emerging. The general trend of the demersal fishery supported this economic theory, although an anomaly occurred in 1996 (Figure 5). Therefore it can be concluded that the pelagic fishery that has gone through severe financial difficulties in the last years did not provide any evidence of a link between the economic return of the fishery and the level of violations. However, the midwater and demersal fisheries both yielded evidence in support of this

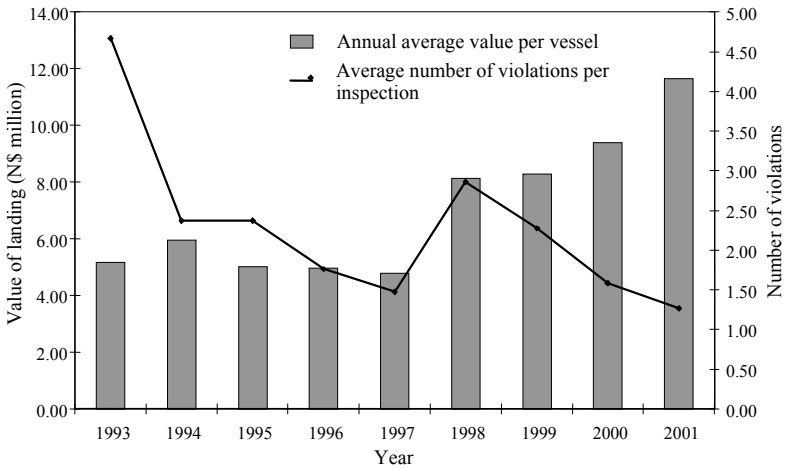


Figure 4. Midwater fishery – annual value of landings per vessel and average detected violations per inspection in Namibia.

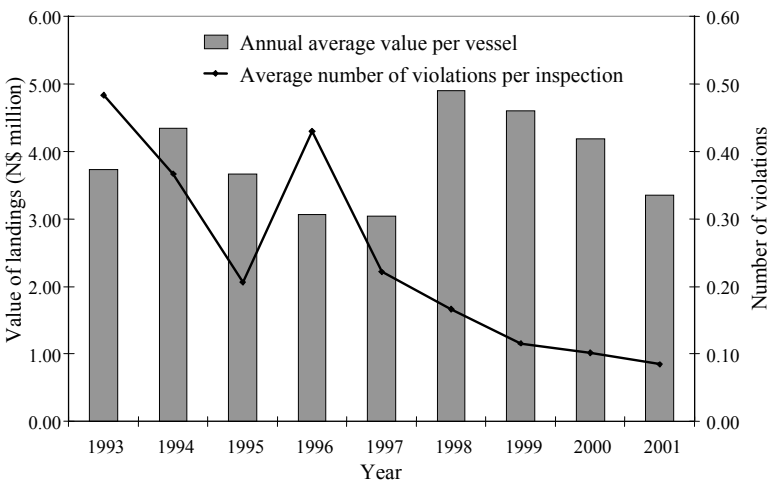


Figure 5. Demersal fishery – annual value of landings per vessel and average detected violations per inspection in Namibia.

theory that with an increase in economic return from the fishery a decrease in violations can be anticipated.

The influence of deterrence and sanctions on compliance - If the chances of detection are low then a fisher is more likely to violate regulations. The survey results indicate that the MCS platforms are perceived to be as important for deterrence as enforcement. Patrol vessels were perceived as the most effective deterrent while the plane was the least effective. The patrol vessels have maintained a steady and high level of patrolling over the last 10 years and thus been a visible presence on the fishing grounds while the plane did not operate in 2001 and only flew for half the normal hours in 2000; this has dramatically reduced the impact of the plane on MCS operations (Figure 6).

For the midwater fishery the patrol vessel inspections have remained at about 2 per vessel per year for the last 4 years (Figure 7). This has coincided with a decrease in the number of violations. It is likely that the presence of the patrol vessel on the fishing grounds and the fact that each vessel expects to be inspected about twice per year has contributed to the reduction of violations. The pelagic fishery yielded an interesting correlation between the two years where high average levels of violations were detected (2.57 and 1.33 per inspection) and the two years when each vessel had less than 20% chance of being inspected (Figure 8). The low level of inspections may have influenced the non-compliant behaviour or it may be that the inspections targeted non-compliant vessels making the sampling non-random; no data was available to verify this. Inspections on the demersal fishery have steadily reduced in

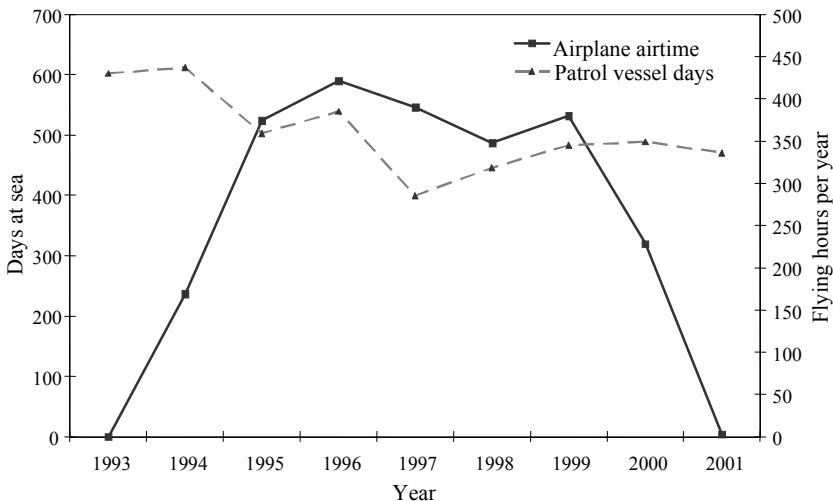


Figure 6. Time spent patrolling for the Namibian fisheries patrol vessels and plane, 1993 to 2001.

the last 4 years (from 2.2 to 1.3 per vessel per year) as have the number of violations over the same period. Therefore it cannot be concluded that an increase in the number of inspections has reduced the number of violations in the fleet. However, it may be that by maintaining the expected number of inspections per vessel above one, the deterrence value is maximised. This observation merits further investigation as it would assist in the setting of operational plans that are linked to a predefined compliance level.

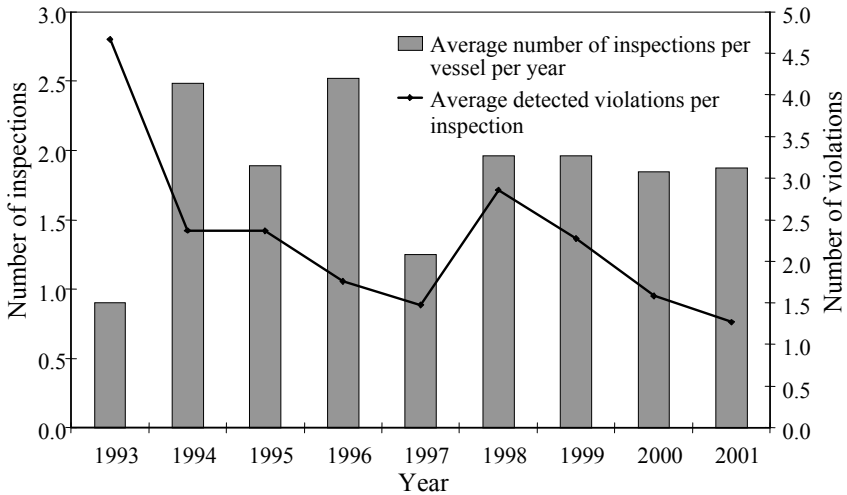


Figure 7. Midwater fishery average number of inspections per vessel per year and the average number of detected violations per inspection in Namibia.

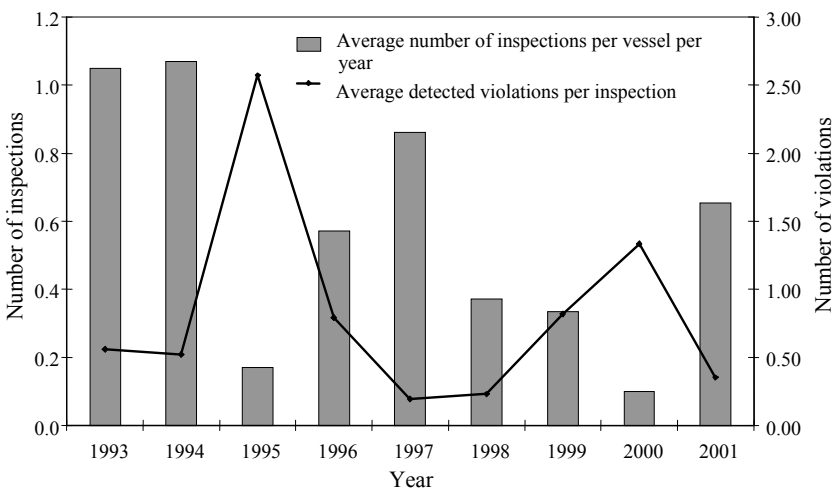


Figure 8. Pelagic fishery average number of inspections per vessel per year and the average number of violations detected per inspection in Namibia.

Once an offence has been detected it is generally considered that immediate action is required to reinforce the deterrent aspect of the punishment and that the punishment should be high enough to deter other potential violators. Survey results showed that the sanctions issued were not considered effective as a means of deterrence, due to very low fines and the lack of immediate action. Very few fines of over N\$300 have been issued (Table 3) as only the courts can issue higher fines. Even when higher fines were issued they were also relatively low in comparison to the potential gain from the crime; this reduces any deterrence value.

The influence of legitimacy on compliance. - The consideration of legitimacy equates to how strongly the fishers believe in the regulatory system and the regulations imposed on them. Various studies have suggested that the stronger this belief, the less likely the fisher is to violate regulations (e.g. Copes, 1986; Tyler, 1990). Issues that build legitimacy include: the level of fisher participation in management, especially in the choice of management measures; meaningful regulations that are compatible with the fishing method; equitable distribution of the resources; impartial targeting of enforcement activity; faith in the assessment that underpins management measures; confidence in fair judicial systems; and a good understanding of the regulations in relation to sustainable management of the resource.

The MFMR has recently been encouraging participation of the industry in the management of the fishery. Efforts include annual meetings with the industry, involvement of the industry in scientific working groups and in the Marine Resources Advisory Council. The issue of confidence in management measures is routinely addressed through the Marine Resources Advisory Council and participation in developing new laws and regulations. All of these factors contribute positively towards creating a sense of legitimacy in the regulatory system. This was confirmed by the survey: an average score of 71% (good to very good) was awarded to the level of co-operation between the government and the industry in the areas of fisheries science (72%), legislation (74%), management (70%) and enforcement (70%). The level of perceived professionalism of the MFMR was acceptably high, but as with all aspects of the regulatory system there is still room for improvement: 79% of those questioned stated that increased participation from the industry in the MFMR would increase compliance.

The influence of morals and norms on compliance. - The influence of norms and what the fisher considers as moral behaviour are important considerations when analysing non-compliant behaviour. Norms can be considered as the characteristic actions, attitudes and expectations among fishers concerning the behaviour and attitude of their peers: in other words social pressure

(Giddens, 1984). Moral on the other hand is based on personal evaluation: what is personally considered right or wrong.

Namibia has a multi-culture, multi-language population and the fishing industry demonstrates this mix along with an additional foreign element. This makes analysis of norms and morals quite complex. The survey asked the question 'are Namibians more complaint than foreigners?'; the answers were 41% yes, 11% no, 39% the same and 9% don't know. This range of answers indicates no real trend in the manner that different stakeholders view the norms of Namibians and foreigners. It is common to assume that foreigners are less compliant because they do not identify with the long-term gains of good management practice. However, with the long-term rights allocations of some joint venture companies in Namibia the picture of cultural norms is not clear. One exception is that of the midwater fleet, that has been identified as the most non-compliant fleet: this fleet has the highest level of foreigners at 80% and is also a fishery that commonly uses flag of convenience.

Ensure that revenue from landings is correctly calculated. - The collection of landings data leading to the calculation of revenue is done manually at the factories by fisheries inspectors before it is entered into the database. The process starts in the moment the catch is landed and ends with a reconciliation of landings information with the vessel operators. Various reviews of the manual and electronic systems have taken place (Blondal, 2000; Iversen and Gilja, 2001). Weaknesses have been identified that make the final calculation of revenue very unreliable. These include: cumbersome work routines when data are collected and registered; an inaccurate reconciliation process leading to almost a 100% confidence in industry figures; large backlogs in data entry; software problems and inadequate training in the use of the database. It was concluded that the present system could be more accurate and timely if work routines were improved and by the implementation of a more user-friendly and reliable software programme.

Lost revenue to the Government due to the weaknesses in the present process was estimated in 1999 to be N\$700 000 in lost bank interest (Blondal, 2000). The loss in terms of inaccurate reconciliation and thus underreported catches is impossible to estimate, but may be considerable. This uncertainty around the catch figures will also have an impact on the scientific calculation of the TAC and may imply that the TACs are over caught as not all caught fish are recorded in the system.

Cost of MCS operations

From a practical point of view, neither complete compliance nor perfect enforcement are realistic objectives for a fishery (described in the section:

analysis of the Namibian MCS system, evaluation of the success of the Namibian MCS system). The costs that would be incurred in perfect enforcement (and thus complete compliance) would be far greater than the economic revenue resulting from it (Sutinen and Andersen, 1985). Based on these principles it is generally agreed that the overall aim in relation to the financing of fisheries management is to strike a balance between the costs incurred and the benefits to be obtained from the fishery. Namibia has followed this principle and over the last six years the revenue from the combined fisheries has remained higher than the operating costs incurred by the government (Figure 9).

When making comparisons it should be kept in mind that profit or benefits can be defined in many ways: analytically the direct revenue generated to government is considered, but in economic terms, profit includes indirect benefits to the country such as employment opportunities, food security, foreign exchange earning and business synergy. If the wider range of social-economic benefits is considered, then the revenue generated would be considerably higher than that shown in Figure 9. It is also possible to include capital costs and donor contributions in the cost calculation. The capital costs, for example the financing of a new patrol vessel or a new inspectorate building, are costs falling under the national development budget and are therefore not included as MFMR operating costs. Donor assistance to the fishery sector has been considerable in the last years (Figure 10), but it is also not considered as operational costs. The inclusion of the full capital and donor contributions, or even inclusion of the full costs of servicing these

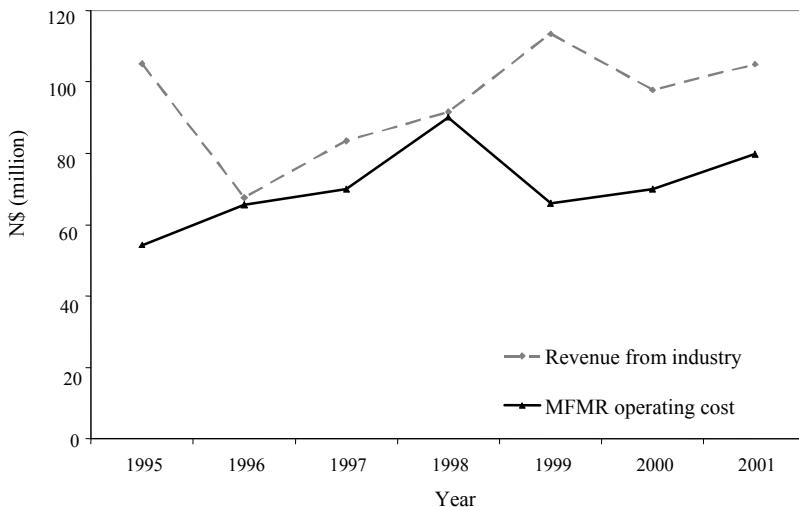


Figure 9. The cost of MFMR operations in relation to revenue (Namibia, 1995 - 2001).

inputs, in the operating cost of the MFMR would give a misleading picture. This is because, firstly, many of the capital and donor supported investments have been one-off events or programmes that are required when developing a new fishery administration and they can be treated as sunk costs, and secondly, some of the donor contributions are not considered fungible in Namibia and thus do not have opportunity costs. Therefore, for the purpose of analysing the MFMR and MCS costs, the comparison presented in Figure 9

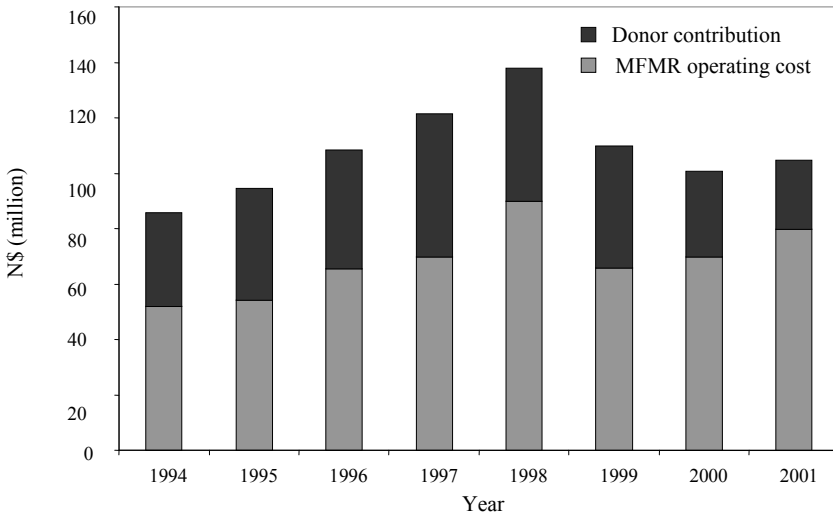


Figure 10. The financial contribution by donors in relation to the MFMR operational costs (Namibia, 1994-2001).

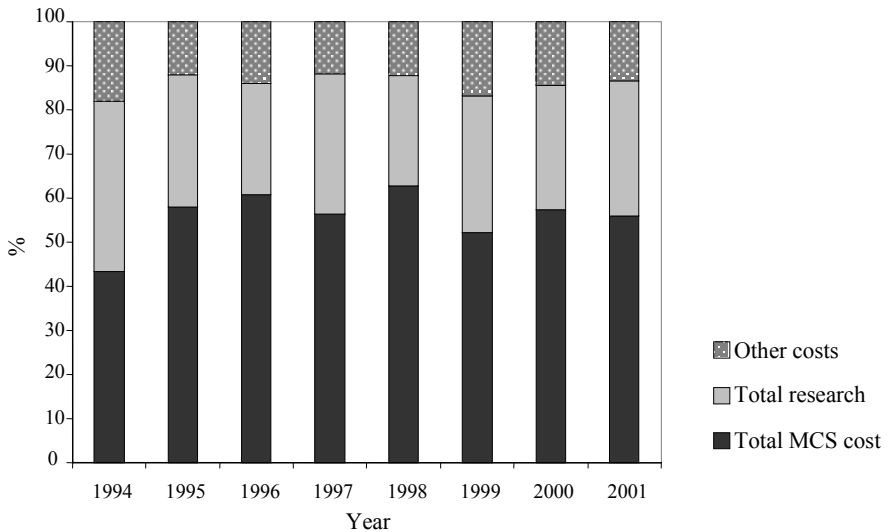


Figure 11. The division of financial resources within the MFMR (Namibia, 1994 – 2001).

is considered to reflect a realistic approach. In the last two years the MFMR has utilised 72% and 76% of the revenue from the industry for fisheries management and 41% and 42% of the industry revenue has been used for the MCS organisation. These figures are verging on the high side in comparison with fishery management organisations globally, but what is important is that these costs are covered by the revenue.

Enforcement is frequently the most costly element of fishery management, accounting for one quarter to one half of all expenditure (Sutinen and Kuperan, 1994). In Namibia the MCS organisation has utilised an average of 56% of the MFMR operating costs between 1994 and 2001 (Figure 11). This figure is higher than that found by Sutinen and Kuperan: a possible explanation for this is the requirement for inherently more expensive enforcement due to the predominance of output controls (e.g. quotas, no discards) as management measures and to the complexity of the multiple monitoring and enforcement platforms (e.g. landings inspections, observers, plane and patrol vessels) used to manage each fishery. Options to streamline operations will become an important consideration for the MFMR if they do not want to see costs escalating above revenue.

In order to plan the optimal MCS operations within a specific financial framework, for example with targets set as a percentage of revenue (Figure 9) or as a percentage of total MFMR expenditure (Figure 11), the MCS manager must collect the costs of the different components of MCS and evaluate these in relation to the compliance levels aimed for and those achieved within each fishery (Kelleher, 2002). In extracting and compiling the MCS operational costs (1999-2001) the average annual cost was nearly N\$40 million. This can be divided by MCS component (Figure 12): operation of the patrol vessels in order to achieve at-sea inspections accounts for 32%, the monitoring of landings and transhipments accounts for 29%, the placing of observers onto fishing vessels accounts for 23%, while the remaining costs are shared between recreational fishery patrols and air patrols (at 8% each).

This figure allows a comparison of the cost of enforcement by MCS component across the entire Namibian EEZ, which is useful as an indicative figure for planning overall operations. However, in order to compare compliance and enforcement with costs, the average cost per event within each component is required. Using the same time period an average cost per event has been calculated (Table 5). It should be noted that determining these figures was fraught with complications as the recording of costs and events is different within each element of MCS. However, the figures provide useful values for comparative purposes.

The earlier section covering the analysis of the Namibian MCS System, evaluation of the success of the Namibian MCS system attempted to determine compliance levels for three fisheries; demersal, midwater and pelagic.

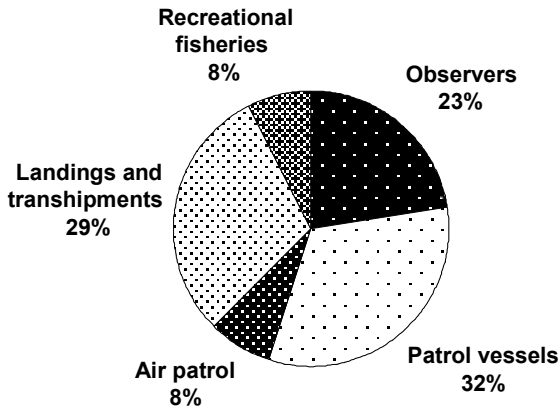


Figure 12. The division of MCS operational costs per MCS component in Namibia (based on an average 1999-2001).

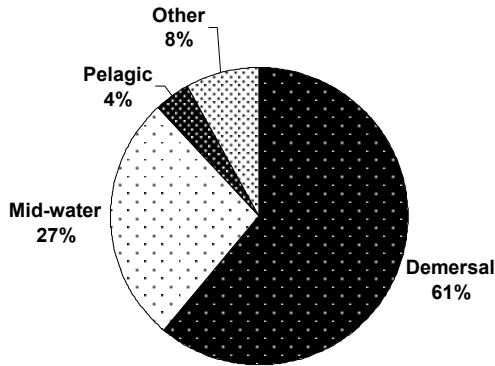


Figure 13. Percentage of MCS operational costs by fishery (Namibia, 1999-2001).

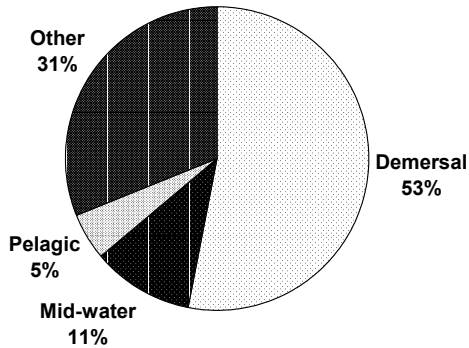


Figure 14. Percentage of landed value by fishery (Namibia, 1999-2001).

Using the figures from Table 5 the average cost of enforcement by component within each fishery has been calculated (Table 6) and the total by fishery as a percentage of the total MCS operational costs is indicated in Figure 13. It is clear that the allocation of the financial resources has a direct impact on the compliance levels observed in each fishery (as described in the earlier section entitled analysis of the Namibian MCS system, evaluation of the success of the Namibian MCS system) with the demersal fishery being the most costly to enforce, but showing the highest compliance level. In planning future activities it is also interesting to compare the cost allocation with the landed value by fishery to gain an indication if the cost is appropriately divided (Fig. 14). Other social-economic factors, such as employment and Namibianisation, should be considered. For example, the low financial commitments in terms of MCS compared with the higher landed value for the midwater fleet is a reflection of the low social economic importance of this fishery.

Table 5. MCS events per year in Namibia, and average operational cost per event (1999-2001).

MCS Event	Average cost per event (N\$ 1999-2001)
Observer at-sea day	240
At-sea inspection of fishing vessel (from patrol vessel)	36 000
Aerial observation of fishing vessel (from airplane)*	2 000
Monitoring of a landing or transhipment	2 400
Coastal patrol mission (for recreational fisheries)	3 200

* The calculations for aerial observations do not include 2001 data as no flights took place during the year.

Table 6. Average total costs (1999-2001) of MCS by components by three fisheries in Namibia.

Component	Demersal (N\$)	Midwater (N\$)	Pelagic (N\$)
Observers	6,453,557	1,515,221	262,460
Patrol vessel	8,292,000	1,728,000	372,000
Aerial observations	1,320,000	240,000	270,000
Landings or transhipments	5,280,000	960,000	1,080,000
Total cost by fishery	21,345,557	4,443,221	1,984,460

FUTURE CHALLENGES

The present MCS system is generally performing well and it is clear that Namibia deserves the international reputation the country has achieved. It is, however, important not to become complacent with this situation, but rather to aim to improve MCS efficiency and effectiveness while remaining flexible enough to meet future challenges.

Setting realistic compliance levels to guide MCS development and operational planning

Perfect MCS with 100% compliance does not exist. It is therefore important to explore what level of compliance is required and realistic for each fishery. These can then be compared with the actual levels of compliance being achieved. The earlier section evaluating the success of the Namibian MCS system presented estimates of compliance levels across three fisheries; this information was then linked to factors that influence compliance (economic situation, deterrence and sanctions, legitimacy, and norms and morals) in order to determine which forces may be driving the non-compliant behaviour within each fishery. This information, combined with knowledge of the main external forces on the system, an assessment of the costs incurred for the MCS operations, an assessment of the overall cost of MCS in relation to income, and a consideration of the scientific risk associated to the sustainability of the stock, provide the basis for setting practically and physically realistic targets for compliance levels.

The first challenge is to estimate present levels of compliance in all fisheries; secondly, to analyse these estimates in relation to the factors discussed in the previous section entitled analysis of the Namibian MCS System; thirdly to set realistic target compliance levels for each fishery; and finally to use these target figures as the shaping influence on the day to day distribution of resources, the operational plans and on future developments of the MCS system.

Improving the efficiency and effectiveness of MCS operational platforms

Improving what is already in place is a constant challenge to managers. Patrol vessels are extremely costly platforms (Table 5, Figure 12); maximising their performance is therefore essential. The use of night inspections and multiple boarding teams are feasible options that may require more than one inspector on each vessel but this is a minor cost compared with the current cost per inspection of N\$36 000. With good information on the location of fishing vessels, strategic patrolling and a quick response is possible. This information will soon be available via the vessel monitoring system, which

will provide an opportunity for improving the deployment of the patrol vessels and the targeting of specific fishing fleets or vessels.

The patrol plane consumes 8% of the annual MCS costs (Figure 12). Aerial surveillance is useful for effective surveillance of the EEZ and border violations. The plane can cover up to 45% of the EEZ during a 5 hour patrol in comparison with the patrol vessel that can only patrol 1-2% of the EEZ in one day. In 2001 the plane was grounded due to operational and human resource problems; this had been noted by the industry as they scored the plane the lowest for deterrence ability (survey results). The operational issues could be addressed through the privatising of the plane and the crew. Efficiency of the aerial surveillance would increase if night patrols existed; this requires the use of night vision equipment in integration with the vessel monitoring system.

Fishery observers represent a valuable and important MCS component. Over the last three years 67% coverage of the fleet has been achieved; although this falls short of the MFMR's objective of 100% it is an acceptable coverage rate. Due to this presence on fishing vessels, at the actual time of fishing, observers have the potential to become one of the most effective and cost-efficient tools in MCS. However, in the survey they were perceived as less effective for compliance and deterrence than the patrol vessels or landings control. The newly established Fisheries Observer Agency therefore has an opportunity to improve this perception and the performance of the fisheries observers.

In the previous assessment of the MCS system, the least successful element was identified as the calculating of revenue from the industry and the quota control. The result of this weakness was identified as not only causing an undetermined loss in revenue but also offering a substantial threat to stock sustainability by the possible over catching of quotas. Both the cumbersome working practices for landings control and data management and the database software system were identified as contributing factors to the system failure: a total redesign of working practices and information management is required, including consideration of an MCS information system.

In the section analysing the key factors that have influenced the MCS system the low level of sanctions given to serious offences was seen as reducing the value of the penalty system as a punishment measure. It is vital that crime doesn't pay and that the penalty is greater than the potential economic gain from the crime. Correcting this imbalance may boost the deterrent effect of penalties enough to allow a reduction in other more costly areas of MCS operations.

Voluntary compliance is the cheapest and most effective MCS solution available. The earlier section analysing the key factors that have influenced

the MCS system demonstrated the links between legitimacy, norms, morals and voluntary compliance. Building on the legitimacy of the system and increasing the participation of the industry in the management cycle may provide an opportunity for increasing the compliance of fishers at little cost.

Facing future financial implications

Changes in the fiscal framework of the MFMR and the MCS organisation are inevitable. The earlier analysis shows that the management costs in 2001 were comfortably within the bounds of the revenue generated from the fishery (Figure 9) and that the MCS costs comprised almost 60% of the management figure (Figure 11). Future changes may be driven by fluctuations in fish stocks, changes in market demands, global political or social events or changes in the priorities of the Namibian government, to name just a few. Whatever is the driving force, the result may bring higher landings, and thus a greater demand on the present resources, or lower landings and thus a reduction in revenue and consequently in the funds available for MCS operations. Donor support to the MFMR is on the decline and will be dramatically reduced over the next years. As Namibianisation of the industry progresses, a reduction in the revenue due to tax incentives is expected. Research findings are forecasting a reduction in some fish stocks in the medium term. These are all signals that call for caution in the near future to maintain a well-proportioned and balanced fisheries management organisation.

The MCS organisation must be sure to contribute to this conservative approach: the previous section relating to future challenges has focused on options to facilitate this. However, the MCS organisation will face large capital repayment costs and increased running costs for MCS platforms in the coming years. A new patrol vessel has just been acquired and a second vessel is soon to arrive. There are plans to acquire a new surveillance plane and potentially a helicopter. This hardware represents an estimated capital investment of more than N\$300 million with predicted running costs of N\$20 - 30 million per year. Optimal management of these new resources is vital if they are going to be cost effective investments. This management will rely heavily on the analysis and assessment of the performance of the MCS organisation in relation to compliance levels.

International and regional challenges

Namibia has taken great pride in participating in international and regional fora and organisations to enhance fisheries management locally and globally. This is exemplified through: the new Southern African Development Community Protocol on Fisheries; the active participation in the establishment of the South East Atlantic Fisheries Organisation (SEAFO); membership to the International Convention on Conservation of Atlantic Tunas (ICCAT), and

the Convention on Conservation of Antarctic Marine Living Resources (CCAMLR); and the efforts made to implement the principles of international legal instruments such as the FAO Code of Conduct for Responsible Fisheries.

The holistic approach of ecosystems management is becoming an increasingly more popular tool used for ocean and coastal management. The World Summit on Sustainable Development held in Johannesburg in 2002 united to reaffirm this trend and to place significant emphasis on the need for this type of approach. Efforts to date have focused on the research challenges related to defining transboundary issues and resources and to developing legislation to support regional management. However, soon a serious test will be given to the MCS organisation when they will be required to implement associated management measures both internally and in neighbouring waters. This will create a demand for qualified personnel such as fishery observers and inspectors to work outside of their home waters, hardware for regional patrolling such as vessels and planes, and the implementation of port state and flag state responsibilities. Systems to professionally deal with these challenges are not yet in place. However, a solid foundation exists that will facilitate the preparation of an implementation plan to allow Namibia to fully participate in these regional and international entities.

CONCLUSION

Following a dramatic initial enforcement of the EEZ in the early 1990s the newly formed MFMR was then faced with developing an MCS organisation with limited resources and an unskilled and inexperienced workforce. Over twelve years, Namibia has developed a complex, multi-dimensional and modern MCS organisation. The system has been shaped by the national-level policies of Namibianisation and transformation; it has been supported by a strong legal framework – although at times the complexity of the law has confounded compliance; the isolated coast of Namibia has facilitated MCS efforts; while the distance between operational units has been an obstacle for communication; the lack of an information system for MCS has reduced the capacity to plan and cross-check information; while finally, the strong reliance on donor support has on the one hand assisted the development, but on the other hand shaped progress in ways that may not always be objective.

Evaluation of the success of the system in relation to the three strategic objectives concluded that the first objective, to restrict fishing activity to those entitled to do so has been fully achieved, while the second objective, to ensure that fishing activity is conducted within legal and administrative

guidelines has been partially achieved, and the third objective, to ensure that the revenue from landings are correctly calculated has not been achieved.

Evidence supports that compliance has generally improved over the last decade, although levels vary considerably across fisheries. Data from patrol vessels, observers and a questionnaire survey were used to assess compliance levels: results from the survey indicated that 88% of violations occur while fishing thus supporting the use of patrol vessel and observer data as indicators. It was observed that regular inspections by the patrol vessels reduced the number of violations. Analysis of the demersal fishery yielded very low violation rates, which were supported by survey results on perceived compliance levels. This fishery gave a strong correlation between economic return from the fishery and the level of violations, supporting the theory that financial viability of the fishery affects the behaviour of fishers. The midwater fishery on the other hand, a fishery of less social and economic importance to Namibia, is faced with unacceptably high levels of non-compliant behaviour. This fishery also provided evidence that an increase in economic return coincided with a decrease in violations. In analysing the norms and morals of the fishers it was evident that this, a predominantly foreign fishery (often utilising flag of convenience), was also the least compliant. The pelagic fishery that has gone through severe financial difficulties in the last years has remained with a steady level of recorded violations, with no evidence of a link between the economic return of the fishery and the violation level. Results indicated that progress in improving the compliance level across all fisheries is hampered by the low deterrence value of the fines imposed and the delay between crime and punishment.

The third objective, ensuring that revenue from landings is correctly calculated, is not successfully implemented. Evidence indicated that the calculation of revenue is very unreliable and that in 1999, N\$700 000 was lost in bank interest, while the loss due to inaccurate reconciliation and underreported catches was impossible to estimate, but may have been considerable.

The cost of MCS in the last two years was 41% and 42% of the industry revenue: this is considered an acceptable level, as was the distribution of cost across MCS components. However, serious concern was raised over the future cost; with two new patrol vessels on the horizon, possibly a new plane and helicopter and a withdrawal of donor support. Careful planning and streamlining will be required if the MCS organisation is to continue to develop a successful and sustainable operation. Improvements are therefore required and various options have been identified to meet this challenge: the setting of compliance targets to streamline logistical operations and planning; the improvement of the performance of MCS platforms to increase cost effectiveness; a more analytical approach to balancing enforcement and voluntary compliance in order to unlock potential increases in compliance;

the shortening of the decision-making process to promote more immediate reactions to serious violations; an increase in fines to ensure that crime doesn't pay; the creation of an MCS information system to facilitate cross verification and improved planning; and finally and most importantly to redesign the working practices and information systems used to calculate landings in order to ensure that catch limits are not exceeded and that revenue is correctly calculated.

It is evident that, against all odds, in a period of twelve years, Namibia has taken control of its EEZ. Poachers have been removed and licensed fishing is managed through a combination of catch limits and technical control measures. A multi-platform, multi-dimensional MCS system has been developed to enforce fishery regulations: a system that, while meeting demands for effective enforcement, has also met the demands of a new social and political order. It can be said that Namibia not only deserve the international reputation it has gained for MCS, but that it is also ready to operate, sustain and develop the MCS system without external assistance. This is a quite considerable achievement.

REFERENCES

- Becker, G.S. (1968): Crime and Punishment: an Economic Approach. *Journal of political economy* 76(2): 169-217.
- Bergh P.E. and Davies, S.L. (2001): Monitoring, control and surveillance. In: *A Fishery Manager's Guidebook* FAO Fisheries Technical Paper, No. 624. Rome, FAO. (K.L. Cochrane, ed.), 175-204.
- Blondal, J. (2000): Report on Namibia's Fisheries Information System. Ministry of Fisheries and Marine Resources, Windhoek. 28 pages.
- Copes, P. (1986): Critical review of the individual quota as a device in fisheries management. *Land Economics* 62 (3): 278-291.
- EBCD and GOPA (1996): Feasibility study for SADC monitoring control and surveillance of fishing activities. Project No. 7, ACP RPR 484: Windhoek. 41 pages.
- Furlong, W.J. (1991): The deterrent effect of regulatory enforcement in the fishery. *Land Economics* 61: 116-129.
- Giddens, A. (1986): *The constitution of Society: outline of the theory of structuration*, Cambridge: Polity Press, Berkeley: University of California. 440 pages.
- Hønneland, G. (1999): A model of compliance in fisheries: compliance behaviour in the fishery. Theoretical foundations and practical application. *Ocean and Coastal Management* 42: 699-716.
- Iversen, F and Gilja, A. (2001): Internal Report on landings routines and management of landings data. MFMR, Windhoek. 37 pages.
- Kelleher, K. (2002): *The costs of monitoring, control and surveillance of fisheries in developing countries*. FAO, Rome, 47 pages.
- Kuperan, K., and Sutinen, J.G. (1998): Blue water crime: legitimacy, deterrence and compliance in fisheries.

- Law and Society Review* 32(2): 309-338.
- MFMR (1999): *Planning in action 1999 – 2000* (Our strategic plan). MFMR, Windhoek. 30 pages.
- Raakjaer Nielsen, J. and Mathiesen, C. (2003): Important factors influencing rule compliance in fisheries – lessons from Danish fisheries. *Marine policy [Amsterdam]* Vol. 27. No. 5. September 2003, 409-416.
- Raakjaer Nielsen, J. and Vedsman, T. (1999): User participation and institutional change in fisheries management: a viable alternative to the failure of “top-down” driven control? *Ocean and Coastal Management* 42(1): 19-37.
- Sutinen, J. and Andersen, P. (1985): The economics of fisheries law enforcement. *Land Economics* 61(4), 387-397.
- Sutinen, J. and Kuperan, K. (1994): A socioeconomic theory of regulatory compliance in economics and trade. In: *Proceedings of the VIIth conference of the international institute of fisheries economics and trade volume 1* (D. Liao, ed.), 18-21 July: 189-203, Taipei, Taiwan. National Taiwan Ocean University Press.
- Sutinen, J. Rieser, A. and Gauvin, J.R. (1990): Measuring and explaining non-compliance in federally managed fisheries. *Ocean Development and International Law* 21: 335-372.
- Tyler, T.R. (1990): *Why People Obey the Law*. Yale University Press, New Haven and London, 273 pages.
- Wiiium, V. and Uulenga, A. (2003): Fishery management costs and rent extraction: the case of Namibia. In: *The Costs of Marine Fisheries Management* (W.E. Schrank, R. Hannesson and R. Arnason, eds.), 173-186, Aldershot: Ashgate Publishers.