

Maldives Livebait Fishery Management Plan 2013



Robert Gillett
A Riyaz Jauharee
M Shiham Adam

**Marine Research Centre
Ministry of Fisheries and Agriculture**

Supported by
Maldives Environment Management Project

Maldives Livebait Fishery Management Plan - 2013

This is an initiative by the government of Maldives to ensure sustainable exploitation of livebait resources in the Maldives. This management plan was supported by Maldives Environment Management Project and funded by World Bank.

© Marine Research Centre, Ministry of Fisheries and Agriculture, Maldives

For bibliographic purposes this report should be cited as follow:

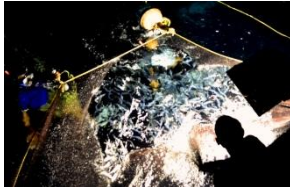
Gillett, R., Jauharee, A. R. and Adam, M. S. (2013). Maldives livebait fishery management plan. Marine Research Centre, Ministry of Fisheries and Agriculture, Maldives

Layout and designed by A R Jauharee

Photos: A R Jauharee

Introduction

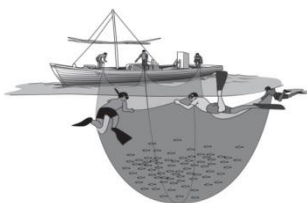
Why a Fishery Management Plan?



Livebait fishing at night



Livebait fishing during daytime



Bait fishing operation

Some General Features of this Plan

There are many different types of fishery management plans. This plan shows how the fishery is to be managed. It summarizes the major features of baitfishing in the Maldives, highlights important issues that require interventions, specifies appropriate interventions, indicates the provisions for implementation and monitoring, and gives procedures for modification. The plan is intended to simplify and make more transparent the process of fisheries management – something that can seem quite complex to fishers and the general public in the Maldives.

This plan for the baitfishery in the Maldives differs from most other fishery management plans. This is because the fishery has existed with little regulation for over a thousand years, the fishers are mostly unaware of the need for and benefits of regulation, and there are very few controls that can be enforced in the country, considering the limited resources available for enforcement and monitoring. Accordingly, the plan addresses a small number of issues and relies on the few controls that have some chance of being enforced. Another important feature of this plan is the large emphasis on raising the awareness of fishers on the need for management: Fishers need to be allies of the process, not opponents – but to modify their attitudes will take time.

Various external organizations have urged the Maldives to formulate a management plan for the baitfishery. These organizations include WWF, Greenpeace, and ISSF. It is likely, however, that the most compelling case for a baitfishery management plan is not from external pressure, but rather for Maldives' own purposes: having something to fall back on to protect a very important national resource should the present favourable baitfish conditions change. Negative changes could come about through such influences as increased pole-and-line fishing, climate change, or new/destructive baitfishing techniques.

Although this management plan can make significant progress towards organizing the management of the baitfishery in the Maldives, it is important to point out what a plan cannot do. The plan is unable to wondrously resolve the most difficult task of fisheries management: effectively placing controls on fishers. In the Maldives such a task is huge and amounts to a revolutionary change in way fisheries are managed, something that this plan can only make a contribution to.

Although numerous agencies promote the use of fishery management plans (e.g. FAO, World Bank), introduction of such plans in developing countries is often not successful. Where there have been successes, those plans usually feature simplicity. This plan has therefore been formulated to be as non-complex as possible, and downplays some features which add complications that could overpower the modest fisheries management capabilities of the Maldives. The goal is to have the plan be a short document that people/agencies will become familiar with and will keep and use.



Trigger fish used as bait in the yellowfin handline fishery

Following from the simplicity sentiment, this plan is not meant to be a treatise on the baitfishery in Maldives, which is probably the best documented baitfishery in the world. Background information is kept to a minimum (mostly confined to an indication of the information that exists) with the idea that this interesting but peripheral information distracts from the core of fisheries management: objectives, controls, arrangements for applying controls, and monitoring.

This plan represents a start on some desirable elements that may be too complex to accommodate in their entirety at the initial introduction of the plan. Examples of these are: ecosystem approach to fisheries management, precautionary approach, quantitative stock assessment, a large number of management objectives. In short, the approach to these concepts in this plan is: “learning to walk before running”.

This plan is not driven by stock assessment. Using experience from the Western Pacific (Papua New Guinea, Solomon Islands, Palau) where years of quantitative stock assessment work had very little impact on management of baitfisheries, an adaptive approach is used in this plan. The fishery is to be closely monitored for trends in catch rates which are used to adjust management controls if required.

Although this plan relies heavily on past work on the baitfishery in the Maldives, it also incorporates the sentiments of an August 2012 meeting of baitfish specialists from the central Indian Ocean, western Atlantic, western Pacific, and eastern Pacific, as well as the results of a recent global study of baitfish management (Gillett 2012).

Some Definitions and Explanations

In this document:

- The terms “bait”, “baitfish”, and “baitfishery” concern live baitfish used in pole-and-line tuna fishing.
- “Management” is defined to be “interventions in support of established objectives”.
- “Fisheries management agency” is the government entity that has overall responsibility for formulating and implementing fisheries management, currently the Marine Research Centre (MRC).
- Interventions can be:
 - Legal instruments (equivalent to controls, rules, measures, regulation), or
 - Action to develop or to increase awareness, such as introducing new gear technology or carrying out an educational program to reduce bait wastage.

The fishery for live bait for pole-and-line fishing is closely related to the fishery for handlining for yellowfin – and many of the management issues overlap. In keeping with the general theme of simplicity, the handline baitfishery is not included in this plan – but once this plan has been successfully implemented there is the possibility of expanding the scope to include the handline baitfishery.

The Baitfishery in the Maldives

General Information

- The baitfishery in the Maldives is very well documented. Summaries of many aspects are given in Anderson (1997), Adam (2006), Anderson (2009), and Gillett (2012).
- Traditionally, baiting was carried out first thing in the morning. A simple, cotton lift net was deployed from one side of the fishing boat using long poles. Starting in the 1970s a number of developments and innovations revolutionised the livebait fishery, especially the use of nylon nets, much larger pole-and-line vessels, and night baiting using lights. Currently, most bait is obtained at night using lights.
- For almost 30 years MRC has collected data on baitfishing activity, and a large amount of data have accumulated at MRC. For various reasons the information has never been adequately analysed. It was the intention to analyse at least some of the data during initiatives in 2000-2004 and in 2009, but due to staff turnover the planned analysis did not occur. A major recent change has been the introduction of a new data form in 2010 – prior to that date trends in catch rates could not be readily ascertained from the data collected.

Anderson (2009) gives the species composition

Bait variety	Scientific Name	Centre & North (Day-time)	Centre & North (Night-time)	Southern Atolls (Day-time)	Southern Atolls (Night-time)
Silver sprat	<i>Spratelloides gracilis</i>	23-43%	26-100%	20-59%	50-90%
Anchovy	<i>Encrasicholina heteroloba</i>	0-4%	0-10%	3-35%	4-12%
Blue sprat	<i>S. delicatulus</i>	0-8 %	0-71%	12-30%	3-38%
Fusiliers	<i>Caesionidae</i>	30-53 %	0	8-29%	0
Cardinalfishes	<i>Apogonidae</i>	8-28%	0-16%	0-8%	0
Others		1-3%	0-10%	0-8%	0-3%

Stock Condition and Structure

- Anderson (1997) states there has been no stock assessment, so the status of livebait stocks is unknown. In general, it is believed to be rather difficult to overfish stocks of small, highly fecund pelagic fishes such as the sprats upon which the Maldivian livebait fishery heavily depends. There are no clear signs of overfishing so far, but given the enormous importance of the livebait fishery, it would be prudent to initiate stock assessment activities.
- Anderson (2006), using an empirical relationship between primary productivity and small pelagic fish yield, makes an estimate of maximum sustainable yield for Maldivian baitfish of about 13,000 ± 2,000 tonnes per year.
- Adam (2011) states that the MRC has undertaken a series of studies on the livebait fishery. Collaboration between CSIRO, Australia, and MRC, under ACIAR funding in the early mid-1980s,

provided important biological information on major species. Surveys done by MRC in the 1980s and 1990s provided important insights on the fishery dynamics, its seasonal and regional variations and estimates of livebait utilization. Despite fishermen's reports of livebait shortages in recent years, livebait utilization has remained more or less constant. Data shows that livebait utilization has linearly increased with the increase in tuna catches implying that there are no declines in availability of livebait.



It has been estimated that annual baitfish harvests in the mid-2000s were about 15,000 tonnes.

- Work on the same anchovy and sprat baitfish species in the western Pacific indicates a degree of genetic isolation between the various baitfishing grounds (Daly and Richardson, 1980). This suggests that each lagoon baitfish population be managed as a self-recruiting meta-population (P.Dalzell, per.com.). Overall, Dalzell and Lewis (1989) indicate that these common baitfish species have a fairly high resilience to fishing pressure.

Current Levels of Baitfish Exploitation

- Until just recently the quality and coverage of the baitfish data collected has not allowed annual baitfish catches or trends in those catches to be estimated. The recent data has not yet been analysed for annual catches or to ascertain if the data quality would allow for such estimates.
- Anderson (2009) states that while there were particular concerns about the status of baitfish resources in some atolls during 2003-06, pole and line fishing effort has fallen about 25% since that time, with a consequent reduction in bait catch. A baitfish monitoring programme has commenced and is focused on four northern atolls (Noonu, Raa, Baa and Lhaviyani).
- Similarly, staff of the Fisheries Management Agency estimate that annual tuna catches by the pole-and-line fleet have averaged 80,000 to 90,000 tonnes in recent years, with the all-time high being 120,000 tonnes in 2006. This suggests that baitfish catches are now well-below the maximum reached half decade ago.
- Adam (2011) indicates that bait used per fishing trip increased from 30 kg in the 1970s to about 400 - 600 kg at present, due to larger pole-and-line vessel size. It has been estimated that annual baitfish harvests in the mid-2000s were about 15,000 tonnes.

Tuna fishing vessel operated in Maldives



Current Regulation of the Fishery

- The legal basis for the management of the baitfishery and other fisheries in the Maldives is the Fisheries Law (Law No. 5/87). New fisheries legislation was drafted several years ago but has not yet been enacted. According to MRC staff, that proposed legislation requires the Minister of Fisheries to formulate fishery management plans and gives the Minister substantial powers to impose necessary fisheries management. There is a trend in the Maldives in recent decades to devolve management authority away from the central government to atoll and island councils, so baitfishing could conceivably be regulated on a national basis or at the levels of atolls/islands.



Bait fishers do not have much experience of having controls applied on their activities.

- Bait fishers do not have much experience of having controls applied on their activities. Before any such controls would be accepted, much awareness raising and education would be required. Currently, fishers often ignore the controls on fisheries, including those for the baitfishery. At least some of the deterrent value of the national regulations is lost because of poor enforcement (cumbersome enforcement process, insufficient resources for enforcement).
- Current regulation of the baitfishery is very limited – and much of what exists was not specifically formulated to mitigate problems in the baitfishery. Examples of controls are:
 - Baitfishing is specifically banned from within 1,000 metres of the tree-line on resort islands by a regulation issued in January 2012 under the Tourism Act.
 - A provision in the Diving Regulations under the Tourism Act states that [tourist] “diving should be avoided in the same area whilst fishermen are engaged in bait fishing”.
 - The export of livebait species has been banned since 1993.
 - Fishermen from one island are discouraged from fishing for bait (or anything else) in the immediate vicinity of another inhabited island.
 - Coral mining was banned on major livebait fishing reefs by a President's Office decree in 1990.
 - If scads are caught by baitfishing in a lagoon, baitfishing by non-residents of that atoll is not allowed.
 - It is not permitted to catch scads from any inhabited island lagoons using nets as these fish are an important source of local food.
 - Baitfishing that disturbs coral (e.g. the use of sticks to pry out bait) is banned on some atolls.

Current Management Issues and Difficulties in the Fishery

Possibility of Over-Exploitation

Bait fishers in the Maldives occasionally complain about baitfish shortages, especially in the southern atolls. While the limited information suggests that chronic over-exploitation of baitfish in the country is not a problem, it is difficult to sort out with the available data any natural fluctuation with fishery induced changes. There is current no robust system in place for detecting baitfishing depletion or mitigating any fishery-induced depletion.

Attitudes of Fishers towards Management

Traditionally, Maldives fishers targeted very large resilient fishery resources that showed little response to heavy fishing pressure (e.g. skipjack, baitfish) which endured without management for centuries. This experience has produced the concept of unlimited fishery resources – and hence fishers have little awareness of the need for, and benefits of, fisheries management. To modify their attitudes will take much time and effort. An analogy has been drawn between the attitudes of Maldivians towards family planning (which has undergone positive change in the last few decades) and fisheries management (where the process of change is just beginning).

Interaction with Tourism

Tourism is the largest economic activity in the Maldives, accounts for 28% of GDP, and over 90% of government tax revenue comes from import duties and tourism-related taxes. The Maldives tourism industry is focussed on the high-end of the market and has a large marine focus – both of which are largely incompatible with nearby industrial fishing activity. To preserve Maldives as a premium tourist destination, some degree of control on baitfishing activities is required to assure in the vicinity of resorts, the abundance of marine life, perceptions of pristine environment, and the absence of pollution by noise and lights.



Bait are poorly handled

Other Issues and Difficulties

Several other issues and difficulties are associated with the bait fishery. Recently it has become apparent that, relative to other pole-and-line fisheries in the world, there is significant waste of baitfish in the Maldives due to poor baitfish handling techniques. There is some question as to the impacts of baitfishing on the ecosystem (removal of juvenile reef fish) and on physical environment (e.g. anchoring pole-and-line boats in coral areas). There has been at least some mention of the interactions between baitfishing and endangered, threatened, or protected species – and information needs to be collected on this subject to determine the magnitude of the problem. Baitfishers have been especially vocal in recent times about: (a) the escalating use of bait-attraction lights at night, with a major problem being the need for all vessels to increase the number and intensity of lights to maintain catch levels; and (b) the use of scuba gear in baitfishing with a major problem being the need for all vessels to use the gear to maintain catch levels.

National Versus Atoll Regulation of the Fishery

This plan is a national plan with national objectives. Considering practicalities, especially enforcement difficulties, it is recognized that some issues are best dealt with at the national level and others at the atoll level. Accordingly, for those issues where atoll level authorities are more sensitive and/or better able to enforce rules, the role of MRC should be to point out to the atoll councils the issue and make suggestions for rules, but the rules would be considered atoll rules. Examples of this would be dealing over-exploitation of baitfish through controls on fishing gear. On the other hand, some issues are best treated uniformly across all atolls and some rules can be enforced better at the national level. An example would be the exclusion zones around resorts. It is realized that at the authorities at atoll level are not currently ready to assume significantly increased fisheries management responsibilities, so that such changes need to evolve slowly.

The Objectives of the Management of the Fishery

If we consider the core of fisheries management to be interventions in support of objectives, the setting of objectives is critically important in the management process. Through extensive discussions with stakeholders, important issues and difficulties in the fishery can be identified. Those that can be addressed or mitigated through various types of governmental action can be transformed into objectives and acted upon. From a practical perspective, not all objectives can be addressed simultaneously or given the same degree of attention, hence some need for prioritizing objectives.

The experience of MRC staff, the documentation on the baitfishery, and initial stakeholder discussions point to several objectives grouped into two levels of priority. The objectives and their priorities need to be further refined by broader stakeholder discussions in the period between this draft management plan and the final plan.

The major objectives of the management of the baitfishery and their priorities are tentatively established to be:

Highest priority:

- Protection of baitfish resources to assure their continued availability for pole-and-line fishing (i.e. reduction of risk of depletion)
- Creation of an awareness among bait fisheries of the need for, and benefits of, fisheries management

Secondary priority:

- Reduction of negative interactions between the baitfishery and tourism
- Reduction in baitfish waste during baitfishing operations
- Reduction of negative impacts of baitfishing on the ecosystem and physical environment
- Reduction of negative impacts of baitfishing on endangered, threatened, or protected species

Objective #1: Protection of Baitfish Resources

Guiding principles	Strategies	Options for Specific Interventions (to be finalized in final management plan)
<ul style="list-style-type: none"> • In the regulation of the fishery, disruptions to established fishing practices in the fishery are to be minimized. • Most of the formerly significant pole-and-line fleets in the world no longer exist due to declining profitability. This new management scheme should not unduly contribute to the financial demise of the Maldives pole-and-line fishery. • Some of interventions are to be adopted but held in reserve until monitoring shows fishery-induced declines in baitfish catch rates. • More appropriate monitoring of the fishery is required. The collection of basic/simple information that is relatively easy to analyse should be favoured over more comprehensive schemes. • Any controls placed on the fishery must have a reasonable chance of being enforced. • A small number of well-enforced controls is better than a large number of that are associated with non-rigorous enforcement. • A few sensible management measures (especially at the beginning) that are understood by baitfishers are better than an array of measures that may confuse/alienate fishers. • Relying on new sources of baitfish and the culturing of baitfish to relieve over-exploitation difficulties is largely wishful thinking – and in no way should replace the more proven fisheries management interventions. • Any increase in exclusionary zones around atolls should be accompanied by increased responsibilities of resorts to collect and report surveillance-type information. 	<ul style="list-style-type: none"> • Some management measures are to be applied at all times, while some measures kick-in only when monitoring shows they are needed. • Baitfish stock structure suggest that atoll-level management makes the most biological sense. • Monitoring of baitfishing needs to be focussed on detecting changes in catch rates at the atoll level. • Those controls that are enforceable are to be favoured over those that may have more biological justification but rely on non-existent enforcement mechanisms. For example, effort limitations are often what is really needed to prevent over-fishing but in the Maldives exclusion zones have a much greater chance of being enforced. • Those management measures are to be favoured that have enjoyed some degree of success in the Maldives in the past. Initially, emphasis will be placed on enhancing the enforcement of well-known and relatively non-controversial exclusion zones. • Because the freedom to move around between atolls is such an important part of the pole-and-line fishing tradition/strategy in the Maldives, preferential access to an atoll will not be used as a management tool. • Alternative uses of baitfish are to be discouraged before markets develop. • In the long-term those measures oriented to reduction of fishing capacity (i.e. caps of numbers of vessels) are to be favoured over those measures that are oriented towards reducing efficiency of individual fishing units – so that profits in the fishery are not unduly dissipated through regulation. • The established government policy of limiting pole-and-line tuna catches to 100,000 tonnes will discourage baitfish catches from approaching the level in the mid-2000s when there was some concern over depletion. • In the banning of gear (e.g. scuba), consideration should be given to mechanisms that lessen financial hardship on fishers (e.g. a phase out period). • The information needed to achieve this objective (and to some extent, the other objectives) will drive the baitfish research agenda. 	<ul style="list-style-type: none"> • Instigate an improved monitoring regime focused on obtaining information on trends in catch per haul at the atoll level and a requirement for annual analysis of the data. • Carry out a publicity campaign and rigorous enforcement of the existing 1,000 metre exclusion zones around resorts, designated dive sites, and marine protected areas. • Ban the commercial sale in markets of baitfish species for food • Ban the use of scuba gear in atolls where desired by atoll authorities • Require MRC approval for the use of any new gear type (e.g. purse seine, beach seine). • Encourage more efficient use of captured bait (see objective #4 below) • When declines in catch rates are evident: <ul style="list-style-type: none"> ○ Expansion of the exclusion zones around resorts from the present 1,000 metres to 1,500 metres ○ Restriction of the use of baitfish attracting lights (number, intensity) ○ Restriction on the size of baitfishing nets ○ Closing an atoll temporarily to all baitfishing, without discriminating between vessels from different atolls.

Objective #2: Raising the Awareness of Baitfishers of Management		
Guiding principles	Strategies	Options for Specific Interventions (to be finalized in final management plan)
<ul style="list-style-type: none"> The fishers need to be allies of the process of safeguarding fishery resources, not opponents. Controls on the fishery are likely to be resisted unless substantial work is done to persuade fishers of benefits. Modification of fishers attitudes will take much time, almost generational. This large initiative cannot be “projectized” but must be integrated into the work program of the MRC. Islamic principles as applied to marine conservation (e.g. Jauhary and Chamberlain, 1999) should be stressed in the education materials developed. 	<ul style="list-style-type: none"> Considering the magnitude and importance of this awareness raising task, a detailed education/communication strategy should be prepared using professional assistance. The magnitude of raising the awareness of fishers indicates that donor funding will be required to develop a course and adequately present it. Whenever possible, existing awareness material should be modified for Maldivian baitfishers, rather than formulating completely new material. Examples are: Jauhary and Chamberlain (1999), King et al. (2002), and King (1995). FAO and other agencies have training videos that could be modified. Consideration should be given to coupling this awareness campaign with that oriented towards reduction of bait wastage. Examples of fisheries management interventions that are indisputably in Maldivian fishers favour should be publicized, with an example being initiatives to limit purse seine effort in the southwest Indian Ocean. Raising the awareness of baitfishers of management is a huge undertaking that may take considerable time, but the long-term nature and expense of this task should not interfere/delay the implementation of the more straightforward components of this management plan (e.g. publicity campaign and rigorous enforcement of the existing exclusion zones) 	<ul style="list-style-type: none"> Formulation of donor proposal Development of short course on fisheries management, targeting Maldivian baitfishers Development of alternative means of reinforcing the message (e.g. posters, billboards, TV, radio, booklets) Integrate delivery of course into regular work program of the MRC. Periodic field visits for delivery of course Refinement of the course Regular interactions with the public and school children to make everyone aware of the importance of fishery management

Objective #3: Reduction of Negative Baitfishery/Tourism Interactions		
Guiding Principles	Strategies	Options for Specific Interventions (to be finalized in final management plan)
<ul style="list-style-type: none"> The type of tourist resorts thriving in the Maldives are largely incompatible with nearby industrial fishing activity. To preserve Maldives as a premium tourist destination, some control on baitfishing activities is required to assure in the vicinity of resorts, the abundance of marine life, perceptions of pristine environment, and the absence of light/noise pollution. 	<ul style="list-style-type: none"> Exclusion zones around resorts can reduce negative impacts of baitfishing on tourism, as well as contribute to the objective of protecting baitfish resources. The self-interests of tourist resorts should be used as a surveillance tool. Resorts are to be encouraged to report illegal baitfishing activity (especially baitfishing in the exclusion zones) to the appropriate enforcement agency and to the MRC. This can be used as evidence to support the contention of surveillance effectiveness. 	<ul style="list-style-type: none"> A publicity campaign (for fishers, resorts, and local councils) and rigorous enforcement of the existing 1,000 metre exclusion zones around resorts, designated dive sites, and marine protected areas. If required, expansion of the exclusionary zones around resorts from the present 1,000 metres to 1,500 metres

Objective #4: Reduction of Baitfish Waste

Guiding Principles	Strategies	Options for Specific Interventions (to be finalize in final management plan)
<ul style="list-style-type: none"> If bait wastage can be reduced, then the bait requirements of the pole-and-line fleet are decreased, which will tend to mitigate to some degree baitfish over-exploitation. Several baitfish species caught by traditional day baiting were characteristically hardy, and night baiting was introduced to the Maldives from areas where hardy species are prevalent. However, the major species of bait caught by Maldivian fishers at night (e.g. sprats, anchovy) require careful handling to obtain high survival rates, such as those obtained in the western Pacific. Gentler bait handling is the “low hanging fruit”, but potential gains are also likely to be made in efficient use of bait during the chumming operation and improved design of bait tanks on fishing vessels. 	<ul style="list-style-type: none"> Show fishers through various ways the various bait handling techniques that lead to high bait survival, especially replacing “dry scooping” with gentle crowding into buckets. Explore the gear technology side of bait wastage, especially that dealing with the bait tanks: circulation, use of lights in the tanks, smooth tank surfaces. Encourage fishers to store excess bait for later use. Downplay the concept of release of excess bait inside lagoons. Consider linking this awareness activity with Objective #2 above: increasing the awareness of fishers of the benefits of fisheries management. 	<ul style="list-style-type: none"> Prepare a booklet explaining the need for reducing wastage and ways that it can be achieved. Send a Maldivian fisheries extension officer and/or a group of fishers to the Solomon Islands to learn gentle bait handling techniques. Collect materials on bait handling techniques in other countries. Prepare poster and/or video on bait handling techniques. Carry out a nation-wide extension program for baitfishers on reduction of bait wastage

Objective #5: Reduction of Negative Impacts on the Ecosystem and Physical Environment

Guiding Principles	Strategies	Options for Specific Interventions (to be finalize in final management plan)
<ul style="list-style-type: none"> Coral destruction and other physical disturbance of the reef should be discouraged. Any impacts of baitfishing on atoll ecosystem and environment should be minimized and any baitfishing-related activities that result in irreversible changes should be banned. Efforts should be made to reduce bycatch in the baitfishery including of juvenile reef fish. 	<ul style="list-style-type: none"> A mixture of controls and education is required. Local authorities and resorts, being keenly aware of physical and biological impacts of baitfish on the environment, are to be encouraged to report harmful activities to atoll councils and the MRC. The bycatch taken by the baitfishery needs to be quantified, and to do so observers are required. 	<ul style="list-style-type: none"> Ban any baitfishing-related activities that are shown to disrupt coral reefs. Incorporate information on why baitfishers should not disturb coral or take significant amounts of bycatch into the awareness booklet under Objective #2 Collection of information by observers on bycatch in the baitfishery.

Objective #6: Reduction of Negative Impacts on Endangered, Threatened, or Protected Species

Guiding Principles	Strategies	Options for Specific Interventions (to be finalize in final management plan)
<ul style="list-style-type: none"> Because there is little hard data available on this subject, additional objective information is required before any action is taken to address the issue. The issue is sensitive and any action taken (or publicity made) be done so with special care. 	<ul style="list-style-type: none"> The strategy for dealing with ETP species in the baitfishery is to be formulated after the situation is better understood. ETP species involved in the baitfishery need to be quantified, and to do so observers are required. A mixture of controls and education is likely to be required. It is premature to formulate specific controls, but it is not too early to sensitize Maldivian baitfishers on the subject. Consideration should be given to incorporating ETP awareness information into the awareness booklet under Objective #2 	<ul style="list-style-type: none"> Preparation of a booklet for baitfishers on ETP species: general ETP situation in the baitfishery, what an ETP interaction is, why it is sensitive, why Maldivian fishers should be involved in the mitigation of impacts of such interactions, why data is needed, and why such data needs to be collected by observers. Collection of information by observers on bycatch in the baitfishery.

Summary of Management Interventions of the Plan

Summary of Legal Interventions

In the previous sections of this plan a number of legal interventions (i.e. rules with the force of law) have been specified. These can be categorized by:

- Time they are implemented: (a) on adoption of this plan, or (b) when declines in baitfish abundance is detected.
- Level of implementation: (a) national level applicable to all atolls, or (b) atoll level. For the latter, this plan is intended to provide guidance to atoll level authorities who may decide to implement a number of options suggested in this plan.

The legal interventions associated with all six management objectives can be consolidated and summarized as:

Legal Interventions	
National Level	<p><u>On adoption of plan:</u></p> <ul style="list-style-type: none"> • Ban on baitfishing around resorts (1,500 m), designated dive sites, and marine protected areas. • Ban on sale of baitfish species for food • Requirement for MRC approval prior to the use of any major new type of baitfishing gear <p><u>When declines in baitfish are detected:</u></p> <ul style="list-style-type: none"> • Expansion of the exclusion zones around resorts from the present 1,000 metres to 1,500 metres
Atoll Level	<p><u>Atoll authorities have the options of:</u></p> <ul style="list-style-type: none"> • Restriction on the use of baitfish attracting lights (number, intensity) • Restriction on the size of baitfishing nets • Ban on use of Scuba gear in baitfishing • Ban any baitfishing-related activities that are shown to disrupt coral reefs. • Closing an atoll temporarily to all baitfishing, without discriminating between vessels from different atolls.

The above interventions require legal drafting, approval by government, and gazetting. The three cases given in the table (immediate implementation, conditional implementation, and the optional atoll-level implementation) require different treatment in the drafting process.

Summary of Interventions Dealing with Monitoring, Development and Awareness

The development/awareness interventions associated with all six management objectives can be consolidated and summarized as:

- Instigation of an improved monitoring regime focused on obtaining information on trends in baitfish catch rates
- Carrying out a publicity campaign on the existing exclusion zones around resorts, designated dive sites, and marine protected areas.
- Development of awareness material for baitfishers on:
 - The rationale for fisheries management
 - Reducing baitfish wastage
 - The reasons for not disturbing coral or taking significant amounts of bycatch
 - The ETP situation in the baitfishery and why fishers should be involved
- Periodic delivery of the above awareness material throughout the Maldives
- Development of observer program

The above development/awareness work is long-term and costly – but these features should not interfere/delay the implementation of the more straightforward legal interventions of this plan.



Awareness poster

Monitoring Associated with this Plan

The collection of data on the baitfishery is to be re-oriented to obtaining information that can be used to give trends of catch rates in the fishery and that is relatedly easy to analyse.

On an opportunistic basis, more sophisticated analysis should be carried out using external expertise – but the lack of that expertise should not be used for justifying the delay of more simple analysis, such as changes in catch per unit effort.

MRC is to report the results of the analysis on an annual basis.

Monitoring is not limited to fishery performance: this plan encourages the reporting of infractions to atoll and national enforcement authorities – and MRC is responsible for collecting/compiling that enforcement-related data. In addition to being useful to gauge problem areas and the rigor enforcement activity, that data will be useful for MSC purposes, because the Maldives needs to provide “evidence that the strategy for reducing risk of depletion of baitfish resources has been implemented” and “some objective basis for confidence that the partial strategy is working”.

Implementation and Adherence Considerations



Weighing bait

Experience shows that the most challenging difficulty with fishery management plans in developing countries is the failure to implement or adhere to plans after some form of formal adoption (Gillett 2012). Accordingly, the approach taken here is to make the plan easy to implement and include multiple mechanisms to encourage adherence.

Easier to implement:

- This plan is intentionally short and simple, with a small number of non-complex interventions.
- The more “do-able” legal interventions are partitioned off from the more aspirational, costly, and time consuming development/awareness work, so that the latter does not stall the implementation of the relatively easy rules.
- MRC is required to nominate a professional staff member who has primary responsibility for the details of plan implementation, including giving wide-publicity to the legal interventions. The designated person will assume a substantial amount of new work associated with this plan and therefore reductions in other work obligations are required.

Multiple mechanisms to assure adherence:

- The legal interventions are to be drafted into regulations that will have the force of law.
- There is a requirement that MRC convene an baitfishery stakeholder consultation each year.
- The MRC-nominated staff member with responsibility for plan implementation also has plan adherence responsibilities and is the primary contact point with stakeholders over plan adherence matters.
- Any stakeholder who is aggrieved by the plan, its implementation, or lack of adherence to plan provisions is authorized to communicate in writing to the Director General of MRC who is required to respond in writing within three weeks, indicating that corrective action will be taken, or why such corrective action is not required. If the aggrieved stakeholder remains unsatisfied, that person is allowed to communicate his views in writing to the Minister responsible for fisheries.

Stakeholder Consultation and Modifying this Plan

Two types of consultation with stakeholders are required under the plan:

- Extensive consultation with fishers, atoll authorities, commercial companies, other government ministries, and interested parties in transforming this draft plan into a final plan ready for government adoption.
- Regular consultations on an annual basis with the above stakeholders to discuss the functioning the plan during the previous year, problems that have arisen in the fishery, and any need to amend the plan. In annual consultation MRC will report on the progress in implementing the plan and on the analysis of the baitfishing data.

Amendments to the plan will be required periodically. This will be in responses to changing conditions in the fishery and to the need to refine the management process (i.e. principle/strategies, and interventions). Proposals for amendments can arise from within the MRC, from stakeholders during the annual consultations, or from the Minister. Minor amendments can be approved by the Director General of MRC, while major amendments will be discussed at the stakeholder consultation and subsequently forwarded to the Minister for approval or otherwise. The distinction between minor/major amendments is that the latter requires changes to the legal interventions and must pass through the standard government legal process.

Financial considerations

The plan has small number fairly simple rules. After formal adoption of the plan by the government, the major task associated with implementing those rules is the legislative drafting – and there is government expertise available for that work.

In this plan there is the principle that lack of financing for some interventions should not prevent aspects of the going ahead that require little/no financing. In other words, the more aspirational aspects of the plan (i.e. development/awareness work) should not delay the simple application of rules.

On the other hand, the interventions of the plan that deal with development and awareness are much more costly. The types of these activities that fall outside MRC's normal work programme are a publicity campaign on current national baitfishing rules, the development of awareness material for baitfishers (especially that for a short course on rationale for fisheries management), the periodic delivery of this awareness material throughout the Maldives, and the development of an observer programme. With the exception of the latter activity¹, there is considerable justification for donor support: the activities tend to be catalytic, could eventually be applied to other fisheries, and to a degree are applicable to areas outside the Maldives. Accordingly, a donor proposal is to be formulated – and considered part of the implementation of this plan.

¹ In other areas of the world observer program development is at least partially funded by regional fishery bodies.

References

- Adam, S. (2006). Country review: Maldives. In: Review of the State of World Marine Capture Fisheries Management: Indian Ocean. Food and Agriculture Organization of the United Nations, Rome.
- Adam, S. (2011). Livebait Management Program – Maldives. Marine Research Centre, Male
- Anderson, C. (1997). The Maldivian Tuna Livebait Fishery: status and trends. In: Workshop on Integrated Reef Resources Management in the Maldives, Bay of Bengal Programme.
- Anderson, C. (2009). Technical Assistance to Bait Fisheries Monitoring - Final Report. Maldives Environmental Management Project.
- Daly, C. and B. Richardson (1980). Allozyme Variation Between Populations of Baitfish Species *Stolephorus heterolobus* and *St. devisi* (Pisces: Engraulidae) and *Spratelloides gracilis* (Pisces: Dussumieriidae) from Papua New Guinea waters. Australian Journal of Marine and Freshwater Research 31(5) 701 - 711 (1980).
- Dalzell, P. and A. D. Lewis (1989). A Review of the South Pacific Tuna Baitfisheries: Small Pelagic Fisheries Associated with Coral-Reefs. Marine Fisheries Review, 51 (4).
- Gillett, R. (2012). The Management of Tuna Baitfisheries: The Results of a Global Study. International Seafood Sustainability Foundation, Washington DC, 72 pages.
- Jauhary, A.R and A.I. Chamberlain (1999). Understanding Fisheries Science 2. Educational Development Centre, Ministry of Education, Maldives.
- King, M., L.Lambeth, S.Sauni, J.Veiliyaki, V.Vuki, A.Vunisea and T.Chamberlain (2002). Fisheries Management. University of the South Pacific Marine Studies Programme, Suva and Secretariat of the Pacific Community, Noumea.
- King, M. (1995). Fisheries Biology, Assessment and Management. John Wiley & Sons

