



FISHERIES TSUNAMI EMERGENCY PROGRAMME

MALDIVES

Fisheries sector rehabilitation mission report

by
Oyvind Gulbrandsen, Naval Architect

25 March to 11 April 2005

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Catching skipjack tuna on the ASDHAAN

REPORT

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Appendix 1. Drawings of 4.5 m boat MDV – 1

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1. SUMMARY AND CONCLUSION

1.1 Boats and boatyards

- The Maldives has a long tradition in boatbuilding. The Dhoni is a design with excellent qualities when propelled by sail or oars.
- Wooden boats for the tourist industry are being built in sizes up to 40 m (135 ft) by Master Boatbuilders, mainly from the Raa atoll, using imported timber and copper fastenings.
- There are five FRP boatyards near Male building boats mainly between 9 m (30 ft) and 23 m (75 ft) from moulds, mainly for the tourist industry.
- Since 1996 there has been a trend in building increasingly larger FRP pole-and-line fishing boats from one-off moulds in temporary sheds. Boats up to 30 m (100 ft) in length have been built and there are plans of even larger boats.
- Some of the larger boats have encountered structural problems.

1.2 Government plans.

- The Ministry of Fisheries, Agriculture and Marine Resources (MOFAMR) will build 89 FRP boats of 4.5 m to replace damaged or lost wooden Bokura boats due to the Tsunami.
- MOFAMR plans initially to build 20 pole-and-line boats of 26 m (85 ft) length and later 30 more. Bids for building the boats have been received from established boatyards. The boats will be built using an existing mould belonging to MOFAMR.
- MOFAMR wants to encourage the development of a Maldivian longline fishery using vessels built in Maldives.

1.3 FRP version of the traditional wooden Bokura.

- The design of a FRP version should not be a copy of the existing wooden Bokura.
- Drawings for a 4.5 m boat in FRP have been prepared (MDV-1). Appendix 1.
- The lofting and the cutting of the frames to be done by the two MOFAMR Master Boatbuilders.
- The construction of the plug, four moulds and 30 boats to be made by a selected experienced boatyard.
- MOFAMR personell to participate in the building of the plug, the mould and the first three boats.
- MOFAMR personell and the FAO Boatbuilder to be responsible for the planning of the training programme and building of the remaining 59 boats at three selected centres in the atolls mainly affected by the Tsunami.
- The outboard engines supplied through the rehabilitation project should be 3 hp long shaft (570 mm transom) and of a model that is already represented by spare part dealers in the Maldives.

1.4 Proposed FAO assistance.

- a. FRP Training Specialist for a one month mission when the training programme and moulding of the first 4.5 m boats starts. See Appendix 2.
- b. Organize and finance of a study tour to other countries doing pole and-line fishery and tuna long-lining by persons from MOFAMR and the fishing industry together with an FAO appointed person. The objective of the study tour is to determine alternative ways of keeping live bait in wells and a suitable design of a tuna long-line vessel for the Maldives.
- c. Advance the project for trials of a RSW system on the 30 m (101 ft) pole and line boat "Shams".
- d. Make further stability calculations of the "Shams", based on existing data, to see what changes are required to satisfy international standards on stability.

- e. Strength investigation of 26 m (85 ft) pole and line boat by selected classification societies to determine required scantlings for FRP construction.
- f. Propose modifications on future pole and line boats, based on findings on study tour and stability and strength investigation.
- g. Specialist on safety regulations for fishing boats to assist the Ministry of Transport and Aviation.
- h. Specialist on structural design of large FRP boats to assist the Ministry of Transport and Aviation in developing scantling standards.
- i. Organize a training course for representatives from the boatbuilding industry to improve on general understanding of principles of Naval Architecture and their application for boats built in Maldives.
- j. Provide technical assistance in the construction of the 26 m (85 ft) pole and line vessels.
- k. Based on the findings of the study tour, select a Naval Architect to provide detailed designs for a FRP long-line vessel to be built in Maldives, including follow up during construction and delivery of the prototype vessel.
- l. Master fisherman for training of the crew on the prototype long-line vessel.

2. Terms of reference

Under the general guidance of the Chief TCEO, the technical guidance of the Chief FIIT and under the direct supervision of the FAO Representative in Maldives and in close cooperation with the FAO fisheries advisor, the government counterpart officials, national and atoll authorities, the consultant will assist the government with the initial preparation of the design and construction of fishing vessels to replace vessels that were destroyed or lost during the Tsunami. In particular, the consultant will undertake following duties:

- 1) Investigate the capacity of local boatyards (as well as other industry providing service to the fishing industry) to produce new vessels, engines and other related equipment and to carry out repairs on existing vessels and equipment. Identify how much local knowledge there is in boatbuilding and repair work and if training is needed.
- 2) Identify Government development plans and strategy relating to the sector.
- 3) Assist the Government in refining the design of small traditional vessels "Bokuras" in fibreglass construction using the traditional (wooden) design.
- 4) Prepare detailed TOR for a 6 months assignment of a naval architect who shall 1) assist the Government in developing standards for the design, construction and equipment of fishing vessels, 2) prepare a detailed design of a 21 metre long vessel in fibreglass construction and 3) assist the Government, in cooperation with a fisheries expert, in developing a long line fishery with these new 21 metre long vessels.
- 5) Prepare inputs to project proposal(s) for medium/long-term assistance (6-24 months) in the new construction of small and medium size fishing crafts.
- 6) Prepare mission report and submit to TCE within 1 week after the completion of the assignment for technical clearance.

3. OBSERVATIONS

3.1 Boats and boatbuilding industry in the Maldives



Small Dhoni



40 m safari boat under construction in Himmafushi, Male atoll



Mould transom of a 30 m pole-and line boat in Viligili village, Gaafu Alifu atoll

Dhaalu atoll had learned to loft the frames in full size from a faired drawing. The frames are cut from 12 mm plywood and supported from the ground by numerous sticks. The inside battens are covered with diagonal strips of 3 mm "Fancyply" with one side plastic covered giving a smooth surface for applying the gelcoat and the FRP materials. The moulding of the



One off mould for 30 m pole- and line boat under construction in Viligili village

Maldives, with 36 major atolls spread over a distance of 800 km from north to south, has all through its history been dependent on boats. In spite of being limited to using coconut palm timber for planking, the most difficult boatbuilding timber in the world, boats of excellent design for propulsion by oars and sail have been developed. Through the boatbuilding training centre at the Alifushi island in the Raa atoll, the use of imported timber, mainly Balau and Merbau from Malaysia and copper rivets for fastenings has spread. The best boatbuilders are reputed to come from the Raa atoll and we met groups of boatbuilders from Raa both in Villingili, near Male, repairing wooden boats and in Himmafushi building a wooden Safari boat of 40 m (135 ft). It is evident that wooden boatbuilding is still active in the Maldives.

FRP as a construction material has a fairly recent start in Maldives, but has developed very rapidly with boatyards near Male building mainly passenger boats from 9 m (30 ft) to 23 m (75 ft). A very recent development starting from 1996 is the building of 20 m (75 ft) to 30 m (100 ft) tuna pole-and-line vessels from one off moulds. The boats are built in makeshift sheds covered with galvanized iron roofing plates giving protection from the sun, rain and wind. The one off moulds are made by Maldivian Master Boatbuilders by eye, using a few main frames and with longitudinal

battens shaping the boat and the intermediate frames. One boatbuilder we visited in Thinadhoo in the Ghaafu Dhaalu atoll had learned to loft the frames in full size from a faired drawing. The frames are cut from 12 mm plywood and supported from the ground by numerous sticks. The inside battens are covered with diagonal strips of 3 mm "Fancyply" with one side plastic covered giving a smooth surface for applying the gelcoat and the FRP materials. The moulding of the hull is done by a team of Sri Lankan workers specialised in this type of work. It is evident that Maldivian boatbuilders are not afraid of venturing into new territory. The risks are however high and some boats were said to need extensive structural modifications after launching. FAO assistance to this industry would be most useful in developing regulations on safety and in structural design as outlined below. This is also the need felt by the Ministry of Fisheries, Agriculture and Marine Resources (MOFAMR) and the Ministry of Transport and Aviation.

3.2 FRP version of traditional “Bokura”



Bokura with 4 hp outboard engine. Note lack of freeboard aft

3.2.1 Design

During the Tsunami an estimated 89 wooden traditional boats called Bokura of length between 4.0 m to 5.0 m length were destroyed. The MOFAMR recommended that the replacement craft should be built in FRP. The traditional Bokura is a double ended craft of very heavy wooden construction. It is an ideal craft taking into account the construction material and its use with oars or sail for propulsion. The majority of the Bokuras are now powered with outboard motors of 3 – 5 hp. We did trials with several Bokuras powered with 4 hp outboard motors and observed that the pointed stern sinks deep down in the water under full speed so that the freeboard under the platform at the stern is practically nil. To make a direct copy of a Bokura in FRP, I consider to be a mistake for two reasons:



FRP Bokura in Villingili

- The FRP version would be much lighter and float higher in the water. The lower waterline beam together with the much lower weight would make it feel unstable and “tippy”. An FRP version of a Bokura built on Villingili island near Male with traditional transverse section and a transom had unsatisfactory stability and large bilge keels had to be added afterwards.
- The higher speed possible with even a small outboard motor makes it necessary to widen the aft part of the hull to increase the buoyancy and avoid excessive resistance due to the sinkage of the stern. It would then be natural to introduce a transom for fixing the outboard motor. In other countries with traditional double ended boats, one has seen the same development when changing to FRP construction and using outboard motors. In Maldives, the motorized FRP pole and line vessels have also changed from a pointed to a transom stern.

Based on these observations I recommend that the FRP version should utilize the full advantage of this construction method to shape the hull for best use of an outboard motor of 3-5 hp and an average load of 3 persons using handline as the main fishing method (gillnetting is banned in Maldives).

The design of the 4.5 m fishing boat MDV-1, incorporates the following features:

- Sharp bow for minimum resistance, same as the traditional Bokura.
- Flat bottom midship and aft to give maximum stability with the light weight of an FRP hull and to be able to dispense with floorboards except in the V-shaped forward part of the boat.
- Moderately wide transom to give buoyancy aft.
- Deep keel aft to give good directional performance, reduced rolling and protection for the hull when hauling up the beach.

- Hull construction with a thick FRP laminate that permits the elimination of internal frames in combination with the rounded hull section. In the forward part with straighter section, it is necessary to stiffen the hull panel with a built in spray rail. The keel section to be filled with a polyester resin and sand mixture to give protection even when the outer FRP laminate is worn through. The same feature is used on all 19 ft FRP boats produced in Sri Lanka.
- FRP coaming to give stiffness to the hull and incorporating the foredeck, the thwart and the transom seat.

The drawings for the 4.5 m FRP boat, design MDV-1, are given in Appendix 1. The drawing of the deck will be prepared well in advance of building the plug for the deck mould.

3.2.2 Construction of plug and mould for 4.5 m boat.



Plug under construction

The MOFAMR has experienced master boatbuilders in Ahamed Hassan and Mohamed Shameem who will be responsible for the lofting of the boat in full size and cutting the frames out of 12 mm plywood. The frames stem and the transom will then be taken to the chosen boatyard for erection on a jig. The plug construction is done following principles commonly used by boatyards in Maldives, where the 12 mm plywood frames are mounted on a jig and thin longitudinal battens fixed to the frames. The hull is then clad diagonally with strips of 3 mm plywood fixed with contact glue. It is not recommended to use the plastic covered plywood

(Fancyply) used on the moulds for the large boats because of the curvature of the small hull. A cover of 300 g/m² of CSM and polyester resin is applied to the plywood and fairing is done with a mixture of polyester resin and talcum powder. Final sanding of the surface gives the required smoothness. The construction of the plug and the four moulds required should be made in a boatyard with experience with this type of plug making. The construction of the plug for the deck should be done using the first hull cast in the mould as a pattern.

3.2.3 Construction of the 4.5 m boat.

A total of 89 boats are to be delivered. To speed up delivery, MFAR suggested that 30 boats are to be built in the same established boatyard making the plug and the four moulds. The remaining 59 boats are to be produced in three selected atoll centres close to the Tsunami affected areas and built through a training program in FRP construction. The trainees will first undergo an introductory course in FRP before starting the actual moulding. The MOFAMR will provide experienced supervisors in each of the three repair centres. The FAO boatbuilder, Derreck Menezes, together with the MFAR will be responsible for the organization of the training scheme, including establishment of boatbuilding sheds and order of materials from suppliers in Male.

3.2.4 Outboard motor for the 4.5 m boat.

FAO had been offered free Chinese outboard motors of 5 hp for the boats. I do not recommend this solution. These engines are unknown on the world market and not represented by spare part dealers in Male. To introduce these engines in a market dominated by Japanese makes such as Yamaha and Suzuki could be very risky. It is probable that Japanese bilateral aid would supply the required engines free of charge if requested by the MFAR. I recommend an outboard engine of the following specification to ensure fuel economy and easy portability:

Power of 3.0 hp at maximum rpm.

Standard long shaft for a transom height of 570 mm.

Neutral gear position in addition to forward gear

3.3 General safety features concerning Maldivian pole and line boats.

3.3.1 Stability

In general one should aim at satisfying the International Maritime Organization (IMO): “Code of Safety for Fishermen and Fishing vessels Part B”, which concerns fishing vessels of above 24 m (78 ft) in length. The stability investigation done by FAO in 2003 on a 15 m (50 ft) and a 30 m (100 ft) revealed that the boats do not satisfy the IMO requirements at larger angles of heel due to low freeboard and hatch covers that cannot be clamped down quickly. The hatch covers presently used over the engine room and the fish holds are loose and would be washed away with seas on deck. The boat would then certainly sink because of lack of intact buoyancy compartments. The pole-and-line boats built in Maldives have high initial stability because of a very large beam in relation to the depth of the hull. Beam to depth ratio varies between 4 to above 6. Normal beam to depth ratio for fishing boats of this size is between 2 to 3. The reason for this extreme low depth in relation to the beam is the need for low



30 m Pole and line boat with a good catch of skipjack tuna. Note lack of freeboard aft.

freeboard aft when catching tuna with the pole and line method. The boat I went fishing on had in fact zero freeboard and water on deck aft when it was fully loaded.

The question is which of the IMO requirements would have the greatest effect on general safety of the Maldivian pole-and-line fishing boats? The following measures should be investigated:

- Increase of freeboard. From a fishing point of view, a low freeboard is desirable. From a safety point of view, a high freeboard is desirable. A compromise here is required. A higher freeboard would give a benefit in a larger bait and fish hold capacity.
- Engine room coamings to be increased in height to a minimum of 600 mm.
- Hatch cover for the engine room be made weathertight and normally clamped down.
- Engine room entrance should have a height of the sill of minimum 600 mm and capable of being rapidly closed.
- Hatches to the fish holds should preferably have a coaming, but flush hatches are acceptable if the hatch covers are hinged, are fitted with a gasket and can be rapidly clamped down.
- Engine room ventilation openings should be as high as possible above deck. The engine room should have forced ventilation of a capacity recommended by the engine manufacturer. Ventilators for fresh air inlet should lead to the lower level of the engine room.

The available stability data on the 15 m and the 30 m boats should be used by FAO to make a new investigation to see whether these measures could satisfy the IMO requirements. In this regard it should be noted that the IMO requirements give some flexibility with regard to the heights of coamings, stability criteria, etc

3.3.2 Structural design

The traditional Maldivian pole and line fishing boats have a very low depth of the hull compared to the length of the hull. Classification societies require that boats with such a high length to depth ratio are not covered by the general rules and require special consideration. The reason is that longitudinal strength is depending on the depth of the hull girder. In addition to the low depth, the structural design of typical Maldivian pole and line boats show little concern for structural continuity in the deck with some deck openings going almost from one side to another. In addition there is often no continuity of the longitudinal bulkheads. In the bait hold there is mostly no longitudinal bulkhead at all. I recommend that one or two Classification Societies are requested to investigate methods of ensuring sufficient strength in the 85 ft hull and the deck with minimum use of materials.

3.3.3 Live bait wells



Baitwell. Plugs for watercirculation towards side. Split plastic pipes used as mould for stiffeners.



Baitwell hatch. The diver has unplugged one of the hull openings. Note plastic pipe to the left for insertion into the hole.

Pole and line fishing for tuna is done in many parts of the world, some fishing from the stern as in Maldives and some from the bow (Japanese style). One major difference between the techniques used in other countries and in Maldives, is the method of keeping the bait alive in the bait well. In Maldives the bait is kept in one large bait well stretching from one side of the boat to the other. I was told that Maldivian master fishermen are strongly opposed to subdivision of the wide bait well by longitudinal bulkheads because it restricts the water flow through the well. Circulation is achieved through a system of plastic pipes which are inserted into holes in the bottom of the boat. The pipes are shaped so that the water is scooped up into the bait well when the boat moves forward. To assist in the supply of water when the boat is not moving, a separate small engine driven pump placed on the deck is provided. The height of the water level in the bait hold is decided by the height of the scoop pipes inside the bait well. The system permits the water level in the bait hold to be higher than the outside water level and is normally fairly close to the deck. There is, however a free surface effect with the water sloshing back and forth, which is detrimental for the bait. In other areas of the world one generally relies on forced circulation of the water into the bait well. The water is introduced into the well with a vertical pipe with many holes placed in such a way that a circulation pattern along the sides of the well is produced. The bait likes to swim against the current and will follow a swimming pattern along the sides of the well. Tests on survival of the bait have shown this to be important. The tests revealed that the corners of the tank should preferably be rounded and the colour light green. There is an overflow of water over the top of the coaming and to the side of the boat. The sides of the coaming are

high and the hatch size limited to reduce stress on the bait caused by the free surface effect with water sloshing back and forth. The introduction of this system should be considered in the Maldives since it would have a beneficial effect on the General Arrangement, permitting the large side to side bait well used at present to be split into

smaller wells with longitudinal and transverse bulkheads. It should also increase the survival of the bait since circulation is assured regardless of whether the boat is moving forward or not. It would be beneficial to arrange a study tour to other parts of the world by persons from MFAR and private Master Fishermen so that they can decide for themselves whether this system would be worth trying in Maldives.

3.3.4 26 m (85 ft) boat for pole and line fishing

The MOFAMR has invited bids from FRP boatyards for the construction of 20 boats. In total it is suggested to introduce 50 boats of this type. A mould for this boat belongs to the MFAMR and will be provided to the boatyard selected. I was asked to comment on the design and construction of this boat, but this task was not included in the TOR given by FAO and it was not possible to go into details during my stay. However the observations given above are applicable to this boat as well.



30 m pole and line boat SHAMS

3.4 Tuna longlining

3.4.1 Background

There are about 60 tuna longliners registered in China, Indonesia and Taiwan, with license to fish in Maldivian territorial waters outside a 75 mile limit. None of these boats have Maldivian crew members. The boats are mainly offloading to freezer ships which bring the fish to Asian destinations. Yellowfin tuna is also caught by Maldivian handline vessels which catch horse mackerel and scad in the lagoon and keep it alive in bait wells. Catch rates are high with live bait, but the boats catch only the smaller yellowfin surface tuna. The larger yellowfin tuna and bigeye tuna must be caught with longline fishing much deeper. The MFAR is interested in developing a Maldivian tuna longline industry and to obtain a suitable design for a tuna longliner of to be built and based in the Maldives. A trial of large mesh driftnetting and tuna longlining in the Maldives was done by the Bay of Bengal Programme (BOBP) in 1987 (Explorative Fishing for Large Pelagics in Maldives). The result was not positive for various reasons such as lack of ice for more than one day fishing trips and problems of disposal of catch, a main part of which was shark. The crew was accustomed to short and intensive day trips on pole and line boats and was not motivated for the longer trips required on a tuna longliner. Several of these factors have changed and probably it would be possible to find a Maldivian crew provided the remuneration is higher than in day fishing on pole and line boats.

There are today 2-3 Maldivian exporters with EU approval for air-freighting of loins of fresh tuna to the European market. Some whole fish goes to the Japanese market, but this is a

very special market where the risks are high. Some tuna are sent to Sri Lanka for re-export to Europe. There is today a high demand for fresh tuna.

In Sri Lanka there are today several private companies engaged in buying tuna for export air-freighted to the European and Asian market. Some of these companies have invested in fishing boats to ensure the supply and the quality required for these markets. One company operate six 16 m (54 ft) tuna longline vessels built in Sri Lanka. A major limitation to the size of boat in Sri Lanka is the overcrowding in the few deep water harbours and the few available slipways for larger boats.

3.4.2 Requirements for a tuna longliner for Maldives

- The general arrangement of the tuna longline boats is most commonly with wheelhouse aft, which has the advantage of the helmsman being able to observe the longline being hauled, but there are also many boats now with wheelhouse forward and both engine and steering controls close to the hauling position. This also saves one man in the crew.
- The fishing trips should be 7-10 days to assure freshness. The tuna must be maximum 14 days old from being caught and until consumed by the customer in Europe or Asia. This means a limitation of the 7 to 10 days fishing trips. The fish is chilled in a mixture of ice and seawater, with preferably a RSW system to cut down on ice consumption.
- The maximum number of hooks operated seems to be around 1000 in order to reduce the possibility of dead fish being landed.
- Hauling and storage of the monofil longline to be on a hydraulically driven drum with the branch lines hooked on with stainless steel snaps. The branch lines with hooks and snaps stored in separate boxes.
- The tuna to be rapidly chilled to 0 degrees in either a mixture of seawater and ice or with a RSW system. The tuna either kept in RSW or on ice in the fish hold.
- The regular supply of high quality bait is critical to the success of the operation. Bait is mainly cuttlefish and pilchard imported frozen in cartons. A combination of cuttlefish and pilchard is mostly used since cuttlefish stays better on the hooks than sardines, but is more expensive. The bait must be stored in a freezer aboard the boat. The cost of bait is a major expense in the operation. The supply of locally caught bait have not proven reliable enough due to seasonable availability, but at times it could possibly add to imported bait if the supply could be organized. In Sri Lanka there is an interest in farming milkfish for use as live bait and the ADB financed aquaculture project is looking into this possibility.

3.4.3 Selecting a suitable design for a tuna longliner

Experience in other countries involved in longlining for tuna should be studied before selecting a suitable design. This can best be achieved by a study tour by selected persons from MOFAMR and from the fishing industry to countries where tuna longlining is carried out. The group should be accompanied by a FAO appointed person with experience from tuna longlining designs who can assist in the evaluation. This study tour should be combined with the observation of methods of keeping livebait alive in tuna pole and line vessels.

4. Proposed FAO assistance

4.1 FRP Training Specialist.

The training programme for building the 59 boats of 4.5 m in the three centres in the atolls would benefit greatly through the assistance of an FRP specialist for 4 weeks. His main task would be to train the staff of the MFAR responsible for the on the job training at the three selected atoll centres. The quality of an FRP boat is decided during the moulding process

and care in following a strict control of materials and lay-up method is essential. The presence of this FRP specialist would also make it possible to organize a one day seminar in Male with invited interested persons from local boatyards to discuss new development in FRP boat construction.

4.2 Study tour for persons from MOFAMR and the fishing industry

As mentioned under 3.4.3 it is important to involve Maldivians in the process of selecting alternative methods in tuna pole and line fishing and in deciding on the new tuna longliner. FAO should determine the places where tuna pole and line fishing and longlining is carried out and plan a study tour to selected places. The number of persons on this study tour should be three, one from MOFAMR, a Master Fisherman from a pole and line boat and one person from FAO.

4.3 Project for trials of RSW system

The TCP/MDV/2903 (A): "Improved handling of fresh fish" proposed in August 2003 an installation of an RSW system on the 30m (101ft) tuna pole and line vessel "Shams". A contract was made with a local company to provide and install the equipment. The system should be capable of chilling down 5 tons of fish from 29° C to 0° C within 5 hours. During trials it was found that this requirement could not be met. The equipment was removed and a new system has not yet been installed. FAO should investigate means of getting the project moving again.

4.4 Stability investigation of 30 m (101ft) pole and line boat

The TCP/MDV/2903 (A) project carried out a detailed stability analysis of the "Shams" and concluded that it did not satisfy international stability regulations due to low freeboard. A new analysis should be made taking into account the changes in hatch covers and engine room coaming proposed under 3.3.1 to see what modifications would be necessary to satisfy international standards.

4.5 Scantling investigation of 26 m (85 ft) pole and line boat.

The MOFAMR has invited bids for building initially 20 of this type. One or two Classification Societies with experience in the construction of large FRP boats should be asked to make an analysis of the scantlings proposed by the selected boatyard for these boats.

4.6 Modifications to future pole and line boats

The study tour and the stability and strength analysis should form the basis for concrete proposals for modifications to future pole and line boats. The modifications should be tested out on a prototype 26 m (85ft) boat.

4.7 Safety regulations for the construction of new fishing vessels.

The Ministry of Transport and Civil Aviation is responsible for regulations for vessels safety. Mr Ahamed Wajeeth, Director General, expressed the need for assistance in this regard. The main question is to what extent the existing IMO "Code of Safety for Fishermen and Fishing Vessels" can be applied in Maldives. This will require the assistance of a Specialist to study the situation in Maldives and recommend regulations that can practically be introduced. A mission of one month is required for this purpose.

4.8 Scantling rules for fishing vessels built of FRP

The Ministry of Transport and Civil Aviation expressed concern with the development into tuna pole-and-line boats of more than 30 m (100ft) without guidelines on the selection of scantlings for these vessels. The experience of existing Classification Societies must be

utilized for this purpose. Under 3.3.2 is proposed assistance by selected Classification Societies to analyse the structural design of the 26 m (85 ft) boat and propose scantlings. This should be followed up with general recommendation on scantling rules for FRP fishing vessels to be built in Maldives. Estimated required time is one month.

4.9 Training course in boat design

Persons from the boatyards and from MOFAMR have expressed great interest in a course showing the practical application of principles of Naval Architecture on boats built in the Maldives. The course would explain methods of calculating weights and displacement, stability, power and speed. Examples of Scantling determination for FRP boats should also be included.

4.10 Technical assistance in the construction of 26 m (85 ft) pole and line boats.

MOFAMR has requested assistance in finance of the 20 boats of this type from the Japanese International Cooperation System. Discussion with the three person Japanese mission in Male indicated that, in case finance was provided, technical assistance from FAO would be required. The Japanese mission would consider it favourably if a Japanese technical expert with experience from construction of this size of vessels and with a good knowledge in English would be recruited by FAO.

4.11 Design and construction of a tuna longliner

The "Terms of reference" suggest that a Naval Architect should be given a 6 month assignment to prepare detailed design of a 21 m longline vessel and also assist the Government to develop standards for the design, construction and equipment of fishing vessels. I recommend that a Naval Architect is selected after the study tour when a suitable design has been located. The Naval Architect should visit Maldives for a period of 3 weeks to familiarize himself with the FRP boat yards in Maldives and the local conditions. He should then return to his design office to finalize the detailed drawings required for the construction of the prototype boat. Further follow up during construction would be required. The assistance to the Government on rules and regulation for safety and strength of vessels is best made by persons specializing in these fields as mentioned under 4.7 and 4.8.

4.12 Training of crew on tuna longliner

A Master Fisherman should be engaged for a period of 6 months with possible extension.