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MANUAL OF BEST PRACTICES IN FISHERIES THAT USE MOORED FISH AGGREGATING DEVICES (FADs)

A joint activity of the CRFM Pelagic Fisheries Working Group and the CRFM/WECAFC/JICA/Ifremer Working Group on Fisheries that use Fish Aggregating Devices

VOLUME IV

SAFETY AND WORKING CONDITIONS ONBOARD FISHING VESSELS USING FAD

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MANUAL OF BEST PRACTICES IN FISHERIES THAT USE MOORED FISH AGGREGATING DEVICES VOLUME I – SAFETY AND WORKING CONDITIONS ONBOARD FISHING VESSELS USING FAD

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FOREWORD

It has been more than three decades since initial experimentation with the use of moored fish aggregating devices (FADs) in the Caribbean region. The main driver for development of FAD fisheries has been the need to reduce fishing costs, increase fishing efficiency, to improve fishers' livelihoods as well as national food security and to reduce fishing pressure on over-exploited coastal resources. However, the development of these fisheries in the region has been influenced by the socio-economic and bio-physical conditions of the respective countries.

This manual on Best Practices in FAD Fisheries Management is being developed as a collaborative effort among the CRFM, the Caribbean Fisheries Co-management Project (funded by the Japan International Cooperation Agency - JICA), the French Institute for Exploitation of the Sea (Ifremer) and the Western Central Atlantic Fishery Commission (WECAFC). These institutions are partners of a regional working group on FAD fisheries that was established at the 15th Session of the WECAFC and during the period 2014 to 2016 is being led by the CRFM. The impetus for development of the manual originated from the recommendations of a joint meeting of the respective institutions in December 2013, in St Vincent and the Grenadines, which were put forward to the 15th Session of the WECAFC. This task was explicitly included in the Terms of Reference of the Working Group and in June 2015 the CRFM convened a Write-Shop on FAD Fisheries Management to advance development of the manual. The manual is being published in five separate volumes addressing interests related to FAD design, construction and deployment, maintaining the quality of FAD-caught fish, fishing and business strategies for sustainable anchored FAD fisheries, safety and working conditions of FAD fishers and governance of FAD fisheries. It represents the combined technical efforts of the Working Group partners and targets a wide range of stakeholders, from FAD fishers, to other industry persons, fisheries scientists and managers. To facilitate wider distribution it is also published online (see www.crfm.int).

The experiences that inform the best practices in FAD fisheries management are drawn from a number of regional initiatives, beginning with establishment of the WECAFC Ad Hoc Working Group on the Development of Sustainable Moored Fish Aggregating Device Fishing in the Lesser Antilles in 2001, followed by the JICA-funded study on Formulation of a Master Plan on Sustainable Use of Fisheries Resources for Coastal Community Development in the Caribbean from 2009 to 2012, the project on the Moored Fish Aggregating Devices in the Lesser Antilles (MAGDELESA Project) from 2011 to 2014 (see http://en.magdelesa.eu) and more recently the JICA-funded Caribbean Fisheries Co-management Project being implemented from 2013 to 2018. As well, these best practices are also informed by collaborative research with the Texas A&M University and the University of Florida, Florida Sea Grant. Both the Ad Hoc Working Group and the MAGDELESA Project were led by the Ifremer and focused primarily on examining the scientific information for development of sustainable FAD fisheries, promoting sub-regional cooperation in the sustainable development and management of FAD fishing and the sharing of related information and experiences. The MAGDELESA project also focused on improving the design and construction of FADs and examining fishing strategies, gear selectivity, fish quality, safety and work conditions of FAD fishers and governance of FAD fisheries. The Master Plan Study, through one of its four pilot projects, further improved FAD fishing technology, initiated FAD data collection programmes and explored aspects of co-management of the fishery in Dominica and Saint Lucia. The pilot project also developed a draft FAD fishery Management Plan for Dominica. The current CARIFICO Project is providing additional support to Antigua and Barbuda, St Kitts and Nevis, Dominica, Saint Lucia, St Vincent and the Grenadines and Grenada to develop FAD fisheries and to address issues of governance.

ACKNOWLEDGEMENT

The production of this volume of the Manual of Best Practices in Fisheries that use Fish Aggregating Devices would not have been possible without the kind assistance and support of various agencies and experts, both regionally and internationally. We would like to thank the French Institute for Exploitation of the Sea, the Caribbean Fisheries Co-management (CARIFICO) Project and the Caribbean Regional Fisheries Mechanism (CRFM) for funding our participation at a Write-Shop on FAD Fisheries Management, which was convened in June 2015 in St Vincent and the Grenadines, to discuss and advance preparation of the Manual. We are also grateful to CRFM Secretariat for organizing this Write- Shop and for facilitating the review, editing, finalization and publication of the respective outputs. We are especially grateful to Ms Pamela Gibson for assisting with technical editing and proof reading of the final document and to Ms Kemara Brackin for the design and layout of the covers of this volume of the Manual. We also wish to express our appreciation to Mr Kazuo Udagawa and Mr Motoki Fujii for their constructive review of the document and suggestions for its improvement. This document has also benefitted from the review of the following fishers from St Vincent and the Grenadines: Mr Roderick Telemaque, Mr Donelee Providence, Mr Esworth Edwards, Mr Calvin Lampkin and Mr Winston Hazellwood, to whom we are deeply grateful. We are also grateful to the CARIFICO Project for funding the publication and dissemination of the Manual in two languages, English and French.

LIST OF ACRONYMS AND ABBREVIATIONS

CARIFICO Caribbean Fisheries Co-management Project

CRFM Caribbean Regional Fisheries Mechanism

FAD Fish Aggregating Device GPS Global Positioning System

IFREMER French Institute for Exploitation of the Sea (L'Institut Français de Recherche pour l'Exploitation de la Mer)

JICA Japan International Cooperation Agency

MAGDELESA Moored fish AGgregating DEvice in the LESser Antilles

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INTRODUCTION

A study by the International Social Security Association has shown that investment in risk prevention pays off. 1,000 euros invested in risk management would bring an average return of 2,200 euros within 18 to 24 months. Risk prevention also contributes to improving companies' economic performance.

Companies and their representative bodies, in the fishing industry as elsewhere, must move occupational health and safety (OHS) management from a regulatory constraint to an approach that reconciles business and health preservation.

The governance of the sector (or the company) must integrate OHS prevention approaches as far upstream as possible. Thus, once a decision is taken, it is necessary to anticipate whether or not it will have an impact on health. For example, the number of shocks received by the human body and the probability of musculoskeletal disorders on a skiff moving at high speed in rough seas increase with the distance of the FADs from the coast. This risk and its consequences must be assessed in the same way as the use of the FAD by recreational boaters.

Whatever the level of action within the sector (of the company), the continuous improvement of safety and working conditions requires, on the one hand, an understanding of the causes of the feared events (capsizing, falling overboard, amputation or other accident) that have already occurred (feedback). This knowledge is essential for all the fishing community. As with understanding the causes of FAD losses, fishermen need to collect information about these events and share it among themselves and with other stakeholders in the industry.

On the other hand, designers and users of vessels and equipment must collaborate and adopt a positive and active approach when a new hazardous working situation arises, such as loading very heavy loads on board a light, open boat to anchor a fish concentrating device (FAD), without losing sight of the fundamentals of the safety of human life at sea.

Consequently, our recommendations concerning the improvement of safety and working conditions on board vessels fishing around FAD recall these fundamentals, present new situations and aim at two distinct targets:

1 - ship architects, shipyards and equipment manufacturers (among which we include FAD manufacturers) on the one hand,

and

2 - professional fishermen and trainers, on the other hand.

In some countries, these two targets become one. In Dominica, for example, the majority of shipbuilders are also fishermen, and in all Lesser Antilles countries, fishermen build their own anchored FADs.

I. RECOMMENDATIONS FOR SHIP ARCHITECTS, SHIPYARDS AND EQUIPMENT MANUFACTURERS

The intrinsic safety of the float on which mariners work requires knowledge that fishermen do not master. On the other hand, working safely on a float built with full knowledge of the state of the art in shipbuilding requires knowledge that is only available to fishermen. Specialisation is therefore necessary, as is permanent consultation between the manufacturer of the "fishing vessel on FAD" tool and its user.

I-1. Transport and launching of heavy loads

The ship's capacity to carry loads and the rules for loading them must be clearly stated. The user of the decked or open vessel deciding to use his fishing vessel for the transport of the elements constituting an anchored FAD shall be able to do so (or decide not to do so) with full knowledge of the capabilities of his vessel under given environmental conditions. The legislative and regulatory framework varies from one country to another and it is up to each builder, fisherman to know and respect it.

It is recommended to use a deck ship, at least 10 m long, ideally it has a door in the transom bulwark. Otherwise a solid and removable table will be proposed to deposit the block of anchorage above the bulwark when the ship is at dock.

The use of sandbags is convenient on smaller vessels; they can easily be loaded from either side of the boat. Once on site the bags are also distributed and suspended from both sides of the ship by a rope passing through two mounting rings. When everything is in place the rope is cut to free the anchor.

On small vessels, the positioning of the load above the beam and the breaking limit of the means of attachment, on a pallet for example, must allow the load to be released overboard in the event of a rolling motion compromising the stability of the vessel.

The vessels are small and poorly mechanized. The vessel's movements and the muscular strength of the crew members are used to overflow the loads and launch them. Consideration should be given to developing means of traction to facilitate launching without compromising the stability of the vessel. All the devices proposed must be accompanied by clear instructions for use which the user can understand, drawing his attention on the one hand to maintaining the stability of the ship and on the other hand to the safety of persons using the device.

I-2. The driver's console

Having become the rule in some countries, the operator's console is expressly recommended for all boats engaged in professional fishing and even more so for skiffs that do a lot of sailing and/or are powered by powerful engines.

Figure 1 gives relevant ergonomic information on the dimensions to be taken into account for its implementation.

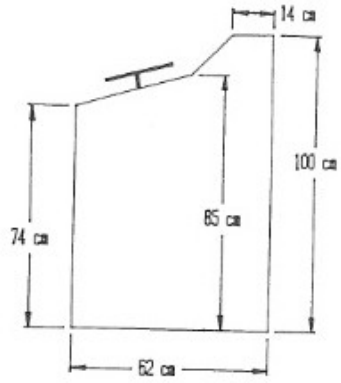
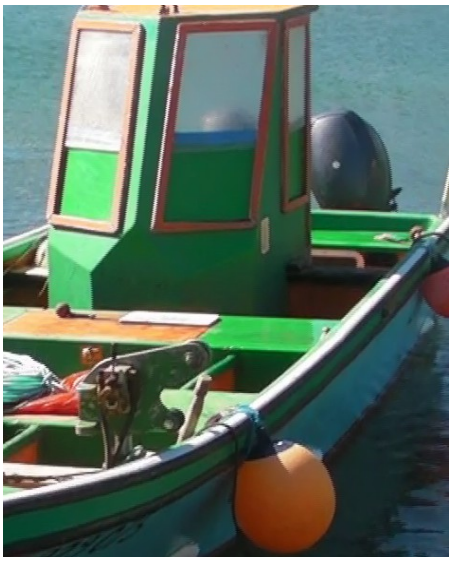


Figure 1: Ergonomic dimensions relevant for a driving console

The protection of this console by a cabin, meeting the requirements of local regulations or international shipbuilding standards, will also improve the thermal comfort of sailors when travelling at high speed.



Picture n°1: cabin on a 9 meters skiff

The standing position, one hand resting on the steering wheel, slightly inclined, the other operating the throttle, allows the sailor, on the one hand, to maintain a stable balance and, on the other hand, to absorb the variations in acceleration resulting from the vessel's passage through the waves of a well-formed sea. The seated or standing positions supported on the console can be alternated according to the sailor's requests. Operating the vessel with one hand and holding the line with the other presents no difficulty on deck or open skiffs.

Care must be taken to place in the immediate volume of the sailor's reach all the controls: helm, engine controls, fishfinder housing, GPS, compass. If there is no cabin, waterproof compartments can be placed under the console for maps, notebooks... but also for the VHF, beacon, rockets and various tools.It is recommended to equip the throttle with a safety strap, especially when the sailor is sailing alone. A small handrail shall also be fixed on each side of the console or in the cab to enable the man at the controls to stand at fixed points other than the driving members.

Photo n°2 : handrail helping to maintain the boat in rough seas.

From an architectural point of view, the securing of the steering console to the deck, and of the seat for 12-metre deck ships, will have to be carefully studied and carried out. The steering wheel will also have to remain on its axis even in the event of strong traction which can be caused by the sailor who is restrained when the skiff suddenly pitches up.

I-3. Lifting auxiliary equipment

Their choice and location will have to integrate the specificities of the boats and their exploitation (lines/ longlines on FAD only or multi-purpose traps and line fishing on FAD for example) and respect the regulations in force.

Their installation must take into account the forces that the lifting aid can exert on the entire structure of the vessel (front part generally on open skiffs), and also take into account the most efficient and ergonomic conditions of use possible. On a skiff, a return pulley attached to the ship's deck allows the sailor to keep his back straight when pulling on a rope, for example.

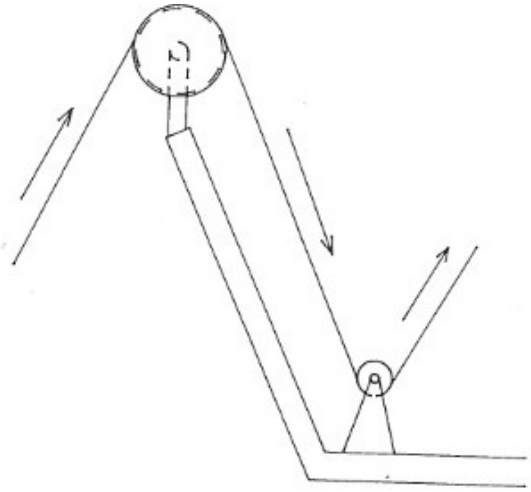


Figure 2: System with return pulley for better use of tractive force

The equipment manufacturers could also consider the development of a capstan-type vertical-axis hauling system, located in the centre of the vessel and hoisting the net, the line from the net or the large pelagic on a roller embedded in part of the beam. This system could be combined with the possibility of a temporary opening of the bulwark for the loading of large pelagics on the 12 metres of deck.

Systems where power is taken directly from the outboard motor should be avoided for lifting aids. This option has the following disadvantages: 1 - it consumes power, the pump runs continuously; 2 - it causes an increase in oil temperature, which can be annoying. The traction aids will therefore be powered by a hydraulic power unit, the layout of which will take into account the reduced volume of work available on these boats.

The availability of a hydraulic power plant facilitates the work of the men, but simple systems of reduction of the muscular force constituted by a rope passing through several pulleys or a winch can also decrease the efforts to be provided in particular at the time of the embarkation of large pelagic fish by only one man, and at the disembarkation of fishing at quay. Removable systems can be used for other ancillary tasks such as handling outboard motors for example.

Lines and longlines are currently stored on "wheels" and wound and unwound manually. The assistance, mechanization or automation of these tasks of spinning and turning lines plunging to great depths (more than 100 meters of nylon) is an important stake for the development of the fishery. Indeed, if the trolling lines capturing bonito (bait) or fishing on the surface of dolphin bream or the "fight" phase with a large fish require direct contact between the nylon and the human hand, certain launching and hauling operations (without catch on the hook) must be automated or assisted (winding on a drum) in order to reduce repetitive gestures soliciting and using the joints of the wrists, elbows and shoulders. Storage on a drum, even when a fish is caught, should also be sought to reduce the risk of loops around a part of the fisherman's body.

Picture n° 3: line storage drum with manual winding

A removable "wheel" system that could either be held in the hand or installed on a crank drum (principle of photo 3) could easily be developed.

Currently some FAD fishermen, assisted by fishery technologists, are looking for a way to catch large numbers of blackfin tuna that concentrate 70 metres below the head of the FAD. The jigging technique seems promising. This technique, well known in recreational fishing, which consists in applying pendulum movements to a fishing rod so that the lure moves in the school of fish, requires considerable and frequent efforts of the upper limbs which will not fail to wear prematurely the **5**

joints solicited. Jigging automation has already proven itself on other fisheries (auto jigger machine - YouTube - video - 1'48"). Equipment manufacturers could work with interested fishermen to adapt existing equipment for tuna fishing on FADs.

Picture n° 4: automatic reel - jigger

I-4. Electronic equipment

Anchored FADs direct fishing offshore, which requires the following basic electronic equipment to be fitted to vessels:

- A means of positioning (GPS) whose interest is no longer to be demonstrated both economically (precise location of the DCP) and in terms of safety (the GPS makes it possible in particular to return with certainty to its starting point, and to stop a fishing strategy from the knowledge of its position and an approximate calculation of consumption)..;

- A track marker coupled to GPS facilitating the return towards drifting longlines;

- The V.H.F. or the portable radio-telephone which also constitute invaluable tools of work and safety for the sailors. A working tool in the sense that it allows an exchange of information over a large fishing area; it also makes it possible to warn the land of the time of arrival and the composition of the catches, which in terms of the organisation of the marketing of catches is not without interest. A safety tool in the sense that it allows contact with other boats in the area, for example in case of need (breakdown...).

I-5. Processing and storage of catches

There is no point in fishing for large pelagics if they are not properly processed on board in order to maintain maximum quality until they are delivered to the buyer. These operations, which increase the workload of seamen, must be facilitated by offering handling aids between the deck and the hold (double block hoist, slides, etc.).

On the skiffs, sometimes armed by a single man, and not equipped with a seawater pump and a water handle, solutions must be sought to bleed and wash large fish without too much impact on safety and working conditions: tuna support system during the drilling of the medullar canal which causes jolts that can injure the sailor. The system will also facilitate bleeding and washing on board or along the edge.

The installation of a cooler (or an isothermal bench) for the conservation of catches is recommended by quality experts, in particular for boats fishing offshore. The skiffs can be equipped with isothermal benches occupying all the width of the ship. This configuration interferes with the sailors' movements between the bow and stern. It would be interesting to propose integrated central coolers leaving a sufficient passage (about 50 cm) on each side of the skiff.

A small hold hatch integrated into the hatch obstructs the entire opening in the hold of the deck vessel, facilitating work at sea when storing the catch. The large and heavy hatch is only exceptionally handled at sea.

Picture n°5: double opening (hatch) of the hold

I-6. Storage, spaces and workstations on board

For fuel storage, the integrated tank is highly recommended. The difficulties associated with fuel distribution points should not be overlooked here. While this recommendation is taken into account on the vast majority of fishing vessels in Martinique and Guadeloupe, it is not the case in Dominica and other Caribbean islands. Fuel cans are stuck together or with various materials and occasionally seized by a rope. It would be preferable here to provide just in front of the console a subdivision by keeping on each side of the boat a zone of traffic before and after. If necessary, take advantage of a stiffening partition to integrate this layout.

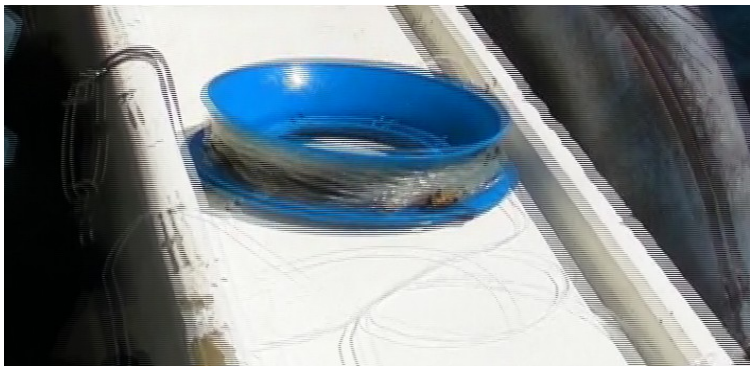
Three solutions can be chosen for the installation of a hydraulic power plant: in the front, in the middle, at the back. The first and third have the undeniable advantage of leaving the middle of the boat available for the location of a cooler as well as for the work of the deck-hand.

The batteries will be placed in ventilated housings (with permanent openings), but protected from bad weather. These slots will be provided on the stern of the boat, at the bottom of the console for example, or even better in the "stern wings". In any case, the batteries shall in no way encroach on the seafarers' working or circulation areas.

Many boats are only equipped with a storage box located at the front, and usually containing the sail and life jackets. The integration of one or two chests from the design stage is to be recommended due to the limited space of the boats, where the congestion by cans of various sizes containing all kinds of equipment is not conducive to a good organization of work.

On the skiffs, the top of the cooler or integrated boxes constitute good work surfaces (preparation of baits, deposition of "wheels" with longlines, evisceration of catches...). These worktops could be increased, if necessary, by means of small folding shelves placed against the rails, or against the solid part of a transverse partition. Their exact number and position are a matter of shipyard/fisherman discussion. The aim here is to take rational account of certain ancillary tasks.

On deck ships a reflection on the width of the beam and its shape according to the dimensions of the materials used: wheels, jigging pole, pike poles, stunner, landing net, screwdriver... will optimize the quality of the movements on board and the speed of access to the tool.



Picture n°6: use the beam as a work surface

For example, holes in the boom will allow vertical storage of all long-handled tools.

Picture n°7 : pike pole arranged vertically within reach.

The hold panel, in addition to being used as a seat for certain activities, can be used as a support for the temporary installation of a removable work surface or a frame that can receive a container. This type of arrangement will enable seamen to keep their backs straight, for example during lengthy evisceration and washing operations of « bags » (fish called « bourses » in french) caught in large quantities around FADs.

On the 12-metre deck, the height of the bulwark, even if it is the subject of precise regulations in some countries (France for example), must be determined in consultation with the fisherman and the administration in order to facilitate the work of the lines along the edge and the embarkation of large pelagics without hindering the prevention of falls overboard. Would it not also be possible to provide a door at one or two judicious places on the bulwark to facilitate the boarding of large fish?

I-7. Circulation and maintenance of balance on board

As far as possible, the various equipment should be arranged in such a way that the sailors' movements from front to back (or vice versa) are as safe and easy as possible; all equipment or storage occupying the entire width of the boat should therefore be avoided. The cables connecting the control console to the motor(s) must be laid in such a way as not to obstruct traffic.

Handrails, on the rail (12 m bridged) or under the rail, are often subjected to forces which require that account be taken of them in terms of their technical fixing methods.

Picture n°8: the railings must resist strong traction.

The same will apply to the metal structure receiving the sun protection roof. Indeed, the sailors are led to use the uprights and transverse in height within reach of hand as handrail to move or be restrained in the event of imbalance.

Picture n°9: the metal structure (above) of the tau serves as a railing.

On the skiffs, the standing position being practically obligatory for the sailors as soon as the sea is rough, and that the speed is important (sitting, the shocks at the level of the buttocks, the pelvis and the kidneys are quickly unbearable), it is imperative to make available to the passengers (sailor or other) a support for the upper limbs. The ropes commonly used on professional vessels are simply effective in case of rear imbalance. For front and side imbalances, these ropes are not effective.

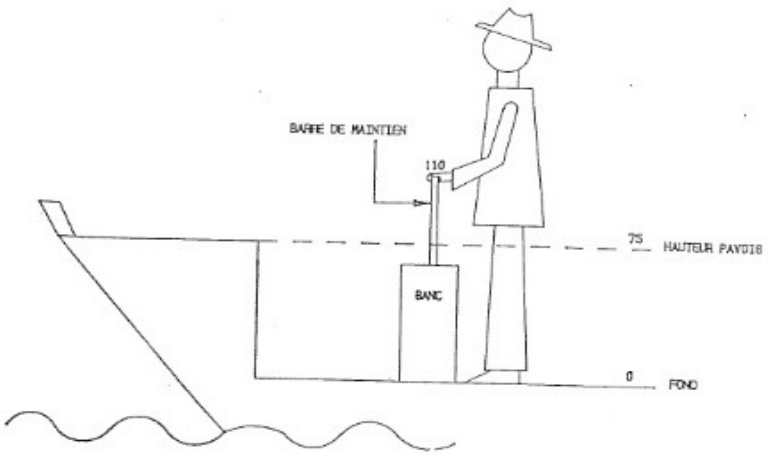


Figure 3: Arrangement of the "deck-hand" position during high-speed voyages.

If the solution of the rope connected to a cleat on the forecastle is maintained in addition to frontal and lateral supports, one will take care of the interface "hand-rope" in order to avoid the bulbs or burns by rubbing.

From our point of view, the installation of seated (or standing) positions when trolling or lifting longlines without catch, so as to offer lumbar support to seamen, must be possible even on a skiff provided that the elements of the seat which become obstacles quickly can be moved when the fish has bitten (standing work with movements), or when the vessel practices another type of fishing.

On a 12 metre deck the sailors naturally find their support from time to time against the bulwarks, the storage container or on the beam.

Picture n°10: a bulwark at 70-75 cm high serves as support.

A properly grasped chair that does not clutter the traffic necessary for "combat" would further improve working conditions.

Boats should be systematically delivered equipped with removable non-slip mats placed on the different floor surfaces. They would reduce the risk of falling and striking, especially when the boat is underway.

On ships travelling at high speed, sailors are exposed to very slow shocks and vibrations of the whole body (2-25 Hz) transmitted from deck to legs and which can generate spinal osteo-articular pathologies mainly: simple lumbago, sciatic pains, herniated discs. On open vessels, these vibrations are transmitted directly from the bottom of the vessel hitting the wave to the body of the seaman, without being damped by frames as on a deck vessel. In addition, on less than 12 metres of open ground, the firm and permanent support of the steering wheel also transmits these vibrations to the upper limbs and can generate joint pathologies in the wrist, elbow or shoulder.

The health effects of mechanical vibration exposure depend on the vibration frequency. Technical prevention involves fitting out the driving and "routing" stations for the sailor or sailors (vibration dampers on the floors, seats, consoles, handrails).

I-8. The lighting

The operation of a vessel on trips of more than 12 hours at sea requires that the vessel be equipped with night warning devices (international recommendations deal with this subject, and some countries have specific regulations). In addition, care will be taken to ensure that seafarers are provided with lighting to enable them to work correctly. Here the yards have international standards recommending lighting levels (unit = Lux) according to the activity: movements, work without strong visual requirements (cleaning of the boat), work requiring an important lighting (attaching a nylon wire to a hook). Although fishers' activities are not mentioned in these standards, it is relatively easy to identify similar work situations.

I-9. Protection against the sun and bad weather

On a skiff and on a deck ship, it is important to provide a tau that will protect all or part of the working deck from sunlight and rain.

II. RECOMMENDATIONS FOR FAD MANUFACTURERS

II -1. Safety of navigation

The head of an anchored FAD can be a hazard to navigation, especially if it consists of a buoy of 600 litres or more. Furthermore, fishermen risk losing their FAD if it is not easily spotted by mariners, even at night or in fog. The mandatory marking is the isolated danger mark (cross of Saint-André - length = 0.5 m - width = 0.12 m). This mark must be visible from all sides. It is therefore necessary that the FAD mast carries two of them, making a right angle between them. Masts and markings should be painted bright yellow. If this mark is not metallic, it is necessary to add a radar reflector installed as high as possible on the flagpole; the light will be yellow and its rhythm will be different from the standard rhythms for regulatory markings.

The disposal of a FAD shall be reported to the administration in charge of the sea. The difficulty is to maintain a visible light signal at night. Indeed, according to specialists in the construction of anchored FADs, they all sink several times a year, under the action of currents, if the surface buoyancy is less than 600 liters. Before deploying a FAD, it is advisable to find out about local currents and the main routes of merchant ships.

Some States are working to develop an anchored FAD whose aggregator system (head) will be submerged several tens of metres below the surface. Too many surface FADs are currently cut by merchant vessels. The development of such a FAD seems delicate at the moment.

Ideally, in areas of heavy traffic, FADs should be equipped with an AIS (Automatic Identification System) giving large commercial vessels instant and accurate information on the nature and position of the device.

II-2. Security during the deployment of the anchored FAD

When anchored FADs are deployed with vessels suitable for transport and overflow at sea of heavy loads (e.g. use of a buoy vessel) the designer may consider a ballast of 600 kg or more in one piece.

Where transport and launching are carried out from a 12 metre deck, the load shall be adapted to the carrying capacity of the ship (deck load) and the means of handling available. The current method of operation for fishermen is to stack pallets in the vessel's centreline against the after bulwark until the top of the last pallet reaches the level of the boom and grab the load over it. Once in the area, three men are enough to push the load out of the ship. The impact of this type of loading on stability under different sea conditions should be checked with the shipbuilder.

The FAD ballasting technique with sandbags seems to us the most suitable for transport and anchoring with two yawls (one for the sand, the other for the orin and the head). A sandbag weighing 50 kilos in the air will weigh 23 kilos in the water. On a sandy or muddy bottom, the bags will "sucker" and sand or sediment will accumulate over the bags on the bottom. Japanese fishermen have had them in the water for 15 years without moving. The technique consists of loading a 20-bag, 50 kg yawl distributed correctly at the bottom of the yawl. On the anchorage area, two 50 kg bags are overflown simultaneously (one on starboard, the other on port) and are kept suspended along the edge, and so on until they have 10 bags on each side. A crow's feet connects the two packs of 10 bags to the rope under the ship. On board, the rope connected to the two bundles and which crosses the skiff is then cut and the two bundles of 10 bags sink simultaneously without unbalancing the skiff. Japanese bags are nylon, and can be loaded to 80 kilos. It is better to limit yourself to 50 kilos for a less arduous job done by two men. Knowledge of the nature of the bottoms will encourage the development of this ballasting technique. It is obvious that the lack of knowledge about the nature of the bottom on which the ballast will rest will encourage the fisherman to ballast his FAD with concrete or metal, as sandbags can tear if they land on rocky bottoms.

II-3. Safety during the maintenance of the anchored FAD

Fishermen take elements of the FAD head on board the vessel to clean them and rid them of the organisms that attach themselves to them and could weigh them down to the point of sinking them or, conversely, make them float. This operation must be able to be carried out without the rope being under tension. Thus, a sudden increase in the tension exerted by the rope is not likely to cause the boat to capsize or to drag a sailor into the sea.

II-4. Safety when fishing on anchored FAD

The design of the PAD shall minimize the risk of hook attachment. The replacement of tarpaulins by strips is a step in this direction. The photo n°11 which shows the launching of the float allows to see blue strips on the surface of the water.

Picture n°11: FAD with strips

II-5. Safety during the manufacture of an anchored FAD

Some fishermen make polyester floats of several hundred litres themselves. There are even some who make the hull of their ship. The construction of floats (or boats) by their users, is generally done by manual coating of glass fabrics with unsaturated polyester resin. The use of laminate floors should not be trivialized: the risks are real and all the more present the closer, through working hours or the application of particular technologies, to professional working conditions.

The products must be well known, transport, storage, handling and machining precautions must be observed; the premises must be designed for a lower risk; the action to be taken in the event of accident or illness must be known. Are linked to the equipment of the workshop: the risks of fire, explosion, respiratory or neurological poisoning, pollution by microfibres. Related to individual behaviour are: eczema of hands, forearms and faces, eye injury by catalyst projection, wound by handling the deburring edge.

Each product has its own characteristics and may present a health risk. Resins are composed of: unsaturated polyesters, epoxides, polyurethanes. Resin thinners contain styrene, methyl methacrylate. Adjuvants - catalysts may contain methyl ethyl ketone peroxides, benzoyl peroxides. Adjuvant accelerators may contain cobalt salts, trichlorofluoromethane (polyurethane foaming agent). Solvents contain acetone. All these products are not harmless, they can be allergenic, cause asthma, irritate the nose, bronchial tubes, skin or eyes, cause neurological disorders, lose sight, be explosive, cause a coma, be flammable. Microfibers: glass, carbon, kevlar cause mechanical irritation of the skin and lung tissue and eczema. They are possibly carcinogenic (pleural mesotheliomas).

It is therefore essential to obtain the safety data sheet (SDS) from the manufacturer or distributor of each product. In France, as in all European Union countries, this is an obligation imposed on manufacturers and distributors. It is then up to the user of the product to read and understand each safety data sheet of the products he uses to implement the recommended prevention measures and in particular to wear the appropriate personal protective equipment.

The qualities of the workshop determine the level of work: a workshop with the standards makes it possible to build in a prolonged and repeated way with less risk and makes possible techniques with high risks like the spraying of gel-coats, the foaming of polyurethanes or the machining of the parts with the electromechanical sander. A ventilation system must be put into service for all laminating, sanding, fabric cutting or cleaning work and during the polymerization of a hull or buoy. Storage of highly flammable and explosive products must be minimalist. The distributor must be required to label containers correctly with the name of the product, its composition and pictograms indicating flammable, explosive, corrosive or toxic characteristics. The catalyst must be stored separately. Stocks of acetone and polyurethane foam must be limited.

Four safety accessories are essential:

- sand in a bucket is used to absorb catalyst run-off;

- a powder extinguisher, industrial model, is hung near the entrance door;

- buckets with lids collect soiled cloths and sand;

- finally a sink allows an immediate and abundant washing in case of catalyst projection.

Personal protection avoids skin discomfort caused by chemicals and fibres: suit closing tightly at the wrists and ankles, liquid gloves on non-irritated hands, vinyl gloves to change often (every hour) on damaged hands; it is absolutely not recommended to clean hands with acetone, which removes the protective lipid layer of the skin and makes it very vulnerable.

Certain working rules are particularly beneficial: do not smoke, throw the soaked rags in a bucket closed by a lid, cap the bottles and cans between two samples. Spilled products are immediately collected with sand in the waste bucket.

III. RECOMMENDATIONS FOR PROFESSIONALS AND TRAINERS

III-1. Comfort on the road

The number of shocks received by the human body and the probability of musculoskeletal disorders on a skiff moving at high speed in rough seas increase with the distance of anchorage of the FADs from the coast. This risk and its consequences must be assessed in the same way as the use of the FAD by recreational boaters.

Co-management of FAD fisheries by fishermen and authorities should be promoted and therefore fishermen should be involved in decision-making processes that take into account scientific advice, local knowledge and the impact on the health of seafarers (journey time).

The attention of the skiff owners should be drawn to :

- the discomfort of any work done by the sailors when the skiff is sailing upwind (preparation of lines, processing of catches...). The organization of the work will have to integrate this factor of tiredness and discomfort, generally underestimated: the lines will be prepared before the departure, the captures will be bled, washed, icy, yawl in drift...

- the very large variations in acceleration to which sailors can be subjected when the skiff is underway or when looking for a FAD (or floating wood), when the skipper's attention is less focused on the conduct of the vessel. The speed should be reduced during this phase.

III-2. Transport and anchoring of the FAD

The trainers will insist on the absolute necessity of using a vessel adapted to the transport of heavy loads both in terms of its stability with the cargo, and in terms of the traction/lifting aids available on board for safe loading and launching.

They will draw sailors' attention to the different techniques for ballasting FADs depending on the type of vessel available. They will encourage mariners not to use skiffs for ballast mooring and if this is really not possible, they will insist on the absolute necessity of using two skiffs, one for the ballast and the other for the orin and the head of the FAD.

On small vessels, the positioning of the ballast above the beam and the breaking limit of the means of attachment, on a pallet for example, must allow the load to be released overboard in the event of a rolling motion compromising the stability of the vessel.

The trainers will also remind you that the rope must be put in the water before the ballast. Although a "first anchor" launching manoeuvre is possible and significantly increases the accuracy of the installation, it is, for obvious safety reasons, excluded on small boats. The "anchor last" manoeuvre is the only one recommended.

All these measures are detailed in Volume I "*Design, manufacture and launching of FAD*" of the Good Fishing Practice Manual on Anchored Fish Concentration Devices (FAD). This volume also specifies the rules to respect to signal the presence of a dcp to the other users of the sea we remind them below.

When the FAD is close to a sea route, the marks, lights and radar reflector must be well maintained and made as visible as possible (colour and flag). Ideally, in areas of heavy traffic, FADs should be equipped with an AIS (Automatic Identification System) giving large commercial vessels instant and accurate information on the nature and position of the device. Failing this, care must be taken to ensure the presence and proper maintenance of the DCP's regulatory equipment: the floats of single buoyed DCPs will be yellow in colour and equipped with a radar reflector installed as high as possible on the flagpole; the light will be yellow and its rhythm will be different from the standard rhythms for regulatory markings.

III-3. Fishing gear

The development of FADs should lead trainers to make seafarers increasingly aware of the handling of heavy loads (movements and postures) and the risks involved in the manufacture and mooring of FADs.

It will also be necessary to look for the reduction of the difficulty of the tasks at the time of the practice of the fishing with drifting longlines (aids with the winding/unwinding of the lines) and jigging.

Common sense safety rules are necessary for vertical drift longline fisheries. The risks come from lines, ropes and hooks. During fishing, the rope or nylon may pass around a leg, or a hook may catch an arm or clothing. In the event that a man's safety is in question during maneuvers, a knife must always be within reach so that rapid action can be taken to cut. A rack with one or two knives is to be provided in a very accessible place on deck. It is also good to provide one or more cleats; or other solid fixed points, allowing to block a rope or monofilament. Pay attention to the tension exerted on the line, especially when a large fish comes to the surface and comes out of the water still alive (weight in the air > weight in the water).

III-4. Traction-lifting aids

It should be stressed that fishing for large pelagic fish is a high-risk occupation for the lumbar spine, as is the occupation of traps or nets, the prevention of which depends on the use of handling aids.

In the case of a large marlin, we can recommend the use of a noose to grab the head after stinging and stunning. Slide the noose around the head and tighten. The end can then be taken to a winch or capstan to be transferred. To facilitate boarding, another rope can be passed around the tail. When at least three men are on board, fangs or pike poles allow a large fish to be loaded quickly and relatively easily when the vessel is not too high on the water.

The trainer will draw the sailors' attention to the specific risks of handling aids: moving parts, trapping with ropes...

III-5. Treatment of catches and their marketing

The trainers will integrate the safety messages into the training sessions delivering knowledge to fishermen on maintaining the quality of fish from the moment they leave the water until they are sold to the consumer.

For example, the operation consisting in piercing the medullar canal of a tuna, has an impact both on the final quality of the product and on the safety of the seamen. Techniques will be developed and taught to enable a single man to pierce the tuna medullar canal without risk during the last jolts of the fish.

The same applies to the bleeding and washing of bled fish. Techniques taking into account the level of equipment of the various vessels (there is no water handle on a skiff) will have to be developed taking into account the impact on the safety and working conditions of seafarers. For example, the idea of dragging a bled fish along the skiff for a few moments to wash it, which is attractive from the point of view of the quality of the product, should be proposed with advice on how to use it (facilitate handling of the fish).

In some countries, large pelagic fish may be cut at sea. In order to facilitate handling during storage in a cooler on a skiff and when fishing is landed, it is important to convey messages so as not to alter the quality of the fish when it is cut.

Quality experts rightly insist on the need to periodically clean and disinfect ships: work surfaces, holds, walls... The trainers will insist on the respect of the dosages (water + bleach for example) and will remind the sailors that each product, in addition to its label, has a safety data sheet, to be requested from the distributor. They will draw sailors' attention to the precautions for use (method, eye, skin, respiratory protection, etc.) of the products, which are specified by the manufacturer on the safety data sheet.

In direct sales, seamen cut tuna and marlin with large knives. The trainer will draw the fishermen's attention to the importance of sharpening the blades, wearing a metal mesh glove (hand holding the fish) and the proximity of a first aid kit in the event of a cut.

The trainer will also draw fishermen's attention to the presence of traces of mercury in the pulpit of most large pelagics. These traces pose no risk to consumers who do not eat this type of fish every day. Fishermen and their families are simply advised not to eat this type of fish every day.

« Bourses » (french name) are fish that are concentrated around FADs. Some fishermen catch them and market them. During handling (evisceration, washing, icing), precautions must be taken regarding the ventral spine and the risk of infection, especially if the fisherman's hands present even slight wounds. Here only the systematic wearing of gloves will avoid an infection that may even require hospitalization.

III-6. Electronic equipment (GPS, plotter, VHF)

The interest of its use for offshore fishing jobs on FADs (or other) has been demonstrated, both from an economic and safety point of view (GPS makes it possible, in particular, to return to its starting point for sure, and to adopt a fishing strategy based on knowledge of its position and an approximate calculation of consumption).

The V.H.F. or the portable radio-telephone are also valuable work and safety tools for sailors. A working tool in the sense that it allows an exchange of information over a large fishing area; it also makes it possible to warn the land of the time of arrival and the composition of the catches, which in terms of the organisation of the marketing of catches is not without interest. A safety tool in the sense that it allows contact with other boats in the area, for example in case of need (breakdown...). Every opportunity should be taken by trainers to remind them of the vital role of VHF, its advantages over the cellular telephone (*with the latter if after the call the connection is cut; we do not know where you are*), and the instructions for using VHF and the "safety" watch.

III-7. Personal protective equipment

It is very insufficiently taken into account. Foot protection at the ship/shore interface, or on board, is very often non-existent. The protection of hands during the manufacture of the FAD, during the transport of its components, during line and longline fishing and during the processing of catches is not always properly ensured.

The trainers will be keen here to make sailors and future sailors aware of the systematic wearing of boots, gloves (or at least finger protection against nylon cuts) and an integrated buoyancy suit.

When handling the heavy parts constituting the ballast weights of the FAD, the boots must be equipped with a protection of the foot against crushing.

When cutting large pelagic fish on the stalls during direct sale, a metal mesh glove is strongly recommended to protect the hand that holds the fish.

Finally, the trainer will indicate that the lumbar belt is not a means of preventing back injuries. Studies have shown that in companies where the employer requires handlers to wear a lumbar belt, the number of work stoppages for back injuries is not lower than in companies where this equipment is not compulsory. When one feels the need for a belt to help maintain the lower back, it means that this part of the body is already affected.

Light clothing and a headgear will cover most of the body and head to protect against the sun. The parts, not covered will be protected by cream of protection against the harmful rays of the sun.

III-8. Organization of work

Seamen should be made aware of the importance of this for the proper rationalisation of the tasks to be carried out and the impact it may have on the quality of production. The organisation of sea outings is a good example in this respect.

Only a small proportion of the sailors, the youngest, go fishing on FADs 25 or 30 miles from home port 4 days a week. The others alternate fishing offshore on FADs with other trips closer to the coast: fishing with traps for example.

A one-week trip to sea, certainly requiring a deck vessel with living quarters and a hold, makes it possible to organise the sale from Saturday morning, a time of the week when many potential buyers interested in the product and informed by the skipper of the arrival of the boat, have time to travel to the port.

Attempts to go out to sea for two days on skiffs not designed to sleep there exist. The conditions of work and stay on board are trying, and on the return, the sailors too tired to organize the sale of fishing in a rational way and to leave quickly at sea.

The organization of work with two vessels for the deployment of DCP or better, from the safety point of view, the use of a vessel designed for the transport and overflowing of heavy loads. This type of organisation should be encouraged at the level of fishing communities. The confidential aspect of the anchorage area should not be neglected.

III-9. Rescue and survival at sea in the event of a breakdown

While it is necessary to insist very strongly with seafarers on the need to keep and periodically check the state of the safety equipment imposed by the regulations of each State (mirrors, whistles, rockets, sails, oars, brassières, beacons, etc.), it is important to ensure that the safety equipment is in good condition.The second engine, combined with the acquisition of electronic positioning and communication equipment, is an option that simultaneously ensures better operation of the boat and better safety for the crews.

However, the acquisition of a distress beacon seems to us to be the essential complement to this equipment when seafarers practice trades taking them offshore at great distances from the coast, and this is increasingly the case with FADs.

Trainers will be keen to make crews aware of the actual destination of the beacon, as an ultimate solution to minimize inappropriate or untimely triggers. For example, in the event of engine failure, VHF should initially be used; other vessels may be in the same fishing area. Then, if the calls remain unanswered, and the boat misses the island and drifts into the Caribbean Sea, it will be time to activate the beacon. Finally, they will draw the sailors' attention to the importance of choosing equipment in containers, the only one capable of preventing untimely triggering, linked to the specific operating characteristics of this type of boat.

The trainers will also remind you of the need to always go out to sea with a water supply that will allow you to wait for help in the event of a breakdown, and to warn people close to your fishing area and the approximate time of your return to shore.

III-10. Organize periodic exercises to deal with emergency situations

The daily actions related to production: fishing, fish processing, mooring the boat... do not require periodic training; they are performed every day. On the other hand, actions to deal with emergency situations: diagnosis of engine failure, basic interventions on the engine, setting up the sail, use of rockets or beacon, emergency call, first aid, survival techniques at sea,... must be the subject of practical exercises repeated periodically, if we do not want to forget them the day we need them.

The fishing communities with the support of the administrations in charge of the sea must facilitate the organisation of these exercises and encourage all fishermen to participate in them.