



**SCIENTIFIC COMMITTEE
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**PARA. 24 of CMM 2008-01
FAD MANAGEMENT AND MONITORING**

**WCPFC-SC5-2009/FT-WP-1
22 July 2009**

Prepared by the Secretariat

Introduction

1. Paragraph 24 of Conservation and Management Measure 2008-01 (CMM 2008-01) requires that:

The Commission Secretariat will prepare a report on additional FAD management options for consideration by the Scientific Committee, the Technical & Compliance Committee and the Commission in 2009 including:

- a. Marking and identification of FADs;*
- b. Electronic monitoring of FADs*
- c. Registration and reporting of position information from FAD-associated buoys;*
and
- d. Limits to the number of FADs deployed or number of FAD sets made.*

Previous discussion in WCPFC

2. The matter of the marking and monitoring of fishing gear in WCPFC managed fisheries was first discussed at the Fifth Preparatory Conference at Rarotonga, Cook Islands (WCPFC/PrepCon/WP.18. *Background Paper on Possible Components for Regional Vessel and Gear Marking Systems*). Since, FAD-related discussions, including monitoring, have largely been confined to the Fishing Technology Specialist Working Group (FT-SWG) of the Scientific Committee (SC) (see “further reading” below).

3. Conservation and Management Measure 2005-01 (CMM 2005-01) (para. 13) required CCMs to develop FAD Management Plans (FMPs) and submit them to the Commission. CMM 2008-01(para. 23) also included a requirement for CCMs to submit FMPs for the use of FADs by their vessels on the high seas by 1st July 2009. An outline for the preparation of FMPs, *Suggested Guidelines for Preparation of FAD Management Plans* was appended at Attachment E of CMM 2008-01(Attachment A). Eight (8) CCMs had submitted FMPs at the time of preparation of this paper (mid-July 2009) while twenty (20) CCMs support purse seine vessels in the WCPO purse seine fishery (see summary at below).

4. The Inter-sessional Working Group for the Regional Observer Programme (ROP-IWG)

developed minimum data fields for the ROP that were adopted by WCPFC5 at Busan, Korea in December 2008. The data field to be completed by observers on board purse seine vessels relating to FADs is limited to “type of school association”.

Marking and identification of FADs

5. The marking of fishing gear is referred to in several international instruments, notably the FAO Code of Conduct for Responsible Fisheries, Article 8.2.4:

“Fishing gear should be marked in accordance with national legislation in order that the owner of the gear can be identified. Gear marking requirements should take into account uniform and internationally recognizable gear marking systems.”

6. The UN Fish Stocks Agreement at Article 18(3) (d) provides:

“Measures to be taken by a State in respect of vessels flying its flag shall include ... requirements for marking of fishing vessels and fishing gear for identification in accordance with uniform and internationally recognizable vessel and gear marking systems, such as the United Nations Standard Specifications for the Marking and Identification of Fishing Vessels.”

7. The FAO Technical Guidelines for Responsible Fisheries - Fishing Operations – 1, Annex III, includes the following proposed system for the marking of fishing gear:

“6. Fish Aggregating Devices

6.1 The authorization to fish should also include conditions in relation to the deployment of fish aggregating devices and, in addition to carrying a mark to identify ownership of a FAD, the authorization should relate to the:

- a) type of FAD;*
- b) location of the allocated datum geographical position; and,*
- c) the fishing activities permitted at the FAD.*

6.2 The responsibility for recovery of drifting FAD's should lie with the owner.

6.3 The loss of a FAD (drifting or anchored) should be treated in the same way as lost or abandoned fishing gear.”

8. Early versions of CMM 2008-01 proposed some FAD marking specifications. These included:

“Each purse seine fishing vessel deploying FADs in the WCPO purse seine fishery will permanently mark each FAD it deploys with i) the name of the parent purse seine fishing vessel, ii) its WIN, iii) a unique number for that FAD including the first two letters of the name of the parent purse seine vessel preceding the number, and iv) the date the FAD was first deployed. These details will be attached to the FAD, in the English language, in the form of an engraved stainless steel name plate no smaller in dimensions than 15cm by 15cm”.

Electronic monitoring¹

9. Rapid advances in communications, increased use of satellite and associated information and radar (for the interrogation of FADs) have increased the efficiency of FADs as an important element of purse seine fishing operations over time. These advances allow purse seiner vessels to minimize search time, assist in the detection of FADs set by other vessels and help direct vessels to the most productive fishing grounds. Advances in marine electronics that improve FAD efficiency are described in detail by Morón *et al.* (2001) and Itano (2002; 2003).

10. GPS receivers were incorporated into transmitting radio or satellite transmitting buoy design in the 1990s which revolutionized tuna purse seine fisheries. Devices, such as SeaStar's "MDS OrbBouy", offer tracking options direct to vessels or through centralized monitoring (with the agreement of unit owners). Such devices are attached to FADs and can transmit a range of information including position, SST, course, speed, current data, and battery state to a receiving station, such as a vessel or shore facility.

11. Radio buoy antennae can be detected by high definition radar which has promoted the development of low profile GPS radio buoys that reduce poaching of FADs by other vessels. Limitations on battery power have been overcome by the incorporation of onboard solar panels to maintain battery power. Newer style low profile GPS radio buoys have no visible antennae, an integrated buoy tracking system and a solar powered GPS radio buoy.

12. More advanced GPS satellite linked buoys act as remote sonar units capable of transmitting an image of biomass density and depth profile beneath a FAD to a receiving station. Recent developments with echo sounding radio buoys result in transmission of much improved images of fish communities beneath a FAD providing more accurate biomass and even species recognition details.

13. In summary, marine electronics to assist FAD purse seining serves three main purposes to:

- a. remotely provide fishing captains with real time information on position and aggregation levels beneath FADs they have deployed and monitor;
- b. help conceal their FADs from other vessels; and
- c. assist in the detection of other operators' FADs.

14. In respect to drifting FADs, the electronic package attached to the FAD is of primary importance and can determine how useful and productive the FAD is to the parent purse seine vessel. In this respect the identification, marking and regulation of FADs should include similar requirements for their associated electronics.

Limits on the number of FADs deployed and the number of FAD sets²

Eastern Pacific Ocean

15. Vessels generally deploy 50–75 (extreme case of 330) FADs annually (Altamirano *et al.*, 2004). The entire Inter-American Tropical Tuna Commission (IATTC) fleet deployed 7,774 drifting FADs in 2006, 8,435 in 2007 and 9,813 in 2008. The extent to which FADs are removed

¹ Summarized from Itano, 2007.

² Partly summarized from information provided in Anon. 2008.

from the water during fishing closures is undocumented and information on the number of FADs retrieved by EPO vessels each year is limited. IATTC Staff estimate that, for 2006, 5,917 FADs were retrieved out of 7,774 deployed; in 2007, 7,391 FADs were retrieved out of 8,435 deployed and in 2008 8,428 were retrieved for 9,813 deployed (Martín Hall, *pers. comm.*).

16. In 1999, IATTC considered (but was unable to adopt) the following measures to reduce by-catch and adverse impacts of FADs on the tuna resource:

- limits on the depth of FADs;
- limits on the number of sets on FADs and floating objects;
- limits on the number of FADs that a vessel can carry;
- analysis of the effects of the use of bait with FADs;
- seasonal or area bans or closures on the use of FADs; and
- modification of the FAD design.

17. Subsequently, in 2004, IATTC Staff have proposed that a unique marking code system be developed for FADs (IATTC 72-13) that could be recorded by observers and could be useful for a variety of scientific purposes, ranging from the stock assessment of target and non-target species to the drift of the FADs. While IATTC has not developed specific regulations on FAD monitoring and management, the Antigua Convention of IATTC (Article VII, 1(g) and (k)) contains language specific to reducing by-catch and developing environmentally safe fishing gear, which could be applicable to FADs:

- adopt appropriate measures to avoid; reduce; and minimize waste, discards, catch by lost or discarded gear, catch of non-target species (both fish and non-fish species), and impacts on associated or dependent species, in particular endangered species; ...
- promote, to the extent practicable, the development and use of selective, environmentally safe and cost-effective fishing gear and techniques and such other related activities, including activities connected with, inter alia, transfer of technology and training; ...

18. A November 2004 IATTC workshop on developing indices of abundance from purse seine catch and effort data re-iterated the need for FAD-related data from the fishery including the unique identification of FADs.

19. The IATTC observer program has assimilated a comprehensive record of FAD-related information through the Flotsam Information Record (FIR) program (with an accompanying data form – see Attachment B). The FIR collects key information that assists with the monitoring and tracking of floating objects (including time and location, description and dimension of the FAD and its components (including vertical appendages and associated electronics), how the FAD was located, and information on the origin or ownership of the FAD, if available). The FIR also describes whether the FAD is left in the water and any significant alterations or enhancements that may have been made. The FIR, and associated guidelines, may serve as a model to enhance the data to be collected under the ROP in relation to FADs in the WCPFC Convention Area.

20. The tracking and identification of a drifting FAD can be problematic, with drifting FADs taken onboard, modified, and in some cases appropriated from other vessels and provided with a different radio buoy. The IATTC has dealt with drifting FAD identification in the following manner (from Instructions to FIR):

“A very important feature of the FIR is that it enables an object to be tracked throughout a trip, by means of the Object No. and Count No. recorded in the form header. When an object is sighted for the first time during a trip, it is assigned a unique number, the Object No., which is used for that object throughout the trip (except in the one case described in

the following paragraph); the Count No. is a sequential number used to track each visit to a particular object during the trip. If an object is taken aboard the vessel and is later returned to the water while the vessel is still drifting (*i.e.* there is no change in the event on the *Daily Activity Record*), the object keeps the same Object No. and the sequence of Count No is continued. In this case, it is assumed that the vessel takes the place of the object when it is taken aboard and, as long as the vessel remains drifting, the ‘habitat’ is maintained, and when the object is returned to the water, it is reunited with the same fauna.

However, if an object is taken aboard and the vessel then leaves the area (*i.e.* a SEARCH or RUN event is recorded in the *Daily Activity Record*) before the object is returned to the water, the object is assigned a new Object No. In this case, the object is considered to have been removed from its original ‘habitat’ and separated from its accompanying fauna, and thus becomes a ‘new’ object for the purposes of the FIR.”

21. At its June 2009 session the IATTC considered a revised measure for the conservation and management of bigeye and yellowfin tuna in the EPO. Resolution C-09-01 includes support for FAD-related research and pilot program which shall include, *inter alia*, provisions for the marking of FADs, maintaining a record of the numbers of FADs on board each vessel at the beginning and end of each fishing trip, and recording the date, time and position of deployment of each FAD. The Resolution became effective in mid-July 2009 for all IATTC members.

Atlantic Ocean

22. Recent information on FAD deployment in the Atlantic purse seine fishery is poor (except in respect of the companies actually using FADs to support their fishing operations). Ménard *et al.* (2000) estimates that the total number of FADs with radio or satellite buoys used by the 45 purse seiners landing in Abidjan (Côte d’Ivoire) in 1998 exceeded 3,000. Recent information for the Atlantic purse seine fishery is lacking on the number of FADs deployed, the number of sets on any given FAD, and the number of FADs retrieved, lost, or appropriated each year.

23. At its November 2009 session the International Commission for the Conservation of Atlantic Tunas (ICCAT) adopted amendments to its recommendation 04-01 relating to the conservation and management of bigeye tuna. Resolution 08-01 includes some FAD-related measures including a time-area closure and prohibition on deployment and servicing of floating objects. This resolution became effective in June 2009.

Indian Ocean

24. Since the 1990s, FAD usage by European Union purse seine fleets has increased significantly in the Indian Ocean (Morón *et al.*, 2001). Deployed FADs generally lack surface rafts or floatation, aside from some purse seine corks and the radio or satellite buoy and are instead ballasted by plastic oil drums suspended below the surface with nylon netting hanging beneath the drums. This style of FAD is popular as it reduces the surface visibility of the FAD and therefore its rate of appropriation by other vessels.

25. The Spanish purse seine fleet operating in the western Indian Ocean is assisted by supply (or tender) vessels; these vessels, in addition to other duties, may search for FADs and logs, build or repair FADs, assess tuna abundance on other floating objects it encounters, guard FADs with large tuna aggregations until their associated purse seiner arrives to effect the set, and appropriate

productive FADs belonging to other vessels (Arrizabalaga *et al.*, 2001). Tender vessels improve the ability of fishing associations to utilize FADs.

26. Skipper surveys from French and Spanish purse seine vessels operating in the western Indian Ocean estimated the total number of actively monitored FADs at approximately 2,100 at any given time (Moreno *et al.*, 2007). The IOTC Secretariat views this number as a highly dynamic estimate, as FADs can sink or be appropriated by other purse seiners and have a lifetime between a few days to several months. In order for IOTC to better understand the fishing effort within the Indian Ocean, the IOTC has requested that its members provide:

- the number and characteristics of supply vessels operating under or assisting purse seine vessels operating under each nation’s flag, or licensed to operate in a nation’s exclusive economic zones;
- the level of activity of supply vessels, including number of days at sea by 1° grid area and on a monthly basis; and
- data on the total number and type of FADs operated by a nation’s fleet by 5° grid area and on a monthly basis (Indian Ocean Tuna Commission, 2007).

27. Despite this requirement, within the IOTC fleet, information is completely lacking on the number of FADs deployed or carried by each vessel; the number of sets on any given FAD; and the number of FADs retrieved, appropriated, or lost each year.

Western and Central Pacific

28. The observer programmes administered through the Forum Fisheries Agency (FFA) and the Secretariat of the Pacific Community (SPC) have been collecting some FAD-related data for many years (see Attachment C). Much of this information is yet to be fully analyzed. No consolidated information is available concerning the number or type of FADs, and associated equipment, deployed in the purse seine fishery in the western and central Pacific Ocean (WCPO) by fleet. The significance of FADs in the WCPO is represented by the number of FAD sets relative to the total number of sets assimilated from information collected from logsheets by SPC-OFP:

Year	Unassociated	Log	Drifting FAD	Anchored FAD	Total
2006	14,767	10,314	4,923	1,729	31,733
2007	18,365	8,330	5,213	1,762	33,670
2008	20,859	4,570	9,508	2,270	37,207

29. A summary of information common to many of the FMPs submitted by CCMs to the Secretariat in response to CMM 2005-01 and CMM 2008-01 is presented in the table below (<http://www.wcpfc.int/mcs-scheme/conservation-and-management-obligations-other-data>). The structure and information content of the FMPs received to date vary significantly. While the majority of FMPs require some form of FAD marking and identification few provide detailed specifications in respect of this requirement.

Element	AUS	BELIZE	FSM	JPN	NZ	PNG	SI	C-T
Declaration	No intention to introduce	No vessels use			Interim			
Definition of a FAD			Yes	Yes		1998 Fish. Man. Act	Yes	Yes
EEZ total limit						1,000		
Vessel limit: Domestic fleet Foreign licensed			100 50			30	Nil	30
Vessels processing 75% of FAD-associated catch locally						40		
FAD types (or materials)			Yes				Yes	Yes
Deployment date			Yes			Yes	Yes	Yes
Position of deployment			Yes			Yes	Yes	Yes
List or Register			Yes			Yes	Yes	
Marking guidelines			Yes			Yes	Yes	Yes
Radar reflector			Yes			Yes	Yes	
FAD ID Number			Yes			Yes	Yes	Yes
Deployment to be witness by official or observer			Yes			Yes	Yes	
FAD sets- FAD number to be included in catch reporting						Yes		
Catch associated with FADs			Yes	Yes	Yes	Yes	Yes	Yes
Lost FADs to be reported			Yes			Yes	Yes	
Number of tender vessels per catch vessel						3		
Restriction on FAD depth								Yes
Retrieval/Lost FAD guidelines			Yes				Yes	
Periodic review			Yes			Yes	Yes	Yes

On lost or/and abandoned FADs

30. The International Convention for the Prevention of Pollution from Ships, 1973 as modified by the Protocol of 1978, (MARPOL), Annex V addresses waste fishing gear in its ban on the discharge of plastics in all areas of the sea. Regulation 3 prohibits the disposal of “all plastics, including, but not limited to, synthetic ropes, synthetic fishing nets, [and] plastic garbage bags”. Regulation 6, however, exempts these discharges from the prohibition if they involve an “accidental loss of synthetic fishing nets, provided that all reasonable precautions have been taken to prevent such loss”.

31. Section 1.7.11 of the Guidelines for the Implementation of Annex V of MARPOL³ defines “fishing gear” as:

“any physical device or part thereof or combination of items that may be placed on or in the water with the intended purpose of capturing, or controlling for subsequent capture, living marine or freshwater organisms”.

FADs meet this definition.

32. Annex V of MARPOL also provides that unless they are composed entirely of natural materials, FADs also fall under the category of synthetic fishing gear. “Wastes” is defined in the Guidelines as “useless, unneeded, or superfluous matter which is to be discarded”. An FAD that is intentionally abandoned becomes waste fishing gear that has been disposed by the vessel.

33. IMO’s member states, acting through IMO’s Marine Environmental Protection Committee (MEPC), recognize that compliance with MARPOL Annex V has been incomplete. In 2006, MEPC charged a group of member states, coordinated by Canada, to complete a review of MARPOL Annex V and its Guidelines. While the review by the MEPC correspondence group is ongoing, a number of fisheries-related problems have been identified and options to rectify them have been suggested by members of the correspondence group. They include:

- Regulations 9(2) and 9(3)(d) (International Maritime Organization, 2006c) only require fishing vessels over 400 gross tons to maintain a garbage management plan and report the loss of fishing gear in either a garbage record book or a special reporting system designed for fishing gear.
- MARPOL Annex V and its Regulations do not include a requirement to mark gear so that it can be identified and traced to its source. Section 3.5.3, the Guidelines for the Implementation of Annex V of MARPOL encourages the use of gear identification systems, but this is not currently widespread practice:

Guidelines for the Implementation of Annex V of MARPOL for Fishing Gear

- 3.5.3. Fishery managers, fishing vessel operators and associations are encouraged to utilize gear identification systems which provide information such as vessel name, registration number and nationality, etc. Such systems may be useful to promote reporting, recovery and return of lost gear.
- 3.5.4. Fishing vessel operators are encouraged to document positions and reasons for loss of their gear. To reduce the potential of entanglement and “ghost fishing”

³ WCPFC CCMs party to MARPOL: Australia, Belize, Canada, China, France, Indonesia, Japan, South Korea, Marshall Islands, Mexico, New Zealand, Papua New Guinea, Philippines, Samoa, Solomon Islands, Tonga, Tuvalu, United States, and Vanuatu.

(capture of marine life by discharged fishing gear), benthic traps, trawl and gillnets could be designed to have degradable panels or sections made of natural fiber twine, wood or wire.

- 3.5.5. Governments are encouraged to consider the development of technology for more effective fishing gear identification systems.
- 7.1.4. Governments should consider ... the use of garbage discharge reporting systems (e.g., existing ship's deck logbook or record book) for ships ... [to] document the date, time, location by latitude and longitude, or name of port, type of garbage ... and estimated amount of garbage discharged.... Particular attention should be given to the reporting of ... the loss of fishing gear ...

Western and Central Pacific

34. The FFA/SPC observer programmes have been collecting MARPOL-related information since 1994 (recorded on a Pollution Report Form; see Attachment D). It is understood that this information has been sent to the Secretariat of the Pacific Regional Environment Programme (SPREP) but its fate is uncertain. Provision for including lost or discarded fishing gear is included on the form.

35. An issue raised with observers by vessel operators when they note observers recording this information is that rubbish discharge facilities at Pacific ports are limited. In addition, some vessels have been denied clearance to discharge accumulated garbage at port due to quarantine or other reasons. Many vessels have incinerators on board and burn some, but not all, of their rubbish at sea.

Advice and recommendations

36. The Scientific Committee is invited to:
- a. Encourage those CCMs that are yet to submit FMPs to do so utilising the *Guidelines* adopted by the Commission;
 - b. Consider scientific objectives for FAD-related research;
 - c. Advise on information relating to FAD monitoring and management that is required for scientific purposes;
 - a. Discuss options, including minimum standards, for the unique marking of FADs and any associated electronic gear(s) that facilitate the monitoring of the number of FADs used per vessel(s) and fleet(s) and tracking of FADs;
 - b. Advise on data fields for the collection of necessary FAD-related information under the ROP including technical information associated with associated electronic gear;
 - c. Invite industry sources to review and advise on potential FAD-related data collection schemes;
 - d. Advise on the possible development of a specific FAD/Flotsam form complete with minimum data fields for the ROP;
 - e. Advise on MARPOL-related matters for the consideration of either the TCC or the Commission;
 - f. Consider means to compile and report on FAD-related data already collected by purse seine observer programmes in the region for reporting to TCC5 and SC6; and
 - g. Provide advice to the Secretariat for further research to enhance the presentation of a revised version of this paper to TCC5.

Further Reading

Altamirano, E., M.A. Hall, and N.W. Vogel. 2004. Sightings of discarded fishing gear in the Eastern Pacific Ocean. In Proceedings of the Seminar Derelict Fishing Gear and Related Marine Debris: An Educational Outreach Seminar Among APEC Partners. Asia-Pacific Economic Cooperation, Singapore.

Arrizabalaga, H., Ariz, J., Mina, X., Delgado de Molina, A. , Artetxe, I., Pallares, P. and Iriondo, A. 2001. Analysis of the activities of purse seine supply vessels in the Indian Ocean from observers data. *Doc. IOTC, WPTT-01-11, 30p.*

Anon. 2008. *Tackling Marine Debris In The 21st Century*. Committee on the Effectiveness of International and National Measures to Prevent and Reduce Marine Debris and Its Impact. Ocean Studies Board. Division on Earth and Life Studies. National Research Council of the National Academies. The National Academies Press. Washington, D.C. www.nap.edu

Food and Agriculture Organization of the United Nations. 2008c. Fish Aggregating Devices. Available: <http://www.fao.org/fishery/topic/14889/en>.

Inter-American Tropical Tuna Commission. 1999. Report of the Chair of the Working Group on Fish-Aggregating Devices. Available: <http://www.iattc.org/PDFFiles/fish-aggregating%20devices%202nd%20meeting%20ENG.pdf>.

International Maritime Organization. 2006b. Guidelines for the Implementation of Annex V of MARPOL. International Maritime Organization, London.

International Maritime Organization. 2006c. Annex V of MARPOL 73/78: Regulations for the Prevention of Pollution by Garbage from Ships. Consolidated Edition, International Maritime Organization, London.

International Maritime Organization. 2006d. Guidelines on the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, 1972. International Maritime Organization, London.

Itano, D. G. 2002. Super superseiner. Working Paper to the 15th Meeting of the Standing Committee on Tuna and Billfish, Honolulu, Hawaii, 22-27 July 2002. FTWG-10.

Itano, D.G.. 2003. Documentation and classification of fishing gear and technology on board tuna purse seine vessels (D.G. Itano). 16th Meeting of the Standing Committee on Tuna and Billfish, Mooloolaba, Australia, 9-16 July 2003. Working Paper FTWG-3

Itano, D.G. 2005. A summarization and discussion of technical options to mitigate the take of juvenile bigeye and yellowfin tuna and associated bycatch species found in association with floating objects. WCPFC Scientific Committee First Regular Session. 8-19 August 2005, Noumea, New Caledonia. FT WP-4.

Itano, D.G. 2007a. A Summary of Operational, Technical and Fishery Information on WCPO Purse Seine Fisheries Operating on Floating Objects. Third Regular Session of the Scientific Committee, 13-24 August 2007, Honolulu, Hawaii, USA. Western and Central Pacific Fisheries Commission, Kolonia, Pohnpei State, Federated States of Micronesia. WCPFC-SC3-FT SWG/IP-4. 61 pages.

Itano, D.G. 2007b. An Examination of FAD-Related Gear and Fishing Strategies Useful for Data Collection and FAD-Based Management. Third Regular Session of the Scientific Committee, 13-24 August 2007, Honolulu, Hawaii, USA. Western and Central Pacific Fisheries Commission, Kolonia, Pohnpei State, Federated States of Micronesia. WCPFC-SC3-FT SWG/WP-3. 13 pages.

Itano, D., Fukofuka, S., and D. Brogan. 2004. The development, design and current status of anchored and drifting FADs in the WCPO. 17th Meeting of the Standing Committee on Tuna and Billfish. 9-18 August 2004. Majuro, Marshall Islands. FTWG INF-FTWG-3. 26 pp.

Ménard, F., A. Fonteneau, D. Gaertner, V. Nordstrom, B. Stéquert, and E. Marchal. 2000. Exploitation of small tunas by a purse-seine fishery with fish aggregating devices and their feeding ecology in an eastern tropical Atlantic ecosystem. *ICES Journal of Marine Science* 57:525-530.

Moreno, G., L. Dagorn, G. Sancho, and D. Itano. 2007. Fish behaviour from fishers knowledge: The case study of tropical tuna around drifting fish aggregating devices (DFADs). *Canadian Journal of Fisheries and Aquatic Sciences* 64(11):1517-1528.

Morón, J., J. Areso, and P. Pallarés. 2001. Statistics and Technical Information about the Spanish Purse-Seine Fleet in the Pacific. 14th Standing Committee on Tuna and Billfish, 9-16 August 2001. Noumea, New Caledonia. FTWG-11. 7 pp.



GUIDELINES FOR PREPARATION OF FAD⁴ MANAGEMENT PLANS

To support obligations in respect of FADs in CMM-2008-01, the FAD Management Plan (FAD-MP) for a CCM purse seine fleet to be submitted to the Commission could include, for example:

- An objective
- Scope:
 - Description of its application with respect to:
 - Vessel-types and support and tender vessels,
 - FAD types [anchored (AFAD) AND drifting (DFAD)],
 - maximum FAD numbers permitted to be deployed [per purse seine or ring net vessel per FAD type],
 - reporting procedures for AFAD and DFAD deployment,
 - catch reporting from FAD sets (consistent with the Commission's Standards for the Provision of Operational Catch and Effort Data),
 - minimum distance between AFADs,
 - incidental by-catch reduction and utilization policy,
 - consideration of interaction with other gear types,
 - statement or policy on "FAD ownership".
- Institutional arrangements for management of the FAD Management Plans
 - Institutional responsibilities,
 - application processes for FAD deployment approval,
 - Obligations of vessel owners and masters in respect of FAD deployment and use,
 - FAD replacement policy,
 - reporting obligations,
 - observer acceptance obligations,
 - relationship to Catch Retention Plans,
 - conflict resolution policy in respect of FADs.
- FAD construction specifications and requirements
 - FAD design characteristics (a description),
 - FAD markings and identifiers,
 - Lighting requirements,
 - radar reflectors,
 - visible distance,
 - radio buoys [requirement for serial numbers],
 - satellite transceivers [requirement for serial numbers].
- Applicable areas
 - Details of any closed areas or periods e.g. territorial waters, shipping lanes, proximity to artisanal fisheries, etc.
- Applicable period for the FAD-MP

⁴ Fish aggregating devices (FAD) are drifting or anchored floating or submerged objects deployed by vessels for the purpose of aggregating target tuna species for purse seine or ring-net fishing operations.

- Means for monitoring and reviewing implementation of the FAD-MP.
- Means for reporting to the Commission

**Inter-American Tropical Tuna Commission
FLOTSAM INFORMATION RECORD (FIR)**

Trip Number	Object No.	Count No.	Set No.	YY	DATE			TIME	LATITUDE	N/S	LONGITUDE	W
					MM	DD						
A. COMPONENTS (check all that are applicable)						B. LOCATING EQUIPMENT (check all that are applicable)						
		As found	As left						As found	As left		
Tree		[] 1	[]						Flag	[] 1	[]	
Dead animal _____		[] 2	[]						Satellite buoy	[] 2	[]	
Chain / cable / rings / weights		[] 3	[]						Buoy, corks, etc.	[] 3	[]	
Cane / bamboo		[] 4	[]						Lights	[] 4	[]	
Bait container / bait		[] 5	[]						Radio transmitter / beeper	[] 5	[]	
Cord / rope		[] 6	[]						Radar reflector	[] 6	[]	
Floats / corks		[] 7	[]						Unknown	[] 7	[]	
Artificial light for attracting fish		[] 8	[]						Other _____	[] 8	[]	
Netting material		[] 9	[]						C. LOCATING METHOD (check only ONE)			
Sacks / bags		[] 10	[]						Radar	[] 1		
Planks / pallets / plywood / spools		[] 11	[]						Direction finder	[] 2		
Metal drum / plastic drum		[] 12	[]						Satellite	[] 3	check	
PVC or other plastic tubes		[] 13	[]						Visual – the object itself	[] 4	only	
Plastic sheeting		[] 14	[]						Visual – birds	[] 5	one	
Unknown		[] 15	[]						Not applicable	[] 6		
Other _____		[] 16	[]						Unknown	[] 7		
									Other _____	[] 8		
D. IF THERE IS NETTING ON THE OBJECT:						E. OTHER DATA						
		Yes	No	Unk					Yes	No	NA	Unk
Netting hanging from the object?		[]	[]	[]					Bait container refilled?	[]	[]	[]
Estimated area of hanging netting (m ²)		[]							Fauna entrapped? _____	[]	[]	[]
Predominant mesh size (inches)		[] . []							Maximum depth of the object (m)	[] . []		
									Dimensions (m)	[] . []	[] . []	[] . []
									Water clarity	Clear []	Turbid []	Very turbid []
									% epibiota	[]	Tag number	[]
F. CAPABILITY OF TRANSMITTING EQUIPMENT (check all that are applicable)						G. PRIOR ORIGIN OF OBJECT (check only ONE)						
		As found	As left									
Direction to the object		[] 1	[]						Your vessel – this trip	[] 1		
Geographic position of the object		[] 2	[]						Your vessel – previous trip	[] 2		
Water temperature		[] 3	[]						Deployed	[] 3		
Tuna quantity		[] 4	[]						Other vessel – with owner consent	[] 4	check	
Tuna species		[] 5	[]						Other vessel – no owner consent	[] 5	only	
Unknown		[] 6	[]						Drifting object found	[] 6	one	
Other _____		[] 7	[]						Unknown	[] 7		
									Other _____	[] 8		
H. EXPERIMENTAL EQUIPMENT (continue on back)												

OBSERVER'S DAILY LOG

Notes on FORM PS-2

<p><u>Observer Name</u> and <u>Vessel Name</u>: Always print each of these names out in full (e.g. an observer name "John Masa", and a vessel name "Hai Hsiang No. 959")</p> <p><u>Observer Trip ID Number</u>: Number issued by the authority you are working for. (e.g. John Masa, on his 3rd trip in 1996 may get Trip ID No.: "JHM 96-03").</p>	<p><u>Page of</u>: Number Form PS-2's through trip as Page 1, Page 2, Page 3, etc. At end of trip check pages are all there (again). Put the last page number on every page (e.g. if there are 36 pages then the first page will be "Page 1 of 36", the fourth page, "Page 4 of 36" and the last page will be "Page 36 of 36").</p>
<p><u>Ships Time</u>: Record the "Ship's time" whenever there is a change of an activity. Be sure to record all activities. Record as often as necessary during the day. At the very least, record a morning, noon and evening position when in transit.</p> <p><u>Latitude, Longitude, N, S, E, W</u>: Record position as degrees, minutes and minutes to three decimal places, which is usually as it is displayed on a GPS. N.B.: dd = degrees; mm = minutes; mmm = decimal minutes. For latitude below 10° put a zero in front of the number (e.g.: write 5° as 05°). Never forget to enter north or south and east or west correctly (for example "05°27.985' S, 152°28.239' W")</p>	<p><u>Start of day</u>: At the start of each day you must match the date and time on the ship's clock (and observer's watch) to the UTC time and date as read from the GPS.</p> <p><u>Ship's Date</u> and <u>Ship's Time</u>: is the date and time used by crew on board normally. The observer's watch should be set to this date and time as soon as they board.</p> <p><u>UTC Date</u> and <u>UTC Time</u>: is standard date and time that scientists use to make corrections to Ship's date and time when it is used incorrectly, as it often is. Once a day, record Ship's and UTC date and time at the same moment. UTC time is normally got from the GPS. Remember that UTC date is sometimes different from the Ship's date. Observers should record Ship's time in all other forms and paperwork.</p>
<p><u>EEZ Code</u>: Place the code for the EEZ (on back of Form GEN-6) for your position. Use the chart supplied or the chart of the vessel to work this out. If you are not sure then put the code for the EEZ where you think you are.</p> <p><u>Wind (kts)</u> (°): Record speed in knots and direction in degrees of the compass (e.g. for a 15 knot easterly wind, under (kts) print "15" and under (°) print "090") If the wind meter shows metres per second then (kts = 2 x m/sec) approximately.</p> <p><u>Sea conditions (C-S-M-R-V)</u>. C = Calm; S = Slight; M = Moderate; R = Rough; V = Very rough. Judge this yourself. A guide is the wind. If it has been blowing awhile then 0-5 kts is calm; 5-10 kts is slight; 10-20 kts is moderate; 20-40 kts is rough; and anything over 40 kts is usually very rough, however not always so.</p> <p><u>Beacon / payao #</u>: Record the number off any beacon used to mark a log, payao or FAD. Record number of an anchored FAD or payao whenever a boat investigates or sets on it. Write a "B" before a beacon number and write a "P" before payao numbers.</p> <p><u>Comments (and Set No. - from PS-3)</u> - for every activity code "1" write the set No. before other comments in this field. Get "set No." from the PS-3 that must be used for every set.</p>	<p><u>Activity and Helicopter Codes</u>: The activity codes are shown on the front. Use only one code per entry. If it seems that two different codes could be used, record only the most important one and note the other in comments column. Please record every activity change throughout the day. There may be many. Note that, except for Helicopter codes, the start of a new activity marked by one code also means the end of the activity identified by the previous activity code. For activity code "1", "8" or "9" also use <i>school association (tuna)</i> and <i>how detected</i> codes, otherwise the school association (tuna) and how detected code fields must be dashed! Use codes 15R and 15D whenever a vessel retrieves or deploys a buoy set on a FAD or log - if changing buoys use 15R on one line and 15D on the next and record both buoy numbers. If using code 16 remember that transshipment includes any transfer between vessels Helicopter codes: Only use helicopter codes if the helicopter is used directly for searching or fishing - not when it is running messages between boats or to shore. <u>Unless there is an accident every "H1" code should have a matching "H2" code.</u> <u>How Detected</u>: Use this code to best show how investigated tuna or object was found. If more than one method used, use code that shows what first made vessel change course to inspect tuna or object. (E.g.: If helicopter reports tuna so vessel turns toward its position but had to use its bird radar to finally find the tuna then use code "2" - seen from helicopter.) Depth sounder/sonar - do not use <i>code 5</i> when investigating an already found object or fish</p>
<p><u>Floating object and school sightings</u>: Through each day try to keep count of floating objects and free schools. Try to note if floating objects have fish with them or not. Also count anchored floating objects (FADs or payaos) and note if they have fish. Note that free schools can be feeding on baitfish or completely unassociated. This can be a rough but sensible count. It is used to get an idea of life in your area.</p> <p>Floating objects can include trees, logs, drums, FADs, payaos or other significant debris.</p> <p><u>Tally</u>: Mark with a stroke every time you sight something (see example on front) <u>No</u>: Count the "tally" strokes at end of day to get the number of each type of sighting.</p>	<p><u>School Association (tuna)</u>: Use the "School Association" code that best describes whether tuna being targeted are with floating object, animal, feeding on baitfish or unassociated. If it is an unusual tuna association please comment and make notes in your diary.</p> <p><u>Did You Observe Any Events To Record On Form GEN-3 Today?</u> Circle Yes if any infringements, as listed on Form GEN-3, were observed. Write notes on Form GEN-3 and in diary; record your diary page No. on this PS-2 form. If there was no incident for the day circle No.</p>

POLLUTION REPORT

*Remember - Fill in one form for each pollution incident. There might be more than one per day.
If forms run out, report this on the last form and continue recording pollution infringements in diary.*

Observer Name	Put first name first, and your family name last.
Vessel Name	Record the full name of the vessel. Do not use any abbreviations.
Observer ID Number	Use the number assigned by the observer programme e.g. AA 03-01
Page of	Number all GEN-6 pages in sequence from the start until the end of the trip

Date of Incident (dd/mm/yy)	Report the date the pollution was seen in the format outlined.
Time (00.00 hrs)	Report the time using the 24hr clock.
Latitude / Longitude	Record the GPS position of the host vessel when the pollution was first seen.
EEZ / Harbour	Record the EEZ or, for shorebase staff, mark port or Harbour name here.
Wind Direction	The prevailing wind direction. Use degree eg. 90 degrees for an east wind
Wind Speed	Record the prevailing wind speed.
Sea Conditions	C- Calm, S- Slight, M- Moderate, R - Rough.
Current (knts and direction)	If the vessel has a current meter find out what the current strength is.
Observer's vessel activity	State the host (observer's) vessel activity at the time of the pollution incident.
	Some activities to consider might be: fishing; transshipping; bunkering; transitting; aground.

Name of offending vessel	Make an effort to record the complete and proper name of offending vessel. Be careful not to make any spelling mistakes which may make it difficult to prosecute the vessel if the report goes through legal proceedings.
IRCS	The international callsign is marked in large letters on the side of the boat.
Type of vessel	Consider the full vessel and aircraft codes on the front of Form GEN-1.
Your position from offending vessel.	Use the vessel compass to get direction of offending vessel from host vessel. The radar can be used to get an exact distance in nautical miles. Otherwise give best estimate and note if it is the observer's or someone else's.

WASTE DUMPED OVERBOARD	
Material	Tick each correct box to show which types of materials were dumped. Only tick two or more materials if vessel has dumped more than one material type over at the same time - e.g.: it dumped plastic and metal at 10:00hrs. If plastic was dumped at 10:00hrs and metal at 16:00hrs - record separately.
Describe type	Give as good a description as possible of the type of dumped material. E.g.: - plastic bags; bait boxes plastic strapping; bait boxes plastic bags; etc.
Describe Quantities	Give a best estimate of the amount dumped. Sometimes this will be easy - e.g., 12 metal oil drums were dumped. At other times the material might be too far away to see the amount. If it is too far away then estimate the amount as well as possible and make note that it is only a rough estimate at distance.

OIL SPILLAGES AND LEAKAGES	
Source	Tick to indicate where the spillage or leak came from
Visual Appearance / Colour	Describe the colour/ thickness/depth of the spill as well as able.
Describe Area and Quantity	Give a best estimate of the size of the spill. The boat could be a size reference - e.g.: it was 4 times bigger than the boat.

**Supplementary notes on Marpol
Regulations**

Note: Vessels may dump garbage as close as 3 nautical miles to the shore if they have a 'comminuter' onboard (a machine that shreds garbage to tiny pieces).

Otherwise they cannot dump garbage within 12 nm of the coast. Report on all vessels dumping within 12nm of the coast. We can check if they have a comminuter onboard later.

Country Codes

AS	American Samoa	NR	Nauru
AU	Australia	NC	New Caledonia
CK	Cook Islands	NZ	New Zealand
FM	Fed. States of Micronesia	NU	Niue
FJ	Fiji Islands	MR	Northern Mariana
FR	France	PW	Palau
PF	French Polynesia	PG	Papua New Guinea
GU	Guam	PH	Philippine
ID	Indonesia	RU	Russia
IW	International Waters	SB	Solomon Islands
JP	Japan	TW	Taiwan
TO	Kingdom of Tonga	TK	Tokelau
KI	Kiribati	TV	Tuvalu
KR	Korea	US	United States
CN	Mainland China	VU	Vanuatu
MY	Malaysia	WS	Samoa
MH	Marshall Islands		