Report of the 3rd IOTC Ad Hoc Working Group on FADs

Zoom Online, 3 – 5 October 2022

DISTRIBUTION:

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Food and Agriculture Organization of the United Nations

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ACRONYMS

AFAD	Anchored Fish Aggregating Device
ALD	Abandoned, Lost or Discarded
CECOFAD	Catch, effort and ecosystem Impacts of FAD fishing
CMM	Conservation and Management Measures (of the IOTC; Resolutions and Recommendations)
CPCs	Contracting Parties and Cooperating Non-Contracting Parties
CPUE	Catch per unit of effort
DFAD	Drifting Fish Aggregating Device
EMS	Electronic Monitoring Systems
EPO	eastern Pacific Ocean
FAD	Fish Aggregating Device
FOB	Floating Object
IOTC	Indian Ocean Tuna Commission
ROS	Regional Observer Scheme

KEY DEFINITIONS

Bycatch	All species, other than the 16 species listed in Annex B of the IOTC Agreement, caught or interacted with by fisheries for tuna and tuna-like species in the IOTC area of competence.
Discards	Any species, whether an IOTC species or bycatch species, which is not retained onboard for sale or consumption.
Large-scale driftnets	Gillnets or other nets or a combination of nets that are more than 2.5 kilometres in length whose purpose is to enmesh, entrap, or entangle fish by drifting on the surface of, or in, the water column.

STANDARDISATION OF IOTC WORKING PARTY AND SCIENTIFIC COMMITTEE REPORT TERMINOLOGY

SC16.07 (para. 23) The SC **ADOPTED** the reporting terminology contained in Appendix IV and **RECOMMENDED** that the Commission considers adopting the standardised IOTC Report terminology, to further improve the clarity of information sharing from, and among its subsidiary bodies.

HOW TO INTERPRET TERMINOLOGY CONTAINED IN THIS REPORT

Level 1: From a subsidiary body of the Commission to the next level in the structure of the Commission:

RECOMMENDED, RECOMMENDATION: Any conclusion or request for an action to be undertaken, from a subsidiary body of the Commission (Committee or Working Party), which is to be formally provided to the next level in the structure of the Commission for its consideration/endorsement (e.g., from a Working Party to the Scientific Committee; from a Committee to the Commission). The intention is that the higher body will consider the recommended action for endorsement under its own mandate, if the subsidiary body does not already have the required mandate. Ideally this should be task specific and contain a timeframe for completion.

Level 2: From a subsidiary body of the Commission to a CPC, the IOTC Secretariat, or other body (not the Commission) to carry out a specified task:

REQUESTED: This term should only be used by a subsidiary body of the Commission if it does not wish to have the request formally adopted/endorsed by the next level in the structure of the Commission. For example, if a Committee wishes to seek additional input from a CPC on a particular topic, but does not wish to formalise the request beyond the mandate of the Committee, it may request that a set action be undertaken. Ideally this should be task specific and contain a timeframe for the completion.

Level 3: General terms to be used for consistency:

AGREED: Any point of discussion from a meeting which the IOTC body considers to be an agreed course of action covered by its mandate, which has not already been dealt with under Level 1 or level 2 above; a general point of agreement among delegations/participants of a meeting which does not need to be considered/adopted by the next level in the Commission's structure.

NOTED/NOTING: Any point of discussion from a meeting which the IOTC body considers to be important enough to record in a meeting report for future reference.

Any other term: Any other term may be used in addition to the Level 3 terms to highlight to the reader of and IOTC report, the importance of the relevant paragraph. However, other terms used are considered for explanatory/informational purposes only and shall have no higher rating within the reporting terminology hierarchy than Level 3, described above (e.g., **CONSIDERED**; **URGED**; **ACKNOWLEDGED**).

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EXECUTIVE SUMMARY

The 3rd Indian Ocean Tuna Commission (IOTC) Ad Hoc Working Group on FADs was held Online on Zoom from 3-5 October 2022. A total of 111 participants (93 in 2021 and 48 in 2017) attended the Session. The list of participants is provided in Appendix I. The meeting was opened by the acting Chairperson, Dr Gorka Merino from AZTI, Spain, who welcomed participants and formally opened the meeting.

The following are the complete recommendations from the WGFAD03 to the Scientific Committee which are also provided in Appendix V.

WGFAD03.01 (Para 134) The WGFAD **AGREED** that the working group should be technical in nature and **RECOMMENDED** that the SC endorse its proposal that the WGFAD report to the SC (via the WPTT and WPEB). As such the WGFAD also **NOTED** that future meetings of the working group should take place before both the WPEB and WPTT so that the outcomes of the WGFAD can be presented to both working parties

WGFAD03.02 (Para 147) The WGFAD **AGREED** on the need to move towards biodegradable FADs and **RECOMMENDED** that the WPTT endorse this process.

1. Opening of the meeting

1. The 3rd Indian Ocean Tuna Commission (IOTC) Ad Hoc Working Group on FADs (WGFAD) was held Online on Zoom from 3-5 October 2022. A total of 111 participants (93 in 2021 and 48 in 2017) attended the Session. The list of participants is provided in Appendix I. The meeting was opened by the acting Chairperson, Dr Gorka Merino from AZTI, Spain, who welcomed participants and formally opened the meeting.

2. Adoption of the Agenda and arrangements for the Session

2. The WGFAD **ADOPTED** the Agenda provided in Appendix II. The documents presented to the WGFAD are listed in Appendix III.

3. The Secretariat **INFORMED** the WGFAD that they had been notified that the previously elected Co-Chair of the WGFAD, Mr. Abdirahim Sheik Heile (Somalia) was no longer available to continue in this role. As such, **NOTING** the IOTC Rules of Procedure (2022), the WGFAD **CALLED** for nominations for the vacant position of Co-Chair of the WGFAD. Mr. Avelino Munwane (Mozambique) was nominated, seconded and elected as the new Co-chair for the next term. The rest of the meeting was Chaired by both Mr. Munwane and Dr. Merino.

3. The IOTC process: outcomes, updates and progress

3.1 Resolution 15/09 – Terms of Reference

4. The WGFAD **NOTED** Resolution 15/09 on a Fish Aggregating Devices (FADs) Working Group including the Terms of Reference for the WG.

5. The WGFAD **AGREED** that the Terms of Reference for and role of the WG should be clarified. As such the WGFAD would provide input on this issue under item 8.

3.2 Outcomes of the 24th Session of the Scientific Committee

6. The WGFAD **NOTED** the report of the 24th Session of the Scientific Committee (SC24) IOTC–2021–SC24–R, particularly the issues specifically related to the work of the WGFAD.

> *(Para. 105) The SC **NOTED** that WGFAD is tasked with providing advice on FAD management, especially with respect to the impact of dFAD on tropical tuna stocks and the assessment of the optimal number of dFADs to deploy. The SC **NOTED** no such advice was provided. This was due to the lack of transparency to provide data that would allow for a qualitative or quantitative assessment to be conducted. The SC **REQUESTED** future WGFAD meetings to take a more pragmatic approach and focus more on technical issues on FAD management.*
>
> *(Para. 106) The SC **NOTED** Japan's proposal to request a study of the major impacts of fisheries (especially FAD fisheries) on tropical Tuna species using the stock assessment results. Such analysis can be used to provide the basis for determining the optimal number of dFADs. The study should be reviewed at the next WGFAD meeting. It was also proposed that the SC convene a special meeting to discuss the results in order to provide advice in time for the Commission meeting in May.*
>
> *(Para. 107) The SC **RECOMMENDED** the Commission endorse the process to improve current definitions of FAD types and FAD activities used by the IOTC, to be conducted by the WPTT and WGFAD.*

3.3 Outcomes of the 26th Session of the Commission and previous decisions of the Commission in relation to FADs

7. The WGFAD **NOTED** the report of the 26th Session of the Commission (S26) IOTC–2022–SC26–R, particularly the issues specifically related to the work of the WGFAD.

8. The WGFAD **NOTED** that no agreement had been reached on new FAD management measures during the 2022 Commission meeting.

9. The WGFAD were **INFORMED** by the Secretariat that at the Commission, an understanding was reached that the proponents of the FAD CMM and a small working group, would work intersessionally to find common ground regarding the elements of a future proposal. The Secretariat further clarified that bilateral discussions on a potential CMM have been ongoing, and while Members have a better understanding of their respective positions on certain measures, some major differences in positions remain. In the meantime, the Special Session on FADs, to be held in Mombasa Kenya on 3-5 February 2023 is proceeding.

3.4 Resolution 19/02 on FADs

10. The WGFAD **NOTED t**he current management measures for FADs as defined in Resolution 19/02 on Procedures on a Fish Aggregating Devices (FADs) Management Plan.

4. Review of data available at the Secretariat on FADs

4.1 Review of the statistical data available for FADs

11. The WGFAD **NOTED** paper IOTC-2022-WGFAD03-03_Rev1 on the Review of the data on drifting fish aggregating devices which provided an overview of the various data assets received by the IOTC Secretariat and specifically relating to information on what the paper defines as Floating Objects (FOBs), including: catch-and-effort by school type (form 3-CE), details on monthly FOB activities by CPC (form 3-FA), geo-spatial data on deployments of FOBs for the years 2018-2019 (form 3-FD), geo-referenced data on the effort exerted by supply vessels (form 3-SU) and individual daily buoys positions (form 3-BU). Excerpts of this document are found in Appendix IV.

12. The WGFAD **NOTED** that the global purse seine catch of tropical tuna has steadily increased since the early 1960s and reached a maximum close to 4 million metric tons of fish in 2019, with the Indian Ocean contributing to about 12% of the total catches through its industrial purse seine component in 2019.

13. The WGFAD further **NOTED** that the volume of tropical tuna caught in association with drifting FOBs has steadily increased since the mid-1970s and has exceeded 2 million metric tons since 2016, representing more than 50% of the total purse seine catch since the early 2000s.

14. The WGFAD **NOTED** that the proportion of purse seine catch on drifting FOBs in the Indian Ocean has steadily increased over the last decades, reaching 87% of the total purse seine catch and amounting to more than 400,000 t in 2021.

15. The WGFAD **NOTED** that the species composition of the purse seine catch on drifting FOBs has shown large inter-annual fluctuations over the last decades, with the contribution of skipjack tuna increasing from about 50% in 2013 to about 70% in 2021.

16. The WGFAD **NOTED** that the very large majority of the tropical tunas caught in association with drifting FOBs are fish smaller than 60 cm fork length, i.e., juveniles in the case of yellowfin and bigeye tunas. The WGFAD further **NOTED** that the average weights of yellowfin and bigeye tunas in the catch on drifting FOBs have shown a major decline since the early 1990s.

17. The WGFAD **NOTED** the comparisons performed by the Secretariat between available data sets to assess the quality and consistency of the FOB-related data submitted to the Secretariat: (i) number of FAD deployments as reported through IOTC forms 3FA and 3FD (only covering the statistical years 2018 and 2019), (ii) number of sets on FOBs as reported through IOTC forms 3FA and 3CE for the fleets having reported the number of sets as unit of effort, and (iii) catches by species on drifting FOBs are reported through IOTC forms 3FA and 3CE.

18. The WGFAD **NOTED** that EU,France resubmitted a full set of forms 3FA covering the period 2013-2021 during the meeting and that a revised version of paper IOTC-2022-WGFAD03-03_Rev1 was circulated to the participants just after the meeting to account for the changes which were due to some misunderstanding about the terminology and structure of the form.

19. The WGFAD **NOTED** that some discrepancies were found for the numbers of drifting FOBs deployed at sea, as reported, with some variability between fleets and years, further **NOTING** that no comparison of deployments was possible for the purse seine fisheries of the Republic of Korea, EU (Italian fleet) and Seychelles in absence of data.

20. The WGFAD **NOTED** that the Japanese purse seine fishery was not active in 2021, which explained the lack of data submitted for that year.

21. The WGFAD **NOTED** that when available, the annual numbers of sets on FOBs were generally consistent between the forms 3CE and 3FA, with some differences observed in some years for some fleets, **ENCOURAGING** the CPCs concerned to liaise with the Secretariat to identify the causes of discrepancies and resubmit new time series when possible.

22. The WGFAD further **NOTED** that some discrepancies were observed for the catches taken on schools associated with FOBs between the forms 3CE and 3FA, particularly between 2017 and 2019 for EU (Spanish fleet).

23. The WGFAD **ACKNOWLEDGED** that part of the discrepancies may have stemmed from some lack of clarity in the 3FA form and **REQUESTED** the Secretariat to liaise with the interested parties to assess and review the forms so as to facilitate their use and improve the quality of the data reported to the Secretariat.

24. The WGFAD **NOTED** that the number of buoys monitored by each purse seiner for some fleets providing information on the buoys shared between vessels was weighed by the number of vessels accessing the information following the methodology described in Maufroy and Goujon (2019).

25. The WGFAD **NOTED** that while fishing on dFADs has substantially developed in the Indian Ocean over the last decades and now largely dominates the purse seine catches (i.e., about 90% of the purse seine catches in 2021), the proportion of catch from dFAD fishing at global scale has remained fairly constant since the early 2000s due to the concomitant development of the free swimming school purse seine fisheries in the Pacific Ocean which contributes to more than 60% of the global purse seine catches.

26. The WGFAD **NOTED** that the ownership of a dFAD occurring in areas of national jurisdiction of a Coastal State and elsewhere is defined *de facto* through the ownership of the satellite-tracked buoy attached to the FAD (when present), but that it is common practice in the purse seine fishery to take ownership of the FAD by attaching its own buoy to the dFAD, this resulting in a “buoy transfer”.

27. The WGFAD **QUERIED** whether the average weights computed for tunas caught on drifting FOBs in the whole Indian Ocean accounted for some spatial stratification, **NOTING** that the weight was computed as the total catch in weight divided by the total catch in number across all spatial strata (i.e., 5°x5° grid areas) using size frequency data and some proxy fleets in some instances where size

data were not available. The WGFAD further **NOTED** that time series of average weights can be computed in smaller areas (e.g., assessment areas) if required.

28. The WGFAD **NOTED** that the average number of buoys monitored by each purse seiner accounts for the sharing of the information collected by the buoys between purse seiners, and that this information about sharing is available for EU (French and Italian fleets), Mauritius, as well as two Seychelles purse seiners prior to 2022.

29. The WGFAD **AGREED** that the figures provided in Table 20 of the paper on the annual numbers of active purse seiners and buoys cannot be used to assess compliance against the limit of 300 buoys at any one time defined as per IOTC Resolution 19/02 as the data are aggregated over the year while the use of the buoys is of highly dynamic nature with a high turn-over in activations/deactivations of the buoys on a daily basis. The WGFAD **NOTED** that the daily information received at the Secretariat through form 3BU indicates that each purse seiner has tracked between 200 and 300 buoys at any time between 2020 and 2022, further **NOTING** that the compliance assessment could not be conducted for the purse seiners flying the flags of Kenya and Republic of Korea in absence of data.

30. The WGFAD **NOTED** that the buoys found at sea and brought back to Port Victoria (Seychelles) are recorded and used for monitoring purpose for a component of the purse seine fishery, but that this information is not reported to the Secretariat.

31. The WGFAD **NOTED** paper IOTC-2022-WGFAD03-05 on Floating Object fishery indicators: A 2021 report, with the following abstract provided by the authors:

    "The importance of monitoring the FAD fishery as a whole has widely been claimed by scientists, managers and other stakeholders. Based on the recommendations and guidelines of the joint technical Working Group on FADs (Lopez 2019), as well as the repeated requests by some member countries on the production of specific data and analyses (e.g. IATTC-93 INF-A), this document compiles a comprehensive series of spatial and temporal indicators for the floating-object fishery in the EPO with the aim to better monitor and assess its potential impacts in the short, medium and long term. The indicators have been grouped into 8 categories: catch and effort, activities on FADs, satellite buoy-based indices, capacity, technology, ecosystem impacts, socio-economic, and biology, ecology and behavior indicators. This document will also serve to identify and shape data collection and reporting needs on FADs and prioritize future actions for conservation and management of target and non-target species."

32. The WGFAD **THANKED** the authors for the comprehensive presentation on the indicators describing the FOB-fishery of the Eastern Pacific Ocean (EPO) which are based on three main data sets: (i) catch and effort data for all vessels, (ii) observer data for class-6 vessels covering 2016-2021, and (iii) daily active buoy data covering the period 2018-2021.

33. The WGFAD **NOTED** that the very large majority of the fishing sets made in the EPO by class-6 vessels between 2006 and 2021 were on artificial FADs while very few sets were made on natural objects.

34. The WGFAD **NOTED** that the IATTC staff requested accessing the historic raw buoy data from fishing companies.

35. The WGFAD **NOTED** that the IATTC has focused on estimating the numbers of satellite-tracked FOBs at sea and that future work will aim to include the component of FADs that are not equipped with buoys.

36. The WGFAD **NOTED** that the composition of FAD materials and proportion of non-entangling dFADs was not included in the list of indicators in use by the IATTC. The WGFAD **NOTED** that preliminary analysis of observer data collected from the largest purse seiners (i.e., class 6) as well as from dFAD reporting forms (equivalent to logbooks) used for smaller purse seine vessels showed very low levels of entangling and ghost mortality.

37. However, the WGFAD **NOTED** that observations of sharks entangled in dFADs sub-surface structure may not well reflect the true levels of entanglement and associated ghost mortality due to depredation and speed of degradation of the tissues which can occur within less than a few days, **AGREEING** that observations of entanglement may only give a snapshot of its extent.

38. The WGFAD **NOTED** that the large differences in set size between the purse seiners of category B and the two other classes were mostly due to the large size of the vessels which mostly operate on FADs.

39. The WGFAD **ACKNOWLEDGED** the interest of breaking down the purse seiners in different size categories as it was found useful to reveal clear patterns between purse seiners's strategies in the EPO, further **NOTING** that there are major differences in size between large-scale purse seiners in the Indian Ocean – between 67 m and 116 m length overall – and that size is correlated with speed, net size and depth, fuel expenses, etc.

5. Review of Definitions and Management Plans across Tuna RFMOs

40. The WGFAD **NOTED** paper IOTC-2022-WGFAD03-21 on what a well-managed FAD use would look like within a tropical purse seine fishery, with the following abstract provided by the authors:

> *"The authors participated in the Global FAD Science Symposium, March 20-23, 2017, in Santa Monica, California and are presented without affiliation. This paper is one of several from the Symposium and does not represent an exhaustive discussion of the issue but includes points agreed by participants. The participants recognized that impacts of FADs and FAD management cannot be considered entirely independently of harvest strategies, issues related to fishing capacity, ecosystem structure, or management of all other fishing gears in tropical tuna fisheries. None of these points alone will address the management challenges associated with FAD use.."* - see document for full abstract

41. The WGFAD **NOTED** that to date, FAD limits have been based on precautionary agreements on numbers and are not quantifiably estimated. The WGFAD further **NOTED** that scientific analyses are being conducted to hopefully provide science based estimates in the future.

42. The WGFAD **NOTED** paper IOTC-2022-WGFAD03-04 on A review of FAD management measures implemented in other RFMOs, with the following abstract provided by the authors:

> *"All tRFMOs now apply a suite of management measures to mitigate stock and ecosystem impacts resulting from the use of drifting fish aggregating devices (dFADs). All but the IOTC have a regionwide dFAD closure period in place, and wherever sufficient data is available these are proving to have a positive impact upon stock conditions. The success of FAD closures comes results largely from mitigating the growth overfishing driven by large proportions of dFAD catch of yellowfin and bigeye tunas being juveniles.". (see paper for full abstract)*

43. The WGFAD **THANKED** the author for this summary of management measures across Oceans and **RECOGNISED** the utility of this exercise.

44. The WGFAD **AGREED** that it may be useful to look at measures being implemented in other oceans and see which methods would be applicable for the Indian Ocean. Some participants commented that, it would be necessary to determine if they would be effective for IOTC fisheries and that the rationale for implementing a particular measure would not be the same in all regions. Other participants commented that the fisheries in the various RFMOs are very similar in operation and therefore proven effective management measures in other oceans should also be effective in the Indian Ocean.

45. The WGFAD **NOTED** the use of closed seasons as a management measure in most other tuna RFMOs. Clarification was sought as to whether the timing and duration of the closed seasons were based on scientific advice. The author was unsure of the exact studies but indicated that this information was available through the other RFMO scientific bodies. Some participants noted that the closures in IATTC were complete closures on all purse seine fishing and not just FAD fishing closures. However, in IATTC, 99% of the skipjack tuna, 94% of yellowfin tuna and 66% of bigeye tuna are caught in purse seine fishing in the last 10 years (Source: IATTC Data). Further, some participants also, noted that the predominance of FAD use by purse seiners in the Indian Ocean would effectively equate to a complete purse seine fishing closure.

46. The WGFAD **AGREED** on the need to limit the number of dFADs, but was not in agreement on whether this limit should apply to actively followed FADs or FADs in the water. The WGFAD **NOTED** that Res 19/02 already provides limits on the number of operational buoys that may be followed by any purse seine vessel at any one time (300) as well as the number of instrumented buoys that may be acquired annually for each purse seine vessel and the number of buoys that may be held in stock at any one time (500). Some participants commented that these limits should be reduced, while others noted that they are already lower than the limits for any other tuna RFMO.

47. The WGFAD **AGREED** on the need for dFADs to be non-entangling and biodegradable. The WGFAD **NOTED** that Res 19/02 stipulates the requirement that CPCs use non-entangling FADs without netting and promotes the use of biodegradable materials in dFAD construction. The participants disagreed as to whether the move to biodegradable dFADS should follow a phased approach or be implemented immediately. Some participants noted the difficulties to have real biodegradable alternatives to substitute certain FAD elements (especially with flotations elements).

48. The WGFAD **NOTED** the recommendation to adopt a dFAD register as outlined in IOTC-2022-S26-REF02). Some participants requested that the authors provide some clarification as to what additional information or utility this registry would provide over the existing IOTC requirements. Some participants highlighted that currently the purse seiners and supply vessels collect fine-scale information in FAD logbooks (by the captains) or in complementary logbooks (by observers), including data on all activities associated with FADs and buoys including date, time, activity type, FOB type, buoy id, ownership and characteristics of the FAD. The author pointed out that the details of the FAD register are provided in document IOTC-2022-S26-REF02 and that these would ensure transparent and verifiable information sharing on FADs.

49. The WGFAD **NOTED** paper IOTC-2022-WGFAD03-16 on Standardizing FAD definitions between RFMOs, with the following summary taken from the paper text:

> *"Noting that differing definitions between RFMOs is not enabling the effective management of dFADs on a global scale, IPNLF proposes that the IOTC learns lessons from the application of such definitions elsewhere and supports the below definition for a FAD: Fish Aggregating Device (FAD) means a permanent, semi-permanent or temporary object, structure or device of any material, man-made or natural, which is deployed and/or tracked and fish may associate with."*

50. The WGFAD **NOTED** the importance of having clear definitions of FADs and ensuring these are standardised between RFMOs.

51. The WGFAD **NOTED** that it was important to simplify the definitions although some participants were of the opinion that the definitions should not be over-simplified as this could adversely affect the ability of scientists to analyse and provide advice on key FAD issues. The author suggested that the high-level definitions regarding FADs could remain very simple, while these categories could be further diversified for technical purposes.

6. Impacts of FADs on Tropical Tuna Fisheries

52. The WGFAD **NOTED** paper IOTC-2022-WGFAD03-19 on developing a science-based framework for the management of drifting Fishing Aggregating Devices, including the following abstract provided by the authors:

    "Fish Aggregating Devices (FADs) are man-made floating objects deployed by fishers to attract tuna and improve their catches. Currently, more than half of the global tropical tuna purse-seine catches occur at FADs. The fast development of the purse-seine fisheries operating on drifting FADs (DFADs) has raised concerns regarding their impacts on tuna populations, on non-target species like sharks, as well as on pelagic and coastal habitats. Consequently, the management of DFAD fisheries is a priority of all tuna regional fisheries management organizations. Limits on the number of DFADs have been set in all oceans, based on the precautionary approach, due to the little availability of science-based advice to support management decisions. This paper discusses a science-based framework for the management of DFADs, relying on indicators and operating models. A set of indicators and models related to the ecological impacts of DFADs is discussed, considering the case study of DFAD fisheries management in the Indian Ocean. The aim of this approach is assessing and predicting the effects of increasing numbers of DFADs on coastal and pelagic ecosystems, in order to support and/or evaluate past, present and future management actions."

53. The WGFAD **NOTED** that the proposed framework for a science-based management of FAD fisheries prioritises the definition of clear management objectives followed by the development of indicators and operating models to support the development and implementation of management measures within tuna RFMOs.

54. The WGFAD **NOTED a** possible list of ecological indicators presented for target, non-target species and habitats identifying the logbook, observers, buoys and Scientific cruises data as the main data sources already available for their development and assessment.

55. The WGFAD **NOTED** that improvements to the quality of other datasets are required including the spatialized number of dFAD sets for all fleets and years, the number of dFAD deployments for all fleets and data on remote buoy operations (deactivation, replacement) in order to reduce the level of uncertainty with these indicators.

56. The WGFAD **NOTED** that defining clear management objectives would assist with the prioritization of indicators, further **NOTING** that the indicators presented here was by no means an exhaustive list.

57. The WGFAD **NOTED** that regular data collection programs are needed including electronic tagging programs monitoring shark entanglement rates and post-release mortality and monitoring of physiological condition of target and non-target species. The WGFAD further **NOTED** that some

preliminary studies have been carried out on estimating levels of silky shark entanglements. Some participants stressed that updated estimates would be required as previously published ones do not represent the current situation as FAD structures subsequently evolved to use primarily non-entangling materials in FAD construction, which would contribute to the reduction of the entangling rates. The WGFAD **DISCUSSED** the limitations of using electronic tagging studies to assess entangling rates bearing in mind the relatively small sample size that would be possible due to the cost of purchasing and operating the electronic tags. The WGFAD **NOTED** that electronic tags can be, and have been used in studies such as the one by Filmalter et al. (2013) to provide information of animal behaviour in addition to information on entanglement rates.

58. The WGFAD **NOTED** some progress in the data submitted to the IOTC and available in recent years and also **NOTED** that an improvement in the IOTC Form 3FA could be required.

59. The WGFAD **NOTED** the suggestion to create operating models (OMs) to assess the indicators, further **NOTING** that the ideal scenario would combine all indicators into one OM but it would take longer to develop such a model rather than a series of individual indicator models.

60. The WGFAD **NOTED** the possibility of using dFAD trajectories to validate dFAD deployment information in IOTC forms but that currently dFAD tracking data is only available at the national level.

6.1 Stock impacts – tuna behaviour

61. The WGFAD **NOTED** paper IOTC-2022-WGFAD03-06 on Impact of DFAD density on tuna associative behaviour and catchability in the Indian Ocean, including the following abstract provided by the authors:

> *"Ecosystems and biodiversity across most of the world are being altered by human activities. Habitat modification and degradation is among the most important drivers of biodiversity loss. These modifications can have an impact on species behavior, which can in turn impact their mortality. The use of Drifting Fish Aggregating Devices (DFADs) by purse seine fisheries is a major concern and offers a good case study to assess the impact of habitat modifications on species behavior and mortality. Because several pelagic fish species, such as tuna, associate with floating objects, fishers have started deploying their own floating objects – DFADs – in the early 1990s to increase tuna catchability."* – see document for full abstract

62. **T**he WGFAD **NOTED** that this study found that the highest FAD density was found in August, however, this study was based only on data from 2020 so may not be representative of the FAD fishery as a whole.

63. The WGFAD **NOTED** paper IOTC-2022-WGFAD03-07 on In-situ experiment to test a hypothesis on tuna movements within an anchored FAD array in the Maldives, with the following abstract provided by the authors:

> *"To test the hypothesis on connectivity of anchored FADs in the Maldivian 65 skipjack and 57 yellowfin tuna were tagged with acoustic transmitters. Tagging campaigns were within a subsection of the array consisting of 21 AFADs, equipped with acoustic receivers. Only three yellowfin tuna (5.2%) and one skipjack tuna (1.5%) were observed to move from one FAD to another. These four fish were tagged together at the same AFAD during the same tagging campaign, while no fish tagged at the other AFADs moved between FADs. Despite being tagged together, the fish that moved between the AFADs were detected at different AFADs, suggesting that they did not have a specific preference in the direction of*

movement. Another important result is that fish departing from the same AFAD is detected at different AFADs, suggesting that tuna left the AFAD in multiple schools." – see document for full abstract.

64. The WGFAD **NOTED** that the connectivity of anchored FADs (aFAD) has been studied in Mauritius and Hawaii where there are also arrays of aFADs but further **NOTED** that the distance between aFADs in these two areas (<10km) is a lot smaller than the distance between aFADs in the Maldives array (distances of 25-48 km apart).

65. The WGFAD **NOTED** that the residency time at aFADs differed depending on the species, year and individual FAD studied. The average residency time was two days for skipjack and four days for yellowfin tuna. The vast majority of tagged fish were not detected at another FAD after leaving the FAD where they were initially encountered and tagged suggesting limited connectivity between FADs.

66. The WGFAD **NOTED** that the acoustic receivers used during the study have a range of around 800m but this can vary depending on sea and environmental conditions.

67. The WGFAD **NOTED** that a specific size class (40-60 cm which is the most common size class) was used to select the fish to be tagged during this study.

68. The WGFAD **NOTED** that at this time it has not been possible to specify the optimum distance between aFADs to avoid the effect of a FAD array. This study shows that in the south of the Maldives, there is not really a large impact on the behaviour which is consistent with the idea of tuna moving with random movements within a FAD array.

69. The WGFAD **NOTED** the need to be cautious when comparing the effects of aFADs with those of dFADs as the available literature appears to suggest that behaviours of tuna are not comparable around these two different types of floating objects.

6.2 Impacts on endangered, threatened, protected (ETP) species and juvenile tunas

70. The WGFAD **NOTED** that there is a need to understand objectively how various fishing methods (including FAD fisheries) impact the stocks due to excess catch of juveniles and/or adults, especially for yellowfin and bigeye tuna.

71. The WGFAD **NOTED** that by using a stock assessment model such as SS3, it would be possible to simulate changes in MSY with various levels of fishing mortality for each fishing method. The WGFAD **NOTED** that this type of analysis has been conducted in ICCAT. Moreover, fishing method impact plots can be used to simulate the relative impact of each fishing method on the stock, which will inform how fishing mortality should be adjusted for each of these fishing methods to maintain sustainable stock levels.

72. The WGFAD **SUGGESTED** that this should be discussed at the WPM to evaluate the most appropriate approach for evaluating the impact of different fishing gears in MSY and in the status of the stock.

73. The WGFAD **NOTED** paper IOTC-2022-WGFAD03-10_Rev1 on Assessing the impact of drifting FADs on silky shark mortality in the Indian Ocean, with the following summary text taken from the paper:

"While it is well documented that silky sharks make up the single biggest bycatch of non-tuna species in dFAD fisheries, and that mortality rates for these bycaught animals are

high (Murura et al. 2021, Eddy et al. 2016, Hutchinson et al. 2015, Poisson et al. 2014), the extent of the overall impact of purse seining with dFADs on this vulnerable shark species is grossly underestimated and too often ignored. The critically endangered Carcharhinus longimanus, the oceanic whitetip shark, is affected in the same way but accounts for much lower numbers of dFAD bycatch as its abundance has already plunged dramatically after decades of overfishing, which was mostly driven by the lucrative fin trade.”. - see paper for full conclusion.

74. The WGFAD **NOTED** that the results presented by the author complements the work previously introduced at the WPEB 18 (IOTC-2022-WPEB18-29_rev1) including additional discard data reported by the 1DI Form to the IOTC for the period between 2016 and 2021.

75. The WGFAD NOTED that Filmater et al (2013) estimated a high level of shark entanglements in dFADs in 2010-2011. The WGFAD were reminded that non-entangling FADs have been mandatory in the IOTC region of competence since 2020 (Res 19/02).

76. The WGFAD **NOTED** that several issues were raised including the stage at which the shark should be released when detected. **NOTING** the high mortality rate of sharks when released after having been brought onboard vessels, sharks should be returned to the water as quickly as possible to increase their survival rate. The WGFAD **NOTED** that the most effective mitigation measure is to avoid the bycatch of sharks in DFAD fisheries.

77. The WGFAD **NOTED** that silky and oceanic whitetip sharks are affected and impacted similarly in dFAD fishing as they are found in the same areas.

78. The WGFAD **NOTED** the need for a new study on the entanglement of sharks to compare with the study conducted 10 years ago, as since 2020 the IOTC requires the use of non-entangling FADs that may have subsequently reduced entanglement rates.

79. The WGFAD **NOTED** the need to study the number of dFADs lost, while **NOTING** that the existing buoys should be used appropriately to improve information provided.

80. The WGFAD **NOTED** that currently echosounder buoys are not able to detect individual sharks, and thus the need for the development of video cameras to be deployed on buoys to detect them was suggested by some participants.

81. The WGFAD **NOTED** paper IOTC-2022-WGFAD03-09 on Assessment on accidentally captured silky shark post-release survival in the Indian Ocean tuna purse seine fishery, with the following abstract provided by the authors:

“Satellite Archival tagging programs are key to evaluate post-release mortality of Endangered, Threatened, and Protected species that are caught incidentally in fishing operations. This work presents results of a tagging program conducted on purse seiners under ECHEBASTAR company, aimed at assessing post-release survival of silky sharks caught in association with tuna schools and released according to the Code of Good Practices. In two fishing trips carried out during 2020 and 2021, sixty silky sharks were tagged (28 and 32 silky sharks in the first and second trip, respectively) with 37 SPATs and 23 MiniPATs. A vitality index based on state and behavior at release was also assigned to all the sharks caught accidentally. The overall predicted silky shark survival was close to 40% based on vitality index derived from tagged sharks. Shark survivorship decreased as

the fishing operation advanced and vitality index declined. This post-release survival estimate duplicates previous estimations obtained in purse seiners. The experience gained over time in the correct application of best practices and fauna release devices installed on-board (i.e., the bycatch conveyor belt) contribute to reducing shark mortality in the purse seiner fishery."

82. The WGFAD **NOTED** that the vitality index was obtained for all the silky sharks caught and the operation stage from which they were released: entangled in the net when hauling or brailed and released **NOTING** that the vitality index decreased when brail number increased.

83. The WGFAD **NOTED** that the overall survivorship obtained by this study was higher than the estimates from previous shark release studies onboard purse seine vessels also **NOTING** that the differences could be due to the fishing operation itself, the time elapsed from the catch to release, and the application of improved handling and release practices

84. The WGFAD **NOTED** that a correlation between shark physiology and total length could be useful to obtain a better understanding of the use of vitality index for post-release mortality assessments of captured silky sharks.

85. The WGFAD **NOTED** paper IOTC-2022-WGFAD03-11 on Preliminary results of an autonomous buoy prototype to count pelagic sharks at FADs was not presented due to the absence of the authors.

6.3 Other ecosystem impacts – e,g. coral damage due to strandings

86. The WGFAD **NOTED** paper IOTC-2022-WGFAD03-12 on Modelling drifting Fish Aggregating Devices (FADs) trajectories arriving at essential habitats for sea turtles in the Pacific Ocean, including the following abstract provided by the authors:

"Purse seine fishers extensively deploy drifting Fish Aggregating Devices (FADs) to aggregate and catch tropical tuna, with 46,000 to 65,000 FADs deployed in the Pacific Ocean annually, and 16,000–25,000 FADs in the eastern Pacific Ocean (EPO) only. Main concerns related to the loss and abandonment of FADs are i) marine pollution; ii) the potential risk of entanglement of sea turtles and other marine fauna in FAD netting while drifting at sea or when stranded; and iii) the potential to cause ecological damage to vulnerable ecosystems via stranding events, including reefs, beaches, and other essential habitats for sea turtles. To explore and quantify the potential connectivity between FADs and important oceanic or coastal sea turtles habitats in the Pacific Ocean, a series of passive-drift Lagrangian simulation experiments were undertaken based on possible FAD drifting behaviour." - see document for full abstract

87. The WGFAD **NOTED:**

- that the next step in this study is to compare these simulated trajectories with real dFAD drifting trajectories on a larger scale
- that following a long-term trajectory can be challenging as dFADs are often deactivated when they leave the main fishing zones.
- that very similar results were found when comparing simulations to actual FAD densities.
- that different results were found when simulating FADs set at different depths.

88. The WGFAD **NOTED** that a similar study comparing real and simulated drift trajectories in the Atlantic and Indian Oceans showed that the model was good at predicting dFADs general trends in trajectories but was not very accurate for individual dFADs. The WGFAD **NOTED** that the type of FAD is thought to impact the drift trajectories but finding this information on an individual level can be challenging.

89. The WGFAD **NOTED** that one of the objectives of this study was to quantify the amount of FAD strandings that could occur in sensitive areas for sea turtles and where these may originate from in order to provide some mitigation guidelines. However, data on ghost mortality of sea turtles from FADs in these sensitive areas was not available at the time of the study but the authors hope to present more information on this at the next WGFAD.

90. The WGFAD **NOTED** that the effect of the reduced lifetime of biodegradable FADs on the overlap, and potential interaction risk, between dFADs and sea turtle distributions have not been investigated and **NOTED** the need to compare potential risks of conventional FADs vs biodegradable FADs.

6.4 Biodegradability of FADs

91. The WGFAD **NOTED** presentation IOTC-2022-WGFAD03-13 on Update on biodegradable dFADs: current status and prospects.

92. The WGFAD **NOTED** the advancements that have been made in the requirements and designs of biodegradable FADs including the ongoing studies on jelly-FAD designs, **NOTING** that testing of Category II FADs (all components are biodegradable except the floatation components and buoy) is being conducted in the Pacific and Atlantic Oceans and also tested in some models built for the BIOFAD project in the Indian Ocean.

93. The WGFAD **NOTED** that Category III FADs (subsurface components are biodegradable) are close to being available on the market and some purse seine companies are using them in general fishing operations.

94. The WGFAD **NOTED** that trials are being conducted to find suitable materials for flotation including balsa wood, however this material is not readily available in the Indian Ocean region so their use would potentially be expensive. Therefore alternatives are also being investigated. The WGFAD **NOTED** that materials for other components are easily available in the Indian Ocean to replace subsurface structure with biodegradable materials.

95. The WGFAD **NOTED** that it is likely that FAD repair or replacement will be higher with biodegradable FADs due to their higher degradation rates but there are currently no estimates of the time that they will last for before requiring replacement.

96. The WGFAD **NOTED** the view of some participants that a FAD register is necessary in order to keep track of buoy owners so they can be held responsible for disposing of FADs, however, other participants stated that this will not be feasible with the current strategy of the purse seine fleet which involves sharing and transfer of FADs between vessels. These participants also noted that this information is already being collected in FAD-logbooks and thus the use of a FAD register would not be necessary.

97. The WGFAD **NOTED** that for some CPCs lots of information is available on FAD use and deployments, however reporting of FAD logbooks to the Secretariat is not always done correctly. However, this information is not made available to other CPCs and are only available to national scientists.

98. Noting the importance for the harmonisation of the FAD work and management framework that other tuna RFMOs are progressing, the WGFAD **NOTED** that the IATTC and WCPFC have agreed on: (1) the following definition of biodegradable FADs “Non-synthetic materials[1] and/or bio-based alternatives that are consistent with international standards[2] for materials that are biodegradable in marine environments. The components resulting from the degradation of these materials should not be damaging to the marine and coastal ecosystems or include heavy metals or plastics in their composition”, and (2) the following biodegradable FAD categories in a gradual implementation process:

- Category I. The FAD is made of 100% biodegradable materials.
- Category II. The FAD is made of 100% biodegradable materials except for plastic-based flotation components (e.g., plastic buoys, foam, purse-seine corks).
- Category III. The subsurface part of the FAD is made of 100% biodegradable materials, whereas the surface part and any flotation components contain nonbiodegradable materials (e.g., synthetic raffia, metallic frame, plastic floats, nylon ropes).
- Category IV. The subsurface part of the FAD contains non-biodegradable materials, whereas the surface part is made of 100% biodegradable materials, except for, possibly, flotation components.
- Category V. The surface and subsurface parts of the FAD contain nonbiodegradable materials.

99. The WGFAD **NOTED** paper IOTC-2022-WGFAD03-15 on evidence that shows that biodegradability of FADs is achievable, including the following abstract provided by the authors:

“Through this paper, SFACT summarizes the opportunity for purse seine fleets to reduce the impacts that their drifting Fish Aggregating Devices (dFADs) are having on marine ecosystems by constructing these devices using biodegradable materials. Fishers operating in open ocean areas have long known that fish congregate around natural debris and flotsam, such as tree stumps and other natural materials. Natural flotsam historically served the role of dFADs before the purse seine tuna fishing industry commercialized dFAD production and deployment to improve the efficiency of their fishing operations. In doing so, they started using more synthetic materials in dFAD designs as a means of minimizing dFAD costs, promoting their durability and providing a means of reusing their old nets.”

100. The WGFAD **NOTED** that some biodegradable dFADs deployed during experimental trials in the Indian Ocean have been shown to have a lifespan of more than 400 days. However, the WGFAD **NOTED** that the information on the lifespan is likely coming from the buoy information rather than the parts of the FAD made of biodegradable materials (as the degradation rate of FAD components

[1] For example, plant-based materials such as cotton, jute, manila hemp (abaca), bamboo, or animal-basedsuch as leather, wool, lard.

[2] International standards such as ASTM D6691, D7881, TUV Austria, European or any such standards approved by the IATTC/WCPFC.

was not considered for the life span estimation) further **NOTING** that in many trials, degradation of the biodegradable materials occurs from around 6 months after deployment.

101. The WGFAD **NOTED** paper IOTC-2022-WGFAD03-14 on The JellyFAD: a paradigm shift in bio-FAD design, with the following abstract provided by the authors:

"Fishers and scientists in the three tropical oceans are investigating different designs of biodegradable FADs (bio-FAD) efficient for fishing. The tactic followed by most fishers is to maintain the same conventional drifting FAD (dFAD) design (submerged netting panels hanging from the raft) but made of organic ropes and canvas. Results of those experiences show that the lifetime of bio-FADs that maintain the conventional dFAD design but made of organic materials, is shorter than that required by most fishers. The short lifespan of those bio-FADs is due to the structural stress suffered by dFAD designs conventionally used. Thus, in order to use organic materials instead of the strong plastic, and increase the lifespan of those bio-FADs, a paradigm shift is needed. Bio-FAD structures should be re-designed to suffer the least structural stress in the water. The present document aims at (i) summarizing what we learned across the different experiences testing bio-FADs in the three oceans, (ii) proposing a new concept in dFAD design, the JellyFAD design, and (iii) providing recommendations to reduce the impact of dFAD structures on the ecosystem and for bio-FADs construction and use."

102. The WGFAD **NOTED** that following the skippers knowledge, the structural features needed for a drifting FAD to be productive are related to the slow drift and shade effect of a dFAD.

103. The WGFAD **NOTED** that the main difficulties encountered in finding an efficient biodegradable FAD were: (i) the structural stress that bioFADs with conventional design undergo in the water, (ii) a lack of clear alternative for the plastic buoys used for bio-FAD´s flotation and (iii) a clear trend to increase the size of the dFAD structure.

104. The WGFAD **NOTED** that balsa wood is one of the promising organic alternatives for flotation and is currently under test in the IATTC region.

105. The WGFAD **THANKED** the authors for the update on this work and **ENCOURAGED** the continuation of this project.

7. TOWARDS A PLAN FOR IOTC

7.1 Applying the precautionary approach

106. The WGFAD **NOTED** paper IOTC-2022-WGFAD03-20_Rev1 on Suggested improvements to 19/02 that will ensure the effective management of dFADs, with the following abstract provided by the authors:

"Noting concerns of non-compliance provided to the IOTC Compliance Committee in May 2022 through submissions IOTC-2022-CoC19-INF03_Rev2 and IOTC-2022-CoC19-INF04, Kenya proposes various improvements to Resolution 19/02 in follow up to submission IOTC-2022-S26-REF06 as below:

- Implement a dFAD Register, following at minimum the requirements listed in IOTC-2022-S26-REF06

- Implement precautionary limits on the number of dFADs that may be deployed and registered to any vessel in the dFAD Register, following at minimum the requirements listed in IOTC-2022-S26-REF06

- Apply an oceanwide dFAD closure of at least three months, with a 15 day period in advance during which dFAD deployments are prohibited and any fished dFADs must be retained by that vessel to reduce the likelihood of dFAD loss during the closure period
- Implement a dFAD Monitoring System that is developed and administered by a an independent third party, following at minimum the requirements listed in IOTC-2022-S26-REF06
- Improve dFAD marking, reporting and compliance obligations following at minimum requirements listed in IOTC-2022-S26-REF06
- Immediately prohibit the deployment of dFADs that are not fully constructed of biodegradable materials or are an entanglement risk due to having any netting or other meshed materials in their design.
- Require the immediate removal from the ocean of any dFADs that are currently constructed of non-biodegradable materials or contain entangling netting."

107. The WGFAD **THANKED** the authors for the presentation that aims to provide suggestions to modify the IOTC Resolution 19/02. As the paper is not a scientific paper, some participants suggested that the term of collapsing stock is misleading when the status of the stock has been assessed by the SC as overfished and subject to overfishing. Other participants disagreed, indicating that the paper made reference to the dFAD registry that would be used to collect data for analysis, among other points.

108. The WGFAD **NOTED** that the use of a buoy unique identifier as identifier of the drifting FADs is compliant with FAO voluntary guidelines on the marking of fishing gear.

109. The WGFAD **NOTED** a question from some participants on whether there was a rationale or justification for a closure to drifting FADs for a period of at least 3 months, and that it would also be crucial to assess the effects of the closure in conjunction with the effects of other management measures such as TACs. The authors indicated that the duration of the closure was based on a precautionary approach derived from experience gained in other tuna RFMOs. Other participants spoke in support of the proposal and for taking the precautionary approach.

110. The WGFAD **RECALLED** that two time-area closures on purse seine fishing on drifting FADs were implemented in the past in the Indian Ocean without any success due to the high mobility of the large-scale purse seiners and their ability to re-allocate their effort elsewhere. The WGFAD **NOTED** that the proposal of closure would concern the whole Indian Ocean to ensure there isn't an issue of effort displacement. Some participants argued that that closures have been effective in other oceans and so they should be effective in the Indian Ocean as well.

111. The WGFAD **NOTED** that it would be important to look at the seasonality of the purse seine catches to assess the potential effects of a closure on the market through disruption of the continuity in supply of raw materials.

112. The WGFAD **NOTED** that there are still some technical issues to move to 100% biodegradable FADs in relation with the supply of biodegradable materials for their construction and that it might be more realistic to consider a progressive transition with a clear timeframe rather than a sharp change that would be impossible to implement. The WGFAD **NOTED** that the authors of the paper recommended a flexible timeline for the adoption of biodegradable FADs.

113. Some participants noted that juveniles of tunas are also caught on anchored FADs and that the loss of such FADs might result in some marine pollution that would need to be assessed. The WGFAD **NOTED** however that about 47% of the total catches of juveniles of tunas is currently caught with

purse seine on drifting FADs in the Indian Ocean while the levels of catches of juveniles are lower for coastal fisheries using anchored FADs.

114. The WGFAD further **NOTED** that a component of the proposed resolution focuses on anchored FADs but that the degree of magnitude may not be comparable, e.g., ~55 anchored FADs are located in the Maldives archipelago while thousands of drifting FADs are annually deployed by large-scale purse seiners in the western Indian Ocean. Some participants however suggested that the number of anchored FADs in the coastal waters of other member states may be much higher.

115. that the implementation of a closure to fishing is not mutually exclusive from the current management based on a TAC for yellowfin tuna. Some participants noted that it would still be possible for purse seiners to fish on free-swimming schools during the closure and therefore highlighted their opinion on the limitation of impact of the implementation of a closure given the current catch limits of the yellowfin rebuilding plan.

7.2 Improved transparency in FAD operations

116. The WGFAD **NOTED** paper IOTC-2022-WGFAD03-18 on Lessons learned from the monitoring of FOB and buoy use by French and associated purse seiners in the Indian Ocean: How to avoid data gaps? Do we need a FAD register?, with the following abstract provided by the authors:

> *"In recent years, conflicting points of views have regularly been expressed in IOTC regarding the appropriate management of Floating OBject (FOB) fisheries. Solving this issue requires high quality data on FOB fisheries, that would allow monitoring the impacts of using dFADs in purse seine (PS) and other tropical tuna fisheries and providing appropriate scientific management recommendations. Though important efforts have been made to improve data collection and reporting, concerns about the lack of information on FOB fisheries are still regularly expressed by many stakeholders and the quality of information reported to IOTC Secretariat on FOBs and buoys is not always sufficient for scientific purposes. Therefore, alternative options such as the implementation of a FAD register has recently been proposed to improve monitoring and reporting procedures."* – see document for full abstract.

117. The WGFAD **THANKED** and **CONGRATULATED** the authors for the paper which provides a good overview of the status on the information collected on FOBs (as defined in the paper) and FOB-related activities in the purse seine fleets of EU (France and Italy), and Mauritius as well as a selection of indicators aimed at monitoring and assessing the effects of drifting FADs on tuna behaviour, juvenile tuna catch, ghost fishing, marine litter, and stranding events.

118. The WGFAD **NOTED** the indication from the authors that there were some impracticalities identified by the fishing industry about the development of a DFAD register as defined in IOTC-2022-S26-REF06, including the provision of information 15 days prior to any FAD deployment/activation/switch, the permanent marking of dFADs, the prohibition of buoys transfers, or the ban of deployment of buoys on natural objects, and that this latter point might result in an increase in the number of artificial drifting FADs at sea.

119. The WGFAD **ACKNOWLEDGED** that part of the current classification used in the IOTC form 3FA is inadequate and may be confusing. The WGFAD **DISCUSSED** moving in the direction of the recommendations proposed by the authors through (1) the adoption of a new definitions and

terminology and (2) the re-design of the IOTC reporting forms, **NOTING** that this would limit the problems of submissions as well as understanding of the resolutions.

120. The WGFAD **NOTED** that IOTC reporting templates do not need to be endorsed by the Commission and that the process would be to have them presented, discussed, and endorsed at the WPDCS and SC. The WPDCS **REQUESTED** the Secretariat to develop new reporting guidelines for FADs and FAD-related activities once a clear and common terminology would be adopted by the Commission, taking into consideration the suggestions of the small Working Group (see para. 138), the WPTT/WPEB, and the SC.

121. The WGFAD **NOTED** that the lack of proper reporting templates should not have prevented CPCs with purse seine fisheries to report FAD-related data to the Secretariat following IOTC Resolutions 15/02 and 19/02, further **NOTING** that the development and implementation of a dFAD register (as proposed in IOTC-2022-S26-REF06) could address the issues of data availability and accessibility for science and compliance.

122. However, the WGFAD **NOTED** a comment by some participants that the voluntary submission of data sets without predefined format standards increases the workload on the Secretariat and does not facilitate their management.

123. The efforts made by the ORTHONGEL-affiliated purse seiners over recent years was discussed, **QUERYING** whether fleets other than EU (France and Italy), and Mauritius also provided the FAD-related data required *as per* IOTC Resolutions 15/02 and 19/02. The WGFAD were informed that dFAD logbooks have been deployed and used in the Spanish purse seine fishery for years and all data have been reported to IOTC according to standards, and that all OPAGAC- and ANABAC-affiliated vessels have very similar FAD logbooks in use.

124. The WGFAD **NOTED** that detailed definitions and terminology may be useful for science and data collection and submission but that a simple definition of FAD covering any floating object at sea that can aggregate tuna (see paper IOTC-2022-WGFAD03-16) may be more relevant from a management perspective. Some participants suggested that the term of FOB would address this need, though others disagreed.

7.3 Management measures to be considered

125. The WGFAD **NOTED** presentation IOTC-2022-WGFAD03-17 on Development of an Agent-Based Bio-Economic Model of Eastern Pacific Tropical Tunas Fisheries. No abstract or summary was provided by the authors.

126. The WGFAD **NOTED** that the model was developed using *POSEIDON*, which is a coupled agent-based ecosystem model and allows the simulations of both vessel behaviour and biom-economic fishery outcome. The simulation emphasises human and spatial dimensions and aims to determine best policies in a multispecies context.

127. The WGFAD **NOTED** The EPO fishery is composed of different vessels employing a variety of fishing strategies, the method used in the study has accounted for the variability of vessels and has been verified in the validation process.

128. The WGFAD **NOTED** paper IOTC-2022-WGFAD03-08 on Unintended effects of single-species fisheries management, with the following abstract provided by the authors:

"Ecosystem-based management is widely recognized as the path to achieve sustainability of ecosystem services. Tuna Fisheries Management Organizations have incorporated an ecosystem approach into their mandate, but their decision-making process essentially relies on individual stock assessments. This study investigates possible unintended consequences of management measures that primarily focus on single target species. In 2016, the Indian Ocean Tuna Commission (IOTC) adopted a plan for rebuilding yellowfin tuna stock. We examined the impacts that this measure might have had on the fishing strategy of purse seine fleets and on silky shark mortality, their main elasmobranch bycatch. The economic dimension of this possible ecological impact was also explored. Logbook and observer data from the French fleet, coupled with IOTC data from Spain, Seychelles and Mauritius, were used." – see document for full abstract

129. The WGFAD **THANKED** the authors and **CONGRATULATED** them for the work.

130. The WGFAD **NOTED** that the authors considered the number of fishing sets made on FADs but that the information on the total numbers of floating objects drifting at sea was not estimated as part of the study and is poorly known.

131. The WGFAD **NOTED** that the effects of the different design of the dFADs on the catch of silky sharks was not accounted for in the analysis.

132. The WGFAD **ENCOURAGED** the authors to apply the approach to other bycatch species.

8. Discussion on the Future Mandate of the WGFAD

133. The WGFAD **NOTED** that there was some uncertainty as to the role and reporting structure of the WGFAD. The Terms of Reference listed in Res. 15/09 did not clarify whether the WGFAD should be a purely technical working group and report to the Scientific Committee or whether it should include policy and management issues and report through one of the Commissions other Committees (such as the Compliance Committee).

134. The WGFAD **AGREED** that the working group should be technical in nature and **RECOMMENDED** that the SC endorse its proposal that the WGFAD report to the SC (via the WPTT and WPEB). As such the WGFAD also **NOTED** that future meetings of the working group should take place before both the WPEB and WPTT so that the outcomes of the WGFAD can be presented to both working parties.

9. Wrap Up, Summary of Discussions and Recommendations

135. **NOTING** that many important discussions had been held during the WGFAD meeting, there was an attempt to summarise the key points arising from the meeting. The WGFAD **ACKNOWLEDGED** that there were many differences of opinion on these issues and therefore sought to prioritise points on which consensus agreement could be reached, while noting other key issues on which no agreement was reached.

136. The WGFAD **RECALLED** the request from the SC to share the daily buoys position received by the IOTC Secretariat (after their anonymization to guarantee business confidentiality) for scientific purposes to provide guidance to the Commission. The WGFAD **AGREED** on the importance of this information and **NOTED** that the Commission had discussed the issue in 2022 (the following is an excerpt from IOTC-2022-S26-R):

"*(Para. 92) The United Kingdom requested that the information provided in paragraph 24 of Resolution 19/02 on DFAD trajectories and ownership shall be made available for specific analysis upon justified request by any CPC in respect of its waters or by the IOTC Scientific Committee and relevant Working Groups with immediate effect. No objection was expressed to this request*"

137. The WGFAD **REITERATED** its desire to continue to function as a technical working group reporting through the WPTT and WPEB to the Scientific Committee as stated in paragraph 134.

138. The WGFAD **ENDORSED** the creation of a small Working Group to discuss methods to facilitate discussions on FAD data submissions (revise existing data submission forms) as well as to develop suggestions for harmonising definitions and classifications related to FAD fisheries. This small group will be convened by the co-chairs of the WGFAD and include technical experts on FAD fishing. The small group will provide a report to the WPDCS in November, including minutes of the meetings held. The report should also be provided to the WPTT and WPEB for review in 2023.

139. The WGFAD **NOTED** that some participants expressed the need to increase reporting on aFAD activities as they stressed that Res 19/02 has no reporting requirements for these FADs. Although no consensus on this issue was reached, the WGFAD were informed by a participant from the Maldives that this issue was likely to be raised at WPDCS as well as the special session of the Commission to be held from the 3 to 5 February 2023.

140. The WGFAD **NOTED** the discussions related to FAD data completeness and availability. As such, the WGFAD **AGREED** that there is a need to address/reduce data gaps and increase transparency and implement mechanisms to cross-reference data. However, some participants **URGED** the need to reference the precautionary approach and suggested alternate wording, "*There is a need to apply the precautionary approach until we address uncertainties, reduce data gaps/increase transparency, and implement mechanisms to cross-reference data for FADs*". This latter text was not agreed to by all participants.

141. The WGFAD **NOTED** the strong views by some participants on the necessity of a dFAD register. These discussions are detailed in paragraphs 49 and 96. These views were not shared by all participants who stated that there are already data collection tools in place for fine resolution information and so no consensus recommendation could be made on this issue.

142. The WGFAD **NOTED** the proposal to consider a dFAD closure as outlined in documents IOTC-2022-WGFAD03-20_Rev1 and IOTC-2022-WGFAD03-04. Some of the participants strongly supported the need to implement a dFAD closure for between 1 to 3 months per year during which all fishing on dFADs would be prohibited. These participants pointed to the application of dFAD closures in other tuna RFMOs as a precedent to adopt this kind of measure. Other participants did not agree that a dFAD closure should be considered at the current time as they indicated that no scientific justification for the length or seasonality of such a closure in the Indian Ocean is available in their opinion. As such, no consensus on this issue could be reached, but some participants suggestd that studies reviewing the potential applicability of this method in the Indian Ocean would be informative as well as looking at ways and effects on the population and fisheries, in which this measure could complement existing FAD and other species management measures in the Indian Ocean.

143. The WGFAD **AGREED** that there was a need to better monitor FADs and evaluate the benefits and consequences of various management options.

144. The WGFAD **NOTED** the request by the Commission (IOTC-2022-S26-R):

"*(Para. 32) The Commission NOTED that different fishing gears and fleets have differing impacts on the yellowfin tuna population. The Commission REQUESTED that the SC conduct a fisheries impact assessment to determine the individual gear/fleet effects on the yellowfin tuna stock status, and productivity*."

145. The WGFAD **REITERATED** the need to investigate the effects of different gears on YFT MSY levels as discussed under section 6.2, paragraphs 70 - 72.

146. The WGFAD **AGREED** that studies on methods to mitigate the mortality of Endangered, Threatened and Protected (ETP) species due to FAD entanglement should be updated in order to provide revised scientific advice to mitigate the effects of FADs on these sensitive species. These studies should take a multi-species approach to limit the negative impacts on non-target species.

147. The WGFAD **AGREED** on the need to move towards biodegradable FADs and **RECOMMENDED** that the WPTT and WPEB endorse this process.

148. The WGFAD **NOTED** the importance of definitions or classifications of biodegradable FADs being consistent across oceans, further **NOTED** that the IATTC and WCPFC have agreed on the common definitions for biodegradable FADs.

10. ADOPTION OF THE REPORT OF THE 2ND SESSION OF THE AD-HOC WORKING GROUP ON FADS

149. The report of the 3rd Session of the Ad-Hoc Working Group on FADs (IOTC–2022–WGFAD03–R) was **ADOPTED** by correspondence.

Appendix I
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APPENDIX II

AGENDA FOR THE 3RD AD-HOC WORKING GROUP ON FADS MEETING

Date: 3 - 5 October 2022
Location: Zoom
Venue: Virtual
Time: 12:00 – 16:00 (Seychelles time)

Co-Chair: Dr. Gorka Merino (European Union); **Co-Chair:** Mr. Avelino Munwane (Tanzania)

1. **OPENING OF THE MEETING** (Co-Chairs)
2. **ADOPTION OF THE AGENDA AND ARRANGEMENTS FOR THE SESSION** (Co-Chairs)
3. **THE IOTC PROCESS: OUTCOMES, UPDATES, AND PROGRESS**
    - 3.1. Resolution 15/09 –Terms of Reference (Update)
    - 3.2. Outcomes of the 24th Session of the Scientific Committee
    - 3.3. Outcomes of the 26th Session of the Commission and previous decisions of the Commission in relation to FADs
    - 3.4. Resolution 19/02 on FADs
4. **REVIEW OF THE DATA AVAILABLE AT THE SECRETARIAT ON FADS** (IOTC Secretariat)
5. **REVIEW OF DEFINITIONS AND MANAGEMENT PLANS ACROSS TUNA RFMOS** (All)
    - 5.1. ICCAT
    - 5.2. WCPFC
    - 5.3. IATTC
6. **IMPACTS OF FADS ON TROPICAL TUNA FISHERIES** (All)
    - 6.1. Stock impacts – juvenile catches
    - 6.2. Impacts on endangered, threatened and protected (ETP) species
    - 6.3. Other ecosystem impacts – e,g. coral damage due to strandings
    - 6.4. Biodegradability of FADs.
7. **TOWARDS A PLAN FOR IOTC**
    - 7.1. Discussion on adopting definitions for FADs and FAD activities in IOTC
    - 7.2. Applying the precautionary approach
    - 7.3. Improved transparency in FAD operations
    - 7.4. Management measures to be considered
8. **DISCUSSION ON THE FUTURE MANDATE OF THE WGFAD (TO REMAIN UNDER SC OR MOVE TO COC)**
9. **WRAP UP, SUMMARY OF DISCUSSIONS AND RECOMMENDATIONS** (Co-Chairs)
10. **ADOPTION OF THE REPORT OF THE 2nd SESSION OF THE AD-HOC WORKING GROUP ON FADs (**Co-Chairs**)**

APPENDIX III
LIST OF DOCUMENTS

Document	Title
IOTC-2022-WGFAD03-01a	Draft: Agenda of the 3rd Ad Hoc Working Group on FADs Meeting
IOTC-2022-WGFAD03-01b	Draft: Annotated agenda of the 3rd Ad Hoc Working Group on FADs Meeting
IOTC-2022-WGFAD03-02	Draft: List of documents of the 3rd Ad Hoc Working Group on FADs Meeting
IOTC-2022-WGFAD03-03	Review of the statistical data on FADs (IOTC Secretariat)
IOTC-2022-WGFAD03-04	A review of FAD management measures implemented in other RFMOs (Shark Guardian)
IOTC-2022-WGFAD03-05	Floating Object fishery indicators: A 2021 report (Lopez *et al*.)
IOTC-2022-WGFAD03-06	Impact of DFAD density on tuna associative behavior and catchability in the Indian Ocean (Dupaix *et al*.)
IOTC-2022-WGFAD03-07	In-situ experiment to test a hypothesis on tuna movements within a FAD array in the Maldives (Jauharee *et al*.)
IOTC-2022-WGFAD03-08	Unintended effects of single-species fisheries management (Tolotti *et al*)
IOTC-2022-WGFAD03-09	Assessment on accidentally captured silky shark post-release survival in the Indian Ocean tuna purse seine fishery (Grande *et al*).
IOTC-2022-WGFAD03-10	Assessing the impact of drifting FADs on silky shark mortality in the Indian Ocean (Ziegler I)
IOTC-2022-WGFAD03-11	Preliminary results of an autonomous buoy prototype to count pelagic sharks at FADs (Forget *et al*).
IOTC-2022-WGFAD03-12	Modeling drifting Fish Aggregating Devices (FADs) trajectories arriving at essential habitats for sea turtles in the Pacific Ocean (Escalle *et al*.).
IOTC-2022-WGFAD03-13	Status of biodegradable FADs development (Zudaire I)
IOTC-2022-WGFAD03-14	The JellyFAD: a paradigm shift in bio-FAD design (Moreno *et al*.)
IOTC-2022-WGFAD03-15	Evidence that shows that biodegradability of FADs is achievable (Kinyua B).
IOTC-2022-WGFAD03-16	Standardizing FAD definitions between RFMOs (Bayley and Dyer)
IOTC-2022-WGFAD03-17	Development of an Agent-Based Bio-Economic Model of Eastern Pacific Tropical Tunas Fisheries (POSEIDON) (Katyana *et al*).
IOTC-2022-WGFAD03-18	Lessons learned from the monitoring of FOB and buoy use by French and associated purse seiners in the Indian Ocean: How to avoid data gaps ? Do we need a FAD register? (Maufroy *et al.*)
IOTC-2022-WGFAD03-19	Developing a science-based framework for the management of drifting Fishing Aggregating Devices (Capello *et al*)
IOTC-2022-WGFAD03-20	Suggested improvements to 19/02 that will ensure the effective management of dFADs. (Kenya and like-minded proponents).
IOTC-2022-WGFAD03-21	What does well managed FAD use look within a tropical purse seine fishery? (Hampton et al)
Information papers	
IOTC-2021-WGFAD02-INF01	Recovery at sea of abandoned, lost or discarded drifting fish aggregating devices (Imzilen T *et al.*)

APPENDIX IV

MAIN ISSUES IDENTIFIED CONCERNING DATA ON FADS

Extract from IOTC–2022–WGFAD03–03

The following section is an excerpt of paper IOTC–2022–WGFAD03–03 which provides a summary of the information available on FAD-related data available at the IOTC Secretariat and shows some of the main issues in the data submitted through the IOTC forms 3FA, 3FD, 3CE, and 3SU. The subsection "At-sea deployments" provides a comparison of the annual number of FAD deployments between the forms 3FA and 3FD. The subsection "Sets on FADs" compares the numbers of fishing operations conducted on tuna schools associated with FADs between the forms 3FA and 3CE. The subsection provides a summary of the information on fishing effort reported to the IOTC Secretariat as per IOTC Resolution 15/02.

At-sea deployments

Data on deployments by Spanish-flagged vessels of the European Union fleet are in relatively good agreement overall between IOTC form 3FD and IOTC form 3FA (see the DIFF column in Table 1). When considering the breakdown of all deployments by vessel type, though, it is evident how the deployment data reported through IOTC form 3FA are erroneously accounted for exclusively by purse seine vessels (see the FA_PS column in Table 1), while the data from IOTC form 3FD indicates an almost even split between FOBs deployed by purse seines and supply vessels in 2018 and 2019 (see the FD_PS and FD_SU columns in Table 1). Regardless of the vessel type, the deployments of FOBs show a negative trend from 2016 onward, after reaching a peak of about 19,000 FOBs deployed by the Spanish fleet during that year.

Table 1: Summary of total number of FOBs deployed by the Spanish component of the European Union purse seine fleet, as reported through IOTC form 3FD and IOTC form 3FA for the period 2015-2021.

FLAG	YEAR	FD	FA	DIFF	FD_PS	FA_PS	DIFF_PS	FD_SU	FA_SU	DIFF_SU
EU,ESP	2015		17,176			17,176				
EU,ESP	2016		19,058			19,058				
EU,ESP	2017		10,749			10,749				
EU,ESP	2018	10,181	10,167	14	5,979	10,167	-4,188	4,202		
EU,ESP	2019	8,176	8,365	-189	4,845	8,365	-3,520	3,331		
EU,ESP	2020		7,902			7,902				
EU,ESP	2021		8,910			3,503			5,407	

Data on deployments by French-flagged vessels from the European Union fleet are in reasonable agreement between IOTC forms 3FD and 3FA, and in particular for the year 2019. Unfortunately, deployments reported through form 3FA were only associated to purse seine vessels, with no information provided on deployments from supply vessels which were instead available through form 3FD. The annual number of deployed FOBs according to IOTC form 3FA increased from 827 in 2013 to 4,281 in 2021.

Table 2: Summary of total number of FOBs deployed by the French component of the European Union purse seine fleet, as reported through IOTC form 3FD and IOTC form 3FA for the period 2013-2021.

FLAG	YEAR	FD	FA	DIFF	FD_PS	FA_PS	DIFF_PS	FD_SU	FA_SU	DIFF_SU
EU,FRA	2013		827			827				
EU,FRA	2014		914			914				
EU,FRA	2015		1,531			1,531				
EU,FRA	2016		2,260			2,260				
EU,FRA	2017		3,627			3,627				
EU,FRA	2018	4,464	4,202	262	3,296	4,202	-906	1,168		
EU,FRA	2019	3,404	3,352	52	2,433	3,352	-919	971		
EU,FRA	2020		3,946			3,946				
EU,FRA	2021		4,281			4,281				

Deployment data for the Japanese fleet are available from both IOTC forms 3FA and 3FD, and show an almost perfect agreement when considering deployments from purse seine vessels only (see the *DIFF_PS* column in **Table 3**). The trends in deployed FOBs derived from either IOTC form 3FD or IOTC form 3FA are in agreement with the evolution of the Japanese purse seine fleet which has been dramatically reducing operations in the Indian Ocean in recent years and not being active in 2021.

Table 3: Summary of total number of FOBs deployed by the Japanese purse seine fleet, as reported through IOTC form 3FD and IOTC form 3FA for the period 2013-2020. Japan did not report purse seine fisheries activities in the Indian Ocean in 2021 to the IOTC Secretariat.

FLAG	YEAR	FD	FA	DIFF	FD_PS	FA_PS	DIFF_PS	FD_SU	FA_SU	DIFF_SU
JPN	2013		93			93				
JPN	2014		183			183				
JPN	2015		227			227				
JPN	2016		224			224				
JPN	2017		251			251				
JPN	2018	331	299	32	301	299	2	30		
JPN	2019	119	69	50	69	69	0	50		
JPN	2020		33			33				

FOBs deployment data for the Korean fleet are exclusively available through IOTC form 3FA and therefore it is not possible to substantiate their accuracy with the help of data from IOTC form 3FD. In any case, the total annual number of FOBs deployed shows a trend similar to what already observed for the EU,Spain, decreasing systematically from a peak level of 1,940 FOBs in 2015 to a minimum of 399 FOBs in 2020 (**Table 4**). In 2021, the number of FOBs deployed increased to reach the levels observed during the period 2014-2016, with a total of 1,861 FOBs deployed during that year.

Table 4: Summary of total number of FOBs deployed by the Korean purse seine fleet, as reported through IOTC form 3FD and IOTC form 3FA for the period 2014-2021.

FLAG	YEAR	FD	FA	DIFF	FD_PS	FA_PS	DIFF_PS	FD_SU	FA_SU	DIFF_SU
KOR	2014		1,618			1,618				
KOR	2015		1,940			1,940				
KOR	2016		1,749			1,749				

KOR	2017		1,445			1,445				
KOR	2018		489			489				
KOR	2019		412			412				
KOR	2020		399			399				
KOR	2021		1,861			1,861				

Since 2017, Mauritius has submitted FOB deployments broken down between purse seiners and their supply vessels. The information on FOBs deployed by Mauritius as provided through IOTC form 3FA shows a generally decreasing trend from a peak of 929 FOBs deployed in 2017 to 408 deployed in 2020, but rose again to 824 in 2021. Whilst deployment from purse seine fishing vessels decreased, deployment by supply vessels increased, whereby over 90% of the FOBs deployed in 2021 was from supply vessels. The comparison of data from IOTC forms 3FA and 3FD for the years 2018 and 2019 shows a perfect agreement in deployments reported by purse seine vessels in 2018, with a mild under-reporting in 2019 (evidence of 53 more FOBs deployed by Mauritian purse seiners in IOTC form 3FD, see the *DIFF_PS* column in **Table 5**). The situation is inverted when considering deployments from supply vessels, in which case, there is a slight over-reporting for 2019 and a more marked over-reporting for 2018 (see the *DIFF_SU* column in **Table 5**).

Additionally, Mauritius reported a single record corresponding to a FOB deployment event through IOTC form 3FA in 2013, but this record actually indicated zero FOBs being deployed (therefore explaining the blank row for 2013 in **Table 5**), and furthermore was followed by a non-NIL value of the number of sets on FOBs: this suggests a potential issue with the provision (through IOTC form 3FA) of both the number of FOBs and the number of sets on FOB for the year and flag concerned.

Table 5: Summary of total number of FOBs deployed by the Mauritian purse seine fleet, as reported through IOTC form 3FD and IOTC form 3FA for the period 2013-2021.

FLAG	YEAR	FD	FA	DIFF	FD_PS	FA_PS	DIFF_PS	FD_SU	FA_SU	DIFF_SU
MUS	2013									
MUS	2015		106			106				
MUS	2016		1			1				
MUS	2017		929			346			583	

MUS	2018	600	718	-118	141	141	0	459	577	-118
MUS	2019	893	848	45	252	199	53	641	649	-8
MUS	2020		408			273			135	
MUS	2021		824			7			817	

Information on FOB deployments for Seychelles is sparse and often inaccurate (**Table 6**). Data from IOTC form 3FA are available for the years between 2013 and 2021, but for 2015, 2016, 2017, 2019, 2020 and 2021 all the records related to FOB deployment activities (*DD*) explicitly indicate zero deployed FOBs. Similarly to what detected for Mauritius, this situation might indicate a potential issue with the provision (through IOTC form 3FA) of the number of FOBs and the number of sets on FOB for the years and flag concerned.

Furthermore, data from IOTC form 3FD for Seychelles are only available for 2019, and indicate all FOBs as exclusively being deployed by Seychellois supply vessels, with no explicit deployment attributed to purse seiners. Forms 3FA for the years 2020 and 2021, while available, only include 'DH' activities and therefore cannot provide any information on deployments of FOBs by Seychelles-flagged purse seiners or supply vessels for the years concerned.

Table 6: Summary of total number of FOBs deployed by the Seychellois purse seine fleet, as reported through IOTC form 3FD and IOTC form 3FA for the period 2013-2019.

FLAG	YEAR	FD	FA	DIFF	FD_PS	FA_PS	DIFF_PS	FD_SU	FA_SU	DIFF_SU
SYC	2013		1,354						1,354	
SYC	2014		4,103						4,103	
SYC	2015									
SYC	2016									
SYC	2017									
SYC	2018									
SYC	2019	1,465						1,465		

Sets on FADs

The Spanish component of the European Union purse seine fleet submitted two efforts information to the Secretariat, *fishing hours* and *number of sets* through IOTC form 3CE in 2021. The analysis shows a comparable number of sets between 3FA and 3CE (Table 7). Nonetheless, prior to 2021, EU.Spain reported only fishing hours as effort in 3CE, with no alternative effort information. Nevertheless, information from the 3FA shows for years between 2016 and 2021 that the number of sets on FOBs remains stable at an average of about 3,700 sets per year, with a detected decrease of around 20% in 2021 compared to the previous year.

Table 7: Summary of total number of FOB sets recorded by the Spanish component of the European Union purse seine fleet, as reported through IOTC form 3CE and IOTC form 3FA for the period 2015-2021.

FLAG	YEAR	EF_LS	FA	DIFF
EU,ESP	2015		2,829	
EU,ESP	2016		3,931	
EU,ESP	2017		3,085	
EU,ESP	2018		4,439	
EU,ESP	2019		4,051	
EU,ESP	2020		4,092	
EU,ESP	2021		3,287	

Effort information as *number of sets* from the French component of the European Union purse seine fleet is available from 2013 onwards through IOTC form 3FA, and from 2018 onwards through IOTC form 3CE. When data on FOB sets are available from both sources (i.e., for the statistical years 2018-2021) these show a perfect agreement in the number of reported sets (see the *DIFF* column in **Table 8**). The general trend in annual number of FOB sets as reported through IOTC form 3FA appears relatively stable, with limited fluctuations around the average of about 1,900 sets per year.

Table 8: Summary of total number of FOB sets recorded by the French component of the European Union purse seine fleet, as reported through IOTC form 3CE and IOTC form 3FA for the period 2013-2021.

FLAG	YEAR	EF_LS	FA	DIFF
EU,FRA	2013		1,860	

EU,FRA	2014		1,657	
EU,FRA	2015		1,518	
EU,FRA	2016		2,009	
EU,FRA	2017		2,160	
EU,FRA	2018	2,463	2,463	0
EU,FRA	2019	1,918	1,918	0
EU,FRA	2020	1,898	1,898	0
EU,FRA	2021	2,012	2,012	0

The number of sets on FOBs reported since 2018 by Japan through both IOTC form 3CE and 3FA are in good agreement with each other as well as with the available information on the operations of the fleet in the Indian Ocean, which has greatly reduced compared to previous years.

Table 9: Summary of total number of FOB sets recorded by the Japanese purse seine fleet, as reported through IOTC form 3CE and IOTC form 3FA for the period 2013-2020.

FLAG	YEAR	EF_LS	FA	DIFF
JPN	2013			
JPN	2014	44	44	0
JPN	2015	142	137	5
JPN	2016	139	124	15
JPN	2017	196	104	92

JPN	2018	146	137	9
JPN	2019	9	7	2
JPN	2020	34	32	2

The Korean purse seine fleet operating in the Indian Ocean has been regularly providing effort information as number of sets from 2013 onward. Besides 2021 3FA data from Korea, where complete FOBs information are provided, unfortunately, there is no corresponding effort information available for the fleet through IOTC form 3FA (Table 10), and therefore a comparative analysis of the two data sources could only be performed for 2021 data.

When considering effort information from IOTC form 3CE only, the number of annual sets on FOBs shows a stable trend from 2017 onward, with values fluctuating between 415 and 521 FOB sets per year, which follows an all-time peak (in the period considered) of 935 FOB sets reported by the fleet for the statistical year 2016. In 2021, the number of sets on FOBs reported through the form 3FA was slightly higher (+7 sets) than reported in the form 3CE (Table 10).

Table 10: Summary of total number of FOB sets recorded by the Korean purse seine fleet, as reported through IOTC form 3CE and IOTC form 3FA for the period 2013-2021.

FLAG	YEAR	EF_LS	FA	DIFF
KOR	2013	704		
KOR	2014	538		
KOR	2015	731		
KOR	2016	935		
KOR	2017	521		
KOR	2018	415		
KOR	2019	451		
KOR	2020	529		

KOR	2021	484	477	7

Mauritius has been regularly reporting efforts from its purse seiner fleet as number of sets since 2014, with official data from IOTC form 3CE showing a relatively stable trend in total annual sets on FOBs, whose values fluctuate between 421 and 580 sets each year from 2017 onward (**Table 11**).

Data from IOTC form 3FA for the fleet are available for 2013 and from 2016 onward, and show constant levels across time. Effort information from both sources is consistent from 2016 to 2021, with a slightly higher number of sets on FOBs reported through IOTC form 3FA (**Table 11**).

Table 11: Summary of total number of FOB sets recorded by the Mauritian purse seine fleet, as reported through IOTC form 3CE and IOTC form 3FA for the period 2013-2021.

FLAG	YEAR	EF_LS	FA	DIFF
MUS	2013		44	
MUS	2014	351		
MUS	2015	273	408	-135
MUS	2016	262	271	-9
MUS	2017	496	510	-14
MUS	2018	452	464	-12
MUS	2019	421	429	-8
MUS	2020	452	460	-8
MUS	2021	580	581	-1

The Seychellois purse seine fleet has never provided effort information as number of sets through IOTC form 3CE. In fact, this information is only available through IOTC form 3FA (since 2013, with the exception of 2014) and shows a relatively stable trend at around 3,000 sets on FOBs per year since 2016, with limited fluctuations that do not seem to suggest a marked decrease in fishing operations from the fleet (**Table 12**).

Table 12: Summary of total number of FOB sets recorded by the Seychellois purse seine fleet, as reported through IOTC form 3CE and IOTC form 3FA for the period 2013-2021.

FLAG	YEAR	EF_LS	FA	DIFF
SYC	2013		1,534	
SYC	2015		2,186	
SYC	2016		3,264	
SYC	2017		2,981	
SYC	2018		2,784	
SYC	2019		2,878	
SYC	2020		3,265	
SYC	2021		3,006	

Supply Vessels

Data on the effort exerted by supply vessels begun to be regularly received by the Secretariat from the statistical year 2017 onward (Table 19), even though IOTC Resolution 15/02 called for its provision starting with the statistical year 2015 (data available for 2014 is the result of submission of historical information from the CPCs concerned).

All information on efforts from supply vessels should be cross-verified with the Active Vessels' List of IOTC (AVL), that provides data on the active vessels operating in the Indian Ocean by year, flag and vessel type, to understand whether the complete lack of effort for some strata is a consequence of non-reporting, or rather of the absence of active supply vessels for the flags and years concerned.

Table 19: Summary of total number of days at sea spent by supply vessels flagged by the major fleets with purse seiners operating, as reported through IOTC form 3SU.

FLAG	2014	2015	2016	2017	2018	2019	2020	2021
EU,ESP	1,172	2,957	3,462	2,633	2,029	2,016	1,755	1,732
EU,FRA					383	1,329	1,248	427

JPN		20	19	17	20	27		
KOR				304	307	298	294	293
MUS				382	397	405	425	510
SYC			1,099		982	863	2,550	2,363
Total	1,172	2,977	4,580	3,336	4,118	4,938	6,272	5,325

FOB-Tracking data

The current FOB-tracking database of the IOTC Secretariat hosts a total of distinct 17,181,115 daily positions transmitted through satellite communication from 71,047 buoys that were monitored at sea by 47 purse seiners between January 2020 and June 2022, and does not include data for the buoys monitored by the Republic of Korea, which have been submitted to the Secretariat but with many issues in reporting format. Also, no information is available from the active purse seiners of I.R. Iran, due to the country being subject to an embargo restricting access to standard satellite communication.

APPENDIX V

CONSOLIDATED RECOMMENDATIONS OF THE 3RD SESSION OF THE AD-HOC WORKING GROUP ON FADS

WGFAD03.01 (Para 134) The WGFAD **AGREED** that the working group should be technical in nature and **RECOMMENDED** that the SC endorse its proposal that the WGFAD report to the SC (via the WPTT and WPEB). As such the WGFAD also **NOTED** that future meetings of the working group should take place before both the WPEB and WPTT so that the outcomes of the WGFAD can be presented to both working parties

WGFAD03.02 (Para 147) The WGFAD **AGREED** on the need to move towards biodegradable FADs and **RECOMMENDED** that the WPTT endorse this process. The WGFAD **NOTED** that the definitions or classifications of biodegradable FADs are not consistent between oceans and that this should be reviewed and resolved to the extent possible.