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**A proposal for a research plan to inform FAD management options for the WCPFC**

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**WCPFC-SC12-ST-WP-06**

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# A proposal for a research plan to inform FAD management options for the WCPFC<sup>1</sup>

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WCPFC-SC12-2016/ST-WP-06

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Chair - FAD Management Options Inter-sessional Working Group

## Executive Summary

At WCPFC11, the Commission formed a FAD management options working group to review reference papers on FADs as well as any relevant information and advice from the Scientific Committee and Technical & Compliance Committee and provide recommendations on a variety of FAD-related issues.

The IWG recommends that the Commission task the Secretariat and Scientific Services Provider to work with the IWG Chair and Vice-Chair to further develop the draft research plan in 2016,

The IWG considered a consultation document containing an outline of a draft research plan on FADs, which was developed during the 2015 meeting. The outline contains broad categories including FAD design and tuna behaviour, hotspots, acoustic FAD information, and fleet behaviour on which specific analysis would be done to inform discussions about and the management of FADs. WCPFC12 recommended that the draft research plan for FADs would be considered a living document and would go to SC12 and TCC12 for their input prior to WCPFC13.

The research plan proposal presented here incorporates some consideration of the costs and benefits of various research and data collection activities to assist with informing prioritizing the work.

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<sup>1</sup> Informal discussion has been had with the science service provider in the formulation of this research proposal.

## 1. Foreword

WCPFC12 recommended that the draft research plan for FADs would be considered a living document and would go to SC12 and TCC12 for their input prior to WCPFC13. This paper represents the Chair's initial draft proposal for a research plan taking into consideration work currently being undertaken. Comments and input from SC12 and TCC12 shall be incorporated into the draft for presentation to the 2<sup>nd</sup> FAD Management Options Inter-sessional Working Group Meeting to be held immediately following TCC12 before consideration by WCPFC13.

## 2. Introduction

Since the inaugural session of the Commission there has been a strong emphasis on the importance of managing the use of floating objects, including fish aggregation devices (FAD) in relation to the catch of non-target species.

In 2008 WCPFC adopted CMM-2008-01, which to a large extent was the first action the WCPFC had taken to address the use of FADs in the purse seine fishery. A seasonal closure for FAD fishing was an integral part of CMM-2008-01 as well as the development of FAD management plans by WCPFC members. Successive iterations of CMM-2008-01 have been limited, due to various considerations, in improving on the prescribed FAD management arrangements prescribed in Attachment E of CMM-2008-01.

The Western and Central Pacific Fisheries Commission's (WCPFC) responsibilities for managing and conserving target and non-target species caught in relation to FAD sets in the Western and Central Pacific Ocean (WCPO) derive from inter alia Articles 5(d) and 10.1(c) of the Convention, which state that

*"[the members of the Commission shall] assess the impacts of fishing, other human activities and environmental factors on target stocks, non-target species, and species belonging to the same ecosystem or dependent upon or associated with the target stocks"*

and

*"[the functions of the Commission shall be to] adopt, where necessary, conservation and management measures (CMMs) and recommendations for*

*non-target species and species dependent on or associated with the target stocks, with a view to maintaining or restoring populations of such species above levels at which their reproduction may become seriously threatened"*

At WCPFC11, the Commission formed a FAD management options working group to review reference papers on FADs as well as any relevant information and advice from the Scientific Committee and Technical & Compliance Committee and provide recommendations on a variety of FAD-related issues.

The FAD Management Options Inter-sessional Working Group (IWG) first meeting was held on 27-28<sup>th</sup> November in Bali, Indonesia.

The IWG recognized the importance of further research and data collection being undertaken to support/inform further discussions on candidate FAD management options within the WCPFC context.

The IWG considered a consultation document containing an outline of a draft research plan on FADs, which was developed during the 2015 meeting. The outline contains broad categories including FAD design and tuna behaviour, hotspots, acoustic FAD information, and fleet behaviour on which specific analysis would be done to inform discussions about and the management of FADs. IWG participants could provide any editorial comments on Attachment D to the IWG Chair, for consideration in a revised document to be presented to WCPFC12.

The IWG recommends that the Commission task the Secretariat and Scientific Services Provider to work with the IWG Chair and Vice-Chair to further develop the draft research plan in 2016, based on Attachment D or its revision. The draft plan should incorporate some consideration of costs and benefits of various research and data collection activities to assist with informing prioritizing the work. Consideration should also be given within the plan to addressing both target and non-target species.

### 3. Research Focus

This research proposal seeks to expand on the elements presented in Attachment D or its revision of the IWG report to WCPFC12. The focus of the research shall be to mitigate the catch of non-target species, characterise effort creep due to FAD use, improve biomass estimates using instrumented FADs investigate and assess the extent of the interaction between non-target species with the purse seine fishery and the effects of FAD density on target species catch rates in order to develop options for improvements to the current management measures in place for FAD use in the purse seine fishery.

The findings from this research proposal shall be used to design future management measures that mitigate the catch of non-target species caught in association with FAD sets and minimize the impact on the fishery for the target species.

#### 4. Work Programme

The work programme is comprised of a combination of desktop activities and, field activities.

##### 4.1 Desktop Activities

The desktop activities shall consist of one data collation and compilation activity and possibly four analyses activities.

###### I. Construction of a species specific set level catch data set

In order to assess this a historic catch records need to be collected and species composition of principal target species determined. Observer species composition data have been shown to exhibit some bias so they data will have to be corrected using spill sampling data. Consideration will also need to be given to the early misidentification of frozen bigeye and yellowfin. In addition bycatch data will also need to be collected and species composition determined for the same time series as the target species.

The kind of work to be carried out can be found in working paper ST-IP-03.

###### II. Characteristics of top purse seine vessels catching non-target species

Once completed, the species-specific set level catch data set can be used to build on the work done by Harley et al. (2015). They found that some vessels caught significantly higher volumes of non-target species compared to others. A vessel league table could be then constructed to identify and compare the factors underpinning the performance of the top, intermediate and bottom vessels in terms of non-target species catch.

###### III. Spatial management considerations

The catch of non-target species differs spatially in the WCPO region, both in terms of longitudinal and latitudinal differences. Blunt management instruments like seasonal FAD closures do not account for these differences. As such spatial management consideration should be given to extend the work of Harley et al. (2015) to identify 'hotspots' for non-target species as well as for effects of FAD density on catch rates of target species based on various criteria.

## 4.2 Methodology

### I. Construction of a species specific set level catch data set

The construction of the data set(s) will be an extension of that described in Harley et al. (2015), which covered the period 2010-2013. The construction of the data set(s) will link all available observer records and the fishing vessel logsheets. The pertinent observer records are the vessel activity report (PS-2), catch record (PS-3), and length and species composition sampling observer forms (PS-4).

To fulfill the objective of research on FAD design on mitigating the catch of non-target species as recommended by the IWG a link between the observer form for species of special interest (GEN-2) and the FAD monitoring forms (GEN-5) needs to be made to further the work of Abascal et al. (2014). This work will however require the unique identification of FADs to track the success of FAD designs in mitigating the catch of non-target species as well as the effective soak time and the attrition rate of different FAD designs. There is a parallel discussion of FAD marking and identification that shall not be entered into here.

### II. Analysis of factors related to the occurrence of non-target species in purse seine catches

Modern statistical methods will be employed to tease out the particular nature of the interaction between non-target species caught in association with FAD sets and the purse seine fishery. The species-specific set level catch data set will be investigated with statistical techniques such as generalized linear models (GLM), generalized additive models (GAM), and regression trees. This will seek to identify specific variables associated with high non-target species interactions such as season, vessel, location, set type and FAD design,

### III. Characteristics of top purse seine vessels catching non-target species

The species-specific set level catch data set will be investigated with statistical techniques to generate purse seine catch estimates at the vessel level for non-target species caught in association with FAD sets. The fishing characteristics of these vessels will be compared in the form of simple data summaries as in Table 3 of Harley et al. (2015) and vessels will be assigned a rank of high, intermediate, and low, in terms of their catch of non-target species. This will supplement the analyses carried out in activity II above and provide the 'vessel league table' of the top catching vessels for non-target species and the operational characteristics that underpin their performance.

### IV. Spatial management considerations

Extending the hotspot analysis of Harley et al. (2015) and the use of the species-specific set level catch data set, hotspots for purse seine catches of non-target species, CPUE, and proportion will be identified using statistical spatial analysis techniques which will allow the identification of adjacent hotspot regions.

For these regions the percentage of overall catches of non-target species and total purse seine catch taken in these hotspots will be calculated. The calculations will also be undertaken at the fleet level, and hotspots will also be described in terms of the EEZs that they may occur in or overlap. Changes in temporal stability in terms of occurrence and spread will also need to be assessed.

#### 4.3 Field Activities

##### I. Tuna Behaviour

Tagging studies contribute to the understanding of the behavioural dynamics of tunas in terms of movement and fishing mortality.

Tagging operations have been centred on targeting anchored FAD arrays in PNG and Solomon Islands. Getting a significant percentage of tagged yellowfin and bigeye tuna has always been a challenge during all the past tagging experiments in the western part of the Pacific Ocean. From the past tagging experiences, we learned that the TAO buoys anchored in PNG

waters are also often associated with yellowfin and bigeye tuna schools. Conventional, archival and acoustic tagging of bigeye tuna associated with the TAO buoys should be considered as part of a larger scale tuna tagging program to get a better understanding of the behaviour of skipjack, yellowfin, bigeye to further this work with floating objects in the western Pacific and for stock assessments.

## II. Acoustic FAD Deployment

The acquisition of acoustic FAD data has the potential to provide significant insights into the dynamics of the nature of the interaction between FADs and bigeye, skipjack and yellowfin tuna. The information gained from this research can inform FAD design options, FAD deployment considerations and spatial management considerations.

Particularly acoustic FAD data can provide ground truthing' for the effective soak time of FADs, biomass estimates from stock assessments and FAD density effects on movement rates and the catch rates of target species or alternatively to limit catches to only FADs with large biomass to reduce proportion of non-target species caught.

### 4.4 Methodology

#### I. Tuna Behaviour

From 2008, specific tagging cruises were designed to catch and tag tuna in areas where pole and line fishing gear is not efficient due to bait ground absence. Using specific trolling gears developed in Hawaii and targeting the NOAA TAO oceanographic buoys anchored between the 180 and the 140 W longitude lines, the Central Pacific tagging cruises improved the overall spatial coverage of the PTTP tag releases.

From the past tagging experiences, we learned that the TAO buoys anchored in PNG waters are also often associated with bigeye tuna schools. These fish have been tagged using pole and line fishing vessel and gear, but rarely in good numbers.

It has been proposed to equip a training vessel with the appropriate fishing gears to assess in PNG the possibility of fish and tag bigeye tuna in the same way than the CP cruises of the Pacific Tuna Tagging Program. The



vessel is based in Kavieng which is conveniently situated not too far from and in between the longitudes 147E and 156E where TAO are anchored.

A trial cruise was undertaken in August 2012 (report in Annex1), targeting the 2 TAO situated north of Manus island on the 147E longitude. This should be considered as part of a larger scale tuna-tagging project to extend the utility of tag recovery data for this work and for stock assessments.

## II. Acoustic FAD Deployment

The Office of the Parties to the Nauru Agreement in collaboration with PEW Charitable Trusts conducted a 'proof-of-concept' trial for FAD monitoring in 2014. During this trial it became apparent acoustically-equipped drifting FADs could provide useful fishery-independent information on tuna abundance in near real time, as well as work on how long it takes to build up a fishable biomass underneath the FAD, and whether there was evidence of FADs 'competing' for fish (in combination with information on FAD density)

### 5. Cost & Benefit for research prioritisation

In assessing the priority research areas to focus on (Table 1), the IWG recommended that the cost and benefit of the research areas be considered. In that regard, the most cost effective would be the desktop analyses for (i) Analysis of factors related to the occurrence of bigeye tuna in purse seine catches, (ii) Characteristics of top bigeye tuna catching purse seine vessels, (iii) Spatial management considerations, and (iv) FAD Design.

For the fourth desktop analysis, it is important to have a unique marking and identification system implemented for this work to add to the juvenile bigeye catch mitigation discussion as such, until that parallel discussion is completed it would be logical to assign less priority to it than the other desktop analyses. There is currently work being carried out under WCPFC Project 77, to progress these desktop analyses, with funding assistance from the European Union with work proposed to be completed by the fourth quarter of 2017. As such these will logically be assigned high priority.

In terms of the field activities (i) Tuna Behaviour and (ii) Acoustic FAD Deployment, there is support through a collaborative effort between SPC and PNG to conduct tagging of bigeye tuna on the TAO buoys in PNG waters. As the information stemming from these efforts will be realised after 24-36 months, it is logical that this be assigned a medium priority.

Table 1. Priority Research Areas

Research Area	Management Focus	Supported	Completion	Priority
1. FAD Design	Mitigation of non-target species catch associated with FADs through FAD design	NO	~24 months	MEDIUM
2. Tuna Behaviour	Movement rates of target and non-target species associated with FADs in the western Pacific	YES*	~36 months	MEDIUM
3. Hotspot Analysis	Longitudinal and latitudinal differences in catch of non-target species to be characterized by way of hotspots.	YES*	~18 months	HIGH
4. Acoustic FADs	*Limit catches to only FADs with large biomass to reduce proportion of non-target species caught.	NO	~36 months	LOW
5. Fleet Behaviour	Characterisation of effort creep due to FAD use and fleet specific factors resulting in high catches of non-target species.	YES*	~18 months	HIGH

