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Abundance, visiting frequency, interactions, fishery connectivity and economics of exploitation of pelagic species by Réunion's artisanal fishery on anchored FADs (AFICHE): a research project implying tagging of dolphinfish, wahoo and tuna

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ABSTRACT

This note present a synthetic description of the project AFICHE: Abundance, visiting frequency, interactions, fishery connectivity and economics of exploitation of pelagic species by Réunion's artisanal fishery on anchored FADs: a research project implying tagging of dolphinfish, wahoo and tuna. This project is funded by the EU under the European Funds for Maritime Affairs, Fishery and Aquaculture (EFMAFA). We provide the project objectives, means, and technics, which will be carried out including a publicity posters and tag return rewards.

Introduction

Anchored and drifting Fish Aggregating Devices (FADs) are important tool in the modern tuna fisheries used both by large-scale industrial fisheries and artisanal fishermen (Beverly et al., 2012; Fonteneau et al., 2013). Tuna and associated species behaviour around FADs have been extensively studied worldwide including insular areas of the central and western Indian Ocean (Maldives and Mauritius) (Cayre. 1991; Marsac, Cayre, 1998; Dagorn et al., 2000; Itano, Holland, 2000; Whitney et al., 2016; Rodriguez-Tress et al., 2017; Forget et al., 2020 ; Jauharee et al., 2021; Thambithurai et al., 2025). While Reunion Island has a wide array of anchored FADs deployed since 1990s, few studies have addressed the fish aggregation dynamics, residence time, local and large-scale movements (Cayre, Marsac, 1993; Marsac, Cayre, 1998). Furthermore, the regional tuna movements and stock connectivity are still poorly understood for the southern tropical Indian Ocean. Past large-scale conventional tagging resulted in very few recaptures of tagged tuna in the vast area of southern tropical Indian Ocean (Fonteneau, Hallier, 2015). Electronic tagging experiments (Sabarros et al., 2015, Sabarros et al., 2025 in press) show fast and wide dispersion of large, adult yellowfin and bigeye tuna acros the region. Meanwhile there is no information available for themigratory behaviour of albacore tuna, juvenile yellowfin tuna or associated species like a dolphinfish and wahoo, which represents an important resource for the small-scale fisheries around anchored FADs (aFADs).

The primary objective of the project AFICHE (Abundance, visiting frequency, interactions, fishery connectivity and economics of exploitation of pelagic species by Réunion's artisanal fishery on anchored FADs) is to understand the aggregative behaviour and regional movements of commercially-exploited pelagic fish species around aFADs in Reunion Island. This will be achieved through a variety of methods such as acoustic buoys, passive acoustic monitoring, conventional and electronic tagging (interna archival tags and satellite tags).

Project description and objectives

The AFICHE project consists of three working packages (WP) focused on four species of pelagic commercially exploited fishes (yellowfin tuna, albacore tuna, wahoo, and dolphinfish):

WP 1: Studies of fish aggregations and movements around anchored FADs and across arrays of FADs.

- Understand aggregations structure and dynamics,
- Understand the behaviour, connectivity and residence at the scale of aFADs arrays,
- Determine the effects of seasonality on visiting frequency and aggregations stability,
- Describe the movements, migratory routes and connectivity of large pelagic fish populations in Réunion's EEZ and at the Indian Ocean (based on the deployment of archival tags and PSAT).

WP 2 'Assessment of interactions with fisheries' through collaborations with coastal fishermen

- Understand the interactions and potential impacts of small-scale fisheries on targeted and non-retained species,
- To collect information on the associated fisheries using self-reporting data on the fish populations present around aFADs,
- Estimate the overall fishing effort on aFADs,
- Evaluate the depredation on catches around aFADs.
- Estimate the abundance of species present at aFADs.
- Build collaboration with longline fishermen for opportunistic tagging operations focused on undersized tuna and by-catch to increase tagging coverage.

WP 3: 'Development of socio-economic indicators'

- Assess the socio-economic benefits of fishing activities on aFAD for the sustainability of small-scale fishing and longline fishing in Reunion Island.

Tagging

The core component of this project is tagging of these four aFAD-associated species by various types of tags: conventional, acoustic, archival pop-up electronic tags and internal archival electronic tags. Here we focus on tagging operations since success of this part of the project highly relies on the co-operation with fishermen both on local and ocean-wide international scale.

Planned tagging operations involves deployment of 35 miniPAT tags (Wildlife Computers, USA) (Figure 1) over the medium (180 days) and long term (365 days), 60 internal archival tags ARCGEO-13TS (LOTEK Wireless Inc., Canada) (Figure 2), 40 V16 internal acoustic tags and 5 V16 external acoustic tags (VEMCO-INNOVA SEA, USA). A total of 55 yellowfin tuna (5 miniPATs, 30 internal archival tags and 20 acoustic tags), 15 albacore tuna (10 miniPATs, and 5 external acoustic tags), 50 wahoo (30 internal archival tags and 20 acoustic tags), and 20 dolphinfish (20 miniPATs).

Adult albacore, which is a mesopelagic species, are difficult to tag. This difficulty is due to the fragility of this species' swim bladder, particularly during abrupt pressure changes following capture. To test the feasibility of deploying miniPATs on albacore tuna, we planning to perform test on albacore tuna survival at the start of the project. A total of five albacore tuna individuals will be tagged with acoustic tags and tracked using a hydrophone (acoustic active tracking).

The individual's ability to tolerate the tagging operation could be quickly detected (within approximately 60 minutes). Tagged individuals remain active during the monitoring period and showing variations in swimming depth, while an individual that not survive the capture stress will be detected by alternated behaviour.

Whether PSAT electronic tags are deployed on albacore tuna will depend on the results of these tests using active acoustic tracking, which will be carried out on five individuals.

Several groups of aFADs will be used during the tagging operations around the island. The electronic and acoustic tagging campaigns will be combined in order to optimise sea trips and reduce costs.

Acoustic tags will be monitored by ten VR2W acoustic receivers (69 kHz) installed on ten anchored FADs distributed around the island, providing a wide-ranging detection system for tagged fish (three receivers in the west, two in the south, one in the east and three in the north).

All fish tagged with electronic tags will be also tagged with a conventional 'spaghetti' tags (orange for fish with archival tag inside and white for fish with acoustic tag inside) PDAT Large (Hallprint Pty Ltd, Australia) (Figure 3). In addition to electronic tagging an opportunistic tagging is planned using conventional 'spaghetti' tags of small undersized yellowfin tuna and other species. We expect a wide voluntary participation of commercial longline fishermen in the opportunistic tagging activities since the release of undersized fish is common practice in Reunion Island-based longline fisheries. A specific tagging kit was developed for opportunistic tagging including small-sized tagging form on waterproof paper. A total of 700 conventional tags (of yellow colour) will be deployed through opportunistic tagging.

Tags return and rewards

The return of tags is an important part of the project, in particular for internal archival and conventional tags. A reward of 300 Euros is set for return of archival tag. A reward of 50 Euros is expected for miniPATs.

A set of visual posters has been developed for wide distribution of the information about the tagging program (Annex I) to facilitate information exchanges and promote tag return.

All contact addresses are provided on posters or on tags, but any of the co-authors can be contacted in case of tag recapture.

Conventional tags are currying the following message:

No. XX00000 CRPMEM Reunion Island !!! REWARD !!! contact@crpmem.re No. XX00000

No. XX00000 CRPMEM La Réunion !!! RECOMPENSE !!! contact@crpmem.re No. XX00000

Archival tags are currying the following message:

CRPMEM La Réunion !!! RECOMPENSE !!! !!! REWARD !!! **300** Euros contact@crpmem.re +262 692883331

Dynamic of biomass at anchored FADs

Besides fish tracking the dynamics of biomass aggregation at aFADs will be studies with sounding buoys. The sonar buoys used in this project are those typically used in purse seine fishing and associated with drifting FADs. Various indicators characterising aggregation (e.g. presence/absence, abundance class, abundance value) will be estimated for both, various levels of resolution in time (day, night, sequence of hours, week, decade, month), and vertical dimension (across the entire water column, depth strata) (Lopez et al., 2017; Baidai et al., 2020). Aggregated biomass data under aFADs for a given level of resolution will be cross-referenced with information characterising the acoustic landscape in the vicinity of the aggregation, which will be collected from submerged hydrophones. The intensity of the frequencies recorded by the hydrophones and their volume will be analysed simultaneously with data from the sonar buoys to identify potential similarities between indicators from each data source, as well as data on the visits of aFADs by fishermen and data on catch volumes.

Socio-economic indicators

Socio-economic indicators will be collected through field surveys among professional fishermen to determine the actual costs incurred by fishing on aFADs (equipment rental and purchase, bait, fuel, etc.) and any associated catches for each trip to sea. These surveys may be carried out at landing sites or during tagging and self-sampling campaigns. This socio-economic assessment of fishing activities on aFADs will enable a comprehensive review of the governance of the 'FAD system' in Réunion (financing, management) and will make it possible to assess the value of the system in terms of the sustainable use of fisheries resources in coastal waters.

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Figure 1. Wildilfe Computers miniPAT tag (MiniPAT-430).

Figure 2. LOTEK ARCGEO-13TS internal archival tag.

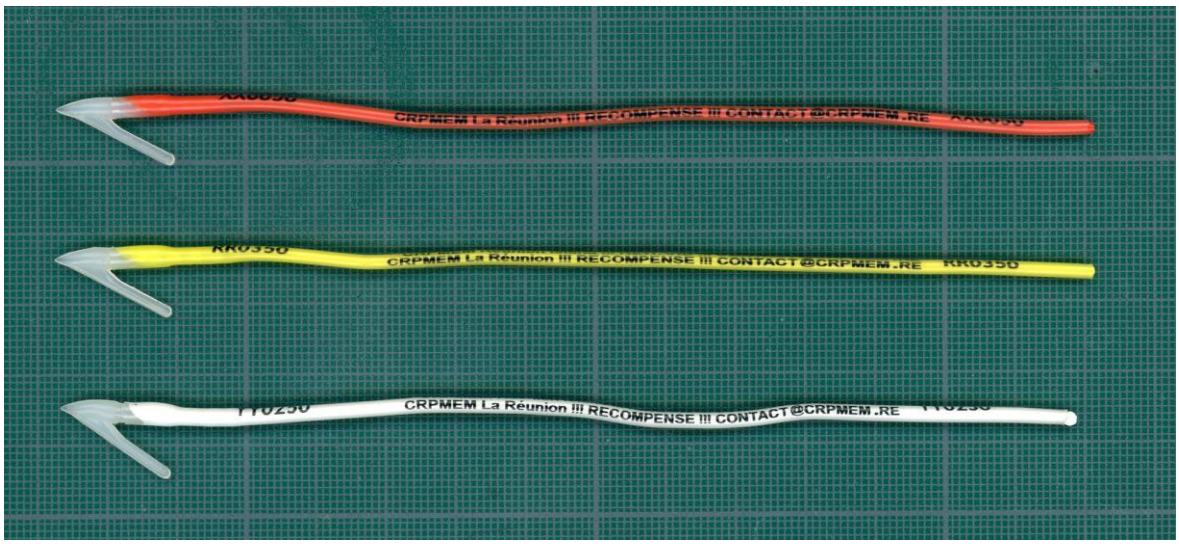


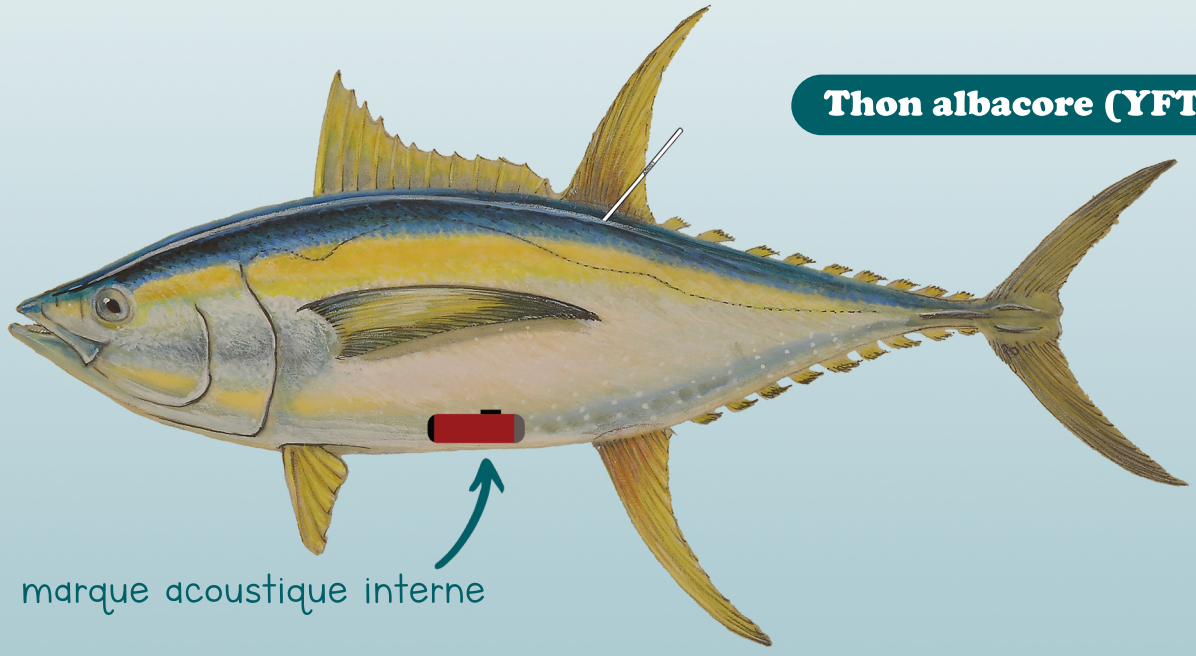
Figure 3. Hallprint convetional “spaghetti” tags PDAT Large. Orange tags are for fish with archival tag inside, white tags are for fish with acoustic tag inside and yellow tag for miniPAT tagged fish or for fish tagged in opportunistic tagging.

Tagging posters

AFICHÉ

INFORMEZ NOUS SUR LES ESPÈCES MARQUÉES AUX SPAGHETTIS BLANCS

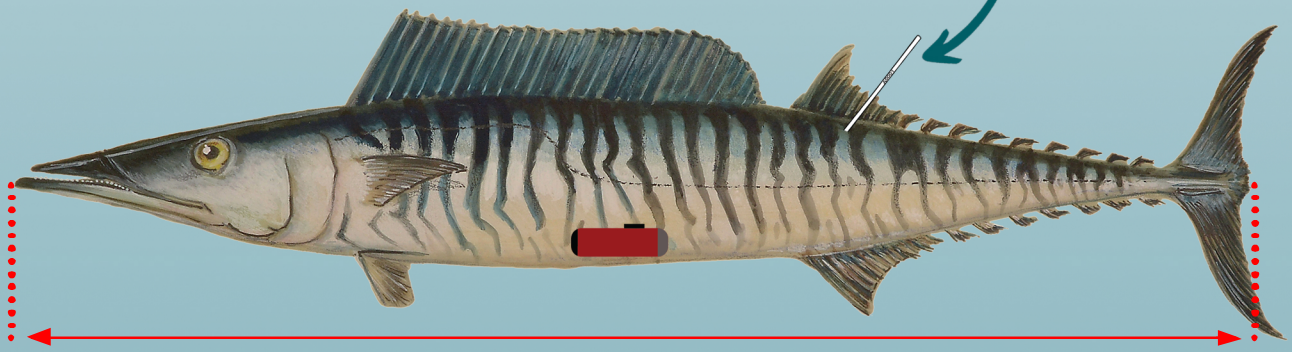
Thon albacore (YFT)



marque acoustique interne

Thon banane (WAH)

spaghetti blanc



longueur à la fourche

Informations à envoyer au CRPMEM de La Réunion :
• Date de capture • Mesure totale à la fourche • Coordonnées GPS

Contactez :

Thomas POIROUT
47 rue Evariste de Parny 97420 Le Port
Téléphone : +262 (0)692 88 33 31
Email : tpoirout@crpmem.re

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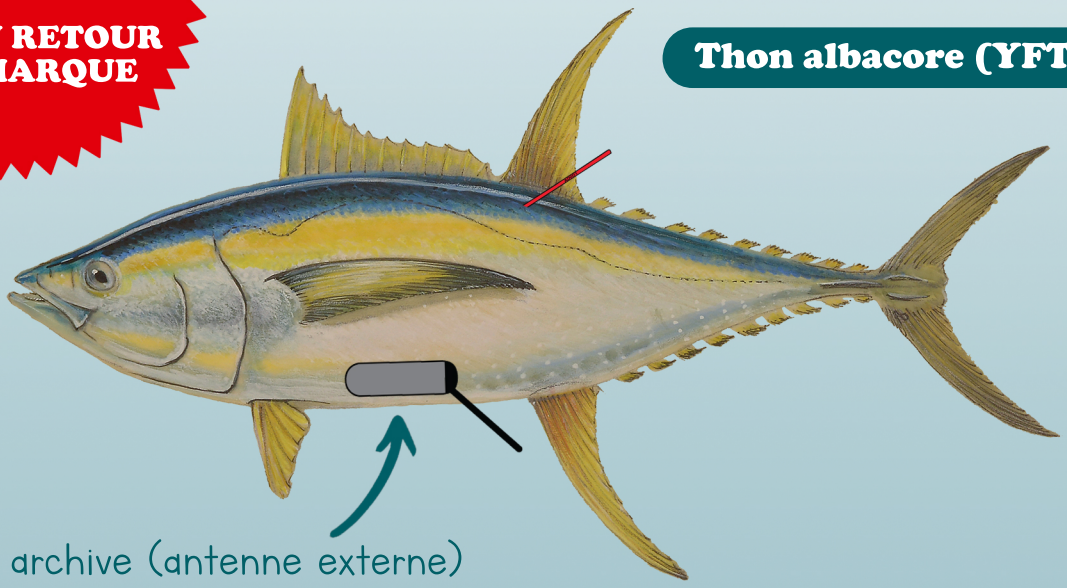
Comité régional des pêches maritimes et des élevages marins CRPMEM de La Réunion

AFICHÉ

INFORMEZ NOUS SUR LES ESPÈCES MARQUÉES AUX SPAGHETTIS ROUGES

RÉCOMPENSE
300 €
POUR UN RETOUR DE LA MARQUE

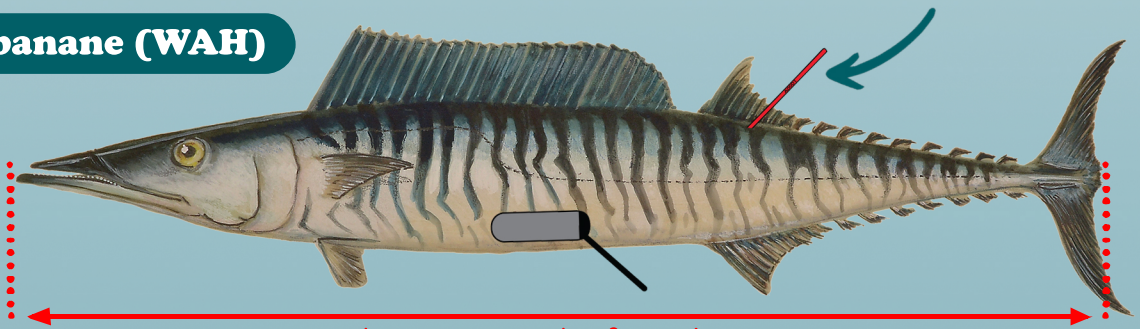
Thon albacore (YFT)



marque archive (antenne externe)

spaghetti rouge

Thon banane (WAH)



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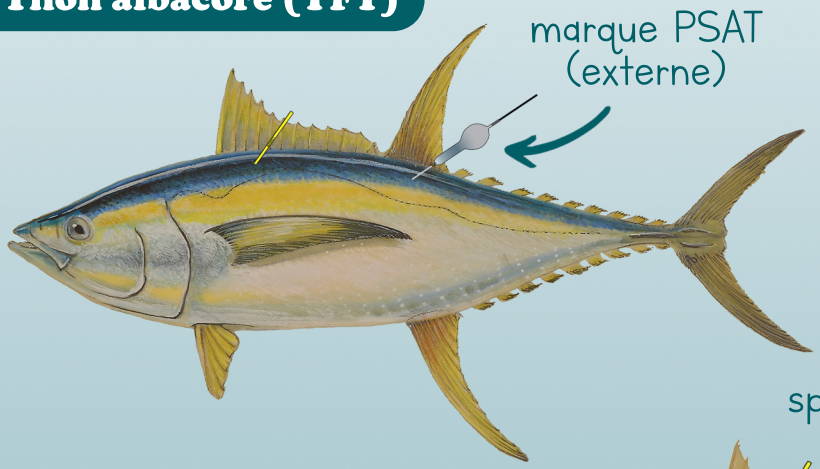
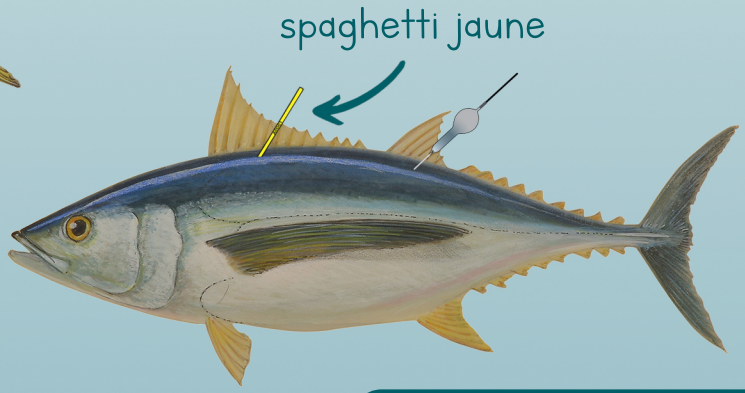
INFORMEZ NOUS SUR LES ESPÈCES MARQUÉES AUX SPAGHETTIS JAUNES

Thon albacore (YFT)

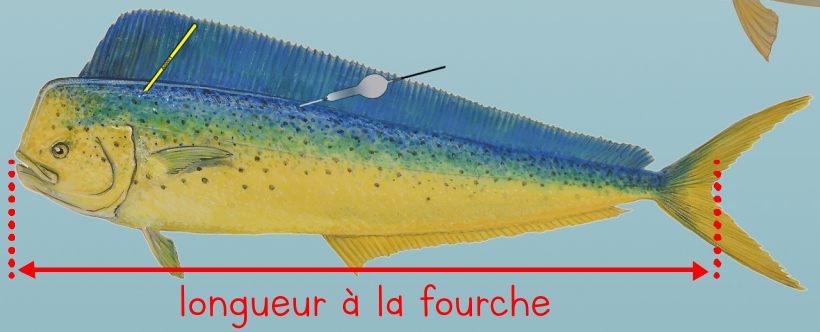


RÉCOMPENSE
50 €
POUR UN RETOUR DE LA MARQUE



Thon germon (ALB)

Dorade coryphène (DOL)



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