"FADIO"

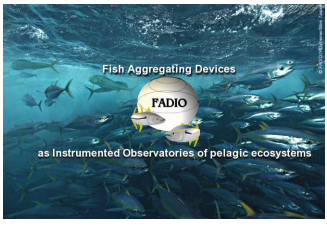
Using Fish Aggregating Devices (FADs) as instrumented observatories of pelagic ecosystems

More than 50% of the world catch of tropical tuna (skipjack, yellowfin, bigeye tuna) comes from industrial tuna fishing around drifting Fish Aggregating Devices (FADs). Large quantities of juvenile tuna and non target species (dolphinfish, wahoo, silky shark rainbow runner, rough triggerfish, etc.) are captured this way, which has raised ecological and ethical questions. Unfortunately, the real effects of FADs on the biology and the behaviour of fish are still unknown.

For centuries, men have noticed that fish tend to gather around objects floating on the surface of the ocean, such as logs, debris, etc. This natural phenomenon has been exploited by fishermen for a long time to help them detect and catch fish. Fishermen then started to build artificial floating objects (buoys, rafts, etc.). These floating objects are called **Fish Aggregating Devices (FADs)** and are mainly used for industrial tuna fisheries (purse seiners) or to maintain or develop artisanal pelagic fisheries. FADs can be either anchored near the coasts (artisanal fisheries) or can drift with the currents (industrial fisheries).

EXAMPLES OF AN ANCHORED AND A DRIFTING BUOY. SOURCE: LAURENT DAGORN, IRD (FRANCE).

There is an urgent need to study the effects of FADs on the biology and the behaviour of tuna and find mitigation methods to reduce by-catch. FADs can also help scientists to better understand the tropical pelagic ecosystems. Actually, these ecosystems are difficult to access and direct information is rare. By concentrating some pelagic fish species, FADs make them available to observations. By instrumenting them, FADs represent ideal scientific observation platforms.



The **FADIO** project was funded by the European Union **to develop new instruments and methods to observe fish around FADs, and to start collecting first data on the behaviour of fish around drifting FADs.** FADIO was built around two principal objectives in order to, in the long term, transform FADs into observatories of the pelagic ecosystems:

- Development of prototypes: new electronic tags and instrumented buoys to observe fish aggregations around FADs.
- Improvement of knowledge on the behaviour of pelagic fish around FADs.

To achieve these objectives, the FADIO team carried out 5 cruises off the Seychelles (allowing to collect the first data on tuna behaviour around drifting FADs), as well as experiments in tanks at the Hawaï Institute of Marine Biology (Hawaii, U.S.A.). During these cruises, excellent relationships were established with the commercial (European) fishing fleets of the western Indian Ocean; this way, an in depth survey of the perceptions of commercial fishermen could be conducted.

Project acronym:
FADIO

Full title of Project:
Fish aggregating devices as instrumented observatories of pelagic ecosystems

EU contract number:
QLRI-CT-2002-02773

Web-site:
http://www.fadio.ird.fr

Coordinator
Mr. Laurent Dagorn
Institut de Recherche pour le Developpement (IRD)
Département Ressources Vivantes
Centre de Recherche Halieutique méditerranéen et tropical
Avenue Jean Monnet - BP 171
34203 Sete cedex
France

Phone : -
Fax : -
Email : dagorn@ird.fr

"SMART FADS CAN NOW BE DEPLOYED ON AN OPERATIONAL BASIS THROUGHOUT THE WORLD'S OCEANS AND PUT TO WORK FOR ASSESSING THE STATUS OF THE OPEN OCEAN BIOME"

Acoustic tags and satellite-linked receivers
FADIO promoted and accelerated the development of novel "modular" architecture for electronic (acoustic) tags. Four new types of electronic tags (pH, motility, hydrophone, accelerometer) that are designed to measure various aspects of the ecology and physiology (e.g. feeding events) of fish were tested and evaluated. Finally, a new acoustic tag with accelerometer sensor was developed in 2007.

The project also contributed to the development of and successfully tested the first satellite-linked acoustic receiver (listening station) that allows remote, real-time monitoring of the open ocean fish implanted with sonic transmitters. This way, the residence time of fish around FADs and their movements could be studied.

Satellite-linked instrumented buoy
An autonomous 360° sweeping sonar buoy with cameras and satellite links designed to monitor FAD-associated fish communities was developed and tested, as well as state-of-the-art software for the quantitative analysis of sonar data, thereby facilitating analysis of school structure and dynamics.

Behaviour of pelagic fish around FADs
Using the developed prototypes, the first scientific descriptions of the species that comprise the community of animals associated with drifting FADs were obtained. Residence times and swimming depth of tuna and other pelagic fish around drifting FADs were measured and the orientation distance of dolphinfish to FADs was estimated using an experimental approach. In addition to this, the first quantitative measurements of the distribution of tuna schools around drifting FADs were obtained and related with effects of the biological environment.

Based on these findings, **theoretical behavioral models** were developed, which enabled the linking of size and distribution of FAD-associated tuna aggregations to the size of the regional tuna population. This way, adding this non-aggregated tuna biomass to the observed tuna biomass associated to FADs, **fishery independent estimates of tuna biomass** could be calculated.

Thanks to the successes of FADIO in both hardware development and in conceptual breakthroughs in data analysis and interpretation, "Smart FADs" can now be deployed on an operational basis throughout the world's oceans and put to work for assessing the status (abundance and diversity) of the open ocean biome. Understanding the biological mechanisms of FADs will facilitate better management of fisheries resources and reduction of by-catch.