

# FADIO

Fish Aggregating Devices as Instrumented  
Observatories of pelagic ecosystems

European Project  
DG Research (5th FP)



Links with all FAD related PFRP projects  
(‘Trophic ecology and structure-associated aggregation behavior’,  
‘Smart FAD’,  
‘Aggregation behavior of FAD-associated small YFT’, ...)

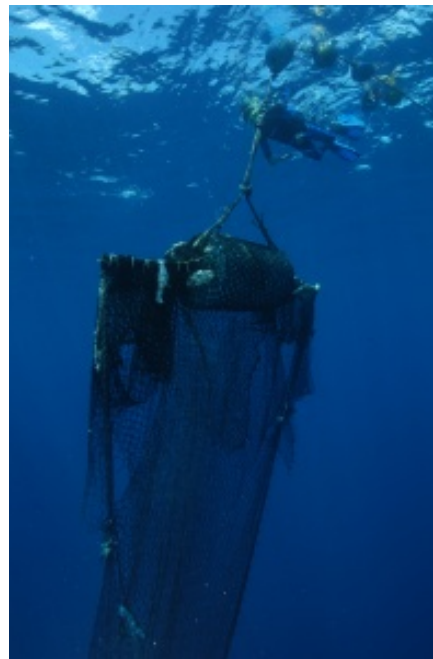
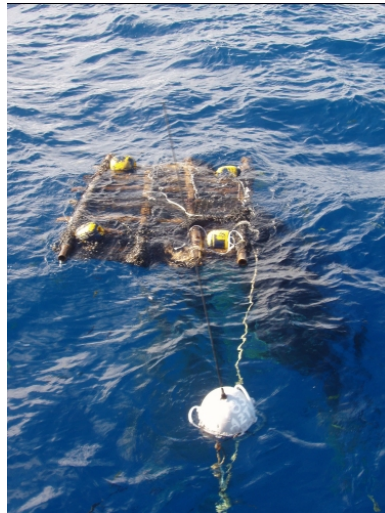
## Participants:

IRD (Fra)  
UH (USA)  
AZTI (Spain)  
IFREMER (Fra)  
ULPGC (Spain)  
SERPE (Fra)  
IMR (Nor)  
UA (Gre)  
ULB (Bel)  
SFA (Sey)

# FADIO: double objective

Development of new instruments to observe fish around FADs

Study of behavior of tuna and other species (dolphinfish, sharks, wahoos) around drifting FADs




## WP2 : new tags

After our research and testing at HIMB,  
agreement with Vemco for the following  
prototypes:

- acoustic tag with **pH sensor** (feeding activity)
- acoustic tag with **hydrophone** (internal and external sounds) → bioacoustics

Should be developed during the first half of 2006



WP2 new tags  
WP3 tracking  
WP4 list.stations  
WP5 acoustics  
WP6 fishermen  
WP7 model  
WP8 instr.buoys

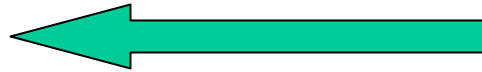
# WP3 : tracking

*YFT tracking: Girard et al., Animal Behaviour, 2004*

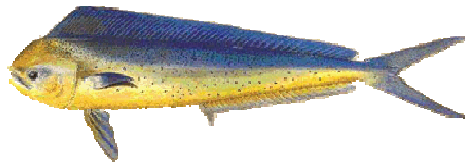
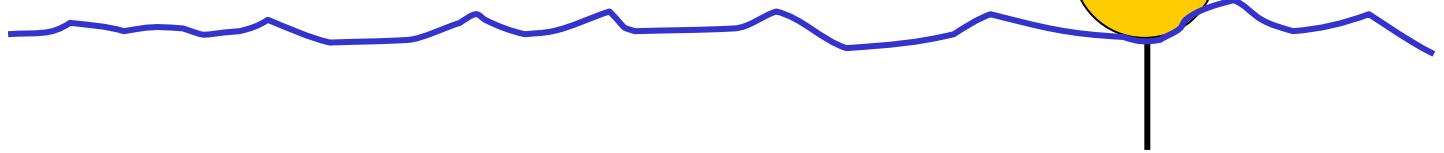
Homing mahimahi



Displacement



70-1720 m



?

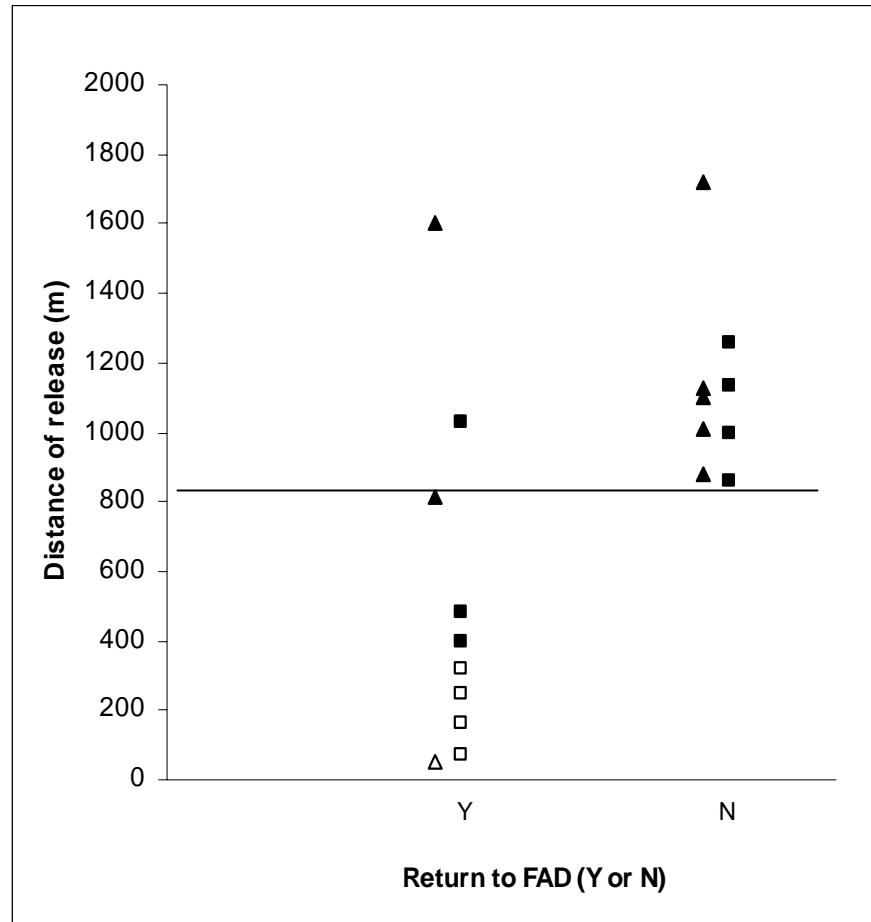


Active and passive tracking

- WP2 new tags
- WP3 tracking
- WP4 list.stations
- WP5 acoustics
- WP6 fishermen
- WP7 model
- WP8 instr.buoys

# WP3 : tracking

WP2 new tags  
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WP5 acoustics  
WP6 fishermen  
WP7 model  
WP8 instr.buoys



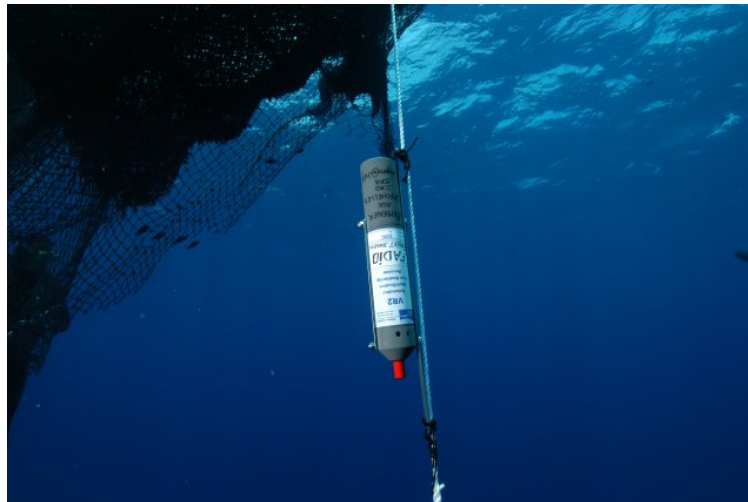
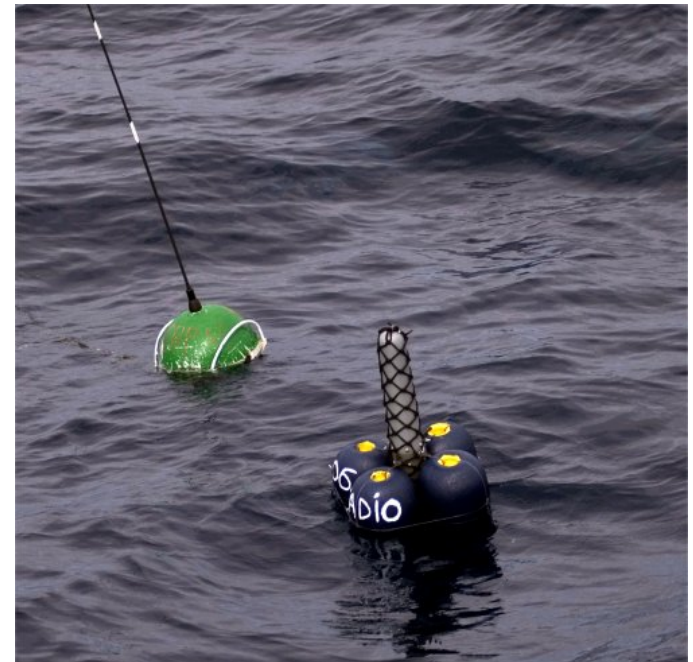
About 800 m

Results of displacement experiments, with fish returning to FADs (Y) and fish not returning to FADs (N). Empty symbols represent fish released within the association area (horizontal dashed line). Triangles correspond to fish equipped with continuous transmitters and actively tracked with a vessel, while squares represent fish equipped with coded transmitters, detected by acoustic receivers at FADs.

# WP4 : listening stations

## Acoustic tagging

WP2 new tags  
WP3 tracking  
WP4 list.stations  
WP5 acoustics  
WP6 fishermen  
WP7 model  
WP8 instr.buoys



# WP4 : listening stations

7 fish species

WP2 new tags  
WP3 tracking  
WP4 list.stations  
WP5 acoustics  
WP6 fishermen  
WP7 model  
WP8 instr.buoys



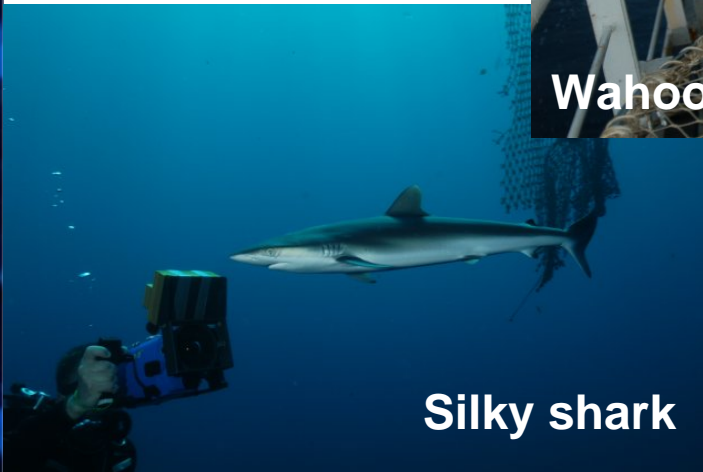
Tuna: YFT, BET, SKJ



Mahimahi



Wahoo



Silky shark

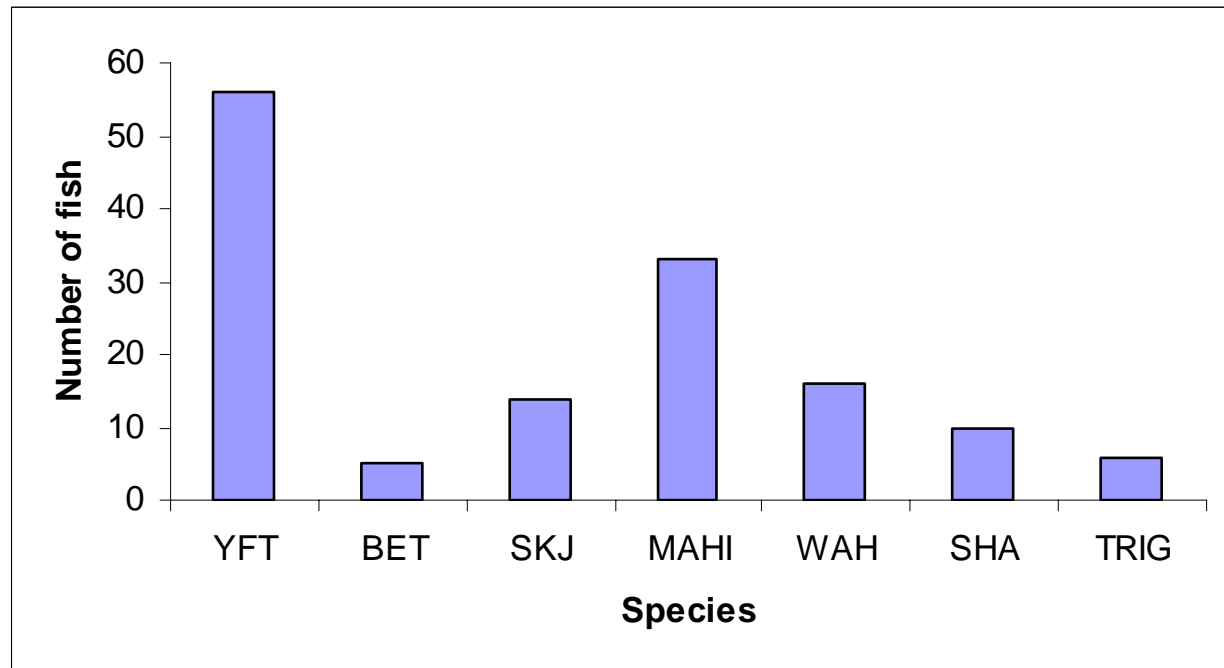


Oceanic triggerfish

# WP4 : listening stations

## Acoustic tagging

140 fish tagged around drifting FADs



Last cruise (FADIO 5): 45 fish (includ. 21 YFT, 1 BET, 4 SKJ)  
Tagged on 3 FADs: TL between 1 day and 3 weeks

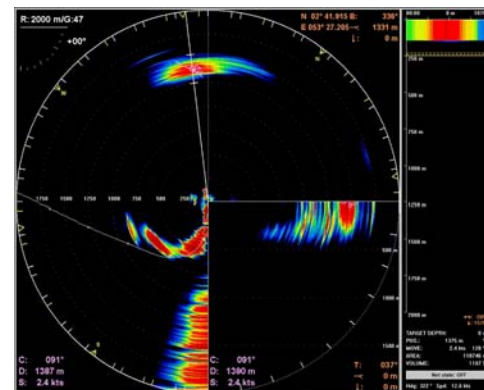
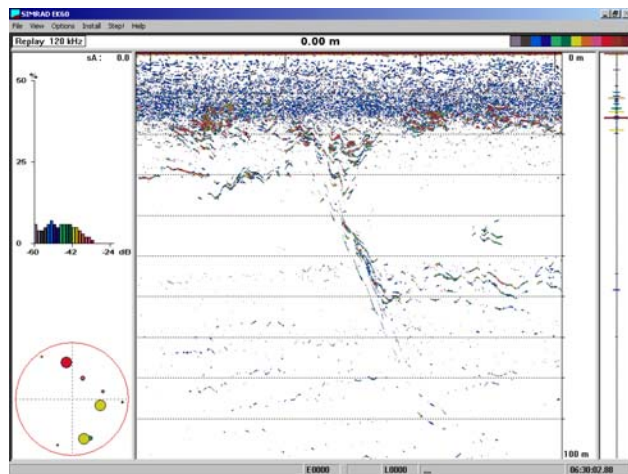
WP2 new tags  
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# WP5 : acoustics

SIMRAD Echosounder EK60 :



SIMRAD sonar SP90:

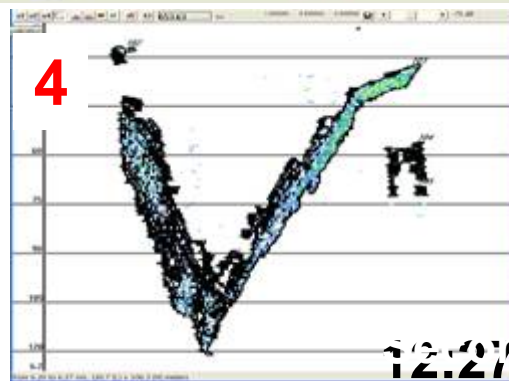
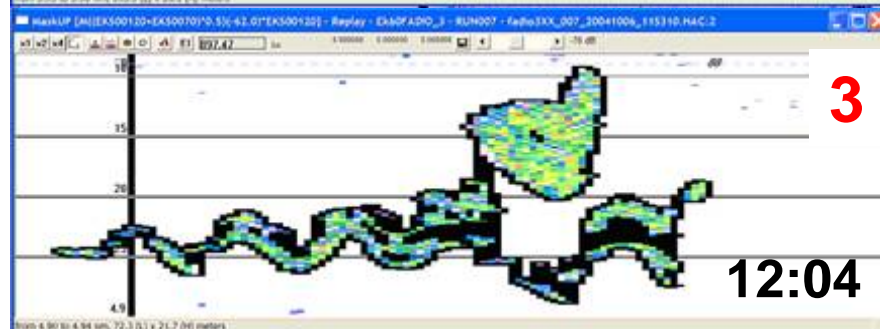
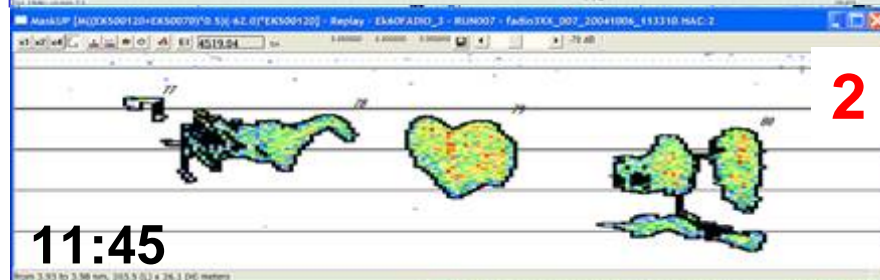
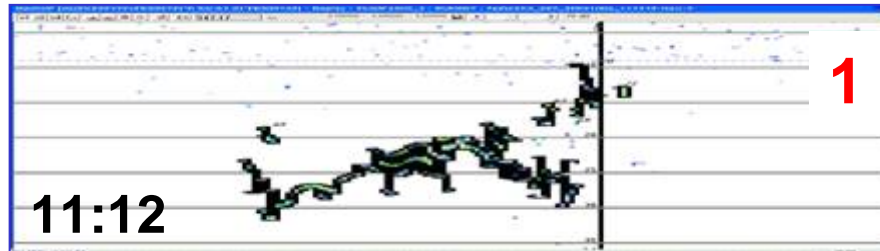


+ RESON Sonar (3D)

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# WP5 : acoustics

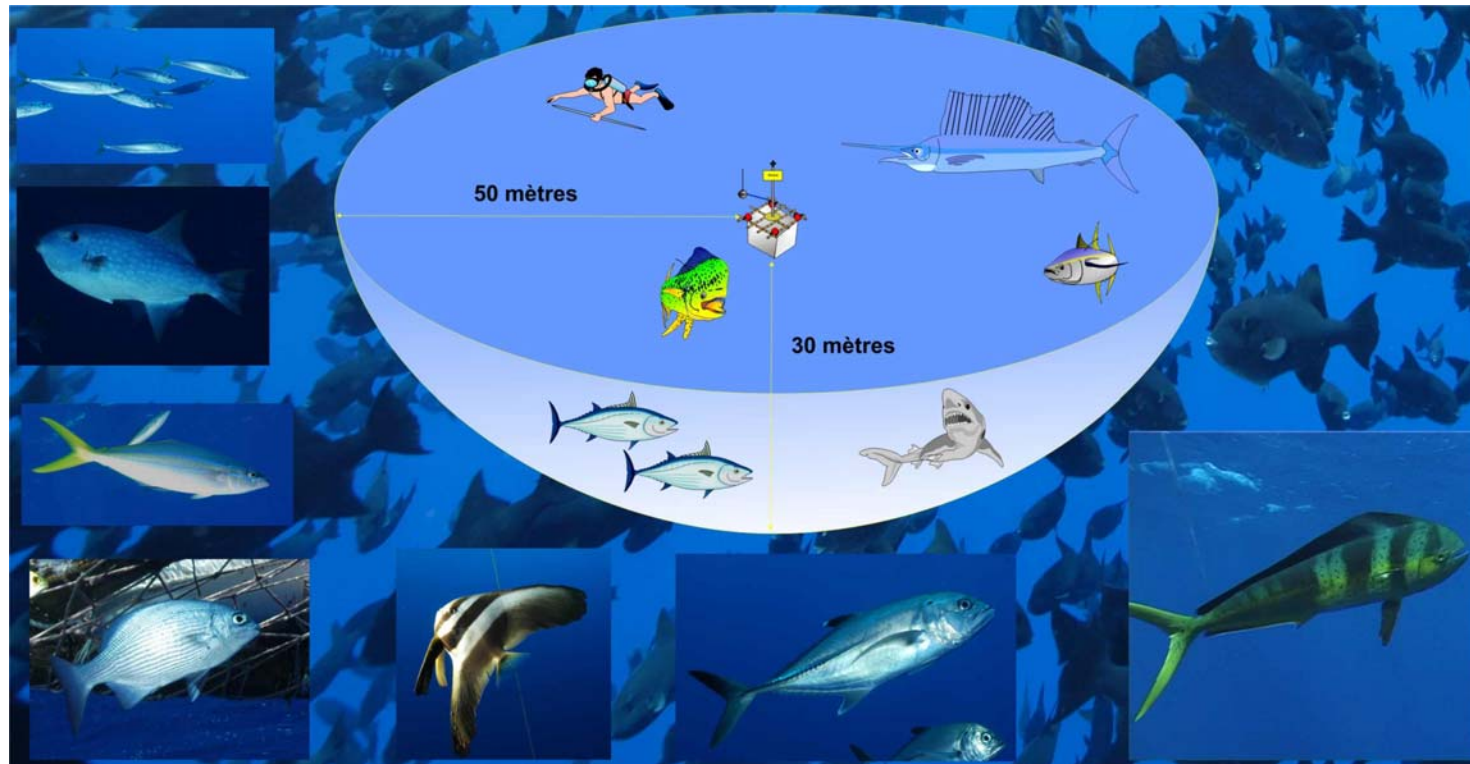
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# WP5 : acoustics

Visual census of associated species:

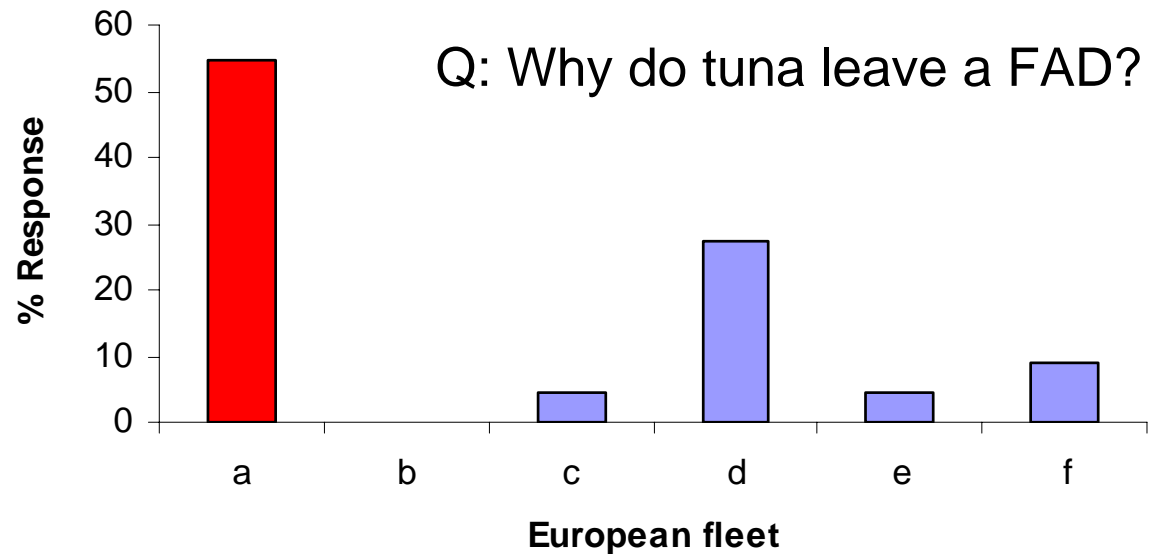
- Great stability in the species composition (15-20 species)
- Good opportunity for observing pelagic biodiversity



WP2 new tags  
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# WP6 : fishermen

About 35 interviews of Spanish and French skippers  
About 40 questions




- a. Change of currents or FAD trajectory
- b. Lack of trophic resources
- c. Presence of marine mammals
- d. Sea state change
- e. Excessively large sized school
- f. Continental platform

WP2 new tags  
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# WP7 : model

PREDICTIONS of the model (with interactions between fishes)

1. If  $N$  (population of fishes) is small :  
equal distribution of the fishes around each FAD
2. If  $N > N_c$  (a critical population)  
a majority of fishes are around one FAD  
e.g.  $X_1 > X_2 = X_3, \dots = X_n$
3. **If the number of FAD is too large ( $q > q^*$ ), the population of fishes are equally distributed around every FAD**

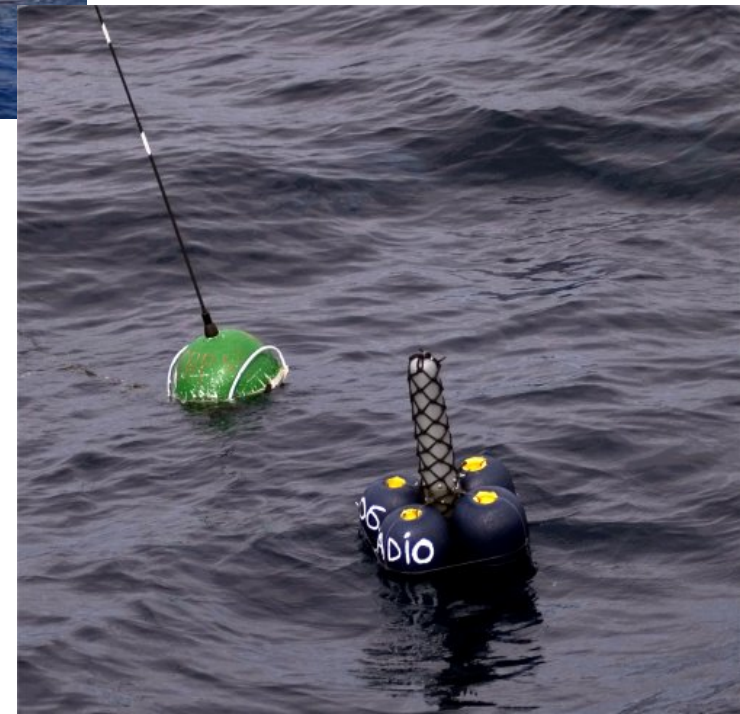


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# WP8 : instrumented buoys



SERPE buoy  
(sonar + cameras)  
Last tests during the  
1st half of 2006



VR3-ARGOS operational  
Tests positive

WP2 new tags  
WP3 tracking  
WP4 list.stations  
WP5 acoustics  
WP6 fishermen  
WP7 model  
WP8 instr.buoys

# What next?

- 2006: data analyses and synthesis
- Oct 2006: final report and demonstration workshop in Europe

## **Towards**

### **Observatories of pelagic ecosystems**

Idea: to diversify the use of FADs, in order to also use them for scientific purposes





## Phase I

### Europe

(2003-2006)

FADIO

Drifting FADs

### PFRP

(2001-2006)

Trophic ecology

Smart FAD

Aggregation behavior

Anchored FADs

→ Ecology tags, instrumented buoys

# Towards observatories of pelagic ecosystems

## Phase I

Pilot or small-scale studies  
2001-2006



Interest & feasibility for large-scale networks of instrumented FADs (along with ecology tags)

- Behavior
- Stock assessment & fishery management (direct estimates of biomass, movements, etc.)
- Pelagic biodiversity



- Technology (tags, instrumented buoys)
- Biology (behavior, models)
- Practical feasibility for anchored FADs
- Practical feasibility for drifting FADs

2006-2008



Observatories of pelagic ecosystems using FADs  
(Indian & Pacific Oceans?)

2008-...

## Phase II

## Phase III