Behavioral features of tuna aggregations around Fish Aggregating Devices: sensory cues, orientation, and residence time

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Importance of floating objects on tropical tuna fisheries

More than 50% of tuna catches made on associated fish

Development or persistence of artisanal fisheries around tropical islands

Stars: artisanal fisheries on anchored FADs

Industrial fisheries on FADs
Basic questions

Why do tuna aggregate around FADs?

What do tuna do around FADs?

What are the effects of FADs on tuna movements?
Range of influence, Residence time

Spatial

Temporal
Small- to large-scale consequences

Respective roles of sea temperature (etc.), prey, FADs, on tuna movements
The probability to find tuna around a floating object is much more important than in a same sized area without floating object.

### Aggregation

**Population level**
- Density

**Individual level**
- Reduce the spatio-temporal diffusion of the movement

### Attraction/Orientation

**Population level**
- Flow

**Individual level**
- Higher probability of approaching the goal than that of moving away from the goal
1. Orientation

New analyses of tracking data of yellowfin tuna at FADs
(Charlotte Girard)
Orientation mechanisms

Taxis

Differential klinokinesis

Oriented movement
Orientation distances

Orientation Distances (km)

Number of observations

Instantaneous drift against the grain (km)

Length covered L (km)

Orientation

distances

7-9 km

7-9 km
2. Sensory cues: sounds
Acoustic signature of a FAD

17 kHz
Distance to FAD 20 m

345 Hz
Distance to FAD: 5000 m

345 Hz
3. Aggregation and Residence time

**Aggregation**

*Population level*
Density

*Individual level*
Reduce the spatio-temporal diffusion of the movement
Residence time from tracking studies

![Bar chart showing time of residency for different yellowfin tuna individuals.]

- **Time of residency (hours)**
  - OI1, OI2, OI3, OI4, OI5, OI6, OP1, OP2, OP3, OP7, OP8

- **Categories:***
  - Red: tagging FAD
  - Grey: 2nd FAD visited
  - Grey: 3rd FAD visited
  - Black: 4th FAD visited

- **Yellowfin tuna**
On- vs. Off-FAD movements

No difference in speed

Instantaneous speed (step/min)

Steps

On-FAD

Off-FAD

Repartition of the mean speed values of all the tunas
On- vs. Off-FAD movements

No difference in tortuosity

No difference in changes of directions (mean + SD)
Results on Orientation/Aggregation

- Tuna orientate to FADs (taxis? klinokinesis?)
- Orientation distance might be 7-9 km (constant?)
- Aggregation processes are not obvious: 
  Fish *Aggregating* Device
  or 
  Fish *Attracting* Device

Need for further experiments
4. Future researches

**Sensory cues**

\[ dB = f(\text{distance}) \]
Multiple tracking
Residence time at FADs
Movements between FADs

Network of listening stations
Distance to FAD: 50 m

345 Hz