Using fishers' echo-sounder buoys for scientific studies

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WE LARGELY IGNORE OUR OCEANS

PELAGIC OBSERVATORIES TO STUDY FAD FISHERY

FADIO EU project
Fish Aggregating Devices as Instrumented Observatories of pelagic ecosystems

Prototype SONAR buoy

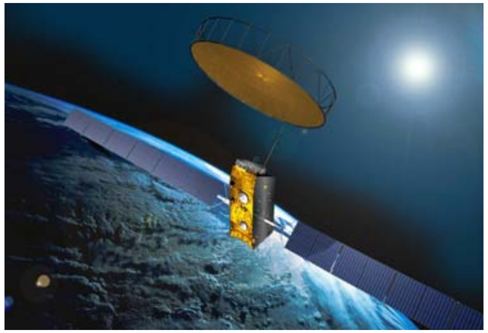
MADE EU Project
Mitigating Adverse Ecological Impacts of open ocean fisheries

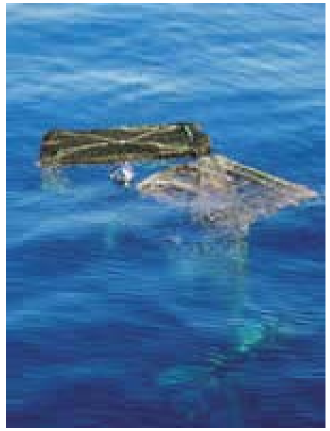
Fishers' ECHOSOUNDER buoys

CONCEPTUAL TROPICAL TUNA FAD FISHERY

4000-5000 buoys/year IO

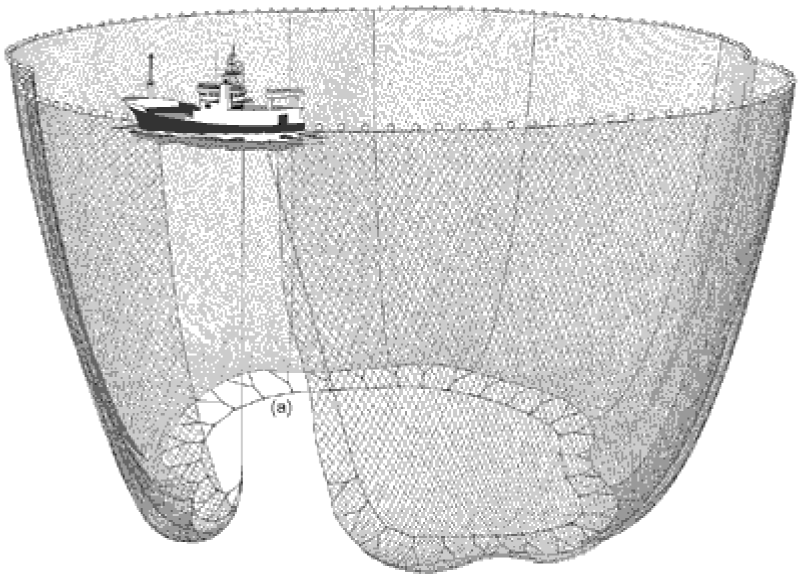
30% Sounder Buoys





5 tons

Biomass estimates



15 tons

60 tons

SAMPLING POTENTIAL

OBJECTIVES

VALIDATE fishers´ echosounder buoys to be used as scientific pelagic observatories:

↓

Transform echosounders´ raw data into **BIOMASS by TARGET and BY-CATCH species**

Set best observing **protocols**

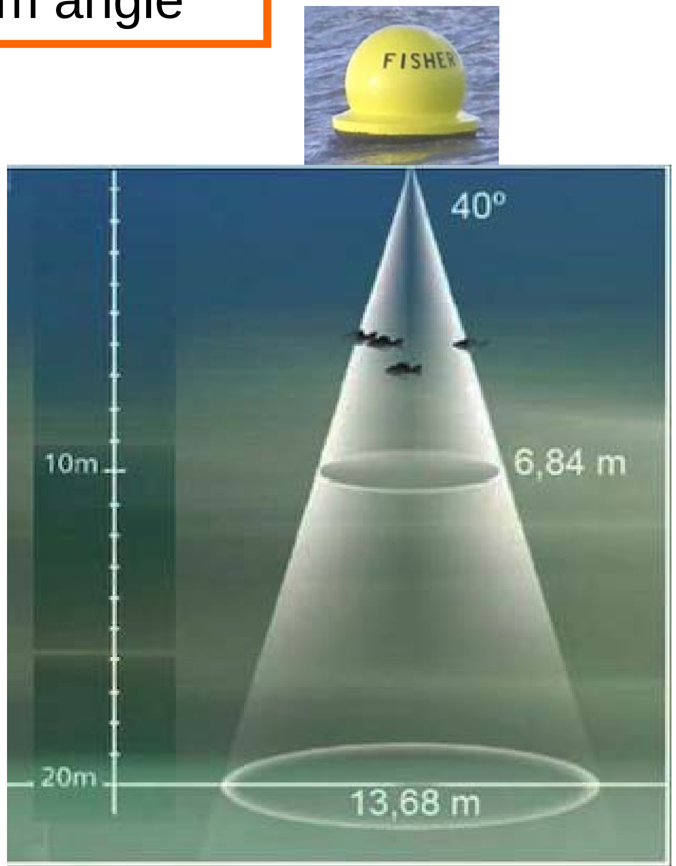
Integrate SCIENTIFIC EXPERTISE to improve the interpretation of the data

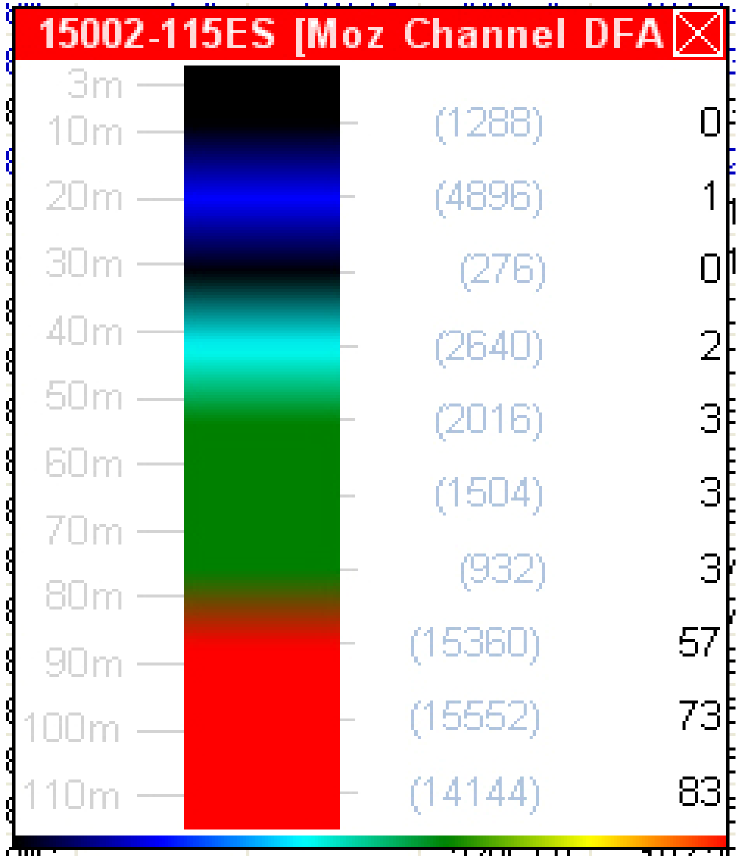
ECHOSOUNDER BUOYS USED BY FISHERS

Freq.: 50-200 Khz.

Range: 115-150m

Wide beam angle





METHODOLOGY

DATA COLLECTION:

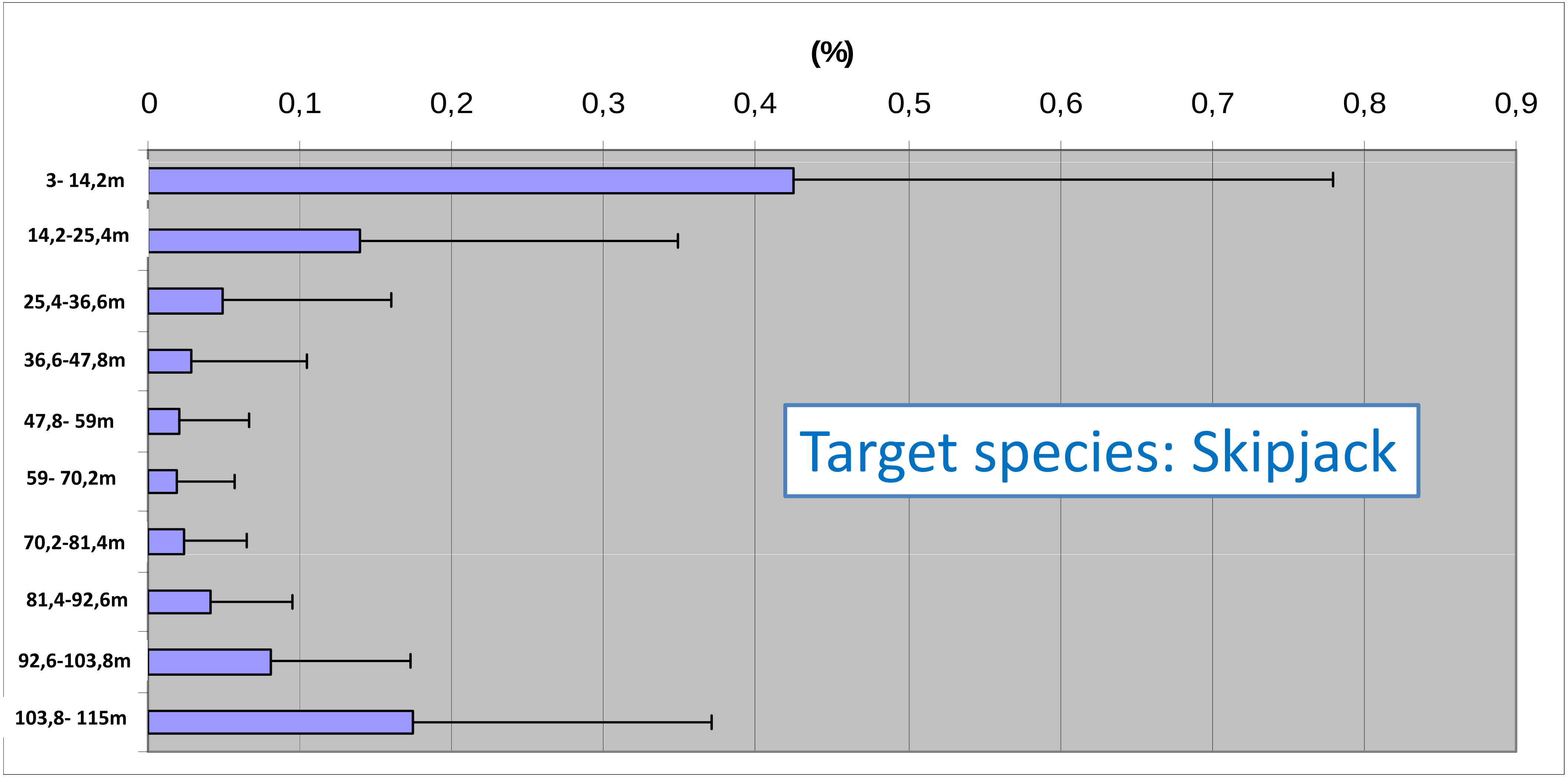
We have collected 300 buoys / 11000 sounder data from Atlantic and Indian Oceans.

QUALITY CONTROL of the database

(Location, speed, biomass errors,etc.)

Sounder DATA ANALYSIS using data from Catches at the same FAD, tagging and observer data

AVERAGED ENERGY CONTRIBUTION PER LAYER TO THE TOTAL ENERGY RECORDED BY THE BUOYS

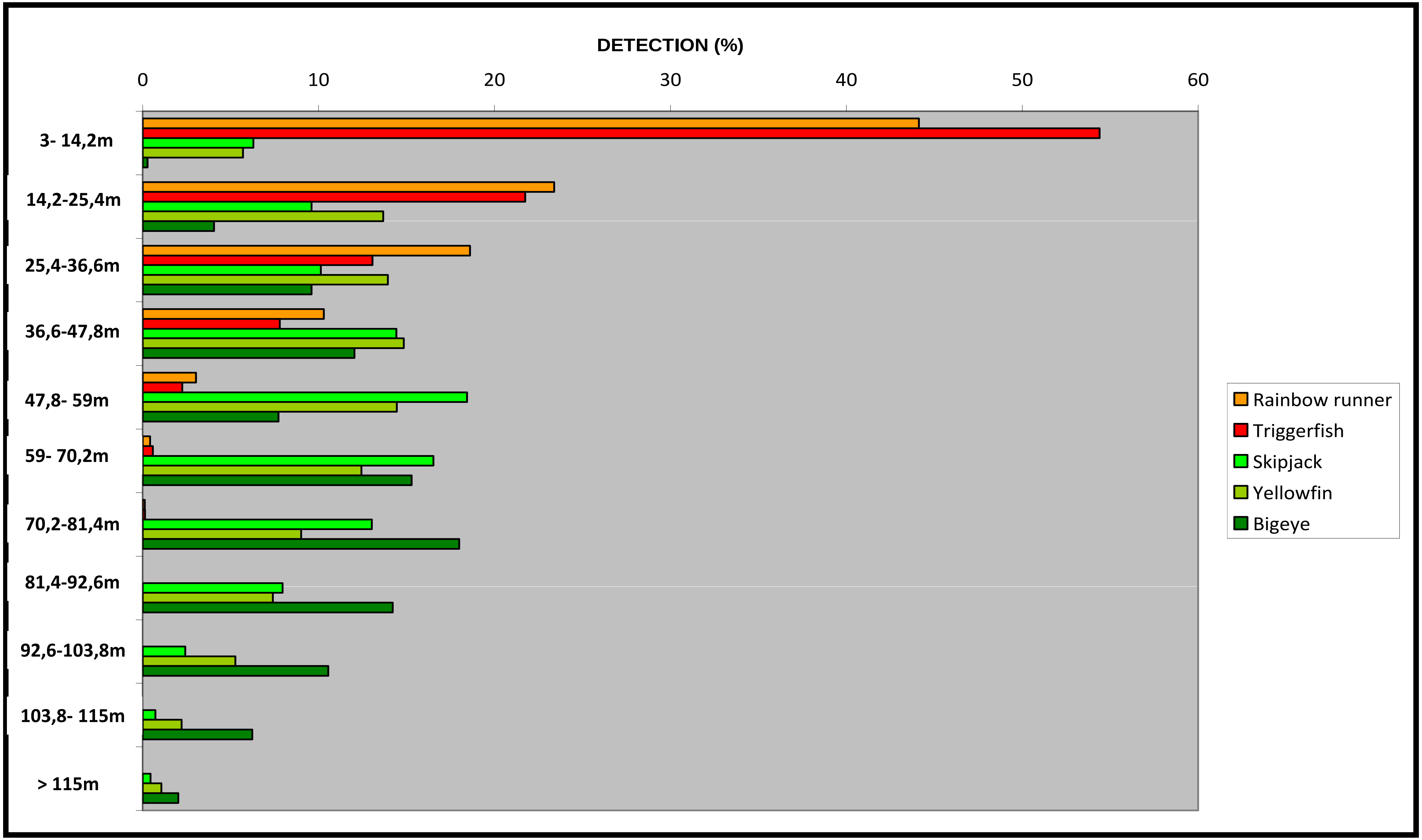


Trigger fish

Rainbow runner

Wahoo

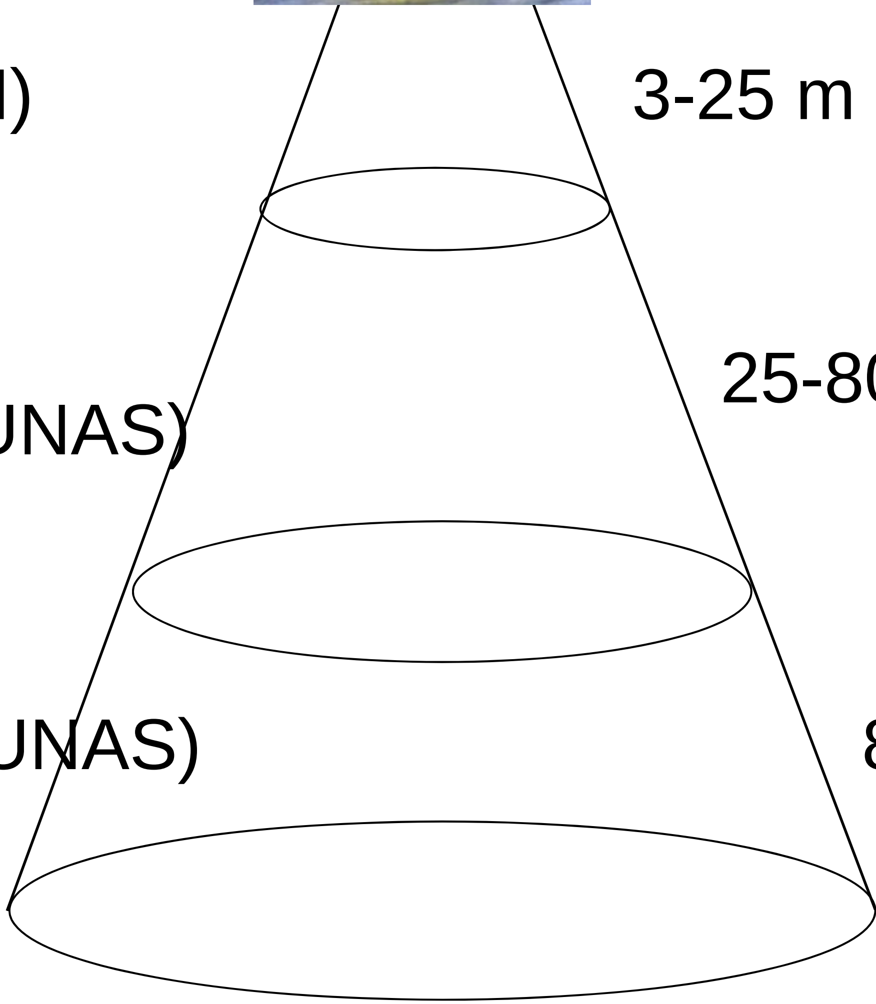
VERTICAL BEHAVIOUR OF SPECIES UNDER THE FAD



DATA ANALYSIS WHEN WE **DON'T** KNOW THE CATCH

3 LAYERS

- Layers
- Add oceanography data

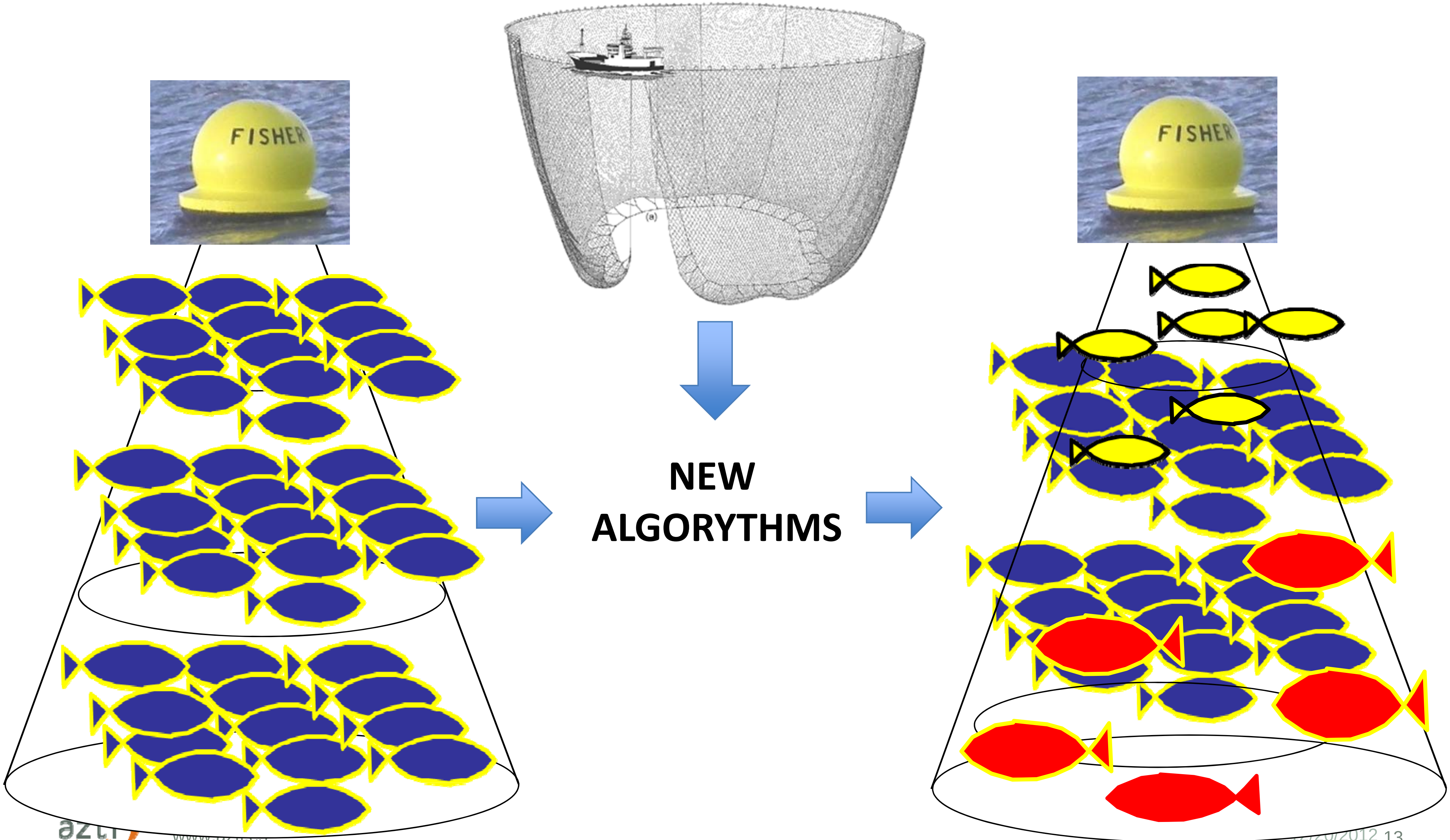


Layer 1 (BYCATCH) 3-25 m

Layer 2 (SMALL TUNAS) 25-80 m

Layer 3 (LARGE TUNAS) 80-115 m

DATA VALIDATION WHEN WE **DO** KNOW THE CATCH



DATA ANALYSIS WHEN WE **DO** KNOW THE CATCH

1) Multiespecific biomass estimation per layer, based on :

$$\tilde{\sigma}_{bs} = \frac{\sum \sigma_{bs(sp_i l_i)} \cdot \left(\frac{C_{(sp_i l_i)}}{TC} .100 \right)}{n}$$

2) Energy (sa) (from brand new algorithms)

$$N_{(sp_i l_i)} = \frac{s_a}{\tilde{\sigma}_{bs}} .\ \mathrm{A.} \left(\frac{C_{(sp_i l_i)}}{TC} \right)$$

3) Number of fish (N)

$$B_{(sp_i l_i)} = \frac{N_{(sp_i l_i)} . W_{(sp_i l_i)}}{1000}$$

4) Number of fish to Biomass

- Final output → Biomass for each species, not layers/groups.

RESULTS

- New algorithms for the different species present at FADs
- Biomass estimation for non target species
- Improvement of biomass estimation for target species
- Good collaboration with manufacturers and fishers

FUTURE STEPS FOR BETTER INTERPRETATION

- TO COLLECT MORE ACCURATE DATA ON:
  - FISH BEHAVIOUR
    - TAGGING
    - MODELS OF VERTICAL BEHAVIOUR OF TUNAS UNDER FADS.

- CHARACTERIZATION of the fauna associated in each FAD per area/seasons → Minimize assumptions when we DON'T know the catch.

CONCLUSIONS

- Great POTENTIAL to be used in FISH BEHAVIOUR studies.
  - ✓ Colonization processes.
  - ✓ Analyze spatial/temporal collective fish behaviour under FADs.
  - ✓ Study fish aggregations at fine/meso/large scales (diel, week or monthly), related to environment.

- Great POTENTIAL to be used in BYCATCH MITIGATION studies.
  - ✓ Discard not favourable fishing FADs remotely.
  - ✓ Identify best fishing practices.