Document FAD-09-RD-G

Acoustic discrimination in tropical tuna purse seine fisheries: state of the art, ongoing projects and future directions

Gala Moreno[1], Guillermo Boyra[2], Jon Uranga[2], Bea Sobradillo[2], Aitor Lekanda[2], Udane Martínez[2], Nagore Cuevas[2], Igor Sancristobal[3], Hilario Murua[1], Maitane Grande[2], Josu Santiago[2], Victor Restrepo[1]

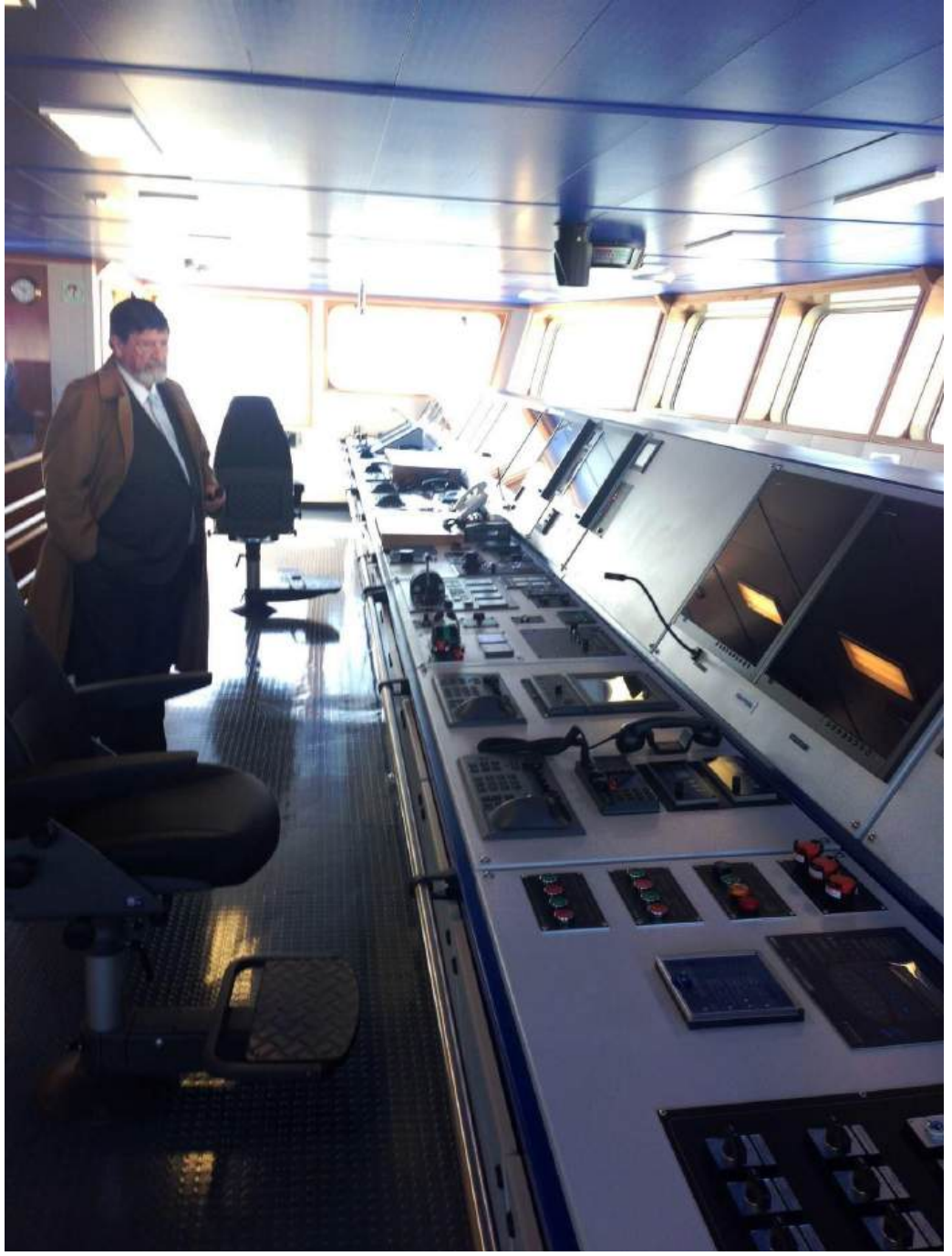
9th Meeting of the *Ad Hoc* Working Group on FADs
La Jolla, California (USA), 28-29 May 2025

ISSF INTERNATIONAL SEAFOOD SUSTAINABILITY FOUNDATION

ISSF (2012)

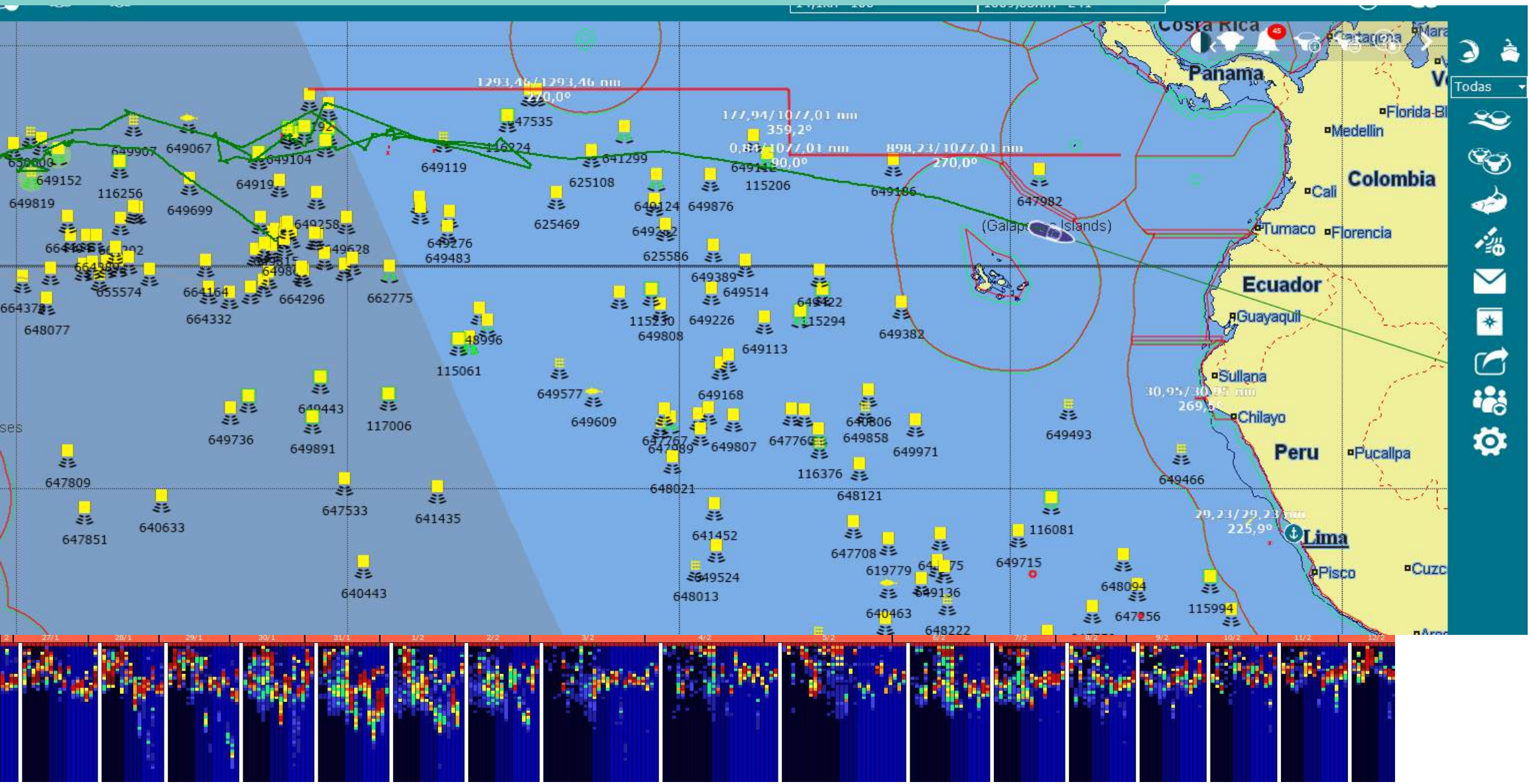
Photo: David Itano

Acoustic technology



SONAR de largo (2 mn) y corto alcance
Sondas oblicuas y verticales 120, 70, 38 kHz
Correntímetros Doppler

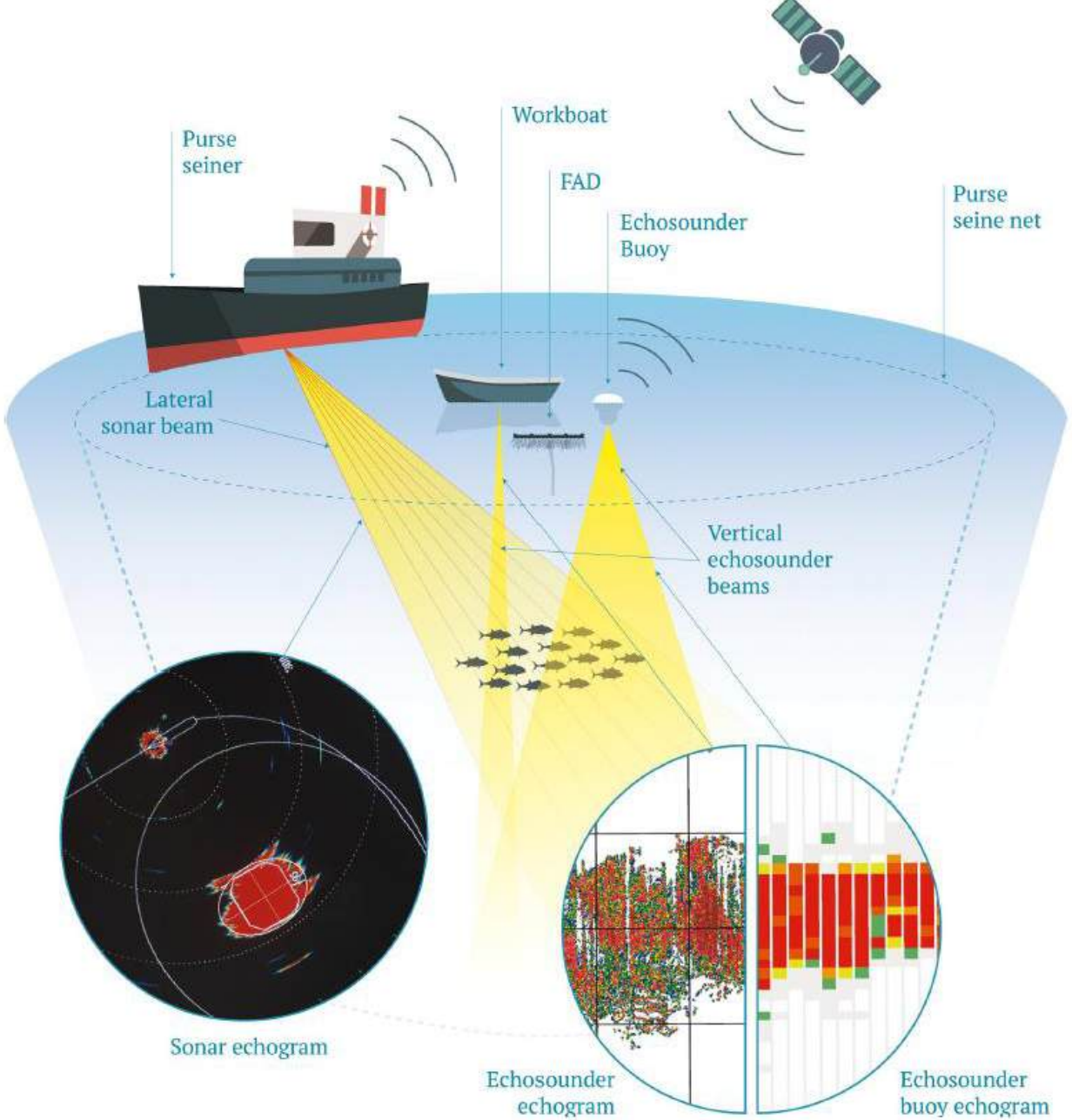
FAD position and biomass in real time



Cortesia de Ugavi (AGAC)

Acoustic technology

- Planning the trip
- Tuna detection
- Fishing set manouver



Moreno et al. 2019

AZTI
MEMBER OF BASQUE RESEARCH & TECHNOLOGY ALLIANCE

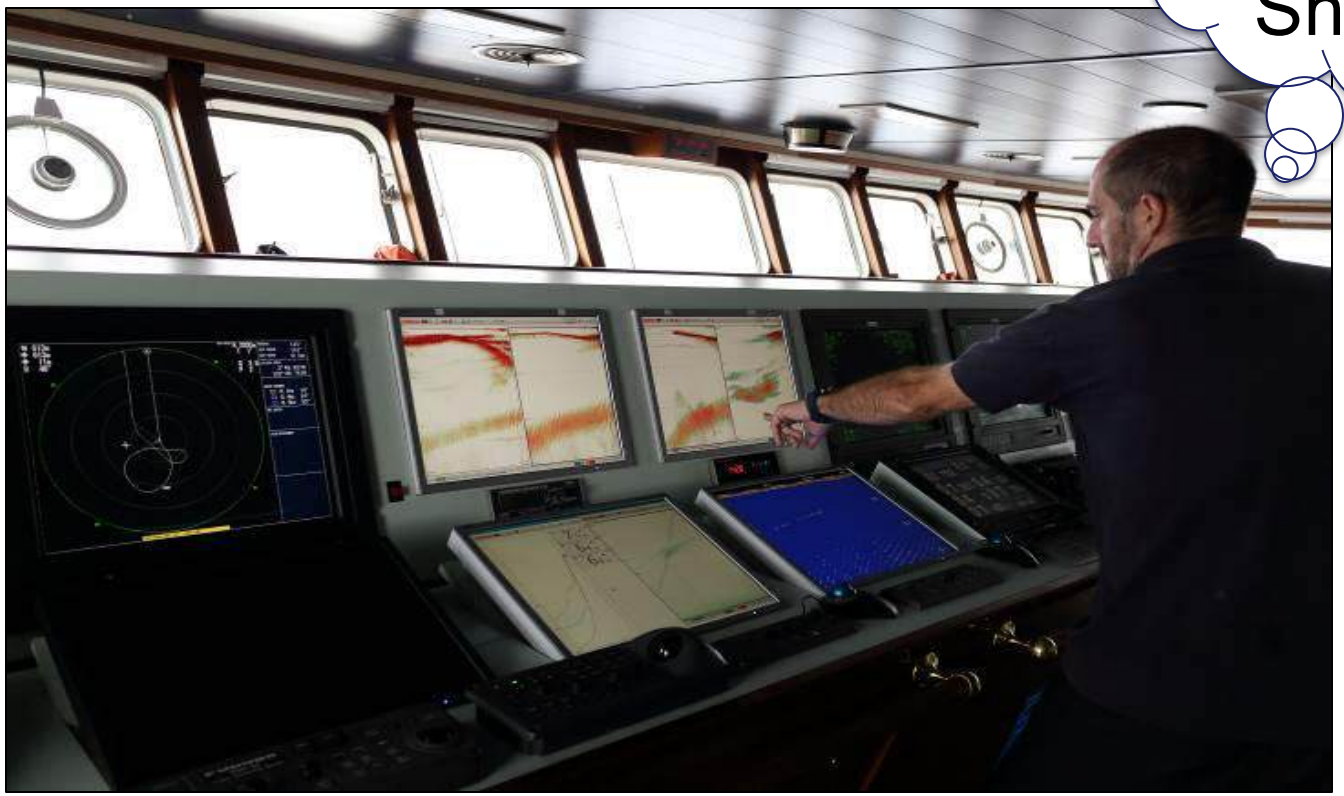
Potential of acoustics for sustainable fishing

ISSF INTERNATIONAL SEAFOOD SUSTAINABILITY FOUNDATION

- Selective fishing
- Catch-independent índices of abundance
- Observatory of the pelagic environment: ecosystem indicators

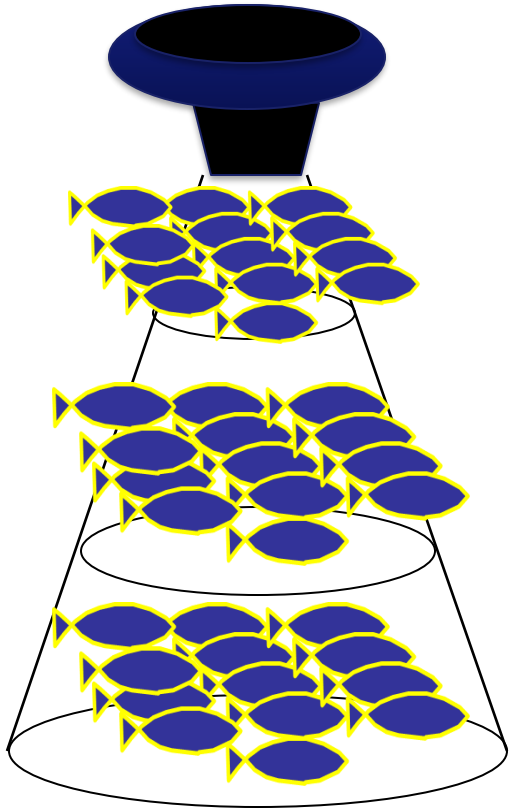
Selective fishing

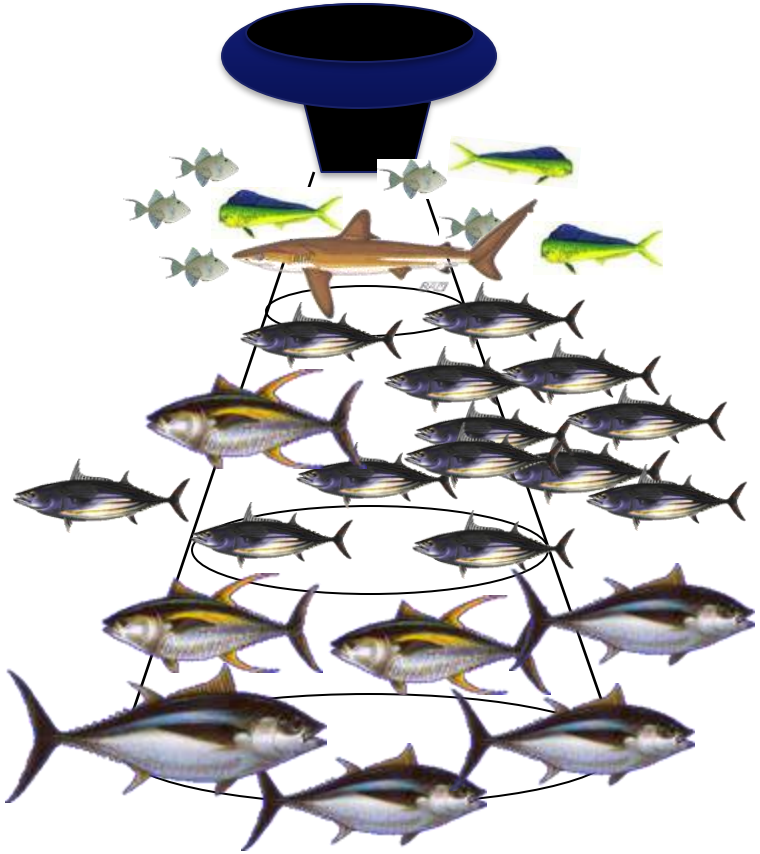
BET?
SKJ?
YFT?
Shark?



- Avoid non-target species
- Avoid tuna species that need to be protected

Concept

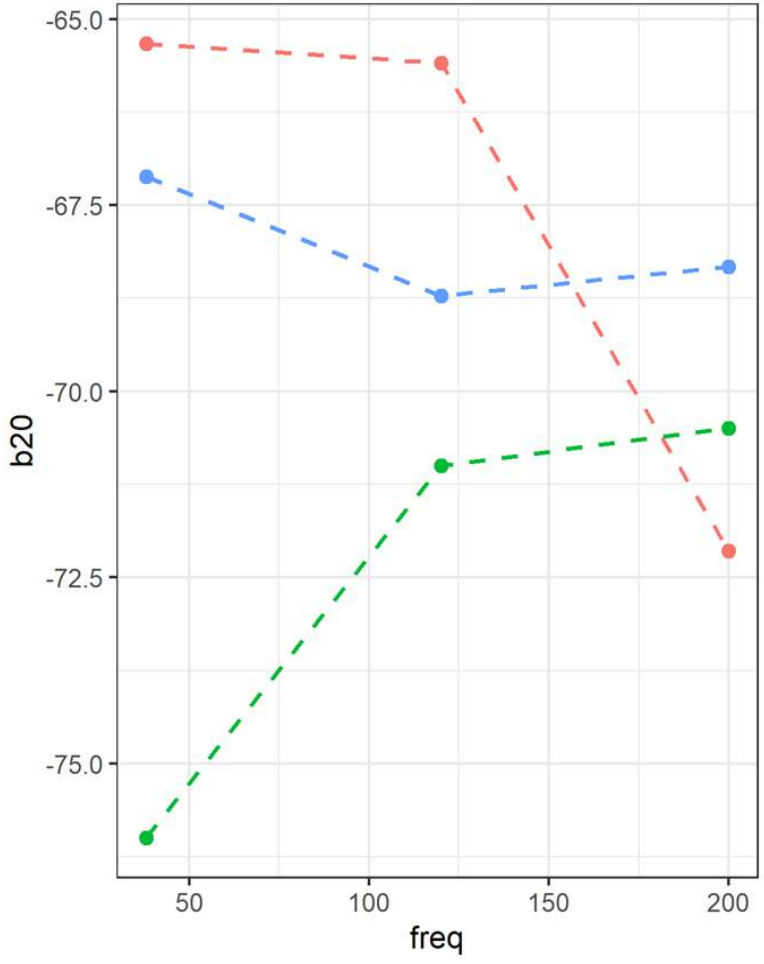




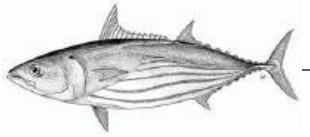
Rough biomass estimates

Biologically relevant measures

Acoustic Discrimination



- **SKJ** TS grows with frequency, as expected, due to its lack of swimmbladder.
- **YFT** TS obtained in Panama has an intermediate value between BET and SKJ and a fairly flat frequency response.
- **BET** TS is much higher, staying at 38 and 120, dropping drastically at 200 kHz.



Skipjack
Katsuwonus pelamis

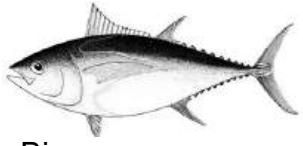
ICES Journal of Marine Science

ICES Journal of Marine Science (2018), 75(5), 1790–1802. doi:10.1093/icesjms/fsy041

Original Article

Target strength of skipjack tuna (*Katsuwanus pelamis*) associated with fish aggregating devices (FADs)

Guillermo Boyra[1]*, Gala Moreno[2], Bea Sobradillo[1], Isabel Pérez-Arjona[3], Igor Sancristobal[1], and David A. Demer[4]



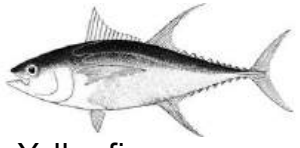
Bigeye
Thunnus obesus

ICES Journal of Marine Science

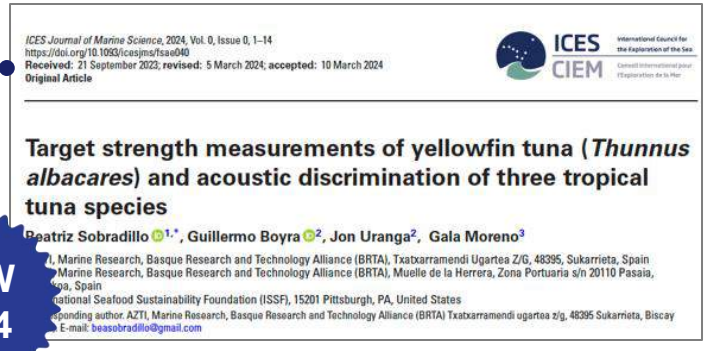
ICES Journal of Marine Science (2019), doi:10.1093/icesjms/fsz131

***In situ* target strength of bigeye tuna (*Thunnus obesus*) associated with fish aggregating devices**

G. Boyra [1]*, G. Moreno[2], B. Orue [1], B. Sobradillo [1], and I. Sancristobal[3]



Yellowfin
Thunnus albacares



ICES Journal of Marine Science, 2024, Vol. 0, Issue 0, 1–14
https://doi.org/10.1093/icesjms/fsae040
Received: 21 September 2023; **revised:** 5 March 2024; **accepted:** 10 March 2024
Original Article

Target strength measurements of yellowfin tuna (*Thunnus albacares*) and acoustic discrimination of three tropical tuna species

Beatriz Sobradillo [1,*], Guillermo Boyra [2], Jon Uranga[2], Gala Moreno[3]

NEW 2024

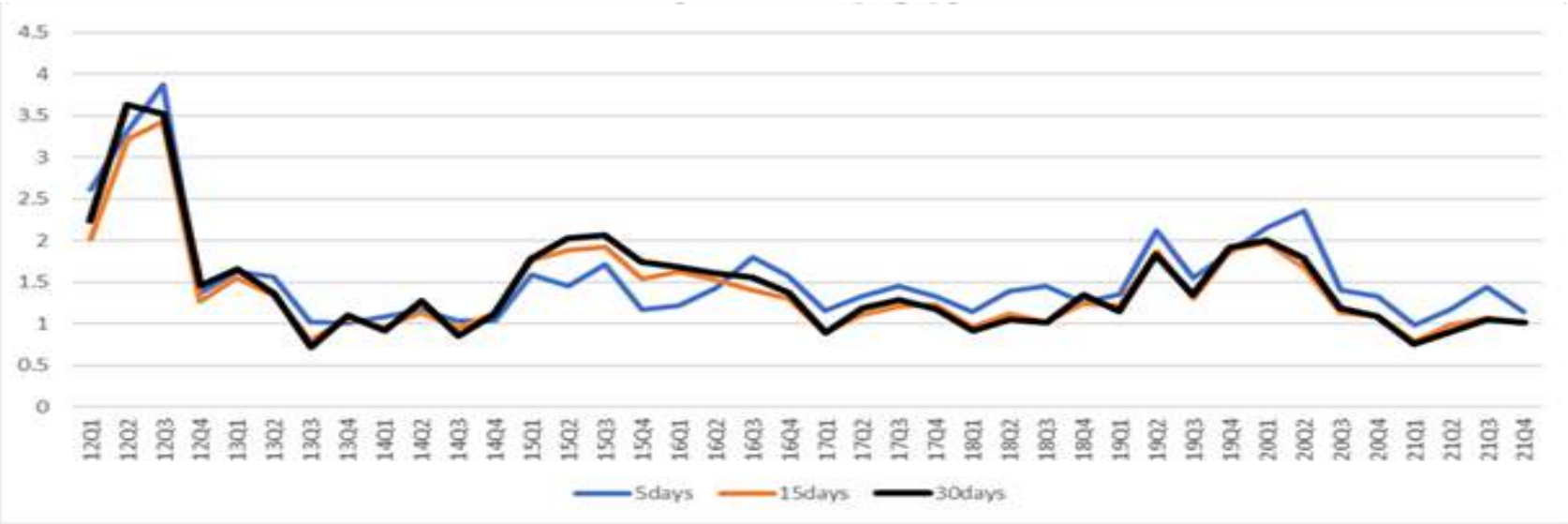
MEMBER OF BASQUE RESEARCH & TECHNOLOGY ALLIANCE

Indices of abundance

From CPUE = q . biomass
to BAI = λ . Biomass

To move from catchability —> detectability the following key assumptions are proposed:

- BAI and abundance is linear (proportional).
- The relationship doesn´t change over the time or space.
- The abundance associated to FADs is proportional to the total abundance.



Are the buoys capable of distinguishing among tuna species?

ISSF INTERNATIONAL SEAFOOD SUSTAINABILITY FOUNDATION

AZTI
MEMBER OF BASQUE RESEARCH & TECHNOLOGY ALLIANCE

Buoy manufacturers

Scientists

Fishers

Workshop with fishers

43 participants

Results

Q1: Do acoustic buoys discriminate **bycatch from tuna?**

Q2: Do acoustic buoys discriminate **skipjack from yellowfin and bigeye?**

Q3: Do acoustic buoys discriminate **yellowfin from bigeye ?**

Q4: Do acoustic buoys **work the same in different zones** within an ocean?

Discussion/Conclusion

For selective fishing:

- Promising recent developments identified by fishers
- Adoption curve and Transition time needed
- Continue research cross-referencing acoustic data and catch data + AI

For Indices of abundance:

- Account for spatial variability within the models
- Standarization across buoy brands and models

For tuna behaviour and ecosystem indicators:

- Research simultaneously individual and collective behaviour and environment (Tagging+ echosounder buoy + satellite environmental data).
- Develop indicators from echosounder buoys

Recommendations

- Ensure access to echosounder buoys´ historical acoustic data, to understand long-term trends, and support model development for indices of abundance.

- Continue investing in acoustic research, particularly in the transformation of acoustic signal into biomass and encourage acoustitians to work on tropical tuna species !!!!!