Towards a Tropical Tuna Buoy-derived Abundance Index (TT-BAI)

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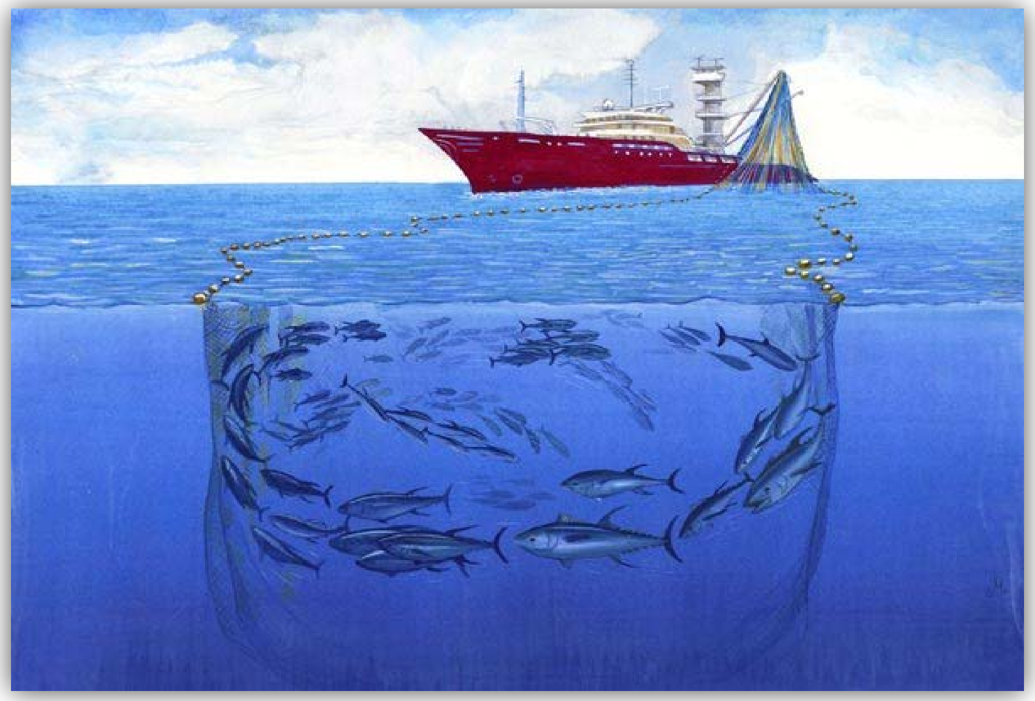
INTRODUCTION

- Conventional fishery-independent surveys are not practicable for highly migratory widely distributed tuna stocks;
- CPUE is the standard abundance index used to guide the assessment of tuna stocks;
- PS-CPUE data are notoriously problematic;
- Catchability (q) is rarely constant and depends on a number of different components;
- Fishing efficiency and dynamics of the fleet are evolving very rapidly due to the fast technological development and the sharp increase of the use of FADs.

CPUE ~ q x Biomasa



competitors

oceanography

Type and size of preys

Habitat disponibility

size

specie

maturity

age

Habitat preference

Vessels characteristics

catsat

DFADs

skipper

echo-sounder

location

time

Bird radar

day

Depth of the set

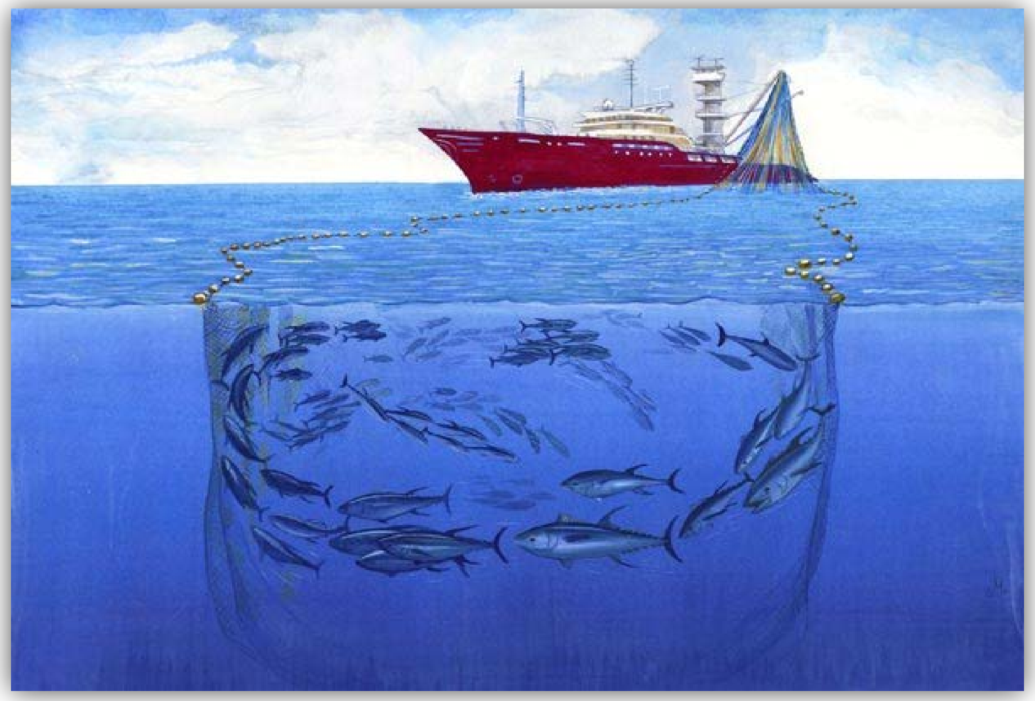
sonar

- One of the most important technological developments:

  satellite linked echo-sounder buoys.

- rapidly spread between all the purse seine fleets worldwide since mid-2000's.
- causing rapid changes in the fishing strategy and fleet behavior
- potential of being a privileged observation platform to evaluate abundances of tunas and accompanying species using catch-independent data.

CPUE ~ q x Biomasa



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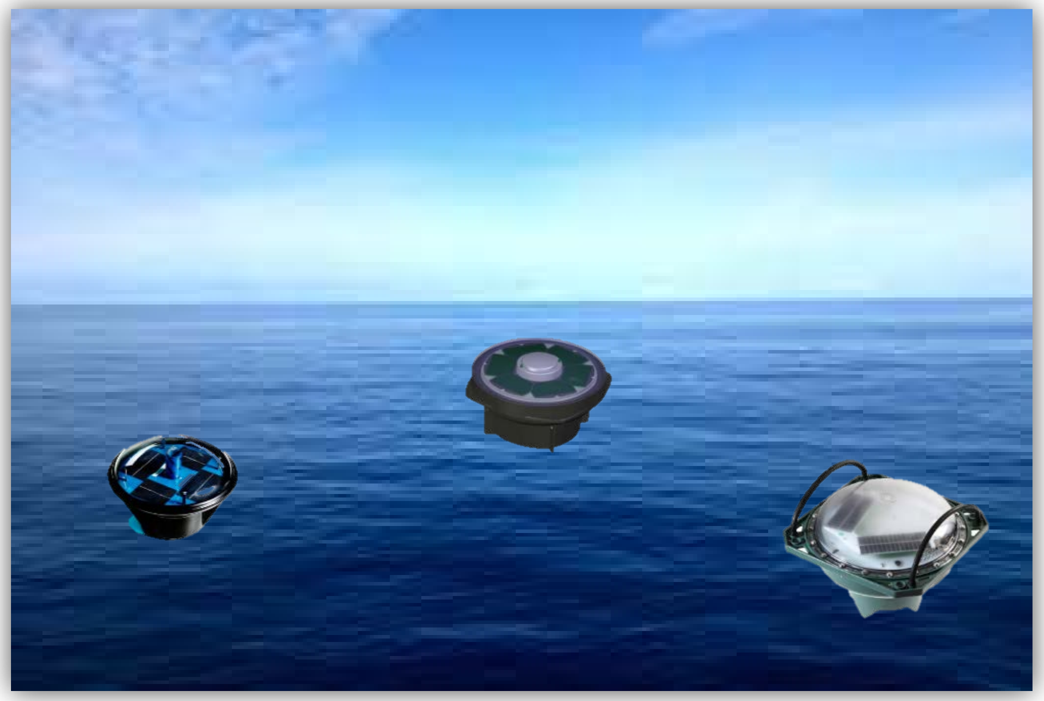
BAI ~ λ x Biomasa



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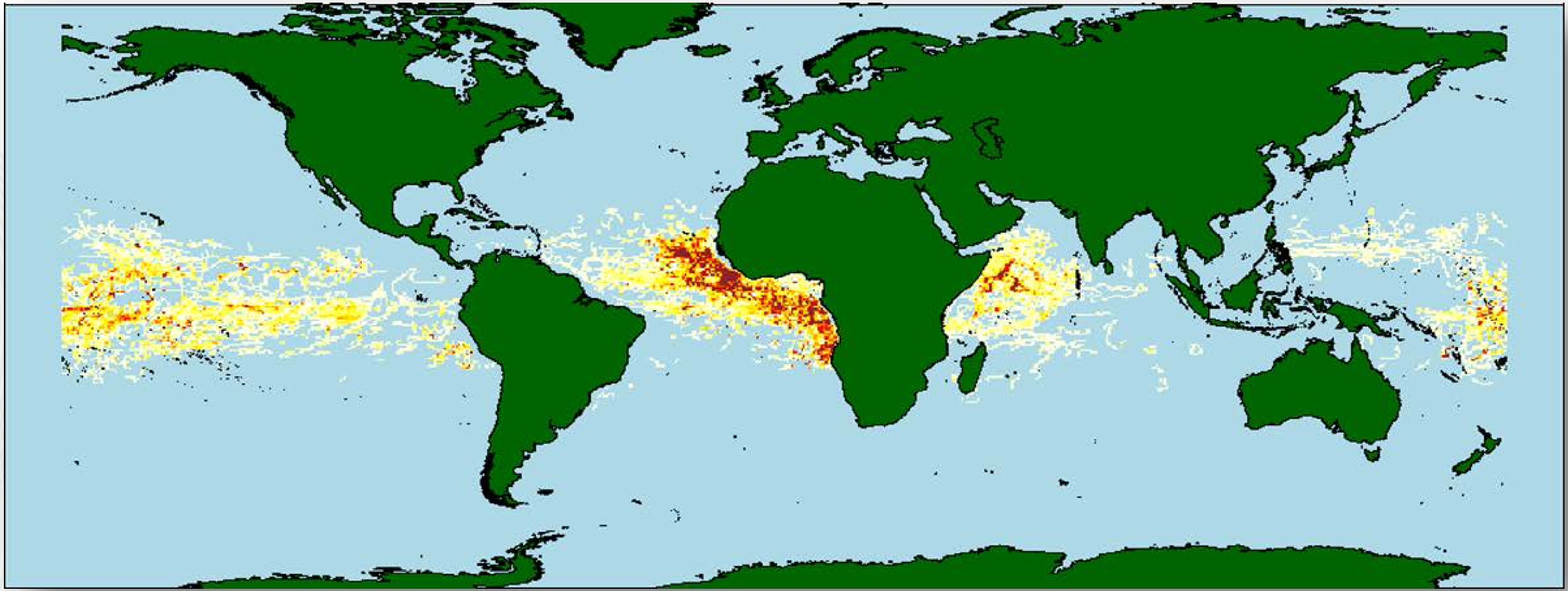
OBJECTIVE

- Initial examination of some of the features of the information potentially available from satellite tracking echo-sounder buoys used and provided by the Spanish TT PS and associated fleet **to ultimately develop a “fishery semi-independent” abundance index**.

MATERIAL & METHODS



- **1 month** : March 2011 (AO & PO) & October 2011 (IO)
- **38 vessels** / **11,705 buoys / 4,196 with echo-sounder**
- **> 1,200,000 records [position] /568,000 echo-sounder records**

3 types of buoys

	Brand A	Brand B	Brand C
Operating frequency (kHz)	50	190.5	120
Range (m)	150	115	100
Number of layers	50	10	-----
Energy source	Solar panels	Battery	Solar panels

TT-BAI
MATERIAL & METHODS

	BRAND A		BRAND B		BRAND C		ALL	
	All	EPO	All	EPO	All	EPO	All	EPO
Vessels	-	-	38	17	31	14	38	17
Buoys	1,634	186	5,522	1,339	4,549	475	11,705	2,000
Buoys with echo-sounder	1,634	186	2,271	558	291	0	4,196	744
% Buoys with echo-sounder	100	100	41,1	41.7	6,4	0	35,8	37%
Number of records	575,966	66,701	262,361	77,342	459,915	58,485	1,298,242	202,528
Acoustic records	486,109	56,864	28,528	10,409	53,368	0	568,005	67,273
Daily acoustic records	38,799	4,909	17,902	6,806	7,825	0	64,526	11,715
Daily positive records	23,443	3,683	14,247	5,638	6,792	-	44,482	9,321
% positives	60%	75%	80%	83%	87%	-	69%	80%

azti tecnalia

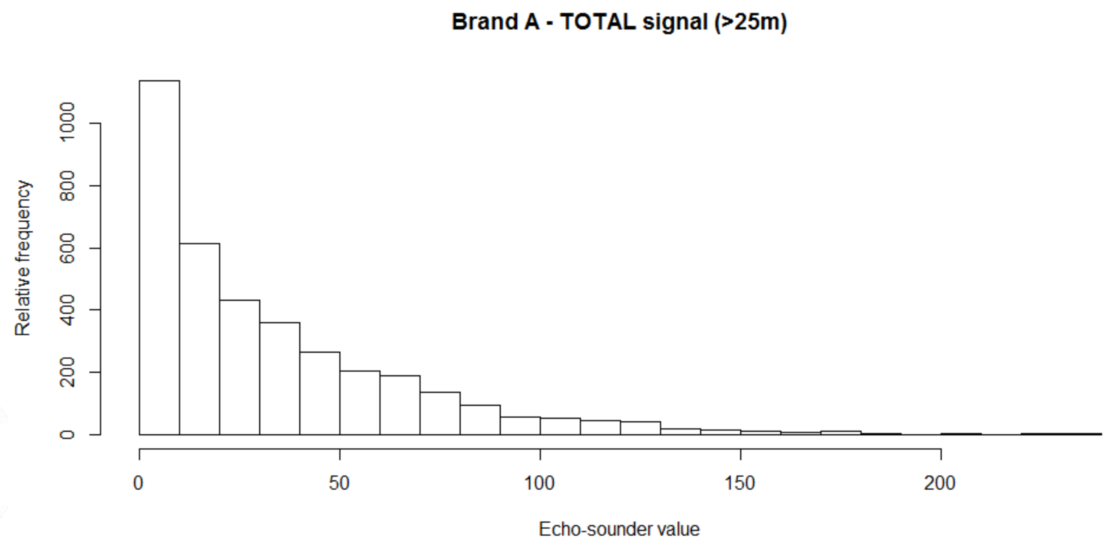
- Ways to integrate buoy information into a catch-independent abundance index for tropical tuna, including
  - **filtering** for acoustic data reductions and exclusions
  - identify **factors that should be considered** in the analysis, either because they may affect the assumption that the acoustic records are proportional to tropical tuna abundance or may influence the coefficient of proportionality (φ).

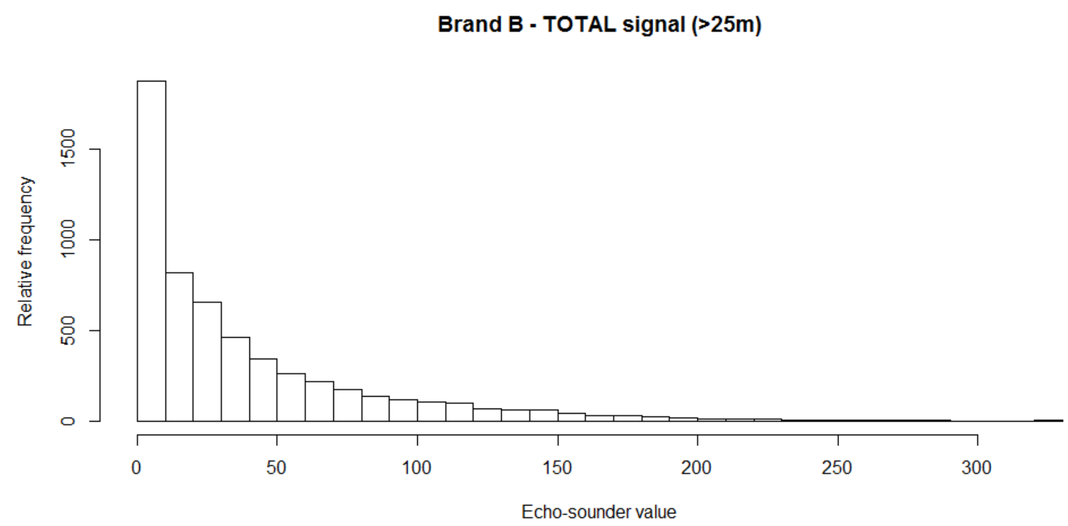
BAI = Buoy-derived Abundance Index

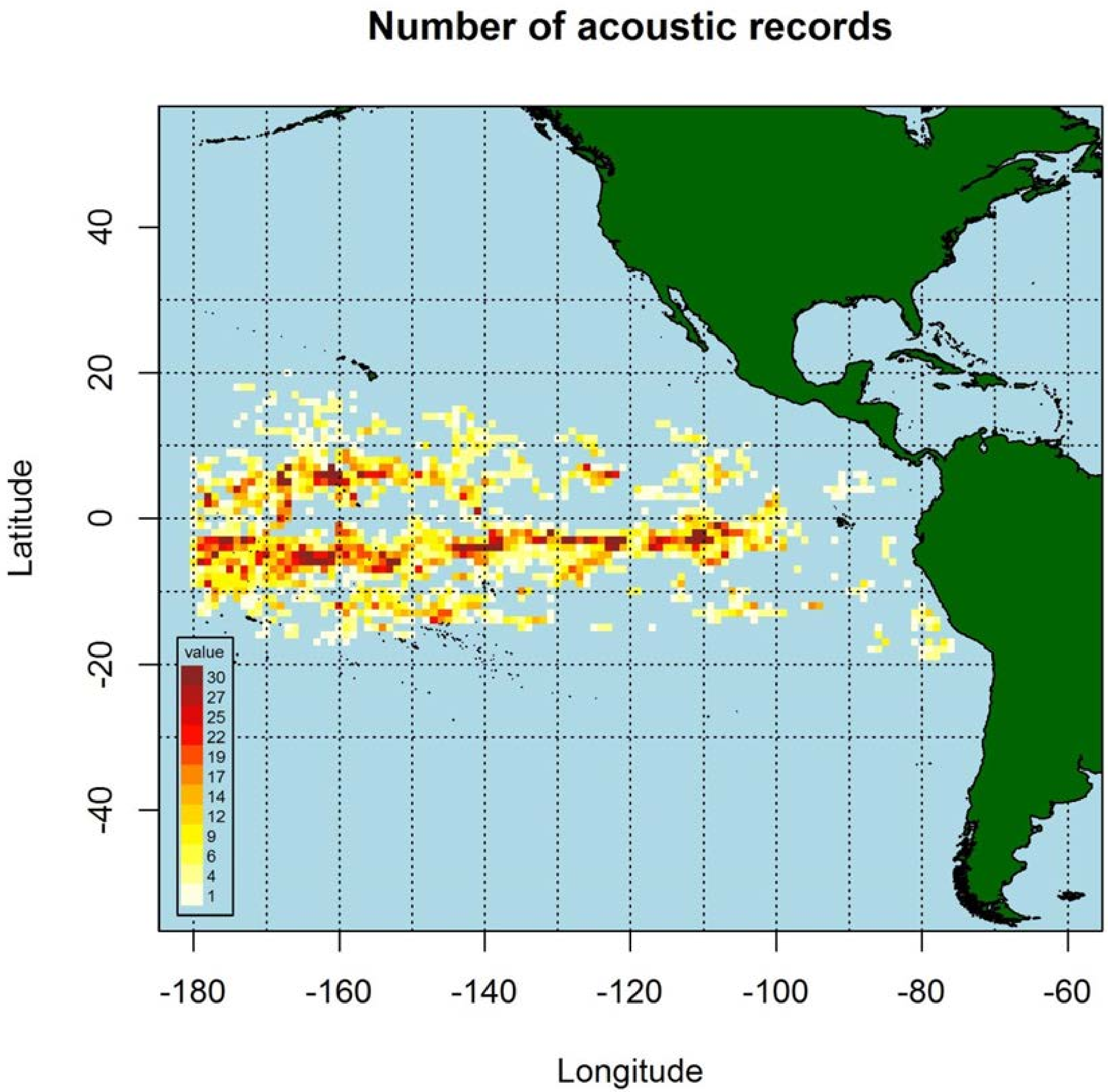
$$BAI_t = \varphi \, . \, B_t$$

- standardization of nominal measurements of the echo-sounders using a Generalized Linear Mixed Modelling approach.
- Delta method, estimating the predicted abundances as the result of two processes:
  i. the probability of encounter tropical tuna in the acoustic observations (proportion of positives) and,
  ii. the mean relative abundance given that a positive observation has been realized.

TT-BAI
RESULTS

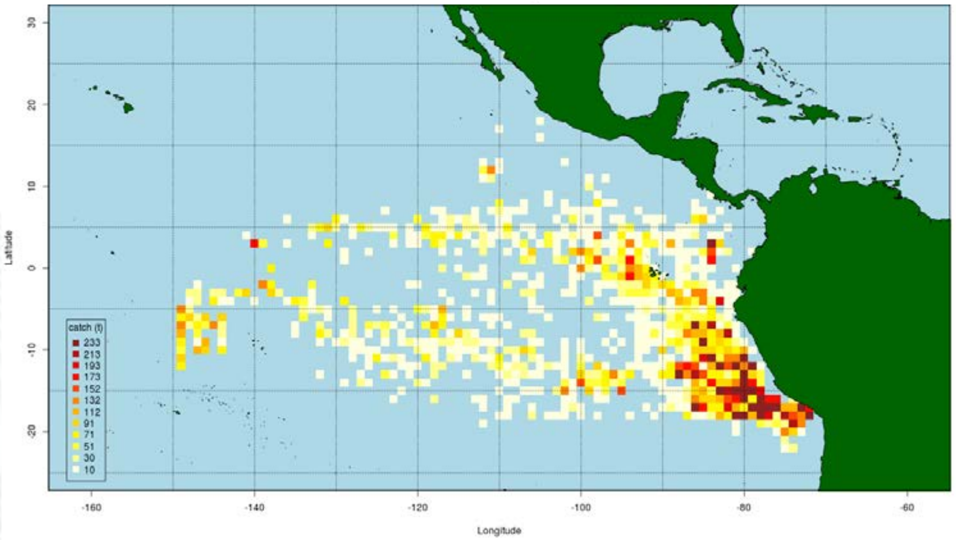




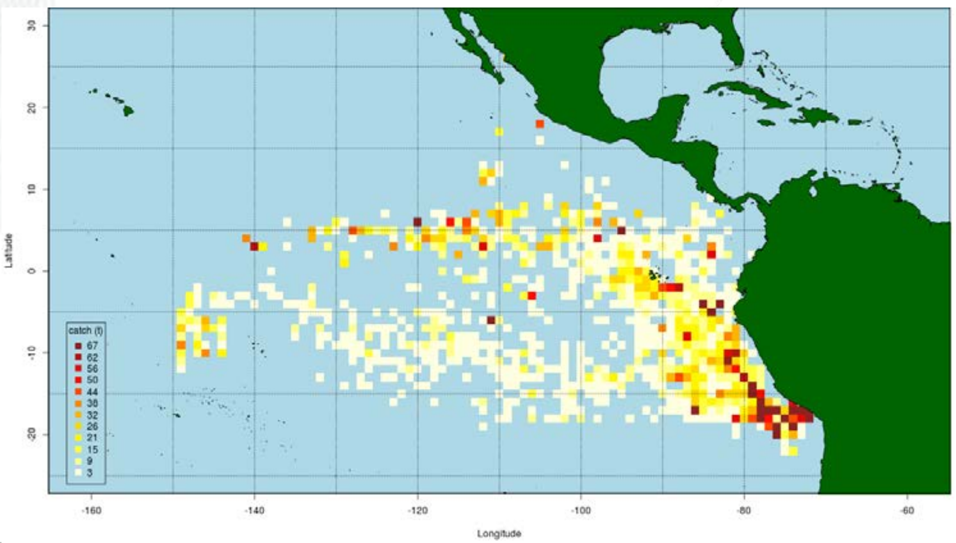

Number of acoustic records
Latitude
40
20
0
-20
-40
Longitude
-180
-160
-140
-120
-100
-80
-60
value
30
27
25
22
19
17
14
12
9
6
4
1

RESULTS

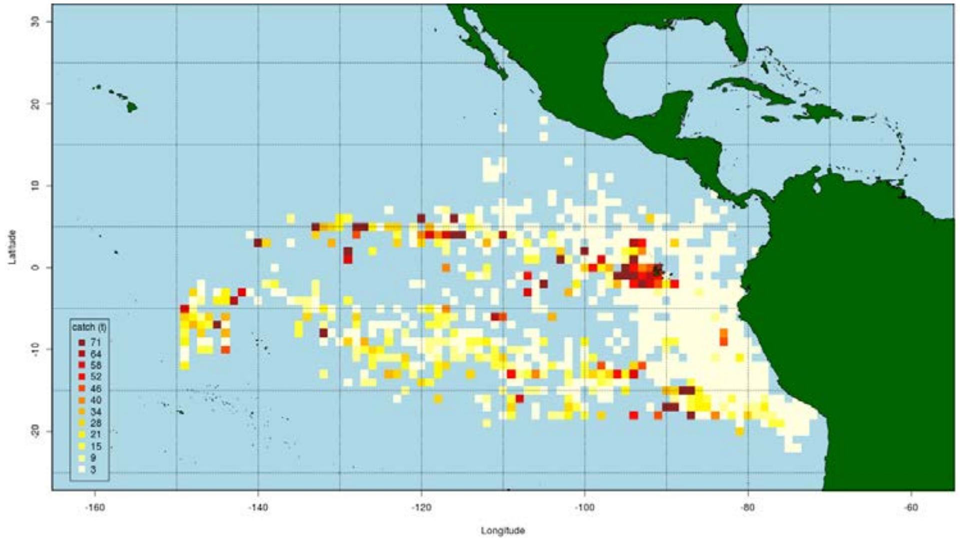
SKJ



YFT



BET



IATTC catch data

Considerations for the exclusion of records

- Time after deployment (or fishing event) [<5 days]
- Vertical range of the buoy [<25 m – non target spp]
- Time of the day [sunrise?]
- Bottom depth [<200 m]
- Speed of the buoy [>3 kn]

Variables to be considered in the standardization apart from year, month, area:

- Soak time
- Buoy type
- Depth of the acoustic layers
- Bearing and speed
- Density of FADs
- Environmental variables
- Species composition underneath the FAD

CONCLUSIONS

- **Work in progress;**
- **Very valuable information to build “Fishery Independent” Biomass Index for use in the stock assessment**
- **But also to investigate the effect of dFADs on Tuna populations and ecosystem;**
- **Long term project which will use acoustic discrimination of species/sizes;**
- **Collaborative project between scientist and vessel owners.**