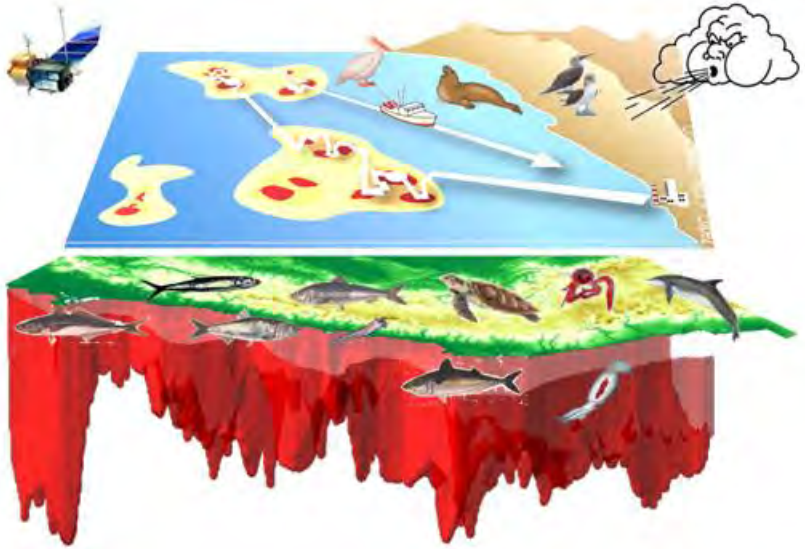
International Symposium Drivers of Dynamics of Small Pelagic Fish Resources



A claim for Adaptive Precautionary Management (APM) in upwelling systems. The case of Peruvian anchovy (*Engraulis ringens*) fishery

Mariano Gutierrez, Francois Gerlotto, Ramiro Castillo, Gary Vargas & Arnaud Bertrand

Victoria BC, Canada, March 6 to 11th, 2017

A claim for Adaptive Precautionary Management (APM) in upwelling systems. The case of Peruvian anchovy (*Engraulis ringens*) fishery

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1. Introduction: On the importance of the Peruvian fishery

- Peruvian Anchovy's amino acid composition of fish protein matches requirements of human beings. Anchovies have some of the highest levels of omega-3 fatty acids.

- Peruvian anchovy fishery yields the world`s largest supplier of marine ingredients. 3 billion of USD/year, 2% of Peru' National Gross Production.

- However it suffers high variability reinforced by successive El Niño events: 2010, 2012, 2014, 2015, 2016 and 2017. This last one was totally unexpected.

- Then, as part of an IMARPE's **Adaptive Precautionary Management (APM)** advice, the Vice Ministry of Fisheries (PRODUCE) enactled:
    1. A complete set of legal regulations (as described by Arias-Schereiber 2001)
    2. Precautionary quotas system;
    3. Cancelations of three fishing seasons (2010,2012,2014);
    4. Many quasi real time closures of fishing grounds, etc

- Nevertheless a certain skepticism exist regarding management. Sustainable Fisheries Partnership (SFP) reduced to B2 level the management of the fishery.

- ***Then, APM must be better explained and promoted***.

2. Why is a need the modelling of upwelling systems

- Modelling is intended to supplant the in situ observations. Modeling must be a tool for management, and must respond to the ecological, social and economic needs of the sustainable use of the marine goods and services.

- However, modelling, and very specially the end-to-end modelling (E2EM) is still far from providing efficient answers such as fishing quotas in large ecosystems and fisheries.

- It is also necessary to recognize the weaknesses of monospecific modelling. These consider as constant some parameters (e.g. M) that have strong variability.

- Nevertheless, to support modeling acoustics algorithms and tools have been developed to estimate fish and macrozooplankton abundance, biovolume plus the volume, roughness and structure of the epipelagic habitat (internal waves, convergent and divergent vorticity etc).

3. EBM for fisheries and the Adaptive Precautionary Management (APM)

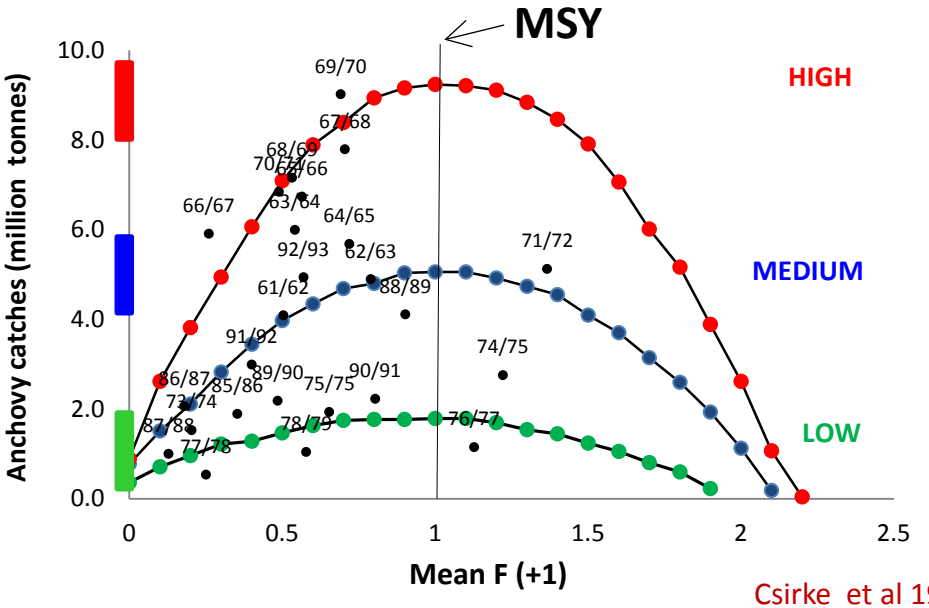
- Ecosystem Based Management (EBM) need of operational approaches to effectively achieve sustainability of fisheries. **APM is actually operational**.

- Based on a experience of decades advising the managing of Peruvian Anchovy fishery IMARPE implemented an APM based on the closest possible observation of the ecosystem:
  1. 51 years using fishing vessels as observers (Eureka Program)
  2. Over 20 years of on board observers program
  3. 19 years of a VMS records (over 1 thousand fishing vessels tracked)
  4. Over 30 years of acoustic surveys produced 110 surveys covering the NHCS (2 surveys/year as an average).

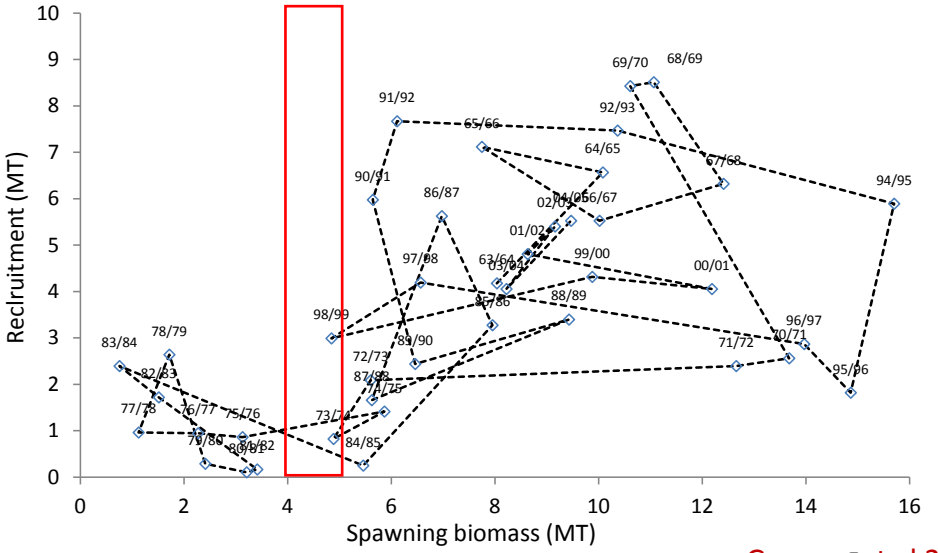
- As another product trophic ecology of the pelagic community deeply studied over the past decade, including top predators and VMS algorithms intended to model the anchovy distribution.

4. How APM works, and related BRP tools

- At least 3 population regimes have been observed since the 50's in relation to Capture/Fishing Mortality.
- Based on this knowledge, Biological Reference points (BRP) have been proposed (among others):
- (1) an exploitation rate (E) lower than 0.4, and
- (2) 4 or 5 MT of surplus spawning biomass (limit and target BRPs respectively) depending on the climatic moment.
- Fishing quotas by vessels reduced the stress on the ecosystem since 2009.



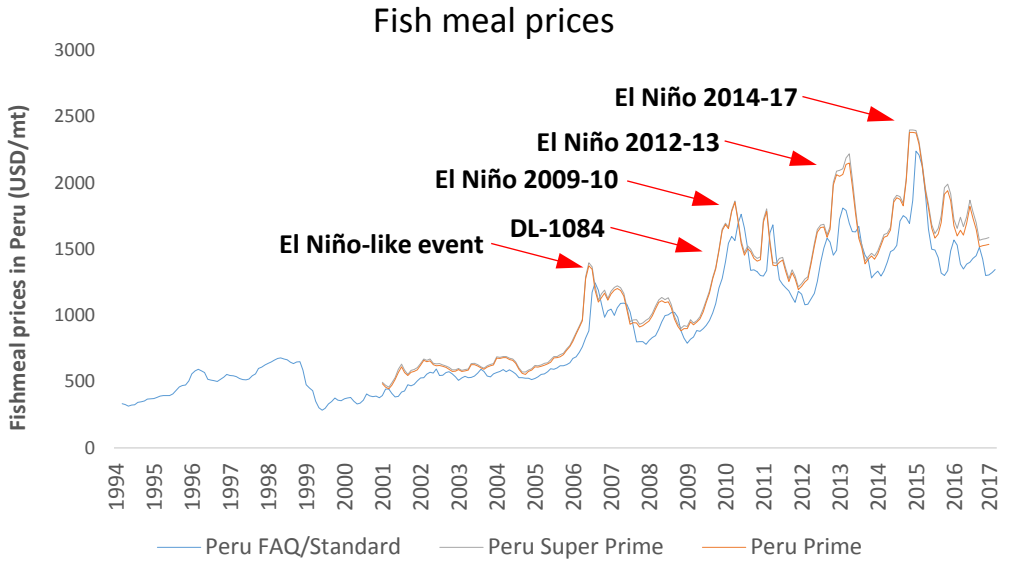
Csirke et al 1996



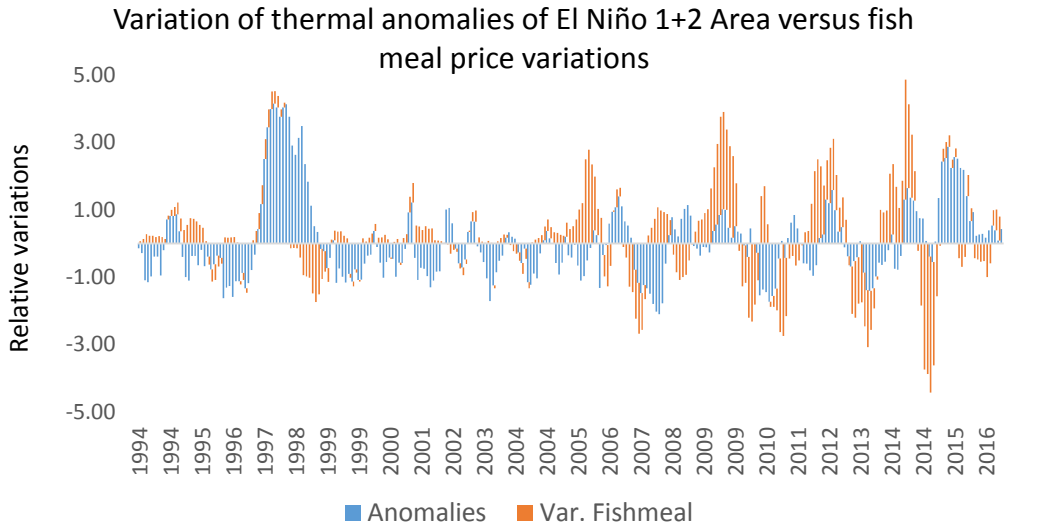
Guevara et al 2010
Oliveros & Diaz 2015

4. How APM works, and related BRP and legal tools (2)

- In 2006 IMARPE limited to 6 MT annual anchovy catches.
- Then, since 2006 fishmeal prices tend to increase though variations are related to changes on environmental conditions.
- The fishing quotas law (DL-1084, 2008) also promoted a new increase of the prices in 2009. Reduction by 40% the number of vessels.
- APM is closely related to thermal anomalies, precautionary measures are taken when El Niño-like event occurs.



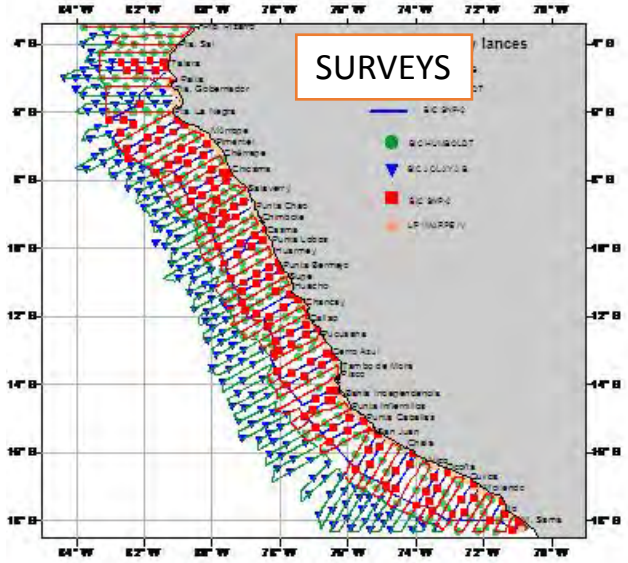
Source: IFFO, elaborated by the authors



Source: NOAA & IFFO, elaborated by the authors

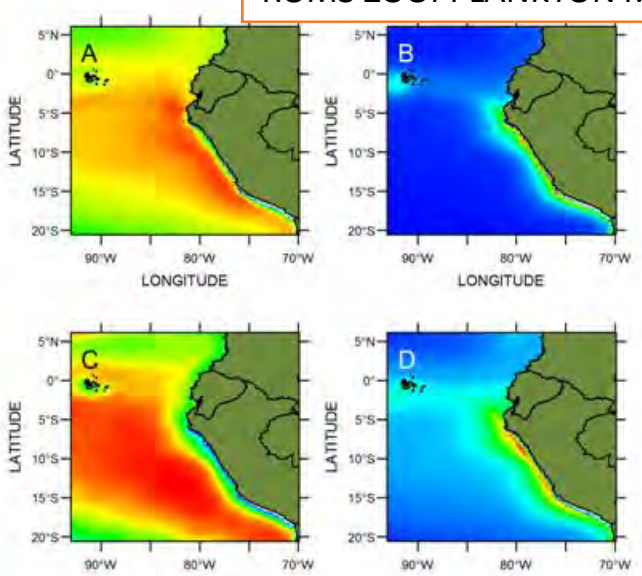
5. Methods for observing the ecosystem

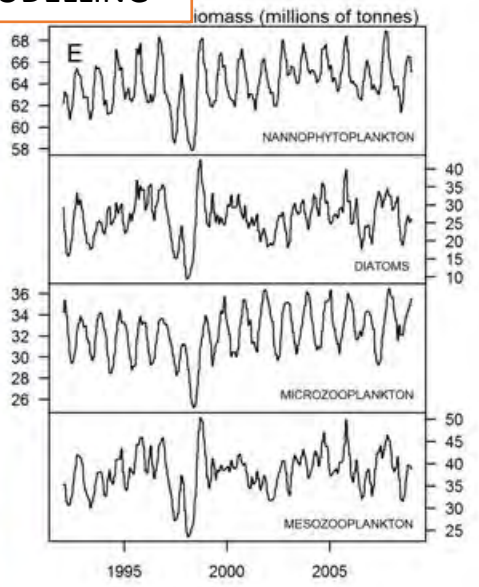
SURVEYS



Gutierrez 2014

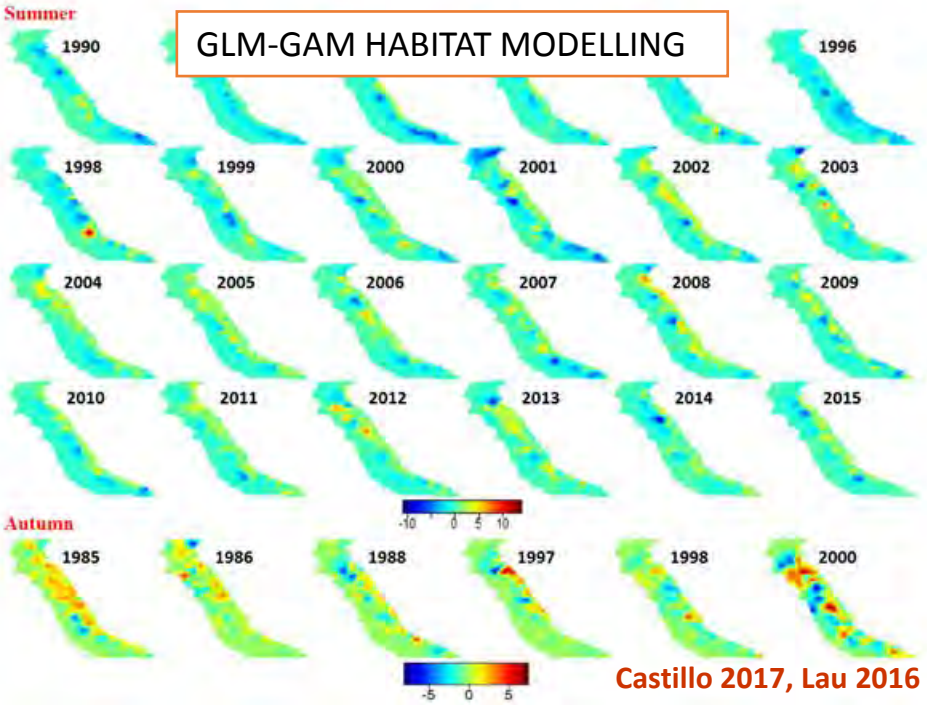
ROMS ZOOPPLANKTON MODELLING





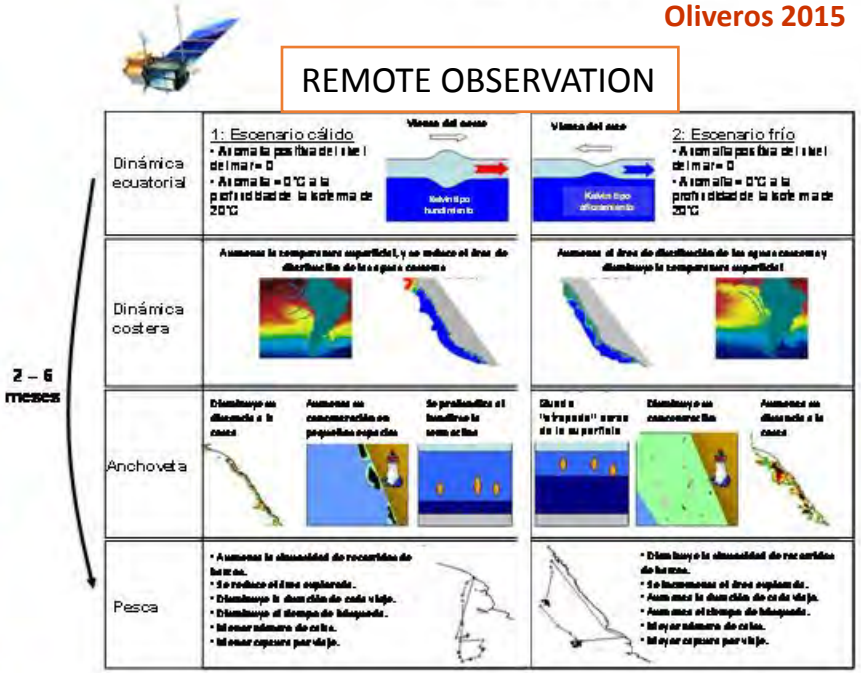
Oliveros 2015

GLM-GAM HABITAT MODELLING



Castillo 2017, Lau 2016

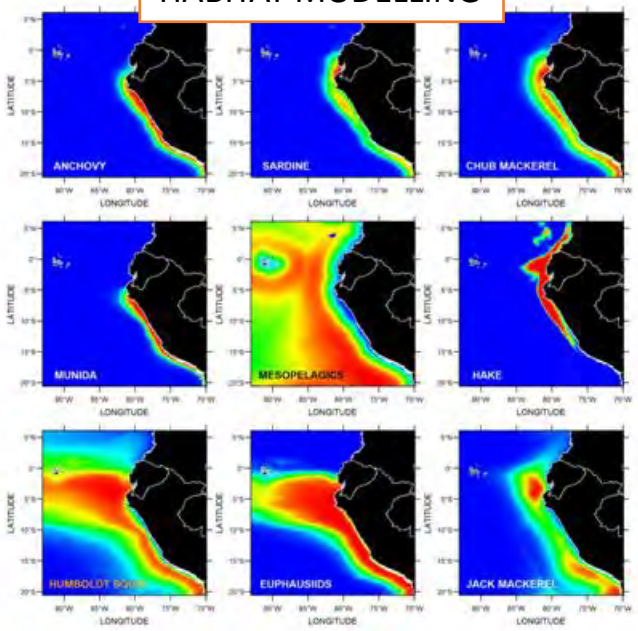
REMOTE OBSERVATION



Bertrand et al 2008

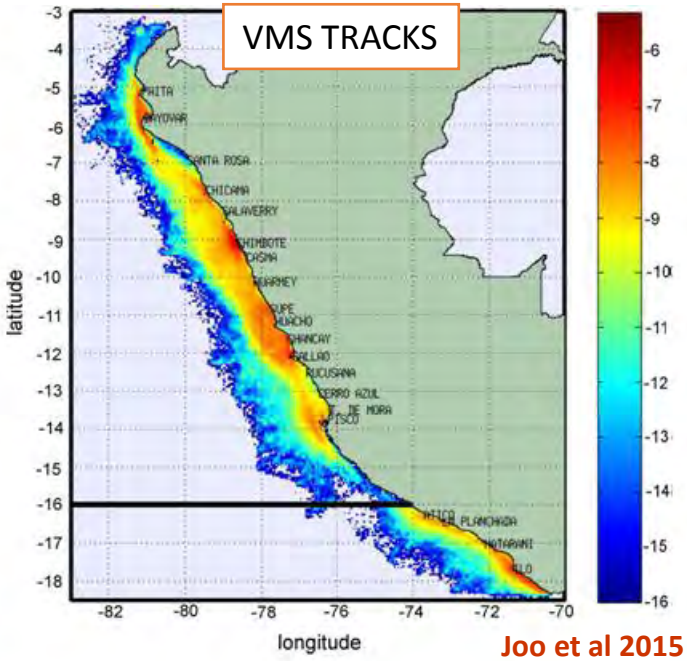
5. Methods for observing the ecosystem (2)

HABITAT MODELLING



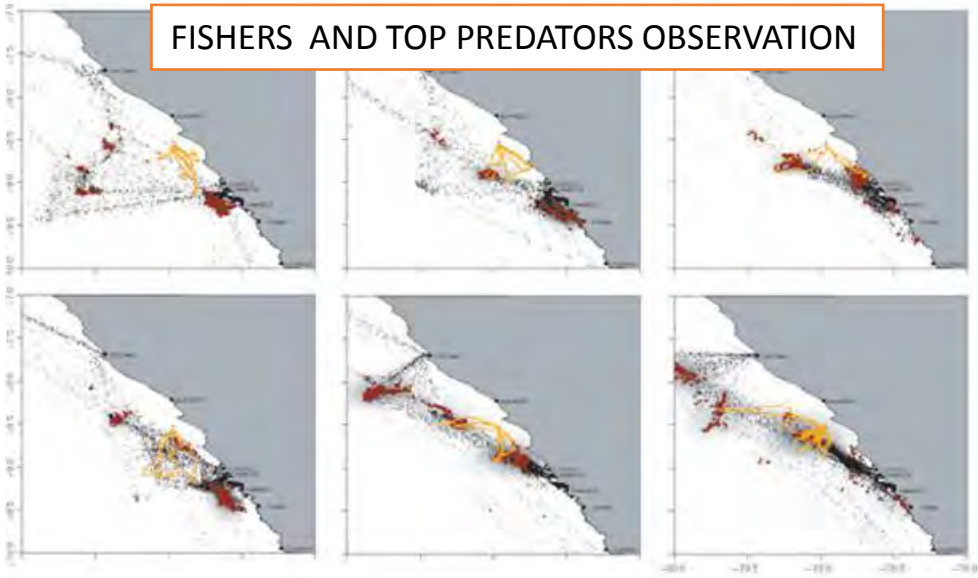
Oliveros 2015

VMS TRACKS



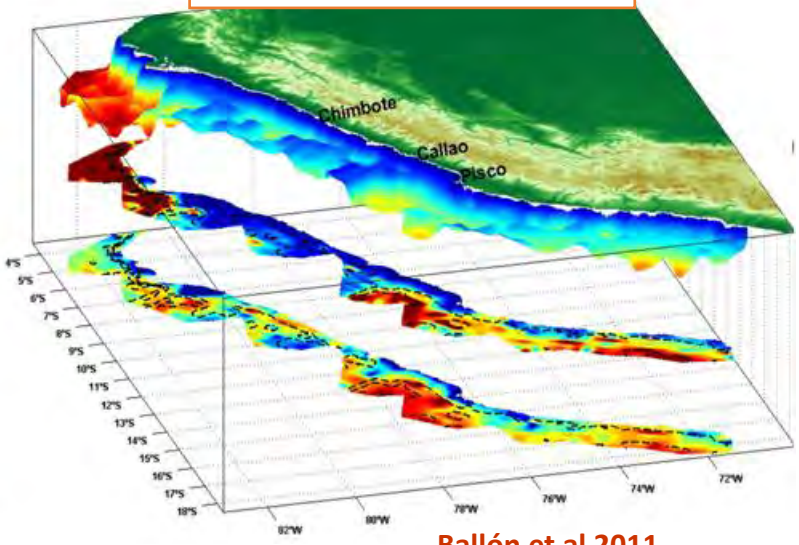
Joo et al 2015

FISHERS AND TOP PREDATORS OBSERVATION



Bertrand et al 2012

QUANTITATIVE ACOUSTICS



Ballón et al 2011

6. The role of fishers regarding ecosystem monitoring

- Peru has led cooperation between private fishing companies with universities and NGOs in order to take advantage of the potential of quality data collected by fishing vessels.

  "*In a period of climate change and regime shift, the fishing vessels are our only permanent observers of the marine ecosystem as a whole*" (F. Gerlotto, IRD).

- Participation is a key ingredient to build an EBM and is its best base. Without it the social-ecological problems and their solutions can not be defined in its human context.

  "*In the process of science-based decisions, participation is the interface between the reality of nature and the fiction of models used to explore solutions. Participation provides a quota of realism to the models used by scientists in the effort to represent the real world*" (S. Garcia, FAO).

IRD Universidad Nacional Federico Villarreal INSTITUTO HUMBOLDT Sociedad Nacional de Pesquería IREA

6. The role of fishers regarding ecosystem monitoring (2)

Source: TASA

ESTÁS EN > PORTADA > ECONOMÍA

Produce dispuso cierre preventivo de ocho zonas marítimas para protección de la anchoveta

Domingo, 20 de noviembre del 2016

ECONOMÍA

15:53

Además exhortó a la industria pesquera a realizar sus faenas en **forma responsable** e informar oportunamente sobre la presencia de juveniles.

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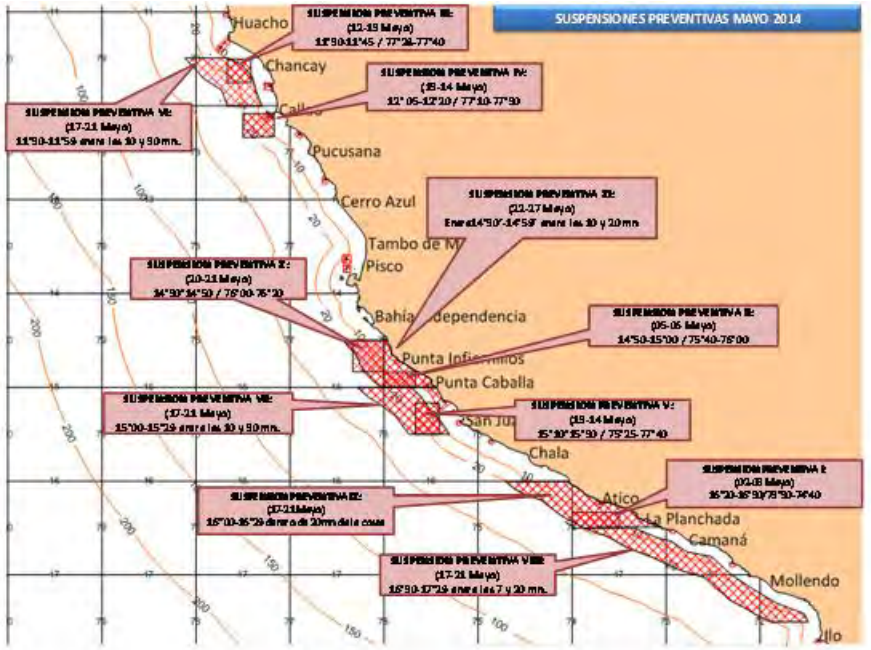
Me gusta

Compartir

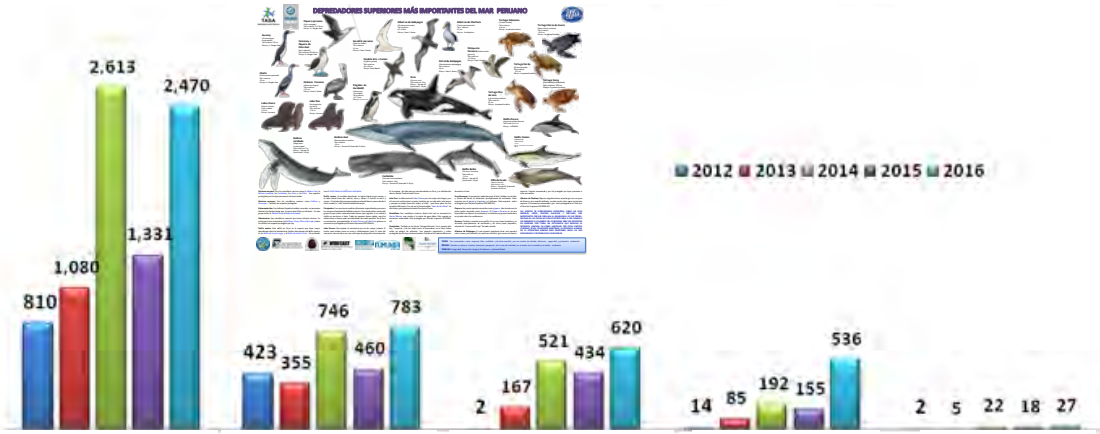
En el marco de las acciones de pesca exploratoria y segunda temporada de pesca de la zona norte centro, el Ministerio de la Producción (**Produce**) dispuso el cierre preventivo de ocho zonas marítimas y como medida precautoria para la

Source: Gestion, 2015

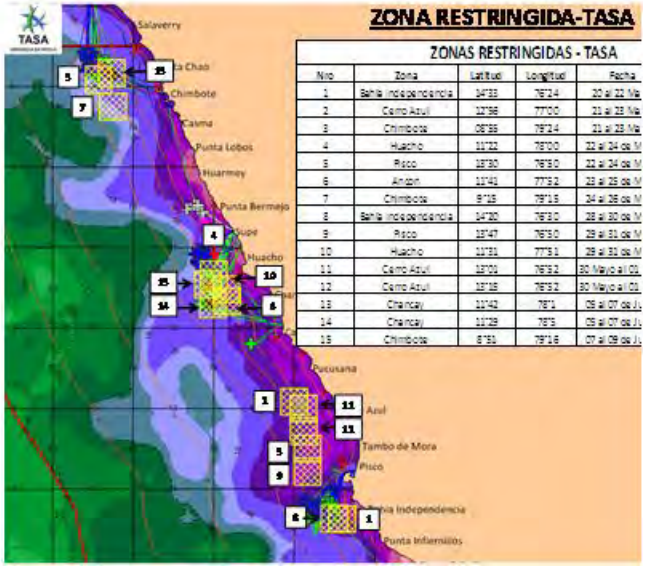


TASA 2014

Observations of top predators from fishing vessels by years



TASA 2017



TASA 2017

6. The role of fishers regarding ecosystem monitoring (3)

Resolución Ministerial

VISTOS: El Memorando N° 3724-2015-PRODUCE/DVPA, el Oficio N° DEC-100-474-2015-PRODUCE/IMP del Instituto del Mar del Perú - IMARPE, el Informe N° 341-2015-PRODUCE/DGP-Dirope de la Dirección General de Políticas y Desarrollo Pesquero y el Informe N° 00159-2015-PRODUCE/ODAJ-consulet de la Oficina General de Asesoría Jurídica; y,

CONSIDERANDO:

Que, el artículo 2 de la Ley General de Pesca – Decreto Ley N° 25977 establece que los recursos hidrobiológicos contenidos en las aguas jurisdiccionales del Perú son patrimonio de la Nación, correspondiendo al Estado regular el manejo integral y la explotación racional de dichos recursos, considerando que la actividad pesquera es de interés nacional;

Que, el artículo 9 de la citada Ley establece que el Ministerio de la Producción, sobre la base de evidencias científicas disponibles y de factores socioeconómicos, determina, según el tipo de pesquerías, los sistemas de ordenamiento pesquero, las cuotas de captura permisibles, las temporadas y zonas de pesca, la regulación del esfuerzo pesquero, los métodos de pesca, las tallas mínimas de captura y demás normas que requieran la preservación y explotación racional de los recursos hidrobiológicos. Asimismo, dispone que los derechos administrativos otorgados se sujetan a las medidas de ordenamiento que mediante dispositivo legal de carácter general dicte el Ministerio;

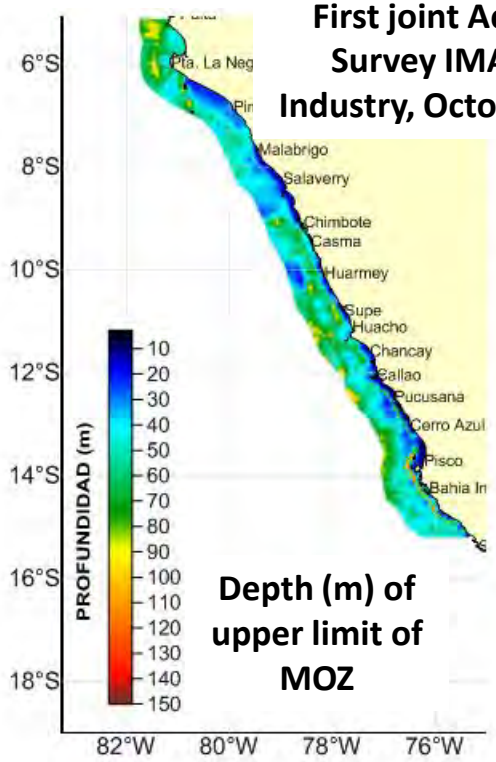
Que, asimismo, la acotada Ley en su artículo 13, menciona que la investigación pesquera está orientada a obtener y proporcionar permanentemente las bases científicas que sustentan el desarrollo integral y armónico del proceso pesquero;

Que, el artículo 21 del Reglamento de la Ley General de Pesca aprobado por Decreto Supremo N° 012-2001-PE, dispone que la investigación pesquera es una actividad a la que tiene derecho cualquier persona natural o jurídica y que para su ejercicio se requerirá autorización previa del Ministerio de la Producción en los casos en que se utilicen embarcaciones, extraiga recursos hidrobiológicos, use espacios acuáticos públicos u opere plantas de procesamiento, siendo dicha autorización intransferible;

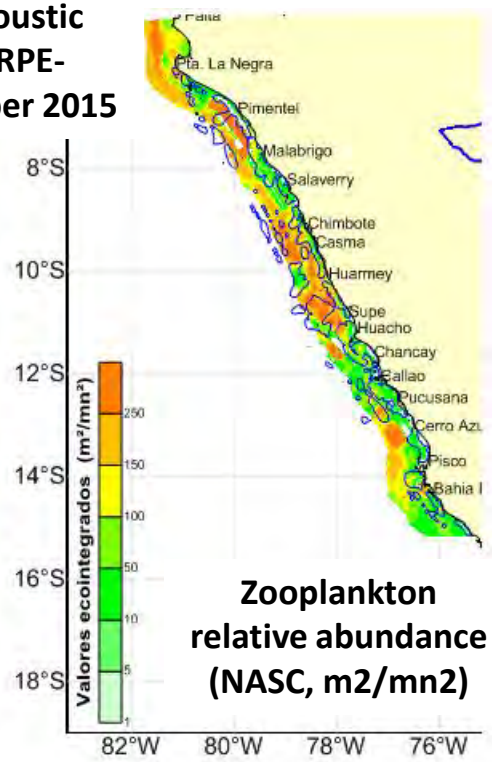
Que, el Instituto del Mar del Perú – IMARPE mediante el Oficio N° PCD-100-441-2015-PRODUCE/IMP, remite el informe "SITUACIÓN DEL STOCK NORTE-CENTRO DE LA ANCHOVETA PERUANA A SETIEMBRE DEL 2015", que contiene los resultados

Source: PRODUCE

First joint Acoustic Survey IMARPE-Industry, October 2015

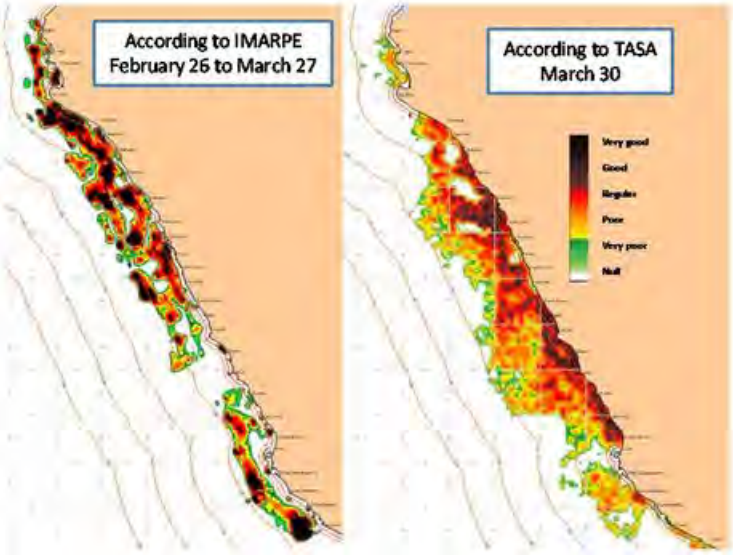


Depth (m) of upper limit of MOZ

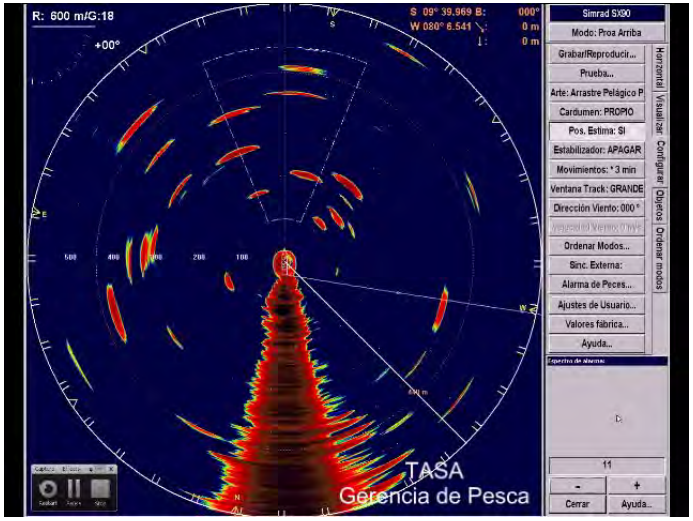


Zooplankton relative abundance (NASC, m2/mn2)

IMARPE 2015



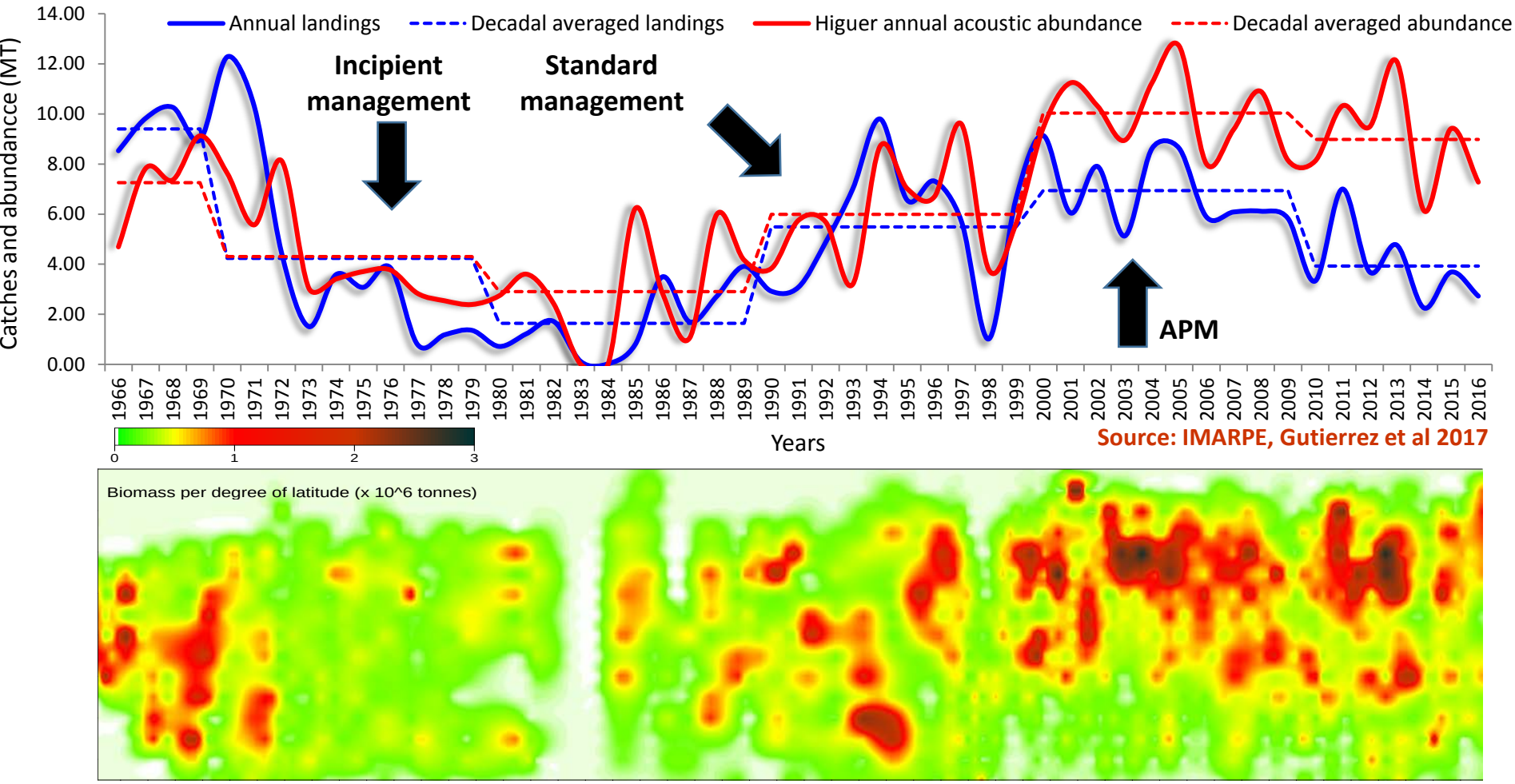
Gutierrez & Vargas 2014



Source: SNP

7. Current situation of the anchovy stock

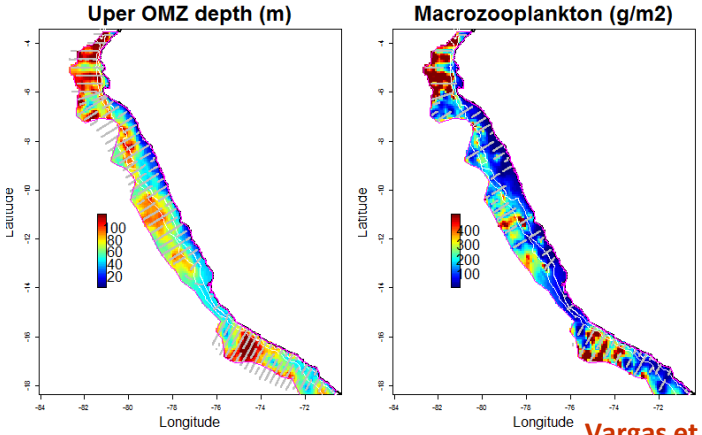
- Decadal abundance reduced 1 MT since 2010 though higher than in previous decades; at the same time catches reduced 3 MT (=APM !).
- High disturbance after El Niño 2009-10, northward trend in anchovy distribution.



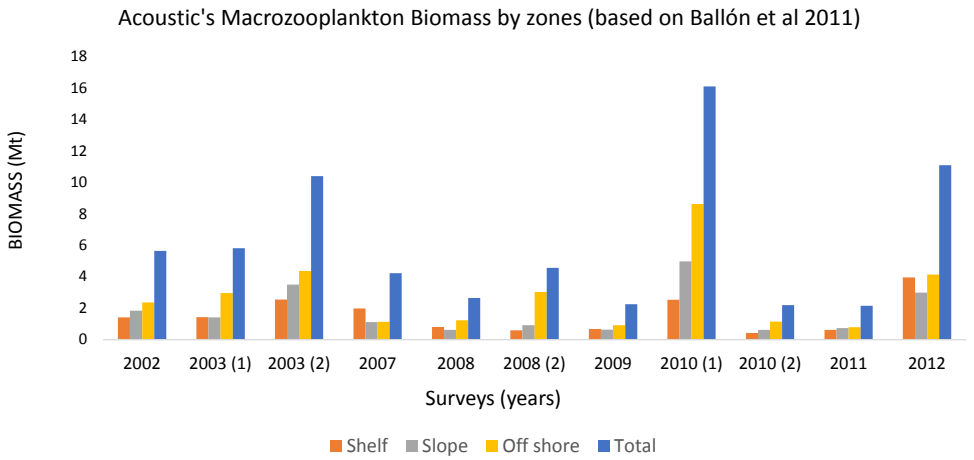
Source: IMARPE, Gutierrez et al 2017

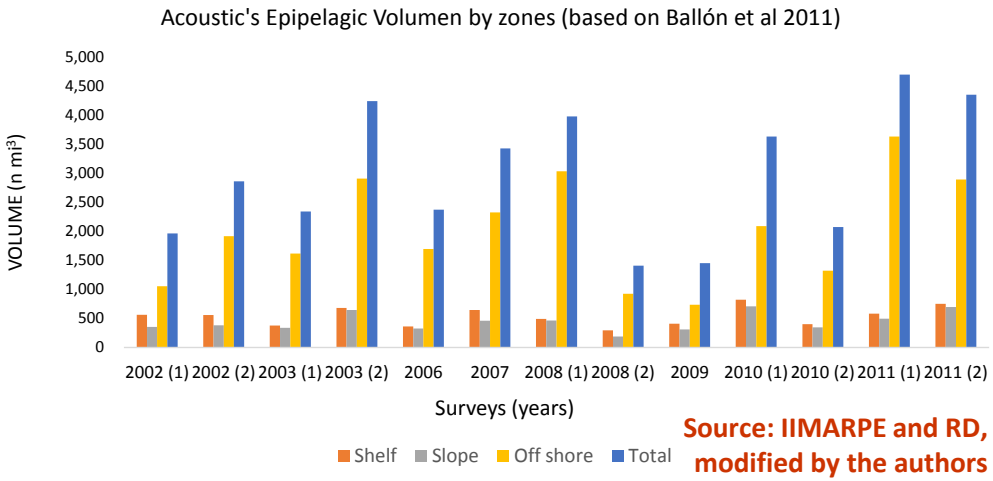
7. Current situation of the anchovy stock (2)

- Capabilities developed for measuring aspects of the anchovy habitat.
- Macrozooplankton is "easily" measured with acoustics, it is the main item of the anchovy diet…. **and do not avoid vessels…**
- Macrozooplankton abundance and the volume of the habitat are being implemented for APM.
- MOZ upper limit can automatically be detected using acoustics, it let us calculate variations of the epipelagic habitat.



Vargas et al 2016

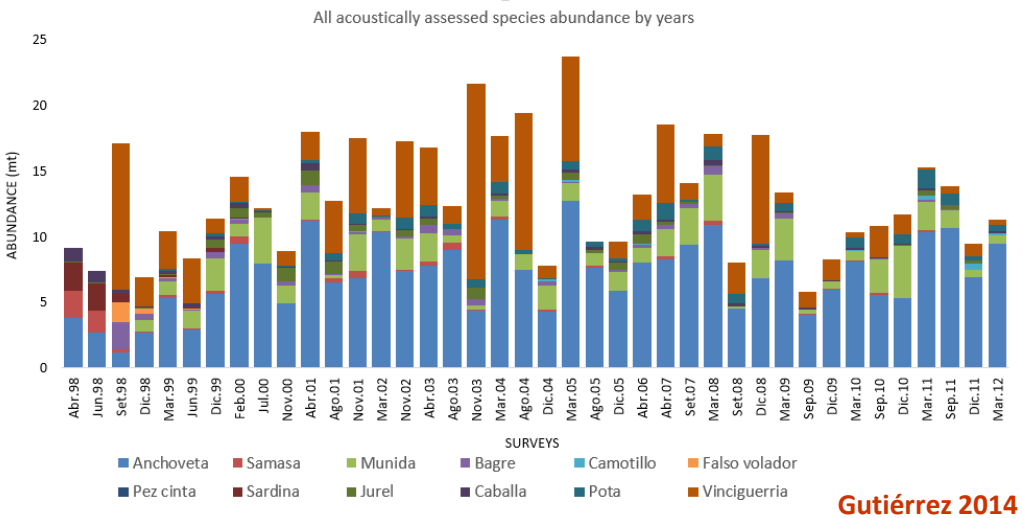




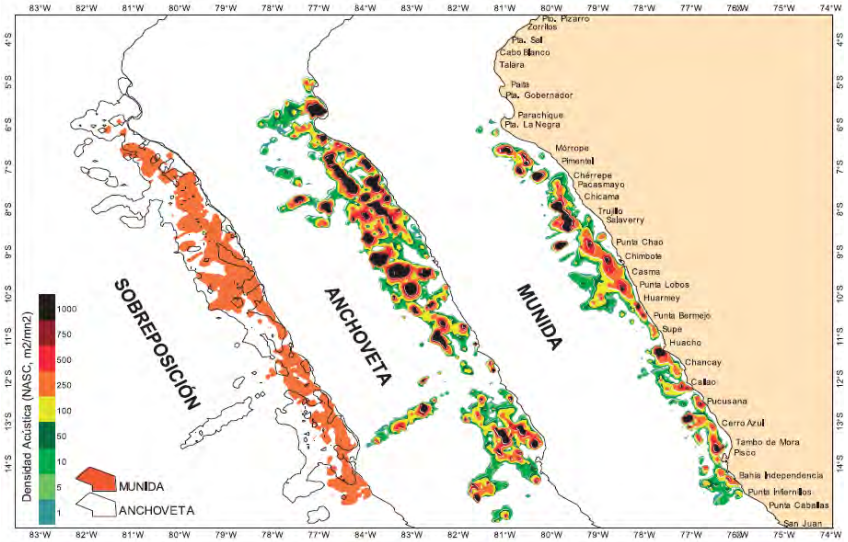
Source: IIMARPE and RD, modified by the authors

7. Current situation of the anchovy stock (3)

- Acoustic Surveys produce information for analyzing the situation of other species (over 10).
- Special attention is given to the relationship between anchovy and its main competitor in the coastal area (the red squat lobster).
- APM will evolve to consider the management of groups of species in the long journey toward E2EM.



Gutiérrez 2014



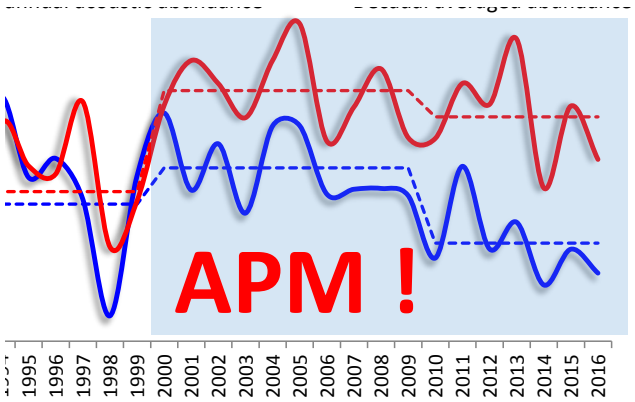
Gutiérrez et al 2008
Gutiérrez & Gerlotto 2017

8. Conclusions: A Claim for precautionary adaptive management in upwelling systems

- Most of our knowledge is based on short-term time series where ephemeral correlation can be observed. **We should be modest about our knowledge, particularly in the current context of global change (or regime shift).**

- The need of **modeling must be supported by an increase of the quantitative monitoring of the ecosystem**. This can only be achieved by using the fishing vessels as collectors of quality data.

- Meanwhile **APM has successfully been applied on the Peruvian Fishery since the mid 90s** and dealt with strong ecosystem changes, demonstrating its efficiency.



- e.g.:The decline of anchovy catches observed in 2010, 2012, 2014, 2015 and 2016 is more the result of the APM adapted to every specific situation than an actual fishery-induced biomass decline:
  - (i) anchovy catches have been far below levels of standing biomass;
  - (ii) large natural forcing induces changes in recruitment preventing the determination of anchovy virgin biomass;
  - (iii) APM focusing in the main specie (anchovy) is also a way to protect the whole ecosystem.