SPRFMO

3rd Meeting of the Scientific Committee

Port Vila, Vanuatu
28 September - 3 October 2015

SC-03-11

Fishing vessels as scientific platforms: Report of activities 2014-15

F. Gerlotto, R. Bernales, S. Peraltilla, M. Gutierrez & P. Trillo

SPRFMO
South Pacific Regional Fisheries Management Organisation

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Fishing vessels as scientific platforms: Report of activities, 2014-2015.

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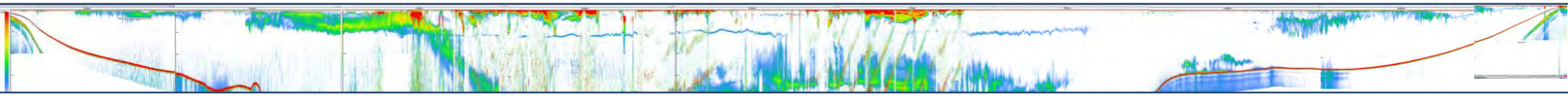
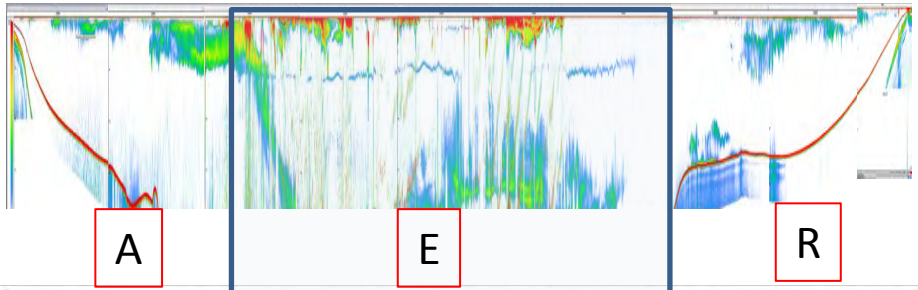
2. SNP (Sociedad Nacional de Pesquerías, Lima, Peru (www.snp.org.pe)
3. Universidad Federico Villareal, Lima, Peru (www.unfv.edu.pe)

Protocol for analyzing a single trip

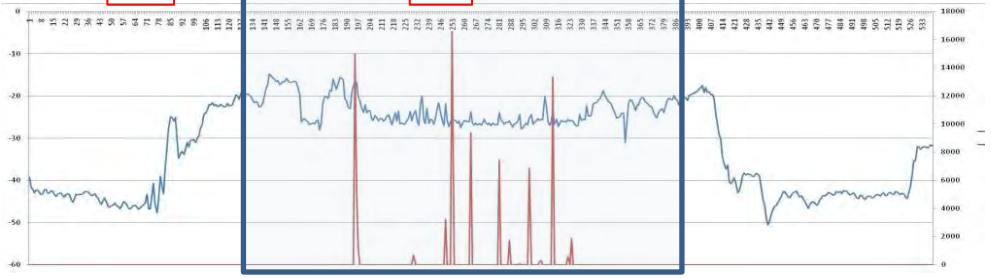


A: route to the fishing grounds; E: exploration and fishing; R: return to the harbor
The difference in shape between A and R compared to E allowed the separation of the trip in 3 parts.

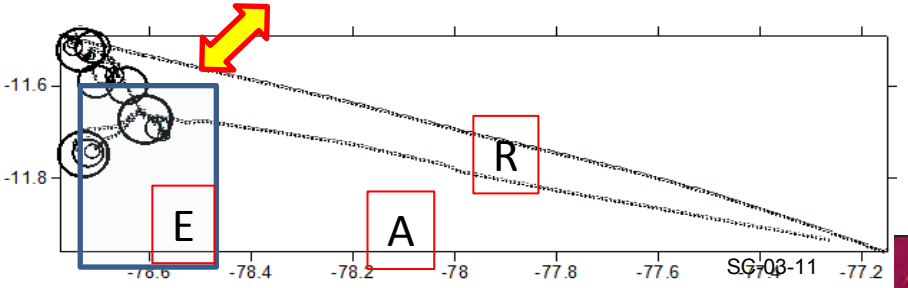
Echogram of the whole trip



Sv (blue) and NASC per school (red) during the trip. EDSU: 0.5 nautical mile



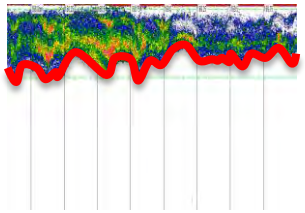
Drawing of the routes and CJM abundance

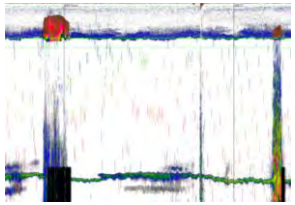


GENERAL OBJECTIVES AND METHODS.
II. INTEGRATED INFORMATION FROM FISHING VESSELS

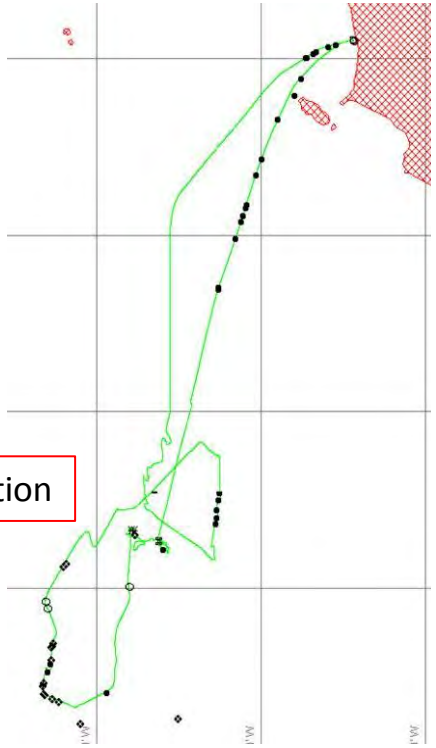
- **Time-spatial location of fishery resources and an indication of "skippers behaviour"**
- **Time-spatial distribution of preys (krill, zooplancton, mesopelagic fish, all micronekton)**
- **Continuous measurement of functioning of ecosystem indexes: thermocline, oxycline, internal waves, biovolume, fish and prey abundance etc.**
- **Detection of top predators and visual identification in the acoustic systems.**
- **Multifrequency species identification on certain vessels equipped with more advanced systems.**
- **Possibility of automated acoustic detection for fishing vessels.**

Oxycline

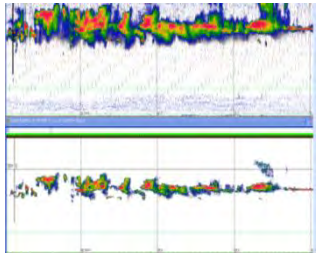


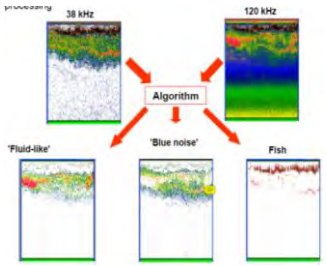


School detection



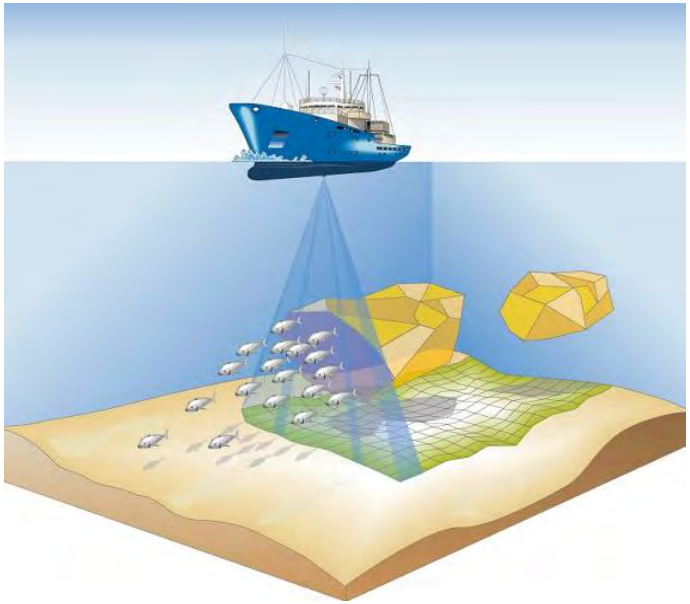
Preys-predators

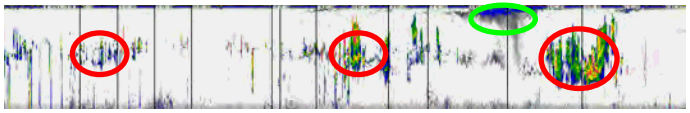




Identification

GENERAL OBJECTIVES AND METHODS.
III. SNP MONITORING SYSTEM

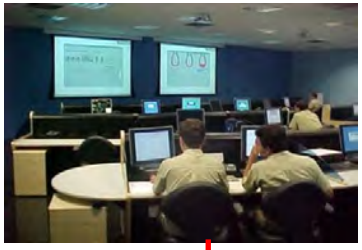


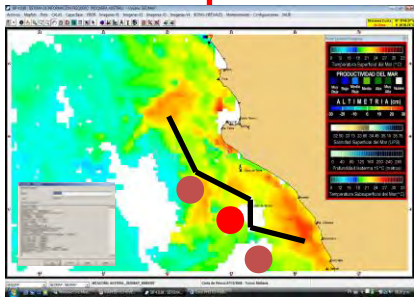


Simrad ES60 Ecosonda

Notebook with Echoview & comunication software

Fleet Management





Mapping of indicators in real time

GENERAL OBJECTIVES AND METHODS.
IV. POTENTIAL HABITAT PROBABLILTY MAP

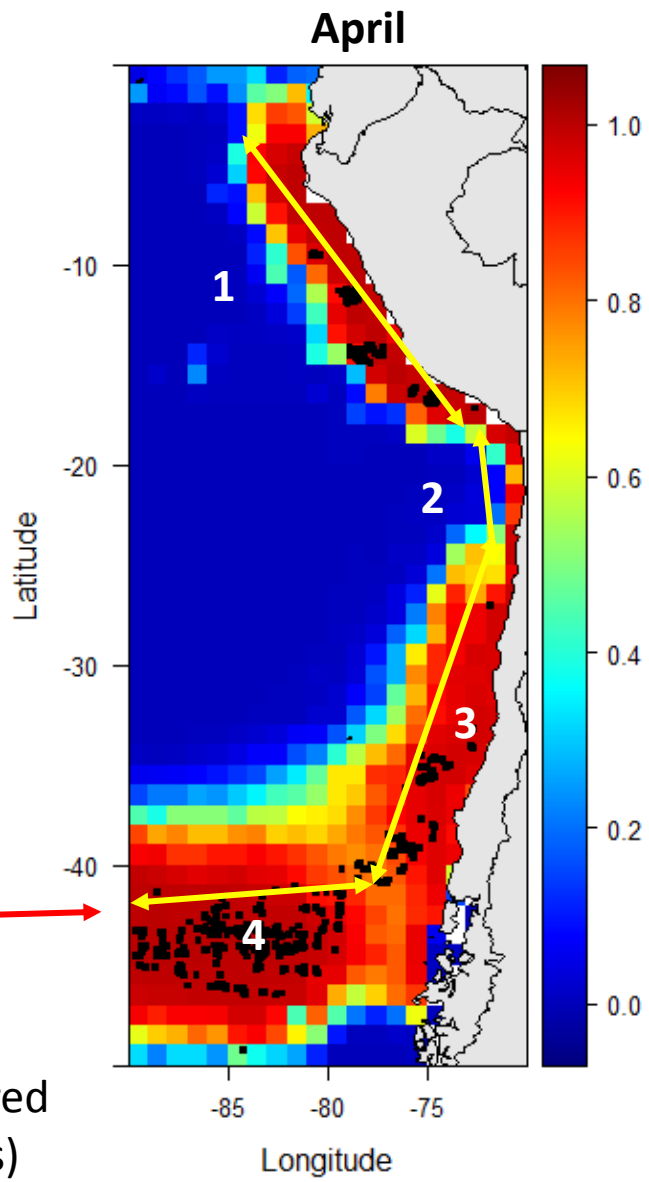
Far North (Peru)

Threshold 20ºS-25ºS

Centre-South Chile

Offshore Chile

Oceanic
(this area has almost disappeared since the late 90s)

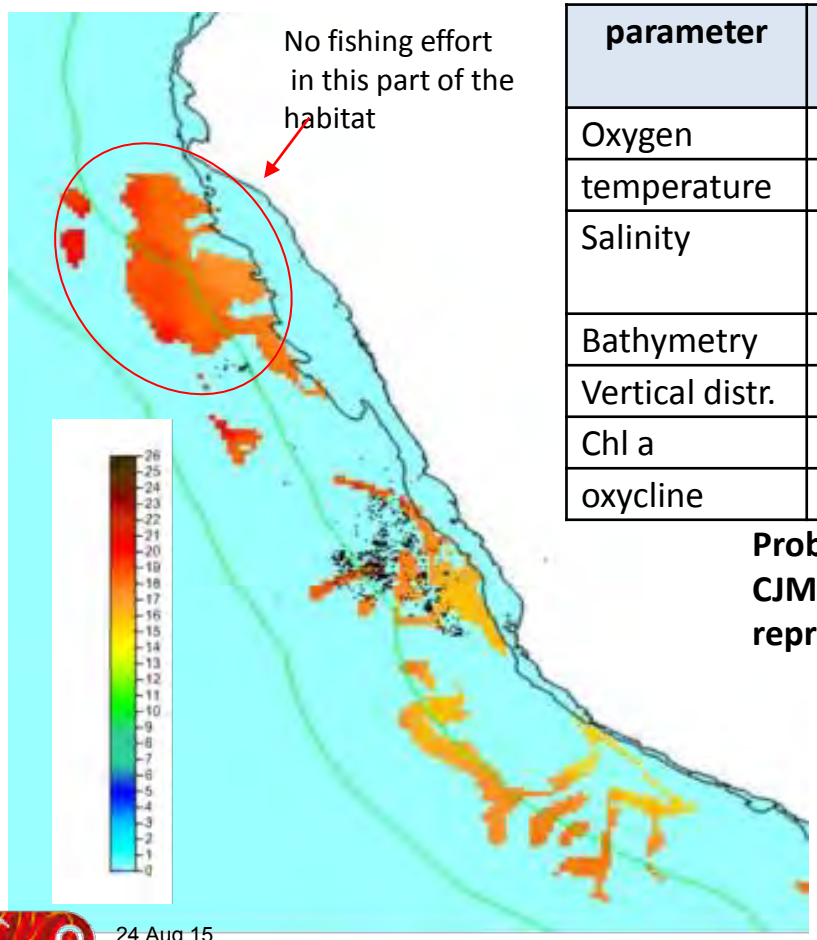


Extracted from the model.

Scale: from blue (low probability , habitat unsuitable) to red (high probablilty, best habitat conditions)

Black dots: fishing activities reported

Example: potential habitat for the Far North sub-population



Limits of the jack mackerel habitat for the main environmental parameters (measured for the Peruvian area during the workshop)

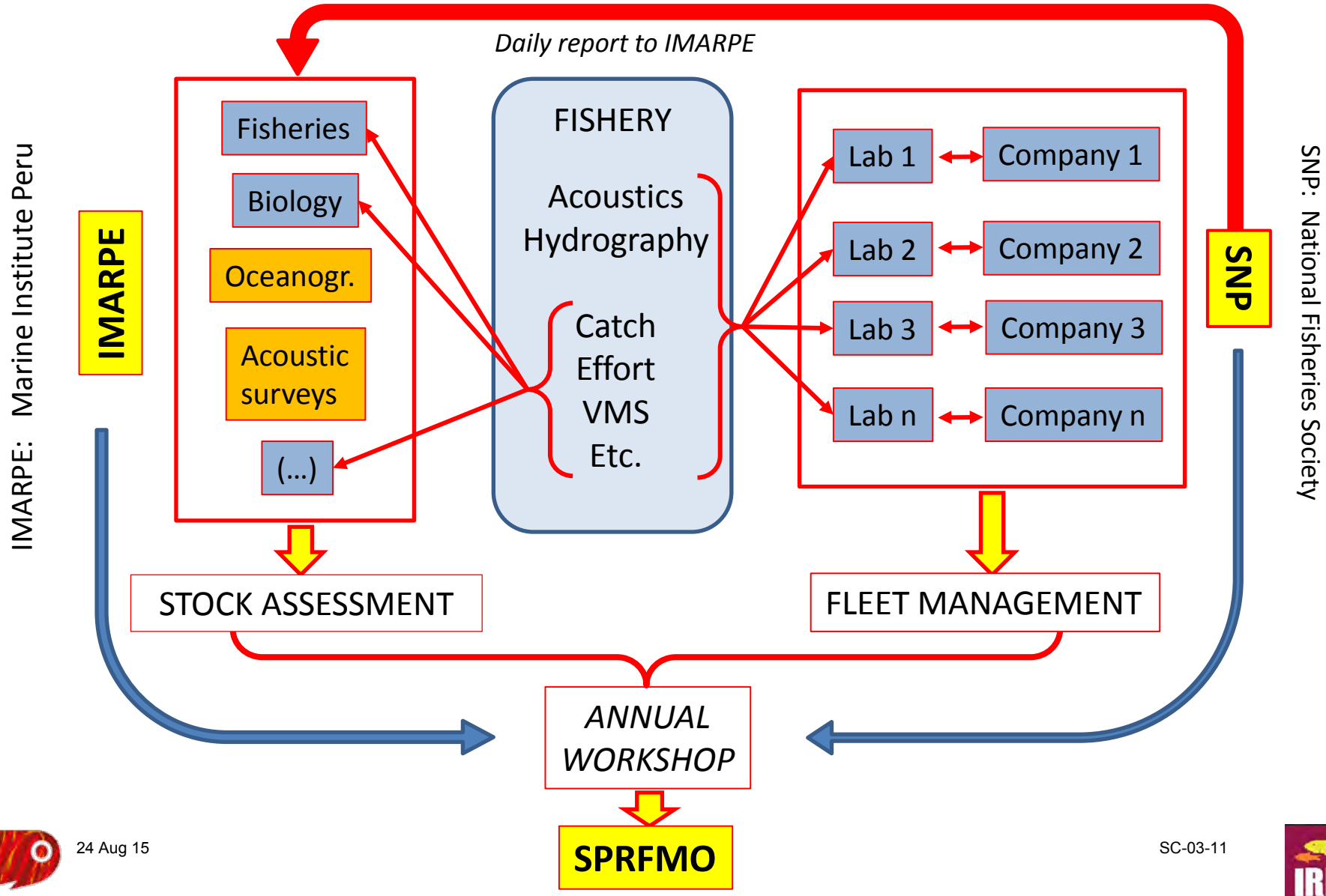
parameter	Lower limit	Upper limit	Lower preferendum	Upper preferendum
Oxygen	0.1 ml/l	-	0.2 ml/l	-
temperature	9º	26º	15º	20º
Salinity	<minimum observed	>maximum observed	34.9	35.1
Bathymetry	-	150 m	-	-
Vertical distr.	400	0	-	-
Chl a	0.07mg/m3	26 mg/m3	0.1	?
oxycline	-	30 m	-	40 m

Probability plot of the map of potential habitat of CJM during the 1st semester 2013. Black dots represent the fishing sets.

Need for indicators to be added:

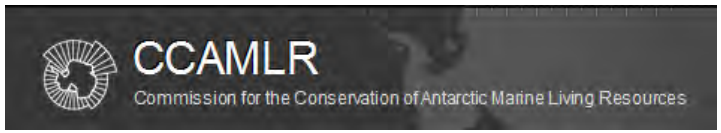
3D distribution of DO
CJM biomass
ENSO situation
Water mass characteristics
Overall biomass (trophic structure) Community structure
Biological issues; etc.

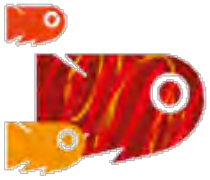
GENERAL OBJECTIVES AND METHODS.
VII. USE FOR STOCK ASSESSMENT: SNP AND IMARPE IN PERU

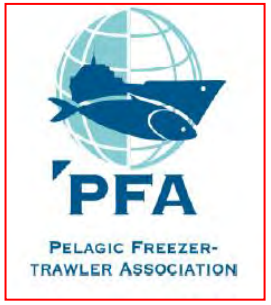


SPRFMO
South Pacific Regional Fisheries Management Organisation

INTERNATIONAL CONTACTS, 2014-2015



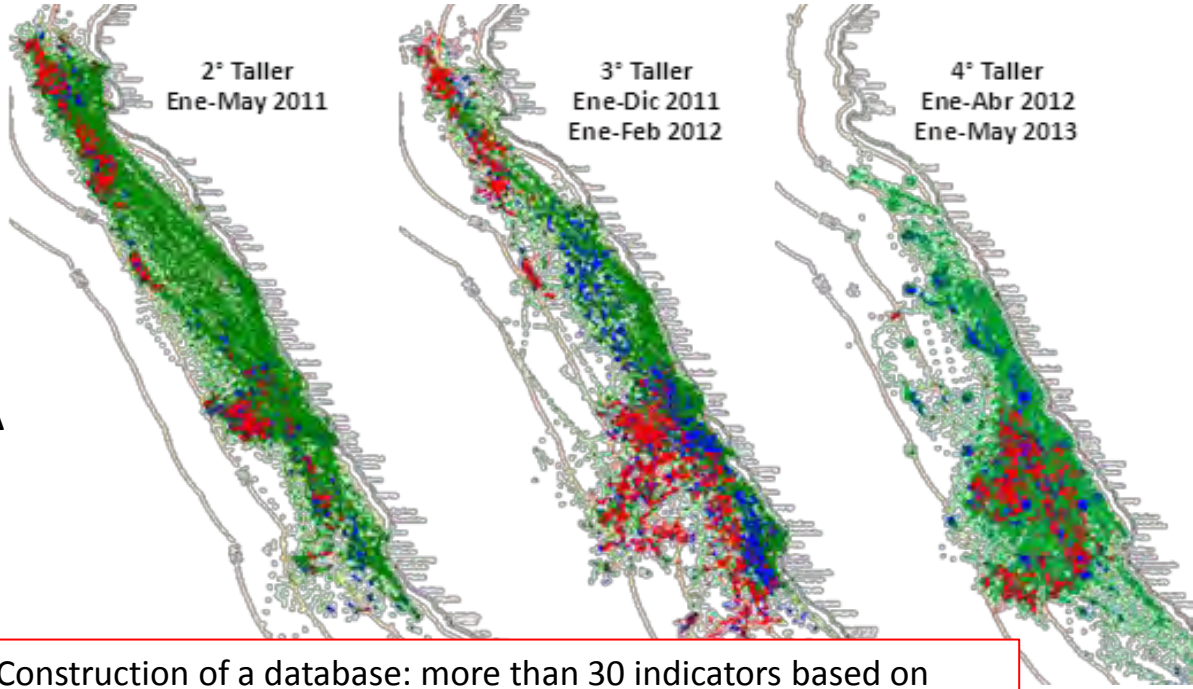




Listing of Institutions using acoustic data from fishing vessels that participated in some of the task group activities:

- CCMLAR (Internactional)
- ICES (International)
- IMARPE (Perú)
- SNP (Perú, prof.)
- CSIRO (Australia)
- NIWA (Nueva Zelanda)
- SEALORD (nueva Zelanda, prof.)
- IFOP (Chile)
- INPESCA (Chile)
- INIDEP (Argentina)
- IMR (Noruega)
- IRD (Francia)
- IFREMER (Francia)
- IMARES (Holanda)
- PFA (Holanda, prof.)
- NOAA (EEUU)
- Etc…

REPORT OF ACTIVITIES
I. SNP / IREA WORKSHOPS ALREADY ACHIEVED



2 expert meetings with the ICES WG FAST :

La Jolla, 2010
Reykjavik, 2011

1 International workshop organized by IREA

Lima, May, 2014

5 workshops organized by the SNP in Lima:

March, 2011
June, 2011
May, 2012
May, 2013
June, 2014
September, 2015

Construction of a database: more than 30 indicators based on more than 200 000 acoustic samples (ESDU) and environmental/biological/fishery information from fishing vessels

1st workshop of the SPRFMO task group organized by the SNP/IMARPE/IREA :

Lima, September, 2015

Reports presented at the SPRFMO Scientific Committees (2012, 2013, 2014, 2015)

REPORT OF ACTIVITIES
II. SNP / IREA INTERNATIONAL ACTIVITIES 2014-2015

Presentations of papers to COP21, Lima, Dec. 2014:

- Bernales et al. (SNP)
- Gerlotto et al. (IREA)

Elaboration of a common agreement between fisheries organizations of Peru, Chile, Ecuador (SNP)

COP21, Lima, dec. 2014. Signed by SNP, (chilenos y ecuadorianos?)

Presentations of papers to the 6th IcES International Symposium on Marine Ecosystem Acoustics, Nantes, June 2015

- Bernales et al., 2015 (SNP)
- Gerlotto et al., 2015 (IREA)
- Joo et al., 2015 (IMARPE)

Presentation of the Peruvian System of F/V data management, PFA International Workshop , Amsterdam, June 2015

- Bernales and Gerlotto, 2015.

Proposal for the organisation of a ICES study Group on fishing vessels as Scientific Platforms.

- Approved by ICES WGFAST.
- A related Theme Session wil be organized during the ICES Annual Science Conference in 2016

Preparation of a Special issue of Fisheries Research on the theme of "Fishing Vessels as Scientific Platforms

REPORT OF ACTIVITIES
II. SNP / IMARPE /IREA WORKSHOP ON CALIBRATION

Date: 8-11 September, 2015

Objectives of the workshop:

- **Standard calibration.** Use of standard techniques and methods as developed in ICES CRR 326. Ideally, one calibration yearly.
- **Specific calibration methods for fishing vessels.** This is not a calibration per se but allows checking whether the general performances of the system is likely nominal. Use of integration of the seafloor, etc. One measurement at each trip.
- **daily test of the system,** by measurement of ambient noise (use of the echo sounder in passsive mode, i.e. without transmission) during a few minutes every day.
- **Analysis of case studies** on existing experiments
- **Edition of a draft document** presenting a protocol for calibration of acoustic devices aboard fishing vessels. To be submitted to SPRFMO during the 3rd meeting of the Scientific Committee

REPORT OF ACTIVITIES
III. DOCUMENTS USED BY THE TASK GROUP

- **2015. ICES COOPERATIVE RESEARCH REPORT 326** (available on www.ices.dk).
- **2009. Guidelines for Acoustic Data Collection aboard Fishing Vessels operating in the SPRFMO area.** W. Karp, R. Kloser, F. Gerlotto, H. Peña, M. Gutiérrez. DRAFT, October 2009, SPRFMO DOCUMENT nº xxx (2009)

Grey literature

- Document Adrian Madirolas
- Document Richard O'Driscoll
- Document étudiants Mariano
- Document Edwin Niklitschek
- Document Patchell
- These Steve Barbeaux
- Document CRR données des bateaux de pêche
- Report WGFAST 2015
- Calibration Protocol IMARPE
- Echoview

FUTURE ACTIVITIES
I. DEFINING INDICATORS

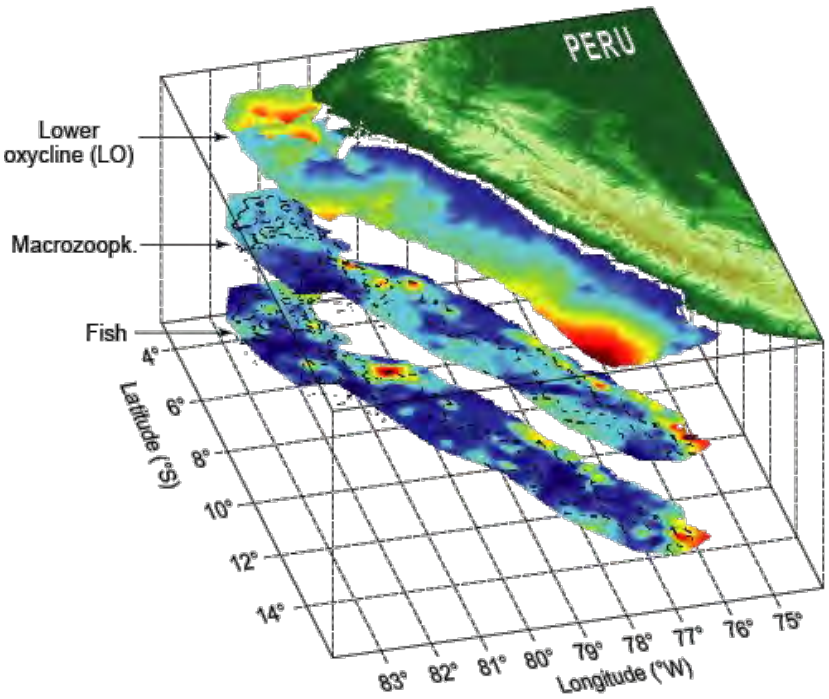
Definition of a list of indicators and metrics needed to describe and follow the dynamics of marine ecosystems in instable regimes:

- **physical indicators** allowing to define the climatic situation (scenario) and dynamics of the ecosystem;

- **environmental and biological indicators** allowing the evaluation of the different trophic levels to obtain the distribution of a species in the whole habitat;

- **behavioural and fishery indicators** for defining the determinism of extension or shrinking of the habitat and how they affect the abundance and distribution of a fish in a changing ecosystem.

Definition of the habitat of anchovy in Peru



DEVELOPING COMMON INSTRUMENTS IN CO-OPERATION WITH INTERNATIONAL ORGANIZATIONS

2nd Task group Workshop on "Fishing vessels as scientific platforms (2016, Lima?)

Potential theme(s):

- Improving calibration procedure
- Statistical use of acoustic data from fishers
- Establishing a final list of indicators
- Others?

Participation in the ICES Working Group under the ICES WGFAST gathering the different teams working on this theme (CCAMLAR, NOAA, SNP, IFOP, DFO, IRD, NIWA, CSIRO, AZTI, PFA, IMR, etc.): Vigo, April 2016

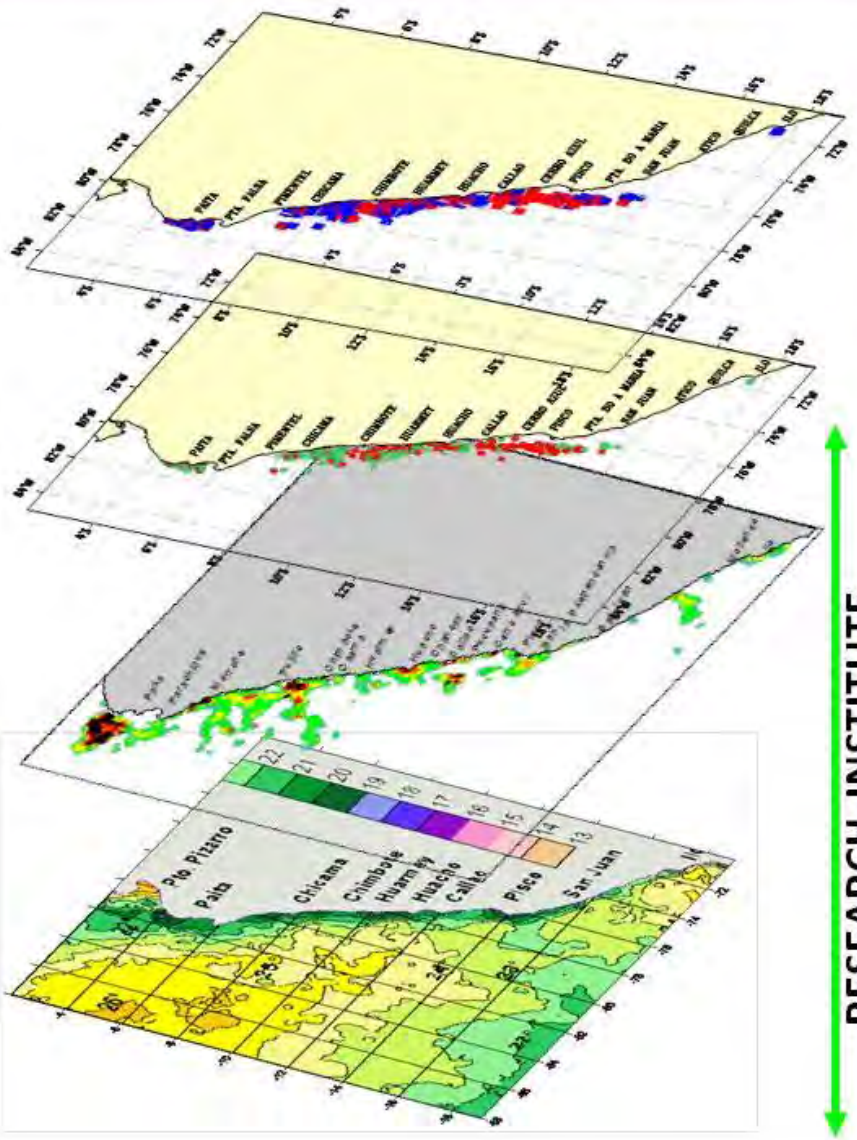
Presentation of contributions to the ASC theme session on "Fishing Vessels as Scientific platforms"

Others

ORGANIZING THE CO-OPERATION BETWEEN INDUSTRY AND RESEARCH

Origin of data

- Catch data
- Acoustic data from fishing vessels
- Observers onboard
- Scientific acoustic surveys
- Biological surveys
- Oceanography
- Climate studies



RESEARCH INSTITUTE

INDUSTRY

Type of indicator

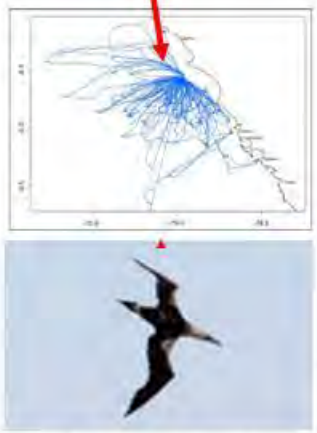
- Evaluation cpue/density
- Interactions fish/fishery
- Dynamics/recruitment
- Ecology
- Behaviour micro-scale
- Abundance estimates and distribution area
- Biology, interaction fish/environment
- Definition of the potential habitat

DEVELOPING NEW TOOLS FOR EXPLOITING INFORMATION FROM FISHING VESSELS

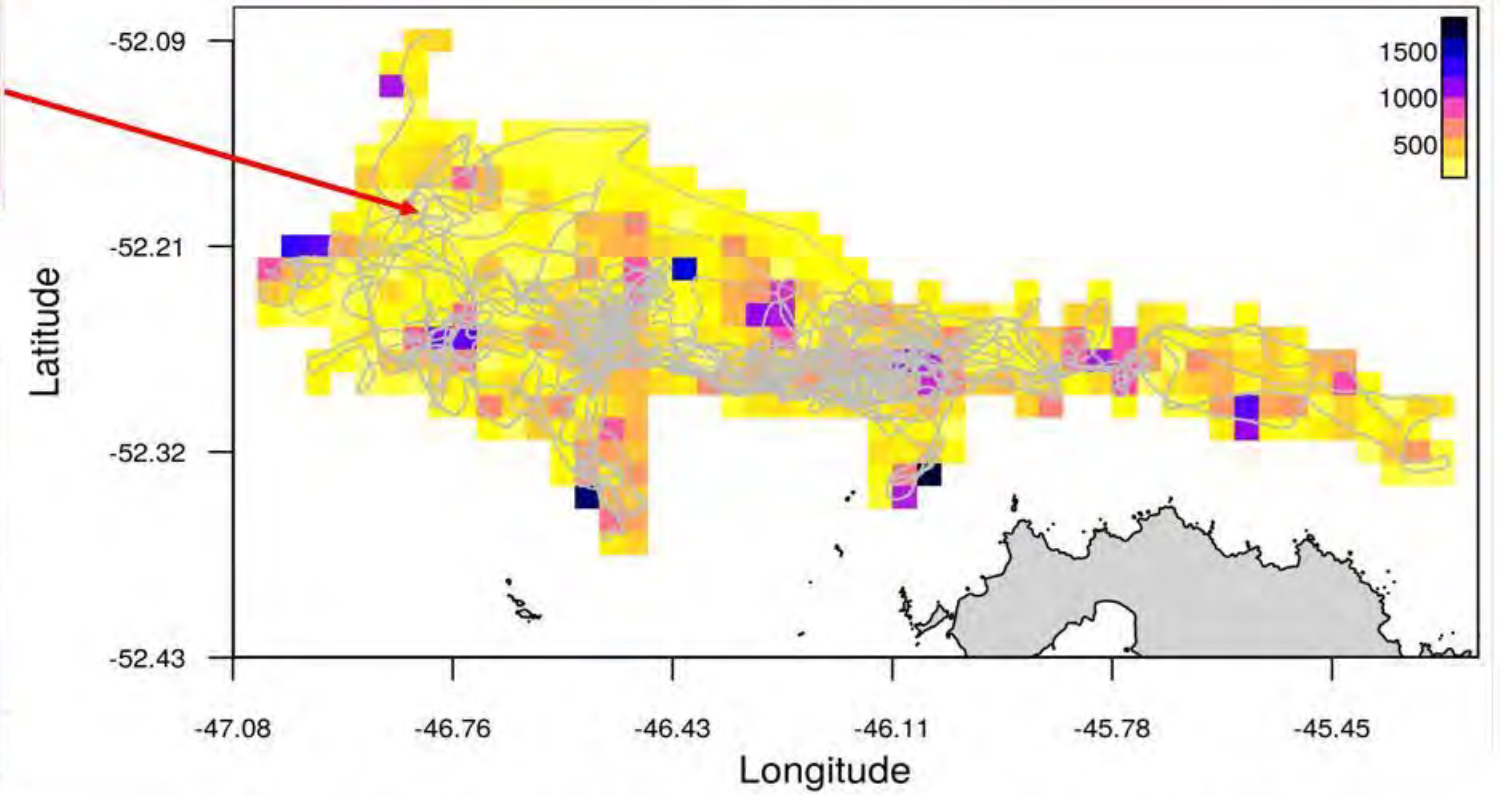
The same "predator" exploring strategy

$$P(l_j) \sim l_j^{-\mu}$$

Lévy fly when $2<\mu<3$



Seabird trajectories around their hatchery



Observation of krill densities in Antarctic (NASC, $m^2 mn^{-2}$) by 4 km^2 cell, as estimated from a 5-weeks survey of one fishing vessel (among 10-12 vessels operating in the area). Grey tracks show the route of the vessel used to produce these estimates (From Niklitschek & Skaret, submitted).