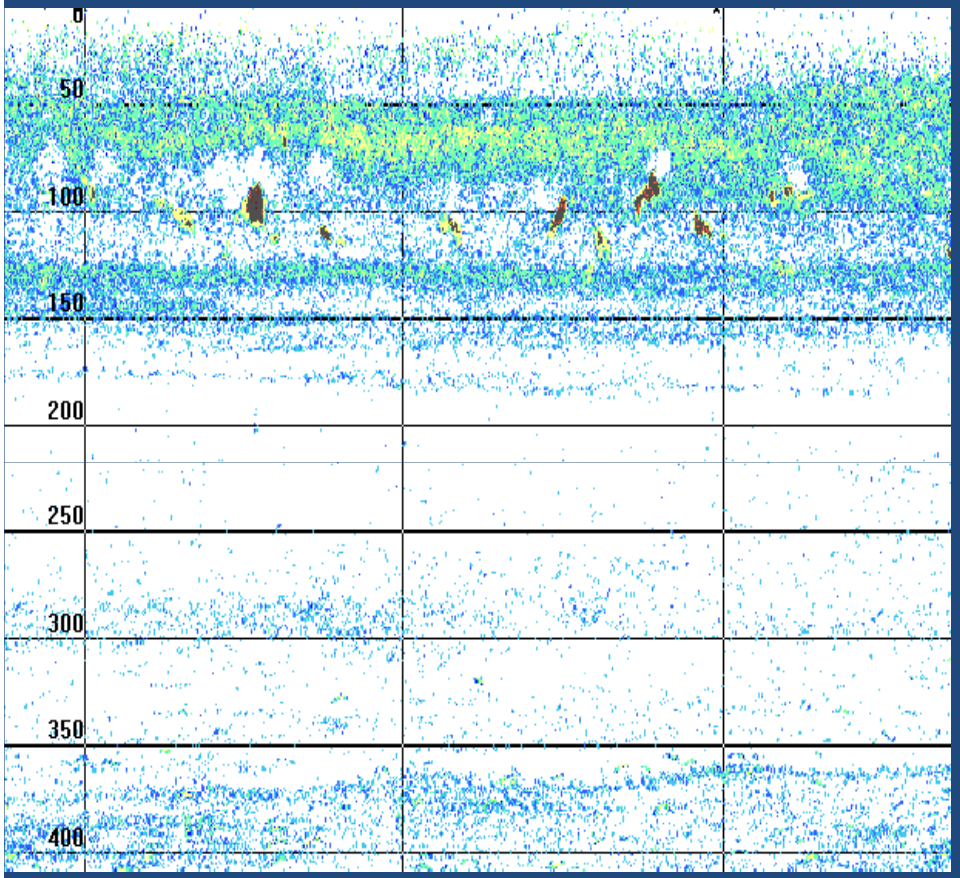
SP-08-SWG-JM-13

METHODOLOGICAL PROPOSAL FOR DIRECT STOCK ASSESSMENT OF MARINE RESOURCES IN THE SPRFMO AREA

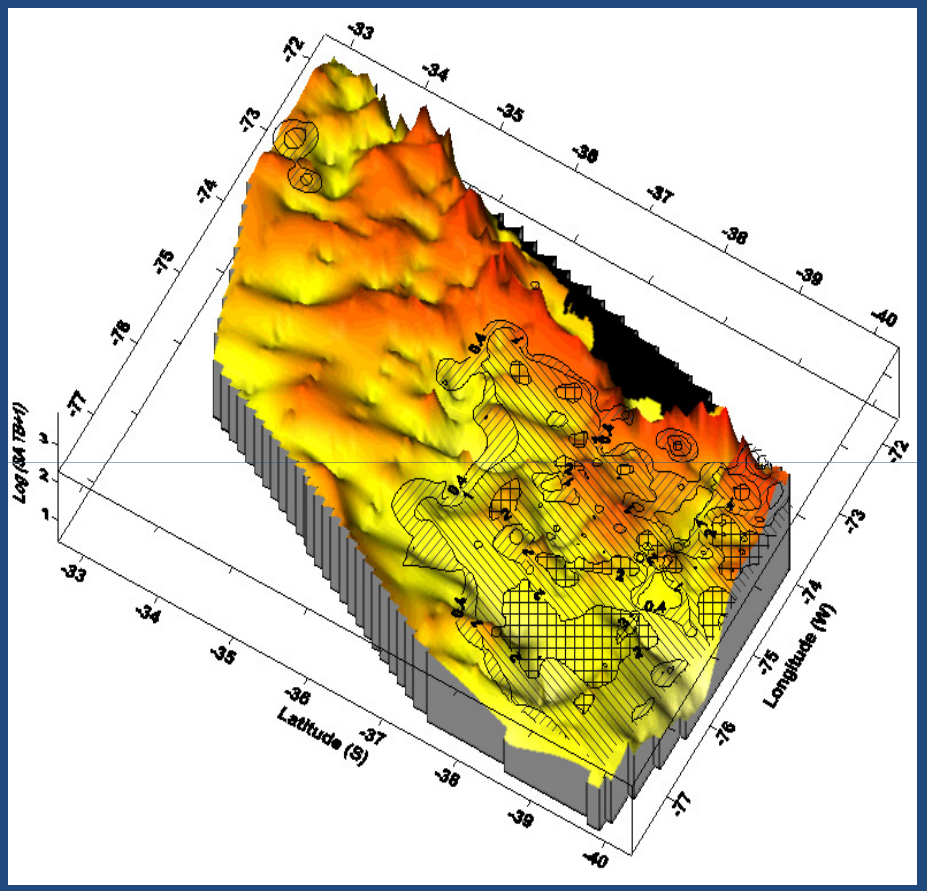
Ecosystem indexes obtained from fishing monitoring

IMARPE – IRD – PERUVIAN FISHING COMPANIES

There is a world around the fish

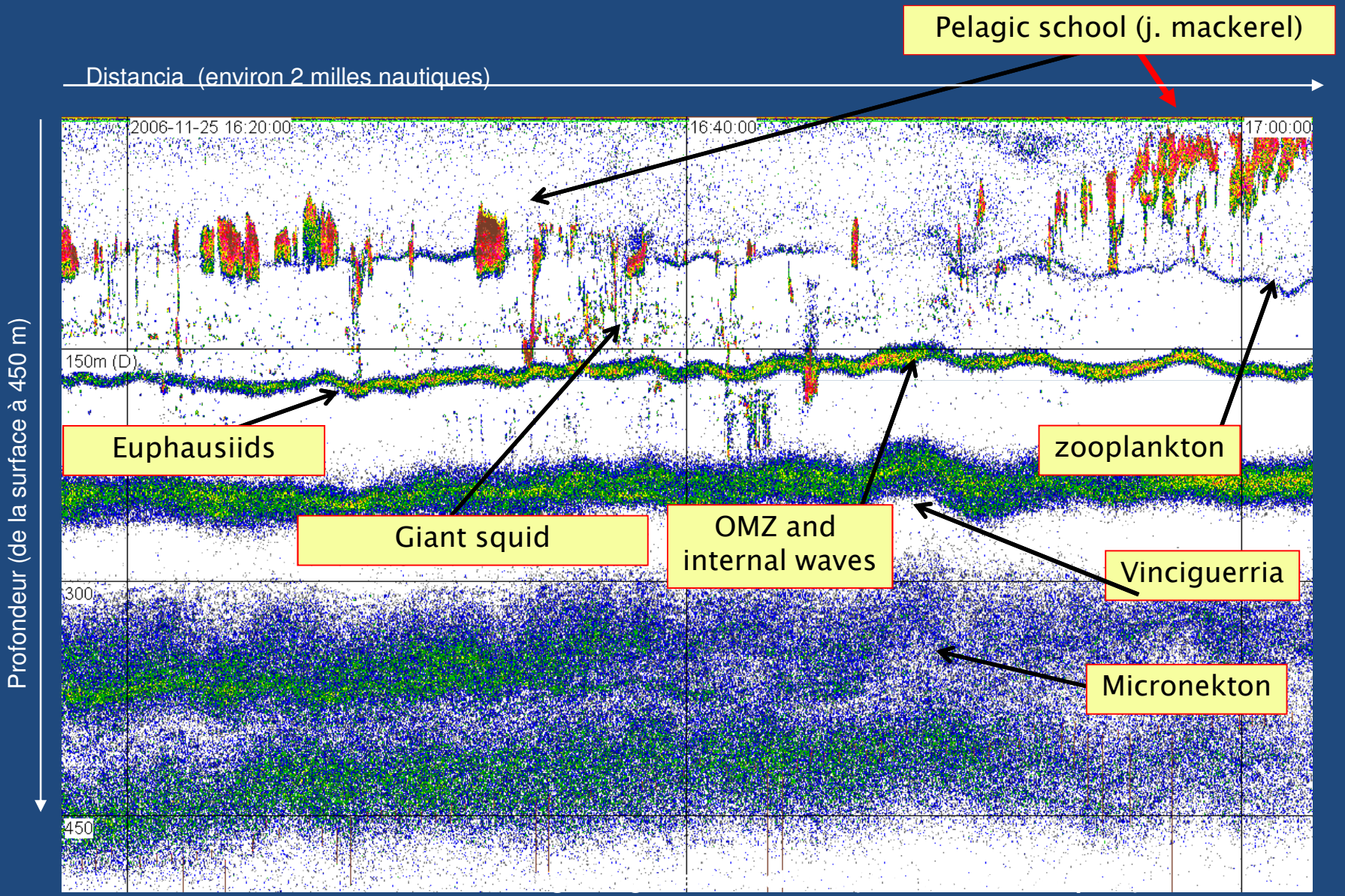


Hole in the micronekton layer produced by a school (Chile)



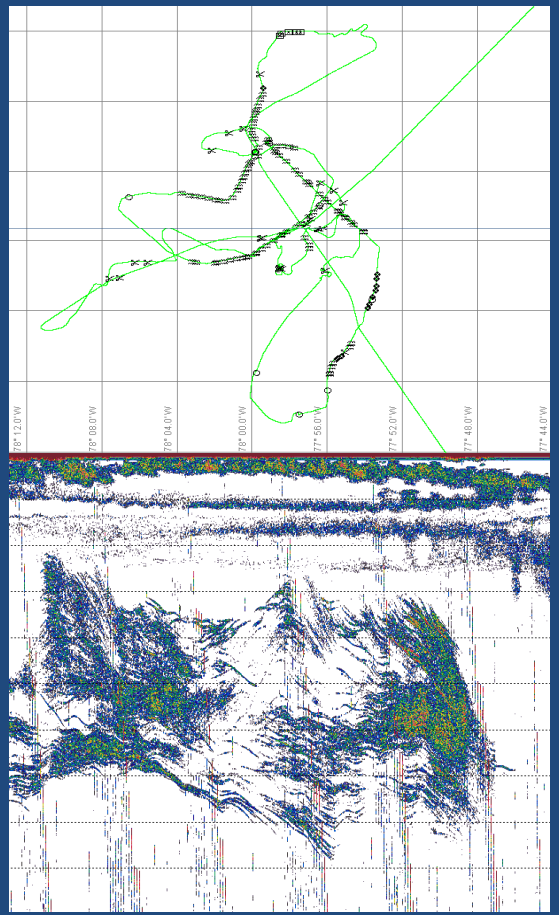
Consumption of micronekton by a population of horse mackerel (Chile)

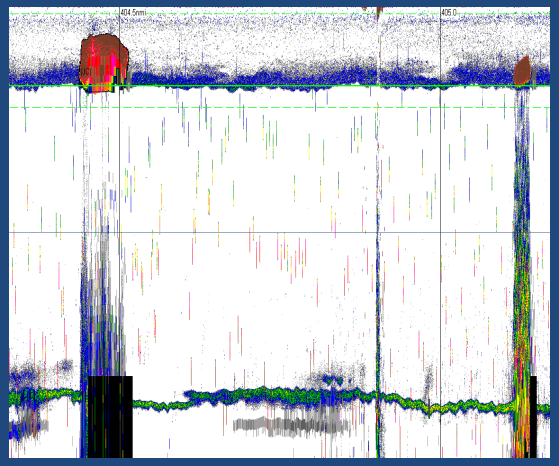
What can be observed, collected and analysed with a vertical echo sounder?

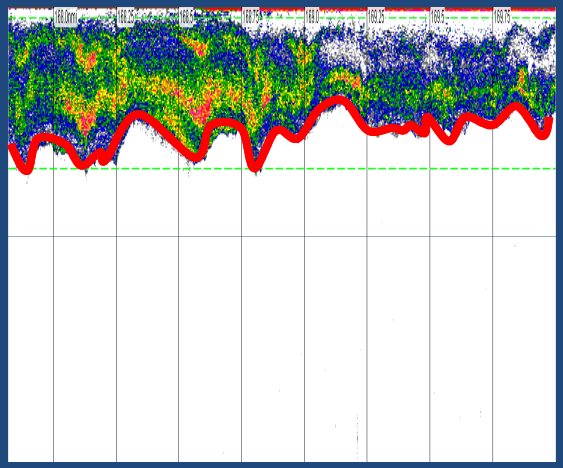


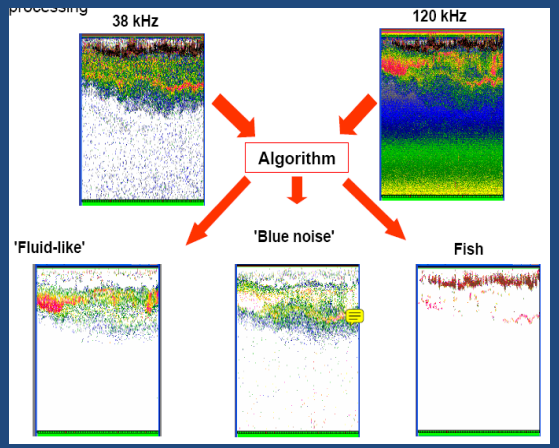
Continuous information collected by digital echosounders aboard fishing vessels

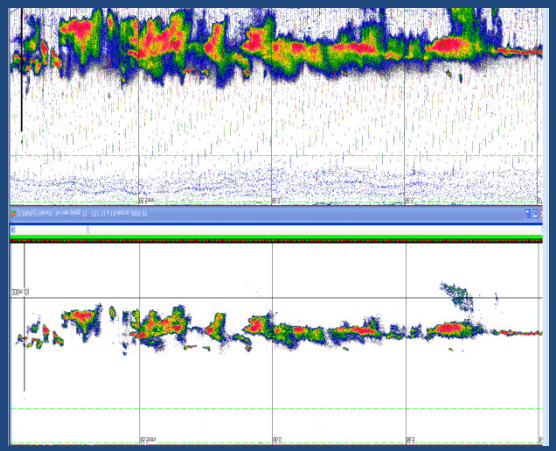
- Time-spatial location of fishery resources and an indication of “skippers behaviour”
- Time-spatial distribution of preys (krill, zooplancton, mesopelagtic fish, all micronekton)
- Continuous measurement of functioning of ecosystem indexes: thermocline, oxycline, internal waves, biovolume, fish and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



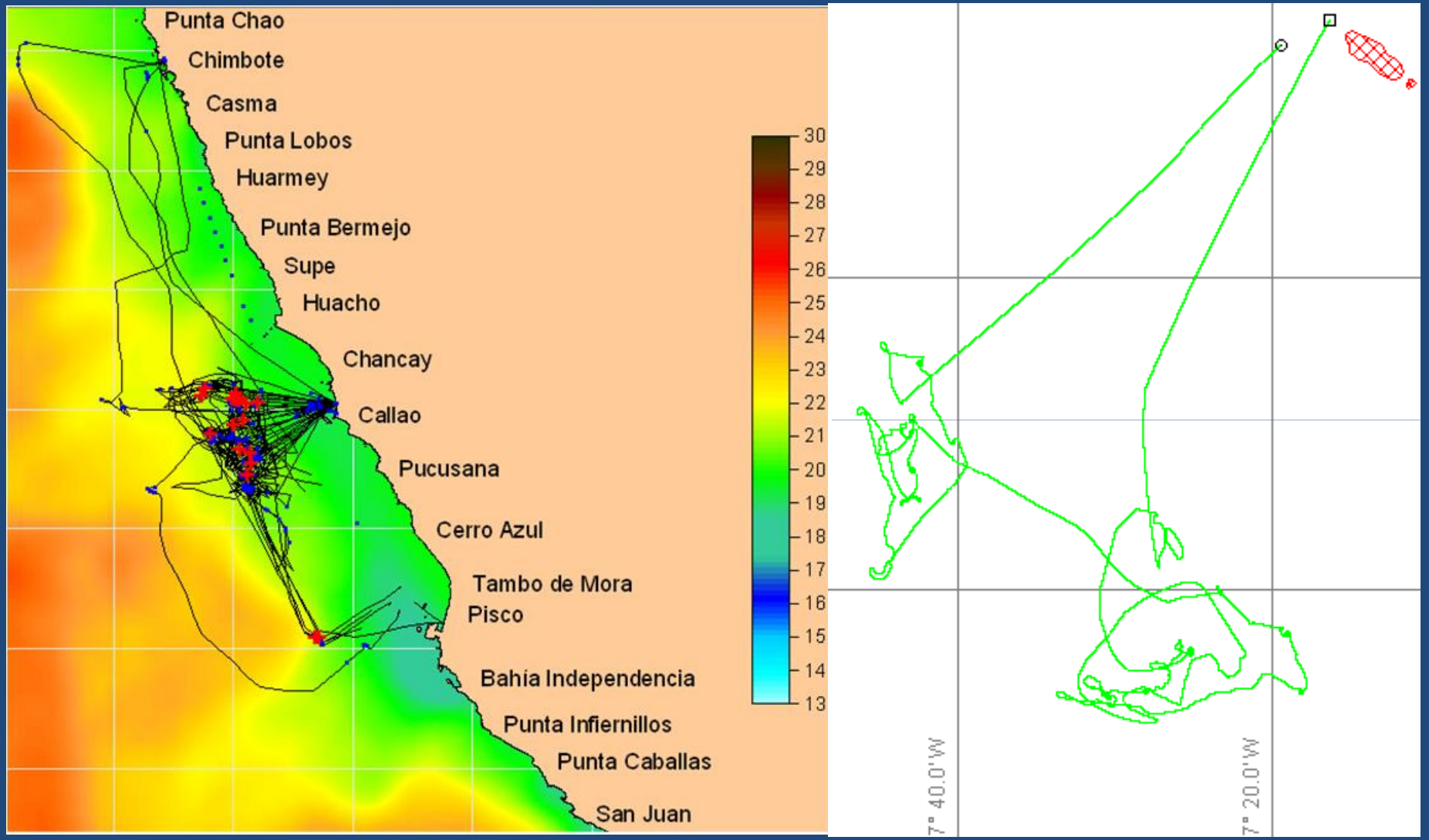






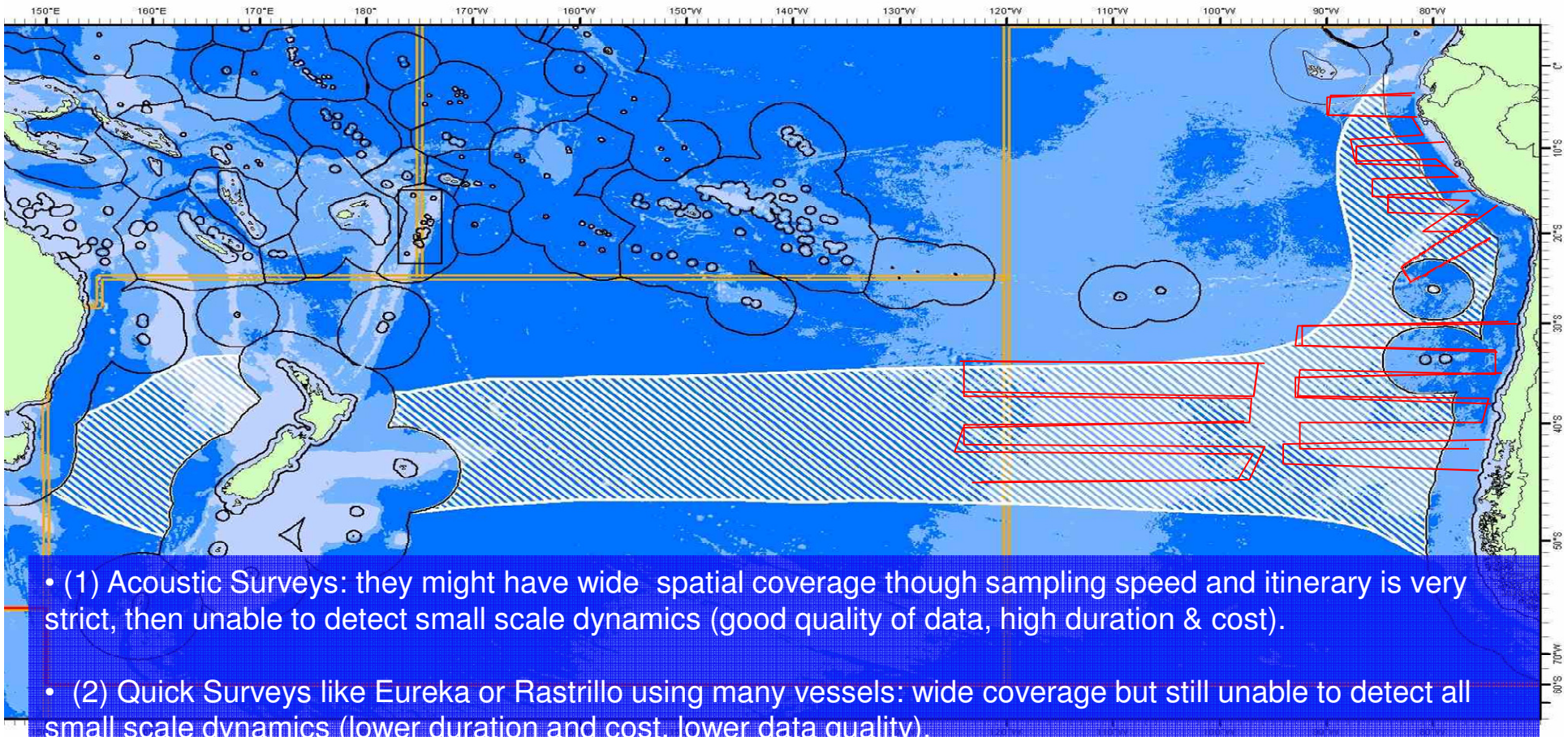


“behavior” of skippers as descriptor of clusters’ and schools sizes



Acoustic data provide a much higher local resolution than VMS as source of information to analyze the location and “importance” of clusters of fish schools among other aspects related to efficiency.

Defining sources of information



• (1) Acoustic Surveys: they might have wide spatial coverage though sampling speed and itinerary is very strict, then unable to detect small scale dynamics (good quality of data, high duration & cost).

• (2) Quick Surveys like Eureka or Rastrillo using many vessels: wide coverage but still unable to detect all small scale dynamics (lower duration and cost, lower data quality).

• (3) Commercial fishery: high resolution observations at very small scales, relate local conditions to particular typology of fish distribution and behavior (questions on data and sampling).

• All these sources are indeed multidisciplinary since they do include biological and oceanographic data though requires of RV and fishing vessels operating digital echosounders.

OBJECTIVES OF THIS PROPOSAL

- To promote the cooperation between scientific institutions and private fishing companies of the SPRFMO area.

- To propose to SPRFMO an environmental (multidisciplinary) approach based on acoustic methods for monitoring and study on high seas resources (not only Jack Mackerel).

- To define some indicators on ecosystem functioning in different time and spatial scales and trophic levels that might be extracted from echograms.

EXISTING LITERATURE AND REPORTS

- CRR ICES N°144 on calibration of acoustic instruments. 1987.
- CRR ICES N°187 on acoustic survey design. 1987
- CRR ICES N°209 on noise measurements. 1995
- CRR ICES N°235 on target strength methodology. 1999
- **CRR ICES N°287, on the use of fishing vessels for scientific data collection. 2007**
- CCAMLR Acoustic Protocol for the Krill's Synoptic Antarctic Survey (1999, reviewed in 2006).
- Book by Rivoirard *et al* on geostatistical techniques for acoustic assessment. 1996.
- CPPS Workshop on standardization of acoustic methods. 2000
- ISPPA (LME) Project (IRD-IMARPE-IFOP). 2002
- Acoustic Black Boxes Project (CoML-IMARPE-IFOP-IRD-INIDEP). 2003
- Methodological proposal issued during 1st Internartional Jack Mackerel Workshop carried out in Santiago ("providing ecological insights from sound"). (TASA-IMARPE-IRD). 2008

Information that can be collected when planning a multidisciplinary acoustic sampling on Jack Mackerel

- **Main objective of surveys**

  Biomass assessment, biology, distribution, population dynamics etc.

- **Acoustic and spatial characteristics**

  Typology of detections
  Area of distribution and habitat characteristics
  Heterogeneity of distributions
  Acoustic target strength
  Acoustic instruments (echosounder, frequencies, sonar, etc.) and vessels (RV, fishing vessels, buoys, etc.)

- **Ecological characteristics**

  Spawning, Feeding and relationships with other trophic niches (Chl, zooplankton, micronecton, preys, predadors). Relationships with environmental indicators (t°, S‰, O_2, pH, transparency, latitude, albedo, ZMO, thermocline, oxycline, eddies, waves, internal waves, Niño/Niña, Viejo/Vieja, water masses, tides, currents, etc.

- **Behavior, dispersion, migration, migratory behavior, avoidance…**

  The variability on the strategies for using the space (regarding biomass, cycles...)

- **Fishing characteristics**

  Demographic structures
  Population characteristics (1 ? 2 ? more populations ?)
  Characteristics of the fishery and of what they might provide in term of information (nets, fish size and weight, biological structures, top predator observations, environmental data, VMS)

Conclusions

• It is acknowledged that jack mackerel stocks status are under fishery and environmental pressures. Very few environmental indicators are available.

•There is a need for acquiring continuous information at the level of fishing ground in order to track preys and predators dynamics at different time-space scales.

• The high cost and limitations of performing scientific surveys makes indispensable all other source of information. The participation of all stakeholders guarantees the quality of data and results.

•Acoustic data in digital format is available for use by several disciplines aboard fishing vessels. This might be of scientific quality if certain protocols are followed up. Whether the use of this kind of equipment might be obligatory for vessels operating in the SP region is to be discussed.

• The proposal implies for SPRFMO to start to build up an ecosystem approach from the monitoring of as much components of ecosystem as possible.

Recommendations

- Decide to collect acoustic data from fishing vessels in operation
  - ⇒Definition of a protocol
  - ⇒Links with ICES ?

- Standardize acoustic methods : workshop on
  - ⇒Definition of protocol for data collection from fishing vessels
  - ⇒TS definition
  - ⇒Standardization of acoustic surveys
    - Scientific surveys
    - Eureka/Rastrillo surveys