Distribution changes and interactions of Jack Mackerel off Peru as observed using acoustics (1983-2008)

providing ecological insights from sound

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Introduction

• A new (peruvian) fishing fleet had replaced the operation of foreign vessels by mid the 1990's.

• Ecosystem off Peru has become colder since last strong El Nino (1997-98).

•A Regime shift affected distribution and abundance patterns of Jack Mackerel (JM) and others as well.

• We're studying the changes in habitat range of on JM.
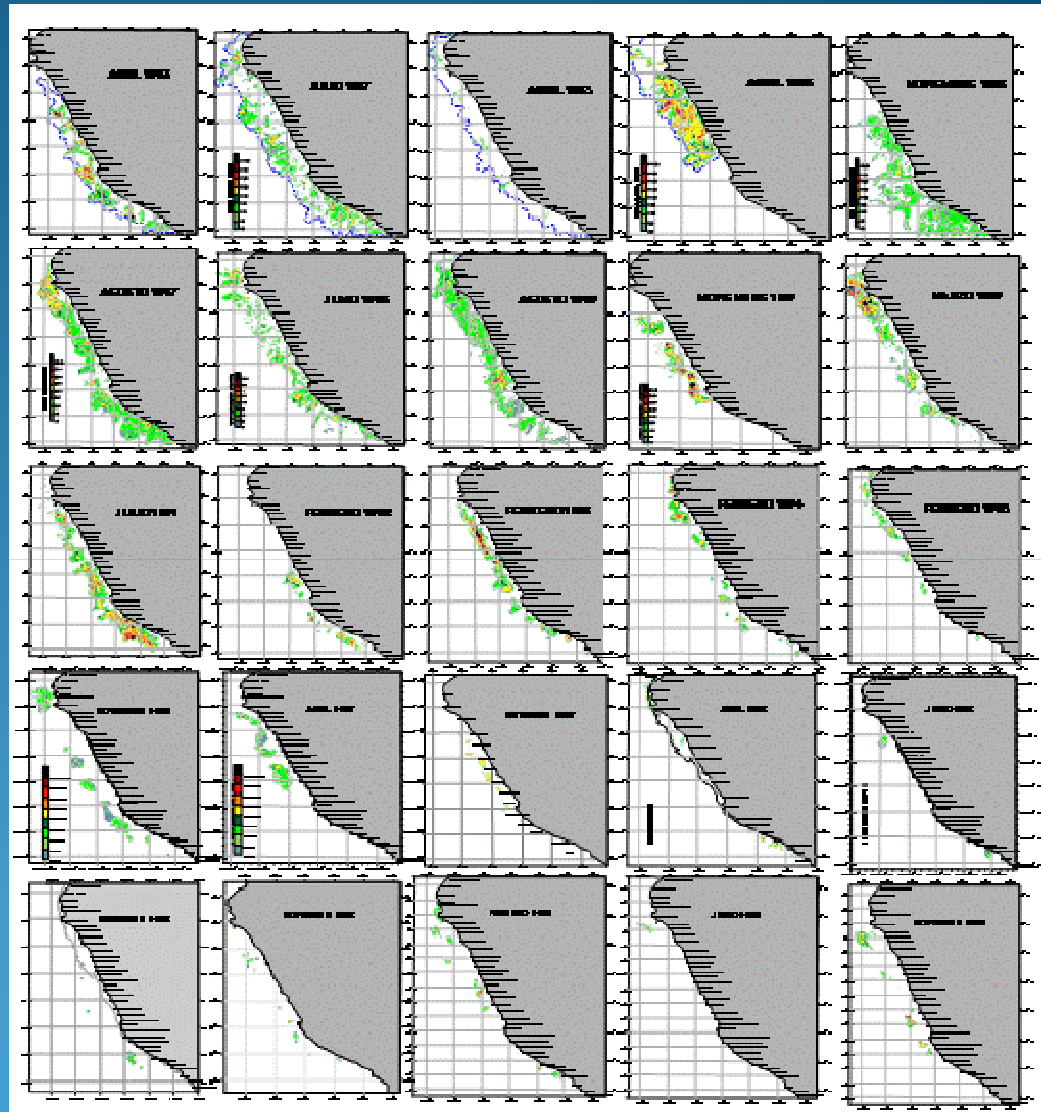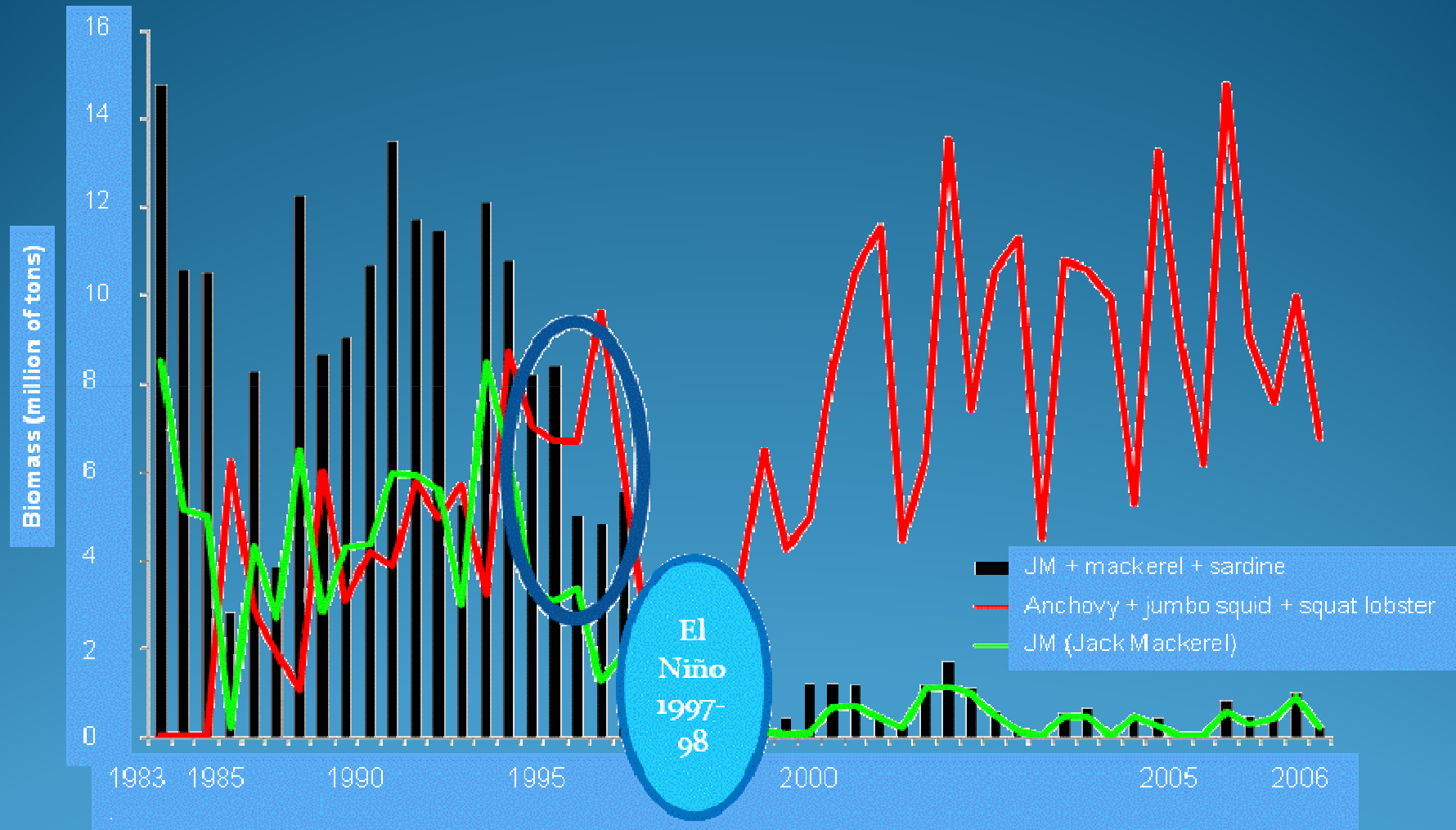

Gutiérrez et al, in prep.

Methods, surveys

- 45 Scientific Acoustic Surveys.

- Fishery-Acoustic Surveys

- CTD probes

- Digital echo sounders

- Acoustic software

- Fishery statistics

- Trophic ecology techniques

- GAM approach to analyze non linear relationships
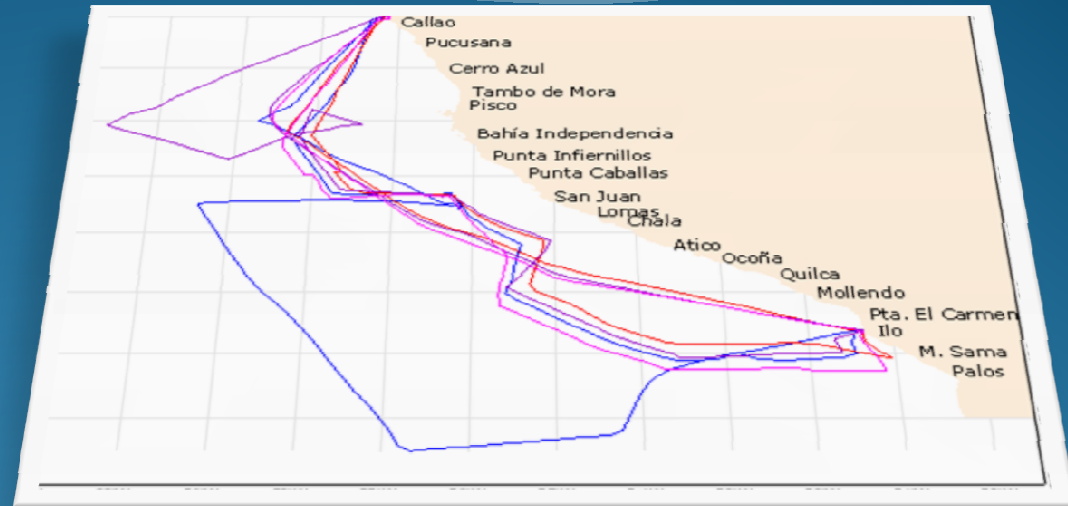
Long-term changes in biomass composition

Acoustic biomass of most abundant species off Peru (1983-2006)

Gutiérrez et al, in prep.

Regime shifts and changes in habitat range

• Biological triggers of regime shift are still hided.

• Changes not only influenced on anchovy and sardine.

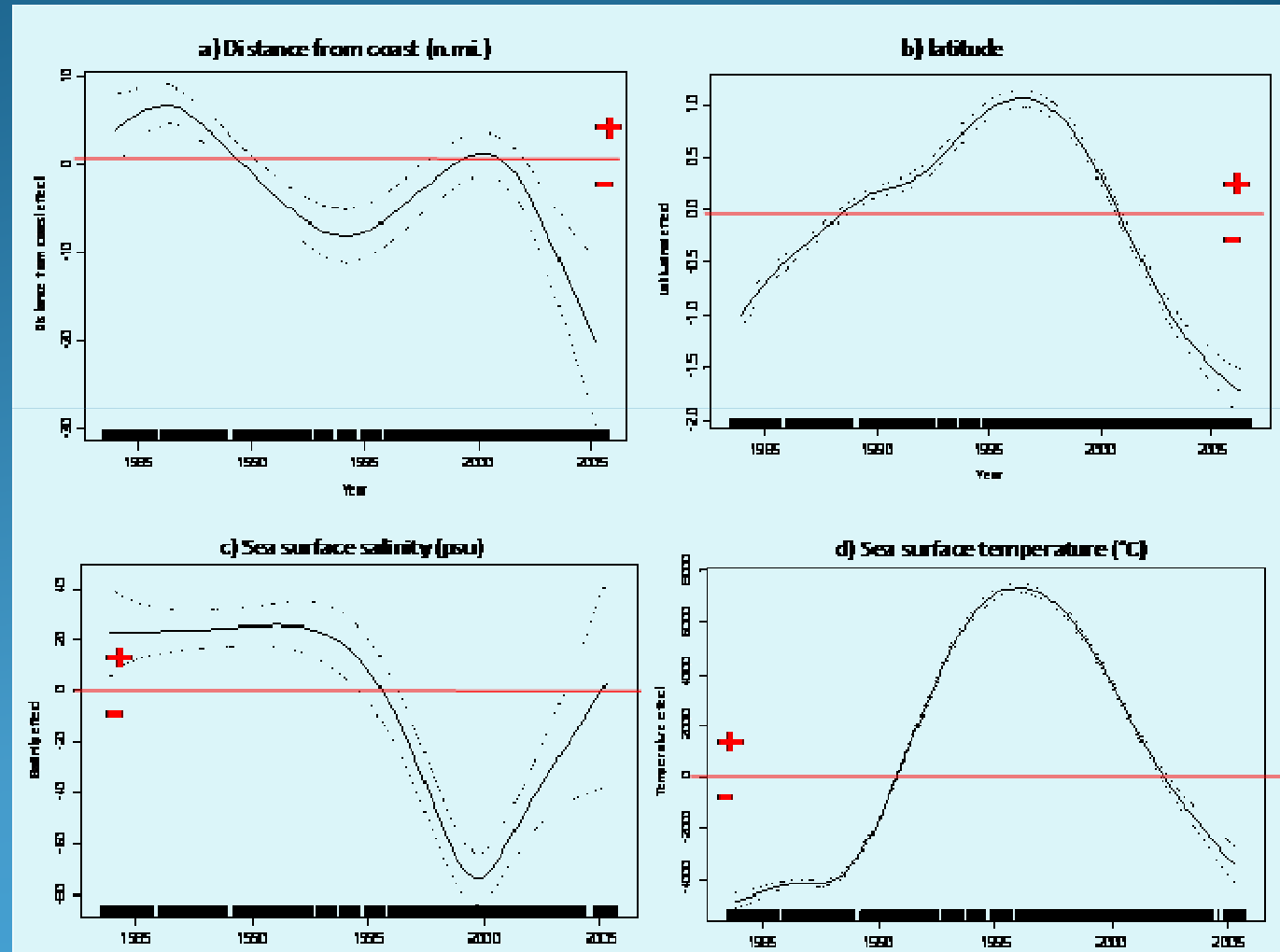• Furhermore there have been changes in planktonic communities (Ayon et al in prep. etc etc)
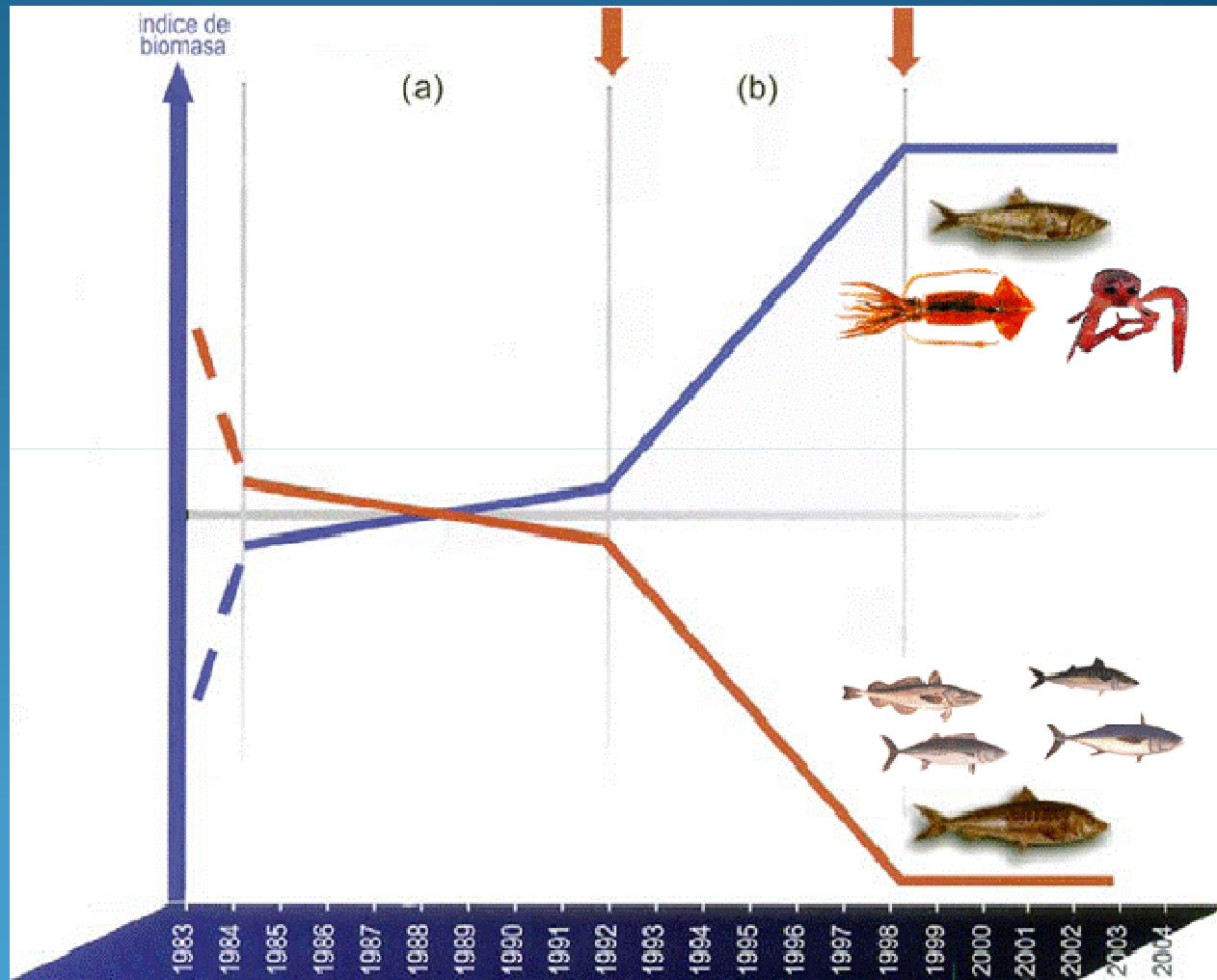
Regime shifts and changes in habitat range
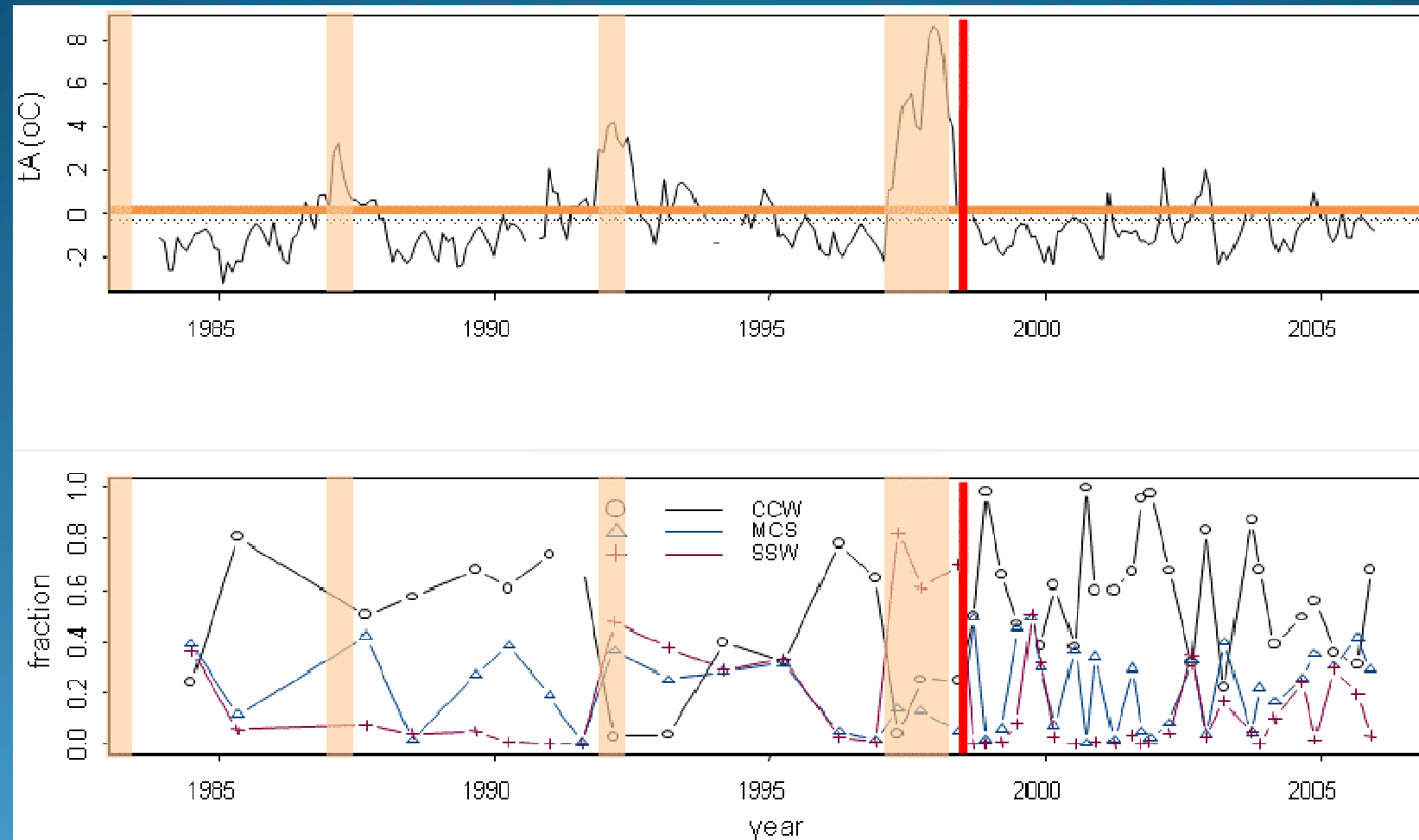
Temperature anomaly (tA) for surface temperature off the Peruvian coast near Chicama (8°S), Peru (b). Percentage of the survey area covered by CCW, SSW, and MCS from 1983 –2005. El Niño periods are shown by salmon coloured bands with intensity proportional to opacity.

Swartzman et al, 2008.

Plasticity of Jack Mackerel : what changed in the ecosystem ?

• It is not biomass but location what is evaluated

• Assessed parameters started to change in 1995

• current conditions remains basically the same since 2000

• however some relationships can be tricky (e.g. distance from the coast)

a) Distance from coast (n.mi.)

b) latitude

c) Sea surface salinity (psu)

d) Sea surface temperature (°C)

Gutierrez, in prep.

Change: Global expansion of Oxygen Minimun Zones (OMZ)

(reduction of habitat range for certain species in the main ecosystems)

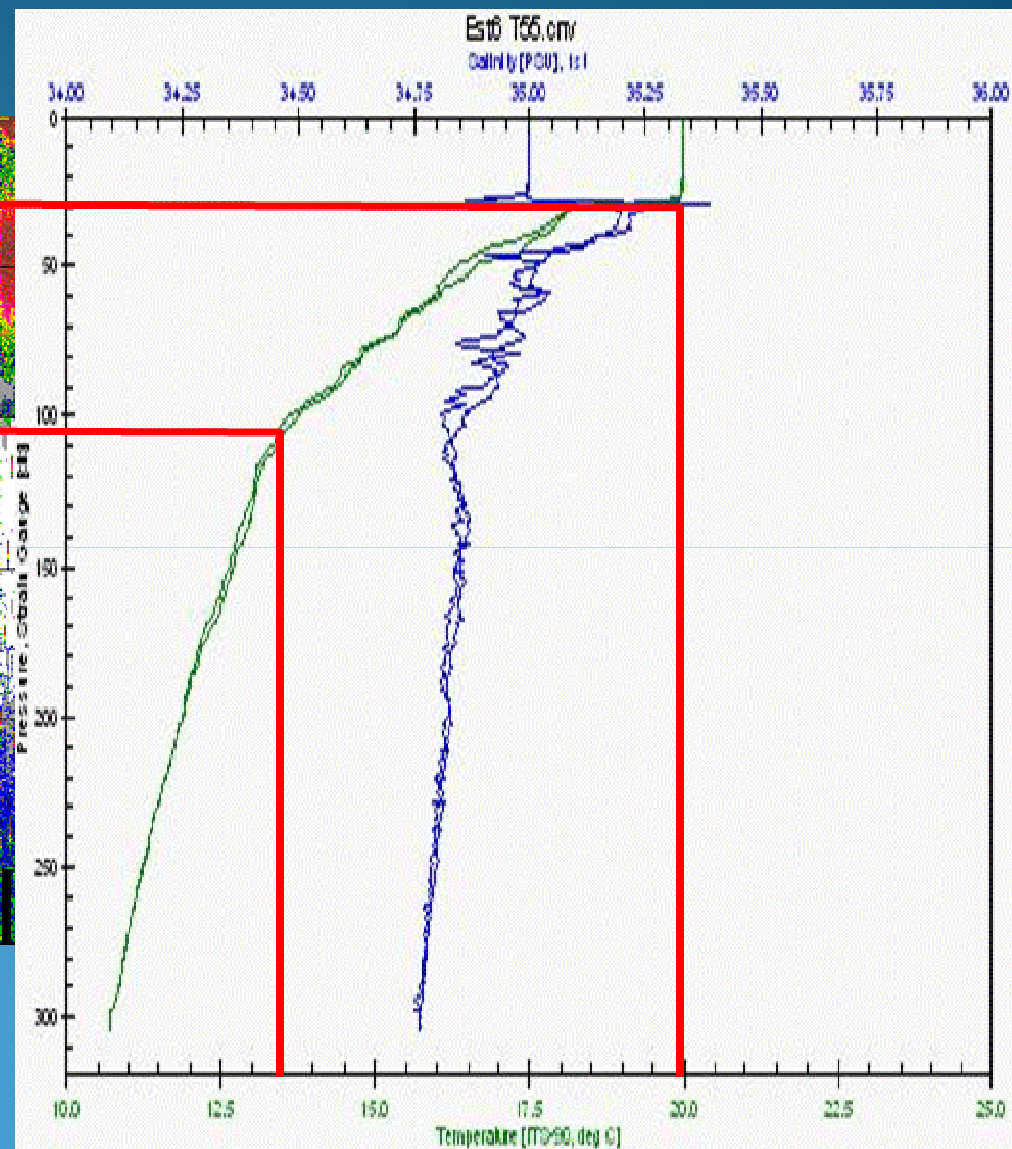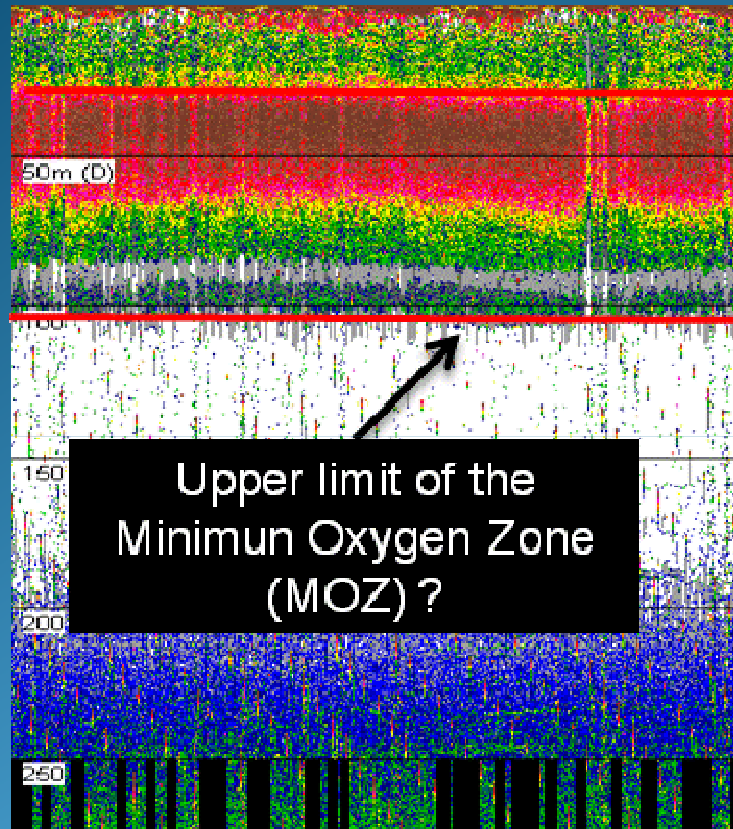Eastern equatorial Pacific   Northern Benguela
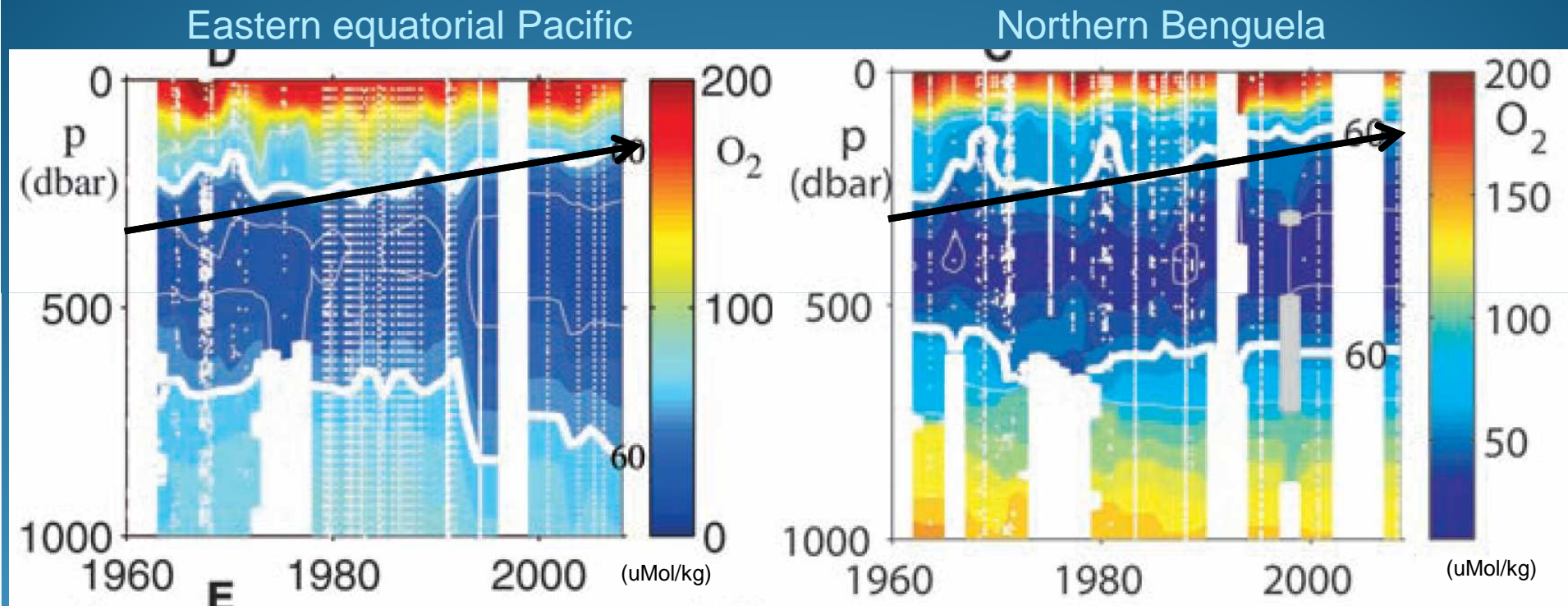
Stramma et al, 2008

Impact on jack mackerel abundance (and other species as well)

Measuirng thermocline

Cast 6, May 14, 18:50
13º33'S, 079º50'W

Upper limit of the Minimun Oxygen Zone (MOZ) ?
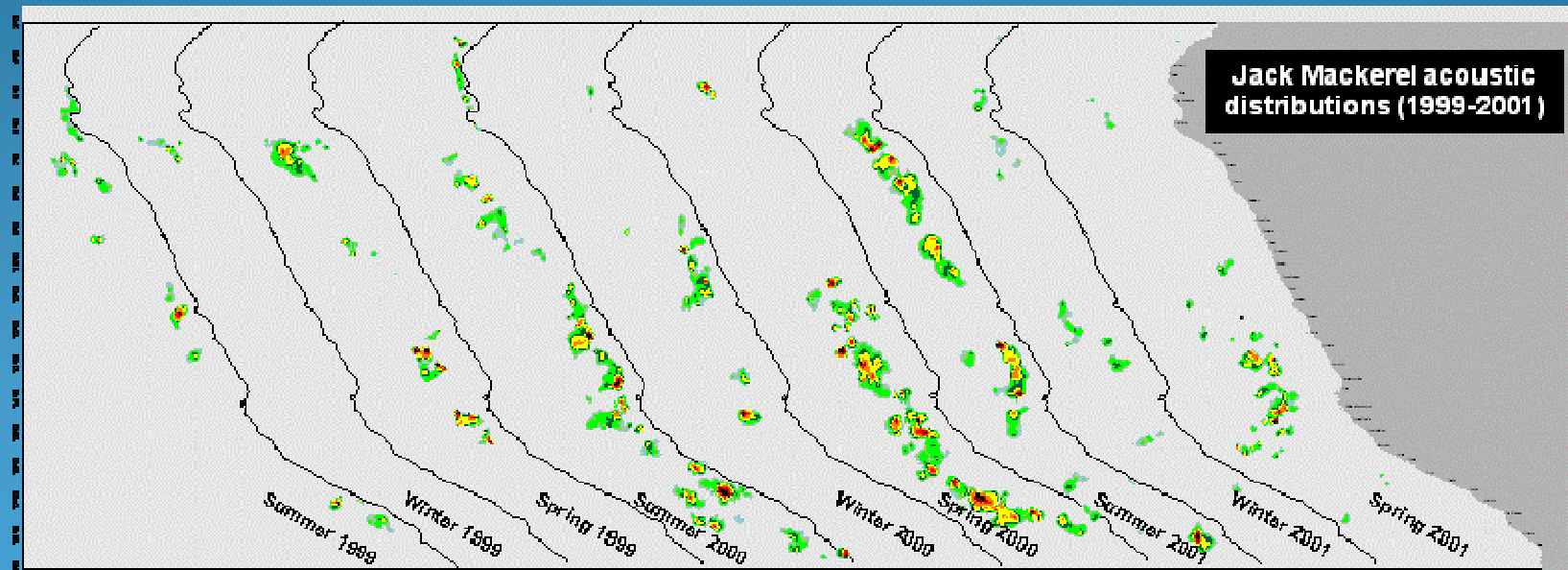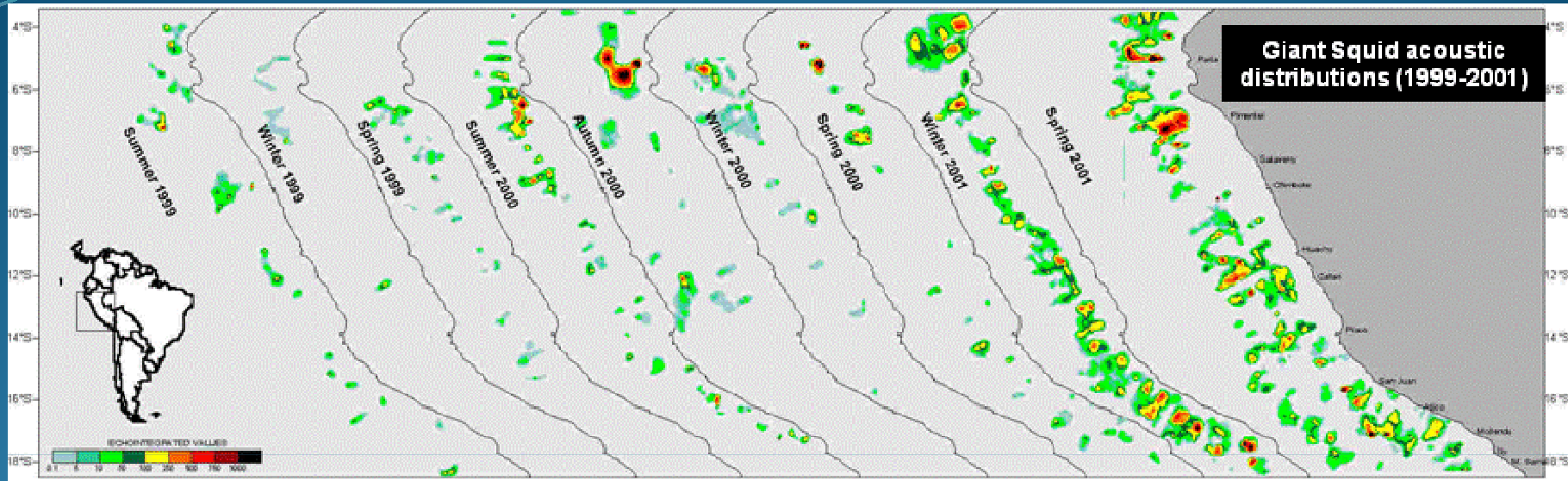
Euphausiids as a proxy of Jack Mackerel abundance
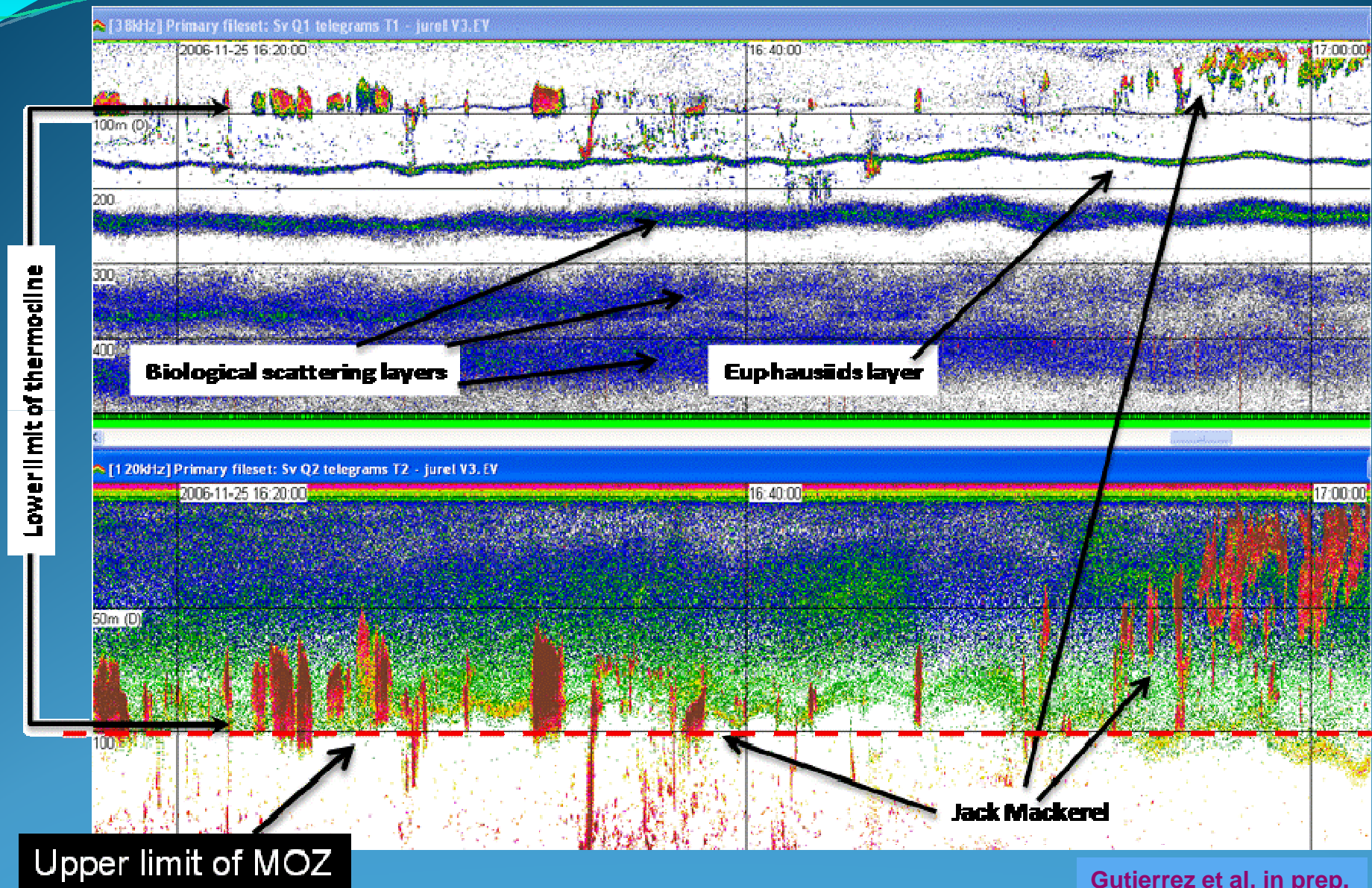
Gutierrez et al, in prep.

Giant Squid 'versus' Jack Mackerel

Giant Squid acoustic distributions (1999-2001)

Jack Mackerel acoustic distributions (1999-2001)

Gutièrrez, 2002.

Discussion, Proposal

• The change in distribution and abundance of JM and others which was observed since mid the 1990's off Peru might be a variation of their habitat range.

• Changes in surface would not explain the variations. We strongly support of the oxygen as a driver of the process.

• It is needed to stress the effort for loading more data about biotic and abiotic factors in an ecosystem approach adapted to the JM fishery.

• Acoustics can contribute with practical solutions to the need of data (e.g. OMZ depth, JM density, zooplankton distribution etc).

• We propose to adopt/adapt the CRR 287 (ADFV) as a common protocol (where pertinent) for the operation of the fishing fleets in the SPRFMO region.