



# Quantitative distribution of seabirds in the South Pacific Ocean in Aug-Nov 2009 related to fish aggregations and oceanographic features

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## Preface

Chilean jack mackerel – CHJM (*Trachurus murphyi* Nichols, 1920) is a pelagic species which inhabits the Southern Pacific Ocean and constitutes the most important fishery for EU, Chile, China and Russia fishing vessels. It shows a wide distribution from Chile to New Zealand and exhibits a significant annual migrations within inhabit region. CHJM aggregates in schools within the Subtropical Southeastern Pacific Frontal (SSPF) zone.



R/V "Atlantida" belonged to FGUP AtlantNIRO in Southern Pacific Ocean (September 2009).

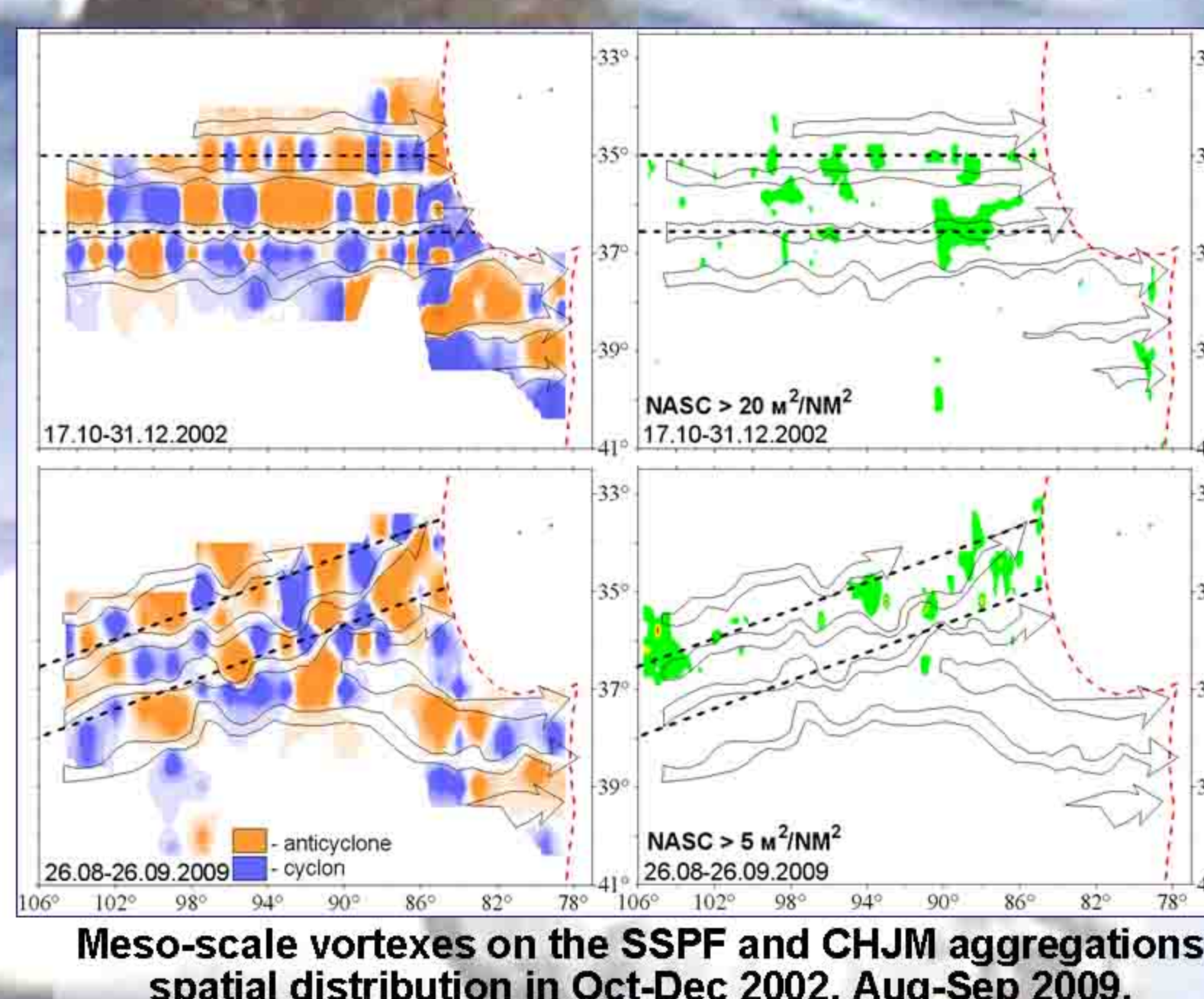
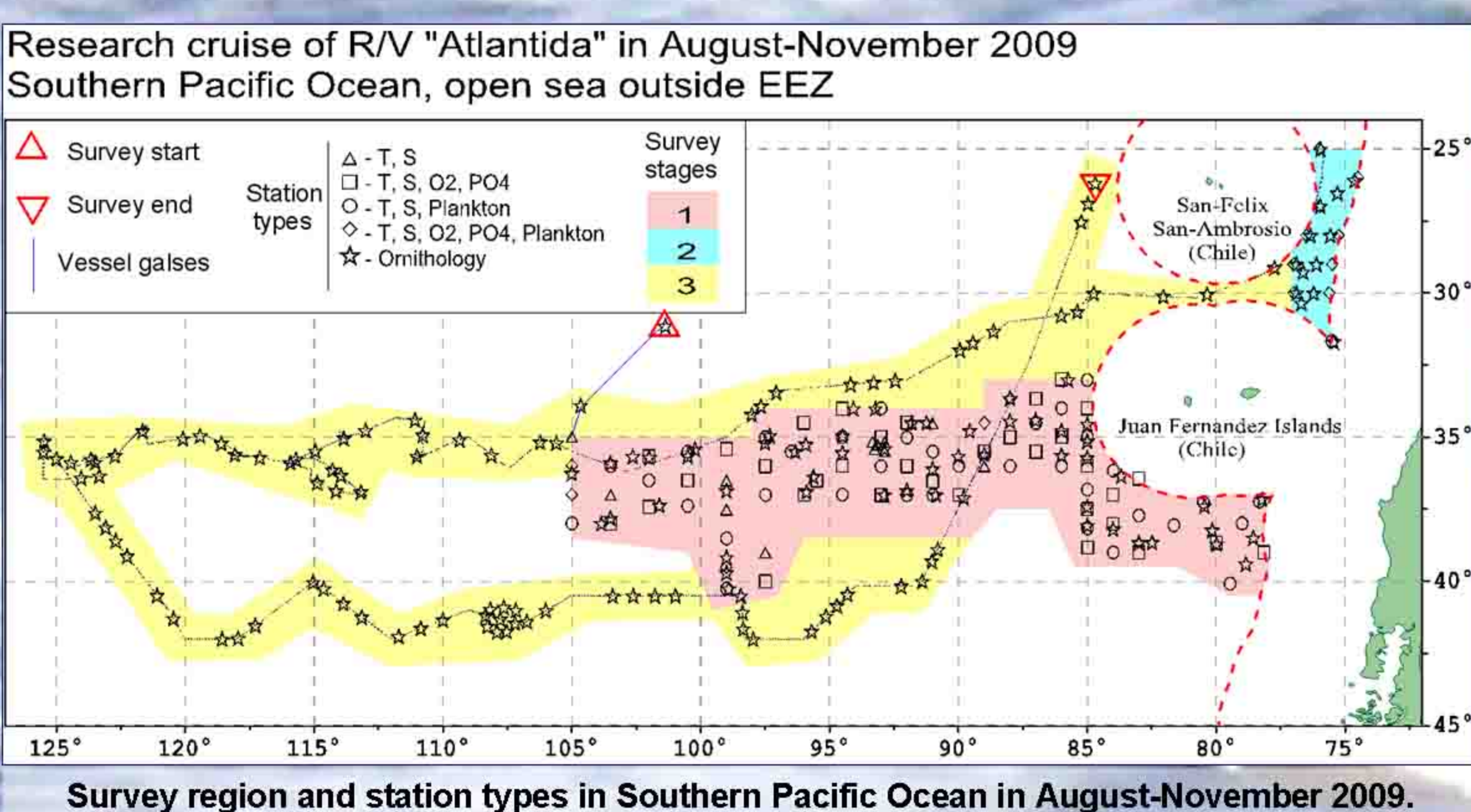
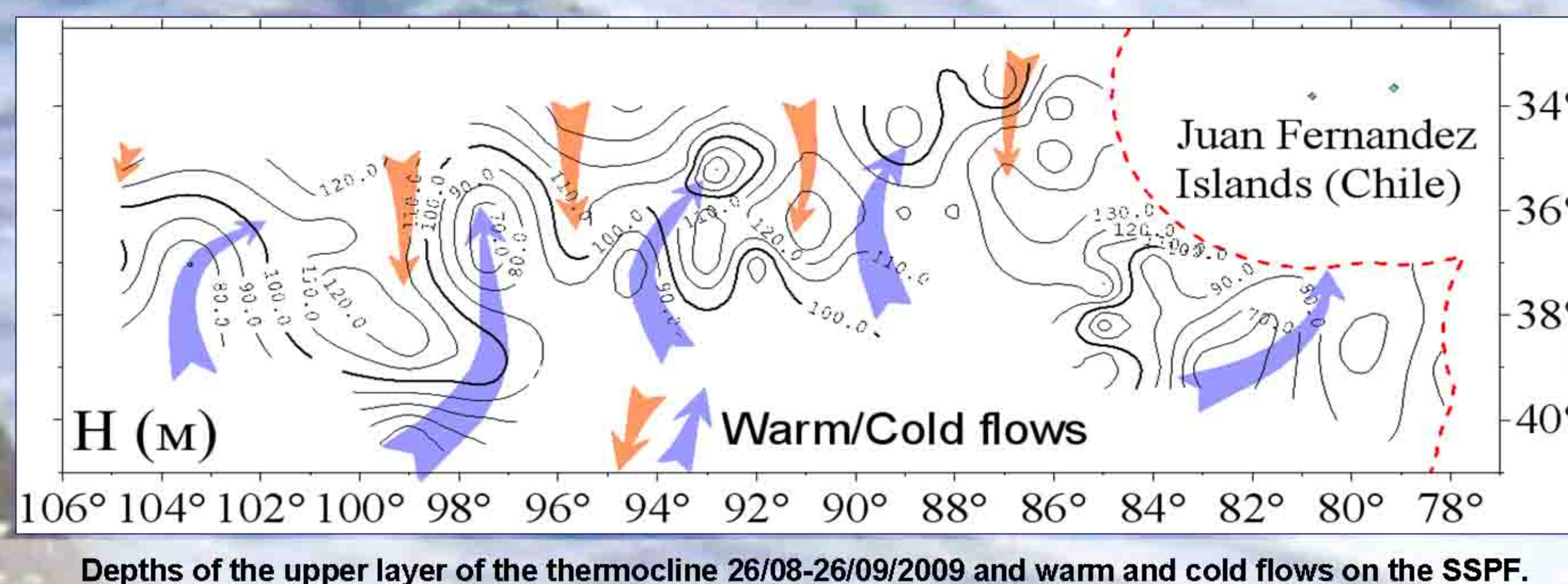
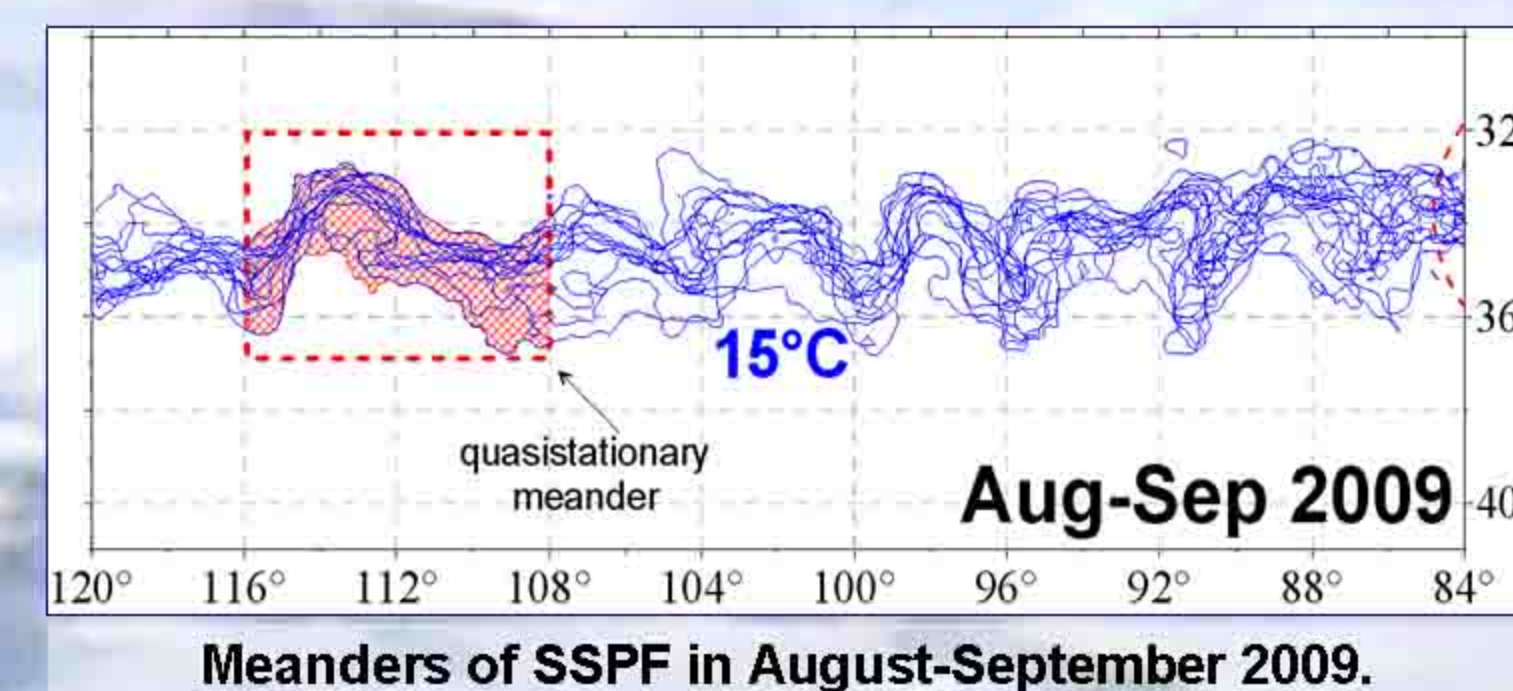
## Basic Materials

The complex survey of CHJM habitat and distribution in the Southeastern Pacific outside Chile's EEZ between 25-42°S/74-126°W (950.000 square NM in total) was carried out aboard Russian R/V "Atlantida" in August-November 2009. The acoustic research, trawl works, ichthyological, hydrological and ornithological surveys were undertaken.

- There were carried out:
- 3 acoustic surveys (380.000 square NM in total) with 45 pelagic trawls;
  - 114 hydrological stations (depth 0-846 m) with 2478 hydrochemical samples (O<sub>2</sub>, PO<sub>4</sub>);
  - 62 zoo- and ichthyological samples;
  - CHJM mass measures included 4728 individuals, biological analysis included 1932 individuals;
  - there were collected 643 CHJM samples for age research, and 327 samples for genetical research;
  - 156 visual seabirds observations.

## Results

The strong differences in density of CHJM within region were revealed, the highest density corresponded to the seasonal position of the SSPF between 33-37°S. This frontal zone was affected by the surface wind (mainly S, SW directions) and subsurface geostrophic circulation (in depth range 0-250 m velocities varied from 0.2-1.0 to 7.0-9.7 cm/sec).



The major CHJM habitats were regions characterized by strong environmental gradients in water T, S, O<sub>2</sub> saturation and subsurface geostrophic circulation. Meso-scale vortexes on the SSPF determined the oceanic biological productivity and CHJM schools distribution. Our results suggest a complex association between CHJM biomass and the seabirds aggregations. It was revealed that both the strongest gradients of SST in SSPF zone and corresponded densest CHJM aggregations, were, in turn, clearly marked by the most abundant seabirds aggregations.

The densest seabirds aggregations in SSPF zone were observed between: 34-36°S/85-87°W; 34-38°S/90-96°W; 34-38°S/103-106°W; 34-35°S/112-114°W and 36-38°S/114-116°W. Zones of the densest seabirds aggregations at the same time corresponded to the most dense of CHJM aggregations and SST gradients of SSPF more than 0.05°C per nm.

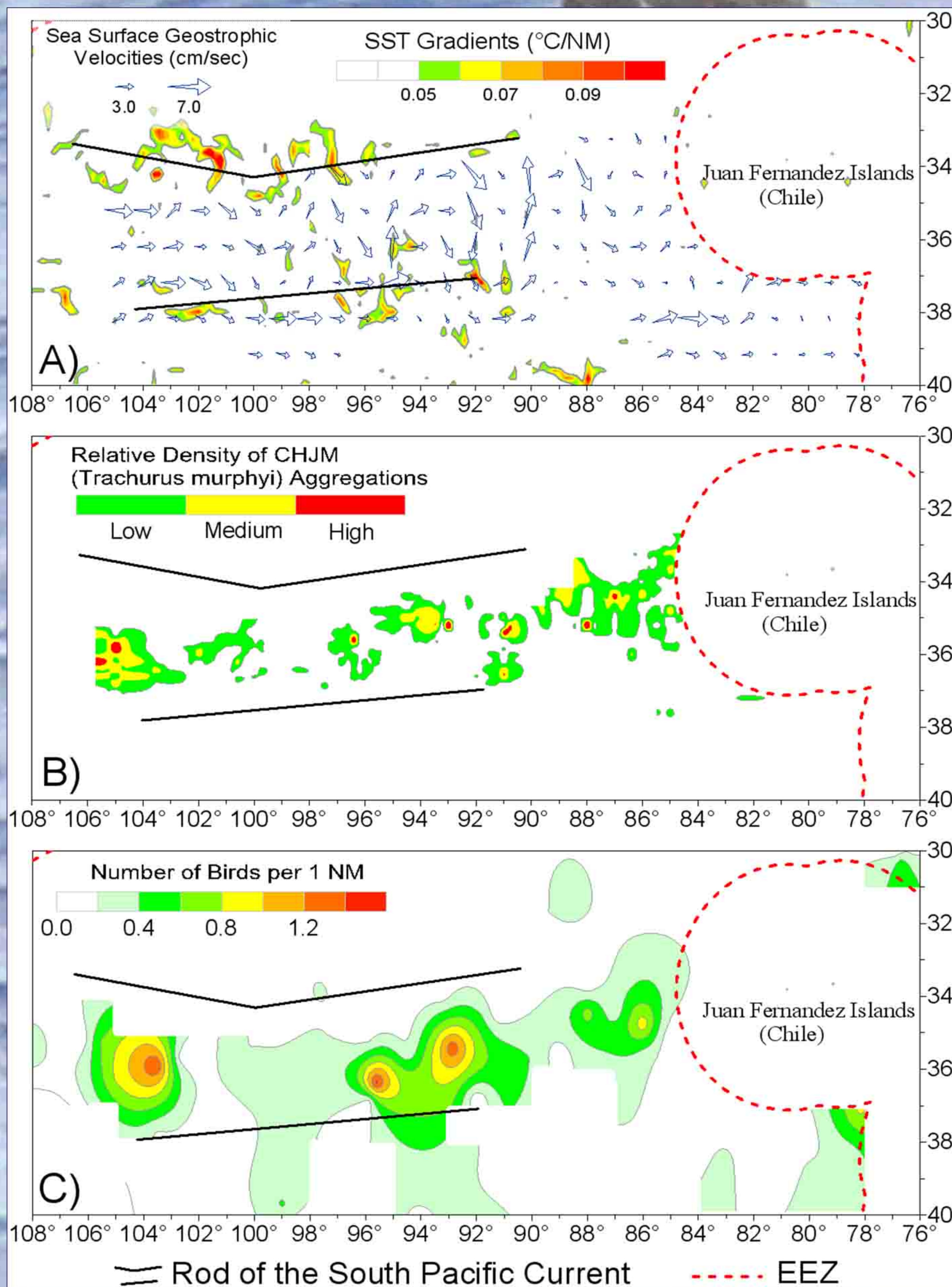
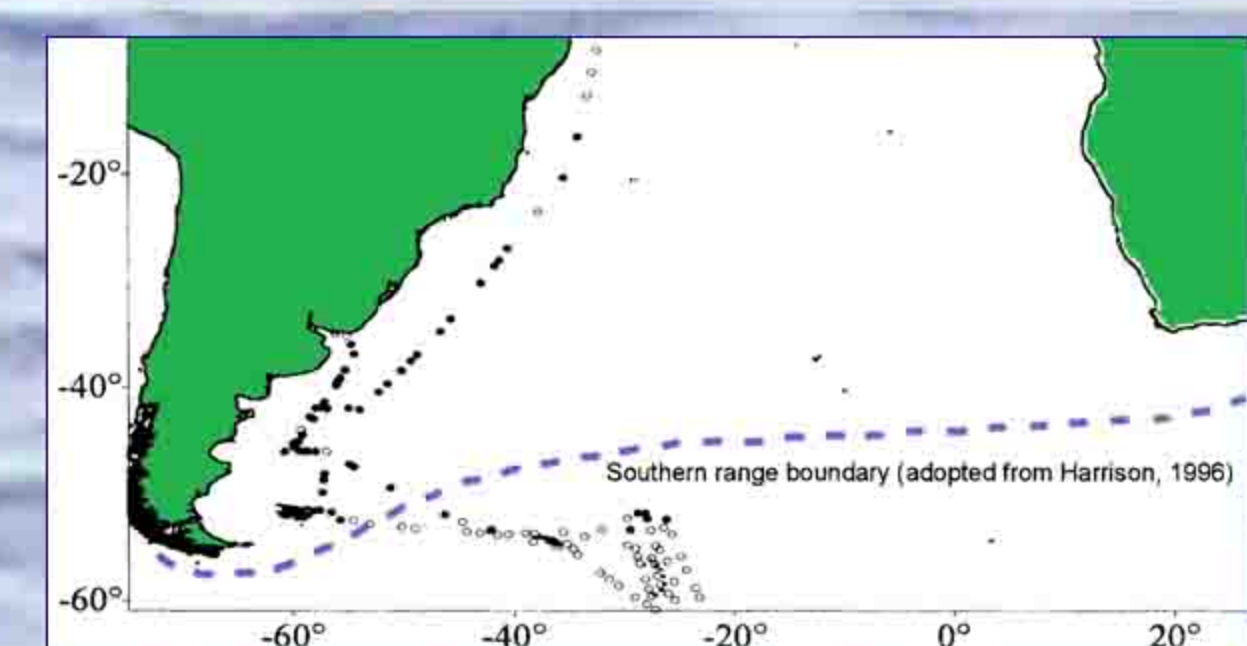
## Subtropical Southeastern Pacific Front, Chilean Jack Mackerel and seabirds aggregations



Chilean jack mackerel—CHJM (*Trachurus murphyi* Nichols, 1920). Photo from FishBase.org

There were registered 31 seabird species from 5 families. The number of seabirds on stations varied from 0-5 (39.7%) to 51-59 (1.9%), maximum 452 (0.6%), 12.9 (16.0%) in average. The number of species on stations varied from 0-2 (31.4%) to 7-9 (3.8%), 3 (23.1%) in average. The maps of distribution of the dominant birds species (*Daption capense* (72%), *Procellaria aequinoctialis* (65%), *Diomedea exulans* (45%), *Diomedea melanophis* (23%) etc.) and all species in a whole related to CHJM aggregations and oceanographic features confirmed it. The information collected may serve as an additional tool for identification of CHJM spatial distribution in this region in the winter-spring season.

Most probable, the strong adherence to certain boundaries and gradient zone is characteristic feature of various groups of the animals, which, for a first glance, may easily pass them through. Despite of their highly increased ability to move, marine birds strictly observe certain boundaries in the ocean, most probable determined by water masses and fronts' positions. Thus, Great shearwater *Puffinus gravis* in 2000 January in the sector north to South Sandwich Islands was never observed southward 53°S despite of certain number of observations carried out up to 60°S. At the southward latitude the birds meet something like "concrete wall", hampering further movement to the South. Another example: similar "strong walls" inside of species ranges, are never, or just exceptionally, passed through by sharks and rays, active and powerful animals.



Position of hydrological Subtropical Southeastern Pacific Front (SSPF) and rod of the South Pacific Current in August-September 2009 (A), relative density of Chilean Jack Mackerel (CHJM) aggregations according to sounding estimations (B) and Spatial distribution of the most abundant seabirds aggregations according to visual observations (C) in the Southern part of Pacific Ocean in August-November 2009.

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