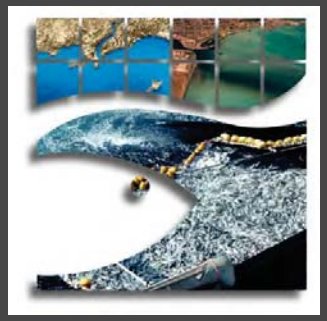
Annex 3. Presentations to the Task Group



Instituto de Investigación Pesquera

ACOUSTIC DATA OBTAINED FROM A FISHING VESSEL SEARCHING CHILEAN JACK MACKEREL AT THE HIGH SEA OFF SOUTH CENTRAL CHILE DURING YEARS 2009 Y 2010

Nicolás Alegría and Aquiles Sepúlveda

OBJECTIVES

In 2008, managers of the fishing industry of Central-South Chile decided to adapt a fishing vessel as a research platform with the following purpose:

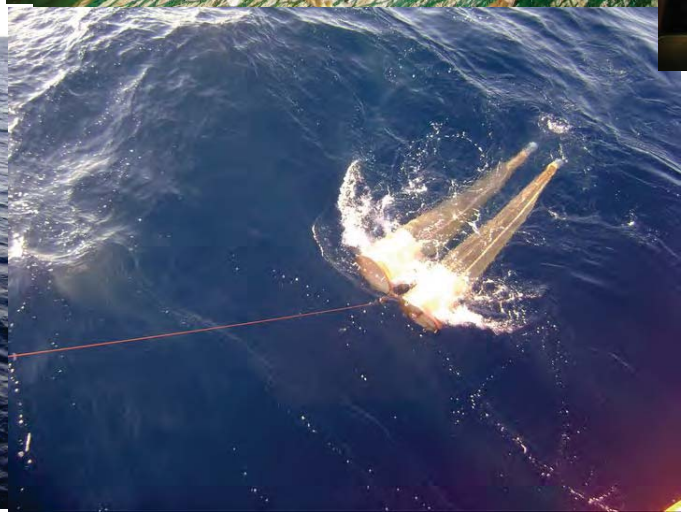
To characterize and assess relative abundance of Chilean Jack Mackerel aggregations offshore.

To relate fish density with oceanographic features and food component distribution and relative abundance.

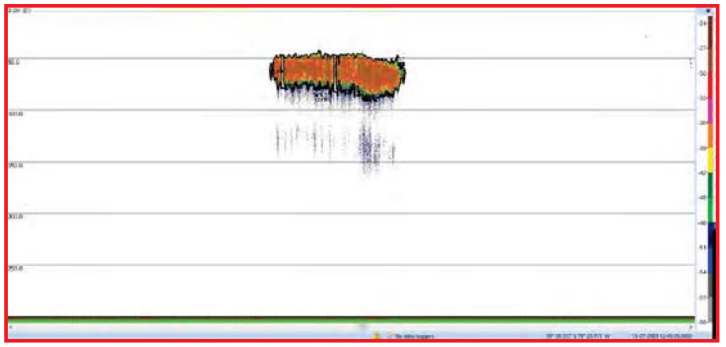
A fishing vessel from the trawling fishery of Chile (Biomar III) was equipped with a scientific echosounder (Simrad EK-60) and a 38 kHz transducer, sonar and oceanographic equipment.

The vessel was operating during two years (2009 and 2010) searching fish for 170 days in year 2009 and 203 days in 2010.

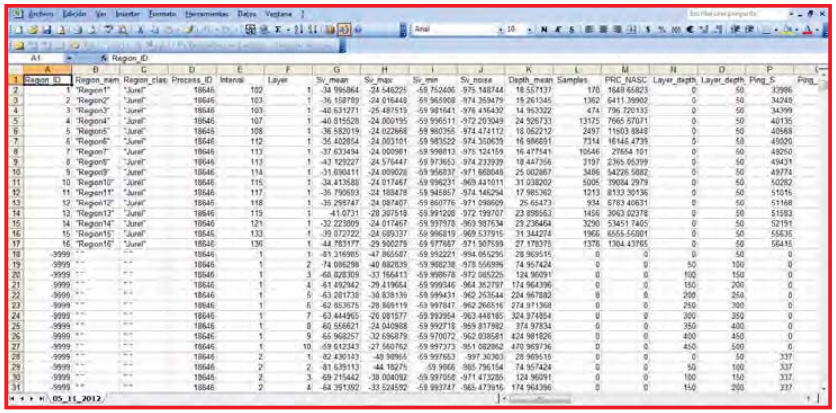
BBIP BIOMAR III

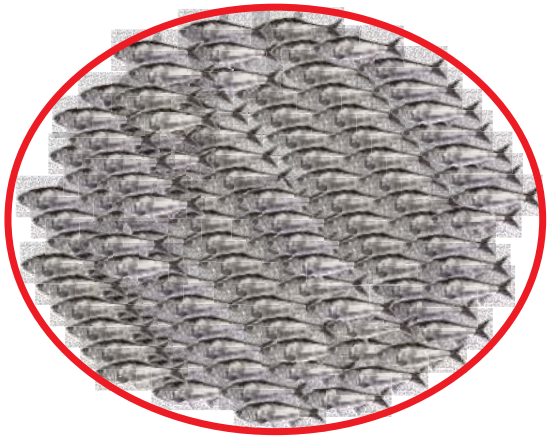


INFORMATION ANALYSIS



- **INTEGRATE AND EXPORT**





DENSITY
(ton/mn²)

RELATIVE ABUNDANCE ESTIMATES

$$z_i(x,y) = \frac{NASC_i(x,y)}{\sigma_{Ton(i)}(x,y)}$$

$$\sigma_{Ton(i)}(x,y) = \frac{\overline{\sigma}_i(x,y)}{\overline{W}_i(x,y)}$$

$\overline{W_i}(x,y)$ Mean weight (in metric tons) of the species *i* by haul of identification at the locality (*x*,*y*)

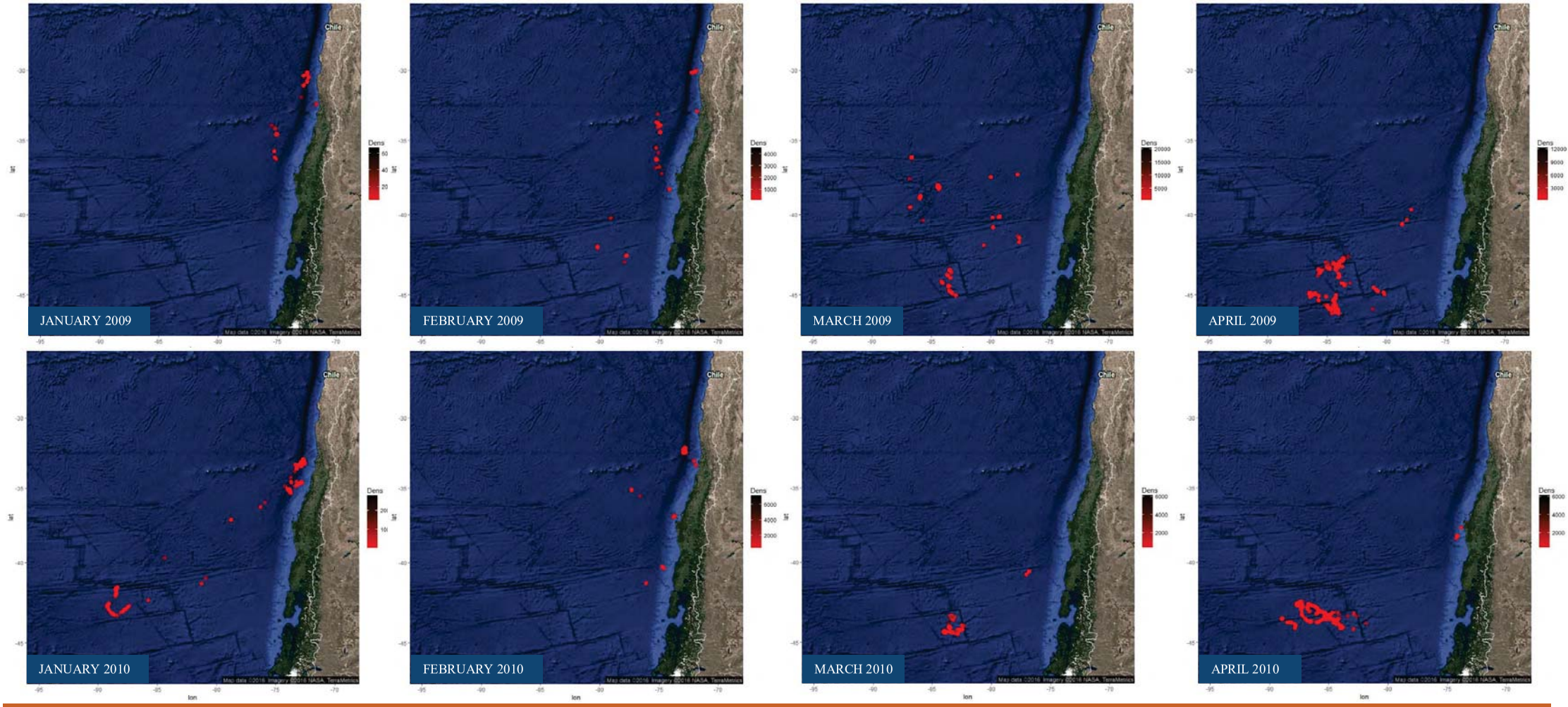
$\overline{\sigma_i}(x,y)$ Is the average transversal section of acoustic backscattering (in m^2) of species *i*:

$$\overline{\sigma_i}(x,y) = 4\pi \sum_j f_j 10^{TS_j/10}$$

TS= 20 log(LH) – 68,91 (Lillo *et al.*, 1996)

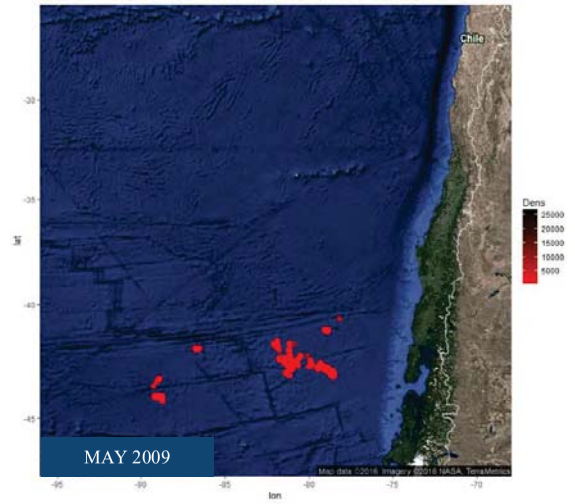
RESULTS

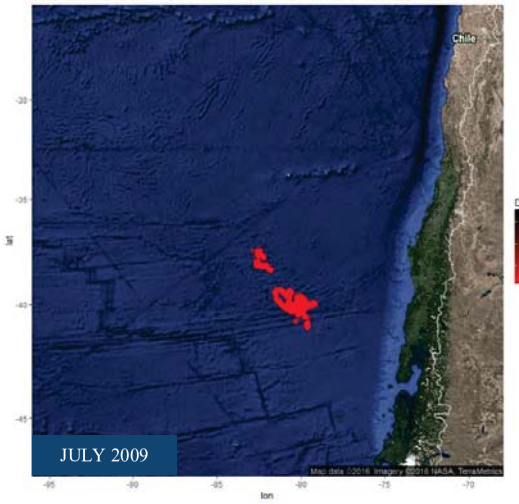
SPATIAL DISTRIBUTION

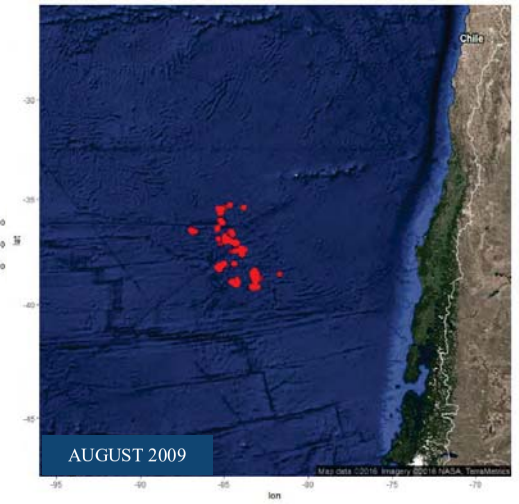


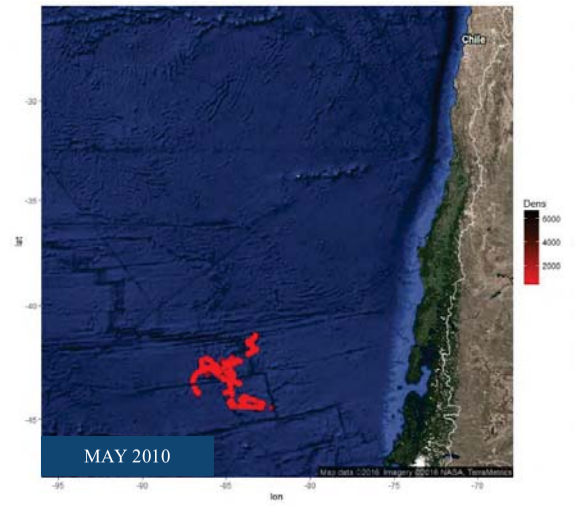
RESULTS

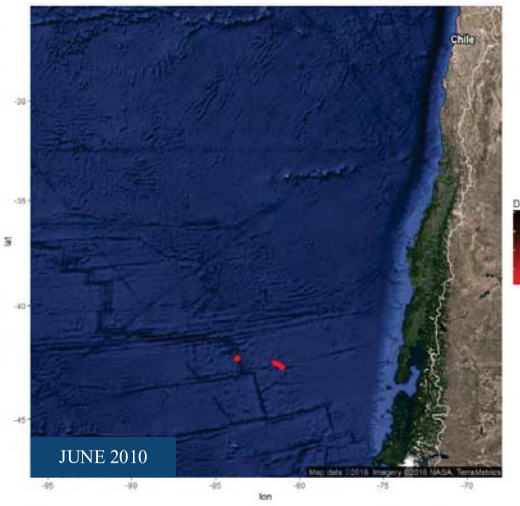
SPATIAL DISTRIBUTION

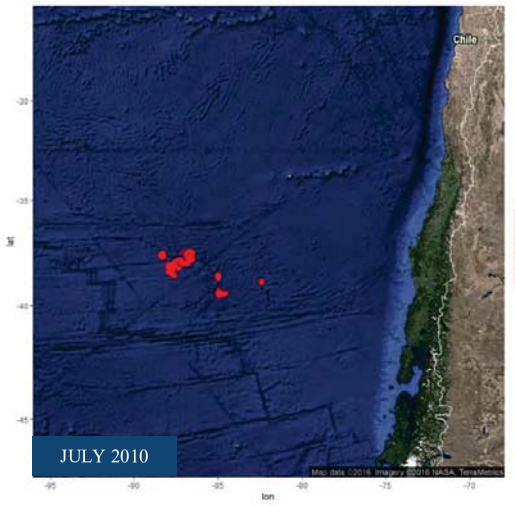


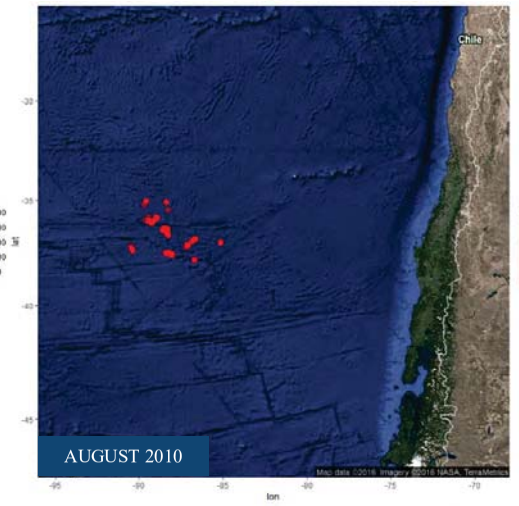






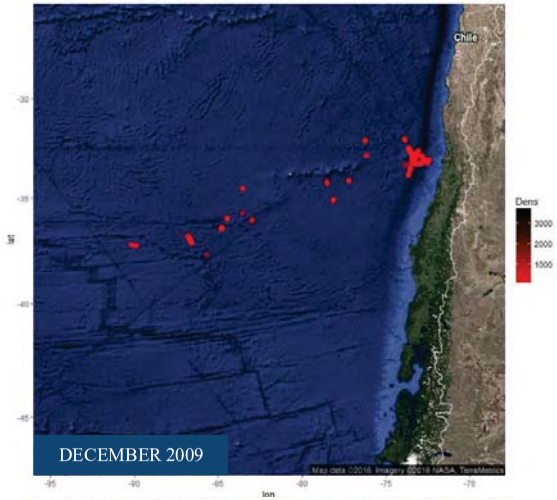


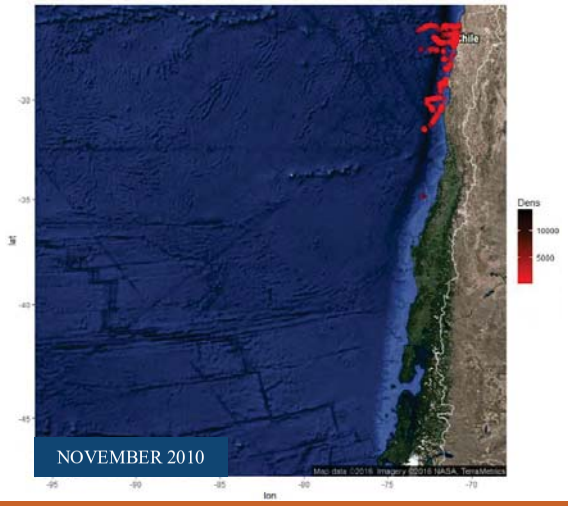


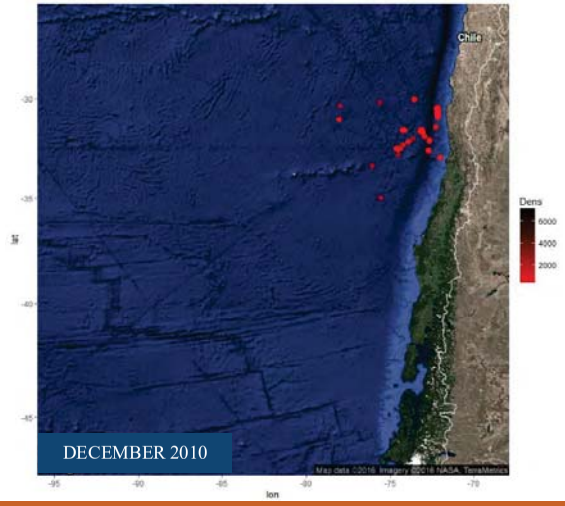


RESULTS

SPATIAL DISTRIBUTION



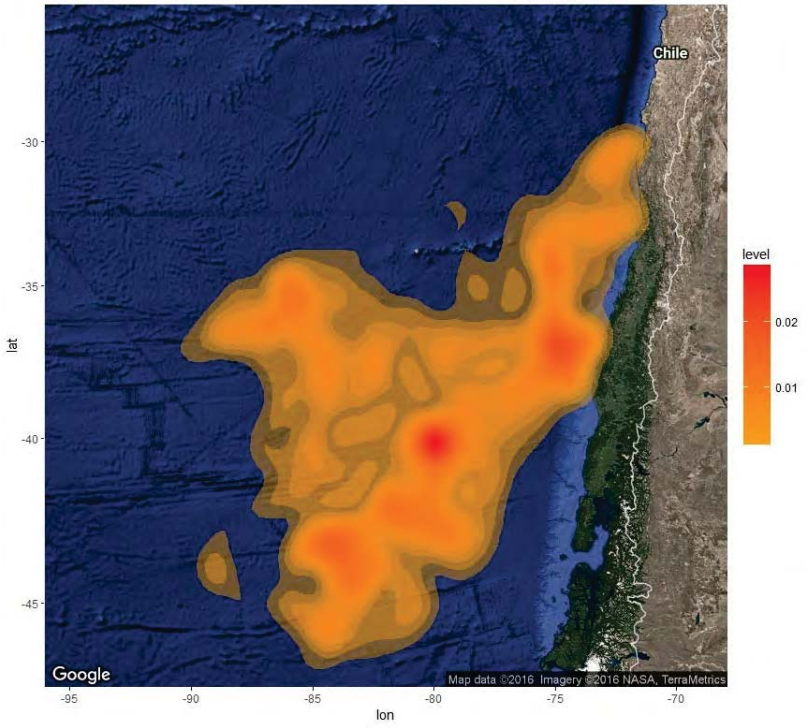




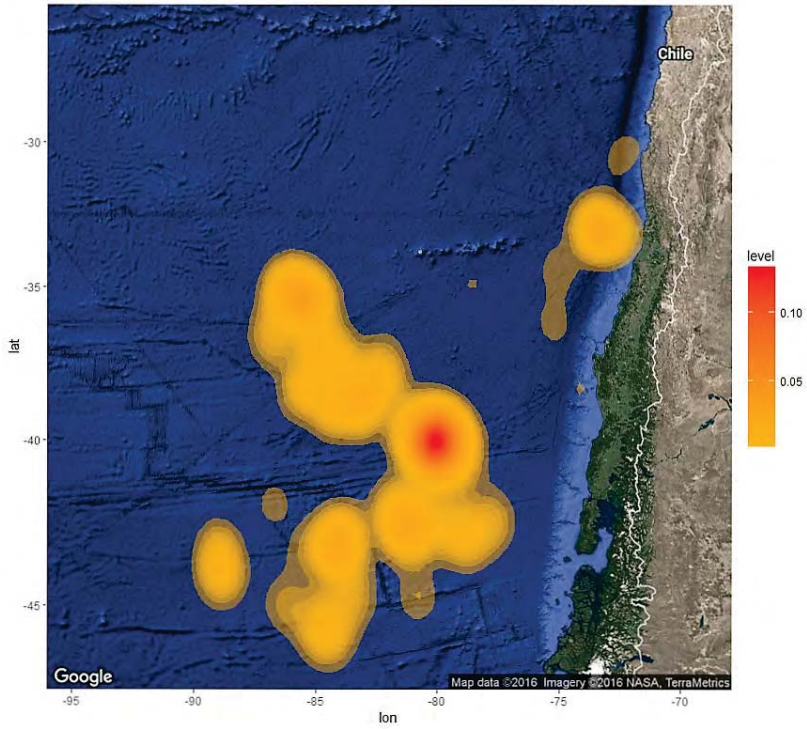
RESULTS

SPATIAL DISTRIBUTION

Zooplankton



T. murphii

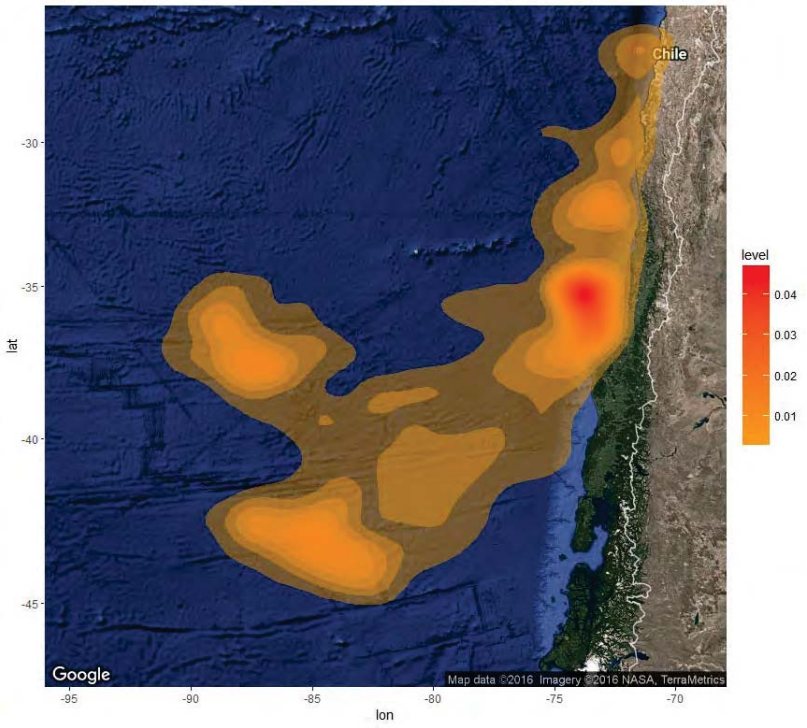


RELATIONSHIP BETWEEN FOOD AVAILABILITY AND PRESENCE OF MACKEREL, YEAR 2009

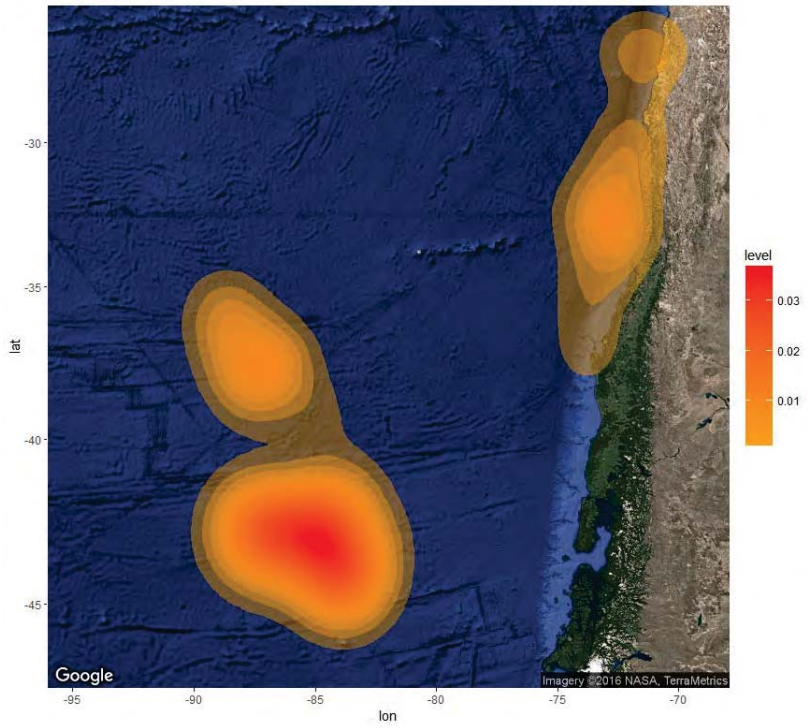
RESULTS

SPATIAL DISTRIBUTION

Zooplankton

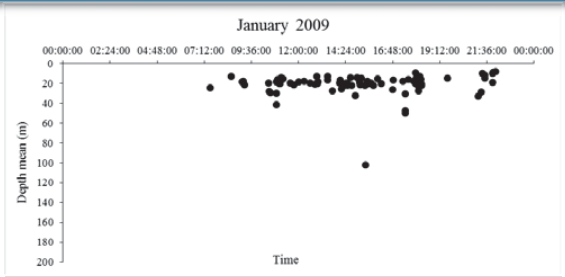


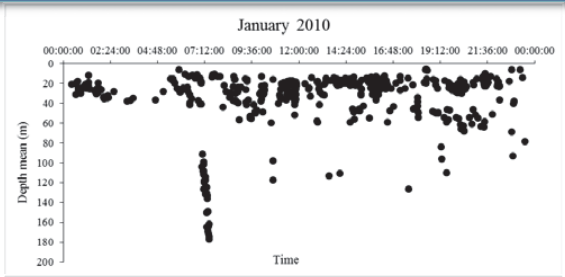
T. murphii

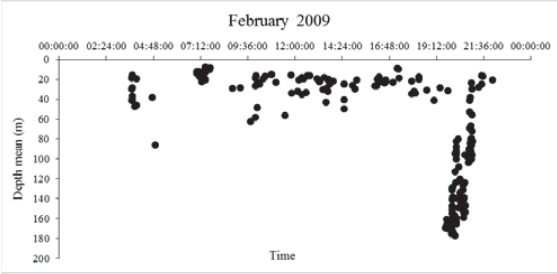


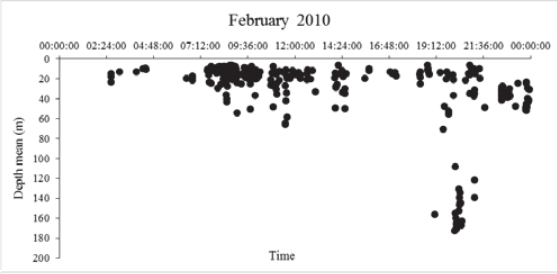
RELATIONSHIP BETWEEN FOOD AVAILABILITY AND PRESENCE OF MACKEREL, YEAR 2010

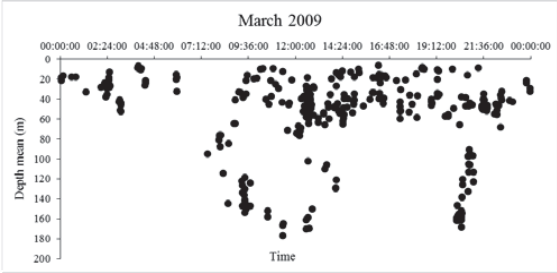
RESULTS

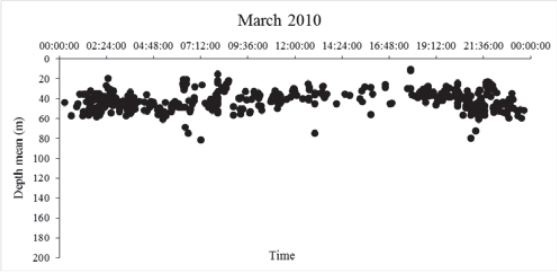

January 2009
Depth mean (m)
Time

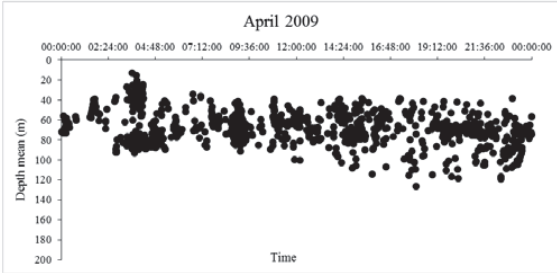

January 2010
Depth mean (m)
Time

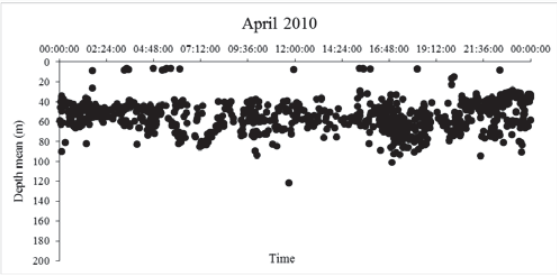

February 2009
Depth mean (m)
Time

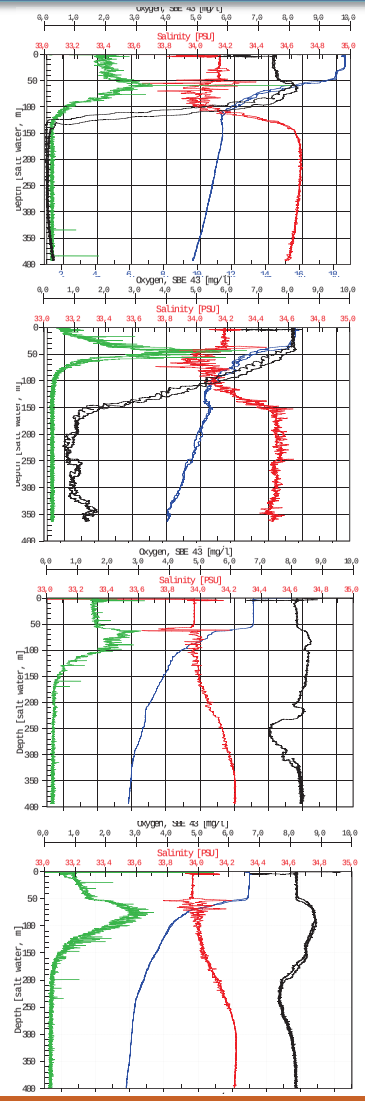

February 2010
Depth mean (m)
Time


March 2009
Depth mean (m)
Time

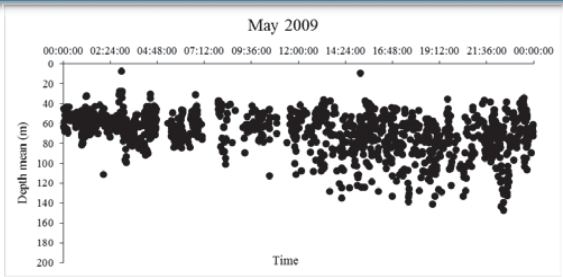

March 2010
Depth mean (m)
Time

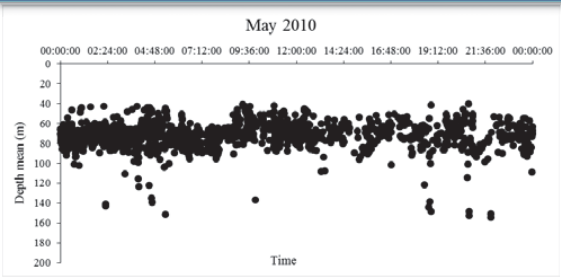

April 2009
Depth mean (m)
Time

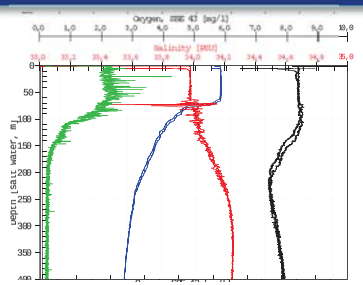

April 2010
Depth mean (m)
Time

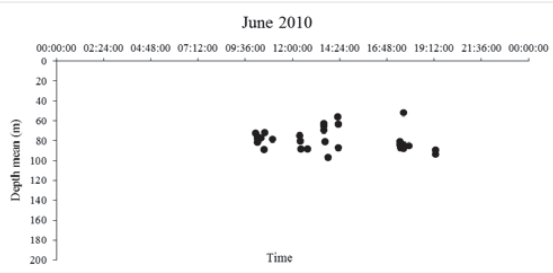

Salinity [PSU]
Oxygen, SBE 43 [mg/l]
Depth [salt water, m]

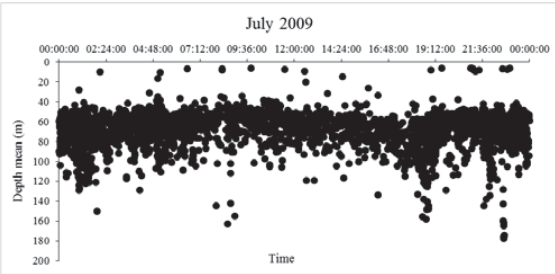
RESULTS

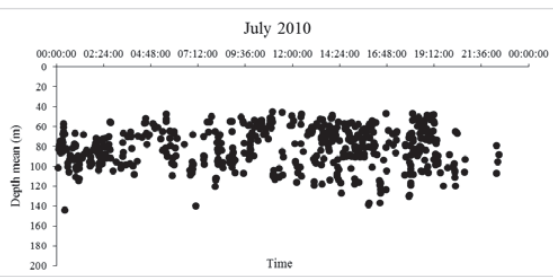

May 2009
Depth mean (m)
Time

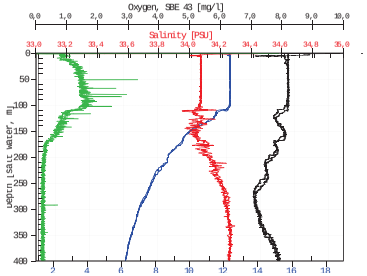

May 2010
Depth mean (m)
Time

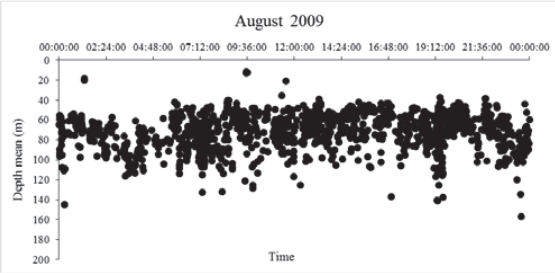

Oxygen, SBE 43 [mg/l]
Salinity [PSU]
Depth [salt water, m]

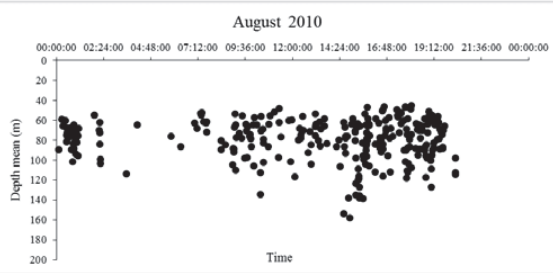

June 2010
Depth mean (m)
Time

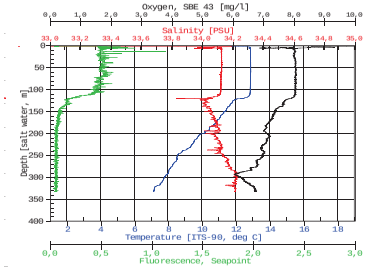

July 2009
Depth mean (m)
Time


July 2010
Depth mean (m)
Time

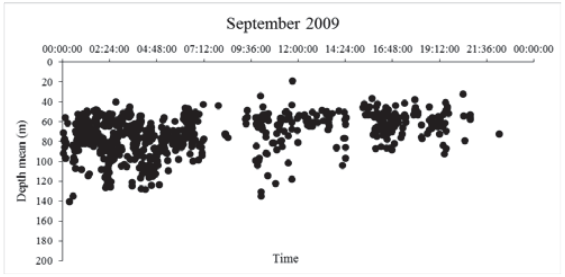

Oxygen, SBE 43 [mg/l]
Salinity [PSU]
Depth [salt water, m]


August 2009
Depth mean (m)
Time

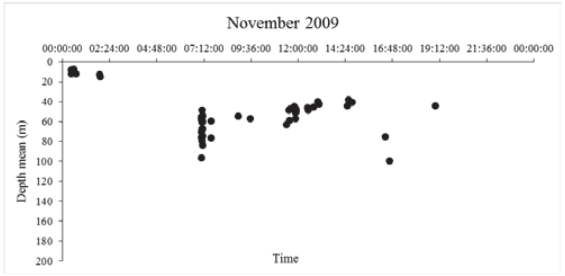

August 2010
Depth mean (m)
Time

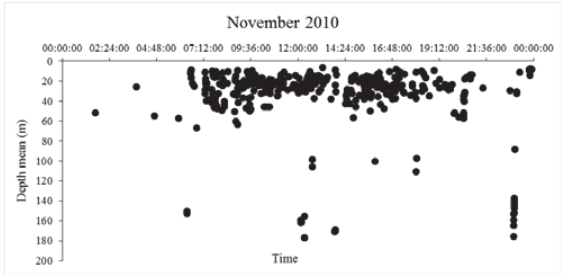

Oxygen, SBE 43 [mg/l]
Salinity [PSU]
Depth [salt water, m]
Temperature [ITS-90, deg C]
Fluorescence, Seapoint

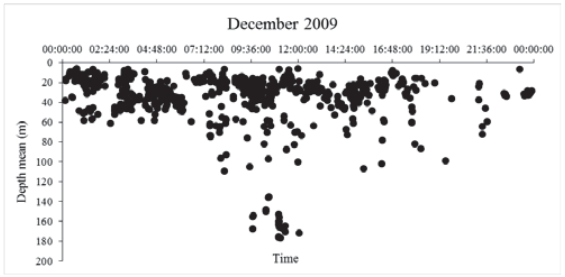
RESULTS

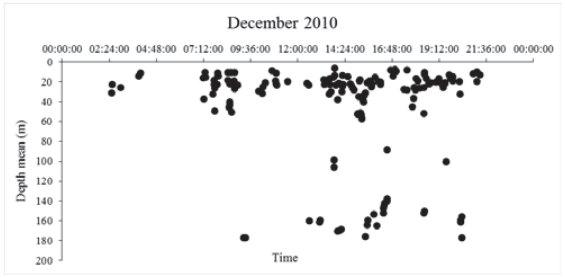

September 2009
Depth mean (m)
Time


September 2010
Depth mean (m)
Time


November 2009
Depth mean (m)
Time

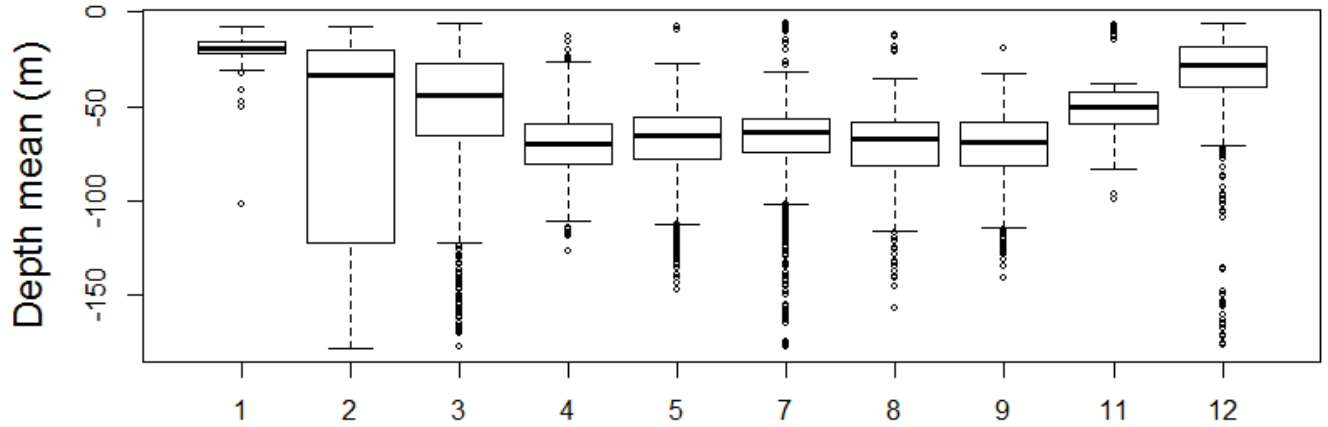

November 2010
Depth mean (m)
Time


December 2009
Depth mean (m)
Time

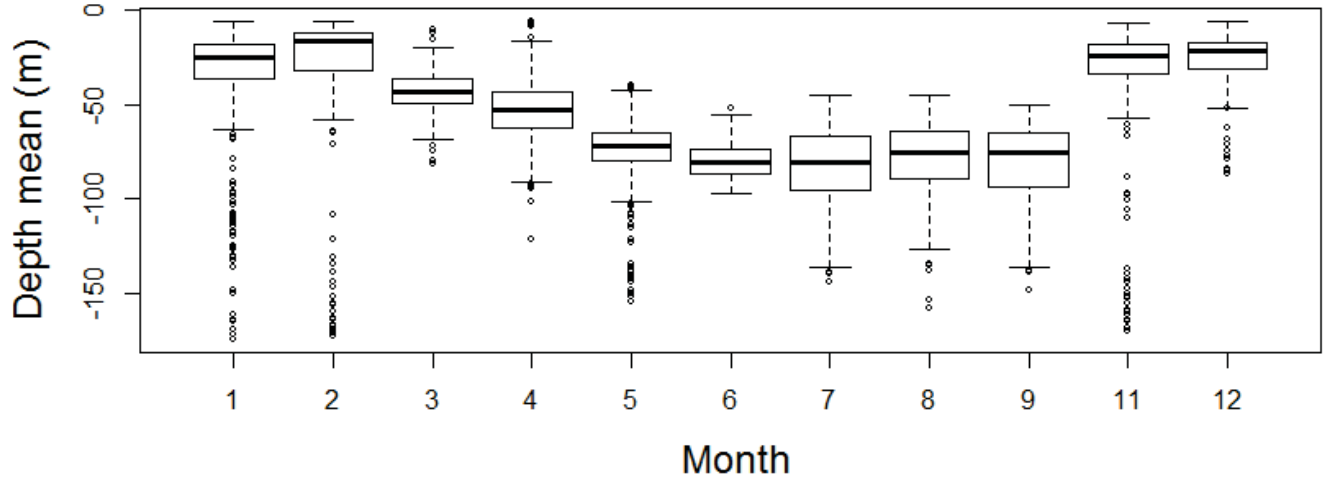

December 2010
Depth mean (m)
Time

RESULTS

2009

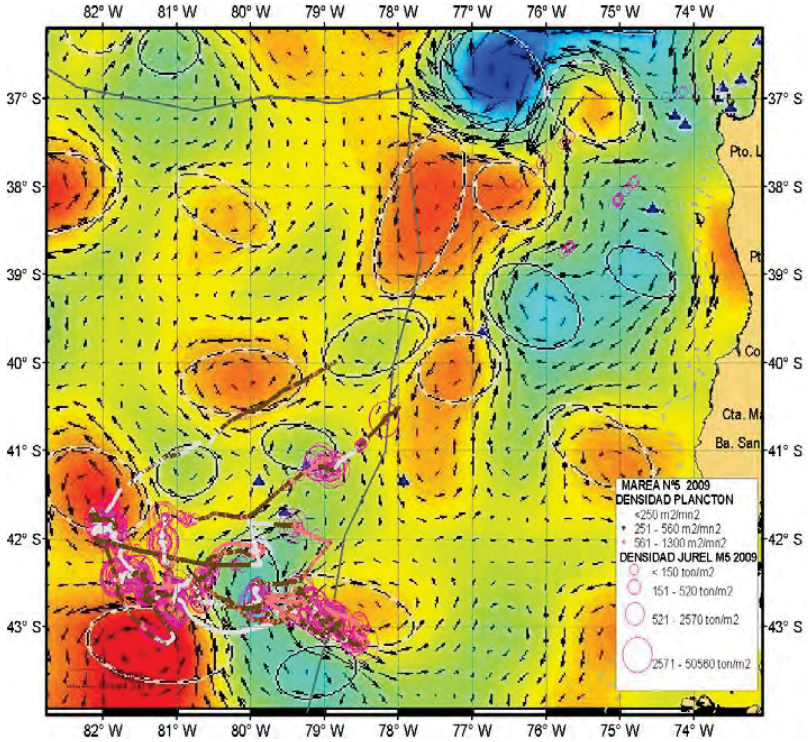


2010

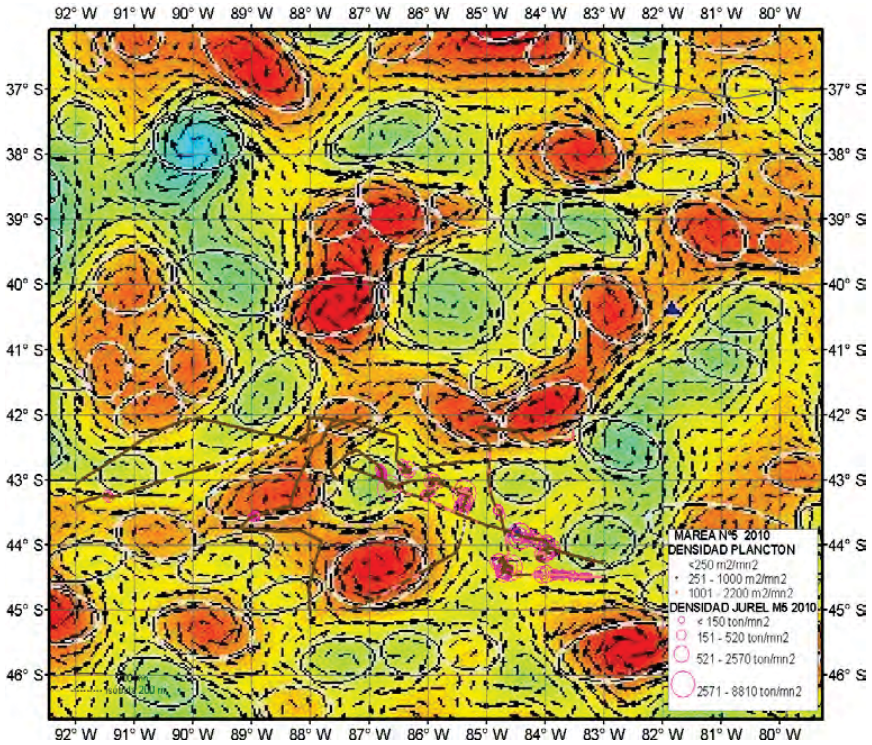


RESULTS: OCEANOGRAPHIC FEATURES AND FISH

MAY 2009



MAY 2010



RESULTS

2009

MONTH	N° UBM Total	N° UBM Pos	TS mean	σ_{sp}	W mean	σ_{Ton}	Dens mean	Σ dens.mean	Variance	Nav. days
JANUARY	1542	89	-39.11	0.00154	376.34	4.09	27.46	42337	747495.22	8
FEBRUARY	3206	218	-39.11	0.00154	384.19	4.01	15.2	48714	23822.33	16
MARCH	4072	324	-38.18	0.00191	557.19	3.43	21.21	86384	134307.66	22
APRIL	4750	1086	-37.06	0.00247	712.96	3.47	38.38	182281	157677.25	24
MAY	5221	1347	-37.05	0.00248	714.26	3.47	119.43	623553	934385.92	25
JUNE	-	-	-	-	-	-	-	-	-	-
JULY	5802	3567	-36.91	0.00256	712.25	3.6	311.5	1807306	4647777.56	19
AUGUST	4886	1435	-36.83	0.0026	726.14	3.59	44.08	215382	104452.18	23
SEPTEMBER	2396	863	-36.82	0.00261	736.11	3.54	25.14	60239	34054.85	10
OCTOBER	-	-	-	-	-	-	-	-	-	-
NOVEMBER	1027	54	-36.83	0.0026	913.19	2.86	17.99	18474	38629.2	5
DECEMBER	3996	758	-40.62	0.00109	222.9	4.89	13.48	53873	14518.82	18
TOTAL	**36898**	**9741**	**-37.852**	**0.00214**	**605.553**	**3.695**	**63.387**	**3138543**	**683712.099**	**170**

2010

MONTH	N° UBM Total	N° UBM Pos	TS mean	σ_{sp}	W mean	σ_{Ton}	Dens mean	Σ dens.mean	Variance	Nav. days
JANUARY	4305	508	-40.3	0.00117	252.8	4.64	35.55	153023	257339.91	23
FEBRUARY	2921	327	-40.3	0.00117	260.49	4.51	43.59	127322	82093.86	18
MARCH	1515	463	-37.37	0.0023	635.68	3.62	86.43	130951	176250.6	6
APRIL	4742	997	-37.18	0.0024	678.13	3.55	19.47	92339	22002.91	23
MAY	5296	1474	-37	0.0025	715.66	3.5	19.48	103182	23233.15	24
JUNE	2810	32	-37	0.0025	720.74	3.48	0.85	2399	352.78	18
JULY	4211	546	-37	0.0025	694.46	3.61	75.03	315940	621793.97	23
AUGUST	3951	276	-37.18	0.00241	638.55	3.77	45.14	178344	293111.03	24
SEPTEMBER	1250	53	-34.71	0.00424	1452.3	2.93	18.14	22676	36517.73	6
OCTOBER										
NOVEMBER	3953	380	-38.83	0.00165	352.11	4.68	17.1	67602	105154.58	20
DECEMBER	3287	162	-38.82	0.00164	430.72	3.82	16.21	53295	43453.71	18
TOTAL	**38241**	**5218**	**-37.79**	**0.00223**	**621.058**	**3.828**	**34.27**	**1247073**	**151027.66**	**203**

CONCLUSIONS

- ✓ Mean densities of Chilean Jack Mackerel in year 2010 were less than the densities obtained in year 2009.
- ✓ Jack Mackerel aggregations are mainly found at the borders of anticyclonic gyres and in zones characterized by relative mean vorticities.
- ✓ Jack Mackerel aggregations detected in year 2010 were distributed more close to the surface than the observed in 2009.
- ✓ A clear seasonal pattern of bathymetric distribution of aggregations was found, with deeper use of the water column during winter months and a shallower vertical distribution in summer.
- ✓ A reduced relative abundance of food organisms was found in year 2010, both at coastal and oceanic waters.
- ✓ Higher densities of Jack Mackerel were close distributed to zones with higher densities of food organisms.