In 1984-1985 after one of the most intensive El-Niño for the latest decades, the catches constituted less than 30,000 tons (23,400 and 27,900 tons respectively) with insignificant areas of fish concentration and total biomass of 0,6-1,2 mln.t.
The highest value of horse mackerel biomass, and catch in the ocean part of the subarea, corresponds to the maximum values of this stock estimated by the Institute of the Sea of Peru (IMARPE) on the basis of echosurveys in 200-mile zone. From 1978 to 1983 maximum biomass were 8.9 mln.t for horse mackerel, 1.8 mln.t for mackerel and 4.8 mln.t. for sardine. During 1988-1990 in "zonal" waters the observed high values of these species stocks were – horse mackerel biomass 7.5 mln.t, mackerel 1.5 mln.t, sardine 8.5 mln.t.
According to IMARPE data in the "zonal" part of the area after El-Niño events of 1982-1983, in 1984-1985, the reduction horse mackerel and mackerel biomass was noted (Muck, Sanchez, 1987). These data agree with the information on fish aggregations that migration outside the zone based on the fishery results in the ocean part of this subarea (in these years the total annual catch of these species did not exceed 28,000 tons) and peculiarities of fish aggregations distribution and available fishing biomass in the grounds of the Soviet Union fleet operation.
When arranging fishery research, special attention should be paid to the time of fish migration into the open sea areas accessible to fishing vessels. The data of figure 1 show, that fish aggregations in the ocean part are forming in May - June or July - August. Formation of fish aggregations in May - June 1980 and 1981, 1985 and 1986, is evidently caused by the cool Peruvian current strengthening. These years are characterized by negative SST anomalies (-1°) in the area 5-10°S during the first half of the year and are not related to the strong El-Niño events (Climate Diagnostics Bulletin, 1991). Formation of fish aggregations in July - August (1979, 1984, 1989-1991) coincides with a situation when in the first half-year positive SST anomalies or their alternation with insignificant (up to – 0.5°) negative anomalies are observed. The years of intensive El-Niño ending (1983, 1988) are the exceptions. Prediction of events, determining migration of fish aggregations outside the zone is the element of El-Niño forecast.
Thus, the time of pelagic fish's migration into the open part of the subarea and the area of fish aggregations is determined by the fish stocks size within 200-mile zone of Peru and hydrologic conditions. The prediction of periodically repeating strong El-Niño is of special importance.
On the basis of AtlantNIRO research data, horse mackerel observed outside Peruvian zone and horse mackerel distributing off Chilean zone belong to different groups. The observed genetic heterogeneity of horse mackerel is caused by reproduction separation of the groups (Alekseev, 1985; Koval, 1981; 1984).
Distribution of horse mackerel in the region located southwards of 25° S outside Chilean 200-mile zone (South subarea) insignificantly depends on the phenomenon El-Niño. El-Niño events in 1982-1983 resulted in water temperature increase by 1° C in this region during 1983 as compared to the average long-term level. This is obviously related to penetration of modified water mass of subtropical origin into the location at 30-35° S. It is possible to consider the occurrence of juvenile horse mackerel of age 1+ together with fish of age 2+-5+ at 37-43°S as a consequence of the above said events. After El-Niño, in 1984, at the same latitude no fish of age 1 + were observed. It is possible to assume, that fish of this age group were distributed further northwards.
Distribution of eggs, larvae and spawning fish during spawning season 1983/84 and up to 1988/89 is shown. It is evident, that westward of 85°W in 1983/84; 1984/85 the spawning occurred in more southern locations. Besides, the analysis of horse mackerel age structure in commercial catches for 1979-1991 based on VPA has shown the absence of strong year-classes after spawning in 1983/1984 and 1984/1985. The strong year-classes appeared after spawning season 1985/1986. Presented data on distribution of various age groups during different quarters of 1983 and 1984, as well as ichthyoplankton and spawning fish distribution show, that in the open sea area southwards of 30 °S horse mackerel at all life cycle stages distribute and these fish are able to provide recruitment for its reproduction. These data allow defining the horse mackerel status in this area as one large population with the distribution area from the coast of Chile to New Zealand, and horse mackerel from different parts of the area contribute the stock reproduction.

HCS100 - Taxonomic composition, diel patterns and ecological importance of the micronecktonic community related to the oxygen minimum zone off Peru

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The Humboldt Current system (HCS) is characterized by the presence of an intense oxygen minimum zone (OMZ), similar to that in other regions (i.e. Arabian Sea, Northwest Pacific, Southwestern Africa) but with a larger extend and a shallower distribution. The intensity and extent of OMZ increases southward of Equator, due to enhanced physical and biological processes like mixing and re-mineralization. The OMZ

has strong impact on the vertical structuring of pelagic ecosystems in particular for the mesopelagic community. Here we aim at describing organism diversity, abundance and distribution related to the OMZ. The study is based on three sources of data collected during three acoustic surveys performed off Peru during austral springs 2001-2003: acoustics, pelagic trawls and hydrographic profiles. Species composition was dominated by organisms adapted to low oxygen concentration (Table 1), in particular (1) the fish Phosichthyidae *Vinciguerria lucetia,* Myctophidae *Diogenichthys laternatus* and *Lampanyctus* spp., Bathylagidae *Leuroglossus* spp.; (2) the crustacean Euphausidae, *Euphausia mucronata* and (3) cephalopods Octopoteuthidae. *Vinciguerria lucetia*, the most abundant species undertakes vertical migrations being distributed in layer and patches in the core and the upper part of the ZMO during the day and in surface layer during the night. This diel behaviour allows *Vinciguerria lucetia* and associated species escaping most of their predators (e.g. jack mackerel, tuna, piscivorous mesopelagic fish) during the day and being distributed in the rich surface layer during the night, when most of organisms are concentrated in shallow water. *Vinciguerria* lucetia interacted with the community adapted to low oxygen during the day and with the whole pelagic community during the night.
Similar to others mesopelagic fish in other highly productive areas (e.g. *Benthosema pterotum, Notoscopelus japonicus, Electrona antartica*, see Gjøsaeter, 1984, and Brodeur and Yamamura, 2005), we can assume that *Vinciguerria lucetia* is a significant component in the oceanic region of the HCS. In particular for trophic relationships as it is an abundant predator for macro-zooplankton (e.g. copepods and euphausids) and prey for apex predators (e.g. giant squid, tuna, jack mackerel, piscivorous mesopelagic, seabirds). *Vinciguerria lucetia* and other species adapted to ZMO can be considered as key organisms as they participate to the vertical transport of organic matter (biological pump) in the water column in highly stratified areas.

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Table 1. *Taxonomic composition of micronekton captured by pelagic trawling off Peru*

Family	Species	Total catch (g*trawl min^{-1})	Family	Species	Total catch (g*trawl min^{-1})
Pisces					Crustaceans
Phosichthyidae	*Vinciguerria lucetia**	115 559.0	Euphausidae	*Euphausia mucronata**	71 610.9
Myctophidae	*Diogenichthys laternatus**	9 836.0	Pasiphaeidae	*Pasiphaea* sp.	445.4
	*Lampanyctus idostigma**	3 002.5	Galatheidae	*Pleuroncodes monodon*	40.0
	*Lampanyctus omostigma**	2 870.7			Cephalopods
	*Lampanyctus sp.**	678.2	Octopoteuthidae*		460.0
	Myctophum aurolaternatum	393.1	Enoploteuthidae		2867.7
	Myctophum nitidulum	328.4	Cranchiidae		254.5
	Triphoturus oculeus	715.6	* Species adapted to low oxygen concentration		
	Hygophum reinhardti	100.2			
	Hygophum proximum	49.1			
	Gonichthys tenuiculum	20.3			
Bathylagidae	*Bathylagus berycoides*	419.1			
	*Leuroglossus stilbius**	243.9			
	Leuroglossus urotranus	1 444.1			
Melamphaeidae	*Melamphaes* sp.*	297.0			
	Scopeloberyx sp.*	67.3			
Sternoptychidae	*Argyropelecus affinis**	48.0			
	*Sternoptyx obscura**	12.5			
Paralepididae	*Paralepis* sp.	417.3			
Serrivomeridae	*Serrivomer sector*	53.5			
Scopelosauridae	*Scopelosaurus* sp.	79.4			
Stomiidae	*Stomias colubrinus**	15.0			
	Stomias sp.*	105.4			
Nemichthyidae	*Nemichthys fronto*	46.3			
Scopelarchidae	*Scopelarchoides nicholsi**	72.8			
Gonostomatidae	*Polymetme* sp.	25.2			
	Gonostoma elongatum	7.7			
Chauliodontidae	*Chauliodus* sp.*	10.0			
Idiacanthidae	*Idiacanthus* sp.*	9.1			
Astronesthidae	*Astronesthes* sp.*	0.4			

HCS205 - Long-term changes in population size of Peruvian guano-producing seabirds

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Keywords: Peruvian guano-producing seabirds, population trends, distribution, diet, seabirds as indicators, fishery effects

Peruvian guano-producing seabirds are an important component of the Humboldt Current System. These seabirds feed primarily on Peruvian anchovies (*Engraulis ringens*). The proportion of anchovy found in the diet of cormorants and boobies is strongly correlated with anchovy biomass (Jahncke y Goya 1998). Peruvian guano-producing seabirds have shown large population changes over time. The population decreased dramatically in the last century from 16-20 million birds in the 1950s to less than one million birds during El Niño 1982-83. Currently, this population is at a critical size (2.5 million birds) and no

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