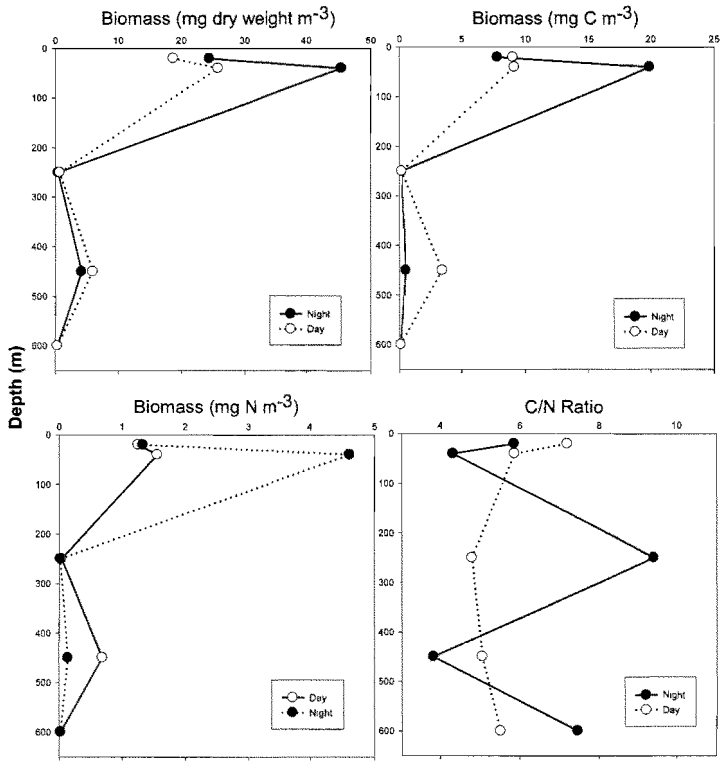

Figure 1. Vertical distribution of zooplankton biomass, C and N contents and the C/N ratio in the coastal upwelling zone off northern Chile in October 2005. Data were averaged from two locations and 2 days sampling at each site.

HCS148 - Revising previous hypothesis on the trophic position and ecological role of the Peruvian anchovy (*Engraulis ringens*)

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The Peruvian anchovy (*Engraulis ringens*) forages on plankton communities and is the main prey of various predators including marine mammals, seabirds, fish, and fisheries. It is therefore a key element of the marine food web in the Humboldt Current system (HCS). In this work, we present results of anchovy stomach content analysis from 1996-2003. Samples came from 23 acoustic surveys and a total of 21,203 stomach contents of anchovy ranging from 3 to 18 cm in length were analyzed. Prey items were identified to the highest taxonomic level possible, then converted to carbon content (µg) and expressed as percent. From 1996-2003, variability in stomach fullness was examined with respect to the taxonomic composition, time of the day, distance from the coast, sea surface temperature (SST), and latitude using generalized additive models (GAMs). Results showed that mean fullness (stomach contents weight expressed as percentage of total fish wet weight) was 0.68% and varied between 0.29% in February-March 1999 to 1.23% in August-September 1999. Phytoplankton largely dominated anchovy diet composing 99.52% of number of prey items. The portion of copepods accounted only the 0.07% and euphausiids the 0.003%. This view of anchovy's diet dramatically changes when considering the carbon content of prey items, whereby zooplankton is by far the most important component (98.0%) with a strong dominance of euphausiids (65.9%) followed by copepods (28.0%). This general view of anchovy diet based on carbon content varied with time but no seasonal trend could be identified. Carbon content of phytoplankton reached its highest level in August-September 1996 with 40.5% and a minimum in June-July 2000 (0.07%). Euphausiids carbon fraction reached as much as 90.1% in August-September 1999, a La Niña period (lower value was 5.4% in November-December 1998) when the maximum proportion of copepods occurred at the end of the El Niño event 1997-98 (87.6%) and the lowest value was observed in November-December 1996 (2.2%). GAMs computed on all surveys showed that main feeding activity occurred during daytime hours, between 07 and 18 hours (Fig. 1). This general pattern was observed for most surveys although nighttimes feeding behaviour made substantial contribution to the total ingestion. Stomach fullness varied with latitude (Fig. 1), with higher values encountered in Northern (< 6°S) and Southern Peru (>13°S), but latitudinal patterns could not be assessed since we obtained some of the highest fullness values in the central part of Peru. Stomach fullness increased with distance from the coast (Fig. 1) and often reached maximum values at sampling stations positioned more than 120 km from the

coast, but strong variability was also observed, e.g. high fullness levels were observed in very coastal areas when anchovy was distributed close to the coast, particularly during the 1997-98 El Niño event. Finally, anchovy stomach fullness had a negative relationship with temperature (Fig. 1) and reached lower values around 22°C. However, the range of temperature varied seasonally, and its effect on stomach fullness can only be partially explained.

In contrast with previous studies, our results show that zooplankton (in particular euphausiids and copepods) is the major component of anchovy diet. Most previous studies concluded that diet of Peruvian anchovy was mainly based on phytoplankton or that phytoplankton and zooplankton played a similar role. However, these works were mainly based on qualitative descriptions of anchovy diet, frequency of occurrence, and percent by numbers rather than carbon content. In terms of diel feeding activity, our results differ from those from Pauly et al. (1989) and Jarre et al. (1991) for the period 1953 – 1982. This difference cannot be related to different methodology i.e., GAM vs. Sainsbury's method. Applying this last method to our data does not change the results.

In summary, the analysis of 21,203 stomach contents shows that zooplankton make up most of the energy for anchovy even though significantly more phytoplankton prey items are ingested. These results put into perspective our current knowledge on anchovy diet, its position in the trophic foodweb, and thus, the trophic models that were build in the HCS.

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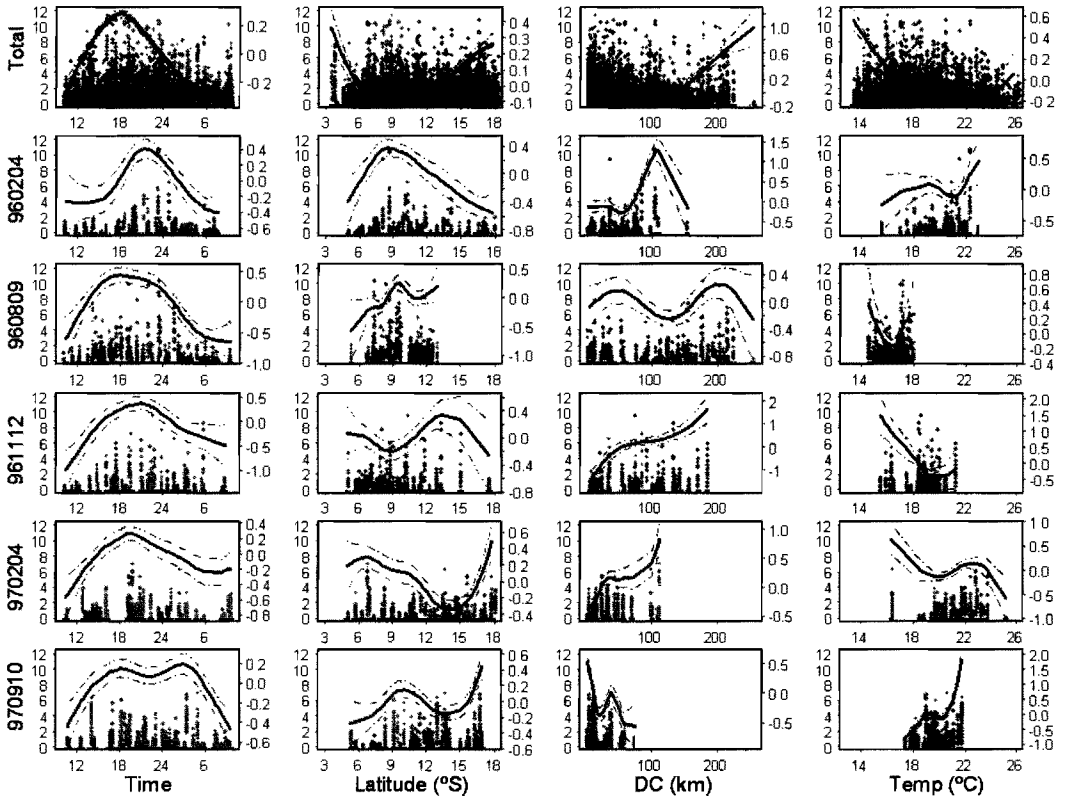

Figure 1. Scatter plot (grey dots) and cubic spline smoothers fits (black solid lines) of GAM models based on fullness on anchovy stomach fullness according to time of day, latitude, distance from the coast (DC) and sea surface temperature (°C) for the complete set of 21,203 stomach contents. Also shown are the fits for 5 of the 23 surveys from which stomach contents were analyzed. The black dotted lines show the 95% confidence limits of GAM models. Left y-axis shows stomach fullness in percent. The right y-axis are in relative scale, they correspond to the spline smoother that was fitted on the data, so that a y-value of zero is the mean effect of the variables on the response.

HCS093 - Comparative trophodynamics of small pelagic fish species in the Benguela Current and Humboldt Current upwelling Systems

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