THE ANSWER MUST BE RED CRABS, OF COURSE.

In the March issue of *Oceanography*, Peter Etnoyer et al. (2004) discuss the location and seasonality of frontal systems in the eastern Pacific that they identify by analysis of slope functions in satellite SST images. They then invoke the complex of fronts that occurs to the west of Baja California as a "hot spot" where tuna, marlin, whales and other pelagic organisms preferentially aggregate. They ask why this should occur, and what these large organisms might be eating? Something, they suggest, draws such species to the Baja California region from far away.

The answer must be, of course, largely the pelagic red crab *Pleuroncodes planipes*, long known as "whale feed" or "lobster-krill" (Matthews, 1932). This galatheid crab resembles a small, red lobster 2-3 cm in length, and is extraordinarily abundant in this region. Other galatheids are widespread in the benthos of continental shelves, but *P. planipes* has an almost unique ecology: adults are capable of very extended pelagic existence. Related forms, such as *Munida gregaria* of the Southern Ocean, are pelagic only up to the megalopa larval stage, while *P. monodon* of the Peru Current appears to be more strictly benthic in the adult stage.

Red crabs are unlikely looking pelagic organisms, but nevertheless they are very successful in the pelagos, capable both of filter-feeding on diatom blooms in green water, and also of "snatching" copepods and other plankters in clear offshore water. Filter-feeding is done by a sweeping movement of the brush-like second maxillipeds against a current that emerges from the branchial chamber: grazing experiments suggested a filtration rate exceeding 250 liters per day (Longhurst et al., 1967). Grazing by *P. planipes* may represent less than 90 percent of all herbivore consumption in upwelling cells of green water off Baja, the individual crabs alternately tail-flipping to the surface and then parachuting down, actively sweep-netting as they go, day and night, tirelessly.

The general distribution of red crabs in the eastern Pacific is well known from survey data including, but not restricted to, the California Cooperative Oceanic Fisheries Investigations (CalCOFI) grid, the Eastern Tropical Pacific (EASTROPAC) expeditions (1967-1968), and the work of the Scripps Tuna Oceanography Research (STOR) group in the 1960s (e.g., Beklemishev, 1960; Longhurst, 1966). Red crabs are most abundant (greater than 100 individuals per standard CalCOFI net tow) in cells and filaments of upwelled water off Southern Baja California and 70 percent of their occurrences in surveys are in water of 16-21°C. The extreme temperature range of their habitat is 9-28°C.

It was originally thought that most individuals return to the benthic phase on becoming adult, and circulation mechanisms have been identified by which this return might occur (Longhurst, 1966). But it was found that many adults may spend as much as two years in the pelagic phase, and are widespread as far as 1000 km SW of Cape San Lucas. It was first assumed that these individuals were lost to the population, but we later found that a second pelagic generation may be formed in these oceanic regions without recourse to the benthic habitat (Longhurst, 1971). This indicates that "snatch" feeding on sparse tropical oceanic plankton is sufficient to support satisfactory growth and maturation rates.

In the dynamic and changeable oceanographic regime of the California Current, it might be assumed that red crab populations would respond appropriately and, indeed, the monthly data from the CalCOFI grid from 1951-1962 show a northward shift of the population in response to the 1958-1958 El Niño Southern Oscillation (ENSO) warm-phase episode. In the cold phase, the population occurred only south of Line 123 at Punta Eugenia, while during the warm phase it extended to Line 80 near Point Conception. It is likely that similar data for other ENSO episodes could be recovered from the CalCOFI archives should anyone care to dig for them.

The best, generally available data on the distribution of large pelagic organisms are perhaps the French Institute of Scientific Research for Development in Cooperation (ORSTOM) atlas and presented in Fontenau (1997), which specifies the global distribution of yellowfin, skipjack, bigeye, and bluefin, spatially and temporally, from 1969-

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1993. Fontenau demonstrates unequivocally that there are two Pacific centers of distribution for yellowfin, in the southwestern and in the eastern regions of the ocean. But, although yellowfin are known to aggregate on red crab concentrations off Baja (Sund et al., 1981), their regional abundance is even greater to the south of that peninsula. In the California Current, yellowfin and skipjack consume red crabs almost exclusively (Alverson, 1963), but to the south red crabs are replaced by a small portunid swimming crab.

During STOR surveys in 1965, it was observed that yellowfin aggregate at the edges of upwelling cells, and are prevented from entering cold water except briefly by the thermal constraint of water less than 20°C (Blackburn, 1969). This physiological constraint of yellowfin suggests that it is not only physical aggregation of prey at convergent fronts that may lead to aggregation of large predators. Red crabs are, of course, subject to such aggregation, and may be found in linear concentrations at sea.

It is a pity that these early and intensive studies of this spectacular member of the fauna of the California Current should have been so quickly lost to view; the references offered here are no more than an entry into this literature. It is certainly true that only some of the relevant works of that period can be recovered from digital bibliographies, but the general problem runs deeper than that. If, as I do, you routinely scan the dates of references in review papers before to committing your time to reading them, you may have noticed that a curtain tends to come down around 1985-1990. Those who forget, or choose to ignore, the previous century of solid observations of the ocean and its biota may find themselves compelled to relive the past.

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We thank Alan Longhurst for his thoughtful and valuable addendum to our manuscript. We were remiss in overlooking these findings in our endeavor to document habitat functions for this pelagic system off Baja California, even though these findings support our methods and results. Dr. Longhurst's contribution shines a light on the base of the food chain in this complex pelagic habitat, and opens many doors to past and future avenues of investigation. This contribution regarding Pleuroncodes planipes, *yellowfin tuna, and skipjack tuna almost doubles the number of species we listed as "highly abundant" in and around the Baja California Frontal System. We know there will be many more species added to the list in the future.*

We encourage Dr. Longhurst and others to insert their experience and knowledge into our work (and that of others) when we have not recognized it properly. There is a definite need to better incorporate traditional surveys of past generations with the contemporary technologies of this generation. We encourage government and non-government funding agencies to support digital access initiatives that deepen online archives. We will always admire and value input from esteemed colleagues who contribute to science and management issues after a long and distinguished research career, and we are reminded to better recognize the fruits of their labors wherever we can.

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Your comments are welcome. Address correspondence to Dr. Ellen Kappel, Editor at ekappel@geo-prose.com. We reserve the right to publish letters and to edit for clarity and length. Please include a telephone number, email, and postal address.