Environmental Data In Marine Mammal Studies

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As part of its basic mission of managing marine resources, the National Marine Fisheries Service studies the biology and ecology of marine mammals. Environmental data can be used to interpret changes in distribution, diet, behavior, and movement of marine mammals. The example presented here is drawn from work on dolphins in the eastern tropical Pacific, and shows how environmental data have been used (1) to describe dolphin habitat quantitatively, and (2) to improve estimates of population size.

From 1986-90, line-transect surveys were carried out in the eastern tropical Pacific to estimate dolphin abundance. Oceanographic variables were measured concurrently with cetacean sightings. A canonical correspondence analysis of dolphin sightings and environmental conditions showed that the first canonical axis, associated with cooler, denser, higher chlorophyll water, separated sightings of common dolphins from spotted and spinner dolphins. Habitat scores based on this analysis indicated that favorable habitat for spotted dolphins expanded in the moderate El Niño year of 1987, and contracted in the strong anti-El Niño year of 1988. The opposite was true for common dolphins, which prefer upwelling-modified water. Such interannual changes in the amount of "good" habitat may cause short-term changes in the apparent abundance of dolphins, and programs to monitor population size should take account of this. Several abundance response indices are suggested, and adjusted indices of abundance, based on weighted combinations of the original line-transect estimates and the environmental information are computed. We conclude that some of the interannual variability in estimated population sizes can be explained by environmental variability.

Remotely Sensed Ocean Surface Currents: Agreement with Satellite Observations of Coastal Upwelling and Ecological Implications

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Remote sensing is an increasingly important tool in ecology. High Frequency (HF) radar is a relatively new remote sensing technology capable of providing synoptic observations of surface currents in the coastal ocean. These currents supply nutrients and recruits to biological populations, but are difficult and expensive to measure by conventional means, such as subsurface moored instruments and drifters. Here we provide vector fields of surface currents synthesized from HF radar observations, and compare these vector fields with maps of sea surface temperature derived from satellite-based Advanced Very High Resolution Radiometer (AVHRR) sensors to show that HF radar successfully detects and tracks coastal upwelling processes. Data from field surveys show correlation between oceanographic structures observed by HF radar and the distribution of planktonic fish and invertebrate larvae. Larval fish, in particular, are abundant in convergence zones detected by HF radar. Also, the single major recruitment event of barnacles to a rocky intertidal habitat near the HF radar observation range was linked to a relaxation and reversal of upwelling currents detected with the HF radar. These results demonstrate that data from HF radar can support improved prediction of ecological population dynamics and other coastal processes.

NOAA Technical Memorandum NMFS

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APRIL 1997

CHANGING OCEANS AND CHANGING FISHERIES: ENVIRONMENTAL DATA FOR FISHERIES RESEARCH AND MANAGEMENT A WORKSHOP

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NOAA-TM-NMFS-SWFSC-239

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