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STUDY TITLE: Ecological Characterization of Shallow Subtidal Habitats in the North Aleutian Shelf.

REPORT TITLE: Ecological Characterization of Shallow Subtidal Habitats in the North Aleutian Shelf.

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KEY WORDS: North Aleutian Basin; St. George Basin; Navarin Basin; North Aleutian Shelf; Bering Sea; biology; subtidal; characterization; habitat; community; epifauna; infauna; sea otter; Enhydra; fish; hydrography; sediment; grain size; aerial observations; feeding; macrophytes; migration.

BACKGROUND: The U.S. Department of the Interior requires a wide range of baseline environmental information prior to making decisions regarding leasing of offshore lands. The North Aleutian Shelf and Bering Sea are generally considered as some of the most productive fishing grounds in the world, and support extensive populations of marine mammals, including sea otters. The potential impacts of oil and gas activities on the sea otter need to be addressed due to their threatened status and ecological role as a top carnivore. This study integrated information about epifaunal and infaunal communities with sea otter population activities in the North Aleutian Shelf to better assess the potential for direct and indirect impacts related to offshore development.

OBJECTIVES: (1) To describe the physical environment, dominant epifaunal and infaunal communities, and local sea otter population; (2) To describe the diet of sea otters and common flatfish species; and (3) To describe potential impacts of oil and gas activities on sea otter-benthic interactions.

DESCRIPTION: This study was conducted in the North Aleutian Shelf and extended from Cape Mordvinof on Unimak Island to Cape Leontovich on the Alaska Peninsula, including the area from shore out to the 50-m isobath. Sampling for physical parameters, infauna, and epifauna was completed along 11 transects crossing four isobaths (10-, 20-, 30-, 60-m) in June, August, and October 1982. Temperature and conductivity were recorded using CTD systems. Sediment samples were collected using 0.25-m^2 Van Veen grab samplers. Three replicate cores taken from each grab were analyzed for percent silt, percent sand, percent gravel, mean phi, geometric mean diameter, and sorting index. Infaunal samples, also collected using Van Veen grab samplers, were sieved through a 1.0-mm screen then fixed and stained. These samples were sorted to major taxa then identified to the lowest possible taxonomic level and counted. Benthic epifauna were collected using a trynet trawl towed along the bottom for 20 minutes. Fishes and macroinvertebrates were sorted to the lowest possible taxon, weighed, and counted. These data were analyzed using cluster analysis to discern community patterns and analysis of variance for individual population trends.

The sea otter population was monitored by aerial survey along 43 transects flown at an altitude of 50 to 70 m during June, August, and October 1982 and in March 1983. Feeding studies were conducted on two numerically dominant fishes, yellowfin sole (Limanda aspera) and rock sole (Lepidopsetta bilineata),

as well as on sea otters. Fish gut samples from ten individuals of each species were collected during August along two transects in 30-m and 60-m water depths. Stomach contents were sorted to the lowest possible taxon and counted, then the volume was estimated. Sea otter diets were determined from scat samples collected in haulout areas. In the laboratory these samples were examined and food items were sorted to the lowest possible taxonomic level.

SIGNIFICANT CONCLUSIONS: The study area consisted of a broad continental shelf with fine sand characterizing nearshore areas and gravel more common offshore. Infaunal communities were distributed within particular depth zones and sediment types. Epifaunal community distribution and species composition were dictated mostly by depth and location. Sea otters were abundant from July to September and scarce from October to June. Sea otter movements and migrations were apparently correlated with movement of crabs and flatfishes, important prey items. Sea otters fed mostly on crabs, bivalves, fish, and possibly sand dollars. Impacts on sea otters associated with oil and gas activities would be greatest during summer months and near Izembek Lagoon where most otters were found.

STUDY RESULTS: Hydrographic measurements revealed that surface and bottom water temperatures ranged from 6.0 to 10.1°C and 5.0 to 9.5°C, respectively. Highest surface temperatures were recorded in August (9.0°C), followed by October (6.9°C) and June (6.6°C). Bottom temperatures followed a similar trend with highest temperatures recorded in August (7.9°C), followed by October (6.9°C) and June (6.1°C). It was evident that a thermal plume, originating in the Izembek area, moved through the study area.

The sedimentary environment was divided into depth zones. Shallow bottoms (10 m) were comprised of 93 to 99% well sorted sands while deeper areas (30 to 60 m) were heterogeneous, characterized by poorly sorted sand and gravel. Gravel content was highest in areas removed from embayments. Areas near coastal embayments consisted mostly of sand with little gravel. Infaunal samples were numerically dominated by polychaetes, molluscs, crustaceans, and echinoderms. Cluster analysis delimited three basic infaunal communities related to water depth and sediment type. Community I consisted of ubiquitous shallow water species occurring mostly on sand bottoms including the bivalve Siliqua patula, along with the polychaetes Capitella capitata, Magelona sacculata, Nephtys longosetosa, Scolopus armiger, and Travisia pupa. Community IIA, the deep sand/gravel community, was composed of sand-dwelling polychaetes Scolopus armiger and Spiophanes bombyx, as well as gravel-dwelling polychaetes Eteone longa, Glycera capitata, Megacrenella columbiana, Owenia fusiformes, and Polygordius sp.

Community IIB was the deep sand community which was characterized by the echinoderm Echinarachnius parma and polychaetes Ophelia limacina, Scolopus armiger, Spio nr. filicornis, and Spiophanes bombyx.

A total of 185 benthic epifaunal taxa were identified including 158 fishes, 121 invertebrates, and 6 plants. Twenty seven taxa represented 92% of the total sample biomass and included 14 fishes, 12 invertebrates, and 1 plant. Yellowfin sole and rock sole were the most frequently captured taxa occurring in at least 85% of the samples. Two invertebrate taxa, a hippolytid shrimp and a sea star Asterias amurensis, each occurred in 70% of the samples. Cluster analysis of epifaunal data resulted in five site groups which separated on substrate type and geographical location. Site groups IA1 and IA2 were characterized by adult flatfish Limanda aspera and Lepidopsetta bilineata inhabiting soft sediment. Site group IB1 was characterized by hard-bottom invertebrates such as hermit crabs, the sea star A. amurensis, the reef-building polychaete Potamilla reniformis, and the tunicate Boltenia ovifera. Group IB2 samples were numerically dominated by flatfish and sea star species found in group IAI but contained other taxa: drift eelgrass Zostera marina, juvenile codfishes, flatfishes, and hippolytid shrimp. Group II samples were characterized by highest mean biomass of L. aspera and the presence of young flatfishes. These samples were found only in shallow water areas off Bechevin Bay, Izembek Lagoon, and Port Moller. Major food items found in L. aspera stomachs were polychaetes, crustaceans, bivalve molluscs, and echinoderms. Utilization of these different prey items varied with depth and transect

location. L. bilineata diets consisted primarily of polychaetes, followed by bivalves and crustaceans. The primary difference between the diets of these two species was the greater use of crustaceans (amphipods) and echinoderms by L. aspera. L. bilineata consumed more polychaetes.

Sea otter abundance displayed significant spatial and temporal variability related to season, depth (or offshore location), and alongshore distribution. The largest population increase occurred between June and August in the Unimak and Izembek areas and into the Port Moller area. Abundance estimates for the survey months were as follows: August (10,325), June (1,880), October (4,737), and March (1,545). Seasonal migrations were evident and may have been related to migratory patterns of bottom fish and crabs. The most frequent items found in sea otter scat samples were crustaceans (crabs, shrimp, and amphipods), molluscs (clams and mussels), echinoderms (sand dollars), and fish. Only nine scat samples from one location were examined precluding a detailed analysis of sea otter diet. The distribution of epifaunal communities is primarily regulated by environmental factors, namely sediment and depth, and by sea otter predation. The seasonal and spatial distribution of sea otters seemed to be regulated mostly by season, secondarily by habitat, and thirdly by distance from the source of migrating animals.

STUDY PRODUCT(S): Cimberg, R. L., D. P. Costa, and P. A. Fishman. 1984. Ecological Characterization of Shallow Subtidal Habitats in the North Aleutian Shelf. A final report by VTN Oregon, Inc., University of California, and Fishman Environmental Services for the U.S. Department of the Interior, Minerals Management Service Alaska OCS Region, Anchorage, AK and the U.S. Department of Commerce, National Oceanic and Atmospheric Administration, OCS Environmental Assessment Program, Anchorage, AK. Contract No. AA851-IA2-04; Research Unit No. 623. 196 pp.

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