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FAUNA OF OFFSHORE STRUCTURES

Offshore oil platforms and ocean outfalls attract a variety of marine organisms and thus function as artificial reefs, although not intended for this purpose. Many of these structures were placed on soft-substrate bottoms and differ greatly from each other in structural complexity and depth. We believe that a comparison of the fauna of oil platforms and ocean outfalls with that of natural soft- and hard-bottom habitats will help to determine how these structures alter the natural communities.

During 1975, scientists from the Coastal Water Project, Scripps Institution of Oceanography, and International Biological Consultants (under the sponsorship of the Institute of Marine Resources, University of California) conducted a series of field surveys to describe the marine life associated with Oil Platforms Hilda and Hazel in the Santa Barbara Channel (Mearns and Moore 1976; Bascom et al. 1976). Scientist-divers equipped with television and 35-mm cameras documented the abundance and diversity of fishes and invertebrates at the platforms as well as at control sites. The Coastal Water Project had also initiated a study in 1974 to describe the fauna associated with deepwater outfall pipes (60- to 100-m terminus) in Santa Monica Bay (Alien et al. in press). The divers used both scuba equipment and submersibles to examine the pipes, and they documented their observations with 35-mm photographs.

COMMUNITY STRUCTURE

The fauna of the oil platforms and outfall pipes consists primarily of rocky bottom species, which differ greatly from those of the surrounding soft-bottom area. Dominant organisms on both structures include attached suspension-feeding invertebrates (mussels, hydroids, gorgonians, and anemones), motile scavenging invertebrates (crabs, shrimp, starfish, and gastropods), and fishes that seek refuge in rock holes and crevices (sculpins, bottom-living rockfishes, and greenlings). Away from both structures, the dominant soft-bottom species (Mearns et al. 1976) are suspension-feeding invertebrates (sea pens, tube anemones, polychaetes, and clams), motile scavenging invertebrates (crabs, shrimp, starfish, gastropods, sea urchins, and sea cucumbers), and benthic fishes (flatfishes, sculpins, combfishes, and benthic rockfishes).

Although many families and classes are represented on both rocky and soft bottoms, the species occurring in each habitat are usually different (Table 1). Most of the species found on a soft bottom do not require a hard surface for attachment and generally are capable of hiding beneath the sediment or, if exposed, of protecting themselves from predation; in contrast, most hard-substrate organisms require a hard surface for attachment or crevices or holes for refuge or ambush.

Schooling fishes, particularly rockfish and perch, are more often found near artificial structures than over any particular area of the soft-bottom. Most species probably utilize these structures as a point of reference for their schools or as a source of food organisms.

We found that there are 20 to 50 times more fish under the oil platforms than over a soft-bottom control of the same area; the platform areas have five times more fish than the hard-bottom control area; and fish abundance on the hard-bottom control area is 4 to 10 times that of the soft-bottom control Although no careful fish abundance estimates were made along the outfalls, shallow-water portions of the out-fall pipes probably had the same number of fish as the hard control areas. Deep-water portions of the pipes, however, have considerably more fish than the shallow portions because of the presence of many schooling species.

The oil platforms provide a more complex habitat than outfall pipes because they extend to the surface, giving both vertical relief and a shady "canopy" similar to that of kelp beds. It is this vertical relief and the attached invertebrates that attract many schooling and aggregating water-column fishes such as the olive rockfish (*Sebastes serranoides*), blue rockfish (*Sebastes mystinus*) , and white seaperch (*Phanerodon furcatus*) . These species represent 30 to 40 percent of the 20,000 to 30,000 fish found near each platform in the summer months. In contrast, water column fishes were not frequent at similar depths along the outfalls. The presence of the schooling fishes probably helps to support an abundant lingcod (*Ophiodon elongatus*) population on the platforms; this large ambushing predator was not observed along the outfall pipes.

The colonial anemone (*Corynactis californica*) was abundant at certain depths along both structures, but gorgonians (*Lophogorgia chilensis* and *Muricea* spp.) were abundant only along the outfall pipes (gorgonian abundance may be related to the amount of horizontal substrate available). The pipes themselves differed in gorgonian diversity; *Muricea* spp. Were infrequent along the sludge pipe, which is only one-sixth the diameter of the effluent pipe. The pile of cuttings (rocks and muds brought up in well drilling) beneath the platform had a very abundant bat star (*Patiria miniata*) population, as well as detached clumps of mussels.

The fauna near the platforms (which are in relatively shallow water) and that along portions of the outfall at the same depths differed somewhat from the fauna at the hard-bottom control areas (located in shallow water near Santa

Barbara), particularly with respect to the fish population. At the control site, senoritas (*Oxyjulis californica*) and silver surfperch (*Hyperprosopon ellipticum*) were the most abundant water-column species, and the dominant platform species, the olive rockfish, was missing. While the most abundant shallow-water, bottom-living rockfish at the platforms and outfalls was the brown rockfish (*Sebastes auriculatus*), the control area was dominated by the black-and-yellow rockfish (*Sebastes chrysomelas*). This reef was covered with the sea urchins, *Strongylocentrotus purpuratus* and *Strongylocentrotus franciscanus*, which were not abundant on the platforms themselves but were common on the cuttings piles beneath the platforms.

DEPTH EFFECTS

Platforms and outfall pipes showed certain differences in faunal composition that are related to differences in the depths range covered by each structure. The California mussel (*Mytilus californianus*), commonly found intertidally, was the dominant sessile organism on the platforms at depths from the surface to 8 m; mussels are not observed on the outfall pipes within the depth range sampled (10 m and deeper). The large white sea anemone (*Metridium senile*) are found on the lower part of the platforms from 12 to 20 m but only occur along the outfall pipes at depths greater than 50 m. This suggests that there may be a geographic variation in the depths range of these anemones within the Bight, with Santa Barbara populations being found in water shallower than that inhabited by Santa Monica Bay populations. The anemone feeds on particulates suspended in the water column, and the dense populations along the outfall pipe may be feeding on suspended sewage particulates. Because the outfalls ex-tend to 60 and 100 m and the platforms studied are at 30-m depths, the outfall fauna contains more deep-water species, in particular, rockfishes such as the bocaccio (*Sebastes paucispinis*), vermilion rockfish (*Sebastes Miniatus*), and shortbelly rockfish (*Sebastes jordani*).

SIZE OF ORGANISMS AND FISHING POTENTIAL

Platform populations of several species included some extremely large individuals. We found a California mussel 25 cm in length and a starfish, *Pisaster giganteus*, with a diameter of 75 cm: Both of these specimens were larger than the previously recorded maximum size for their species.

Many of the fishes found at both structures can contribute to the sport fishery. Young and subadult rock-fishes, kelp bass and perch are abundant and will presumably add to the sport fishery in several years. We estimate that about one-quarter of the fish seen at each structure were already of suitable size for fishing. Notable was the occurrence of about 50 lingcod on each platform. Rockfish near the Hyperion outfall are already under fishing pressure.

CONCLUSIONS

The fauna around the offshore structures is considerably more abundant than that of the surrounding soft-bottom area. The species composition at the artificial structures differs from that of the soft bottom, because these attract species that require a hard surface for attachment or crevices for refuge. As least in shallow water, the fauna around the oil platforms are more abundant and diverse than that of the outfalls and hard-bottom control areas. The species composition at both structures varies with depth.

We believe that our rather brief but detailed inventory of the fauna of the oil platforms and photographic exploration of the wastewater discharge pipes is an important step toward understanding the life that develops on and around man-made structures in southern California.

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Biologists examining the mass of life on oil platform Hilda found several examples of giantism, including starfish with an 80-cm spread.

Robert Evans, La Mer Bleu Productions, Santa Barbara

Robert Evans, La Mer Bleu Productions, Santa Barbara

On the sea floor beneath oil platform Hazel (left), the mound of cuttings left by the drilling in the early 1960s is covered thickly with the shells of large mussels, many still living. The flower-like anemone, ***Metridium senile***, characteristically lives where food is abundant. The shaded waters beneath Hilda (below) are teeming with fish. Nearly 40 percent of the twenty to thirty thousand fish beneath this platform are rockfish.

Robert Evans, La Mer Bleu Productions, Santa Barbara

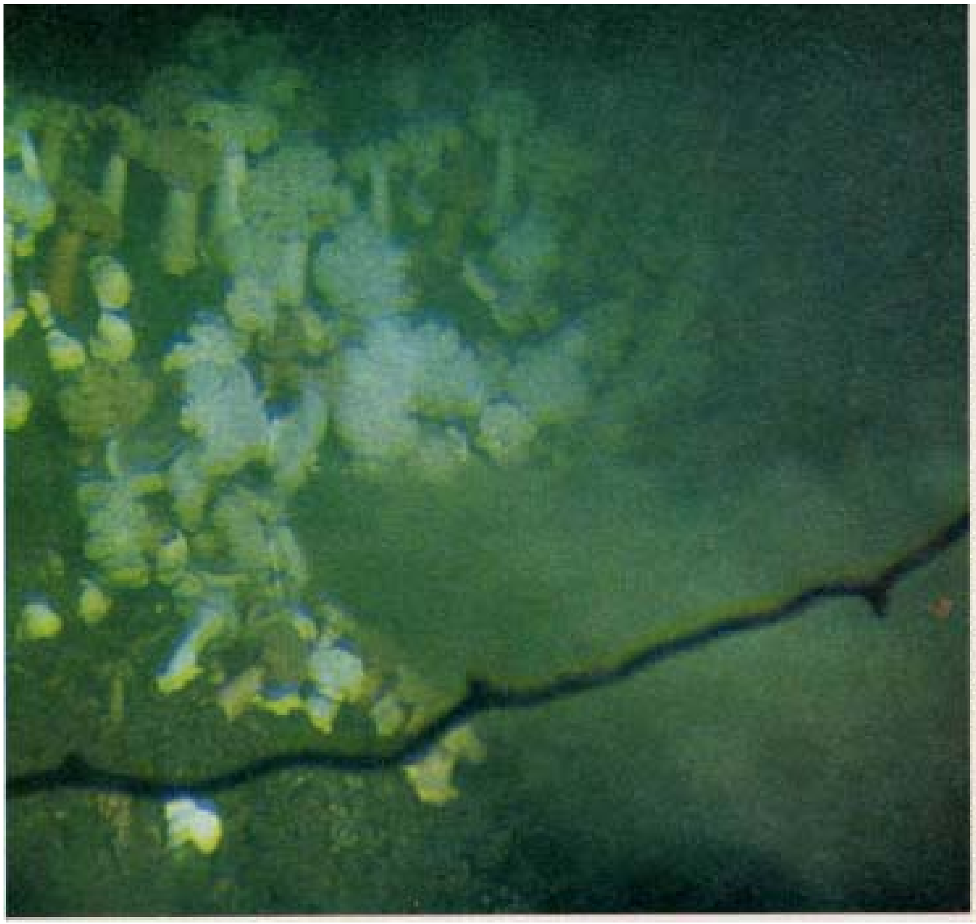
Table 1. Dominant organisms at 10 to 30 m on four habitats in southern California.

Species	Oil Platform	Outfall Pipe	Rocky Bottom	Soft Bottom
Sessile Invertebrates				
Sea anemone *(Anthopleura elegantissima)*			•	
Sea anemone *(Corynactis californica)*	•	•	•	
Sea anemone *(Metridium senile)*	•			
Tube anemone, Ceriantharia sp.				•
Gorgonian *(Lophogorgia chilensis)*		•		
Gorgonian *(Muricea* sp.*)*		•		
Sea pen *(Acanthoptilum* sp.*)*				•
Sea pen *(Stylatula elongata)*				•
Mussel *(Mytilus californicus)*	•			
Motile Invertebrates				
Crab *(Cancer anthonyi)*		•		•
Starfish *(Astropecten verrilli)*				•
Starfish *(Luidia foliolata)*				•
Starfish *(Patiria miniata)*	•			
Starfish *(Pisaster giganteus)*	•			
Starfish *(Pisaster ochraceus)*			•	
Sea urchin *(Strongylocentrotus franciscanus)*			•	
Sea urchin *(Strongylocentrotus purpuratus)*	•		•	
Fishes				
Brown rockfish *(Sebastes auriculatus)*		•		
Black-and-yellow rockfish *(Sebastes chrysomelas)*			•	
Blue rockfish *(Sebastes mystinus)*	•			
Olive rockfish *(Sebastes serranoides)*	•			
Silver surfperch *(Hyperprosopon ellipticum)*			•	
White seaperch *(Phanerodon furcatus)*	•			
Señorita *(Oxyjulis californica)*			•	
Speckled sanddab *(Citharichthys stigmaeus)*				•
English sole *(Parophrys vetulus)*				•
Hornyhead turbot *(Pleuronichthys verticalis)*				•

The 3.5-meter diameter Hyperion outfall pipe offers a hard stratum that attracts sea life. Some of the *Metridium senile* grow to be almost a meter high, and rockfish abound.

Harry Pecorelli, Aqua-Contractors and Oceanographics, Inc., Redondo Beach

A jet of wastewater issues from amid a crowd of *Metridium senile* growing on the diffuser section of the Hyperion outfall.



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