

OBSERVATIONS WITH A BAITED MOVIE CAMERA

The kind and number of benthic organisms that live California coastal waters, particularly the larger is a subject of intense interest. In the past, we mainly on data from daytime trawl and grab samples questions have been raised as to whether or not these complete story. Trawl nets may be avoided by the more active bottom fish. The benthic grabs sample small area of the bottom. And both trawl and grab tell us little about major population changes that from day to night as organisms move in and out of Thus we are trying new techniques to identify the invertebrates; one such technique is the use of a underwater movie camera.

METHODS

The camera equipment used in this experiment was developed at Scripps Institution of Oceanography by Professor John D. Isaacs and Richard Shutts for use in deep water and generously loaned to us at cost. Mr. Shutts personally brought and operated the cameras. The "Sea S Dee," of the Los Angeles County Sanitation Districts, served as the camera launch and recovery platform.

Generally, the system operates as follows: First, the self contained camera, light, and bait package ([Figure 1](#)) is lowered to the bottom. At regular intervals, such as 7.5 minutes, the lights go on, and the camera photographs the area around the bait for, say, 15 seconds. After 24 hours, the entire system is retrieved. Between 26 November and 7 December 1973, we experimented with the system at 10 stations on the Palos Verdes shelf ([Figure 2](#) and [Table 1](#)). One drop was made at each station; Drop 10 was unsuccessful.

The camera arrangement shown in Figure 1 was developed for deep water as a free instrument (it returns to the surface on its own after a clock timer or a magnesium link releases the buoyed camera from its anchor), but we secured it to a surface buoy so that we could retrieve it conveniently.

The camera used was a Bell & Howell transport system with 400 foot film spools. The film was Ektachrome 7242, processed at Consolidated Film Industries with normal development. Lens aperture was f/2.8; critical focal distance was set at 8 feet. The three 250 watt lamps and the camera were powered by 20 Yardley nickel cadmium batteries.

The bait package was secured to a pole that held it in the camera's field of view. One objective of the study was to identify the fishes that feed on Dover sole (*Microstomus pacificus*), a flatfish known to have a high population density in the Palos Verdes area. Thus, two kinds of bait were used: Dover sole and rockfish. On six of the drops, the bait was accessible; it was placed in a protective cage on the remaining drops.

The number of "scenes" or samples (10 or 15 second exposures of film) in the films from the eight best drops ranged from 29 to 53; each scene was examined in detail by our

biologists. Some general results of the examination of scenes are given in the following paragraphs.

WATER AND SEDIMENT CHARACTERISTICS

There appeared to be as much or more particulate matter in the water column at the control stations as at the outfall stations. The bottom sediment was generally silty at all sites and easily stirred by passing fish (except at the rocky reef sites, Drops 5 and 6). On several occasions in the films from both areas, we noted a flocculent white precipitate in the water column.

The particulate matter in the water allowed us to make some observations on water movement in three of the films. The current showed abrupt scene to scene changes in both direction and velocity of movement of particulates. At the deepest station (Drop 9), the water velocity was low, but the direction of its movement changed frequently between scenes and during a scene.

DEPTH DIFFERENCES IN SPECIES COMPOSITION

All of the films included scenes of fish, crabs, shrimp, snails, urchins, and other organisms: Forty species of fish and 19 species of invertebrates were tentatively identified in the scenes (Southern California Coastal Water Research Project 1973).

The inshore rocky reef stations (Drops 5 and 6) were occupied by the most diverse fauna ([Table 2](#)). In contrast, the deeper stations (61 and 137 to 152 meters) were occupied by only a few species at a time (crabs, snails, sablefish (*Anoplopoma fimbria*), bocaccio (*Sebastes paucispinis*), and shortbelly rockfish (*Sebastes jordani*)), and fish and invertebrates were rare at the 305 meter station. Most dramatic was the large abundance of sablefish at 61 meters. Sablefish are common but not abundant except at night in trawl surveys, and these films suggest that this is a dominant species.

DIFFERENCES IN SPECIES COMPOSITION AT CONTROL AND OUTFALL SITES

As shown in Table 2, there were no significant differences in the number of species at control and outfall stations of the same depth, except between the two inshore rocky reef stations (Drops 5 and 6). Blue rockfish (*Sebastes mystinus*), rock crabs (*Cancer antennarius*), senoritas (*Oxyjulis californica*), and blackeye gobies (*Coryphopterus nicholsi*) were common at both stations, but the control station, Drop 6, was occupied by a number of additional species, including swell sharks (*Cephaloscyllium ventriosus*), spiny dogfish (*Squalus acanthias*), rosy rockfish (*Sebastes rosaceus*), treefish (*Sebastes serriceps*), whitebelly rock fish (*Sebastes vexillaris*), painted greenlings (*Oxylebius pictus*), kelp bass (*Paralabrax clathratus*), white seaperch (*Phanerodon furoatus*), and yellow crabs (*Cancer anthonyi*).

DAY/NIGHT DIFFERENCES IN SPECIES COMPOSITION

The films from each of the nine successful drops included both day and night observations, but the proportion of each varied depending on the time of the drop (Table 1). [Table 3](#) shows the times of day that we observed the species most common in the films.

At the inshore rocky shelf station in the control area (Drop 6), there was a marked progressional change in the fish fauna during dusk. As shown in [Figure 3](#), senioritas, blackeye gobies, and blue rockfish gave way to treefish, whitebelly rockfish, and swell sharks after dark.

BEHAVIORAL OBSERVATIONS

The films showed that there was a great deal of interest in the bait at all stations. But, possibly because of the lights, only spiny dogfish, sablefish, Pacific hagfish (*Eptatretus stout*), and yellow crabs were actually filmed eating the bait. Baits that were accessible were generally consumed during the daylight hours (the bait was not consumed at either of the inshore stations, Drops 5 and 6). Of the two types of bait, the Dover sole was eaten in one half the time the rockfish baits were consumed.

The films revealed interesting types of behavior and interactions among the species. For example:

- One pointer crab (*Mursia gaudichaudii*) approached several sea urchins (*Allocentrotus fragilis*) that were crawling over the bait cage and bait pole and poked and pushed them repeatedly with its chelipeds. It finally dislodged one urchin, which rolled upside down. The crab then ignored it and went to another urchin, which it overturned. It repeated this behavior twice again, always ignoring the urchins as soon as it had removed them from the bait cage or pole.
- Sablefish were often seen resting on the bottom during the day. They swam upward and away when the camera lights went on at the beginning of a scene.
- In the film from Drop 7, sablefish were observed in every scene except one in which a spiny dogfish was present. This may indicate that these two species avoid each other. In the same film, a shortbelly rockfish was present and seemed to dart away from both the sablefish and spiny dogfish.
- The spiny dogfish was seen at night only at the inshore control station (Drop 6). At deeper stations, this species was observed during the daylight filming and once at dusk. This suggests an inshore movement of this species after dark, a conclusion born out by experienced fishermen.
- Hundreds of small, light colored snails (probably *Nassarius sp.*) littered the soft bottom at all depths and appeared to be attracted to bits of the bait. The bait also attracted starfish (*Patiria miniata*), which moved in and then out again, to be replaced by urchins. As the urchins moved out, they were replaced by crabs (*Cancer* and *Mursia*).

- A stripetail rockfish (*Sebastes saxicola*) appeared to be feeding on the tube feet of urchins.
- The Dover sole was observed swimming actively at dusk. In day and night films, this species was present but appeared to be resting on the bottom.

SUMMARY AND CONCLUSIONS

The experimental cine camera survey produced different types of results than trawl surveys at the same depths in the same area. A trawl survey covering about 20 stations on the Palos Verdes shelf will generally produce 60 to 70 species of fish and nearly as many invertebrate species. The trawl rarely captures species from the reef areas, which were shown to have a diverse fauna in the films. Many species common in the trawl catches (speckled sanddabs (*Cithariakthys stigmaeus*) and other small bottom fish) were absent in the films. But the films showed much higher densities of sablefish, spiny dogfish, and crabs than have been found in daytime trawl catches. The baited camera thus appears to be a complement to trawls and other remote sampling devices. In addition, it provides information on behavior and day/night changes in the benthic fauna that could not otherwise be obtained except by much more expensive methods (diver or submarine observations). We are planning to apply this technique in a sampling program that will cover areas near and away from other outfalls in the coming year.

REFERENCES

- Shutts, R. 1973. Cinematography on the ocean floor. *Amer. Cinematog.* 54:462.
- Southern California Coastal Water Research Project. 1973. Baited camera observations of demersal fish. TM 207. E1 Segundo, Calif.

FIGURES

Figure 1.

Isaacs Shutts cine camera system (shown on ocean bottom) From Shutts 1973

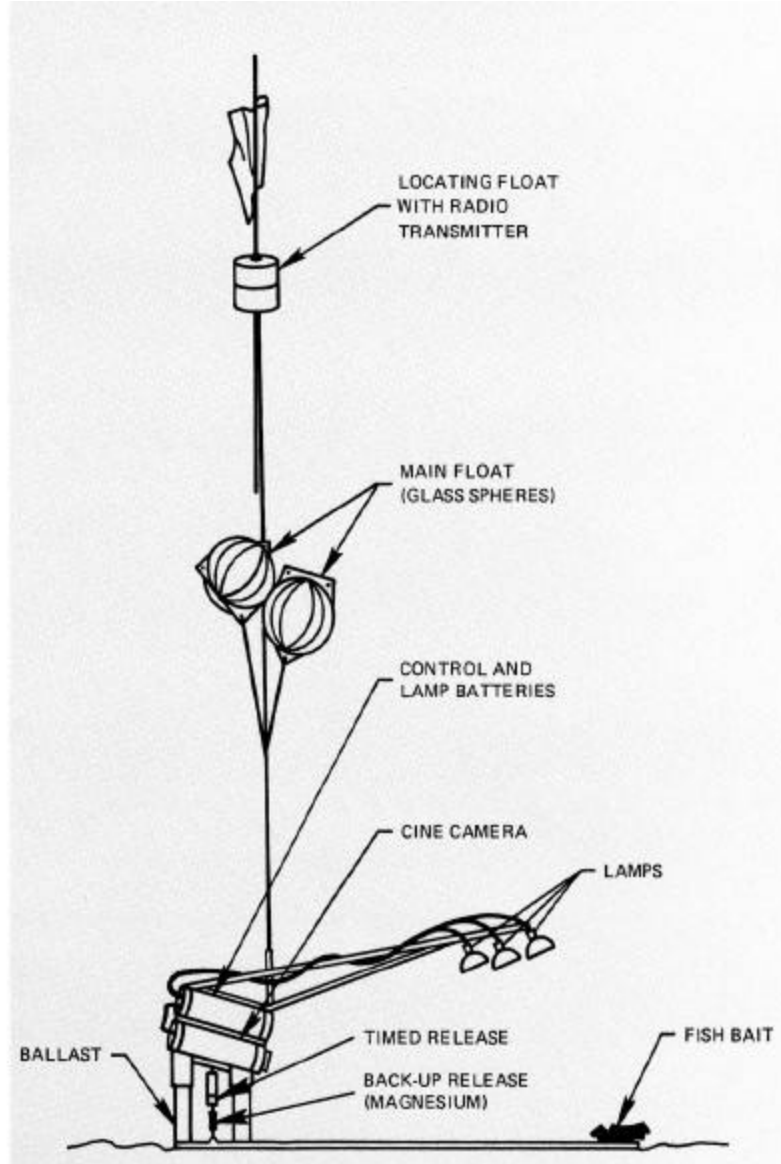


Figure 2.

Locations of cine camera drops, Palos Verdes shelf, 26Nov 7Dec 1973

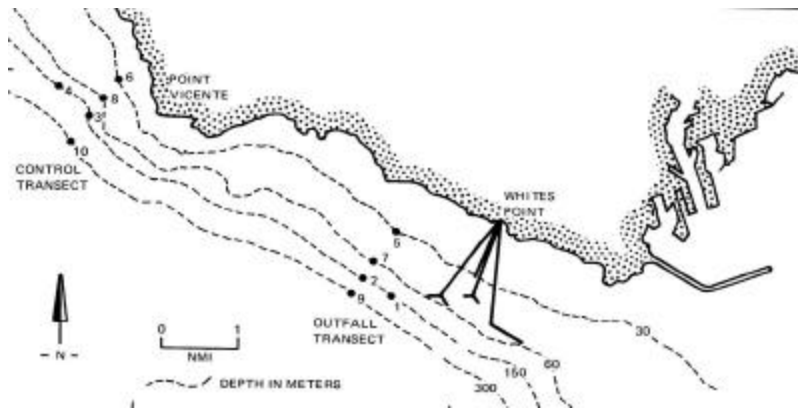
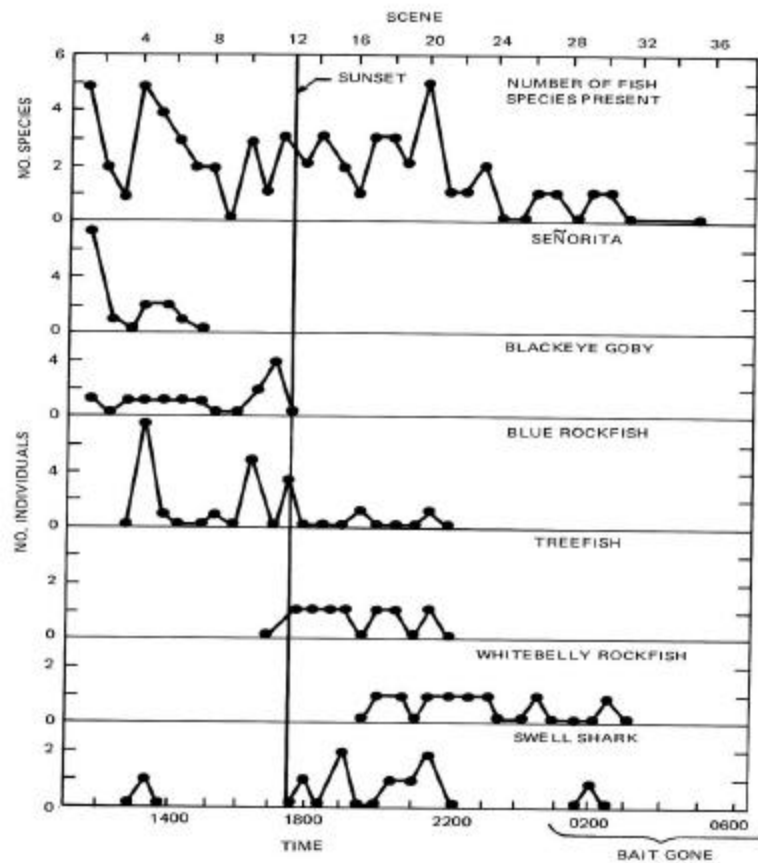


Figure 3.

Number of species per scene and activity patterns of six fishes observed off Pt. Vicente {Drop 6), 29 30 November 1973



TABLES

Table 1.

Time and depth of cine camera drops off Palos Verdes

Drop No.	Depth (m)	Time Span of Filming	Date of Drop
1	164	1600-2100	26 November
2	146	1530-2130	26 November
3	137	1200-1500	27 November
4	146-56	1200-0230	27 November
5	23	1045-0145	29 November
6	23	1130-0430	29 November
7	63	1100-1715	4 December
8	61	1100-1700	5 December
9	305	0915-1600	6 December
10	305	(unsuccessful)	6 December

Table 2.

Number of species observed in cine camera films off Palos Verdes

Depth	Fishes	Invertebrates	Total
23 meters			
Drop 6 (control)	16	6	22
Drop 5 (outfall)	9	5	14
61 meters			
Drop 8 (control)	1	3	4
Drop 7 (outfall)	5	2	7
137-152 meters			
Drop 3 (control)	6	3	9
Drop 4 (control)	6	3	9
Drop 1 (outfall)	5	6	11
Drop 2 (outfall)	3	7	10
305 meters			
Drop 9 (outfall)	3	2	5

Table 3.

Day/night differences in species composition observed in the cine camera survey off
Palos Verdes

Species		Common Name
	Species observed only during the night	
<i>Cephaloscyllium ventriosum</i>		Swell Shark
<i>Chilara taylori</i>		Spotted dusk-eel
<i>Sebastes serriceps</i>		Treefish
<i>Sebastes vexillaris</i>		Whitebelly rockfish
<i>Hyperprosopon argenteum</i>		Walleye surfperch
<i>Phanerodon furcatus</i>		White seaperch
<i>Zalembeus rosaceus</i>		Pink seaperch
Unidentified eel-like fish		
<i>Cancer antennarius</i>		Rock crab
<i>Cancer anthonyi</i>		Yellow crab
<i>Spirontocaris</i> sp.		Broken-back shrimp
<i>Kelletia kelletii</i>		Kellett's whelk
	Species observed only during the day	
<i>Eptaretus stouti</i>		Pacific hagfish
<i>Sebastes mystinus</i>		Blue rockfish
<i>Sebastes paucispinus</i>		Bocaccio
<i>Sebastes rosaceus</i>		Rosy rockfish
<i>Embiotoca jacksoni</i>		Black perch
<i>Xeneretmus latifrons</i>		Blacktip poacher
<i>Paralabrax clathratus</i>		Kelp bass

<i>Oxylebius pictus</i>		Painted greenling
	Species observed both day and night	
<i>Squalus acanthias</i>		Spiny dogfish
<i>Sebastes serranoides</i>		Olive rockfish
<i>Caulolatilus princeps</i>		Ocean whitefish
<i>Oxyjulis californica</i>		Senorita
<i>Microstomus pacificus</i>		Dover sole
<i>Patriia miniata</i>		Bat star
<i>Mursia gaudichaudii</i>		Pointer crab
Small Shrimps		