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THE KELP FORESTS OF PALOS VERDES PENINSULA 1982

Forests of giant kelp, *Macrocystis pyrifera*, off Palos Verdes Peninsula in Los Angeles County, are among the most interesting and diverse marine communities. They provide food and shelter for a multitude of marine fishes and invertebrates, many of which are of direct importance to sport and commercial fisheries. Records indicate that *Macrocystis* itself was harvested routinely from the Palos Verdes beds as early as 1932. Over the last four decades the condition and size of these kelp forests has fluctuated greatly. In 1928 they covered approximately 728 hectares (1,800 acres) of nearshore rocky substrate. Beginning in the mid-forties the Palos Verdes kelp forests began to deteriorate and by 1954 they had diminished to the point where commercial harvesting was no longer feasible. This deterioration continued, and by mid-1967 the last two adult *Macrocystis* plants died. However, in 1974, the kelp forests and associated biotic communities began to recover and by 1982 approximately 287 ha (700ac) of kelp forest existed (Figure 1). This paper summarizes and updates earlier writing on the conditions of Palos Verdes kelp forests and discusses some of the changes contributing to their return.

Many factors, both natural and man-generated, caused these major changes in the kelp forest and the dependent animal communities. Solids in the wastewater fromLos Angeles County Sanitation Districts discharged off White Point contributed substantially to the decline and eventual total loss of kelp forests surrounding Palos Verdes Peninsula. This is demonstrated by the excellent inverse correlation between the age of the kelp canopy and the amount of waste solids discharged (Figure 1). It is much harder to specify exactly which of the possible effects of solids is the worst offender; doubtless, all contributed to some extent. Among those suggested are: the siltation and burial of rocky surfaces by floc originating from both plankton, which increased in response to the eutrophicated conditions, and directly form the suspended solids in the sewage itself (Grigg and Kiwala 1970, Grigg 1978, DeVinney and Volse 1978, Meistrell and Montagne 1979); reduction in depth of euphotic zone by suspended materials (Peterson 1974); and high concentration of toxic chemicals (Mearns 1977).

Major declines in kelp forests have also been attributed to extended periods of abnormally warm ocean temperatures occurring from 1957 to 1959 (State Water Resources Control Board 1964), and overgrazing by sea urchins and other herbivorous animals (State Water Resources Control Board 1964, North 1976, Leighton et al 1966).

The extent to which each of the above factors contributed to the decreases in Palos Verdes kelp forests is not known. However, since 1971, improvements in Los Angeles County's sewage treatment facilities have substantially reduced the discharge of suspended solids. This has

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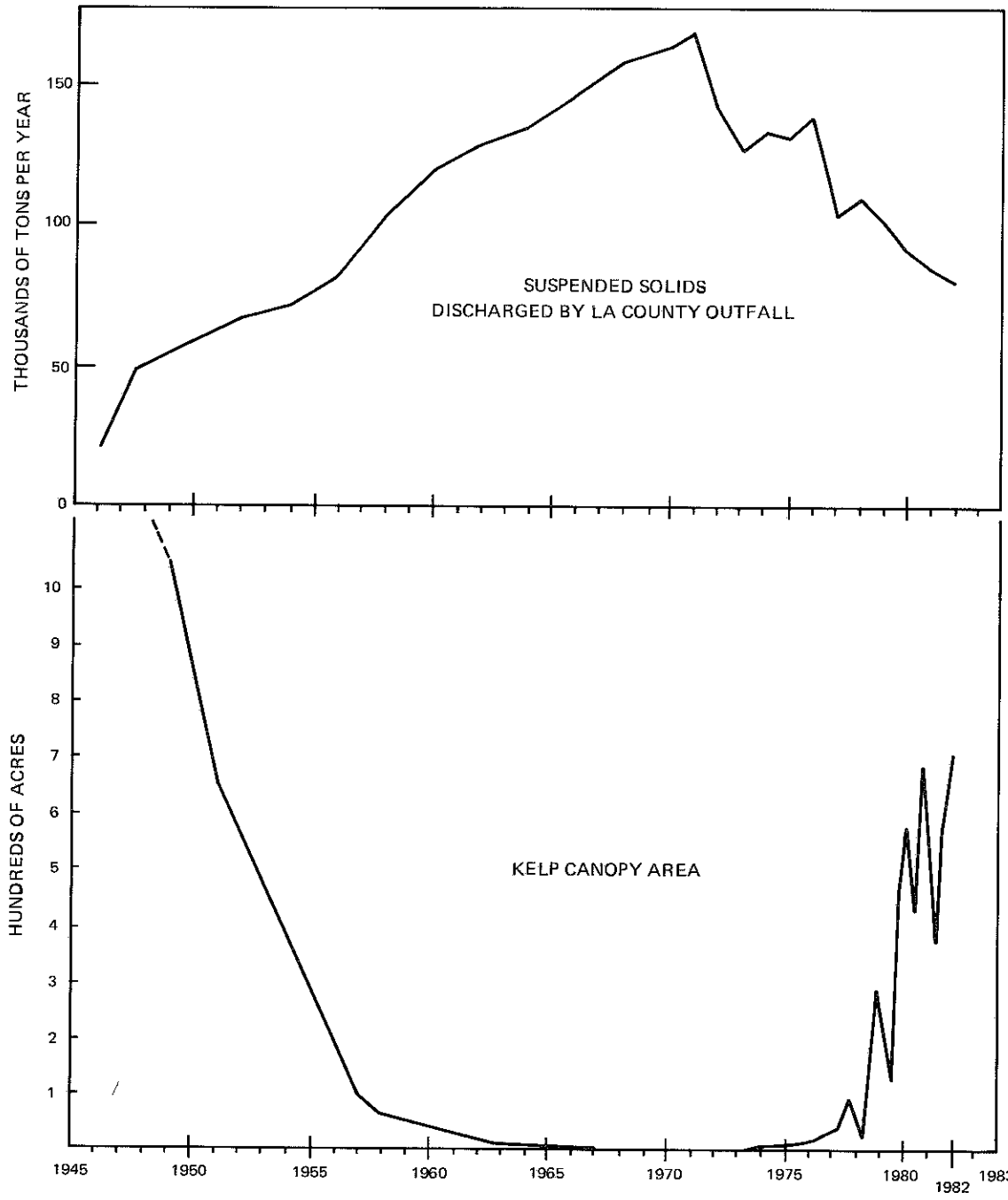

greatly benefited the kelp forests (Wilson et al.1978). Environmental changes contributing to regrowth of kelp were probably related to improvements in the quantity and quality of light available for growth of *Macrocystis* and to diminished substrate burial. Commercial harvesting of red sea urchins, *Strongylocentrotus franciscanus*, also contributed markedly to the return of substantial portions of the Palos Verdes kelp forest. Approximately 3.5 million pounds of red urchins (4.7 million individuals were harvested from urchin-dominated areas of Palos Verdes Peninsula since 1973 [Parker pers. comm.[1]]. Urchin fishing effort has been particularly heavy from Palos Verdes Point to Malaga Cove and from Portuguese Bend to Point Fermin in depths

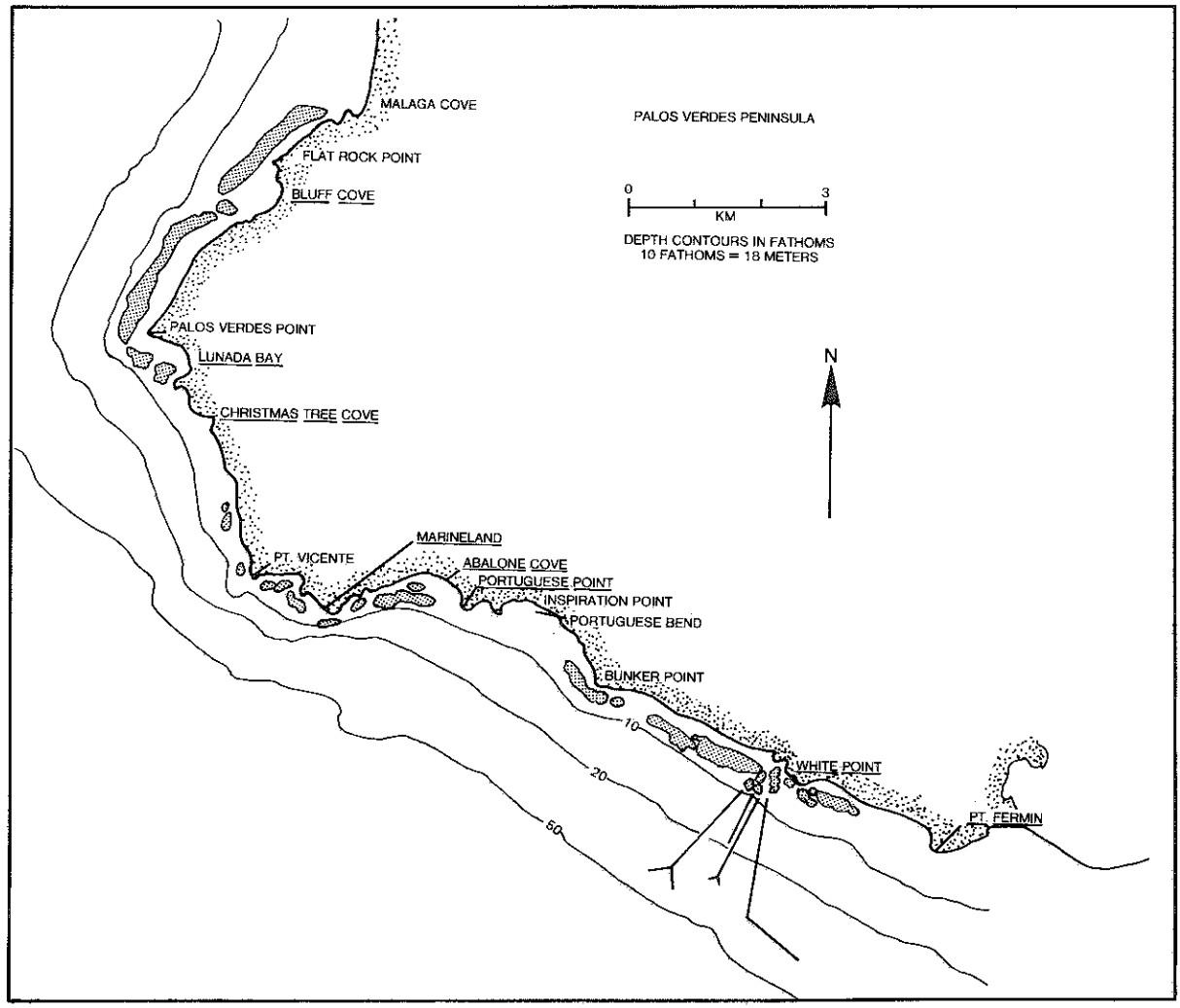

Figure 1. The Palos Verdes Peninsula kelp beds in mid 1982.

ranging from 4.6 to 10.7m (15 to 35 ft.). The remarkable recovery of kelp forests along these stretches of coast which followed initial kelp restoration efforts was undoubtedly influenced by the above factors.

Red sea urchin populations are diminishing along Palos Verdes in response to long-term intensive commercial harvesting pressure. However, extensive populations of purple sea urchins. *S. purpuratus*, and white urchins, *Lytechinus anamesus*, persist and appear to be increasing in many areas. Purple urchin-dominated ground, devoid of all fleshy vegetation, occur on approximately 128 ha (317 ac) of rocky substrate otherwise suitable for growth of kelp forests. These barren grounds occur at depths ranging from 1 to 6m (6 to 20 ft.) along approximately 12.3k (7.3 miles) of Palos Verdes coastline from Inspiration Point to Palos Verdes Point. Purple and white urchins are not harvested commercially and will continue to cause instability, loss of restored kelp beds, and will prevent recovery of former kelp beds in certain areas unless their numbers are controlled.

Suspended solids in LACSD White Point effluent increased from 16,752 mt/yr in 1945 to a maximum of 169,260 mt in 1971. Since then, because of the installation of modern solids removal facilities and improved sewage handling techniques, the amount of suspended solids

discharged has progressively decreased. By 1981, the level declined to 83,970 mt/yr which is approximately equal to 1956 levels. The inverse relationship between the amount of suspended solids discharged and the area of kelp forest is made quite clear by Figure 2. It is expected that this downward trend will continue once secondary treatment facilities, now under construction, and proposed additional solids handling facilities are in full operation.

We feel that a high intensity kelp restoration program coupled with further improvements in sewage treatment facilities will do much to enhance kelp forest habitat and associated marine resources of Palos Verdes Peninsula.

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