

## OUR VANISHING ESTUARIES

A. S. Boughey  
University of California  
Irvine, California

**Abstract:** Estuaries are among the most productive of ecosystems as a consequence of the relative abundance of water, and the continuous replenishment of nutrients. This high productivity supports a unique specialized plant flora, and an equally unique fauna of invertebrates and both resident and migrant birds. Figures are supplied of Audubon Society counts made on upper Newport Bay in Southern California illustrating the remarkable richness of these estuarine bird populations.

Various developments of upper Newport Bay are described, and similar estuaries between Los Angeles and the Mexican border discussed. It is recommended that conservation efforts be concentrated on preserving certain of the still largely undeveloped estuarine areas in this region,

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My talk this morning could equally well have been entitled "Death of an Estuary" because I want to confine my remarks more especially to Newport Bay, California. Like the other estuaries on the Pacific Coast, Newport Bay can be defined geomorphologically as a drowned river mouth. It is therefore tidal, and being tidal is a saline type of habitat and thereby distinct from the freshwater marshes of the hinterland. In a geological sense estuaries are recent, having been inundated by the rise in sea level which followed the last Ice Ages.

Estuaries such as Newport Bay and others along the Pacific Coast are extremely interesting both to the ecologist, to the wildlife conservationist and to the naturalist for two basic reasons. In the first place they rank with such other ecosystems as paddy rice fields, and irrigated sugar cane, in the top group of high productivity ecosystems. This high productivity is a result of a combination of ecological factors, of which the two most important are the abundance of water and the continuous replenishment of nutrients. As the water table in all estuarine areas is never far below the surface, water does not become a limiting factor to plant growth

as it does in so many other western habitats. The tides twice daily, or at least monthly, bring in fresh supplies of nutrients, and the rivers which still empty into many of the estuaries, at least seasonally, bring down further supplies of nutrients.

The other main ecological feature of the estuarine habitat is the wide and rapid fluctuations which can occur in the salinity of surface and ground water. This varies from a very low value when the parent river is coming down in flood, to a value higher than sea water when evaporation has concentrated pools or ponds. The organisms which occupy the salt marshes and tidal flats of an estuarine habitat are therefore adapted to tolerate a range of fluctuations in salt concentrations in soil and ground water which is not encountered in any other kind of habitat, except perhaps in salt pans.

This unique estuarine habitat, with its high productivity and wide range of salinity, is characteristically and uniquely exploited by a specialized flora of generally succulent plants, and an abundant fauna of invertebrates and both resident and migrant bird populations. Some aspects of the ecology of the migrant bird populations have recently been well described by H. F. Recher (1966, Some aspects of the ecology of migrant shorebirds, Ecology 47:393-407) as regards the San Francisco Bay area, Sonoma and Monterey Counties in California. Recher points out that the staggering of peak population densities among migratory shorebird assemblages, minimizes interspecific interactions and prevents the operation of the competitive exclusion factor.

The unique richness of this estuarine bird fauna is well brought out by examination of the Audubon Society counts which are carried out periodically in these as in other areas. Such a count made on December 27, 1965 by the Sea and Sage Audubon Society on Upper Newport Bay listed 102 bird species and some 23,000 individual birds. This did not include a further 45 species observed here at other times of the year but not figuring in the Christmas count. On the day of the count there were 2,630 pintail (Anas acuta), 2,884 shoveler (Spatula clypeata), and 2,628 ring-billed gull (Larus delawarensis). Among residents were 85 ruddy duck (Oxyura jamaicensis) and 710 American avocets (Recurvirostra americana). The more interesting visitors included 23 Canadian geese (Branta canadensis), and among the residents were eight black-necked stilts (Himantopus mexicanus).

This great aggregation of birds recorded in the Christmas count of the Audubon Society is characteristic not only of Newport Bay but also of other estuarine areas in southern California. As Recher has described, it represents the ever changing but always abundant population of shorebird assemblages which are the dominant consumer element of this highly productive ecosystem type. Other less conspicuous organisms play an equally essential

role in the estuarine complex of food webs. To the ecologist and marine biologist, these other organisms are of as uniquely great interest and concern as the bird assemblages are to the ornithologist, and destruction of their habitat causes equally grievous loss.

At the present time Upper Newport Bay has unfortunately been overtaken by the population explosion, and the bluffs above the bay are already being developed as high priced housing areas. A land swap agreement between Orange County, the City of Newport Beach and the Irvine Company has been approved by the State Lands Commission, and further development of the Upper Bay is now proceeding. The end result of this development will be to remove all the salt marsh and tidal flat habitats from the Upper Bay and replace them by concrete bulkheads, boat slips, a marina, a rowing course and a dredged channel. Only in two places will there be small areas of County parks, for which the plans presently prepared appear to include no significant areas of estuarine habitat. There is a possibility that two small islands could be created from dredged material, one inside the marina, and the other in the turning circle towards the upper end of the dredged channel. The situation of these areas in the developed bay is indicated in the attached diagram (fig. 1). As regards the great aggregations of birds presently dependent on the Upper Bay, the provision of two such small islands will have no significance. Such islands might however serve as suitable habitats for certain of the marine invertebrates which are able to colonize mobile situations, and to establish themselves in comparatively small areas.

In view of this imminent destruction of Newport Bay as an estuarine habitat, it is pertinent to examine the other estuarine areas between Los Angeles and the Mexican border. Immediately to the north of Newport Bay is Bolsa Chica Bay. The northwest end of this bay is within the boundaries of the U.S. Naval Weapons Station, and the southeast is being developed very rapidly because of the Huntington Harbor housing developments. This area, like most of the adjoining shore line, lies over an oil field, and oil wells have been drilled in the bay and are being operated at the present time.

Further south the next significant estuarine area also lies within a military establishment, the salt marshes and tidal flats at the mouth of the Santa Margarita River being within the boundaries of Camp Pendleton. This area is much disturbed by vehicle activity, and probably is of limited consideration for the future. Still further to the south however are a series of lagoons indicated on the attached map (fig. 2) which, apart from the embankments which have been thrown across them to carry the coast highway, the coast freeway or the railway lines, are not in a seriously disturbed or presently threatened situation. In a portion of the Buena Vista Lagoon south of Oceanside the Nature Conservancy has established a bird sanctuary. Unfortunately however a custom has seemingly developed

of feeding the birds at a particular point on the lagoon shore, so that considerable concentrations of many species are to be found sitting around on the beach waiting for handouts. The Agua Hedionda Lagoon, the lagoon behind Solano Beach, the San Elijo Lagoon, and the estuarine area immediately north of the Torrey Pines Park, are all still relatively undisturbed estuarine areas. The initiative has been taken to include part of the estuarine area adjoining the Torrey Pines to the north within this state park.

Further south the extensive estuarine salt marsh and tidal flats of Mission Bay have virtually been eliminated by development, and it has been possible to reserve only small portions of it. Huge flocks of black brant (Branta nigricans) which used to feed on eel grass (Zostera marina) beds in Mission Bay are no longer to be found there for the eel grass beds have gone.

The estuarine habitats between Los Angeles and the Mexican border listed here are or were major feeding areas on the Pacific flyway. Several, such as Mission Bay have already been virtually eliminated, Newport Bay is about to become so. The best approach for wildlife conservationists would appear to be to concentrate on preserving those remaining estuarine areas, such as that adjoining the Torrey Pines State Park, not already extensively modified or immediately threatened. Only in this way will it be possible to provide for the vast assemblages of resident and migratory shorebirds which once utilized these southern estuarine habitats on the Pacific Flyway, and maintain for posterity at least a portion of this unique estuarine habitat, its fauna and its flora.

Figure 1. Upper Newport Bay, showing (stippled) the present areas of tidal flat and salt marsh. The dotted lines indicate the planned boundaries of the realigned bay, and the two crosshatched areas at the end of the bay are proposed islands to be created by dumping dredged materials.

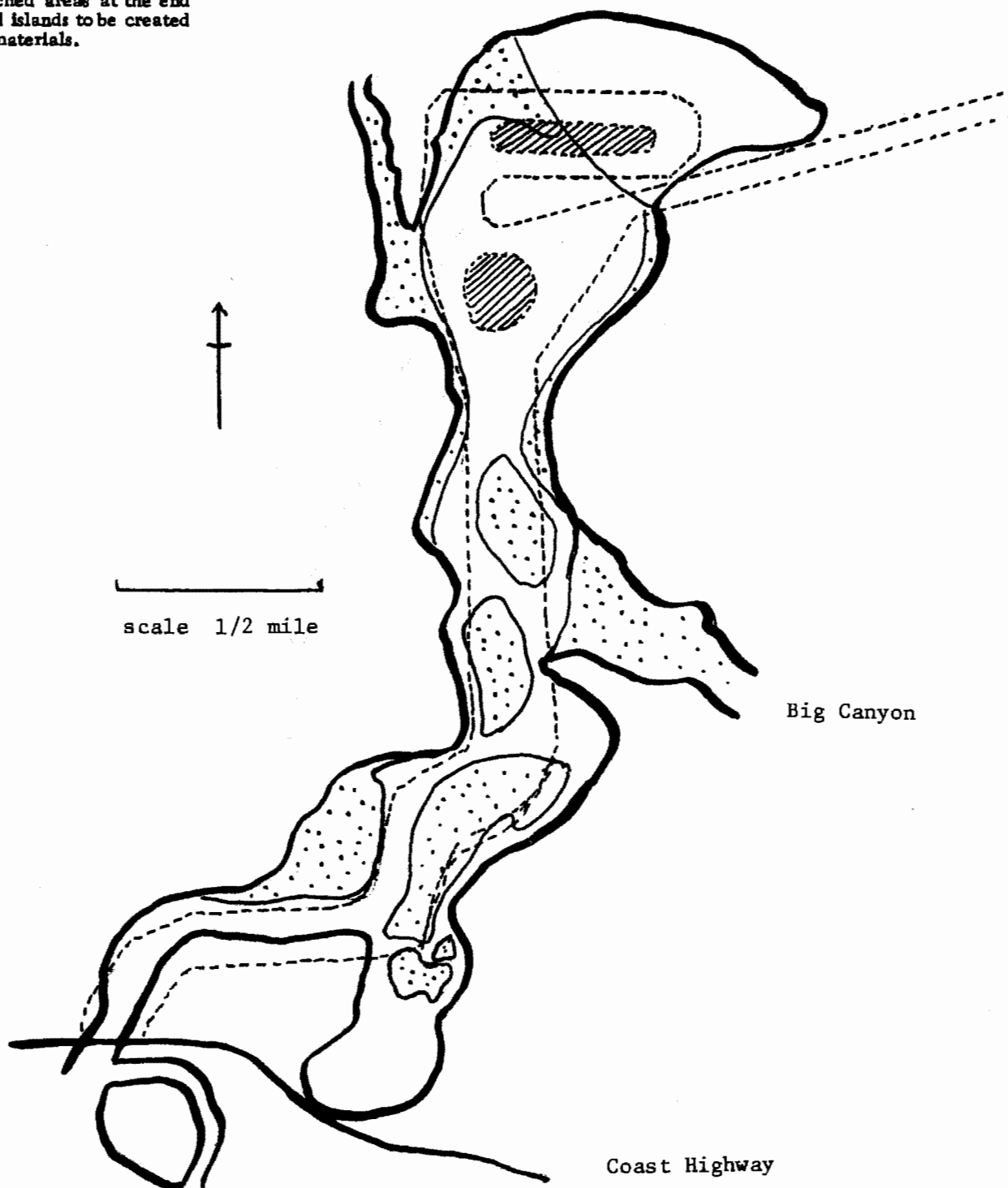


Figure 2. The coast line of Southern California from Oceanside to San Diego, indicating the position of the largest estuaries, and the Torrey Pines State Park.

