

# Preliminary List of the Marine Fishes and Other Vertebrate Remains from the Late Pleistocene Palos Verdes Sand Formation at Costa Mesa, Orange County, California

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## INTRODUCTION

Pleistocene marine deposits along the southern coast of California have produced the most diverse assemblages of marine fishes from any period of the Cenozoic in the western United States. The most extensive deposit, the late Pleistocene Palos Verdes Sand, was first collected by Arnold (1903), and later by Kanakoff (1956) who reported 28 taxa of marine fishes. Further excavations by Fitch (1970) yielded fossil remains of 18 taxa of elasmobranchs and 84 taxa of teleosts from several localities in southern California, including outcrops of the Palos Verdes Sand in Newport Beach, Orange County, California.

Unfortunately, these localities, and most other Pleistocene marine deposits reported by Fitch (1964, 1966, 1967, 1968, 1970) have since been destroyed by construction projects. However, a large-scale, long-term construction project in Costa Mesa, Orange County, California, opened a new locality, a southern extension of the late Pleistocene Palos Verdes Sand Formation, containing a wealth of vertebrates, including at least 41 species of marine fishes. Of these, six are first fossil records, and 19 species are southern records for the deposit.

## LOCALITY

Construction of an extension of freeway 55 along Newport Boulevard in Costa Mesa, Orange County, California, exposed a series of large and deep pits that cut into the southernmost extension of the Palos Verdes Sand. This excavation exposed several sections of highly fossiliferous marine sediments one to five meters thick. I collected at University of California Museum of Paleontology vertebrate locality V-93124, at the intersection of Newport Boulevard and the south side of Santa Isabel Avenue, approximately 33° 39' 26" N and 117° 54' 08" W (Figure 1). This locality has since been paved over and is no longer accessible.

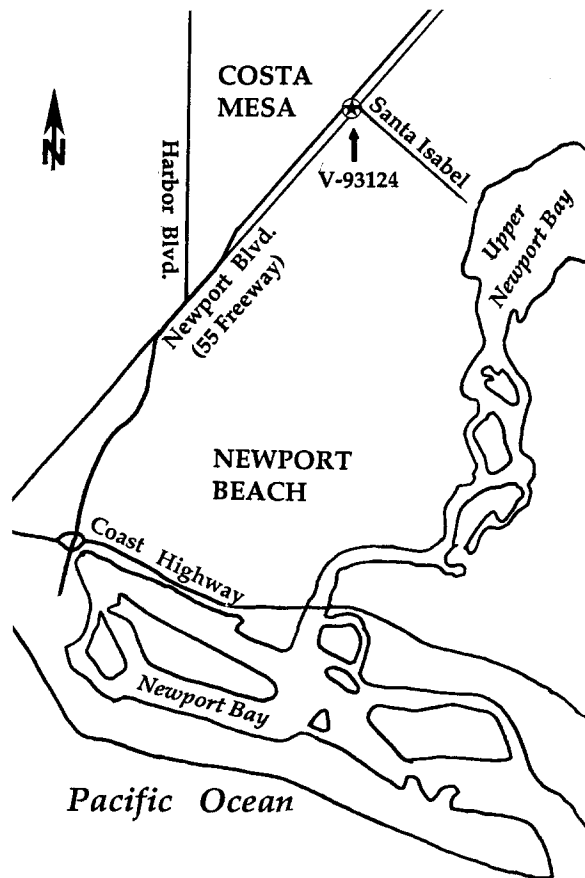


Figure 1. Map of the Costa Mesa-Newport Beach area (Orange County, CA) showing the location of site V-93124 (Late Pleistocene Palos Verdes Sand Formation) where specimens discussed in this paper were collected.

## AGE

Based on the invertebrate fauna, Mount (1981) estimated the age of the site to be roughly 120,000 years old. An outcrop of the Palos Verdes Sand from the San Joaquin Hills south of Newport Beach, possibly from the same horizon as the Santa Isabel site, was estimated to be about 120,000 to 130,000 years old (Barrie et al., 1991).

## METHODS

The deposit contained strata of very dry and friable sands, gravels, and uncemented shell hash. The exposed shell beds were dug and dry-screened on site using four sizes of mesh, the smallest being 40 mesh. The size-sorted matrix was later picked for vertebrate material, the smallest size fraction was picked under a stereomicroscope. Identifications of fish remains were based on recent comparative material in the University of California Museum of Paleontology Recent element collection, and from the private collection of M. A. Roeder.

## RESULTS

Aside from several reptile, bird, and mammal fossils (Table 1), this site produced 17 species of elasmobranchs and 24 species of teleosts (Appendix 1). Elasmobranch remains were represented largely by isolated teeth, but many vertebrae were identified to the species level, and large dermal denticles and tail barbs from batoids were also identified. Identifications of teleosts were based primarily on otoliths, teeth, jaws, vertebrae and some isolated diagnostic bones.

TABLE 1. List of non-fish vertebrates from the late Pleistocene Palos Verdes Sand Formation at Costa Mesa, Orange County, California.

### REPTILIA

*Clemmys marmorata* Western pond turtle

### AVES

*Gavia* sp. Loon

*Uria aalge* Common murre

*Diomedea* sp. Albatross

*Puffinus* sp. Shearwater

### MAMMALIA

*Lagomorpha* indet. Rabbit

*Enhydra lutris* Sea otter

*Eumetopias jubatus* Steller sea lion

*Zalophus californianus* California sea lion

*Equus* sp. Horse

*Camelops hesternus* Extinct

camel

*Bison* sp. Bison

## DISCUSSION

Of the 41 taxa of marine fishes collected from this locality (Appendix 1), six taxa are the first fossil records of extant species. The

elasmobranchs *Mustelus californicus*, *M. henlei*, *Carcharhinus brachyurus*, *Rhinobatos productus*, and *Platyrrhinoidis triseriata* are currently found in waters off southern California, but have no fossil record. The teleosts *Sardinops sagax* and *Sebastes helvomaculatus*, live today in waters off California, but also have no known fossil record. Of the remaining fish species, 19 are first records from the southern exposures of the Palos Verdes Sand.

In agreement with Fitch (1970), the overall assemblage seems to suggest a relatively shallow (less than 30 m deep) depositional environment. The fossil fauna does not differ greatly from the current ichthyofauna presently found off southern California (Allen, 1985, Allen and Herbinson, 1991). However, the presence of *Carcharhinus brachyurus*, *Rhizoprionodon longurio* and *Calamus brachysomus* indicates that this locality may represent either a period of relatively warmer marine temperatures than presently exists in the area, or that some fishes were brought north from southern waters by periodic warm-water currents (Radovich, 1961; Long, 1992).

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APPENDIX 1. List of fishes collected from the late Pleistocene Palos Verdes Sand Formation at Costa Mesa, Orange County, California. Common and scientific names follow Eschmeyer et al. (1983).

Species	Common Name	Otolith	Tooth	Vertebrae	Other
<b>ELASMOBRANCHS</b>					
<b>HETERODONTIDAE</b>					
<i>Heterodontus francisci</i>	Horn shark		19	3	
<b>SQUATINIDAE</b>					
<i>Squatina californica*</i>	Pacific angel shark		6	9	
<b>ALOPIIDAE</b>					
<i>Alopias vulpinus*</i>	Thresher shark			2	
<b>LAMNIDAE</b>					
<i>Carcharodon carcharias</i>	White shark		2		
<i>Isurus oxyrinchus</i>	Mako shark		1		
<b>TRIAKIDIDAE</b>					
<i>Mustelus californicus**</i>	Gray smoothhound		1		
<i>Mustelus henlei**</i>	Brown smoothhound		2		
<i>Triakis semifasciata</i>	Leopard shark		7		
<b>CARCHARHINIDAE</b>					
<i>Galeorhinus galeus</i>	Soupfin shark		11		
<i>Carcharhinus brachyurus**</i>	Narrowtooth shark		1		
<i>Carcharhinus</i> sp.			6		
<i>Rhizoprionodon longurio*</i>	Sharpnose shark		2		
<b>RHINOBATIDIDAE</b>					
<i>Rhinobatos productus**</i>	Shovelnose guitarfish			12	
<b>PLATYRHINIDAE</b>					
<i>Platyrrhinoidis triseriata**</i>	Thornback guitarfish				4 <sup>1</sup>
<b>RAJIDAE</b>					
<i>Raja</i> sp.*	Skate		4		1 <sup>1</sup>
<b>UROLOPHIDAE</b>					
<i>Urolophus halleri</i>	Round stingray				30 <sup>2</sup>
<b>MYLIOBATIDIDAE</b>					
<i>Myliobatis californica</i>	Bat ray		164		
<b>TELEOSTS</b>					
<b>CLUPEIDAE</b>					
<i>Sardinops sagax**</i>	Pacific sardine			1	
<b>ENGRAULIDIDAE</b>					
<i>Engraulis mordax*</i>	Northern anchovy	1			
<b>GADIDAE</b>					
<i>Microgadus proximus*</i>	Pacific tomcod	1			
<b>MERLUCCIIDAE</b>					
<i>Merluccius productus*</i>	Pacific hake	2			
<b>OTOPHIDIIDAE</b>					
<i>Chilara taylori</i>	Spotted cusk eel	1			
<i>Ophidion scrippsae</i>	Baksetweave cusk eel	7			
<b>BATRACHOIDIDAE</b>					
<i>Porichthys notatus*</i>	Plainfin midshipman	2	4		
<b>ATHERINIDAE</b>					
<i>Atherinopsis californiensis*</i>	Jacksmelt	3			

## Appendix 1 continued.

Species	Common Name	Otolith	Tooth	Vertebrae	Other
<b>SCORPAENIDAE</b>					
<i>Sebastes diploproa</i> *	Splitnose rockfish				
<i>Sebastes helvomaculatus</i> **	Rosethorn rockfish	1			
<i>Sebastes jordani</i> *	Shortbelly rockfish	4		-	
<i>Sebastes</i> sp.		-		1	
<b>HEXAGRAMMIDAE</b>					
<i>Ophiodon elongatus</i> *	Lingcod				1 <sup>3</sup>
<b>COTTIDAE</b>					
<i>Leptocottus armatus</i>	Staghorn sculpin				1 <sup>4</sup>
<b>SPARIDAE</b>					
<i>Calamus brachysomus</i> *	Pacific porgy		2		
<b>SCIAENIDAE</b>					
<i>Atractoscion nobilis</i>	White seabass	2			
<i>Genyonemus lineatus</i>	White croaker	116			
<i>Umbrina roncadore</i> *	Yellowfin croaker	8			
<i>Seriphus politus</i>	Queenfish	41			
<b>EMBIOTOCIDAE</b>					
<i>Damalichthys vacca</i>	Pile surfperch	-	3		1 <sup>3</sup>
<i>Cymatogaster aggregata</i>	Shiner surfperch	4			
<b>SPHYRAENIDAE</b>					
<i>Sphyræna argentea</i> *	California barracuda	1	1		
<b>LABRIDAE</b>					
<i>Semicossyphus pulcher</i>	Sheephead		2	1	
<b>GOBIIDAE</b>					
<i>Lepidogobius lepidus</i> *	Bay goby	1			
<b>PLEURONECTIDAE</b>					
<i>Paralichthys californicus</i> *	California halibut		20	2	2 <sup>3</sup>

\*\* First fossil record

\* Southern occurrence for the Palos Verdes Sand Formation

1 Dermal denticles

2 Caudal spine

3 Jaw

4 Opercular spine