

Santa Cruz Island, and the National Park Service, Channel Islands National park, has provided continued support. Staff at the Ventura and Santa Barbara County Historical Societies, as well as, Susan Dixon, librarian at the Santa Barbara Museum of Natural History's Channel Islands Archives were very helpful in tracking down historical information. Brent Stewart (Hubbs Research Institute) and Charles Woodhouse (Santa Barbara Museum of Natural History) provided encouragement and support through numerous projects involving pinnipeds. Finally, I thank fellow participants of the Marine Mammal Stranding Network, whose efforts have immeasurably deepened our understanding and awareness of pinnipeds.

Literature Cited

- Ashkenazy, I. 1980. On safari off Santa Cruz Island. *Oceans* 12(5): 25-28 [May].
- Cornell, L. 1978. Capture, transportation, restraint, and marking. Pp. 573-580. *In*: M.E. Fowler (ed.), *Zoo and wild animal medicine*. W.B. Saunders: Philadelphia, PA.
- Daugherty, A. 1972. *Marine mammals of California*. Calif. Dept. Fish & Game. 66 pp.
- Dunn, R. 1931. Hunting seals off California's coast. *Los Angeles Times*, 11 October.
- Eaton, M.H. 1980. *Diary of a sea captain's wife*. McNalley & Loftin, West: Santa Barbara, CA. 256 pp.
- Gidney, C., B. Brooks and E. Sheridan. 1917.

- History of Santa Barbara, San Luis Obispo and Ventura Counties, California: Vol. 2. Lewis Publishing: Chicago, IL. 651 pp.
- Holder, C.F. 1910. *The Channel Islands of California*. A.C. McClurg & Co.: Chicago, IL. 397 pp.
- Howorth, P.C. 1974. Sealing. *Aquarius*. 3(5):18-19; 34-35 [May].
- _____. 1984. Pinniped collection methods and equipment used by commercial collectors in the southern California Bight from 1878 to 1983. Unpubl. Report prepared for The Nature Conservancy. 20 pp.
- _____. 1986. The infamous *Kate and Ann*. *Waterfront*, 7(9):20 [March].
- _____. and D.T. Hudson. 1993. Submerged archaeological and historical sites in the Channel Islands National Park and Channel Islands National Marine Sanctuary. *In*: F.G Hochberg (ed.), *Third California Islands Symposium: recent advances in research on the California Islands*. Santa Barbara Museum of Natural History: Santa Barbara, CA.
- Hudson, D.T. and P.C. Howorth. 1985. A preliminary survey on sensitive marine archaeological and historical sites located within the boundary of the Channel Islands National Park and Marine Sanctuary. Pt. 2. Unpubl. Report prepared for Channel Islands National Park and Channel Islands National Marine Sanctuary. 22pp.
- Peterson, G.A. and G.A. Bartholomew. 1967. The natural history and behavior of the California sea lion. *Amer. Soc. Mammal.* 79 pp.
- Phillips, M. 1927. *History of Santa Barbara County, California*. Vol. 1. S.J. Clarke Publishing: Los Angeles, CA. 556 pp.

Submerged Archaeological and Historical Sites in the Channel Islands National Park and Channel Islands National Marine Sanctuary

Peter C. Howorth¹ and D. Travis Hudson^{2†}

¹Howorth & Associates, Inc.,

3930 Harrold Avenue, Santa Barbara, CA 93110

²Department of Anthropology, Santa Barbara Museum of Natural History
Santa Barbara, CA 93105

Abstract – The waters of the Channel Islands National Park and Channel Islands National Marine Sanctuary contain numerous submerged archaeological and historical sites. Stone artifacts discovered in 18 submerged archaeological sites span the period from some 9,000 years ago to recent history. The remains of shipwrecks cover the period from possibly as early as Cabrillo's voyage (1542-1543) to the present and includes 105 wreck sites.

Introduction

Submerged archaeological material dating from as much as 9,000 years ago to recent history exists in the Southern California Bight (Hudson 1976). In addition to Indian artifacts, the submerged material includes ships, from perhaps as early as Cabrillo's voyage in 1542-1543 to the present, as well as 20th century aircraft (L. Pierson, pers. comm.; Howorth 1984a; Hudson & Howorth 1985). Such materials constitute an important part of the nation's cultural, archaeological and historical resources.

Submerged prehistoric cultural resources have been reported from numerous sites along the mainland coast of the Southern California Bight, particularly in San Diego County (Carter 1953; Marshall & Moriarty 1964; Masters 1983, 1985; Moriarty 1961, 1964, 1969; Tuthill & Allanson 1954). In the northern part of the bight fewer such resources have been

documented (Harrington 1928; Holt 1937; Howorth 1974, 1975, 1976b, 1983a; Hudson 1976, 1979, 1980; Mucbe 1978; Orr 1968; Phelps & Mucbe 1977; Pierson & Stickel 1978; Wallace & Kritzman 1956). Most of the material from the northern part of the bight came from the mainland coast (Hudson 1976), however, a recent study found 17 submerged prehistoric localities at Channel Islands National Park and National Marine Sanctuary (Hudson & Howorth 1985). Another prehistoric locality has been discovered since that study.

Submerged historical sites within the boundaries of the Channel Islands National Park and Channel Islands National Marine Sanctuary consist of shipwrecks, parts of shipwrecks, artifacts lost or jettisoned from ships and aircraft wrecks. To date only one historic wreck, the paddlewheeler *Winfield Scott*, has been documented in detail by a professional maritime historian (Delgado 1983). Several other shipwrecks are now the subjects of ongoing investigations by trained diver/archaeologists and by nautical historian Stephen Haller (National Park Service). Forty-eight submerged historic sites within the Channel Islands National Park and National Marine Sanctuary were included in an archaeological literature survey and sensitivity zone map compiled for the Bureau of Land Management (Pierson 1980; Pierson & Stickey 1978). In 1987, Pierson & co-authors prepared another shipwreck report for the Minerals Management Service (MMS), covering the area from Morro Bay to the Mexican border and including the California Islands. In this study, Pierson added six shipwrecks to Channel Islands National Park and National Marine

¹Current Address: 3930 Harrold Avenue,
Santa Barbara, CA 93110

†Deceased

Sanctuary, bringing his total to 54. In 1984, the National Oceanic and Atmospheric Administration (NOAA), National Ocean Service, published their Automated Wreck and Obstructions Information System (AWOIS), a computer-generated list, but this included only three shipwrecks within Channel Islands National Park and National Marine Sanctuary. A recent study commissioned by the Channel Islands National Park and National Marine Sanctuary (Hudson & Howorth 1985) documented 91 submerged historic sites in the National Marine Sanctuary, including the 48 sites discussed in Pierson's report (1980). Fourteen wrecks have been discovered since this last study.

The preliminary report by Hudson & Howorth (1985) followed 11 years of research on submerged prehistoric archaeological sites and over 20 years of work on shipwrecks, respectively. This pilot study outlined the wealth of submerged archaeological and historical sites discovered to date at Channel Islands National Park and National Marine Sanctuary. The importance and sensitivity of each site was assessed based on our present knowledge. The locational reliability of previously reported sites was investigated, and prioritized recommendations were made for further research and for management. Several separate studies resulted, and this paper summarizes our efforts to date.

Methods

A comprehensive literature survey was conducted to gather as much information as possible on all submerged archaeological sites within Channel Islands National Park and National Marine Sanctuary. Each site was listed as a "marine locality" or simply "locality" because a precise position of each find usually was lacking. Although locational reliability increases with repetitive finds in a given area (Masters 1983), most finds in Channel Islands National Park and National Marine Sanctuary were made by single informants, and thus, the

location often was imprecise.

Unpublished literature also was examined, including Pierson & Stickel (1978) which listed 74 marine localities within the Southern California Bight and records kept by Masters at Scripps Institution of Oceanography. All 110 marine sites recorded have been included in earlier reports (Hudson 1976; Pierson & Stickel 1978). In preparing their report (Hudson & Howorth 1985), Hudson included his personal knowledge of select marine localities and data gleaned from several informants.

Localities were plotted on standard NOAA navigational charts (18727 - San Miguel Passage; 18728 - Santa Cruz Channel; 18729 - Anacapa Passage). The coordinates of each locality were recorded on data sheets, along with the accuracy of the coordinates when known. Each locality was assigned a number on the data sheets. The prefix "A" designated an archaeological locality, followed by a number which represented the order in which the localities became known to Hudson. Each data sheet also included: 1) the informant's name; 2) date of find; 3) typological description of artifactual material as developed by Hudson (1976); 4) depth of find(s); 5) description of area; 6) final deposition of find(s); 7) impacts on locality; 8) accessibility and 9) references. Hudson's untimely death in 1985 cut short his study of marine archaeology at Channel Islands National Park and National Marine Sanctuary, but the conclusions and recommendations he made up to that time are included in the present paper, along with a listing of his archaeological localities plus a recent find.

For the historical section, a literature search for shipwrecks in Channel Islands National Park and National Marine Sanctuary was conducted. Aside from the studies by Delgado (1983) and Pierson (1977, 1980, 1987), an academic approach to the study of wrecks in the area had not been undertaken previously. A number of popular accounts on specific wrecks have been published (see articles by Howorth). Accounts in popular books, magazines and

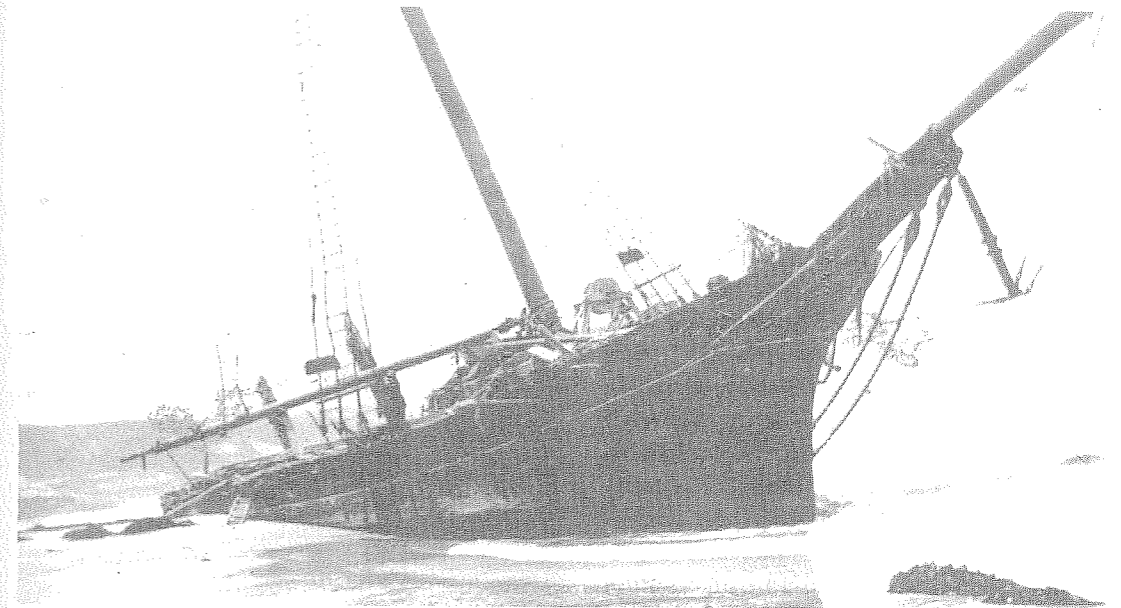


Figure 1. Wreck of the *Comet* on San Miguel Island. Built in 1886, this three-masted coastal lumber schooner hit Wilson Rock on 2 September 1911 then drifted through the surf and was beached on the island. Photograph courtesy Santa Barbara Museum of Natural History.

newspapers abound, but so do technical errors. Photographs in the archives of historical museums in Santa Barbara and Ventura provided valuable information. The Channel Islands Archives at the Santa Barbara Museum of Natural History provided useful information and photographs. Landmarks and geographical features in historical photographs often can be compared to recent features to identify sites and specific shipwrecks that in some cases occurred over a century ago. As an example a photograph of the schooner *Comet*, taken shortly after it went aground at San Miguel Island, was used to positively identify wreckage in one locality as belonging to that vessel (Fig. 1).

The National Maritime Museum (San Francisco, CA) provided old shipping records, owners' records and artifacts from similar vessels useful in narrowing down the vintage of certain wrecks from artifactual material. Interviews were conducted with survivors and witnesses of shipwrecks and their descendants, and with divers, fishing captains and recreational boating and diving enthusiasts who had first-hand knowledge of various wreck

localities. Personal knowledge of several previously unreported localities also were referenced in this study.

Data sheets were prepared on each wreck locality. Each wreck was prefixed with "W" followed by a number, assigned as it became known. A predetermined series of numbers were assigned for each island: Anacapa Island (1-99); Santa Cruz (100-199); Santa Rosa (200-299); San Miguel (300-399) and Santa Barbara (400-499). Data sheets included the following information: 1) latitude and longitude of each locality; 2) LORAN C coordinates; 3) appropriate navigational chart number; 4) bearing and distance from the nearest landmark; 5) accuracy of the position; 6) depth; 7) description of the area; 8) accessibility; 9) impacts on the locality (*e.g.*, professional salvage work, pilfering, weathering as well as other natural effects; 10) condition of the material; 11) name of the wreck; 12) type and purpose; 13) construction materials; 14) propulsion; 15) length; 16) beam; 17) tonnage; 18) date built; 19) builder's name; 20) where built; 21) registry; 22) home port; 23) owner;

23) date wrecked and 24) how it was wrecked (e.g., grounded). Diagrams of the wrecks were made when possible and relevant comments, such as the name of the informant(s) and appropriate references were included.

Pierson's studies (1977, 1980) were reviewed, and in several cases were found to be in error. Also, several wrecks were scattered over wide areas, so in some cases, more than one location was given for the same specific wreck. In their preliminary study (Hudson & Howorth 1985), all reported wreck localities were listed, even when the precise location or identity of a wreck was in question, rather than risk overlooking an important site. When the location or identity of a wreck described on one data sheet seemed to contradict another, this was indicated on the data sheets, along with recommendations for clarifying any discrepancies. Studies were subsequently initiated by the author and Don Morris to clear up such discrepancies.

The study mainly was confined to vessels over 50 ft in length or over 50 tons. Literally hundreds of small craft, virtually all of no historical interest, have been lost in the Channel Islands National Park and National Marine Sanctuary. A few small craft wrecks of historical significance were documented. In addition, several small craft were listed when they occurred over or close to historic wrecks in order to aid later researchers in differentiating between the wreckage material. Because, the modern material often was easy to locate, it could be used to guide researchers to the older material buried underneath.

In one area, no less than six and quite likely as many as eight wrecks occurred along a 1/4 - mile stretch of coast. In another locality, a 19th century windjammer lay over the top of what Howorth & Hudson (1985) believed to be a galleon. Shipwreck data sheets continue to be prepared because of the tremendous volume of research required to document each wreck. A list of the wrecks is included in Table 1.

The next phase of the study was undertaken by the NOAA ship *Fairweather*, which investigated several promising localities

recorded in Hudson & Howorth (1985). For shallow water work, two small boats were deployed from the *Fairweather*. Deeper sites were probed by the ship itself. All three vessels were equipped with recording fathometers, sidescan sonar, sub-bottom profilers and proton magnetometers, in addition to sophisticated navigational and positioning equipment. Several promising sites were pinpointed for later investigation. During this same period, Haller (pers. comm.) initiated research on several specific wrecks discussed by Hudson & Howorth (1985), and came up with considerable historical information on these wrecks.

In 1986 Howorth contracted with the National Park Service to investigate localities documented by the *Fairweather* as well as sites he personally had located on earlier expeditions. The research team also investigated several reported localities that had not been pinpointed. Seven shipwreck localities and one submerged aircraft were examined (Howorth 1986). The National Park Service sponsored two additional cruises to document two of the wrecks in detail (*Goldenhorn* and *Aggi*). Divers laid measured lines over each wreck, then videotaped, photographed, and sketched details so that complete scale renderings could be made. The sites of the above two shipwrecks have been nominated for the National Register of Historic Places and several more from the 1985 study have been proposed for nomination (J. Delgado, pers. comm.).

Archival research was continued until 1987. The completeness and positional accuracy of some of the shipwrecks listed in Pierson & Stickel (1978) were reviewed. Independent field work resulted in additional finds which are included here along with recent discoveries reported by Don Morris (pers. comm.).

Results

Archaeological sites: Eighteen localities with submerged prehistoric archaeological

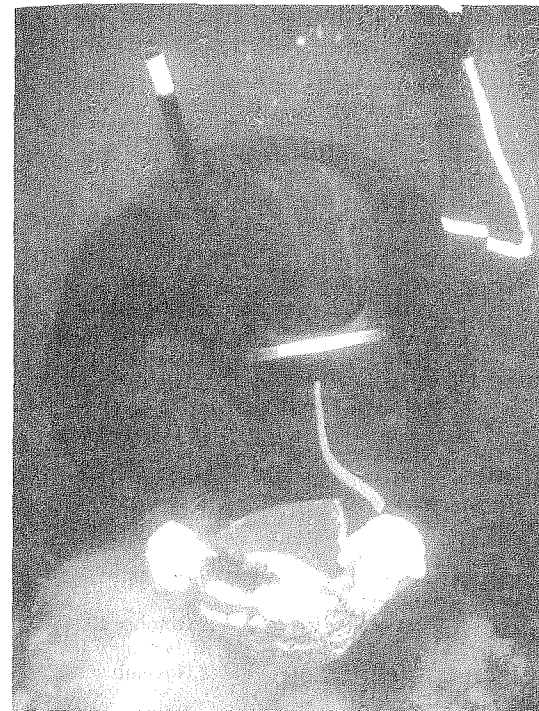


Figure 2. Diver Mark Torresani brings up an old Chumash Indian bowl. Photograph by Peter C. Howorth.

material were documented within the boundaries of the Channel Islands National Park and National Marine Sanctuary. Of these, 3 were off Anacapa, 7 off Santa Cruz, 3 off Santa Rosa and 5 off San Miguel. No localities have been found off Santa Barbara Island. The specific locations of two Anacapa and two Santa Cruz Island sites are unknown, as is one of the Santa Rosa Island localities. The accuracy of the positions on the remaining 12 localities vary from 1/5 - 4/5 nautical mile. A total of nearly 50 artifacts have been recovered at these 18 sites.

The earliest submerged find was made by a Native American some 4,000 years ago. A sandstone bowl was recovered in a Cañada Verde Dunes site on Santa Rosa Island excavated by Orr (1968). Marine borings in the vessel indicate that it had been in the sea for an unknown length of time after it was manufactured (Hudson & Howorth 1985). Ethnohistorical accounts pertaining to the Chumash suggest that these people may have

found artifacts near their villages during low or minus tides (Blackburn 1975).

The first recent discovery of submerged archaeological material in the Channel Islands National Park and National Marine Sanctuary was made in the early 1950s off San Miguel Island by divers from Scripps Institution of Oceanography. Due to its size and weight, the large stone vessel, was not recovered until years later (Hudson 1976). Other localities have been reported since then, bringing the total to 17 (Hudson & Howorth 1985). In 1987, a site containing a concentration of artifacts was discovered by a charter dive boat operator and reported to the National Park Service (D. Morris, pers. comm.). This site, which makes the total 18, may represent a ceremonial area, which is discussed later.

The majority of the artifacts found were stone vessels (Fig. 2), although, a fishhook, two donut stones, a scraper, two net weights, four "supervessels" and some human bones also have been located. Although artifacts have been found from the intertidal zone to a depth of nearly 60 m, most were found in relatively shallow water, 2-24 m (Hudson & Howorth 1985).

Although datable organic material was not discovered in the context of the submerged artifacts, Hudson was able to roughly estimate the ages of the artifacts by comparing them with similar artifacts which had been excavated on terrestrial sites and dated by using adjacent organic material. The submerged artifacts appear to span a time period from 9,000 B.P. to historic times.

Historical Wreck Sites: A total of 105 shipwreck localities were documented, including 14 wrecks recently discovered by Don Morris (pers. comm.) and Howorth (Table 1). Of this total, 100 were boat- or shipwrecks and five were aircraft. The shipwrecks included: 30 sailing vessels, 22 diesel-powered propeller-driven vessels, 34 of unknown rig, 9 steamships, 2 paddlewheelers, 2 gasoline-powered, propeller-driven vessels and 1 barge. Total localities for each island are: Anacapa (21); Santa Cruz (28); Santa Rosa (21);

Table 1. Shipwrecks recorded in the Channel Islands National Park and Channel Islands National Marine Sanctuary. Wrecks are listed by location number for each island. * = Spelling questionable. (?) = vessel type and propulsion not determined.

Wreck Location No.	Vessel Name	Vessel Type	Propulsion	Date Wrecked
ANACAPA ISLAND				
001	<i>Gypsy Q</i>	-	-	-
002	-	-	-	-
003	<i>Beulah</i>	-	-	22 September 1933
004	-	-	-	-
005	-	-	-	-
006	<i>San Guiseppe</i>	-	Oil screw	19 December 1950
007	<i>San Francisco</i>	-	Oil screw	31 October 1939
008	<i>Balboa</i>	-	Oil screw	18 January 1949
009	<i>Del Rio</i>	-	Oil screw	28 October 1952
010	<i>Equator</i>	-	Oil screw	2 July 1949
011	-	-	Oil screw	-
012	<i>St. Anne of the Sunset</i>	-	Oil screw	17 October 1955
013	<i>Bar-bee</i>	-	Steam screw	-
014	<i>Liebre</i>	Tanker	Steam screw	February 1921
015	-	Military aircraft	Propellers (4)	-
016	-	Military aircraft (B-29)	Propellers (4)	-
017	<i>Winfield Scott</i>	Passenger/freighter	Steam sidewheeler	2 December 1853
018	-	-	Steam paddlewheeler	-
019	<i>Labor*</i>	-	Gas screw	2 October 1924
020	<i>Hueneme</i>	Schooner (sealer)	Sail	16 February 1876
021	<i>Louise Roy</i>	Trawler	Screw	6 November 1937
SANTA CRUZ ISLAND				
100	<i>International I</i>	Barge	Tow	13 September 1918
101	-	Military aircraft	Propeller	March 1954
102	<i>Spirit of America</i>	Minesweeper	Oil screw	-
103	-	Antisub aircraft (AF Guardian)	Propeller	-
104	-	Military aircraft	-	-
105	<i>Billcona</i>	Tug	Oil screw	27 June 1952
106	<i>Marie</i>	LCVP-charterboat	Oil screw	1960
107	<i>Aurora</i>	-	Oil screw	7 November 1952
108	<i>Golden Gate</i>	-	Oil screw	30 January 1952
109	-	Minesweeper	Oil screw	-
110	-	-	-	-
111	-	Minesweeper	Oil screw	-
112	<i>City of Sausilito</i>	-	Oil screw	11 December 1941
113	-	-	-	-
114	<i>Bob and Jocko</i>	Fishing vessel	-	28 April 1949
115	<i>Babina</i>	-	-	1923
116	<i>Thornton</i>	-	-	1910
117	<i>Crescent City</i>	-	-	-
118	<i>Nancy Lee</i>	-	-	1946
119	<i>Seahoph*</i>	-	-	-
120	<i>Typhoon</i>	Pleasure yacht	Sail	28 June 1931
121	<i>Sealion</i>	Fishing sloop	Sail	29 October 1906
122	<i>Black Dolphin</i>	Pleasure boat	Hermaphrodite brig	1960s or 1970s
123	<i>Yukon</i>	Schooner	Sail	6 January 1938
124	<i>Santa Cruz</i>	Schooner	Sail (later diesel)	6 December 1960
125	<i>Galileo</i>	-	-	1853
126	<i>San Buenaventura</i>	Sloop	Sail	13 October 1858
127	<i>Santa Cruz</i>	Steamer	Screw	25 December 1912
SANTA ROSA ISLAND				
200	? Part of <i>Jane L. Stanford</i>	-	-	-
201	<i>Aristocratis</i>	-	-	-
202	<i>Jane L. Stanford</i>	Barkentine	Sail	30 August 1929

Wreck Location No.	Vessel Name	Vessel Type	Propulsion	Date Wrecked
203	-	Spanish period (?)	Sail (?)	-
204	<i>Dora Bluhm</i>	Schooner	Sail	26 May 1910
205	<i>Aggi</i>	Fully-rigged ship (collier)	Sail	1 May 1915
206 & 207	<i>Goldenhorn</i>	Fully-rigged ship (collier)	Sail	12 September 1892
208	-	-	Sail (?)	-
209	-	-	-	-
210	-	-	-	-
211	-	1800s	-	-
212	-	-	-	-
213	-	-	Oil screw	-
214	<i>Bluefin</i>	-	Oil screw	3 September 1944
215	<i>Broadbill</i>	Fishing vessel	Oil screw	1967
216	<i>Patria</i>	Freighter (Liberty ship)	Steam screw	21 June 1954
217	<i>Crown of England</i>	Passenger ship	Steam screw	7 November 1894
218	<i>Chickasaw</i>	Freighter (Victory ship)	Steam screw	7 February 1962
219	-	Yacht	-	1952
220	<i>Ella G.</i>	Schooner (sealer)	Sail	2 February 1908
SAN MIGUEL ISLAND				
300	-	Schooner (?)	Sail	-
301	<i>Legend</i>	Racing sloop	Sail	1967
302 & 303	<i>J.M. Colman</i> (also <i>J.M. Coleman</i>)	Schooner	Sail	3 September 1905
304	-	Schooner	Sail	-
305	<i>Watson A. West</i>	Schooner	Sail	23 February 1923
306	<i>J.F. West</i>	Schooner	Sail	1898
307	<i>Kate and Annie</i> (also <i>Kate and Ann</i>)	Schooner (sealer & smuggler)	Sail	9 April 1902
308	-	Galleon	Sail	1801
309	<i>Watson A. West</i>	Schooner	Sail	23 February 1923
310 & 311	<i>Comet</i>	Schooner	Sail	2 September 1911
312	-	Schooner (?)	Sail (?)	-
313	-	Schooner (?)	Sail (?)	-
314	<i>Pectan</i>	Schooner	Sail	-
315	<i>N.B.</i>	Schooner (otter hunter)	Sail	23 December 1879
316	<i>Surprise</i>	Schooner (sealer)	Sail	13 March 1881
317	<i>G.W. Prescott</i>	Schooner	Sail	15 August 1879
318	-	Power craft	Oil screw (?)	-
319	-	-	-	-
320	-	Fishing vessel (?)	Oil screw (?)	-
321	-	-	-	-
322	-	-	-	-
323	-	-	Oil screw	-
324	<i>Deano</i>	Fishing vessel	Oil screw	1970s
325	<i>Gold Coast</i>	Fishing vessel	Oil screw	1986
326	<i>Josie Lena</i>	Fishing vessel	-	1962
327	<i>Cuba</i>	Passenger ship	Steam screw	8 September 1923
328	<i>Anubis</i>	Freighter	Steam screw	20 June 1908
329	<i>Tortuga</i>	U.S. Navy Landing Ship Dock LSD-26	Steam screw	15 December 1987 (Used as target)
SANTA BARBARA ISLAND				
400	<i>The Pacific</i>	-	-	1951
401	<i>Milmar</i>	-	-	22 August 1950
402	<i>Adriatic</i>	-	Oil screw	28 December 1930
403	<i>Emperor</i>	-	Oil screw	15 July 1932
404	<i>Dante Alighieri</i>	-	Gas screw	1938

San Miguel (30) and Santa Barbara (5).

Three sailing vessel localities may be of major historic importance because the artifacts could represent Spanish period ships (L. Pierson, pers. comm.) Off Santa Rosa Island, four wooden stock anchors of the vintage and type found on Spanish caravels and small galleons reportedly were discovered in the early 1950s by Conrad Limbaugh, a diver from Scripps Institution of Oceanography (L. Pierson, pers. comm.). At San Miguel Island, an ornate ring was found amidst wreckage of a Spanish period vessel. One other Spanish period site is indicated at San Miguel. Of the remainder of the sailing vessels, 27 are 19th century windjammers which played a significant role in California history. One of these was wrecked at Anacapa Island, 5 at Santa Cruz, 6 at Santa Rosa and 15 at San Miguel.

Also significant are the wrecks of at least one, and possibly two, steam paddlewheelers at Anacapa Island, three propeller-driven, steam-powered vessels, one at Santa Cruz, another at Santa Rosa and a third off San Miguel Island, all of which were built in the 1800s and represent an important part of shipping history. The paddlewheeler, *Winfield Scott*, at Anacapa Island, is listed on the National Register of Historic Places (J. Delgado, pers. comm.).

The locational reliability of all wreck sites listed by Hudson & Howorth (1985) were reviewed and the majority were pinpointed. The accuracy of reported positions of wrecks is dependent on obtaining an accurate fix before a vessel sinks. If a fix was not obtained and if a wreck was not found or identified, only an approximate position could be given. In the case of vessels which went aground or foundered on a reef and were visible, although their locations were common knowledge at the time, often little importance was placed in determining the exact positions of such wrecks. As these wrecks deteriorated and disappeared, their locations often were forgotten. In cases of insurance fraud or negligence, erroneous positions sometimes were provided deliberately by the masters or crew of vessels to avoid

scrutiny. Even when such wrecks eventually were located, their positions often were kept secret. In fact, erroneous positions sometime were given in order to prevent the wrecks from being located.

The reliability of the "exact coordinates" for a few selected sites reported by Pierson (1980, 1987) were reevaluated. The results are listed below.

1) Off Santa Rosa Island, the location of the square-rigger *Goldenborn*, was off by nearly one nautical mile and the position indicated for the *Aggi* was close but certainly not exact. In the case of these two wrecks proof of their identity and true position were obtained from the nameplates which have been recovered from both wrecks (G. Miller, pers. comm.). The possibility exists that pieces of these wrecks might still lie in another location. However, this seems unlikely because both were metal ships and nearly all of the hull compartments remain in their confirmed positions. Discrepancies in Pierson's positions may represent different wrecks, his source of information may have been inaccurate, or typographical or plotting errors could have been made.

2) A search of the "exact" position reported by Pierson (1980) for the wreck of an unknown ship off Santa Rosa Island was undertaken during a cruise of the *Fairweather*. Divers, guided by accurate navigational positioning equipment, a recording fathometer and a proton magnetometer failed to locate any trace of wreckage within a one nautical mile radius of the position. A possibility exists that the wreck lies buried beneath the sand, but the proton magnetometer did not reveal any signature consistent with buried metal or a shipwreck (L. Murphy, pers. comm.). To confirm the presence of a shipwreck in this vicinity, a larger survey would be necessary.

3) Off Santa Cruz Island, the location of a military aircraft near Gull Island is off by nearly 3/4 nautical mile. It likely represents the military plane pinpointed by Howorth (Hudson & Howorth 1985).

4) The location given by Pierson (1980) for the tug, *Billcona*, wrecked at Santa Cruz Island, placed the vessel over 1/3 nautical mile inland, up a steep slope. This probably represents a plotting or typographical error. Pierson (1987) also listed the *Billcona* as being wrecked in Ventura County; however, Santa Cruz Island is in Santa Barbara County.

Discussion

The question of how archaeological material came into the marine environment has been addressed by a number of researchers (Shepard & Grant 1947; Carter 1953; Tuthill & Allanson 1954; Wallace & Kritzman 1956; Rozaire 1962; Shepard *et al.* 1964; Marshall & Moriarty 1964; Rose 1966; Greenwood & Browne 1969; Walters 1969, 1972; Hudson 1976, 1978; Hudson & Howorth 1985). No single theory explains every find in the National Park and Marine Sanctuary. However, four explanations seem likely, and one more is possible.

Many eroding coastal cliffs along the islands are capped by archaeological sites. Without doubt, erosion contributes to the deposition of archaeological material into the sea. In several places human remains and artifacts have been observed falling into the sea (D. Morris and W. Murray, pers. comms.). Secondary deposition accounts for the presence of submerged archaeological material in at least five and possibly in as many as seven localities.

Such depositions constitute a significant loss of the terrestrial archaeological record. The age and distribution of artifacts in the sea may provide some indication as to the extent of this loss. The types of artifacts, though taken out of cultural content, still allow inferences to be made of the material culture (Hudson & Howorth 1985).

Some artifacts could have been dropped intentionally into the sea during ceremonies (Tuthill & Allanson 1954; Wallace & Kritzman 1956; Rozaire 1962; Hudson 1976; Hudson & Howorth 1985). Large flowerpot-shaped

vessels up to perhaps 2,500 years old have been found in relatively deep water in two localities off Anacapa Island and one each off Santa Cruz and San Miguel Islands. More recently, a concentration of small vessels was found in deep water off Santa Rosa (D. Morris, pers. comm.). Relatively recent artifacts, such as those indicated above, would not have found their way into deep water by natural means. The distribution of large artifacts appears to be random which suggests that they may not have been dropped in specific areas. However, the discovery of these large artifacts has been purely by chance rather than the result of an organized professional survey. The concentration of small vessels off Santa Rosa Island suggests that they may have been deliberately deposited there. Thus the possibility exists that certain areas off the northern Channel Islands were sacred, as are several marine localities off the mainland coast, notably at Point Conception (Hudson 1976). If continued research determines that certain offshore areas at Channel Islands National Park and National Marine Sanctuary also were sacred, it would be culturally significant to present-day Native Americans, even though the ceremonies discussed are not known to have been practiced in historic times.

Ethnographic evidence suggests that grooved or notched cobbles, as well as stone balls, probably were used to anchor fishing nets (Hudson 1976; Hudson & Blackburn 1982). A grooved stone ball was found in one locality at San Miguel Island, suggesting the area may have been used for fishing. Until more fishing-related artifacts are discovered, inferences about nearshore fishing practices and associated technology can not be elucidated.

Eustatic sea level changes could account for the presence of some submerged archaeological material (Carter 1953, 1957; Shumway *et al.* 1961; Moriarty 1964; Marshall & Moriarty 1964; Shepard 1964; Hudson 1976; Hudson & Howorth 1985). Beginning about 18,000 years ago, the melting of massive continental glaciers contributed to a rapid rise in sea level (perhaps

as much as 117 m) within the Southern California Bight (Emery 1960; Curray 1965; Junger & Johnson 1980). The present-day level was reached about 2,000-3000 years ago (Nordin *et al.* 1981). Artifacts which are older than the marine inundation of their locality probably became submerged due to rising sea levels (Marshall & Moriarty 1964). One locality at Anacapa, one at Santa Cruz and two at San Miguel Island may represent submerged coastal village sites from 4,000-9,000 years old. Submerged localities in this date range suggest that the paleoclimate record is incomplete for this period. Undoubtedly most artifacts were destroyed as the sea level rose, because only the sturdiest artifacts now remain beneath the sea.

The unexplained presence of artifacts at one locality at Anacapa, one at Santa Rosa and three at San Miguel may represent material jettisoned from swamped watercraft. Ethnographic data indicate that the Chumash watercraft were leaky (Hudson 1976). Canoes were ballasted with stones and also could carry heavy cargo, including stone implements. Harrington (see Hudson *et al.* 1978) mentioned an incident in which such heavy items were thrown over the side of a canoe that swamped. Canoes occasionally sank; in one storm alone, 29 canoes were lost (Hudson *et al.* 1978). Quite likely, the wood of a canoe's hull would break up and decompose on the sea floor, leaving only the stone artifacts. Even if some wood remained, it may have gone unnoticed by divers.

Fortunately, underwater "pot-hunting" off the California Islands does not seem to be the problem it has become at some mainland sites (J. Johnson & D. Morris, pers. comms.). As more and more people visit the islands it is likely that artifacts will be removed more frequently. For this reason, rangers should be trained to identify cultural resources in the marine context so they can protect sites and report finds. Terrestrial sites which are eroding into the sea should be surveyed so that material can be recovered, if necessary, before it is lost. Although salvaging such artifacts seems desirable, Native Americans do not necessarily

favor the recovery of their cultural artifacts for archaeological study.

Intertidal areas also should be surveyed for concentrations of artifacts. Submerged sites should be studied to collect data on topography, sediments and geomorphology, such as drowned streams, submerged terraces and other features which could point out former coastline configurations in relation to submerged archaeological sites.

Marine archaeological localities have considerable potential in addressing a variety of anthropological questions, including: 1) chronologies; 2) cultural associations; 3) settlement patterns; 4) response of coastal dwellers to changes in both sea level and marine ecology; 5) areas of specific ceremonial significance; 6) economic and technological variables associated with fishing activities (particularly changes in methods and equipment which might mirror ecological changes) and 7) the effect of the marine environment on the preservation and destruction of artifactual material. Archaeological finds within the Park and Sanctuary should be reported to a centralized database at the Santa Barbara Museum of Natural History so that information can be stored for access by the scientific community.

With regard to shipwrecks, comparing vessel type, method of propulsion, purpose, route and period with the cause of the wreck points out several interesting patterns. At one anchorage, at least 6, and perhaps as many as 8, vessels dragged anchor and were driven ashore. At San Miguel Island, 15 historic sailing vessels have been wrecked, while only 6 have been wrecked at Santa Rosa, 5 at Santa Cruz and 1 at Anacapa. Although no wrecks of particular historical interest have been reported off Santa Barbara Island, it is quite possible that historic sailing vessels have been wrecked there. The pattern for engine-powered craft seems much more random, apparently due more to engine failure and navigational errors rather than to the strong winds and uncharted reefs prevalent in sailing vessel accidents.

One pattern that emerged from an interpretation of shipwreck data is that the better-known, easily accessible wrecks have been significantly impacted by both amateur and professional salvage operations. Lesser-known or more difficult to reach wrecks, have received somewhat less attention. Wrecks known to few if any other persons showed little or no impact from salvage operations.

These findings raise an important question: Who owns the wrecks? Under Federal Abandoned Shipwreck Bill Act of 1987 (Public Law 100-298) the State of California claims ownership of all wrecks in State waters (up to 3 nautical miles offshore) when the vessels have been abandoned by their owners. Historic wrecks are protected under the California State Penal Code (Section 622 1/2: Objects of Archaeological or Historical Interest). In addition, several parts of Channel Islands National Park and National Marine Sanctuary are State Ecological Reserves. It is illegal to remove or disturb any historical or cultural material from a reserve, a park or sanctuary without a permit. [California Administration Code, Title 14, Section 630(a)(1), General Regulations for Ecological Reserves].

In the case of more modern wrecks, ownership rests with whomever has title, whether this be the insurance underwriters (in the event of a total loss) or the registered owner. An abandoned vessel and all its parts, including its cargo, is always owned, either by the State or by the holder of the title. Persons who knowingly disturb or remove any part of a wreck without a salvage permit or contract can be subject to civil and criminal proceedings.

The paddlewheeler *Winfield Scott* is listed in the National Register of Historic Places and is particularly well-protected, at least by law. Unfortunately, this has not stopped divers from repeatedly looting the wreck. A number of individuals have been prosecuted successfully for removing material from the *Winfield Scott*, the *Goldenborn* and the *Aggi*. In the last decade, several arrests have been made by the Santa Barbara County Sheriff's Department for the

looting of modern wrecks.

Attempts to educate the public as to the cultural and historic value of shipwrecks have been only partially successful (D. Morris, pers. comm.). Recent prosecutions reflect a change in the attitude of cultural resource managers and law enforcement personnel toward the value of shipwrecks. Until recently, materials from shipwrecks have been looked upon by the general public as just another exploitable resource. When valuable cargo (*e.g.*, coins, jewelry and precious metals) are involved, the salvage prospect became even more inviting to the uninformed public. The problem with this thinking is that historic shipwrecks are not a renewable resource.

Preservation of wrecks through prosecution of those who would indiscriminately salvage them has made those whose past exploits were glorified by the media "look like criminals" according to one avid wreck diver. In the past divers salvaged material from historic wrecks with a clear conscience, knowing no one disapproved of such activities. In many cases, divers had gone to considerable effort to research each wreck and to preserve artifacts they recovered. Following establishment of the national park and marine sanctuary such activities were no longer acceptable. However, a considerable amount of historical material, which could yield much valuable data, currently resides in private collections. Many wreck divers have expressed an interest in donating this material to a nautical or historical museum, but they now fear prosecution for their past actions. While no question exists about prosecuting present-day offenders, pursuing individuals for past actions may be counterproductive, particularly when many individuals are willing to share their finds with researchers provided they are not prosecuted. Far more could be gained if material salvaged many years ago could be made available to contemporary researchers. Clearly, we face a philosophical crossroads in the ethics of shipwreck salvage.

Another critical management issue is whether to recover historical artifacts being threatened by the elements. Intertidal material suffers from sand scouring, corrosion, battering by waves and cobble, electrolysis and other impacts. Some intertidal material undoubtedly may be destroyed if no action is taken. However, detailed, nondestructive surveys must be made to determine exactly what is worth preserving at each intertidal site. Once artifacts are removed, many deteriorate rapidly unless costly and time-consuming preservation methods are employed. Subtidal material is far less threatened by natural impacts.

Total excavation or removal of submerged historic wrecks is not recommended. Murphy (1983) explained the reasons very well: "Often wrecks must be partially uncovered for survey-evaluation purposes. This subjects a stabilized site to a renewed period of deterioration before equilibrium with the environment recurs." Moreover ".....shipwrecks, even in shallow water, have exceptional preservation and contextual integrity when compared to terrestrial sites." Stabilized, buried wrecks are not subject to the impacts (e.g., freeze-thaw cycles, rot and wind) faced in terrestrial environments.

From a cultural resource management standpoint, a regional, systematic method of survey and sampling to inventory and evaluate all wreck sites is recommended. According to Gould (1983), Murphy "approached this issue from the viewpoint of a public archaeologist whose primary concern is to identify zones for the protection of different sorts of cultural resources." Certainly this view agrees with the management policies of the Channel Islands National Park and National Marine Sanctuary (W. Ehorn & F. Cava, pers. comms.).

The submerged archaeological material at Channel Islands National Park and National Marine Sanctuary spans virtually the entire maritime history of the west coast (Hudson & Howorth 1985). These historic and cultural resources are of national significance and worthy of protection, particularly considering that similar resources in other areas have been

severely depleted. The result of widespread looting of shipwrecks "has been the rapid destruction of an irreplaceable part of our historic and cultural heritage as well as an important source of anthropological knowledge in general" (Gould, 1983). "We are at the point in our historical development where we must either put shipwrecks into an anthropological perspective or drop the matter once and for all. In many areas of the world, shipwrecks are an endangered species and all discussion may become academic in a few decades" Lenihan (1983). The severity of the problem was explained by Cockrell (1983) even more emphatically: "I trust that anthropologists will soon recognize shipwrecks as phenomena deserving legitimate scientific attention, and join the losing battle for their preservation; unless both moral and legal restraints are adopted, discussion for the study of shipwrecks as anthropological phenomena will be academic, as none will remain to be studied. In the three decades since the advent of technological advances [SCUBA] the rapists have decimated these once-plentiful windows to the past."

Considering such sobering statements from researchers elsewhere in the nation, the broad legal coverage and effective law enforcement afforded the Channel Islands National Park and National Marine Sanctuary, provides an unparalleled opportunity for preserving archaeological, historical, and cultural resources of national significance. In few places on earth other than at the Channel Islands, can you walk across so much history in so few steps, from the remains of perhaps the earliest people on the California Islands, dating back some 10,000 years, to the remnants of shipwrecks spanning the history of Europeans on the west coast.

Acknowledgments

We thank the following persons at Channel Islands National Park for their cooperation and continuing support: William Ehorn (superintendent), Don Morris (archaeologist),

Nick Whelan and Jack Fitzgerald. Carol Pillsbury and Francesca Cava, managers at Channel Islands National Marine Sanctuary, provided enthusiastic help, as did Glen St. Amant (administrative assistant). National Park Service personnel Larry Murphy (archaeologist with the Submerged Cultural Resource Unit) and maritime historians James Delgado and Stephen Haller, deserve special thanks for their interest and assistance in this project. Janice Timbrook, John Johnson and Susan Dixon of the Santa Barbara Museum of Natural History provided invaluable assistance. Staff with The Nature Conservancy - in particular, Robert Hansen, Peter Schuyler and Will Murray, supported the project with comments and ideas. Thomas Blackburn provided thoughtful insight.

Literature Cited

- Blackburn, T. 1975. December's child: a book of Chumash oral narratives. University of California Press: Berkeley, CA. 359 pp.
- Carter, G. 1953. On submarine archaeology about San Diego. *Masterkey*. 29(1):21-27.
- Curry, J.R. 1965. Late Quaternary history and continental shelves of the United States. Pp. 723-735. In: H.E. Payne and D.G. Frey (eds.), *The Quaternary of the United States*. Princeton University Press: Princeton, NJ.
- Delgado, J. 1983. Waterlogged and covered with barnacles: the wreck of the S.S. Winfield Scott. *Pac. Hist.* 27(2):
- Eaton, M.H. 1980. *Diary of a sea captain's wife*. McNally & Loftin, West: Santa Barbara, CA. 255 pp.
- Emery, K.O. 1960. The sea off southern California: a modern habitat of petroleum. J. Wiley & Sons: New York, NY. 366 pp.
- Gibbs, J. 1971. *Shipwrecks of the Pacific Coast*. Binfords & Mort: Portland, OR. 316 pp.
- Gould, R. 1983. Looking below the surface: shipwreck archaeology as anthropology. Pp. 3-22. In: R.A. Gould (ed.), *Shipwreck anthropology*. School of American Research Book, University of New Mexico Press: Albuquerque, NM.
- Greenwood, R. and R.O. Browne. 1969. A coastal Chumash village: excavation of Shisholop, Ventura Co., California. *Mem. Southern Calif. Acad. Sci.*, No. 8: 1-79.
- Haller, S. in prep. *Schooners, sealers and steamers: the shipwrecks of San Miguel and Santa Rosa Islands*.
- Harrington, J.P. 1913a. Untitled and unpublished notes on Chumash canoe construction MS 6017, Box 1, Bundle 3, U.S. Nat'l. Mus., Anthro. Archives, Washington, DC.
- _____. 1913b. Untitled and unpublished linguistic notes on Chumash canoes. MS 6017, Box 1, Bundle 3, U.S. Nat'l. Mus., Washington, DC.
- _____. 1927. Exploration of the Burton mound at Santa Barbara, Calif. 44th Ann. Report of the Bur. of Amer. Ethnology, 1926-1927, Pp. 23-168.
- Holt, W.B. 1937. Tomolos rode at anchor. *Santa Barbara Mus. Nat. Hist. Leaflet No.* 7:88.
- Howorth, P.C. 1971. A graveyard of ships. *Westways* 63(3):30-39, 54-55 [March].
- _____. 1973a. The sea takes all: shipwrecks of Southern California. *Aquarius* 2(6):6-7, 24-27 [June].
- _____. 1973b. Sing a song of shipwreck. *Aquarius* 2(7): 7-9; 24-26 [July].
- _____. 1974. The forgotten ones. *Aquarius* 3(7):24-28 [July].
- _____. 1975. Undersea archaeology: a search for lost Indian villages. *Santa Barbara Magazine* 1(4):17-21 [Winter].
- _____. 1976a. Graveyard of ships. *Santa Barbara Magazine* 2(1):7-9 [Spring].
- _____. 1976b. Seeking deep secrets. *Westways* 68(9): 38-42 [September].
- _____. 1976c. The voyage of the *Helek*. *Santa Barbara Magazine* 2(4):17-21 [Winter].
- _____. 1977. Return of the sea hawk. *Westways* 69(5):23-28 [May].
- _____. 1980. California's ancient canoe. *Woodenboat* 6(7):82-87 [July].
- _____. 1983a. The undersea villages of southern California. *Waterfront* 5(2):12-13 [August].
- _____. 1983b. The great toy wreck. *Waterfront* 5(4):12 [October].
- _____. 1983c. The wreck of the *Winfield Scott*. *Waterfront* 5(4):12 [October].
- _____. 1983d. The sinking ship leaves the rats. *Waterfront* 5(6):12 [December].
- _____. 1984a. The sunken bird. *Waterfront* 5(10): 14 [April].
- _____. 1984b. The colliers. *Waterfront* 6(1):15-16 [July].
- _____. 1984c. The wreck of the *Jane L. Sanford*. *Waterfront* 6(3):12-13 [September].

- _____. 1984d. The foul area. *Waterfront* 6(4):14-15 [October].
- _____. 1984e. Southern California's mysterious galleons. *Waterfront* 6(5):14-15 [November].
- _____. 1986a. California shipwrecks: finders, weepers. *Waterfront* 7(8):62-65 [February].
- _____. 1986b. The infamous *Kate and Ann*. *Waterfront* 7(9):20 [March].
- _____. 1986c. Treasures of the deep. *Santa Barbara Magazine*, 12(2):16-24 [April/May].
- _____. 1986d. The strange fate of the twin sisters. *Waterfront* 7(11):21-22 [May].
- _____. 1986e. Death of a steamship: the *Cuba*. *Waterfront* 7(12):65-66; 75 [June].
- _____. 1986f. The windjammer *Watson A. West*. *Waterfront* 8(1):53 [July].
- _____. 1987a. The toppled *Crown of England*. *Waterfront* 8(8):40 [February].
- _____. 1987b. Richardson's Rock: a fateful landmark. *Waterfront* 8(11):35 [May].
- _____. 1987c. The sea shall give up its dead. *Sea* 9(2):30-33; 63 [August].
- _____. 1987d. The golden age of sail. *Waterfront* 9(5):48-49; 53-54 [November].
- Hudson, D.T. 1976. Marine archaeology along the Southern California coast. *San Diego Mus. of Man* No. 9:1-54.
- _____. 1979. A charmstone from the sea off Pt. Conception, California. *J. Calif. & Great Basin Anthro.* 1(2):363-367.
- _____. and T. Blackburn. 1982. The material culture of the Chumash interaction sphere: Vol. 1: Food procurement and transportation. *Ballena Press Anthro. Papers* No. 25: 461 pp.
- _____. and P.C. Howorth. 1985. A preliminary survey on sensitive marine archaeological and historical sites located within the boundary of the Channel Islands National Marine Sanctuary. Two parts, four vols. Prepared for Channel Islands National Marine Sanctuary and Channel Islands National Park. Contract nos. 8120-6100-454 and 8120-6100-454-2500.
- _____, J. Timbrook and M. Rempe. 1978. Tomol: Chumash watercraft as described in the ethnographic notes of John P. Harrington. *Ballena Press Anthro. Papers* No. 9. 197 pp.
- Junger, A. and D. Johnson. 1980. Was there a Quaternary land bridge to the northern Channel Islands? Pp. 33-39. *In*: D. Power (ed.), *The California Islands: proceedings of a multi-disciplinary symposium*. Santa Barbara Museum of Natural History: Santa Barbara, CA.
- Lenihan, D. 1983. Rethinking shipwreck archaeology: a history of ideas and considerations for new directions. Pp. 24-27. *In*: R.A. Gould (ed.), *Shipwreck anthropology*. Vol. 3. School of American Research Book, University of New Mexico Press: Albuquerque, NM.
- Marshall, N. and J. Moriarty. 1964. Principals of underwater archaeology. *Pacific Discovery* 17:18-25.
- Masters, P. 1983. Detection and assessment of prehistoric artifact sites off the coast of Southern California in Quaternary. Pp. 189-213. *In*: P. Masters and N.C. Fleming (eds.), *Quaternary coastlines and marine archaeology*. Academic Press: London, ENGLAND.
- _____. 1985. Coastal evolution and marine archaeology in southern California. *Oceanus*. (in prep.). 34 pp.
- Moriarty, J. 1961. Submarine archaeology. Academic Press: New York, NY. 34 pp.
- _____. 1964. The interdisciplinary use of oceanography in a submarine archaeological site. *Contributions of the Fifth Underwater Council*, Los Angeles, CA.
- _____. 1969. Marine archaeology in submerged prehistoric sites. *Oceans Magazine* 3(2):47-49.
- Murphy, L. 1983. Shipwrecks as data base for human behavioral studies. Pp. 65-90. *In*: R.A. Gould (ed.), *Shipwreck anthropology*. Vol. 4. School of American Research Book, University of New Mexico Press: Albuquerque, NM.
- Nardin, T.R., R. H. Osborne, D. J. Bottjer and R. C. Scheidemann. 1981. Holocene sea-level curves for Santa Monica shelf, California coastal borderland. *Science* 213:331-333.
- Orr, P.C. 1968. Prehistory of Santa Rosa Island. *Santa Barbara Museum of Natural History: Santa Barbara, CA*. 253 pp.
- Phelps, P. and J. Mucche. 1977. Analysis and correlation of lithic remains recovered off the southern California coast. *Search* 1(1):2-14.
- Pierson, L. 1980. A supplement to submerged historic site list in an archaeological literature survey and sensitivity zone mapping of the Southern California Bight. Final Report, BLM Contract YNO10-PHO-56.
- _____. and G.E. Stickel. 1977. An archaeological literature survey and sensitivity zone mapping of the Southern California Bight area. Vol. 1: Technical report. BLM Contract AA550-CT7-32.
- _____. and _____. 1987. Archaeological resource study: Morro Bay to Mexican border. Final report, MMS Contract 14-12-0001-30272.
- Rose, F.P. 1968. A flint ballast station in New Rochelle, New York. *Amer. Antiq.* 33(2):240-243.
- Rozaire, C. 1962. Underwater finds at Dana Point. *Masterkey* 36(2):77-78.
- Shepard, F.P. 1964. Sea level changes in the past 6,000 years: possible archaeological significance. *Science* 143:574-576.
- _____. and U.S. Grant. 1947. Wave erosion along the California coast. *Bull. Geol. Soc. Amer.* 58:919-926.
- Shumway, G., C. Hubbs and J. Moriarty. 1961. Scripps Estates site, San Diego California: a La Jolla site dated 5,460 to 7,370 years before the present. *Ann. NY Acad. Sci.* 93:37-132.
- Stickel, E.G. and L. Pierson. 1977. An underwater and on land cultural resource survey, Port San Luis, California. Unpub. manuscript on file, Environmental Research Archaeologists: a Scientific Consortium for the U.S. Army Corps of Engineers: Los Angeles, CA.
- Tuthill, C. and A. Allanson. 1954. Ocean bottom artifacts. *Masterkey* 28(6):222-231.
- Wallace, E. and G. Kritzman. 1956. A shell-encrusted artifact. *Newsl. Arch. Assoc. S. Calif.* 3(2):11-12.
- Walters, K.R. 1969. An underwater artifact. *Masterkey* 43(2): 72-74.
- _____. 1972. Another underwater artifact. *Masterkey* 46(3):112-115.