A Summary of Rocky Shore Monitoring Projects in the Monterey Bay National Marine Sanctuary

Final Report to the

California Urban Environmental Research and Education Center
No. 51-33-017-009

Prepared by

Andrew De Vogelaere[1]
Michele Jacobi[1]
Ronald Walder[1,2]
and Michael Foster[2]

June 1999

[1] Monterey Bay National Marine Sanctuary, 299 Foam St. Monterey, CA 93940
[2] Moss Landing Marine Laboratories, P.O. Box 450, Moss Landing CA 95039

Introduction

The mission of the Monterey Bay National Marine Sanctuary (MBNMS) Program is to identify, designate and manage marine areas of special national significance. To achieve the mission, research goals include promoting and coordinating scientific research on, and monitoring of MBNMS resources to assist in their protection and management for sustainable, multiple use. While the MBNMS is a federal program, local oversight of the program is achieved through bi-monthly public meetings of a 20 member Sanctuary Advisory Council, including representatives from regional interest groups (e.g., agriculture, business, tourism, fishing, conservation, research, education). The MBNMS complements the goals of CUEREC: promoting a system approach to environmental policy development and implementation; building an environmentally compatible economy by balancing socio-economic concerns with responsible stewardship of natural resources; coordinating environmental research with California universities; focusing on interfaces between business, society, government and the environment. In particular, the MBNMS benefits greatly by strong links with Moss Landing Marine Laboratories to manage rocky shore natural resources.

The MBNMS encompasses 220 kilometers of rocky coastline between San Francisco and Cambria (Research Planning Inc. 1994). Important management issues related to this habitat include understanding natural variation in the system, preparing for natural resource damage assessment after small ship groundings and large oil spills, and impacts from human trampling and collecting (DeVogelaere 1996). The MBNMS Scientific Research Plan, written by representatives from 15 research institutions around Monterey Bay, indicates that monitoring the rocky shore habitat is a necessary component of managing the resource (MBNMS Research Advisory Committee 1993). The North-East Pacific shoreline has received extensive attention by rocky shore ecologists (see reviews by Ricketts et al. 1985; Foster et al. 1988, 1991) and some regional monitoring efforts have detected interesting regional results; however, the project data sets were collected for a

variety of purposes by many different investigators and consulting groups; moreover, information is scattered throughout various institutions. By compiling this information, MBNMS will have resource management data readily accessible and be able to develop a comprehensive monitoring plan based on existing data sets, relevant ongoing work, and gaps in information that must be addressed.

Methods

This project consisted largely of cataloguing and compiling information on a diverse array of studies. The effort included: (1) Identifying rocky shore monitoring data sets; (2) Locating the available data sets in electronic or hard copy format; (3) Compiling copies of existing photographs and photoquadrats from past study sites; (4) Summarizing information for each study: site name, title of project, investigators, site location, zones and assemblages considered, sampling dates, study purpose, methods, data format, contact information to obtain the data, and quality control measures; and (5) Developing study site maps and incorporating meta data into the MBNMS geographic information system.

Results

Thirty-one locations and forty-eight studies relevant to rocky shore monitoring were located within the boundaries of the Monterey Bay National Marine Sanctuary (Figure 1, Table 1). The geographic range of the studies is broad; however, there are fewer study sites along the along the Big Sur coast, particularly between Mill Creek and Point Sierra Nevada near Lucia, because steep cliffs prohibit adequate access. The obvious geographic gap in study sites is located in the Monterey Bay because this region consists of expansive sandy beaches. Some raw data sets were gathered but obtaining all this information would be a Herculean task, not worthy of the effort unless numbers are needed for a specific analyses. There are few study site position locations described by the accurate, more recent digital GPS methods. Site maps and photographs are not available for most studies. These

rocky shore studies used a broad range of techniques to ask a variety of questions. In general, they found that rocky shores of central California have relatively high biodiversity; compared to higher latitude North American sites, the percent cover of bare rock substrate is high; between site variability in community structure is high; some of this variability can be attributed to large-scale oceanographic features; recovery rates after disturbances vary with tidal height and species assemblage; human trampling has seriously impacted some sites; and a species trend consistent with global warming has been documented in one location.

Discussion

This review has produced significant baseline information for developing a Monterey Bay National Marine Sanctuary rocky shore monitoring program. Draft tables and figures of this report have already been used in determining the rocky shore site selection for the 17 million dollar Partnerships in Interdisciplinary Studies of Coastal Oceans (PISCO) project. A Research Fellow position has been secured to work with an advisory committee to complete a regional monitoring program. Finally, the University of California Sea Grant Extension Program continues to collaborate with California State University Monterey Bay to put these maps and meta data information onto a geographic information system.

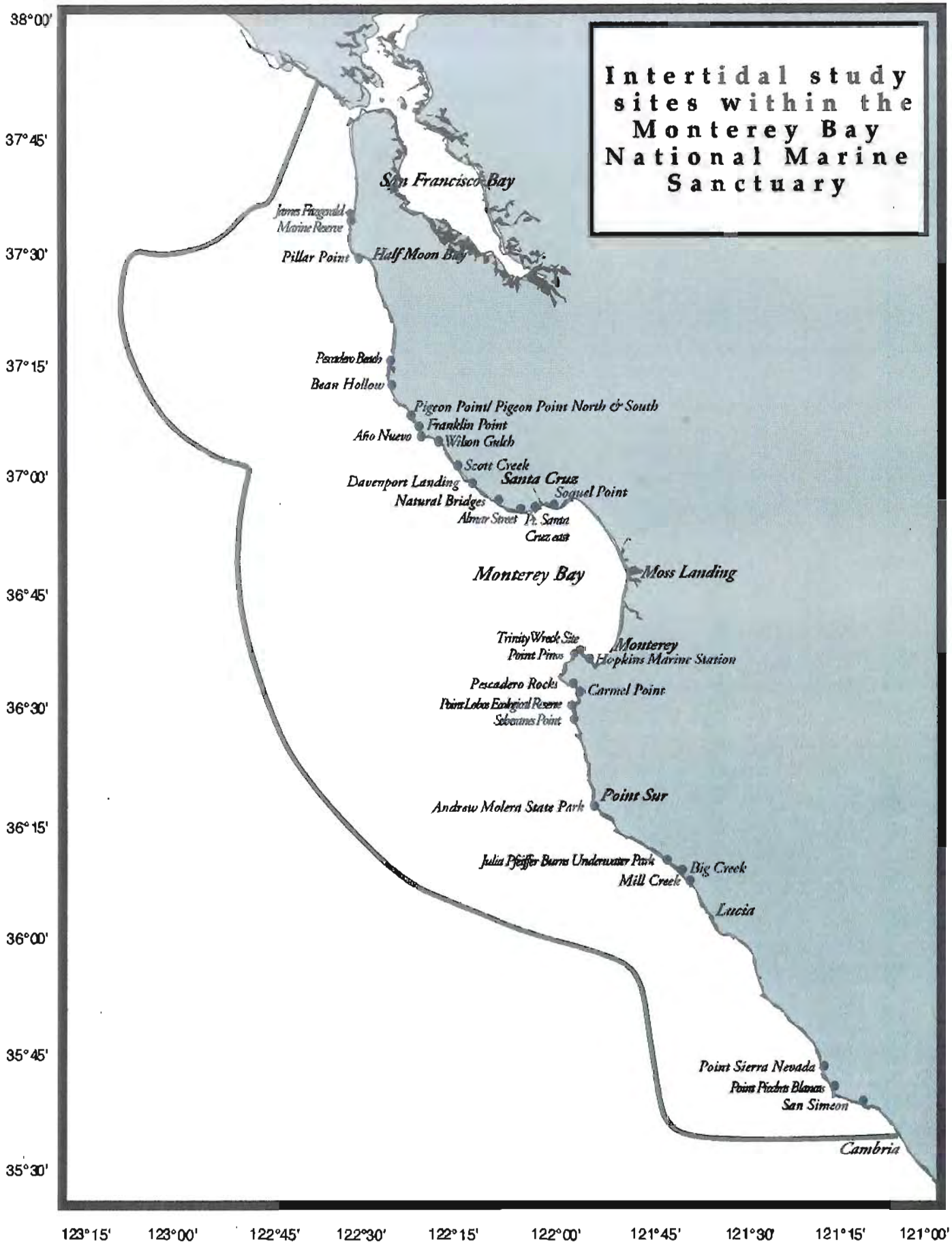


Figure 1. Locations of rocky shore monitoring sites within the MBNMS.

Table 1. Areas of special designation, species lists, and monitoring data sets for rocky intertidal sites within the Monterey Bay National Marine Sanctuary. Sites are arranged from north to south.

Location	Special Attribute	Citation
1) Fitzgerald Reserve	A) ASBS[1] Species list B) Quantitative survey	State Water Resources Control Board 1979 Breen 1994
2) Pillar Point	Quantitative survey	Kinnetic Labs Inc. 1985
3) Pescadero Beach	Quantitative survey	Connolly and Roughgarden 1998
4) Bean Hollow	Quantitative survey	Cosentino Consulting 1998
5) Pigeon Point	Quantitative survey	Cosentino Consulting 1998
6) Pigeon Point North	Quantitative survey & Species list	Pearse 1998, Summary in Foster et al. 1988
7) Pigeon Point South	Quantitative survey & Species list	Pearse 1998, Summary in Foster et al. 1988
8) Franklin Point	Species list	Pearse In prep.
9) Año Nuevo Point and Island	A) ASBS[1] B) Species list	State Water Resources Control Board 1981 Pearse 1981 and 1998
10) Año Nuevo Cove	Species list	Pearse 1981 and 1998
11) Wilson Gulch	Quantitative survey	Connolly and Roughgarden 1998
12) Scott Creek	A) Quantitative survey B) Species list	Kinnetic Labs Inc. 1985 Pearse 1998
13) Davenport Landing	Quantitative survey & Species list	Pearse 1998, Summary in Foster et al. 1988
14) Natural Bridges	A) Quantitative survey & Species List B) Quantitative survey C) Quantitative survey D) Species list	Pearse 1998, Summary in Foster et al. 1988 Beauchamp and Gowing 1982 De Vogelaere 1991 Malone and Wilson 1994
15) Almar Street	Quantitative survey & Species list	Pearse 1998, Summary in Foster et al. 1988
16) Point Santa Cruz east	Species list	Pearse 1998
17) Soquel Point	Species list	Pearse 1998
18) Hopkins Marine Stn.	A) Species list B) Quantitative Survey	Glynn 1965 Hewatt 1937, Barry et al. 1995
19) *Trinity* Wreck	Quantitative survey	Walder et al. 1997 and 1999
20) Point Pinos	Species list	Pearse In prep.

Table 1 (continued). Areas of special designation, species lists, and monitoring data sets for rocky intertidal sites within the Monterey Bay National Marine Sanctuary. Sites are arranged from north to south.

21) Pescadero Rocks	A) Quantitative survey	Kinnetic Labs Inc. 1985
	B) Quantitative survey	Kinnetic Labs Inc. 1992
	C) Quantitative survey	De Vogelaere 1991
	D) Quantitative survey	Walder et al. 1999
22) Carmel Point	Species list	Pearse In prep., Malone and Wilson 1994
23) Point Lobos State Reserve	ASBS Species list	State Water Resources Control Board 1979
24) Soberanes Point	Quantitative survey	Connolly and Roughgarden 1998
25) Andrew Molera State Park	A) Quantitative survey	Kinnetic Labs Inc. 1985
	B) Quantitative survey	Connolly and Roughgarden 1998
26) Julia Pfeiffer Burns Underwater Park	ASBS Species list	State Water Resources Control Board, 1980
27) Big Creek	Quantitative Survey & Species list	Malone and Wilson 1994, Pearse 1998
28) Mill Creek	A) Quantitative survey	Kinnetic Labs Inc. 1985
	B) Quantitative Survey	Connolly and Roughgarden 1998
	C) Species list	Pearse In prep.
29) Point Sierra Nevada	A) Quantitative survey	Kinnetic Labs Inc. 1985
	B) Quantitative survey	Kinnetic Labs Inc. 1992.
	C) Quantitative survey	Raimondi 1998
	D) Quantitative survey	Walder et al. In prep.
30) Point Piedras Blancas	A) Quantitative survey	Kinnetic Labs Inc. 1985
	B) Quantitative survey	Raimondi In prep.
31) San Simeon	A) Quantitative survey	Kinnetic Labs Inc. 1985
	B) Quantitative survey	Connolly and Roughgarden 1998

1. Area of Special Biological Significance (a State Water Resources Control Board designation)

Appendix I. Summary Information, by site, of rocky shore monitoring programs in the Monterey Bay National Marine Sanctuary.

SITE 1A: **Fitzgerald Marine Reserve - A**
See Figure I-1.

TITLE: California marine waters areas of special biological significance reconnaissance survey report.

INVESTIGATOR(S): Deborah J. Vanderwilt, Gaye V. Cazanjian, Ann C. Hurley and Michael S. Foster

CONTACT PERSON(S):
Michael S. Foster
Moss Landing Marine Laboratories
P.O. Box 450
Moss Landing, CA 95039
(831) 755-8650
foster@mlml.calstate.edu

LOCATION: 37°31' N, 122°30' W. (approximately)
From Pillar Point Harbor to the town of Montara.

ZONE(S) AND ASSEMBLAGE(S):
Intertidal biota from all 4 zones, subtidal biota, and land vegetation.

SAMPLING DATE(S):
Periodic sampling of intertidal zone on days in which low tides were less than 0.0 feet from 1971-1976. Subtidal surveys were conducted in October 1977 and May 1978.

PURPOSE: To assist the State Water Resources Control Board in evaluating the status of protection of the James V. Fitzgerald Marine Reserve ASBS by using existing background information and additional field work.

METHODS: Community structure, as indicated by species composition and relative abundance of major organisms, was noted for different intertidal areas and habitats. A species list was compiled. Previously unpublished data from R. Breen examined densities of turban snails and a visual count of starfish observed during walks. Subtidal surveys were conducted in localized areas or along transect headings. A species list was compiled for the reserve based on these visual surveys.

DATA FORMAT:
Printed Report: California State Water Resources Control Board. 1979. James V. Fitzgerald Marine Reserve, San Mateo County. California Marine Waters Areas of Special Biological Significance Reconnaissance Survey Report No. 79-12.

QUALITY CONTROL:
Experts in field identification were present during sampling.

SITE 1B: **Fitzgerald Marine Reserve - B**
See Figure I-2.

TITLE: Rocky intertidal monitoring protocols.

INVESTIGATOR(S): Bob Breen

CONTACT PERSON(S):
Bob Breen
Fitzgerald Marine Reserve
P.O.Box 451
Moss Beach, CA. 94038
(415) 728-3584

LOCATION: Three adjacent areas near public access within the reserve.

ZONE(S) AND ASSEMBLAGE(S):
All zones accessible during low tides.

SAMPLING DATE(S):
1995-Ongoing

PURPOSE: To monitor changes in the intertidal communities due to visitor impacts such as trampling.

METHODS: Seven monitoring sites were selected, each encompassing 100 square meters. Three are experimental sites, which are cordoned off at every low tide and restricted from public access. The remaining four serve as control sites and are not restricted from access. Two of these control sites are mussel beds, which correspond to the mussel bed that is in one of the experimental sites. Sites are surveyed monthly for species abundance, using PVC quadrats and photoquadrats that are taken periodically.

DATA FORMAT:
Electronic version: *Microsoft Excel*
Printed Report: Breen, B. 1994. Rocky intertidal monitoring protocols. Fitzgerald Marine Reserve. Moss Beach, California.

QUALITY CONTROL:
Use of protocol manual to standardize individual sampling techniques and periodic reviews of each observer's sampling to further standardize sampling techniques.

SITE 2: **Pillar Point**
See Figure I-3.

TITLE: Successional and seasonal variation of the central and northern California rocky intertidal communities as related to natural and man-induced disturbances.

INVESTIGATOR(S): Kinnetic Laboratories, Incorporated

CONTACT PERSON(S):

Kinnetic Laboratories Inc.
307 Washington Street
Santa Cruz, CA 95060
(831) 457-3950
kinnetic@cruzio.com

Mary-Elaine Dunaway
Mineral Management Service
770 Paseo Camarillo
Camarillo, CA 93010
(805) 389-7520
mary_elaine-dunaway@smtp.mms.gov

LOCATION: Site faces west into Half Moon Bay; top of site on crest of southern most island of Pillar Point. (122°29'58" W, 37°29'30" N - approximately)

ZONE(S) AND ASSEMBLAGE(S):
Transects across all zones; assemblages include: *Chthamalus/Balanus; Pelvetia/Pelvetiopsis; Endocladia/Gigartina; Mytilus; Mazzaella; Rhodomela/Odonthalia.*

SAMPLING DATE(S):
March 14, 1984

PURPOSE: To supply the Mineral Management Service with a recommended Field Survey Plan for evaluating species composition and abundance of organisms and the effects of disturbance on organisms. This was one of 20 sites surveyed to determine which rocky shore assembleges were appropriate for a longer term study on disturbance and recovery processes.

METHODS: Point-contact sampling along four vertical transects was performed, with topical description of substrata and a map of transect location noted. Transects were arranged to cross as many assemblages as possible within each site and in an area suitable for field survey. Individual transect line locations were determined by placing a line parallel to the water and marking four random points. From these four random points the beginning of each vertical transect was then run to the water's edge. The species were noted under 100 evenly spaced points, along each transect and percent cover estimated.

DATA FORMAT:
Electronic version: relational database - *PRODAS*.
Printed Report: Kinnetic Laboratories Inc. 1985. Successional and seasonal variation of the central and northern California rocky intertidal communities as related to natural and man-induced disturbances. OCS Study MMS 14-12-0001-30057. U.S. Department of the Interior, Los Angeles.

QUALITY CONTROL:
Identification done by teams headed by Drs. Mike Foster and John Pearse. Voucher specimens were collected for lab identification and stored by the Minerals Management Service.

SITE 3: Pescadero Beach

TITLE: A latitudinal gradient in northeast Pacific intertidal community structure: evidence for an oceanographically based synthesis of marine community theory.

INVESTIGATOR(S): Sean Connolly and Joan Roughgarden

CONTACT PERSON(S):

Joan Roughgarden
Department of Biological Sciences
Stanford University
Stanford, CA 94305-5020
(650) 723-3648
rough@pangea.stanford.edu

LOCATION: Pescadero Beach, 37°16' N

ZONE(S) AND ASSEMBLAGE(S):
Mid and low intertidal zones

SAMPLING DATE(S):
March 1997-May 1998

PURPOSE: The goal of this project was to determine the relationships among regional patterns in upwelling intensity, recruitment rate of intertidal mussels and barnacles whose larvae are transported in upwelling-related currents, and regional differences in the structure of intertidal communities.

METHODS: Recruitment of barnacles was monitored on six 5 x 10 cm settlement plates in the mid intertidal zone. Plates were styrene covered with 3M safety walk tape, and secured to the substrate. Mussel recruitment was monitored using SOS scrubbing pads instead of settlement plates. One meter photoquadrats were used to monitor growth rates and mortality of barnacles in the area. Nearshore measurements of upwelling intensity included salinity and nutrient level measurements of water samples taken on site and temperature data recorded with Optic Stow Away temperature loggers. Productivity measurements were performed by measuring the fluorescence of monthly seawater samples from each site. Community structure was surveyed during the summer using transect-quadrat methods.

DATA FORMAT:
Printed Report: Connolly, S.R. and J. Rougharden. 1998. A latitudinal gradient in northeast pacific intertidal community structure: evidence for an oceanographically based synthesis of marine community theory. The American Naturalist 151:311-326.

QUALITY CONTROL:
Undescribed

SITE 4: Bean Hollow
See Figure I-4.

TITLE: Monitoring the rocky intertidal communities within the Gulf of the Farallones and the northern portion of the Monterey Bay National Marine Sanctuaries.

INVESTIGATOR(S):
Cosentino Consulting

CONTACT PERSON(S):

Jan Roletto
Gulf of the Farallones National Marine Sanctuary.
Fort Mason Bldg. 201
San Francisco, CA 94123
(415) 561-6622 Office
(415) 561-6616 Fax
jrolletto@ocean.nos.noaa.gov

LOCATION: Located south of Half Moon Bay approximately 20 miles. (37°13' N, 122°24' W)

ZONE(S) AND ASSEMBLAGE(S):
High, middle, and low intertidal zones.

SAMPLING DATE(S):
Winter 1995 - Ongoing

PURPOSE: Collection of baseline data on species abundance, diversity and distribution for assessment of natural and anthropogenic disturbances to rocky intertidal populations of algae and invertebrates.

METHODS: Site assessed by establishing 12 quadrats (6 permanent and 6 stratified random quadrats) in the low, middle, and high algal zones. Each quadrat was 30 x 50 cm. A random point contact method (Foster et al. 1991) was conducted to assess species distribution, richness, and percent cover . Two photographs (f-stop of 5.6 and 8.0) were also taken of each quadrat. Three 12 m transects were also assessed at each location to determine the density of dominant species. Transects were positioned by a tape measure either perpendicular to shore or horizontally, depending on the dimensions of the site. Transects coincided with at least three permanent quadrats and a minimum of one transect began at the highest point devoid of vegetation and extended through each zone to the waterline. A 30 x 50 cm quadrat was positioned at each meter mark and analyzed for presence/absence in the winter sampling and abundance measurements during the summer sampling. Photographs were not taken along transect lines.

DATA FORMAT:
Printed Reports: Cosentino Consulting 1998. Monitoring the Rocky Intertidal Communities within the Gulf of the Farallones and Monterey Bay National Marine Sanctuaries. Final Report. Study funded by U.S Department of the Interior, National Park Service, Golden Gate National Recreation Area, San Francisco, CA. Contract No. 1443CX8140-95-039 141 pp.

QUALITY CONTROL:
Species not identified in the field were taken to CA State Univ. at Humboldt for laboratory identification. Voucher specimens of algae were pressed and invertebrates were fixed in isopropyl alcohol and are stored at the GFNMS office.

SITE 5: **Pigeon Point**
See Figure I-5.

TITLE: Monitoring the rocky intertidal communities within the Gulf of the Farallones and the northern portion of the Monterey Bay National Marine Sanctuaries.

INVESTIGATOR(S):
Cosentino Consulting

CONTACT PERSON(S):
Jan Roletto
Gulf of the Farallones National Marine Sanctuary.
Fort Mason Bldg. 201
San Francisco, CA 94123
(415) 561-6622 Office
(415) 561-6616 Fax
jrolletto@ocean.nos.noaa.gov

LOCATION: 37°11' N, 122°23' W. Located half a mile south of the Pigeon Point Lighthouse and is accessed by traversing down a sea bluff.

ZONE(S) AND ASSEMBLAGE(S):
High, middle, and low intertidal zones.

SAMPLING DATE(S):
Winter 1995 - Ongoing

PURPOSE: Collection of baseline data on species abundance, diversity and distribution for assessment of natural and anthropogenic disturbances to rocky intertidal populations of algae and invertebrates.

METHODS: Site assessed by establishing 12 quadrats (6 permanent and 6 stratified random quadrats) in the low, middle, and high algal zones. Each quadrat was 30 x 50 cm. A random point contact method (Foster et al. 1991) was conducted to assess species distribution, richness, and percent cover . Two photographs (f-stop of 5.6 and 8.0) were also taken of each quadrat. Three 12 m transects were also assessed at each location to determine the density of dominant species. Transects were positioned by a tape measure either perpendicular to shore or horizontally, depending on the dimensions of the site. Transects coincided with at least three permanent quadrats and a minimum of one transect began at the highest point devoid of vegetation and extended through each zone to the waterline. A 30 x 50 cm quadrat was positioned at each meter mark and analyzed for presence/absence in the winter sampling and abundance measurements during the summer sampling. Photographs were not taken along transect lines.

DATA FORMAT:
Printed Reports: Cosentino Consulting 1998. Monitoring the Rocky Intertidal Communities within the Gulf of the Farallones and Monterey Bay National Marine Sanctuaries. Final Report. Study funded by U.S Department of the Interior, National Park Service, Golden Gate National Recreation Area, San Francisco, CA. Contract No. 1443CX8140-95-039 141 pp.

QUALITY CONTROL:

Species not identified in the field were taken to CA State Univ. at Humboldt for laboratory identification. Voucher specimens of algae were pressed and invertebrates were fixed in isopropyl alcohol and are stored at the GFNMS office.

SITE 6: Pigeon Point North

See Figure I-6.

TITLE: Biodiversity of the rocky intertidal in the Monterey Bay National Marine Sanctuary: a 24-year comparison.

INVESTIGATOR(S): John Pearse

CONTACT PERSON(S):

John Pearse
Institute of Marine Sciences
University of California
Santa Cruz, CA 95064
(831) 426-0542 (office)
(831) 459-2455 (lab)
pearse@biology.ucsc.edu

LOCATION: Just north of the Pidgeon Point Lighthouse

ZONE(S) AND ASSEMBLAGE(S):

Throughout all the intertidal zones..

SAMPLING DATE(S):

Quarterly sampling from fall 1971 through spring 1973 and spring1996 through spring 1997.

PURPOSE: To organize data collected in 1971- 1973 on species found at selected rocky intertidal sites along the central California coastline and to compare these data with similar data collected in the same way at the same sites during 1996-1997. These data document changes in species diversity, composition, and abundance and could be used in the development of long term management plans.

METHODS: In 1996-97, students from the University of California at Santa Cruz resurveyed species richness at the same areas sampled in a 1971-73 study. Teams focused on specific taxa, systematically searching for all species present. Relative abundance data on all major plant and animal macroscopic taxa were taken. Moreover, relatively abundant, easily identified plants and animals also had their abundance estimated by counting either absolute numbers or the number of 10 x 10 cm squares within a 50 x 50 cm quadrat that included the species.

DATA FORMAT:

Electronic version: *Microsoft Access.*
Printed Report: Pearse, J.S. 1998. Biodiversity of the rocky intertidal in the Monterey Bay National Marine Sanctuary: a 24-year comparison. R/CZ-132. Report of Completed Projects, 1994-1997. California Sea Grant College System, University of California, San Diego. No. R-044.

QUALITY CONTROL:

Voucher specimens from original study sites were maintained (algae available at UCSC, to be transferred to UC Berkeley Herbarium, invertebrates at California Academy of Sciences). Specialists were brought in as consultants for difficult groups (Isabella Abbott 1971-1973. Kathy Ann Miller, 1997 for algae, Welton Lee for sponges, Judith Winston for Bryozoans, 1996-1997).

SITE 7: Pigeon Point South

See Figure I-6.

TITLE: Biodiversity of the rocky intertidal in the Monterey Bay National Marine Sanctuary: a 24-year comparison.

INVESTIGATOR(S): John Pearse

CONTACT PERSON(S):

John Pearse
Institute of Marine Sciences
University of California
Santa Cruz, CA 95064
(831) 426-0542 (office)
(831) 459-2455 (lab)
pearse@biology.ucsc.edu

LOCATION: Just south of the Pidgeon Point Lighthouse

ZONE(S) AND ASSEMBLAGE(S):

Throughout all the intertidal zones..

SAMPLING DATE(S):

Quarterly sampling from fall 1971 through spring 1973 and spring1996 through spring 1997.

PURPOSE: To organize data collected in 1971- 1973 on species found at selected rocky intertidal sites along the central California coastline and to compare these data with similar data collected in the same way at the same sites during 1996-1997. These data document changes in species diversity, composition, and abundance and could be used in the development of long term management plans.

METHODS: In 1996-97, students from the University of California at Santa Cruz resurveyed species richness at the same areas sampled in a 1971-73 study. Teams focused on specific taxa, systematically searching for all species present. Relative abundance data on all major plant and animal macroscopic taxa were taken. Moreover, relatively abundant, easily identified plants and animals also had their abundance estimated by counting either absolute numbers or the number of 10 x 10 cm squares within a 50 x 50 cm quadrat that included the species.

DATA FORMAT:

Electronic version: *Microsoft Access*.
Printed Report: Pearse, J.S. 1998. Biodiversity of the rocky intertidal in the Monterey Bay National Marine Sanctuary: a 24-year comparison. R/CZ-132. Report of Completed Projects, 1994-1997. California Sea Grant College System, University of California, San Diego. No. R-044.

QUALITY CONTROL:

Voucher specimens from original study sites were maintained (algae available at UCSC, to be transferred to UC Berkeley Herbarium, invertebrates at California Academy of Sciences). Specialists were brought in as consultants for difficult groups (Isabella Abbott 1971-1973, Kathy Ann Miller, 1997 for algae, Welton Lee for sponges, Judith Winston for Bryozoans, 1996-1997).

SITE 8: **Franklin Point**

Figures may be available via the world wide web in 1999 through the California Academy of Sciences web server: (http/www.calacademy.org/)

TITLE: Biodiversity of the rocky intertidal in the Monterey Bay National Marine Sanctuary: a 24-year comparison.

INVESTIGATOR(S): John Pearse

CONTACT PERSON(S):

John Pearse
Institute of Marine Sciences
University of California
Santa Cruz, CA 95064
(831) 426-0542 (office)
(831) 459-2455 (lab)
pearse@biology.ucsc.edu

LOCATION: Undescribed

ZONE(S) AND ASSEMBLAGE(S):

Throughout all the intertidal zones..

SAMPLING DATE(S):

Quarterly sampling from fall 1971 through spring 1973 and spring1996 through spring 1997.

PURPOSE: To organize data collected in 1971- 1973 on species found at selected rocky intertidal sites along the central California coastline and to compare these data with similar data collected in the same way at the same sites during 1996-1997. These data document changes in species diversity, composition, and abundance and could be used in the development of long term management plans.

METHODS: In 1996-97, students from the University of California at Santa Cruz resurveyed species richness at the same areas sampled in a 1971-73 study. Teams focused on specific taxa, systematically searching for all species present. Relative abundance data on all major plant and animal macroscopic taxa were taken.

DATA FORMAT:

Electronic version: *Microsoft Access.*
Printed Report: Pearse, J.S. In Prep. Biodiversity of the rocky intertidal in the Monterey Bay National Marine Sanctuary: additional sites a 24 year comparison. University of California, Santa Cruz.

QUALITY CONTROL:

Voucher specimens from original study sites were maintained (algae available at UCSC, to be transferred to UC Berkeley Herbarium, invertebrates at California Academy of Sciences). Specialists were brought in as consultants for difficult groups (Isabella Abbott 1971-1973, Kathy Ann Miller, 1997 for algae, Welton Lee for sponges, Judith Winston for Bryozoans, 1996-1997).

SITE 9A: Año Nuevo Point and Island

See Figure I-7.

TITLE: California marine waters areas of special biological significance reconnaissance survey report.

INVESTIGATOR(S): Gordon L. Chan, Valerie A. Breda and Michael S. Foster

CONTACT PERSON(S):

Michael S. Foster
Moss Landing Marine Laboratories
P.O. Box 450
Moss Landing, CA 95039
(831) 755-8650
foster@mlml.calstate.edu

LOCATION: 37°06' N, 122°20' W. (approximately)

ZONE(S) AND ASSEMBLAGE(S):

Throughout the intertidal zone; at a subtidal site 50 meters off the northeast point of Año Nuevo Island; above the rocky shoreline area and within dune locations.

SAMPLING DATE(S):

Intertidal and land surveys were conducted on February 13 and April 3, 1980; one subtidal survey was conducted in June 1969.

PURPOSE: To assist the State Water Resources Control Board in evaluating the status of protection of the Año Nuevo Point and Island ASBS. A reconnaissance survey involved a qualitative evaluation of physical, chemical and biological aspects of the subtidal and intertidal regions and human land and water use aspects as well as and actual or potential pollution threats.

METHODS: Along the baseline of the highest tide line, a point was chosen randomly from which a perpendicular transect was plotted and ten contiguous square meter quadrats were qualitatively sampled for species. One transect line was performed at Año Nuevo Point and three on Año Nuevo Island. In addition, the density and diversity of marine life at Año Nuevo Island was assessed using a square meter quadrat at three different stations.

The subtidal transect dive was surveyed using SCUBA approximately about 50 m off the northeast point of Año Nuevo Island at a bottom depth of 18 feet. Four one meter square samples were taken at the bottom and diver observations of fish and other biota in the water column, above the quadrat, were noted. For land areas, qualitative observations were made within the dune locations, plants and animals identified and geology and geography of land forms described.

DATA FORMAT:

Printed Report: California State Water Resources Control Board. 1981. Año Nuevo Point and Island, San Mateo County. California Marine Waters Areas of Special Biological Significance Reconnaissance Survey Report No. 81-2.

QUALITY CONTROL:

Experts in field identification were present during sampling.

SITE 9B: Año Nuevo Point and Island

See Figure I-8.

TITLE: Biodiversity of the rocky intertidal in the Monterey Bay National Marine Sanctuary: a 24-year comparison.

INVESTIGATOR(S): John Pearse

CONTACT PERSON(S):

John Pearse
Institute of Marine Sciences
University of California
Santa Cruz, CA 95064
(831) 426-0542 (office)
(831) 459-2455 (lab)
pearse@biology.ucsc.edu

LOCATION: 122°19'46" W, 37°06'44" N (approximately)

ZONE(S) AND ASSEMBLAGE(S):

Throughout all the intertidal zones..

SAMPLING DATE(S):

Quarterly sampling from fall 1971 through spring 1973 and spring1996 through spring 1997.

PURPOSE: To organize data collected in 1971- 1973 on species found at selected rocky intertidal sites along the central California coastline and to compare these data with similar data collected in the same way at the same sites during 1996-1997. These data document changes in species diversity, composition, and abundance and could be used in the development of long term management plans.

METHODS: In 1996-97, students from the University of California at Santa Cruz resurveyed species richness at the same areas sampled in a 1971-73 study. Teams focused on specific taxa, systematically searching for all species present. Relative abundance data on all major plant and animal macroscopic taxa were taken.

DATA FORMAT:

Electronic version: *Microsoft Access*
Printed Reports: Pearse, J.S. 1981. Intertidal Invertebrates. Pp. 205-236 in The natural history of Año Nuevo. B.J. LeBouef and S. Kaza, eds. Boxwood, Pacific Grove, California.
and
Pearse, J.S. 1998. Biodiversity of the rocky intertidal in the Monterey Bay National Marine Sanctuary: a 24-year comparison. .R/CZ-132. Report of Completed Projects, 1994-1997. California Sea Grant College System, University of California, San Diego. No. R-044.

QUALITY CONTROL:

Voucher specimens from original study sites were maintained (algae available at UCSC, to be transferred to UC Berkeley Herbarium, invertebrates at California Academy of Sciences). Specialists were brought in as consultants for difficult groups (Isabella Abbott 1971-1973, Kathy Ann Miller, 1997 for algae, Welton Lee for sponges, Judith Winston for Bryozoans, 1996-1997).

SITE 10: Año Nuevo Cove

Figures may be available via the world wide web in 1999 through the California Academy of Sciences web server: (http/www.calacademy.org/)

TITLE: Biodiversity of the rocky intertidal in the Monterey Bay National Marine Sanctuary: a 24-year comparison.

INVESTIGATOR(S): John Pearse

CONTACT PERSON(S):

John Pearse
Institute of Marine Sciences
University of California
Santa Cruz, CA 95064
(831) 426-0542 (office)
(831) 459-2455 (lab)
pearse@biology.ucsc.edu

LOCATION: Undescribed

ZONE(S) AND ASSEMBLAGE(S):

Throughout all the intertidal zones..

SAMPLING DATE(S):

Quarterly sampling from fall 1971 through spring 1973 and spring1996 through spring 1997.

PURPOSE: To organize data collected in 1971- 1973 on species found at selected rocky intertidal sites along the central California coastline and to compare these data with similar data collected in the same way at the same sites during 1996-1997. These data document changes in species diversity, composition, and abundance and could be used in the development of long term management plans.

METHODS: In 1996-97, students from the University of California at Santa Cruz resurveyed species richness at the same areas sampled in a 1971-73 study. Teams focused on specific taxa, systematically searching for all species present. Relative abundance data on all major plant and animal macroscopic taxa were taken.

DATA FORMAT:

Electronic version: *Microsoft Access*
Printed Reports: Pearse, J.S. 1981. Intertidal Invertebrates. Pp. 205-236 in The natural history of Año Nuevo. B.J. LeBouef and S. Kaza, eds. Boxwood, Pacific Grove, California.
and
Pearse, J.S. 1998. Biodiversity of the rocky intertidal in the Monterey Bay National Marine Sanctuary: a 24-year comparison. .R/CZ-132. Report of Completed Projects, 1994-1997. California Sea Grant College System, University of California, San Diego. No. R-044.

QUALITY CONTROL:

Voucher specimens from original study sites were maintained (algae available at UCSC, to be transferred to UC Berkeley Herbarium, invertebrates at California Academy of Sciences). Specialists were brought in as consultants for difficult groups (Isabella Abbott 1971-1973, Kathy Ann Miller, 1997 for algae, Welton Lee for sponges, Judith Winston for Bryozoans, 1996-1997).

SITE 11: Wilson Gulch

TITLE: A latitudinal gradient in northeast Pacific intertidal community structure: evidence for an oceanographically based synthesis of marine community theory.

INVESTIGATOR(S): Sean Connolly and Joan Roughgarden

CONTACT PERSON(S):

Joan Roughgarden
Department of Biological Sciences
Stanford University
Stanford, CA 94305-5020
(650) 723-3648
rough@pangea.stanford.edu

LOCATION: Near Wilson Gulch at the Santa Cruz/San Meteo county line, 37°07' N

ZONE(S) AND ASSEMBLAGE(S):

Mid and low intertidal zones

SAMPLING DATE(S):

March 1997-May 1998

PURPOSE: The goal of this project was to determine the relationships among regional patterns in upwelling intensity, recruitment rate of intertidal mussels and barnacles whose larvae are transported in upwelling-related currents, and regional differences in the structure of intertidal communities.

METHODS: Recruitment of barnacles was monitored on six 5 x 10 cm settlement plates in the mid intertidal zone. Plates were styrene covered with 3M safety walk tape, and secured to the substrate. Mussel recruitment was monitored using SOS scrubbing pads instead of settlement plates. One meter photoquadrats were used to monitor growth rates and mortality of barnacles in the area. Nearshore measurements of upwelling intensity included salinity and nutrient level measurements of water samples taken on site and temperature data recorded with Optic Stow Away temperature loggers. Productivity measurements were performed by measuring the fluorescence of monthly seawater samples from each site. Community structure was surveyed during the summer using transect-quadrat methods.

DATA FORMAT:
Printed Report: Connolly, S.R. and J. Rougharden. 1998. A latitudinal gradient in northeast pacific intertidal community structure: evidence for an oceanographically based synthesis of marine community theory. The American Naturalist 151:311-326.

QUALITY CONTROL:
Undescribed

SITE 12A: Scott Creek - A
See Figure I-9.

TITLE: Successional and seasonal variation of the central and northern California rocky intertidal communities as related to natural and man-induced disturbances.

INVESTIGATOR(S): Kinnetic Laboratories, Incorporated

CONTACT PERSON(S):

Kinnetic Laboratories Inc.	Mary-Elaine Dunaway
307 Washington Street	Mineral Management Service
Santa Cruz, CA 95060	770 Paseo Camarillo
(831) 457-3950	Camarillo, CA 93010
kinnetic@cruzio.com	(805) 389-7520
	mary_elaine-dunaway@smtp.mms.gov

LOCATION: Site is approximately 200 m wide at inner side (base of cliff), and extends out approximately 75 m in a wide arc.

ZONE(S) AND ASSEMBLAGE(S):
Transects across all zones; assemblages include: *Chthamalus/Balanus; Pelvetia/Pelvetiopsis; Endocladia/Gigartina; Mytilus; Mazzaella; Rhodomela/Odonthalia.*

SAMPLING DATE(S):
March 13, 1984

PURPOSE: To supply the Mineral Management Service with a recommended Field Survey Plan for evaluating species composition and abundance of organisms and the effects of disturbance on organisms. This was one of 20 sites surveyed to determine which rocky shore assembleges were appropriate for a longer term study on disturbance and recovery processes.

METHODS: Point-contact sampling along four vertical transects was performed, with topical description of substrata and a map of transect location noted. Transects were arranged to cross as many assemblages as possible within each site and in an area suitable for field survey. Individual transect line locations were determined by placing a line parallel to the water and marking four random points. From these four random points the beginning of each vertical transect was then run to the water's edge. The species were noted under 100 evenly spaced points, along each transect and percent cover estimated.

DATA FORMAT:

Electronic version: relational database - *PRODAS*.
Printed Report: Kinnetic Laboratories Inc. 1985. Successional and seasonal variation of the central and northern California rocky intertidal communities as related to natural and man-induced disturbances. OCS Study MMS 14-12-0001-30057. U.S. Department of the Interior, Los Angeles.

QUALITY CONTROL:

Identification done by teams headed by Drs. Mike Foster and John Pearse. Voucher specimens were collected for lab identification and stored by the Minerals Management Service.

SITE 12B: Scott Creek - B

Figures may be available via the world wide web in 1999 through the California Academy of Sciences web server: (http/www.calacademy.org/)

TITLE: Biodiversity of the rocky intertidal in the Monterey Bay National Marine Sanctuary: a 24-year comparison.

INVESTIGATOR(S): John Pearse

CONTACT PERSON(S):

John Pearse
Institute of Marine Sciences
University of California
Santa Cruz, CA 95064
(831) 426-0542 (office)
(831) 459-2455 (lab)
pearse@biology.ucsc.edu

LOCATION: Undescribed

ZONE(S) AND ASSEMBLAGE(S):

Throughout all the intertidal zones..

SAMPLING DATE(S):

Quarterly sampling from fall 1971 through spring 1973 and spring1996 through spring 1997.

PURPOSE: To organize data collected in 1971- 1973 on species found at selected rocky intertidal sites along the central California coastline and to compare these data with similar data collected in the same way at the same sites during 1996-1997. These data document changes in species diversity, composition, and abundance and could be used in the development of long term management plans.

METHODS: In 1996-97, students from the University of California at Santa Cruz resurveyed species richness at the same areas sampled in a 1971-73 study. Teams focused on specific taxa, systematically searching for all species present. Relative abundance data on all major plant and animal macroscopic taxa were taken.

DATA FORMAT:
Electronic version: *Microsoft Access*.
Printed Report: Pearse, J.S. 1998. Biodiversity of the rocky intertidal in the Monterey Bay National Marine Sanctuary: a 24-year comparison. R/CZ-132. Report of Completed Projects, 1994-1997. California Sea Grant College System, University of California, San Diego. No. R-044.

QUALITY CONTROL:
Voucher specimens from original study sites were maintained (algae available at UCSC, to be transferred to UC Berkeley Herbarium, invertebrates at California Academy of Sciences). Specialists were brought in as consultants for difficult groups (Isabella Abbott 1971-1973, Kathy Ann Miller, 1997 for algae, Welton Lee for sponges, Judith Winston for Bryozoans, 1996-1997).

SITE 13: Davenport Landing
See Figure I-10.

TITLE: Biodiversity of the rocky intertidal in the Monterey Bay National Marine Sanctuary: a 24-year comparison.

INVESTIGATOR(S): John Pearse

CONTACT PERSON(S):
John Pearse
Institute of Marine Sciences
University of California
Santa Cruz, CA 95064
(831) 426-0542 (office)
(831) 459-2455 (lab)
pearse@biology.ucsc.edu

LOCATION: Undescribed

ZONE(S) AND ASSEMBLAGE(S):
Throughout all the intertidal zones..

SAMPLING DATE(S):
Quarterly sampling from fall 1971 through spring 1973 and spring1996 through spring 1997.

PURPOSE: To organize data collected in 1971- 1973 on species found at selected rocky intertidal sites along the central California coastline and to compare these data with similar data collected in the same way at the same sites during 1996-1997. These data document changes in species diversity, composition, and abundance and could be used in the development of long term management plans.

METHODS: In 1996-97, students from the University of California at Santa Cruz resurveyed species richness at the same areas sampled in a 1971-73 study. Teams focused on specific taxa, systematically searching for all species present. Relative abundance data on all major plant and animal macroscopic taxa were taken. Moreover, relatively abundant, easily identified plants and animals also had their abundance estimated by counting either absolute numbers or the number of 10 x 10 cm squares within a 50 x 50 cm quadrat that included the species.

DATA FORMAT:
Electronic version: *Microsoft Access.*
Printed Report: Pearse, J.S. 1998. Biodiversity of the rocky intertidal in the Monterey Bay National Marine Sanctuary: a 24-year comparison. R/CZ-132. Report of Completed Projects, 1994-1997. California Sea Grant College System, University of California, San Diego. No. R-044.

QUALITY CONTROL:
Voucher specimens from original study sites were maintained (algae available at UCSC, to be transferred to UC Berkeley Herbarium, invertebrates at California Academy of Sciences). Specialists were brought in as consultants for difficult groups (Isabella Abbott 1971-1973, Kathy Ann Miller, 1997 for algae, Welton Lee for sponges, Judith Winston for Bryozoans, 1996-1997).

SITE 14A: **Natural Bridges - A**
See Figure I-11.

TITLE: Biodiversity of the rocky intertidal in the Monterey Bay National Marine Sanctuary: a 24-year comparison.

INVESTIGATOR(S): John Pearse

CONTACT PERSON(S):
John Pearse
Institute of Marine Sciences
University of California
Santa Cruz, CA 95064
(831) 426-0542 (office)
(831) 459-2455 (lab)
pearse@biology.ucsc.edu

LOCATION: Undescribed

ZONE(S) AND ASSEMBLAGE(S):
Throughout all the intertidal zones..

SAMPLING DATE(S):
Quarterly sampling from fall 1971 through spring 1973 and spring1996 through spring 1997.

PURPOSE: To organize data collected in 1971- 1973 on species found at selected rocky intertidal sites along the central California coastline and to compare these data with similar data collected in the same way at the same sites during 1996-1997. These data document changes in species diversity, composition, and abundance and could be used in the development of long term management plans.

METHODS: In 1996-97, students from the University of California at Santa Cruz resurveyed species richness at the same areas sampled in a 1971-73 study. Teams focused on specific taxa, systematically searching for all species present. Relative abundance data on all major plant and animal macroscopic taxa were taken. Moreover, relatively abundant, easily identified plants and animals also had their abundance estimated by counting either absolute numbers or the number of 10 x 10 cm squares within a 50 x 50 cm quadrat that included the species.

DATA FORMAT:
Electronic version: *Microsoft Access*.
Printed Report: Pearse, J.S. 1998. Biodiversity of the rocky intertidal in the Monterey Bay National Marine Sanctuary: a 24-year comparison. R/CZ-132. Report of Completed Projects, 1994-1997. California Sea Grant College System, University of California, San Diego. No. R-044.

QUALITY CONTROL:
Voucher specimens from original study sites were maintained (algae available at UCSC, to be transferred to UC Berkeley Herbarium, invertebrates at California Academy of Sciences). Specialists were brought in as consultants for difficult groups (Isabella Abbott 1971-1973, Kathy Ann Miller, 1997 for algae, Welton Lee for sponges, Judith Winston for Bryozoans, 1996-1997).

SITE 14B: Natural Bridges - B

TITLE: A quantitative assessment of human trampling effects on a rocky intertidal community

INVESTIGATOR(S): Kate A. Beauchamp and M.M. Gowing

CONTACT PERSON(S):
Kate Beauchamp
University of California at Davis
Davis, California.

LOCATION: Adjacent to Natural Bridges State Park, De Anza Mobile Estates and Long Marine Laboratories (36°57'05" N; 122°04'45" W).

ZONE(S) AND ASSEMBLAGE(S):
Mussel assemblage and rockweed assemblage.

SAMPLING DATE(S):
Three consecutive days in December, 1977 and three consecutive days in December, 1978.

PURPOSE: To compare species diversity and density of organisms in an intertidal area with three distinct levels of usage by humans and identify organisms that appear susceptible to human trampling.

METHODS: Dominance diversity curves for numbers of animals and wet weights of algae by season and site were constructed in twenty 10 x 10 cm plots which were randomly allocated within a 10 m^2 area within each of 3 sites. Each site experienced different levels of human disturbance (trampled, intermediate, untrampled). Plots were scraped bare of plants and animals with a putty knife and collected. Shell lengths of mussels were also measured. *Pelvetiopsis limitata* was sampled in 24 random 1/4 m^2 plots with photos. Percent cover of *P. limitata* was determined by projecting slides on paper, tracing the outline of the algal covering and weighing the paper cut outs.

DATA FORMAT:

Electronic version: *SPSS* and *SAS*
Printed Report: Beauchamp, K.A. and M.M. Gowing. 1982. A quantitative assessment of human trampling effects on a rocky intertidal community. Journal of Marine Research 7:279-293.

QUALITY CONTROL:

Animals and algae were identified using Smith and Carlton (1975) and Abbott and Hollenberg (1976) respectively.

SITE 14C: Natural Bridges - C

TITLE: Quantifying spatial patterns in a central California mussel assemblage and a re-evaluation of the fugitive species concept.

INVESTIGATOR(S): Andrew P. De Vogelaere

CONTACT PERSON(S):

Andrew De Vogelaere
Monterey Bay National Marine Sanctuary
299 Foam Street
Monterey, CA 93940
(831) 647-4213
andrew.p.devogelaere@noaa.gov

LOCATION: Natural Bridges State Beach (37° N, 122° W)

ZONE(S) AND ASSEMBLAGE(S):

Mussel assemblage

SAMPLING DATE(S):

October 26 - November 12, 1989

PURPOSE: To quantify the distribution pattern of five species of algae in a central California mussel bed.

METHODS: One 8.4 x 6.0 m plot was established on nearly an entire mussel assemblage associated with a mudstone intertidal bench. The plot was sampled with 5040 contiguous 10 x 10 cm quadrats. The quadrats contained 9 evenly spaced rubber-band cross hairs which could be lifted and depressed as layers of species beneath the cross hairs were identified and recorded.

DATA FORMAT:

Summary data sheets, *Canvas* images
Printed Report: DeVogelaere, A.P. 1991 Disturbance, succession and distribution pattterns in rocky intertidal communities of central California. Dissertation. University of California at Santa Cruz. 136 pp.

QUALITY CONTROL:

Species considered were common and relatively easy to identify.

SITE 14D: Natural Bridges - D

TITLE: Temporal comparisons of the intertidal biota of the Landels-Hill Big Creek Reserve and spatial comparison of the reserve with three other central California sites: Oystercatcher Point, Carmel Point, and Natural Bridges.

INVESTIGATOR(S): Catherine Malone and Melissa Wilson

CONTACT PERSON(S):

Melissa Wilson
Moss Landing Marine Laboratories
P.O. Box 450
Moss Landing, CA 95039
mwilson@mlml.calstate.edu

LOCATION: Site on extensive broken platform between two rocky points and in the lee of offshore rocks.

ZONE(S) AND ASSEMBLAGE(S):

All zones and assemblages

SAMPLING DATE(S):

1978, 1981, and 1993

PURPOSE: To reveal any changes in abundance and species composition that have occurred over the years in Natural Bridges State Park. In addition this study made species comparisons between relatively close geographic sites(Oystercatcher Point, Carmel Point and Big Creek).

METHODS: Intense search and documentation of all plants and animals present within site.

DATA FORMAT:

Printed Report: Malone, C. and Wilson, M. 1994. Temporal comparison of the intertidal biota of the Landels-Hill Big Creek Reserve and spatial comparison of the reserve with three other central Californian sites: Oystercatcher Point, Carmel Point, and Big Creek. Senior Thesis in Biology. University of California at Santa Cruz. 89 pp.

QUALITY CONTROL:

Identification done in teams headed by John Pearse. Voucher specimens were collected for storage at UCSC.

SITE 15: **Almar Street**
See Figure I-12.

TITLE: Biodiversity of the rocky intertidal in the Monterey Bay National Marine Sanctuary: a 24-year comparison.

INVESTIGATOR(S): John Pearse

CONTACT PERSON(S):

John Pearse
Institute of Marine Sciences
University of California
Santa Cruz, CA 95064
(831) 426-0542 (office)
(831) 459-2455 (lab)
pearse@biology.ucsc.edu

LOCATION:

Undescribed

ZONE(S) AND ASSEMBLAGE(S):

Throughout all the intertidal zones..

SAMPLING DATE(S):

Quarterly sampling from fall 1971 through spring 1973 and spring1996 through spring 1997.

PURPOSE: To organize data collected in 1971- 1973 on species found at selected rocky intertidal sites along the central California coastline and to compare these data with similar data collected in the same way at the same sites during 1996-1997. These data document changes in species diversity, composition, and abundance and could be used in the development of long term management plans.

METHODS: In 1996-97, students from the University of California at Santa Cruz resurveyed species richness at the same areas sampled in a 1971-73 study. Teams focused on specific taxa, systematically searching for all species present. Relative abundance data on all major plant and animal macroscopic taxa were taken. Moreover, relatively abundant, easily identified plants and animals also had their abundance estimated by counting either absolute numbers or the number of 10 x 10 cm squares within a 50 x 50 cm quadrat that included the species.

DATA FORMAT:

Electronic version: *Microsoft Access*.
Printed Report: Pearse, J.S. 1998. Biodiversity of the rocky intertidal in the Monterey Bay National Marine Sanctuary: a 24-year comparison. R/CZ-132. Report of Completed Projects, 1994-1997. California Sea Grant College System, University of California, San Diego. No. R-044.

QUALITY CONTROL:

Voucher specimens from original study sites were maintained (algae available at UCSC, to be transferred to UC Berkeley Herbarium, invertebrates at California Academy of Sciences). Specialists were brought in as consultants for difficult groups (Isabella Abbott 1971-1973, Kathy Ann Miller, 1997 for algae, Welton Lee for sponges, Judith Winston for Bryozoans, 1996-1997).

SITE 16 **Santa Cruz Point east**
See Figure I-13.

TITLE: Biodiversity of the rocky intertidal in the Monterey Bay National Marine Sanctuary: a 24-year comparison.

INVESTIGATOR(S): John Pearse

CONTACT PERSON(S):
John Pearse
Institute of Marine Sciences
University of California
Santa Cruz, CA 95064
(831) 426-0542 (office)
(831) 459-2455 (lab)
pearse@biology.ucsc.edu

LOCATION: 122°01'33" W; 36°57'07" N (approximately)

ZONE(S) AND ASSEMBLAGE(S):
Throughout all the intertidal zones..

SAMPLING DATE(S):
Quarterly sampling from fall 1971 through spring 1973 and spring 1996 through spring 1997.

PURPOSE: To organize data collected in 1971- 1973 on species found at selected rocky intertidal sites along the central California coastline and to compare these data with similar data collected in the same way at the same sites during 1996-1997. These data document changes in species diversity, composition, and abundance and could be used in the development of long term management plans.

METHODS: In 1996-97, students from the University of California at Santa Cruz resurveyed species richness at the same areas sampled in a 1971-73 study. Teams focused on specific taxa, systematically searching for all species present. Relative abundance data on all major plant and animal macroscopic taxa were taken.

DATA FORMAT:
Electronic version: *Microsoft Access*.
Printed Report: Pearse, J.S. 1998. Biodiversity of the rocky intertidal in the Monterey Bay National Marine Sanctuary: a 24-year comparison. R/CZ-132. Report of Completed Projects, 1994-1997. California Sea Grant College System, University of California, San Diego. No. R-044.

QUALITY CONTROL:
Voucher specimens from original study sites were maintained (algae available at UCSC, to be transferred to UC Berkeley Herbarium, invertebrates at California Academy of Sciences). Specialists were brought in as consultants for difficult groups (Isabella Abbott 1971-1973, Kathy Ann Miller, 1997 for algae, Welton Lee for sponges, Judith Winston for Bryozoans, 1996-1997).

SITE 17: **Soquel Point**
See Figure I-14.

TITLE: Biodiversity of the rocky intertidal in the Monterey Bay National Marine Sanctuary: a 24-year comparison.

INVESTIGATOR(S): John Pearse

CONTACT PERSON(S):
John Pearse
Institute of Marine Sciences
University of California
Santa Cruz, CA 95064
(831) 426-0542 (office)
(831) 459-2455 (lab)
pearse@biology.ucsc.edu

LOCATION: Undescribed

ZONE(S) AND ASSEMBLAGE(S):
Throughout all the intertidal zones..

SAMPLING DATE(S):
Quarterly sampling from fall 1971 through spring 1973 and spring1996 through spring 1997.

PURPOSE: To organize data collected in 1971- 1973 on species found at selected rocky intertidal sites along the central California coastline and to compare these data with similar data collected in the same way at the same sites during 1996-1997. These data document changes in species diversity, composition, and abundance and could be used in the development of long term management plans.

METHODS: In 1996-97, students from the University of California at Santa Cruz resurveyed species richness at the same areas sampled in a 1971-73 study. Teams focused on specific taxa, systematically searching for all species present. Relative abundance data on all major plant and animal macroscopic taxa were taken.

DATA FORMAT:
Electronic version: *Microsoft Access*.
Printed Report: Pearse, J.S. 1998. Biodiversity of the rocky intertidal in the Monterey Bay National Marine Sanctuary: a 24-year comparison. R/CZ-132. Report of Completed Projects, 1994-1997. California Sea Grant College System, University of California, San Diego. No. R-044.

QUALITY CONTROL:
Voucher specimens from original study sites were maintained (algae available at UCSC, to be transferred to UC Berkeley Herbarium, invertebrates at California Academy of Sciences). Specialists were brought in as consultants for difficult groups (Isabella Abbott 1971-1973, Kathy Ann Miller, 1997 for algae, Welton Lee for sponges, Judith Winston for Bryozoans, 1996-1997).

SITE 18A: Hopkins Marine Station - A

TITLE: Community composition, structure, and interrelationships in the marine intertidal *Endocladia muricata-Balanus glandula* association in Monterey Bay, California.

INVESTIGATOR(S): Peter Glynn

CONTACT PERSON(S):
Library
Hopkins Marine Station of Stanford University
Pacific Grove, CA 93950

LOCATION: In front of Hopkins Marine Station (36°37' N; 121°54' W) on the rocky shore directly protected from shoreward moving swells by marginal outcropping islands.

ZONE(S) AND ASSEMBLAGE(S):
Endocladia muricata-Balanus glandula assemblage.

SAMPLING DATE(S):
January 8, 1959 - December 20, 1961.

PURPOSE: To qualitatively and quantitatively investigate the composition and structure of the *Endocladia-Balanus* association and the autecologies of the more influential species present in this association.

METHODS: To determine variation in community composition in this assemblage with place and season, biomass and numbers of species were sampled in sixteen randomly placed 20 x 20 cm quadrats and qualitative monthly samples collected over nearly 3 years. Field observations were carried out during day and night, high and low tide to determine conditions of the physical environment and the movement and density of the more transient members. Autecological studies were made of the more abundant forms. To make possible a portrayal of a web diagram of the food relationships, qualitative determinations were made of the feeding habits and food inter-relationships with the association and species inhabiting adjacent pelagic and benthic communities.

DATA FORMAT:
Printed Report: Glynn, P. 1965. Community composition, structure and interrelationships in the marine intertidal *Endocladia muricata - Balanus glandula* association in Monterey Bay, California. Beaufortia 12:1-198.

QUALITY CONTROL
Species were sent to several experts worldwide for identification.

SITE 18B: Hopkins Marine Station - B
See Figure I-15.

TITLE: Climate-related, long-term faunal changes in a California rocky intertidal community.

INVESTIGATOR(S): James P. Barry, Chuck H. Baxter, Rafe D. Sagarin, Sarah E. Gilman and W.G. Hewatt.

CONTACT PERSON(S):

James P. Barry
Monterey Bay Aquarium Research Institute
7700 Sandholt Road
Moss Landing, CA 95039
(831) 775-1726
barry@mbari.org

LOCATION: 36°37.3' N; 121°54.3' W. Thirty-five plots located along a fixedrocky intertidal transect 99.8 m long. Transect crosses exposed granite bedrock and boulders from high to low intertidal zones at a site semi protected from ocean swells.

ZONE(S) AND ASSEMBLAGE(S):
Low to high intertidal zones.

SAMPLING DATE(S):
1931-1933; 1993-1994

PURPOSE: To report changes in the abundance of 45 species of invertebrates in a central California intertidal community between the period of 1931-1933 and the period 1993-1994. The study also reports continuous records of shoreline ocean temperatures spanning this period and considers several hypothesis to explain faunal shifts.

METHODS: A study by W.G. Hewatt, from 1931-1933, which identified and counted individual invertebrates and algae in 35 plots was precisely replicated in 1993-1994. The 1993 - 1994 data were compared to the previous study and to prior descriptions and photographs of the site. Shifts in species abundance was correlated with temperature changes.

DATA FORMAT:
Printed Report: Barry, J.P., C.H. Baxter, R.D. Sagarin and S.E. Gilman. 1995. Climate-related, long-term faunal changes in a california rocky intertidal community. Science 267:672-675.
and
Hewatt, W.G. 1937. Ecological studies of selected marine intertidal communities of Monterey Bay, CA. The American Mid Naturalist 18:161.

QUALITY CONTROL:
Brass bolts marking original site were found, therefore researchers were confident they were re-examining the same quadrats as the original study.

SITE 19: *Trinity* Wreck Site
See Figure I-16.

TITLE: Recovery of rocky intertidal assemblages following the wreck and salvage of the *F/V Trinity*

INVESTIGATOR(S): Michael S. Foster, Ronald K. Walder and Andrew P. DeVogelaere

CONTACT PERSON(S):

Andrew DeVogelaere
Monterey Bay National Marine Sanctuary
299 Foam Street
Monterey, CA 93940
(831) 647-4213
andrew.p.devogelaere@noaa.gov

LOCATION: 100 m south of Point Pinos (36°38'12"N; 121°55'47" W, approximately)

ZONE(S) AND ASSEMBLAGE(S):

Low intertidal surf grass, mid intertidal mussel and mid/high intertidal red algae assemblages

SAMPLING DATE(S):

April 1996 - ongoing

PURPOSE: The grounding and subsequent salvage of the *F/V Trinity*, a 51 foot steel hull seiner, on April 20, 1996 resulted in 251 m^2 of physical and 287 m^2 of chemical influence to the rocky intertidal habitat. Biological damage and recovery were investigated to understand the recovery process. A potential restoration technique also was tested to enhance recovery.

METHODS: Rates of recovery within the surf grass, mussel, and red algal assemblages were determined quantitatively by sampling the species composition and percent cover of sessile organisms in 0.25 x 0.25 m plots within areas where new rock surfaces were exposed. Sampling was done in June, August, and December of 1996, June and December of 1997 and June 1998. Plots were established on newly disturbed horizontal rock surfaces in the surf grass, mussel and red algal assemblages. Each disturbed plot was matched with a control plot (wreck control) that was placed in the intact habitat adjacent to disturbed plots and another (spill control) was placed outside of the potential chemical spill area for comparison. Percent cover was determined using the point quadrat technique described by Foster et al. (1991). Plots were photographed in June 1996 and will be photographed every June thereafter to provide a visual record of temporal change. Recovery of rubble beds, newly exposed vertical rock surfaces and sand plots were qualitatively assessed. To examine feasibility of a restoration technique nine small (15-30 cm) and nine large (40-60 cm) boulders were transplanted to a rubble bed, and survival and reproductive condition of species on boulders was qualitatively assessed.

DATA FORMAT:

Electronic version: *Microsoft Excel*
Printed reports: Walder, R.K., M.S. Foster and A.P. De Vogelaere. 1997. Recovery of rocky intertidal assemblages following the wreck and salvage of the *F/V Trinity*. Year 1 Progress Report. Monterey Bay National Marine Sanctuary and Moss Landing Marine Laboratories. 35 pp.
and
Walder, R.K., M.S. Foster and A.P. De Vogelaere. 1999. Recovery of rocky intertidal assemblages following the wreck and salvage of the *F/V Trinity*. Final Report. Monterey Bay National Marine Sanctuary and Moss Landing Marine Laboratories. 51 pp.

QUALITY CONTROL:

Algal species difficult to identify in the field were collected and later identified in the laboratory by Michael S. Foster and Ronald K. Walder. Todd Newberry and Jonna Engel assisted in identification of invertebrates.

SITE 20: **Point Pinos**

Figures may be available via the world wide web in 1999 through the California Academy of Sciences web server: (http/www.calacademy.org/)

TITLE: Biodiversity of the rocky intertidal in the Monterey Bay National Marine Sanctuary: additional sites, A 24-year comparison.

INVESTIGATOR(S): John Pearse

CONTACT PERSON(S):

John Pearse
Institute of Marine Sciences
University of California
Santa Cruz, CA 95064
(831) 426-0542 (office)
(831) 459-2455 (lab)
pearse@biology.ucsc.edu

LOCATION: Undescribed

ZONE(S) AND ASSEMBLAGE(S):

Throughout all the intertidal zones.

SAMPLING DATE(S):

Quarterly sampling from fall 1971 through spring 1973 and spring1996 through spring 1997.

PURPOSE: To organize data collected in 1971- 1973 on species found at selected rocky intertidal sites along the central California coastline and to compare these data with similar data collected in the same way at the same sites during 1996-1997. These data document changes in species diversity, composition, and abundance and could be used in the development of long term management plans.

METHODS: In 1996-97, students from the University of California at Santa Cruz resurveyed species richness at the same areas sampled in a 1971-73 study. Teams focused on specific taxa, systematically searching for all species present. Relative abundance data on all major plant and animal macroscopic taxa were taken.

DATA FORMAT:

Electronic version: -*Microsoft Access*.
Printed Report: Pearse, J.S. In Prep. Biodiversity of the rocky intertidal in the Monterey Bay National Marine Sanctuary: additional sites a 24 year comparison. University of California, Santa Cruz.

QUALITY CONTROL:

Voucher specimens from original study sites were maintained (algae available at UCSC, to be transferred to UC Berkeley Herbarium, invertebrates at California Academy of Sciences). Specialists were brought in as consultants for difficult groups (Isabella Abbott 1971-1973, Kathy Ann Miller, 1997 for algae, Welton Lee for sponges, Judith Winston for Bryozoans, 1996-1997).

SITE 21A: Pescadero Rocks - A

See Figure I-17 and I-19.

TITLE: Successional and seasonal variation of the central and northern California rocky intertidal communities as related to natural and man-induced disturbances.

INVESTIGATOR(S): Kinnetic Laboratories, Incorporated

CONTACT PERSON(S):

Kinnetic Laboratories Inc.	Mary-Elaine Dunaway
307 Washington Street	Mineral Management Service
Santa Cruz, CA 95060	770 Paseo Camarillo
(831) 457-3950	Camarillo, CA 93010
kinnetic@cruzio.com	(805) 389-7520
	mary_elaine-dunaway@smtp.mms.gov

LOCATION: Site within Stillwater Cove and faces southwest into mouth of Carmel Bay; top of site on southwest side of crest of small island 70m in diameter (western most of three main islands forming Pescadero Rocks). Site is about 60m wide at top which curves around crest of island; extends out 20-30m with a bottom delineation about 80m in length (36°34' N, 121°56' W).

ZONE(S) AND ASSEMBLAGE(S):

Transects across all zones; assemblages include: *Chthamalus/Balanus; Pelvetia/Pelvetiopsis; Endocladia/Gigartina; Mytilus; Mazzaella; Rhodomela/Odonthalia.*

SAMPLING DATE(S):

March 15, 1984

PURPOSE: To supply the Mineral Management Service with a recommended Field Survey Plan for evaluating species composition and abundance of organisms and the effects of disturbance on organisms. This was one of 20 sites surveyed to determine which rocky shore assembleges were appropriate for a longer term study on disturbance and recovery processes.

METHODS: Point-contact sampling along four vertical transects was performed, with topical description of substrata and a map of transect location noted. Transects were arranged to cross as many assemblages as possible within each site and in an area suitable for field survey. Individual transect line locations were determined by placing a line parallel to the water and marking four random points. From these four random points the beginning of each vertical transect was then run to the water's edge. The species were noted under 100 evenly spaced points, along each transect and percent cover estimated.

DATA FORMAT

Electronic version: relational database - *PRODAS*.
Printed Report: Kinnetic Laboratories Inc. 1985. Successional and seasonal variation of the central and northern California rocky intertidal communities as related to natural and man-induced disturbances. OCS Study MMS 14-12-0001-30057. U.S. Department of the Interior, Los Angeles.

QUALITY CONTROL:

Identification done by teams headed by Drs. Mike Foster and John Pearse. Voucher specimens were collected for lab identification and stored by the Minerals Management Service.

SITE 21B: Pescadero Rocks - B

See Figure I-18 and I-19.

TITLE: Study of the rocky intertidal communities of central and northern California.

INVESTIGATOR(S): Kinnetic Laboratories, Inc. for the Minerals Management Service

CONTACT PERSON(S):

Kinnetic Laboratories Inc.	Mary-Elaine Dunaway
307 Washington Street	Mineral Management Service
Santa Cruz, CA 95060	770 Paseo Camarillo
(831) 457-3950	Camarillo, CA 93010
kinnetic@cruzio.com	(805) 389-7520
	mary_elaine-dunaway@smtp.mms.gov

LOCATION: Plots are situated on the western shore of a gently sloping bench that is composed of a hard conglomerate and sandstone. Average elevation on *Mytilus* assemblage plot is +1.4 m; elevation of *Endocladia/Mastocarpus* assemblages plots is + 1.9 m. (36°34' N, 121°56' W)

ZONE(S) AND ASSEMBLAGE(S):

Mytilus assemblage and *Endocladia/Mastocarpus* assemblage

PURPOSE: The objectives were to describe seasonal and successional variation in rocky intertidal community structure; determine the response of rocky intertidal communities to natural and human-induced disturbances; correlate results with successional, seasonal, and latitudinal variation and results of other studies.

SAMPLING DATE(S): Spring 1985 - Spring 1991 for *Endocladia*, Spring 1985 - Winter 1998 for *Mytilus*.

METHODS: Ten 1x 2 m rectangular plots were chosen at random in the center of the vertical distribution of the assemblage in March and April 1985, with the criteria that adjacent plots were separated by at least 1 m. Random allocation was then used to designate four control, three spring cleared and three fall cleared plots. Cover in each quadrat was determined by a random point quadrat method using 20 points. This method is described in detail by Foster et al. (1991). Motile molluscs and echinoderms greater than 0.5 cm were counted within each quadrat. Smaller motile molluscs and echinoderms were sampled in a 10 x 10 cm quadrat placed in the center of the larger quadrat. All plots were photographed. Sampling was done in the spring and fall of every year.

DATA FORMAT:

Electronic version: relational database - *PRODAS*.
Printed Report: Kinnetic Laboratories. 1991. Study of the rocky intertidal communities of central and northern California. OCS Study MMM 91-0089. U.S. Department of the Interior, Los Angeles.

QUALITY CONTROL:

Continuation of previous Kinnetic Labs study with some of the same scientists. Voucher specimens were collected for lab identification.

SITE 21C: Pescadero Rocks - C

See Figure I-19.

TITLE: Disturbance, succession and distribution pattterns in rocky intertidal communities of central California.

INVESTIGATOR(S): Andrew De Vogelaere

CONTACT PERSON(S):

Andrew De Vogelaere
Monterey Bay National Marine Sanctuary
299 Foam Street
Monterey, CA 93940
(831) 647-4213
andrew.p.devogelaere@noaa.gov

LOCATION: Plots are situated on the northern shore of a gently sloping bench that is composed of a hard conglomerate and sandstone. Average elevation on *Mytilus* assemblage plots is +1.4 m (36°34' N, 121°56' W).

ZONE(S) AND ASSEMBLAGE(S):

Mytilus assemblage

SAMPLING DATE(S):

1984 - 1989.

PURPOSE: To investigate the effects of disturbance severity and size on four years of succession in a central California rocky intertidal community.

METHODS: Four replicates of each of the following treatments were randomly allocated to a 500 m^2 mussel bench: four sizes of complete disturbances (10, 50 , 100, 150 cm on a side) and one size of partial disturbance (50 cm on a side). Plots were at least 1 m apart and marked with stainless steel bolts and epoxy. On bimonthly then quarterly sampling dates, 10 x 10 cm areas were subsampled in each plot and cover estimated with a point quadrat method. Grazers were counted on each sampling date in two plots of each size and type of disturbance.

DATA FORMAT:

Electronic version: *StatView*
Printed Report - DeVogelaere, A.P. 1991 Disturbance, succession and distribution pattterns in rocky intertidal communities of central California. Dissertation. University of California at Santa Cruz. 136 pp.

QUALITY CONTROL:

Identification of algae and invertebrates identified done by Andrew De Vogelaere and Kinnetics Labs Inc.Voucher specimens collectively catalogued by A. De Vogelaere and Kinnetics Labs Inc in association with the project "Study of the rocky intertidal communities of central and northern California." See site 21B.

SITE 21D: Pescadero Rocks – D

TITLE: Precision estimates and long term trends in species cover for the upper intertidal assemblages of two sites in the Monterey Bay National Marine Sanctuary.

INVESTIGATOR(S): Andrew P. De Vogelaere, Ronald K. Walder and Michael S. Foster

CONTACT PERSON(S):

Andrew DeVogelaere
Monterey Bay National Marine Sanctuary
299 Foam Street
Monterey, CA 93940
(831) 647-4213
andrew.p.devogelaere@noaa.gov

LOCATION: Plots are located on the northern and western shore of a gently sloping bench that is composed of a hard conglomerate and sandstone (approximately 36°34' N, 121°56' W). Plots can be located by triangulation from fixed site bolts.

ZONE(S) AND ASSEMBLAGE(S):

Endocladia/Mastocarpus and Splash zone assemblage

SAMPLING DATES:

1984 – ongoing

PURPOSE: To investigate long term changes and seasonal variability in the red algal and splash assemblages.

METHODS: Twenty-three Endocladia/Mastocarpus assemblage and twenty-five splash zone assemblage plots are photographed biennially intially, then sporadically.Percent cover and species richness is determined from photographs of the 40 x 60 cm plots.

DATA FORMAT:

Electronic version: Microsoft Excel.
Printed Report: Walder, R.K., A.P. DeVogelaere and M.S. Foster.1999. Precision estimates and long term trends in species cover for the upper intertidal assemblage of two sites in the Monterey Bay National Marine Sanctuary. Monterey Bay National Marine Sanctuary, Monterey, California.

QUALITY CONTROL:

Identification of algae and invertebrates done from photos by Ronald Walder and Andrew DeVogelaere

SITE 22 **Carmel Point**

Figures may be available via the world wide web in 1999 through the California Academy of Sciences web server: (http/www.calacademy.org/)

TITLE: Temporal comparisons of the intertidal biota of the Landels-Hill Big Creek Reserve and spatial comparison of the reserve with three other central California sites: Oystercatcher Point, Carmel Point, and Natural Bridges.
and
Biodiversity of the rocky intertidal in the Monterey Bay National Marine Sanctuary: additional sites, A 24-year comparison.

INVESTIGATOR(S): Catherine Malone, Melissa Wilson and John Pearse

CONTACT PERSON(S):

Melissa Wilson
Moss Landing Marine Laboratories
P.O. Box 450
Moss Landing, CA 95039
(831) 459-2455 (lab)
mwilson@mlml.calstate.edu

LOCATION: At the northern intersection of Scenic road and Ocean View Avenue in Carmel.

ZONE(S) AND ASSEMBLAGE(S):
Throughout all the intertidal zones.

SAMPLING DATE(S):
1978, 1981, and 1993

PURPOSE: To reveal any changes in abundance and species composition that have occurred over the years at Carmel Point. In addition this study made species comparisons between relatively close geographic sites (Oystercatcher Point, Big Creek and Natural Bridges).

METHODS: Intense search and documentation of all plants and animals present within site.

DATA FORMAT:
Printed Report - Malone, C. and M. Wilson 1994. Temporal comparison of the intertidal biota of the Landels-Hill Big Creek Reserve and spatial comparison of the reserve with three other central Californian Sites: Oystercatcher Point, Carmel Point, and Natural Bridges. Senior Thesis in Biology. University of California at Santa Cruz. 89 pp.
and
Pearse, J.S. In Prep. Biodiversity of the rocky intertidal in the Monterey Bay National Marine Sanctuary: additional sites a 24 year comparison. University of California, Santa Cruz.

QUALITY CONTROL:
Identification done in teams headed by John Pearse. Voucher specimens were collected for storage at UCSC.

SITE 23: Point Lobos Ecological Reserve
See Figure I-20.

TITLE: California marine waters areas of special biological significance reconnaissance survey report.

INVESTIGATOR(S): Gaye Violet Cazanian, Deborah J. Vanderwilt, Ann C. Hurley, Michael S. Foster, and James L. Cox.

CONTACT PERSON(S):
Michael S. Foster
Moss Landing Marine Laboratories
P.O. Box 450
Moss Landing, CA 95039
(831) 755-8650
foster@mlml.calstate.edu

LOCATION: 36°31' N; 121°56' W. (approximately)

ZONE(S) AND ASSEMBLAGE(S):
Intertidal biota of all 4 zones, subtidal biota, and land vegetation.

SAMPLING DATE(S):
Surveys taken on minus tides during November, December, March, and April 1978-79. Subtidal surveys were conducted on May 19, 1978.

PURPOSE: To assist the State Water Resources Control Board in evaluating the status of protection of the Point Lobos Ecological Reserve ASBS by using existing background information and additional field work.

METHODS: Different areas and habitats within the site were qualitatively described in the context of community structure, noting composition and abundance of major organisms present.

DATA FORMAT:
Printed Report - California State Water Resources control Board. 1979. Point Lobos Ecological Reserve, Monterey County. California Marine Waters Areas of Special Biological Significance Reconnaissance Survey Report No. 79-9.

QUALITY CONTROL:
Experts in field identification were present during sampling.

SITE 24: Soberanes Point

TITLE: A latitudinal gradient in northeast Pacific intertidal community structure: evidence for an oceanographically based synthesis of marine community theory.

INVESTIGATOR(S): Sean Connolly and Joan Roughgarden

CONTACT PERSON(S):

Joan Roughgarden
Department of Biological Sciences
Stanford University
Stanford, CA 94305-5020
(650) 723-3648
rough@pangea.stanford.edu

LOCATION: Near Soberanes Point at 36°27' N

ZONE(S) AND ASSEMBLAGE(S):
Mid and low intertidal zones

SAMPLING DATES:
March 1997-May 1998

PURPOSE: The goal of this project was to determine the relationships among regional patterns in upwelling intensity, recruitment rate of intertidal mussels and barnacles whose larvae are transported in upwelling-related currents, and regional differences in the structure of intertidal communities.

METHODS: Recruitment of barnacles was monitored on six 5 x 10 cm settlement plates in the mid intertidal zone.Plates were styrene covered with 3M safety walk tape, and secured to the substrate. Mussel recruitment was monitored using SOS scrubbing pads instead of settlement plates.One meter photoquadrats were used to monitor growth rates and mortality of barnacles in the area.Nearshore measurements of upwelling intensity included salinity and nutrient level measurements of water samples taken on site and temperature data recorded with Optic Stow Away temperature loggers.Productivity measurements were performed by measuring the fluorescence of monthly seawater samples from each site.Community structure was surveyed during the summer using transect-quadrat methods.

DATA FORMAT:
Printed Report: Connolly, S.R. and J. Rougharden.1998. A latitudinal gradient in northeast pacific intertidal community structure: evidence for an oceanographically based synthesis of marine community theory.The American Naturalist 151:311-326.

QUALITY CONTROL:
Undescribed

SITE 25A: Andrew Molera State Park - A

TITLE: Successional and seasonal variation of the central and northern California rocky intertidal communities as related to natural and man-induced disturbances.

INVESTIGATOR(S): Kinnetic Laboratories, Incorporated

CONTACT PERSON(S):

Kinnetic Laboratories Inc.
307 Washington Street
Santa Cruz, CA 95060
(831) 457-3950
kinnetic@cruzio.com

Mary-Elaine Dunaway
Mineral Management Service
770 Paseo Camarillo
Camarillo, CA 93010
(805) 389-7520
mary_elaine-dunaway@smtp.mms.gov

LOCATION: Site is a circular platform connected to shore by sand and rock beach; rock stack on northeast corner of site.

ZONE(S) AND ASSEMBLAGE(S):
Transects across all zones; assemblages include: *Chthamalus/Balanus; Pelvetia/Pelvetiopsis; Endocladia/Gigartina; Mytilus; Mazzaella; Rhodomela/Odonthalia.*

SAMPLING DATE(S):
May 17, 1984

PURPOSE: To supply the Mineral Management Service with a recommended Field Survey Plan for evaluating species composition and abundance of organisms and the effects of disturbance on organisms. This was one of 20 sites surveyed to determine which rocky shore assembleges were appropriate for a longer term study on disturbance and recovery processes.

METHODS: Point-contact sampling along four vertical transects was performed, with topical description of substrata and a map of transect location noted. Transects were arranged to cross as many assemblages as possible within each site and in an area suitable for field survey. Individual transect line locations were determined by placing a line parallel to the water and marking four random points. From these four random points the beginning of each vertical transect was then run to the water's edge. The species were noted under 100 evenly spaced points, along each transect and percent cover estimated.

DATA FORMAT:
Electronic version: relational database - *PRODAS*.
Printed Report: Kinnetic Laboratories Inc. 1985. Successional and seasonal variation of the central and northern California rocky intertidal communities as related to natural and man-induced disturbances. OCS Study MMS 14-12-0001-30057. U.S. Department of the Interior, Los Angeles.

QUALITY CONTROL:
Identification done by teams headed by Drs. Mike Foster and John Pearse. Voucher specimens were collected for lab identification and stored by the Minerals Management Service.

SITE 25B: Andrew Molera State Park - B

TITLE: A latitudinal gradient in northeast Pacific intertidal community structure: evidence for an oceanographically based synthesis of marine community theory.

INVESTIGATOR(S): Sean Connolly and Joan Roughgarden

CONTACT PERSON(S):

Joan Roughgarden
Department of Biological Sciences
Stanford University
Stanford, CA 94305-5020
(650) 723-3648
rough@pangea.stanford.edu

LOCATION: Molera Point at 121°54'08" W; 36°18'26" N (approximately)

ZONE(S) AND ASSEMBLAGE(S):
Mid and low intertidal zones

SAMPLING DATE(S):
March 1997-May 1998

PURPOSE: The goal of this project was to determine the relationships among regional patterns in upwelling intensity, recruitment rate of intertidal mussels and barnacles whose larvae are transported in upwelling-related currents, and regional differences in the structure of intertidal communities.

METHODS: Recruitment of barnacles was monitored on six 5 x 10 cm settlement plates in the mid intertidal zone. Plates were styrene covered with 3M safety walk tape, and secured to the substrate. Mussel recruitment was monitored using SOS scrubbing pads instead of settlement plates. One meter photoquadrats were used to monitor growth rates and mortality of barnacles in the area. Nearshore measurements of upwelling intensity included salinity and nutrient level measurements of water samples taken on site and temperature data recorded with Optic Stow Away temperature loggers. Productivity measurements were performed by measuring the fluorescence of monthly seawater samples from each site. Community structure was surveyed during the summer using transect-quadrat methods.

DATA FORMAT:
Printed Report: Connolly, S.R. and J. Rougharden. 1998. A latitudinal gradient in northeast pacific intertidal community structure: evidence for an oceanographically based synthesis of marine community theory. The American Naturalist 151:311-326.

QUALITY CONTROL:
Undescribed

SITE 26: Julia Pfeiffer Burns UnderWater Park
See Figure I-22.

TITLE: California marine waters areas of special biological significance reconnaissance survey report.

INVESTIGATOR(S): Craig P. Seltenrich, John D. DeMartini and James Barry.

CONTACT PERSON(S):

State Water Resources Control Board
901 P Street
Sacramento, CA 95814
(916) 657-0935

LOCATION: 30°10' N; 121°45' W

ZONE(S) AND ASSEMBLAGE(S):
Intertidal biota of all 4 zones, subtidal biota, and landside vegetation.

SAMPLING DATE(S):
Intertidal surveys were conducted in October, 1980. Subtidal surveys were conducted primarily in July and August 1979

PURPOSE: To assist the State Water Resources Control Board in evaluating the status of protection of the Julia Pfeiffer Burns UnderWater Park ASBS by using existing background information and additional field work.

METHODS: Qualitative visual analysis of all intertidal zones. Some photographs were taken to aide in site characterization. A species list then was compiled.

DATA FORMAT:
Printed Report: California State Water Resources Control Board. 1980. Julia Pfeifer Burns Underwater Park, Monterey County. California Marine Waters Areas of Special Biological Significance Reconnaissance Survey Report No. 80-4.

QUALITY CONTROL:
Experts in field identification were present during sampling.

SITE 27: Big Creek
Figures may be available via the world wide web in 1999 through the California Academy of Sciences web server: (http/www.calacademy.org/)

TITLE: Temporal comparisons of the intertidal biota of the Landels-Hill Big Creek Reserve and spatial comparison of the reserve with three other central California sites: Oystercatcher Point, Carmel Point, and Natural Bridges. and
Biodiversity of the rocky intertidal in the Monterey Bay National Marine Sanctuary: additional sites, a 24-year comparison.

INVESTIGATOR(S): Catherine Malone Melissa Wilson and John Pearse

CONTACT PERSON(S):
Melissa Wilson
Moss Landing Marine Laboratories
P.O. Box 450
Moss Landing, CA 95039
mwilson@mlml.calstate.edu

LOCATION: Site on extensive broken platform between two rocky points and in lee of offshore rocks.

ZONE(S) AND ASSEMBLAGE(S):
All zones and assemblages

SAMPLING DATE(S):
1978, 1981, and 1993

PURPOSE: To reveal any changes in abundance and species composition that have occurred over the years in Big Creek Reserve. In addition this study made species comparisons between relatively close geographic sites (Oystercatcher Point, Carmel Point and Natural Bridges).

METHODS: Intense search and documentation of all plants and animals present within site.

DATA FORMAT:
Printed Report - Malone, C. and M. Wilson 1994. Temporal comparison of the intertidal biota of the Landels-Hill Big Creek Reserve and spatial comparison of the reserve with three other central Californian Sites: Oystercatcher Point, Carmel Point, and Natural Bridges. Senior Thesis in Biology. University of California at Santa Cruz. 89 pp. and Pearse, J.S. In Prep. Biodiversity of the rocky intertidal in the Monterey Bay National Marine Sanctuary: additional sites a 24 year comparison. University of California, Santa Cruz.

QUALITY CONTROL:
Identification done in teams headed by John Pearse. Voucher specimens were collected for storage at UCSC.

SITE 28A: Mill Creek - A
See Figure I-23.

TITLE: Successional and seasonal variation of the central and northern California rocky intertidal communities as related to natural and man-induced disturbances.

INVESTIGATOR(S): Kinnetic Laboratories, Incorporated

CONTACT PERSON(S):

Kinnetic Laboratories Inc.	Mary-Elaine Dunaway
307 Washington Street	Mineral Management Service
Santa Cruz, CA 95060	770 Paseo Camarillo
(831) 457-3950	Camarillo, CA 93010
kinnetic@cruzio.com	(805) 389-7520
	mary_elaine-dunaway@smtp.mms.gov

LOCATION: Site on second platform south of Mill Creek.

ZONE(S) AND ASSEMBLAGE(S):
Transects across all zones; assemblages include: *Chthamalus/Balanus; Pelvetia/Pelvetiopsis; Endocladia/Gigartina; Mytilus; Mazzaella; Rhodomela/Odonthalia.*

SAMPLING DATE(S):
May 8, 1984

PURPOSE: To supply the Mineral Management Service with a recommended Field Survey Plan for evaluating species composition and abundance of organisms and the effects of disturbance on organisms. This was one of 20 sites surveyed to determine which rocky shore assembleges were appropriate for a longer term study on disturbance and recovery processes.

METHODS: Point-contact sampling along four vertical transects was performed, with topical description of substrata and a map of transect location noted. Transects were arranged to cross as many assemblages as possible within each site and in an area suitable for field survey. Individual transect line locations were determined by placing a line parallel to the water and marking four random points. From these four random points the beginning of each vertical transect was then run to the water's edge. The species were noted under 100 evenly spaced points, along each transect and percent cover estimated.

DATA FORMAT:
Electronic version: relational database - *PRODAS*.
Printed Report: Kinnetic Laboratories Inc. 1985. Successional and seasonal variation of the central and northern California rocky intertidal communities as related to natural and man-induced disturbances. OCS Study MMS 14-12-0001-30057. U.S. Department of the Interior, Los Angeles.

QUALITY CONTROL:
Identification done by teams headed by Drs. Mike Foster and John Pearse. Voucher specimens were collected for lab identification and stored by the Minerals Management Service.

SITE 28B: Mill Creek - B

TITLE: A latitudinal gradient in northeast Pacific intertidal community structure: evidence for an oceanographically based synthesis of marine community theory.

INVESTIGATOR(S): Sean Connolly and Joan Roughgarden

CONTACT PERSON(S):
Joan Roughgarden
Department of Biological Sciences
Stanford University
Stanford, CA 94305-5020
(650) 723-3648
rough@pangea.stanford.edu

LOCATION: Undescribed

ZONE(S) AND ASSEMBLAGE(S):
Mid and low intertidal zones

SAMPLING DATE(S):
March 1997-May 1998

PURPOSE: The goal of this project was to determine the relationships among regional patterns in upwelling intensity, recruitment rate of intertidal mussels and barnacles whose larvae are transported in upwelling-related currents, and regional differences in the structure of intertidal communities.

METHODS: Recruitment of barnacles was monitored on six 5 x 10 cm settlement plates in the mid intertidal zone. Plates were styrene covered with 3M safety walk tape, and secured to the substrate. Mussel recruitment was monitored using SOS scrubbing pads instead of settlement plates. One meter photoquadrats were used to monitor growth rates and mortality of barnacles in the area. Nearshore measurements of upwelling intensity included salinity and nutrient level measurements of water samples taken on site and temperature data recorded with Optic Stow Away temperature loggers. Productivity measurements were performed by measuring the fluorescence of monthly seawater samples from each site. Community structure was surveyed during the summer using transect-quadrat methods.

DATA FORMAT:
Printed Report: Connolly, S.R. and J. Rougharden. 1998. A latitudinal gradient in northeast pacific intertidal community structure: evidence for an oceanographically based synthesis of marine community theory. The American Naturalist 151:311-326.

QUALITY CONTROL:
Undescribed

SITE 28C: Mill Creek - C
Figures may be available via the world wide web in 1999 through the California Academy of Sciences web server: (http/www.calacademy.org/)

TITLE: Biodiversity of the rocky intertidal in the Monterey Bay National Marine Sanctuary: additional sites, a 24-year comparison.

INVESTIGATOR(S): John Pearse

CONTACT PERSON(S):
John Pearse
Institute of Marine Sciences
University of California
Santa Cruz, CA 95064
(831) 426-0542 (office)
(831) 459-2455 (lab)
pearse@biology.ucsc.edu

LOCATION: Undescribed

ZONE(S) AND ASSEMBLAGE(S):
Throughout all the intertidal zones..

SAMPLING DATE(S):
Quarterly sampling from fall 1971 through spring 1973 and spring1996 through spring 1997.

PURPOSE: To organize data collected in 1971- 1973 on species found at selected rocky intertidal sites along the central California coastline and to compare these data with similar data collected in the same way at the same sites during 1996-1997. These data document changes in species diversity, composition, and abundance and could be used in the development of long term management plans.

METHODS: In 1996-97, students from the University of California at Santa Cruz resurveyed species richness at the same areas sampled in a 1971-73 study. Teams focused on specific taxa, systematically searching for all species present. Relative abundance data on all major plant and animal macroscopic taxa were taken.

DATA FORMAT:

Electronic version: -*Microsoft Access*.
Printed Report: Pearse, J.S. In Prep. Biodiversity of the rocky intertidal in the Monterey Bay National Marine Sanctuary: additional sites a 24 year comparison. University of California, Santa Cruz.

QUALITY CONTROL:

Voucher specimens from original study sites were maintained (algae available at UCSC, to be transferred to UC Berkeley Herbarium, invertebrates at California Academy of Sciences). Specialists were brought in as consultants for difficult groups (Isabella Abbott 1971-1973, Kathy Ann Miller, 1997 for algae, Welton Lee for sponges, Judith Winston for Bryozoans, 1996-1997).

SITE 29A: Point Sierra Nevada - A

See Figure I-24 and I-27.

TITLE: Successional and seasonal variation of the central and northern California rocky intertidal communities as related to natural and man-induced disturbances.

INVESTIGATOR(S): Kinnetic Laboratories, Incorporated

CONTACT PERSON(S):

Kinnetic Laboratories Inc.	Mary-Elaine Dunaway
307 Washington Street	Mineral Management Service
Santa Cruz, CA 95060	770 Paseo Camarillo
(831) 457-3950	Camarillo, CA 93010
kinnetic@cruzio.com	(805) 389-7520
	mary_elaine-dunaway@smtp.mms.gov

LOCATION: Site on extensive broken platform between two rocky points and in lee of offshore rocks (35°43'57" W). The site is north of the real Point Sierra Nevada and is called "Dream Point" by local residents.

ZONE(S) AND ASSEMBLAGE(S):

Transects across all zones; assemblages include: *Chthamalus/Balanus; Pelvetia/Pelvetiopsis; Endocladia/Gigartina; Mytilus; Mazzaella; Rhodomela/Odonthalia.*

SAMPLING DATE(S):

May 7, 1984

PURPOSE: To supply the Mineral Management Service with a recommended Field Survey Plan for evaluating species composition and abundance of organisms and the effects of disturbance on organisms. This was one of 20 sites surveyed to determine which rocky shore assembleges were appropriate for a longer term study on disturbance and recovery processes.

METHODS: Point-contact sampling along four vertical transects was performed, with topical description of substrata and a map of transect location noted. Transects were arranged to cross as many assemblages as possible within each site and in an area suitable for field survey. Individual transect line locations were determined by placing a line parallel to the water and marking four random points. From these four random points the beginning of each vertical transect was then run to the water's edge. The species were noted under 100 evenly spaced points, along each transect and percent cover estimated.

DATA FORMAT:

Electronic version: relational database - *PRODAS*.
Printed Report: Kinnetic Laboratories Inc. 1985. Successional and seasonal variation of the central and northern California rocky intertidal communities as related to natural and man-induced disturbances. OCS Study MMS 14-12-0001-30057. U.S. Department of the Interior, Los Angeles.

QUALITY CONTROL:

Identification done by teams headed by Drs. Mike Foster and John Pearse. Voucher specimens were collected for lab identification and stored by the Minerals Management Service.

SITE 29B: Point Sierra Nevada - B

See Figure I-25 and I-27.

TITLE: Study of the rocky intertidal communities of central and northern California.

INVESTIGATOR(S): Kinnetic Laboratories, Inc.

CONTACT PERSON(S):

Kinnetic Laboratories Inc.	Mary-Elaine Dunaway
307 Washington Street	Mineral Management Service
Santa Cruz, CA 95060	770 Paseo Camarillo
(831) 457-3950	Camarillo, CA 93010
kinnetic@cruzio.com	(805) 389-7520
	mary_elaine-dunaway@smtp.mms.gov

LOCATION: The site is north of the real Point Sierra Nevada and is called "Dream Point" by local residents. It is located on a relatively flat bench just seaward of bluffs. Average elevation on *Mytilus* assemblage plot is +1.4 m; elevation of *Endocladia/ Mastocarpus* assemblages plots is + 1.9 m. (35°43' 57" W)

ZONE(S) AND ASSEMBLAGE(S):

Mytilus assemblage and *Endocladia/ Mastocarpus* assemblage

PURPOSE: The objectives were to describe seasonal and successional variation in rocky intertidal community structure; determine the response of rocky intertidal communities to natural and human-induced disturbances; correlate results with successional, seasonal, and latitudinal variation and results of other studies.

SAMPLING DATE(S):

Summer 1985 - Spring 1991 (biennially).

METHODS: Ten 1x 2 m rectangular plots were chosen at random in the center of the vertical distribution of the assemblage in March and April 1985, with the criteria that adjacent plots were separated by at least 1 m. Random allocation was then used to designate four control, three spring cleared and three fall cleared plots. Cover in each quadrat was determined by a random point quadrat method using 20 points. This method is described in detail by Foster et al. (1991). Motile molluscs and echinoderms greater than 0.5 cm were counted within each quadrat. Smaller motile molluscs and echinoderms were sampled in a 10 x 10 cm quadrat placed in the center of the larger quadrat. All plots were photographed. Sampling was done in the spring and fall of every year

DATA FORMAT:

Electronic version: relational database - *PRODAS.*
Printed Report: Kinnetic Laboratories. 1991. Study of the rocky intertidal communities of central and northern California. OCS Study MMM 91-0089. U.S. Department of the Interior, Los Angeles.

QUALITY CONTROL:

Continuation of previous Kinnetic Labs study with some of the same scientists. Voucher specimens were collected for lab identification.

SITE 29C: Point Sierra Nevada - C

See Figure I-26 and I-27.

TITLE: Inventory of rocky intertidal resources

INVESTIGATOR(S): Peter Raimondi

CONTACT PERSON(S):

Peter Raimondi
Institute of Marine Sciences
University of California at Santa Cruz
Santa Cruz, CA 95064
raimondi@biology.ucsc.edu

LOCATION: West towards ocean from turnout, 1/2 mile north of mile marker 68.0. A stake on the cliff edge indicates the study area below. The site is north of the real Point Sierra Nevada and is called "Dream Point" by local residents.

ZONE(S) AND ASSEMBLAGE(S):

Barnacle, brown turf, red turf, rockweed, mussel and surf grass assemblages inclusive of *Pelvetia*, *Fucus*, *Hesperophycus*, *Mastocarpus*, *Endocladia muricata*, *Mazzaella* sp.,barnacles, Mytilus californianus, *Policipes*, Haliotis cracherodii, seastars, *Phyllospadix* sp., tar, birds and mammals.

SAMPLING DATE(S):

October 1995 - ongoing

PURPOSE: To establish a long term monitoring program to follow ecological trends in the rocky intertidal as well as establish a baseline database in case of a catastrophic disturbance such as an oil spill.

METHODS: Permanent photoplots have been established to monitor *Pelvetia compressa* *Fucus* sp., *Hesperophycus harveyanus*, *Mastocarpus papillatus*, *Endocladia muricata*, *Mazzaella* sp., Barnacles, *Mytilus californianus*, *Policipes polymerus* and Tar. Irregular plots have been established to monitor *Haliotis cracherodii* and Seastars. Point intercept transects are used to monitor *Phyllospadix* spp. cover.

DATA FORMAT:

Electronic version: *Lotus*
Printed Report: Raimondi, P.T., R.F. Ambrose, J.M. Engle, S.N. Murray and M. Wilson. In Prep. Rocky intertidal resources in San Luis, Santa Barbara, and Orange Counties. OCS Study MMS 98-0000. U.S. Department of the Interior, Minerals Management Service Camarillo, CA.

QUALITY CONTROL:

All species were identified in field by Peter Raimondi and Melissa Wilson. Species identified from photos done by Melissa Wilson.

SITE 29D: Point Sierra Nevada - D

See Figure I-27.

TITLE: Precision estimates and long term trends in species cover for the upper intertidal assemblages of two sites in the Monterey Bay National Marine Sanctuary.

INVESTIGATOR(S): Andrew P. De Vogelaere, Ronald K. Walder and Michael S. Foster

CONTACT PERSON(S):

Andrew De Vogelaere
Monterey Bay National Marine Sanctuary
299 Foam Street
Monterey, CA 93940
(831) 647-4213
andrew.p.devogelaere@noaa.gov

LOCATION: The site is north of the real Point Sierra Nevada and is called "Dream Point" by local residents. Plots are situated on the northern and eastern shore of a gently sloping bench that is composed of a hard conglomerate and sandstone. (approximately 35°43'57" W)

ZONE(S) AND ASSEMBLAGE(S): *Endocladia/Mastocarpus* and Splash zone assemblage

SAMPLING DATE(S): 1984 - ongoing

PURPOSE: To investigate long term changes and seasonal variability in the red algal and splash assemblages.

METHODS: Twenty-three *Endocladia/Mastocarpus* assemblage and twenty-five splash zone assemblage plots are photographed biennially intially, then spordically. Percent cover and species richness is determined from photographs of the 40 x 60 cm plots.

DATA FORMAT:

Electronic version: *Microsoft Excel*
Printed Report: Walder, R.K., A.P. De Vogelaere and M.S. Foster. In prep. Precision estimates and long term trends in species cover for the upper intertidal assemblage of two sites in the Monterey Bay National Marine Sanctuary. Monterey Bay National Marine Sanctuary, Monterey, California.

QUALITY CONTROL:

Identification of algae and invertebrates done from photos by Ronald Walder, Andrew De Vogelaere and Danny McKeever

SITE 30A: Point Piedras Blancas - A

See Figure I-28.

TITLE: Successional and seasonal variation of the central and northern California rocky intertidal communities as related to natural and man-induced disturbances.

INVESTIGATOR(S): Kinnetic Laboratories, Incorporated

CONTACT PERSON(S):

Kinnetic Laboratories Inc.	Mary-Elaine Dunaway
307 Washington Street	Mineral Management Service
Santa Cruz, CA 95060	770 Paseo Camarillo
(831) 457-3950	Camarillo, CA 93010
kinnetic@cruzio.com	(805) 389-7520
	mary_elaine-dunaway@smtp.mms.gov

LOCATION: Site is at tip of Point Piedras Blancas in lee of Piedras Blancas Rock (121° 17'02" W; 35°39'50" N).

ZONE(S) AND ASSEMBLAGE(S):

Transects across all zones; assemblages include: *Chthamalus/Balanus; Pelvetia/Pelvetiopsis; Endocladia/Gigartina; Mytilus; Mazzaella; Rhodomela/Odonthalia.*

SAMPLING DATE(S):

May 6, 1984

PURPOSE: To supply the Mineral Management Service with a recommended Field Survey Plan for evaluating species composition and abundance of organisms and the effects of disturbance on organisms. This was one of 20 sites surveyed to determine which rocky shore assembleges were appropriate for a longer term study on disturbance and recovery processes.

METHODS: Point-contact sampling along four vertical transects was performed, with topical description of substrata and a map of transect location noted. Transects were arranged to cross as many assemblages as possible within each site and in an area suitable for field survey. Individual transect line locations were determined by placing a line parallel to the water and marking four random points. From these four random points the beginning of each vertical transect was then run to the water's edge. The species were noted under 100 evenly spaced points, along each transect and percent cover estimated.

DATA FORMAT:

Electronic version: relational database - *PRODAS*.
Printed Report: Kinnetic Laboratories Inc. 1985. Successional and seasonal variation of the central and northern California rocky intertidal communities as related to natural and man-induced disturbances. OCS Study MMS 14-12-0001-30057. U.S. Department of the Interior, Los Angeles.

QUALITY CONTROL:

Identification done by teams headed by Drs. Mike Foster and John Pearse. Voucher specimens were collected for lab identification and stored by the Minerals Management Service.

SITE 30B: Point Piedras Blancas - B

TITLE: Inventory of rocky intertidal resources

INVESTIGATOR(S): Peter Raimondi

CONTACT PERSON(S):

Peter Raimondi
Institute of Marine Sciences
University of California at Santa Cruz
Santa Cruz, CA 95064
raimondi@biology.ucsc.edu

LOCATION: Undescribed

ZONE(S) AND ASSEMBLAGE(S):

Barnacle, brown turf, red turf, rockweed, mussel and surf grass assemblages inclusive of *Pelvetia*, *Fucus*, *Hesperophycus*, *Mastocarpus*, *Endocladia muricata*, *Mazzaella* sp.,barnacles, Mytilus californianus, *Policipes*, Haliotis cracherodii, seastars, *Phyllospadix* sp., tar, birds and mammals.

SAMPLING DATE(S):

October 1997 - ongoing

PURPOSE: To establish a long term monitoring program to follow ecological trends in the rocky intertidal as well as establish a baseline database in case of a catastrophic disturbance such as an oil spill.

METHODS: Permanent photoplots have been established to monitor *Pelvetia compressa* *Fucus* sp., *Hesperophycus harveyanus*, *Mastocarpus papillatus*, *Endocladia muricata*, *Mazzaella* sp., Barnacles, *Mytilus californianus*, *Policipes polymerus* and Tar. Irregular plots have been established to monitor *Haliotis cracherodii* and Seastars. Point intercept transects are used to monitor *Phyllospadix* spp. cover.

DATA FORMAT:

Electronic version: *Lotus*
Printed Report: Raimondi, P.T., Ambrose, R.F., Engle, J.M., Murray, S.N. and Wilson, M. In prep. Rocky Intertidal Resources in San Luis, Santa Barbara, and Orange Counties. OCS Study MMS 98-0000. U.S. Department of the Interior, Camarillo, CA.

QUALITY CONTROL:
All species were identified in field by Peter Raimondi and Melissa Wilson. Species identified from photos done by Melissa Wilson.

SITE 31A: San Simeon - A
See Figure I-29.

TITLE: Successional and seasonal variation of the central and northern California rocky intertidal communities as related to natural and man-induced disturbances.

INVESTIGATOR(S): Kinnetic Laboratories, Incorporated

CONTACT PERSON(S):

Kinnetic Laboratories Inc.	Mary-Elaine Dunaway
307 Washington Street	Mineral Management Service
Santa Cruz, CA 95060	770 Paseo Camarillo
(831) 457-3950	Camarillo, CA 93010
kinnetic@cruzio.com	(805) 389-7520
	mary_elaine-dunaway@smtp.mms.gov

LOCATION: Site is about 1 km north of San Simeon creek mouth, just north of the only seashore residence in the area.

ZONE(S) AND ASSEMBLAGE(S):
Transects across all zones; assemblages include: *Chthamalus/Balanus; Pelvetia/Pelvetiopsis; Endocladia/Gigartina; Mytilus; Mazzaella; Rhodomela/Odonthalia.*

SAMPLING DATE(S):
May 5, 1984

PURPOSE: To supply the Mineral Management Service with a recommended Field Survey Plan for evaluating species composition and abundance of organisms and the effects of disturbance on organisms. This was one of 20 sites surveyed to determine which rocky shore assembleges were appropriate for a longer term study on disturbance and recovery processes.

METHODS: Point-contact sampling along four vertical transects was performed, with topical description of substrata and a map of transect location noted. Transects were arranged to cross as many assemblages as possible within each site and in an area suitable for field survey. Individual transect line locations were determined by placing a line parallel to the water and marking four random points. From these four random points the beginning of each vertical transect was then run to the water's edge. The species were noted under 100 evenly spaced points, along each transect and percent cover estimated.

DATA FORMAT:
Electronic version: relational database - *PRODAS*.
Printed Report: Kinnetic Laboratories Inc. 1985. Successional and seasonal variation of the central and northern California rocky intertidal communities as related to natural and man-induced disturbances. OCS Study MMS 14-12-0001-30057. U.S. Department of the Interior, Los Angeles.

QUALITY CONTROL:
Identification done by teams headed by Drs. Mike Foster and John Pearse. Voucher specimens were collected for lab identification and stored by the Minerals Management Service.

SITE 31B: San Simeon - B

TITLE: A latitudinal gradient in northeast Pacific intertidal community structure: evidence for an oceanographically based synthesis of marine community theory.

INVESTIGATOR(S): Sean Connolly and Joan Roughgarden

CONTACT PERSON(S):
Joan Roughgarden
Department of Biological Sciences
Stanford University
Stanford, CA 94305-5020
(650) 723-3648
rough@pangea.stanford.edu

LOCATION: Undescribed

ZONE(S) AND ASSEMBLAGE(S):
Mid and low intertidal zones

SAMPLING DATE(S):
March 1997-May 1998

PURPOSE: The goal of this project was to determine the relationships among regional patterns in upwelling intensity, recruitment rate of intertidal mussels and barnacles whose larvae are transported in upwelling-related currents, and regional differences in the structure of intertidal communities.

METHODS: Recruitment of barnacles was monitored on six 5 x 10 cm settlement plates in the mid intertidal zone. Plates were styrene covered with 3M safety walk tape, and secured to the substrate. Mussel recruitment was monitored using SOS scrubbing pads instead of settlement plates. One meter photoquadrats were used to monitor growth rates and mortality of barnacles in the area. Nearshore measurements of upwelling intensity included salinity and nutrient level measurements of water samples taken on site and temperature data recorded with Optic Stow Away temperature loggers. Productivity measurements were performed by measuring the fluorescence of monthly seawater samples from each site. Community structure was surveyed during the summer using transect-quadrat methods.

DATA FORMAT:
Printed Report: Connolly, S.R. and J. Rougharden. 1998. A latitudinal gradient in northeast pacific intertidal community structure: evidence for an oceanographically based synthesis of marine community theory. The American Naturalist 151:311-326.

QUALITY CONTROL:
Undescribed

Literature Cited

Abbott, I.A. and G.J. Hollenberg. 1976. Marine algae of California. Stanford, Stanford University Press. 827 pp.

Barry, J.P., C.H. Baxter, R.D. Sagarin and S.E. Gilman. 1995. Climate-related, long-term faunal changes in a california rocky intertidal community. Science 267:672-675.

Beauchamp, K.A. and M.M. Gowing. 1982. A quantitative assessment of human trampling effects on a rocky intertidal community. Journal of Marine Research 7:279-293.

Breen, B. 1994. Rocky intertidal monitoring protocols. Fitzgerald Marine Reserve. Moss Beach, California.

California State Water Resources Control Board. 1979. Point Lobos Ecological Reserve, Monterey County. California Marine Waters Areas of Special Biological Significance Reconnaissance Survey Report No. 79-9.

California State Water Resources Control Board. 1979. James V. Fitzgerald Marine Reserve, San Mateo County. California Marine Waters Areas of Special Biological Significance Reconnaissance Survey Report No. 79-12.

California State Water Resources Control Board. 1980. Julia Pfeifer Burns Underwater Park, Monterey County. California Marine Waters Areas of Special Biological Significance Reconnaissance Survey Report No. 80-4.

California State Water Resources Control Board. 1981. Año Nuevo Point and Island, San Mateo County. California Marine Waters Areas of Special Biological Significance Reconnaissance Survey Report No. 81-2.

Connolly, S.R. and J. Rougharden. 1998. A latitudinal gradient in northeast pacific intertidal community structure: evidence for an oceanographically based synthesis of marine community theory. The American Naturalist 151:311-326.

Cosentino Consulting 1998. Monitoring the rocky intertidal communities within the Gulf Of The Farallones and Monterey Bay National Marine Sanctuaries. Final Report. Study funded by U.S Department of the Interior, National Park Service, Golden Gate National Recreation Area, San Francisco, CA. Contract No. 1443CX8140- 95-039 141 pp.

DeVogelaere, A.P. 1991 Disturbance, succession and distribution patttems in rocky intertidal communities of central California. Dissertation. University of California at Santa Cruz. 136 pp.

DeVogelaere, A.P. 1996. Biological Communities:-Rocky intertidal habitats. In J. Guerrero and R. Kvitek (editors). Monterey Bay National Marine Sanctuary Site Characterization. http:/bonita.mbnms.nos.noaa.gov.

Foster, M.S., A.P De Vogelaere, C Harrold, J.S. Pearse and A.B. Thum. 1988 Causes of spatial and temporal patterns in rocky intertidal communities of central and northern California. Memoirs of the California Academy of Sciences. No. 9.

Foster, M.S.; A.P. De Vogelaere, J.S. Oliver, P.S. Pearse, C Harrold. 1991. Open coast intertidal and shallow subtidal ecosystems of the northeast Pacific; Ecosystems of the World. 24:235-272.

Glynn, P. 1965. Community composition, structure and interrelationships in the marine intertidal *Endocladia muricata - Balanus glandula* association in Monterey Bay, California. Beaufortia 12:1-198.

Hewatt, W.G. 1937. Ecological studies on selected marine intertidal communities of Monterey Bay, CA. The American Mid Naturalist 18:161.

Kinnetic Laboratories Inc. 1985. Successional and seasonal variation of the central and northern California rocky intertidal communities as related to natural and man-induced disturbances. OCS Study MMS 14-12-0001-30057. U.S. Department of the Interior, Los Angeles.

Kinnetic Laboratories. 1991. Study of the rocky intertidal communities of central and northern California. OCS Study MMM 91-0089. U.S. Department of the Interior, Los Angeles.

Malone, C. and M. Wilson 1994. Temporal comparison of the intertidal biota of the Landels-Hill Big Creek Reserve and spatial comparison of the reserve with three other central Californian Sites: Oystercatcher Point, Carmel Point, and Natural Bridges. Senior Thesis in Biology. University of California at Santa Cruz. 89 pp.

MBNMS Research Advisory Committee. 1993. Scientific research plan for the Monterey Bay National Marine Sanctuary. National Ocean Service, Office of Ocean and Coastal Resource Management, Sanctuaries and Reserves Division, National Oceanic and Atmospheric Administration. 55pp.

Pearse, J.S. 1981. Intertidal invertebrates. pp. 205-236 in The natural history of Año Nuevo. B.J. LeBouef and S. Kaza, eds. Boxwood, Pacific Grove, California.

Pearse, J.S. 1998. Biodiversity of the rocky intertidal in the Monterey Bay National Marine Sanctuary: a 24-year comparison. .R/CZ-132. Report of Completed Projects, 1994-1997. California Sea Grant College System, University of California, San Diego. No. R-044.

Pearse, J.S. In Prep. Biodiversity of the rocky intertidal in the Monterey Bay National Marine Sanctuary: additional sites a 24 year comparison. University of California, Santa Cruz.

Raimondi, P.T., R.F. Ambrose, J.M. Engle, S.N. Murray and M. Wilson. In Prep. Rocky intertidal resources in San Luis, Santa Barbara, and Orange Counties. OCS Study MMS 98-0000. U.S. Department of the Interior, Minerals Management Service Camarillo, CA.

Research Planning Inc. 1994. Sensitivity of coastal environments and wildlife to spilled oil. Prepared for Oil Spill Prevention and Response, California Department of Fish and Game, Sacramento, CA. and Hazardous Materials Response and Assessment Division, National Oceanic and Atmospheric Administration, Seattle, WA..

Ricketts, E.F., J. Calvin, J.W. Hedgepeth and D.W. Phillips. 1985. Between Pacific tides. Fifth edition. Stanford University Press, Stanford, California.

Smith, R.I. and J.T. Carlton (Eds). 1975. Light's Manual: Intertidal invertebrates of the central California coast. University of California Press, Berkeley, CA. 716 pp.

Walder, R.K., M.S. Foster and A.P. De Vogelaere. 1997. Recovery of rocky intertidal assemblages following the wreck and salvage of the *F/V Trinity*. Year 1 Progress Report. Monterey Bay National Marine Sanctuary and Moss Landing Marine Labs. 35 pp.

Walder, R.K., M.S. Foster and A.P. De Vogelaere. 1999. Recovery of rocky intertidal assemblages following the wreck and salvage of the *F/V Trinity*. Final Report. Monterey Bay National Marine Sanctuary and Moss Landing Marine Laboratories. 51 pp.

Walder, R.K., A.P. De Vogelaere and M.S. Foster. 1999. Precision estimates and long term trends in species cover for the upper intertidal assemblage of two sites in the Monterey Bay National Marine Sanctuary. Monterey Bay National Marine Sanctuary.

List of tables and figures.

Report

Table 1. Areas of special designation, species lists, and monitoring data sets for rocky intertidal sites within the Monterey Bay National Marine Sanctuary.

Figure 1. Map of intertidal monitoring sites within the Monterey Bay National Marine Sanctuary.

Appendix I

Figure I-1. Site map of James Fitzgerald Marine Reserve with study area designated by dashed line.

Figure I-2. Site map of James Fitzgerald Marine Reserve with study plot area designated by boxes.

Figure I-3. Site map for Pillar Point with transect locations.

Figure I-4. Site map of Bean Hollow depicting study plots and transect locations.

Figure I-5. Site map of Pigeon Point depicting study plots and transect locations.

Figure I-6. Images of study sites at Pigeon Point North and Pigeon Point South.

Figure I-7. Site map for Año Nuevo Island with transect locations.

Figure I-8. Image of study site at Año Nuevo Point.

Figure I-9. Site map for Scott Creek with transect locations.

Figure I-10. Image of study site at Davenport Landing.

Figure I-11. Image of study site at Natural Bridges.

Figure I-12. Image of study site at Almar Street.

Figure I-13. Image of study site at Santa Cruz Point East.

Figure I-14. Image of study site at Soquel Point.

Figure I-15. Site map of Hopkins Marine Hopkins Marine Station with transect location.

Figure I-16 Image of study site at the *Trinity* Wreck Area.

Figure I-17. Site map of Pescadero Rocks with transect locations.

Figure I-18. Site map of Pescadero Rocks with plot locations.

Figure I-19 Image of Pescadero Rocks.

Figure I-20. Site map and area description for Point Lobos Ecological Reserve.

Figure I-21. Site map for Andrew Molera State Park with transect locations.

Figure I-22. Site map for Julia Pfeifer Burns Underwater Park.

Figure I-23. Site map for Mill Creek with transect locations.

Figure I-24. Site map for Point Sierra Nevada with transect locations.

Figure I-25. Site map for Point Sierra Nevada with plot locations.

Figure I-26. Site map for Point Sierra Nevada.

Figure I-27 Image from Point Sierra Nevada.

Figure I-28. Site map for Point Piedras Blancas with transect locations.

Figure I-29. Site map for San Simeon with transect locations.

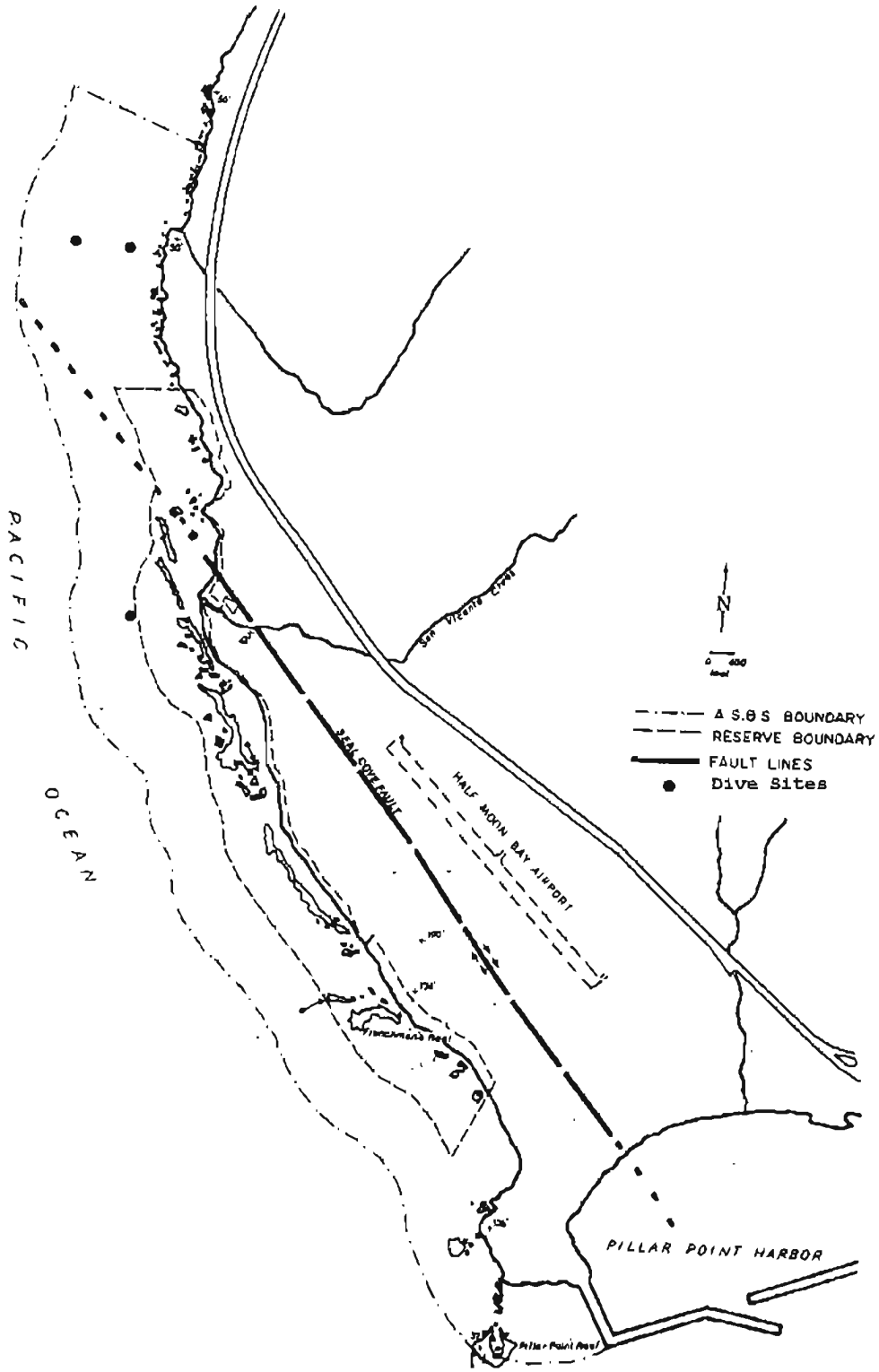


Figure I-1. Site map for James Fitzgerald Marine Reserve with study area designated by dashed line. Reprinted from Water Quality Monitoring report no. 79-12, 1979.

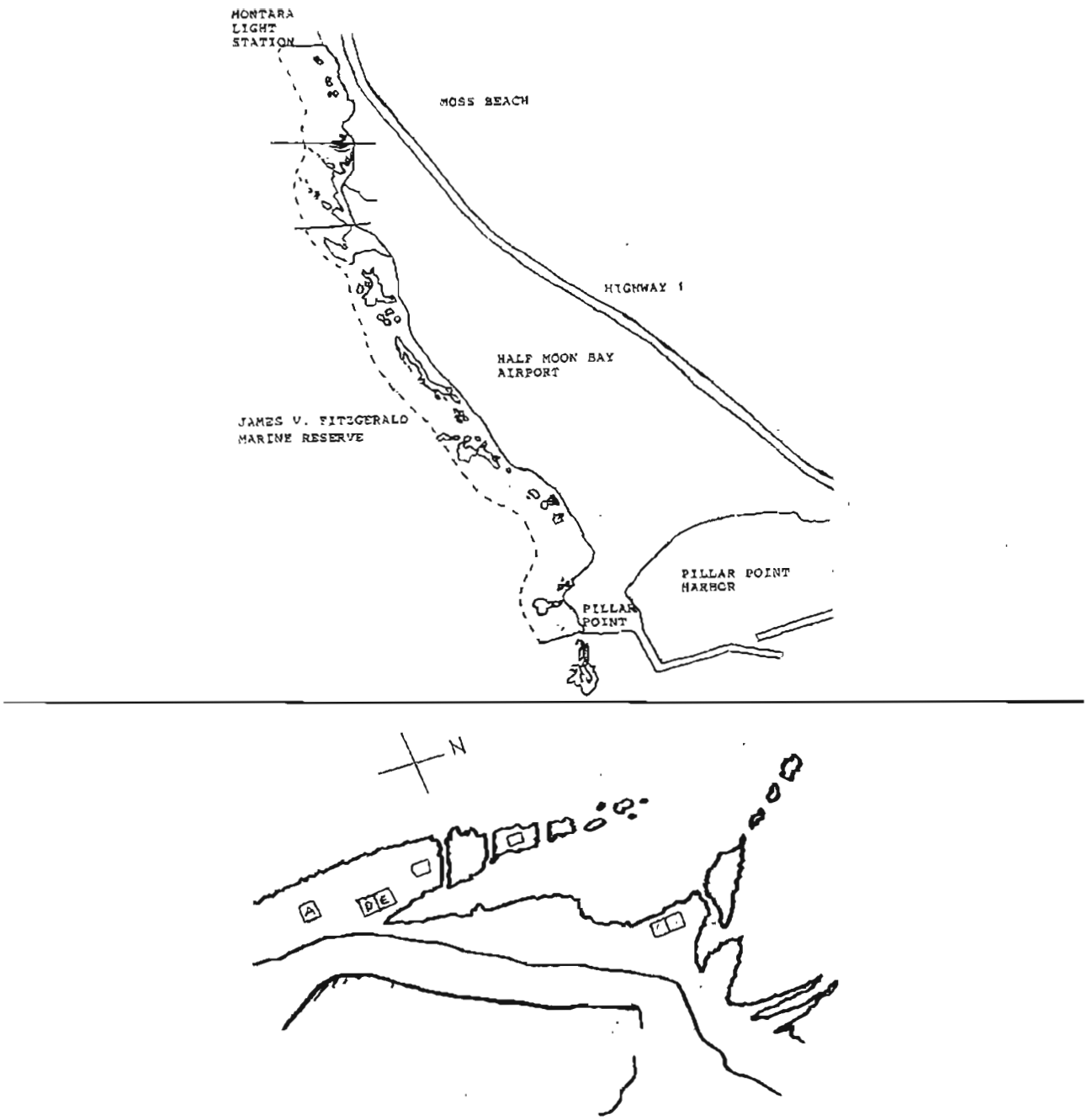


Figure I-2. Site map for Fitzgerald Marine Reserve with study plot area designated by boxes. Reprinted from Fitzgerald Marine Reserve Report, 1994.

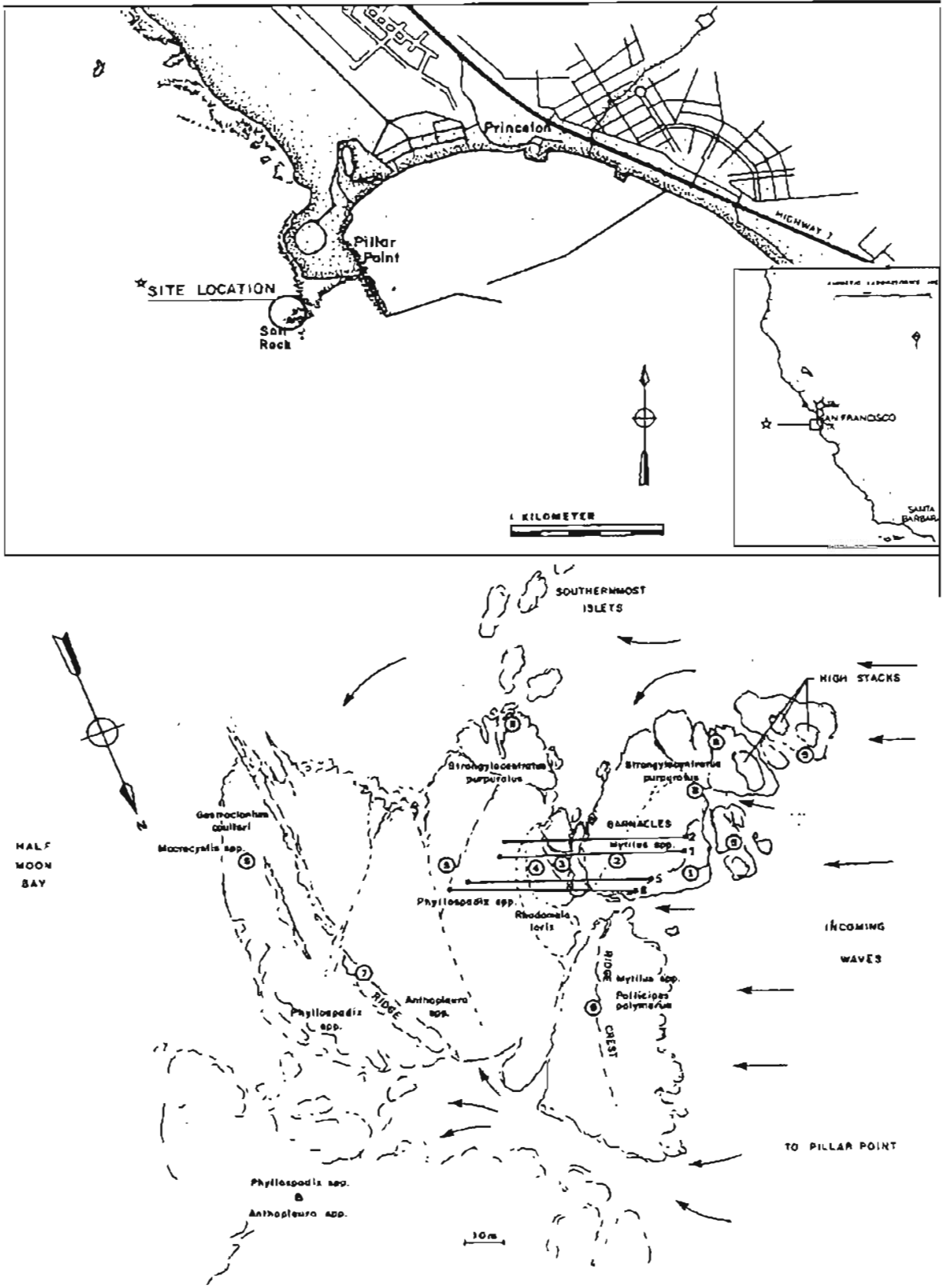


Figure I-3. Site map for Pillar Point with transect locations. Reprinted from Kinnetic Laboratories Inc., 1985.

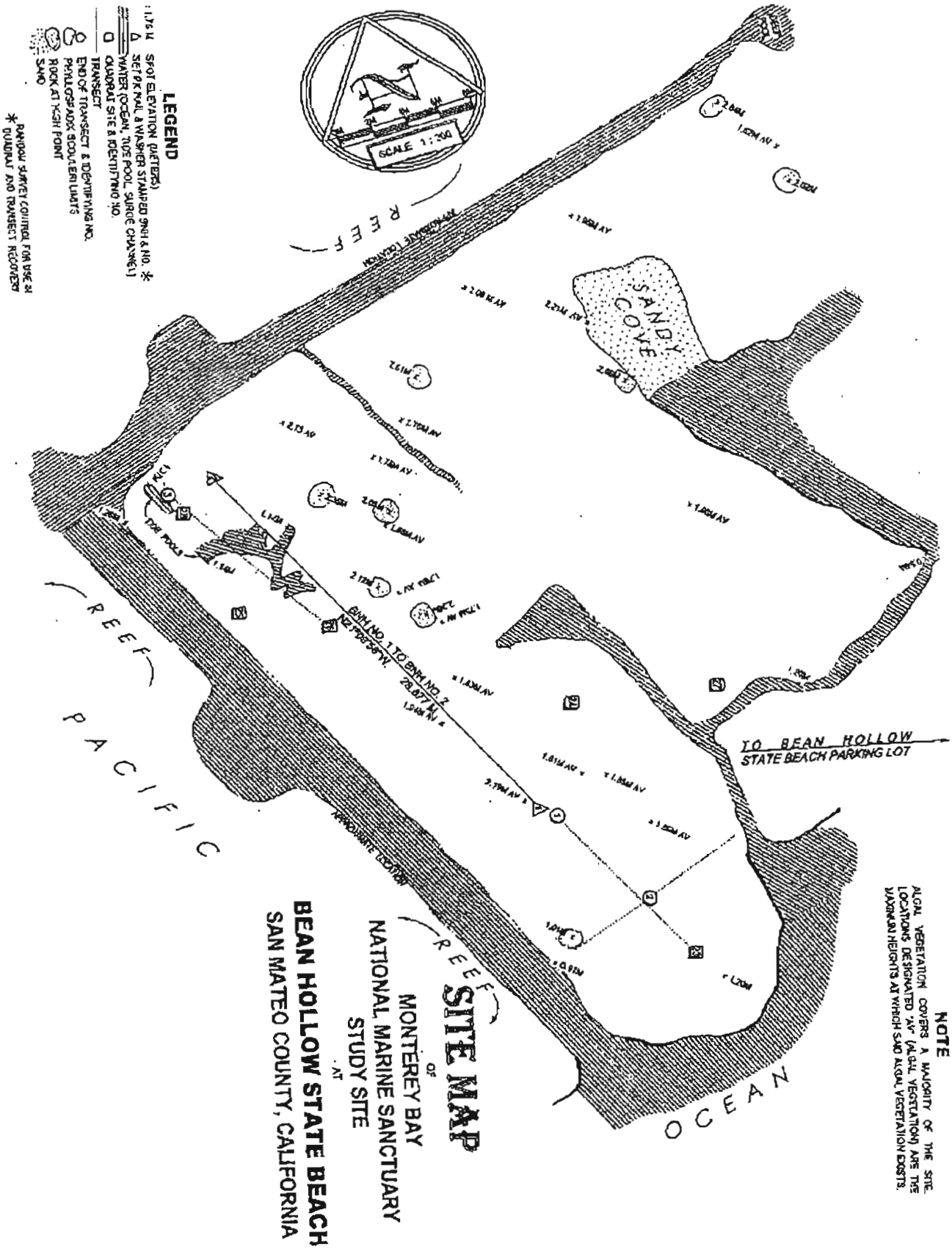


Figure I-4. Site map of Bean Hollow depicting study plots and transect locations. Reprinted with permission of Cosentino Consulting, 1997.

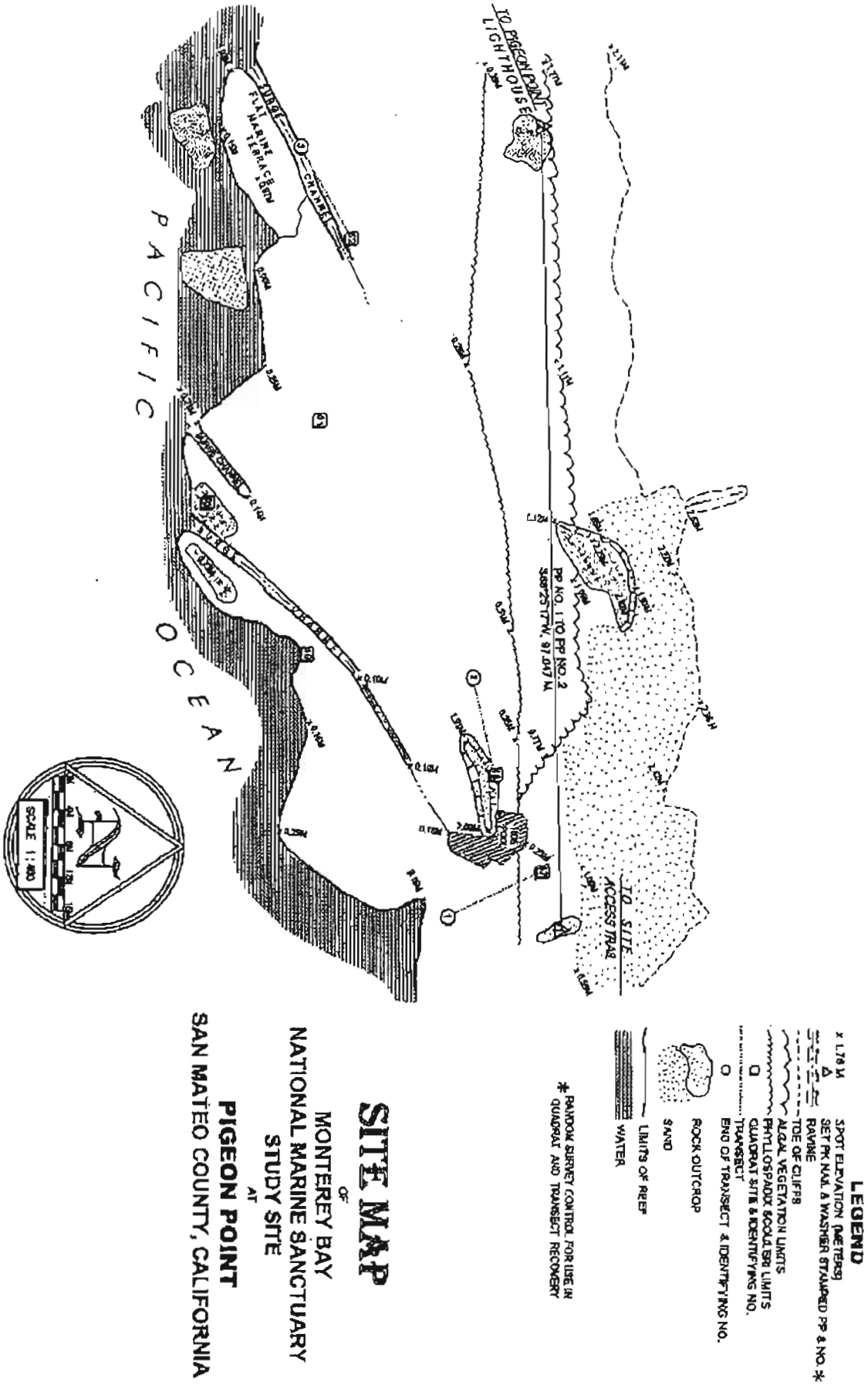
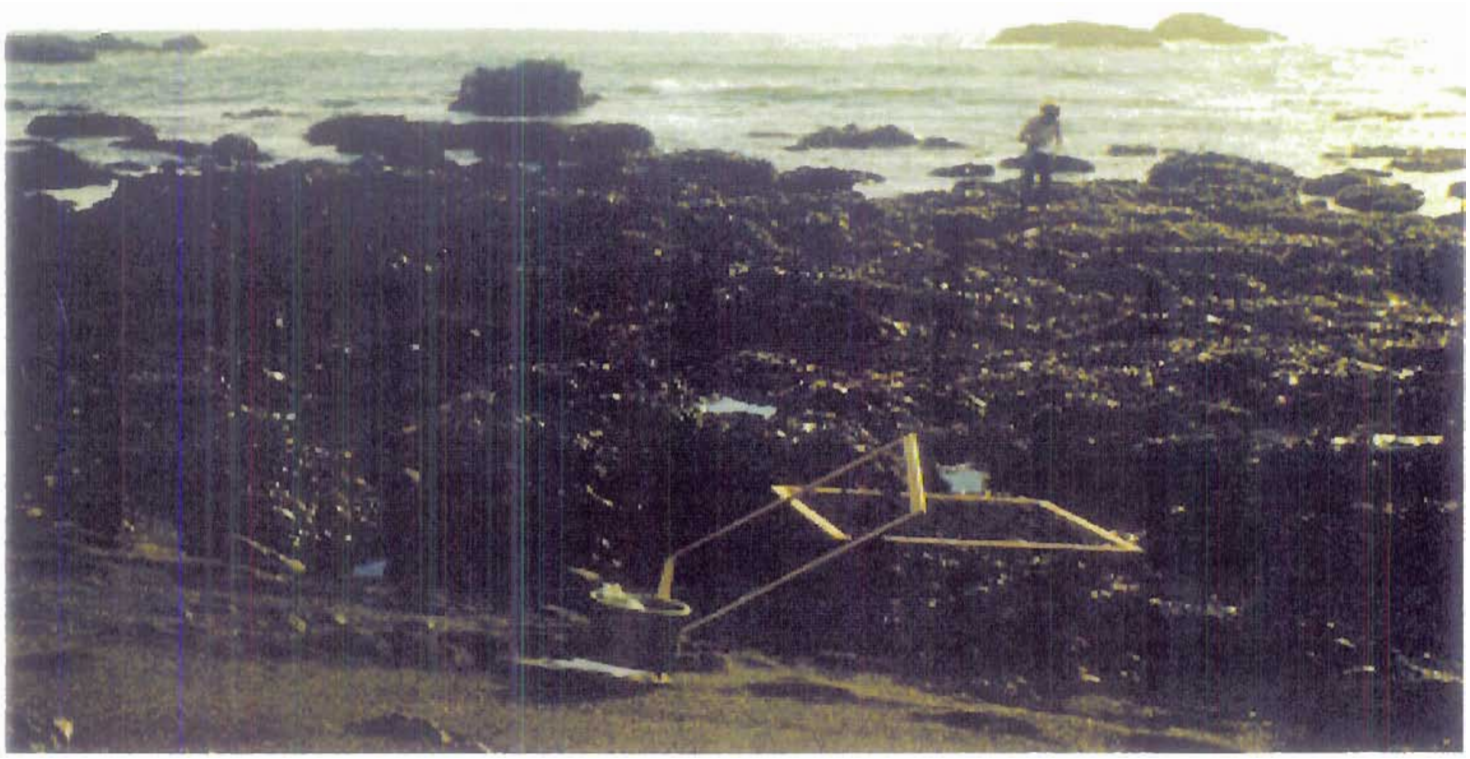


Figure I-5. Site map of Pigeon Point depicting study plots and transect locations. Reprinted by permission of Cosentio Consulting, 1997.



John Pearse

John Pearse

Figure I-6. Images of study sites at Pigeon Point North (above) and Pigeon Point South (Below).

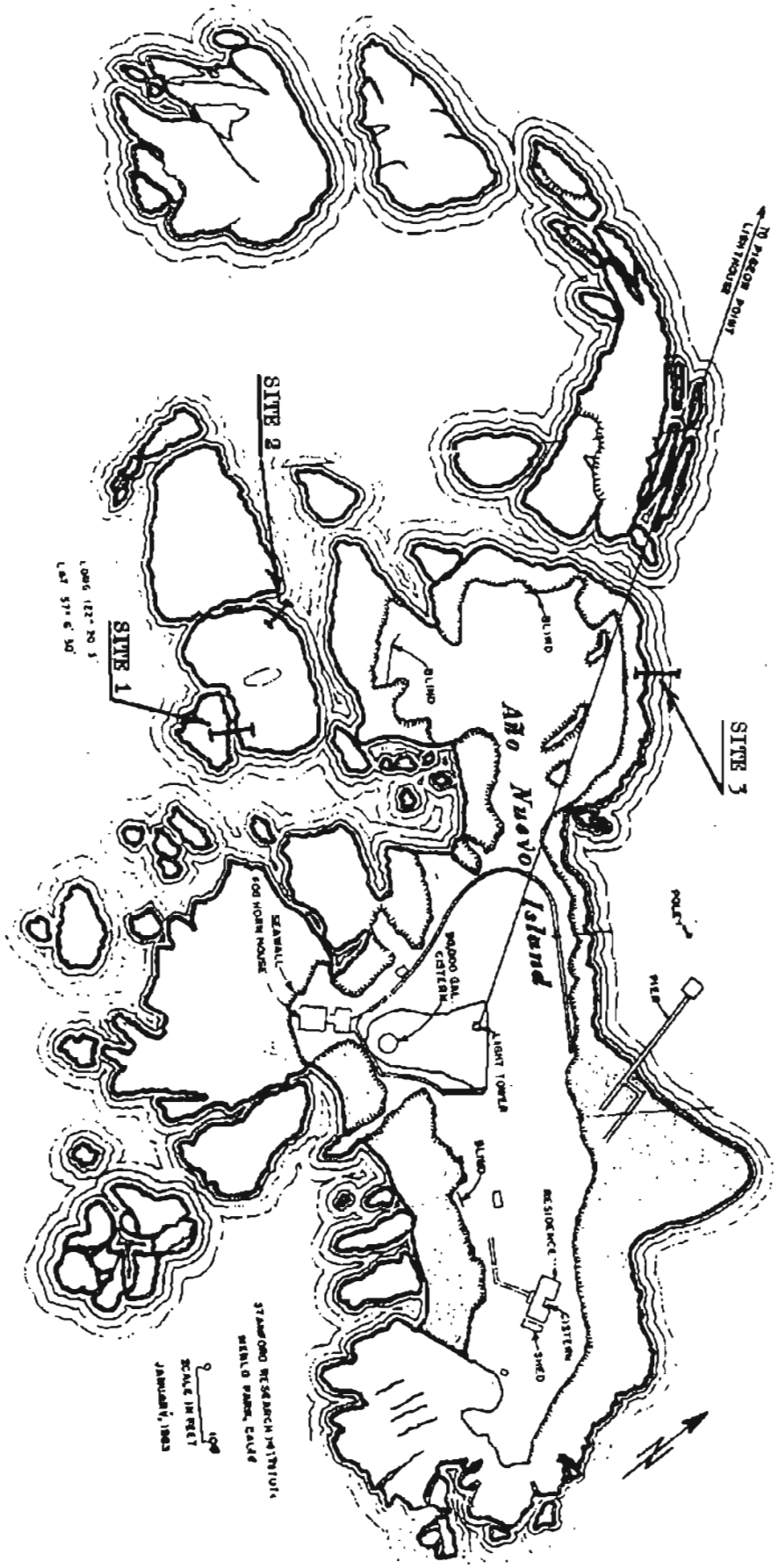
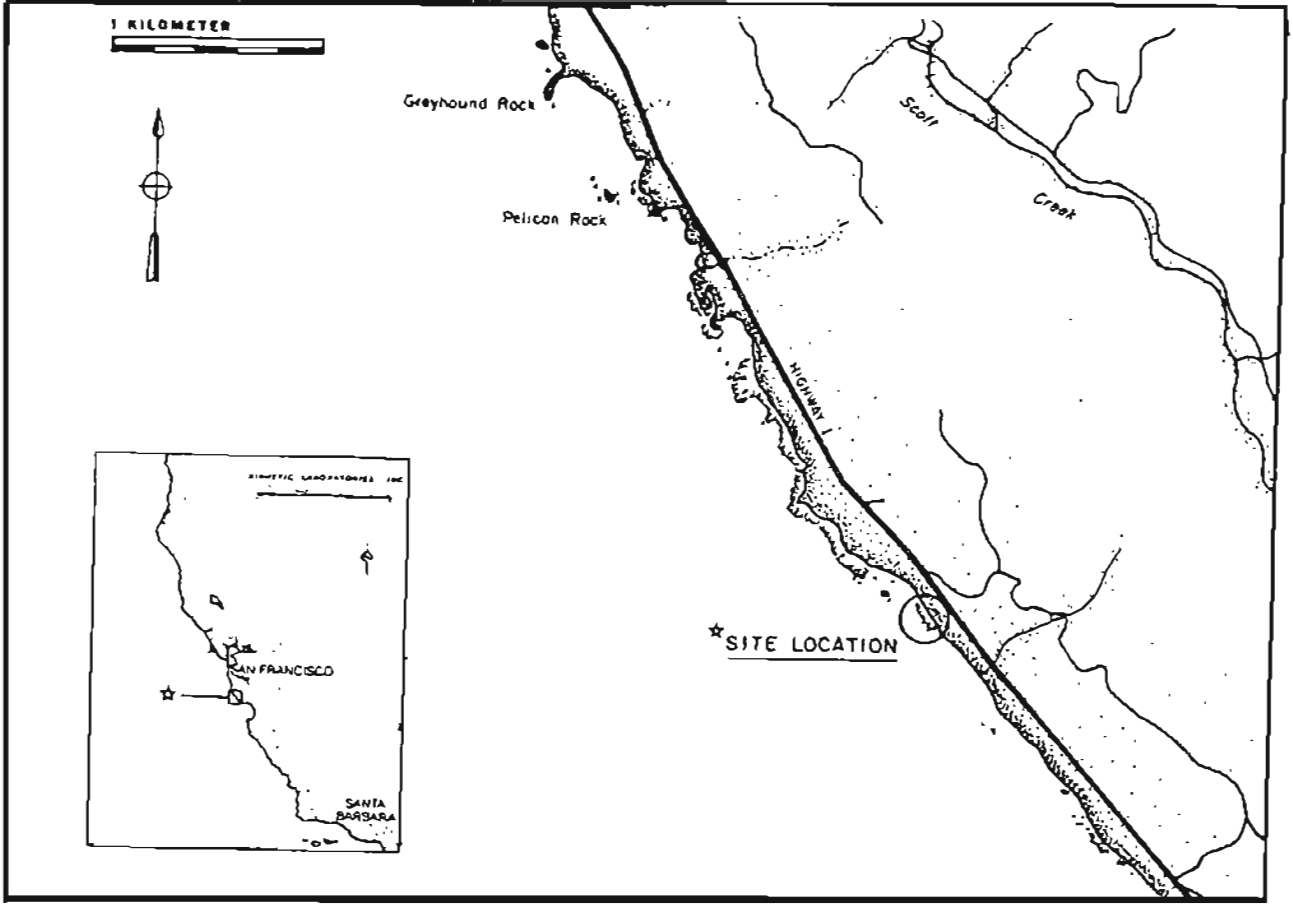


Figure I-7. Site map for Año Nuevo Island with transect locations. Reprinted from Water Quality Monitoring Report, 1981.

John Pearse

Figure I-8. Image of study site at Año Nuevo Point.



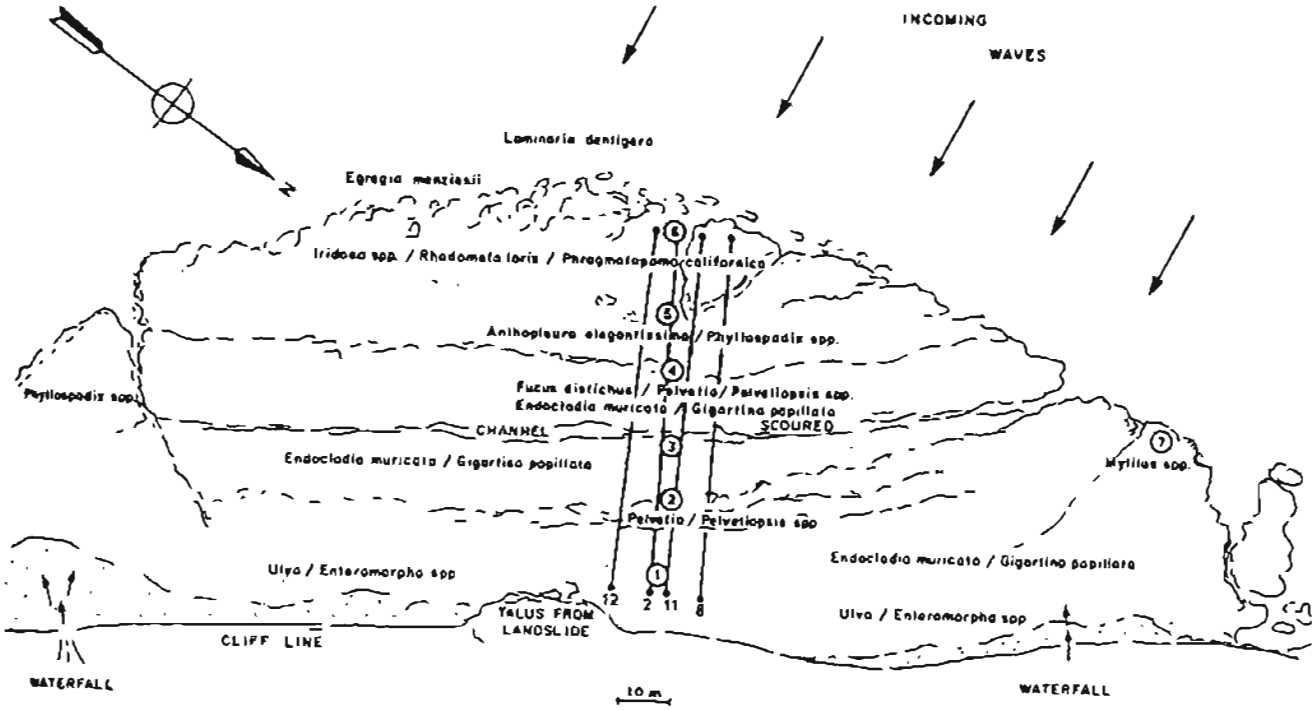
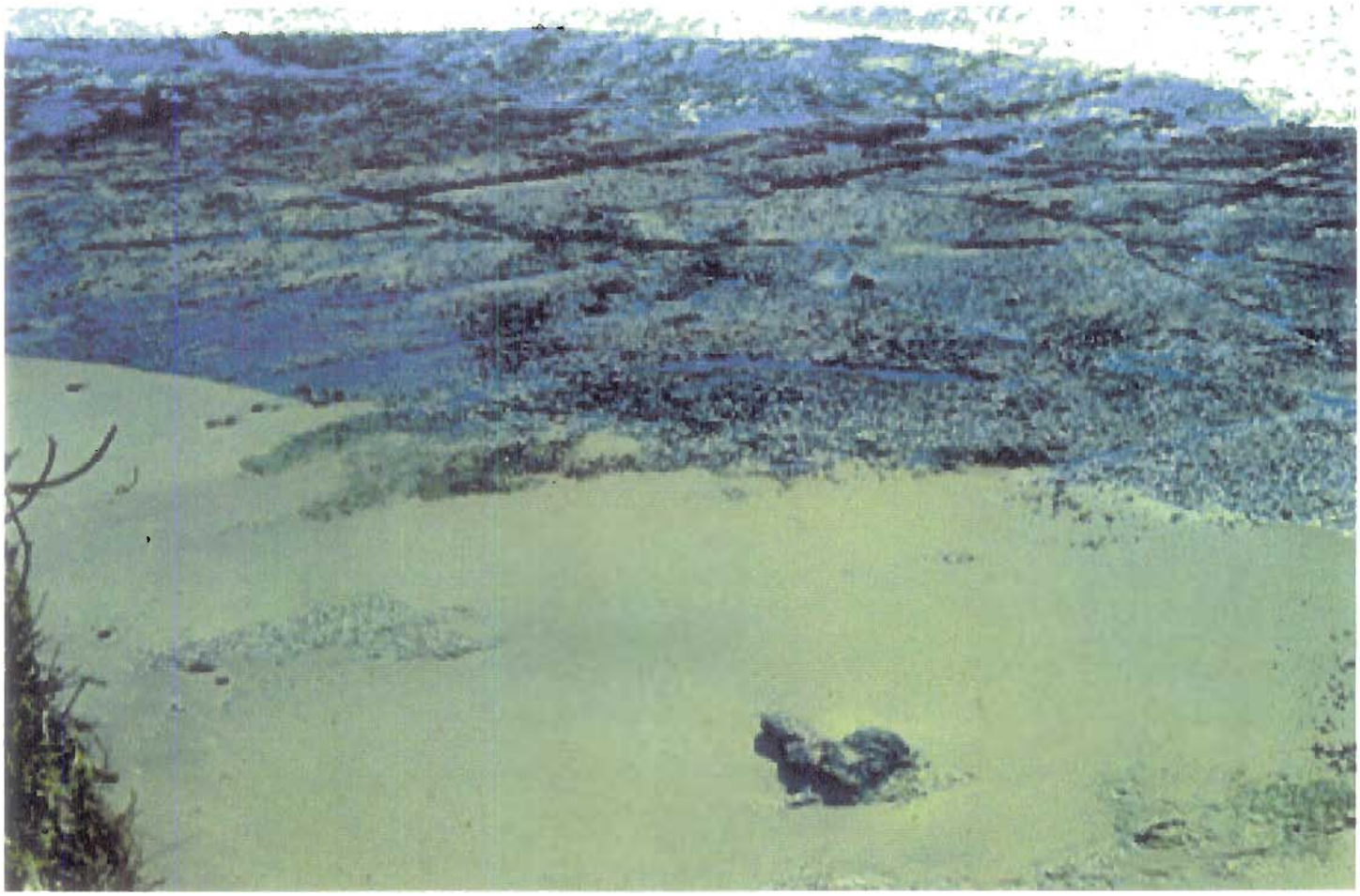


Figure I-9. Site map for Scott Creek with transect locations. Reprinted from Kinnetic Laboratories Inc., 1985.



John Pearse

Figure I-10. Image of study site at Davenport Landing.

John Pearse

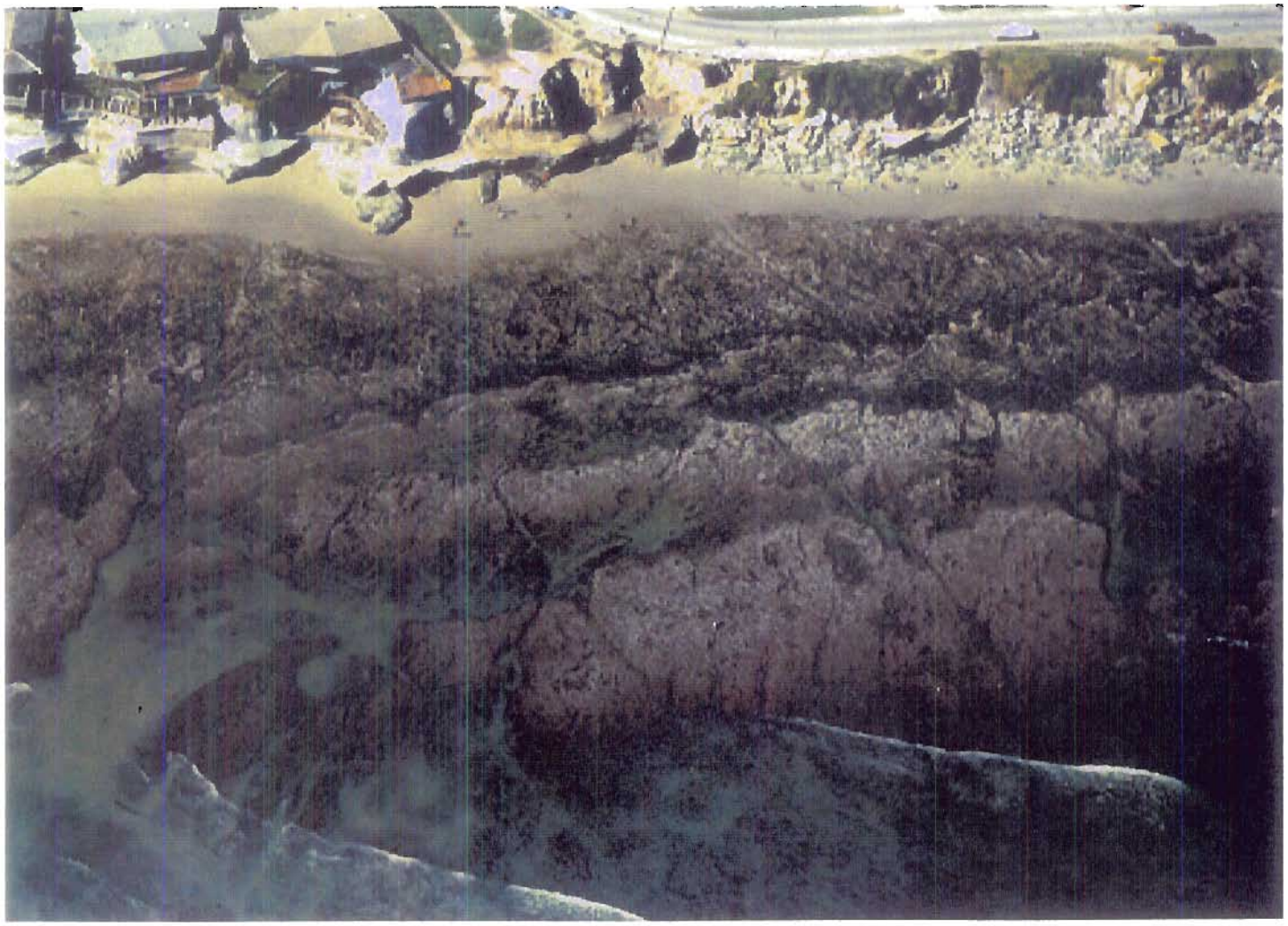
Figure I-11. Image of study site at Natural Bridges.

John Pearse

Figure I-12. Image of study site at Almar Street.

John Pearse

Figure I-13. Image of study site at Santa Cruz Point East.



John Pearse

Figure I-14. Image of study site at Soquel Point.

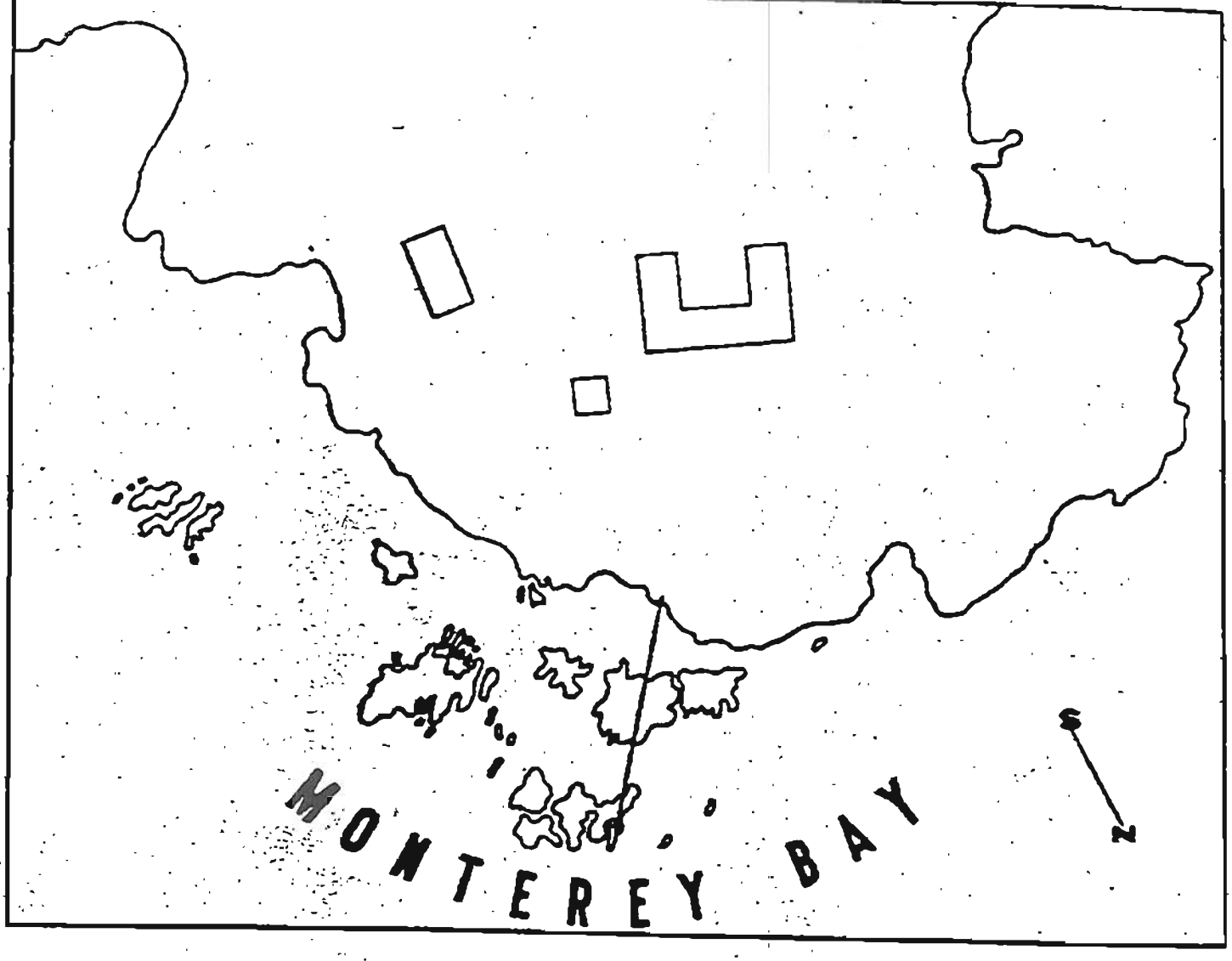
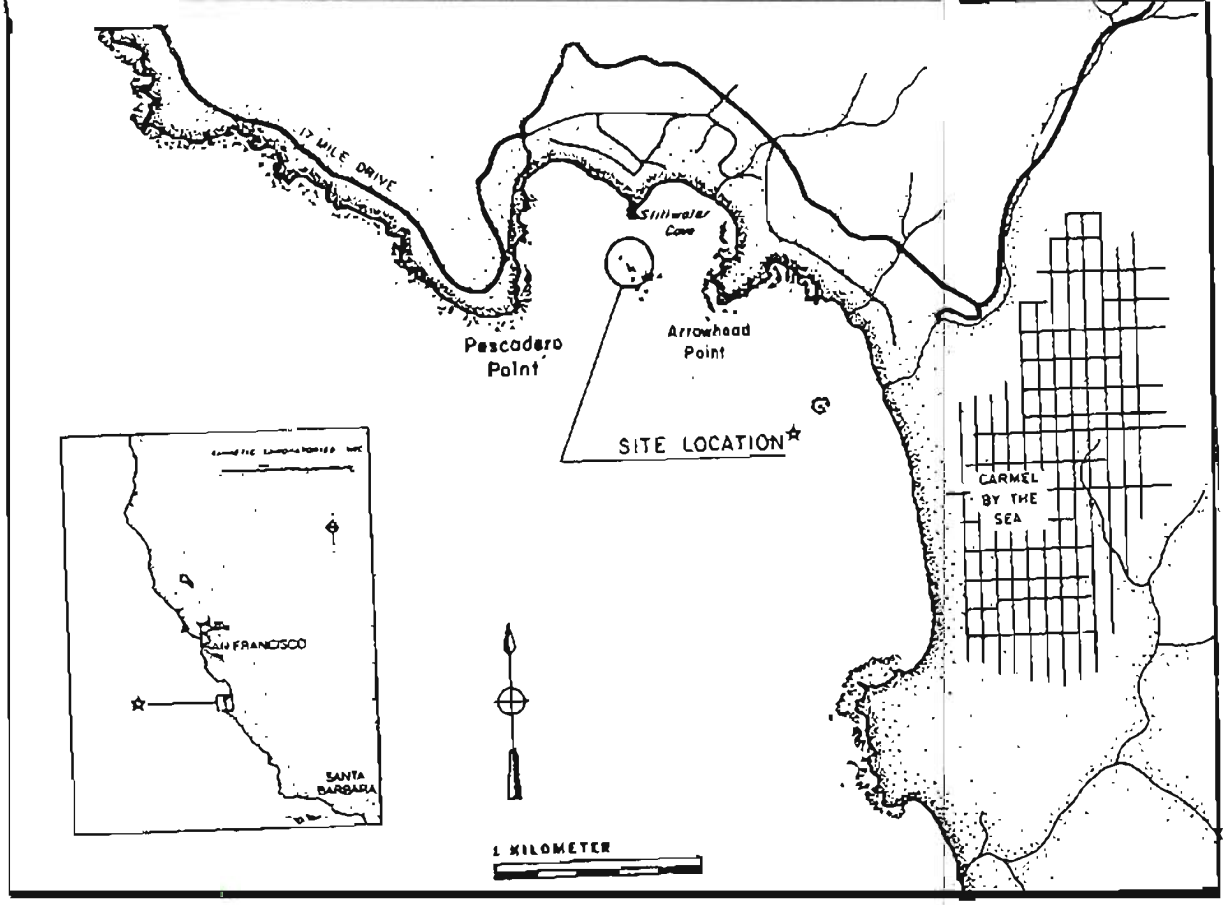


Figure I-15. Site map of Hopkins Marine Station with transect location (From Hewatt 1937).

Andrew De Vogelaere

Figure I-16. Image study site at *Trinity* Wreck Area.



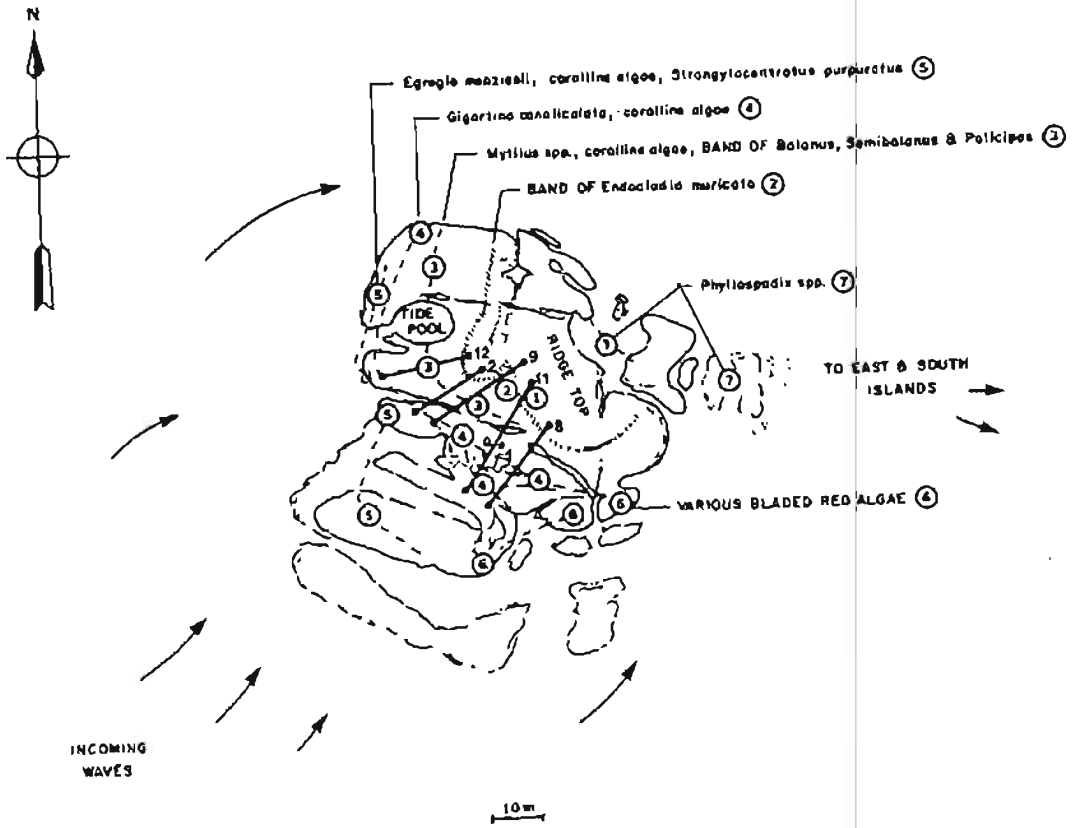


Figure I-17. Site map of Pescadero Rocks with transect locations. Reprinted from Kinnetic Laboratories Inc., 1985.

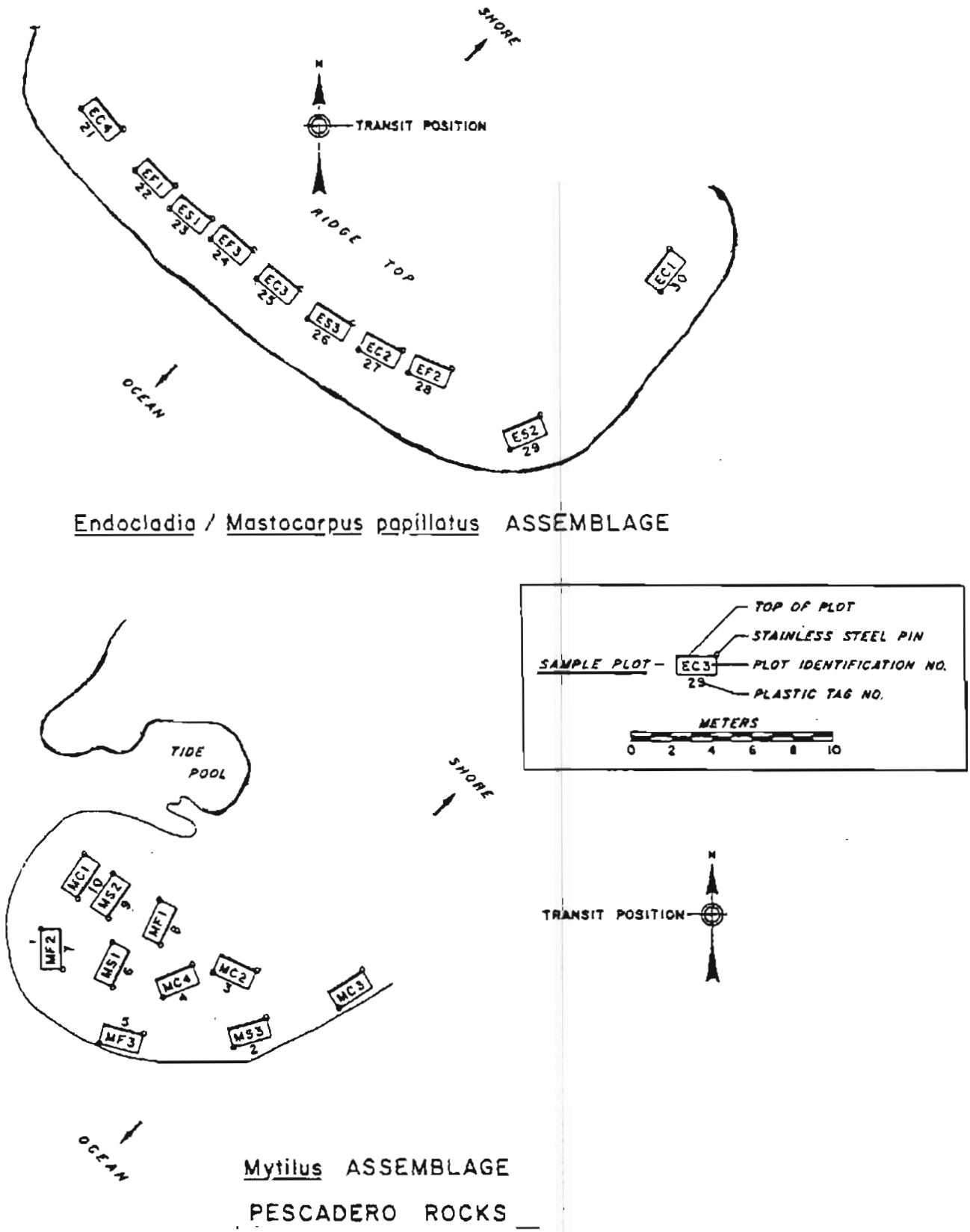
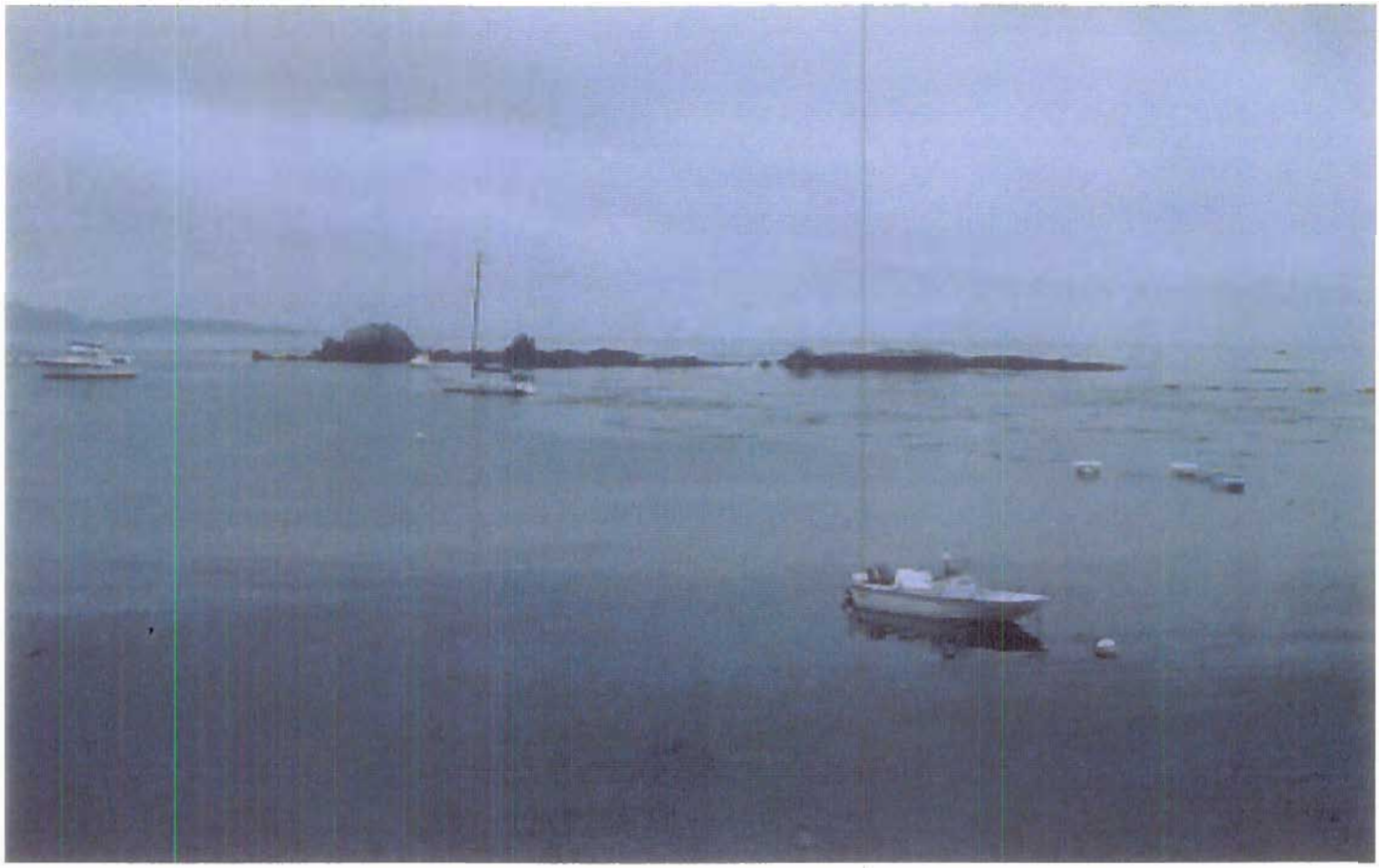


Figure 1-18. Site map of Pescadero Rocks with plot locations. Reprinted from unpublished data collected by Kinnetic Laboratories Inc., 1992.



Andrew De Vogelaere

Figure I-19. Image of Pescadero Rocks.

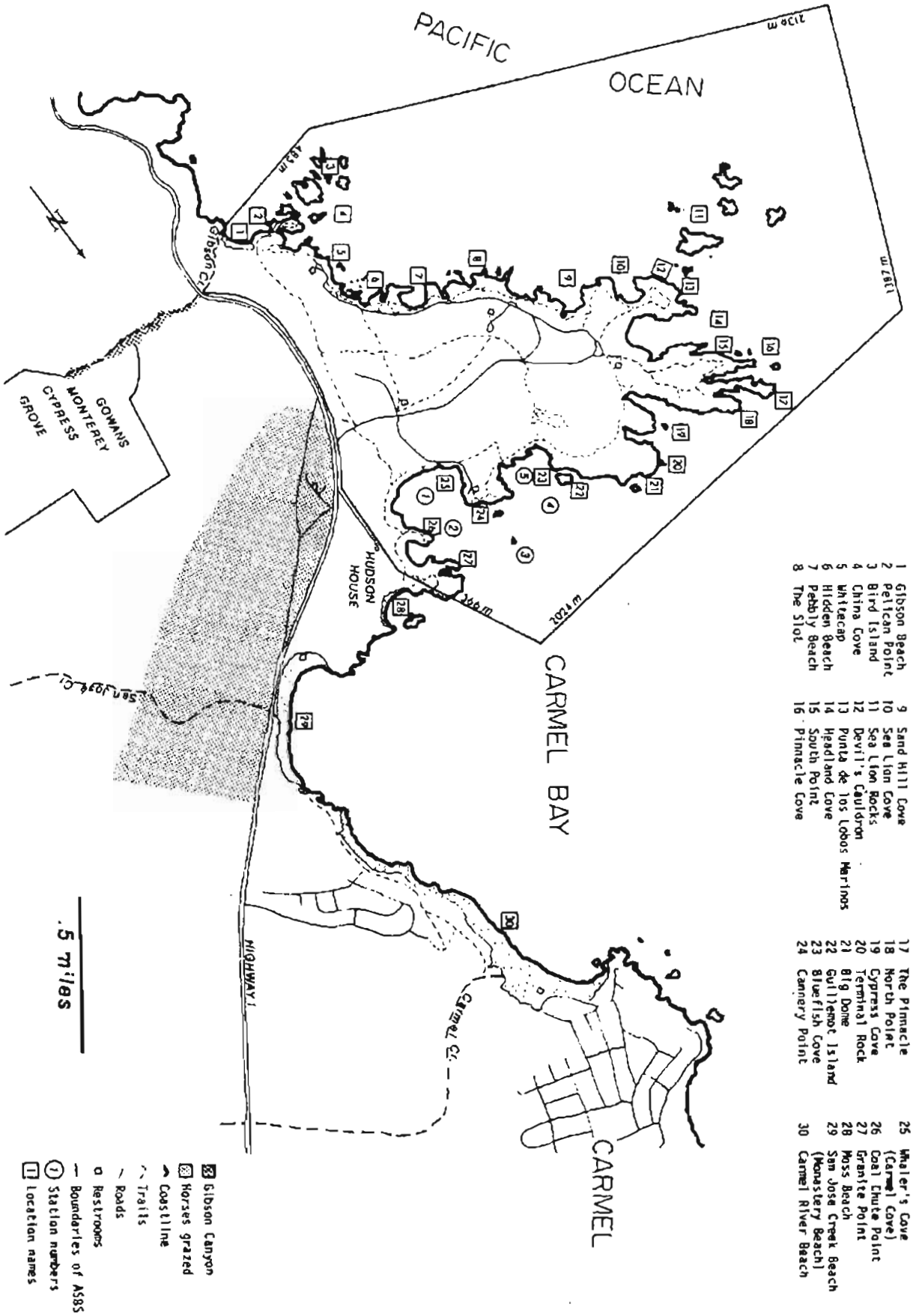


Figure I-20. Site map and area description for Point Lobos Ecological Reserve. Land use and description of coastline. Reprinted from Water Quality Monitoring Report 79-9, 1979.

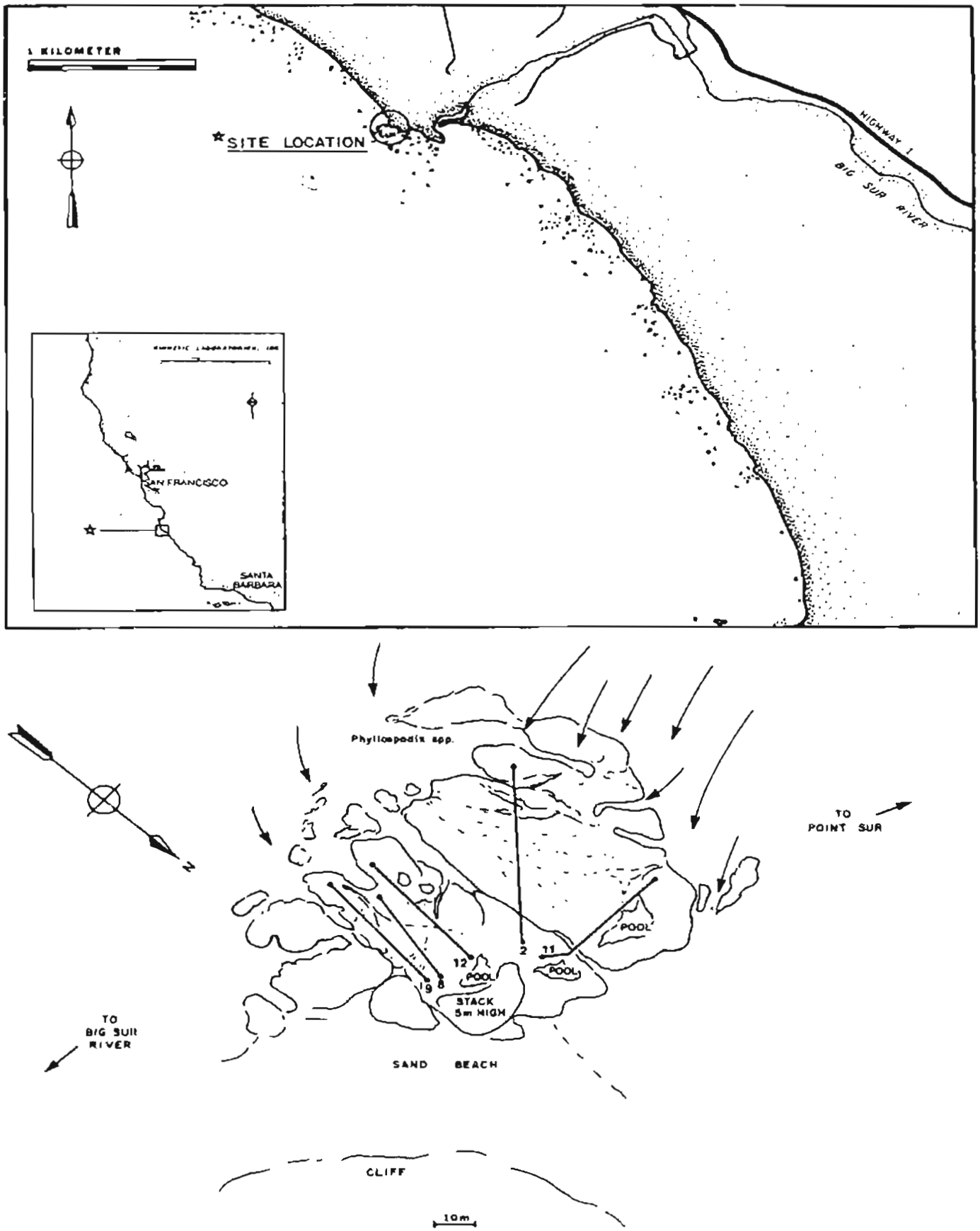


Figure 1-21. Site map for Andrew Molerea State Park with transect locations. Reprinted from Kinnectic Laboratories Inc., 1985.

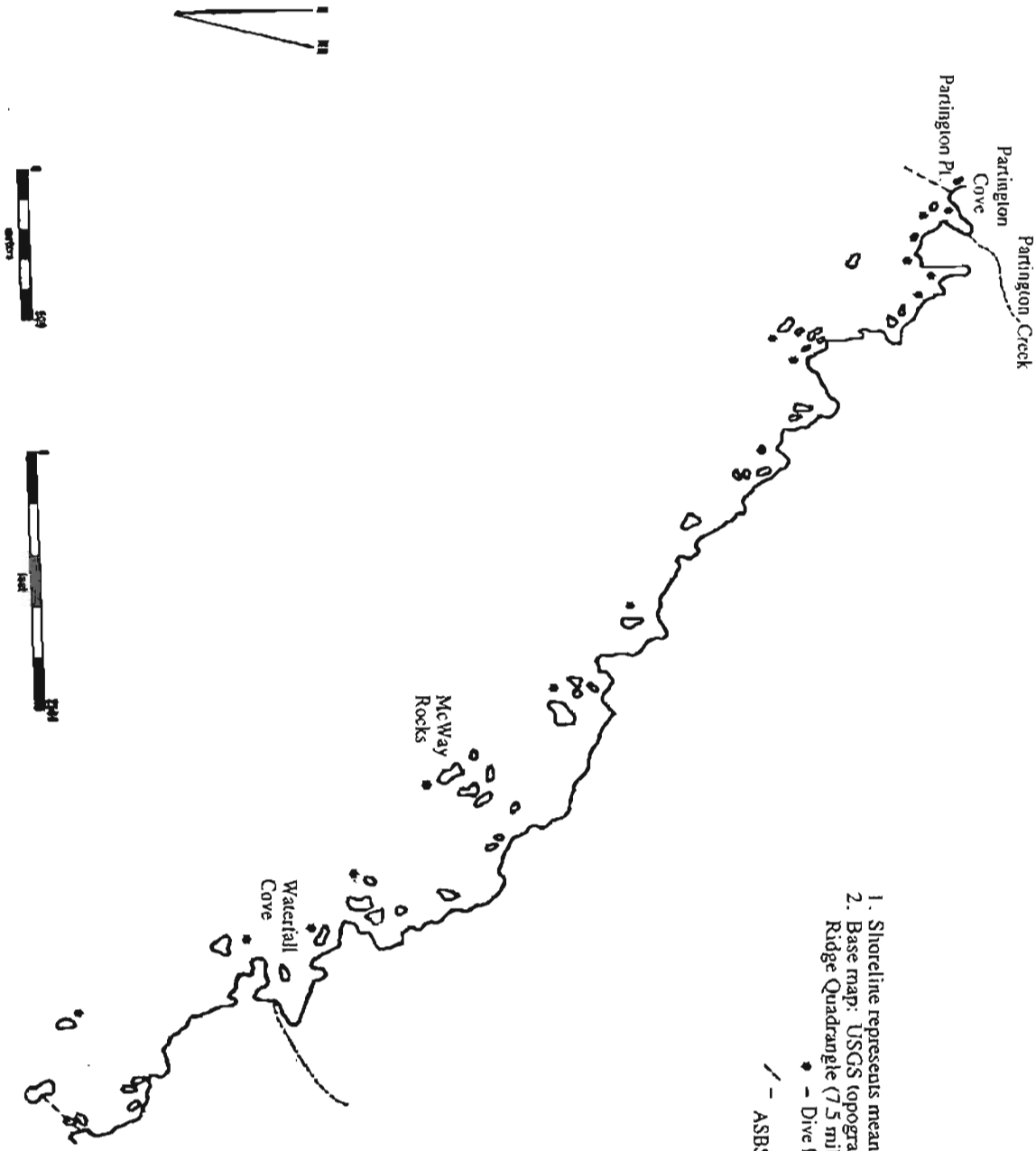


Figure 1-22. Site map for Julia Pfeiffer Burns Underwater Park. Reprinted from Water Quality Monitoring Report no.80-4, 1980.

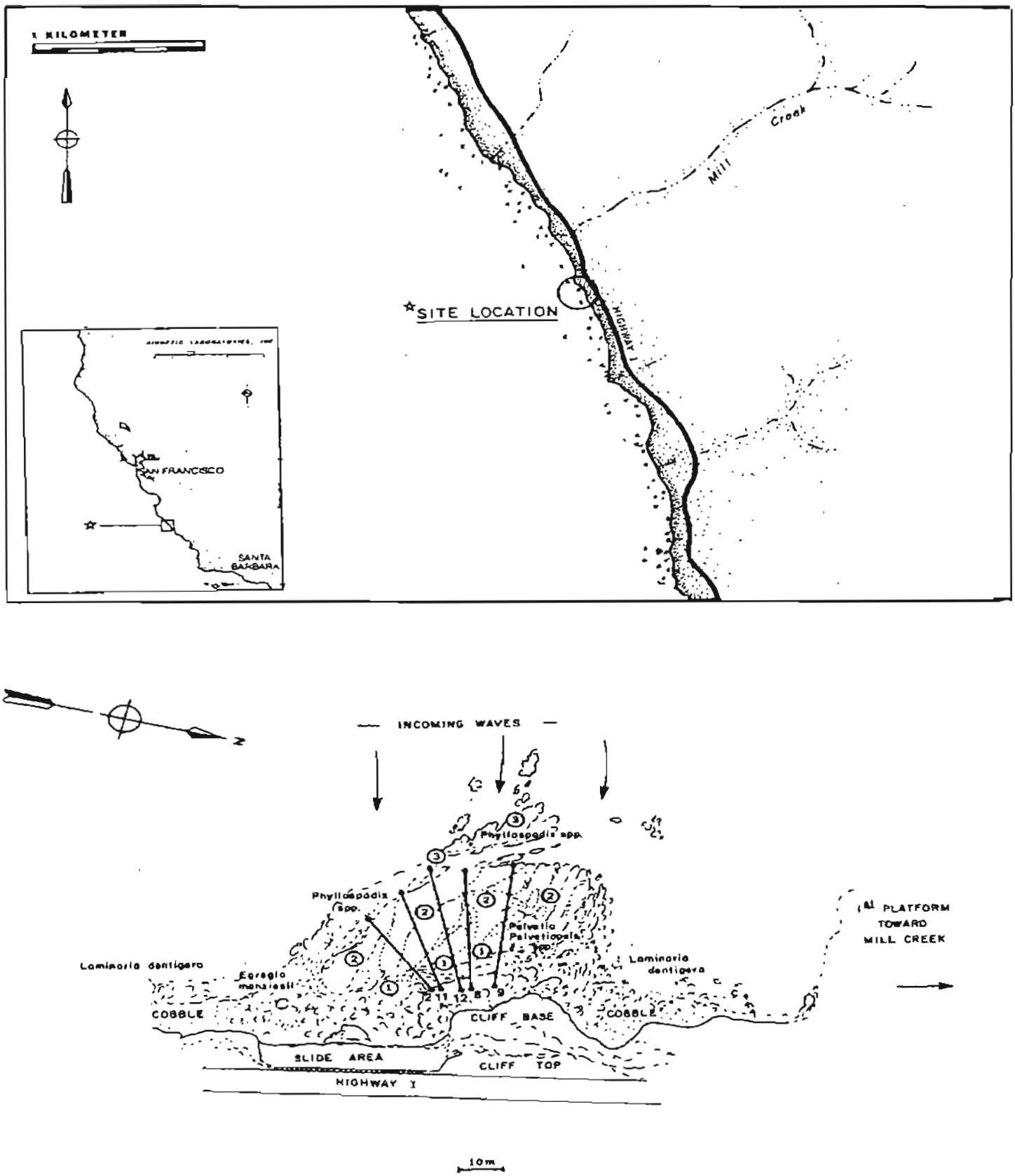


Figure 1-23. Site map for Mill Creek with transect locations. Reprinted from Kinnetic Laboratories Inc., 1985.

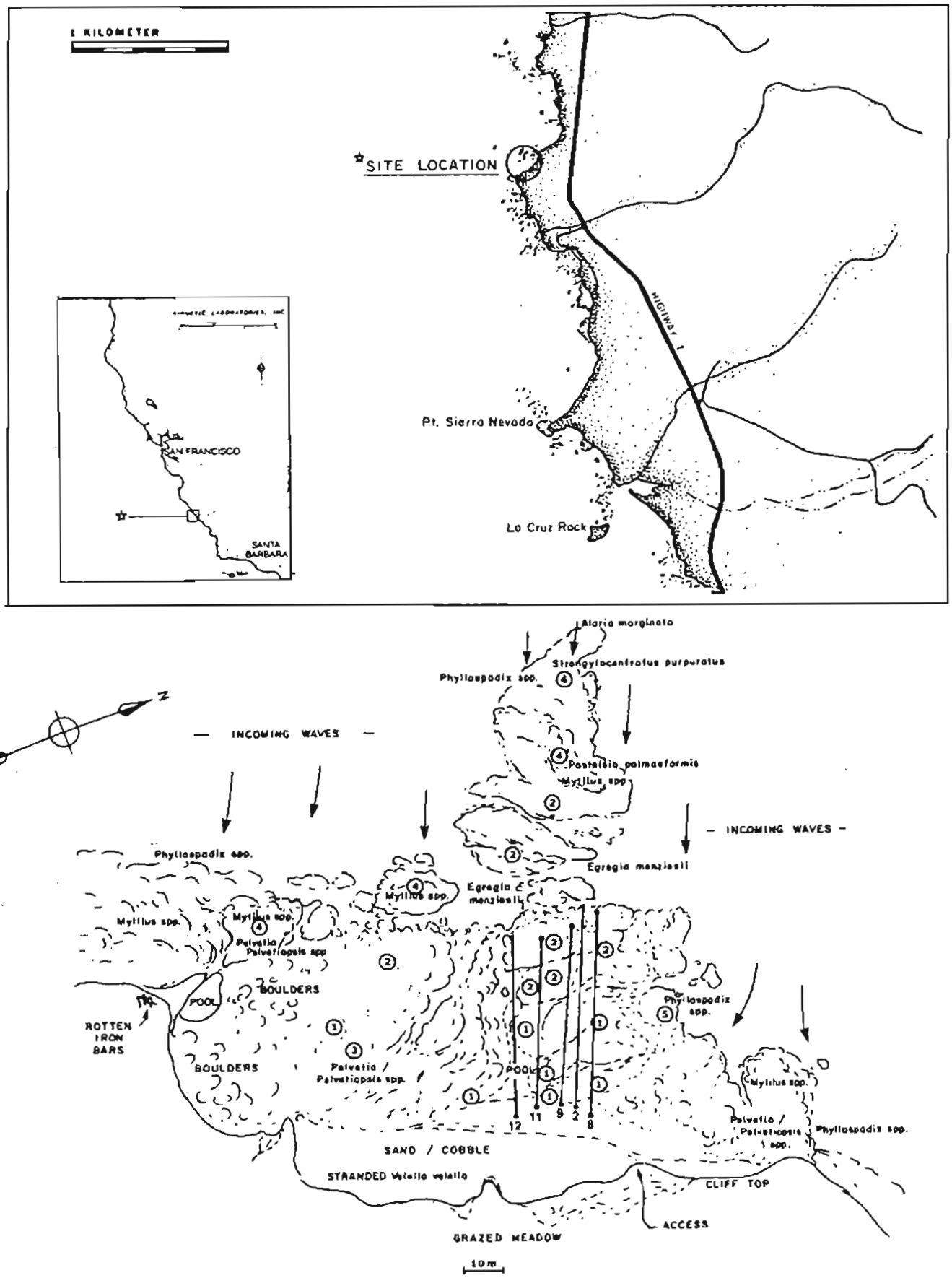
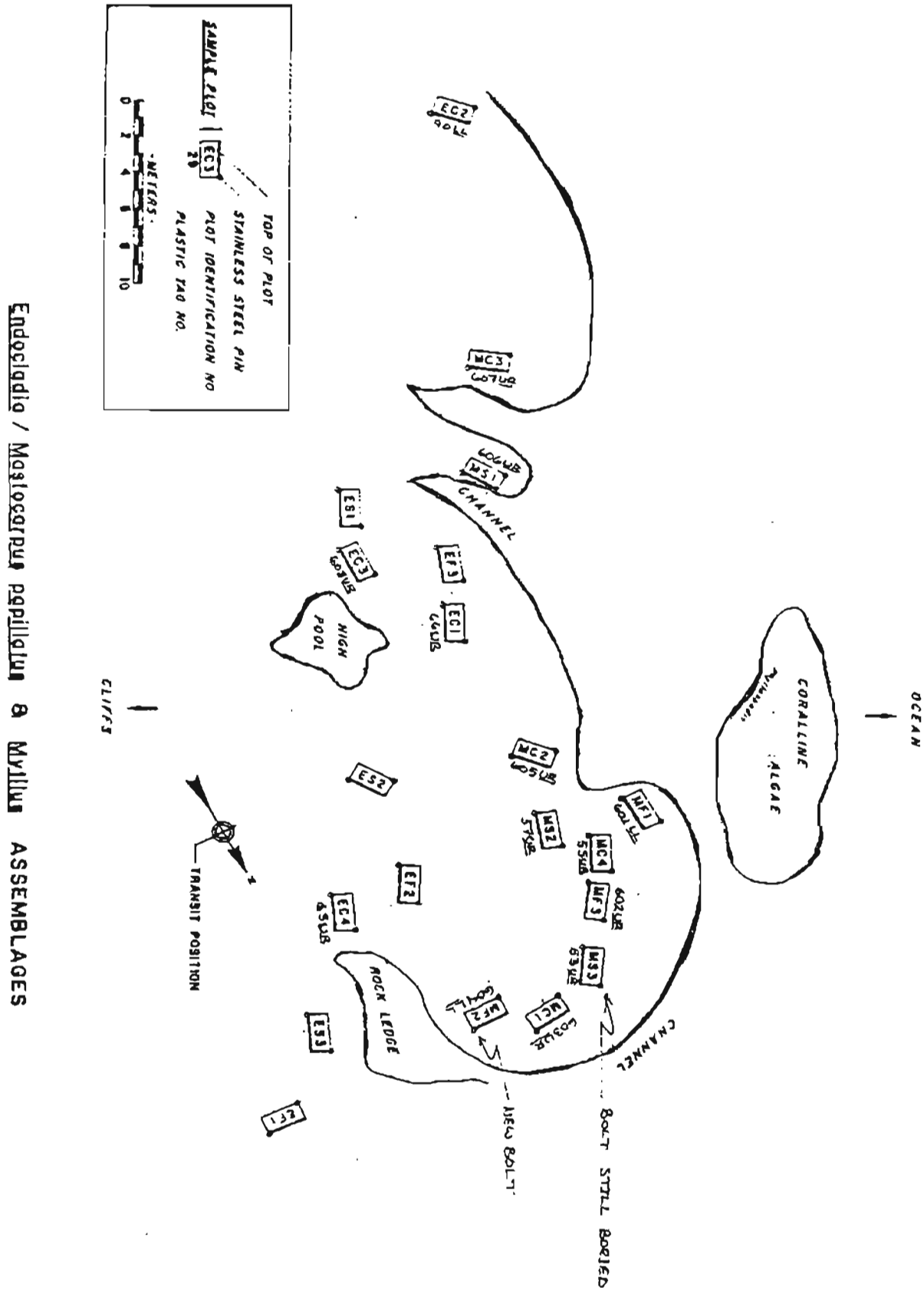


Figure 1-24. Site map for Point Sierra Nevada with transect locations. Reprinted from Kinnetic Laboratories Inc., 1985.



Endocladia / Mastocarpus papillatus & Mytilus ASSEMBLAGES

Figure 1-25. Site map for Point Sierra Nevada with plot locations. Reprinted from unpublished data collected by Kinnetic Laboratories Inc., 1992.

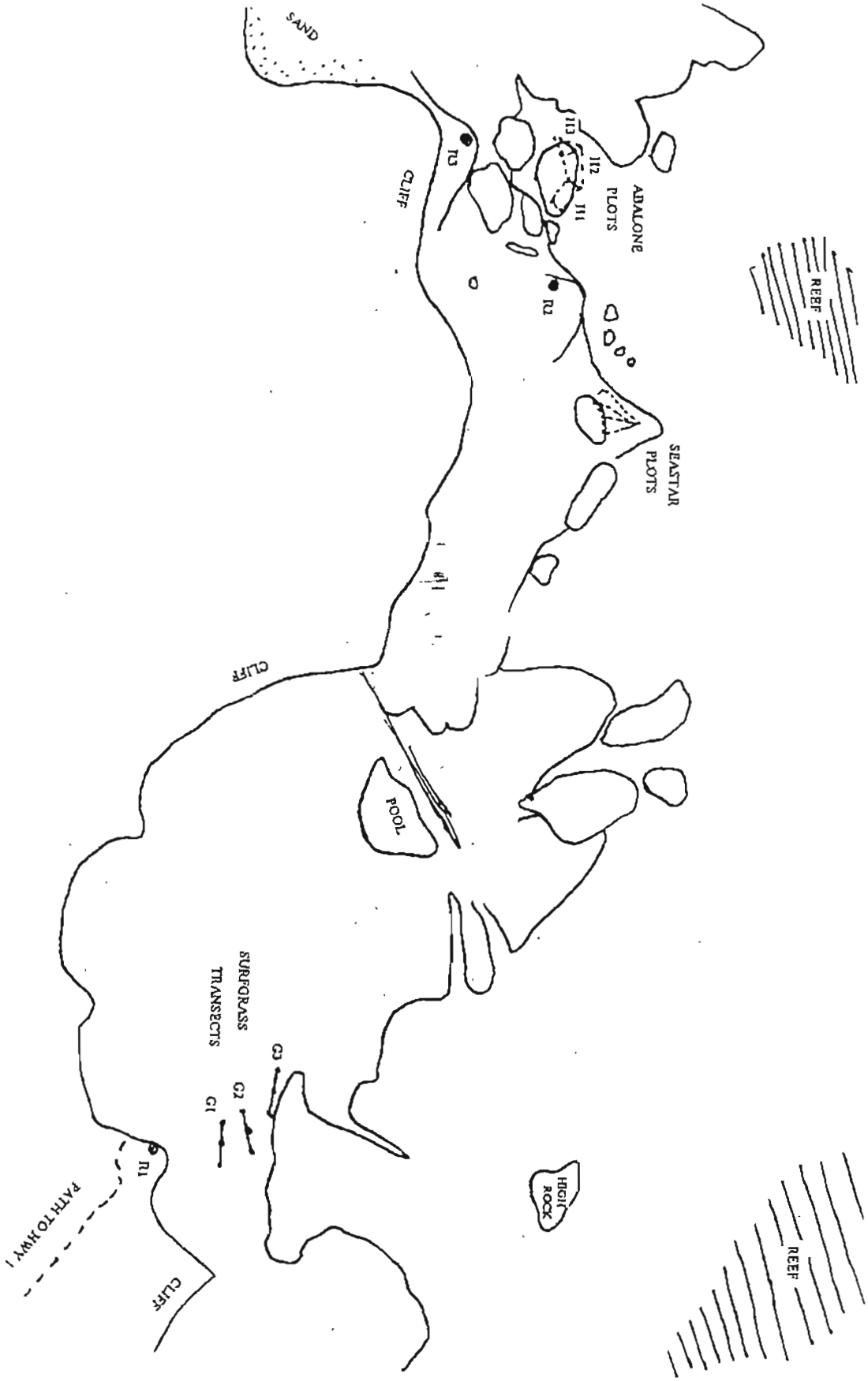


Figure I-26. Site map for Point Sierra Nevada (From Raimondi 1988)

Andrew De Vogelaere

Figure I-27. Image from Point Sierra Nevada

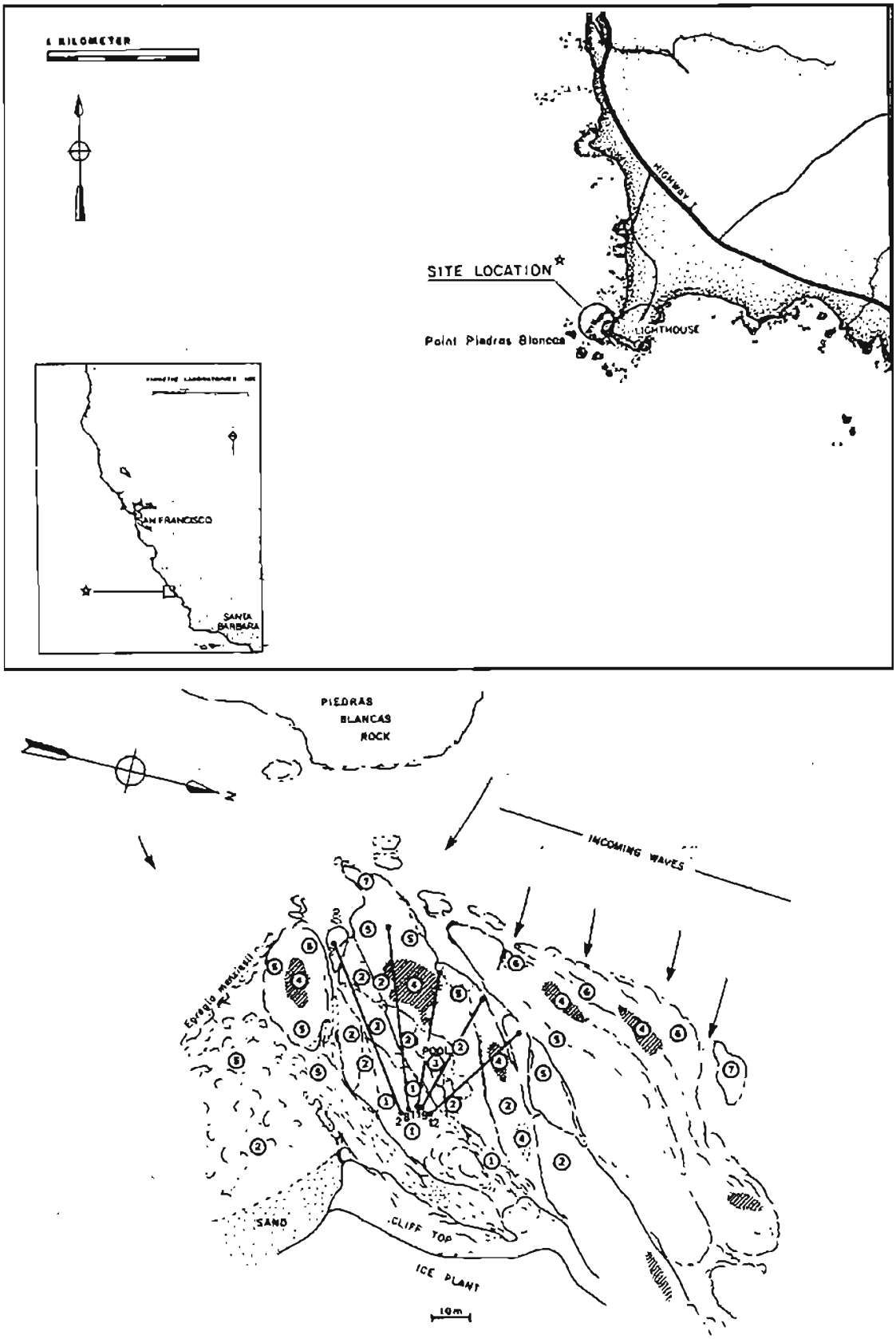
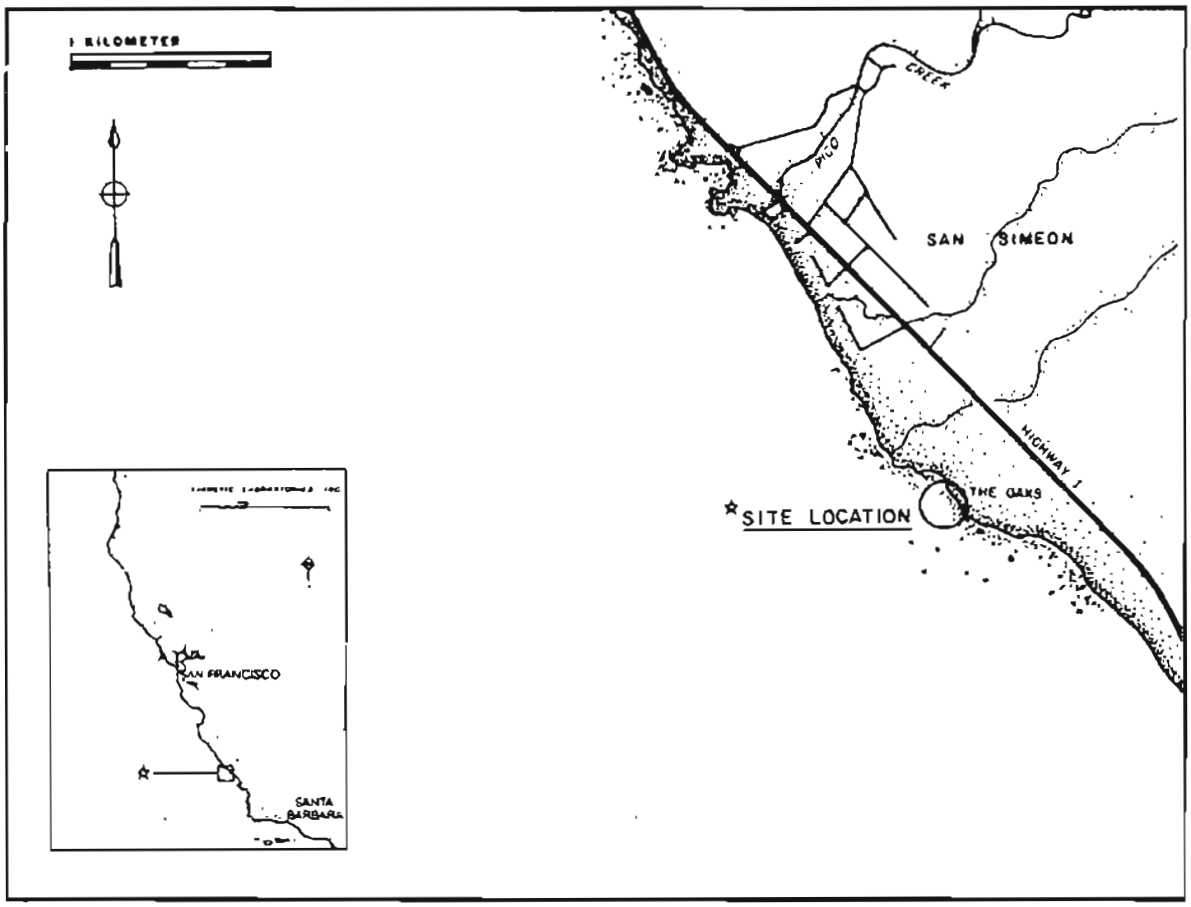


Figure I-28. Site map for Point Piedras Blancas with transect locations. Reprinted from Kinnetic Laboratories Inc., 1985.



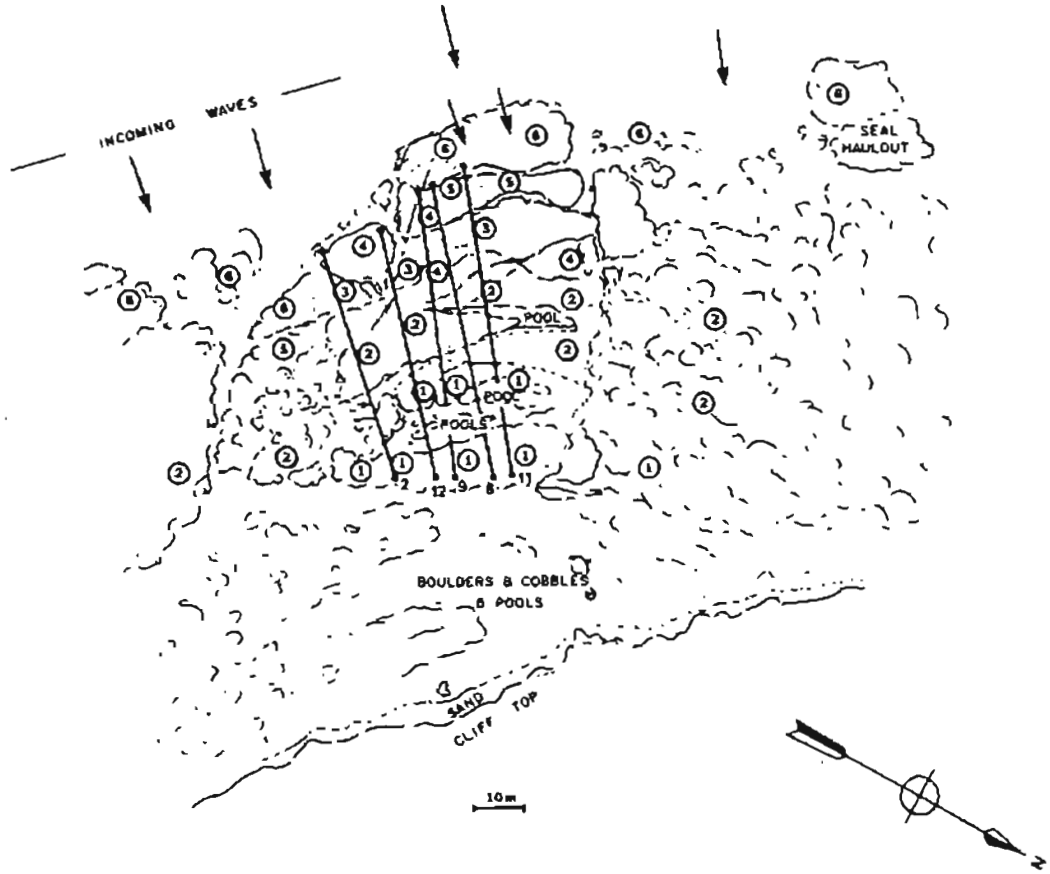


Figure 1-29. Site map for San Simeon with transect locations. Reprinted from Kinnetic Laboratories Inc., 1985.