



Rocky Intertidal Community Monitoring at Channel Islands National Park

2011 Annual Report

Natural Resource Data Series NPS/MEDN/NRDS—2020/1298



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ON THE COVER

Tidepool at Landing Cove, Santa Barbara Island

Photograph by: Dan Richards

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2011 Annual Report

Natural Resource Data Series NPS/MEDN/NRDS—2020/1298

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Executive Summary

Channel Islands National Park includes the five northern islands off the coast of southern California and the surrounding waters out one nautical mile. There is approximately 176 miles of coastline around the islands; about 80% of which is composed of rock. The diversity and undisturbed nature of the tidepools of this rocky coastline was recognized as a special feature of the islands in the enabling legislation. To conserve these communities unimpaired for future generations, the NPS has been monitoring the rocky intertidal communities at the islands since 1982. Sites were established between 1982 and 1998. Site selection considered visitation, accessibility, presence of representative organisms, wildlife disturbance, and safety. This report summarizes the 2011 sampling year efforts (from March 2011 to January 2012) and findings of the Channel Islands National Park (CHIS) Rocky Intertidal Community Monitoring Program.

Specific monitoring objectives are: 1) to determine the long-term trends in percent cover of key sessile organisms in the rocky intertidal ecosystem (Table 1), and 2) to determine population dynamics of *Haliotis cracherodii*, *Lottia gigantea*, and *Pisaster ochraceus*. Objectives were met by monitoring percent cover of core species in target intertidal zones using photo-plots and transects, monitoring species composition and abundance of motile invertebrates using photo-plots, and measuring size frequency and abundance of black abalone, owl limpets, and sea stars using fixed plots or timed searches.

Thirteen key species or assemblages have been monitored twice per year at 21 sites on the five park islands (Figure 1) as part of the Rocky Intertidal Community Monitoring Program. Fixed photo-plots were used to monitor the percent cover of thatched and acorn barnacles (*Tetraclita rubescens*, *Balanus glandula/Chthamalus* spp., respectively), mussels (*Mytilus californianus*), rockweeds (*Silvetia compressa*, and *Hesperophycus californicus*), turfweed (*Endocladia muricata*), red algal turf (*Pterocladia* spp. and *Gelidium* spp.), goose barnacles (*Pollicipes polymerus*) and tar. Point-intercept transects were used to determine the percent cover of surfgrass (*Phyllospadix* spp.). Information about size distribution (i.e. “size-frequency” data) was collected for owl limpets (*Lottia gigantea*) in circular plots. Size distribution and relative abundance of black abalone (*Haliotis cracherodii*) and ochre sea stars (*Pisaster ochraceus*) were determined using timed searches. The maximum number of shorebirds and pinnipeds seen at one time were counted at each site. The number of concession boat visitors to the Anacapa tidepools was collected and reported.

Most sites including all the Santa Barbara, Santa Cruz, San Miguel and the majority of the Anacapa sites were not monitored in spring due to a combination of inclement weather, logistical difficulties, a need to catch-up on reporting requirements and avoidance from disturbing nesting California brown pelicans (e.g., Sea Lion Rookery, Santa Barbara Island). However, all but two sites (Anacapa Middle West and Middle East) were sampled during the fall monitoring season. Weather conditions during the spring and fall site-visits were satisfactory, but high wind coupled with strong swell and surge limited some of the abalone and sea star searches.

Most key species or assemblages targeted in the photo-plots were highly variable among sites. Seasonal variation could not be determined for the majority of sites since many were not sampled in

spring 2011. However, for the sites (all Santa Rosa sites and Orizaba Cove, Santa Cruz Island) that were sampled twice during the year, abundances of key target sessile species remained comparable between spring and fall. Mussels, *Mytilus californianus*, and both rockweeds, *Silvetia compressa* and *Hesperophycus californicus*, occurred in low abundances again this year at the majority of sites compared to combined averages for previous years. All three species have decreased markedly during the last several years at most sites. Barnacle, *Chthamalus/Balanus* spp., abundances were comparable to long term averages at approximately half the sites sampled in spring and fall. *Endocladia muricata* cover declined more than one standard error at less than one-quarter of sites, but increased at nearly half the sites during both monitoring seasons compared to long term means.

Motile invertebrate densities within sites often vary substantially from year to year. In 2011, taxa commonly associated with barnacle and *Endocladia* plots (*Littorina* spp. and small [< 5 mm] and medium-sized [5–15 mm] limpets) reached all-time high abundances at many sites. The same organisms also reached record-high densities within the *Silvetia* plots at several sites. Record-low abundances also occurred for *Littorina* spp. and small-sized limpets at several sites this year. The highest recorded numbers of *Lepidochitona* spp. were measured within the *Silvetia* zones at two sites this year. Likewise, the snail, *Chlorostoma funebris*, reached all-time high abundances in the *Silvetia* plots at a couple sites this year. *Mytilus* plots supported more *Nuttallina* spp. than previous years at one site, and had slightly higher abundances of *Nucella emarginata* at two sites.

Black abalone, *Haliotis cracherodii*, abundances at the islands are still less than one percent of 1985 population levels. Only three black abalone were seen within fixed plots in 2011. Zero abalone were found at Cuyler Harbor, Landing Cove, Northwest-Talcott, Sea Lion Rookery and South Frenchy's Cove. Eight sites supported greater than 30 black abalone. With few exceptions, counts at all sites were consistent with the range of counts seen in recent years. Anacapa and Santa Cruz Island size frequencies for black abalone indicate the effects of recruitment in recent years since the populations are skewed towards smaller (< 50 mm) animals. The opposite is true at San Miguel Island where we continue to find very few juvenile abalone; instead, the population is dominated by older individuals.

Ochre sea stars, *Pisaster ochraceus*, were moderately-abundant in 2011 at most sites around the islands. More than 500 *P. ochraceus* were counted during 30-minute searches at two sites in fall, and 100–500 sea stars were counted at over half of all sites monitored during spring, fall or both seasons. *P. ochraceus* populations at most sites followed normal size frequency distributions with modes typically between 90 mm and 110 mm. Exceptions were at Anacapa Middle West, Landing Cove, Orizaba Cove, Otter Harbor, Scorpion Rock and Willows Anchorage whereby seastars were either negatively or positively skewed during one or both sampling seasons.

Giant owl limpet, *Lottia gigantea*, densities varied minimally, if at all in 2011, from past years according to five-sample moving trends. In contrast, the mean sizes of *L. gigantea* in 2011 varied spatially among sites and islands, and to a lesser degree, temporally within most sites. The smallest limpets were measured at Cat Rock and the largest individuals were seen at Northwest-Talcott.

Surfgrasses, *Phyllospadix* spp., are typically monitored biannually at two sites each on Santa Cruz and Santa Rosa Islands. This year, Fraser Cove and Trailer on Santa Cruz were only sampled in fall.

Five-sample trends indicate that *Phyllospadix* spp. cover on the three transects at Fraser has been increasing during the last three years. At Trailer, five-sample trends indicate that overall abundances have been slowly decreasing in recent years. In contrast, surfgrass cover at both sites monitored on Santa Rosa Island has remained relatively stable over time.

Black oystercatchers were the most ubiquitous shorebird seen at all sites; seasonal abundances were relatively comparable to those observed in recent years. One American oystercatcher was present at two sites, and black turnstones were observed at nine sites throughout 2011. Other notable observations include 40 western gulls counted at Sea Lion Rookery in fall and 70 cormorants seen at both East Point and Crook Point in fall.

Harbor seals, *Phoca vitulina*, were seen at nine sites in 2011. As in past years, *P. vitulina* were most abundant at Otter Harbor. Elephant seals, *Mirounga angustirostris*, were seen at four sites during the year. California sea lions, *Zalophus californianus*, were observed at Sea Lion Rookery and Landing Cove, Santa Barbara Island. Approximate numbers of sea lions at the two sites ranged 28–200. Additionally, one sea lion was seen nearby Orizaba Rock and Fraser Cove in spring and fall, respectively.

Visitation to all but two intertidal sites, South Frenchy's Cove on Anacapa and Prisoner's Harbor at Santa Cruz, is low or nonexistent. However, Frenchy's Cove particularly receives moderate usage due to its close proximity to the mainland and relative ease of access. In 2011, Island Packers Company conducted 19 trips to Frenchy's Cove to allow visitors access to the tidepools. Total visitation was 1,383 passengers. Most visitation (79%) occurred during February through April with March being the busiest month (634 visitors).

Acknowledgments

The National Park Service, Channel Islands National Park (CHIS) funded this program. California Department of Fish and Game and Channel Islands National Marine Sanctuary (CINMS) provided staff time and general assistance on several events. Boat time (two days in spring and five in fall) was provided by CINMS. Temperature loggers and temperature data management were provided by the Partnership for Interdisciplinary Studies of Coastal Oceans (PISCO) Marine Science Institute, University of California, Santa Barbara (UCSB).

As with any large project there are many people “behind the scenes” that make it possible to actually conduct the work. We are indebted to the administrative clerks, dispatchers, boat operators, maintenance workers, and rangers of Channel Islands National Park that help with the day-to-day operations.

In 2011 we received funding from the National Marine Fisheries Service Endangered Species Program to hire a biological technician (Andrew Domingos) and conduct additional sampling for black abalone. Andrew’s assistance in the field along with digital file management was greatly appreciated.

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Last but not least, this report would not have been possible without the concerted effort of the Inventory and Monitoring Database Manager for the Mediterranean Network, Lena Lee. Lena provided valuable expertise and dedicated a tremendous amount of time to designing an efficient and user-friendly database for the Rocky Intertidal Community Monitoring Program at Channel Islands National Park. In addition, Ms. Lee assisted with the formatting challenges that always occur when writing a document of this size.

List of Acronyms

Acronym	Description
ANI	Anacapa Island
CHIS	Channel Islands National Park
CINMS	Channel Islands National Marine Sanctuary
ENSO	El Niño Southern Oscillation
GIS	Geographic Information System
MARINe	Multi-Agency Rocky Intertidal Network
MLLW	Mean Lower Low Water
NMFS	National Marine Fisheries Service
NOAA	National Oceanographic and Atmospheric Administration
NPS	National Park Service
PISCO	Partnership for Interdisciplinary Studies of Coastal Oceans
PIT	Passive Integrated Transponder
SCA	Student Conservation Association
SBI	Santa Barbara Island
SCI	Santa Cruz Island
SMCA	State Marine Conservation Area
SMI	San Miguel Island
SMR	State Marine Reserve
SRI	Santa Rosa Island
TNC	The Nature Conservancy
UCLA	University of California Los Angeles
UCSB	University of California Santa Barbara
UCSC	University of California Santa Cruz
WS	Withering Syndrome

Introduction

The rocky intertidal zone is a compact and biologically-diverse area between marine and terrestrial habitats. Marine organisms living within this zone are highly adapted to physical disturbance and severe-temperature fluctuations and are subject to both marine and terrestrial predators. The intense pressure from both physical and biological entities has promoted highly-diverse invertebrate and algal assemblages within the rocky intertidal zone as indicated by the vast number of organisms that cannot live without the alternating exposure to both air and sea.

Channel Islands National Park (CHIS) and Channel Islands National Marine Sanctuary (CINMS) encompass the four northern Channel Islands and Santa Barbara Island off the coast of southern California. The park islands and surrounding waters bear the designation of an International Biosphere Reserve and State of California Areas of Special Biological Significance. The State of California maintains jurisdiction over the marine resources and manages them through the California Department of Fish and Wildlife. In 2003, a network of marine reserves was established around the Channel Islands. Four of the rocky intertidal monitoring sites fall inside State Marine Reserves and two more are immediately adjacent to reserve boundaries (Figure 1).

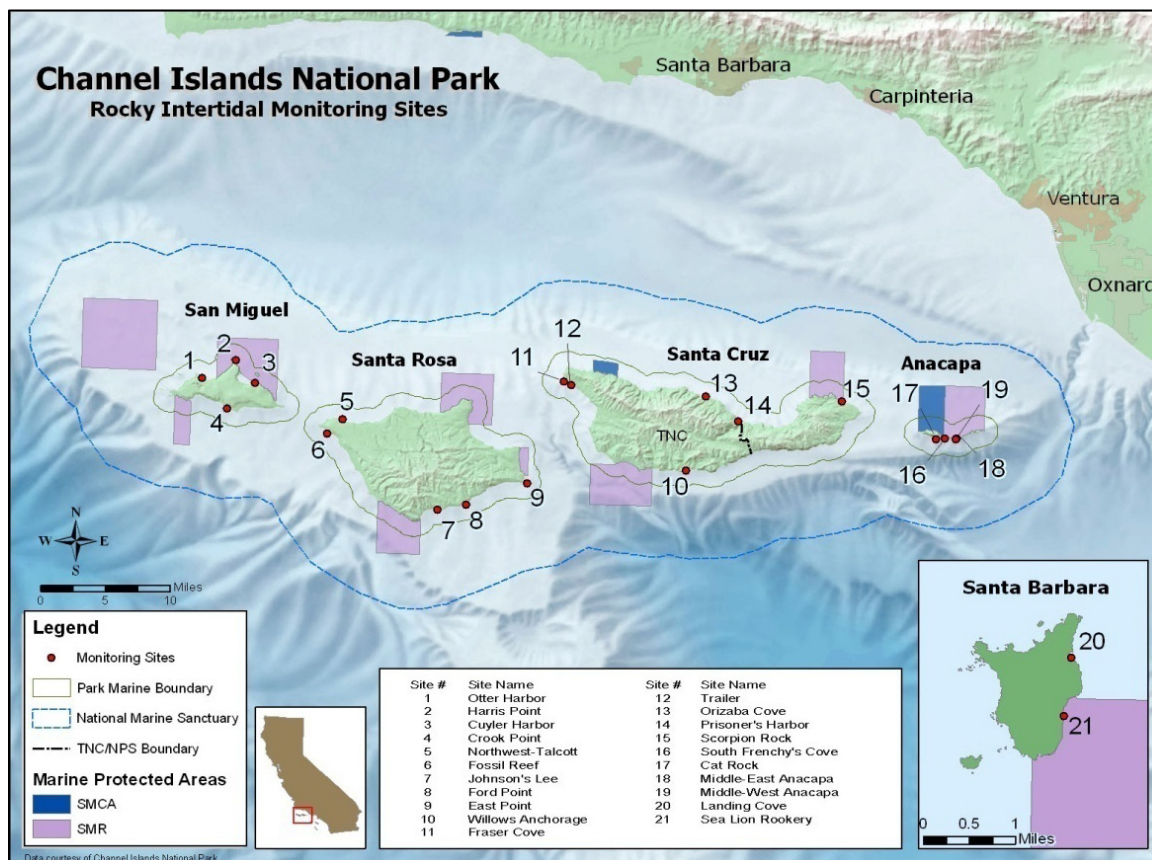


Figure 1. Rocky Intertidal Community Monitoring site locations in Channel Islands National Park. Note: TNC= The Nature Conservancy, SMCA= State Marine Conservation Area, SMR= State Marine Reserve, Sites 18 and 19 are on adjacent reefs.

The “undisturbed tide pools” are unique features specifically mentioned in the enabling legislation for CHIS. The law establishing the park (16-USC-410) also mandated the development of inventories and monitoring of natural resources in the park. Rocky intertidal monitoring began in 1982 with the following goals: 1) to monitor trends in population dynamics of selected indicator organisms, 2) to determine normal limits of variation, 3) to discover abnormal conditions, 4) to provide remedies for management problems, and 5) to measure the success of management actions.

Specific monitoring objectives are: 1) to determine the long-term trends in percent cover of key sessile organisms in the rocky intertidal ecosystem, and 2) to determine population dynamics of *Haliotis cracherodii*, *Lottia gigantea*, and *Pisaster ochraceus*. Objectives are met by monitoring percent cover of core species in targeted intertidal zones using fixed photoplots and fixed transects, monitoring species composition and abundance of motile invertebrates using photoplots, measuring size frequency and abundance of black abalone, owl limpets, and seastars using fixed plots or timed searches. Monitoring is done twice each year during spring and fall to monitor the effects of winter storms and summer warm water.

Rocky intertidal monitoring initially began at Anacapa Island (VTN Oregon 1984) following concerns that visitor usage (e.g., trampling, collecting, etc.) may increase and thus negatively impact rocky intertidal communities (see Littler 1978). Beginning in 1985, the program was expanded to include sites at Santa Barbara, Santa Rosa and San Miguel Islands. Sites were added at Santa Cruz Island in 1994–1998 by UCSB personnel and assumed by CHIS in 1998. Sampling site locations were chosen subjectively based on accessibility, safety and the relative locations of target organisms, among other variables.

Because intertidal areas are so heterogeneous, an impractically large number of plots would be necessary to detect temporal changes in species abundance using probability-based sampling (Ambrose et al. 2002, 1995b). Therefore a sampling design involving fixed plots was selected in an attempt to maximize the ability to detect temporal changes in target species distribution and abundance. The disadvantage of this sampling design is that results from plots cannot be extrapolated to the larger, un-sampled population (Engle 2008), and statistical comparison among sites is not possible (Murray et al. 2006).

CHIS Rocky Intertidal Monitoring is part of a government and non-government consortium called the Multi-Agency Rocky Intertidal Network (MARINe) (Dunaway et al. 1998). Within MARINe, the goal is to standardize collection of data at sites spanning from Baja California to Alaska, including the Channel Islands, and make it available to member groups in a centralized database (Engle 2008). By working with MARINe we have access to consistent data that can be used for much broader regional analyses of changes to intertidal communities.

This report summarizes the 2011 sampling year efforts (from March 2011 to January 2012) and documents activities and observations of the CHIS Rocky Intertidal Community Monitoring Program. Monitoring results were previously reported in Richards 1986, 1988, 1998; Richards and Lerma 2000, 2002, 2005; Richards et al. 2011, Richards and Rich 2009, 2012; Richards and Whitaker 2012a, 2012b, 2012c, 2012d; and Whitaker and Richards 2012. Additional black abalone

monitoring results have been presented in Haaker et al. 1992, Davis et al. 1992, and Richards and Davis 1993.

Methods

Study Area

The California Channel Islands are comprised of eight islands in the Southern California Bight; five of the islands are located within the CHIS. The five park islands have about 323 kilometers (176 miles) of coastline, the majority (approximately 80%) of which is rocky shore. Rock types vary from hard, weathered volcanic basalt or breccias to easily eroded Monterey shale and sandstone. Sites were originally established to include the various exposures and rock types of each of the islands, though broad rocky benches were targeted.

The Park islands span the transition zone between cooler waters of the Oregonian biogeographic province and the warmer Californian waters from the south. Mean annual air temperature along the mainland in this area is 15°C. Mean rainfall is about 38 cm per year (Daily et al. 1993). There is a climatic gradient across the island chain with San Miguel Island having the most precipitation, cloud cover, and wind. Santa Barbara Island to the southeast is the warmest and driest. The mean monthly sea temperatures range from 13°C in April at San Miguel Island to nearly 20°C at Santa Barbara Island in August and September (Engle and Richards 2001). Swell varies throughout the year with winter storms bringing high northwest wind and waves during the winter and spring, and distant southern hemisphere storms sending large swells to the south-facing shores in summer.

Monitoring

The CHIS Rocky Intertidal Community Monitoring Program has 21 sites on the five park islands (Figure 1) that were established between 1982 and 1998. Sites generally consist of an array of 15–35 photoplots, 3–5 irregular-shaped and circular plots used to monitor black abalone and owl limpet densities, respectively, and *P. ochraceus* transects. Surfgrass transects are monitored at four sites. Site selection considered visitation, accessibility, presence of representative organisms, wildlife disturbance, and safety. Sampling is usually conducted twice each year, once in spring and fall. In 2011, monitoring occurred at 6 sites in spring (March–May) and 20 sites in fall (October–January 2012). Monitoring protocols detailed in Richards and Davis (1988) and Engle et al. (1998) were followed. Updated protocol summaries can be found in Richards and Lerma (2000), Richards et al. (2011), and Engle (2008). See Appendix A for additional notes about the 2011 program.

Data are maintained in Microsoft Access databases and Excel files in the Channel Islands National Park network and MARiNe. The annual reports are available on the internet at <https://www.nps.gov/im/medn/reports-publications.htm>.

The percent coverage of thirteen core species or assemblages is monitored in fixed photoplots (Table 1). The chosen target species and assemblages commonly occur throughout the SCB and are generally used to define a band or zone within the intertidal zone. Target species and assemblages include thatched and acorn barnacles (*Tetraclita rubescens*, *Balanus glandula*/*Chthamalus* spp., respectively), mussels (*Mytilus californianus*), rockweeds (*Silvetia compressa*, and *Hesperophycus californicus*), turfweed (*Endocladia muricata*), red algal turf (*Pterocladia* spp. and *Gelidium* spp.), goose (or leaf) barnacles (*Pollicipes polymerus*), and tar which occurs naturally from oil seeps in the channel and can form a thick, persistent cover over substrata. An additional 32 taxa or substrata are

also monitored when present (see Table 1 for list of taxa¹). Fixed plots (50 x 75 cm) are photographed on each visit. In most cases, there are five replicate plots in each zone that were initially established over high densities of the target species. Not all core species (zones) are represented at each site. Four new *M. californianus* plots were established in the *Mytilus* zone at Johnson's Lee in fall 2008 to replace plots that had been devoid of mussels for over 15 years (Whitaker and Richards 2012).

Table 1. Core Species, Higher Taxa, and Substrata Scored in Photoplots, Point Intercept Transects, Circular Plots, Abalone/Seastars, and Mobile Invertebrate Counts at all CHIS Sites.

Category	Species or Substrate	Photo plots	Surfgrass Transects	Circular Plots	Abalone/ Sea star	Motile Inverts
Green algae	<i>Cladophora columbiana</i>	X	–	–	–	–
	<i>Ulva/Enteromorpha</i>	X	–	–	–	–
	Other Green Algae (any greens not listed above)	X	X	–	–	–
Brown algae	<i>Egregia menziesii</i> (Boa Kelp)	X	X	–	–	–
	<i>Eisenia arborea</i>	–	X	–	–	–
	<i>Endarachne/Petalonia</i>	X	–	–	–	–
	<i>Halidrys dioica/Cystoseira</i> spp.	–	X	–	–	–
	<i>Hesperophycus californicus</i> * (= <i>H. harveyanus</i>)	X	–	–	–	–
	<i>Sargassum muticum</i>	–	X	–	–	–
	<i>Scytosiphon</i> spp.	X	–	–	–	–
	<i>Silvetia compressa</i> * (= <i>Pelvetia fastigiata</i>)(Rockweed)	X	–	–	–	–
	Other Brown Algae (any browns not listed above)	X	X	–	–	–
	Ephemeral browns	X	–	–	–	–
Red algae	<i>Endocladia muricata</i> * (Turfweed)	X	–	–	–	–
	<i>Chondracanthus canaliculatus</i> (= <i>Gigartina canaliculata</i>)	X	–	–	–	–
	<i>Chondracanthus spinosus</i>	X	–	–	–	–
	<i>Gelidium coulteri/ Pterocliadiella capillacea</i>	X	–	–	–	–
	<i>Mastocarpus papillatus</i> (blade)	X	–	–	–	–

* Target species (also shown in bold)

¹ Taxa are defined as species or groups of similar species that may not be easily separated in the field. Core taxa are those identified by MARINE as species to be searched for and counted by all groups (Engle 2008).

Table 1 (continued). Core Species, Higher Taxa, and Substrata Scored in Photoplots, Point Intercept Transects, Circular Plots, Abalone/Seastars, and Mobile Invertebrate Counts at all CHIS Sites.

Category	Species or Substrate	Photo plots	Surfgrass Transects	Circular Plots	Abalone/ Sea star	Motile Inverts
Red algae (continued)	Mazzaella affinis (= Rhodoglossum affine)	X	–	–	–	–
	Mazzaella spp. (= Iridaea spp.)	X	–	–	–	–
	Porphyra spp.	X	–	–	–	–
	Prionitis spp.	X	–	–	–	–
	Articulated Corallines (Erect Corallines)	X	X	–	–	–
	Crustose Corallines (Encrusting Corallines)	X	X	–	–	–
	Other Red Algae (any reds not listed above)	X	X	–	–	–
Algae/plants	Phyllospadix scouleri/torreyi* (Surfgrass)	X	X	–	–	–
	Non-Coralline Crusts (reds and browns)	X	X	–	–	–
	Other Plant/Algae	–	X	–	–	–
Anemones	<i>Anthopleura elegantissima/sola</i> (Green Anemone)	X	X	–	–	–
Polychaete worms	<i>Phragmatopoma californica</i>	X	X	–	–	–
Molluscs	<i>Acanthina</i> spp.	–	–	–	–	X
	Chitons	X	–	–	–	X
	<i>Fissurella volcano</i>	–	–	–	–	X
	<i>Haliotis cracherodii*</i> (Black Abalone)	–	–	–	X	–
	<i>Lepidochitona hartwegii</i>	–	–	–	–	X
	<i>Littorina</i> spp.	–	–	–	–	X
	<i>Lottia gigantea*</i> (Owl Limpet)	–	–	X	–	X
	<i>Mopalia</i> spp.	–	–	–	–	X
	<i>Mytilus californianus*</i> (California Mussel)	X	X	–	–	–
	<i>Nucella emarginata</i>	–	–	–	–	X
	<i>Nuttallina</i> spp.	–	–	–	–	X
	<i>Ocenebra circumtexta</i>	–	–	–	–	X
	<i>Chlorostoma funebris</i> (= <i>Tegula funebris</i>)	–	–	–	–	X
	<i>Chlorostoma gallina</i> (= <i>Tegula gallina</i>)	–	–	–	–	X
	<i>Chlorostoma</i> spp. (= <i>Tegula</i> spp.)	X	–	–	–	–
	Limpets	X	–	–	–	–

* Target species (also shown in bold)

Table 1 (continued). Core Species, Higher Taxa, and Substrata Scored in Photoplots, Point Intercept Transects, Circular Plots, Abalone/Seastars, and Mobile Invertebrate Counts at all CHIS Sites.

Category	Species or Substrate	Photo plots	Surfgrass Transects	Circular Plots	Abalone/ Sea star	Motile Inverts
Molluscs (continued)	Large Limpets > 15mm (excluding <i>L. gigantea</i>)	–	–	–	–	X
	Medium Limpets 5–15mm	–	–	–	–	X
	Small Limpets < 5mm	–	–	–	–	X
	<i>Littorina</i> spp.	X	–	–	–	X
	<i>Septifer/Brachydontes</i>	X	–	–	–	–
Barnacles	<i>Chthamalus dalli/fissus</i> & <i>Balanus glandula</i> * (Acorn Barnacle)	X	–	–	–	–
	<i>Tetraclita rubescens</i> * (Thatched Barnacle)	X	–	–	–	–
	<i>Pollicipes polymerus</i> * (Goose Barnacle)	X	–	–	–	–
	Barnacles	–	X	–	–	–
	Other Barnacles (any barnacles not listed above)	X	–	–	–	–
Echinoderms	<i>Pisaster ochraceus</i> * (Ochre Star)	X	X	–	X	X
	<i>Pisaster giganteus</i>	–	–	–	X	X
	<i>Patiria miniata</i>	–	–	–	X	X
	<i>Strongylocentrotus purpuratus</i>	–	–	–	–	X
Crustaceans	<i>Pachygrapsus crassipes</i>	–	–	–	–	X
	<i>Pagurus</i> spp.	–	–	–	–	X
Invertebrates	Other Invertebrates (Other Animals) (any inverts not listed above)	X	X	–	–	–
Substrates	Rock (Bare Rock)	X	X	–	–	–
	Sand	X	X	–	–	–
	Tar	X	X	–	–	–
Undetermined	Unidentified (cannot tell if plant, invert or substratum)	X	X	–	–	–

* Target species (also shown in bold)

In 2011, all photoplots were photographed with a digital camera (Olympus 1030 SW). The percent cover of core organisms was determined either in the field by laying a grid (50 x 75 cm) of one-hundred evenly-spaced points (10 x 10) over the plot (Figure 2), or in rare cases in the office from digital images of the plots, when conditions were unfavorable or insufficient time was available. In the office, a digitized grid was created in Adobe Photoshop and overlaid on the image to provide complete coverage of the plot. Under both scoring protocols, layered organisms were not counted separately. Therefore the total cover of the top-most layer (with few exceptions—see Engle 2008)

summed 100%. Data were recorded onto pre-printed data sheets, transcribed into the computer database and 100% reviewed for errors.



Figure 2. Stephen Whitaker scoring photoplots at Otter Harbor, San Miguel Island. Can you spot the harbor seal in the background?

Relative abundance and size structure data were collected for black abalone at each site by searching a defined area of the reef or by utilizing a timed-interval search. Sites are of variable sizes and the areas are defined by natural breaks in the reef allowing repeated searches of similar area. Timed searches are typically 30-minutes long. More time is often devoted to searches at sites that have the greatest numbers of abalone (e.g., Otter Harbor, San Miguel Island and Willows Anchorage, Santa Cruz Island). These protocols were implemented in response to abalone population levels declining. Prior to the effects of Withering Syndrome, black abalone were counted and measured in fixed-irregular plots (5 plots per site) at 11 sites. Fixed plots were used when abalone were abundant and often too numerous to count and measure over the whole reef. However, the fixed plots became inadequate for sampling by the early 1990s as abalone disappeared. Fixed plots are still checked for comparison to early samples but abalone are rarely encountered in the plots.

During the timed or defined-area searches for black abalone, typically one observer searches for individuals by carefully inspecting crevices and cavities among boulders, and checking under kelp or other canopy-forming seaweeds. Abalone are identified to species, shell lengths are measured with vernier calipers or estimated if an accurate measurement is not possible, and the nearest neighbor

distance is recorded using five spatially-descriptive categories (touching, < 10 cm, 10–100 cm, 1–5 m, >5 m). Aggregation sizes (number of abalone within one meter of another) are generally noted as well. Shell size serves as a proxy for age, and thus provides a glimpse of the population structure. Nearest neighbor distance and aggregation size provide insight to the theory that abalone aggregate naturally. The information may also serve as an indication of spawning potential, since, as broadcast spawners, black abalone reproductive options increase with proximity to other individuals.

Lottia gigantea, giant owl limpet, abundance and size structure were assessed within fixed, circular plots (3 to 5 plots per site) at 12 sites. Within each plot, an area of 3.14 m² delineated by circling a fixed bolt with a pre-measured (1 m in length) line was used to measure and count all owl limpets > 15 mm (< 15 mm limpets can be difficult to identify to species) for maximum shell length (Figure 3).



Figure 3. Stephen Whitaker measuring giant owl limpets at Otter Harbor, San Miguel Island.

Pisaster ochraceus, ochre seastars, were counted along with other species of seastars (*Pisaster giganteus*, *Patiria miniata*, *Pycnopodia helianthoides*, and *Leptasterias hexactis*) in a general search of the reef (for 30-minutes). When possible (time and weather permitting), 50–100 *P. ochraceus* were measured (center of disk to tip of longest ray) for size distribution. At three sites (Johnson's Lee, Fossil Reef, and Landing Cove) where *P. ochraceus* were abundant, fixed transects (2m x ~8m) were used as a rough measure of density within that area.

Smaller motile invertebrates (Table 1) were counted by carefully searching each photoplot (Figure 4). Select species were measured for size-frequency distribution. Abundant littorine snails and small

limpets were sub-sampled in three small plots (either 20cm x 20cm or 10cm x 10cm, depending on density) within the photoplot area. Motile-invertebrates are usually sampled once annually.



Figure 4. Stephen Whitaker counting motile invertebrates at Otter Harbor, San Miguel Island.

Phyllospadix spp., surfgrass, cover was measured on fixed point-intercept transects (10 m long, 100 points) (three transects per site) at four sites (Trailer, Fraser Cove, East Point, Northwest-Talcott). Special circumstances and general conditions that may have affected sampling were described on daily logs, and reported in the trip reports. Surfgrass transect scoring methods follow the MARINE protocol, adding *Phyllospadix* spp. understory for surfgrass covered by algae.

Shorebird and pinniped observations were made on arrival and throughout the day at each site visit. The numbers reported for each species were the greatest number observed at any one time while working at a site. Visitor numbers were reported by concessioners (Island Packers Company and Truth Aquatics) to the park. No independent counts of visitors were made to verify reported figures.

Field work was conducted during low tides, generally below mean low water (minus tides) known as spring tides, as opposed to neap tides. Spring tides occur twice each month but often during dark hours. Sampling dates for spring and fall seasons were chosen for minus tide series occurring during daylight hours. Sampling was conducted by Dan Richards and Stephen Whitaker with assistance from others, primarily for data recording and sea star counts. Notes regarding sampling variations, personnel changes, and equipment are documented in trip reports in Appendix C.

Optic Stowaway temperature loggers from Onset Computer Corporation were placed in PVC (Polyvinyl Chloride) pipe housings epoxied to rocks near the mean-tide line. Units were downloaded in the field to an Optic Shuttle device and processed with Onset's Boxcar software.

Taxonomy and nomenclature follow Smith and Carlton (1975), Carlton (2007), Abbott and Hollenberg (1976), McLean (1978), Morris et al. (1980), and http://ucjeps.berkeley.edu/californiaseaweeds_refs.html. Note that in this report, we have adopted the taxonomy of Carlton (2007) with the genus name change from *Tegula* to *Chlorostoma* for turban snails.

Data Analysis

The purpose of this report is to present data collected in 2011. Advanced statistical analyses on the data have not been performed. Any trends presented are simple summary statistics and should be viewed as preliminary. Basic trends of percent cover, averaged by zone, were graphed for key species in photoplots (acorn barnacles, thatched barnacles, mussels, rockweeds [*Silvetia* and *Hesperophycus*], goose barnacles, red algal turf, and tar) using stock charts in Microsoft Excel. These charts provide a quick view of the cover by season compared to the overall range and mean of values through time for each taxon at each site. To minimize variability, photoplot target types were not pooled from different zones for analysis. For example, the percent cover of mussels in only mussel zone plots was considered. Descriptive statistics (density, average size, minimum and maximum size), averaged by site were determined for all circular owl-limpet plots, and the trend through time was graphed by sampling event. Readers are cautioned that although densities are provided for comparative purposes, plots were chosen within high density areas, are not randomly placed, and should not be considered to be representative of larger areas. Surfgrass trends were plotted for temporal reference.

Photoplots, circular plots, and line transects were all "fixed" or measured in the same location every season. It is not possible to extrapolate trends in the plots to entire sites without using additional information specific to the area (Murray et al. 2006). Therefore, results from photoplots, transects, and circular plots should be interpreted with care.

Results and Discussion

Photoplots

Photoplot data are summarized in Figures 5–7 for each target zone and season. Mean percent cover is pooled for all replicate plots per zone by site and season, and is compared to the range and cover averaged across all previous years. Percent cover values of core taxa in each plot are presented in Appendix B. Summary tables (by zone) for each site can be found in the trip reports (Appendix C). As in most years, the mean percent cover of nearly all targeted species in 2011 was highly variable among sites. Temporal comparisons between spring and fall sampling seasons could only be made at a limited number of sites since the majority was not sampled in spring (Figures 5–7).

Mussel, *Mytilus californianus*, mean percent cover fell more than one standard error below the combined means for previous years at 4 of 6 sites sampled in spring and 8 of 19 sites in fall (Figures 5–6). Mean abundances in 2011 remained comparable to long-term means at 1 of 6 sites in spring and 8 of 19 sites in fall. Three sites, Johnson’s Lee, Landing Cove and South Frenchy’s Cove, had markedly higher (greater than one standard error) mussel cover in 2011 (measured in fall) compared with the mean value for cumulative past years at those sites. Four sites (Fossil Reef, Orizaba Cove, Prisoners Harbor and Scorpion Rock) had nearly zero percent cover of *M. californianus* in the mussel plots, thereby reaching nearly the lowest, if not the least, recorded abundances for each site since monitoring began. However, recruitment of juvenile mussels was noted to be particularly common at Willows Anchorage.

Rockweed, *Silvetia compressa*, abundances were again very low in 2011 compared to previous years. *S. compressa* cover averaged across representative plots at each site was more than one standard error below long-term averages at nearly all sites sampled in spring (3 of 4 sites) and fall (12 of 15 sites) (Figures 5–6). Eight sites had less than 10% *S. compressa* cover measured in spring, fall or both seasons. Most sites exhibited marked declines in *S. compressa* abundances beginning in 2005–2006 with little recovery observed for the rockweed through 2011.

The other rockweed, *Hesperophycus californicus*, declined below long-term means at 3 of 8 sites sampled in fall (Figures 5–6). Extremely low quantities (< 10%) of *H. californicus* were measured at Prisoners Harbor, Trailer and Willows Anchorage. Above average abundances of *H. californicus* were measured at Harris Point and Orizaba Cove in fall. Abundances remained comparable to grand averages at Orizaba Cove and East Point in spring and Fraser Cove, Scorpion Rock and Willows Anchorage during the fall monitoring season.

Endocladia muricata cover declined more than one standard error at 1 site, remained the same at 3 sites, and increased at 2 of 6 sites sampled in spring compared to long term means calculated for each site (Figures 5–6). During the fall sampling period, three sites, Crook Point, Johnson’s Lee and Otter Harbor, had below average *E. muricata* cover. In fall, 3 of 16 sites that were sampled had below average abundances of *E. muricata*. Above average abundances were measured at 6 of 16 sites and nearly as many (7 of 16) sites had comparable levels of the alga to grand means calculated from previous years.

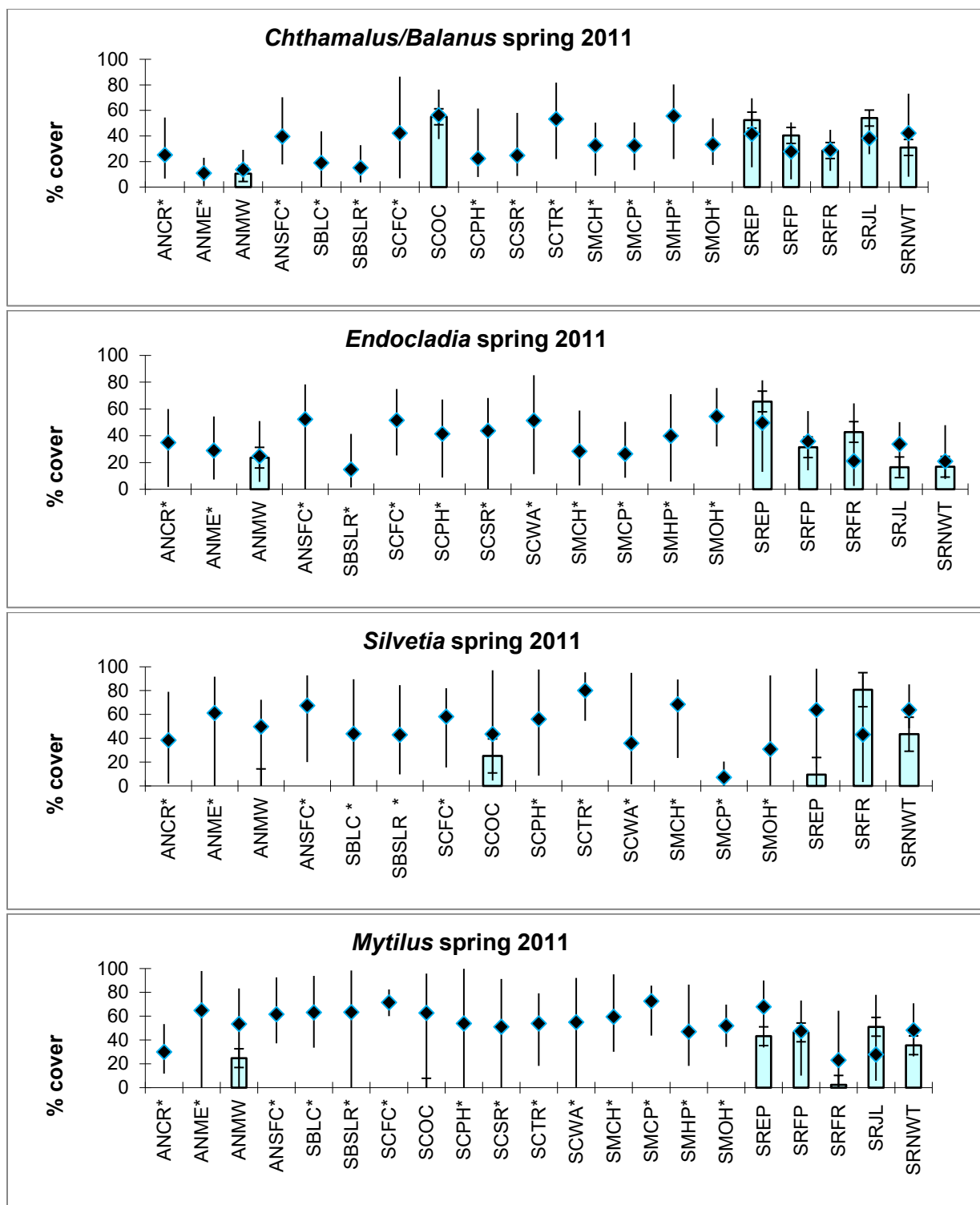


Figure 5. Percent cover of target species (*Chthamalus/Balanus*, *Endocladia muricata*, *Silvetia compressa*, and *Mytilus californianus*) in fixed plots by zone in spring 2011. Bars represent the seasonal mean percent cover from five plots within that zone; error bars represent ± 1 standard error of the plot abundances at that site. Vertical lines represent the range of means since monitoring began at that site. Diamonds represent the overall mean for all years at that site. See Appendix A Table A-1 for site codes. (* denotes no sample in 2011).

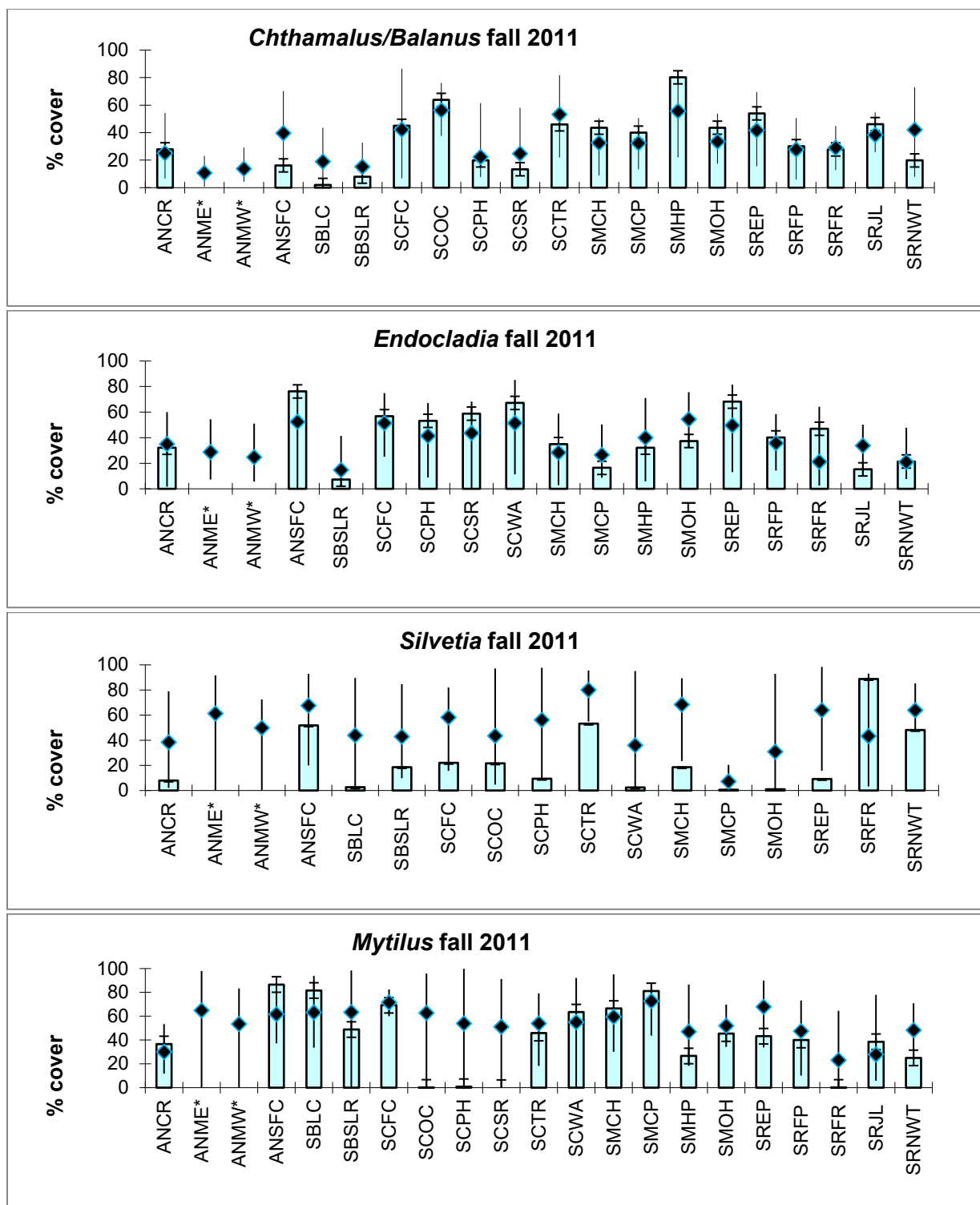


Figure 6. Percent cover of target species (*Chthamalus/Balanus*, *Endocladia muricata*, *Silvetia compressa*, and *Mytilus californianus*) in fixed plots by zone in fall 2011. Bars represent the seasonal mean percent cover from five plots within that zone; error bars represent ± 1 standard error of the plot abundances at that site. Vertical lines represent the range of means since monitoring began at that site. Diamonds represent the overall mean for all years at that site. See Appendix A Table A-1 for site codes. (* denotes no sample in 2011).

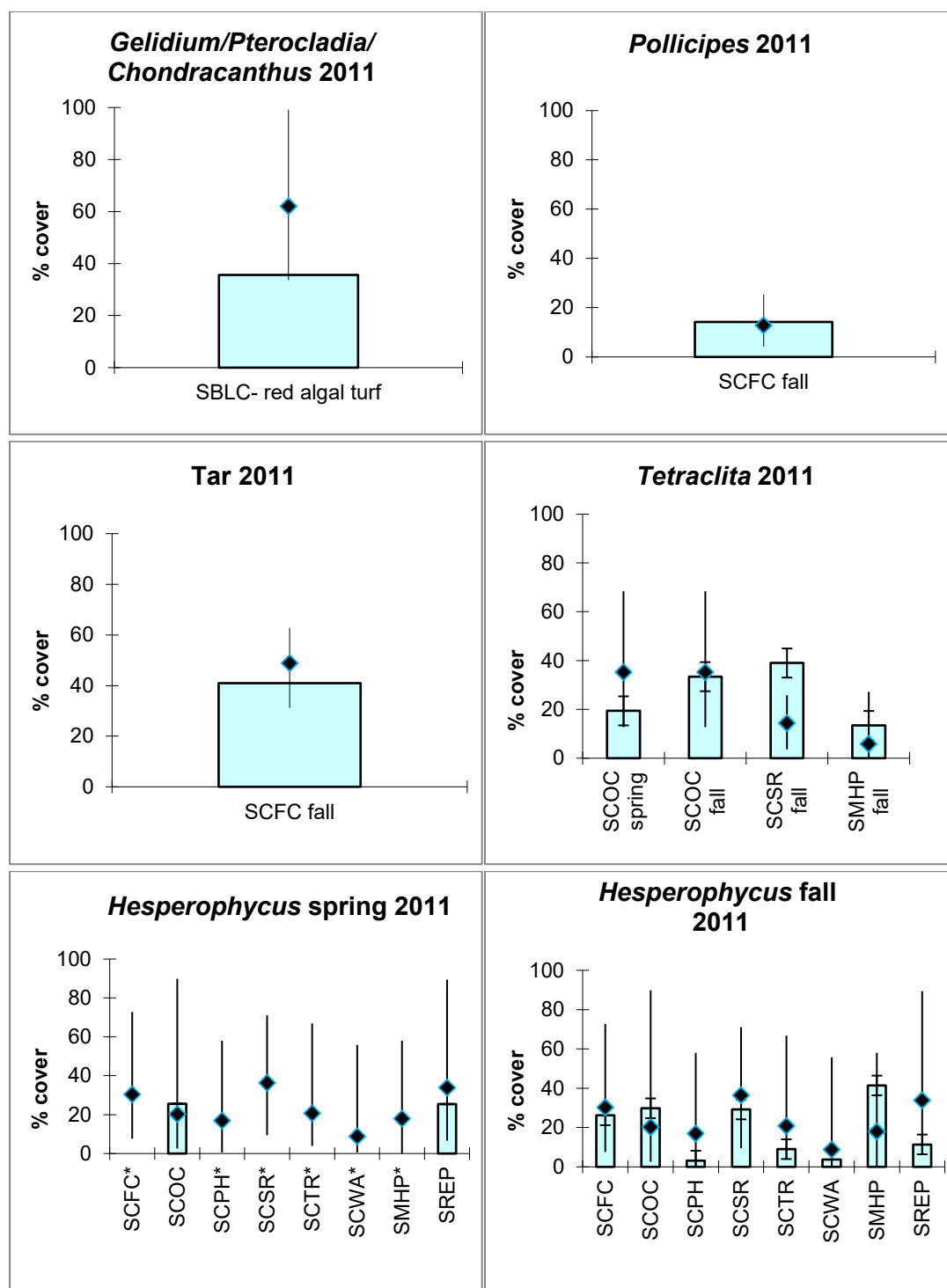


Figure 7. Percent cover of target taxa (Red algal turf, Tar, *Tetraclita rubescens*, *Pollicipes polymerus*, and *Hesperophycus californicus*) in fixed plots by zone in 2011. Bars represent the seasonal mean percent cover from five plots within that zone; error bars represent ± 1 standard error of the plot abundances at that site. Vertical lines represent the range of means since monitoring began at that site. Diamonds represent the overall mean for all years at that site. See Appendix A Table A-1 for site codes. (* denotes no sample in 2011).

Barnacle, *Chthamalus/Balanus* spp., abundances remained comparable to long term means at 3 of 7 sites sampled in spring and 9 of 18 sites that were monitored during the fall season. Approximately half the sites sampled in spring (3 of 7) and 5 of 18 sites sampled in fall had above average barnacle abundances. Only one site, Northwest-Talcott, had below average levels of *Chthamalus/Balanus* spp. in spring. Alternatively, 4 of 18 sites sampled in fall attained markedly low abundances for the barnacle species.

Red algal turf, composed of *Gelidium* sp., *Pterocladia* sp., and *Chondracanthus canaliculatus* is only monitored at Landing Cove. The algal assemblage is typically very stable and usually dominates the lower intertidal zone at most sites. At Landing Cove, it is conspicuous in three out of five plots, yet the surfgrass, *Phyllospadix torreyi*, has increasingly become more established in two of the plots over the past several years. In 2011, red algal turf abundance fell markedly below the long-term mean, and was replaced primarily by articulated corallines, other species of red algae and mussels (Figure 7, Appendix B). Surfgrass was only present in plot 323 (cover = 56%).

Goose or leaf barnacle, *Pollicipes polymerus* zone plots have only been established at Fraser Cove. There, goose barnacle cover has declined slowly over time from approximately 20% to slightly below 10%. However, no substantial change in *P. polymerus* was documented in 2011 since cover was 14% (Figure 7).

The thatched barnacle, *Tetraclita rubescens* is monitored at three sites (Harris Point, Orizaba Cove, Scorpion Rock) (Figure 7). At Harris Point, *T. rubescens* cover was not sampled in spring, but comparable abundances to long-term means for the site were measured in fall. Below-average abundances of *T. rubescens* were seen at Orizaba Cove in spring; these increased in fall to levels comparable to previous years. Scorpion Rock had markedly higher cover of *T. rubescens* in fall compared with abundances from earlier years.

Tar is monitored at Fraser Cove where it is naturally deposited from seeps in the Santa Barbara Channel onto extensive substrata in the upper intertidal. There was only a slight decline (< 10%) in tar cover in fall from the long-term mean (approximately 50%) (Figure 7).

Motile Invertebrates

Select motile invertebrate species have been counted, and a subset of species have been measured, within photoplots at nearly all sites (excluding Middle Anacapa East) annually since 2000. Figures 8–12 display abundances for the most commonly encountered species in the barnacle (*Chthamalus/Balanus*), turfweed (*Endocladia*), rockweed (*Silvetia*) and mussel (*Mytilus*) zones at each site. Counts and measurements were also conducted for motile invertebrate species occurring in photoplots established within other less ubiquitous zones (e.g. *Tetraclita*, *Pollicipes*, *Hesperophycus*, Tar), but are not presented in this report. In 2011, motile invertebrate populations were sampled at all sites except Anacapa Middle West, Anacapa Middle East and Orizaba Cove.

The most common motile invertebrates counted within the barnacle plots are *Littorina* spp. and small (< 5 mm) and medium-sized (5–15 mm) limpets. Counts for each of these groups have fluctuated markedly at most sites over the years. In 2010 and 2011, abundances for all three motile invertebrate

groups (particularly medium-sized limpets) reached all-time highs at many sites (Figure 8). *Littorina* spp. were more abundant during the last couple of years than any previous year at Cat Rock, East Point, Fraser Cove, Harris Point, Johnson's Lee and Sea Lion Rookery. The same occurred for small-sized limpets at Cuyler Harbor, Ford Point, Orizaba Cove and Trailer. Medium-sized limpets were the most common this year at Crook Point, Cuyler Harbor, Ford Point, Fossil Reef, Fraser Cove, Johnson's Lee, Northwest-Talcott, Orizaba Cove, Scorpion Rock, Sea Lion Rookery, South Frenchy's Cove and Trailer. Record-low densities only occurred for small limpets at Crook Point during the last couple of years. Record-low abundances of medium-sized limpets and *Littorina* spp. were not seen at any site during the past two years.

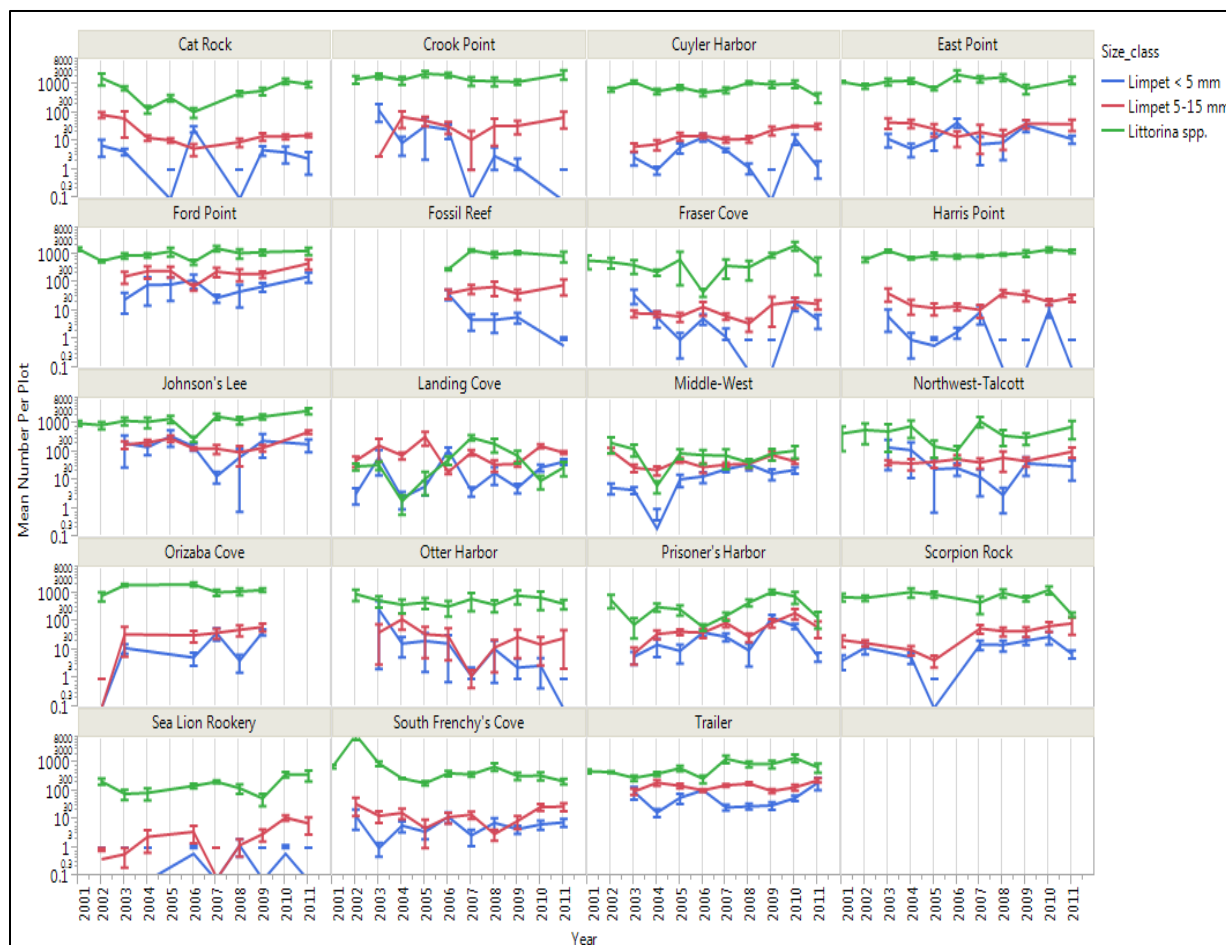


Figure 8. Common motile invertebrates in *Chthamalus/Balanus* plots. Note log scale of y-axis. Error bars are constructed using 1 standard error from the mean.

Endocladia plots usually occur within approximately the same tidal gradient as the barnacle plots, and therefore typically support high numbers of *Littorina* spp. and small (< 5 mm) and medium-sized (5–15 mm) limpets. Record-high abundances of limpets and littorine snails were measured at several sites in 2011 (Figure 9). *Littorina* spp. were most abundant this year at Harris Point and Northwest-Talcott compared to past abundances. Small limpets were the most common this year at Northwest-

Talcott. Medium-sized limpet densities were greater at six sites (Cuyler Harbor, Harris Point, Johnson's Lee, Northwest-Talcott, Otter Harbor and Scorpion Rock) than ever before. Record-low abundances were measured for littorine snails at Fossil Reef, South Frenchy's Cove and Willows Anchorage. The lowest recorded number of small limpets was measured at Crook Point, Cuyler Harbor, East Point, Otter Harbor and Prisoner's Harbor. Densities of medium-sized limpets were the lowest in 2011 since monitoring began at East Point.

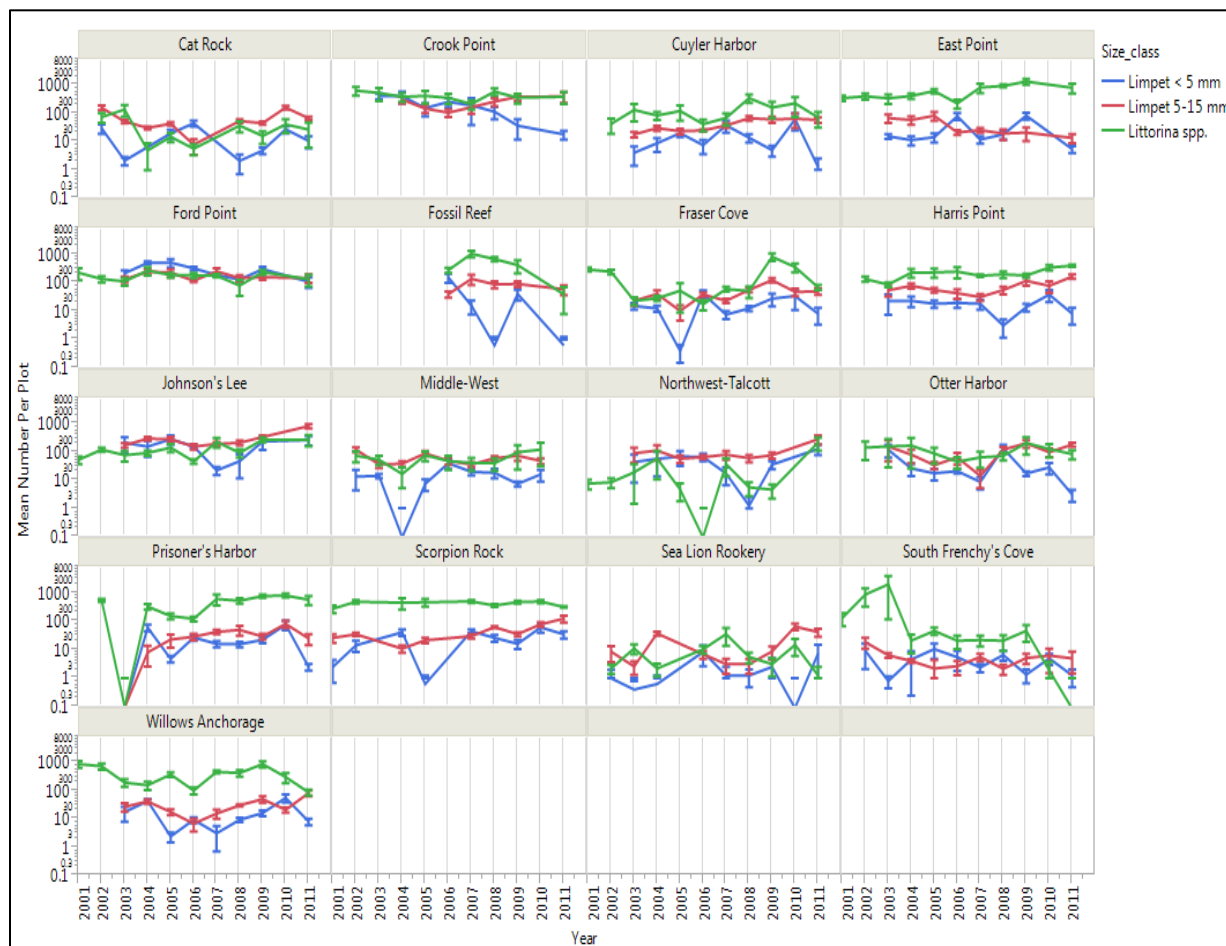


Figure 9. Common motile invertebrates in *Endocladia* plots. Note log scale of y-axis. Error bars are constructed using 1 standard error from the mean.

Silvetia plots commonly have high numbers of chitons (*Lepidochitona* spp. [formerly identified as *Lepidochitona hartwegii*]), turban snails (*Chlorostoma funebris* [formerly named *Tegula funebris*]), *Littorina* spp. and limpets, among other taxa. In 2011, *Lepidochitona* spp. were slightly more abundant than previous years at Cat Rock and Fossil Reef (Figures 10–11). The chitons did not decrease to record-low densities at any sites in 2011. *C. funebris* was marginally more common this year at Fossil Reef and Willows Anchorage; the snails were only slightly less common in 2011 at Northwest-Talcott. *Littorina* spp. were slightly more abundant this year at Northwest-Talcott and Otter Harbor compared to earlier surveys. Record-low abundances for littorine snails were seen at

Fossil Reef and South Frenchy's Cove whereby numbers plummeted markedly. Vastly more small-sized (<5 mm) limpets were counted this year at Orizaba Cove than previous years. Small-sized (<5 mm) limpets decreased in abundance in 2011 at many sites, but this was not the lowest year on record for any location. Medium-sized limpet densities were slightly greater during the past couple years at Anacapa Middle West, Cuyler Harbor, Landing Cove and Northwest-Talcott than prior years.

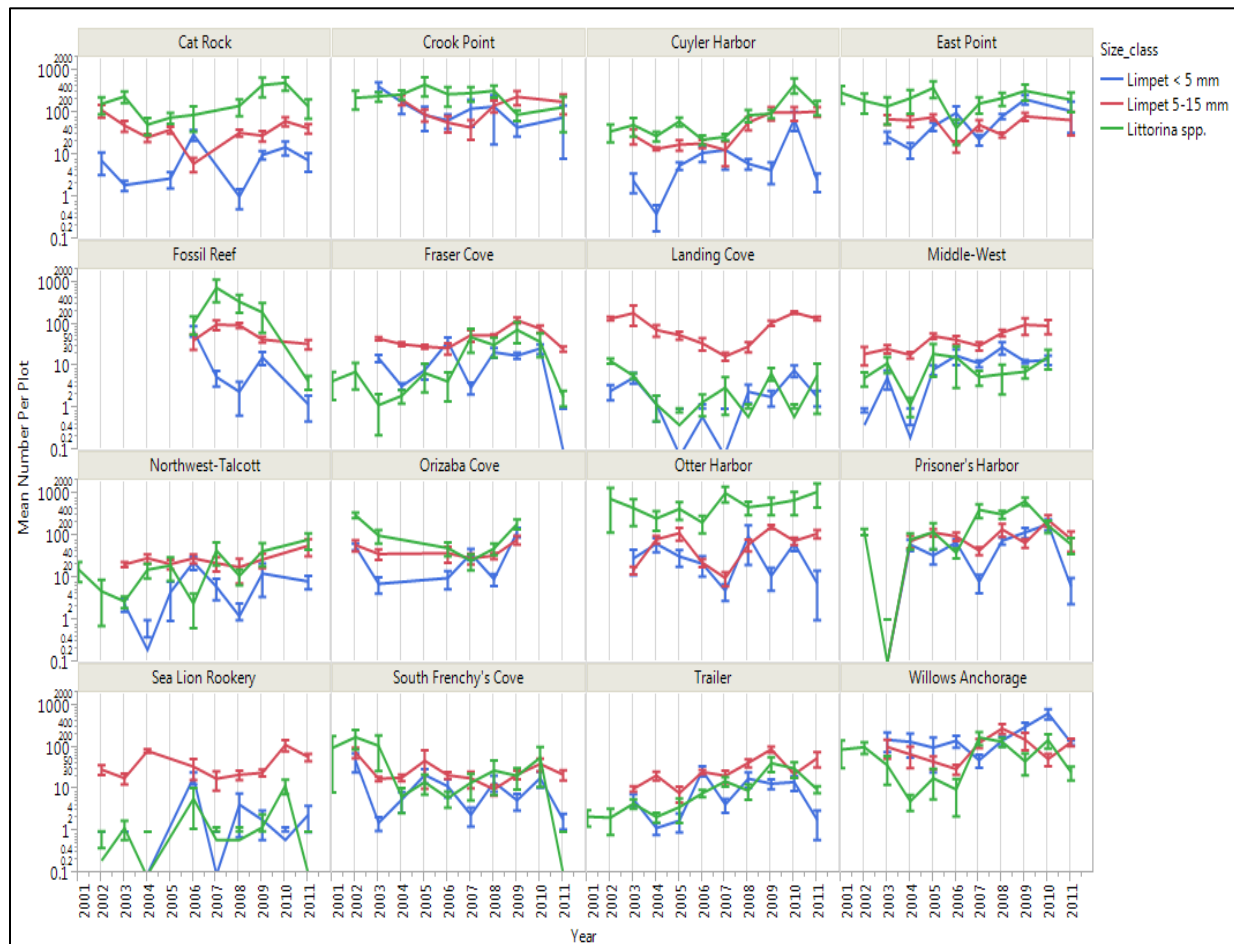


Figure 10. Common motile invertebrates in *Silvetia* plots. Note log scale of y-axis. Error bars are constructed using 1 standard error from the mean. Note that *Lepidochitona hartwegii* was identified as *Lepidochitona* spp. beginning approximately 2003 at most sites.

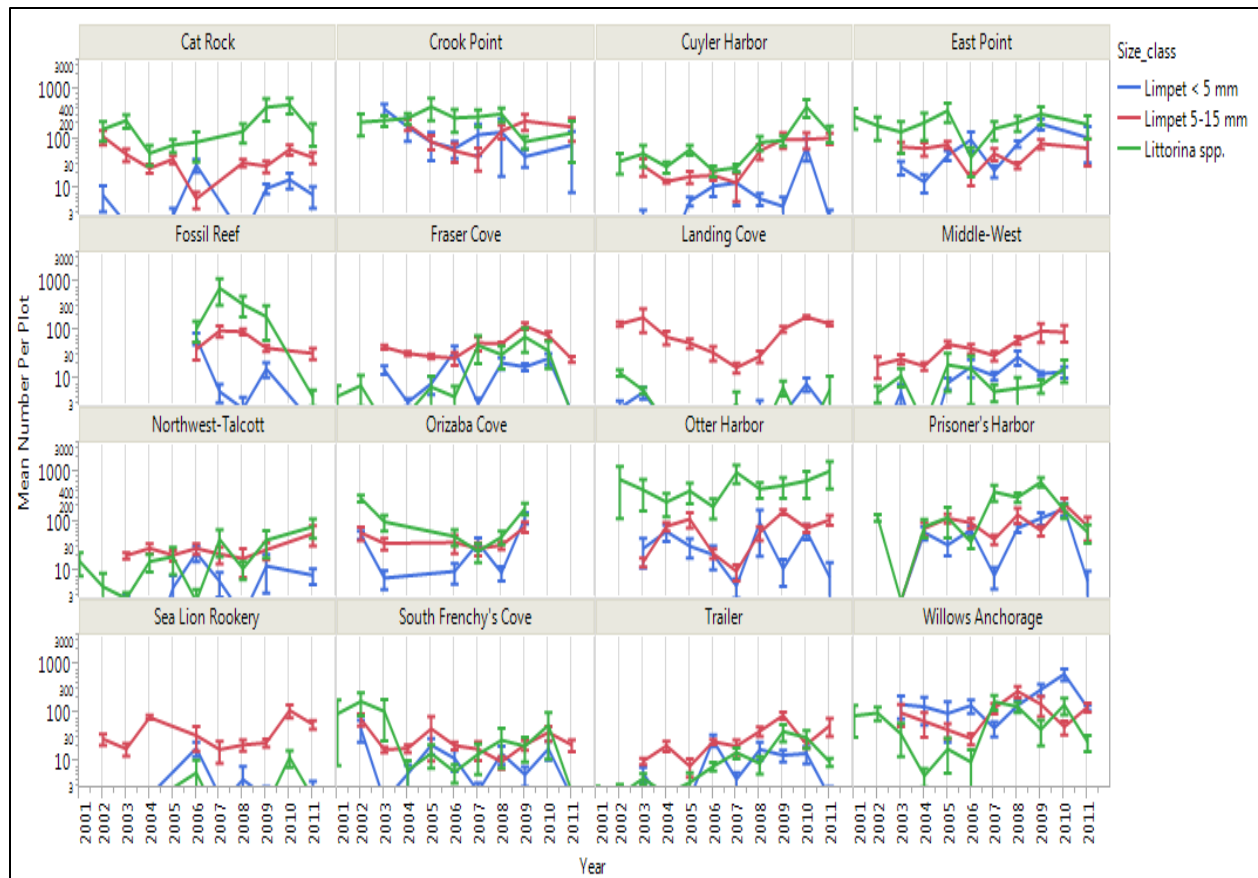


Figure 11. Common motile invertebrates in *Silvetia* plots. Note log scale of y-axis. Error bars are constructed using 1 standard error from the mean.

Mytilus plots can support a diverse assemblage of motile invertebrates, but typically have consistent numbers of chitons (*Nuttallina* spp.) and dogwinkle snails (*Nucella emarginata/ostrina*). Compared with past seasons, slightly more *Nuttallina* spp. were counted in 2011 at Sea Lion Rookery (Figure 12). *Nucella emarginata/ostrina* was slightly more common this year at Harris Point and Johnson's Lee compared with earlier years. Counts of dogwinkle snails only slightly decreased at Anacapa Middle West this year. However, in 2007 and 2009, *N. emarginata/ostrina* abundances markedly decreased at Prisoner's Harbor and Scorpion Rock, respectively, and have not increased since.

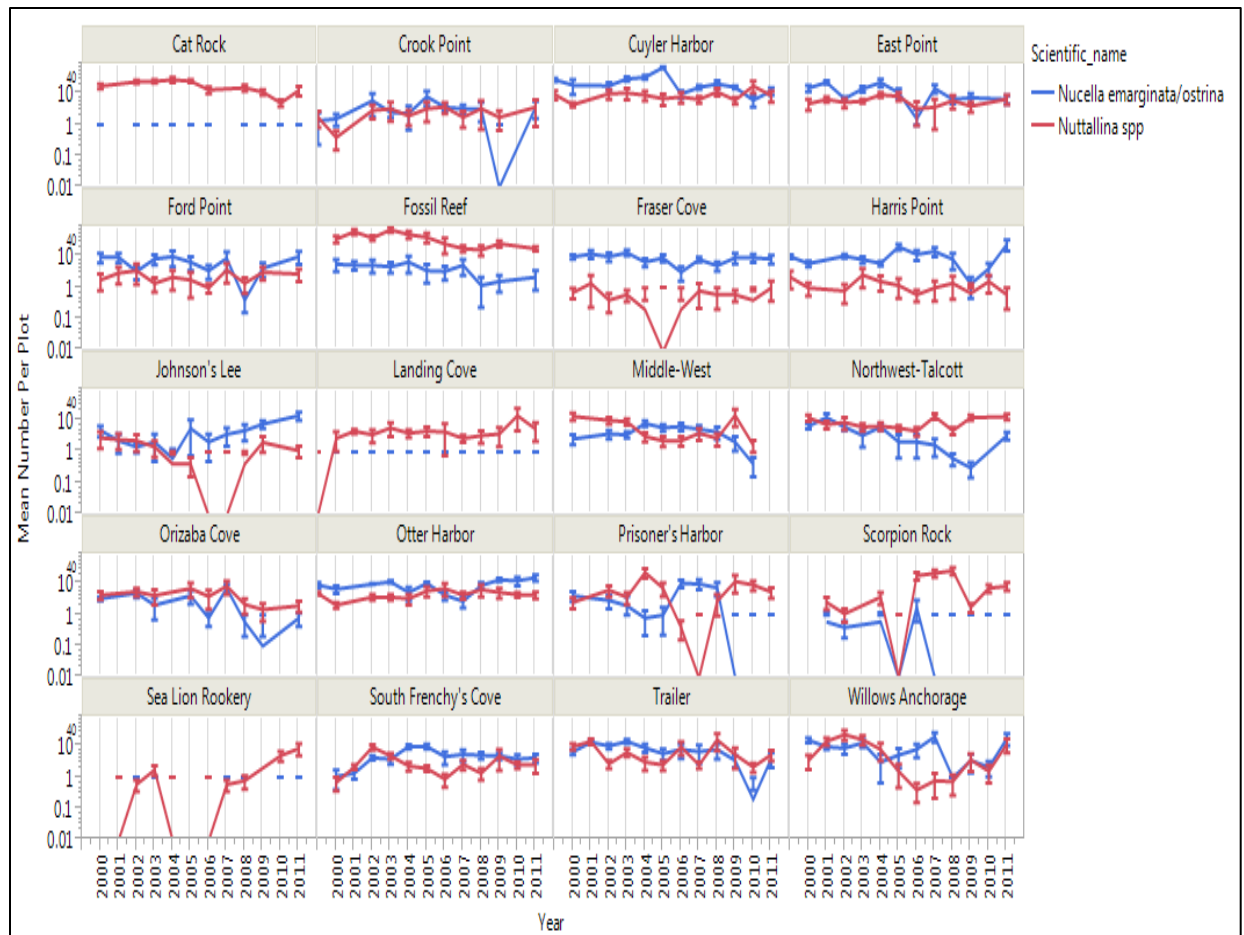


Figure 12. Common motile invertebrates in *Mytilus* plots. Note log scale of y-axis. Error bars are constructed using 1 standard error from the mean.

Size frequencies are presented in Figures 13–17 for select motile invertebrate taxa. Measurements represent individuals sampled from various zones/assemblages (e.g. mussels, rockweeds, barnacles, etc.).

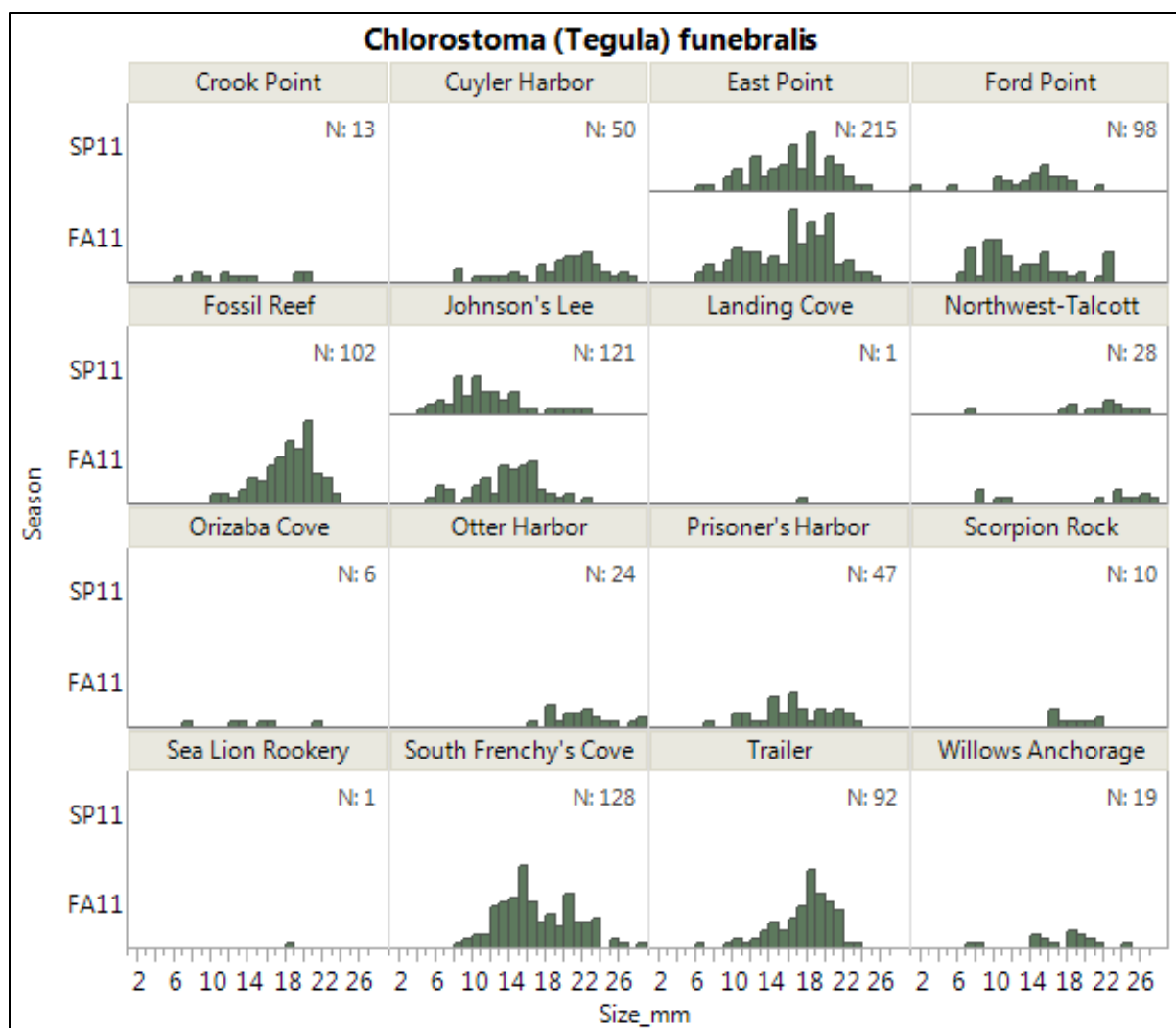


Figure 13. *Chlorostoma (Tegula) funebris* size distributions in all plots at each site. Figures show proportion of total and do not reflect abundance. SP= spring, FA= fall.

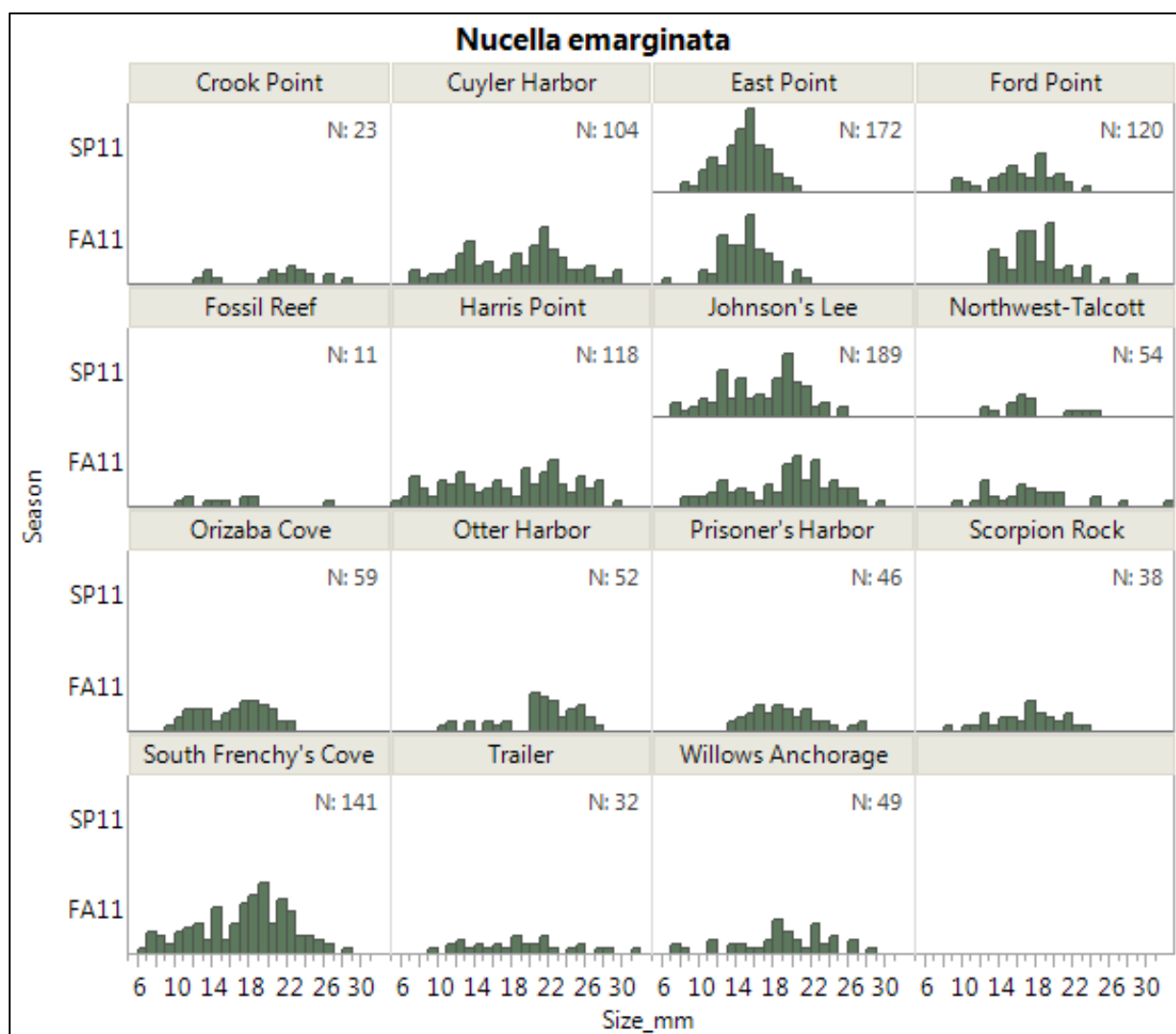


Figure 14. *Nucella emarginata* size distributions in all plots at each site. Figures show proportion of total and do not reflect abundance. SP= spring, FA= fall.

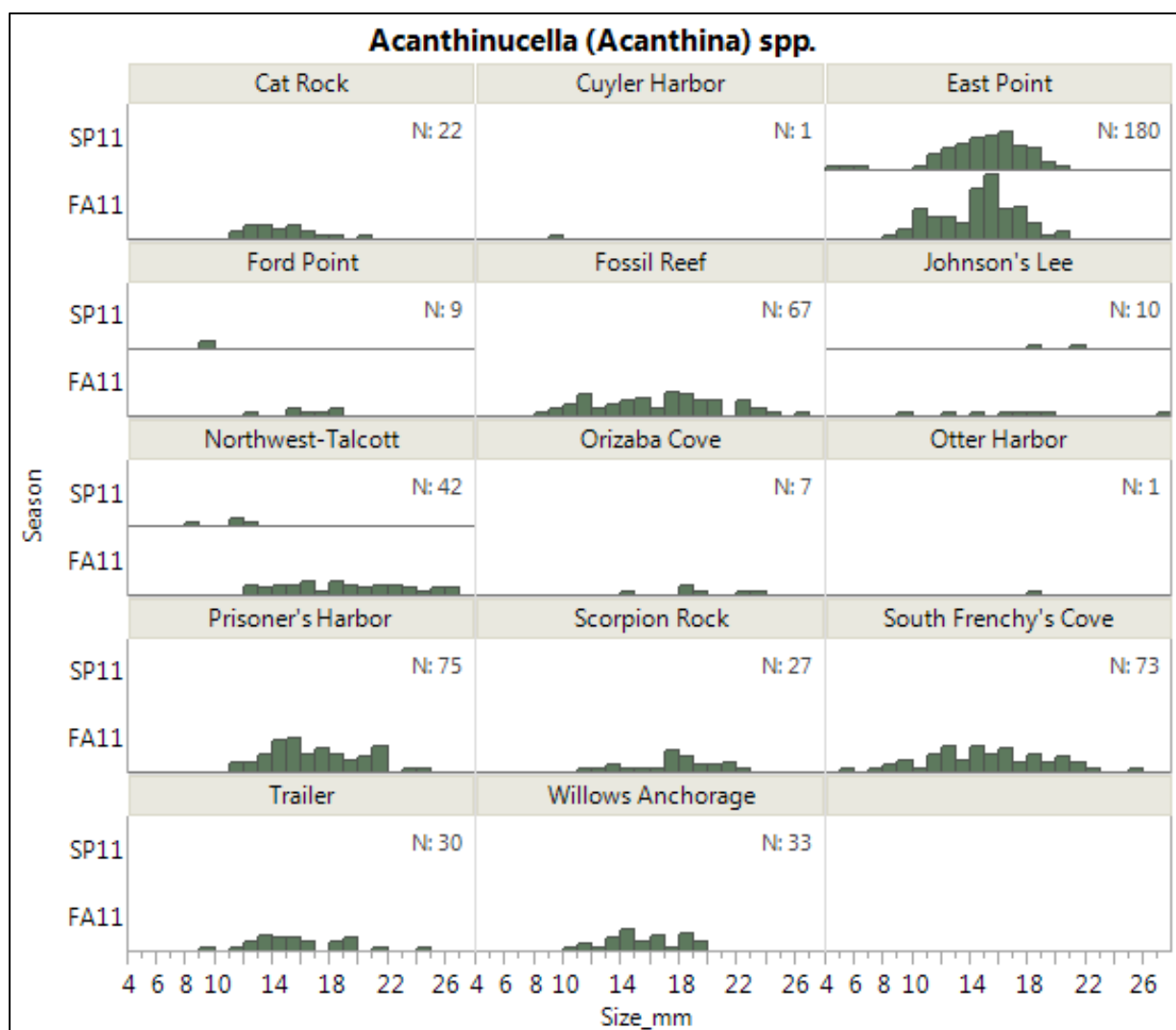


Figure 15. *Acanthinucella (Acanthina) spp.* size distributions in all plots at each site. Figures show proportion of total and do not reflect abundance. SP= spring, FA= fall.

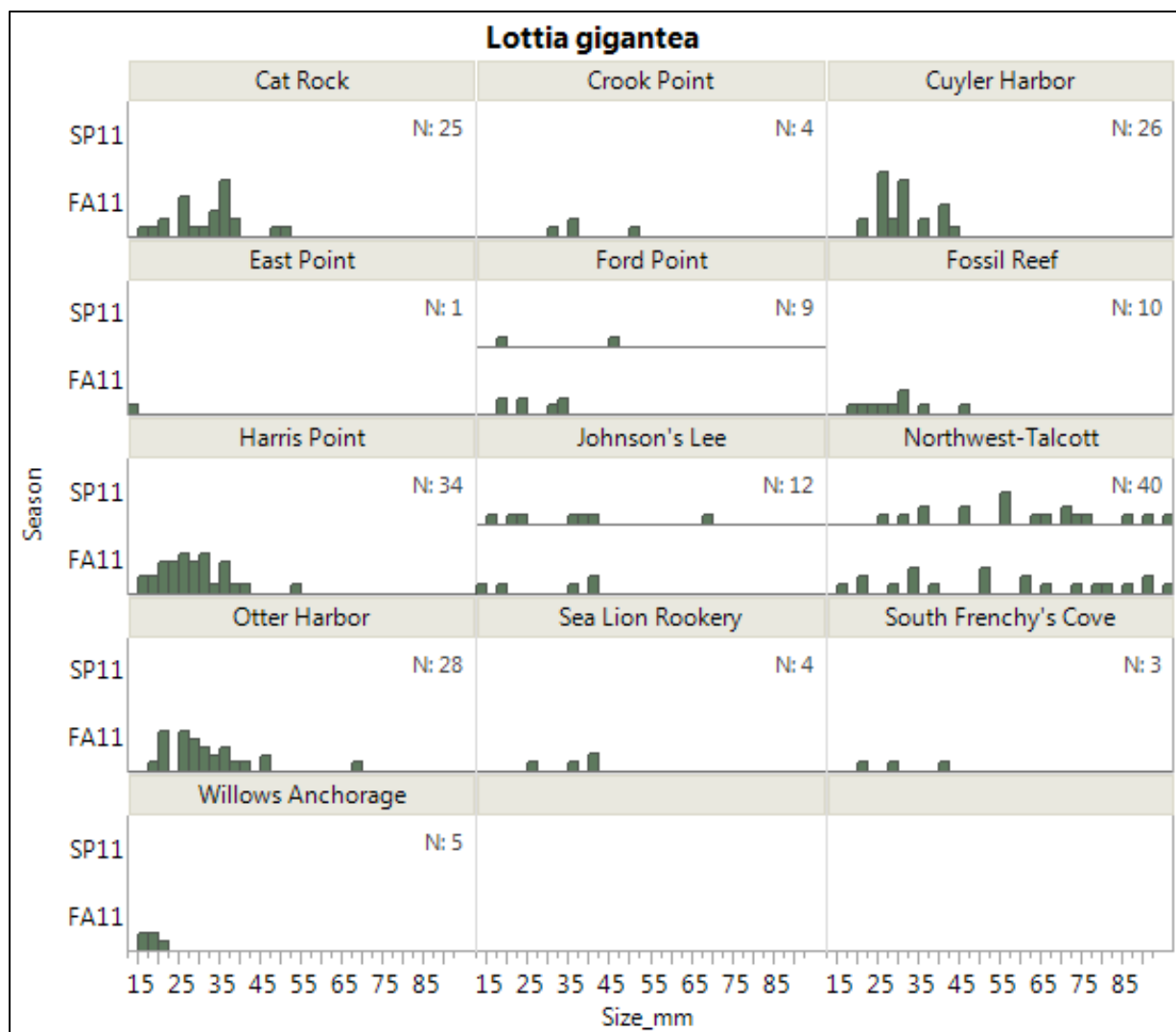


Figure 16. *Lottia gigantea* size distributions in all plots at each site. Figures show proportion of total and do not reflect abundance. SP= spring, FA= fall.

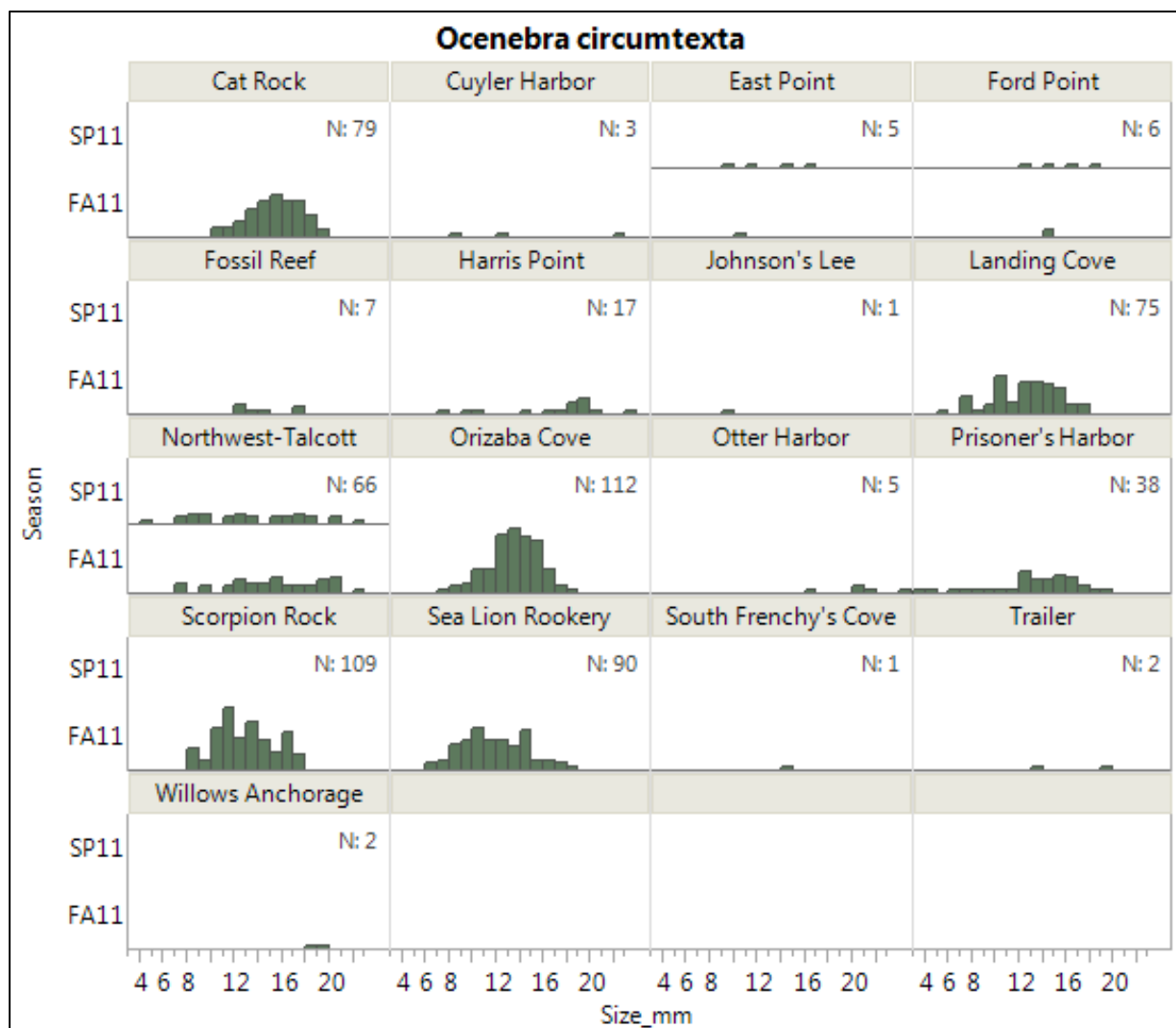


Figure 17. *Ocenebra circumtexta* size distributions in all plots at each site. Figures show proportion of total and do not reflect abundance. SP= spring, FA= fall.

Haliotis cracherodii

Following the collapse of the black abalone population in southern California due to Withering Syndrome in the late 1980s and 1990s, most monitoring sites at CHIS have supported extremely low numbers of abalone (Figure 18 [density graph]). In 2011, only three black abalone (one at Harris Point and two at Ford Point) were found within fixed plots (Tables 2–3). During routine timed searches, black abalone were entirely absent from Cuyler Harbor, Landing Cove, Northwest-Talcott, Sea Lion Rookery and South Frenchy's Cove. Fewer than 10 black abalone were observed at Fraser Cove, Harris Point, Johnson's Lee, Prisoners Harbor and Scorpion Rock (Tables 2–3). However, > 100 black abalone were observed at three sites (Otter Harbor, Valley Anchorage and Willows Anchorage) (Tables 2–3). Note that search effort was increased at several sites including Ford Point, Fossil Reef, Harbor Seal Arch (site is monitored as part of Anacapa Middle West), Orizaba Cove, Otter Harbor and Willows Anchorage due to the greater number of abalone that occurred at those

locations and the availability of time. With few exceptions, counts at all sites were consistent with the range of counts seen in recent years (Figure 19 [timed search for all years]).

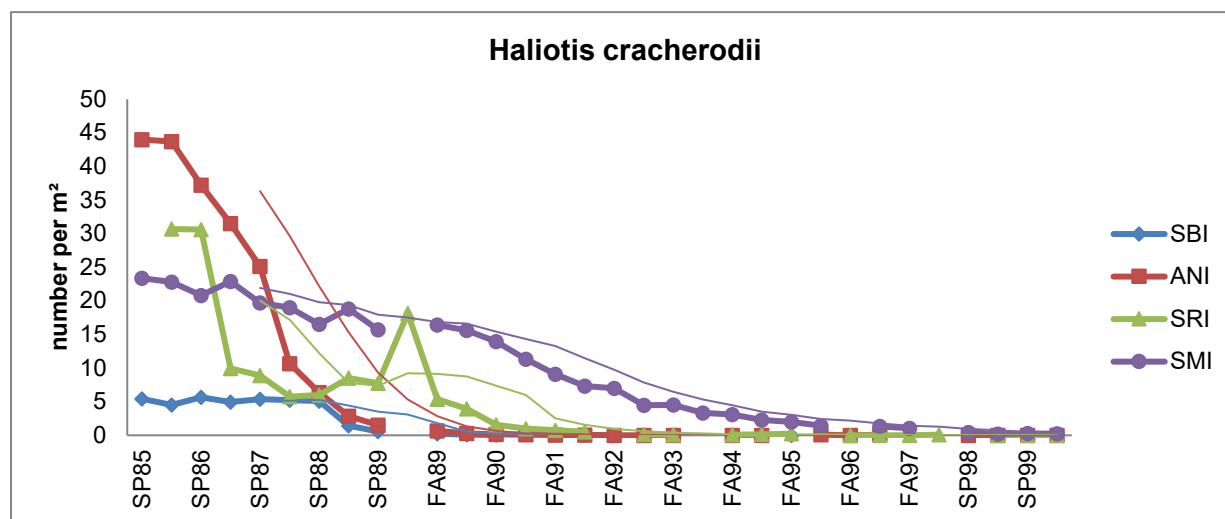


Figure 18. *Haliotis cracherodii* density estimates at all islands except Santa Cruz from 1985–1999. Thin color-coded lines represent five-sample moving temporal trends for black abalone density measurements at each island. Note that Santa Cruz Island was not sampled for black abalone until 1998. SBI=Santa Barbara Island, ANI=Anacapa Island, SRI=Santa Rosa Island, SMI=San Miguel Island. SP=spring, FA=fall.

Table 2. *Haliotis cracherodii* searches in spring 2011. x indicates no plot or transect, nc (no count performed).

Site	Sampling Date	Abalone in plots	Abalone search
Cuyler Harbor, SMI	nc	x	nc
Crook Point, SMI	nc	nc	Nc
Otter Harbor, SMI	nc	nc	Nc
Harris Point, SMI	nc	nc	Nc
Fossil Reef, SRI	nc	nc	Nc
Johnson's Lee, SRI	3/11	0	4 (30 min)
Ford Point, SRI	3/11	0	36 (38 min)
Northwest-Talcott, SRI	3/11	0	0 (30 min)
East Point, SRI	3/11	x	25 (30 min)
Fraser Cove, SCI	nc	nc	Nc
Trailer, SCI	nc	nc	Nc
Willows Anchorage, SCI	nc	nc	Nc

Table 2 (continued). *Haliotis cracherodii* searches in spring 2011. x indicates no plot or transect, nc (no count performed).

Site	Sampling Date	Abalone in plots	Abalone search
Scorpion Rock, SCI	nc	nc	Nc
Prisoner's Harbor, SCI	nc	nc	Nc
Orizaba Cove, SCI	3/11	x	47 (60 min)
Cat Rock, ANI	nc	nc	Nc
South Frenchy's Cove, ANI	nc	x	Nc
Middle Anacapa-West	3/12	0	24 (30 min at site) 43 (60 min at HSA)

Table 3. *Haliotis cracherodii* searches in fall 2011. x indicates no plot or transect, nc (no count performed).

Site	Sampling Date	Abalone in plots	Abalone search
Cuyler Harbor, SMI	12/11	x	0 (30 min)
Crook Point, SMI	12/11	0	36
Otter Harbor, SMI	12/11	0	147 (110 min)
Harris Point, SMI	12/11	1	7 (30 min)
Fossil Reef, SRI	1/12	0	39 (30–60 min)
Johnson's Lee, SRI	1/12	0	3 (30 min)
Ford Point, SRI	1/12	2	50 (67 min)
Northwest-Talcott, SRI	1/12	0	0 (30 min)
East Point, SRI	1/12	x	25 (30 min)
Fraser Cove, SCI	1/12	x	1 (30 min)
Trailer, SCI	1/12	x	41 (30 min)
Willows Anchorage, SCI	1/12	x	315 (30 min)
Scorpion Rock, SCI	11/11	x	4 (15 min at site A), 29 (30 min at site B)
Prisoner's Harbor, SCI	1/12	x	1 (30 min)
Orizaba Cove, SCI	12/11	x	66 (60 min)
Cat Rock, ANI	12/11	0	13 (30min)
South Frenchy's Cove, ANI	11/11	x	0 (30min)
Middle Anacapa-West	nc	nc	nc
Sea Lion Rookery, SBI	10/11	0	0 (30min)
Landing Cove, SBI	10/11	x	0 (30min)

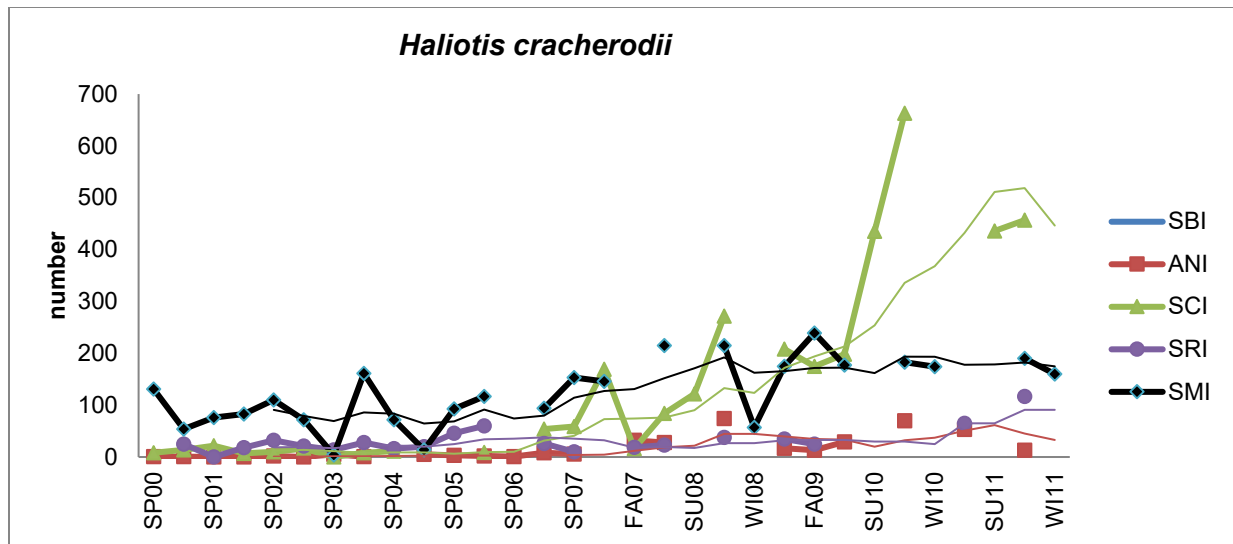


Figure 19. *Haliotis cracherodii* counts at all islands from 2000–2011. Count data are generally derived from site-wide searches. Thinner, color-coded lines represent five-sample moving temporal trends for black abalone counts at each island. SBI=Santa Barbara Island, ANI=Anacapa Island, SCI=Santa Cruz Island, SRI=Santa Rosa Island, SMI=San Miguel Island. SP=spring, FA=fall.

Beginning in 2005, substantial increases (from zero to hundreds) in the numbers of juvenile black abalone have been documented at Willows Anchorage and Valley Anchorage, Santa Cruz Island (Figure 19), as well as various locations along the south and north sides of Santa Cruz Island that were sampled once in 2010 (see Whitaker and Richards 2012). To a lesser extent, similar increases in abundances of black abalone have been observed at Orizaba Cove on Santa Cruz Island and Middle Anacapa Island during the same survey period. In 2011, the size frequencies for Anacapa and Santa Cruz Island sites reflected the effects of recruitment and the presence of juvenile black abalone with modes ranging 50–90 mm (Figures 20–22). At Santa Cruz Island, the size distributions for black abalone were moderately positive-skewed in summer and fall, further indicating the presence of juvenile individuals (Figures 20–22).

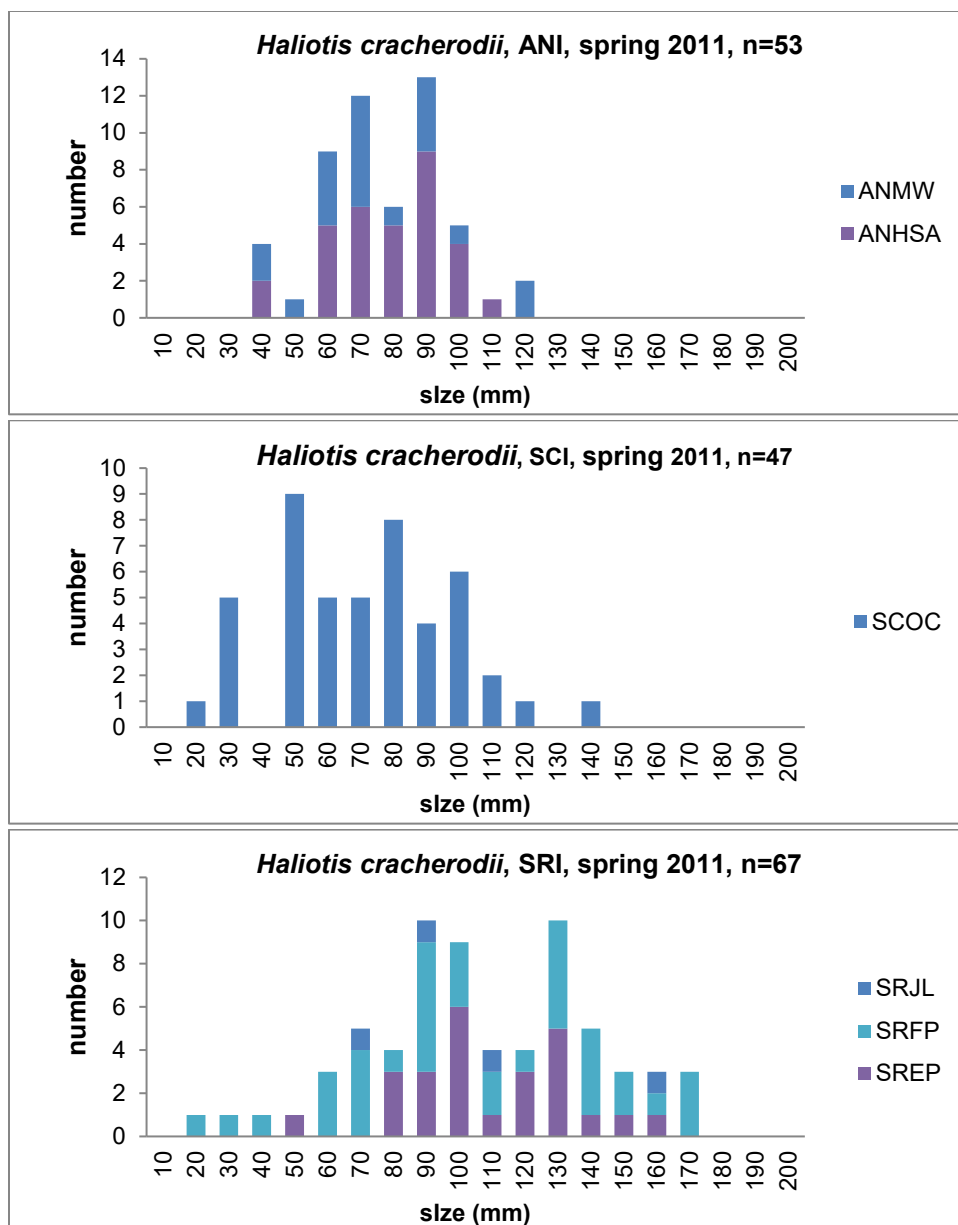


Figure 20. *Haliotis cracherodii* size distributions in spring 2011. All sites that were sampled in spring were combined by island in each histogram. Note differences in scale of y-axes.

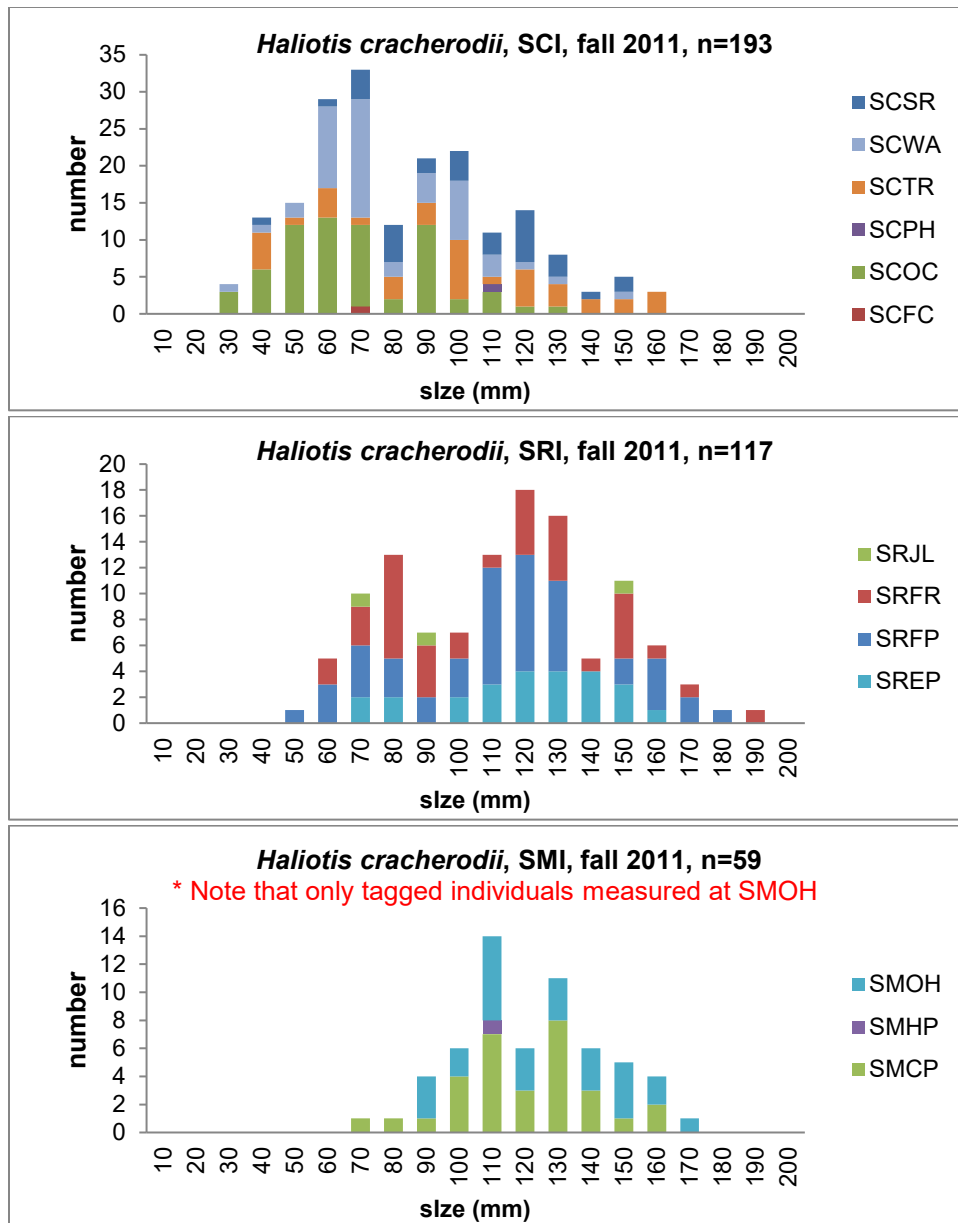


Figure 21. *Haliotis cracherodii* size distributions in fall 2011. All sites that were sampled in fall were combined by island in each histogram. Note differences of scale of y-axes.

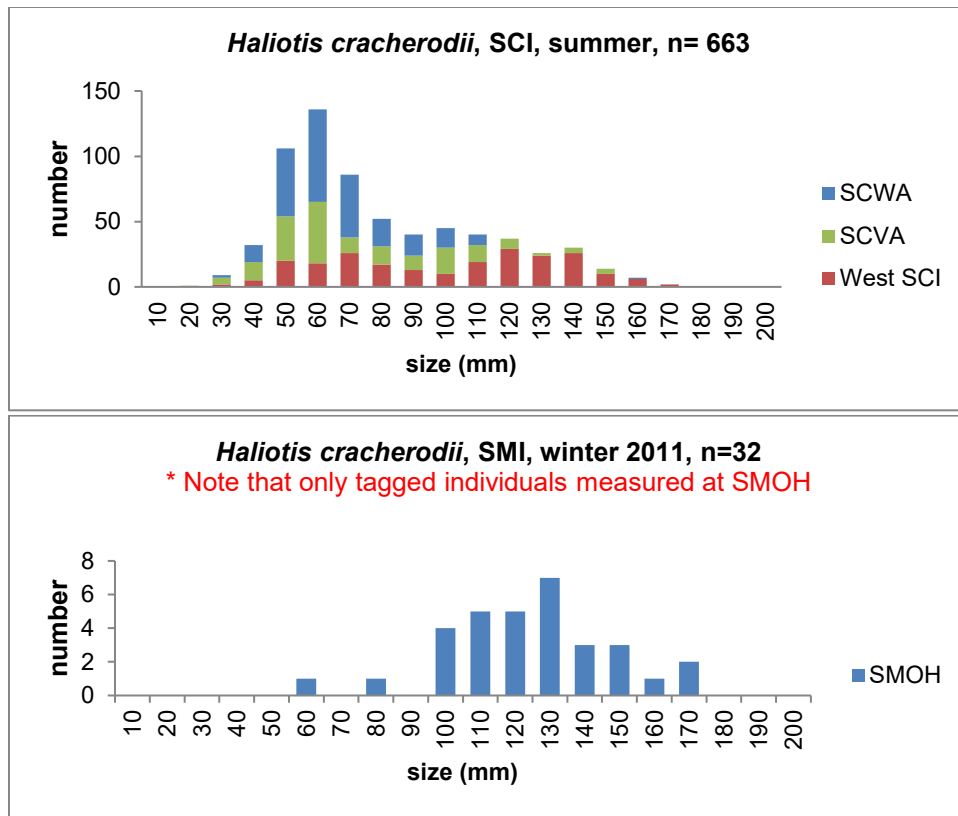


Figure 22. *Haliotis cracherodii* size distributions in summer and winter 2011. Note that West SCI is located near the monitoring site at Fraser Cove, SCI. All sites that were sampled in summer were combined by island in the top histogram. Note differences in scale of y-axes.

Black abalone populations at San Miguel, Santa Rosa and Santa Barbara Islands continue to show little sign of expansion and juveniles are rarely seen (Figures 20–21). As a result, populations at those islands remain less than one percent of historic levels. The size frequency data for black abalone at San Miguel Island were fairly symmetric in both fall and winter samples with modes centered on 110 mm and 130 mm, respectively. It should be noted however that the estimates from Otter Harbor during both monitoring visits may not necessarily be representative of the population at that site since only subsets (individuals with PIT tags) of black abalone were measured. At Santa Rosa, the size-distributions of abalone during spring and fall were also approximately symmetrical-shaped even though both samples were relatively bimodal (Figures 20–21).

Note that the Santa Barbara size-distribution was not estimated in 2011 because black abalone were not seen at either of the two sites on the island.

One large abalone that appeared to be shrunken, a symptom of Withering Syndrome (WS), was found at Otter Harbor during the spring sample. The animal was however, firmly attached to the substratum and responded with movement and increased grip when it was measured. No other abalone with signs of WS were observed at any of the monitoring sites at 2011.

Lottia gigantea

Owl limpets, *Lottia gigantea*, are typically sampled in fall, alternating with motile invertebrate counts in spring. However *L. gigantea* were sampled at the Santa Rosa Island sites in both spring and fall. Anacapa Middle West was the only site that was not sampled in 2011. Five-sample moving trends indicate minimal, if any, changes in mean densities for each site sampled in 2011 compared with previous years (Figures 23–26). Ford Point had the lowest density (0.7 m^{-2} in spring and 1.1 m^{-2} in fall) of owl limpets measured in 2011 followed by South Frenchy's Cove (1.9 m^{-2}). Intermediate ($2\text{--}5 \text{ m}^{-2}$) densities of owl limpets were measured at Fraser Cove, Johnson's Lee, Trailer, Northwest-Talcott and Harris Point. The highest ($7\text{--}10 \text{ m}^{-2}$) densities of *L. gigantea* were found at Otter Harbor, Cat Rock, Willows Anchorage and particularly Fossil Reef (11.5 m^{-2} in spring and 12.6 m^{-2} in fall). Data are presented for individual plots in the trip reports (Appendix C). There are no fixed plots for sampling owl limpets at Santa Barbara Island; however, we did randomly collect size frequency measurements at Sea Lion Rookery (Table 4, Figure 27).

The mean sizes of *L. gigantea* in 2011 varied spatially among sites and islands, but only minimal temporal changes were documented within most sites according to five-sample moving trends (Figures 23–26, Table 4). Mean sizes ranged 33–75 mm across all sites sampled in 2011 with the smallest owl limpets measured at Cat Rock and the largest at Northwest-Talcott. When pooled across islands, the smallest (mean~ 35 mm) limpets occurred at Anacapa and San Miguel followed by Santa Cruz and Santa Barbara (mean = 42–46 mm) and Santa Rosa (mean~ 53 mm).

Compared with previous years, the mean sizes of *L. gigantea* at most sites remained equivalent or increased slightly (Figures 23–26). Owl limpets at Trailer increased markedly in size from 54 mm in 2010 to 73 mm in 2011 reaching the second highest year on record for mean sizes of limpets at the site. Interestingly, Ford Point owl limpets decreased noticeably over the course of one season from 65 mm in spring to 46 mm in fall. The decrease in mean sizes of limpets at Ford Point is apparent in the histogram whereby a greater number of smaller individuals were measured in fall than spring (Figure 25).

L. gigantea size distributions pooled by sites and islands are displayed in Figures 27–28.

Distributions at Anacapa, Santa Barbara and Santa Rosa Islands appeared symmetric with similar mean and median values for each island population (Figures 27–28, Table 4). As in past years, Santa Cruz, and to a lesser degree, San Miguel Island size distributions for owl limpets were positive-skewed in 2011 whereby mean values for both populations were higher than the median sizes.

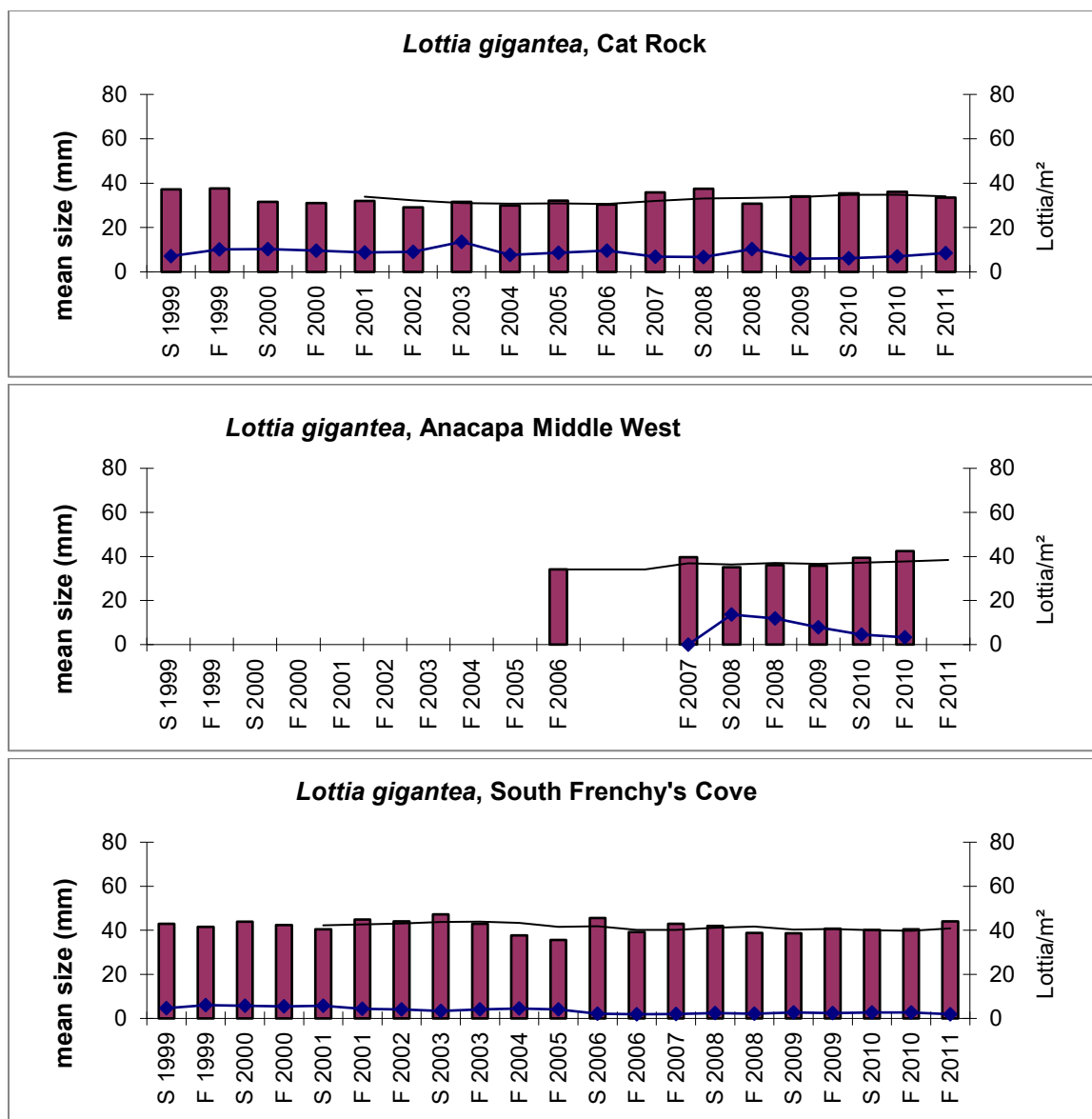


Figure 23. *Lottia gigantea* at Anacapa Island 1999–2011. Bars represent mean size (mm), blue diamonds and corresponding lines represent mean density from three fixed plots, black lines indicate five-sample moving trends for mean size. S=spring samples, F=fall samples.

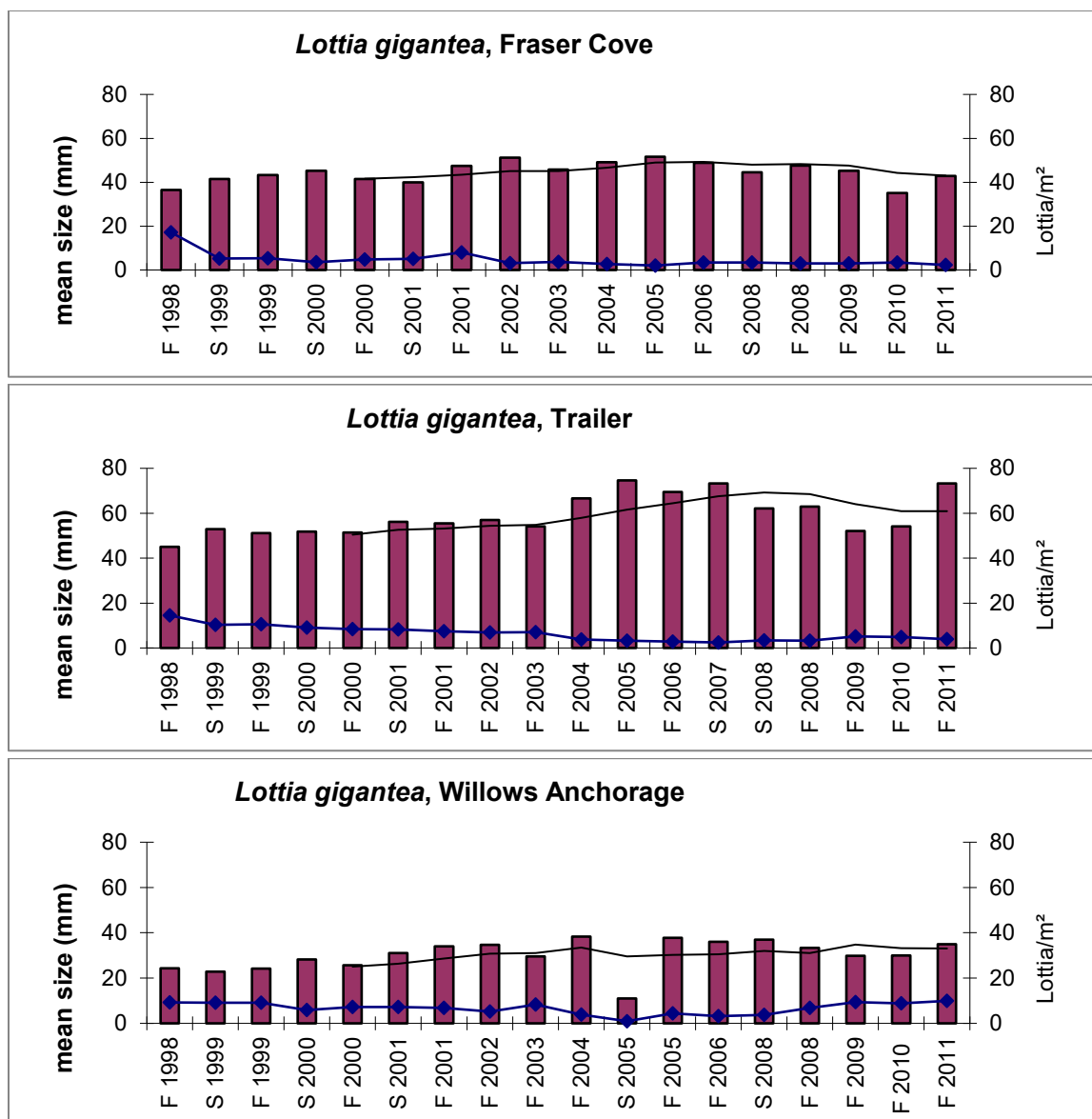


Figure 24. *Lottia gigantea* at Santa Cruz Island 1998–2011. Bars represent mean size (mm), blue diamonds and corresponding lines represent mean density from five fixed plots, black lines indicate five-sample moving trends for mean size. S=spring samples, F=fall samples.

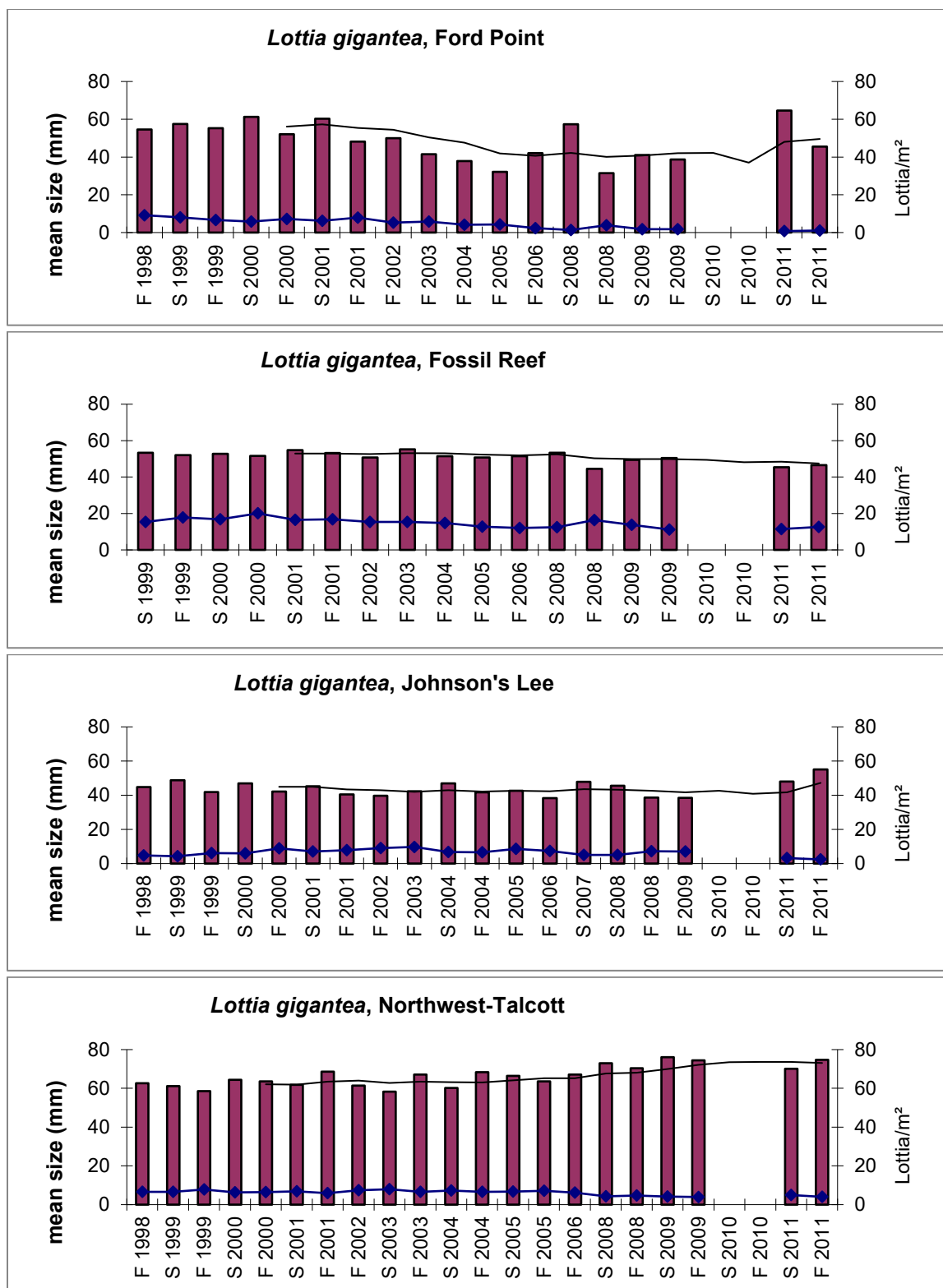


Figure 25. *Lottia gigantea* at Santa Rosa Island 1998–2011. Bars represent mean size (mm), blue diamonds and corresponding lines represent mean density from five fixed plots, black lines indicate five-sample moving trends for mean size. S=spring samples, F=fall samples. Note that Santa Rosa Island sites were not monitored in 2010 due to logistical difficulties.

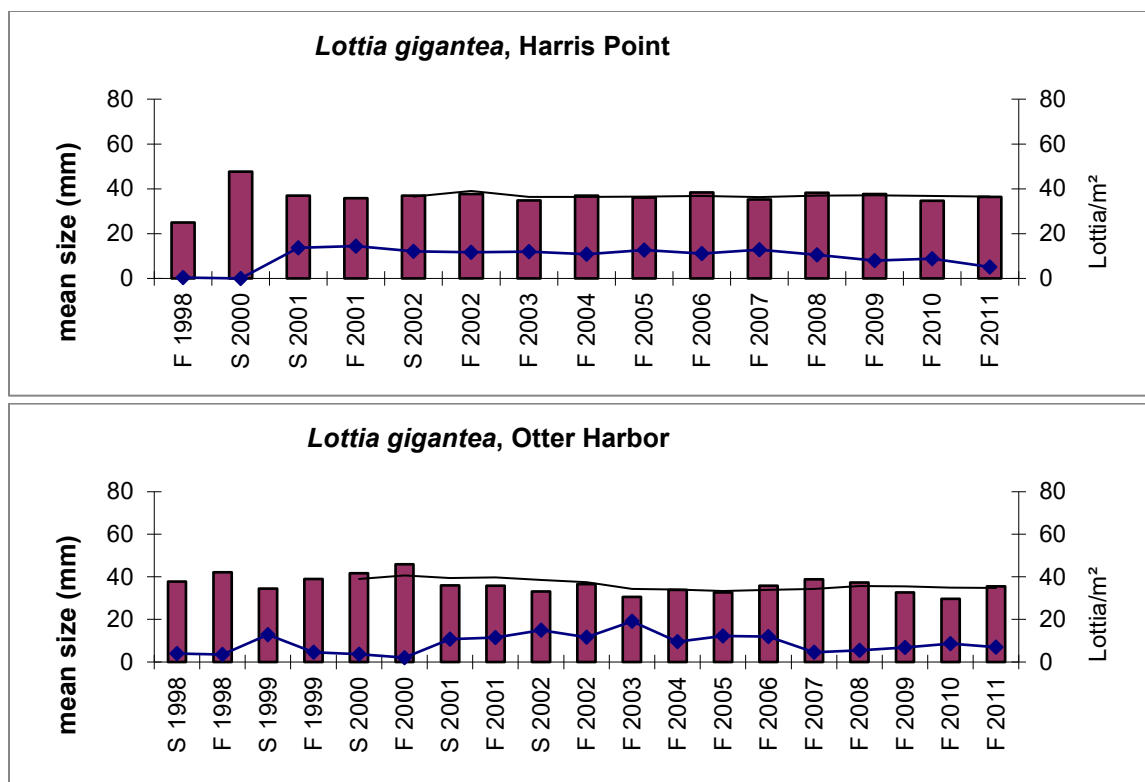


Figure 26. *Lottia gigantea* at San Miguel Island 1988–2011. Bars represent mean size (mm), blue diamonds and corresponding lines represent mean density from five fixed plots, black lines indicate five-sample moving trends for mean size. S=spring samples, F=fall samples.

Table 4. *Lottia gigantea* plot count and size information for 2011. All sites pooled by island (Santa Rosa spring sample was only two sites). AN=Anacapa, SB= Santa Barbara, SC=Santa Cruz, SM= San Miguel, SR=Santa Rosa.

Island Code	Season	Count Random	Count Density	Area	Density	Median Size	Mean Size	St Dev	Min Size	Max Size
SR	spring	0	316	56.54	5.589	53.00	52.38	22.34	13	102
AN	fall	0	98	18.85	5.200	36.00	35.45	10.95	15	60
SB	fall	82	0	N/A	.000	47.00	46.37	8.40	27	62
SC	fall	0	230	40.83	5.633	37.00	42.38	19.06	14	102
SM	fall	0	189	31.41	6.017	34.00	35.88	11.97	14	78
SR	fall	0	317	62.82	5.046	52.00	53.12	20.71	14	106

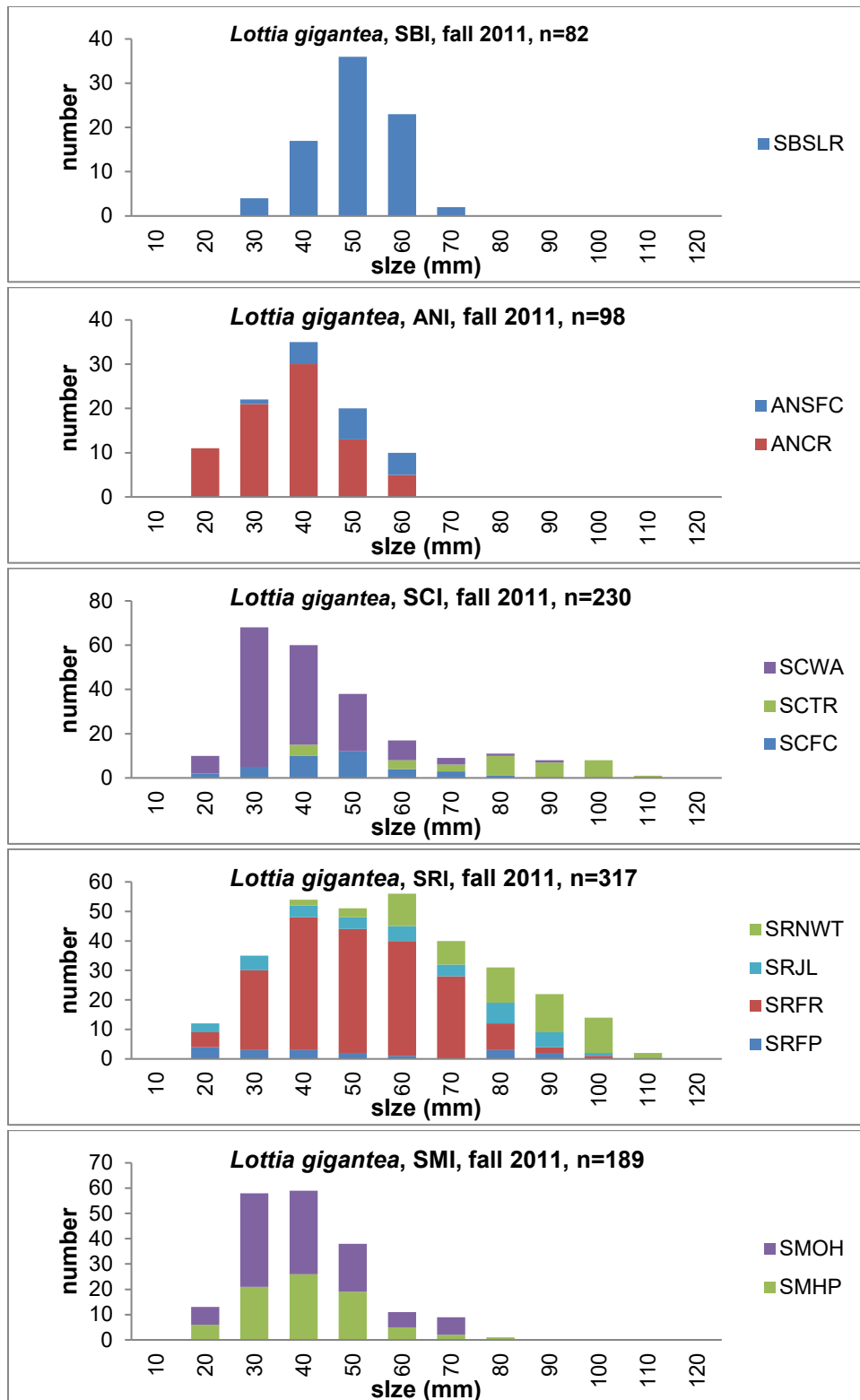


Figure 27. *Lottia gigantea* size distributions in fall 2011 at each island. Note differences in scale of y-axes.

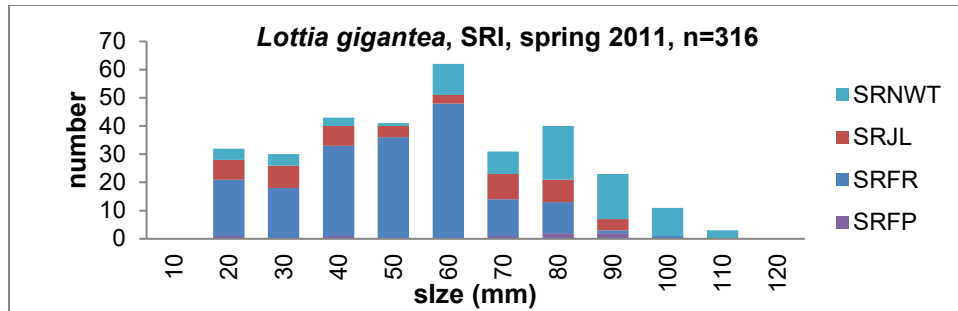


Figure 28. *Lottia gigantea* size distributions in spring 2011 at Santa Rosa Island. These were the only sites sampled in spring 2011.

Pisaster ochraceus

Temporally, the abundances of *P. ochraceus* have fluctuated markedly at most sites, with the exceptions of Cat Rock, Harris Point, Northwest-Talcott, and South Frenchy's Cove which have historically supported low (i.e. < 35 *P. ochraceus*) numbers of sea stars. Note that most sites (except all Santa Rosa sites, Anacapa Middle West and Orizaba Cove) were only sampled in fall. Compared with previous years, seastars were moderately abundant at most sites in 2011 (Tables 5–6 and Figure 29). Extremely high abundances (~ 500 *P. ochraceus*) were only documented at two sites (Anacapa Middle West and Willows Anchorage) in contrast to the past two years whereby as many as five sites had unusually high numbers of sea stars counted during 30-minute searches. Still, 11 of 20 sites had between 100 and 380 sea stars during one or both seasons in 2011. *P. ochraceus* was not seen at Northwest-Talcott, but it is not unusual to find very few, if any, ochre stars at that site.

Table 5. Sea star searches in spring 2011. x indicates no plot or transect, ns indicates no sample, P.o. = *Pisaster ochraceus*, P.g. = *P. giganteus*, P.b. = *P. brevispinous*, P.h. = *Pycnopodia helianthoides*, P.m. = *Patiria miniata*.

Site	Sampling Date	Seastars in 30 min	Seastars in transects
Crook Point, SMI	ns	ns	x
Cuyler Harbor, SMI	ns	ns	x
Harris Point, SMI	ns	ns	ns
Otter Harbor, SMI	ns	ns	x
East Point, SRI	3/16	178	x
Ford Point, SRI	3/15	357 (45 min)	x
Fossil Reef, SRI	3/18	ns	ns
Johnson's Lee, SRI	3/14	293	37
Northwest-Talcott, SRI	3/17	0, 1 P.g.	x
Fraser Cove, SCI	ns	ns	ns

Table 5 (continued). Sea star searches in spring 2011. x indicates no plot or transect, ns indicates no sample, P.o. = *Pisaster ochraceus*, P.g. = *P. giganteus*, P.b. = *P. brevispinous*, P.h. = *Pycnopodia helianthoides*, P.m. = *Patiria miniate*.

Site	Sampling Date	Seastars in 30 min	Seastars in transects
Orizaba Cove, SCI	3/31	358	x
Prisoner's Harbor, SCI	ns	ns	x
Scorpion Rock, SCI	ns	ns	x
Trailer, SCI	ns	ns	x
Willows Anchorage, SCI	ns	ns	x
Cat Rock, ANI	ns	ns	x
Middle Anacapa-West	3/30	453	x
South Frenchy's Cove, ANI	ns	ns	x

Table 6. Sea star searches in fall 2011. x indicates no plot or transect, ns indicates no sample, P.o. = *Pisaster ochraceus*, P.g. = *P. giganteus*, P.b. = *Pisaster brevispinous*, P.h. = *Pycnopodia helianthoides*, P.m. = *Patiria miniata*.

Site	Sampling Date	Seastars in 30 min	Seastars in transects
Crook Point, SMI	12/18	72	x
Cuyler Harbor, SMI	12/10	62	x
Harris Point, SMI	12/9	21, 1 P.g., 4 P.m.	5
Otter Harbor, SMI	12/7	110, 4 P.g.	x
East Point, SRI	1/20	316	x
Ford Point, SRI	1/22	278	x
Fossil Reef, SRI	1/18	302, 4 P.g., 6 P.m.	76
Johnson's Lee, SRI	1/17	142	ns
Northwest-Talcott, SRI	1/19	0, 18 P.g., 5 P.m.	x
Fraser Cove, SCI	1/9	193	x
Orizaba Cove, SCI	12/20	380	x
Prisoner's Harbor, SCI	1/6	16, 3 P.g.	x
Scorpion Rock, SCI	11/22	110	x
Trailer, SCI	1/8	152	x
Willows Anchorage, SCI	1/7	481	x
Cat Rock, ANI	12/21	14	x
Middle Anacapa-West	ns	ns	x
South Frenchy's Cove, ANI	11/23	27	x
Landing Cove, SBI	10/23	157	34
Sea Lion Rookery, SBI	10/24	183	x

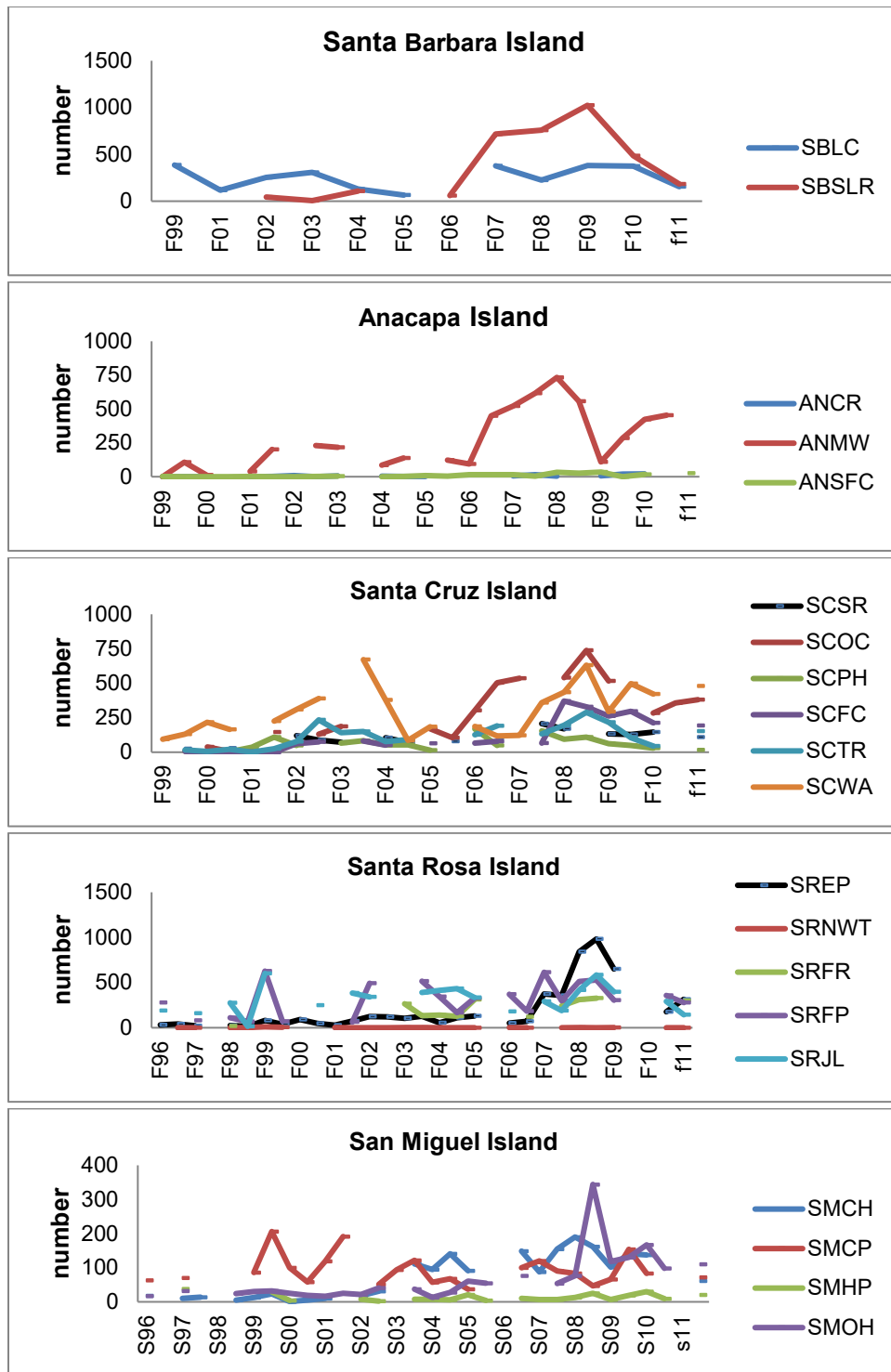


Figure 29. *Pisaster ochraceus* counts at each site from 1999–2011. Count data were attained from timed- (30 minute) searches. Note that y-axes vary by graph.

Size frequency measurements were collected whenever possible (Figures 30–32). *P. ochraceus* populations at most sites were normally-distributed with modes typically between 90 mm and 110

mm. Exceptions were at Orizaba Cove in spring, Willows Anchorage, and to a lesser degree Anacapa Middle West, whereby populations were moderately positive-skewed. Additionally in the fall, sea star populations at Landing Cove, Otter Harbor, and to a lesser degree Scorpion Rock, were moderately negative-skewed. Smaller (mode = 60–70 mm) sea stars were measured at Johnson’s Lee, Ford Point and Fossil Reef. The largest (mode = 120–130 mm) sea stars were observed at Fraser Cove, Cuyler Harbor and Otter Harbor.

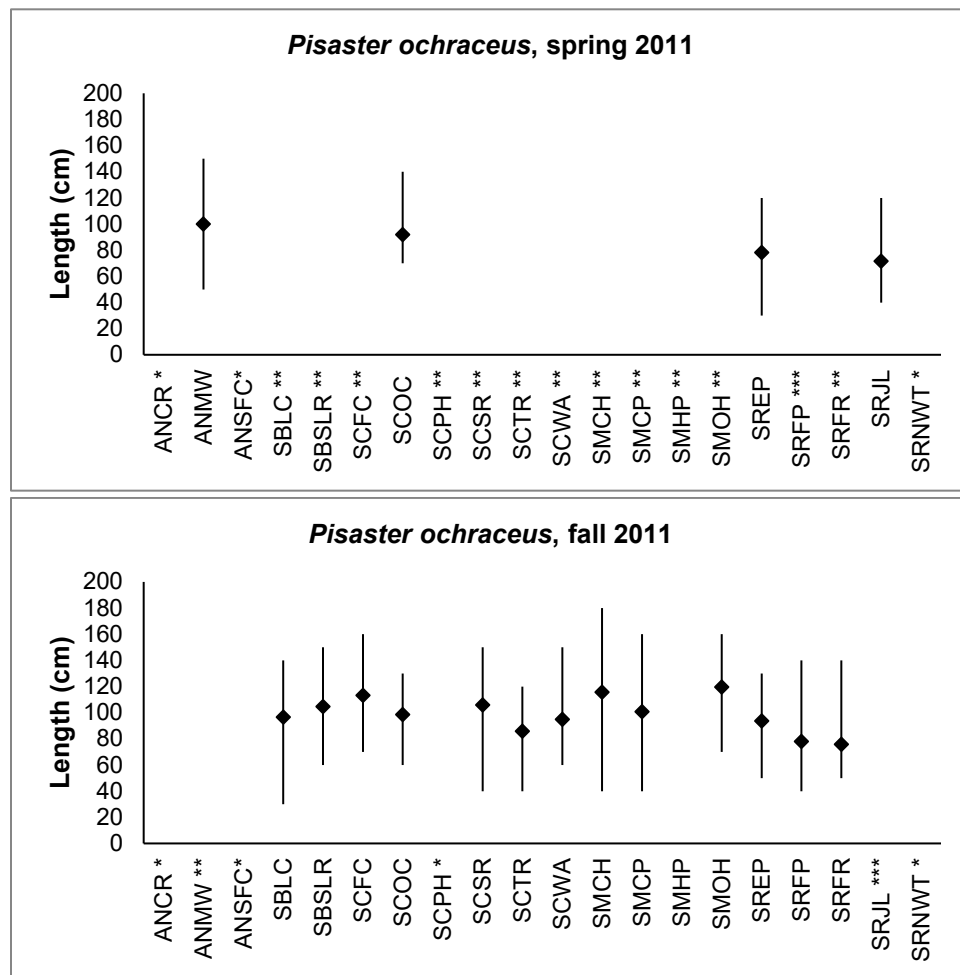


Figure 30. *Pisaster ochraceus* sampled in 2011. Diamonds represent the mean length (measured as longest ray), and vertical lines represent the range of lengths measured at each site. $N \geq 30$ *P. ochraceus* were measured at each site. See Appendix A Table A-1 for site codes. * Indicates insufficient numbers of sea stars were seen, ** Site was not sampled, *** Sea star measurements were not taken.

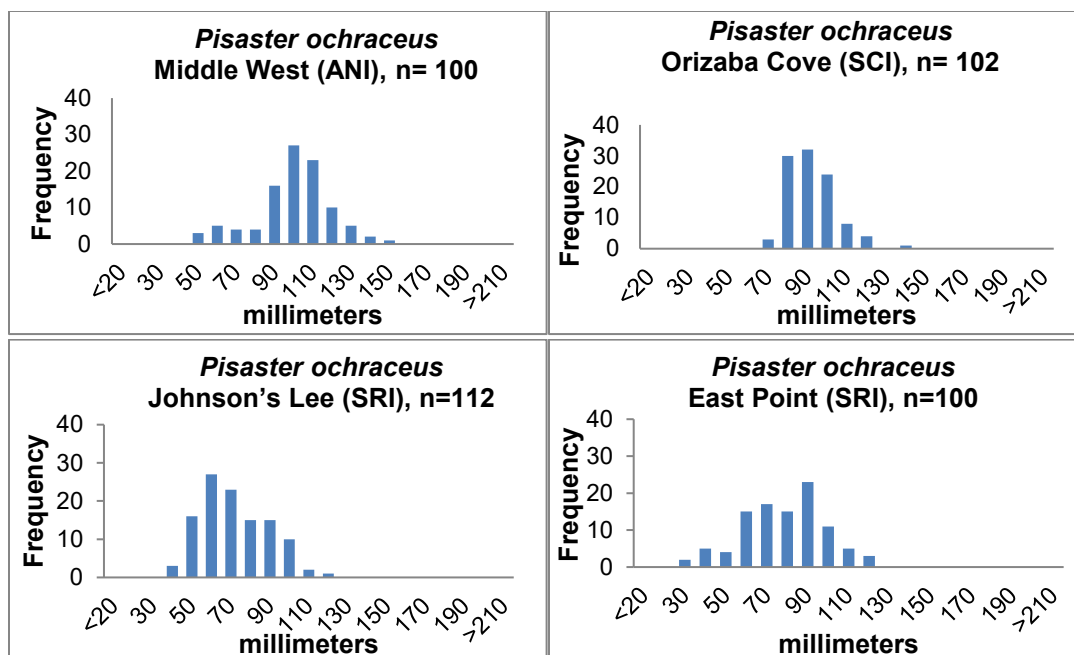


Figure 31. *Pisaster ochraceus* size distributions in spring 2011 at each site. Some sites are excluded due to insufficient numbers of *P. ochraceus* or lack of sampling.

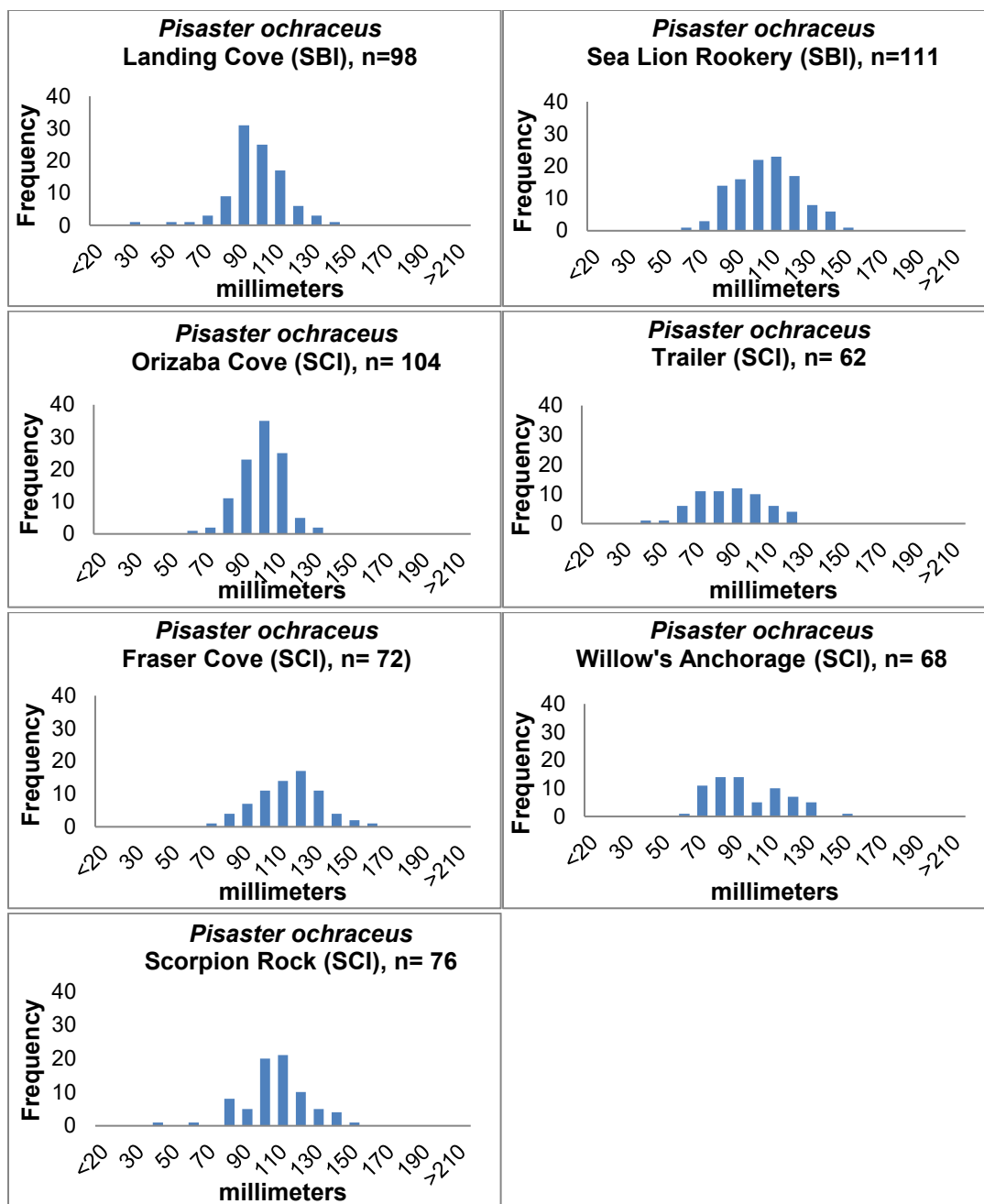


Figure 32. *Pisaster ochraceus* size distributions in fall 2011 at each site. Some sites are excluded due to insufficient numbers of *P. ochraceus* or lack of sampling.

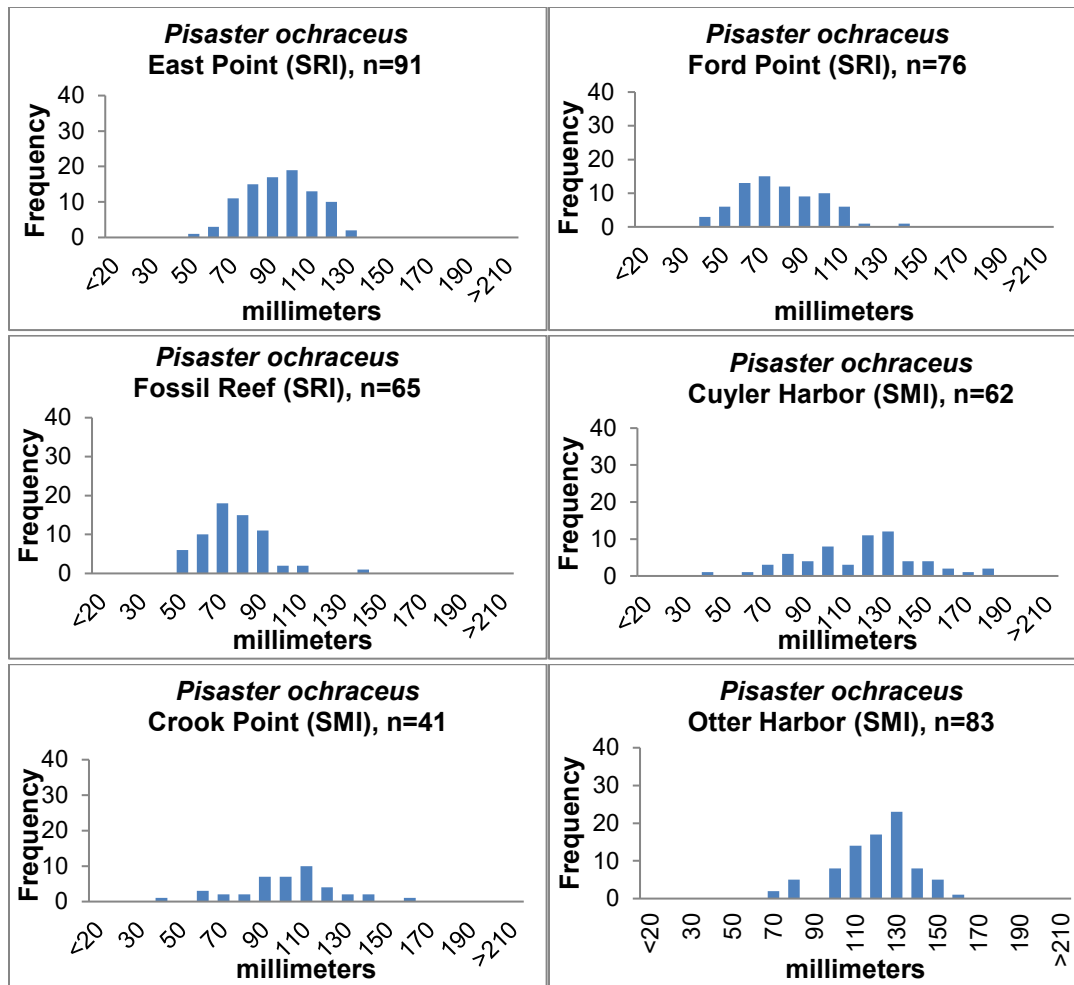


Figure 32 (continued). *Pisaster ochraceus* size distributions in fall 2011 at each site. Some sites are excluded due to insufficient numbers of *P. ochraceus* or lack of sampling.

***Phyllospadix* spp.**

Phyllospadix spp., surfgrass cover has been monitored at two sites on Santa Cruz Island since spring, 1995, and at two sites on Santa Rosa Island since spring, 2002 (Figures 33–34 and Appendix C). The four sites were chosen for study based on the relatively high density of surfgrass habitat present when sites were established. *Phyllospadix torreyi* has been the dominant species in most transects but some *P. scouleri* has also been present.

Strong seasonal patterns have been observed over the years at the two Santa Cruz Island sites, Fraser Cove and Trailer, whereby surfgrass overstory cover has routinely declined in spring and increased in fall. In 2011, unfortunately seasonal trends could not be determined since sites at Santa Cruz Island were only sampled in fall. However, surfgrass cover on all three transects at Fraser Cove was remarkably similar in fall 2011 compared with fall 2010. At Trailer, surfgrass decreased slightly in overall abundance during the course of one year. Five-sample trends indicate that *Phyllospadix* spp. cover on the three transects at Fraser has been increasing during the last three years including 2011. At Trailer, five-sample trends indicate that abundances on Transects-1 and-3 have been slowly

decreasing since spring 2008 and spring 2010, respectively. Both transects reached their all-time lowest recorded abundances for surfgrass in spring 2010, with T-3 further declining in 2011. Surfgrass cover on Transect-2 at Trailer has remained relatively stable during the past several years. Over time, *Phyllospadix* spp. cover at Fraser Cove has ranged approximately 20–80 % among the three transects and approximately 40–90 % among the three transects at Trailer.

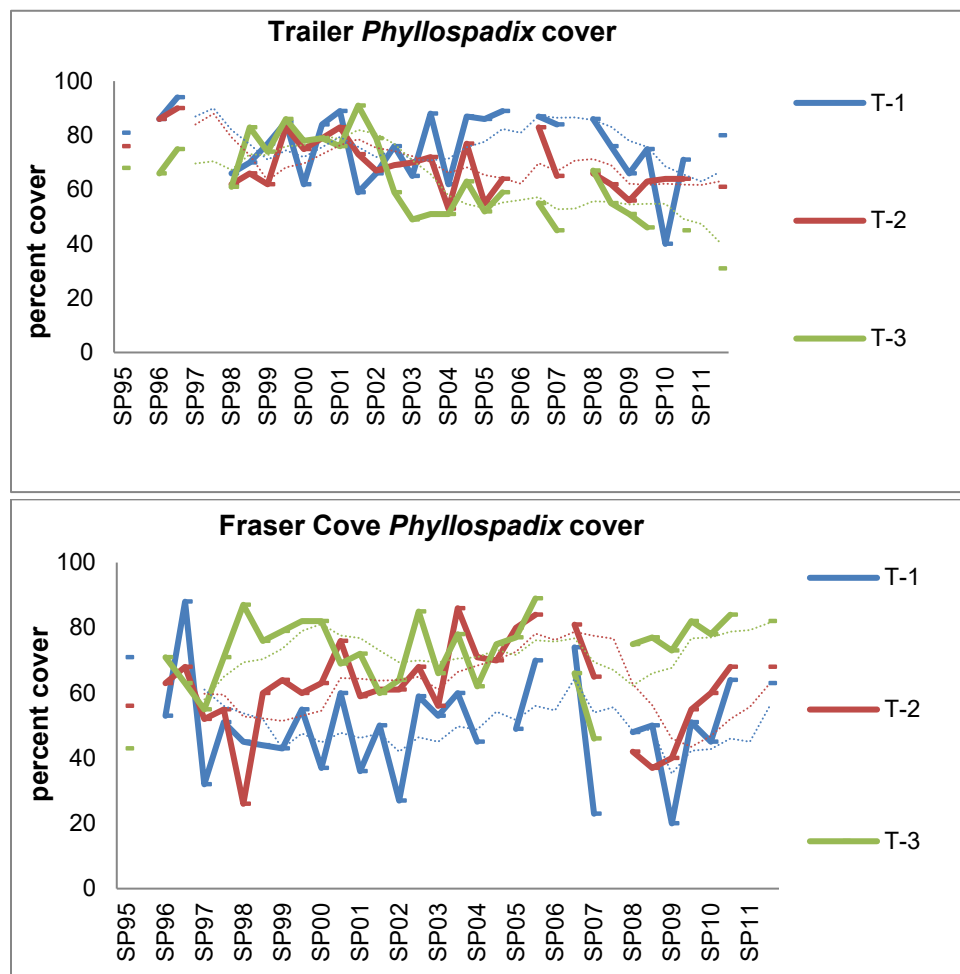


Figure 33. *Phyllospadix* spp. cover trends on 10m point-intercept transects at Fraser Cove and Trailer, Santa Cruz Island. S=spring samples, F=fall samples. Dashed, color-coded lines indicate five-sample moving trends for percent cover of *Phyllospadix* spp. cover on each transect.

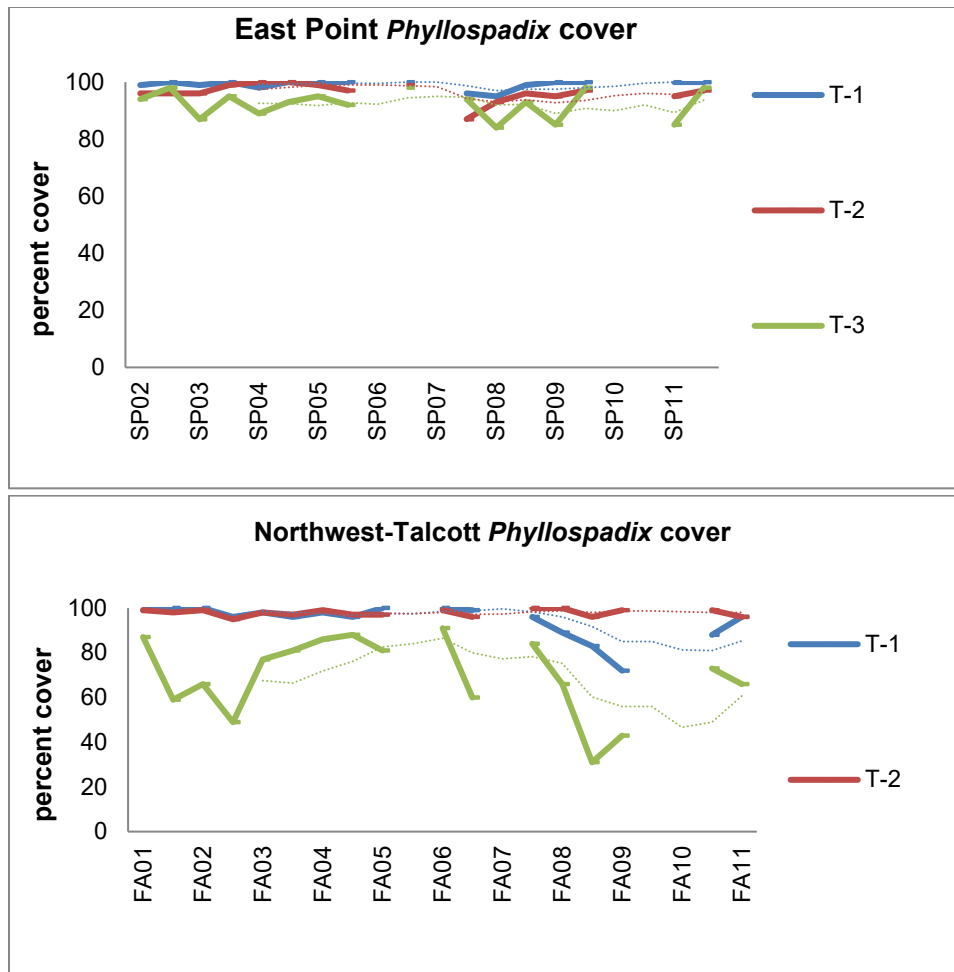


Figure 34. Surfgrass, *Phyllospadix* spp., cover trends on 10m point-intercept transects at East Point and Northwest-Talcott, Santa Rosa Island. S=spring samples, F=fall samples. Dashed, color-coded lines indicate five-sample moving trends for percent cover of *Phyllospadix* spp. cover on each transect.

Santa Rosa sites, East Point and Northwest-Talcott, typically have not displayed a strong seasonal pattern in *Phyllospadix* spp. abundances. Instead, surfgrass on all three transects at East Point and cover on two transects at Northwest-Talcott has remained relatively stable over time. Transect-3 surfgrass at the latter site has fluctuated markedly over the monitoring period declining rapidly several times by as much as 40% followed by gradual increases in cover. Unfortunately, neither East Point nor Northwest-Talcott were sampled in 2010 due to logistical challenges. In spring 2011, surfgrass overstory cover on all three transects at both Santa Rosa sites was comparable to the mean cover of previous years.

Red algae, composed primarily of *Chondracanthus canaliculatus*, *Prionitis lanceolata*, and *Mazzaella affinis*, were relatively common on the three transects at both Fraser Cove and Trailer in fall 2011. Red algae abundances averaged across the three transects at the two sites ranged 11% to 14% in fall. The sandcastle worm, *Phragmatopoma californica*, was also relatively common on the

surfgrass transects at both Santa Cruz sites (mean ranged 10–16%). At Santa Rosa Island, red algae (mean ranged 1–6%) was less common, and *Phragmatopoma* was not present.

The overall condition of surfgrass at the two sites on Santa Cruz and Santa Rosa Islands appeared to be healthy with only minimal cover of epiphytic algae (e.g. *Smithora naiadum* and *Melobesia mediocris*) and low to medium level of bleaching observed.

Shorebirds and Pinnipeds

The maximum number of shorebirds and pinnipeds observed at any one time during a visit to the sites in 2011 is summarized in Tables 7 and 8. Overall, the abundances and diversity of shorebirds in 2011 at all sites appeared similar to observations made in recent years. Likewise, there were no marked changes to the abundances of pinnipeds observed in 2011.

Table 7. Shorebirds and pinnipeds at monitoring sites in spring 2011 (maximum seen at any one time). ns=not sampled, *= nearby but not on reef, ¹=Forney's Cove, Santa Cruz Island.

Site	Black Oystercatcher/ (American)	Black Turnstone	Other birds	<i>Phoca vitulina</i>	<i>Mirounga Angustirostris</i>	<i>Zalophus californianus</i>
ANCR	ns	ns	ns	ns	ns	ns
ANMW	2	0	2 western gulls	0	0	0
ANSFC	ns	ns	ns	ns	ns	ns
SCFC ¹ (Fraser)	ns	ns	ns	ns	ns	ns
SCTR	ns	ns	ns	ns	ns	ns
SCWA	ns	ns	ns	ns	ns	ns
SCSR	ns	ns	ns	ns	ns	ns
SCPH	ns	ns	ns	ns	ns	ns
SCOC	4	0	0	2*	0	1*
SREP	4	0	40 cormorants	0	0	0
SRFP	2	5	0	1	0	0
SRFR	12	2	4 western gulls	2	0	0
SRJL	2	0	6 western gulls	0	0	0
SRNWT	4	12	6 western gulls	11	0	0
SMCH	ns	ns	ns	ns	ns	ns
SMCP	ns	ns	ns	ns	ns	ns
SMHP	ns	ns	ns	ns	ns	ns
SMOH	8(1)	0	4 western gulls	36	0	0

Table 8. Shorebirds and pinnipeds at monitoring sites in fall 2011 (maximum seen at any one time).
ns=not sampled, *= nearby but not on reef, ¹=Forney's Cove, Santa Cruz Island.

Site	Black Oystercatcher/ (American)	Black Turnstone	other birds	<i>Phoca vitulina</i>	<i>Mirounga Angustirostris</i>	<i>Zalophus californianus</i>
SBLC	3	2	4 western gulls	0	0	28
SBSLR	5	5	40 western gulls, approx. 20 western grebes*	0	0	approx. 200
ANCR	8(1)	0	4 western gulls, 1 black phoebe	1	0	0
ANSFC	3	0	0	0	0	0
Middle – all	ns	ns	ns	ns	ns	ns
SCFC ¹	13	0	0	2*	0	1*
SCTR	3	0	0	0	0	0
SCPH	2	0	0	1*	0	0
SCWA	2	0	0	0	0	0
SCSR	2	0	2 western gulls	0	0	0
SCOC	1	2	0	2	0	0
SREP	5	0	70 cormorants, 20 small unidentified shorebirds	0	0	0
SRFP	3	0	0	0	1*	0
SRFR	2	2	6 cormorants, 50 western gulls	0	0	0
SRJL	2	10	3 western gulls	0	3	0
SRNWT	4	2	0	0	1, 1*	0
SMCH	2	6	0	0	0	0
SMCP	12	16	70 cormorants, 4 western gulls, 6 western sandpipers, 2 whimbrels	0	18	0
SMHP	4	0	0	9	0	0
SMOH	13(1)	0	5 cormorants	0	0	0

Black oystercatchers were again one of the more common shorebirds at the rocky intertidal sites. At least one black oystercatcher was present at each site during spring and fall, and as many as 12 individuals were seen in spring at one site (Fossil Reef). Flocks of 13 black oystercatchers were observed at Cat Rock and Otter Harbor in fall, and almost as many (12 black oystercatchers) were counted at Crook Point.

American oystercatchers have gradually become more common at the islands in recent years. In 2011, one American oystercatcher was sighted at Otter Harbor in spring and fall, and another was seen at Cat Rock in fall. The birds were not seen at other sites.

Black turnstones were present at three out of eight sites (Ford Point, Fossil Reef and Northwest-Talcott) sampled in spring. Abundances ranged 2–12 individuals per site. In fall, 2–16 turnstones were seen at eight sites (Crook Point, Cuyler Harbor, Fossil Reef, Johnson’s Lee, Landing Cove, Northwest-Talcott, Orizaba Cove and Sea Lion Rookery).

Less common shorebirds such as wandering tattlers and ruddy turnstones are occasionally seen on the reefs while black-bellied plovers and snowy plovers usually inhabit adjacent beaches. Seabirds such as cormorants, gulls, pelicans and occasionally pigeon guillemots, are sometimes observed resting on the reef or hunting in the nearshore zone. The numbers of gulls often vary widely spatially and temporally. Less than 10 gulls (primarily western gulls) are typically seen at most sites, but as many as 40 gulls were seen at Sea Lion Rookery in fall. The same trend applies to the abundance of cormorants. If cormorants are present, they are typically not abundant. However, it is not uncommon to encounter as many as 70 cormorants at a site which was the case at East Point and Crook Point (common roosting locations) in fall. Approximately 40 cormorants were seen at East Point in spring.

While not generally considered shorebirds, black phoebes and song sparrows are commonly seen catching flies on the shore while common ravens are primarily scavenging for dead animals washed ashore. Ravens and gulls have both been observed foraging in the mussel beds and other intertidal areas for invertebrates.

Harbor seals, *Phoca vitulina*, were observed at or within the immediate vicinity of five out of the eight sites (Ford Point, Fossil Reef, Northwest-Talcott, Orizaba Cove and Otter Harbor) sampled in spring. In fall, harbor seals were seen at or near approximately a quarter of sites (Cat Rock, Fraser Cove, Harris Point, Orizaba Cove and Prisoner’s Harbor).

Northern elephant seals, *Mirounga angustirostris*, usually prefer sandy beaches over rocky shelves to haul out. They are common sights on beaches near Cuyler Harbor, Crook Point, and Fossil Reef in spring where we typically observe weaned pups that have not yet gone to sea or adults coming ashore to molt. In 2011, elephant seals were seen at or nearby Crook Point, Ford Point, Johnson’s Lee and Northwest-Talcott in the fall.

California sealions, *Zalophus californianus*, were abundant (approximately 200) at the aptly named, Sea Lion Rookery on Santa Barbara Island as well as the other site (Landing Cove) sampled on the island. One sea lion was also seen nearby Orizaba Cove and Fraser Cove in spring and fall, respectively.

Visitation

Most visitors accessed the rocky intertidal at Frenchy’s Cove, though some visitors also explored East Point and Prisoner’s Harbor tidepools on Santa Rosa and Santa Cruz Islands, respectively. At South Frenchy’s Cove and adjacent reefs, Island Packers Company conducts classroom programs for

school groups which combine oceanography and tidepooling typically during winter and spring months.

Visitation statistics for Frenchy's Cove are available from monthly reports based on concessionaire reporting from Island Packers Company and Truth Aquatics (Table 9, Figure 33). No records are available for the number of private boaters that went ashore at any of the Channel Islands in the National Park. Additionally, there are no records for the number of visitors that accessed the intertidal zone at East Point or Prisoner's Harbor.

The total number of visitors from concession boats in 2011 was 1,383 passengers in 19 trips (Table 9) which was less than the 1704 passengers in 2010, and less than the number of passengers in 2009 (Figure 35). In fact, visitation in 2011 was the third lowest year on record with slightly more visitors than 2006 and 2007. March was again the top month for visitation with 634 passengers on eight trips (Figure 36). Seventy-nine percent of the visitation occurred in spring (February–May). No visitation by concession boats occurred from May to October and December.

Table 9. Visitors to South Frenchy's Cove, Anacapa Island in 2011 (visitation with Island Packers).

Year	Month	#Passengers	#Trips
2011	January	0	0
2011	February	185	4
2011	March	634	8
2011	April	279	3
2011	May	0	0
2011	June	0	0
2011	July	0	0
2011	August	0	0
2011	September	0	0
2011	October	105	1
2011	November	180	3
2011	December	0	0
2011	Total	1,383	19

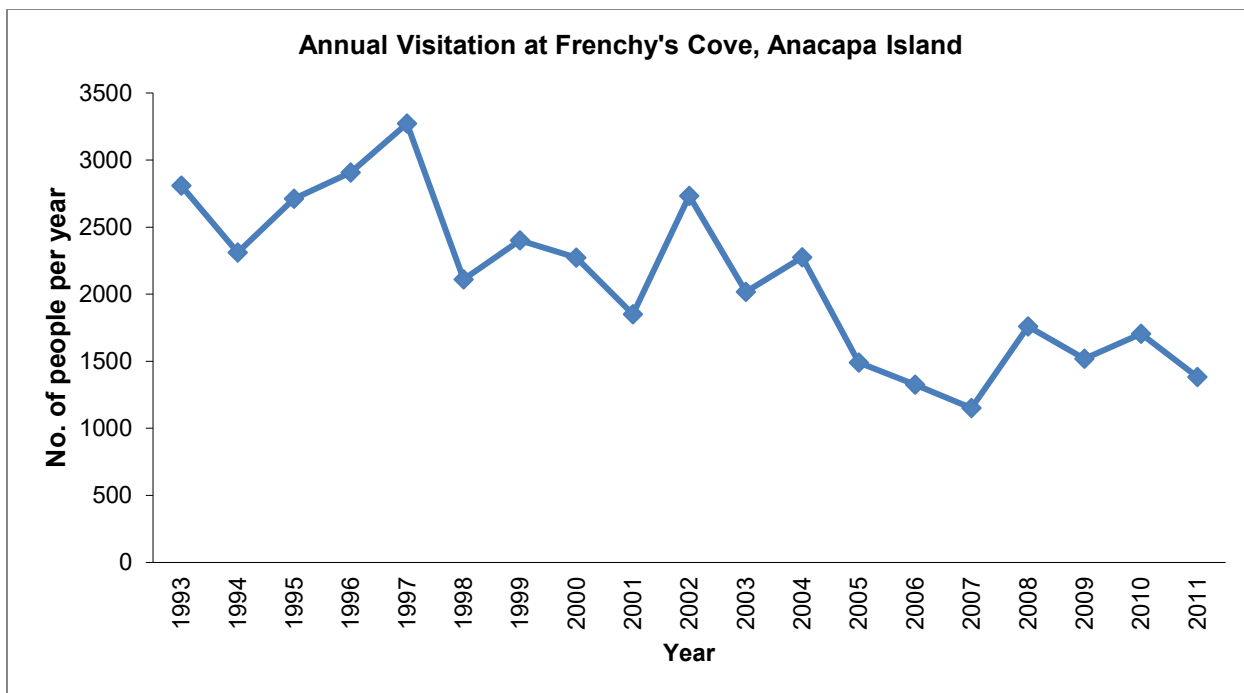


Figure 35. Annual commercial visitation at Frenchy's Cove, Anacapa (via Island Packers Company).

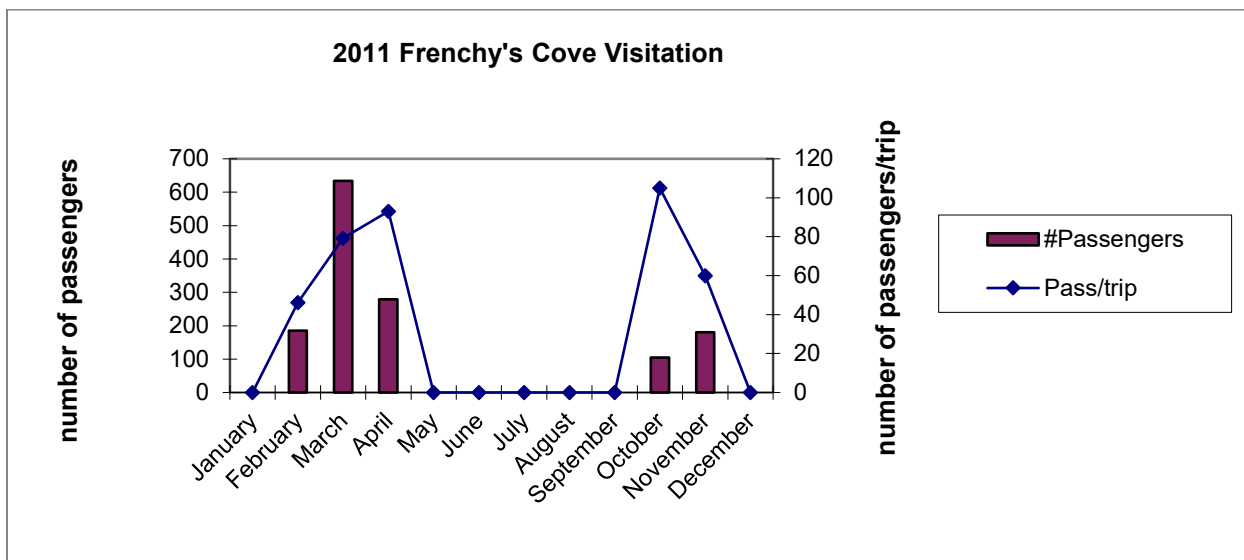


Figure 36. Monthly visitation at Frenchy's Cove, Anacapa Island (via Island Packers Company).

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Appendix A. Program Notes

2011 Sampling Events

Only seven sites were sampled in spring, but nearly all (except Middle Anacapa) were visited in fall (Table A-1). The two sites at Santa Barbara Island were not sampled in spring because of difficulties with access due to nesting California brown pelicans. Other sites were not sampled in spring due to a combination of factors most of which resulted from inclement weather. The five sites at Santa Rosa Island were however sampled in spring and fall.

Table A-1. 2011 Sampling dates for Rocky Intertidal Monitoring sites.

Site	Site code	Spring	Fall
Cuyler Harbor, SMI	SMCH	–	12/10/11
Crook Point, SMI	SMCP	–	12/8/11
Otter Harbor, SMI	SMOH	–	12/7/11
Harris Point, SMI	SMHP	–	12/9/11
Fossil Reef, SRI	SRFR	3/18/11	1/18/12
Johnson's Lee, SRI	SRJL	3/14/11	1/17/12
Ford Point, SRI	SRFP	3/15/11	1/22/
Northwest-Talcott, SRI	SRNWT	3/17/11	1/19/12
East Point, SRI	SREP	3/16/11	1/20/12
Fraser Cove, SCI	SCFC	–	1/9/12
Trailer, SCI	SCTR	–	1/8/12
Willows Anchorage, SCI	SCWA	5/20/11 ^a	9/28/11, 1/7/11
Scorpion Rock, SCI	SCSR	–	11/22/11
Prisoner's Harbor, SCI	SCPH	–	1/6/12
Orizaba Cove, SCI	SCOC	3/31/11	12/20/11
Cat Rock, ANI	ANCR	–	12/21/11
South Frenchy's Cove, ANI	ANSFC	–	11/23/11
Middle Anacapa-West	ANMW	3/30/11	–
Middle Anacapa-East	ANME	3/30/11	–
Landing Cove, SBI	SBLC	–	10/25/11
Sea Lion Rookery, SBI	SBSLR	–	10/24/11
Valley Anchorage	–	–	9/26/11
Fraser Point	–	–	9/27/11

Significant-sized swell and heavy surge from south and westerly swells impeded some sampling protocols at East Point and Northwest-Talcott in spring, Willows Anchorage in the summer and Otter Harbor in fall.

Funding provided by the NMFS Endangered Species Program for black abalone monitoring allowed for the temporary hire of a biological technician (Andrew Domingos) beginning in March. Additionally, the funds enabled us to conduct an abalone tagging trip to Otter Harbor, San Miguel Island in February. The focus of the trip was not only to measure abalone at the site, but to map the crevices utilized by black abalone with GIS to allow better tracking of the movement of tagged individuals. The same procedures were conducted at Willows Anchorage, Santa Cruz Island in June. Over 400 black abalone and 11 juvenile red abalone were found during the sampling trip.

Beachwalk surveys (shorebirds, pinnipeds and carcass counts) were conducted in conjunction with the rocky intertidal monitoring on San Miguel and Santa Rosa Islands making efficient use of personnel and island time. Western snowy plover surveys on Santa Rosa Island were conducted during late May and early June. Sand beach monitoring was conducted at Santa Rosa Island during the summer; those data will be reported separately.

On March 11, 2011, a 9.0 magnitude earthquake occurred off the coast of Japan. Strong currents from surges impacted harbors along the California mainland. Reports of waters receding up to 200 feet from shore were reported at Santa Cruz Island and Bechers Bay on Santa Rosa Island. We did not see any evidence of damage from the tsunami that could be discerned from the normal high tides. We walked Water Canyon beach on 3/13 and it was clean having been swept by the high tide. The large dune by the access road was mostly gone but may have eroded during heavy surf earlier in the year.

Near the end of /December 2011, a fishing boat washed up on the southeast corner of Santa Barbara Island and wrecked (Figure A-1). Within a short time the boat had completely broken apart and debris was scattered in the area. It is not known how much fuel was on board or if any other toxic materials were on board. The sea quickly claimed the remains and no injuries to wildlife were reported by biologists stationed on the island. The wreck site is 600–800 m from the Sea Lion Rookery monitoring site.



Figure A-1. Photograph of wreckage from small fishing boat at Sea Lion Rookery, Santa Barbara Island.

Appendix B. Trip Reports

The following are trip reports from the Rocky Intertidal Monitoring 2011 field season (March 2011 through January 2012). Reports were prepared by Stephen Whitaker and Dan Richards. The reports summarize the work done during each monitoring event, provide a quick summary of the data collected, include many of the data tables and site-specific graphs, and serve as metadata for the information collected.

San Miguel Island, February 27–29, 2011

(Database event #2011-A)

Prepared by Dan Richards and Stephen Whitaker

Purpose:

To monitor black abalone at Santa Miguel Island.

Personnel:

- Dan Richards, Marine Biologist, Channel Islands National Park
- Stephen Whitaker, Bio-tech, CHIS

Procedure and general observations:

We flew out for a short trip just to monitor abalone. We stayed at the Point Bennett Research Station. We measured and read tags of tagged abalone and counted all abalone at the site. Additional abalone were tagged with Passive Integrated Transponder (PIT) tags embedded in Z-Spar epoxy. The location (crevice number) and distance to nearest neighbor was recorded for all individuals. Size measurements were not taken of abalone without tags to save time. We visited Leuzarder Point on the southwest side of the island to look for abalone briefly. The maximum number of shorebirds and pinnipeds observed at each site was recorded. Hobotemp Tidbit temperature loggers were downloaded from both housings at Otter Harbor.

27 February 2011, Otter Harbor.

Low tide -0.3 ft at 1317 hrs. Conditions were cool and windy with a heavy swell from the northwest. During the night of Feb. 25–26, it rained approximately 0.68 inches. Winds were moderate at 15–20 mph. Water temperature was 12.9°C . We landed on the Dry Lake airstrip about noon and proceeded directly to the site.

There were four western gulls, eight black oystercatchers, and one American oystercatcher. Thirty-six harbor seals were present on the reef. As on the past couple of visits there, one harbor seal was very tolerant of us and remained on the reef the entire time. We arrived at the site at 1230 and worked until 1630.

We worked each crevice area, locating all abalone present, noting the total abalone in each defined crevice area. Untagged abalone were counted and recorded in bins of nearest neighbor distance (touching, 1–10cm, 11–50 cm, 51–100 cm, 1–5 m, and >5 m). Tagged abalone were identified by the presence of marine epoxy on the shell. We generally relied on visual discovery to locate tags but at

least one tag that was heavily overgrown by barnacles and encrusting algae was discovered by blindly waving the reader over abalone. Maximum shell length was recorded for all tagged abalone and pit tags were read with a Biomark pocket reader. Two PIT tags were not functioning, but one of those had a visual tag we were able to read. Both of the non-functioning tags were in crevice 14.

A total of 137 black abalone were found with most of them in the touching and 1–10 cm bins. We found 18 tagged abalone, including the two non-functioning tags. An additional non-functioning tag was discovered in crevice 4 on 2/28, which would bring the total number of tagged individuals to 19. Sizes ranged from 81–157 mm. We were prevented from checking some crevice areas at the west end of the site by incoming tide and swells. Only two small abalone (approximately 50 mm) were found. One of those was in abalone plot 368, the only abalone found in a plot.

One large abalone was found on the side of a small rock in crevice 13 that appeared to be shrunken, a symptom of withering syndrome. It was; however, firmly attached to the rock and responded to our presence with some movement and increased grip. It was in the same place on 2/28 and tag number xx3153 was attached.

28 February 2011, Leuzarder Point.

Low tide –0.5 ft at 1355 hrs. Conditions were excellent with calm wind and light swell. We checked Leuzarder point on the western side of Tyler Bight. There were six harbor seals, one elephant seal, and about 20 California sea lions in the area. There were six black oystercatchers and 8–10 Brant's cormorants on the bluff above the site. We found about 20 black abalone at the site between 1000 and 1100 hrs. Most of the abalone found were large, estimated to be over 130 mm. No juveniles were seen.

There was good algal growth at the site with abundant *Silvetia* and *Hesperophycus* throughout the area. At least one moderate sized holdfast of *Analipus japonica* was found. *Mytilus californianus* were patchy and few large individuals were seen. Juvenile recruitment seemed to be good with dense patches of 2–3 cm shells. *Balanus glandula* were dense on the rocks.

At Otter Harbor, between 1230–1700 hrs, we tagged 26 black abalone. We tagged abalone that were exposed enough to reach and measure reasonably accurate. Some were too close to rocks get the calipers completely over, but we were able to estimate the size reasonably we thought. We recounted abalone in all of the crevices since conditions were better, finding 160 abalone total. We found 159 in early December 2010, still down slightly from a year ago when we found 174.

At Otter Harbor there was abundant *Hesperophycus* (small “Harris Point” form) but little *Silvetia*. *Endocladia* and *Balanus* were abundant at the site. Numerous *Strongylocentrotus purpuratus* were found that were losing spines. Many of these were in urchin holes and therefore not very exposed to the surf. That would seem to indicate that the spine loss is related to disease (rather than abrasion) as we have seen at other islands. Numerous empty urchin tests were present on the reef.

Two empty old shells (dull interior or growth on interior) were found on 2/28 (94 and 163 mm) and one old shell was found on 2/27.

Santa Rosa Island, March 13–18, 2011

(Database event #2011-B)

Prepared by Dan Richards and Stephen Whitaker

Purpose:

To monitor rocky intertidal sites at Santa Rosa Island.

Personnel:

- Dan Richards, Marine Biologist, Channel Islands National Park
- Stephen Whitaker, Bio-tech, CHIS
- Connie Jenkins, volunteer
- Trey Demmond, volunteer

Procedure and general observations:

We flew out with Channel Islands Aviation on 3/13. Standard procedures were used for monitoring rocky intertidal sites. All plots and site overviews were photographed with an Olympus Stylus 1030SW digital camera. All photoplots were scored in the field except at Fossil Reef and Northwest Talcott. Sea stars and black abalone were counted at all sites except Fossil Reef. Surfgrass transects were read at Northwest Talcott and East Point. The maximum number of shorebirds and pinnipeds observed at each site was recorded. Hobotemp Tidbit temperature loggers were downloaded at Northwest Talcott and Fossil Reef. Mussel sizes and mussel bed depth were measured at Johnson's Lee, Ford Point and Northwest Talcott.

New splashzone plots were installed at Johnson's Lee, Ford Point and Northwest Talcott. These were set up above the *Chthamalus* zone to document rising sea levels and changing zonation following recommendations from the MARINe workshop in January 2011.

On 3/11/11, a Tsunami was generated from an 8.9 earthquake in Japan. Strong currents from surges impacted harbors along the California mainland. Reports of waters receding up to 200 feet from shore were reported at Santa Cruz Island and Bechers Bay on Santa Rosa Island. We did not see any evidence of damage from the tsunami that could be discerned from the normal high tides. We walked Water Canyon beach on 3/13 and it was clean having been swept by the high tide. The large dune by the access road was mostly gone but may have eroded during heavy surf earlier in the year.

14 March 2011, Johnson's Lee.

Low tide -0.0 ft at 1325 hrs. Conditions were cool and windy with a moderate swell. Winds were moderate at 15–20 mph. Water temperature was 12.7°C. We were on site from 1000–1800 hrs.

There were six western gulls, two black oystercatchers. One harbor seal and one elephant seal were seen in the water off the site. Elephant seals were present at Officers Beach to the west.

The sand level at the site was moderate with the back area cobble mostly covered with sand but some still exposed and lower rocks to the east bare of sand. Large *Ligia occidentalis* were common on the sand.

Phragmatopoma californica was abundant around the site and large mounds were common. Most of the area around mussel plot 514 was covered and we were unable to locate any of the corner bolts so did not photograph that plot. The temperature logger housing was apparently hidden under a large mound and could not be found.

Dan scored all photo plots in the field. Barnacle plots averaged 54% barnacle cover. Plot 503 had 37% *Endocladia*. *Endocladia* plots averaged 16.4% *Endocladia*, 16.6% barnacles, 14.4% mussel and 2.4% limpet cover. Mussel cover averaged 23.5% in four of the original mussel plots and 57.5% across all the mussel plots. *Phragmatopoma* averaged 33.8% across all the eight *Mytilus* plots.

Stephen and Connie counted motile invertebrates in the photo plots. Barnacle plots had very few invertebrates besides littorine snails and small to medium sized limpets (all latter organisms were moderately abundant). Plots 503 and 504 each had six *Nucella emarginata*. *Endocladia* plots had mostly *Nucella emarginata* (mean= 7.8, max= 18 individuals). Several *Endocladia* plots had 1–2 *Lottia gigantea* and a couple plots had a *Nutallina*, shore or hermit crab, or a large limpet. Mussel plots had numerous *Tegula funebris* (mean= 11.3 individuals/plot) and most plots had several *Nucella* (mean= 13.4/plot). Other motile invertebrates were present in most plots in low abundances.

Dan searched for abalone and seastars and found four *Haliotis cracherodii* (70–156 mm) and 293 *Pisaster ochraceus* (40–120 mm, mode= 60 mm). Most of the *Pisaster* were fairly well hidden and they seemed less numerous than in recent years. The 10x2 m transect on the outer reef had 19 and 18 *P. ochraceus* on the inside and outside, respectively.

Stephen and Dan worked together to try out the new mussel measurement protocol from MARiNe. Two mussels were measured from each of five sub-plots in each of the mussel zone photoplots and the depth of the mussel bed was taken in each plot. We only measured five of the nine mussel zone plots at SRJL. The technique works but we still have some questions regarding what if mussels occur only outside the predetermined points. The time was reasonable but still could impact our overall time at a site since the measurements must be made while the tide is fairly low.

Splash-zone plots were established on the upper reef spread between plots 500 and 502. Area photos were taken, the plots were added to the map and inter-plot distances were made for all the new plots. The plots were 100% bare rock with some *Littorina* spp. present.

We made all plot repairs that were practical and needed, including adding bolts to the new mussel zone plots.

15 March, 2011. Ford Point.

Low tide –0.4 ft at 1404 hrs. Conditions were nice early then windy with a moderate swell. Winds were moderate at 15–20 mph onshore but appeared strong offshore. Gusts in excess of 30 mph were measured while walking back to the truck from the site. We were on site from 1030–1800 hrs.

Two black oystercatchers and five black turnstones were seen near the vicinity of the monitoring reef. One harbor seal was seen offshore of the site.

Two *H. cracherodii* were found inside the abalone plots and a total of 38 were found at the site ranging from 20–170 mm. Several large individuals were found in crevices among the lower rocks. Most abalone here are found under boulders high on the reef. 357 *Pisaster* were counted at the site. As at Johnson's Lee, it seemed that there were fewer seastars but Dan was able to make a thorough search.

Dan scored all the photoplots in the field. Barnacle cover averaged 40% in the barnacle plots. *Endocladia* cover in plot 523 was 65%. *Endocladia* cover averaged 31.4% in its representative zone. Mussel cover averaged 6.6% and barnacle cover averaged 5.8% across all the *Endocladia* plots. Overall, the *Endocladia* plots were quite diverse. Mussel cover averaged 46.4% in the *Mytilus* zone. *Phragmatopoma* was 80% and 87% in plots 532 and 534, respectively.

Stephen counted motile invertebrates in the photoplots with Connie recording. Barnacle plots had few motiles present aside from low to moderate numbers of small to medium-sized limpets and littorine snails. All *Endocladia* plots had 4–5 different taxa present not including the small to medium-sized limpets and littorines. Numbers of individuals per taxon ranged 1–6 though plot 528 had 13 *Tegula funebris*. Mussel plots were not highly diverse. Four *Mytilus* plots had *Nucella emarginata* present and plot 533 had 25 individuals present. Plot 532 had 42 purple urchins. Other motile invertebrates were present in most plots in low abundances.

Stephen and Connie counted and measured *Lotita gigantea* in the fixed circular plots. Plots 600 and 604 each had zero limpets and plot 601 only had one individual present. Plot 602 had four *L. gigantea* and plot 603 had two individuals.

We set up five splash-zone plots in the vicinity of plot 524 on the back reef. Plot and area photos were shot and we took inter-plot distances. Plots were bare rock with some *Littorina* sp.

Repairs were made to existing plots where needed including some additional bolts. All plots were found without problem, though some corners were hidden under *Phragmatopoma*.

16 March, 2011. East Point.

Low tide –0.6 ft at 1439 hrs. Conditions were clear and windy with a high swell. Winds were moderate at 15–20 mph. Water temperature was 13.9°C. We were on site from 1130–1730 hrs. We hiked from Water Canyon to the site due to significant road damage at WC. The walk took 2.5 hours each direction. Trey Demmond joined us around 1400 hrs after flying to the island on an afternoon flight.

Forty cormorants and four black oystercatchers were seen near or on the reef. No pinnipeds were observed most of the day but at least one harbor seal was seen swimming in the surf offshore before departing the site.

Dan scored all the photoplots in the field. Barnacle cover averaged 52.4% in the barnacle plots. Plot 377 had 63% *Endocladia*. *Endocladia* plots had 65.6% *Endocladia* cover along with 18.8% mean barnacle cover. *Hesperophycus* plots had 25.4% mean *Hesperophycus* cover, 46.4% mean *Endocladia* cover and 8.8% mean barnacle cover. *Silvetia* plots had 9.6% mean *Silvetia* cover though

only three plots had any of the rockweed present. Mean *Endocladia* cover in the *Silvetia* zone was 7.6% and *Cladophora columbiana* cover was 16.4%. Mussel plots had 43.2% mean mussel cover, 41.4% *Phragmatopoma*, and 5.2% articulated corallines.

Stephen worked with Connie to count all the motile invertebrates in the photoplots. Most barnacle plots had minimal numbers of invertebrates present aside from plot 576 which had six taxa not including small to medium sized limpets and littorine snails. Twenty-three *Tegula funebris* were counted in 576. All *Endocladia* plots had *Nucella emarginata* present (numbers of individuals ranged 1–9/plot) with very few other invertebrates present. *Hesperophycus* plots mostly had *Acanthina* spp., *Tegula funebris* and *Nucella* with nearly all plots inhabited by 1–18 individuals from all three taxa. Littorine counts were moderately high in barnacle, *Endocladia* and *Hesperophycus* zones. Nearly all *Silvetia* plots had *Lepidochitona* spp., *Nucella*, *Acanthina*, and *Tegula funebris* present in high numbers. *Nucella* numbers ranged 3–1, *Acanthina* ranged 12–56, and *T. funebris* ranged 20–51 individuals/plot. All *Mytilus* plots had *Nutallina* spp. (2–23 indiv./plot) and *Nucella emarginata* (1–21 indiv./plot) present. Other motile invertebrates were present in most plots in low abundances.

Twenty-five abalone were found with sizes ranging from 50–160 mm.

Dan measured surfgrass abundances on the three fixed transects. Transect-1 had 100% *Phyllospadix* overstory cover. Transects-2 and -3 had 95% and 85% cover, respectively. There was a lot of algal and surfgrass debris scattered over the site. The wrack was mostly composed of small (<10cm) fragments. The surfgrass on each transect was moderately bleached and abraded. A number of squid egg cases were also seen around the reef.

No plot repairs were made though many plots were missing corners, primarily the *Mytilus* plots.

17 March, 2011. Northwest-Talcott.

Low tide –0.7 ft at 1514 hrs. Conditions were very windy with a high swell. Winds were moderate at 15–20 mph. Water temperature was 12.9°C. We were on site from 1200–1630 hrs. Swell and surge were both high due primarily to the gusty conditions onshore (17 mph average wind speed, max= 21 mph). The heavy surf pushed water up onto the site throughout the low tide wetting the *Mytilus* plots frequently.

Six western gulls, four black oystercatchers and 12 black turnstones were seen near the vicinity of the reef and 11 harbor seals were swimming immediately offshore. Several mother/calf pairs were seen from above the site on the bluff.

We had to wait for the tide to recede before we could access the site then we had to work quickly to get the work completed before the tide rose. As a result, the plots were not scored in the field.

Dan searched for abalone throughout the entire site finding zero individuals. Seastar search yielded no *Pisaster ochraceus* and one *P. giganteus*.

Stephen counted motile invertebrates in the photoplots with Connie recording. All barnacle plots were minimally populated with motiles with the exception of plot 562 which six taxa present not

including small to medium-sized limpets and littorine snails. There were 22 *Lepidochitona* and 11 *Ocenebra circumtexta* among other less abundant species counted in 562. Medium-sized limpets were moderately abundant in nearly all barnacle plots. *Endocladia* plots were relatively diverse in terms of motile invertebrates. Most plots had at least six taxa not including limpets or littorines. However, all counts were less than five. *Lepidochitona*, *Nucella emarginata* and *Ocenebra* were the most ubiquitous taxa present in the *Endocladia* plots. *Silvetia* plots had slightly fewer numbers of motiles than the *Endocladia* plots. *Lepidochitona* were the most commonly encountered species; plot 568 had ten individuals. *Mytilus* plots all had *Nutallina* and *Lottia gigantea* present and most had *Nucella* and *Ocenebra*. Most counts were equal to or less than five individuals/taxon though three plots had more than ten *Nutallina*.

Stephen scored the photoplots in the office. Barnacle cover averaged 31% in the barnacle plots. *Silvetia* was present in moderate amounts (6–42%) in three of the plots and non-coralline crust equaled 2–17% in four plots among other less common taxa. *Endocladia* plots had 16.8% *Endocladia* and 35.4% barnacles. *Silvetia* plots had 43.4% *Silvetia* and 5.2% non-coralline cover among other less ubiquitous species. *Mytilus* plots had 35.6% mussels and were relatively diverse. *Pollicipes* and *Phragmatopoma* (means each =4.4%) and articulated corallines (mean=12.6%) were the most common space-occupiers.

Dan and Trey worked together to measure *Lottia gigantea* in the fixed circular plots. Counts ranged 11–23 individuals per plot and sizes ranged 13–102mm.

Surfgrass abundances measured by Dan ranged 73–99% on the three established transects. Other red algae comprised the majority of non-surfgrass contacts.

We set up five splash-zone plots on the back reef. Plot and area photos were shot and we took inter-plot distances. Plots were bare rock with some tar and other green algae. Repairs were made to existing plots where needed including some additional bolts. All plots were found without problem, though some corners were hidden under *Silvetia*.

18 March, 2011. Fossil Reef.

Low tide –0.6 ft at 1548 hrs. Conditions were very nice with only a light wind with a small swell. Water temperature was 11.9°C. We were on site from 1130–1400 hrs.

We needed to be back on the east side of the island for a 5:00 plane departure so we had to leave the site two hours before low tide. The tide was still washing the outer plots and a couple of the limpet plots when we arrived. We were unable to score photoplots in the field or search for abalone and seastars or count motile invertebrates. One fresh black abalone shell was found measuring 140mm.

Dan photographed the plots and made site observations noting that *Silvetia*, *Endocladia* and *Balanus* were abundantly present and *Mytilus* were present on the outer reef. Most of the outer reef was dominated by *Phragmatopoma*.

Stephen measured *Lottia gigantea* in the fixed circular plots with Connie recording. Plots one and two only had one and three limpets, respectively. The other three plots had 37–84 limpets. Sizes ranged <15–91mm.

Stephen scored the photoplots in the office. Mean barnacle cover was 28.6% in the barnacle zone. Plot 607 had 19% *Endocladia*. *Endocladia* averaged 42.8% in the representative zone. Mean *Silvetia* cover measured 22% across the five *Endocladia* plots and was 64% in plot 611. *Silvetia* averaged 80.8% in the *Silvetia* zone. *Mytilus* cover was low in the mussel plots; only plot 623 had mussels present (12%). The mussel plots were relatively diverse with most space occupied by coralline crusts (mean=19%), *Ulva* (mean=19.8%) and *Phragmatopoma* (mean=28.6%).

Anacapa/Santa Cruz Island March 30–31, 2010

(Database event #2011-C)

Prepared by Stephen Whitaker

Personnel:

- Dan Richards, Marine Biologist, Channel Islands National Park
- Stephen Whitaker, Biotech, CHIS
- Andrew Domingos, Biotech, CHIS
- Kelly Moore, Biotech, CHIS
- Danielle Lipski, CINMS
- Kristen Hislop, Sea Grant Fellowship, CINMS
- Jade Willard, VIP
- Tony Willard, VIP
- Terrence Shinn, CINMS
- Charlie Lara, CINMS
- Matthew Davis, CINMS

Procedure and General Notes:

The R/V Shearwater was provided by the Channel Islands National Marine Sanctuary for transportation to do the monitoring. We conducted day trips from Ventura. Middle Anacapa Island including Harbor Seal Arch and Orizaba Cove at Santa Cruz Island were monitored. Standard procedures were followed for photographing fixed plots. Percent cover of photo plots was determined in the office at both sites sampled during the trip. Black abalone, *Haliotis cracherodii*, and seastars were counted in site-wide searches and measured for size distribution at both sites. Due to time limitations, owl limpets, *Lottia gigantea*, and motile invertebrates were not sampled at either site. The highest number of shorebirds and pinnipeds seen was recorded at both sites.

On March 30th, Dan, Stephen, Dani and Kelly conducted a survey dive at Cat Rock and a site located west of Goldfish Bowl, Anacapa Island to look for *Sargassum horneri* and black abalone in the

shallow subtidal zone. No black abalone were seen, but *S. horneri* was seen in low abundance near Goldfish Bowl.

March 31st, Dan, Stephen and Matt dove at Orizaba Cove, Santa Cruz Island in front of the intertidal site to search for *S. horneri* and black abalone as well as qualitatively sample seastar densities. No black abalone or *S. horneri* plants were seen. *Pycnopodia* and *Pisaster giganteus* were common to abundant and *P. ochraceus* were seen down to at least -30 ft MLLW.

Results (Daily and Site Description)

March 30, 2011, Middle Anacapa Island.

Low tide +0.1 ft at 1339 hrs. Light wind and minimal swell; good sampling conditions. Water temperature was 14.9°C. Two black oystercatchers and two western gulls were seen at the site. Numerous western gulls were seen flying above and sitting on the water near the site. Brown pelicans were nesting above the site in cactus patches. No marine mammals were observed near the site.

Dan, Kelly, Dani, Kristen, Jade and her father, Tony, worked the main reef at Middle Anacapa from 1300–1530 hrs. Dan, Jade and Tony photographed all plots and panoramas. Dani, Kelly and Kristen worked together to search for and measure *Pisaster ochraceus* (453 sea stars counted in 30 minutes, 100 stars measured [range=50–150mm, mode=100mm]) and *Haliotis cracherodii* (21 individuals were found and measured throughout the entire site, sizes ranged 33–118mm).

Stephen and Andrew were skiffed over to Harbor Seal Arch to count and measure black abalone. We measured 32 black abalone in approximately 60 minutes (sizes ranged 40–110mm).

Throughout the main site, Dan noticed that *Phragmatopoma* was common but not very widespread. Several dense patches of mussels were present; most mussels were typically only 2–3cm long. Littorine snails were abundant in the upper pools. *Chthamalus/Balanus* and *Tetraclita* were all abundant. No *Caulacanthus* was observed while surveying Middle West but it was seen in the photographs of several plots. The invasive alga was fairly common in places at Harbor Seal Arch.

The barnacle plots on the west reef only had 10.6% mean cover of barnacles. Several of the barnacle plots had moderately-high *Ulva* cover (mean=24.6%). *Endocladia* plots had 23.6% mean *Endocladia* cover along with low abundances of numerous other species. *Silvetia* was again absent from the *Silvetia* plots. *Mazzaella affinis* (mean=13.2%) was the most dominant species within the *Silvetia* plots and *Tetraclita* (mean=10.6%) was the second most abundant taxa. *Mytilus* plots had 24.8% mean mussel cover which increased from 10% last fall. Diversity in the mussel plots was relatively high with the highest ranking species being *Tetraclita* (mean=16.8%), articulated corallines (mean=14.2%), *Gelidium coulteri* (mean=7%) and *Mazzaella affinis* (mean=10%).

March 31, 2010, Orizaba Cove, Santa Cruz Island.

Low tide +0.2 ft at 1405 hrs. Weather conditions were generally good for sampling with clear, warm skies, light wind and medium-sized swell and surge. Water temperature was 13.9 °C. Four black oystercatchers were observed at the site. Two harbor seals and one sealion were seen in the water.

Dan, Stephen, Andrew, Dani and Kristen worked from 1215–1500 hrs. Dan and Andrew photographed the plots and panoramas. Stephen counted and measured sea stars (358 *Pisaster ochraceus* [range=70–140mm, mode=90mm], were observed in 30 minutes throughout the site). Everyone searched for and measured black abalone (N=47 black abalone were seen, size range=20–100mm).

Barnacle plots had 55% mean barnacle cover. *Hesperophycus* plots had 25.6% mean *Hesperophycus* cover, 40.4% mean *Endocladia* cover and 15.6% mean barnacle cover among other less common species. *Silvetia* plots had 25.2 % mean *Silvetia* cover along with 21.2% *Ulva*, 20.4% *Endocladia*, 5.8% barnacle and 3.2% *Tetracilita* cover. Mussels were absent from the *Mytilus* plots. The most abundant taxa in the mussel plots were articulated corallines (mean=30.6%), *Mazzaella affinis* (mean=21.4%), coralline crusts (mean=10.4%) and *Tetracilita* (mean=10.4%). *Tetracilita* plots had 19.4% *Tetracilita* cover, 29.4% *Ulva*, 12% barnacle cover and various other less common taxa.

Santa Cruz Island May 20–21, 2011

(Database event #2011-D)

Prepared by Dan Richards

Personnel:

- Dan Richards, Marine Biologist, Channel Islands National Park
- Stephen Whitaker, Biotech, Channel Islands National Park
- Eilea Knotts, Volunteer

Procedure and General Notes:

We used Island Packers transportation to and from the Santa Cruz Island. This work was performed in part at the University of California Natural Reserve System, Santa Cruz Island Reserve on property owned and managed by The Nature Conservancy. We stayed at the UC Natural Reserve System, field station. The purpose of this trip was to check on the status of *Haliotis cracherodii*, black abalone, at Willows and Valley Anchorage sites and to locate and identify as many tagged abalone as we could find at Willows. Shells had previously been tagged with Passive Integrated Transponder tags (from Biomark) attached to the shell with marine epoxy compound. Areas were searched by crawling over rocks, searching crevices and feeling under boulders for all abalone. Maximum shell length was measured or estimated to the nearest centimeter using vernier calipers. The temperature loggers were downloaded to the HOBO shuttle and water temperature was measured with a digital thermometer.

Willows Anchorage, 20 May, 2011:

Low tide –0.9 ft at 0657 hrs. Water temperature was 13.2°C, Air 16°C. We had clear weather but it rained approximately a half inch in two fronts on May 16 and 18 prior to the trip. The swell was quite large and made working on the outer reef unsafe. Two black oystercatchers were seen on the reef. A common raven, and several white throated swifts were seen flying around above the area. We were on site from about 0600–0900 hrs.

Because of the swell, we could not access the lower crevices for good counts there. No check was made for abalone beyond crevice 17 (west side of site). Over 200 abalone were counted on the inner reef and out to crevice 17 (on the west side of the Endocladia plots). There was not enough time to count and measure all abalone so some areas were only searched for presence of tagged shells. A total of 18 tags were found, of which 2 were no longer functional. One of the epoxy covers had been worn down and the PIT tag was obviously broken. Neither of those shells had a secondary visual tag.



Abalone shell with broken PIT tag in ground off epoxy.

Mytilus californianus recruitment had been fairly high (see photo). *Pisaster ochraceus* were still numerous and there were many small individuals. *Hesperophycus californicus* was also fairly numerous on the inner reef with new recruitment at the base of the cliff. The three highest plots however were primarily bare rock and did not reflect that recruitment.



Mytilus californianus recruitment at Willows Anchorage.

Abalone shell sizes ranged from 45 to 153mm. The majority of abalone were within 10 cm from at least one other abalone and nearly all were under one meter away from another.

Both temperature loggers (in the same housing) recorded identical patterns and temperatures varied from about 47°–65°F.

Valley Anchorage, 21 May 2011.

Low tide –0.5 ft at 0749 hrs. Water temperature was 12.7°C and air was 13.1°C. No shorebirds were seen. Barn swallows were flying about the area. We were on site from 0700–0900 hrs.

Dan measured 193 *H. cracherodii* in about 2 hours on the boulder beach primarily. A few were measured on the inner most part of the rocky reef and surge channel/pool. The outer rock reef was too rough to work because of the swell. Most abalone were clustered together, as at Willows, and the majority (111) were within 10 cm of their nearest neighbor (group A or B). The size range was 20–150 mm with the majority in the smaller sizes (54 were less than or equal to 50 mm). Six were 140 mm or greater and I was surprised to find them so large.

Santa Cruz Island September 26–29, 2011

(Database event #2011-E)

Prepared by Dan Richards

Personnel:

- Dan Richards, Marine Biologist, Channel Islands National Park
- Stephen Whitaker, Biotech, Channel Islands National Park
- Andrew Domingos, Biotech, Channel Islands National Park

Procedure and General Notes:

We used Island Packers transportation to and from the Santa Cruz Island. This work was performed in part at the University of California Natural Reserve System, Santa Cruz Island Reserve on property owned and managed by The Nature Conservancy. We stayed at the UC Natural Reserve System, field station. The purpose of this trip was to check on the status of *Haliotis cracherodii*, black abalone, and to locate and identify as many tagged abalone as we could find at Willows. Shells had previously been tagged with Passive Integrated Transponder (PIT) tags (from Biomark) attached to the shell with marine epoxy compound. Areas were searched by crawling over rocks, searching crevices and feeling under boulders for all abalone. Maximum shell length was measured or estimated to the nearest centimeter using vernier calipers. Nearest neighbor distance was estimated as one of five categories. The temperature loggers were downloaded to the HOBO shuttle and water temperature was measured with a digital thermometer.

Valley Anchorage, 26 September, 2011:

Low tide +0.1 ft at 1533 hrs. Water temperature was 18.9°C, Air 19.7°C. We had clear weather. Two black oystercatchers were seen on the reef. A wandering tattler and three unidentified sandpipers were observed in the rocks to the east.

We were on the late boat to Prisoners Harbor and did not get to the site until about 1500 and then were somewhat limited by the marginal tide. Thinking our time was limited we just counted *H. cracherodii* and assessed the general condition. All of the abalone we encountered appeared quite

healthy. Several were in active feeding posture as the tide started coming in. We encountered at least 219 *H. cracherodii* on the reef and main boulder area. At least 15 were found on the reef. We continued to search among the rocks to the east but did not find many. The first set of rocks appeared to be pretty scoured by sand and we did not see any abalone; however, were limited in our search somewhat by the advancing tide. We stopped short of the small reef to the east because numerous cormorants were present there but it looked like potentially good habitat and we saw two abalone among the rocks near the reef. We did not make any measurements but the size range appeared to include abalone from about 40 mm to 150 mm. I placed the digital thermometer under an abalone shell on the sunny side of a rock and recorded its mantle temperature at about 26.6°C, almost 7°C above the ambient air temperature.

One red abalone shell and two older black shells were found.

Algal cover on the reef and boulders at Valley Anchorage were particularly thick and lush. *Chondracanthus canaliculatus*, *Mastocarpus papillatus*, *Mazzaella affinis*, *Calliarthron pikeanum* and a *Ceramium* sp. were noted as being especially robust and dense.

Fraser Point, 27 September 2011:

Low tide -0.3 ft at 1619 hrs. The weather and sea conditions were excellent. There were four black oystercatchers (one group) 8 black turnstones, and two black-bellied plovers in the area. We noted that *Phyllospadix torreyi* was flowering. We found one *Cancer antennarius* and a large monkey-faced prickleback *Cibidichthys violaceus*. We were in the area from about 1500–1800 hrs. Andrew came out on Island packers and was able to join us in the field.

We have not surveyed this part of the point before. We started a little west of the surfgrass #3 transect. Inside the cove we did not see any abalone. Towards the point we crossed a sandy beach and started finding abalone. For about two hours we measured *H. cracherodii* size and nearest neighbor distance finding about 222 before we stopped. Sizes ranged from 25 to 164 mm. The start of the abalone was at N 34° 03.575', W 120°55.443' and the end was at N 34° 03.623', W 120°55.454'. The reef was about 15 m wide in most parts.

There was beautiful dense *Chondracanthus canaliculatus* and *Endocladia muricata* in the area. *Hesperophycus californicus* appeared to be fertile with large robust plants and large inflated conceptacles. *Balanus glandula* were very dense in patches. *Mytilus californianus* were fairly dense but many *Pisaster ochraceus* were feeding on them. In the low intertidal zones, the rock was quite barren and *Strongylocentrotus purpuratus* was abundant.

Willows Anchorage, 28 September, 2011:

Low tide -0.5 ft at 1708 hrs. We had overcast but bright conditions with a heavy surge, which made working on the outer reef difficult. The surge prevented us from working on the reef when we first arrived at noon. There were two pairs of black oystercatchers in the area. Two harbor seals were swimming in the cove. A sailboat was anchored off the site when we arrived a sea urchin diver was scouting the area near ship rock.

Stephen measured sizes and nearest neighbor distances of abalone with Andrew recording. He measured about 250 *H. cracherodii* just on the inner part of the reef (crevices 2–9). There were abalone in the outer crevices and on the upper part of the reef. Many abalone were present in the western part of the reef (crevice 19). Dan concentrated on finding and measuring previously tagged abalone finding 13 but was only able to read 12 of the PIT tags. Twenty-four new PIT tags were attached to abalone with Z-spar epoxy. Sizes ranged from 25–155 mm. Most of them seem to be in the 50–60 mm range and quite a few of the tagged abalone were in that range. The size of tagged abalone ranged from 20–155 mm. Only two empty shells were found (48 and 107mm).

Using the new methods from MARINE, Stephen measured the mussels in mussel plots. Besides the swell causing problems, it was difficult to decide when a mussel under the designated point was attached to the rock or to another mussel as an epibiont. Often the first mussel encountered was an epibiont. The other issue was deciding how to measure bed depth when we have irregular rock heights within the plot (which is most of the time). What do we do if there is a single mussel in the center of the sub-plot but a cluster at the edge of the sub-plot? There generally was not a lot of variation of size within a plot.

Small *Aplysia californica* were common at the site. There was a nice band of small *Mytilus californianus* on the point of the reef but the *P. ochraceus* were hitting them pretty hard.

Johnson's Beach, 29 September 2011.

High tide 6.0 at 1108. We were on site from 1015–1145 hrs. Weather was overcast but nice. We went to Johnson's Lee Beach/ Playa Larga because I had been forwarded a message from one of the island techs (Ania) who reported finding numerous seastars on the beach on 9/10/11. We found dried and bleached *Patiria miniata* among the wrack on the upper part of the beach. The wrack was mostly surfgrass but some *Macrocystis* and *Egregia* was also present. There were just moderate piles of wrack. This beach is usually pretty clean though and is not much of a depositional beach. We noted that the kelp debris was pretty far up the creek channel at the west end of the beach indicating the surge (and possibly tide) had been quite high earlier in the month.

We walked about $\frac{3}{4}$ of the beach but it appeared that the eastern portion of the beach was clean. Stephen counted 543 *Patiria miniata*. All the stars were long dead and most had apparently been dried out judging from the bleaching so I don't think there has been recent deposition since the 9/10 incident. Some of the stars were falling apart but I could not tell if they had been affected by wasting disease or if it was just normal decomposition on the beach. Most were fully intact with no indication of wasting disease however. There were four *Pisaster*, but we were not sure which species due to the bleaching. We found two fresh pismo clam shells, carcasses of three cormorants and a northern fulmar, several balloons, a couple of wine bottles and that was about it. There was also a very decomposed immature California sea lion. The wrack was mostly surfgrass with a little *Macrocystis* and *Egregia*.

I think it is unusual for so many *Patiria* to be washed up by a swell since they are usually pretty good at hanging on. Maybe that swell came up fast and they got caught inshore somewhere or possibly as Jack Engle suggested, they were climbing kelp and were pulled off with it. There were a LOT of

Patiria to be all up in the kelp though and we did not see that much kelp debris. Possibly they were in the shallows around the surfgrass. Still a bit of a mystery, I guess.

On Tuesday (9/27), folks coming out on the boat reported that they were seeing jumbo squid, *Dosidicus gigas*, chasing and eating market squid, *Loligo opalescens* at the surface about half way between the rigs and the island. On Thursday there were numerous Humboldt squid on the beach at Prisoners and it looked like at least a few were at Scorpion Valley beach. Risso's and common dolphin were observed on the trip back to Ventura.

Santa Barbara Island, October 23–26, 2011

(Database event #2011-F)

Prepared by Stephen Whitaker

Personnel:

- Dan Richards, Marine Biologist, Channel Islands National Park
- Stephen Whitaker, Bio-tech, CHIS

Procedure and general observations:

Standard procedures were used for monitoring rocky intertidal sites. All plots and site overviews were photographed with a Panasonic Lumix digital camera. All photoplots were scored in the field. Counts were made of all motile invertebrates inside the photoplots. Thirty-minute searches were conducted to count seastars and black abalone at both sites. The maximum number of shorebirds and pinnipeds observed at each site was recorded.

23 October 2011. Landing Cove.

Low tide 0.8 ft at 1338 hrs. Conditions were overcast with minimal (< 1') swell. There were four western gulls, one black oystercatcher and one California sea lion near the south side of Landing Cove. More gulls were observed on the cliff and approximately 40 sea lions were seen in the cove. We were onsite from 1215–1600 hrs.

We came out on IPCO during their last scheduled trip for the year. Doug Eernisse from Cal State Fullerton joined us for the afternoon before departing on the return trip to Ventura. Doug was primarily interested in searching for a small limpet (*Siphonaria brannani*) that had been previously recorded at the island during the BLM surveys in the 1970s. Dan recalled seeing the limpet since then in moderate abundances. We searched the south side of Landing Cove and found the limpets relatively quickly. Doug helped us to identify some of the other cryptic limpets and chitons.

Dan photographed the plots and site, scored plots, counted/measured sea stars and searched the site for abalone. Stephen counted motile invertebrates in the plots. Most plots were easy to find aside from 326 and 327 which both were missing all but the lower left bolts. Both plots were densely populated with mussels.

Barnacle plots had extremely low *Balanus/Chthamalus* cover (2 plots had 5% cover, all others measured 0%). In the barnacle plots, *Tetraclita* cover ranged 17–27% (mean=22%), *Mytilus* mean

cover was 17.6%, *Gelidium/Pterocladia* cover averaged 10.8% and *Ulva* averaged 8.4% among other less abundant taxa. *Silvetia* plots only had 2.6% mean rockweed cover; the most abundant species assemblages were *Mazzaella* (mean=30.2%), *Ulva* (mean=15.2%) and *Gelidium/Pterocladia* (mean=14.8%). Red turf plots were again dominated by *Chondracanthus* (mean=18.6%) and *Gelidium/Pterocladia* (mean=17%). Mussels accounted for 61–66% of two turf plots and articulated corallines averaged 9.8%. Mussel cover in *Mytilus* plots ranged 57–99% and averaged 81.6%. The next most abundant species in mussel plots was *Pollicipes* (mean=7%). Dense *Mytilus* recruitment was observed throughout most of the site.

Pisaster ochraceus sizes ranged 30–140mm (mode=90mm) and 157 were found during a 30-minute timed count. For reference, 375 sea stars were found last fall. No abalone were observed during a timed search of the entire site. However, the tide only receded to 0.8' and some of the lower reaches of the site may not have been adequately surveyed.

Motile invertebrates were relatively abundant and diverse within the barnacle plots. On average, 5.2 *Lepidochitona*, 7.2 *Nuttalina* and 5.6 *Ocenebra circumtexta* were found in the barnacle plots along with very few littorine snails, and low to moderate numbers of small and medium-sized limpets. *Silvetia* plots averaged 0.4 *Lepidochitona*, 1.2 *Nuttalina*, 1 *Pachygrapsus*, 1.4 *Pagurus*, 4.6 *Ocenebra* sp. per plot with spotty occurrences of several other motile taxa. Littorine snails and small limpets were scarce, but medium-sized limpets were moderately abundant in the rockweed plots. We encountered the same snail that was difficult to identify last fall. We are tentatively calling it *Ocenebra* sp. since it primarily bears the same characteristics as *Ocenebra circumtexta* (the snail in question has a shell that appears more worn down). *Mytilus* plots averaged 1.2 *Lepidochitona*, 5.2 *Nuttalina*, 1.2 *Pachygrapsus* and 15.2 *Ocenebra circumtexta* per plot among other rare-occurring taxa. Medium-sized limpets were moderately common and small limpets were rare in the mussel zone. We do not count motile invertebrates in red turf plots.

24 October 2011. Sea Lion Rookery.

Low tide 0.0 at 1418 hrs. Excellent conditions with overcast sky, calm wind and seas. There were approximately 200 *Zalophus californianus* in the area. Most of the pups were robust and healthy-looking, but at least one appeared to be starving perhaps as a result of losing its mother. There were five black turnstones, five black oystercatchers, and approximately 40 western gulls in the area. Additionally, at least four yellow-rumped warblers were seen at the site but were not entered into the TP database. Approximately 20 western grebes were seen offshore. We were on site from 1100–1710 hrs.

Dan photographed the plots and site, scored plots, counted/measured sea stars and searched for abalone. Stephen counted motile invertebrates in the plots and measured *Lottia gigantea* randomly throughout the southern portion of the site (vicinity of the rockweed plots). Most plot markers were intact and legible except for three corner bolts for 353. We did not make any plot repairs.

Barnacle plots averaged 8% *Balanus/Chthamalus* cover and 37.4% *Ulva*. *Endocladia* plots had 7.2% mean *Endocladia* cover along with 41.8% *Ulva*, 13.2% *Mazzaella*, 6.4% *Mytilus* and 4.8% *Tetraclita* cover among other less common taxa. As typically seen at this site, the upper plots (barnacle and

Endocladia zones) were dominated by short *Ulva californica*. Rockweed plots averaged 19% *Silvetia*, 21.8% *Mazzaella*, 16.4% *Ulva*, 12.4% *Gelidium/Pterocladia* cover along with scarce amounts of several other taxa. *Mytilus* plots were primarily composed of mussels (mean=48.8%). Other less common species/assemblages populating the *Mytilus* plots were *Anthopleura* (mean=16.4%), articulated corallines (mean=13.6%) and *Tetraclita* (mean=9.4%).

Pisaster ochraceus were not as abundant this year (N=183) compared with last fall (N=487). Sizes ranged 60–150mm (mode=110mm). No abalone were seen in the plots or throughout the site during a general search. Eighty-two *Lottia gigantea* were measured ranging 27–62mm (weak mode=50mm) to obtain a size frequency.

Motile invertebrates were not common in the barnacle plots with the exception of littorine snails. A couple of the barnacle plots had 1–11 *Ocenebra* sp. present along with 1–2 *Pachygrapsus* and large limpets. *Endocladia* plots primarily had large limpets (mean=2.6) and *Ocenebra circumtexta* (1–10 present in two plots), and sporadic occurrences of *Nuttalina*, *Pachygrapsus* and *Ocenebra* sp. Limpets and littorines were rare in the *Endocladia* zone. *Silvetia* plots averaged 9.8 *Pagurus*, 4.6 large limpets, 3.6 *Ocenebra* sp., 1.6 *Lepidochitona* and 1.4 *Ocenebra circumtexta* among other less abundant species. *Mytilus* plots primarily had *Ocenebra circumtexta* (mean=9.4), *Fissurella* (mean=10.8), *Nuttalina* (mean=8.8), *Strongylocentrotus purpuratus* (mean=8.4) and *Pachygrapsus* (mean=3.8). Littorine snails and small limpets were nonexistent and rare, respectively in the mussel plots, but mid-sized limpets were moderately abundant.

25 October. Landing Cove.

Low tide –0.8 ft at 1504 hrs. Conditions were workable with overcast sky, light wind and moderately-sized swell/surge. Light drizzle occurred around noon. We completed the north site plots and then measured mussels in the *Mytilus* plots on the south section.

Refer to the above description of Landing Cove on October 23rd for status of plots located at the north end (*Silvetia* and red turf) of the site.

Mussel measurements were conducted within each of the mussel plots. This is the first season that we collected mussel measurements in an effort to supplement the photoplot (percent cover) dataset with size frequencies of non-motile organisms. The new protocol requires that one mussel is measured in the upper-left corner and center of a 20x20cm² quadrat placed in each corner and center of the photoplot. Additionally, epibiont mussels encountered under each location are measured and recorded separately, and one depth measurement of the mussel bed is recorded for each quadrant including the center. Mussel lengths ranged 1–6cm and depths ranged 2–10cm throughout all five plots at Landing Cove. We did not collect mussel measurements at Sea Lion Rookery.

Anacapa/Santa Cruz Island November 22–23, 2011

(Database event #2011-G)

Prepared by Stephen Whitaker

Personnel:

- Dan Richards, Marine Biologist, Channel Islands National Park
- Stephen Whitaker, Biotech, CHIS
- Andrew Domingos, Biotech, CHIS
- Connie Jenkins, VIP

Procedure and General Notes:

The Ocean Ranger provided transportation to do the monitoring. We did day trips from Ventura. Scorpion Rock at Santa Cruz Island and South Frenchy's Cove at Anacapa Island were monitored. Standard procedures were followed for photographing fixed plots and counting motile invertebrates in the plots. Percent cover of photo plots was determined in the field at South Frenchy's Cove but not at Scorpion Rock. Black abalone, *Haliotis cracherodii*, and seastars were counted in 30-minute searches, but were only measured for size distribution at Scorpion Rock since abundances were insufficient for seastars at South Frenchy's Cove and zero black abalone were seen. Owl limpets, *Lottia gigantea*, were measured in fixed one-meter radius plots at South Frenchy's Cove. The highest number of shorebirds and pinnipeds seen was recorded at both sites.

Results (Daily and Site Description)November 22, 2011, Scorpion Rock.

Low tide -0.4 ft at 1430 hrs. Light wind and minimal swell; good sampling conditions. Water temperature was 15.9°C. Two black oystercatchers and two western gulls were seen at the main site. At the *Hesperophycus* site, one black oystercatcher, one American oystercatcher and one hybrid were observed. No marine mammals were observed near either location.

Dan, Stephen and Andrew borrowed kayaks from the seabird crew to access both Areas of the site. We worked from 1045–1350 hrs at the Area A and then moved over to the Area B at Scorpion Rock to complete the *Hesperophycus* plots. We paddled back to the Anchorage by 1430 to catch the Ocean ranger back to Ventura. Dan and Andrew photographed all plots and panoramas. Stephen started counting motile invertebrates and Andrew later helped to record. Dan searched for and measured *Pisaster ochraceus* (110 sea stars counted in 30 minutes, 76 stars measured [range=40–150mm, mode=110mm]) and *Haliotis cracherodii* (4 individuals were found and measured throughout the main entire site and 29 black abalone were located at the *Hesperophycus* reef, sizes ranged 40–150mm). Additionally, 3 *P. giganteus*, 4 *Patiria miniata* and 26 *Megathura crenulata* were seen at the main site. Dan also counted motile invertebrates in three plots in an effort to expedite the process. Mussel measurements were not conducted due to absence of mussels in the plots.

Throughout Area A, Dan noticed that *Mytilus* were scarce (only one small patch was observed next to plot 810). Heavy *Tetraclita* and *Balanus* cover as well as dense *Strongylocentrotus purpuratus*, *Anthopleura* and *Endocladia* were also seen at various locations throughout the site. At Area A, barnacle plots had 13.4 % mean barnacle cover and 4.4 % mean *Endocladia* cover. Most barnacle plots had at least one *Lepidochitona*, *Pachygrapsus*, large limpet, *Nucella emarginata*, and *Ocenebra circumtexta* counted within. *Littorina* snails were moderately abundant in the barnacle plots. *Endocladia* plots had 58.8 % mean *Endocladia* cover and similar abundances of all the motile

invertebrate species found in the barnacle plots except *Ocenebra circumtexta* which were slightly more abundant in the *Endocladia* plots. *Tetraclita* and *Mytilus* plots had similar abundances of *Tetraclita* (means= 39 % and 41.6 % in *Tetraclita* and *Mytilus* plots, respectively). Mussels only comprised 1 % of one *Tetraclita* plot and were absent from all other plots including mussel plots. *Mazzaella* comprised 13.8 % of *Tetraclita* plots and 16.6 % of *Mytilus* plots. *Mytilus* plots also had moderate abundances of articulated corallines (mean= 19.8 %). Abundances of motile invertebrate species such as *Lepidochitona*, *Nuttalina*, *Fissurella*, *Pachygrapsus*, and *Ocenebra circumtexta* were comparable within the *Tetraclita* and mussel plots with *Ocenebra* being the most common (mean=approx. 32.8 individuals/plot). Mussel plots also had moderately-high numbers of purple urchins (mean= 23 /plot).

At Area B, the *Hesperophycus* plots had 29.2 % mean *Hesperophycus* cover, 5.2 % mean *Silvetia* cover and 33.2 % mean *Endocladia* cover. At least one *Lepidochitona*, *Nuttalina*, *Pachygrapsus*, large limpets, *Nucella emarginata*, and *Acanthina* were counted in 2–3 plots within the *Hesperophycus* plots.

November 23, 2011, South Frenchy's Cove, Anacapa Island.

Low tide –1.0 ft at 1421 hrs. Weather conditions were clear and sunny with low wind and surge. Water temperature was 16.8 °C. Three black oystercatchers were the only birds observed at the site. One harbor seal was in the water but no others were seen ashore even before our arrival.

Dan, Stephen, Andrew and Connie worked from 1100–1515 hrs. Dan and Andrew worked together to photograph the plots and panoramas. Connie recorded for Stephen as he counted motile invertebrates in the plots. Dan scored photoplots with Andrew recording, measured mussels in the *Mytilus* plots and made repairs. Stephen counted sea stars finding 27 during a 30-minute search, but did not measure due to low abundance of individuals. He also observed 6 *Cancer antenarrius*, 2 *Pugettia producta* and 1 *Thetys vagina* among other more ubiquitous organisms. Zero *Haliotis cracherodii* were located during the 30-minute search conducted primarily for *Pisaster ochraceus*. Dan measured *Lottia gigantea* in plot one and Stephen measured *L. gigantea* in the other two plots while Connie recorded. N=2, 10, and 6 limpets were measured in plots 1–3, respectively. Abundances were remarkably similar to those measured in spring 2010. Sizes ranged 26–58 mm.

Ulva was common in the upper intertidal and reds were lush and abundant in the lower intertidal. Unlike last year, the rockweed plots appeared to be well-populated with *Silvetia*. The temp logger was located and collected. We will replace the logger during the next site visit. It was buried under a massive colony of *Phragmatopoma* last spring.

Mean barnacle cover in the barnacle plots was 16.2 %. Motile invertebrates were rarely encountered in most plots, particularly the barnacle and *Endocladia* plots. *Pachygrapsus* (1–3 individuals) was seen in almost every *Chthamalus* plot. *Littorina* spp. ranged 0–84 individuals/20x20cm quadrats in the barnacle zone and zero littorine snails were seen in the *Endocladia* plots. *Endocladia* cover was relatively high in the barnacle zone (39.4 %) and the *Endocladia* zone (76.2 %). *Silvetia* accounted for 51.8 % of the mean cover in the *Silvetia* plots. The rockweed zone supported at least one *Nuttalina*, *Lepidochitona*, *Pachygrapsus*, medium and large-sized limpets, *Acanthina* and *Tegula*

gallina in several of the plots. Mean cover of mussels in the *Mytilus* plots was 86.6 %. *Nuttalina*, *Pachygrapsus*, *Nucella* and *Acanthina* were *relatively* common in some of the mussel plots.

The sand level was fairly high between the reefs. *Phyllospadix* and various sand loving algae were common in the sand channels. Several of the plot corners were difficult to find due to the abundant growth since last spring including thick *Endocladia* and *Mytilus*. *Anthopleura elegantissima* was present along the channel wall near plot 260. On the north side there were abundant small anemones, *Diadumene* sp. in the pools. A few *Beroe* were found in the pools and along with the *Thetys* indicate quantities of jelly plankton in the waters nearshore.

San Miguel Island, December 7–13, 2011

(Database event #2011-H)

Prepared by Stephen Whitaker

Purpose:

To conduct standard intertidal monitoring protocols at the four sites located on Santa Miguel Island.

Personnel:

- Dan Richards, Marine Biologist, Channel Islands National Park
- Stephen Whitaker, Bio-tech, CHIS
- Dani Lipski, CINMS

Procedure and General Observations:

We flew out to the west end of the island on 12/7 to monitor Otter Harbor and then hiked back to the Ranger Station to stay for the remainder of the trip. Standard procedures were used for monitoring rocky intertidal sites. All plots and site overviews were photographed with a Panasonic Lumix digital camera. Photoplots were scored in the field. Counts were made of all motile invertebrates inside the photoplots. Thirty-minute searches were conducted to count seastars and black abalone at all sites. The maximum number of shorebirds and pinnipeds observed at each site was recorded.

7 December 2011, Otter Harbor.

Low tide 0.0 ft at 1428 hrs. Conditions were excellent with light wind (<5mph) and low surge. We landed on the Dry Lake airstrip about noon and proceeded directly to the site. There were six western gulls and four black oystercatchers. Forty-seven harbor seals and one elephant seal were present on the reef. As during past visits there, one harbor seal was very tolerant of us and remained on the reef the entire time. We arrived at the site at 1300 and worked until 1700.

Stephen counted motile invertebrates in the photoplots with the aid of Dani recording. Dan photographed plots and panoramas then searched for tagged abalone and conducted timed counts for black abalone and sea stars. Maximum shell length was recorded for all tagged abalone and pit tags were read with a Biomark pocket reader. His searches resulted in 30 tagged black abalone (5 tags were defective) (sizes ranged 87–165mm), 149 black abalone located in 1 hour 50 minutes across the entire reef (Dan noted that noticeably fewer abalone were present in crevices compared with past visits) and 110 *Pisaster ochraceus* in 30 minutes. Two *P. giganteus* and one *Leptasterias* were also

seen during the sea star search. *P. ochraceus* sizes ranged 70–160mm with the majority measuring 160mm. Dan also scored plot 374, but did not have time to score others on this visit. We returned to the site on 12/11 to complete scoring of all photoplots and limpet plots and measure mussels in the mussel plots.

8 December 2011, Crook Point.

Low tide –0.3 ft at 1500 hrs. Conditions were generally good with moderate wind (15mph out of west), clear skies and light swell (1–2' NW). There were 35 cormorants, 2 western gulls, 6 black oystercatchers, 8 black turnstones, 1 whimbrel, 3 western sandpipers and 9 elephant seals at or near the site upon arrival. Very few seals were present on the beaches, but several elephant seals were piled together on the sand at the gap between the reefs and a couple individuals were floating in the channel. One dead harbor seal pup was seen in the gap between reefs. We arrived at 1200 and worked until 1700. The temperature logger was not downloaded.

Dan photographed plots and panoramas at the site then proceeded to score plots and search for abalone and sea stars. Stephen counted motile invertebrates in the plots and measured sea stars and mussels. Black abalone were counted, measured and recorded in bins of nearest neighbor distance (touching, 1–10cm, 11–50 cm, 51–100 cm, 1–5 m, and >5 m). A total of 36 abalone were located ranging 65–160mm in length (5 individuals were not measured). Most were within 1–10cm apart from each other. Seventy-two *Pisaster ochraceus* were counted during a 40-minute search of the entire outer reef conducted concurrently with the abalone search. Sizes of sea stars ranged 40–160mm with a size frequency mode equal to 110mm.

Barnacle plots had 40% mean *Balanus/Chthamalus* cover. The majority of space in all five plots was unoccupied bare rock. Motile species within the barnacle plots were limited to low counts of small-medium sized limpets and moderate numbers of littorine snails. *Endocladia* plots averaged 16.4% *Endocladia*. Plot 387 was occupied by a relatively diverse community of algae and plot 389 had 51% *Mytilus*. Motile inverts were also minimally present in the *Endocladia* plots with very low sightings of chitons, shore crabs, *Nucella* and *Tegula funebris*. The *Endocladia* plots had low numbers of small limpets, moderate counts of littorines and numerous medium sized limpets. *Silvetia* was hardly present in the representative plots with only 3% measured in plot 398. Mussels were common in *Silvetia* plots (mean=24%). Plot 397 was 100% *Mytilus*. Motile inverts in the *Silvetia* plots were limited to low numbers of littorine snails and small-medium sized limpets. Mussels averaged 81% in the *Mytilus* zone. *Nucella* and limpets occurred in low abundance within the mussel plots. Other motile organisms were scarce in the plots.

Dan's observations of the reef: no change from last year, normal overall. *Cladophora* and *Ulva* common on outer reef, small tufts of *Analipus japonica* scattered throughout outer reef. *Polysiphonia* and *Microcladia borealis* common. *Codium fragile* and *C. setchellii* present. *Pollicipes*, *Anthopleura xanthogrammica* and *Dodecaceria* common. Abundant large *Mytilus* present on outer reef.

9 December 2011, Harris Point.

Low tide –0.5 ft at 1532 hrs. Conditions were mostly unworkable with moderate wind (10–15mph NW), clear skies and large long-period swell that washed over most photoplots near plot 435 the

entire afternoon. There were 2 black oystercatchers and 5 harbor seals present when we arrived. One harbor seal had a plastic ring or net wrapped tightly around its neck. We arrived at the site at 1200 and departed at 1700.

All photoplots and panoramas were shot by Dan. Dan also measured *Lottia gigantea* in the plots, searched for abalone and repaired photoplots. Stephen counted motile invertebrates in the plots that were not affected by the swell which were mostly located on the western side of the site. We returned to the site on 12/12 to completely sample the photoplots for percent cover of sessile taxa and total number of motile invertebrates.

Eight black abalone were located throughout the site, but the search was compromised by the large swell. None of the abalone were seen close to each other. One individual (110mm) was observed in plot 443 and one was in the crevice transect. *Lottia gigantea* numbers were reduced in all plots except L4 with only n=3, n=8, n=13, n=43 and n=13 limpets in plots 1–5, respectively. Sizes of *L. gigantea* were relatively small (range=14–78mm, mode=35mm). Numerous large *L. limatula* were observed in the plots, however. Twenty-one *Pisaster ochraceus* (most measuring approximately 160mm) were seen throughout the site during the 30-minute search. Additionally, 1 *Pycnopodia* and 4 *Patiria* were located.

Barnacles (primarily *Balanus* spp.) averaged 80% in the representative plots. Motile invertebrates were scarce in the barnacle plots with the exception of littorine snails. Mean *Endocladia* cover in the representative plots was 32%. Barnacle cover was moderately high (21.6%) in the *Endocladia* plots. Medium sized limpets and littorine snails were the only motile taxa that occurred in moderate abundances; all other taxa were scarce or nonexistent. *Hesperophycus* plots were primarily dominated by 41% mean *Hesperophycus*, 18% *Endocladia* and 7% barnacle cover. Four out of five rockweed plots had 2–14 *Nucella emarginata* and all had moderate abundances of littorine snails among other less abundant motile organisms. *Mytilus* plots mostly had 26.6% mean mussel cover and 17% mean *Balanus/Chthamalus* cover. High numbers of *Nucella emarginata* (counts ranged 7–62) were found in most of the *Mytilus* plots. Additionally, a couple mussel plots had 8–11 large limpets and 8–44 purple urchins. Littorine snails were surprisingly common in the *Mytilus* plots. *Tetraclita* plots were mostly colonized by 22.6% mean mussel, 13.4% mean *Tetraclita*, 7.6% mean non-coralline and 6.4% mean articulated cover. The same plots harbored quite a diverse and abundant assemblage of motile invertebrates. Most *Tetraclita* plots had 1–5 *Lepidochitona*, 6–30 *Nuttalina*, 7–34 large limpets, 15–37 *Nucella*, 3–15 *Lottia gigantea* and moderate numbers of medium-sized limpets.

10 December 2011, Cuyler Harbor.

Low tide –0.6 ft at 1605 hrs. Conditions were mostly workable despite the powerful long-period swell (8–10' NW) in the water. Wind was moderate (10mph). Two black oystercatchers and six black turnstones were observed at the site upon arrival. On Cuyler Beach, nine elephant seals, five black oystercatchers and two dead sealions were seen. We traversed the bluff above the middle rocks to access the site due to the high swell arriving at 1150 and departing at 1700.

Dan photographed plots and panoramas at the site then proceeded to score plots and search for abalone and sea stars. Stephen counted motile invertebrates in the plots and measured mussels. No abalone and 62 *Pisaster ochraceus* (sizes ranged 40–180mm, mode=130mm) were found throughout the entire site during a 30-minute search.

Barnacle cover averaged 43.6% and mean *Endocladia* cover was 21.2% in the barnacle plots. *Nucella* were present in all but one barnacle plot (plot 420) and littorine counts were high in all plots except the same plot. *Endocladia* plots had 35% mean *Endocladia* cover and a relatively diverse assemblage of motile organisms including 4–13 *Nucella* and 4–19 *Tegula funebris* in most plots. *Silvetia* was only present (35–58%) in two rockweed plots. Dominant taxa in the *Silvetia* plots were barnacles (13.8%), *Endocladia* (12.4%) and *Mazzaella* (3.6%). *Nucella* were abundant in the *Silvetia* plots ranging 2–24 individuals per plot as were *Tegula funebris* in two plots (n=17–26). *Mytilus* plots had 66.4% mean mussel cover and 7.6% mean *Phragmatopoma* cover among other less dominant taxa. The same plots had 4–25 *Nucella* and 3–21 *Nuttalina* per plot as well as markedly fewer occurrences of several other motile taxa.

11 December 2011, Otter Harbor.

Low tide –0.6 ft at 1605 hrs. Conditions were mostly cloudy with light wind (5mph, NW) and high swell/surge (4–6' NW). Five cormorants, 5 black oystercatchers, 1 American oystercatcher and 11 harbor seals were present at the site when we arrived at 1140. We departed at 1630. The purpose of revisiting this site was to complete monitoring that was left unfinished on 12/7.

Dan scored all the photoplots and measured *Pisaster ochraceus* while Stephen repaired plots, measured *Lottia gigantea* and mussels.

Mean barnacle cover was 43.6% in the barnacle plots. Plot 374 has been dominated by red algae for many years and continues to be composed primarily of *Chondracanthus* and *Mazzaella*. Littorine snails were the only motile invertebrates that occurred in relatively moderate abundance in the barnacle plots aside from *Tegula funebris* and *Pagurus* that are highly numerous in plot 374. *Endocladia* plots had 37.4% mean *Endocladia* cover along with scant abundances of other taxa. Most *Endocladia* plots had 1–5 *Lepidochitona*, 3–9 large limpets, and moderate abundances of medium-sized limpets. *Silvetia* plots only had *Silvetia* present in two plots (1–4%). The rockweed plots were instead dominated by 33.2% barnacle, 16.8% *Endocladia* and 6.8% *Mazzaella* cover. Three of the *Silvetia* plots had large limpets present (n=4–37) and all had moderate abundances of littorine snails and medium-sized limpets. *Mytilus* plots had 45.4% mussels, 12.4% non-coralline crust, 8.4% articulated corallines and 8% coralline crusts among other less common taxa. The most common motile taxa in the mussel plots were *Nucella* (n=7–26) and *Lottia gigantea* (n=1–12).

12 December 2011, Harris Point.

Low tide –0.5 ft at 1714 hrs. Conditions were conducive to sampling with light wind and decent sea conditions despite the medium-heavy long-period swell activity that rolled in intermittently. It rained overnight 0.28". Squalls were present along the mainland and a water spout was seen near the Gaviota coast.

Dan completed the plot scoring and Stephen finished counting motile invertebrates in the photo plots. See information above detailing the first visit to Harris Point for description of photo plots.

Anacapa/Santa Cruz Island December 20–21, 2011

(Database event #2011-I)

Prepared by Stephen Whitaker

Personnel:

- Dan Richards*, Marine Biologist, Channel Islands National Park
- Stephen Whitaker*, Biotech, CHIS
- Andrew Domingos, Biotech, CHIS
- Stacey Osterman-Kelm, NPS Inventory and Monitoring Program
- Connie Jenkins*, VIP
- Danielle Lipski*, Channel Islands National Marine Sanctuary

*Indicates person was present on both monitoring days.

Procedure and General Notes:

The CINMS R/V Shearwater provided transportation to and from both sites. We conducted day trips from Ventura. Orizaba Cove at Santa Cruz Island and Cat Rock at Anacapa Island were monitored. We had planned on monitoring Anacapa Middle West and East on 12/22 but conditions were not conducive to sampling due to strong northeast wind that negatively affected the channel crossing and sampling conditions at the site. Standard procedures were followed for photographing fixed plots and counting motile invertebrates in the plots. However, only a subset of plots (5 randomly chosen plots per zone) from each zone at Cat Rock were sampled. Percent cover of photo plots was determined in the field at Orizaba Cove but only half of the plots were field-scored at Cat Rock. Black abalone, *Haliotis cracherodii*, and seastars were counted in 30-minute searches, but most abalone were only measured for size distribution at Orizaba Cove since abundances were insufficient at Cat Rock. Owl limpets, *Lottia gigantea*, were measured in fixed one-meter radius plots at Cat Rock. The highest number of shorebirds and pinnipeds seen was recorded at both sites.

Results (Daily and Site Description)

December 20, 2011, Orizaba Cove.

Low tide –0.1 ft at 1241 hrs. Light wind and medium-sized swell; good sampling conditions. Water temperature was not measured. One black oystercatcher and two black turnstones were seen at the site in addition to two harbor seals.

The Shearwater departed Ventura at 0930 and arrived at the site around 1100. We departed Orizaba Rock at 1600. Jeremy Long, a professor at San Diego State University, and one of his students (Laura Porturas) visited the site to gain a better understanding of island logistics for a possible future project, but did not assist in the routine sampling.

Dan worked with Stacey to photograph all plots and panoramas. Stacey volunteered her assistance on this trip to gain a better understanding of the intertidal program. Stephen counted motile invertebrates and Connie recorded for most plots. Stacey later helped to record for several plots. Andrew and Dani searched for and measured *Pisaster ochraceus* (380 sea stars counted in 30 minutes, 104 stars measured [range=60–130mm, mode=100mm]) and *Haliotis cracherodii* (66 individuals were found and measured throughout the entire site [48 black abalone were seen in 30 minutes], sizes ranged 23–123mm). Mussel measurements were not conducted due to absence of mussels in the plots.

Throughout the site, Dan noticed that *Mytilus* were scarce and the plots were dominated by coralline algae and *Mazzaella affinis*. *Tetraclita* and *Balanus* were densely populated throughout much of the site and *Strongylocentrotus purpuratus* were abundant below the zero tide line. Barnacle plots had 63.8 % mean barnacle cover and little else aside from bare rock cover. All barnacle plots were devoid of motile invertebrates aside from moderate numbers of medium-sized limpets and littorine snails. *Hesperophycus* plots had 29.8 % mean *Hesperophycus* cover, 21.4% mean *Endocladia* cover, 14.6% barnacle cover and 6.8% *Mazzaella* cover among other less abundant taxa. *Ocenebra* counts ranged 4–20 in 4 out of 5 *Hesperophycus* plots. Although other motile spp. were present in the *Hesperophycus* plots, most occurred in low abundances if at all with the exceptions of medium-sized limpets and littorines. Motile invertebrate assemblages in the *Silvetia* plots were similar whereby 2–10 *Ocenebra* occurred in 4 of 5 plots and most other spp. were scarce aside from 1–17 *Nucella* present in each plot. *Silvetia* cover accounted for 21.6% of the average cover in the representative plots. Other common species in the *Silvetia* plots were *Ulva* (33%), *Endocladia* (10.6%), barnacles (8.6%) and *Mazzaella* (6.6%).

Tetraclita and *Mytilus* plots had measurable abundances of *Tetraclita* (means= 33.4 % and 10.2 % in *Tetraclita* and *Mytilus* plots, respectively). Mussels only comprised 1–5 % of two *Tetraclita* plots and 1% of one plot in the mussel zone. *Mazzaella* comprised 11.4% of *Tetraclita* plots and 21.8 % of *Mytilus* plots. *Mytilus* plots also had moderate abundances of articulated corallines (mean= 39.8 %) and *Tetraclita* plots were moderately populated with *Ulva* (23.6% mean cover). The most abundant motile taxa in the *Tetraclita* plots were *Ocenebra* (range= 3–19 individuals/plot) and *Nuttalina* (range= 0–21 individuals/plot). Mussel plots had high numbers of purple urchins (2–83 individuals/plot) and several *Ocenebra* (0–8 individuals/plot) among other scarcely present taxa. Interestingly, one black abalone was present in plot 863 and one *Megathura* was seen in plot 862.

December 21, 2011, Cat Rock, Anacapa Island.

Low tide –0.7 ft at 1334 hrs. Weather conditions were clear and sunny with no wind and light surge. Water temperature was not measured. Eight black oystercatchers, four western gulls, one American oystercatcher and black phoebe were observed at the site. One harbor seal weiner was in the water but no others were seen ashore even before our arrival. Risso's dolphins were seen offshore.

The Shearwater departed Ventura at 0930 transporting us to the site around 1050. Dan, Stephen, Dani and Connie worked until 1600. Dan and Dani worked together to photograph the plots and panoramas. Connie recorded for Stephen as he counted motile invertebrates in five randomly chosen plots in each zone. Dan walked to South Frenchy's Cove to replace the temperature logger then returned to score 18 photo plots and measure mussels in the *Mytilus* plots. *Pisaster* were sampled by

Dani (N=14 seen in 30 minutes ranging 60–140mm). Black abalone were also sampled by Dani (N=11 located throughout the site). Most individuals were not measured. Owl limpets were counted in the circular plots by Dan and Stephen whereby N=45, 29, 6 were seen in plots 1–3, respectively. Sizes of owl limpets ranged 15–60mm.

Barnacle cover within the *Balanus/Chthamalus* zone averaged 27.9% and mean *Endocladia* cover was 30.6%. Barnacle plots had few motile invertebrates present other than *Acanthina* (1–9 per plot) and moderate to high numbers of littorine snails. *Endocladia* plots had 32.2% *Endocladia* and a relatively diverse assemblage of other taxa that each occurred in low abundances. *Nuttalina* were common (8–44 per plot) in the *Endocladia* plots as were *Ocenebra* (0–17 per plot) and *Lepidochitona* (3–7 per plot) to a lesser degree.

In the *Silvetia* plots, *Endocladia* was the most common (44.2%) space occupier followed by *Hesperophycus* (11%) and *Silvetia* (7.9%). *Mytilus* plots had 36.7% mean mussel cover, 15.8% *Tetraclita*, 13.8% articulated corallines and 8.8% *Gelidium/Pterocladia* cover. Motile invertebrates were uncommon in the rockweed zone, but quite numerous in the mussel plots. *Ocenebra* ranged 11–17 per plot. Additionally, there were 8–29 *Nuttalina*, 2–13 *Lottia gigantea* and 0–5 *Lepidochitona* located throughout the *Mytilus* plots.

Santa Cruz Island January 6–10, 2012

(Database event #2011-J)

Prepared by Stephen Whitaker

Personnel:

- Dan Richards, Marine Biologist, Channel Islands National Park
- Stephen Whitaker, Biotech, Channel Islands National Park
- Andrew Domingos, Biotech, Channel Islands National Park

Procedure and General Notes:

We used Island Packers transportation to Santa Cruz Island and returned via the NPS Ocean Ranger. This work was performed in part at the University of California Natural Reserve System, Santa Cruz Island Reserve on property owned and managed by The Nature Conservancy. We stayed at the UC Natural Reserve System, field station. Standard procedures were used for monitoring rocky intertidal sites. All plots and site overviews were photographed with an Olympus Stylus 1030SW digital camera. Most photoplots were scored in the field. Sea stars and black abalone were counted at all sites. Surfgrass transects were sampled at Trailer and Fraser Cove. *Lottia gigantea* were counted and measured in fixed plots at Willows Anchorage, Trailer and Fraser Cove. The maximum number of shorebirds and pinnipeds observed at each site was recorded. Hobotemp Tidbit temperature loggers were downloaded. Motile invertebrates were counted in photoplots at all four sites visited on this trip.

6 January, Prisoners Harbor

Low tide –0.4 ft at 1437 hrs. Air temperature was 17.4° C, clear sky, light wind, and 2–3' swell in the harbor (large NW swell in the channel made for a rough crossing). The scoring quadrat was swept off

the reef and lost to waves that continuously wetted the site particularly on the north-facing side. Water in bay was murky. Two black oystercatchers and one unidentified sandpiper were seen on the reef. One harbor seal was seen in the cove during our visit from 1245–1700 hrs.

As observed last year, *Chthamalus/Balanus* cover was dense within a narrow band along the reef. *Endocladia* was scarce but appeared healthy. Rockweed cover was low overall, but recruitment was observed from both species, particularly *Hesperophycus*. Dan again noticed that rockweed cover was often higher in areas outside of plots. *Scytosiphon dotyi* densely covered much of the western reef particularly in the upper intertidal obscuring barnacles. *Mytilus* were very scarce. A patch of mussels was observed inshore of plot 841 with most individuals measuring 20–30 mm and the largest equal to 55 mm. Less than 10 percent were estimated to be *M. galloprovincialis*. *Chondracanthus leptorhynchus* and *Laurencia pacifica* were common in the *Mytilus* zone.

Andrew and Dan photographed the plots and site. Stephen counted motile invertebrates in the plots with Andrew recording. Dan assisted with the counts for the last several plots (*Hesperophycus* and *Silvetia* zones). Dan scored six plots, but a wave swept the scoring quadrat off the site near plot 844 making it impossible to score the remaining plots. He recorded notes on species distributions within plots to facilitate scoring plots in office. Dan counted and measured 16 *P. ochraceus* (range=80–140mm), 3 *P. giganteus* and 1 black abalone (104mm) during a 30-minute search of the entire site.

The barnacle plots had 20% mean *Balanus/Chthamalus* cover. *Ulva* was moderately abundant (mean=18%) in the barnacle zone. Motile invertebrate species counts were typical of the barnacle zone with moderate counts of littorines and low numbers of small to medium-sized limpets.

The *Endocladia* plots had 53% mean *Endocladia* cover (more than twice the abundance measured last year). Barnacles (mean=22%) were also common in the five plots. Littorine snails were moderately abundant as were *Acanthina* spp. (mean=12.8) and *Nucella emarginata* (mean=11.2). *Tegula funebris* and *Ocenebra* were relatively numerous in at least two *Endocladia* plots.

Only two *Mytilus* plots had mussels present (both plots measured 2%). *Phragmatopoma* (mean=29%), Articulated corallines (mean=22%), *Chondracanthus* (mean=22%) and *Mazzaella affinis* (mean=14%) were the most abundant assemblages and species in the mussel zone. Aside from 0–10 *Nuttalina*, motile invertebrates were scarce in the mussel plots.

Silvetia zone only had *Silvetia* in three plots (mean=9%). *Endocladia* (mean=6%) and *Mazzaella* (mean=10%) were moderately abundant. Motile invertebrates were not particularly common in any of the *Silvetia* plots.

Hesperophycus plots only had 3% mean *Hesperophycus* cover. Mean barnacle and *Endocladia* cover was 41% and 21%, respectively. Littorine snails were moderately abundant but other invertebrates with the exception of *Tegula funebris* (mean=6) and *Acanthina* (mean=18) were uncommon.

7 January, Willows Anchorage

Low tide –0.6 at 1508 hrs. Light swell/surge and wind made for pleasant sampling conditions. Two black oyster catchers were seen at the site and hundreds of gulls were observed at the offshore rock

along with at least one more black oystercatcher. Marine mammals were not observed at or nearby the site. We were on site from 1045 to 1700 hrs.

Dan and Andrew shot photos of the plots and site. Stephen counted motile invertebrates in the plots with Andrew later recording. Dan counted 315 black abalone in 30 minutes after scoring all photoplots. Only 51 abalone (mostly tagged) were measured. A total of 21 tagged abalone were found, but four of those tags were not functioning. One fresh black abalone shell (54mm) was found. Stephen counted 481 *P. ochraceus* in 30 minutes and measured 68 individuals (sizes ranged 60–150mm, mode=80–90mm). *P. giganteus* and *Patiria* were noted to be present. Stephen sampled the *Lottia gigantea* plots with Andrew recording. Abundances were n=63, 33, 44, 12 and 3 in plots 1–5, respectively. The temperature logger was downloaded during this visit.

Mean *Endocladia* cover in the *Endocladia* plots was 67%. *Silvetia* and *Hesperophycus* were absent from all but one to two plots in each of their representative zones. *Endocladia* (mean=39%) and coralline crusts (mean=42%) occupied most of the space in the *Hesperophycus* plots. The *Silvetia* plots had relatively high cover of *Endocladia* (mean=33%) and *Mazzaella* (mean=13%) compared with other space-occupying species. Mean cover for *Mytilus* in the mussel plots was 63%. Articulated corallines occupied 11% of the mussel pots.

Littorine snails were common in all zones except *Mytilus*. Small and medium-sized limpets were common in most plots. Diversity of motile invertebrates was relatively high in most plots except those in the *Hesperophycus* zone. All of the mussel plots had numerous purple urchins.

8 January, Trailer

Low tide –0.8 ft at 1538. Northwest swell was still fairly large and impacting Fraser Cove so we worked at Trailer. The mussel plots were occasionally wetted when we arrived but entire site was workable during low tide. Three black oystercatchers were seen at the reef at arrival.

Dan and Andrew shot photos of the plots and site. Stephen counted motile invertebrates and drove over to Fraser to photograph the rockweed plots. Dan scored photo plots and surfgrass transects. Overstory cover of surfgrass was 80, 61 and 31% in the three consecutive transects, respectively. Surfgrass was healthy along the transects but a few large patches of bleached grass were seen around the site. Andrew counted 152 *P. ochraceus* in 30 minutes and measured 62 individuals (sizes ranged 40–120mm). Dan counted 41 black abalone in 30 minutes covering the site from the mussel plots to the large boulders and noted that a fair number of abalone were present on the south reef. *Lottia gigantea* plots sampled by Dan had n=15, 15, 0, 7 and 0 in plots 1–5, respectively.

Balanus and *Chthamalus* were common in the barnacle plots (mean=46%). *Silvetia* was common (mean cover=53% in the *Silvetia* plots) and appeared healthy. *Hesperophycus* was scarce (mean cover=11% in the *Hesperophycus* plots). *Endocladia* appeared thick and healthy (mean cover=14% in the *Hesperophycus* plots).

Tegula funebris were highly abundant in the rockweed zone (*Silvetia* plots had 56–127 per plot and *Hesperophycus* plots had 8–42 individuals counted in 4/5 plots). *Silvetia* plots also supported 1–13 *Acanthina* per plot among other less abundant motile invertebrates. *Mytilus* plots were predominantly

occupied by *Nuttalina* (4–13 individuals observed in 4/5 plots) and *Nucella* (1–12 snails seen in 4/5 plots). Purple urchins numbered 9–19 in two of the mussel plots. A total of 12 *Tegula gallina* was counted throughout all of the plots.

9 January, Fraser Cove

Low tide –0.8 ft at 1608. Surf was high when we arrived at 1030 but we were able to work safely as the tide dropped. Thirteen black oystercatchers were seen at the site. Two eared grebes, two harbor seals and a sea lion were observed swimming in the cove. An American oystercatcher was seen the day before. At Forney, several hundred gulls were observed apparently feeding on the numerous squid eggs seen washed up on the shore. We monitored the sites from 1200 to 1745 hrs.

We started working at the Fraser plots. Dan and Andrew photographed the plots and site. Stephen counted motiles with Andrew recording. Dan and Andrew counted *Pisaster* (n=193) (range=70–160mm, mode=120mm) and abalone (n=1, size =70mm) for 30 minutes. Dan scored all the photo plots and surfgrass transects at Fraser and measured mussels. Overstory cover of surfgrass was 63, 60 and 82% in the three consecutive transects, respectively. Ninety-nine percent of the surfgrass in transect-1 was bleached. Stephen went to Forney to count motile invertebrates in the rockweed plots. Additionally, he scored all but four of the rockweed plots for sessile species cover.

Barnacle cover averaged 44% in the barnacle plots. Mean *Endocladia* cover was 57% throughout the *Endocladia* zone. *Silvetia* comprised 22% of the total cover in the *Silvetia* plots and *Hesperophycus* mean cover was 26% in the representative zone. Mean *Endocladia* cover was 22% in the *Silvetia* plots and 24% in the *Hesperophycus* zone. The *Pollicipes* plots only had a mean cover of 14% for *Pollicipes*, but *Mytilus* were fairly abundant throughout averaging 39%. *Phragmatopoma* was present in 4 out of 5 plots averaging 12%. *Mytilus* cover averaged 69% in the mussel plots. Tar cover in the tar plots averaged 41%.

Littorine snail counts were moderate to highly-abundant in the barnacle and tar plots. An average of 15 *Nucella emarginata* per plot was observed in the *Pollicipes* and *Mytilus* zones. *Tegula funebris* were most abundant in the rockweed zones averaging 15 and 22 individuals in the *Hesperophycus* and *Silvetia* plots, respectively. However, barnacle and *Endocladia* plots also had low to moderate abundances of *T. funebris*.

Santa Rosa Island, January 17–24, 2012

(Database event #2011-K)

Prepared by Dan Richards and Stephen Whitaker

Purpose:

To monitor rocky intertidal sites at Santa Rosa Island.

Personnel:

- Dan Richards, Marine Biologist, Channel Islands National Park
- Stephen Whitaker, Bio-tech, CHIS
- Connie Jenkins, volunteer

- Jessie Altstatt, volunteer

Procedure and General Observations:

Dan was on island for snowy plover surveys and the others came out on the Park boat. Standard procedures were used for monitoring rocky intertidal sites. All plots and site overviews were photographed with an Olympus Stylus 1030SW digital camera. Photoplots were scored in the field at East Point, Northwest Talcott, and part of Fossil Reef. Sea stars and black abalone were counted at all sites except Fossil Reef. Surfgrass transects were read at Northwest Talcott and East Point. *Lottia gigantea* were counted and measured in fixed plots at Johnson's Lee, Fossil Reef, and Northwest Talcott. The maximum number of shorebirds and pinnipeds observed at each site was recorded. Hobotemp Tidbit temperature loggers were downloaded at Northwest Talcott and Fossil Reef. Mussel sizes and mussel bed depth were measured at Johnson's Lee, East Point and Northwest Talcott.

1/17/12. Johnson's Lee.

Low tide +0.5 ft at 1145. After arriving on island and putting away food we went to Johnson's Lee, arriving about 1330. We hadn't planned to do monitoring today but rain was predicted for the weekend and we were not sure if we would be able to visit all the sites. Despite the incoming tide we had pretty good working conditions though the lowest parts of the reef were inaccessible during the seastar and abalone counts. The weather was excellent: calm and clear. There were three western gulls, 10 black turnstones and 2 black oystercatchers on the reef. Two immature bull elephant seals and a yearling seal were sleeping on the sand behind the reef. Water temp was 14.2.

There was not enough time to field score the plots but most of the plots should be straightforward to score from the images. I was unable to open the temperature logger housing. A pipe wrench is probably needed to get the cap off. It has been buried under *Phragmatopoma* since at least last March when we could not even find it. No repairs were made but only one corner was a problem. The bolts marking the *Lottia* plots should be replaced soon as the silicon bronze bolts have worn down to thin wires.

Phragmatopoma was abundant on the lower shelf but there were openings in the mats and the tubes were not very large on top of the plots there. Mussels on the higher shelves looked good and were abundant. *Balanus/Chthamalus* were both abundant. *Endocladia* was common but patchy. Connie counted 142 *Pisaster ochraceus* in 30 minutes but the count was started three hours after the low tide. No seastar measurements were taken. The same with the abalone count and Dan only found three black abalone. The splash zone plots had a few *Littorina* and some cyanobacteria but nothing else. A total of 37 *Lottia gigantea* were found in the five one-meter radius plots.

1/18/12. Fossil Reef.

Low tide -0.2 ft at 1248 hrs. Water temperature was 13.1. There were elephant seals on the adjacent beach but nothing on the monitoring reef. Birds on the reef included about 50 western gulls when we arrived, 6 Brandt's cormorant, 2 black turnstones and 2 black oystercatchers. There were several urchin diving boats in the area between Sandy Point and Bee Rock.

We completed most of the sampling at Fossil Reef. The temperature logger was successfully down loaded. Only the five mussel plots were field-scored; the others should be relatively straightforward to score from the images. Only one point of mussel cover was recorded for the five plots which were dominated by *Phragmatopoma*, articulated coralline algae and *Ulva* sp. Mussel measurements were not done because there were essentially no mussels in the plots. Stephen counted motile invertebrates with Connie recording. *Nuttalina* sp. and *Strongylocentrotus purpuratus* were common in the mussel zone. *Tegula funebris* and *Acanthina* sp were common in the *Endocladia* and *Silvetia* zones.

Jessie helped Dan with photos and counts. In 30 minutes Dan counted 302 *Pisaster ochraceus*, 4 *P. giganteus* and 6 *Patiria miniata*. *Pisaster* sizes ranged from 50–140 mm but most were about 70 mm. Jessie measured 42 *Haliotis cracherodii* in about a 60 minute search. Dan measured 198 *Lottia gigantea* in the five plots. Sizes ranged from <15 to 91 mm. Numbers were very low in plots 1 and 2.

1/19/12. Northwest-Talcott.

Low tide –0.7 ft at 1338 hrs. Water temperature was 13.4. Air was about 12.9. Conditions were good except for a cold wind. The tide was very low so waves were not a problem. Ryan Munes came along today to see what we do and helped with recording. Jessie counted motile invertebrates while Stephen scored plots. We repaired all the missing plots corners. In the near future all the *Lottia* plot bolts should be replaced as the bronze bolts are getting worn down.

It was quite windy but the long period swell was low so the waves were not large. There were four black oystercatchers and two black turnstones in the area. Two elephant seals were using the beaches between the access and the site. Dan and Ryan did a 30 minute search of the area and found no abalone and no *Pisaster ochraceus*. We did find 18 *P. giganteus* and 6 *Patiria miniata*. We spent some time searching around the cobble and found numerous juvenile octopus, pricklyback eels, rockweed gunnels and juvenile crabs of several species. We measured 63 *Lottia gigantea* in the plots with sizes ranging from 36–106 mm.

Dan conducted the surfgrass transects and mussel measurements. Transect 3 had thin cover of surfgrass and many patches of red algae. The cover of transect 3 was 66% *Phyllospadix*; transects 1 and 2 had 96% surfgrass cover. Epiphyte cover was low especially for this site and bleaching was fairly minimal. Mussel distribution was patchy and parts of some plots did not have enough mussels to measure.

1/20/12. East Point.

Low tide –1.1 ft at 1423 hrs. The conditions were excellent with partly cloudy sky, light wind and light surf. There were about 70 Brandt's cormorants on the point when we arrived. There were five black oystercatchers and about 20 sandpipers. There was a bull elephant seal and a harbor seal that watched us from the surf zone. On the small beach north of the site there were 6 elephant seal pups and their mothers.

There were many dead barnacle tests in the *Endocladia* and *Silvetia* zone plots. Plenty of live barnacles were present though and most of the barnacle zone had dense cover. *Endocladia muricata* was abundant and high cover in the plots. *Cladophora columbiana* was dense in the rockweed zone

and a fair amount of it was bleached. *Phragmatopoma* was abundant especially in the lower mussel zone on the inner reef and in the surge channel. *Pisaster* were plentiful but not as apparent on the reef top advancing on mussels as we saw last year. *Mytilus californianus* were dense and appeared healthy on the outer reef. Only two plots are on the outer reef and those both had high cover of *Mytilus*, the inside plots were dominated by *Phragmatopoma californica*. There were some patches of mussel recruitment on the inner reef. *Nucella emarginata*, *Acanthina* sp. and *Tegula funebris* were all abundant in most plots except the barnacle zone. Limpets and *Littorina* were relatively low in number.

Dan counted 316 *Pisaster ochraceus* in a 30-minute search of the reef. Stephen measured *Pisaster* finding a range from 50–130 mm. Most were 90–100 mm. Dan found 25 *Haliotis cracherodii* in a search of the reef; sizes ranged from 65–155 mm. The surfgrass transects all had high cover (97–99%) of *Phyllospadix* sp. The surfgrass was all in good shape with only about 10% bleached blades and few epiphytes. We looked around on the reef west of the site after completing monitoring and found an extensive mussel bed there. We also found at least 10 *H. cracherodii*.

We made many plot repairs including adding bolts to mussel plots with existing worn down bronze bolts.

1/21/12.

Rain in early morning (.026 in), and high wind in the afternoon. Spent the day catching up on computer reports and nursing colds.

1/22/12. Ford Point.

Low tide –1.3 ft at 1539 hrs. Water temperature 13.2. Clear sky with occasional 5 ft surf. Light winds. Excellent conditions. There were three black oystercatchers in the area. Ford Point beach was full of elephant seals.

Dan measured *Lottia gigantea* finding a total of 17 in the six plots. Sizes ranged 18–90 mm. Many of the plots had extensive *Balanus* colonization and *Mytilus* occupies about 5–40% of all but plot 601.

Stephen scored the photoplots. There were a few *Chthamalus* in the splash zone plots but no hits occurred during scoring. Barnacle and *Endocladia* cover were moderate. *Mytilus californianus* was doing well on the middle step of the reef but was mostly absent from the lower shelf where *Pisaster* were abundant and *Phragmatopoma californica* dominated. Mussel cover was moderate. Plot 532 was dominated by *Phragmatopoma* and plot 534 was dominated by *Chondracanthus canaliculatus* and *Ulva* with *Phragmatopoma*.

Jessie and Connie counted motile invertebrates finding fair numbers of *Tegula funebris* and *Nucella emarginata*.

Stephen counted 278 *Pisaster ochraceus* in a 30-minute search. Many of the stars were under ledges or hunkered down between mussels apparently avoiding the waves. The mode of the sizes for *Pisaster* was only 70 mm. Dan measured abalone over the reef for an hour finding 50 *H. cracherodii* ranging from 50–170 mm.

1/23/12.

Moderate rain totaling about 0.6 inches through mid-day, so we were restricted to computer work.

1/24/12.

Depart island on Ocean Ranger.

The Department of the Interior protects and manages the nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors its special responsibilities to American Indians, Alaska Natives, and affiliated Island Communities.

NPS 159/173891, December 2020

National Park Service
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