



Rocky Intertidal Community Monitoring at Channel Islands National Park

2015–16 Annual Report

Natural Resource Data Series NPS/MEDN/NRDS—2021/1310



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ON THE COVER

Water rushing into the intertidal zone near Cat Rock, Anacapa Island
Photograph by: Michael Ready

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2015–16 Annual Report

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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 are 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 were recognized as special features 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 2015–16 sampling year efforts (from October 2015 to February 2016) 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, 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.

Some sites including Anacapa Middle East, Orizaba Cove, Landing Cove and Sea Lion Rookery were not monitored in 2015–16 due to a combination of inclement weather and logistical difficulties. All other sites were sampled during the fall/winter monitoring season. This was the first year that we officially reduced our sampling interval from twice per year (spring and fall) to once in the fall to streamline the program and allow for the implementation of additional protocols. Weather conditions during the site-visits were satisfactory, but high wind coupled with strong swell and surge limited or prevented the completion of some of the abalone and sea star searches.

The percent cover for most key species or assemblages targeted in the photo-plots was highly variable among sites. Mussel, *Mytilus californianus*, cover remained below average at Anacapa, Santa Barbara and Santa Rosa Islands. Record or near record-low abundances for *M. californianus*

were measured at Anacapa Middle West, East Point, Harris Point, Prisoner's Harbor, and Sea Lion Rookery. The only sites that appeared to have above average *Mytilus* cover were Cuyler Harbor, Orizaba Cove and Willows Anchorage. Most other sites had mussel cover near or below the long-term mean. Qualitatively, *Mytilus* cover appeared to be increasing at most locations as newly-recruited mussels were common. Both rockweed species, *Silvetia compressa* and *Hesperophycus californicus*, continued to decrease markedly in abundance this year at the majority of sites compared to combined averages for previous years. Barnacle, *Chthamalus/Balanus* spp., cover fell below the long-term means at all islands except Anacapa whereby barnacle cover was approximately average. *Endocladia muricata* abundances remained comparable to grand means calculated for previous years at Santa Barbara Island, while cover of the alga decreased slightly below the long-term means at Anacapa, San Miguel, Santa Cruz and Santa Rosa.

Black abalone abundances at the islands remain less than one percent of 1985 population levels. Zero abalone were found throughout the entire site at South Frenchy's Cove. Counts for black abalone were fairly consistent with the range of counts seen since 1995 at 9 of the 17 sites sampled in 2015–16. At all other sites, counts increased above the long-term mean calculated for previous years at each site. For the second consecutive year since Withering Syndrome decimated populations of black abalone, size frequencies for all islands except Santa Barbara reflected signs of recruitment through the presence of juvenile (< 50 mm) abalone.

Ochre sea star populations crashed last year at all monitoring sites due to Sea Star Wasting Syndrome, an illness characterized by a suite of symptoms that generally result in death. The mortality event was widely considered to be the largest mortality event for marine diseases ever seen. Beginning in June 2013, the disease swiftly and significantly impacted *P. ochraceus* (among other species of sea stars) populations along the North American Pacific coast from Alaska to Baja California, Mexico. By the beginning of 2014, *P. ochraceus* abundances had declined by >95% at nearly all Channel Islands long-term intertidal monitoring sites, in addition to numerous other locations along the west coast. At various times during the past decade, extremely high abundances (~ 500 *P. ochraceus*) have been observed at multiple sites, and most locations have supported >100 sea stars counted during 30-minute site-wide searches. This year, abundances ranged 0–43 individuals per site with the majority having fewer than 10 *P. ochraceus* seen during routine searches. Insufficient numbers of sea stars were seen to accurately estimate the size structure of *P. ochraceus* populations.

Giant owl limpet densities in 2015–16 were comparable or slightly below the long-term mean at all sites except Fraser Cove, Fossil Reef and Otter Harbor. At the three latter sites, owl limpet abundances were exceptionally-high relative to past years. The sizes of *L. gigantea* this year varied among sites and islands. The smallest *L. gigantea* were observed at Fraser Cove and Johnson's Lee and the largest were seen at Trailer followed closely by Northwest-Talcott. Temporally, the mean sizes of *L. gigantea* in 2015–16 decreased at Santa Cruz, Santa Rosa and San Miguel and remained stable at Anacapa relative to the cumulative mean values generated for each island population

Surfgrasses are typically monitored biannually at two sites each on Santa Cruz and Santa Rosa Islands. This year, all transects at each of the four monitoring sites were sampled during the

fall/winter season. Relative to past years, cover of surfgrass increased above the long term mean at Fraser Cove, East Point and Northwest-Talcott. Surfgrass cover at Trailer has been below average since at least 2010, but this year it increased slightly to match the long-term mean.

Overall, the abundances and diversity of shorebirds in 2015–16 at all sites appeared similar to observations made in recent years with the exception of a sharp increase in the number of cormorants at East Point. Black oystercatchers were the most ubiquitous shorebird seen at all sites. One American oystercatcher was sighted at Otter Harbor. Black turnstones were relatively common whereby a total of 19 birds were seen across four sites.

Pinniped abundances remained comparable in 2015–16 to historical counts for all three species that are commonly seen at the islands. Harbor seals, *Phoca vitulina*, were seen at in the vicinity of seven sites this year. As in past years, harbor seals were most abundant at Otter Harbor; 31 harbor seals were seen at the site in the fall. Elephant seals, *Mirounga angustirostris*, were seen at six sites during the year whereby abundances ranged 1–16 individuals per location. Only two California sea lions were seen this year; one at Harris Point and another at Otter Harbor. The sites with the greatest numbers of sea lions historically, Sea Lion Rookery and Landing Cove at Santa Barbara Island, were not surveyed this year.

Visitation to all but two intertidal sites, South Frenchy's Cove on Anacapa and Prisoner's Harbor at Santa Cruz, is low or nonexistent. Frenchy's Cove, however, receives moderate usage due to its close proximity to the mainland and relative ease of access. In 2015–16, Island Packers Company transported 318 visitors to access the tidepools at Frenchy's Cove. This was less than half the number of visitors in 2014–15 (709), and markedly less than the number in 2013–14 (560) and all subsequent years. In fact, visitation in 2015–16 was the lowest since record keeping initiated in 1993.

Acknowledgments

The National Park Service (NPS), Channel Islands National Park (CHIS) funded this program. The NPS Mediterranean Coast Network Inventory and Monitoring (MEDN I&M) Program provided support for data analyses and database assistance. Temperature loggers were provided by the Partnership for Interdisciplinary Studies of Coastal Oceans (PISCO) Marine Science Institute, University of California, Santa Barbara (UCSB) and the MEDN I&M Program.

Dr. Pete Raimondi at UCSC provided two junior biological technicians (Kenan Chan and Kate Vylet) to assist the CHIS Rocky Intertidal Monitoring Program (RIMP) during the entire field season. The two researchers helped tremendously with duties including conducting searches and measurements for black abalone, sea stars and owl limpets as well as assisting with photographing plots and site panoramas.

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 CHIS that help with the day-to-day operations.

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. Thanks to Dr. Lyndal Laughrin and staff at the UC reserve field station for their assistance. Thanks also to Carol Blanchette and others from the Partnership for Interdisciplinary Studies of Coastal Oceans (PISCO) Marine Science Institute, University of California, Santa Barbara (UCSB) and UC Santa Cruz (UCSC) for their collaboration.

We are grateful to the many people that assisted with the monitoring during the 2015–16 sampling seasons including Geoff Dilly, CSUCI; Jack Engle, UCSB; Evelyn Garcia, CSUCI; David Kushner, CHIS; Jenna Miani, CSUCI; Kathy-Ann Miller, UC Berkeley; Randy Moran, CSUCI; Dan Richards, VIP; and Josh Sprague, CHIS.

We are especially grateful for the database support that Lena Lee (MEDN I&M) provided to ensure smooth program operation.

Glossary

ANI	Anacapa Island
C	Centigrade
CDFW	California Department of Fish and Wildlife
CHIS	Channel Islands National Park
CINMS	Channel Islands National Marine Sanctuary
MARINe	Multi-Agency Rocky Intertidal Network
NOAA	National Oceanographic and Atmospheric Administration
NPS	National Park Service
PISCO	Partnership for Interdisciplinary Studies of Coastal Oceans
PVC	Polyvinyl chloride
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
SSWD	Sea Star Wasting Disease
SSWS	Sea Star Wasting Syndrome
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, biologically diverse area between marine and terrestrial habitats. Marine organisms living in this zone are highly adapted to physical disturbance and severe temperature fluctuations. They 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, evident in the vast number of organisms that cannot live without the alternating exposure to both air and sea.

CHIS and 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 designations 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 (CDFW). 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).

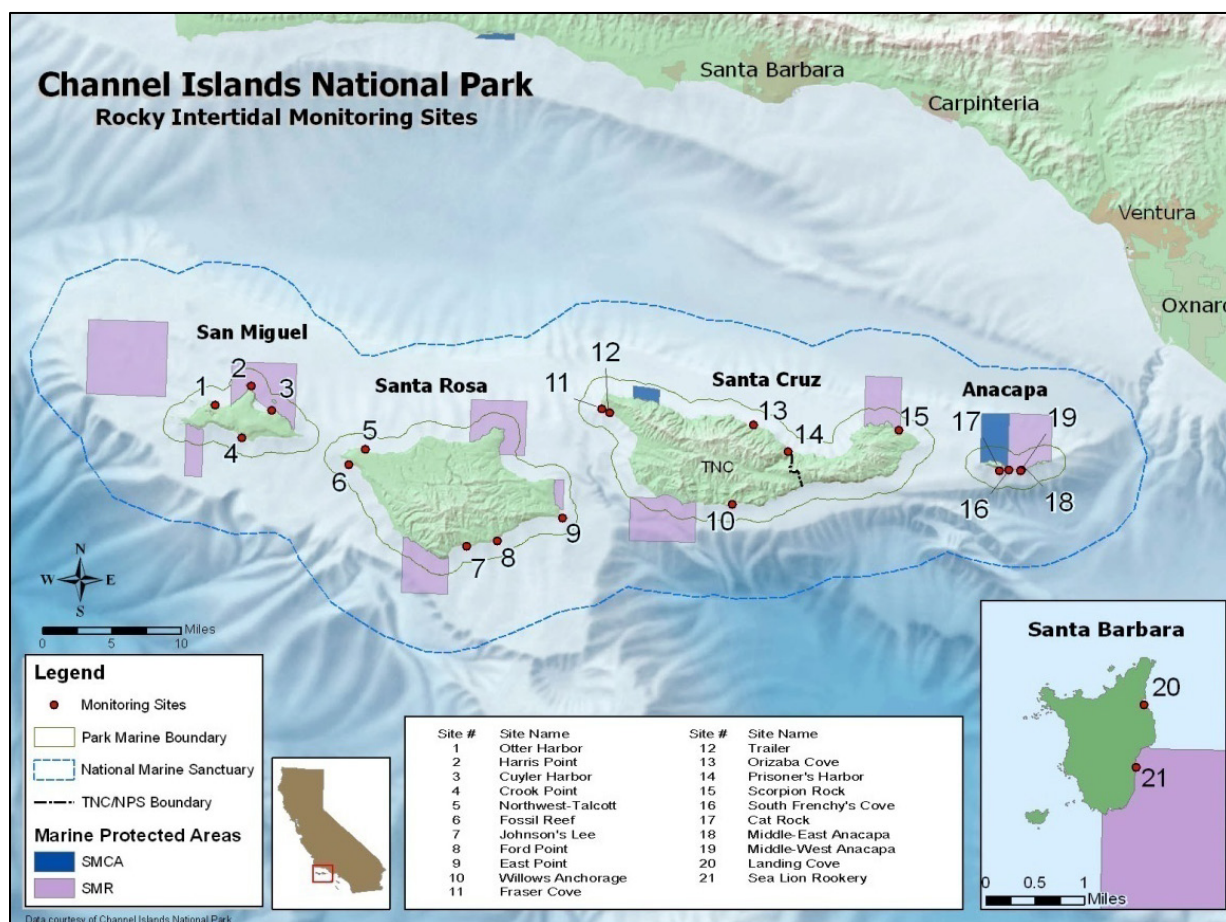


Figure 1. Rocky Intertidal Community Monitoring site locations in Channel Islands National Park. Note: TNC= The Nature Conservancy, SMCA= State Marine Conservation Area, SMR= State Marine Reserve; Sites 18 and 19 are on adjacent reefs.

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, and measuring size frequency and abundance of black abalone, owl limpets, and seastars using fixed plots or timed searches.

Monitoring has been conducted twice each year, during spring and fall, to assess the effects of winter storms and summer warm water. This year, however, in an effort to streamline and modify the program, the decision was made to sample each site annually. The basis for this decision was primarily supported by a power analysis conducted by Dr. Pete Raimondi (UCSC) which indicated there was sufficient power to detect changes within species assemblages targeted by the program (Raimondi 2018). This year and during subsequent years, monitoring will occur in fall and winter, and low tide series in the spring will be reserved for making up any monitoring missed during the primary survey window.

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 (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. Monitoring of the intertidal zone was part of a long-term “vital signs” ecological monitoring program developed at CHIS (Davis et al. 1994) that eventually served as the model for ecological monitoring conducted through the NPS Inventory and Monitoring Program (Davis 2005). CHIS is one of three parks in the Mediterranean Coast Network of the NPS Inventory and Monitoring Program.

Because intertidal areas are so heterogeneous, an impractically high number of plots would be necessary to detect temporal changes in species abundance using probability-based sampling (see Ambrose et al. [1992, 1995] and Murray et al. 2006). A sampling design involving fixed plots was selected, therefore, 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 2015–16 sampling season (Fall-Winter) efforts (from October 2015 to February 2016) 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, 2013; Richards and Rich 2009, 2012; Richards and Whitaker 2012a, 2012b, 2012c, 2012d; Whitaker and Richards 2012, 2020; Whitaker 2020a, 2020b. Additional black abalone monitoring results have been presented in Haaker et al. 1992, Davis et al. 1992, and Richards and Davis 1993. The annual reports are available on the internet at <https://www.nps.gov/im/medn/reports-publications.htm>.

Methods

Study Area

The California Channel Islands comprised 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 (Dailey 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 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. Note that one site, Anacapa Middle East, was dropped indefinitely this year in an effort to streamline the program. Anacapa Middle East was originally set up to serve as a control for Anacapa Middle West which is located on the adjacent reef.

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. 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 fall 2015 and winter 2016, monitoring occurred at 17/21 sites. 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 2015–16 program.

Data are maintained in Microsoft Access databases in the NPS MEDN I&M and MARINe. Electronic data were verified (checked against the original datasheet) and validated (queried to identify outliers or nonsensical values) and then certified as ready to analyze.

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, Timed Searches, and Mobile Invertebrate Counts^a at all CHIS Sites.

Category	Species or Substrate	Photoplots	Point Intercept Transects	Circular/Irregular Plots	Timed Searches	Mobile 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> ^b (= <i>H. harveyanus</i>)	X	–	–	–	–
	<i>Sargassum muticum</i>	–	X	–	–	–
	<i>Scytosiphon</i> spp.	X	–	–	–	–
	<i>Silvetia compressa</i> ^b (= <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> ^b (Turfweed)	X	–	–	–	–

^a Note that motile invertebrate counts were dropped from the standard protocol in 2011.

^b 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, Timed Searches, and Mobile Invertebrate Counts^a at all CHIS Sites.

Category	Species or Substrate	Photoplots	Point Intercept Transects	Circular/Irregular Plots	Timed Searches	Mobile Inverts
Red algae (continued)	<i>Chondracanthus canaliculatus</i> (= <i>Gigartina canaliculata</i>)	X	–	–	–	–
	<i>Chondracanthus spinosus</i>	X	–	–	–	–
	<i>Gelidium coulteri</i> / <i>Pterocliadiella capillacea</i>	X	–	–	–	–
	<i>Mastocarpus papillatus</i> (blade)	X	–	–	–	–
	<i>Mazzaella affinis</i> (= <i>Rhodoglossum affine</i>)	X	–	–	–	–
	<i>Mazzaella</i> spp. (= <i>Iridaea</i> spp.)	X	–	–	–	–
	<i>Porphyra</i> spp.	X	–	–	–	–
	<i>Prionitis</i> 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	<i>Phyllospadix scouleri/torreyi</i> ^b (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> ^b (Black Abalone)	X	–	X	X	–
	<i>Lepidochitona hartwegii</i>	–	–	–	–	X
	<i>Littorina</i> spp.	–	–	–	–	X
	<i>Lottia gigantea</i> ^b (Owl Limpet)	–	–	X	–	X
	<i>Mopalia</i> spp.	–	–	–	–	X

^a Note that motile invertebrate counts were dropped from the standard protocol in 2011.

^b Target species (also shown in bold)

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

Category	Species or Substrate	Photoplots	Point Intercept Transects	Circular/Irregular Plots	Timed Searches	Mobile Inverts
Molluscs (continued)	<i>Mytilus californianus</i> ^b (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	–	–	–	–
	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> ^b (Acorn Barnacle)	X	–	–	–	–
	<i>Tetracita rubescens</i> ^b (Thatched Barnacle)	X	–	–	–	–
	<i>Pollicipes polymerus</i> ^b (Goose Barnacle)	X	–	–	–	–
Echinoderms	<i>Pisaster ochraceus</i> ^b (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

^a Note that motile invertebrate counts were dropped from the standard protocol in 2011.

^b Target species (also shown in bold)

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

Category	Species or Substrate	Photoplots	Point Intercept Transects	Circular/Irregular Plots	Timed Searches	Mobile Inverts
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	–	–	–

^a Note that motile invertebrate counts were dropped from the standard protocol in 2011.

^b Target species (also shown in bold)

In 2015–16, 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 there was insufficient time. 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, verified (checked against the original datasheet), validated (queried to identify outliers or nonsensical values) and then certified as ready to analyze.



Figure 2. Stephen Whitaker scoring photoplots at Cat Rock, Anacapa Island. Photo by Michael Ready

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. The sites vary in size and natural breaks in the reef defined the areas, facilitating repeated searches of similar area. Timed searches are typically 30-minutes long. More time has been 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), but a concerted effort is made to limit search time to 30 minutes per site to remain consistent with other surveys. These protocols were implemented in response to the decline of abalone population levels. Prior to the effects of Withering Syndrome (WS), 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. The fixed plots became inadequate for sampling, however, 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 are 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 is used to measure and count all owl limpets > 15 mm (< 15 mm limpets can be difficult to identify to species by less-experienced observers) for maximum shell length (Figure 3).



Figure 3. Josh Sprague measuring giant owl limpets and technician, Kate Vylet recording at Johnson's Lee, Santa Rosa Island.

Pisaster ochraceus, ochre seastars, are counted along with other species of seastars (*Pisaster giganteus*, *Patiria miniata* and *Pycnopodia helianthoides*) in a general search of the reef (for 30-minutes). When possible (time and weather permitting), 50–100 *P. ochraceus* are measured (center of disk to tip of longest ray) for size distribution.

Mytilus californianus, California mussels, are sampled for size frequency within the fixed plots targeting *M. californianus* to complement the mussel cover data. At 10 predetermined locations within each plot, the nearest mussel is measured along the length of its axis to the nearest centimeter. Additionally, the thickness of the mussel bed or patch is measured to the nearest centimeter at five predetermined locations within each of the fixed mussel plots.

From 2002 to 2011, smaller motile invertebrates (Table 1) were counted by carefully searching each photoplot. 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 were usually sampled once annually. However, after 2011 the protocol was no longer implemented due to changes in personnel and insufficient assistance. The motile invertebrate protocol was extremely time-consuming and required a relatively high level of expertise to conduct. In addition, it was determined by another intertidal monitoring group in the region that the protocol may require adjustments to improve effectiveness to detect significant changes in motile invertebrate communities (Miner et al. 2015). Therefore the decision was made to cancel routine monitoring of smaller motile invertebrates until staffing increased and/or a complete data analysis is conducted. Motile invertebrate data from earlier years are included in CHIS Rocky Intertidal Community Monitoring Program annual reports for years 2009–2011.

Phyllospadix spp., surfgrass, cover was measured on three 10m fixed point-intercept transects (100 points) at four sites (Trailer, Fraser Cove, East Point, Northwest-Talcott) (Figure 4). 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.



Figure 4. Stephen Whitaker (left) and Josh Sprague (right) sampling a surfgrass transect at East Point, Santa Rosa Island.

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

Fieldwork is 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 are chosen for minus tide series occurring during daylight hours. Stephen Whitaker conducted sampling with assistance from others for data recording and sea star counts. Notes regarding sampling variations, personnel changes, and equipment are documented in trip reports in Appendix B.

Optic Stowaway temperature loggers from Onset Computer Corporation were placed in PVC (Polyvinyl Chloride) pipe housings and fixed with epoxy to rocks near the mean-tide line at 17 sites. Units are 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 fall/winter 2015–16. 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 JMP (JMP, Version 12. SAS Institute Inc., Cary, NC, 1989–2019). 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), 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 abundances are provided for comparative purposes, plots were chosen within high density areas, were 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 for each target zone. Mean percent cover of target species and other dominant taxa along with bare rock cover are pooled for all replicate plots per zone by site.

Departure from the long-term mean graphs are displayed for each target species pooled across sites at each island.

As in most years, the mean percent cover of nearly all targeted species in 2015–16 was highly variable among sites. The mean cover of target taxa within representative plots (e.g., *Mytilus* within *Mytilus* plots) was typically near or below the long-term mean value calculated for most sites. In rare cases, the mean percent cover measured in 2015–16 increased above the long-term mean.

Mussel, *Mytilus californianus* mean percent cover in 2015–16 remained comparable to the mean of previous years at the majority of sites (Figures 5–7). However, record or near record-low abundances for *M. californianus* were measured at Anacapa Middle West, East Point, Harris Point, Prisoner's Harbor, and Sea Lion Rookery. In the cases of Anacapa Middle West, Fossil Reef and Prisoner's Harbor, mussels plummeted to near zero percent cover. Compared to last year, mussel cover increased markedly to approximately the value of the long-term mean at Ford Point, Fossil Reef, Northwest-Talcott, Scorpion Rock and South Frenchy's Cove; many other sites also had values at or near the long-term average. This year, the only sites that appeared to have above average *Mytilus* cover were Cuyler Harbor (only slightly above average), Orizaba Cove and Willows Anchorage. Qualitatively, *Mytilus* cover appeared to be increasing at most locations as newly-recruited mussels were common.

Overall, mussel cover has decreased below the long-term mean at Anacapa, Santa Barbara and Santa Rosa Islands during the past five years (Figure 6). *M. californianus* percentages were approximately average at San Miguel and Santa Cruz Islands in 2015–16 (Figure 6). At most sites, with several exceptions, mussel plots have been and remain populated with moderate to high cover of *M. californianus* and relatively low cover of *Phragmatopoma* among other species (Figure 7).

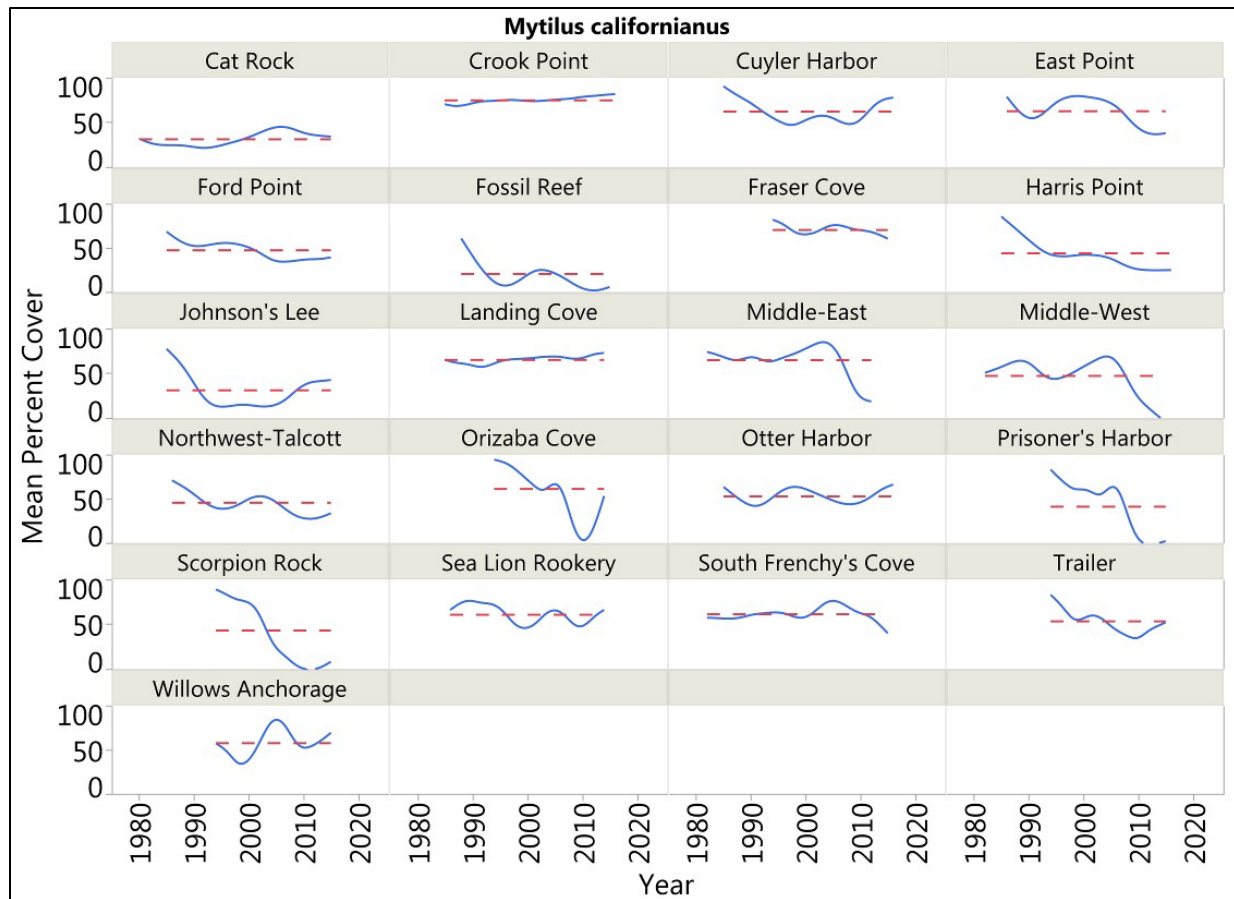


Figure 5. Departure from the long-term mean for *Mytilus californianus*. Blue lines represent mean cover of *M. californianus* within the representative zone pooled across plots at each site. Red dashed lines represent long-term mean. Note that four new *Mytilus* plots were installed in 2008 at Johnson's Lee; all nine *Mytilus* plots are displayed here. Also note that Middle-East was not sampled in 2014 or 2015.

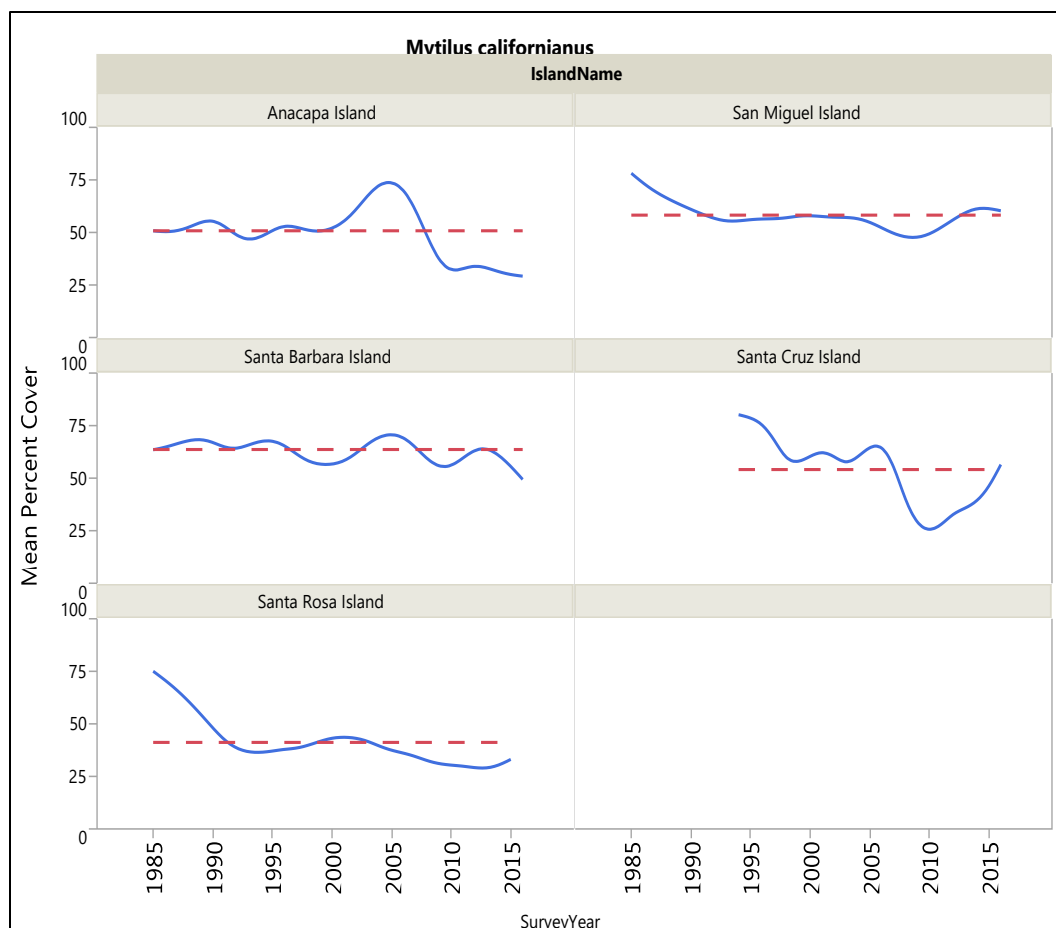


Figure 6. Departure from the long-term mean for *Mytilus californianus*. Blue lines represent mean cover of *M. californianus* within the representative zone pooled across plots and sites at each island. Red dashed lines represent long-term mean. Note that four new *Mytilus* plots were installed in 2008 at Johnson's Lee, Santa Rosa Island; all nine *Mytilus* plots are included here.

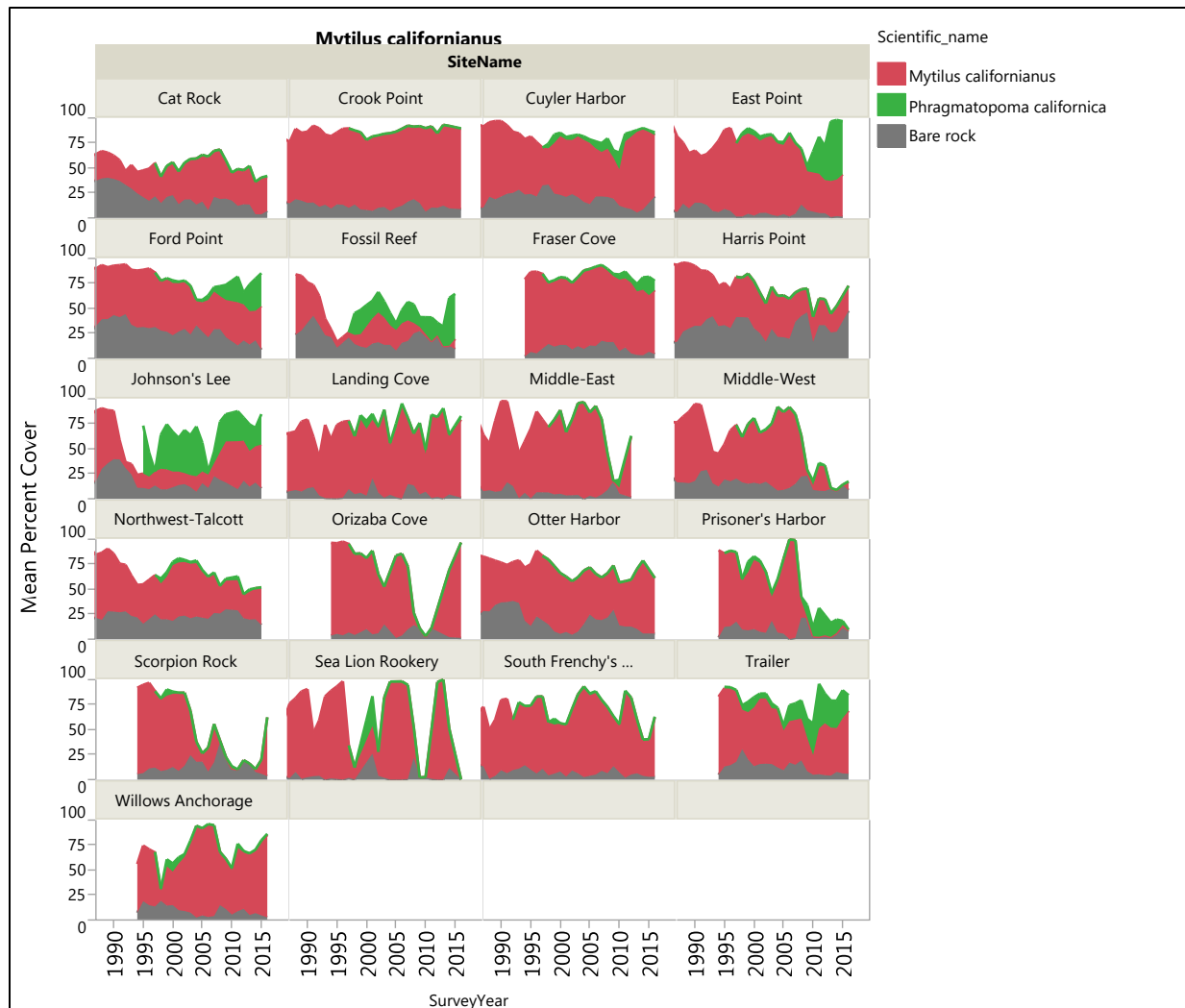


Figure 7. Percent cover of *Mytilus californianus* along with *Phragmatopoma californica* and bare rock in fixed plots within the *Mytilus* zone at each site. Colored areas represent the mean percent cover for representative and dominant taxa/substrata from replicated (usually five) *Mytilus* plots. Note that four new *Mytilus* plots were installed in 2008 at Johnson's Lee; all nine *Mytilus* plots are displayed here. Also note that Middle-East was not sampled in 2014 or 2015.

Rockweed, *Silvetia compressa*, abundances were very low in 2015–16 compared to previous years (prior to 2000 in most cases). *S. compressa* cover averaged across representative plots at each site was well below long-term averages and measured < 20% absolute cover at most sites (11 of 16 sites), many of which had the lowest recorded abundances and/or near-zero percent cover of rockweed (Figures 8–10). Fossil Reef was again the only site that exhibited above average cover of rockweed. Most sites exhibited marked declines in *S. compressa* abundances beginning in the early 2000s with little recovery observed for the rockweed through this year. When pooled across sites at each island, *S. compressa* cover was markedly lower than the long-term averages for all islands except Santa Rosa (Figure 9). At most sites, plots have been dominated primarily by *S. compressa* and other less common species such as *Chthamalus*/ *Balanus* and *Endocladia* (Figure 10).

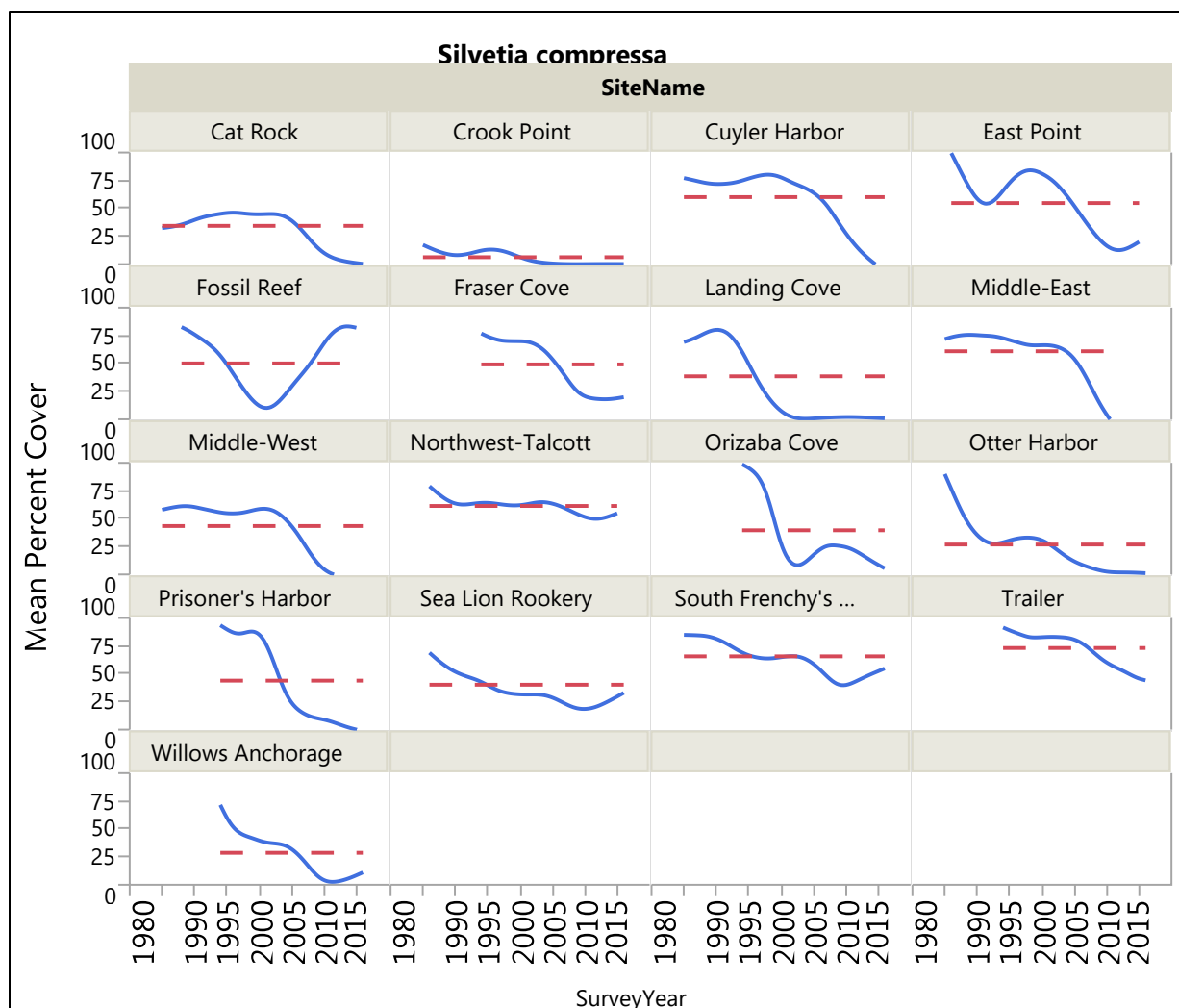


Figure 8. Departure from the long-term mean for *Silvetia compressa*. Blue lines represent mean cover of *S. compressa* within the representative zone pooled across plots at each island. Red dashed lines represent long-term mean. Note that Middle-East was not sampled in 2014 or 2015.

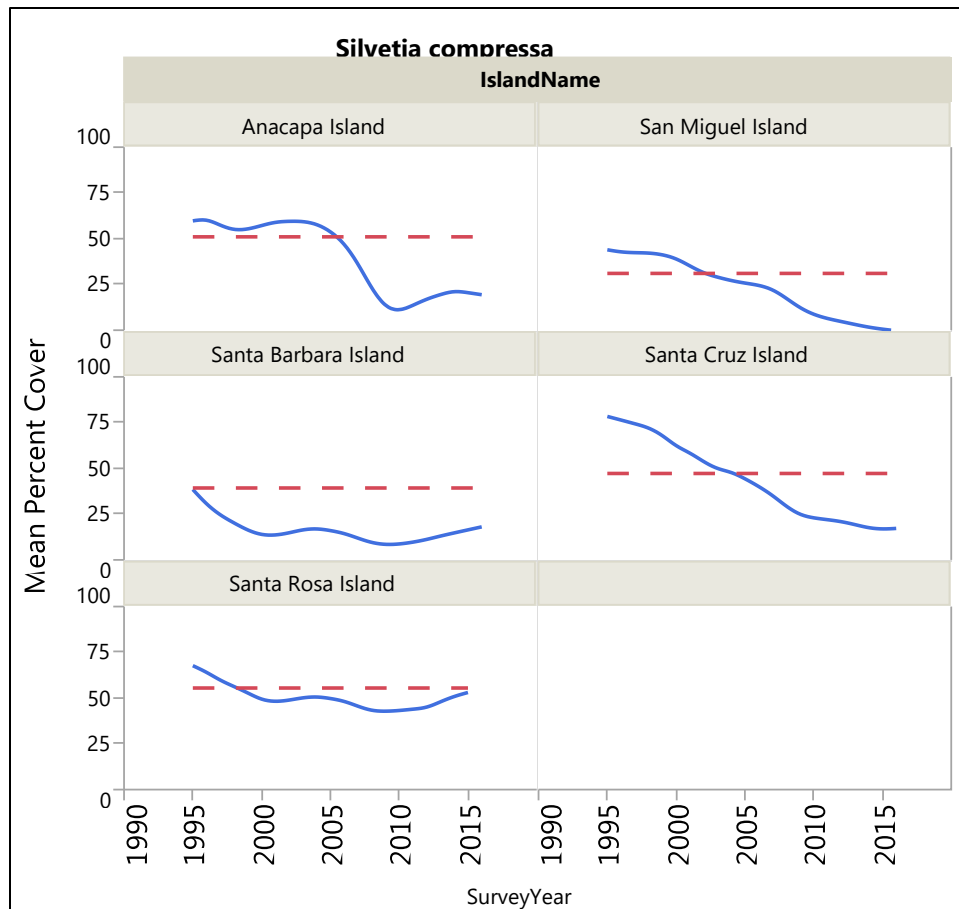


Figure 9. Departure from the long-term mean for *Silvetia compressa*. Blue lines represent mean cover of *S. compressa* within the representative zone pooled across plots and sites at each island. Red dashed lines represent long-term mean.

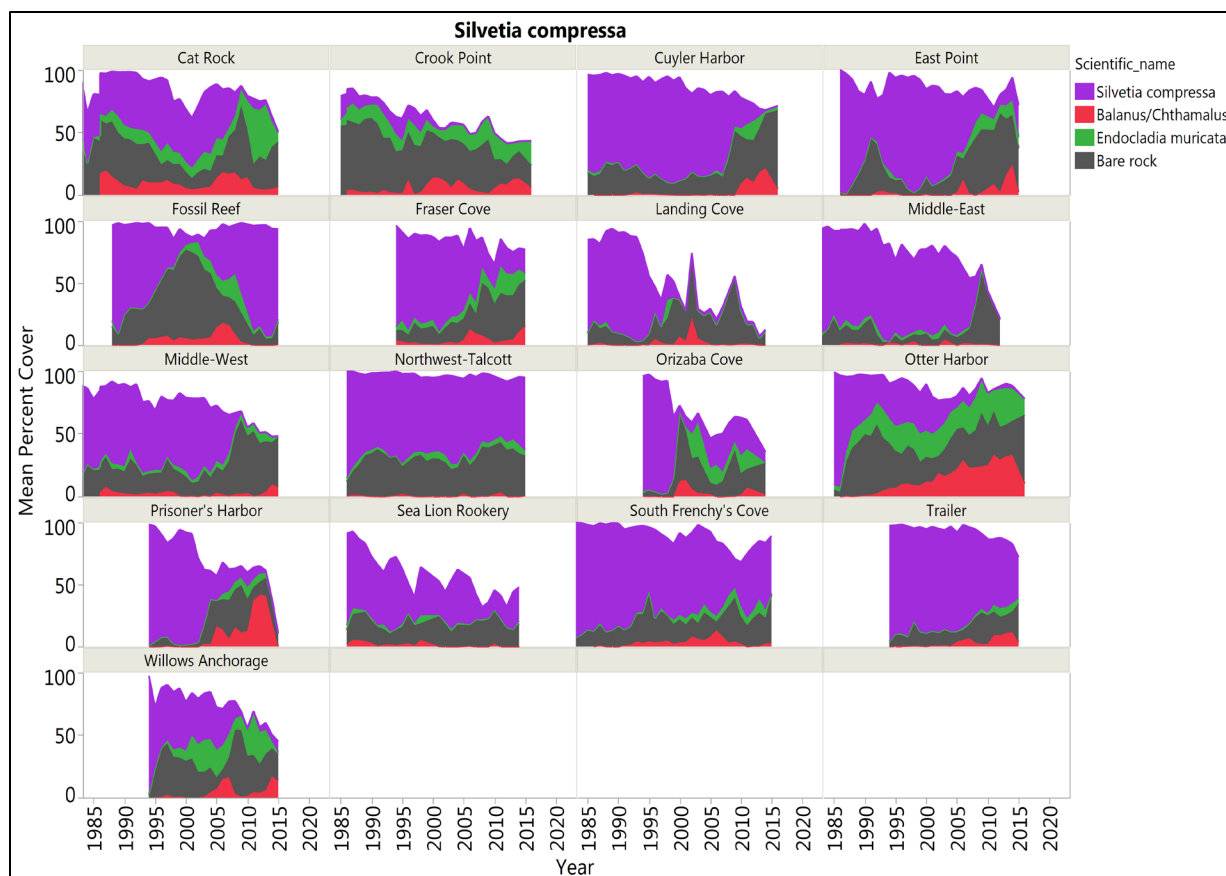


Figure 10. Percent cover of *Silvetia compressa* along with other dominant taxa and bare rock in fixed plots within the *Silvetia* zone at each site. Colored areas represent the mean percent cover for representative and dominant taxa/ substrata from replicated (usually five) *Silvetia* plots. Note that Middle-East was not sampled in 2014 or 2015.

The other rockweed, *Hesperophycus californicus* that occurs in the region, also declined or remained low in abundance at all but two monitoring sites (6 of 8 sites) (Figures 11–13). *H. californicus* cover reached near record-low abundance at Fraser Cove, Harris Point, Prisoner’s Harbor, Scorpion Rock, Trailer and Willows Anchorage. Alternatively, relatively high cover of the rockweed was measured at East Point and Orizaba Cove had average *H. californicus* cover in 2015–16. Pooled across sites at each island, *H. californicus* cover measured above the long-term mean at Santa Rosa and below that of Santa Cruz and San Miguel Islands. Record-low rockweed cover was measured this year at Santa Cruz Island. Over time, plots at most sites have been composed largely of *H. californicus*, *S. compressa*, *E. muricata*, and *Chthamalus/ Balanus* (Figure 13).

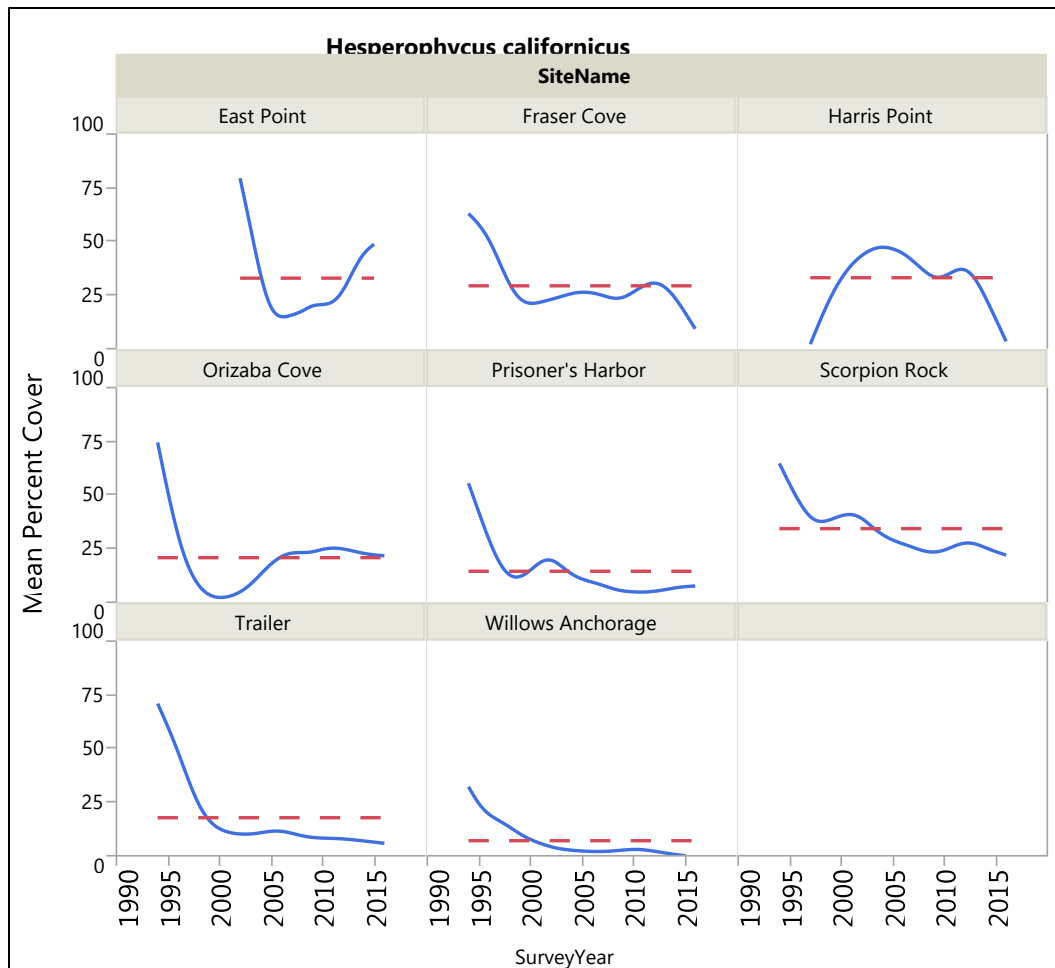


Figure 11. Departure from the long-term mean for *Hesperophycus californicus*. Blue lines represent mean cover of *H. californicus* within the representative zone pooled across plots at each site. Red dashed lines represent long-term mean.

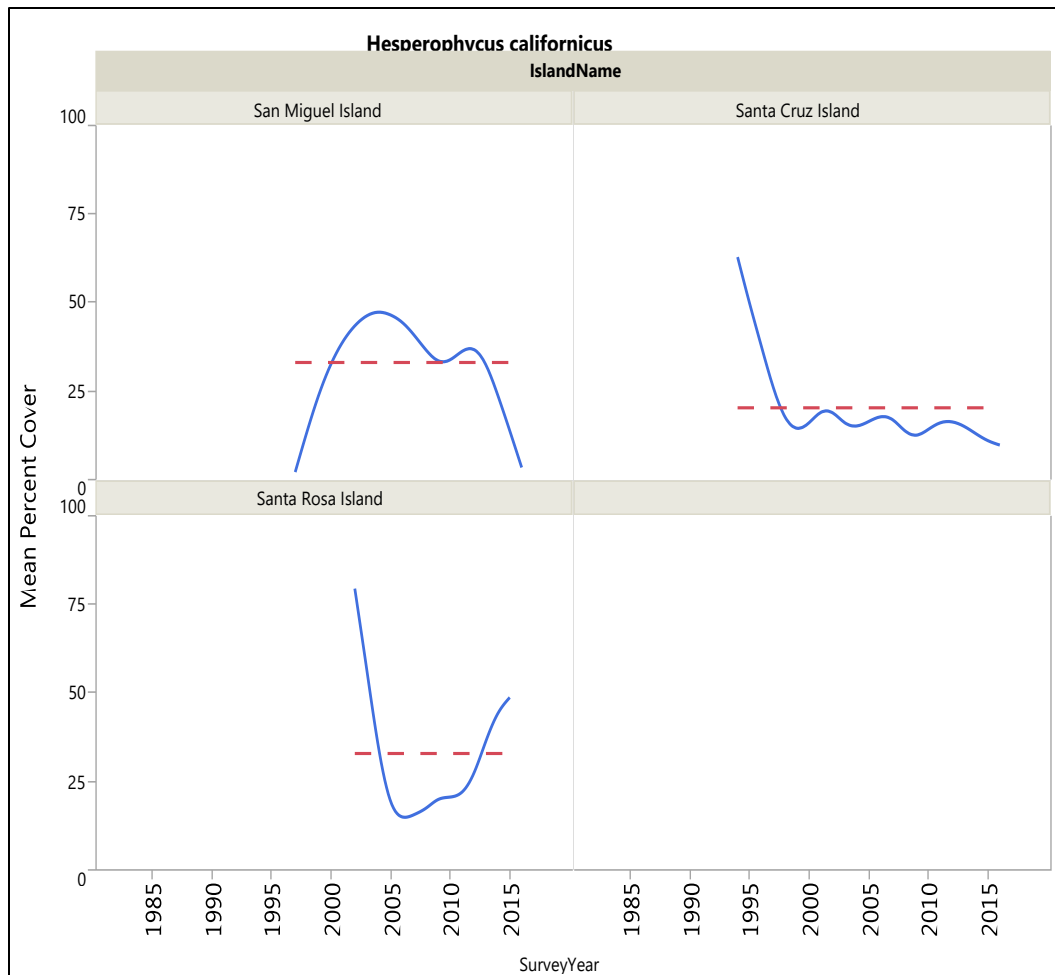


Figure 12. Departure from the long-term mean for *Hesperophycus californicus*. Blue lines represent mean cover of *H. californicus* within the representative zone pooled across plots and sites at each island. Red dashed lines represent long-term mean.

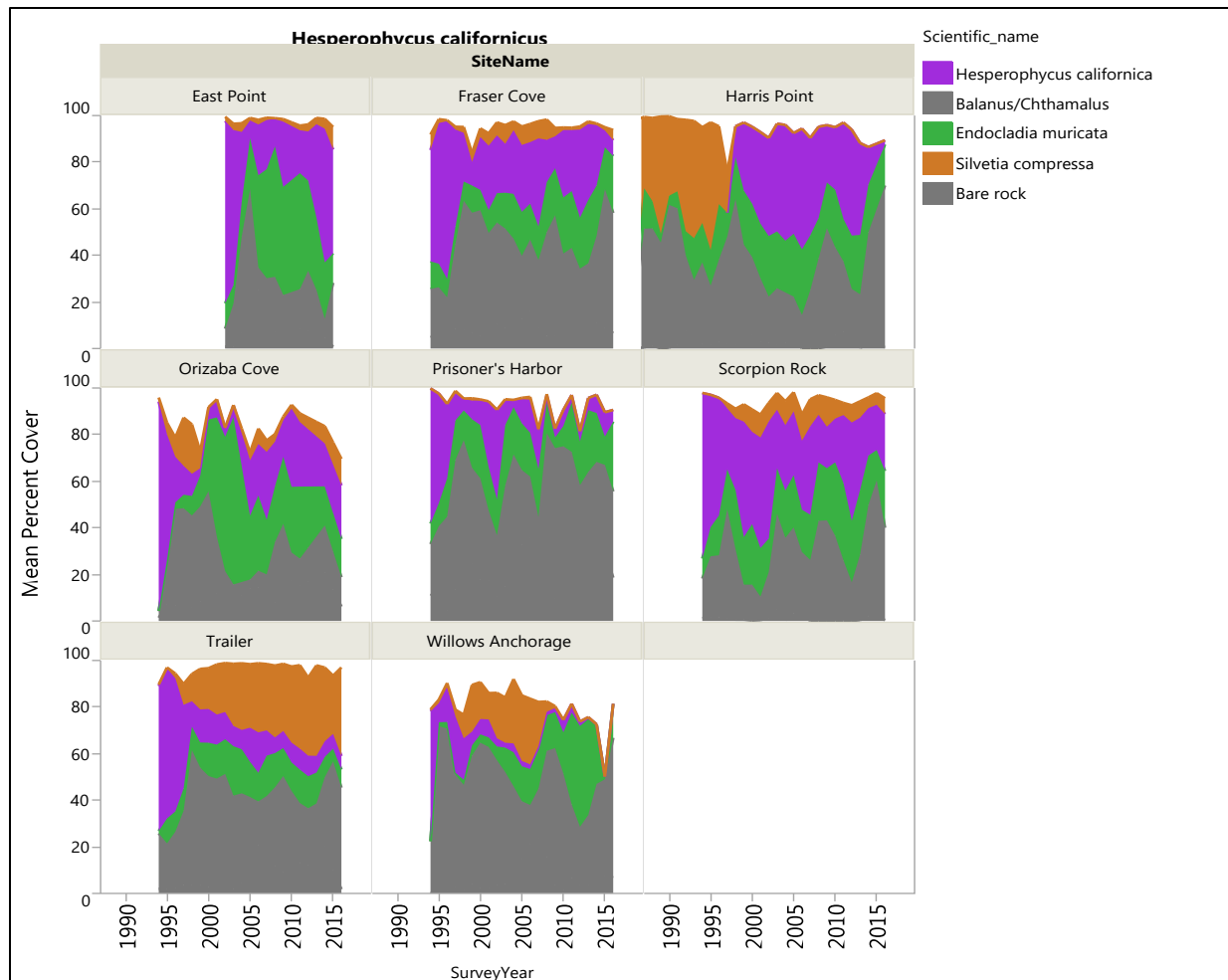


Figure 13. Percent cover of *Hesperophycus californicus* along with other dominant taxa and bare rock in fixed plots within the *Hesperophycus* zone at each site. Colored areas represent the mean percent cover for representative and dominant taxa/ substrata from five *Hesperophycus* plots.

Endocladia muricata cover in 2015–16 remained roughly equivalent to mean abundances measured in past years at most sites (11 of 17 sites) (Figures 14–16). Exceptions included Cat Rock, Scorpion Rock, South Frenchy's Cove and particularly Anacapa Middle West, Otter Harbor, Willows Anchorage which had record low *E. muricata* abundances relative to long-term means at the respective sites. Moderately-high cover of *E. muricata* compared to earlier years was not measured at any sites. Pooled across sites at each island, *E. muricata* abundances were approximately average at Santa Barbara. Cover of the alga was slightly below the long-term means at Santa Rosa and particularly Anacapa, San Miguel and Santa Cruz Islands (Figure 15). Other dominant species in *E. muricata* plots have been *S. compressa* and *Chthamalus/ Balanus* (Figure 16).

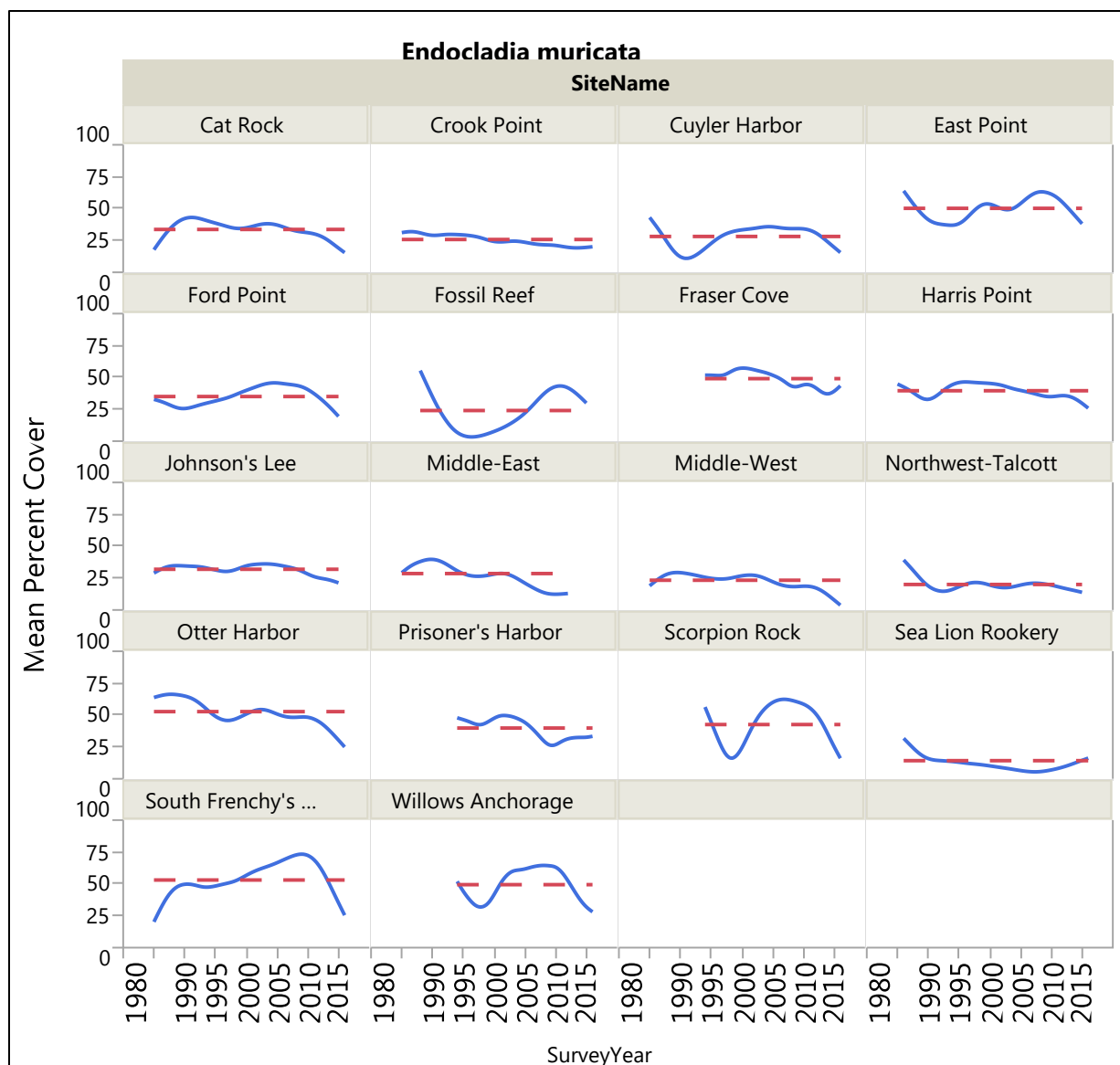


Figure 14. Departure from the long-term mean for *Endocladia muricata*. Blue lines represent mean cover of *E. muricata* within the representative zone pooled across plots at each site. Red dashed lines represent long-term mean. Note that Middle-East was not sampled in 2014 or 2015.

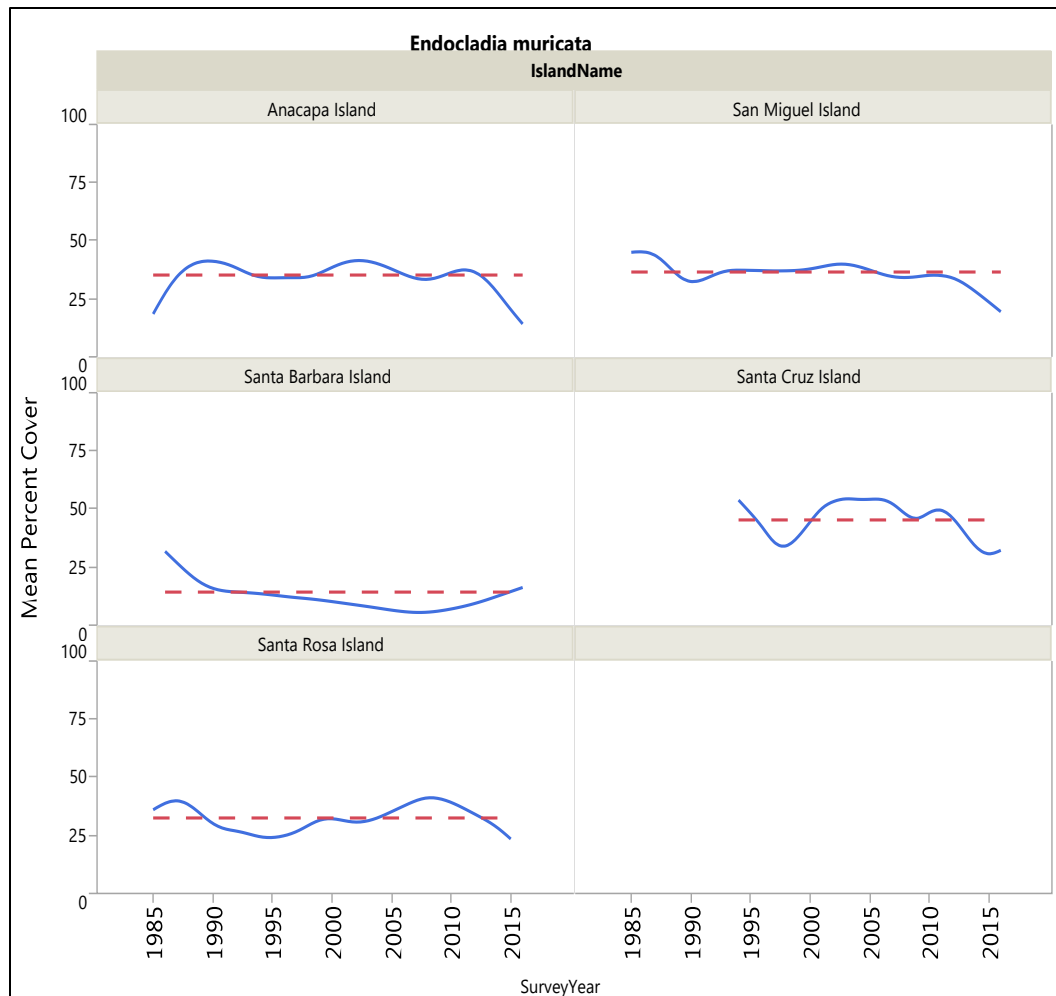


Figure 15. Departure from the long-term mean for *Endocladia muricata*. Blue lines represent mean cover of *E. muricata* within the representative zone pooled across plots and sites at each island. Red dashed lines represent long-term mean.

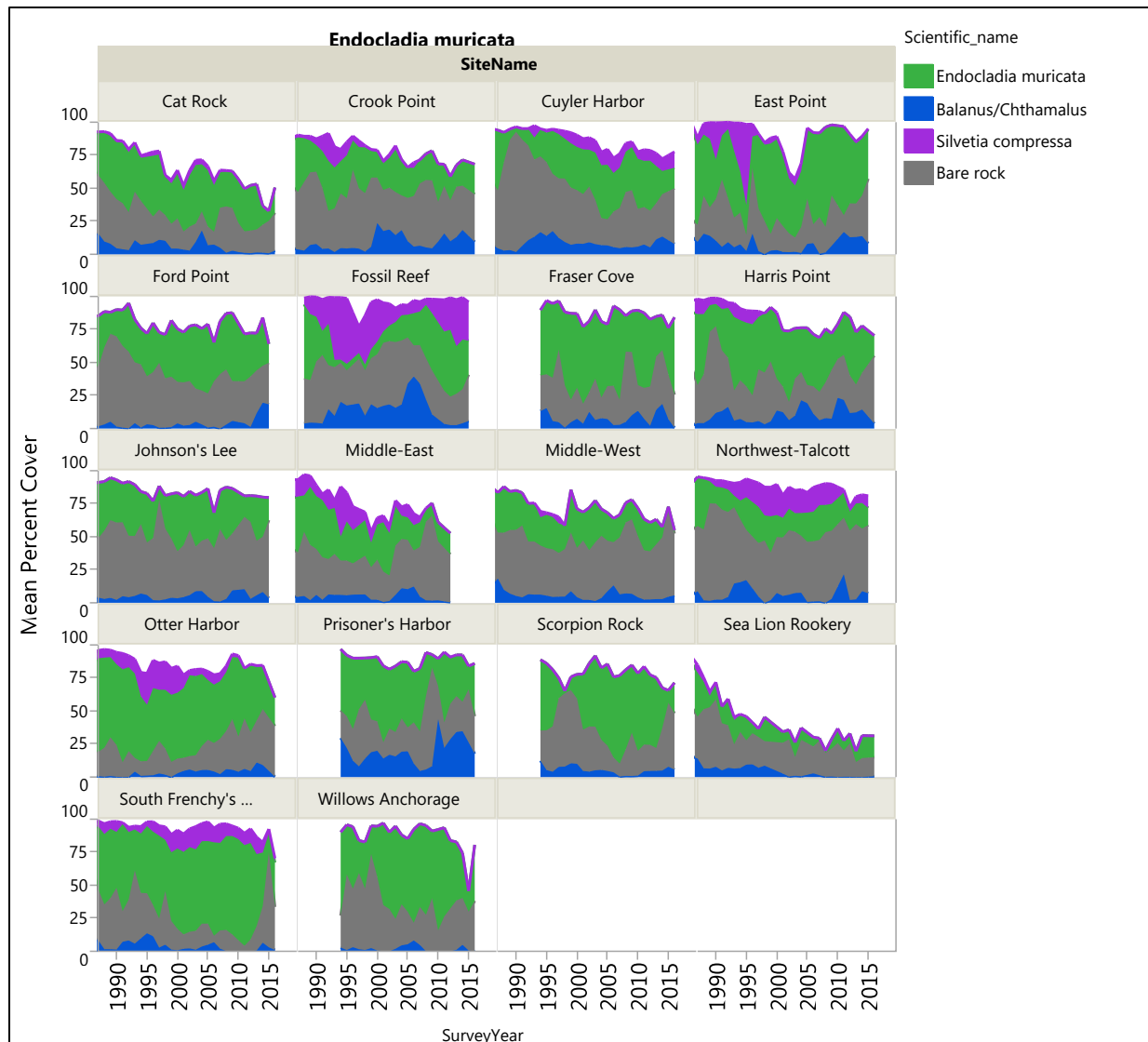


Figure 16. Percent cover of *Endocladia* along with other dominant taxa and bare rock in fixed plots within the *Endocladia* zone at each site. Colored areas represent the mean percent cover for representative and dominant taxa/ substrata from replicated (usually five) *Endocladia* plots. Note that Middle-East was not sampled in 2014 or 2015.

Barnacle, *Chthamalus/Balanus* spp. abundances pooled across sites in 2015–16 fell below the long-term means at all islands except Anacapa whereby barnacle cover was approximately average (Figures 17–19). At the site level, *Chthamalus/Balanus* spp. abundances in 2015–16 appeared below average at the majority (11 of 19) of sites with near record low abundances documented at Fraser Cove, Harris Point, Landing Cove, Northwest-Talcott, Orizaba Cove and South Frenchy’s Cove (Figure 17). Relative to the long-term mean, six sites had approximately average cover of *Chthamalus/Balanus* spp. while only two locations (Cuyler Harbor and Scorpion Rock) had above average barnacle cover. Other dominant species in *Chthamalus/Balanus* spp. plots have primarily been *S. compressa* and *E. muricata* (Figure 19)

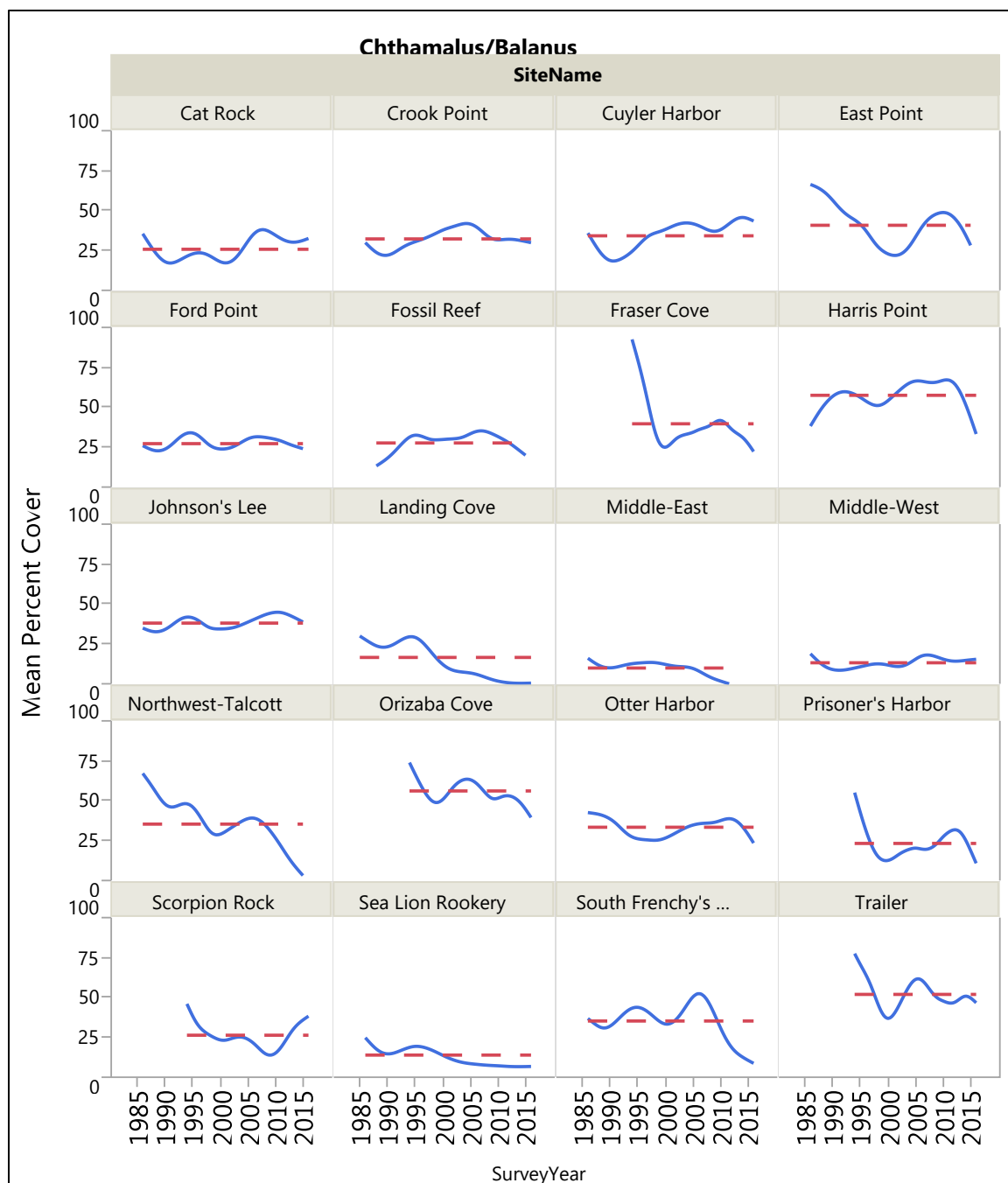


Figure 17. Departure from the long-term mean for *Chthamalus/Balanus*. Blue lines represent mean cover of *Chthamalus/Balanus* within the representative zone pooled across plots at each site. Red dashed lines represent long-term mean. Note that Middle-East was not sampled in 2014 or 2015.

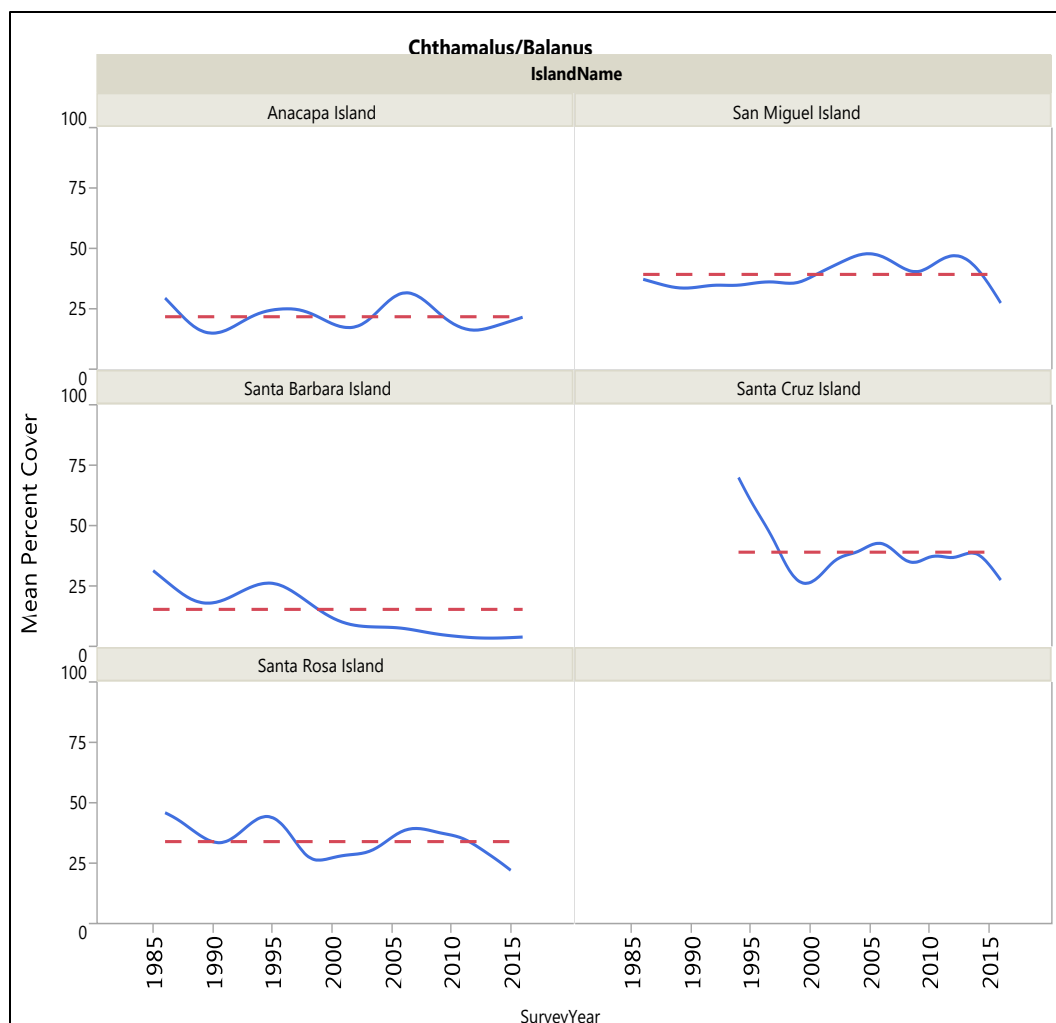


Figure 18. Departure from the long-term mean for *Chthamalus/Balanus*. Blue lines represent mean cover of *Chthamalus/Balanus* within the representative zone pooled across plots and sites at each island. Red dashed lines represent long-term mean. Note that Middle-East was not sampled in 2014 or 2015.

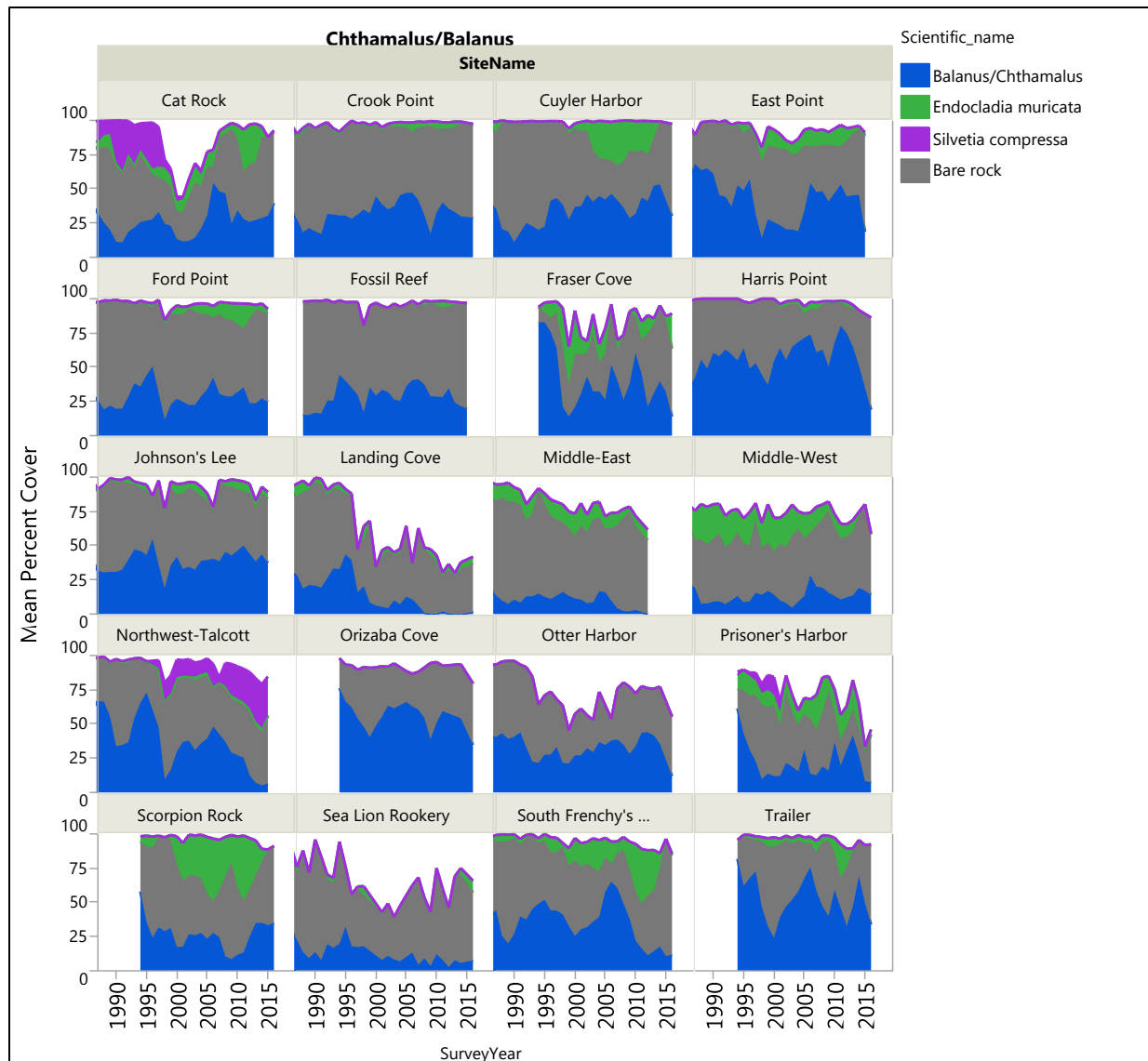


Figure 19. Percent cover of barnacles, *Chthamalus/Balanus*, along with *Endocladia*, *Silvetia compressa* and bare rock in fixed plots within the barnacle (*Chthamalus/Balanus*) zone at each site. Note that barnacle species were not separated. Colored areas represent the mean percent cover for representative and dominant taxa/ substrata from replicated plots (usually five) within the *Chthamalus/Balanus* zone. Note that Middle-East was not sampled in 2014 or 2015.

Goose or leaf barnacle, *Pollicipes polymerus* zone plots have only been established at Fraser Cove, where goose barnacle cover has declined slowly over time from approximately 20% to well below 10% by 2009. *P. polymerus* cover increased markedly since 2009 and was above the long-term mean in 2015–16 (Figures 20–21). Other dominant species in the *P. polymerus* plots have included *M. californianus* and *T. rubescens* (Figure 21).

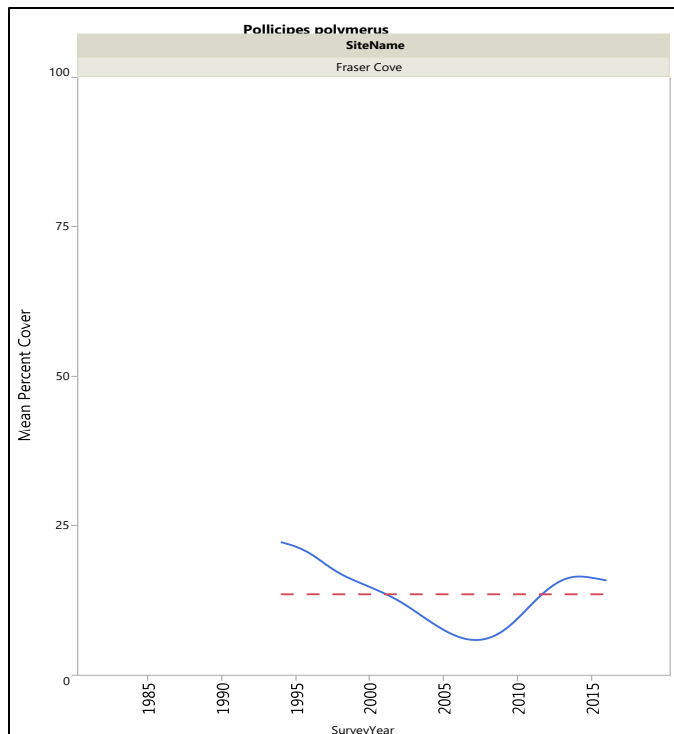


Figure 20. Departure from the long-term mean for *Pollicipes polymerus*. Blue lines represent mean cover of *P. polymerus* within the representative zone pooled across plots at Fraser Cove. Red dashed line represents long-term mean.

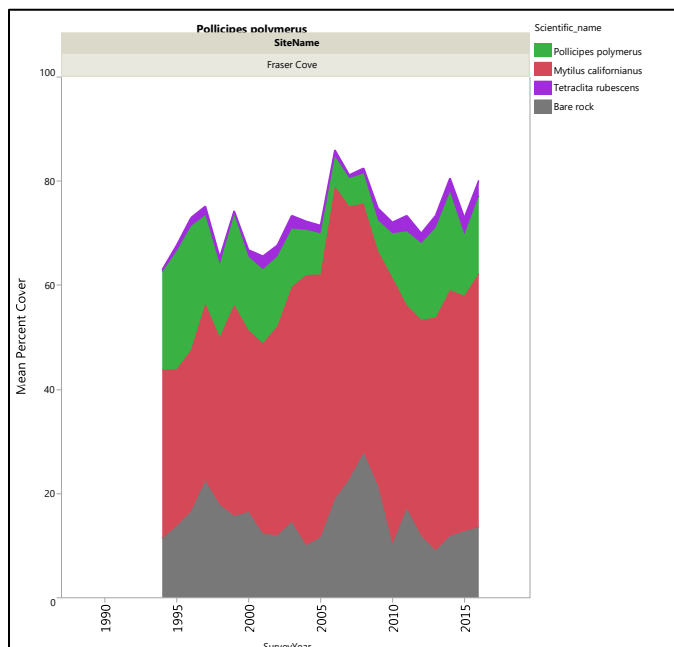


Figure 21. Percent cover of *Pollicipes polymerus* along with other dominant taxa and bare rock in fixed plots within the *Pollicipes* zone at Fraser Cove, Santa Cruz Island. Colored areas represent the mean percent cover for representative and dominant taxa/ substrata from five *Pollicipes* plots.

The thatched barnacle, *Tetraclita rubescens* is only monitored at three sites (Harris Point, Orizaba Cove and Scorpion Rock). Thatched barnacles increased above the long-term mean at the Santa Cruz Island sites (Orizaba Cove and Scorpion Rock) and marginally at Harris Point (Figures 22–23). Other dominant species in the *T. rubescens* plots have included *M. californianus* and *P. polmerus* (Figure 23).

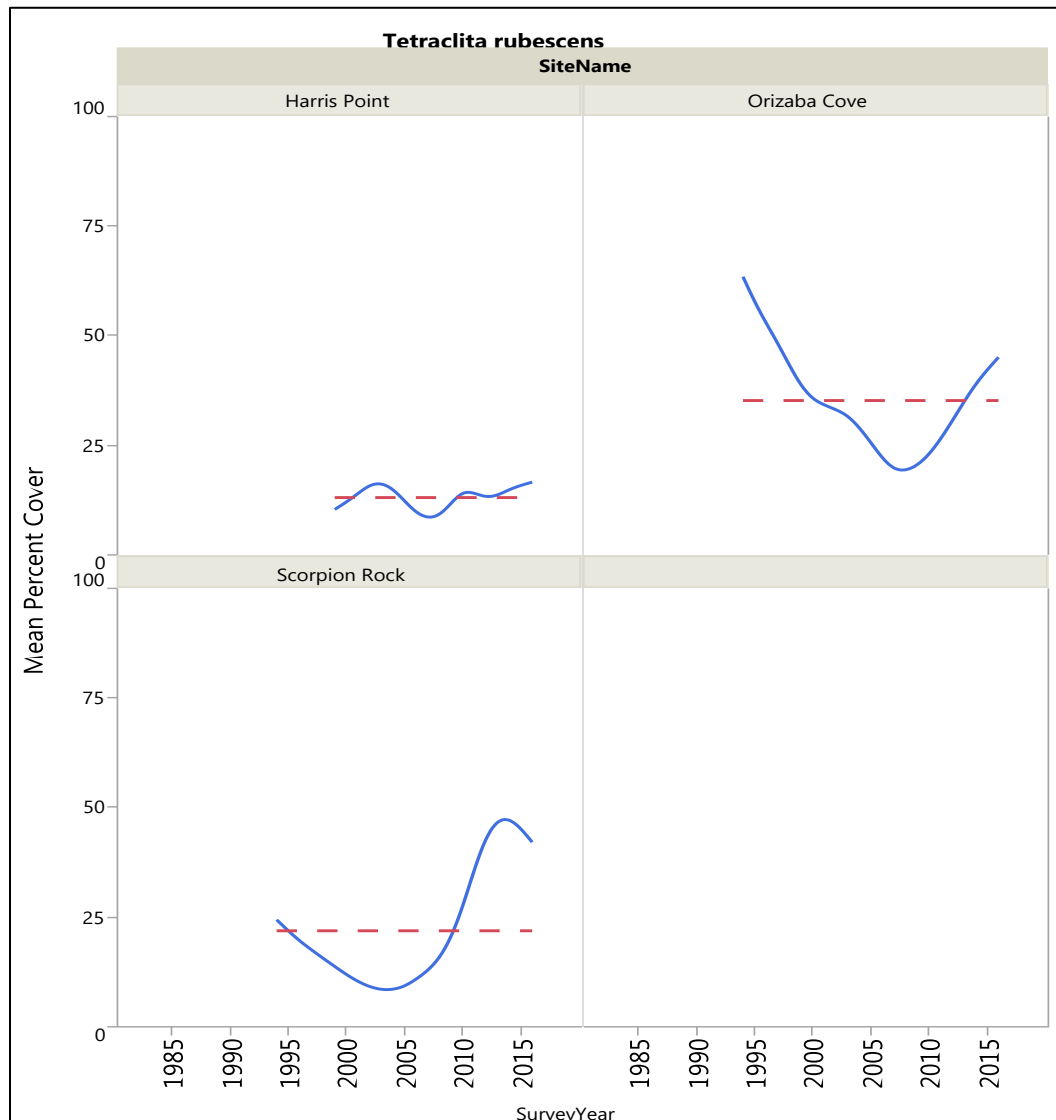


Figure 22. Departure from the long-term mean for *Tetraclita rubescens*. Blue lines represent mean cover of *T. rubescens* within the representative zone pooled across plots at each site. Red dashed lines represent long-term mean.

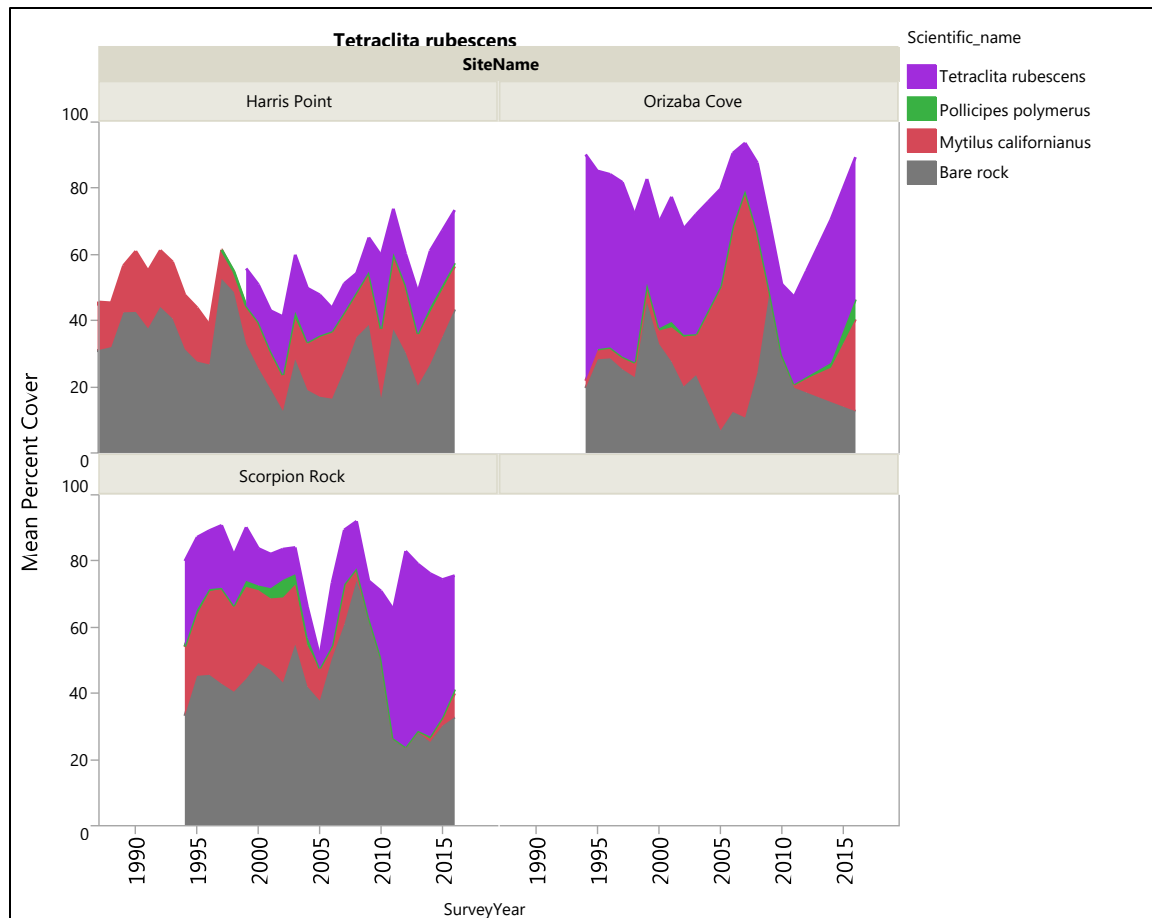


Figure 23. Percent cover of *Tetracita rubescens* along with other dominant taxa and bare rock in fixed plots within the *Tetracita* zone at each site. Colored areas represent the seasonal mean percent cover for representative and dominant taxa/ substrata from five *Tetracita* plots.

Tar is only monitored at Fraser Cove where it is naturally deposited from seeps in the Santa Barbara Channel onto extensive stretches of the upper intertidal on the west end of Santa Cruz Island. There was a slight increase (< 10%) in tar cover in 2015–16 from the long-term mean (approximately 50%) (Figures 24–25).

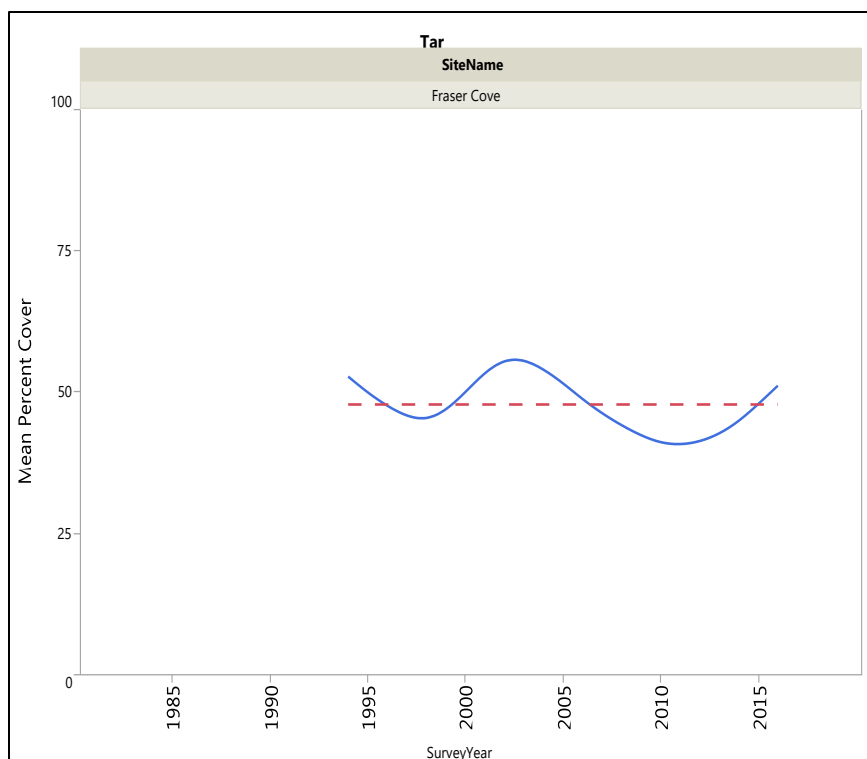


Figure 24. Departure from the long-term mean for tar. Blue lines represent mean cover of tar within the representative zone pooled across plots at Fraser Cove. Red dashed line represents long-term mean.

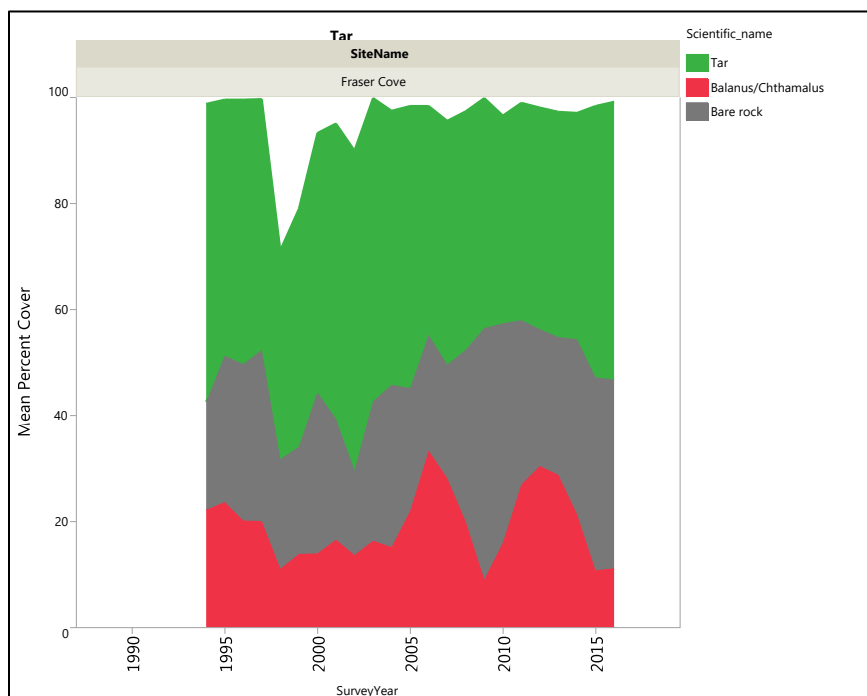


Figure 25. Percent cover of tar along with other dominant taxa and bare rock in fixed plots within the tar zone at Fraser Cove, Santa Cruz Island. Colored areas represent the mean percent cover for representative and dominant taxa/substrata from five tar plots.

Haliotis cracherodii

Following the collapse of the black abalone population in southern California due to Withering Syndrome (WS) in the late 1980s and early 1990s, most monitoring sites at CHIS have supported extremely low numbers of abalone relative to historical abundances (Figures 26–27 [density and timed search graphs]). As mentioned in the Methods section, prior to the effects of Withering Syndrome (WS), 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. The fixed plots became inadequate for sampling, however, by the early 1990s as abalone disappeared. Fixed plots have been checked most years for comparison to early samples, but abalone have rarely been encountered in the plots. In 2015–16 fixed plots at most sites were not sampled due to the inability to accurately locate most of the marker bolts that are used to identify the perimeters of the plots. A concerted effort will be made in the near-future to replace the eroded or missing bolts with new ones by consulting historic photographs and bolt-to-bolt location measurements.

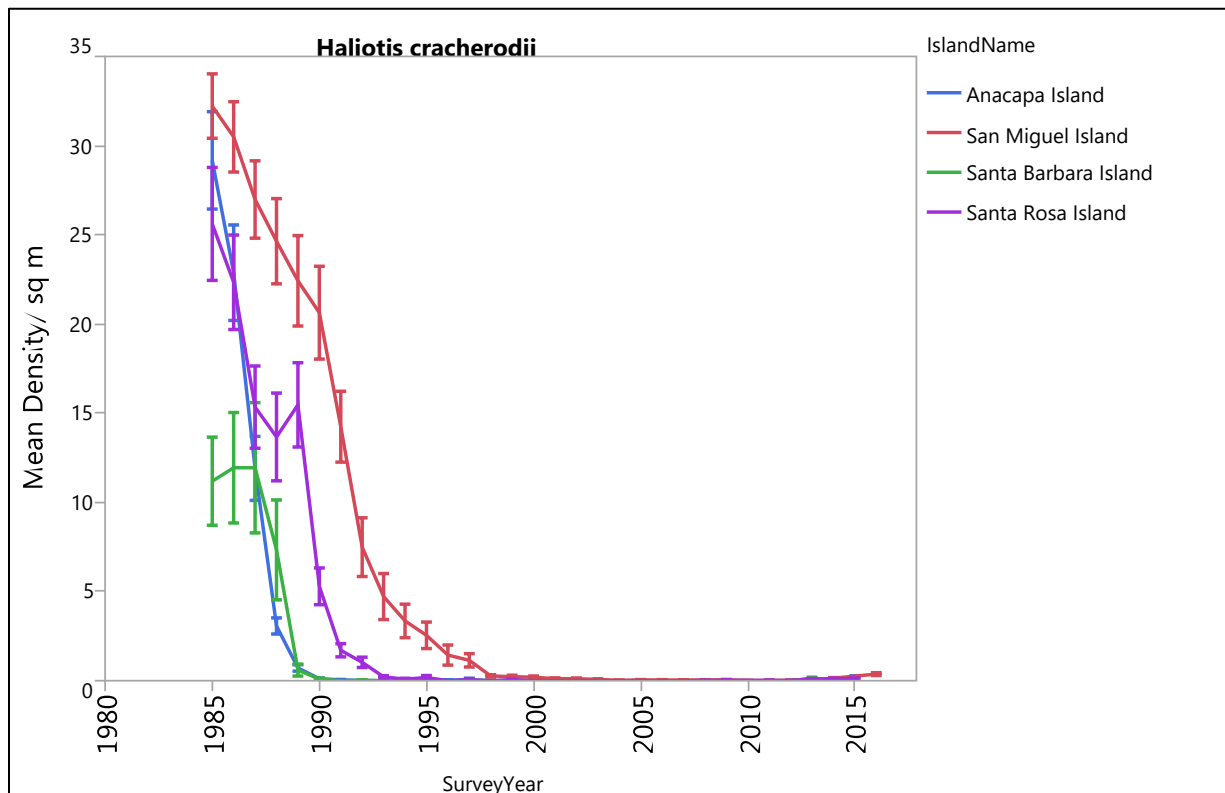


Figure 26. *Haliotis cracherodii* counts from fixed plots at all islands except Santa Cruz from 1985–2015–16. Note that fixed plots were not established at Santa Cruz Island. Standard error bars were constructed using 1 standard error from the mean.

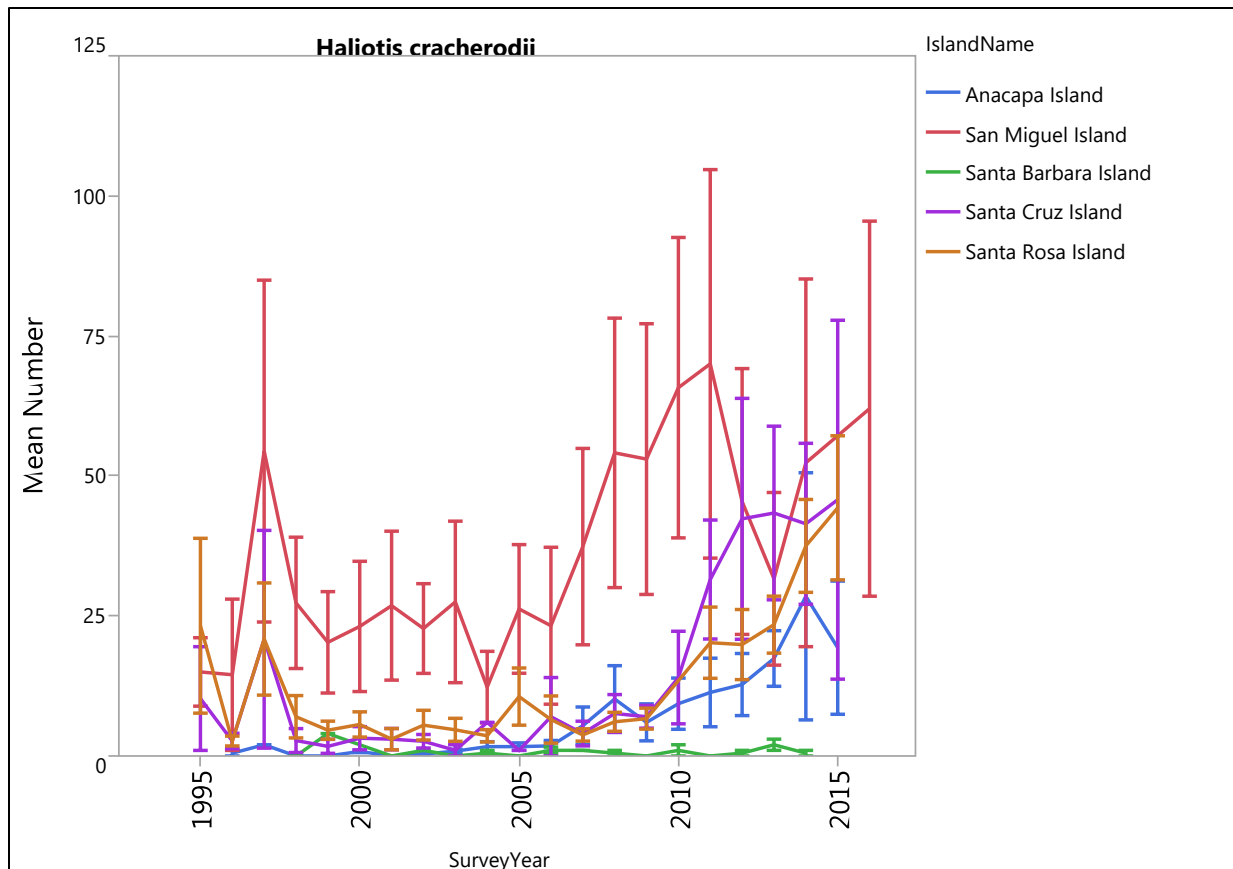


Figure 27. Black abalone, *Haliotis cracherodii*, mean counts at all islands from 1995–2015–16. Count data are generally derived from site-wide searches. Error bars were constructed using 1 standard error from the mean.

During routine timed searches, black abalone were entirely absent from South Frenchy’s Cove. Of the remaining sites where black abalone were seen, fewer than 10 individuals were located at Cuyler Harbor, and Fraser. In contrast, > 100 black abalone were observed at Otter Harbor and Trailer (Figure 28). Note that search effort increased at Anacapa Middle West, Cat Rock, Crook Point, East Point, Ford Point, Fossil Reef, Harris Point, Johnson’s Lee, Otter Harbor, Scorpion Rock, Trailer and Willows Anchorage due to the greater number of abalone that occurred at those locations and the greater availability of time. Searches at all sites except Willows Anchorage were conducted within the confines of the site boundaries as defined by the CHIS Rocky Intertidal Monitoring Program (Richards and Davis 1988) and updated protocol summaries (Richards and Lerma 2000). At Willows, a subset of the entire site was searched (see corresponding trip reports in Appendix B for details).

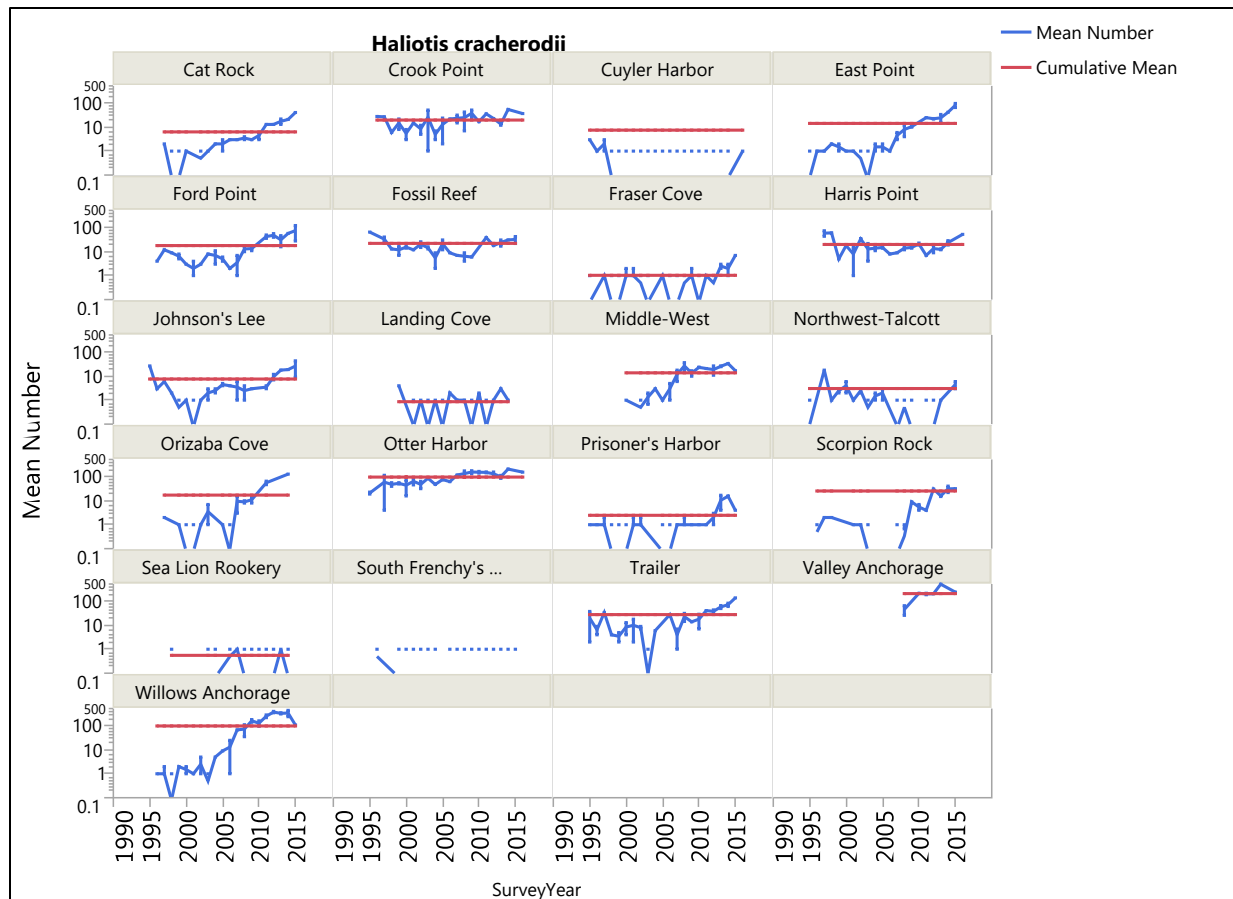


Figure 28. Departure from the long-term mean for *Haliotis cracherodii* at each site. Blue lines represent mean number of *H. cracherodii* at each site. Red lines represent cumulative mean. Note that data are displayed on a logarithmic scale.

More than half (9 of 17) of the sites sampled in 2015–16 resulted in counts of black abalone that were fairly consistent with the range of counts at the representative sites seen since 1995 (Figure 28 [timed search for all years]). At the remaining sites, black abalone counts increased above the long-term mean calculated for previous years at each site. In some cases, increases were only slightly above the long-term mean, but substantial increases in abundances were documented in 2015–16 at Cat Rock, East Point, Ford Point and Johnson's Lee. At most locations where black abalone counts have increased above the long-term mean, abundances began increasing approximately 2007–2009.

Of particular concern was a marked decrease in black abalone abundance at Willows Anchorage this year relative to recent past years. Greater than 300 abalone were observed at this site from 2010 until this year when the total decreased to N=109 black abalone. For reference, in fall 2014, N=444 *H. cracherodii* were seen in the same area of the site searched this year. In addition to the low abundance of abalone seen here this year, and perhaps related, last year, 35 empty black abalone shells that appeared fresh and clean on the inside were located. Two black abalone (alive) appeared to be slightly withered as they exhibited a shrunken foot and had difficulty adhering tightly to the

substratum. Another withered individual was found dead on the beach and was collected for subsequent genetic analysis purposes.

At the island level, mean abundances of *H. cracherodii* in 2015–16 measured above the cumulative mean calculated from all years post 1995 at Anacapa and Santa Cruz (Figure 29). Populations at San Miguel and Santa Rosa were comparable to the long term means generated for the respective islands. Note that only a few black abalone have been observed at Santa Barbara Island in recent years, and the population at that island has yet to exhibit any signs of recovery.

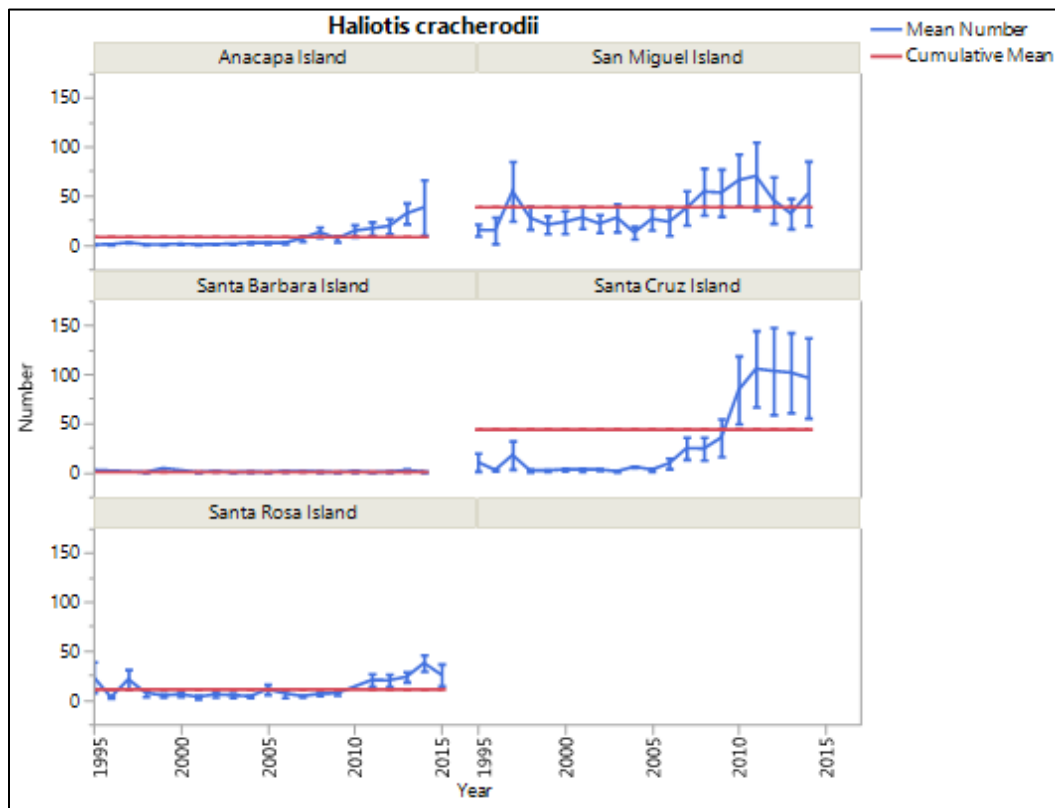


Figure 29. Departure from the long-term mean for *Haliotis cracherodii* at each island. Blue lines represent mean number of *H. cracherodii* at each island. Red lines represent cumulative mean. Error bars were constructed using 1 standard error from the mean.

In 2015–16, the size frequency distributions for all islands (except Santa Barbara) reflected the effects of recruitment through the presence of juvenile (≤ 30 mm shell length) black abalone (Figures 30–32). Modes for populations at Anacapa, Santa Cruz, Santa Rosa and San Miguel ranged approximately 50–75 mm. Anacapa Island had a relatively flat but normally-distributed population with a mode in the range 50–75 mm. The population at Santa Cruz Island also followed a normal distribution with the majority of abalone measuring approximately 50–75 mm. Santa Rosa *H. cracherodii* were skewed towards larger individuals with a mode at approximately 50–75 mm. At San Miguel, the size distribution was also skewed right with a mode at 50–75 mm. Note that the two sites at Santa Barbara Island were not sampled this year due to logistical challenges. However, in

past years, too few abalone were observed at Santa Barbara sites to accurately assess population size distribution.

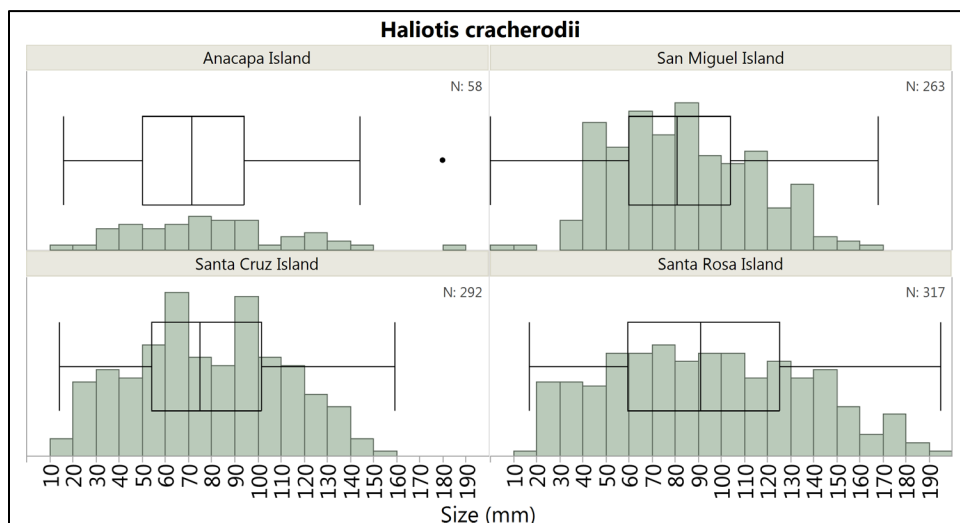


Figure 30. *Haliotis cracherodii* size distributions pooled across sites at each island measured in 2015–16. Box-and-whisker plots indicate the spread and degree of skewness of the size frequency data. The ends of the boxes represent the 25th and 75th quartiles, the vertical line inside the box indicates the median value, the whiskers extend from the ends of the box to the outermost data point that falls within 1.5 of the lower and upper quartiles and dots indicate outlier values.

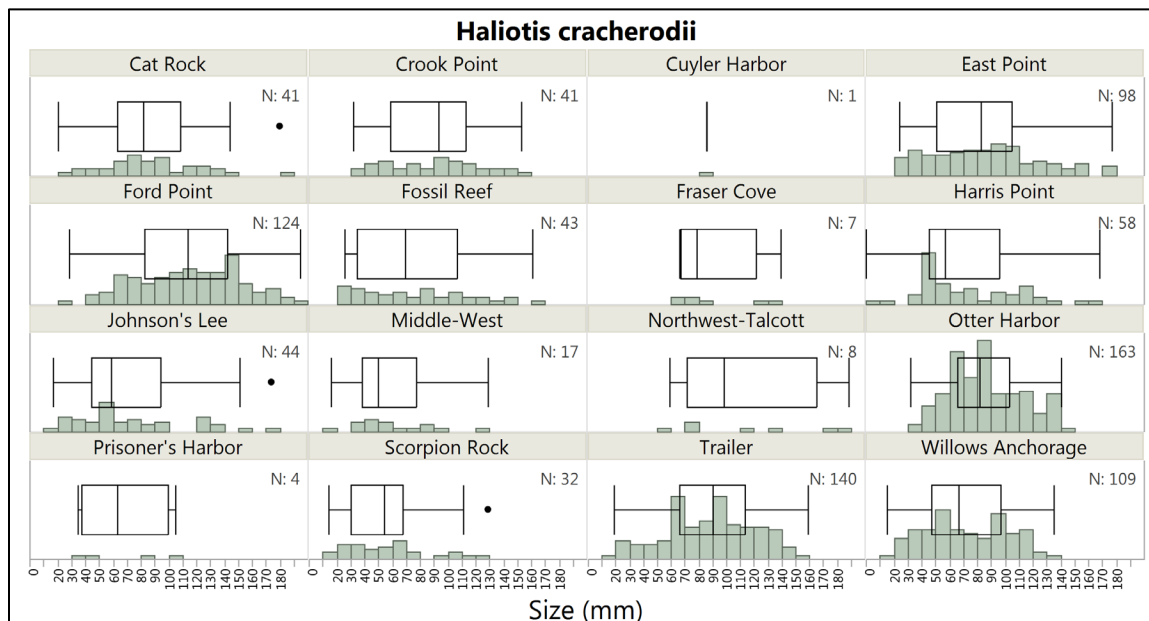


Figure 31. Size frequency distributions of *Haliotis cracherodii* measured at each site in 2015–16. Box-and-whisker plots indicate the spread and degree of skewness of the size frequency data. The ends of the boxes represent the 25th and 75th quartiles, the vertical line inside the box indicates the median value, the whiskers extend from the ends of the box to the outermost data point that falls within 1.5 of the lower and upper quartiles and dots indicate outlier values.

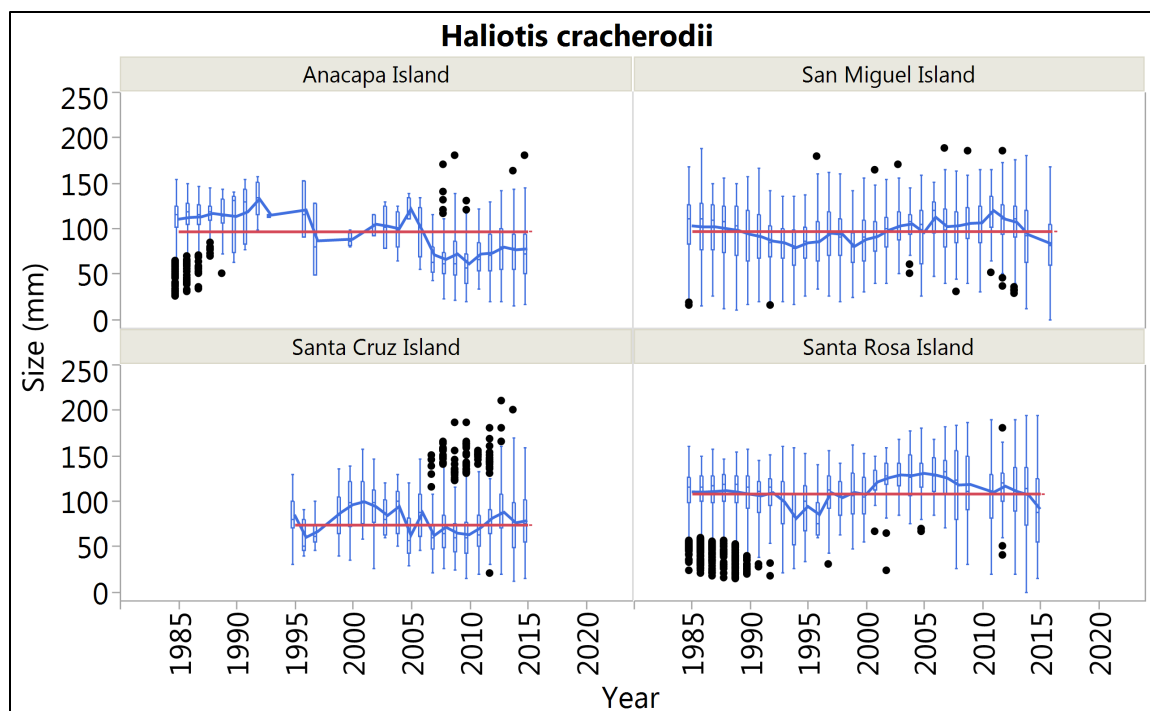


Figure 32. Box plots for annual size frequency distributions of *Haliotis cracherodii* at each island. Blue lines represent mean sizes of *H. cracherodii* at each island pooled across and sites. Red lines represent the cumulative mean.

Shrunken foot, one of the symptoms of Withering Syndrome (WS), was not observed in 2015–16. During the past few years, several abalone that appeared to have shrunken foot were observed. It is unknown whether any of the abalone that appeared shrunken were suffering from WS.

Lottia gigantea

Owl limpets, *Lottia gigantea*, were sampled at all sites in 2015–16 where fixed plots for *L. gigantea* have been established. Averaged across sites for each island, the mean number of limpets increased above the long-term mean at Santa Rosa and particularly San Miguel; both islands reached record high abundances of owl limpets (Figure 33). Alternatively, *L. gigantea* abundances at Anacapa were below average this year. The Santa Cruz population was slightly (within 1 SE) above the long-term mean for the island. Note that there are not any fixed plots for *L. gigantea* at Santa Barbara Island sites.

At the site level, abundances of *L. gigantea* were comparable to the long-term mean values calculated for the respective sites at five locations (Figure 34). Owl limpet abundances were exceptionally high at three sites (Fraser Cove, Fossil Reef, Otter Harbor) this year. Below-average abundances of limpets were measured at all the Anacapa sites (Anacapa Middle West, Cat Rock, South Frenchy's Cove), Ford Point and Trailer.

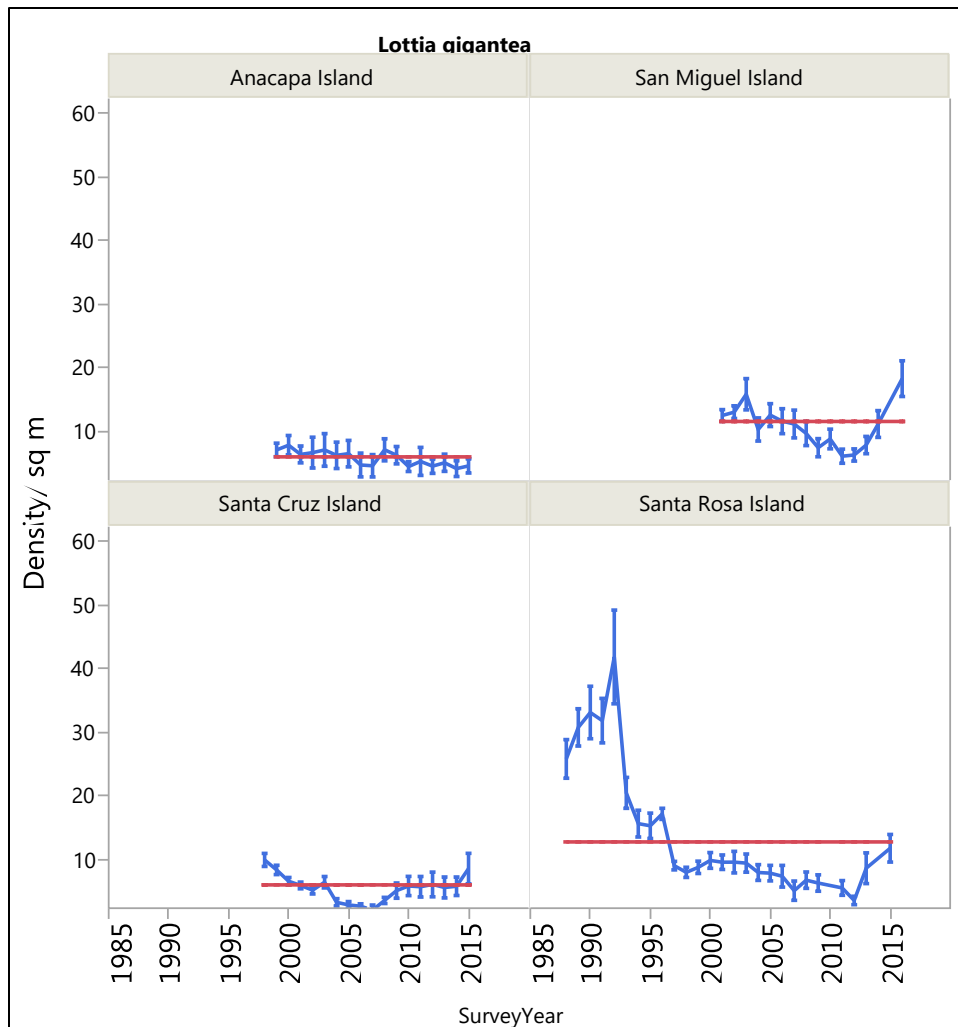


Figure 33. Departure from the long-term mean for *Lottia gigantea* at each island. Blue lines represent mean density of *L. gigantea* at each island pooled across fixed plots and sites. Red dashed lines represent cumulative mean density. Error bars were constructed using 1 standard error from the mean.

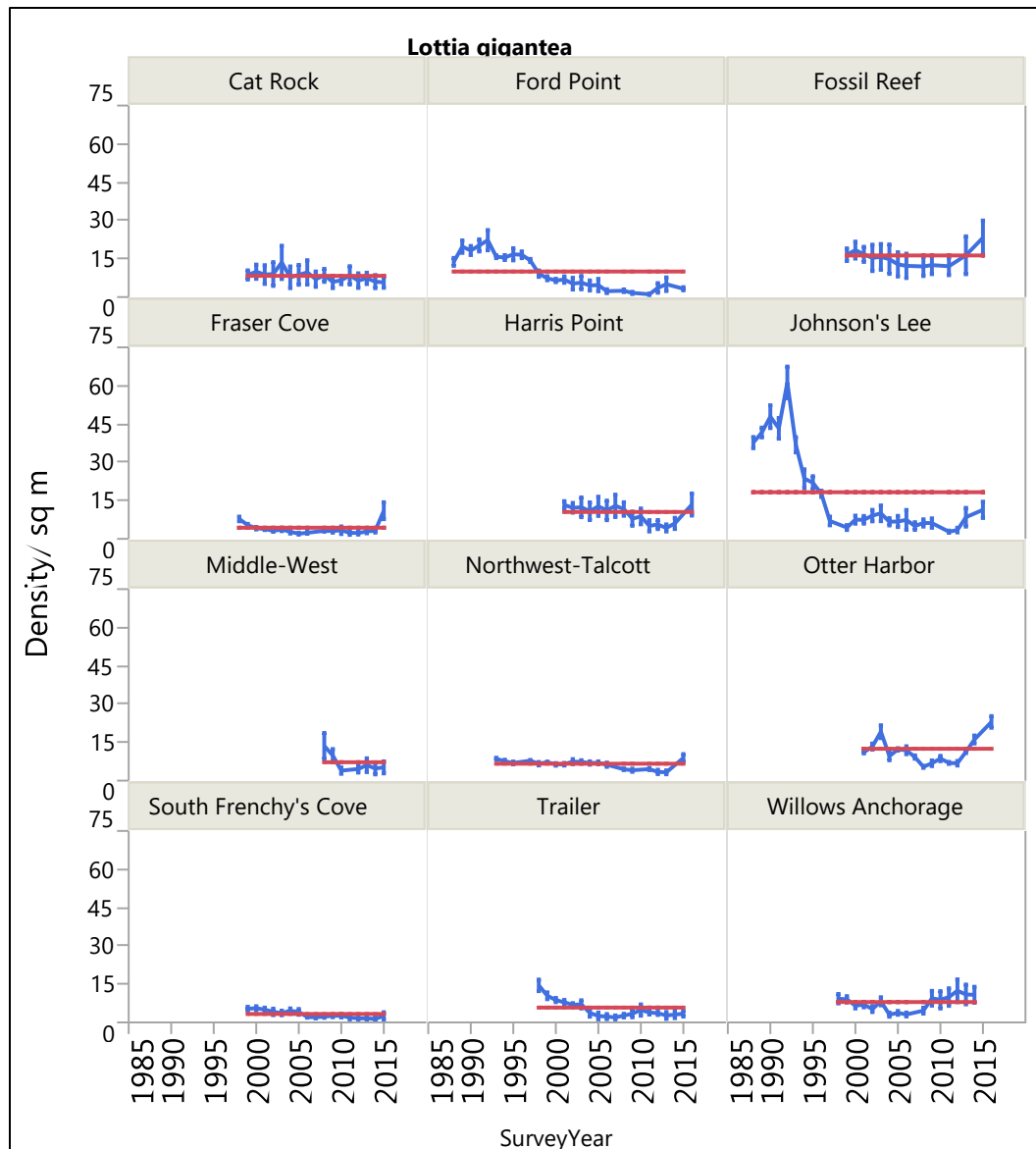


Figure 34. Departure from the long-term mean for *Lottia gigantea* at each site. Blue lines represent mean density of *L. gigantea* at each site pooled across fixed plots. Red dashed lines represent cumulative mean density. Error bars were constructed using 1 standard error from the mean.

The mean size of *L. gigantea* varied among islands (range = 36.5–46.1 mm) and sites (range = 34.4–57.2 mm) in 2015–16 (Figure 35). Relative to the mean values, median sizes of owl limpets were less spread among islands (range = 35.5–42 mm), but at the site level, the range of median values (33–62.5 mm) was greater. The smallest *L. gigantea* were observed at Fraser Cove and Johnson's Lee and the largest were seen at Trailer followed closely by Northwest-Talcott (Figure 36).

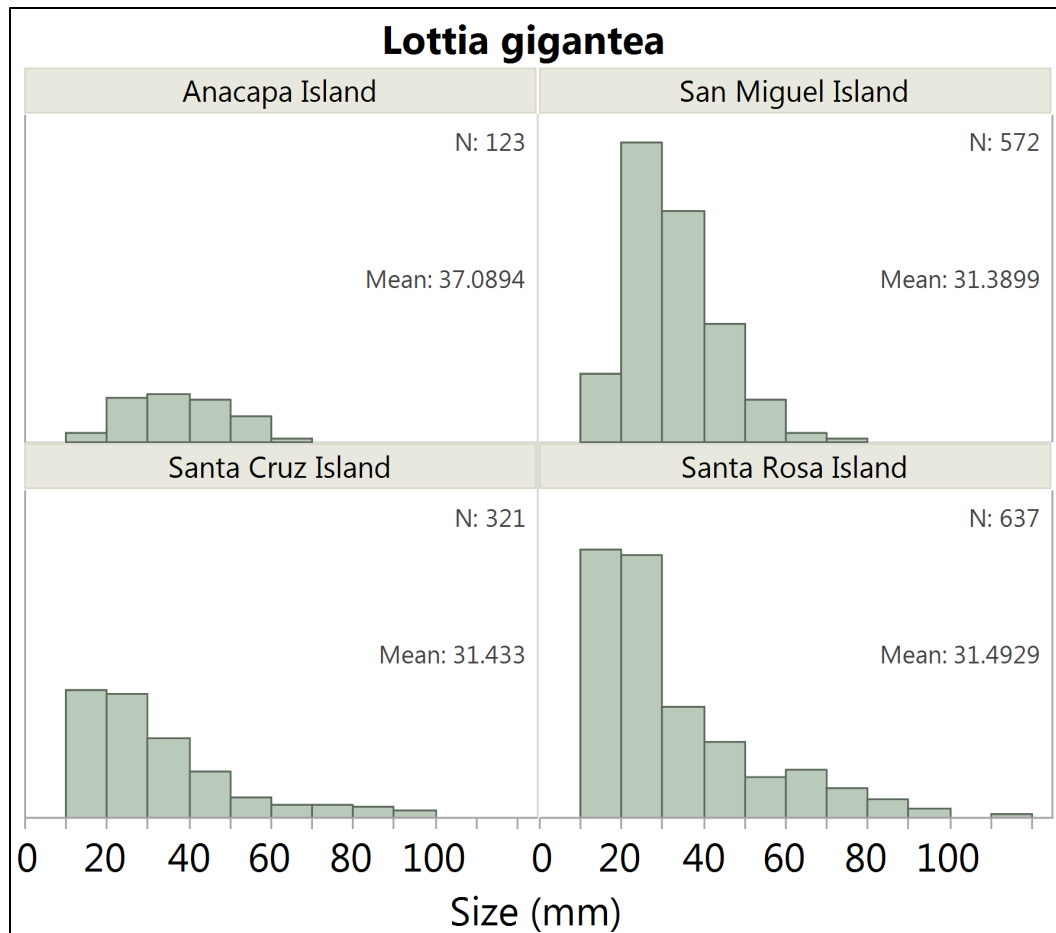


Figure 35. *Lottia gigantea* size distributions at each island measured in 2015–16. Bars indicate the number of individuals within each size bracket. Mean value indicates the mean size of *L. gigantea* at each island.

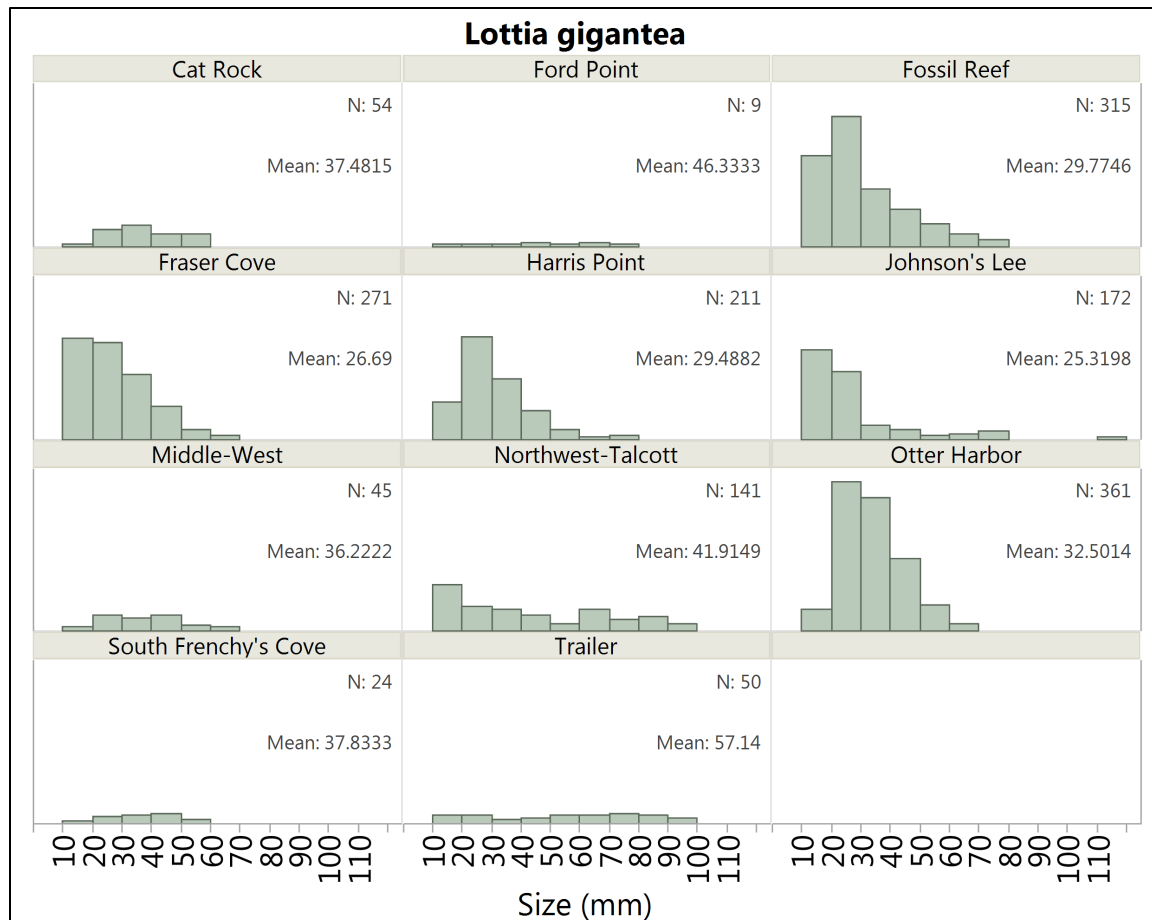


Figure 36. *Lottia gigantea* size distributions at each site measured in 2015–16. Bars indicate the number of individuals within each size bracket. Mean value indicates the mean size of *L. gigantea* at each site.

Temporally, the mean sizes of *L. gigantea* in 2015–16 decreased at Santa Cruz, Santa Rosa and San Miguel relative to the cumulative mean values generated for each island population (Figure 37). Anacapa owl limpet mean sizes were comparable to the long-term mean. At the site level, mean sizes of owl limpets were near or below average at all locations due to the increased presence of smaller individuals (Figure 38).

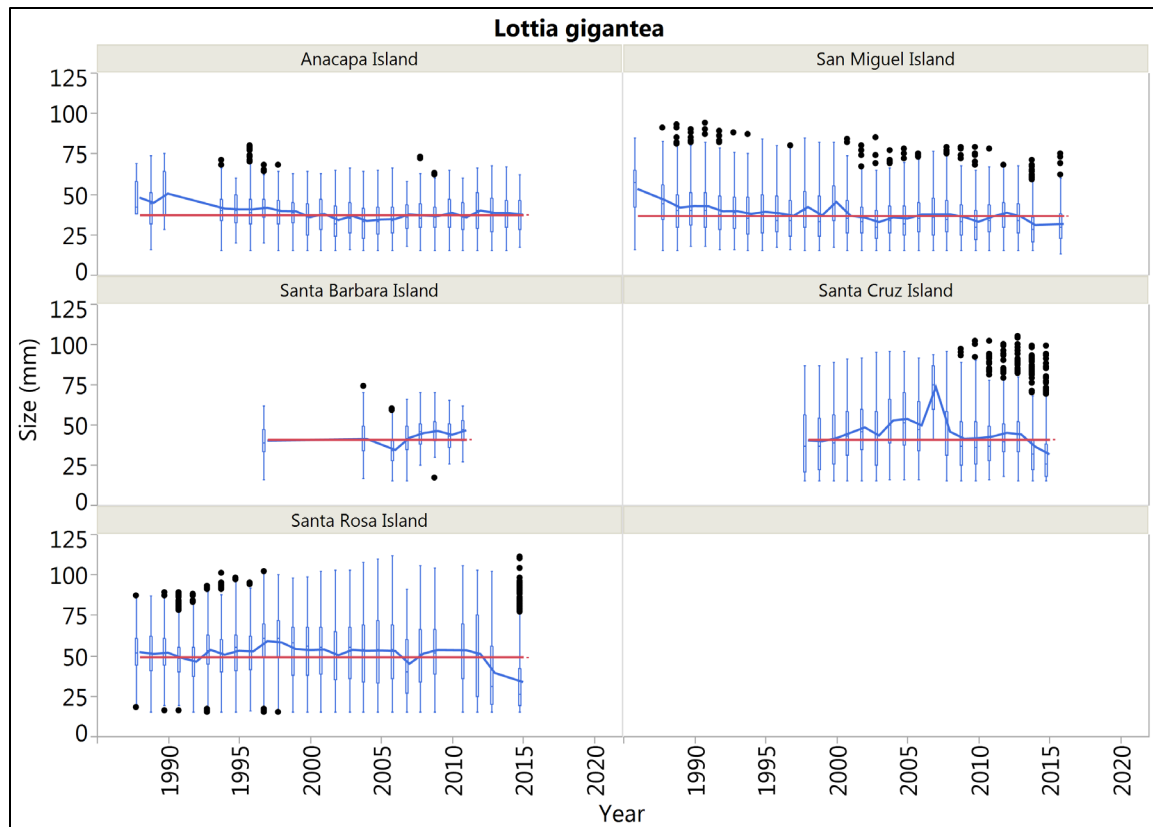


Figure 37. Box plots for annual size frequency distributions of *Lottia gigantea* at each island. Black lines represent mean sizes of *L. gigantea* at each island pooled across fixed plots and sites. Red lines represent the cumulative mean.

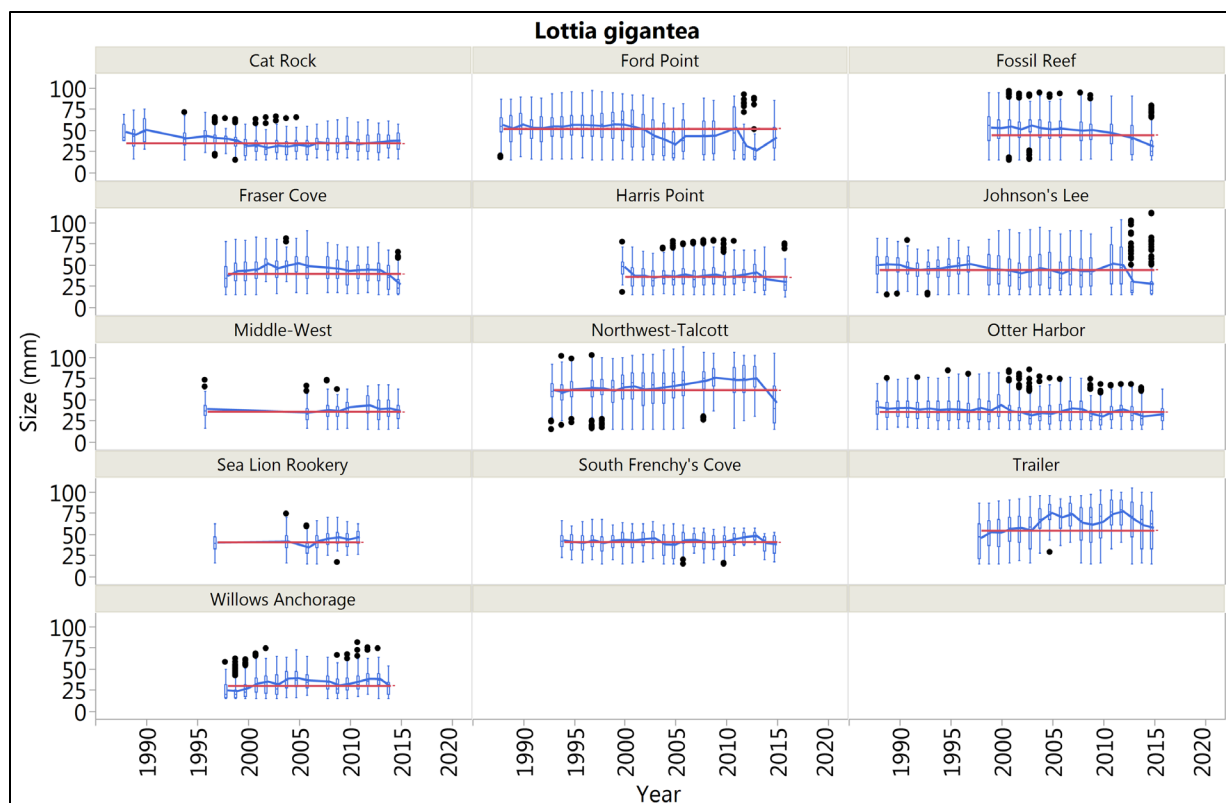


Figure 38. Box plots for annual size frequency distributions of *Lottia gigantea* at each site. Black lines represent mean sizes of *L. gigantea* at each site pooled across fixed plots. Red lines represent the cumulative mean.

Pisaster ochraceus

Temporally, the abundances of *P. ochraceus*, sea stars have fluctuated markedly at most sites, with the exceptions of Cat Rock, Harris Point, Northwest-Talcott, and South Frenchy's Cove which historically have supported low (i.e. < 35 *P. ochraceus*) numbers of sea stars. The sites Orizaba Cove, Landing Cove and Sea Lion Rookery were not sampled for sea star abundance in 2015–16.

Compared with previous years, sea star abundances in 2015–16 and last year plummeted at all sites that were sampled (Figures 39–41). At various times during the past decade, extremely high abundances (~ 500 *P. ochraceus*) have been observed at multiple sites, and most locations have supported >100 sea stars counted during 30-minute site-wide searches. This year, abundances ranged 0–43 individuals per site with the majority of sites having fewer than 10 *P. ochraceus* seen during routine searches. The highest abundances (range = 23–42 *P. ochraceus*/site) were seen at Crook Point, Ford Point, Johnson's Lee and Willows Anchorage.

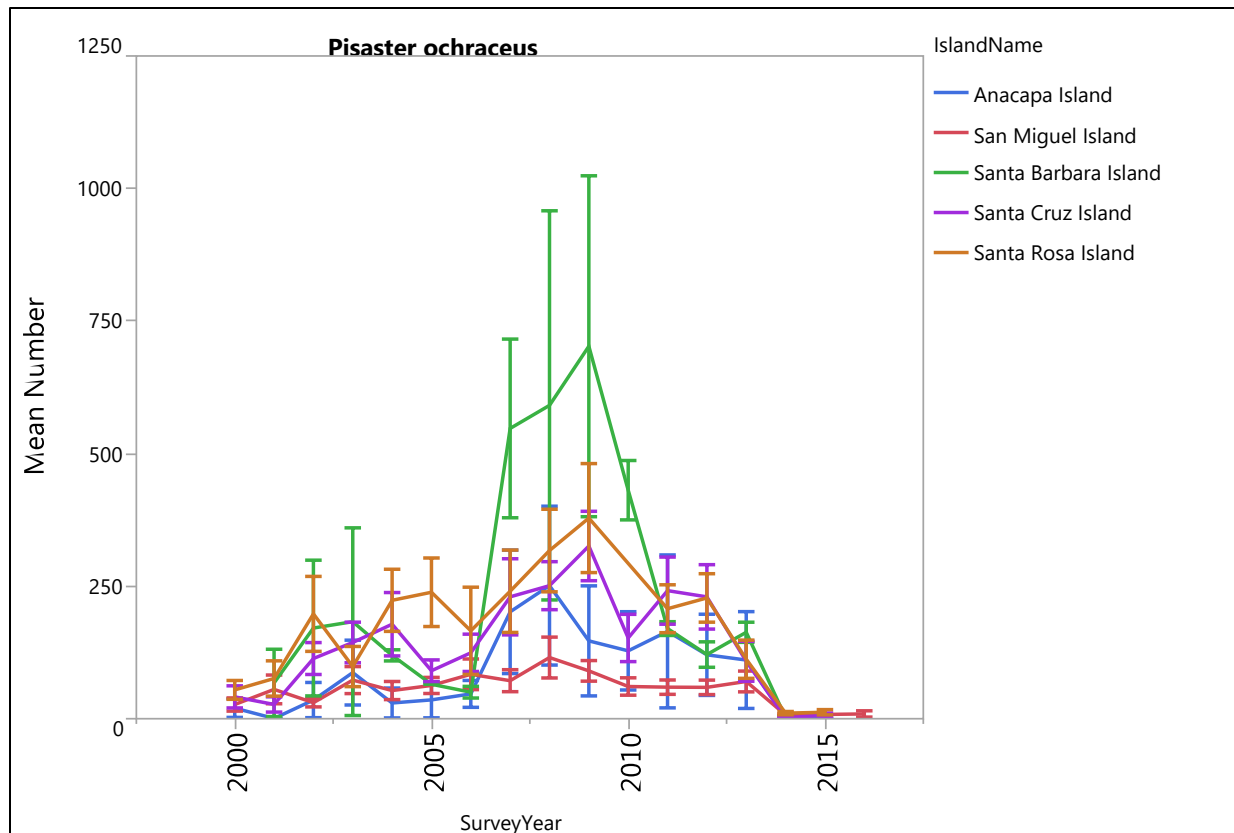


Figure 39. *Pisaster ochraceus* counts pooled across all sites at each island from 1999–2015–16. Count data were obtained from timed (30 minute) searches.

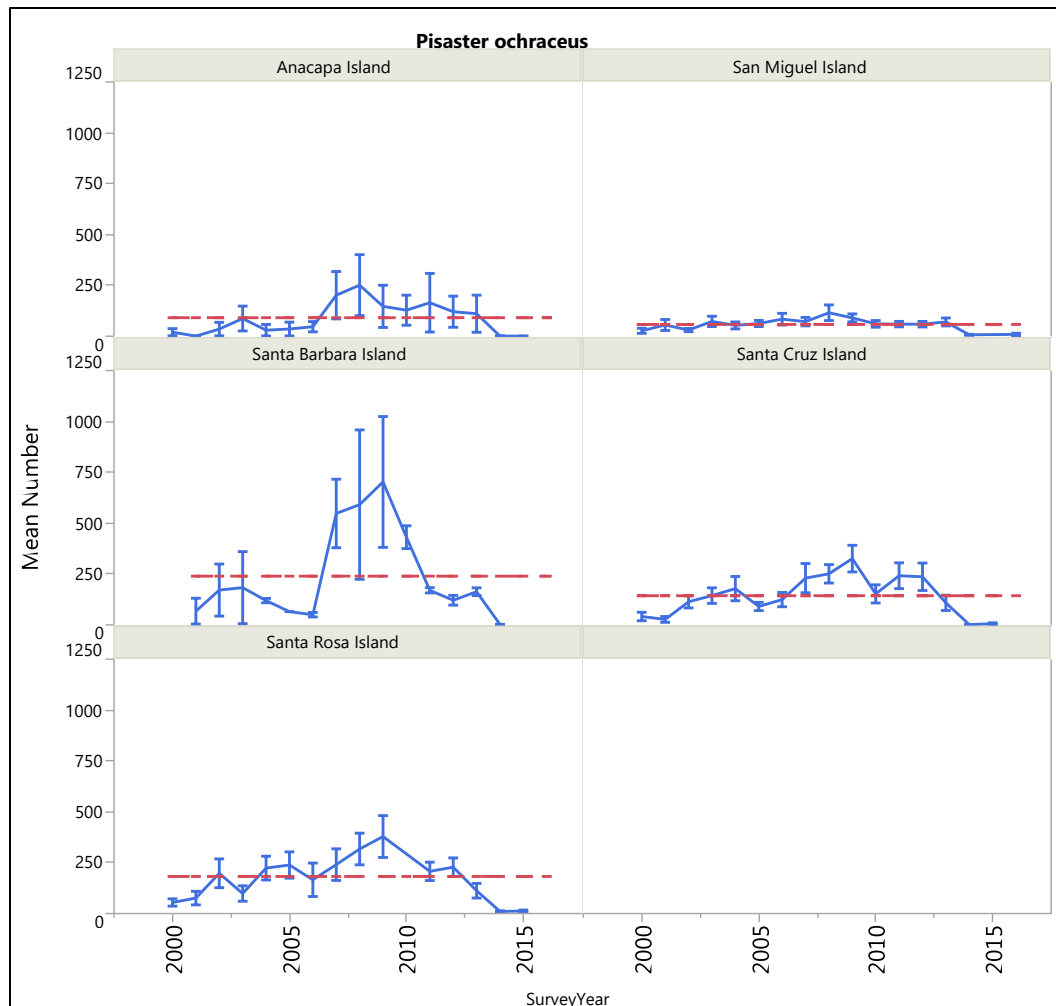


Figure 41. *Pisaster ochraceus* counts at each island from 2000–2015–16. Count data were obtained from timed-(30 minute) searches. Blue lines represent the number of *P. ochraceus* and red dashed lines indicate the long-term mean number of *P. ochraceus* at each site.

Beginning in June 2013, a disease event swiftly and significantly impacted *P. ochraceus* (among other species of sea stars) populations along the North American Pacific coast from Alaska to Baja California, Mexico. By the beginning of 2014, *P. ochraceus* abundances had declined by >95% at nearly all CHIS long-term intertidal monitoring sites, in addition to numerous other locations along the west coast. The magnitude and spatial scale of this wasting event were unprecedented by any other die-offs that have been documented in recent decades.

The mortality event, often referred to as sea star wasting syndrome (SSWS) or disease (SSWD), is typically characterized by a suite of symptoms that initially consist of lesions forming in the ectoderm which then leads to fragmentation of the body and death as the illness progresses. The manifestation of symptoms and subsequent death can occur in as little as two days. It's unclear what causes the syndrome although there is evidence that a densovirus (SSaDV) is linked to SSWS (Hewson et al. 2014).

According to Hewson et al. (2014), SSaDV was observed in higher quantities within sick sea stars compared to asymptomatic individuals. When inoculated with the densovirus, outwardly-appearing healthy animals rapidly succumbed to the symptoms of SSWS. However, it should be noted that the densovirus was also detected in museum specimens of sea stars dating back to 1942, and it was observed within other species of echinoderms that were asymptomatic. More research is needed to determine causative agents for the disease.

Size frequency measurements for *P. ochraceus* were collected at all sites sampled in 2015–16. However, insufficient numbers of sea stars were seen to accurately estimate the size structure of *P. ochraceus* populations. Despite low abundances of sea stars in 2015–16, size frequency data for each island (sites lumped across islands) and site are displayed in Figures 42–45. Even though abundances were low, the presence of small juvenile (e.g., < 50 mm) *P. ochraceus* was documented at many of the monitoring sites.

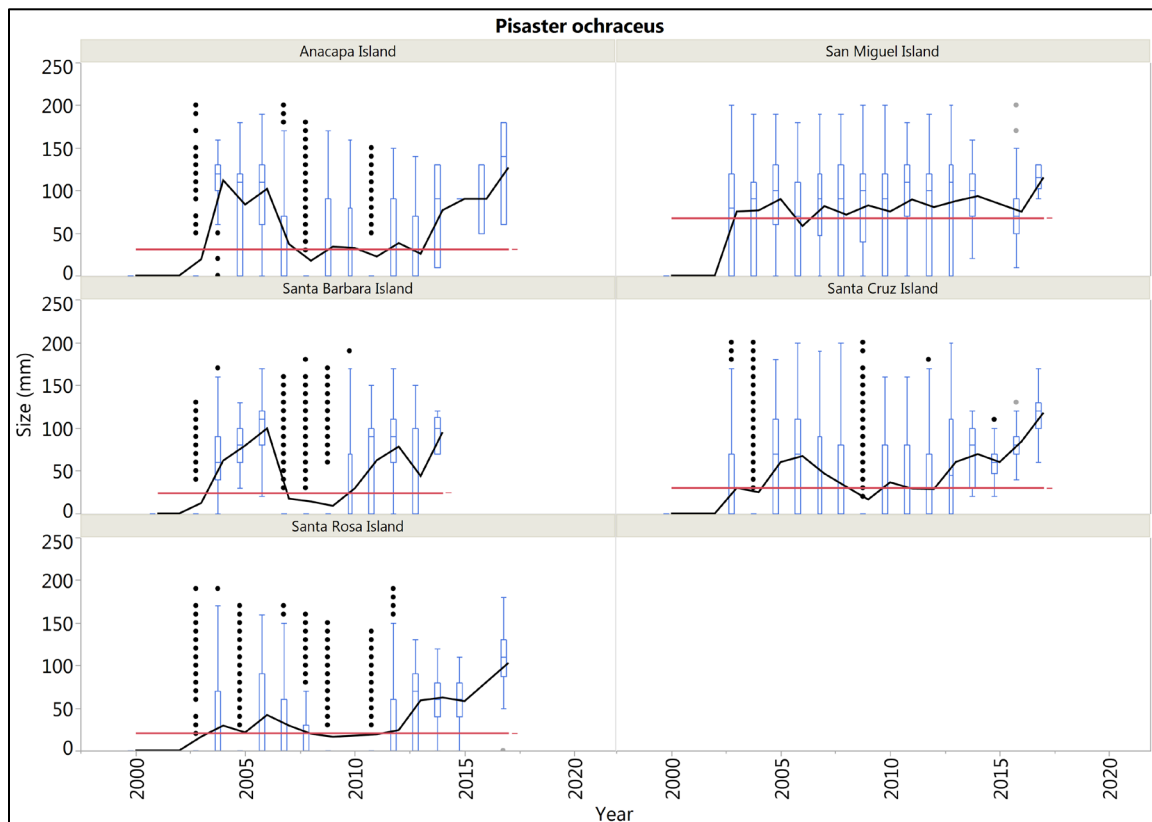


Figure 42. Box plots for annual size frequency distributions of *Pisaster ochraceus* at each island. Black lines represent mean sizes of *P. ochraceus* at each island pooled across sites. Red lines represent the cumulative mean. Note that low abundances of *P. ochraceus* were observed at nearly all sites in 2015–16.

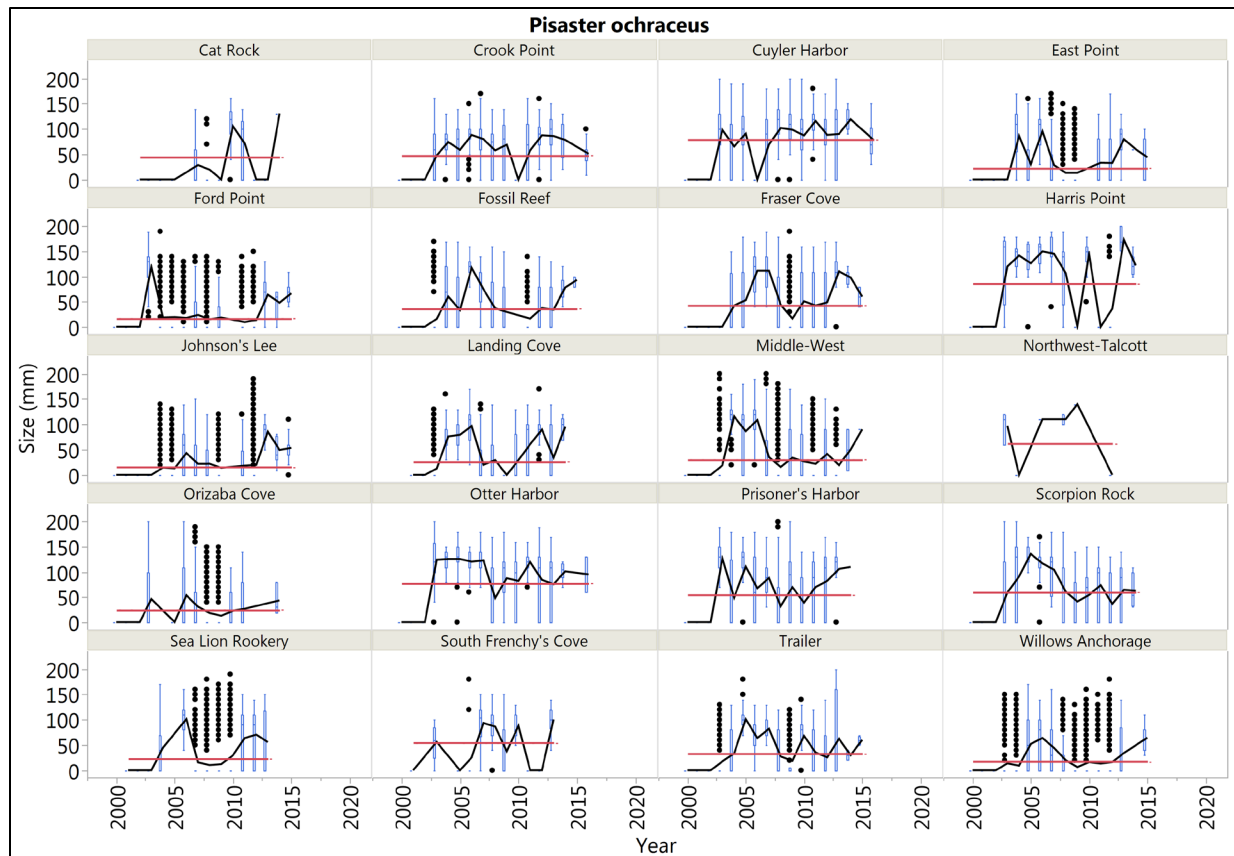


Figure 43. Box plots for annual size frequency distributions of *Pisaster ochraceus* at each site. Black lines represent mean sizes of *P. ochraceus* at each site. Red lines represent the cumulative mean.

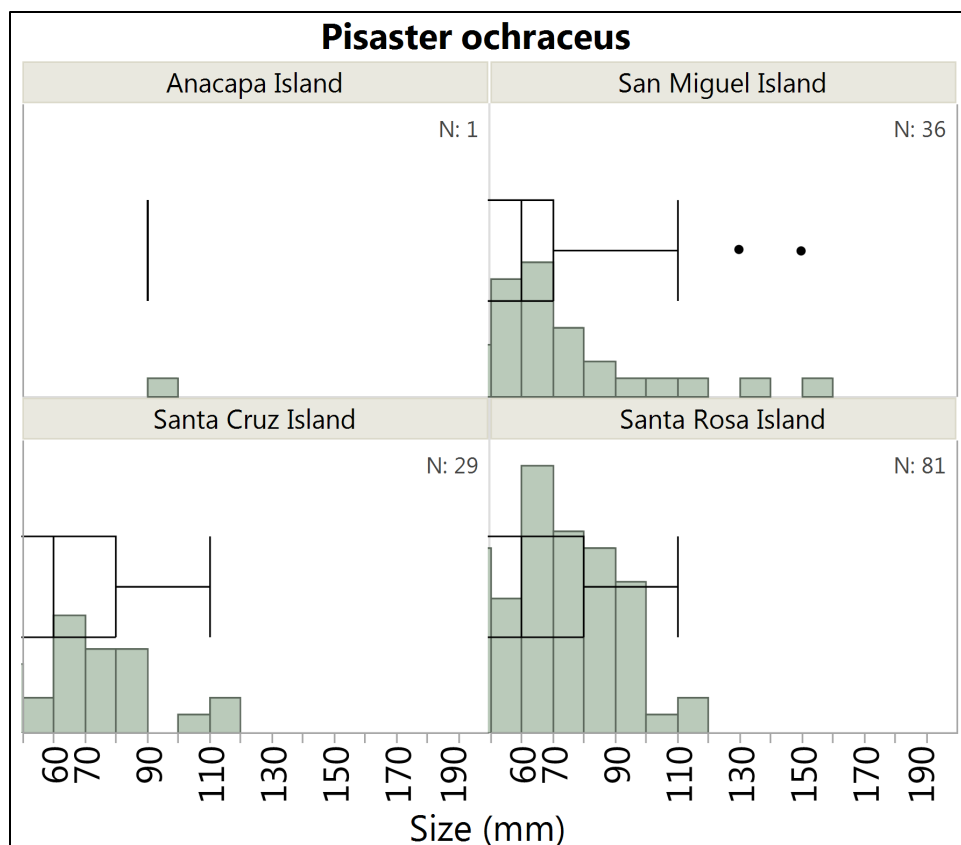


Figure 44. *Pisaster ochraceus* size distributions at each island measured in 2015–16. Box-and-whisker plots indicate the spread and degree of skewness of the size frequency data. The ends of the boxes represent the 25th and 75th quartiles, the vertical line inside the box indicates the median value, the whiskers extend from the ends of the box to the outermost data point that falls within 1.5 of the lower and upper quartiles and dots indicate outlier values.

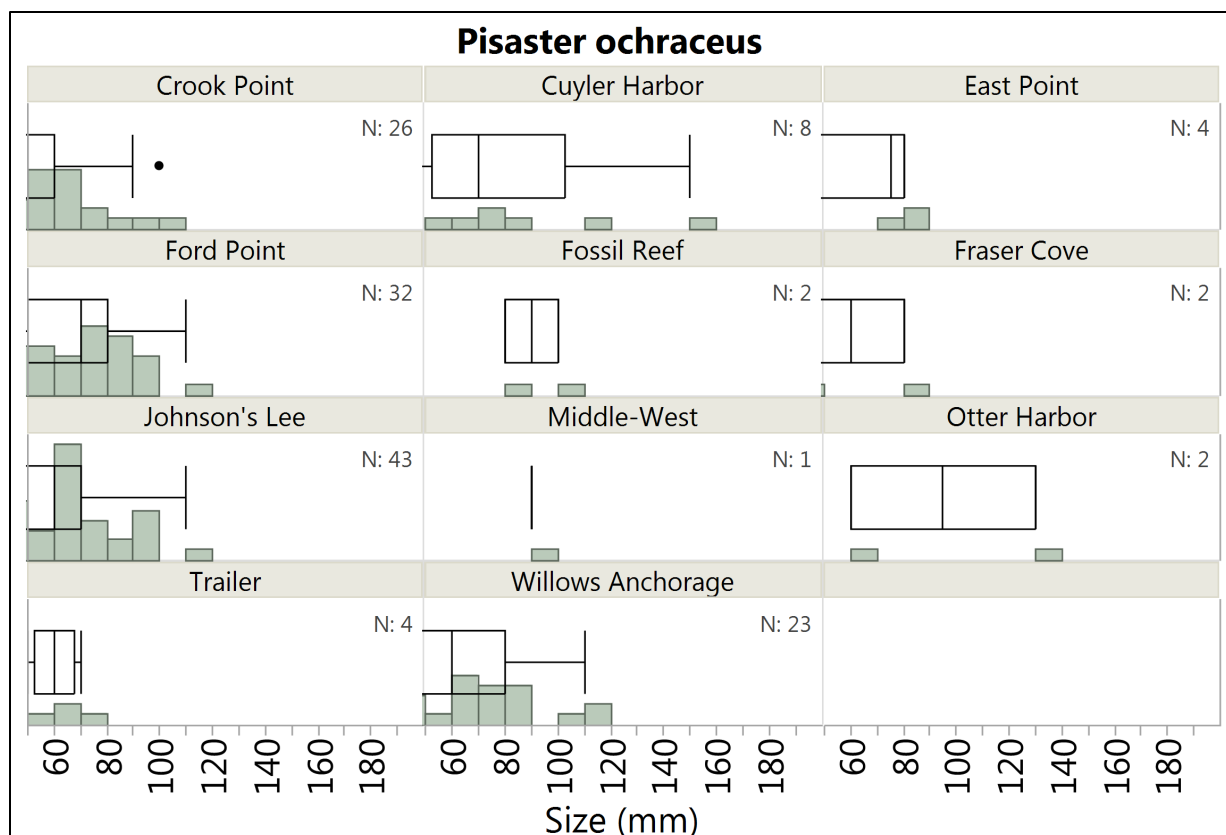


Figure 45. *Pisaster ochraceus* size distributions at each site measured in 2015–16. Box-and-whisker plots indicate the spread and degree of skewness of the size frequency data. The ends of the boxes represent the 25th and 75th quartiles, the vertical line inside the box indicates the median value, the whiskers extend from the ends of the box to the outermost data point that falls within 1.5 of the lower and upper quartiles and dots indicate outlier values. Note that three sites are not displayed because they were not sampled in 2015–16.

Mytilus californianus

Mytilus californianus shell length and bed depth measurements were obtained at each site annually since 2014 (Figures 46–48). At the island level, in 2015–16, the range and median sizes of mussels decreased relative to 2014 measurements at all islands (note that Santa Barbara Island data are not available) except Santa Cruz Island. At Santa Cruz, the median mussel size remained comparable to 2014 measurements and the range appeared to increase slightly. Median bed depth measurements in 2015–16 decreased slightly at Santa Rosa and San Miguel Islands relative to 2014 measurements. At Santa Cruz and Anacapa Islands, median bed depth measurements remained comparable from 2014 to 2015–16.

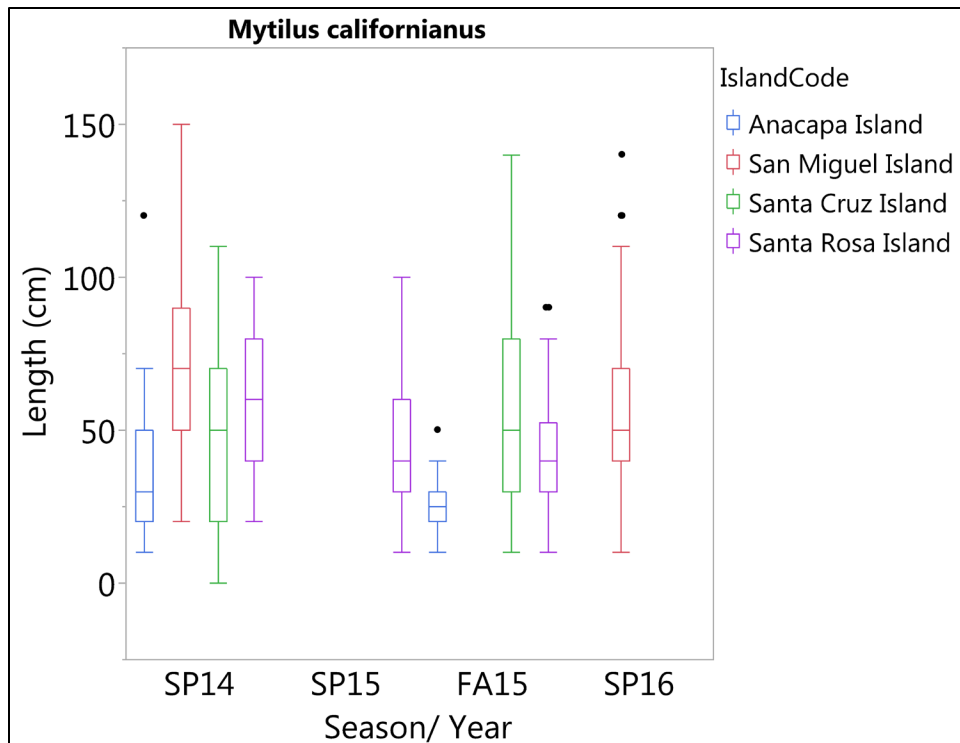


Figure 46. Shell measurements for *Mytilus californianus* summarized across plots and sites for each island. SP = Spring, FA = Fall.

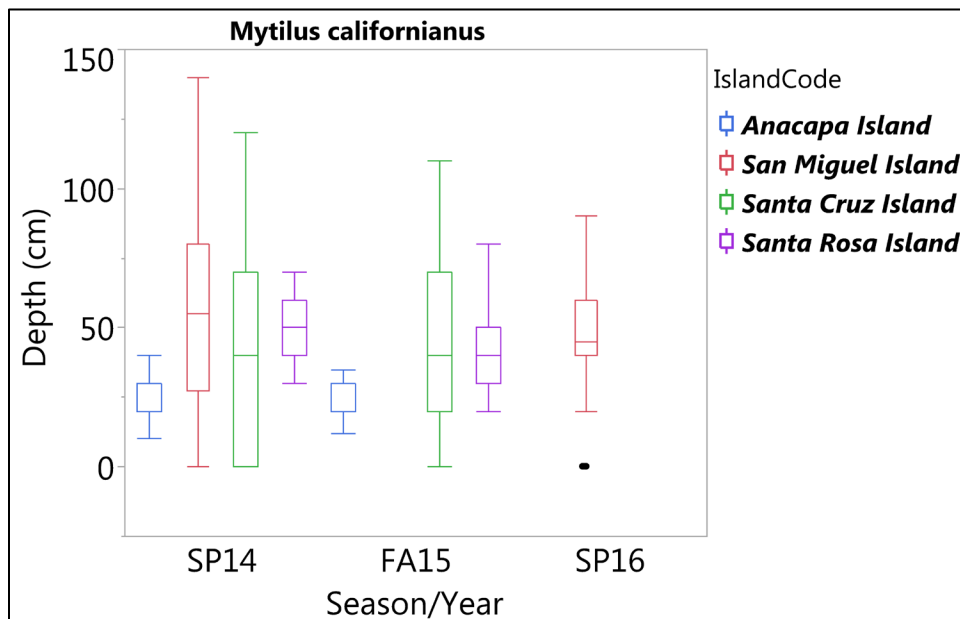


Figure 47. Bed depth measurements for *Mytilus californianus* summarized across plots and sites for each island. SP = Spring, FA = Fall.

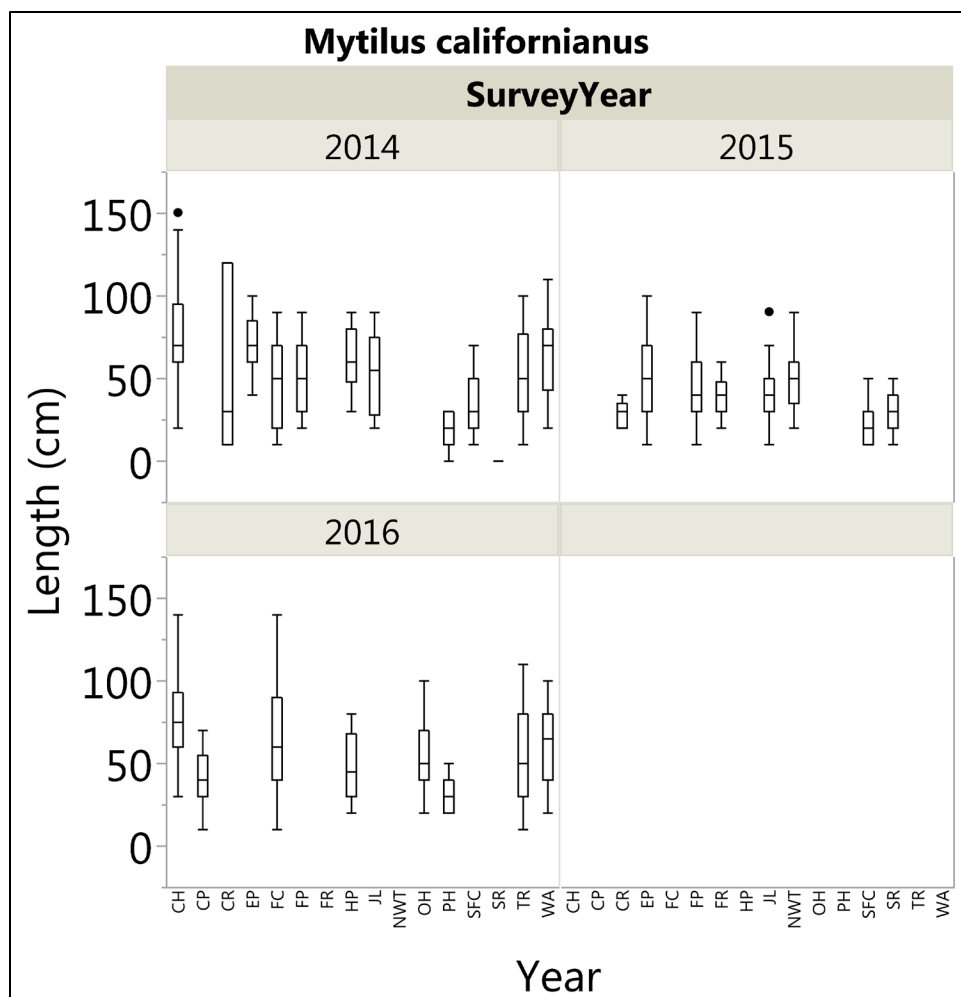


Figure 48. Shell measurements for *Mytilus californianus* summarized across plots for each site.

***Phyllospadix* spp.**

Phyllospadix spp., surfgrass cover has been monitored at two sites (Fraser Cove and Trailer) on Santa Cruz Island since spring 1995, and at two sites (East Point and Northwest-Talcott) on Santa Rosa Island since spring 2002 (Figures 49–51). The four sites were chosen for study based on the relatively high abundance of surfgrass habitat present when the sites were established. *Phyllospadix torreyi* has been the dominant species in most transects but some *P. scouleri* has also been present. An attempt is made each year to sample surfgrass abundance on the fixed transects at each of the four monitoring sites. In 2015–16, all transects were successfully sampled at the four monitoring sites.

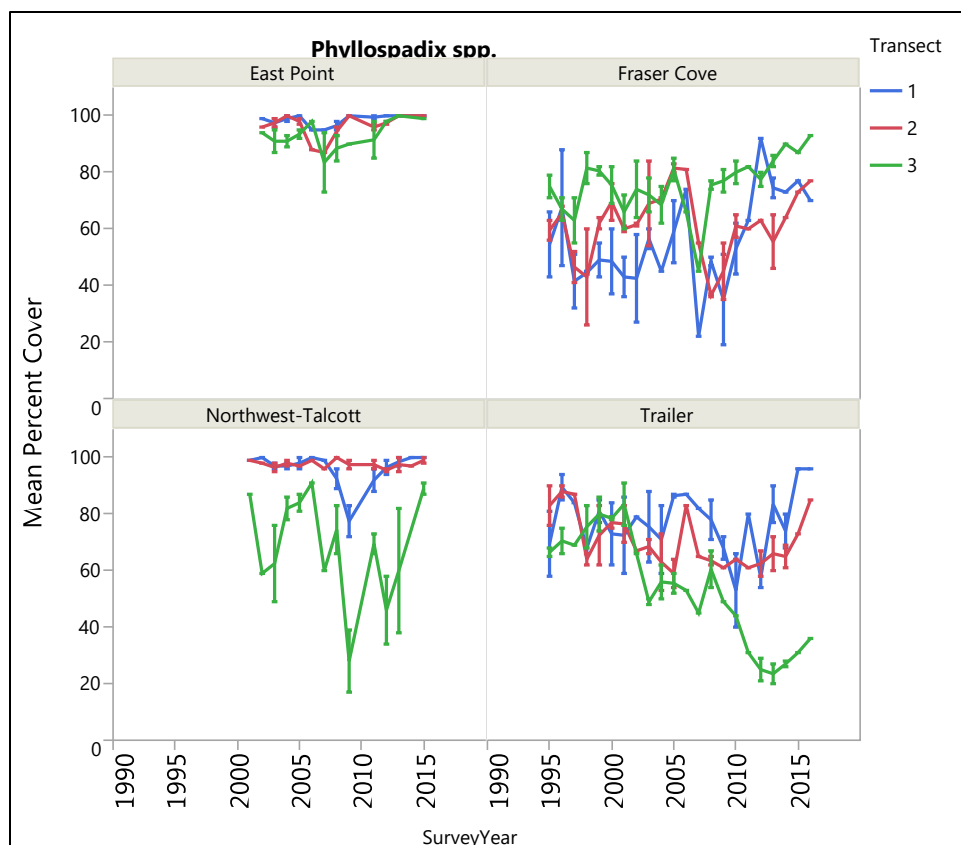


Figure 49. Mean percent cover of *Phyllospadix* spp. at each site.

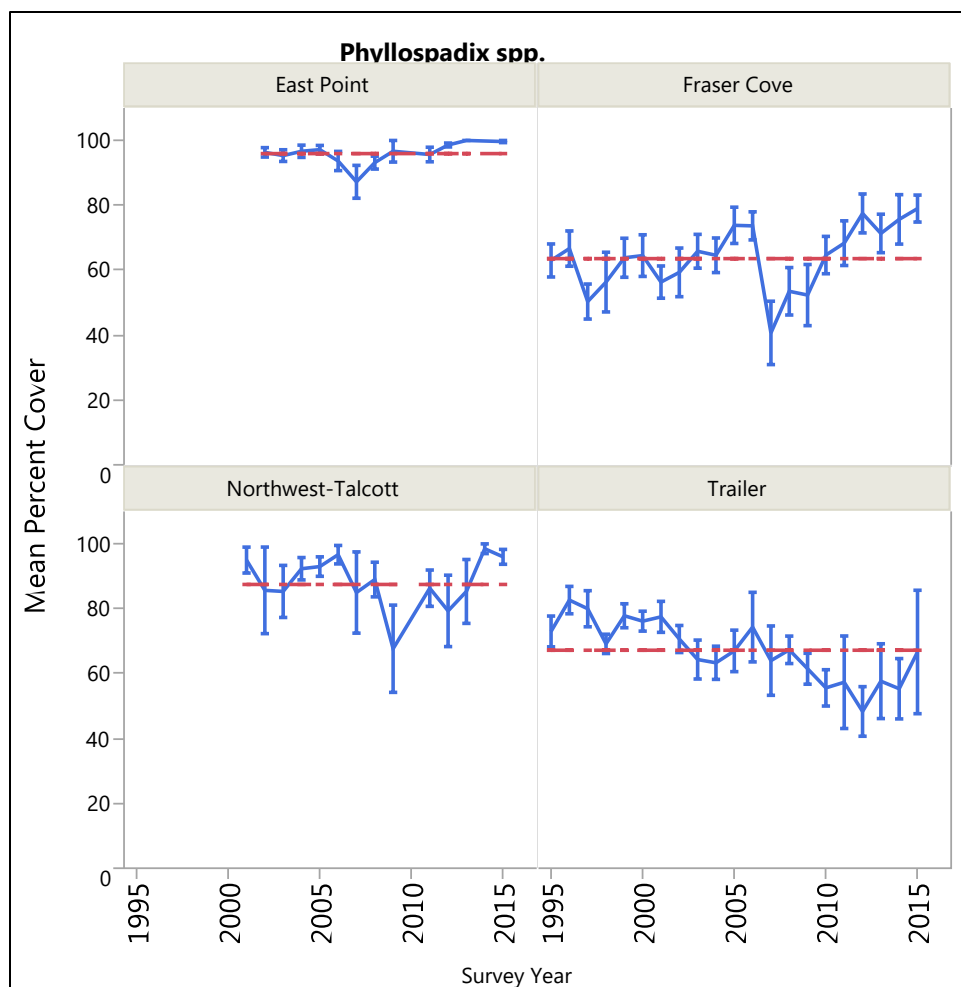


Figure 50. Mean percent cover of *Phyllospadix* spp. pooled across transects at each site. Blue lines represent the mean percent cover of *Phyllospadix* spp. and red dashed lines indicate the long-term mean percent cover of *Phyllospadix* spp. at each site.

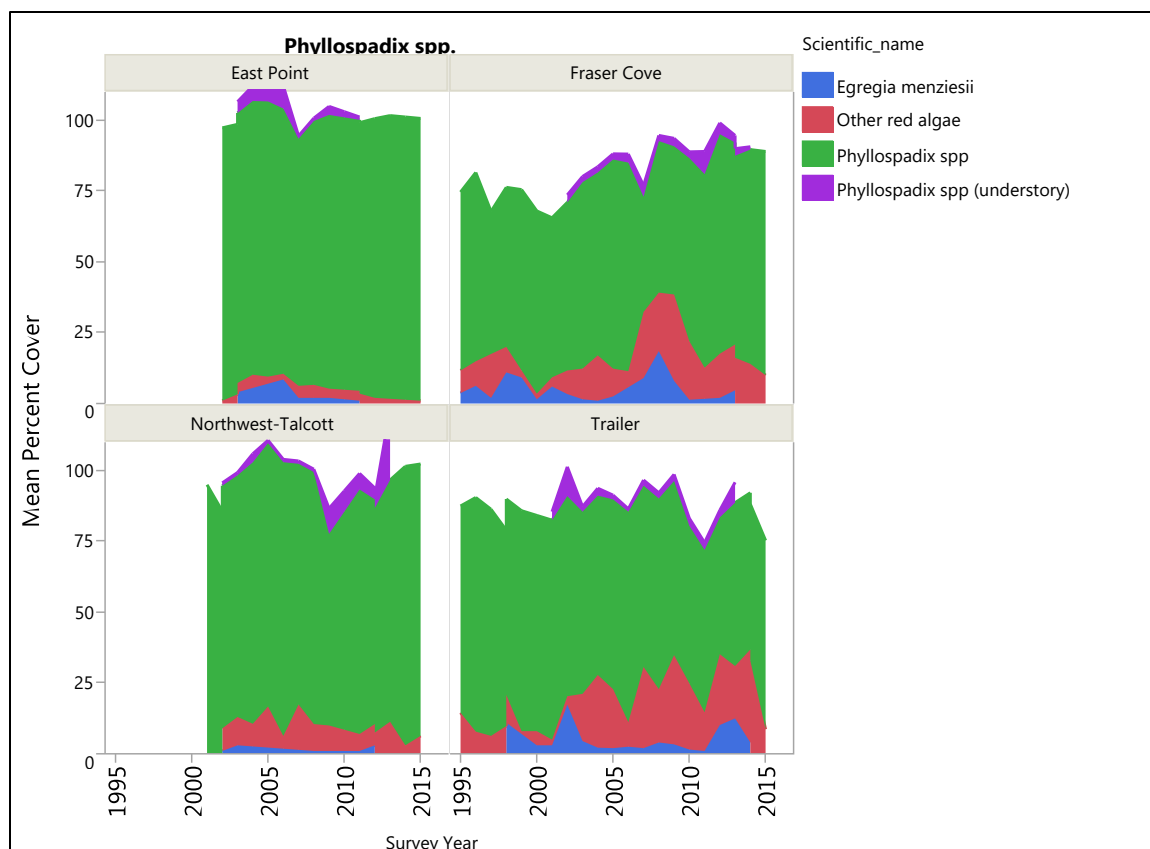


Figure 51. *Phyllospadix* spp. cover at all sites. Colored areas represent the mean percent cover for *Phyllospadix* spp. and other dominant taxa from 10m point-intercept transects. Note that biological cover can exceed 100 percent when *Phyllospadix* spp. (understory) is present.

Strong seasonal patterns have been observed over the years at the two Santa Cruz Island sites, whereby surfgrass overstory cover has routinely declined in spring and increased in fall. In 2015–16, the sites were only sampled in fall precluding any ability to study seasonal differences. However, relative to past years, cover of *Phyllospadix* spp. along the three transects at Fraser Cove increased above the long term mean for the fourth consecutive year (Figure 50). At Trailer, surfgrass cover has been below average since at least 2010. This year cover increased slightly to match the long-term mean (Figure 50). The decline in past years was due to low surfgrass cover recorded on one transect that then increased slightly beginning in 2013. Over time, *Phyllospadix* spp. cover has ranged approximately 45–75 % at Fraser Cove and approximately 50–80 % at Trailer.

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 (Figure 49). 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. In 2015–16, surfgrass overstory cover at East Point was near 100% on all three transects which is typical of past year abundances at this site. At Northwest-Talcott, *Phyllospadix* cover ranged 91–100% on the three

transects. Combined, the mean cover for surfgrass was well above the long-term mean this year (Figure 50).

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 2015–16. Red algae abundances averaged across the three transects at the two sites was approximately 10% at both sites (Figure 51). At the two Santa Rosa Island sites, red algae have historically been much less abundant, particularly at East Point. This year, less than 5% cover of red algae was observed at both sites.

The overall condition of surfgrass at the two sites on Santa Cruz appeared to be healthy with only low to medium cover of epiphytic algae (e.g. *Smithora naiadum* and *Melobesia mediocris*) and minimal bleaching observed. At Northwest-Talcott and East Point on Santa Rosa, epiphytic algal cover was also low, but bleached blades were observed at Northwest-Talcott.

Shorebirds and Pinnipeds

The maximum number of shorebirds and pinnipeds observed at any one time during a visit to the sites during the 2015–16 field season is summarized in Table 2 and Figures 52–53. Overall, the abundances and diversity of shorebirds in 2015–16 at all sites appeared similar to observations made in recent years with the exception of a sharp increase in the number of cormorants observed at East Point. Likewise, there were no marked changes to the abundances of pinnipeds observed in 2015–16.

Table 2. Shorebirds and pinnipeds most commonly encountered at monitoring sites in 2015–16 (maximum seen at any one time). Note some sites are not presented since zero birds or mammals were observed at the locations.

Site Name	Black Oystercatcher	Black Turnstone	California Sea Lion	Cormorant	Harbor Seal	Northern Elephant Seal	Western Gull
Cat Rock	–	–	–	–	3	–	–
Crook Point	4	–	–	22	–	2	–
East Point	2	3	–	1500	1	–	–
Ford Point	4	1	–	–	1	–	–
Fossil Reef	25	–	–	40	–	1	1
Fraser Cove	18	–	–	–	–	–	2
Harris Point	–	–	1	–	9	1	–
Johnson's Lee	2	5	–	–	–	16	–
Northwest-Talcott	3	–	–	–	–	–	2
Otter Harbor	2	10	1	3	31	–	–
Scorpion Rock	2	–	–	–	1	1	3
South Frenchy's Cove	2	–	–	–	–	–	–
Willows Anchorage	–	–	–	–	3	–	–

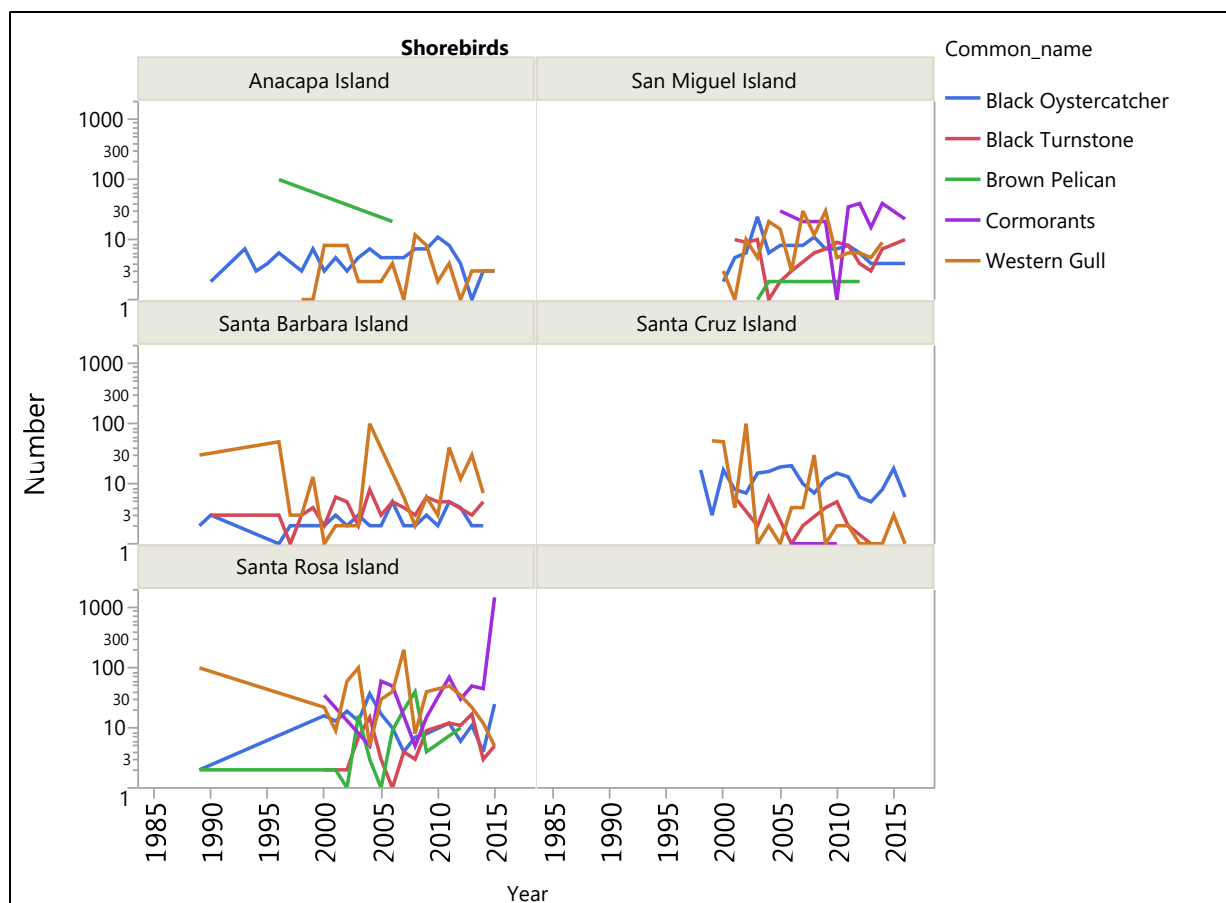


Figure 52. Max number of shorebirds pooled across sites at each island. Note that data are displayed on a logarithmic scale.

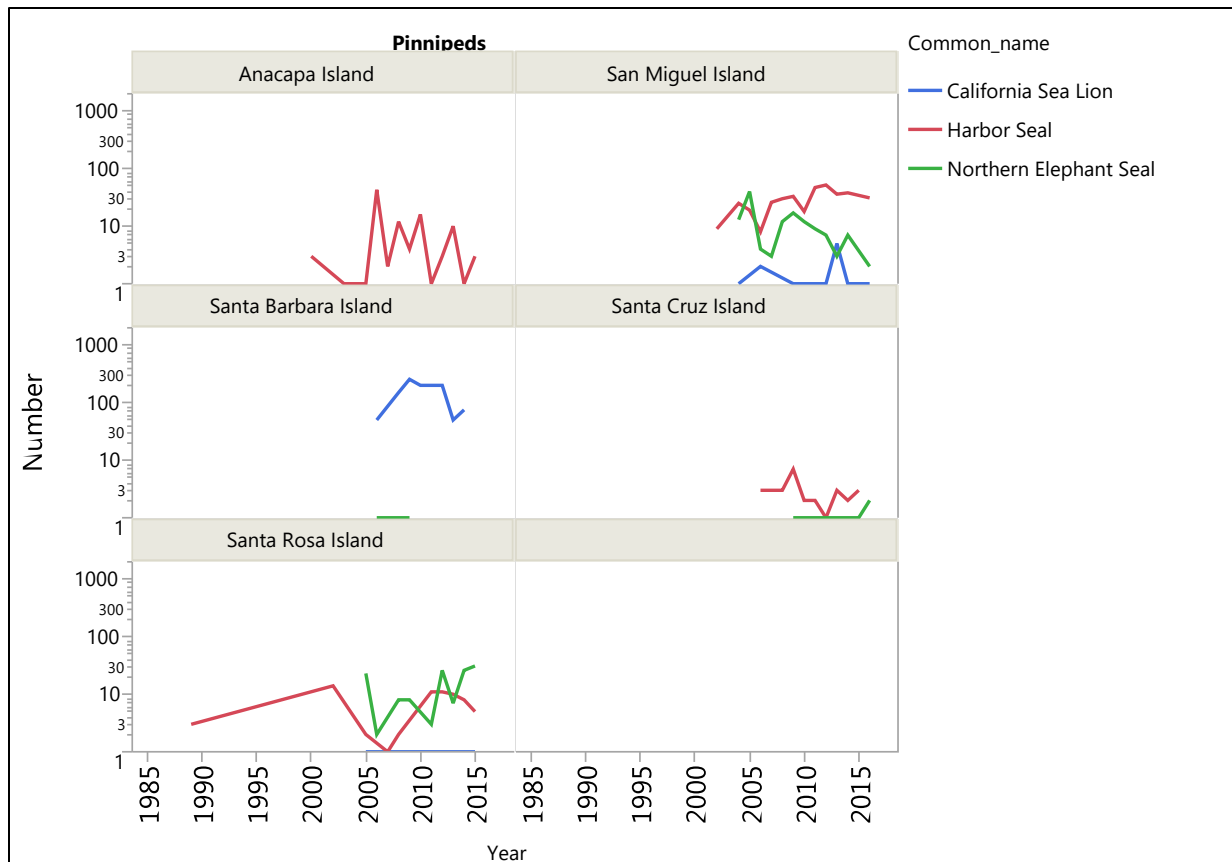


Figure 53. Mean number of pinnipeds pooled across sites at each island. Note that data are displayed on a logarithmic scale.

Black oystercatchers were again the most ubiquitous shorebirds at the rocky intertidal sites. With the exception of seven sites (Anacapa Middle West, Cat Rock, Cuyler Harbor, Harris Point, Prisoner's Harbor, Trailer, Willows Anchorage), at least one black oystercatcher was present at each site. Relatively large flocks of black oystercatchers were observed at Fossil Reef and Fraser Cove (N=25 and N=18, respectively) and smaller flocks were seen at numerous other sites.

American oystercatchers have gradually become more common at the islands in recent years. However, in 2015–16, only one American oystercatcher was sighted at a site (Otter Harbor). The birds were not seen at any other sites.

Black turnstones were relatively common in 2015–16 compared with previous years. Nineteen black turnstones were seen across four sites (East Point, Ford Point, Johnson's Lee, Otter Harbor).

Less common shorebirds such as wandering tattlers and willets 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.

Abundances of gulls often vary widely spatially and temporally. Less than 10 gulls (primarily western gulls) are typically seen at most sites. When large groups of gulls are observed they are normally just resting on the reef, whereas smaller groups and individuals are sometimes witnessed feeding. In 2015–16, gulls were less common than usual since they were only present at approximately half the sites sampled during the field season. At the locations gulls were seen, abundances ranged 1–150 individuals per site. Large flocks were seen at Otter Harbor and Prisoner’s Harbor (N= approximately 100 and N= approximately 150, respectively).

Cormorant numbers also tend to fluctuate in space and time. When present, they are typically not abundant. However, it is not uncommon to encounter several dozen cormorants at some sites such as East Point and Crook Point (common roosting locations). This year, approximately 1500 cormorants were seen at East Point. At Crook Point, 22 cormorants were observed roosting on the reef. Forty cormorants were seen at Fossil Reef.

Harbor seals, *Phoca vitulina*, were observed at or within the immediate vicinity of seven sites; abundances ranged 1–31. The greatest number of seals was seen at Otter Harbor followed by Harris Point (both locations are commonly-used haul outs for harbor seals). Abundances in 2015–16 were comparable to counts obtained in past years.

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 they are typically observed as weaned pups that have not yet gone to sea or adults coming ashore to molt. In 2015–16, elephant seals were seen at six sites; abundances ranged 1–16 individuals per site. The greatest number of elephant seals was seen at Johnson’s Lee. Abundances in 2015–16 were comparable to counts obtained in past years at most locations with the exception of San Miguel Island sites which had slightly fewer seals relative to past years.

California sealions, *Zalophus californianus*, are generally most common at the aptly named, Sea Lion Rookery on Santa Barbara Island as well as the other site (Landing Cove) sampled on the island. Unfortunately, neither of the Santa Barbara Island sites was sampled this year due to logistical difficulties related to the damaged pier at the island. At all remaining sites, only two individuals were observed (one at Harris Point and another at Otter Harbor). Relative to past years, abundances of sea lions this year were considered average.

Visitation

Most visitors accessed the rocky intertidal at Frenchy’s Cove, though some visitors also explored East Point and Prisoner’s Harbor tidepools among other locations 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 annual reports based on concessionaire reporting from Island Packers Company (Figure 54). 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.

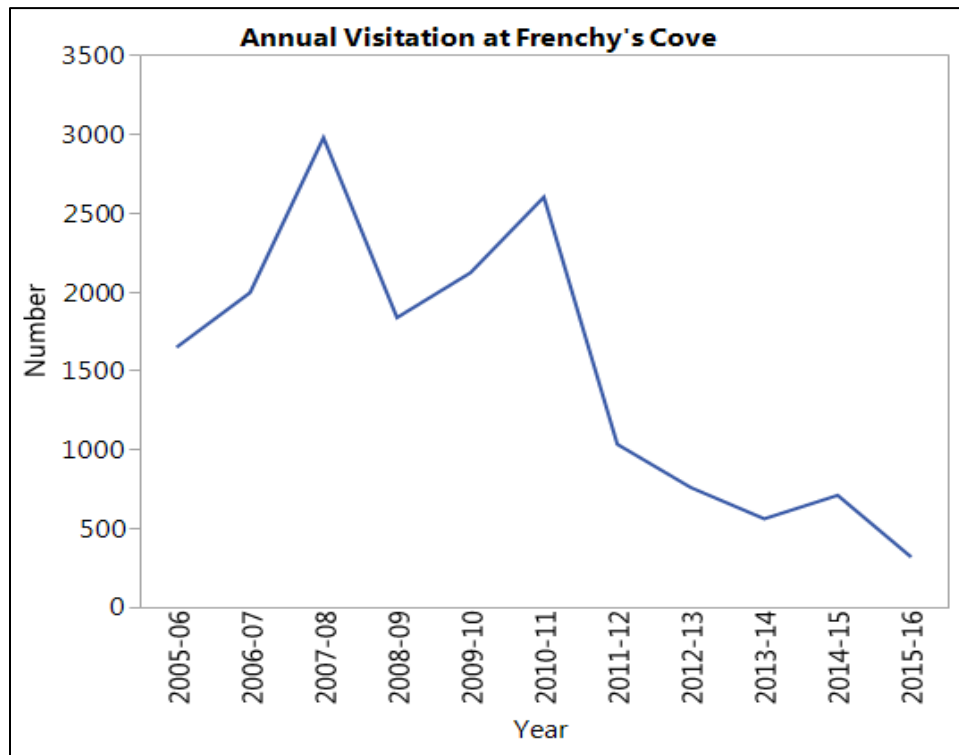


Figure 54. Annual commercial visitation at Frenchy's Cove, Anacapa (Island Packers Company).

The total number of visitors from concession boats in 2015–16 was 318 passengers. This was less than half the number of visitors in 2014–15 (709), and markedly less than the number in 2013–14 (560) and all subsequent years. In fact, visitation in 2015–16 was the lowest since record keeping initiated in 1993.

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Appendix A. Program Notes

From an ecological perspective, 2015 was a consequential year. One of the strongest El Niño events on record began in April 2015 and lasted through the winter into spring 2016. Additionally, the warm water “Blob” which was first detected in late 2013 persisted and spread throughout 2014 and 2015. The effects of these warm water events rippled through the marine food web. Unusual Mortality Events were declared for California sea lions and Guadalupe fur seals in 2015. Thousands of Cassin’s auklets starved in Oregon. Kelp forests were decimated in northern California resulting in the starvation of urchins and abalone among other herbivorous species. Numerous unusual observations were reported for the northern Channel Islands region including: high densities of pelagic red crabs (*Pleuroncodes planipes*) and *Velella velella* washing up on the beaches nearly all year, basking sharks observed in the Santa Barbara channel, a tropical fish (*Luvaris imperialis*) was caught at Rincon Point, a live paper nautilus (*Argonauta nodosa*) was seen by the CHIS kelp forest monitoring crew along with several warm-water finfish species and a green sea turtle was seen in Ventura Harbor.

An oil spill occurred on May 19, 2015 immediately north of Refugio State Beach in Santa Barbara County as a result of a corroded underground pipeline that leaked oil down to the ocean. An estimated 142,800 U.S. gallons (3,400 barrels) of crude oil spread along seven miles of shoreline. CHIS marine biologists assisted MARINE scientists by conducting post-spill biological assessments for affected rocky shorelines.

Time was secured on the CINMS NOAA Vessel Shearwater this year to assist with several of the monitoring sites that require vessel access. In fall, all three of the Anacapa Island sites were accessed via the Shearwater. We used kayaks to access one of the other sites, Scorpion Rock, that traditionally has required a vessel, but we were unable to access Orizaba Cove due to logistical constraints.

Several sites were not monitored in 2015/16 including the two Santa Barbara Island sites, Sea Lion Rookery and Landing Cove along with Anacapa Middle East and Orizaba Cove. All four of the sites were not monitored due to logistical constraints or poor sampling conditions. We attempted to sample the Santa Barbara sites but the swell inhibited us from doing anything at Landing Cove other than photographing the upper intertidal plots. Many of the mussel plots could not be photographed safely. We also were unable to access the northern side of the pier where the rockweed and turf plots are located. Searches for abalone and sea stars were not conducted. All of our gear was nearly washed off the reef by a rogue set of waves.

It should be noted that Anacapa Middle East was originally set up as a control site to monitor the effects of visitor usage on the adjacent site, Anacapa Middle West. As such, it has not received the full complement of monitoring including searches or measurements for black abalone, sea stars or owl limpets. Photo plots at Anacapa Middle East are also less numerous than other sites since they are only replicated three times per zone. Over the course of the program, it has been determined that visitor usage at Anacapa Middle West is significantly lower than originally expected. Based on this information and logistical difficulties in access, the program will be evaluating the need to continue

monitoring Anacapa Middle East. We do not have any plans to discontinue monitoring Orizaba Cove.

We experienced excellent working conditions at many sites throughout the year. However, strong northwest swell impacted our ability to safely and accurately assess black abalone and sea star abundances through timed-searches at Ford Point in both the spring and fall along with Northwest-Talcott, Fossil Reef and East Point in the spring and South Frenchy's Cove, Cat Rock, Trailer and Otter Harbor in the fall. Surfgrass cover was not assessed in spring or fall at East Point due to moderately-low tides combined with relatively-large sized swell.

A special trip was taken to San Miguel Island to document the common rocky intertidal macrophytes at the four monitoring sites and to collect voucher specimens. Participants for the survey included: Stephen Whitaker, Dan Richards (Marine Biologist, CHIS Emeritus), Kathy-Ann Miller (Algal Taxonomist, UC Berkeley) and Jack Engle (Marine Biologist, UCSB). At Otter Harbor, we observed at least 39 red algal species, 9 browns and 6 greens. At Crook Point, at least 44 red algal species, 12 browns and 8 greens were seen. Harris Point had at least 22 red algal species, 8 browns and 3 greens, and at Cuyler Harbor there were at least 34 red algal species, 9 browns and 8 greens. All specimens are stored at the Jepson Herbarium at UC Berkeley.



Kathy-Ann Miller (left) holding a specimen of *Sargassum horneri* found cast onto the beach at Cuyler Harbor, San Miguel Island, and Stephen Whitaker (right).

The annual MARINe workshop was held at Moss Landing Marine Laboratories in Monterey, CA this year. Stephen Whitaker was the only marine ecologists at CHIS that participated in the workshop since it was not considered local. Discussions centered on sea star wasting disease, oil spill training and assessment of long-term protocols. A hands-on field exercise was hosted by the California Office of Spill and Prevention and Response to illustrate how collect biological samples in a contaminated environment.

One of the benefits of a long-term monitoring program at a network of sites is the capability to recognize and document the colonization and spread of non-native species. The invasive red alga, *Caulacanthus ustulatus*, has been observed at Anacapa Middle East and West sites since 2005. It was first documented in southern California in 1999 and has since exceeded the cover of several native red algal species at mainland sites south of Santa Monica Bay. It was still prevalent throughout Anacapa Middle West (Anacapa Middle East was not sampled) in 2015. In fall 2013, *C. ustulatus* was observed growing at Northwest-Talcott, Santa Rosa Island. Some patches of the alga measured approx. 14 cm across. This was the first time that *Caulacanthus* was observed at any other site beside the two at Middle Anacapa. This year, *C. ustulatus* appeared to have spread to other locations throughout Northwest-Talcott along with areas east of the site whereby it occupied patches several square meters in area. *Caulacanthus* was also observed for the first time this year at Fossil Reef. The invasive alga was seen within and nearby plot 610 encompassing an area approx. 1–2 sq ft. Unfortunately, the invasive alga is likely here to stay at Santa Rosa and Anacapa Islands since removal experiments have proven unsuccessful (Smith et al. 2014).

Another invasive species, the brown alga, *Sargassum horneri*, was observed at Anacapa Middle West in fall 2013 for the first time. It was first observed in southern California in Long Beach Harbor in October 2003. Since then, it has appeared in numerous subtidal locations along the mainland as far south as Baja, CA and around the following islands: San Clemente, Catalina, Santa Barbara, Anacapa, and Santa Cruz. *S. horneri* was documented in the intertidal zone at one of the MARINe monitoring sites at Shaw's Cove in Laguna Beach in fall 2009 (J. Smith personal communication, n.d.). This species is not expected to impact the intertidal zone to the same extent it does in the subtidal, but it may occur anywhere from 0 ft MLLW to about 20 m depth and form dense thickets that could shade out other species. Its palatability is unknown at this time but it does not appear to be a preferred food item. In 2014, *S. horneri* appeared to have expanded its distribution at Anacapa Middle West and now occupies a portions of several fixed photo plots and other areas in the mid and lower intertidal.

We received two data requests in 2015. Black abalone data from 2010 and 2011 were requested by Lisa Crosson, a PhD student at the University of Washington working with Glenn Van Blaricom and Carolyn Friedman on an abalone withering syndrome project. California mussel measurement data were requested by Breana Campbell, a graduate student at SDSU studying under Todd Braje to assess historical changes in mussel sizes using modern measurements and shells from middens.

Beachwalk surveys (shorebirds, pinnipeds and carcass counts) were conducted in conjunction with the rocky intertidal monitoring on San Miguel and Santa Rosa Islands making use of the personnel and island time. Western snowy plover surveys on Santa Rosa Island were conducted during spring

and winter months overlapping with rocky intertidal monitoring. Routine sand beach monitoring was conducted at Santa Rosa Island during the summer; those data are reported separately.

Appendix B. Trip Reports

The following are trip reports from the Rocky Intertidal Monitoring 2015–16 field season (February 2015 through February 2016). Reports were prepared by Stephen Whitaker. The reports summarize the work done during each monitoring event, provide a quick summary of the data collected and serve as metadata for the information collected.

San Miguel Island, February 17–21, 2015

(Database event #2015-B)

Prepared by Stephen Whitaker

Purpose:

To collect voucher specimens for common rocky intertidal macrophytes at the four long term rocky intertidal monitoring sites on San Miguel Island.

Personnel:

- Stephen Whitaker, Marine Ecologist, Channel Islands National Park
- Dan Richards, CHIS Emeritus
- Kathy-Ann Miller, Algal Taxonomist, UC Berkeley
- Jack Engle, Marine Biologist, UCSB

Procedure and General Observations:

Channel Islands Aviation transportation was utilized to access and depart the island. The standard procedures for routine surveys were not employed during this trip. Instead, we dedicated several hours to each of the four long term intertidal monitoring sites to collect voucher specimens for common intertidal macrophytes. Species were photographed and collected *in situ*. At housing, specimens were sorted, identified when possible and pressed for archival purposes. A general species list for marine seaweeds was compiled for each site.

2/17/2015. Otter Harbor.

Low tide –1.4 ft at 1424 hrs. We flew out to the Ranch, dropped our gear off, and then flew to the lakebed. The conditions were excellent for sampling with partly cloudy sky, light (10–15kt) breeze and very small (1–2') swell. There were 6 western gulls and 2 black oystercatchers (one was a hybrid) along with 26 harbor seals and 1 California sea lion at the site upon arrival. The charismatic harbor seal that we typically encounter at the site was not present. No harbor seal pups were observed at the site. Two dead sea lion pups and one dead elephant seal were seen at the site. The site was monitored from 1500 to 1715.

We observed at least 39 red algal species, 9 browns and 6 greens. No disturbances to the site were apparent. *Mytilus* recruitment was considered moderate.

2/18/2015. Crook Point.

Low tide –1.4 ft at 1502 hrs. The conditions were good overall even though the surf was moderately-high (3–5'). Wind was moderate (15–20kt) and sky was partly cloudy. There was a moderate amount of sand in the surge channel that splits the site. There were approx. 25 cormorants and 2 black oystercatchers at the site upon arrival. Nine elephant seals including one bull were observed on the beach east of the site. The site was monitored from 1330 to 1645.

There was a fair amount of sand inundating the tidepools in the vicinity of the biodiversity transects. A high number of purple urchins were missing in the depressions formed in many of the sand-influenced tidepools. This site appeared to have the highest diversity of marine macrophytes compared to the three other monitoring sites. We observed at least 44 red algal species, 12 browns and 8 greens. The high diversity is likely attributed to the presence of the sand channel at the site and respective sand-influenced species.

2/19/2015. Harris Point.

Low tide –1.2 ft at 1540 hrs. The conditions were excellent with clear sky, light (10–15 kt) wind and minimal (2–3') swell. One western gull, one black oystercatcher and three harbor seals were seen at the site throughout the day; zero seals were hauled out when we arrived. Two very thin CA sea lion pups were seen near the site and two dead CASL pups were found nearby. One dead cormorant. The site was monitored from 1430 to 1630.

A dozen or more *Chlorostoma galena* were observed in the upper intertidal outside of pools; *C. funebris* was observed nearby but was almost always submerged in pools. Purple urchin densities were extremely high within the cove. However, urchin tests were also fairly abundant. Algal diversity appeared to be lower here than observed at the other sites. We observed at least 22 red algal species, 8 browns and 3 greens.

2/20/2015. Cuyler Harbor.

Low tide –0.8 ft at 1618 hrs. The conditions were excellent with overcast sky, light (5–10 kt) wind and small (1–2') swell. There were 2 black oystercatchers and 1 black turnstone at the site upon arrival. We did not enumerate the pinnipeds and shorebirds on the beach. However, there were numerous elephant seals including bulls, mature females and pups along with approx. 25 whimbrels. Approx. 50 surf scoters were seen in the cove. Two dead CASL pups (one had an orange tag—photo taken) were seen on the beach. The sand level on the beach was higher than usual. We were able to easily cross the surge channel at mid tide. The site was monitored from 1545 to 1730.

A drift specimen of *Sargassum horneri* (reproductive) was seen on the west beach adjacent to the monitoring site.

At the site, at least three *P. ochraceus* (all healthy) were seen. The condition of the site appeared unchanged from that of our previous visit in December. Algal diversity was fairly high compared to the other sites we surveyed on the island. We observed at least 34 red algal species, 9 browns and 8 greens. One of the outer tidepools had a *Panulirus* and a relatively large cabezon.

Santa Rosa Island, April 14–21, 2015

(Database event #2015-B)

Prepared by Stephen Whitaker

Purpose:

To monitor rocky intertidal sites at Santa Rosa Island.

Personnel:

Stephen Whitaker, Marine Ecologist, Channel Islands National Park

Josh Sprague, Marine Ecologist, Channel Islands National Park

Procedure and General Observations:

Park transportation was utilized to access the island. Standard procedures were used for monitoring rocky intertidal sites. Plots and site overviews were photographed with an Olympus Stylus 1030SW digital camera. Photoplots were scored in the field at all sites. Sea stars and black abalone were counted during 30-minute site-wide searches at all five sites. Surfgrass transects were read at Northwest-Talcott, but all three transects at East Point could not be safely and accurately sampled due to large swell and/or poor low tide conditions. *Lottia gigantea* were sampled this season at all of the monitoring sites that have fixed plots. Motile invertebrates were not sampled this season at any of the monitoring sites. The maximum number of shorebirds and pinnipeds observed at each site was recorded. The Hobotemp Tidbit temperature logger at Fossil Reef was exchanged, but the logger at Johnson's Lee was not due to large surf. The temp logger at Northwest-Talcott appears to have been lost. Mussel sizes and mussel bed depths were measured at all monitoring sites.

4/14/2015. Johnson's Lee.

Low tide -0.2 ft at 1325 hrs. The conditions were poor since we arrived well after low tide (today was a travel day to the island), the swell was relatively large (3–5') and the wind was blowing 25–30 kt. Note that we were able to revisit the site on 4/20 (see below for full description). There were 2 black oystercatchers at the site at various times throughout the day. Additionally, there were 31 elephant seals and one harbor seal on the beach in the middle of the site. Another harbor seal was observed in the water near the site. The site was monitored from 1445 to 1800.

Plots were photographed by Josh. Site panoramas were photographed by Stephen. All photoplots except the *Mytilus* plots were scored in the field by Stephen on 4/14; the *Mytilus* plots were scored on 4/20.

A thirty-minute search was conducted for black abalone (*Haliotis cracherodii*) presence by Josh.

N=10 (approx. half the amount that was seen last season) black abalone were observed site-wide from R1 at the west end to the tip of the reef at the east end not including any of the offshore reefs (sizes ranged 55–140 mm, most individuals were spaced 11–50 cm or 1–5 m apart from one another). The black abalone plots were searched; plots 1–4 were devoid of abalone (although there were two abalone that were located very close to the boundaries of plots 2 and 3), but plot 5 had one individual (117mm). Note that the search on 4/14 was not ideal for locating black abalone, so the search was

repeated on 4/20 (results reported above) when conditions were much more conducive to searching in the lower intertidal.

A thirty-minute search was conducted for ochre star (*Pisaster ochraceus*) presence by Josh on 4/14 and 4/20. N=27 ochre stars were observed site-wide (see area searched during black abalone search) (sizes ranged 20–90 mm) on 4/20. Note that less than half the number of sea stars seen on 4/20 were observed on 4/14 due to the poor sampling conditions. For reference, N=11 *P. ochraceus* were seen at this site last spring, N=84 sea stars in fall 2013, and N=251 were seen in spring 2013. One *P. ochraceus* appeared to have two significant lesions (one on two arms). Still, this was the highest number of sea stars we observed at any of the Santa Rosa Island sites and nearly all the other sites we sampled last fall.

Owl limpets (*Lottia gigantea*) were counted and measured in the fixed plots by Stephen and Josh. Plots 1–5 had N= 3, 2, 8, 51 and 50 owl limpets, respectively. Sizes throughout all five plots ranged <15–110 mm. For reference, in November 2013, plots 1–5 had N= 2, 20, 5, 62 and 44 *L. gigantea*, respectively. Sizes of owl limpets in all the plots combined ranged 11–97 mm.

Bolts (UL, UR and LL) were placed in plots 500–502. UL and UR bolts installed in 505. All abalone plots still require new bolts.

The barnacle (*Chthamalus* spp./ *Balanus* spp.) had 43.8% mean barnacle cover. The majority of point contacts in the five plots were bare rock. *Endocladia* plots had 13.2% mean *Endocladia* cover. The majority of point contacts in the five plots were bare rock. Mussel (*Mytilus californianus*) plots had 41.4% mean cover overall including the four new plots. Without the additional plots the original five plots had 19.8% mean mussel cover. This was a substantial increase in mussel cover from last spring (mean=11%) whereby only one plot had mussels present. Mussels were documented in all plots this visit. Still, the majority of cover in the five plots was occupied by *Phragmatopoma* (mean=50%). The splash plots were devoid of biota aside from *Littorina*; plots 1–5 had N=4, 42, 76, 96 and 106 littorine snails, respectively.

Mussels were measured in the five original *Mytilus* plots by Stephen. Sizes of mussels ranged 30–90 mm and mussel bed depths ranged 3–6 cm; all plots were monolayers.

The site appeared similar to previous visits with no major disturbances observed. *Mytilus* appeared healthy and perhaps more abundant than I've observed at the site before; a fair amount of recruitment was observed particularly in the *Phragmatopoma*. The sand level at the site, particularly between the two monitoring reefs, was very high. A lobster trap (likely the same one observed here last spring) was seen in the upper intertidal near the center of the site.

4/15/2015. East Point.

Low tide –0.3 ft at 1407 hrs. The conditions were excellent for sampling with the exception of the moderately-low tide which was not low enough for us to sample the surfgrass transects. All other protocols were conducted successfully. The sky was clear with light (<10 kt) wind. There were approx. 50 cormorants, 2 black oystercatchers and zero pinnipeds at the site upon arrival. The site was monitored from 1020 to 1600.

Plots were photographed by Josh. Site panoramas were photographed by Stephen. All 25 photoplots were scored in the field by Stephen.

A 30-minute search was conducted for black abalone (*Haliotis cracherodii*) presence by Josh. N=66 black abalone were observed site-wide from the sand channel on the north side of the site to plot 594 on the south end (sizes ranged approx. 15–163 mm, most individuals were close enough to touch one another). The fixed abalone transect was not sampled. Note that a flashlight was used during the abalone search. For reference, last spring, N=41 black abalone were observed site-wide (sizes ranged approx. 38–177 mm, most individuals were spaced 1–10 cm apart from one another).

A thirty-minute search was conducted for ochre star (*Pisaster ochraceus*) presence by Josh. N=6 ochre stars were observed site-wide. All six individuals appeared to be healthy. Last spring, only three sea stars were seen at this site.

Surfgrass transects were not sampled due to the relatively-high low tide combined with moderately-high waves on 4/15. We revisited the site on 4/19 at 0600 when the tide was -1.0' to attempt to score the surfgrass transects, but the waves relentlessly impacted the *Phyllospadix* transects enough to make sampling them ineffective.

The field log was completed by Stephen.

A bolt was placed in the upper left corner of plots 580–583 and 592. A bolt was placed in the upper right corner of plots 574 and 589. All plots are relatively easy to locate, but some still require a bolt or two to ensure that they all have three bolts.

The barnacle (*Chthamalus* spp./ *Balanus* spp.) had 21.2% mean barnacle cover (less than half measured last spring). The majority of point contacts in the five plots were bare rock. *Endocladia* plots had 46.6% mean *Endocladia* cover. The majority of cover in the five plots was occupied by *Endocladia*. The *Silvetia* plots had 24% mean *Silvetia* cover. Most of the point contacts within the *Silvetia* zone were bare rock. The *Hesperophycus* plots had 52.8% mean *Hesperophycus* cover which is nearly the same measured in the five plots last spring but approximately twice the cover seen for this species last year. Most of the cover within the *Hesperophycus* zone was dominated by *Hesperophycus*. Mussel (*Mytilus californianus*) plots had 40.2% mean cover. Unlike previous years whereby only two plots (593 and 594) had mussels present, this year mussels were present in all five plots. The majority of cover in the five plots was occupied by *Phragmatopoma* (mean= 55.4%).

Mussels were measured in the five original *Mytilus* plots by Stephen. Sizes of mussels ranged 10–100 mm and mussel bed depths ranged 2–9 cm; all plots were monolayers.

The following was written for an earlier trip report but has been edited to reflect observations from this visit:

The mussel bed on the north side of the reef is still dominated by *Phragmatopoma*, but unlike last spring whereby only solitary mussels were seen scattered throughout, this year there were small patches of mussels present. Sea star abundances were slightly higher this visit

compared to last year during the population crash. Barnacles were not as densely populated as observed here last year. Ephemeral species such as *Scytosiphon*, and *Endarachne* were not observed this year in contrast to last spring whereby both species occurred in medium to high abundances, respectively.

4/16/2015. Northwest-Talcott.

Low tide -0.25 ft at 1447 hrs. The conditions were workable but the wind was blowing 15–20 out of the east-northeast and the swell was moderate-sized (5–6'). We successfully completed all protocols including sampling the mussel plots and surfgrass transects and searching for black abalone and sea stars. There were 5 western gulls and 4 black oystercatchers at the site upon arrival. Five harbor seals (no pups) were also observed. The site was monitored from 1200 to 1645.

Plots were photographed by Josh. Site panoramas were photographed by Josh. All photoplots were scored in the field by Stephen.

A thirty-minute search was conducted for black abalone (*Haliotis cracherodii*) presence by Josh. N=3 black abalone were seen (2 were located near *Mytilus* plot 1 and another was seen near abalone plot 571). For reference, in fall 2013, zero black abalone were observed.

A thirty-minute search was conducted for ochre star (*Pisaster ochraceus*) presence by Josh. Zero sea stars were observed. Low abundances of sea stars are not unusual for this site even before the widespread population crash in early 2014.

Surfgrass transects were sampled by Stephen. Transects 1–3 had *Phyllospadix* cover = 100, 98 and 87%, respectively. *Phyllospadix* on all three transects was heavily fouled with epiphytic algae (appeared to be *Ulva intestinalis*) and was moderately bleached/browned.

The *Lottia gigantea* plots were sampled by Josh. Plots 1–5 had N= 14, 18, 32, 14 and 16 *L. gigantea*, respectively. Sizes of owl limpets in all the plots combined ranged <15–104 mm.

The field log was completed by Stephen.

No repairs were completed during this visit. However, all plots could use bolts in the lower-left and upper-right corners and plot 568 still needs a number bolt in the upper-left corner. Plot 558 was difficult to locate accurately since only one bolt (UL) was located. The rock appeared to have broken out at the UL location of several plots.

The barnacle (*Chthamalus* spp./ *Balanus* spp.) plots had 6.6% mean barnacle cover; only slightly higher than measured last spring. The majority of point contacts in the five plots were bare rock, but *Silvetia compressa* and non-coralline crust occupied 26.4% and 15.8% cover, respectively. *Endocladia* plots had 19.6% (nearly equivalent to that measured last spring) mean *Endocladia* cover. The majority of point contacts in the five plots were bare rock. The rockweed plots had 51.6% (nearly equivalent to that measured last spring) mean *Silvetia* cover. Most of the cover within the rockweed zone was dominated by *Silvetia*. Mussel (*Mytilus californianus*) plots had 35.8% (nearly equivalent to that measured last spring) mean cover. The majority of cover in the five plots was

occupied by *Mytilus*, but all the plots were fairly diverse with coralline crusts and articulated corallines ranking as the next most abundant taxa.

Mussels were measured in the five original *Mytilus* plots by Stephen. Sizes of mussels ranged 20–70 mm and mussel bed depths ranged 2–7 cm; all plots were monolayers.

The invasive alga, *Caulacanthus ustulatus*, was first seen in November 2013 occupying small areas throughout the site from plots 555–559. Some patches of the alga measured approx. 14 cm across. This was the first time that *Caulacanthus* has been observed at any site besides the two sites at Middle Anacapa. Unfortunately, the invasive alga is likely here to stay at Northwest-Talcott and Anacapa since removal experiments have proven unsuccessful (J. Smith, per com). *Caulacanthus* was seen again during this visit, but it appeared to be in the same locations as originally seen and likely did not spread much.

The site appeared similar to past visits with no obvious disturbances. As usual, *Silvetia* and *Phyllospadix* dominated the site and both taxa appeared to be healthy with the exception of some bleaching and fouling on portions of the surfgrass beds. The mussel plots appeared unchanged from the last visit. Mussels were present in low to moderate densities as was *Endocladia*. Very low recruitment was observed for *Mytilus*. *Silvetia* appeared to be second only to *Phyllospadix* in terms of abundance throughout the site. *Velella velella* tests were abundant on the beach and some appeared to be freshly-deposited.

4/17/2015. Fossil Reef.

Low tide –0.1 ft at 1526 hrs. The conditions were only satisfactory due to moderate-sized (3–5') swell that inundated the site (primarily the *Mytilus* plots) regularly. Wind was <10 kt. There were 3 western gulls, 1 cormorant and 2 black oystercatchers along with 6 elephant seals at the site upon arrival. Two juvenile elephant seals were seen hauled out between the main reef and the *Lottia* plots. The site was monitored from 1150 to 1730.

Plots were photographed by Josh. Site panoramas were photographed by Stephen. All 20 photoplots were scored in the field by Stephen.

A thirty-minute search was conducted for black abalone (*Haliotis cracherodii*) presence by Josh. N=22 black abalone were observed site-wide from the east end of the western reef including the monitoring reef and the flat area with large boulders back to the west side of the eastern reef (sizes ranged 30–131 mm, most individuals were either 1–10cm apart or 1–5m apart from one-another). A flashlight was not used during the abalone search. No black abalone were observed in any of the fixed abalone plots. For reference, N=30 black abalone (sizes ranged 38–175 mm, most individuals were either 1–10cm apart or >5m apart from one-another) were observed site-wide last spring.

A thirty-minute search was conducted for ochre star (*Pisaster ochraceus*) presence by Josh.

N=1 ochre star (100mm—observed to be healthy) was observed site-wide from the west side of the abalone plots, east to the cobble beach, placing the reef with the monitoring plots in the center. For reference, last spring, N=18 ochre stars were observed site-wide from the west side of the abalone

plots, east to the cobble beach, placing the reef with the monitoring plots in the center (sizes ranged 40–120 mm, mode = 60 mm). Most sea stars were observed to be healthy, but one *P. ochraceus* was categorized as stage 1 and another was stage 2 meaning that they had one and two lesions present, respectively. Two other *P. ochraceus* were classified as stage 4 since they had severe tissue deterioration. Note that N=227 *P. ochraceus* were observed at this site in November 2013.

The *Lottia gigantea* plots were sampled by Stephen. Plots 1–5 had N= 3, 6, 69, 104 and 185 *L. gigantea*, respectively. Sizes of owl limpets in all the plots combined ranged <15–79 mm.

The field log was completed by Stephen. No plot repairs were conducted during this visit. However, several of the upper plots still require bolts. *Mytilus* plot 623 needs a LL bolt (orientate the plot so that existing upper bolts are facing west and LL bolt that needs to be installed is to the east). The temperature logger was exchanged at 1635.

The barnacle (*Chthamalus* spp./ *Balanus* spp.) plots had 20.6% (approx. equivalent to that measured last spring) mean barnacle cover. The majority of point contacts in the five plots were bare rock. *Endocladia* plots had 28.8% (37.6% measured last spring) mean *Endocladia* cover. The majority of point contacts in the five plots were bare rock, but *Silvetia* was also relatively abundant (mean= 30.8%). The rockweed plots had 71.4% (86.6% measured last spring) mean *Silvetia* cover. Most of the cover within the rockweed zone was dominated by *Silvetia*. Mussel (*Mytilus californianus*) plots had 7.8% (0% measured last spring) mean cover. The majority of cover in the five plots was occupied by a diverse mixture of species dominated by *Phragmatopoma* (mean= 40.8%), *Tetraclita* (mean= 9.4%) and articulated corallines (13.6%).

Mussels were measured in the five original *Mytilus* plots by Stephen. Sizes of mussels ranged 20–50 mm and mussel bed depths ranged 2–5 cm; all plots were monolayers.

Mytilus appeared to be more abundant than it has been during recent years with recruitment apparent in and around the mussel plots. *Silvetia* was highly abundant and reproductive and occupied more space than most other biota. *Endocladia* may have been the second most abundant taxa present at the site. *Chthamalus* was only about half as common as *Balanus*. Living *Velellas* were observed near and onshore.

4/18/2015. Ford Point.

Low tide 0.24 ft at 1604 hrs. The conditions were satisfactory bordering on poor due to the relatively large (3–5') long-period swell that routinely inundated the entire site. Wind was <10 kt. There were 4 black oystercatchers and 1 black turnstone at the site at various times throughout the day. One California sea lion was seen in the water near the site. The two beaches located east of the site had 750–1000 elephant seals present when we arrived. The site was monitored from 1315 to 1730.

Plots were photographed by Josh. Site panoramas were photographed by Josh. All 15 photoplots were scored in the field by Stephen.

A thirty-minute search was conducted for black abalone (*Haliotis cracherodii*) presence by Josh. (N=28) black abalone were observed site-wide (from the area in the vicinity of abalone plot 535 to

the east end of the site near 534) (sizes ranged 50–154 mm, most individuals were located 1–10 cm apart from one another). The conditions were not ideal for finding black abalone given the relatively large swell. For reference, last spring, (N=58) black abalone were observed site-wide (sizes ranged 51–195 mm, most individuals were located 1–10 cm apart from one another). The black abalone plots were not sampled. A flashlight was used during the abalone search.

A thirty-minute search was conducted for ochre star (*Pisaster ochraceus*) presence by Josh. N= 7 ochre stars were observed site-wide (from the area in the vicinity of abalone plot 535 to east end of the site near 534) (sizes ranged 50–80 mm). All observed *P. ochraceus* appeared to be healthy. For reference, last spring, N=9 sea stars were observed, and in November, 2013 N= 123 ochre stars were seen.

The field log was completed by Stephen.

No plot repairs were necessary since numerous bolts were installed last season. All plots had three bolts except 532 (missing LL).

The barnacle (*Chthamalus* spp./ *Balanus* spp.) had 25.8% mean barnacle cover. The majority of point contacts in the five plots were bare rock. *Endocladia* plots had 20% mean *Endocladia* cover. The majority of point contacts in the five plots were bare rock. Mussel (*Mytilus californianus*) plots had 38.6% (up from 29.6% last spring) mean cover. The majority of cover in the five plots was occupied by *Mytilus*, but *Phragmatopoma* occupied 33.8%. The splash plots were devoid of biota aside from littorine snails (abundances in plots 1–5 = 4, 54, 136, 84 and 149, respectively) and cyanobacteria.

Mussels were measured in the five original *Mytilus* plots by Stephen. Sizes of mussels ranged 10–90 mm and mussel bed depths ranged 1–8 cm; all plots were monolayers.

Owl limpets (*Lottia gigantea*) were counted and measured in the fixed plots by Stephen and Josh. Plots 1–6 had N= 9, 0, 10, 13, 12 and 19 owl limpets, respectively. Sizes throughout all five plots ranged <15–86 mm.

Phragmatopoma was abundant throughout most of the zone previously occupied by *Mytilus*. However, about 25% of the area that *Phragmatopoma* has dominated in recent years on the east end of the site appeared to have been ripped out. Medium-sized mussel beds were still present however, but only moderate levels of recruitment were observed for the species. Small patches of barnacles (primarily *Balanus*) were observed to have been removed at various locations throughout the site, and it appeared that some large boulders had been repositioned since our last visit. *Phyllospadix* was heavily-fouled with *Smithora*. Zebra perch were observed in a tidepool near the mussel plots. *Endocladia* appeared to be abundant and robust.

4/19/2015. East Point and Skunk Point.

Low tide –1.07 ft at 0453 hrs. The conditions were okay overall with moderate (10–15 kt) wind and medium-sized (3–4') swell, but they were not conducive to sampling the lower intertidal. We attempted to sample the surfgrass transects at East Point. However the swell continuously washed

over the entire *Phyllospadix* bed making it impractical to lay out transect tapes. We arrived at the site at 0600.

All the beaches between East Point and Southeast Anchorage were monitored for presence of snowy plovers, other shorebirds and carcasses from 0645 to 1000.

The reefs west of Skunk Point had N=2 black oystercatchers.

Skunk Point beach was dry this visit unlike last spring whereby it appeared to have been partially submerged by seawater near the center. N=7 snowy plovers were seen approximately 100 m west of the point. In addition to the snowy plovers, N=30–40 sanderlings and approx. 100 gulls were seen on the western half of the beach.

Skunk Point (south) had N=15 snowy plovers located just south of the point and approx. 200 m from the south end of the beach. In addition, 2 black-bellied plovers, 1 black oystercatcher, approx. 100 gulls and N=18 brant geese were seen. In the water, approx. 40 grebes were observed close to shore.

Along the beaches located nearby the lagoons, 4 mallard ducks, 1 great blue heron, 1 great egret, 4 black oystercatchers, 5 western gulls, 3 horned larks and 1 unidentified plover or sandpiper.

There was a minimal amount of debris on the beaches below the high tide line consisting primarily of plastic items including buoys, bottles and other plastic items. N=13 marine mammal carcasses were seen on the beaches. One was an immature (fresh) elephant seal and all others were California sea lions (5 mature and 7 juvenile). All were relatively fresh but appeared to have been scavenged recently and therefore somewhat recognizable. No cause of death was readily discernable though it is likely that the juveniles died of starvation since many others have been washing up on beaches throughout SoCal in various states of starvation. Additionally, 2 dead grebes and 3 dead cormorants were observed. *Velella* tests were seen in moderate abundances along the beaches.

4/20/2015. Johnson's Lee.

Low tide –1.05 ft at 0540 hrs. We revisited the site to complete the monitoring that was not finished on 4/14. Conditions were much better compared to 4/14 since the tide was significantly lower but the swell was still relatively large and powerful since it originated out of the southern hemisphere and this is a south-facing site. Still, we were able to complete the field-scoring for all photoplots and resurvey for black abalone and sea stars. See site summary for 4/14 above for details.

Santa Cruz Island, October 25, 2015

Prepared by Stephen Whitaker

Purpose:

To monitor the rocky intertidal site Scorpion Rock at Santa Cruz Island.

Personnel:

- Stephen Whitaker, Marine Ecologist, Channel Islands National Park
- Kenan Chan, UCSC Technician, CHIS VIP

- Kate Vylet, UCSC Technician, CHIS VIP

Procedure and General Observations:

Island Packers transportation was utilized to access the island. Standard procedures were used for monitoring the rocky intertidal site. Plots and site overviews were photographed with an Olympus Stylus 1030SW digital camera. Photoplots were scored in the field at Site A; the five *Hesperophycus* plots at Site B were scored in the office. Sea stars and black abalone were counted during timed site-wide searches at Site A only. There are no *Lottia gigantea* plots at Scorpion Rock. Motile invertebrates are no longer sampled in photoplots at all sites. The maximum number of shorebirds and pinnipeds observed at each site was recorded. Hobotemp Tidbit temperature loggers are not present at Scorpion Rock. Mussel sizes and mussel bed depth were measured at Scorpion Rock. Island Packers provided transportation off the island at the end of the day.

10/25/2015. Scorpion Rock.

Low tide 0.0 ft at 1429 hrs. The conditions were good with clear sky, light (<10 kt) wind and minimal (approx. 1–2') swell. No precipitation had been detected for more than a week. There were no shore birds, one harbor seal and a juvenile elephant seal at Site A upon arrival. At Site B, there were 3 western gulls and 2 black oystercatchers. There were numerous (approx. 50–100) kayakers paddling in the area throughout the day. Three sailboats were anchored nearby at various times during our site visit. The sites were monitored from 1115 to 1530.

Plots were photographed by Stephen and Kenan. Site panoramas were photographed by Kenan. The 20 photoplots at Site A were scored in the field by Stephen, and the five rockweed plots at Site B were scored by Stephen in the office.

A 60-minute search was conducted for black abalone (*Haliotis cracherodii*) presence at Site A by Kate and Kenan. N=32 black abalone were observed site-wide at Site A (sizes ranged 14–129 mm, most individuals were located 11–50 cm apart from one another). For reference, last fall, N=41 black abalone were observed site-wide at Site A (sizes ranged 25–108 mm, most individuals were located 11–50 cm apart from one another). In fall 2013, N=17 black abalone were observed site-wide at Site A (sizes ranged 25–105 mm, most individuals were located 11–50 cm apart from one another). Note that Site B was not sampled for black abalone due to lack of time.

A thirty-minute search was conducted for ochre star (*Pisaster ochraceus*) presence at Site A by Kate and Kenan. N=0 ochre stars were observed site-wide. For reference, last fall, N=4 ochre stars were observed site-wide (sizes ranged 30–105 mm); all appeared to be healthy. In spring 2014, zero *P. ochraceus* were seen, and spring 2013, N=162 ochre stars were observed site-wide (sizes ranged 70–150 mm, mode = 100 mm).

The field log was completed by Stephen. Plot 822 was missing a lower-left bolt (bolt was found loose at the site during the fall 2014 visit). A slab of rock at R2 was broken loose in 2013. Epoxy was placed at both of these locations, but no bolts were installed.

The barnacle (*Chthamalus* spp./ *Balanus* spp.) had 33.4% mean barnacle cover. Coincidentally, the same percentage of barnacle cover was measured last year. The majority of point contacts in the five

plots were bare rock (mean= 54.8%). *Endocladia* plots had 9.4% mean *Endocladia* cover. The majority of point contacts in the five plots were bare rock (mean= 48.4%). For reference, last fall, *Endocladia* plots had 15.4% mean *Endocladia* cover, and 56.6% mean *Endocladia* cover in fall 2013. The *Hesperophycus* plots had 19.4% mean *Hesperophycus* cover. Most of the point contacts within the *Hesperophycus* zone were bare rock (mean= 58.6%). For reference, last fall, ~15% mean *Hesperophycus* cover was measured in the representative plots. Mussel (*Mytilus californianus*) plots had 14% mean mussel cover (5% mean cover for *Mytilus* measured last fall). The majority of cover in the five plots was occupied by articulated corallines (mean= 33%) and *Tetraclita* (mean=37.6%). The *Tetraclita* plots had 41.6% mean *Tetraclita* cover (47.2% mean *Tetraclita* cover measured last fall). The majority of cover in the five plots was occupied by *Tetraclita*.

Mussels were measured in the five *Mytilus* plots by Stephen. Sizes of mussels ranged 10–50 mm and mussel bed depths ranged 1–5 cm; all plots were monolayers.

The site appeared to be in good shape with no obvious disturbances. *Chthamalus/Balanus* and particularly *Tetraclita* were very abundant at Site A. Recruitment was observed for all three species throughout the site. *Endocladia* appeared to be healthy but not quite as abundant at Site A relative to recent visits. *Mytilus* still occurs in low abundance, but the species has increased slightly in cover over the past year. Some small patches of *M. californianus* recruitment were observed. *Anthopleura elegantissima* and *A. sola* were extremely common throughout the reef particularly within the tidepool located at the northern tip of the reef. *Megathura* (N=5) was less common compared with previous visits. *S. purpuratus* were observed in low to moderate numbers. One *Aplysia californica* was seen.

Anacapa Island, November 11–12, 2015

Prepared by Stephen Whitaker

Purpose:

To monitor rocky intertidal sites at Anacapa Island.

Personnel:

Stephen Whitaker, Marine Ecologist, Channel Islands National Park; David Kushner, CHIS; Kate Vylet, Junior Technician, UCSC; Kenan Chan, Junior Technician, UCSC; Randy Moran, student, CSUCI; Evelyn Garcia, student, CSUCI; Jenna Miani, student, CSUCI; Geoff Dilly, Professor, CSUCI; Nate Fletcher, Research Technician, UCSC; Laura Anderson, Research Technician, UCSC; Kate Melanson, Research Technician, UCSC

Procedure and General Observations:

We utilized the R/V Shearwater to access the island. Standard procedures were used for monitoring all three rocky intertidal sites. The trip was originally scheduled for 11/10–12, but high wind and swell caused us to lose one sampling day. Therefore, we had to sample Cat Rock and South Frenchy's Cove together on November 11th. This was accomplished by deploying two teams of biologists (one at Cat Rock consisting of Stephen Whitaker and crew and another at South Frenchy's Cove with David Kushner and crew). Photographs of plots were taken at all sites, but not all plots were scored in the field at Cat Rock and South Frenchy's Cove due to lack of time. Plots and site

overviews were photographed with an Olympus Stylus 1030SW digital camera. Timed-searches for black abalone and sea stars were conducted. *Lottia gigantea* were sampled this season at all three sites. Motile invertebrates are no longer sampled in photoplots at all sites. The maximum number of shorebirds and pinnipeds observed was recorded. The Hobotemp Tidbit temperature logger was replaced at South Frenchy's Cove. Mussel sizes and mussel bed depths were measured at all three sites. The UCSC field crew joined us both days to conduct black abalone habitat mapping at and nearby our monitoring sites.

11/11/2015. South Frenchy's Cove.

Low tide -0.1 ft at 1507 hrs. Field team consisted of David Kushner, Geoff Dilly, Evelyn Garcia and Jenna Miani. The conditions were not ideal due to the frequent wetting of the outer reefs due to the long period, moderate-sized (2-4') swell. The sky was mostly clear and wind was 15-20 kt. The periodic nature of the swell allowed for thorough surveys for black abalone and seastars. One juvenile gull and 2 black oystercatchers were observed at the site upon arrival. The site was monitored from 1200 to 1600.

Plots were photographed by David. Site panoramas were photographed by David. A subset of the photoplots was scored in the field by David (see field sheet for details).

A ninety-minute search was conducted for black abalone (*Haliotis cracherodii*) presence by Geoff and students. N=0 black abalone were observed site-wide.

A ninety-minute search was conducted for ochre star (*Pisaster ochraceus*) presence by Geoff and students. N=0 ochre stars were observed site-wide.

The field log was not completed.

Lottia gigantea were measured within the fixed plots by David (Geoff and students assisted). Abundances ranged N=2-17 in the three plots. Sizes ranged 18-51 mm.

Numerous plot repairs were conducted during last year's visit. No repairs were necessary this year.

The barnacle (*Chthamalus* spp./ *Balanus* spp.) plots had 10.8% mean barnacle cover. For reference, last fall, mean barnacle cover was 17.8%. The majority of point contacts in the five plots were bare rock. *Endocladia* plots had 14.2% mean *Endocladia* cover (in fall 2014, mean *Endocladia* cover = 37.8%). The majority of point contacts in the five plots was bare rock. The rockweed plots had 46.2% mean *Silvetia* cover, down from 60.8% last fall. Most of the cover within the rockweed zone was dominated by *Silvetia*. Mussel (*Mytilus californianus*) plots had 36.6% mean cover. The majority of cover in the five plots was occupied by *Mytilus*. For reference, last fall, mean mussel cover was 35.4%.

Mussels were measured in the five original *Mytilus* plots by David. Sizes of mussels ranged 10-50 mm and mussel bed depths ranged 1-4 cm; all plots were monolayers.

Sand level at the site was relatively low compared to recent years where the level of sand has been high enough to inundate several of the inshore photoplots. Much of the reef was covered in a film of

either diatoms or *Ectocarpus*. The brown film was more abundant throughout the south side of Anacapa Island than ever observed during the past seven years that Stephen Whitaker has been conducting intertidal monitoring on the islands.

11/11/2015. Cat Rock.

Low tide -0.1 ft at 1507 hrs. The conditions were not conducive for sampling due to frequent wetting from relatively large (2–4') waves and moderate (15–20 kt) wind. As a result, searches for black abalone and sea stars were slightly impacted. We had very limited time to work given the late afternoon low tide and because we were required to be back on the Shearwater at 16:00. No shorebirds were observed at the site, but three adult harbor seals were observed in the water near the site upon arrival. The site was monitored from 1200 to 1600. Personnel for the day consisted of Stephen Whitaker, Kenan Chan, Kate Vylet and Randy Moran.

Note that this season we reduced the number of plots at Cat Rock from 9/zone to 5/zone. Rationale for dropping plots was based on the results of a power analysis done by Pete Raimondi which indicated that minimal loss in power to detect change would occur if we reduced the number of photoplots to the number of plots monitored at all other sites. Each of the zones at Cat Rock consist of 3 plots that were trampled once, 3 that were scraped and three controls. In most cases, we will continue to monitor all the control plots for each zone. Two other plots were chosen randomly among the six remaining plots for each zone. From this point forward, the following plots will be photographed and monitored:

- CHT (1–5) = 32, 36, 39, 33, 35
- END (1–5) = 53, 19, 54, 14, 467=17
- SIL (1–5) = 4, 8, 10, 5, 6
- MYT (1–5) = 203, 473, 472, 468, 470

Plots and site panoramas were photographed by Stephen and Kate. Only four photoplots were scored in the field by Stephen. Others were not scored in the field due to lack of time, but were scored from the photographs in the office.

A ninety-minute search was conducted for black abalone (*Haliotis cracherodii*) presence by Kate and Kenan. N=41 black abalone were observed site-wide (from *Lottia* plot #3 on the west end of the site to the abalone plots at the east end). Most individuals were located 1–5 m apart. Sizes ranged 50–143 mm. Flashlights were used during the survey. For reference, last fall N=22 black abalone were observed site-wide. The abalone plots were not officially sampled due to lack of time, but it appeared unlikely that any abalone were residing within any of the plots.

A sixty-minute search was conducted for ochre star (*Pisaster ochraceus*) presence by Kate and Kenan. N=0 ochre stars were observed site-wide (from *Lottia* plot #3 on the west end of the site to the abalone plots at the east end). Last fall, N=1 *P. ochraceus* was seen at this site. As a side note, the black abalone habitat mapping team from UCSC surveyed the entire intertidal area from our site at South Frenchy's to Cat Rock and only saw N=2 *P. ochraceus*.

The field log was not completed due to lack of time.

Lottia gigantea were measured within the fixed plots by Stephen. Abundances ranged N=6–29 in the three plots. Sizes ranged 17–57 mm.

Numerous plot repairs were conducted during this visit. Three bolts (upper-left, upper-right and lower-left corners) were installed in plots 33, 35, 14, 5, 17, 54, 468 and 470. The bolt installed in the upper-left corner was etched to indicate the number (e.g. 1–5) of the plot in each target zone. Plot repairs were made by Randy, Kate and Kenan with Stephen supervising. Last fall, three bolts (upper-left, upper-right and lower-left corners) were installed in nearly all (with exception of plot 52) the control plots for each zone. **Plot 472 still needs at least one bolt.**

Mussels were measured in the five *Mytilus* plots by Stephen. Sizes of mussels ranged 20–40 mm and mussel bed depths ranged 2–3 cm; all plots were monolayers.

Note that the mean abundances for sessile target species reported below were calculated using the subset (N=5) of photoplots in each target assemblage/zone. The barnacle (*Chthamalus* spp./ *Balanus* spp.) plots had 30.4% mean barnacle cover which was close to the same (28.7%) as measured in fall 2014. The majority of point contacts in the five plots were bare rock. *Endocladia* plots had 7.4% mean *Endocladia* cover (in fall 2014, mean *Endocladia* cover = 14.2%). The majority of space in the five plots was bare rock. The rockweed plots had 1.2% mean *Silvetia* cover and 15.8% *Hesperophycus* cover. Most of the space within the rockweed zone was bare rock. For reference, 4.1% mean *Silvetia* cover and 13.8% *Hesperophycus* cover was measured last fall. Mussel (*Mytilus californianus*) plots had 36.8% mean cover. The majority of cover in the five plots was occupied by *Mytilus*. For reference, last fall, mean mussel cover was 29.1%.

Ephemeral species such as *Endarachne*, *Colpomenia* and diatoms/ *Ectocarpus* were conspicuously more abundant this visit compared to previous years even though cover of *Endarachne* was exceptionally high last year. Many algal species (primarily articulated and crustose corallines, *Chondracanthus* and *Mazzaella*) were bleached. *Mazzaella affinis* at this site primarily consists of the narrow-bladed morph which made it problematic at times for identification. *Silvetia* was less common than *Hesperophycus*. *Mytilus* and *Endocladia* were relatively abundant, but mussels were relatively small (20–40 mm). Overall, this site lacks distinct species assemblages likely because elevation change is mild.

11/12/2015. Middle West.

Low tide –0.1 ft. at 1542 hrs. The conditions were perfect for sampling. The sky was clear, wind was light (<5 kt) and swell was < 1'. No shorebirds or pinnipeds were observed at the site all day. The site was monitored from 1200 to 1530. Personnel for the day consisted of: Stephen Whitaker, Connie Jenkins, Kenan Chan, Kate Vylet, Nate Fletcher, Laura Anderson and Kate Melanson.

Plots were photographed by Kenan. Site panoramas were photographed by Kenan. Photoplots were scored in the field by Stephen.

A 65-minute search was conducted for black abalone (*Haliotis cracherodii*) presence by Kenan and Kate. N=17 black abalone were observed site-wide (note that the UCSC crew also conducted a separate count and arrived at the same number of abalone). Most individuals were located 1–5 m

apart. Sizes ranged 16–129 mm. Markedly fewer abalone were seen this year compared to last fall in which N=34 black abalone were observed site-wide. Black abalone were also counted and measured at Harbor Seal Arch by the UCSC crew.

A thirty-minute search was conducted for ochre star (*Pisaster ochraceus*) presence by Kenan and Kate. N=1 ochre star (90 mm) was observed site-wide. The individual appeared to be healthy and free of lesions.

The field log was completed by Stephen.

Lottia gigantea were measured within the fixed plots by Kenan and Kate. Abundances ranged N=7–31 in the three plots. Sizes ranged <15–60 mm.

One bolt installed in UL corner of plot 458. No other repairs were necessary.

The mussel measurement protocol was implemented in the five *Mytilus* plots by Stephen. However, there were zero mussels in all plots.

The barnacle (*Chthamalus* spp./ *Balanus* spp.) had 17% mean barnacle cover. For reference, last fall, mean barnacle cover was 19.2%. The majority of point contacts in the five plots were bare rock, though the plots were relatively diverse for the barnacle zone. *Caulacanthus* comprised 3% and 5% of plots 448 and 450, respectively. *Endocladia* plots had 1% mean *Endocladia* cover (in fall 2014, mean *Endocladia* cover = 12.6%). The majority of point contacts in the five plots were bare rock. However, the *Endocladia* plots were fairly diverse with moderate amounts of articulated corallines, *Mazzaella* and non-coralline crust. *Caulacanthus* comprised 3% of plots 457 and 458 and 1% of plot 460. The rockweed plots had 0% mean *Silvetia* cover. In fact, similar to observations in recent years, no *Silvetia* was seen throughout the entire site; rather, most of the space within the rockweed plots was bare rock. *Mazzaella*, *Chondracanthus*, articulated corallines, non-coralline crust and *Tetraclita* all occurred in moderate abundance within the *Silvetia* plots. *Caulacanthus* comprised 4% and 1% of plot 454 and 455, respectively. Mussel (*Mytilus californianus*) plots had 0% mussels. The majority of cover in the five plots was occupied by *Mazzaella*, *Gelidium*, *Chondracanthus* and articulated corallines. For reference, last fall, mean mussel cover was 0.4%.

The site overall appeared similar to previous visits. *Caulacanthus* is still quite prevalent throughout the site but does not appear to be spreading or growing in abundance relative to recent years. *Sargassum horneri* moved further up into the intertidal last year and continues to be a presence at the site. *Sargassum muticum* is also quite common and robust. *Mytilus* is still relatively scarce and conspicuously absent from the mussel plots. Rockweeds were once again absent. Contrary to last year, *Endocladia* was relatively rare.

Santa Rosa Island, November 24–December 1, 2015

Prepared by Stephen Whitaker

Purpose:

To monitor rocky intertidal sites at Santa Rosa Island.

Personnel:

- Stephen Whitaker, Marine Ecologist, Channel Islands National Park
- Josh Sprague, Marine Ecologist, Channel Islands National Park
- Kenan Chan, Technician, UCSC
- Kate Vylet, Technician, UCSC

Procedure and General Observations:

Park transportation was utilized to access the island. Standard procedures were used for monitoring rocky intertidal sites. Plots and site overviews were photographed with an Olympus Stylus 1030SW digital camera. Photoplots were scored in the field at all sites. Sea stars and black abalone were counted during timed site-wide searches at all five sites. Surfgrass transects were read at the two sites (Northwest-Talcott and East Point) that have fixed transects. *Lottia gigantea* were sampled this season at all of the monitoring sites that have fixed plots. The maximum number of shorebirds and pinnipeds observed at each site was recorded. The Hobotemp Tidbit temperature loggers at Fossil Reef and Johnson's Lee were exchanged. Mussel sizes and mussel bed depths were measured at all monitoring sites.

11/24/2015. Johnson's Lee.

Low tide -0.96 ft at 1437 hrs. The conditions were excellent but we arrived well after low tide (today was a travel day to the island), the swell was relatively low to moderate (2-4') and the wind was 10-15 kt. Note that we were able to revisit the site on 11/29 to complete monitoring for the site (see below for full description). There were 2 black oystercatchers and 5 black turnstones at the site. Additionally, there were 16 elephant seals on the beach in the middle of the site. The site was monitored from 1415 to 1715 on 11/24.

Plots were photographed by Stephen. Site panoramas were photographed by Stephen. About half the photoplots were scored in the field by Stephen on 11/24; all others were scored in the field on 11/29.

A 60-minute search (time includes effort involved in measuring all encountered individuals) was conducted for black abalone (*Haliotis cracherodii*) presence by Kate and Kenan. N=45 black abalone were observed site-wide from R1 at the west end to the tip of the reef at the east end not including any of the offshore reefs (sizes ranged 24-174 mm, most individuals were spaced 11-50 cm apart from one another). The black abalone plots were not searched closely since the bolts marking the locations of the plot corners have disappeared. The general locations of the plots were searched for presence of abalone; plot 1 appeared to be devoid of abalone, plots 2-4 appeared to have 7 black abalone among the three plots, and plot 5 appeared to have one individual. For reference, last spring, N=10 (approx. half the amount that was seen in fall 2014) black abalone were observed site-wide from R1 at the west end to the tip of the reef at the east end not including any of the offshore reefs (sizes ranged 55-140 mm, most individuals were spaced 11-50 cm or 1-5 m apart from one another). The black abalone plots were searched; plots 1-4 were devoid of abalone (although there were two abalone that were located very close to the boundaries of plots 2 and 3), but plot 5 had one individual (117mm).

A 60-minute search was conducted for ochre star (*Pisaster ochraceus*) presence by Kate and Kenan. N=44 ochre stars were observed site-wide (see area searched during black abalone search) (sizes ranged 20–110 mm). All individuals appeared healthy and free of lesions. For reference, N=27 *P. ochraceus* were seen at this site last spring, N=11 *P. ochraceus* were seen at this site in spring 2014, N=84 sea stars in fall 2013, and N=251 were seen in spring 2013. This was one of the first locations that we observed recovery of *P. ochraceus* following the devastating disease outbreak in winter 2014.

Owl limpets (*Lottia gigantea*) were counted and measured in the fixed plots by Josh. Plots 1–5 had N= 8, 48, 23, 94 and 70 owl limpets, respectively. Sizes throughout all five plots ranged <15–111 mm. For reference, last spring, plots 1–5 had N= 3, 2, 8, 51 and 50 *L. gigantea*, respectively. The abundances of owl limpets in nearly all plots at this site have been increasing over the last several years.

Bolts (UR) were placed in plots 515, 516, 505. A LR bolt was placed in plot 514 since the LL corner appeared too low (submerged) for a bolt. *Lottia* #5 was missing a bolt, so we installed a new one. All abalone plots still require new bolts.

The barnacle (*Chthamalus* spp./ *Balanus* spp.) had 31% (43.8% mean barnacle cover measured last spring) mean barnacle cover. The majority of point contacts in the five plots were bare rock. *Endocladia* plots had 21% (13.2% mean *Endocladia* cover measured last spring) mean *Endocladia* cover. The majority of point contacts in the five plots were bare rock. Mussel (*Mytilus californianus*) plots had 38.9% (41.4% mean *Mytilus* cover overall including the four new plots measured last spring) mean *Mytilus* cover overall including the four new plots. Without the additional plots the original five plots had 28.8% (19.8% mean mussel cover measured last spring) mean mussel cover. This was a substantial increase in mussel cover from spring 2014 (mean=11%) whereby only one plot had mussels present. Mussels were documented in all plots this visit. Still, the majority of cover in the five plots was occupied by *Phragmatopoma* (mean=54%). The splash plots were devoid of biota aside from *Littorina* and *Chthamalus*; plots 1–5 had N= 152, 406, 331, 312 and 66 littorine snails, respectively. Plots 3–4 had 2 and 18 *Chthamalus*, respectively.

Mussels were measured in the five original *Mytilus* plots by Stephen. Sizes of mussels ranged 10–70 mm and mussel bed depths ranged 2–6 cm; all plots were monolayers.

Target species (*Balanus*/ *Chthamalus*, *Mytilus* and *Endocladia*) appeared healthy and relatively abundant relative to observations made over the last several years. *Phragmatopoma* was still dominant on the lower shelf below the new *Mytilus* plots. The sea star count increased markedly compared to recent counts. Zebra perch were again observed in the tidepool situated in the center of the site. Appears to have been a disturbance near *Lottia* #5 based on the high abundance of *Ulva* present (see picture). The sand level at the site, particularly between the two monitoring reefs, was very high. A lobster trap (likely the same one observed here in spring 2014) was seen in the upper intertidal near the center of the site.

11/25/2015. East Point.

Low tide –1.23 ft at 1522 hrs. The conditions were excellent for sampling due to the exceptionally low tide and light swell (2–3'). The sky was clear with moderate (15–20 kt) wind. There were approx. 1,500 cormorants, 2 black oystercatchers, 1 great egret and 3 black turnstones along with 1 harbor seal at the site upon arrival. The site was monitored from 1225 to 1600. King tide photos were taken at the pier in the morning around 8:30 AM.

Plots were photographed by Kate. Site panoramas were photographed by Kate. All 25 photoplots were scored in the field by Stephen.

A 90-minute search (time includes effort involved in measuring all encountered individuals) was conducted for black abalone (*Haliotis cracherodii*) presence by Kate and Kenan. N=98 black abalone were observed site-wide from the sand channel on the north side of the site to plot 594 on the south end excluding the outer reefs (sizes ranged approx. 24–177 mm, most individuals were 1–10 cm apart from one another). The fixed abalone transect was not sampled. Note that flashlights were used during the abalone search. For reference, last spring, N=66 black abalone were observed site-wide (sizes ranged approx. 15–163 mm, most individuals were spaced 1–10 cm apart from one another). In spring 2014, N=41 black abalone were observed site-wide (sizes ranged approx. 38–177 mm, most individuals were spaced 1–10 cm apart from one another).

A 90-minute search was conducted for ochre star (*Pisaster ochraceus*) presence by Kate and Kenan. N=4 ochre stars were observed site-wide (sizes ranged 30–80 mm). All four individuals appeared to be healthy. Last spring, only 6 sea stars were seen at this site and 3 were seen in spring 2014.

Surfgrass transects were sampled by Stephen. Surfgrass percent cover on transects 1–3 was 100, 100 and 99%, respectively. Epiphytic cover from *Smithora* was absent but *Melobesia* was observed in low to moderate abundance on surfgrass within the three transects. Bleaching and blade abrasion was observed on a low percentage of the surfgrass. No evidence of flowering was observed.

The field log was completed by Stephen.

Mussels were measured in the five *Mytilus* plots by Josh. Sizes of mussels ranged 10–90 mm and mussel bed depths ranged 3–6 cm; all plots were monolayers.

No bolts or other repairs were necessary. All plots have at least three bolts present.

The barnacle (*Chthamalus* spp./ *Balanus* spp.) had 16% (21.2% mean barnacle cover measured last spring which was about half the overall cover that was measured in spring 2014) mean barnacle cover. The majority of point contacts in the five plots were bare rock. *Endocladia* plots had 28.2% (46.6% mean *Endocladia* cover measured last spring) mean *Endocladia* cover. The majority of the point contacts in the five plots were bare rock. The *Silvetia* plots had 27.6% (24% mean *Silvetia* cover measured last spring) mean *Silvetia* cover. Most of the point contacts within the *Silvetia* zone were bare rock. The *Hesperophycus* plots had 36.2% (40.2% mean *Hesperophycus* cover measured last spring) mean *Hesperophycus* cover. Most of the point contacts within the *Hesperophycus* zone were bare rock. Still, abundances for *Hesperophycus* have doubled within the representative plots

since 2013. Mussel (*Mytilus californianus*) plots had 44.6% (40.2% mean *Mytilus* cover measured last spring) mean cover. Unlike previous years whereby only two plots (593 and 594) had mussels present, the last couple of years have been marked by the presence of mussels in all five plots. The majority of cover in the five plots was occupied by *Phragmatopoma* (mean= 50.8%).

Rockweeds (particularly *Silvetia*) appear robust and may be expanding in abundance. *Mytilus* abundances also appear to be increasing in abundance. Patches of recruitment observed for *Mytilus* throughout the mussel bed. *Ulva* appeared to be relatively abundant throughout the site likely due to the excessive nutrients from nearby roosting cormorants. Black abalone abundances appear to be increasing each visit over the last several years.

11/26/2015 “Thanksgiving”. Fossil Reef.

Low tide –1.26 ft at 1607 hrs. The conditions were excellent despite the moderate wind (15–20 kt) that was a bit uncomfortable at times. Otherwise the swell was minimal (2–3') and the tide was exceptionally low. There were 40 cormorants, 25 black oystercatchers and 1 western gull along with 1 elephant seal at the site upon arrival. The site was monitored from 1130 to 1645.

Plots were photographed by Josh. Site panoramas were photographed by Josh. All 20 photoplots were scored in the field by Stephen.

A 90-minute search (time includes effort involved in measuring all encountered individuals) was conducted for black abalone (*Haliotis cracherodii*) presence by Kate and Kenan. N=43 black abalone were observed site-wide from the east end of the western reef including the monitoring reef and the flat area with large boulders back to the west side of the eastern reef (sizes ranged 26–146 mm, most individuals were observed touching one-another). Flashlights were used during the abalone search. No black abalone were observed in any of the fixed abalone plots. For reference, N=22 black abalone (sizes ranged 30–131 mm, most individuals were either 1–10cm apart or >5m apart from one-another) were observed site-wide last spring, and N=30 black abalone (sizes ranged 38–175 mm, most individuals were either 1–10cm apart or >5m apart from one-another) were observed site-wide in spring 2014.

A 60-minute search was conducted for ochre star (*Pisaster ochraceus*) presence by Kate and Kenan. N=2 ochre stars (80mm and 100mm—observed to be healthy) were observed site-wide from the west side of the abalone plots, east to the cobble beach, placing the reef with the monitoring plots in the center. For reference, last spring, N=1 ochre star was observed site-wide from the west side of the abalone plots, east to the cobble beach, placing the reef with the monitoring plots in the center (size =100 mm). In spring 2014, N=18 ochre stars were observed site-wide from the west side of the abalone plots, east to the cobble beach, placing the reef with the monitoring plots in the center (sizes ranged 40–120 mm, mode = 60 mm). Most sea stars were observed to be healthy, but one *P. ochraceus* was categorized as stage 1 and another was stage 2 meaning that they had one and two lesions present, respectively. Two other *P. ochraceus* were classified as stage 4 since they had severe tissue deterioration. Note that N=227 *P. ochraceus* were observed at this site in November 2013.

The *Lottia gigantea* plots were sampled by Josh. Plots 1–5 had N= 4, 3, 86, 123 and 155 *L. gigantea*, respectively. Sizes of owl limpets in all the plots combined ranged <15–76 mm. For reference, last spring, plots 1–5 had N= 3, 6, 69, 104 and 185 *L. gigantea*, respectively. Sizes of owl limpets in all the plots combined ranged <15–79 mm.

The field log was completed by Stephen.

Numerous bolts were installed. All plots now have three markings (bolt or epoxy). The following plots still require the installation of bolts: 608–610 (UR, LL), 611 (LL), 612–614 (LL, UR), 616 (UR, LL), 619 (UR), 620 (LL) [17 bolts Total].

The temperature logger was downloaded at approx. 1600.

The barnacle (*Chthamalus* spp./ *Balanus* spp.) plots had 18.6% (21.2% mean barnacle cover measured last spring) mean barnacle cover. The majority of point contacts in the five plots were bare rock. *Endocladia* plots had 22.6% (28.8% measured last spring) mean *Endocladia* cover. The majority of point contacts in the five plots were bare rock, but *Silvetia* was also relatively abundant (mean= 27.8%). The rockweed plots had 73.8% (71.4% measured last spring) mean *Silvetia* cover. Most of the cover within the rockweed zone was dominated by *Silvetia*. Mussel (*Mytilus californianus*) plots had 13% (7.8% measured last spring) mean cover. The majority of cover in the five plots was occupied by a diverse mixture of species dominated by *Phragmatopoma* (mean= 49.4%), *Tetraclita* (mean= 7.2%) and articulated corallines (11.4%).

Mussels were measured in the five original *Mytilus* plots by Stephen. Sizes of mussels ranged 20–60 mm and mussel bed depths ranged 2–6 cm; all plots were monolayers.

The following site description was modified from the description written for the spring 2015 visit: *Mytilus* appeared to be more abundant than it has been during recent years with recruitment apparent in and around the mussel plots. *Silvetia* was highly abundant and reproductive and occupied more space than most other biota. *Endocladia* may have been the second most abundant taxa present at the site, although it was not very common within the representative plots. The alga appeared to be healthy with no obvious signs of bleaching. *Chthamalus* was only about half as common as *Balanus*, but neither species was abundant overall and only a scant amount of recruitment was observed for either species.

Caulacanthus ustulatus was observed for the first time at this site. The invasive alga was seen within and nearby plot 610 encompassing an area approx. 1–2 sq ft. Unfortunately, it appeared to be doing well. It was quite challenging to decipher between *Caulacanthus* and *Endocladia* requiring an inordinate amount of time examining both species before feeling confident that both were identified correctly. Along with Northwest-Talcott and Anacapa Middle East and West, this is the only other site where we have observed *Caulacanthus*.

11/27/2015. Northwest-Talcott.

Low tide –1.08 ft at 1653 hrs. The conditions were excellent for working but the wind was blowing 15–20 out of the east-northeast making it rather chilly; swell was small-sized (2–3'). We successfully

completed all protocols including sampling the mussel plots and surfgrass transects and searching for black abalone and sea stars. There were 2 western gulls and 3 black oystercatchers at the site upon arrival. Six black turnstones were seen near the access point when the tide was higher. No pinnipeds were observed. The site was monitored from 1345 to 1730.

Plots were photographed by Josh. Site panoramas were photographed by Josh. All photoplots were scored in the field by Stephen.

A thirty-minute search (time includes effort involved in measuring all encountered individuals) was conducted for black abalone (*Haliotis cracherodii*) presence by Kate and Kenan. N=8 black abalone (sizes ranged approx. 59–188 mm, most individuals were 1–10 cm to one another) were seen which is more than any other time for at least seven years. A concerted effort was made to sample the abalone plots despite the fact that most of the bolts marking the locations of the corners were missing. Plots 1–2 each appeared to have one abalone and plots 3–5 had zero individuals. For reference, last spring, three black abalone were observed.

A thirty-minute search was conducted for ochre star (*Pisaster ochraceus*) presence by Kate and Kenan. Zero sea stars were observed. Low abundances of sea stars are not unusual for this site even before the widespread population crash in early 2014.

Surfgrass transects were sampled by Stephen. Transects 1–3 had *Phyllospadix* cover = 100, 100 and 90%, respectively. *Phyllospadix* on all three transects was lightly to heavily fouled with epiphytic algae (*Melobesia*) and was moderately bleached/browened. Very low abrasion was observed on any of the blades and no flowers were seen.

The *Lottia gigantea* plots were sampled by Josh. Plots 1–5 had N= 37, 32, 64, 24 and 28 *L. gigantea*, respectively. Sizes of owl limpets in all the plots combined ranged <15–96 mm. For reference, last spring, plots 1–5 had N= 14, 18, 32, 14 and 16 *L. gigantea*, respectively. Sizes of owl limpets in all the plots combined ranged <15–104 mm.

The field log was only partially-completed by Stephen due to lack of working time and impending darkness.

Numerous bolts were installed this visit. However, many plots still require at least one bolt to ensure that all plots have bolts marking three corners. Splash plots (particularly 4–5) need maintenance in addition to the abalone plots.

Mussels were measured in the five original *Mytilus* plots by Stephen. Sizes of mussels ranged 20–90 mm and mussel bed depths ranged 2–6 cm; all plots were monolayers.

The barnacle (*Chthamalus* spp./ *Balanus* spp.) plots had 6.4% (21.2% mean barnacle cover measured last spring) mean barnacle cover. The majority of point contacts in the five plots were bare rock, but *Silvetia compressa* occupied 30% cover. *Endocladia* plots had 6% (19.6% measured last spring) mean *Endocladia* cover. The majority of point contacts in the five plots were bare rock. The rockweed plots had 65.4% (51.6% measured last spring) mean *Silvetia* cover. Most of the cover

within the rockweed zone was dominated by *Silvetia*. Incidentally, *Silvetia* cover has been steadily increasing at this site in recent years. Mussel (*Mytilus californianus*) plots had 38.6% (35.8% measured last spring) mean cover. The majority of cover in the five plots was occupied by *Mytilus*, but all the plots were fairly diverse with coralline crusts and articulated corallines ranking as the next most abundant taxa.

The invasive alga, *Caulacanthus ustulatus*, was first seen in November 2013 occupying small areas throughout the site from plots 555–559. Some patches of the alga measured approx. 14 cm across. This was the first time that *Caulacanthus* has been observed at any site besides the two sites at Middle Anacapa. Unfortunately, the invasive alga is likely here to stay at Northwest-Talcott and Anacapa since removal experiments have proven unsuccessful (J. Smith, per com). *Caulacanthus* was seen again during this visit, and it appeared to have spread to other locations throughout the site along with areas east of the site whereby it occupied patches several sq m in area).

The site appeared similar to past visits with no obvious disturbances. As usual, *Silvetia* and *Phyllospadix* dominated the site and both taxa appeared to be healthy with the exception of some minor bleaching and fouling on portions of the surfgrass beds. The mussel plots appeared unchanged from the last visit. Mussels were present in low to moderate densities as was *Endocladia*. Very low recruitment was observed for *Mytilus*. *Silvetia* appeared to be second only to *Phyllospadix* in terms of abundance throughout the site; some thalli were > 1m long. A rockweed gunnel was located in the large *Silvetia* patch east of the site.

11/28/2015. Ford Point.

Low tide –0.73 ft at 1740 hrs. The conditions were satisfactory bordering on poor due to the relatively large (4–5') and powerful long-period swell that routinely inundated the entire site making it challenging to stay dry particularly while conducting searches for sea stars and abalone. Wind was 5–10 kt. There were 4 black oystercatchers and 1 black turnstone at the site at various times throughout the day. One harbor seal was seen in the water near the site. Ford Point beach east of the site had approx. 85 elephant seals and approx. 15 harbor seals present when we arrived. The site was monitored from 1345 to 1800.

Plots were photographed by Josh. Site panoramas were photographed by Josh. All 15 photoplots were scored in the field by Stephen.

A 90-minute search (time includes effort involved in measuring all encountered individuals) was conducted for black abalone (*Haliotis cracherodii*) presence by Kate and Kenan. (N=124) black abalone were observed site-wide (from the area in the vicinity of abalone plot 535 to the east end of the site near 534) (sizes ranged 28–183 mm, most individuals were located 1–10 cm apart from one another). The conditions were not ideal for finding black abalone given the relatively large swell, however more abalone were seen this visit compared to any other visit in at least the last seven years. A concerted effort was made to sample the abalone plots, but the fact that most of the bolts marking the locations of the corners were missing made it too challenging to adequately sample them. For reference, last spring, (N=28) black abalone were observed site-wide (from the area in the vicinity of abalone plot 535 to the east end of the site near 534) (sizes ranged 50–154 mm, most individuals

were located 1–10 cm apart from one another). The conditions were not ideal for finding black abalone given the relatively large swell. In spring 2014, (N=58) black abalone were observed site-wide (sizes ranged 51–195 mm, most individuals were located 1–10 cm apart from one another). The black abalone plots were not sampled. A flashlight was used during the abalone search.

A 90-minute search (time includes effort involved in measuring all black abalone and sea stars) was conducted for ochre star (*Pisaster ochraceus*) presence by Kate and Kenan. N= 32 ochre stars were observed site-wide (from the area in the vicinity of abalone plot 535 to east end of the site near 534) (sizes ranged 40–110 mm). All observed *P. ochraceus* appeared to be healthy. For reference, last spring, N=7 sea stars were observed, and in spring, 2014 N= 9 ochre stars were seen.

The field log was only partially completed by Stephen due to time constraints and impending darkness.

No plot repairs were necessary since numerous bolts were installed last year. All plots had three bolts.

The barnacle (*Chthamalus* spp./ *Balanus* spp.) had 23.2% (25.8% measured last spring) mean barnacle cover. The majority of point contacts in the five plots were bare rock. *Endocladia* plots had 8.6% mean (20% measured last spring) *Endocladia* cover. The majority of point contacts in the five plots were bare rock, but each of the five plots were quite diverse hosting relatively high cover of *Mytilus*, barnacles, noncoralline crusts and crustose corallines. Mussel (*Mytilus californianus*) plots had 48.8% (38.6% measured last spring) mean cover. The majority of cover in the five plots was occupied by *Mytilus*, but *Phragmatopoma* occupied 32%. The splash plots were devoid of biota aside from littorine snails (abundances in plots 1–5 = 21, 184, 198, 30 and 170, respectively) and *Chthamalus* (abundances in plots 1–5 = 0, 260, 41, 50 and 282, respectively).

Mussels were measured in the five original *Mytilus* plots by Stephen. Sizes of mussels ranged 10–80 mm and mussel bed depths ranged 3–8 cm; all plots were monolayers.

Owl limpets (*Lottia gigantea*) were counted and measured in the fixed plots by Josh. Plots 600 (old) and 600 (new) – 604 had N= 11, 0, 16, 20, 11 and 24 owl limpets, respectively. Sizes throughout all six plots ranged <15–83 mm. For reference, last spring, plots 600 (old) and 600 (new) – 604 had N= 9, 0, 10, 13, 12 and 19 owl limpets, respectively; Sizes throughout all six plots ranged <15–86 mm.

Overall, the site appeared similar to its condition last year whereby *Phragmatopoma* was abundant throughout most of the zone previously occupied by *Mytilus*. Still, it seems as though *Phragmatopoma* abundances have decreased relative to recent years. The opposite held true for black abalone abundances which were exceptionally high this visit. Black abalone abundances have proven to be highly variable at this site for one reason or another perhaps due, in part, to the high number of large boulders and deep shelves available for abalone to seek refuge under during large swells. Zebra perch were again observed in a tidepool near the mussel plots.

11/29/2015. Johnson's Lee and China Camp.

Low tide -0.30 ft at 1803 hrs. We drove out to China Camp in the morning to count snowy plovers along with other shorebirds and pinnipeds. There were approx. 70 elephant seals (including approx. 10 pups and 3 bulls) on east end of the beach. Approx. 20 additional elephant seals were seen on China Camp beach on the way to Cluster Point. N=39 snowy plovers were seen along the stretch of beach including one that was banded (NO:YW). At Cluster Point, approx. 200 elephant seals, 100 western gulls, 50 cormorants and 6 ravens were observed.

Afterward, we drove out to Johnson's Lee to complete the monitoring that left over from 11/24. See site description for Johnson's Lee above for details.

11/30/2015. Skunk Point.

All the beaches between East Point and Southeast Anchorage were monitored for presence of snowy plovers, other shorebirds and carcasses from 1100 to 1400.

Along the beaches located nearby the lagoons, 1 black-bellied plover, 1 great blue heron and 1 great egret were seen. The wrack on the beach was comprised of high numbers of red crabs and *Zostera*.

Skunk Point (south) had 6 surf scoters nearby offshore, 30 black-bellied plovers, 1 marbled godwit along with 1 dead California sea lion and 2 dead cormorants.

Skunk Point (north) had three large groups of black-bellied plovers with approx. 31, 110 and 50 individuals in each respective group. There were four groups of snowy plovers seen with approx. 13, 17, 40 and 3 individuals in each respective group. Two birds were banded (GG:AB and WB:AR). We obtained photos of all banded birds observed on this trip. Additionally, other birds present included: 2 Brandt's geese, approx. 400 sanderlings, 8 terns, approx. 400 gulls, 1 black phoebe and 3 Say's phoebes. Three dead cormorants, 3 dead unidentified birds and 1 dead western gull were also present.

Along the beach north of Skunk, several paper nautilus, 20-25 *Blepharipoda* carcasses or molts and several *Vellela* tests were seen.

Santa Cruz Island, January 19-24, 2016

(Database event #2015-16-F)

Prepared by Stephen Whitaker

Purpose:

To monitor rocky intertidal sites at Santa Cruz Island.

Personnel:

- Stephen Whitaker, Marine Ecologist, Channel Islands National Park
- Josh Sprague, Marine Ecologist, Channel Islands National Park
- Kenan Chan, Technician, UCSC
- Kate Vylet, Technician, UCSC

Procedure and General Observations:

Island Packers transportation was utilized to access the island. Standard procedures were used for monitoring rocky intertidal sites. Plots and site overviews were photographed with an Olympus Stylus 1030SW digital camera. Photoplots were scored in the field at all sampling sites. Sea stars and black abalone were counted during site-wide searches. Surfgrass transects were read at Trailer and Fraser Cove. *Lottia gigantea* were sampled this season at all sites where fixed plots have been established. The maximum number of shorebirds and pinnipeds observed at each site was recorded at all sites. The Hobotemp Tidbit temperature logger was downloaded at Willows Anchorage. Mussel sizes and mussel bed depth were measured at all sites. Island Packers provided transportation off the island on 1/24.

1/19/2016. Prisoners Harbor.

Low tide -0.24 ft at 1250 hrs. The conditions were surprisingly workable even though a large, long-period swell out of the N-NW direction was running in the channel. Occasional sets of waves impacted the site, but generally, the swell was low (1-3'). Light wind (<5 kt) and overcast sky prevailed all day. It began drizzling steadily from about 2 pm through the remainder of the day and early evening. There were approx. 150 gulls (mix of western, California and Herrman) on the site when we arrived and three surf scoters were on the surface of the water immediately offshore. No pinnipeds were seen all day. The site was monitored from 1215 to 1600.

Plots were photographed by Josh. Site panoramas were photographed by Josh. All photoplots except *Hesperophycus* plots 1-4 were scored in the field by Stephen; the others were scored by Josh. The field log was completed by Stephen.

A 30-minute search was conducted for black abalone (*Haliotis cracherodii*) presence by Kenan. N=4 black abalone were observed site-wide (sizes ranged 35-105 mm, two individuals were spaced 1-10cm from one another and the other two were >5 m apart). For reference, in fall 2014, N=16 black abalone were observed site-wide, and N=15 individuals were located in spring 2014. However, only four individuals were located in spring 2013, so it is not unusual to find relatively low numbers of abalone here. In fact, it is somewhat peculiar to have seen higher numbers of abalone last year followed by low numbers again this year.

A 30-minute search was conducted for ochre star (*Pisaster ochraceus*) presence by Kate and Kenan. Zero *P. ochraceus* were located throughout the entire site. For reference, last fall, zero sea stars were found and only one individual was seen in spring 2014; it appeared to have at least one lesion on its body. In spring 2013, N=31 ochre stars were observed site-wide (sizes ranged 90-140 mm, mode = 100 mm).

No repairs were necessary since nearly all plots have three bolts marking the locations of three corners. The plot(s) that do not have three bolts have two bolts plus epoxy that clearly indicate the location of the plots.

The barnacle (*Chthamalus* spp./ *Balanus* spp.) plots had 8.4% (32.2% mean barnacle cover measured last fall) mean barnacle cover. The majority of point contacts in the five plots were Enderachne

(mean=37%), although the barnacle plots were quite diverse with many species occupying space. *Endocladia* plots had 17.6% (24.2% measured last fall) mean *Endocladia* cover. The majority of point contacts in the five plots was bare rock, but *Chthamalus* spp./ *Balanus* spp. were relatively common (mean=26.2%). The *Silvetia* plots had 0.0% (0.4% measured last fall) mean *Silvetia* cover. Within the *Silvetia* zone, there was a relatively even mix of species occupying space including *Endarachne*, *Mazzaella*, *Mytilus* and *Tetraclita*. The *Hesperophycus* plots had 10.4% (8.8% measured last fall) mean *Hesperophycus* cover. Most of the point contacts within the *Hesperophycus* zone were bare rock, but *Chthamalus* spp./ *Balanus* spp were quite common (mean= 29.6%). Mussel (*Mytilus californianus*) plots only had 3% (0.8% measured last fall) mean cover. Mussel cover was only documented in *Mytilus* plots 1–3. The majority of cover in the five plots was occupied by articulated corallines (mean= 28.8%) and *Chondracanthus canaliculatus* (mean= 24.6%).

Mussels were measured in the five original *Mytilus* plots by Kenan and Kate. Sizes of mussels ranged 20–50 mm and mussel bed depths ranged 1–4 cm; all plots were monolayers.

There appeared to be a very high cover of ephemeral algal species including *Scytosiphon*, *Endarachne*, diatoms, *Ulva* as well as an assortment of filamentous red and green algae prevalent throughout the site, particularly at the west end. Rockweeds (especially *Silvetia*) occurred in low abundance. *Mytilus* was also relatively scarce. *Mytilus galloprovincialis* and *Septifer* were present in moderate abundances. *Endocladia* was only seen in small patches. A relatively large (several sq m) area appeared scraped clean of most biota in the vicinity of the *Mytilus* plots 1–3 and *Silvetia* plot 5. The reef appears particularly bare at the interface with the cobble beach whereby large swaths of *Mytilus* have been removed.

1/20/2016. Valley Anchorage.

Low tide –0.73 ft at 1338 hrs. Due to the light rain that fell steadily yesterday, we were not permitted to drive on the roads west of the valley. Given our limited options, we decided to utilize the low tide to count and measure black abalone and sea stars at Valley Anchorage. The conditions were decent for sampling despite the moderately-large (3–4') swell originating out of the south. Fortunately, the sets of waves were spaced long enough apart to allow for decent working time between sets. The wind was light (<5 kt). No shorebirds were seen at the site throughout the day. One harbor seal was spotted in the water nearby. The site was monitored from 1500 to 1700. Note that there are not any fixed plots for any target species at this site, however, we attempt to conduct census counts for black abalone and sea stars as often as possible and the UCSB folks (Blanchette lab) do as well.

A site-wide search lasting approximately 60 minutes was conducted for black abalone (*Haliotis cracherodii*) presence by Josh, Kate and Kenan. N=35 black abalone were observed in the area of the site from the surge channel near the entrance to the cave on the west end of the site to the beginning of the boulder field on the eastern end. Throughout the boulder field, N=208 black abalone were seen (N=107 were measured, sizes ranged 30–147 mm, most individuals were touching one another or spaced 1–10 cm apart). Note that the conditions were not ideal for accessing the low portions of the site due to the frequent sets of waves. Twelve relatively fresh-looking black abalone shells were located and measured. One black abalone appeared to be withered and was collected and frozen to preserve for analysis (the specimen will be sent to Jim Moore).

A 30-minute search was conducted for ochre star (*Pisaster ochraceus*) presence by Kenan and Stephen. N=13 *P. ochraceus* were seen at the site; all appeared to be healthy (sizes ranged 20–80 mm). Note that only the bedrock portion of the site was surveyed—not the boulders. Tissue was taken from several individuals to be sent off to Ian Hewson's lab at Cornell University to analyze as part of a study investigating SSWD (sea star wasting disease).

1/21/2016. Fraser Cove.

Low tide –1.05 ft at 1420 hrs. The conditions were excellent despite the moderate-sized (3–5') swell. The sky was overcast and the breeze was light (10–15kt). The tide was exceptionally low. Black oystercatchers (N=18) and two western gulls were seen at the site throughout the day. One large, male CA sea lion was seen on the beach east of our tar plots at Fraser. The site was monitored from 1145 to 1700. All plots at Fraser and Forney were scored during the same day.

Plots were photographed by Josh. Site panoramas were photographed by Josh. All 35 photoplots were scored in the field by Stephen.

A 30-minute search was conducted for black abalone (*Haliotis cracherodii*) presence by Kate and Kenan. N=7 black abalone (sizes ranged 66–139mm) were observed site-wide from plot 891 to plot 905. For reference, last fall, N=3 black abalone (54, 101, 120 mm) were observed site-wide from plot 891 to plot 905. All were >5m apart from one another.

A 30-minute search was conducted for ochre star (*Pisaster ochraceus*) presence by Kate and Kenan. Only two *P. ochraceus* (40mm, 120 mm) were observed site-wide from plot 891 to plot 905. Both individuals appeared to be healthy. For reference, last fall, N=1 ochre star was observed site-wide, and N=2 were seen in spring 2014.

Surfgrass transects were sampled by Stephen. Transects 1–3 had *Phyllospadix* cover = 79, 77 and 87%, respectively. Most of the surfgrass appeared to be in good shape overall with very minimal bleaching and only minor fouling from *Melobesia*, but the surfgrass in the vicinity of transect #3 had a moderate level of fouling from *Smithora*. For reference, last fall, transects 1–3 had *Phyllospadix* cover = 72, 70 and 90%, respectively.

The fixed owl limpet plots were sampled by Josh. Plots 1–5 had N= 13, 6, 11, 14 and 10 *Lottia gigantea*, respectively. Throughout the five plots, sizes ranged <15–65 mm. For reference, last fall, plots 1–5 had N= 12, 2, 11, 17 and 8 *Lottia gigantea*, respectively. Throughout the five plots, sizes ranged <15–67 mm.

Bolts were installed in the LL corners of plots 884 and 893 as well as the UR corner of plot 909. All plots now have three bolts marking boundaries of the corners.

The barnacle (*Chthamalus* spp./ *Balanus* spp.) plots had 31.8% (33.4% measured last fall) mean barnacle cover. The majority of point contacts in the five plots were bare rock. *Endocladia* plots had 35.2% (34.6% measured last fall) mean *Endocladia* cover. The majority of point contacts in the five plots were *Endocladia* followed closely by bare rock (34%). The *Silvetia* plots had 19.4% (20% measured last fall) mean *Silvetia* cover. Most of the point contacts within the *Silvetia* zone were bare

rock, however, the *Silvetia* plots were relatively diverse. The *Hesperophycus* plots had 7.2% (26.6% measured last fall) mean *Hesperophycus* cover. Most of the point contacts within the *Hesperophycus* zone were bare rock. Mussel (*Mytilus californianus*) plots had 56.6% (67.6% measured last fall) mean mussel cover. The majority of cover in the five plots was occupied by *Mytilus californianus*. *Pollicipes* plots had 11.8% (18.4% measured last fall) mean *Pollicipes* cover. The majority of cover in the five plots was occupied by *Mytilus californianus* (mean= 45.2%). Tar plots had 51.2% mean tar present. Overall, in comparison to data collected for the all the photoplots at this site during the past two years, all target taxa except *Hesperophycus* appear to have remained relatively unchanged.

Mussels were measured in the five original *Mytilus* plots by Kate. Sizes of mussels ranged 10–140 mm and mussel bed depths ranged 3–11 cm; only plot 1 qualified as a monolayer.

The site appeared to be in surprisingly fair shape given all the large wave events that have been impacting west and north-facing shorelines this winter. The only obvious signs of disturbance were several areas of *Phragmatopoma* that were scraped clean. *Phragmatopoma* abundance, in general, appeared lower than usual relative to recent years. All target species except *Hesperophycus* within the photoplots were relatively common and comparable in abundance to that of recent years. *Silvetia* was reproductive. Note that a robomussel was installed inside *Mytilus* plot 5 by the UCSB folks. The mistake will be corrected next year when the group replaces the logger.

1/22/2016. Trailer.

Low tide –1.18 ft at 1458 hrs. The conditions were mediocre bordering on poor due to large (5–6') long-period waves that washed through most of the site throughout the day including during the exceptionally low tide. Because of this, searches for sea stars and abalone were slightly hampered. Wind was light (5–10kt). There were no shorebirds or pinnipeds at the site all day. The site was monitored from 1230 to 1615.

Plots were photographed by Josh. Site panoramas were photographed by Josh. All photoplots were scored in the field by Stephen. The field log was completed by Stephen.

A 30-minute search was conducted for black abalone (*Haliotis cracherodii*) presence by Kate and Kenan. N=63 black abalone were observed site-wide from the surge channel at the east end just passed surfgrass transect-3 to the *Lottia* plots at the west end. A more thorough search of the same area in which all encountered individuals were measured yielded N=144 black abalone (sizes ranged 19–147 mm, most individuals were located 1–10 cm apart from one another). For reference, last fall, N=61 black abalone were observed site-wide (sizes ranged 27–141 mm, most individuals were located 1–10 cm apart from one another). In spring 2014, N=75 black abalone were observed (sizes ranged 45–165 mm, most individuals were located 1–10 cm apart from one another).

A 30-minute search was conducted for ochre star (*Pisaster ochraceus*) presence by Kate and Kenan. N=4 *P. ochraceus* (presumably healthy) (sizes ranged 50–70 mm) were seen at the site. For reference, last fall, only one *P. ochraceus* (appeared healthy) was seen. In spring 2014, only one *P. ochraceus* (appeared healthy) also was seen.

Surfgrass transects were sampled by Stephen. Transects 1–3 had *Phyllospadix* cover = 95, 73 and 31%, respectively. *Phyllospadix* was lightly fouled by *Melobeisa*, and a low percentage of the beds appeared bleached and/or abraded. For reference, last fall, transects 1–3 had *Phyllospadix* cover = 95, 69 and 28%, respectively. In spring 2014, transects 1–3 had *Phyllospadix* cover = 68, 61 and 26%, respectively.

The fixed owl limpet plots were sampled by Josh. Plots 1–5 had N= 18, 20, 6, 9 and 1 *Lottia gigantea*, respectively. Throughout the five plots, sizes ranged <15–99 mm. For reference, last fall, plots 1–5 had N= 19, 21, 2, 6 and 0 *Lottia gigantea*, respectively.

Three bolts were installed in plot H6. All plots now have three bolts marking locations of corners.

The barnacle (*Chthamalus* spp./ *Balanus* spp.) had 49.6% (70.6% measured last fall) mean barnacle cover. Despite having markedly lower cover in barnacles relative to last fall, the majority of point contacts in the five plots were *Chthamalus* spp./ *Balanus* spp. The *Silvetia* plots had 33.2% (44.6% measured last fall) mean *Silvetia* cover. Most of the cover within the *Silvetia* zone was dominated by *Silvetia*. The *Hesperophycus* plots had 6.3% (7.4% measured last fall) mean *Hesperophycus* cover. Most of the point contacts within the *Hesperophycus* zone were bare rock. Mussel (*Mytilus californianus*) plots had 55.2% (46.4% measured last fall) mean cover. The majority of cover in the five plots was dominated by *Mytilus* though *Phragmatopoma* (mean= 21.4%) was also particularly dominant. Overall, in comparison to data collected for the all the photoplots at this site during the past two years, all target taxa, with the exception of *Chthamalus* spp./ *Balanus* spp., appear to have remained relatively unchanged.

Mussels were measured in the five original *Mytilus* plots by Kenan and Kate. Sizes of mussels ranged 10–110 mm and mussel bed depths ranged 2–10 cm; only plot 1 qualified as a monolayer.

All target species for photoplots appeared healthy and moderately abundant. *Silvetia* was approx. three times more abundant than *Hesperophycus*. Both rockweed species were reproductive. The tidepool between the rockweed plots and the *Mytilus* plots was partially silted in with sand and it appeared that *Phragmatopoma* had been scoured in many places. *Phyllospadix* was lush and abundant with very little fouling or abrasion. No flowers were observed. *Mytilus* appeared healthy and common and perhaps more abundant relative to recent years in the vicinity of the mussel plots. *Balanus* and *Chthamalus* appeared abundant and healthy with only a low percentage observed to be dead. *S. purpuratus* was abundant and appeared healthy with no lesions observed.

1/23/2016. Willows Anchorage.

Low tide –1.14 ft at 1534 hrs. The conditions were very good for sampling. There was a large and powerful swell originating out of the NW, but this south-facing site was sufficiently protected and very little wrap-around swell was experienced. The wind was moderate (15–20 kt) and swell (1–3') was light (1–3'). No shorebirds were seen at the site throughout the day other than one black oystercatcher west of the *Lottia* plots. Three harbor seals were noticed in the water between the site and the offshore rock. The site was monitored from 1230 to 1715.

Plots were photographed by Josh. Site panoramas were photographed by Josh. All of the photoplots were scored in the field by Stephen. The field log was completed by Stephen. The temperature logger was downloaded and replaced.

A 30-minute search was conducted for black abalone (*Haliotis cracherodii*) presence by Kate and Kenan. N=75 black abalone were observed in the area of the site between the first *Hesperophycus* plot and the *Endocladia* plots. A more thorough search of the same area (approx. 90-min) in which all encountered individuals were measured yielded N=109 black abalone (sizes ranged 15–135 mm, most individuals were either touching or located 1–10 cm apart from one another). For reference, last fall, a search lasting approx. 120 minutes was conducted for black abalone (*Haliotis cracherodii*) presence by Cori and Emily. N=444 black abalone were observed in the area of the site between the first *Hesperophycus* plot and the *Endocladia* plots (sizes ranged 20–140 mm, most individuals were observed to be touching one another). N=35 empty, clean shells were located and measured. Three live abalone and one dead individual appeared slightly withered; the dead one which was seen on the beach adjacent to the site was collected and placed in the annex freezer (sample will be sent to Jim Moore). There was obviously a marked decline in the number of black abalone observed this visit relative to last fall. Relative abundances of black abalone during the past 4–5 years have been relatively high (comparable to fall 2014). The reason for the marked decrease in abalone abundance this year is not yet clear.

A 30-minute search was conducted for ochre star (*Pisaster ochraceus*) presence by Kate and Kenan. N=23 *P. ochraceus* were seen across the entire site from H1 to L5 (sizes ranged 30–110 mm, mode=60 mm). All individuals appeared healthy with no lesions observed. For reference, last fall, as well as fall 2013, zero sea stars were located.

A bolt was placed in the UL corner of plot 946 and epoxy was used to shore up several plots that appeared loose. No other repairs were necessary. Note that all bolts were present indicating locations of *Mytilus* and *Lottia* plots despite being very challenging to locate since many were folded over.

The fixed owl limpet plots were sampled by Josh. Plots 1–5 had N= 65, 72, 98, 44 and 13 *Lottia gigantea*, respectively. Throughout the five plots, sizes ranged <15–58 mm. For reference, last fall, plots 1–5 had N= 61, 34, 48, 26 and 3 *Lottia gigantea*, respectively. Throughout the five plots, sizes ranged <15–54 mm.

Endocladia plots had 15.6% (29.4% measured last fall) mean *Endocladia* cover. The majority of cover in the five plots was occupied by crustose corallines (mean=45.6%). The *Silvetia* plots only had 8.6% (6% measured last fall) mean *Silvetia* cover (only plot 949 had *Silvetia* present [43%]). Most point contacts within the *Silvetia* zone were crustose corallines (mean=36.8%). The *Hesperophycus* plots had 0% (0% measured last fall) mean *Hesperophycus* cover. Most point contacts within the *Hesperophycus* zone were bare rock. Mussel (*Mytilus californianus*) plots had 72.6% (60.6% measured last fall) mean cover. The majority of cover in the five plots was occupied by *Mytilus*.

Mussels were measured in the five original *Mytilus* plots by Stephen. Sizes of mussels ranged 20–100 mm and mussel bed depths ranged 4–9 cm; all plots were monolayers.

Several *Norrissia* were seen in the mid to upper intertidal zone. All the rockweed in the vicinity of H2-5 and P5 has disappeared. *Mytilus* recruitment was apparent below the *Endocladia* plots and around the *Lottia* plots. *Phragmatopoma* does not appear to be as abundant as last year this time. Black abalone abundance decreased markedly as only about 1/4th the number of abalone seen last fall were present. No signs of withering were observed.

San Miguel Island, February 4–9, 2016

(Database event #2015-16G)

Prepared by Stephen Whitaker

Purpose:

To monitor rocky intertidal sites at San Miguel Island.

Personnel:

- Stephen Whitaker, Marine Ecologist, Channel Islands National Park
- Kenan Chan, Technician, UCSC
- Kate Vylet, Technician, UCSC

Procedure and General Observations:

Channel Islands Aviation transportation was utilized to access the island; we flew out to the lakebed and are remaining gear was then flown to NOS housing. Standard procedures were used for monitoring rocky intertidal sites. Plots and site overviews were photographed with an Olympus Stylus 1030SW digital camera. Photoplots were scored in the field at all four sampling sites. Sea stars and black abalone were counted during site-wide searches at all four sampling sites. *Lottia gigantea* were sampled this season at the two sites (Otter Harbor and Harris Point) that have fixed plots. Motile invertebrates are no longer sampled at any of the intertidal sampling sites. The maximum number of shorebirds and pinnipeds observed at each site was recorded at all sites. Hobotemp Tidbit temperature loggers were replaced at Otter Harbor and Crook Point. Mussel sizes and mussel bed depths were measured at all four sampling sites. Channel Islands Aviation provided transportation off the island on Tuesday, February 9th.

2/4/2016. Otter Harbor.

Low tide –0.14 ft at 1345 hrs. The conditions were mediocre at best due to relatively large (5–8') swell that increased throughout the day. By the late afternoon, the swell had become consistently 10–12'. Despite the large swell, we were able to complete all protocols by working between the sets of waves. It is definitely possible that the searches for sea stars and black abalone were negatively affected by the high state of the swell. Breeze was moderate at 10–15 kt and sky was clear due to light Santa Ana conditions. There were approx. 100 gulls, 2 black oystercatchers, 1 hybrid American/black oystercatcher, 10 black turnstones, 3 cormorants, 2 marbled godwits along with 31 harbor seals and 1 juvenile California sea lion (appeared gaunt) at the site upon arrival. The charismatic harbor

seal that we typically encounter at the site remained on the site the entire day. No harbor seal pups were observed at the site. The site was monitored from 1100 to 1700.

Plots were photographed by Kenan. Site panoramas were photographed by Kenan. All photoplots were scored in the field except plot 374 that was scored in office by Stephen. The temp loggers were exchanged around 14:30 and the data were downloaded during the evening.

A 30-minute search was conducted for black abalone (*Haliotis cracherodii*) presence by Kate and Kenan. The entire site was searched from R1 at the east end of the site near the surge channel to R2 (search started on east end of site). N=129 black abalone were observed site-wide (sizes ranged 32–140 mm, most individuals were either touching or were located 1–10 cm apart from one another). During an extended search of the site (approx. 120 mins), N=163 black abalone were measured. All five abalone plots were sampled; it is possible that plots 1–2= 0, plot 3= 1, plot 4= 1, plot 5= 4, however Stephen was unable to verify the precise locations of the five plots. Note that two individuals appeared to be withered. For reference, N=211 black abalone were observed site-wide (sizes ranged 27–145 mm, most individuals were either touching or were located 1–10 cm apart from one another) during our last visit in December 2014. All five abalone plots were sampled; zero abalone were seen in any of the plots.

A 30-minute search was conducted for ochre star (*Pisaster ochraceus*) presence by Kate and Kenan. N=2 ochre stars were observed site-wide from R2 to the east end near the surge channel (sizes were 60mm and 130mm). No other sea star species were seen. No signs of sea star wasting disease were observed. For reference, in January 2014, N=96 ochre stars were observed site-wide from R2 to the east end near the surge channel (sizes ranged 80–170 mm, mode = 110 mm). By March 2014, only two *P. ochraceus* were seen throughout the entire site, and N=6 were seen in December 2014.

Owl limpets (*Lottia gigantea*) were counted and measured in the fixed plots by Stephen. Plots 1–5 had N= 57, 77, 65, 63 and 98 owl limpets, respectively. Sizes throughout all five plots ranged 15–62 mm. For reference, in December 2014, plots 1–5 had N= 48, 65, 44, 58 and 37 owl limpets, respectively. Sizes throughout all five plots ranged <15–64 mm.

The field log was completed by Stephen. No plot repairs were conducted during this visit since all plots had three bolts marking the locations of corners. Note that the UL bolt for plot 380 was not etched and plot 379 is incorrectly labeled #4—should be #3.

The barnacle (*Chthamalus* spp./ *Balanus* spp.) plots had 12% mean barnacle cover. The majority of point contacts in the five plots were bare rock. Note that *Chthamalus* spp./ *Balanus* spp. cover was approx. 45% two years ago. Plot 374 remains dominated by red algae comprised primarily of *Chondracanthus* and *Mazzaella*/ *Mastocarpus*. *Endocladia* plots had 21.6% (down from 32.8% measured in December 2014) mean *Endocladia* cover. The majority of point contacts in the five plots were bare rock. The rockweed plots only had 0.2% mean *Silvetia* cover; the rockweed only occupied 1% of one plot). Rockweed cover has declined at this site in recent years. Most of the point contacts within the rockweed zone were bare rock. Mussel (*Mytilus californianus*) plots had 55.4% mean

cover (lower than 67.8% measured last year, but an increase from 47% measured in March 2013). The majority of cover in the five plots was occupied by mussels.

Mussel lengths ranged 20–100mm and bed depths ranged 30–70mm in plots 1–5. All plots appeared to be comprised of monolayers of *Mytilus*. Measurements were taken by Stephen.

No obvious disturbances to the site were observed other than a relatively large (> 1sqm) rock that had been broken from the ledge in front of *Lottia* plot #1 and flipped upside-down. All target zones with the exception of *Silvetia* were common to abundant. *Silvetia* was present in very low abundances. Unfortunately no observations were made for *Hesperophycus* due to time constraints, but the alga has have been slightly more abundant than *Silvetia* at this site in recent years. A relatively high level of recruitment was observed for *Mytilus* but not for other species. *Endocladia* was abundant and lush with no apparent bleaching. In fact, bleaching was not observed for any algal species. *Mastocarpus* was nearly as common as *Mazzaella*. *Chthamalus* was much more common than *Balanus*. Ephemeral algae including *Bangia*, *Porphyra* and *Ulva* dominated the upper intertidal zone. Black abalone abundances appeared to be slightly lower than observed here in recent years but the search this year may have been hampered by the swell. Note that two individuals appeared to be withered.

2/5/2016. Cuyler Harbor.

Low tide –0.56 ft at 1418 hrs. The conditions were excellent despite the large swell (6–8') running out of the northwest. This site is remarkably protected from northwest swells due to a finger reef that protrudes out in front of it. Sky was clear and wind was light (<5 kt). There were 4 marbled godwits at the site upon arrival. Along the beach the following were observed: approx. 500 elephant seals including >100 pups and 100's of gulls in the water west of Nidever Canyon; approx. 150 elephant seals and approx. 70 willets between Nidever Canyon and the surge channel; approx. 100 elephant seals including approx. 50 pups between the surge channel and monitoring site. The sand level on the beach was lower than usual whereby a >10' deep cut in the sand had been removed near the surge channel making it necessary to climb up and over to access the eastern end of the beach and the site.

No dead animals were seen along the beach. The site was monitored from 1300 to 1700.

Plots were photographed by Kate. Site panoramas were photographed by Kate. All 20 photoplots were scored in the field by Stephen.

A thirty-minute site-wide search was conducted for black abalone (*Haliotis cracherodii*) presence by Kenan. One black abalone (86mm) was observed under the large rock near plot 405. This was the first black abalone seen at this site for at least 7 years.

A thirty-minute search was conducted for ochre star (*Pisaster ochraceus*) presence by Kenan. N=6 ochre stars were observed site-wide (sizes ranged 30–150 mm, mode = 70 mm). All sea stars appeared to be healthy with no visible lesions. No other sea star species were seen at the site. An additional N=2 *P. ochraceus* were seen during a survey of the reef adjacent to the site on the southwest side. For reference, during the last visit (December 2014), N=9 *P. ochraceus* were seen site-wide; all individuals appeared to be healthy. In January 2014, N=99 ochre stars were observed

site-wide (sizes ranged 50–210 mm, mode = 130 mm). Several sea stars (N=3) were observed to have severe tissue deterioration and/or >3 missing arms and one individual had a lesion on an arm.

The field log was completed by Stephen. Numerous plot repairs were made during this visit (see photo log for details). All plots now have three bolts marking the locations of three corners.

The barnacle (*Chthamalus* spp./ *Balanus* spp.) had 30.2% mean barnacle cover. The majority of point contacts in the five plots were bare rock. *Chthamalus* spp./ *Balanus* spp. cover has been gradually declining during the past year from 62.4% in January 2014 (cover was 47.4% in December 2014). *Endocladia* plots had 15.6% mean *Endocladia* cover (17.4% mean *Endocladia* cover measured in December 2014). The majority of point contacts in the five plots were bare rock. The rockweed plots did not have any *Silvetia* cover present (*Silvetia* only comprised 2% of plot 407 and was not present in any of the other plots in December 2014). The majority of point contacts in the five plots were bare rock. Mussel (*Mytilus californianus*) plots had 61.2% mean cover of mussels (76.8% mean cover measured in December 2014). The majority of cover in the five plots was occupied by mussels. For reference, in January 2014, mussel plots had 83.8% mean cover.

Mussel lengths ranged 30–140mm and bed depths ranged 40–90mm in plots 1–5. All plots appeared to be comprised of monolayers of *Mytilus*. Measurements were taken by Stephen.

Overall, the site condition appeared similar to previous visits with no obvious disturbances with the exception of a substantial portion of *Phragmatopoma* obviously damaged or removed from much of the lower portions of the site. Consistent with recent surveys of the site, *Mytilus* was again conspicuously abundant; all sizes of mussels were seen (extremely large (e.g. >150mm) mussels along with a moderate level of newly-recruited individuals). The barnacle zone was dominated by *Balanus*. Rockweeds present consisted primarily of *Silvetia* (mainly around plot 413) that occupied an area approx. 3 sqm, and a small patch (approx. 9 thalli) was seen near plot 417 that appeared relatively tattered. The larger patch of *Silvetia* appeared healthy and reproductive. Thirty-one *Hesperophycus* plants were also seen mixed in with the larger patch of *Silvetia*. *Endocladia* was not particularly abundant with most occurring around plot 420. *Chthamalus* was present in relatively low abundances. *Phyllospadix* appeared healthy with minimal fouling or bleaching. *Strongylocentrotus purpuratus* was common and appeared healthy.

2/6/2016. Crook Point.

Low tide –0.89 ft at 1451 hrs. The conditions were very good overall with small to moderate-sized (2–4') ground swell, light (5–10 kt) wind out of southwest and clear sky. Still, the larger sets made for wet conditions when conducting surveys for black abalone and sea stars. There was very little sand in the surge channel splitting the site. There were approx. 22 cormorants, 3 western gulls and 4 black oystercatchers at the site upon arrival. Two elephant seals (both bulls) were observed lounging in the surge channel at various times throughout the day. One elephant seal was observed on the beach east of the site. Approx. 500 elephant seals were on the beach west of the site including numerous pups. The site was monitored from 1130 to 1700.

Plots were photographed by Kenan. Site panoramas were photographed by Kenan. All photoplots were scored in the field by Stephen. The field log was completed by Stephen. The temp logger was exchanged at 15:20.

Bolts were installed in plots 383 (UR) and 389 (LR). All plots now have three bolts marking the locations of three corners. Abalone plots 4 and 5 still require four bolts to indicate the locations of the corners.

A 30-minute search was conducted for black abalone (*Haliotis cracherodii*) presence by Kate and Kenan. N= 21 black abalone were observed site-wide from the east end excluding the offshore reef to the east end in line with plot 388. An extended period of time was spent searching and measuring abalone within the site perimeter revealing N=42 black abalone in total (sizes ranged 32–153mm, most individuals were touching one another). An attempt was made to survey abalone plots 1–5, but only plots 1, 3 and 4 were confidently located. Abalone plots 1, 3, 4 had N=1, 3, 1 black abalone, respectively. For reference, in December 2014 N= 55 black abalone were observed site-wide (sizes ranged 33–155 mm, most individuals were located 1–10cm apart from one another). Abalone plots 1–5 had N=0 black abalone present. The area encompassing the Biodiversity transects was surveyed separately for black abalone; N=35 observed. In January 2014, N= 26 black abalone were observed site-wide and sizes ranged 65–148 mm.

A 30-minute search was conducted for ochre star (*Pisaster ochraceus*) presence by Kate and Kenan. N=15 ochre stars were observed site-wide (from the east end excluding the offshore reef to the east end in line with plot 388) (sizes ranged 10–100 mm); all individuals appeared to be healthy. An extended timed-search of the same area revealed a total of N=26 *P. ochraceus* at the site. For reference, in December 2014 N=23 ochre stars were observed site-wide (from the east end excluding the offshore reef to the east end in line with plot 388) (sizes ranged 20–130 mm, mode = 40 mm); all individuals appeared to be healthy. This was the greatest number of *P. ochraceus* that we had seen at any site surveyed thus far this season. In January 2014, N=10 ochre stars were observed site-wide (from the east end excluding the offshore reef to the east end in line with plot 388) (sizes ranged 70–120 mm). All individuals appeared to be healthy.

Mussel lengths ranged 10–70mm and bed depths ranged 30–60mm in plots 1–5. All plots appeared to be comprised of monolayers of *Mytilus*. Measurements were taken by Stephen.

The barnacle (*Chthamalus* spp./ *Balanus* spp.) plots had 28.8% mean barnacle cover (27% measured in December 2014). The majority of point contacts in the five plots were bare rock. *Endocladia* plots had 22.8% mean *Endocladia* cover (exactly the same as measured in December 2014). The majority of point contacts in the five plots were bare rock. *Endocladia* plot 389 had 54% mussels present. The rockweed plots had 0% mean *Hesperophycus* and *Silvetia* cover which was nearly equivalent to abundances measured in December 2014. Most of the cover within the rockweed zone was dominated by mussels (mean=30.4%). Mussel (*Mytilus californianus*) plots had 80.2% mean mussel cover (82.4% mean mussel cover measured in December 2014). The majority of cover in the five plots was occupied by mussels.

Overall, in comparison to data collected for the all the photoplots at this site during the past two years, the target taxa appear to have remained relatively unchanged.

The overall condition of the site appeared unchanged from recent past visits with the exception of significant-sized patches of *Phragmatopoma* damaged and quite a bit of sand deposited in many of the tidepools. *Mytilus*, *Balanus* and *Endocladia* were abundant and appeared to be healthy. Low to moderate level of recruitment was observed for *Mytilus* particularly in the *Phragmatopoma*. Ephemeral algae (*Ulva*, *Bangia*, *Endarchne*, *Porphyra*, *Scytosiphon*) were relatively common and even abundant in places. Rockweeds were rare; only *Hesperophycus* (Harris Point variety) was seen. *Anthopleura xanthogrammica* common. *S. purpuratus* was abundant in the pools and no lesions were observed on any individuals. *Mastocarpus* appeared to be nearly as abundant as *Mazzaella affinis*.

2/7/2016. Harris Point.

Low tide –1.09 ft at 1525 hrs. The conditions were good despite the occasional wetting during the larger sets. Sky was clear, warm to relatively hot air temperature due to the Santa Ana conditions, breeze was light (5–10 kt) and swell was medium-sized (3–5' long period out of NW). There were not any shore birds observed at the site. Nine harbor seals, 1 CA sea lion and 1 elephant seal (bull) were seen at the site upon arrival. The elephant seal was hauled out in the surge channel near the center of the site and had a large (grapefruit-sized) growth under the skin on his back. A gray whale was observed approx. 100 m offshore moving south. The site was monitored from 1315 to 1715. We surveyed Simonton Beach for marine debris for approx. two hours prior to sampling Harris Point.

Plots were photographed by Kate and Kenan. Site panoramas were photographed by Kate and Kenan. All 25 photoplots at the site were scored in the field by Stephen.

A 30-minute search was conducted for black abalone (*Haliotis cracherodii*) presence by Kate and Kenan. N=25 black abalone were observed site-wide (from R2 at the west end within the boulder field to the crack east of plot 430) (sizes ranged 18–168 mm, most individuals were spaced 1–10cm apart from one another). Note that an extended search of the same area resulted in a total of N=57 black abalone observed and measured at the site. The fixed abalone plots were sampled: plot 441 and 443 had one abalone each, plots 442 and 445 had zero, and plot 444 had three abalone. Two individuals appeared to be withered; one was located near plot 438 out in the open and the other was near limpet plot 4. Neither individual was collected. For reference, in December 2014, N=30 black abalone were observed site-wide and sizes ranged 42–180 mm, most individuals were spaced 1–10cm apart from one another.

A 30-minute search was conducted for ochre star (*Pisaster ochraceus*) presence by Kate and Kenan. N=0 ochre stars were observed site-wide (from R2 at the west end within the boulder field to the crack east of plot 430). For reference, in December 2014, N=3 ochre stars were observed site-wide (from R2 at the west end within the boulder field to the crack east of plot 430) (sizes ranged 100–160 mm). Additionally, N=8 *Patiria miniata* were seen throughout the site.

Mussel lengths ranged 20–70mm and bed depths ranged 30–60mm in plots 1–5. All plots appeared to be comprised of monolayers of *Mytilus*; plots 427 and 428 had <10 *Mytilus* present. Measurements were taken by Stephen.

Owl limpets (*Lottia gigantea*) were measured in the fixed plots by Stephen. Plots 1–5 had N= 12, 28, 74, 76 and 21 owl limpets, respectively. Sizes of *L. gigantea* lumped across the five plots ranged 13–75 mm, mode= 27 mm). For reference, in December 2014, plots 1–5 had N= 2, 11, 28, 41 and 13 owl limpets, respectively. Sizes of *L. gigantea* lumped across the five plots ranged <15–71mm, mode= 27mm).

The field log was completed by Stephen. Numerous plot repairs were made by Kate and Kenan; see photo log for details. However, the following plots still require bolts: 424(2), 425(1), 427(1), 428(1), 429(1), 432(1), 433(2), 434(1), 435(1), 439(1), 440(1), 441(2), 442(1), 444(1) (Total = 17 bolts needed).

The barnacle (*Chthamalus* spp./ *Balanus* spp.) plots had 19% (down from 40.8% measured in December 2014 and 59.8% measured in January 2014) mean barnacle cover. The majority of point contacts in the five plots were bare rock. *Endocladia* plots had 15.2% (down from 29.2% measured in December 2014) mean *Endocladia* cover. The majority of point contacts in the five plots were bare rock. The rockweed plots only had 0% mean *Hesperophycus* cover. This was lower than what was measured in December 2014 (mean=2.2%) and significantly lower than what was measured in January 2014 (mean=24.4%) and March 2014 (mean=30%). Most of the point contacts within the rockweed zone were instead bare rock. Mussel (*Mytilus californianus*) plots had 25% mean cover (nearly the same that was measured in December 2014 but nearly double the percentage of mussels measured in spring 2014). The majority of point contacts in the five plots were bare rock (mean= 51.6%). The *Tetracrita* zone had 16% (exactly the same measured in December 2014) mean *Tetracrita* cover and was dominated by bare rock (mean= 44%).

The biological condition of the site appeared much different compared to that observed during recent years. For one, the highest abundance of *Endarachne* ever observed over the past seven years was seen at the site; it was particularly abundant around plots 424–435 and 439–425. *Hesperophycus* was rare and appears to have decreased even more since last year when it had declined markedly from the year before. The few thalli present appeared tattered and unhealthy. *Lottia gigantea* abundances in plots have increased markedly compared with recent past years. *Mazzaella affinis* and *Endocladia* appeared abundant and healthy. A small percentage (approx. 25%) of articulated corallines throughout the site appeared bleached. *S. purpuratus* was abundant and appeared free of disease (no lesions seen on any of the urchins). *Balanus* was visibly scraped (removed from rock) in places. *Mytilus* and *Tetracrita* abundances appeared comparable to abundances measured in recent past years. The rock appears to have been broken loose around R2.

2/8/2016. Harris Point.

Low tide –1.2 ft at 1526 hrs. The site was revisited to complete monitoring for one of the *Lottia* plots and searches for the black abalone and sea stars. The conditions were excellent. Sky was clear, wind was light (5–10 kt) and swell was low to medium-sized (2–4' out of NW). There was 1 black

oystercatcher along with 1 California sea lion, 5 harbor seals and 1 elephant seal observed at the site upon arrival.

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