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Rocky Intertidal Community Monitoring at Channel Islands National Park

2017–2018 Annual Report

Natural Resource Report NPS/MEDN/NRR—2023/2557



ON THE COVER
Black abalone (*Haliotis cracherodii*) in the intertidal zone.
Photograph by: NPS/STEPHEN WHITAKER

Rocky Intertidal Community Monitoring at Channel Islands National Park

2017–2018 Annual Report

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Executive Summary

Channel Islands National Park includes the five northern islands and the surrounding waters out one nautical mile off the coast of southern California: San Miguel, Santa Rosa, Santa Cruz, Anacapa, Santa Barbara. 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 National Park Service (NPS) has been monitoring the rocky intertidal communities at the islands since 1982. Sites were established between 1982 and 1998. Sites were selected after considering visitation, accessibility, presence of representative organisms, wildlife disturbance, and safety. This report summarizes the 2017–2018 sampling year efforts from November 2017 to January 2018, and findings of the Channel Islands National Park (CHIS)/Mediterranean Coast Network Rocky Intertidal Community Monitoring Program.

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

Twelve target species or assemblages, as well as the tar substrate, have been monitored twice per year at 21 sites on the five park islands as part of the rocky intertidal community monitoring program. Fixed photoplots 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*), 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 in circular plots. Size distribution and relative abundance of black abalone and ochre sea stars 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 Island tidepools was collected and reported.

This was the second year that we officially reduced our sampling interval from twice per year, spring and fall, to one sampling interval in the fall. This was changed to streamline the program and allow for the implementation of additional protocols (Raimondi et al. 2018). Additionally, not all sites were monitored for all species in 2017–2018. 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 photoplots was highly variable among sites. Mussel, *Mytilus californianus*, cover remained below average at Anacapa Island and

Santa Barbara Island. Record or near record-low abundances for *M. californianus* were measured at the following sites: Anacapa Middle West, East Point on Santa Rosa Island, Harris Point on San Miguel Island, Prisoner's Harbor and Scorpion Rock on Santa Cruz Island, and Sea Lion Rookery on Santa Barbara Island. The only sites that appeared to have above average *Mytilus* cover were Cuyler Harbor and Otter Harbor on San Miguel Island, Johnson's Lee on Santa Rosa Island, Landing Cove (slightly) on Santa Barbara Island, and Willows Anchorage on Santa Cruz Island. All 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 last year and most appear to have persisted this year. Both rockweed species, *Silvetia compressa* and *Hesperophycus californicus*, continued to decrease markedly in abundance this year at most sites compared to combined averages for previous years. Fossil Reef on Santa Rosa Island 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. Barnacle (*Chthamalus* and *Balanus* spp.) cover fell below the long-term means at all islands except Anacapa whereby barnacle cover was slightly above average. *Endocladia muricata* abundance remained comparable to the grand mean 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 islands.

Black abalone (*Haliotis cracherodii*) abundances at the islands remain less than one percent of 1985 population levels. Zero abalone were found throughout the entire site at Landing Cove on Santa Barbara Island and South Frenchy's Cove on Anacapa Island. Above average abundances relative to the long-term mean generated from post-1995 data were observed at all but four sites. Juvenile black abalone were seen at all islands except Santa Barbara.

Ochre sea star (*Pisaster ochraceus*) populations crashed in 2014 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* and other species of sea star 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 about 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 0–28 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 2017–2018 were comparable or slightly above the long-term mean at all sites except Ford Point and Johnson's Lee on Santa Rosa Island. Exceptionally high densities were measured at Fossil Reef on Santa Rosa Island and Otter Harbor on San Miguel Island. The sizes of *L. gigantea* this year varied among sites and islands. The smallest *L. gigantea* were observed at

Johnson's Lee followed closely by Willows Anchorage and Fraser Cove on Santa Cruz Island and the largest were seen at Northwest-Talcott on Santa Rosa Island. Temporally, the mean sizes of *L. gigantea* in 2017–2018 decreased below the long-term mean at each island, particularly Santa Rosa.

Surfgrasses (*Phyllospadix* spp.) are typically monitored biannually at two sites each on Santa Cruz and Santa Rosa Islands. This year, all transects at each of the monitoring sites except East Point on Santa Rosa Island were sampled during the fall/winter season. At East Point, the conditions were not conducive to sampling the surfgrass transects, but qualitatively, percent cover of surfgrass appeared to be near 100% on all three transects. Relative to past years, cover of surfgrass increased above the long-term mean at the three sites that were sampled.

Overall, the abundances and diversity of shorebirds in 2017–2018 at all sites appeared similar to observations made in recent years with the exception of slightly elevated numbers of cormorants (*Phalacrocorax* spp.) observed at Crook Point on San Miguel Island, and East Point and Fossil Reef on Santa Rosa Island. Black oystercatchers (*Haematopus bachmani*) were the most ubiquitous shorebird seen at all sites. Black turnstones *(Arenaria melanocephala*) were not common relative to past years.

Pinniped abundances remained comparable in 2017–2018 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 six sites this year. As in past years, harbor seals were most abundant at Otter Harbor on San Miguel Island. Elephant seals (*Mirounga angustirostris*) were seen at three sites during the year whereby abundances ranged 1–3 individuals per location. California sea lions (*Zalophus californianus*) were common at Santa Barbara Island where 140 individuals, mostly juveniles, were observed. One to two sea lions were also seen nearby Crook Point, Cuyler Harbor, Otter Harbor, and Harris Point on San Miguel Island, and Johnson's Lee on Santa Rosa Island. Relative to past years, abundances this year were considered average at other locations.

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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.

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Glossary

C:	Centigrade
CINMS:	Channel Islands National Marine Sanctuary
MARINe:	Multi-Agency Rocky Intertidal Network
NOAA:	National Oceanographic and Atmospheric Administration
NPS:	National Park Service
SMCA:	State Marine Conservation Area
SMR:	State Marine Reserve
SSWS:	Sea Star Wasting Syndrome
TNC:	The Nature Conservancy
UCSC:	University of California Santa Cruz

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.

Channel Islands National Park (CHIS) and Channel Islands National Marine Sanctuary (CINMS) and 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 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 Channel Islands National Park. The law establishing the park (Public Law (PL) 96-199; 16 USC § 410ff) 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 key species in targeted intertidal zones using fixed photoplots and fixed transects, monitoring species composition using photoplots, and measuring size frequency and abundance of black abalone, owl limpets, and sea stars 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 was the second 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 (Raimondi et al. 2018). In this and subsequent years, monitoring will occur once during fall–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 University of California at Santa Barbara personnel and assumed by Channel Islands National Park in 1998. Sampling site locations were chosen subjectively based on accessibility, safety and the relative locations of target organisms, among other variables.

Because intertidal areas are so heterogeneous, an impractically high number of plots would be necessary to detect temporal changes in species abundance using probability based sampling (see Ambrose et al. 1992, 1995; Murray et al. 2006). A sampling design involving fixed plots was selected, therefore, 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).

Channel Islands National Park 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 (Mexico) 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 2017–2018 sampling season (fall–winter) efforts (from November 2017 to January 2018) and documents activities and observations of the Channel Islands National Park Rocky Intertidal Community Monitoring Program. Published reports from past years of monitoring are available on the Mediterranean Coast Network website: https://www.nps.gov/im/medn/rocky-intertidal-habitat.htm. Additional black abalone monitoring results have been presented in Haaker et al. (1992), Davis et al. (1992), Richards and Davis (1993), and Richards and Whitaker (2012)

Methods

Study Area

The California Channel Islands comprise eight islands in the Southern California Bight; five of the islands are located within Channel Islands National Park. 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.

Field Data Collection

The Channel Islands National Park 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 and 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 was usually conducted twice each year, once in spring and fall, until 2015 when sampling frequency was reduced to once per year. In fall 2017 and winter 2018, monitoring occurred at 17 of the 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), and Engle (2008). See Appendix A for additional notes about the 2017–2018 program.

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.

Data are maintained in Microsoft Access databases by the NPS Mediterranean Coast Network Inventory and Monitoring Program and MARINe. Annual reports are available at https://www.nps.gov/im/medn/reports-publications.htm

The percent coverage of 12 target species or assemblages, as well as the substrate, tar, is monitored in fixed photoplots (Table 1). The chosen target species and assemblages commonly occur throughout the Southern California Bight, 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*), 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 taxa. (Taxa are defined as species or groups of similar species that may not be easily separated in the field. Target taxa are those identified by MARINe as species to be searched for and counted by all groups (Engle 2008)). 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 target 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. Target species, higher taxa, and substrata scored in photoplots, point intercept transects, circular/irregular plots, timed searches and mobile invertebrate counts at all Channel Islands National Park sites.[1]

Category	Species or Substrate	Photoplots [2]	Point Intercept Transects [2, 3]	Circular/ Irregular Plots [2]	Timed Searches [2]	Mobile Invertebrate Counts [2]
Green Algae	*Cladophora columbiana*	X	–	–	–	–
	Ulva/Enteromorpha	X	–	–	–	–
	Other Green Algae (any greens not listed above)	X	X	–	–	–
Brown Algae	*Egregia menziesii* (Boa Kelp)	X	X	–	–	–
	Eisenia arborea		X	–	–	–
	Endarachne/Petalonia	X	–	–	–	–
	Halidrys dioica/Cystoseira spp.	–	X	–	–	–
	Hesperophycus californicus *(= H. harveyanus)* [4]	X	–	–	–	–
	Sargassum muticum	–	X	–	–	–
	Scytosiphon spp.	X	–	–	–	–
	Silvetia compressa (= *Pelvetia fastigiata*) (Rockweed) [4]	X	–	–	–	–
	Other Brown Algae (any browns not listed above)	X	X	–	–	–
	Ephemeral Browns	X	–	–	–	–
Red Algae	***Endocladia muricata*** (Turfweed) [4]	X	–	–	–	–
	Chondracanthus canaliculatus (= *Gigartina canaliculata*)	X	–	–	–	–
	Chondracanthus spinosus	X	–	–	–	–
	Gelidium coulteri/ Pterocladiella capillacea	X	–	–	–	–
	Mastocarpus papillatus (blade)	X	–	–	–	–
	Mazzaella affinis (= *Rhodoglossum affine*)	X	–	–	–	–
	Mazzaella spp. (= *Iridaea* spp.)	X	–	–	–	–

[1] Note that motile invertebrate counts were dropped from the standard protocol in 2011.

[2] An "X" indicates that the species was observed, and an endash "–" indicates that it was not observed.

[3] Counts not conducted at all sites.

[4] Target species and the substrate, tar; also shown in bold.

Table 1 (continued). Target species, higher taxa, and substrata scored in photoplots, point intercept transects, circular/irregular plots, timed searches and mobile invertebrate counts at all Channel Islands National Park sites.[1]

Category	Species or Substrate	Photoplots [2]	Point Intercept Transects [2, 3]	Circular/ Irregular Plots [2]	Timed Searches [2]	Mobile Invertebrate Counts [2]
Red Algae (continued)	*Porphyra* spp.	X	–	–	–	–
	Prionitis spp.	X	–	–	–	–
	Articulated Corallines (Erect Corallines)	X	X	–	–	–
	Crustose Corallines (Encrusting Corallines)	X	X	–	–	–
	Other Red Algae (any reds not listed above)	X	X	–	–	–
Algae/Plants	***Phyllospadix scouleri/torreyi*** (Surfgrass) [4]	X	X	–	–	–
	Non-Coralline Crusts (reds and browns)	X	X	–	–	–
	Other Algae/Plants	–	X	–	–	–
Anemones	*Anthopleura elegantissima/sola* (Green Anemone)	X	X	–	–	–
Polychaete Worms	*Phragmatopoma californica*	X	X	–	–	–
Molluscs	*Acanthina* spp.	–	–	–	–	X
	Chitons	X	–	–	–	X
	Fissurella volcano	–	–	–	–	X
	Haliotis cracherodii (Black Abalone) [4]	X	–	X	X	–
	Lepidochitona hartwegii	–	–	–	–	X
	Littorina spp.	–	–	–	–	X
	Lottia gigantea (Owl Limpet) [4]	–	–	X[3]	–	X
	Mopalia spp.	–	–	–	–	X
	Mytilus californianus (California Mussel) [4]	X	X	–	–	–

[1] Note that motile invertebrate counts were dropped from the standard protocol in 2011.

[2] An "X" indicates that the species was observed, and an endash "–" indicates that it was not observed.

[3] Counts not conducted at all sites.

[4] Target species and the substrate, tar; also shown in bold.

Table 1 (continued). Target species, higher taxa, and substrata scored in photoplots, point intercept transects, circular/irregular plots, timed searches and mobile invertebrate counts at all Channel Islands National Park sites.[1]

Category	Species or Substrate	Photoplots [2]	Point Intercept Transects [2, 3]	Circular/ Irregular Plots [2]	Timed Searches [2]	Mobile Invertebrate Counts [2]
Molluscs (continued)	*Nucella emarginata*	–	–	–	–	X
	Nuttallina spp.	–	–	–	–	X
	Ocenebra circumtexta	–	–	–	–	X
	Chlorostoma funebralis (=Tegula funebralis)	–	–	–	–	X
	Chlorostoma gallina (=Tegula gallina)	–	–	–	–	X
	Chlorostoma spp. (=*Tegula* spp.)	X	–	–	–	–
	Limpets	X	–	–	–	–
	Large Limpets >15 mm (excluding *L. gigantea*)	–	–	–	–	X
	Medium Limpets 5–15 mm	–	–	–	–	X
	Small Limpets <5 mm	–	–	–	–	X
	Littorina spp.	X	–	–	–	X
	Septifer/Brachydontes	X	–	–	–	–
Barnacles	***Chthamalus dalli/fissus & Balanus glandula*** (Acorn Barnacle) [4]	X	–	–	–	–
	Tetraclita rubescens (Thatched Barnacle) [4]	X	–	–	–	–
	Pollicipes polymerus (Goose Barnacle) [4]	X	–	–	–	
Echinoderms	***Pisaster ochraceus*** (Ochre Star) [4]	X	X	–	X	X
	Pisaster giganteus	–	–	–	X	X
	Patiria miniata	–	–	–	X	X
	Strongylocentrotus purpuratus	–	–	–	–	X

[1] Note that motile invertebrate counts were dropped from the standard protocol in 2011.

[2] An "X" indicates that the species was observed, and an endash "–" indicates that it was not observed.

[3] Counts not conducted at all sites.

[4] Target species and the substrate, tar; also shown in bold.

Table 1 (continued). Target species, higher taxa, and substrata scored in photoplots, point intercept transects, circular/irregular plots, timed searches and mobile invertebrate counts at all Channel Islands National Park sites.[1]

Category	Species or Substrate	Photoplots [2]	Point Intercept Transects [2, 3]	Circular/ Irregular Plots [2]	Timed Searches [2]	Mobile Invertebrate Counts [2]
Crustaceans	*Pachygrapsus crassipes*	–	–	–	–	X
	Pagurus spp.	–	–	–	–	X
Invertebrates	Other Invertebrates (Other Animals) (any inverts not listed above)	X	X	–	–	–
Substrates	Rock (Bare Rock)	X	X	–	–	–
	Sand	X	X	–	–	–
	Tar [4]	X	X	–	–	–
	Unidentified (cannot tell if plant, invert or substratum)	X	X	–	–	–

[1] Note that motile invertebrate counts were dropped from the standard protocol in 2011.

[2] An "X" indicates that the species was observed, and an endash "–" indicates that it was not observed.

[3] Counts not conducted at all sites.

[4] Target species and the substrate, tar; also shown in bold.

The percent cover of target organisms is determined either in the field by laying a grid (50 x 75 cm) of 100 evenly-spaced points (10 x 10 cm) 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 is created in Adobe Photoshop and overlaid on the image to provide complete coverage of the plot. Under both scoring protocols, layered organisms are not counted separately. Therefore, the total cover of the top-most layer (with few exceptions – see Engle 2008) is summed to 100%. Data are recorded onto pre-printed data sheets, transcribed into the computer database and 100% reviewed for errors. In 2017–2018, all photoplots were photographed with a digital camera (Olympus Tough TG-5).

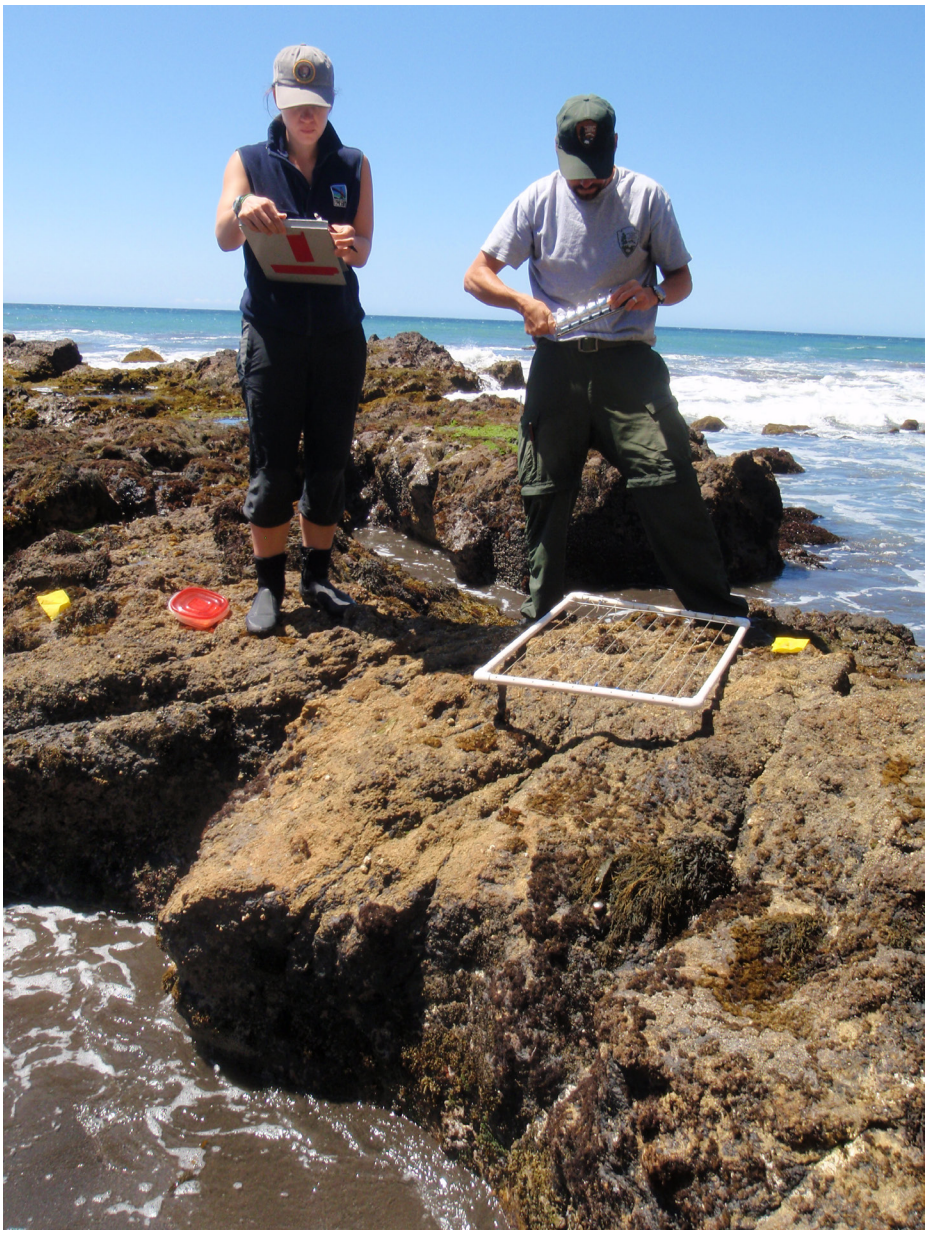


Figure 2. Stephen Whitaker (right) scoring photoplots at South Frenchy's Cove, Anacapa Island, with Kari Eckdahl (left) recording data.

Relative abundance and size structure data are 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, black abalone were counted and measured in fixed-irregular plots (five 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. The nearest neighbor distance is recorded using five spatially descriptive categories (i.e., touching, < 10 cm, 10–100 cm, 1–5 m, >5 m). Aggregation sizes, or the number of abalones 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.

Giant owl limpet (*Lottia gigantea*) abundance and size structure are assessed within fixed, circular plots. For example, we record these measurements in three to five plots per site at 12 sites. Within each plot, an area of 3.14 m^2 delineated by circling a fixed bolt with a pre-measured 1 m long line is used to measure and count all owl limpets >15 mm for maximum shell length. Owl limpets <15 mm can be difficult to identify to species by less-experienced observers.

Ochre sea stars (*Pisaster ochraceus*) are counted along with other species of sea stars (*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 from the center of the disk to tip of longest ray for size distribution.

Mussels (*Mytilus californianus*) 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.

Surfgrass (*Phyllospadix* spp.) cover is measured on fixed point-intercept transects that are 10 m long for 100 points. There are three cover transects per site at the following four sites: Fraser Cove,

Trailer, East Point, Northwest-Talcott. Special circumstances and general conditions that may have affected sampling are described on daily logs and reported in the trip reports. Surfgrass transect scoring methods follow the MARINe protocol, adding *Phyllospadix* spp. understory for surfgrass covered by algae.

Shorebird and pinniped observations 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. Island Packers Company and Truth Aquatics concessionaires reported numbers of visitors to the park. No independent counts of visitors were made to verify reported figures.

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), 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 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 of 2017–2018. Advanced statistical analyses on the data have not been performed. Any trends presented are simple summary statistics and should be viewed as preliminary. Using statistical software program, JMP (version 12, SAS Institute Inc., Cary, NC, 2020), basic percent cover trends were averaged by zone, and graphed for target species in photoplots. Target species included: acorn barnacles, thatched barnacles, mussels, rockweeds, goose barnacles, red algal turf, and tar. To minimize variability, photoplot target types were not pooled from different zones for analysis. For example, the percent cover of mussels was only calculated from mussel zone plots. Descriptive statistics of density and average size averaged by site were determined for all circular owl-limpet plots. The trend through time was graphed by sampling event. Abundances are provided for comparative purposes only. The 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 in the figures below for each target species 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.

As in most years, the mean percent cover of nearly all targeted species in 2017–2018 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 2017–2018 was higher than the long-term mean.

Mytilus californianus

Mussels, *Mytilus californianus,* mean percent cover in 2017–2018 remained comparable to the mean of previous years at the majority of sites (Figures 3–5). However, record or near record-low abundances for *M. californianus* were measured at Anacapa Middle West, East Point, Harris Point, Prisoner's Harbor, Scorpion Rock and Sea Lion Rookery. In the cases of Anacapa Middle West, Fossil Reef and Prisoner's Harbor and Scorpion Rock, there was approximately zero percent mussel cover. Above-average cover of mussels was measured at Cuyler Harbor, Johnson's Lee, Landing Cove (slightly), Otter Harbor and Willows Anchorage; other sites had values at or near the long-term average. Note that the graph for Johnson's Lee represents the addition of four new mussel plots that were added in 2009. Without the additional plots, the five original *M. californianus* plots averaged approximately 25% mussel cover in 2017–2018. Qualitatively, *Mytilus* cover continued to increase at most locations as newly-recruited mussels were common last year and most appear to have persisted this year.

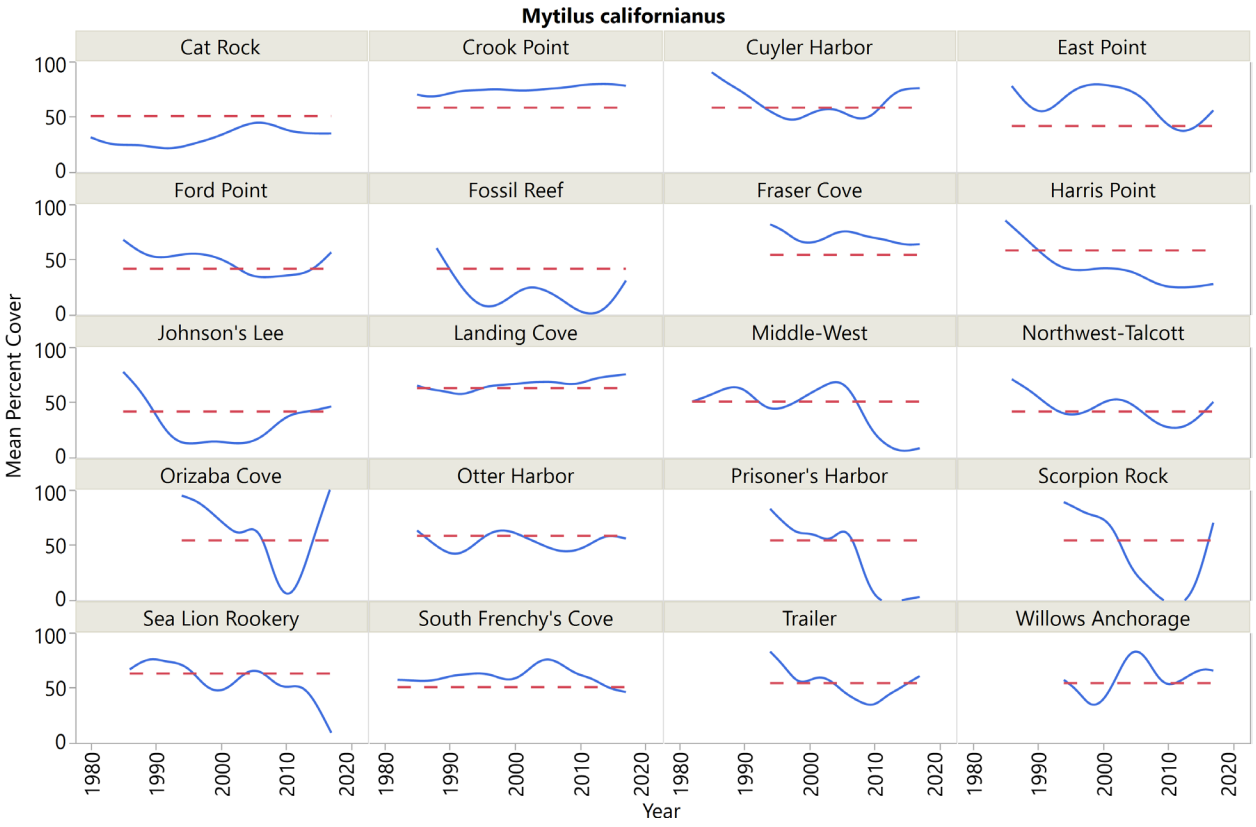


Figure 3. Departure from the long-term mean of percent cover for mussel (*Mytilus californianus*) at each site in Channel Islands National Park. Blue wavy lines represent mean cover of *M. californianus* within the representative zone pooled across plots at each site. Red dashed lines represent long-term mean. Note that four new *Mytilus* plots were installed in 2008 at Johnson's Lee; all nine *Mytilus* plots are displayed here.

Overall, mussel cover has decreased below the long-term mean at Anacapa and Santa Barbara Islands during the past five years (Figure 4). *Mytilus californianus* percentages were approximately average at San Miguel and Santa Cruz Islands in 2017–2018. 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 5).

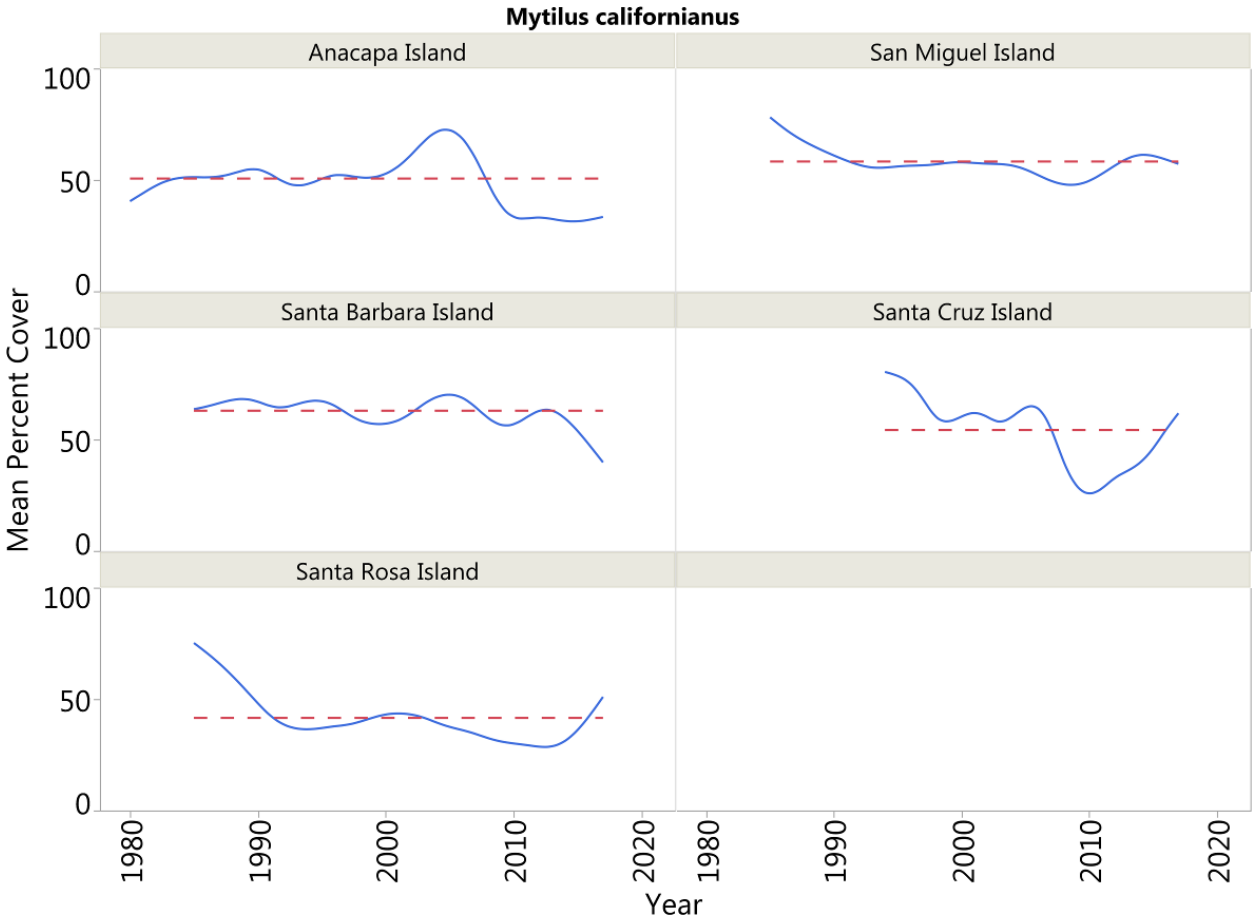


Figure 4. Departure from the long-term mean of percent cover for mussels (*Mytilus californianus*) at each island in Channel Islands National Park. Blue wavy lines represent mean cover of *M. californianus* within the representative zone pooled across plots and sites at each island. Red dashed lines 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.

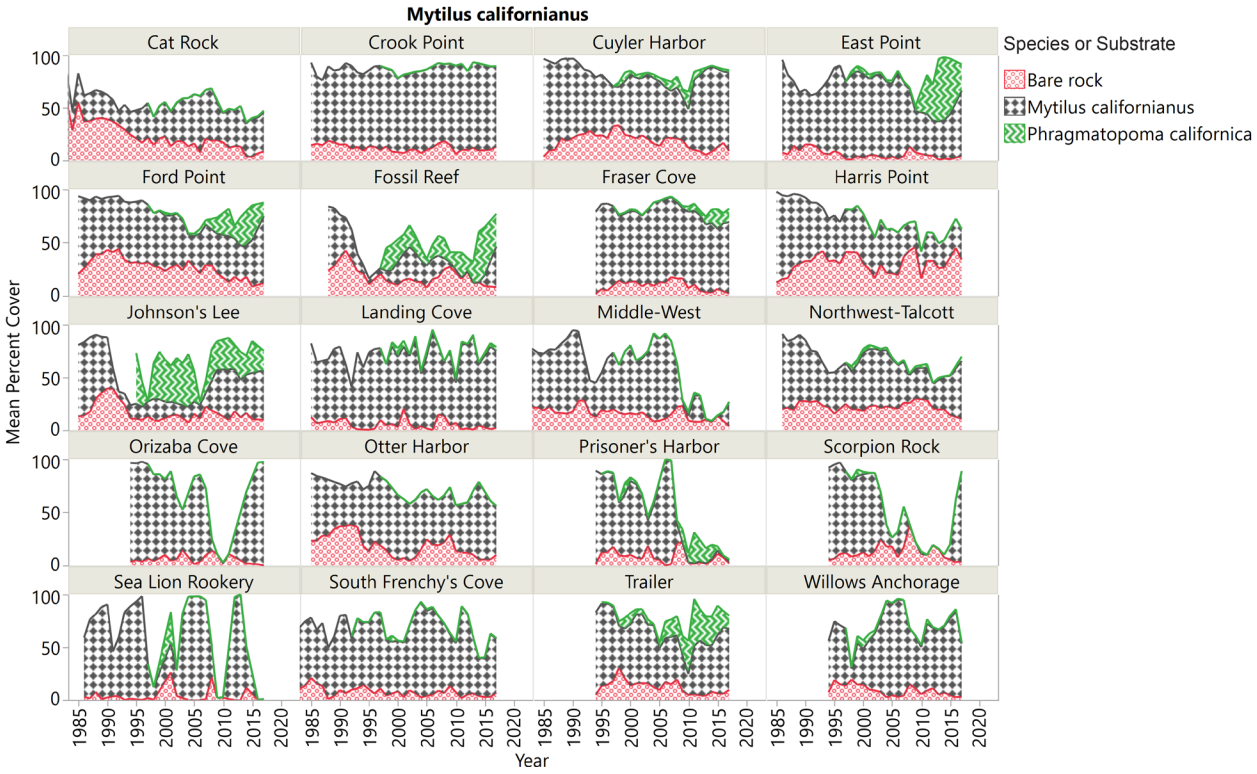


Figure 5. Percent cover of mussels (*Mytilus californianus*) along with polychaete worm (*Phragmatopoma californica)* and bare rock in fixed plots within the *Mytilus* zone at each site in Channel Islands National Park. Colored areas represent the mean percent cover for representative and dominant taxa/substrata 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.

Silvetia compressa

Rockweed (*Silvetia compressa*) abundances were very low in 2017–2018 compared to previous years (prior to 2000 in most cases). *Silvetia compressa* cover averaged across representative plots at each site was well below long-term averages and measured <20% absolute cover at 11 of the 17 sites, many of which had the lowest recorded abundances and/or near 0% cover of rockweed (Figure 6). 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 7). At most sites, plots have been dominated primarily by *S. compressa* and other less common species such as *Chthamalus/Balanus* and *Endocladia* (Figure 8).

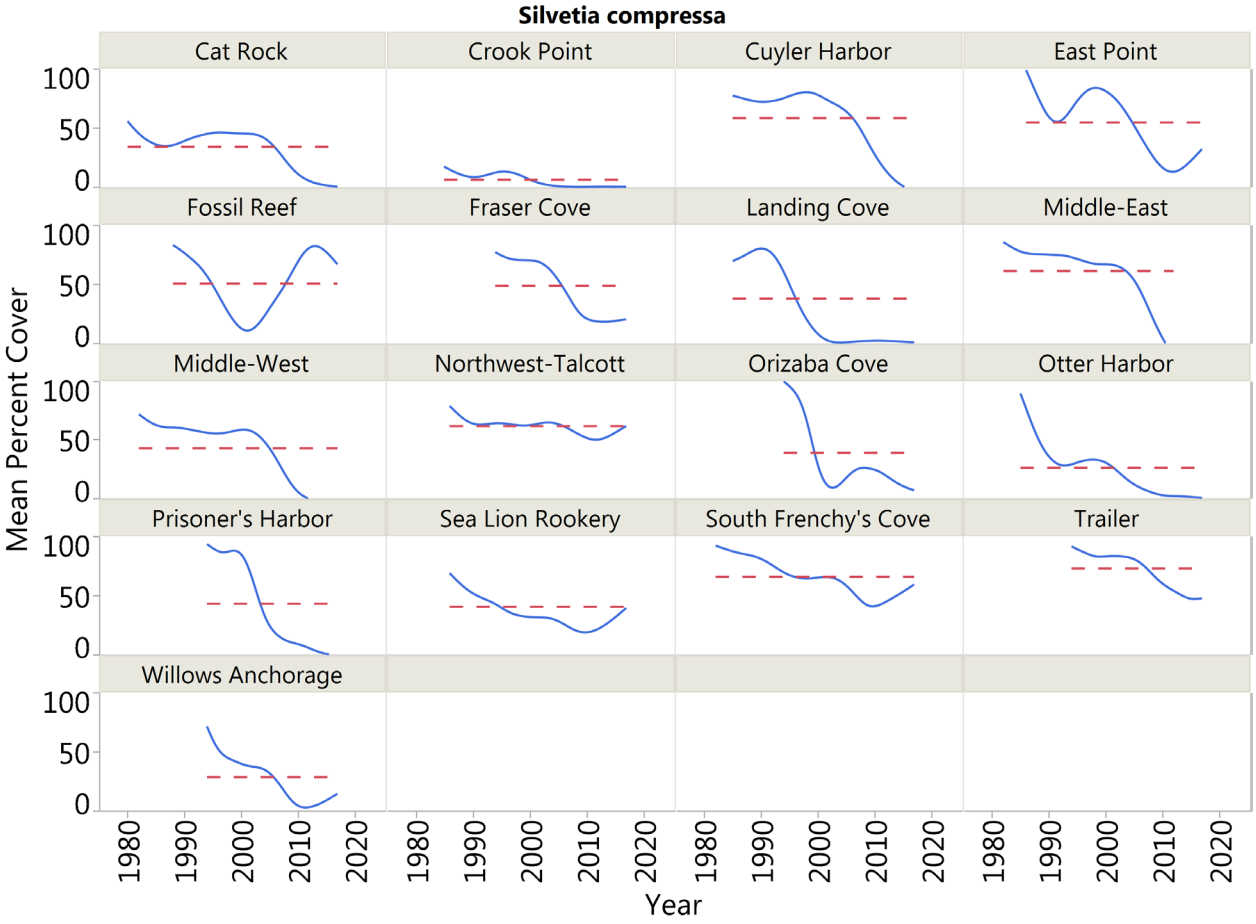


Figure 6. Departure from the long-term mean of percent cover for rockweed (*Silvetia compressa*) at each site in Channel Islands National Park. Blue wavy lines represent mean cover of *S. compressa* within the representative zone pooled across plots at each island. Red dashed lines represent long-term mean. Note that Middle-East has not been sampled since 2013.

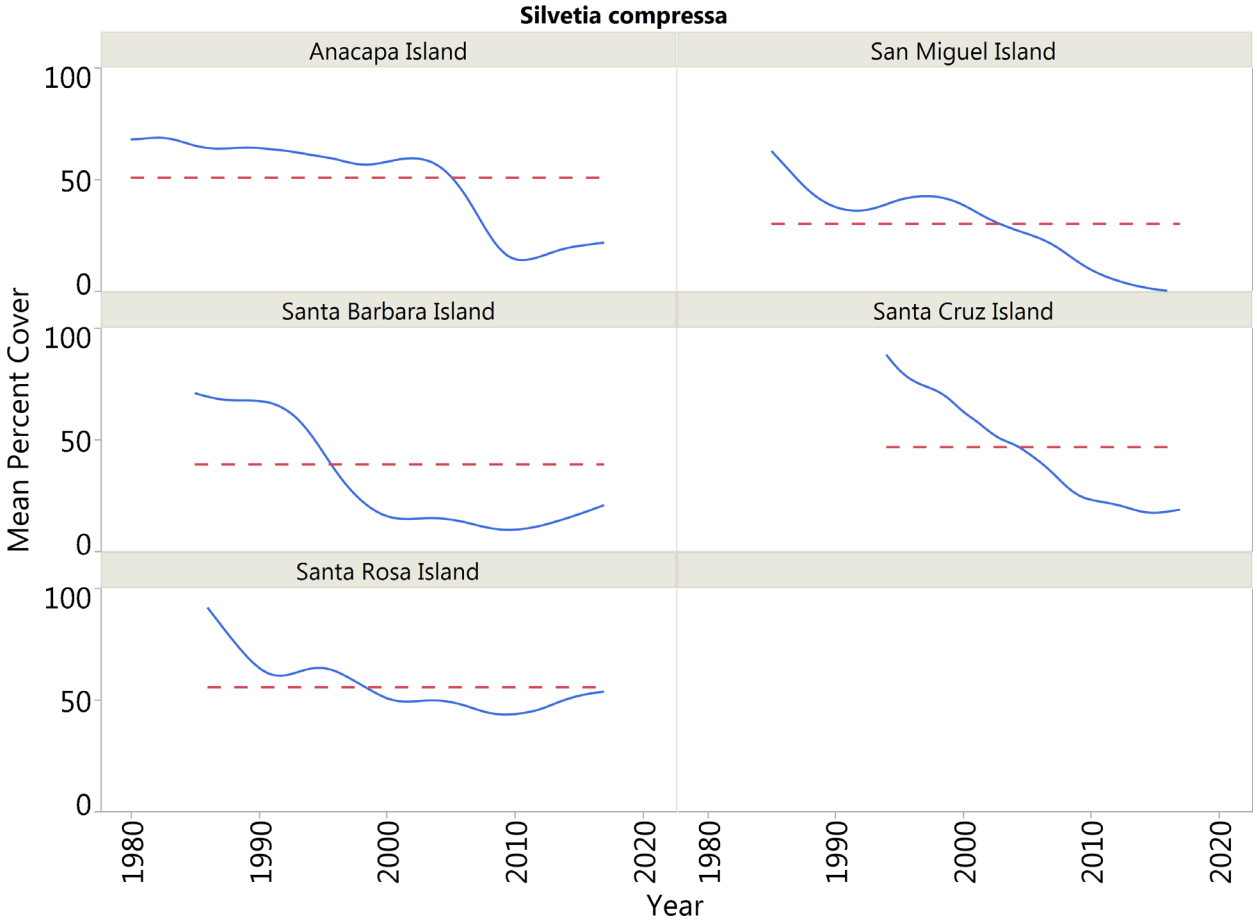


Figure 7. Departure from the long-term mean of percent cover for rockweed (*Silvetia compressa*), by island, in Channel Islands National Park. Blue wavy lines represent mean cover of *S. compressa* within the representative zone pooled across plots and sites at each island. Red dashed lines represent long-term mean.

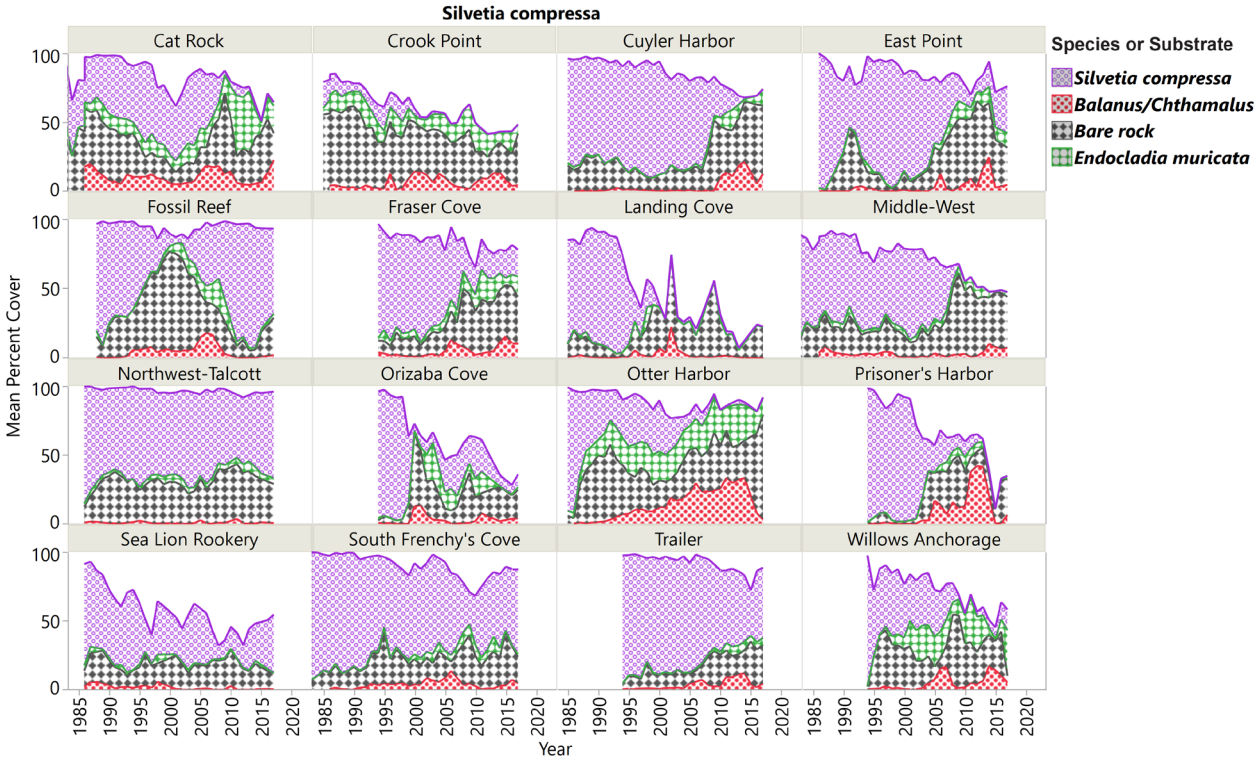


Figure 8. Percent cover of rockweed (*Silvetia compressa*), along with other dominant taxa and bare rock in fixed plots within the *Silvetia* zone at each site in Channel Islands National Park. Colored areas represent the mean percent cover for representative and dominant taxa/substrata from replicated (usually five) *Silvetia* plots.

Hesperophycus and *Pelvetiopsis*

The other rockweeds (*Hesperophycus californicus*) and (*Pelvetiopsis hybrida*) that occur in the region also declined or remained low in abundance at all sites (Figure 9). Note that *P. hybrida* was only recently identified as a separate species from *H. californicus*. Morphologically, *P. hybrida* is similar to *H. californicus* and therefore it has historically been identified as *H. californicus*. Beginning in 2016, we identified the two species separately, but we lumped the two species for purposes of reporting.

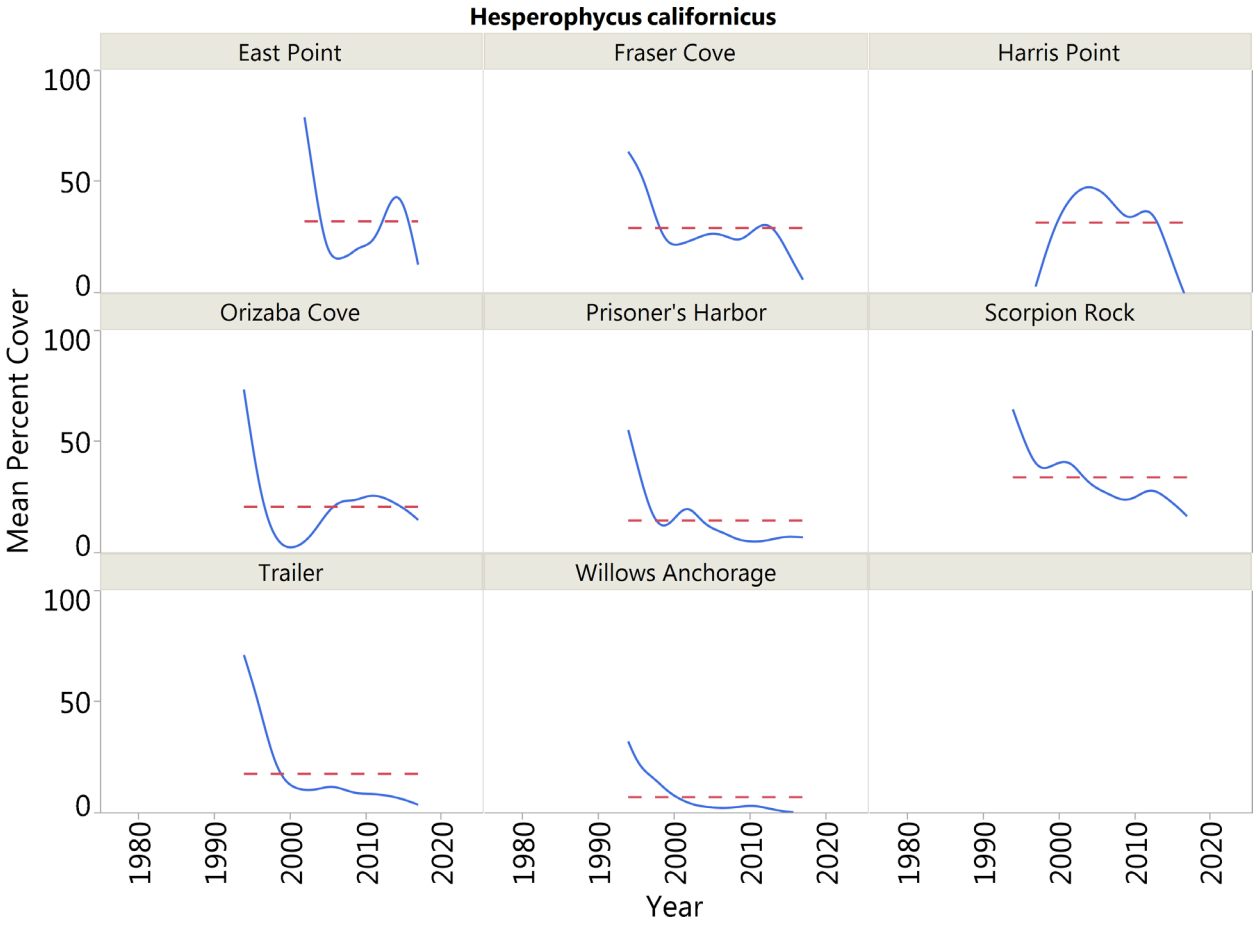


Figure 9. Departure from the long-term mean of percent cover for rockweed (*Hesperophycus californicus*) at each site in Channel Islands National Park. Blue wavy lines represent mean cover of *H. californicus* within the representative zone pooled across plots at each site. Red dashed lines represent long-term mean.

Hesperophycus californicus cover reached near record-low abundance at Fraser Cove, Harris Point, Prisoner's Harbor, Scorpion Rock, Trailer and Willows Anchorage. Orizaba Cove had average *H. californicus* cover in 2017–2018. Pooled across sites at each island, *H. californicus* cover measured below the long-term mean at all three islands where the species complex is monitored (Figure 10). In fact, near record-low rockweed cover was measured this year at all three of the islands. Over time, plots at most sites have been composed largely of *H. californicus, Silvetia compressa, Endocladia muricata,* and *Chthamalus/Balanus* (Figure 11).

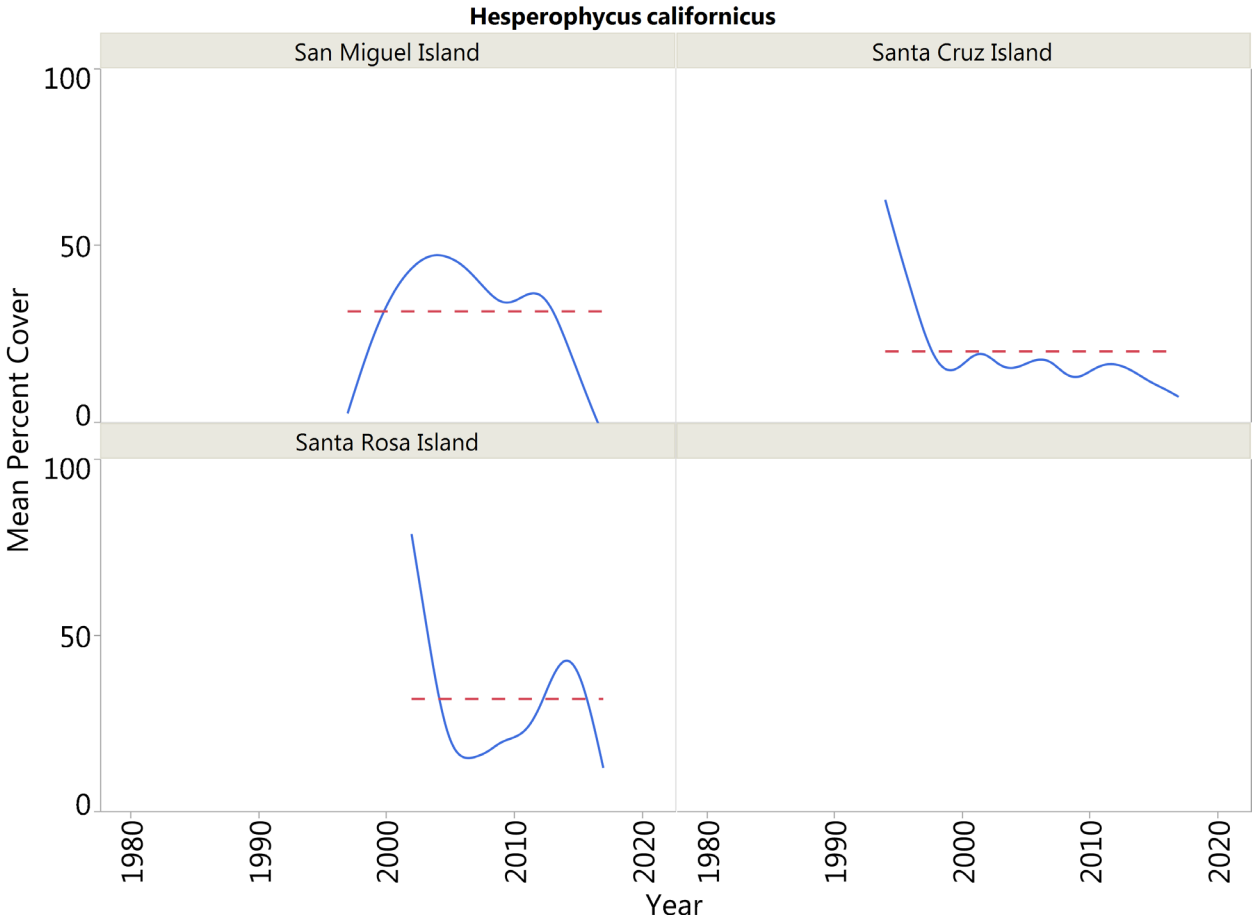


Figure 10. Departure from the long-term mean of percent cover for rockweed (*Hesperophycus californicus*), by island, in Channel Islands National Park. Blue wavy lines represent mean cover of *H. californicus* within the representative zone pooled across plots and sites at each island. Red dashed lines represent long-term mean.

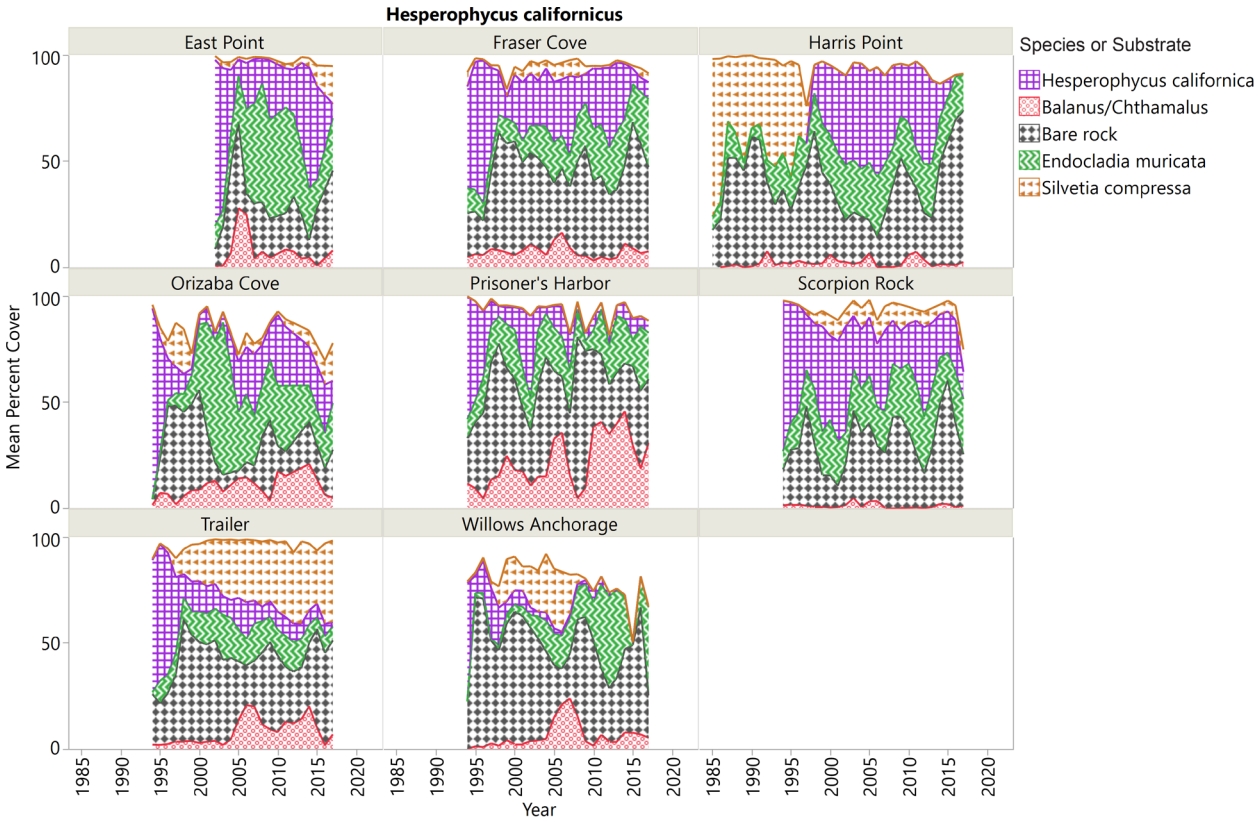


Figure 11. Percent cover of rockweed (*Hesperophycus californicus*) along with other dominant taxa and bare rock in fixed plots within the *Hesperophycus* zone at each site in Channel Islands National Park. Colored areas represent the mean percent cover for representative and dominant taxa/substrata from five *Hesperophycus* plots.

Endocladia muricata

Turfweed (*Endocladia muricata*) cover in 2017–2018 remained roughly equivalent to mean abundances measured in past years at several sites (7 of 17 sites that were sampled in 2017/18) (Figure 12). Record-low *E. muricata* abundances relative to long-term means were measured at numerous other locations, but in most cases, abundances were only slightly below the long-term mean. Exceptions were Anacapa Middle West, Cat Rock, Otter Harbor, Scorpion Rock and South Frenchy's Cove which either had extremely low abundances overall or decreasing trends in cover markedly below the long-term mean. 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 Island. Cover of the alga was slightly below the long-term means at Santa Rosa and more so at Anacapa, San Miguel and Santa Cruz Islands (Figure 13). Other dominant species in *E. muricata* plots have been *Silvetia compressa* and *Chthamalus/Balanus* (Figure 14).

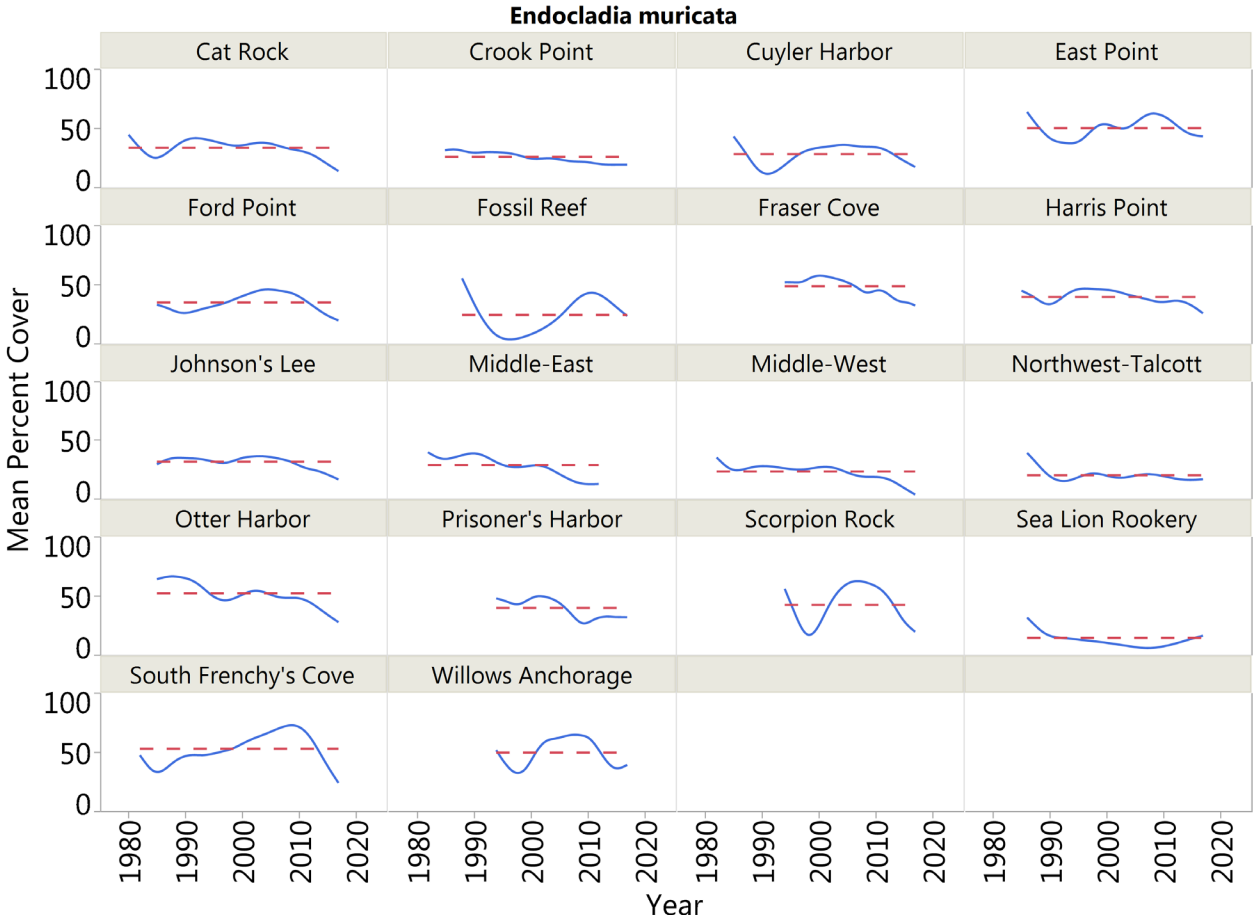


Figure 12. Departure from the long-term mean of percent cover for turfweed (*Endocladia muricata*) at each site in Channel Islands National Park. Blue wavy lines represent mean cover of *E. muricata* within the representative zone pooled across plots at each site. Red dashed lines represent long-term mean. Note that Middle-East has not been sampled since 2013.

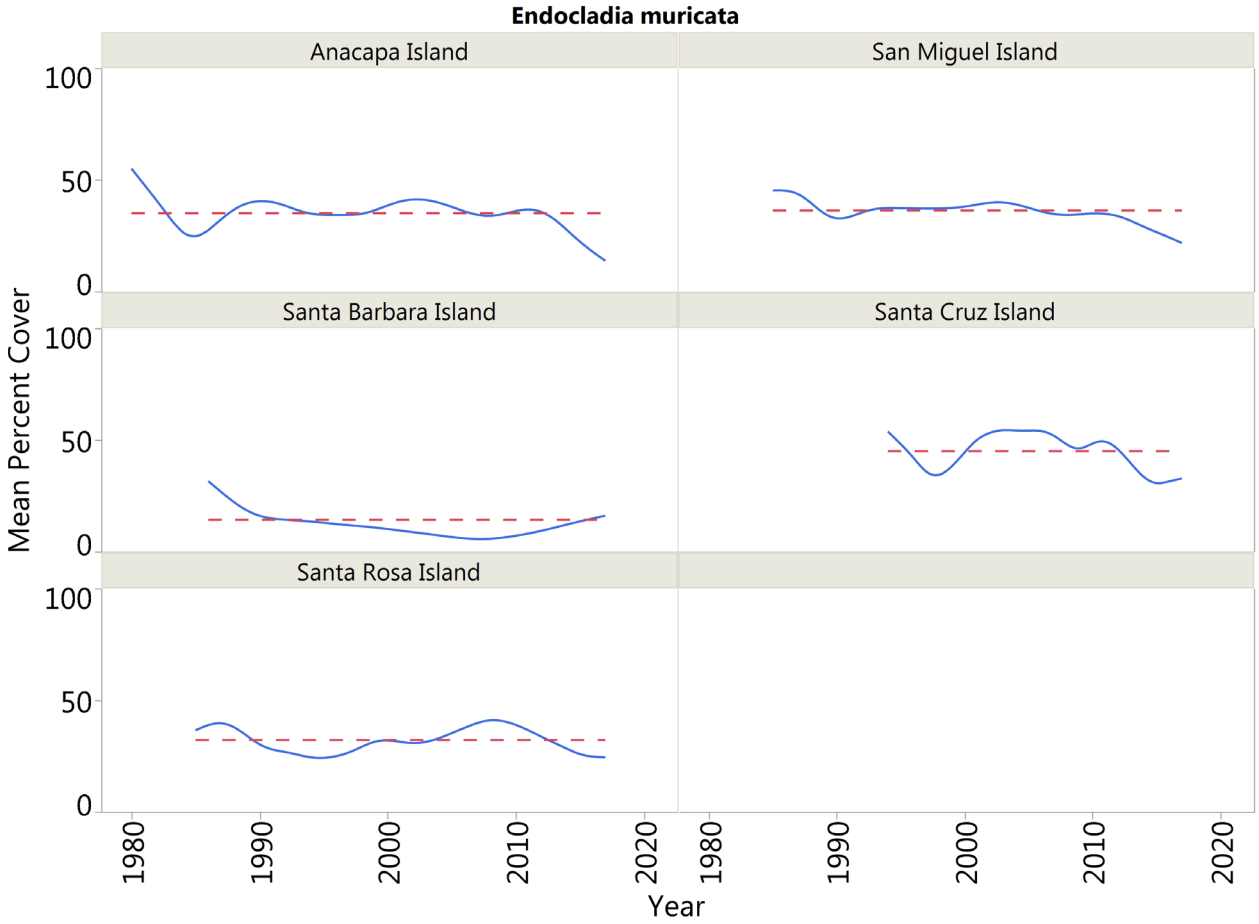


Figure 13. Departure from the long-term mean of percent cover for turfweed (*Endocladia muricata*), by island, in Channel Islands National Park. Blue wavy lines represent mean cover of *E. muricata* within the representative zone pooled across plots and sites at each island. Red dashed lines represent long-term mean.

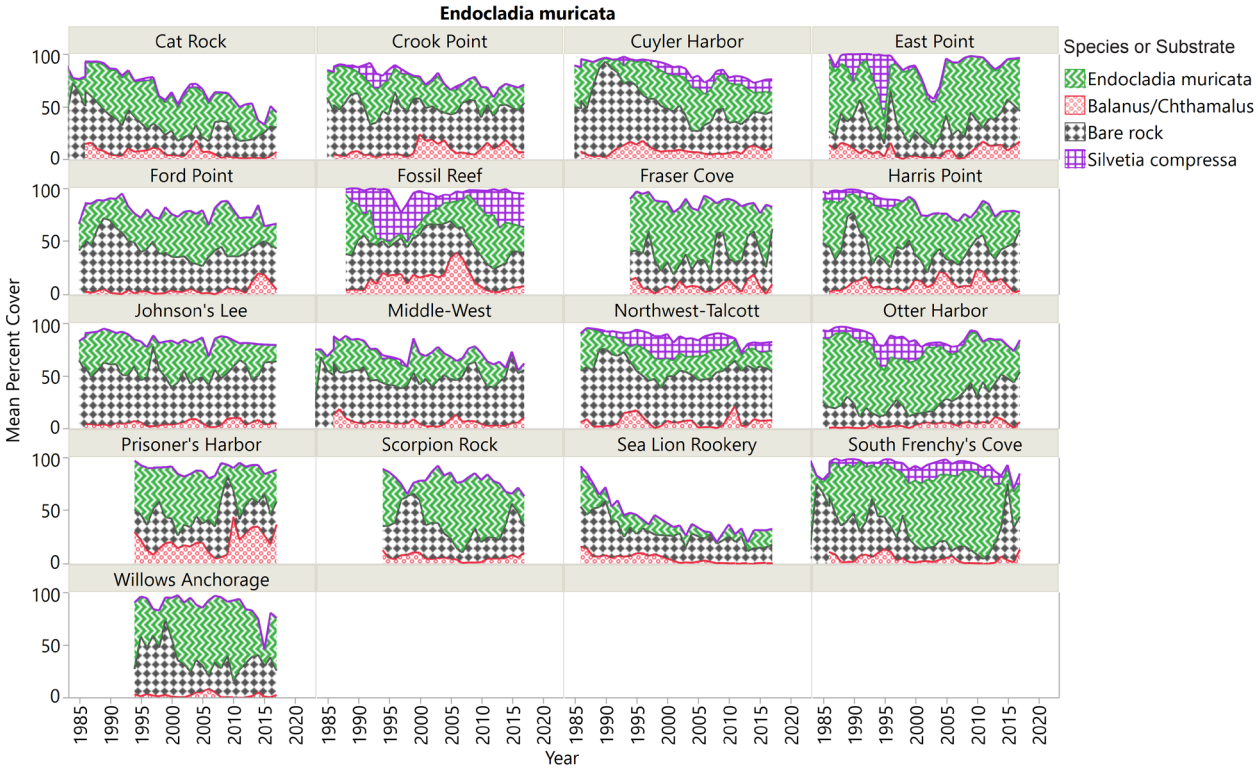


Figure 14. Percent cover of turfweed (*Endocladia muricata*) along with other dominant taxa and bare rock in fixed plots within the *Endocladia* zone at each site in Channel Islands National Park. Colored areas represent the mean percent cover for representative and dominant taxa/substrata from replicated (usually five) *Endocladia* plots.

Chthamalus/Balanus

Barnacle (*Chthamalus/Balanus* spp.) abundances in 2017–2018 appeared below average at 7 of the 19 sites sampled, with near record low abundances documented at Ford Point, Fraser Cove, Harris Point, Landing Cove, Northwest-Talcott, Orizaba Cove, Otter Harbor, Prisoner's Harbor and Sea Lion Rookery (Figure 15). Relative to the long-term mean, four sites had approximately average cover of *Chthamalus/Balanus* spp. while only two locations, Cat Rock and Scorpion Rock, had slightly above average barnacle cover. *Chthamalus/Balanus* spp. abundances pooled across sites in 2017–2018 fell below the long-term means at all islands except Anacapa, where barnacle cover was slightly above average (Figure 16). Other dominant species in *Chthamalus/Balanus* spp. plots have primarily been *Silvetia compressa* and *Endocladia muricata* (Figure 17).

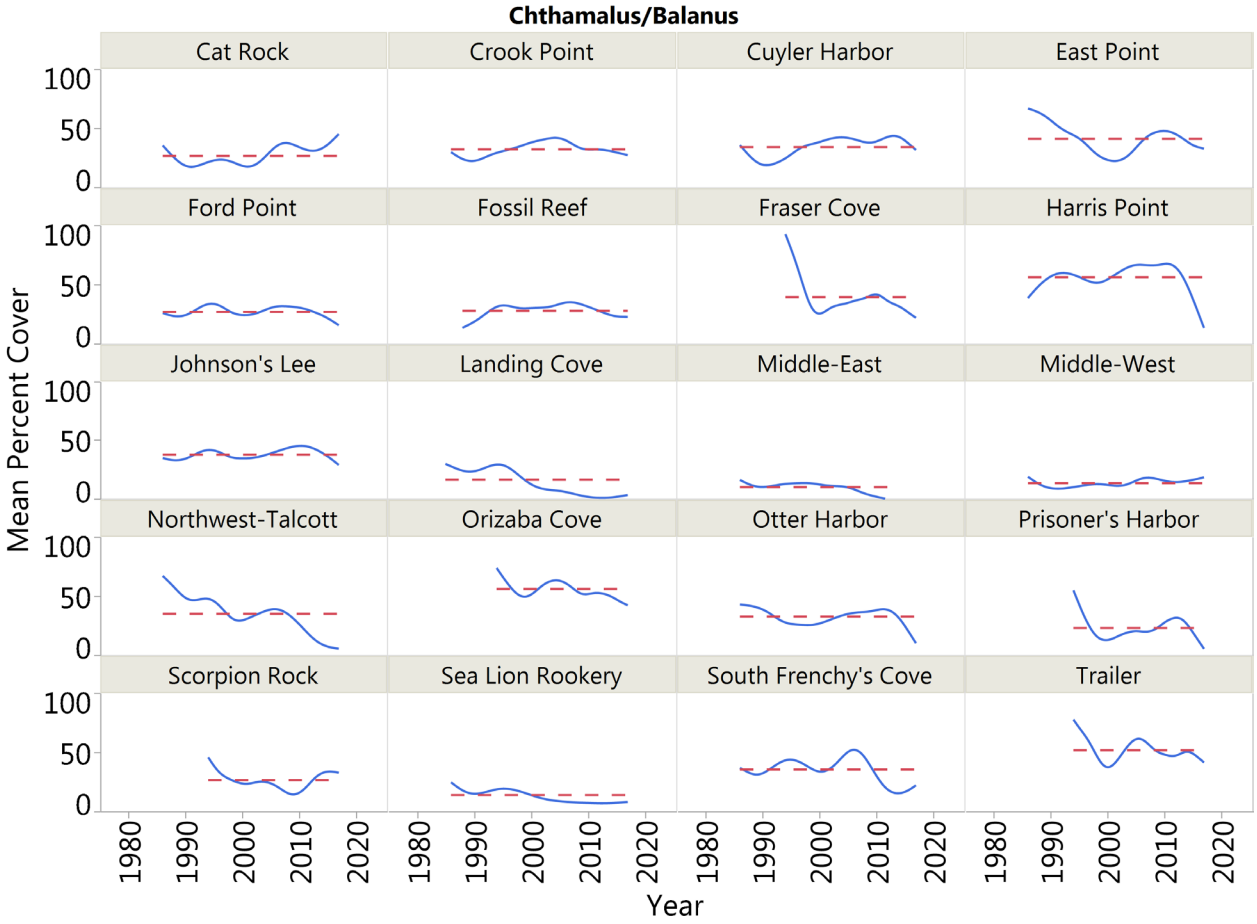


Figure 15. Departure from the long-term mean of percent cover for barnacles (*Chthamalus/Balanus* spp.) at each site in Channel Islands National Park. Blue wavy lines represent mean cover of *Chthamalus/Balanus* within the representative zone pooled across plots at each site. Red dashed lines represent long-term mean. Note that Middle-East has not been sampled since 2013.

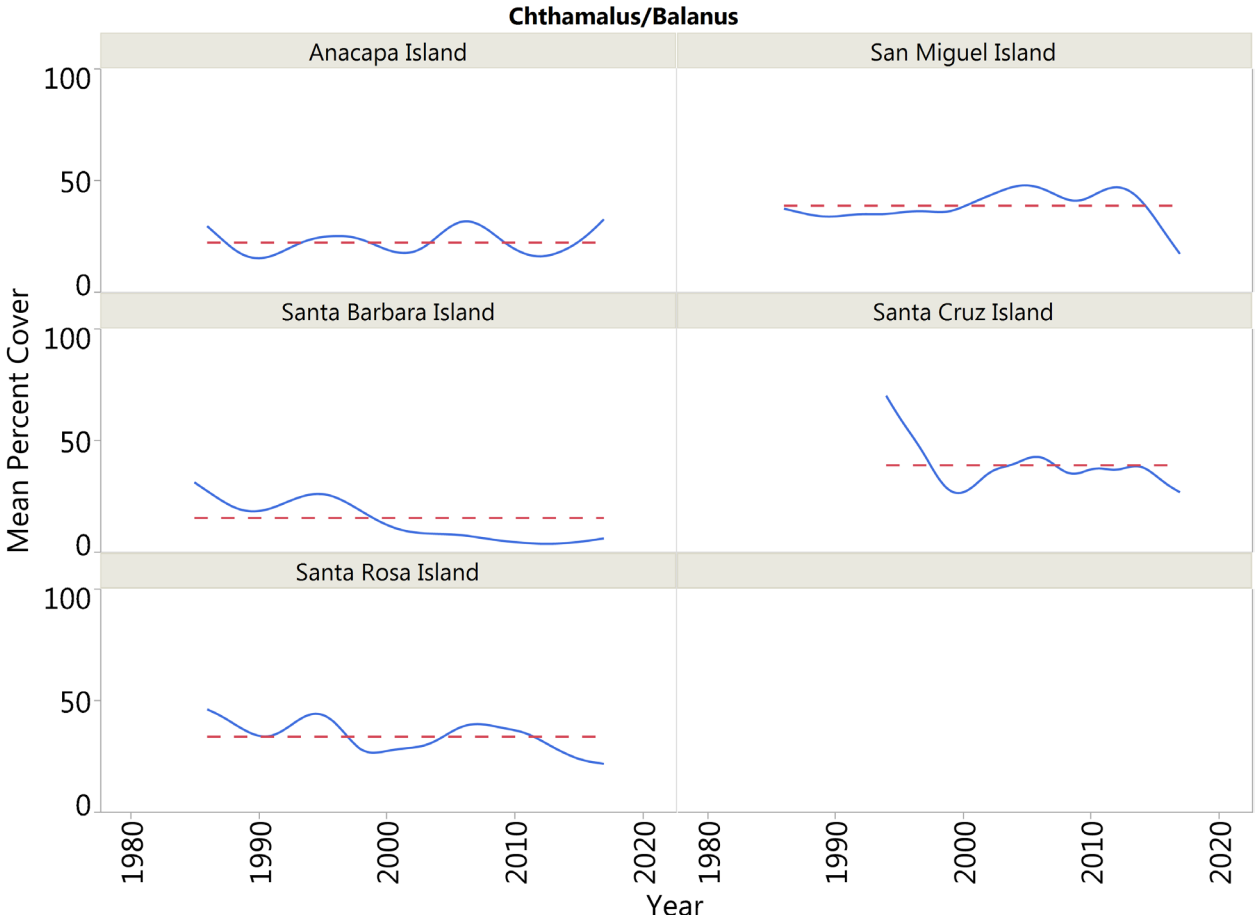


Figure 16. Departure from the long-term mean of percent cover for barnacles (*Chthamalus/Balanus* spp.), by island, in Channel Islands National Park. Blue wavy lines represent mean cover of *Chthamalus/Balanus* within the representative zone pooled across plots and sites at each island. Red dashed lines represent long-term mean.

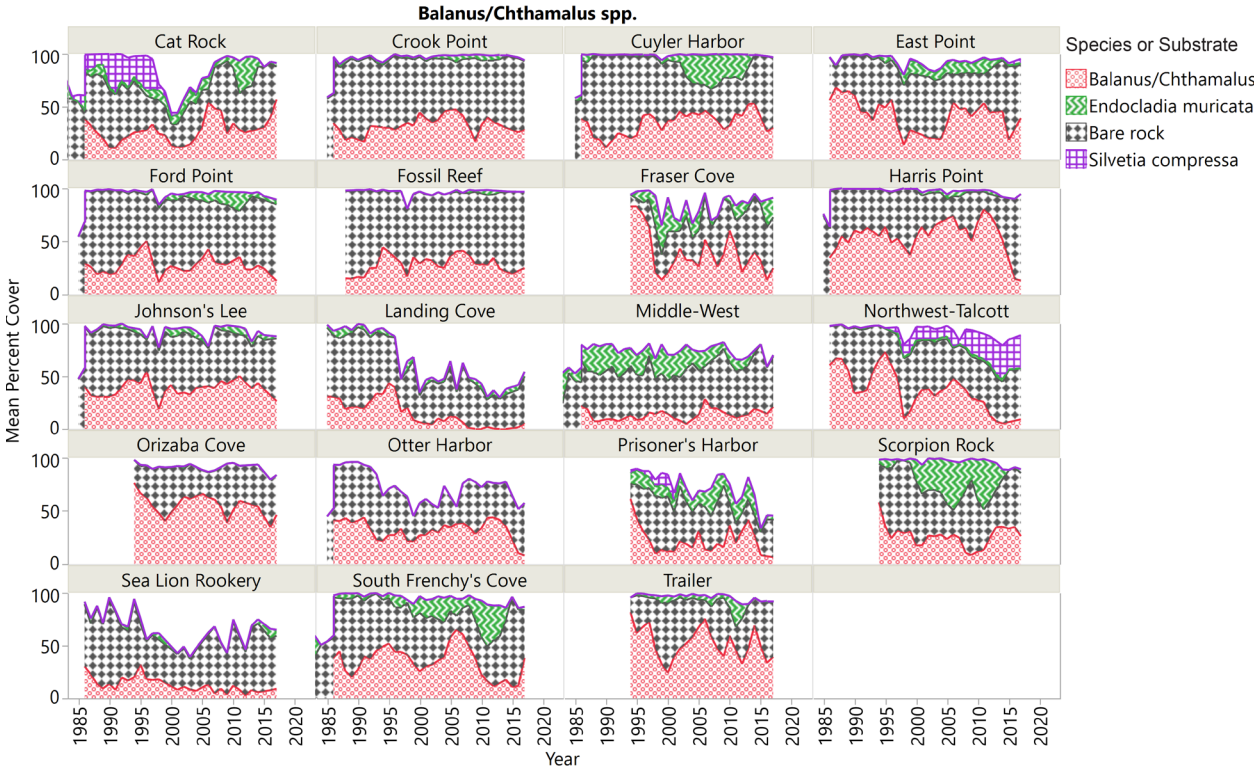


Figure 17. Percent cover of barnacles (*Chthamalus/Balanus* spp.) along with turfgrass (*Endocladia muricata*) rockweed (*Silvetia compressa*) and bare rock in fixed plots within the barnacle (*Chthamalus/Balanus*) zone at each site through 2017–2018 in Channel Islands National Park. Note that barnacle 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.

Pollicipes polymerus

Goose or leaf barnacle (*Pollicipes polymerus*) zone plots have only been established at Fraser Cove. Over time, goose barnacle cover has declined slowly over time from approximately 20% in the mid-1990s to well below 10% by 2009. *Pollicipes polymerus* cover has increased markedly since 2009 and was slightly above the long-term mean in 2017–2018 (Figure 18). Other dominant species in the *P. polymerus* plots have included *Mytilus californianus* and *Tetraclita rubescens* (Figure 19).

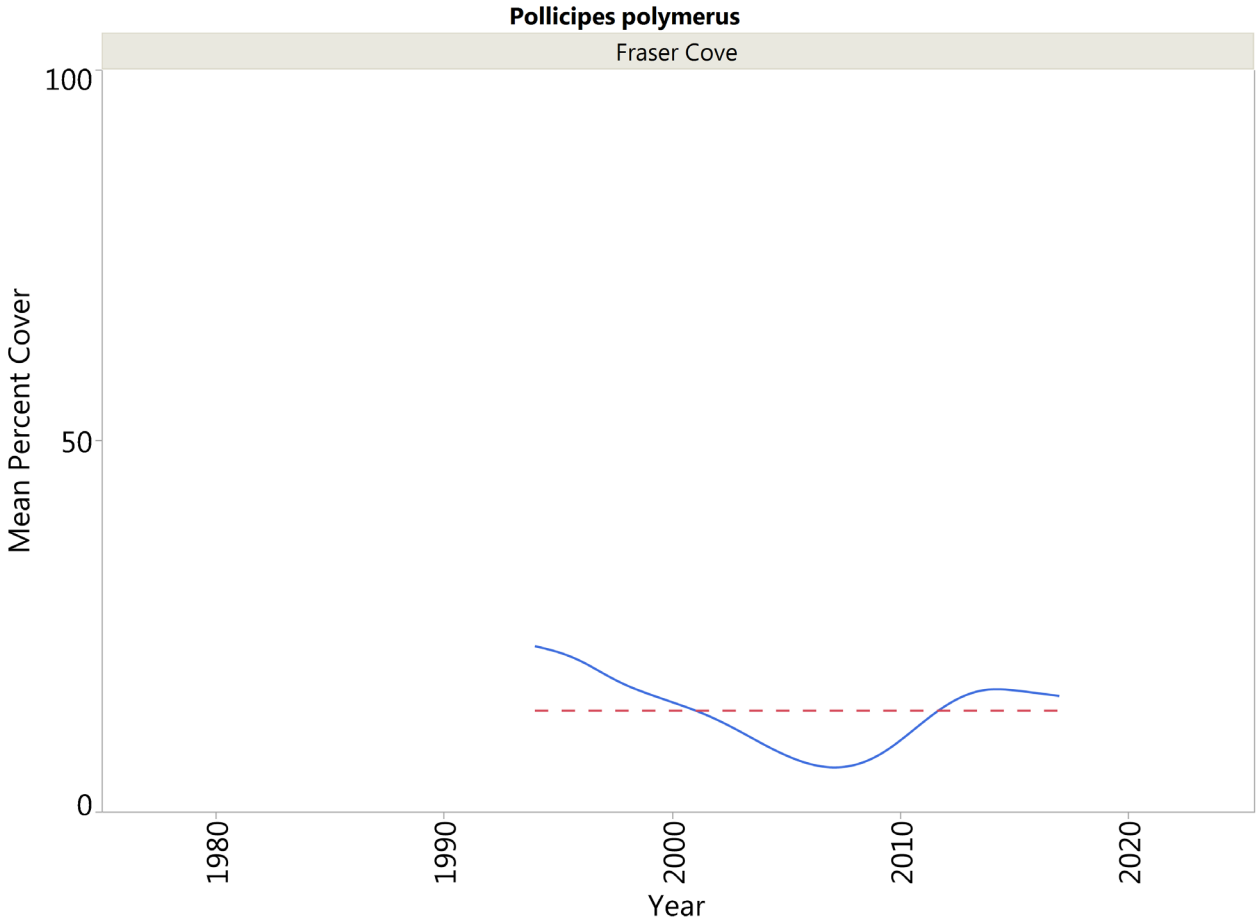


Figure 18. Departure from the long-term mean of percent cover for goose or leaf barnacles (*Pollicipes polymerus*) at Fraser Cove on Santa Cruz Island in Channel Islands National Park. Blue wavy lines represent mean cover of *P. polymerus* within the representative zone pooled across plots at Fraser Cove. Red dashed line represents long-term mean.

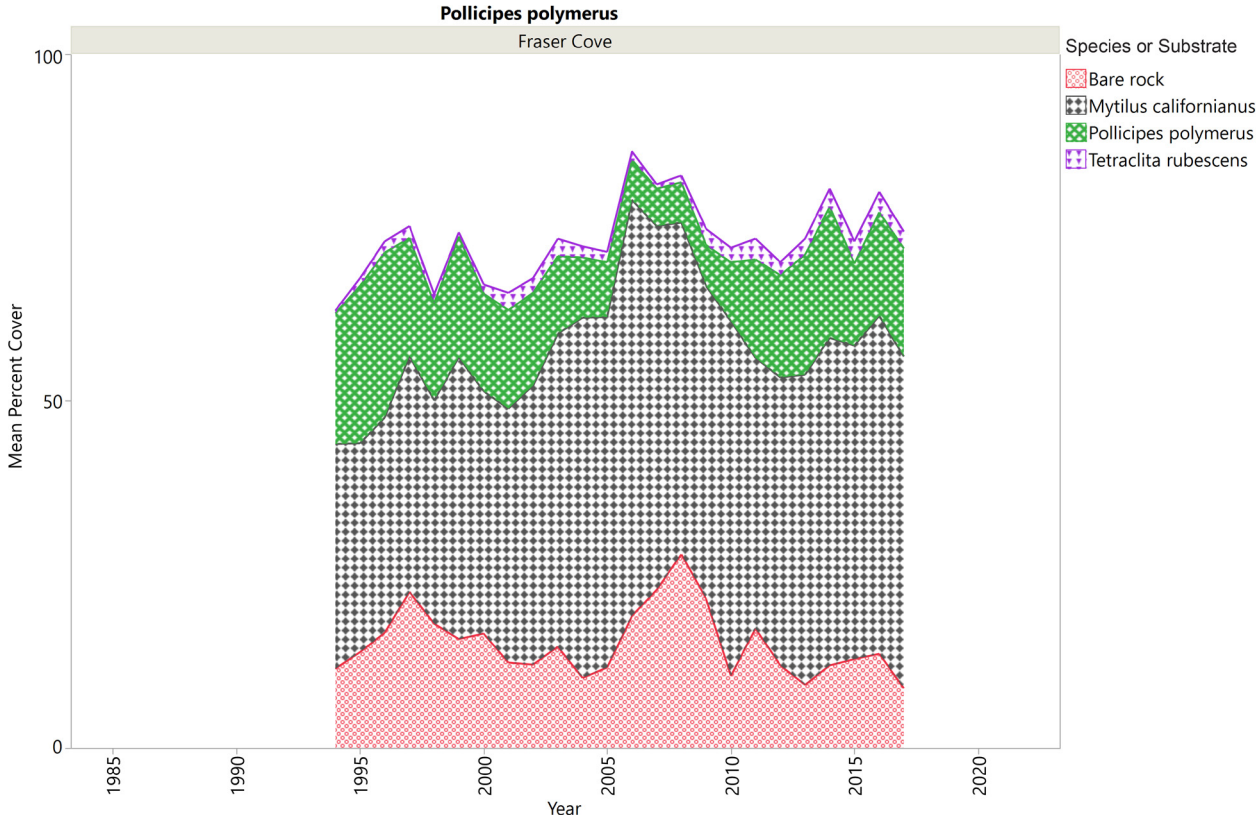


Figure 19. Percent cover of goose or leaf barnacles (*Pollicipes polymerus*) along with other dominant taxa and bare rock in fixed plots within the *Pollicipes* zone at Fraser Cove, Santa Cruz Island, in Channel Islands National Park. Colored areas represent the mean percent cover for representative and dominant taxa/substrata from five *Pollicipes* plots.

Tetraclita rubescens

The thatched barnacle (*Tetraclita rubescens*) is only monitored at three sites: Harris Point, Orizaba Cove and Scorpion Rock. Thatched barnacles remained slightly above the long-term mean at all three locations in 2017–2018 (Figure 20). Other dominant species in the *T. rubescens* plots have included *Mytilus californianus* and *Pollicipes polymerus* (Figure 21).

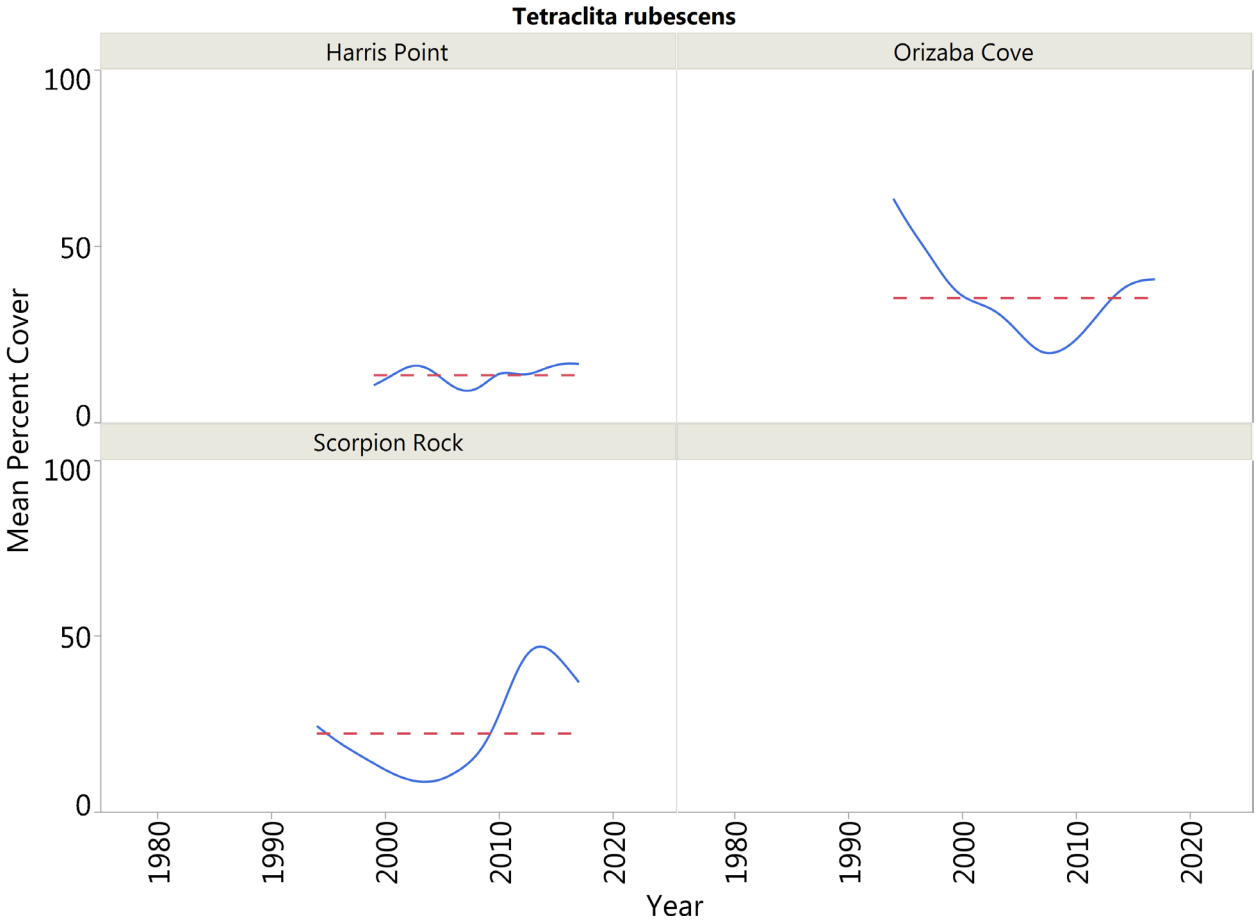


Figure 20. Departure from the long-term mean of percent cover for thatched barnacles (*Tetraclita rubescens*) at sites in Channel Islands National Park. Blue wavy lines represent mean cover of *T. rubescens* within the representative zone pooled across plots at each site. Red dashed lines represent long-term mean.

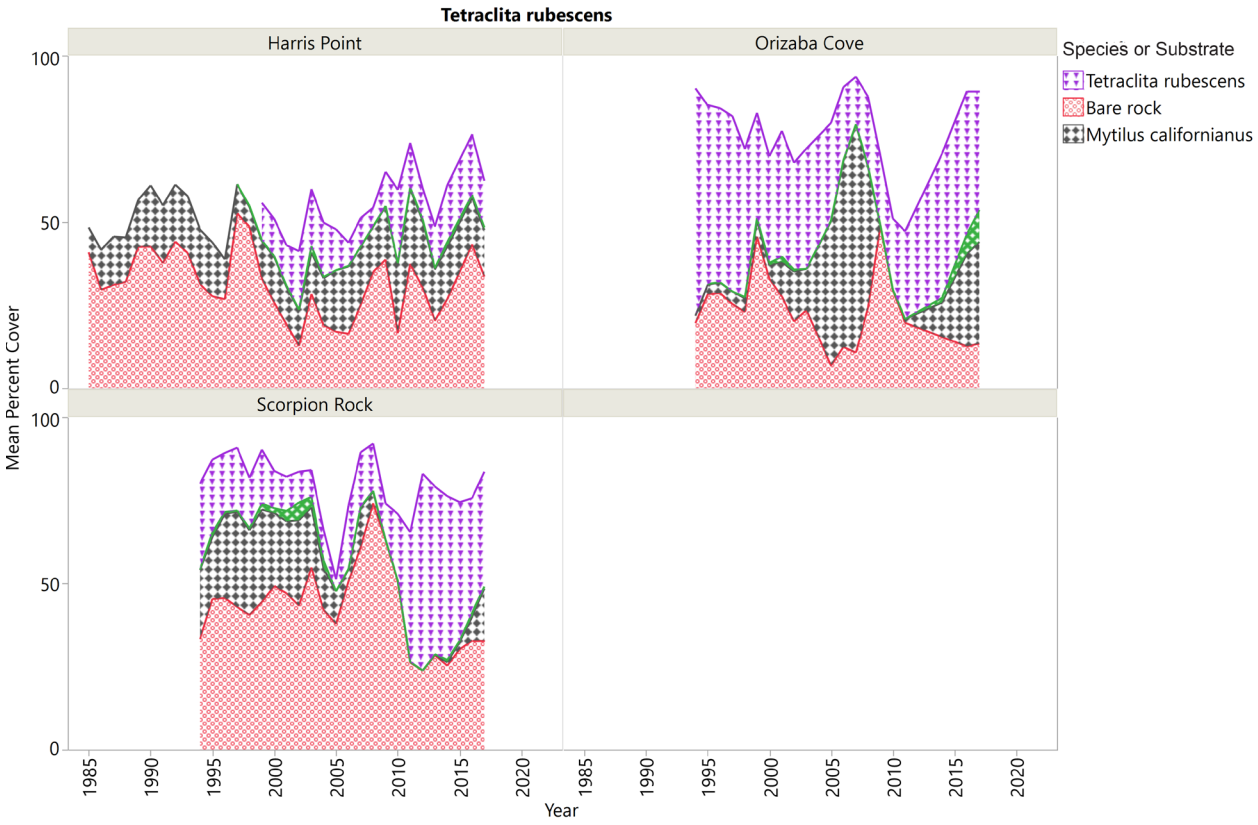


Figure 21. Percent cover of thatched barnacles (*Tetraclita rubescens*) along with other dominant taxa and bare rock in fixed plots within the *Tetraclita* zone at each site in Channel Islands National Park. Colored areas represent the seasonal mean percent cover for representative and dominant taxa/substrata from five *Tetraclita* plots.

Tar

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 2017–2018 from the long-term mean of approximately 50% (Figures 22 and 23).

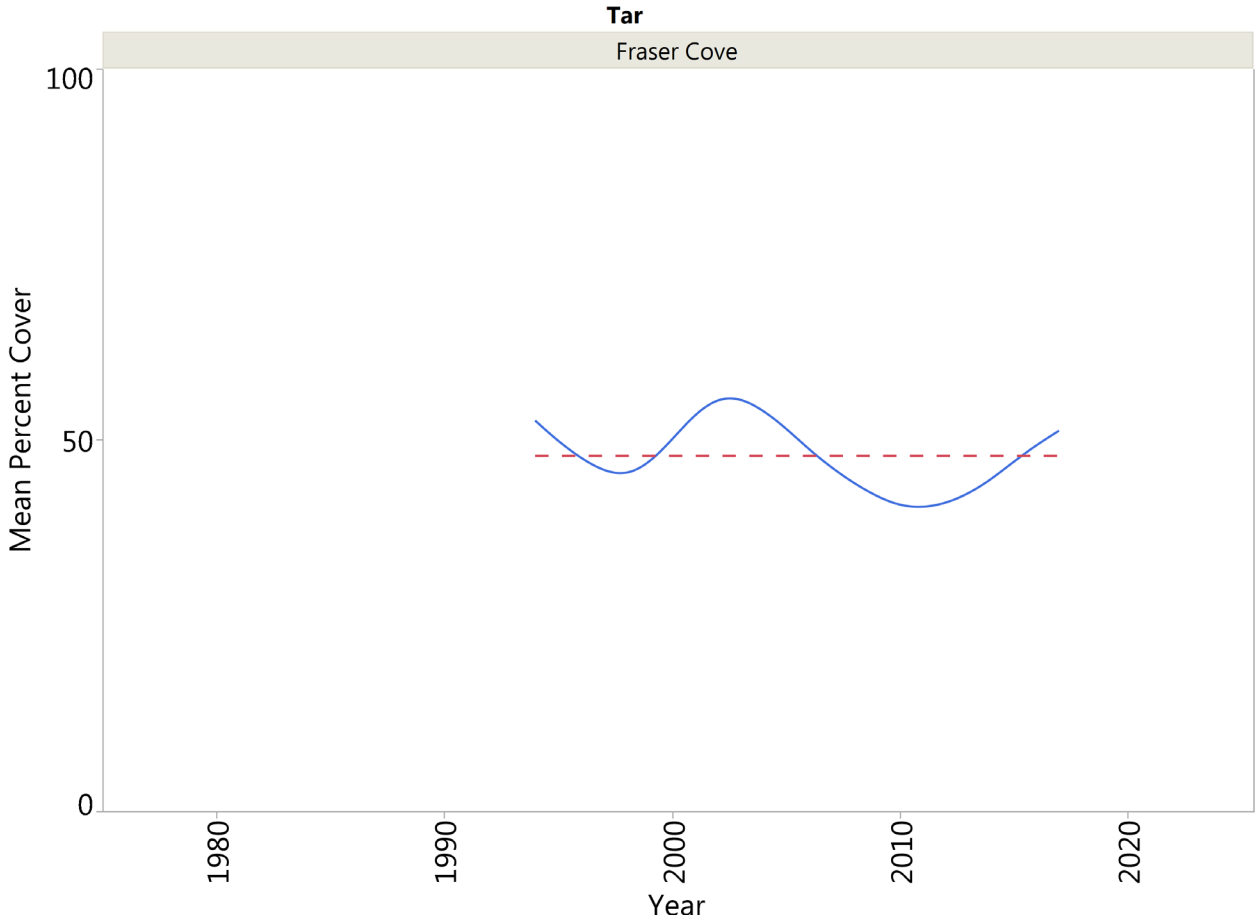


Figure 22. Departure from the long-term mean of percent cover for tar at Fraser Cove on Santa Cruz Island in Channel Islands National Park. Blue wavy line represents mean cover of tar within the representative zone pooled across plots at Fraser Cove. Red dashed line represents long-term mean.

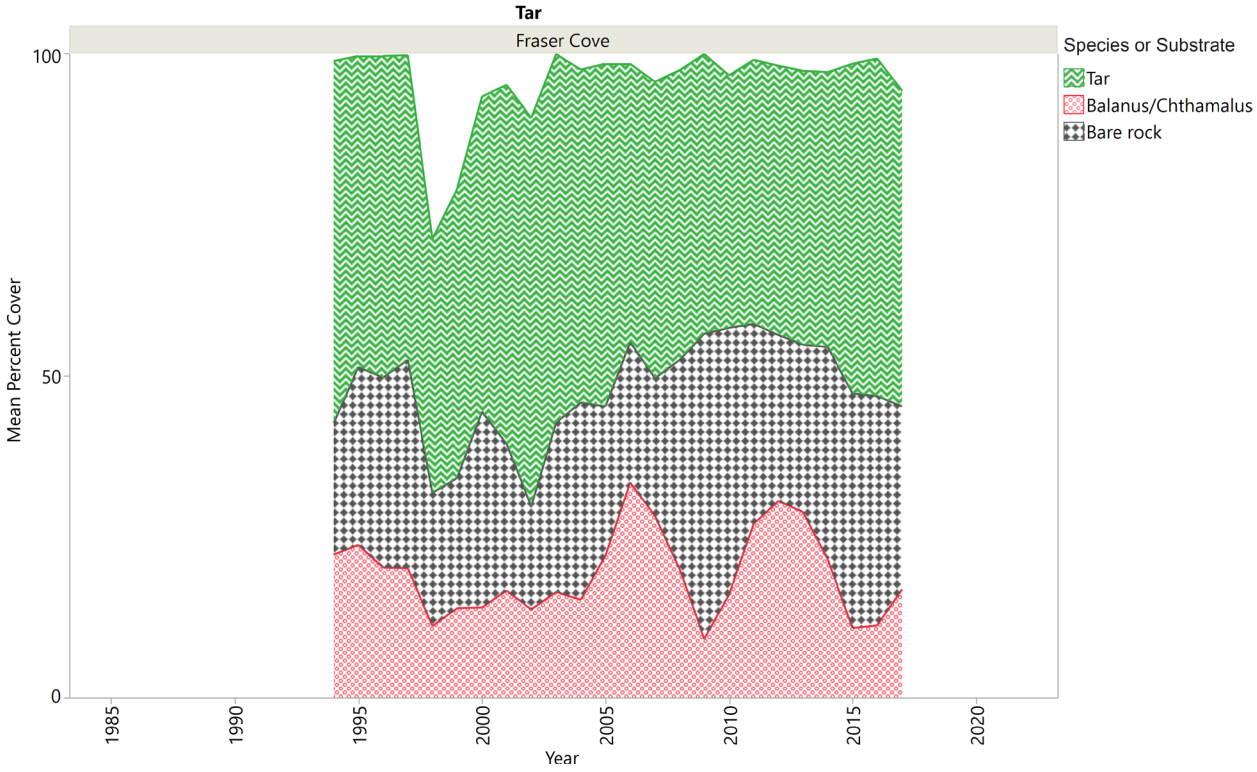


Figure 23. Percent cover of tar along with other dominant taxa and bare rock in fixed plots within the tar zone at Fraser Cove, Santa Cruz Island, in Channel Islands National Park. Colored areas represent the mean percent cover for representative and dominant taxa/substrata from five tar plots.

Haliotis cracherodii

Following the collapse of the black abalone (*Haliotis cracherodii*) population in southern California due to withering syndrome in the late 1980s and early 1990s, most monitoring sites at Channel Islands National Park have supported extremely low numbers of abalone relative to historical densities (Figure 24). Prior to the effects of withering syndrome, black abalone were counted and measured in fixed-irregular plots (five plots per site) at 11 sites. Fixed plots were used when abalone were abundant and often too numerous to count and measure over the whole reef. However, by the early 1990s fixed plots became inadequate for sampling as the abalone disappeared. Most years fixed plots were checked for comparison to early samples, but abalone were rarely encountered in the plots. In 2017–2018 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 historical photographs and bolt-to-bolt location measurements.

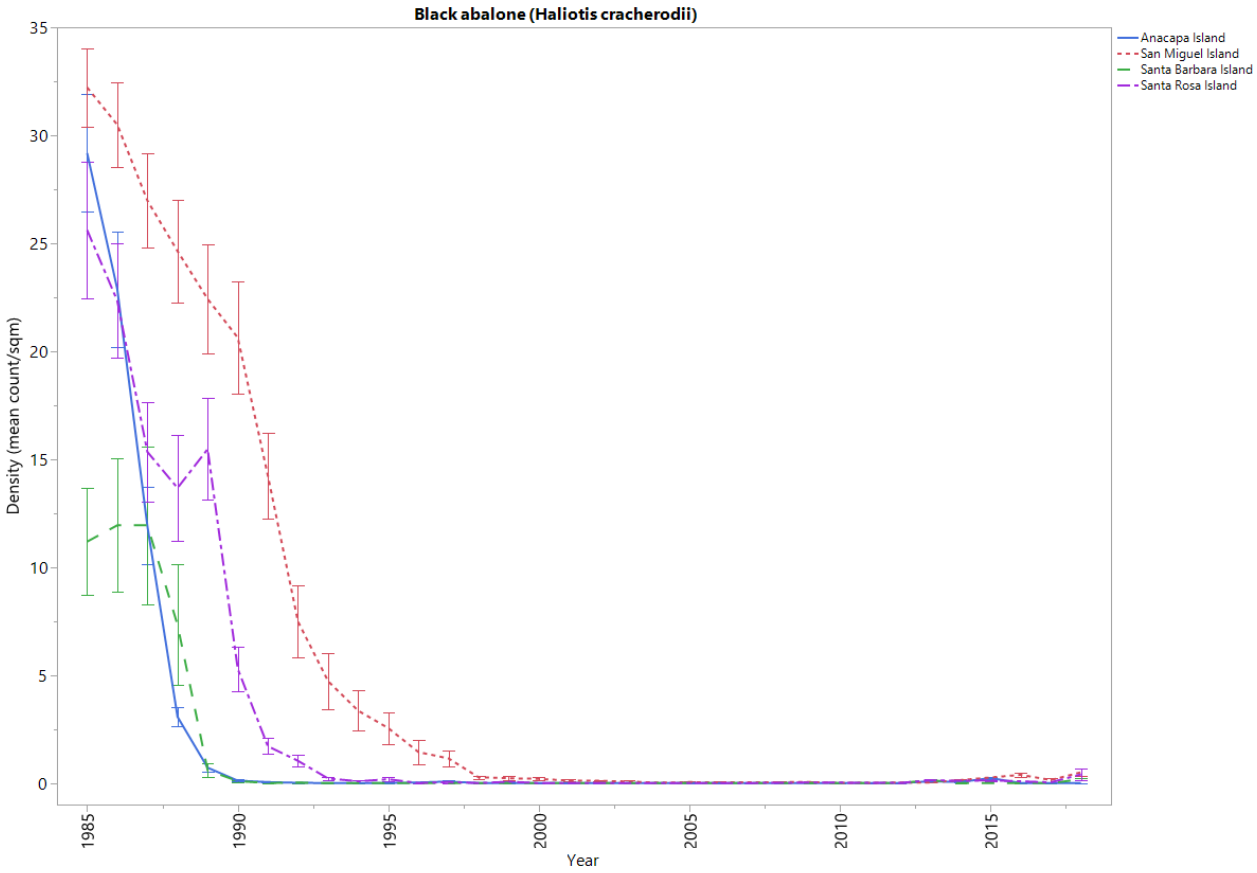


Figure 24. Black abalone (*Haliotis cracherodii*) density from fixed plots at all islands except Santa Cruz from 1985 to 2017/18 in Channel Islands National Park. Note that fixed plots were not established at Santa Cruz Island. Standard error bars were constructed using one standard error from the mean.

During routine timed searches, black abalone were entirely absent from Landing Cove and South Frenchy's Cove. Of the remaining sites where black abalone were seen, fewer than 10 individuals were located at Prisoner's Harbor and Sea Lion Rookery. In contrast, >100 black abalone were observed at six sites: East Point, Ford Point, Otter Harbor, Scorpion Rock (Site B), Trailer, and Willows Anchorage (Figure 25). Note that search effort increased at several locations due to the greater number of abalone encountered 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 Channel Islands National Park Rocky Intertidal Community 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).

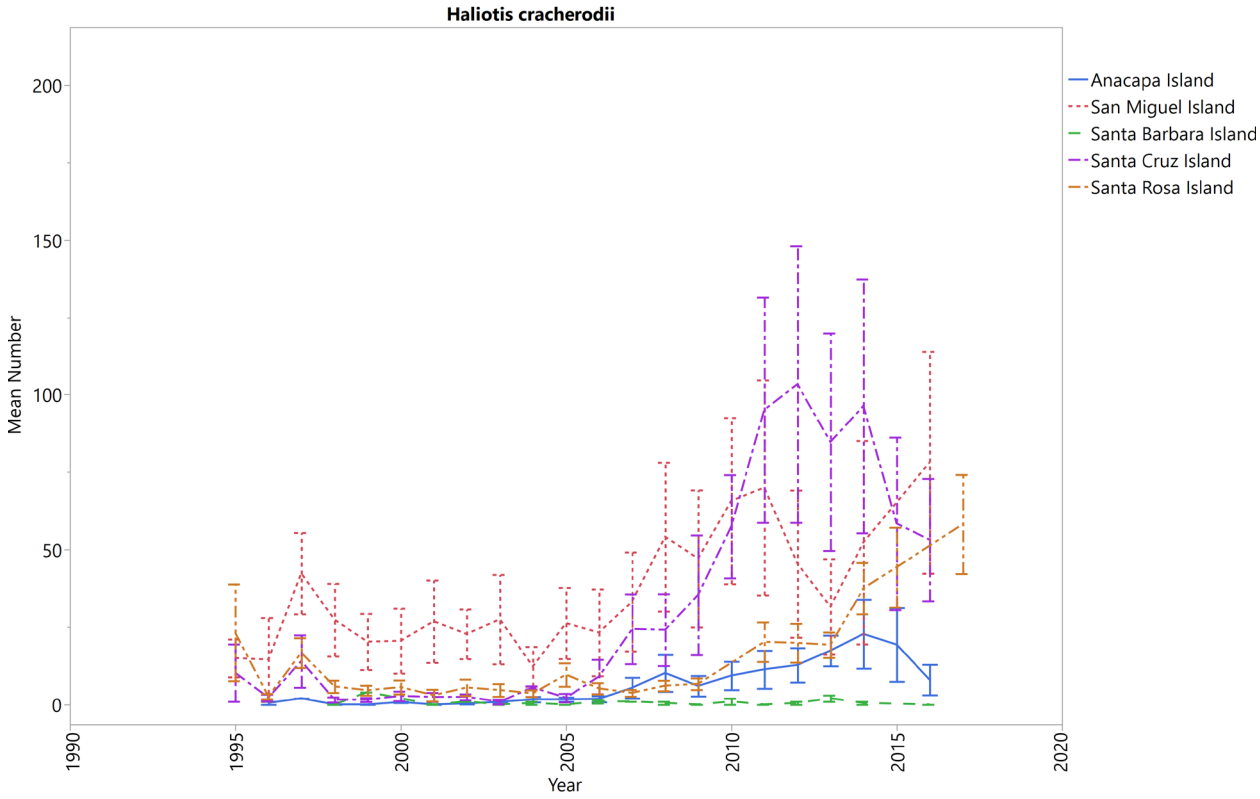


Figure 25. Black abalone (*Haliotis cracherodii*) mean counts at all islands from 1995 to 2017–2018 in Channel Islands National Park. Count data are generally derived from site-wide searches. Error bars were constructed using one standard error from the mean.

Above average abundances relative to the long-term mean generated from post-1995 data were observed at all but four sites: Anacapa Middle West, Landing Cove, Prisoner's Harbor, and Willows Anchorage (Figure 26). In some cases, increases were only slightly above the long-term mean, but substantial increases in abundances were documented in 2017–2018 at East Point, Ford Point, Northwest-Talcott, Scorpion Rock Site B, and Trailer. Black abalone counts have increased above the long-term mean at most sites. Increased abundances became noticeable between 2007 and 2009.

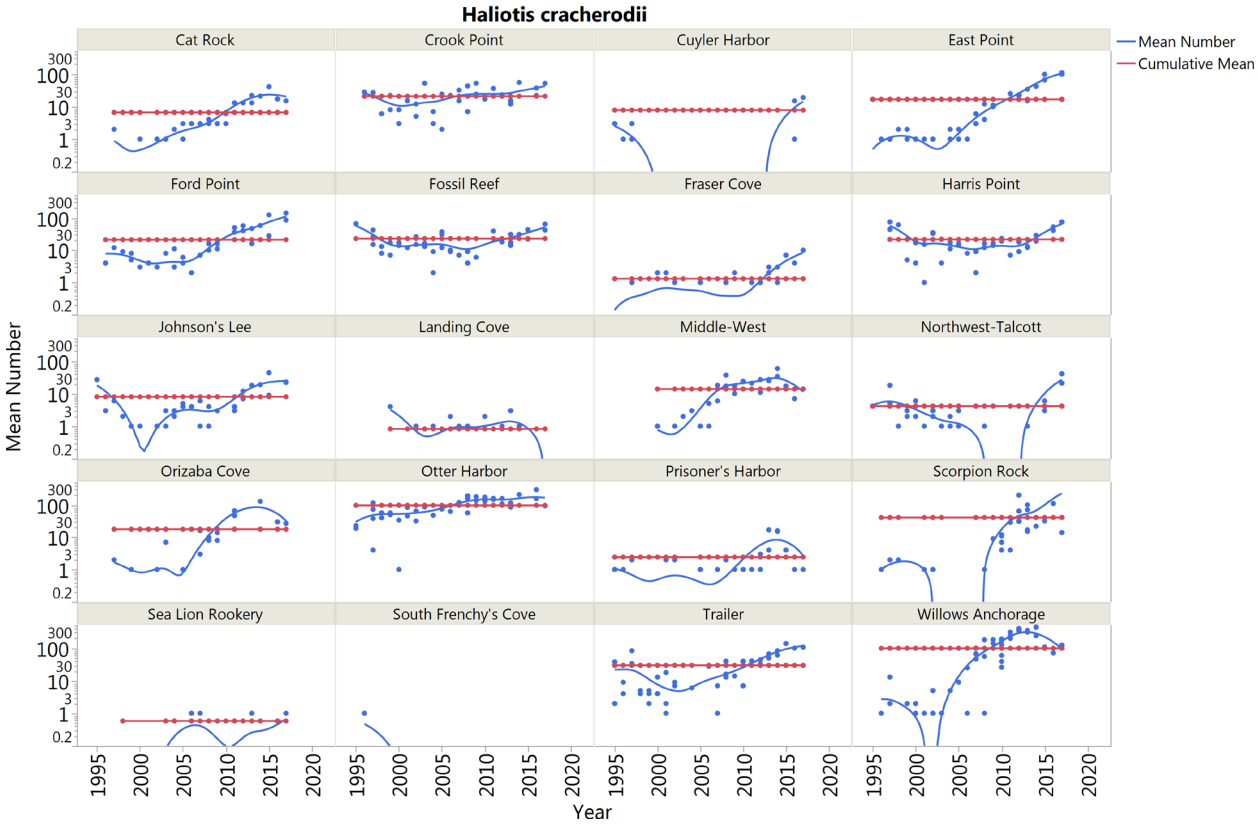


Figure 26. Departure from the long-term mean for black abalone (*Haliotis cracherodii*) at each site in Channel Islands National Park. Blue wavy lines represent the trend of the mean number of *H. cracherodii* at each site. Horizontal red lines represent cumulative mean. Note that data are displayed on a logarithmic scale.

At the island level, mean abundances of *Haliotis cracherodii* in 2017–2018 measured above the cumulative mean calculated from all years post-1995 for Santa Cruz, Santa Rosa and San Miguel Islands (Figure 27). The population at Anacapa Island was comparable to the long-term mean. 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.

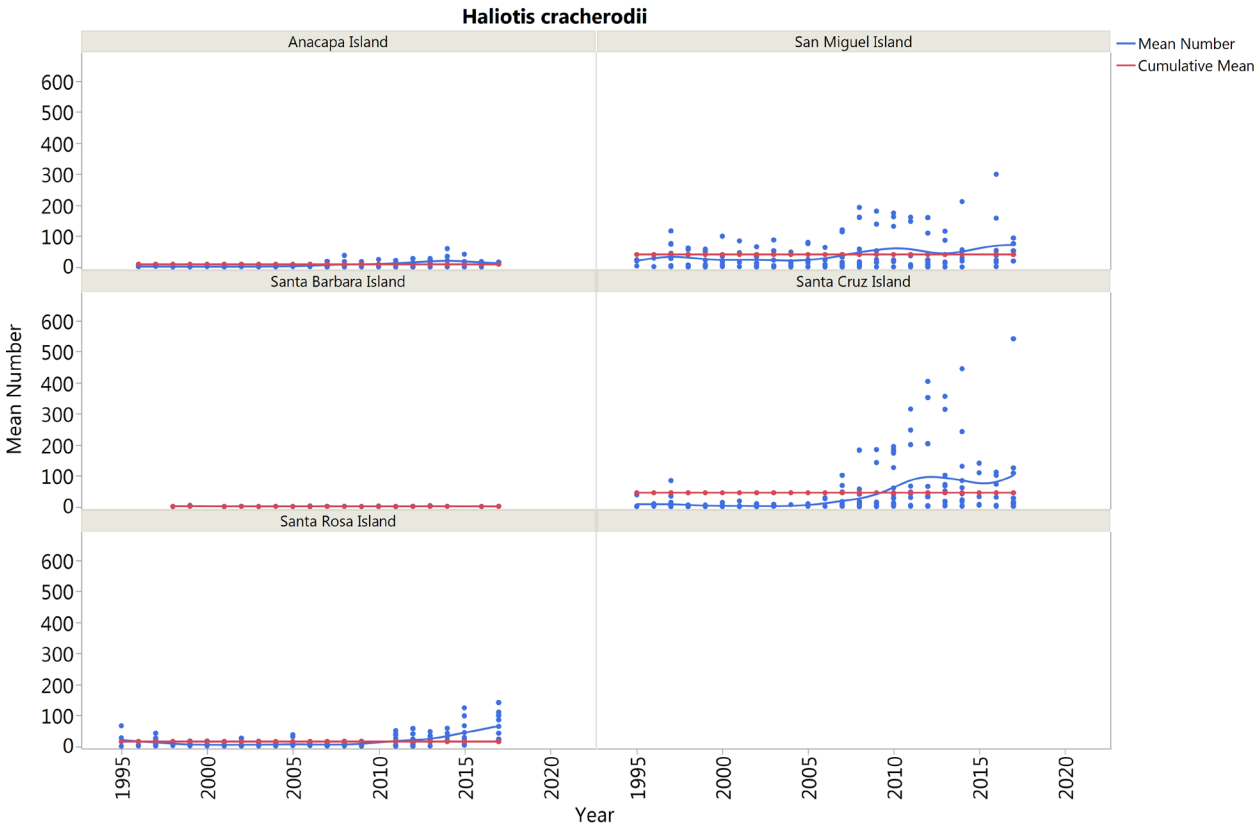


Figure 27. Departure from the long-term mean for black abalone (*Haliotis cracherodii*) at each island in Channel Islands National Park. Blue wavy lines represent the trend of the mean number of *H. cracherodii* at each island. Horizontal red lines represent cumulative mean.

In 2017–2018, the size frequency distributions of black abalone for all islands, except Santa Barbara, reflected the effects of recruitment through the presence of juvenile (≤50 mm shell length) black abalone (Figures 28–30). Modes for populations at Anacapa, Santa Cruz, Santa Rosa and San Miguel ranged from approximately 60 to 100 mm. Anacapa Island had a relatively flat size frequency distribution with a subtle mode around 60 mm. The population at Santa Cruz Island was slightly skewed towards larger individuals with a mode centered around 50–75 mm. Santa Rosa Island *Haliotis cracherodii* followed a fairly normal size distribution with the majority approximately 75 mm. At San Miguel Island, the size distribution was skewed right with a mode of approximately 70–90 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 Island sites to accurately assess population size distribution.

Shrunken foot, one of the symptoms of withering syndrome, was not observed in 2017–2018. 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 withering syndrome.

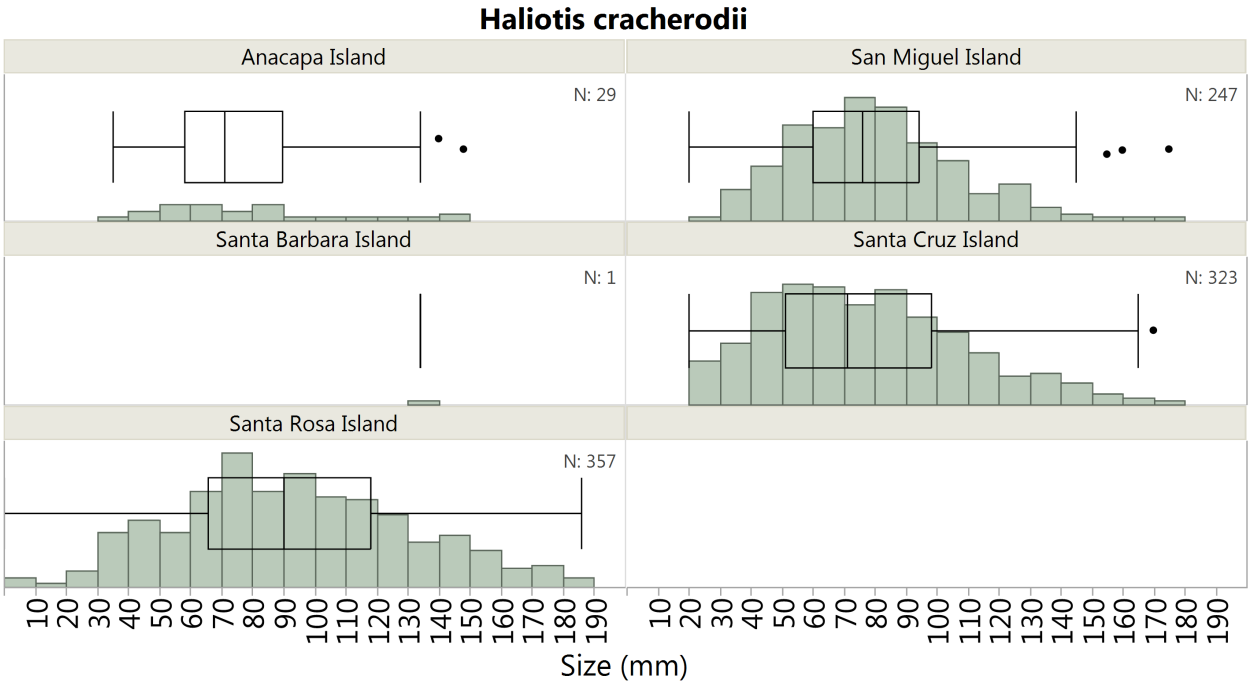


Figure 28. Black abalone (*Haliotis cracherodii*) size frequency distributions pooled across sites at each island measured in 2017–2018 in Channel Islands National Park. Box-and-whisker plots indicate the spread and degree of skewness of the size frequency data. The ends of the boxes represent the 25th 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.

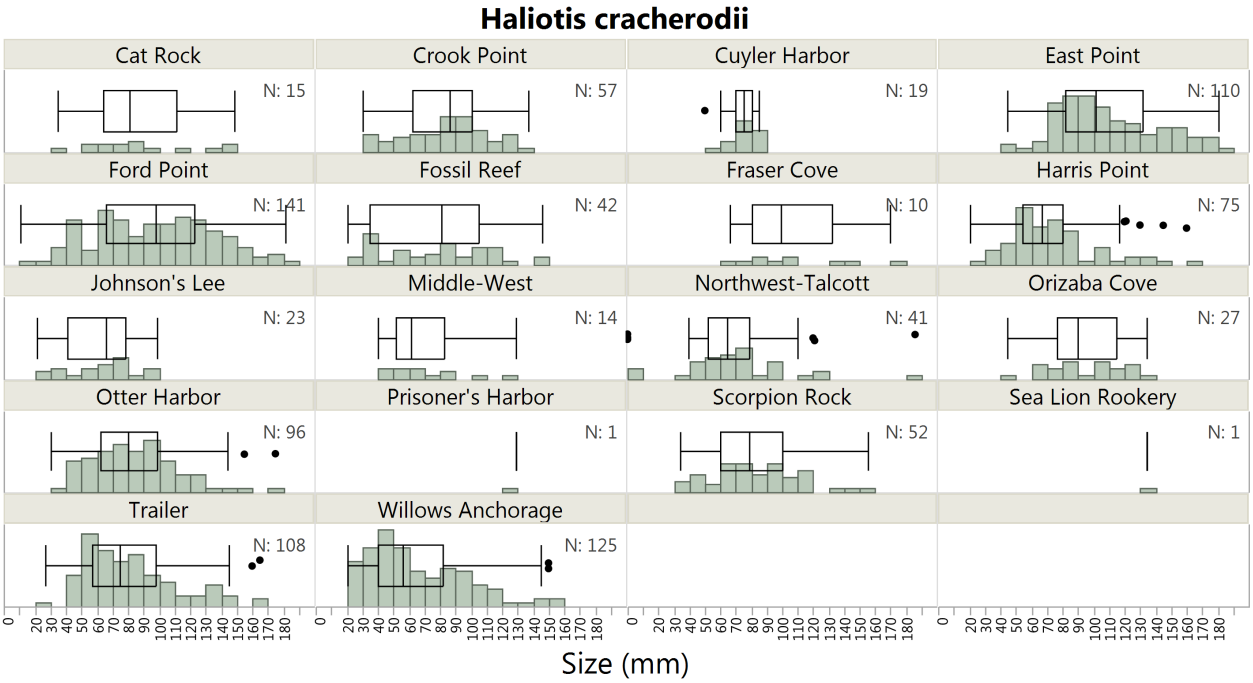


Figure 29. Size frequency distributions of black abalone (*Haliotis cracherodii*) measured at each site in 2017–2018 in Channel Islands National Park. Box-and-whisker plots indicate the spread and degree of skewness of the size frequency data. The ends of the boxes represent the 25th and 75th quartiles, 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.

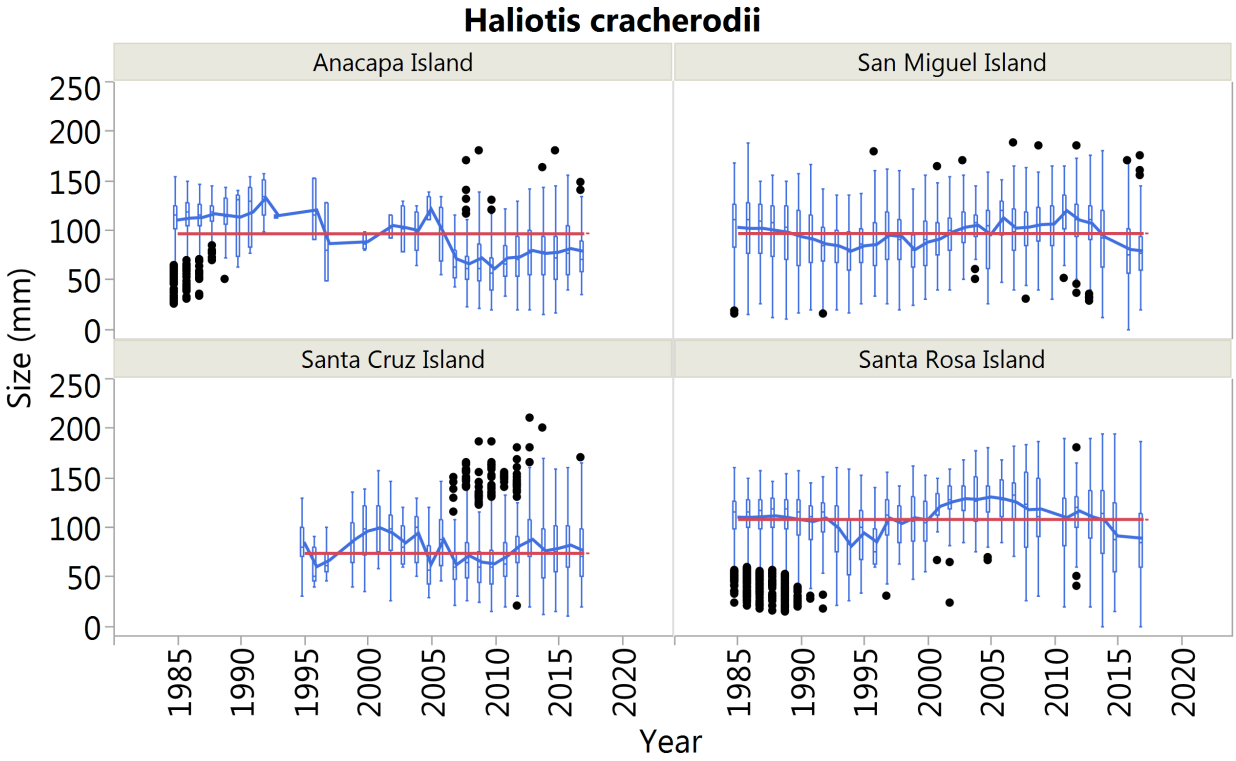


Figure 30. Box plots for annual size frequency distributions of black abalone (*Haliotis cracherodii*) at each island in Channel Islands National Park. Blue wavy lines represent mean sizes of *H. cracherodii* at each island pooled across and sites. Horizontal red lines represent the cumulative mean.

Lottia gigantea

Owl limpets, *Lottia gigantea*, were sampled at all sites in 2017–2018 where fixed plots for *L. gigantea* have been established. Averaged across sites for each island, the mean density of limpets increased above the long-term mean at San Miguel; record high abundances of owl limpets occurred at San Miguel Island this year and last year (Figure 31). The mean densities of *L. gigantea* were comparable to the long-term means at the other three islands, Anacapa, Santa Cruz and Santa Rosa, where fixed plots exist. Note that there are not any fixed plots for *L. gigantea* at Santa Barbara Island sites.

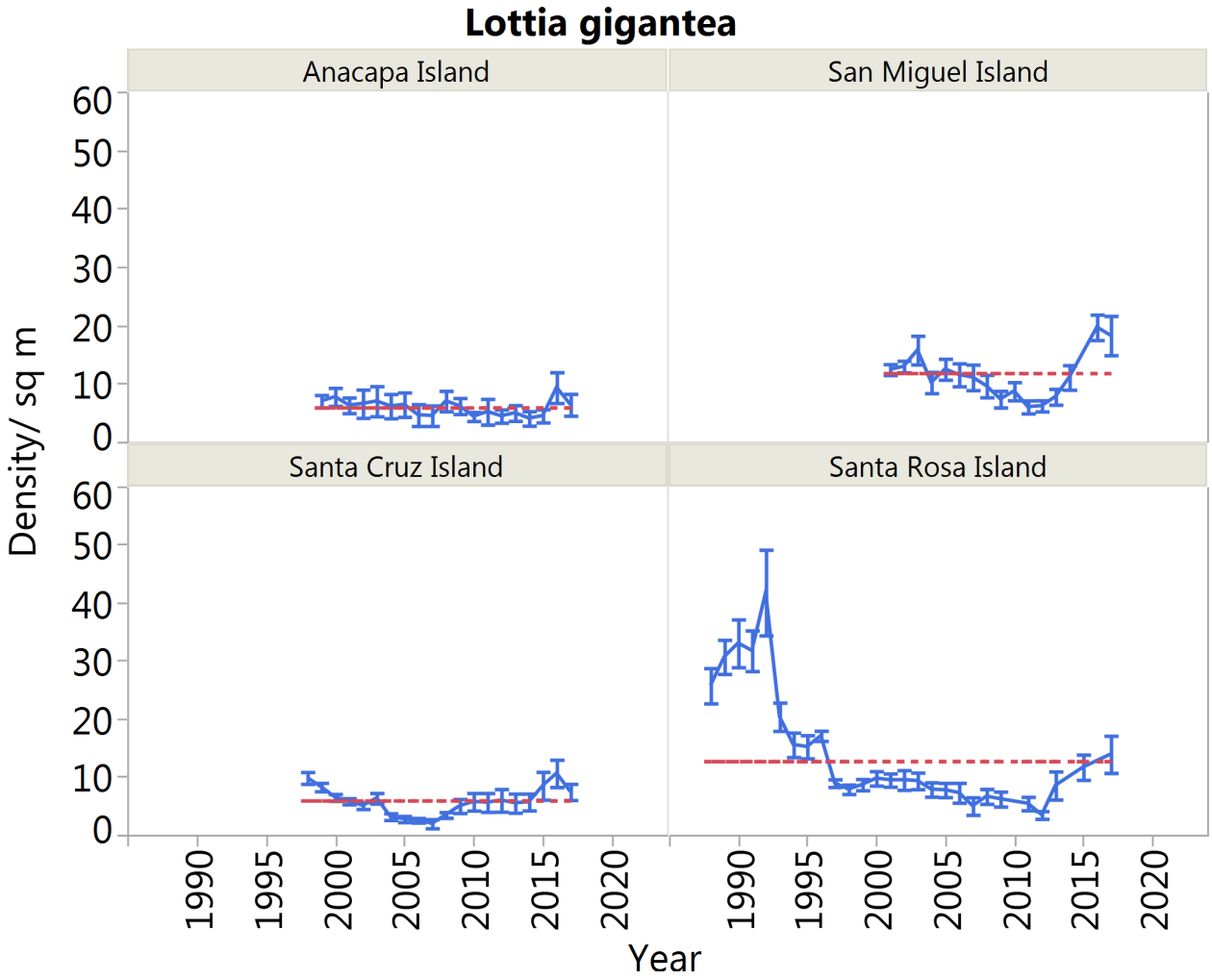


Figure 31. Departure from the long-term mean in density for owl limpet (*Lottia gigantea*) at each island in Channel Islands National Park. Blue lines represent mean density of *L. gigantea* at each island pooled across fixed plots and sites. Red dashed lines represent cumulative mean density. Error bars were constructed using one standard error from the mean.

At the site level, mean densities of *L. gigantea* were comparable to the long-term mean values calculated for the respective sites at seven locations (Figure 32).Owl limpet densities were exceptionally high at two sites, Fossil Reef and Otter Harbor this year. Below-average densities of limpets were measured at Ford Point and Johnson's Lee.

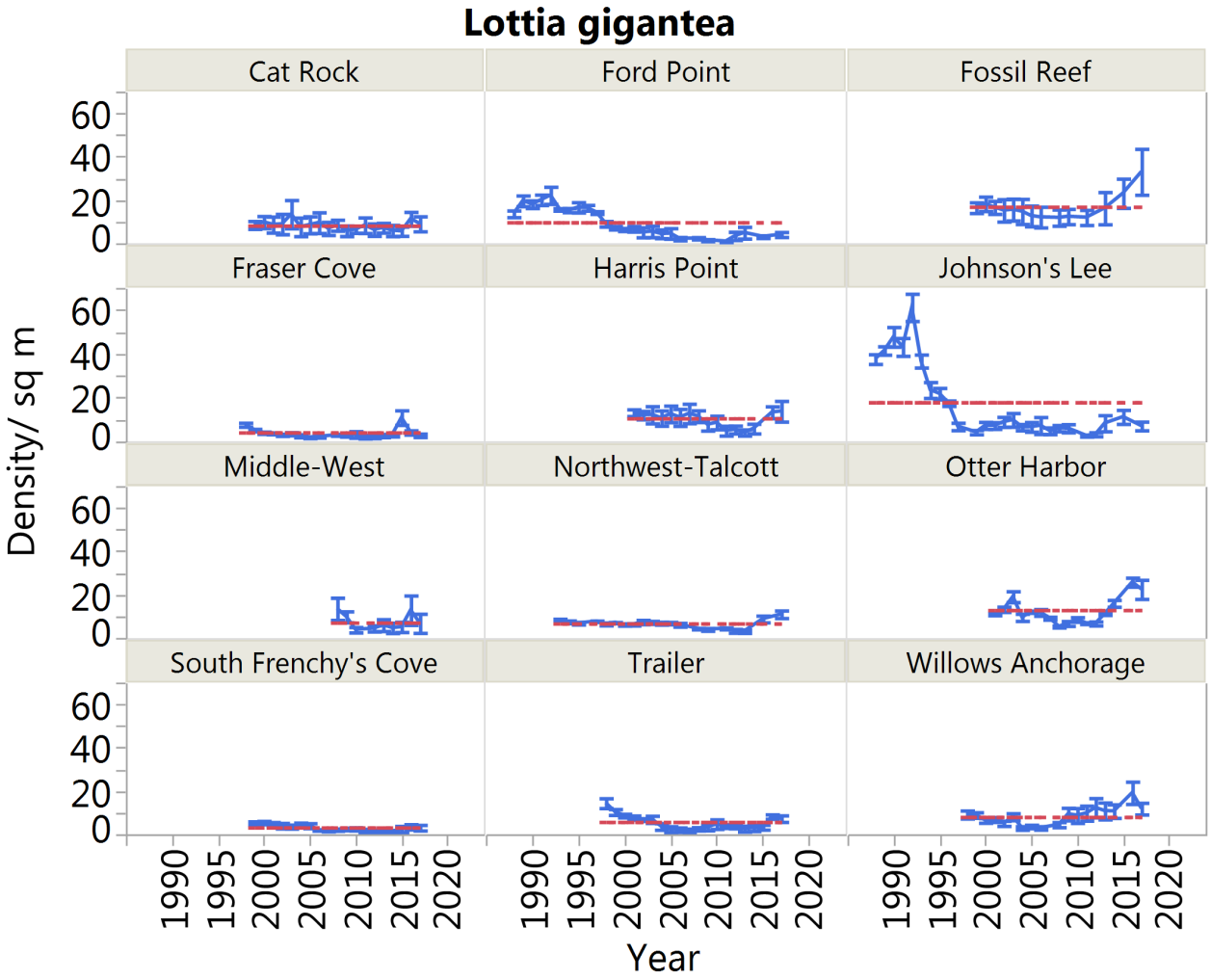


Figure 32. Departure from the long-term mean in density of owl limpet (*Lottia gigantea*) at each site in Channel Islands National Park. Blue wavy lines represent mean density of *L. gigantea* at each site pooled across fixed plots. Red dashed lines represent cumulative mean density. Error bars were constructed using one standard error from the mean.

The mean size of *L. gigantea* varied among islands (range = 29.9–33.7 mm) and sites (range = 23.8–43.8 mm) in 2017–2018 (Figures 33–34). Relative to the mean values, median sizes of owl limpets were slightly higher among islands (range = 33–36 mm) and sites (range = 27–53 mm). The smallest *L. gigantea* were observed at Johnson's Lee, followed closely by Willows Anchorage and Fraser Cove, and the largest were seen at Northwest-Talcott.

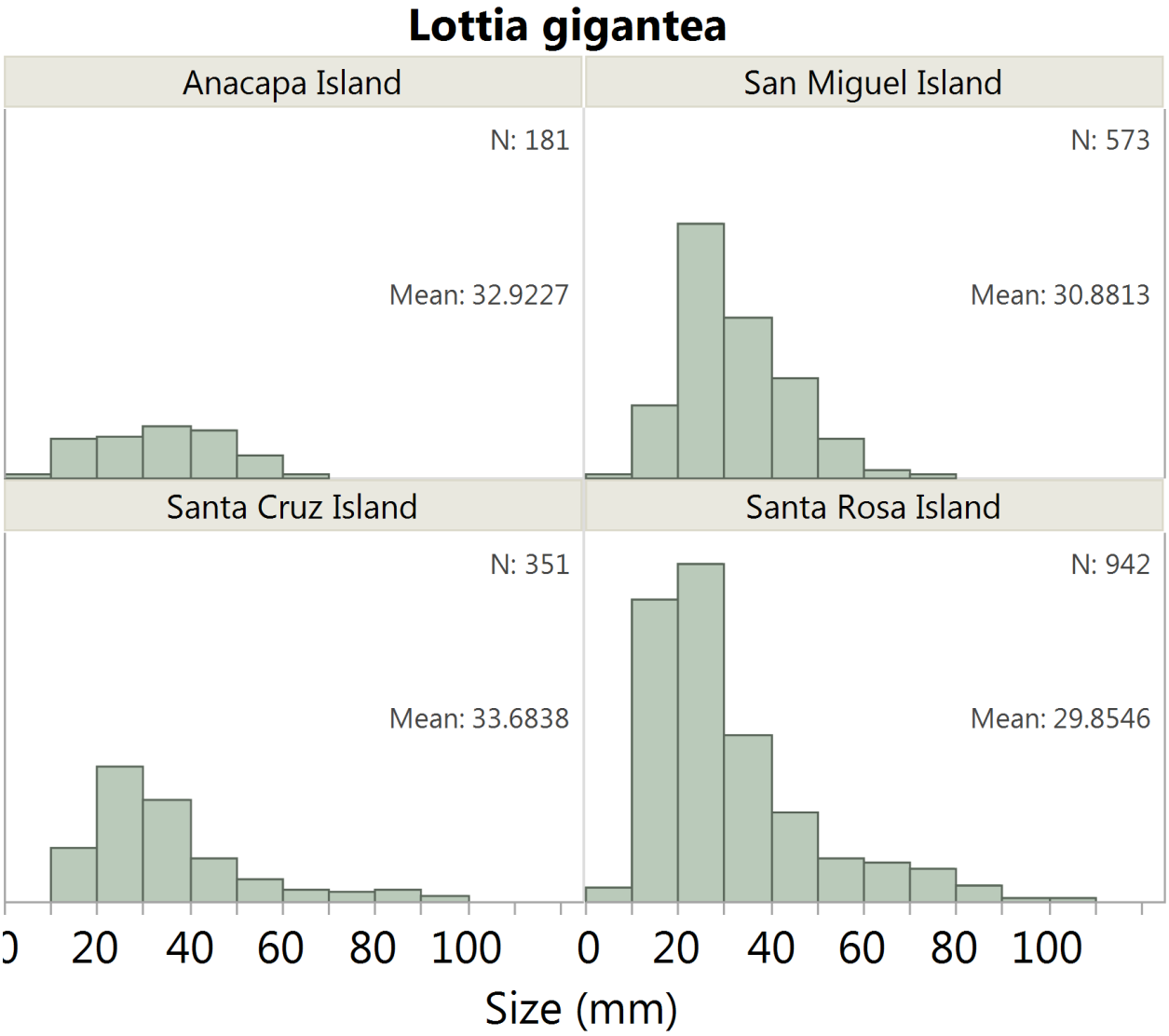


Figure 33. Owl limpet (*Lottia gigantea*) size distributions at each island measured in 2017–2018 in Channel Islands National Park. Bars indicate the number of individuals within each size bracket. Mean value indicates the mean size of *L. gigantea* at each island.

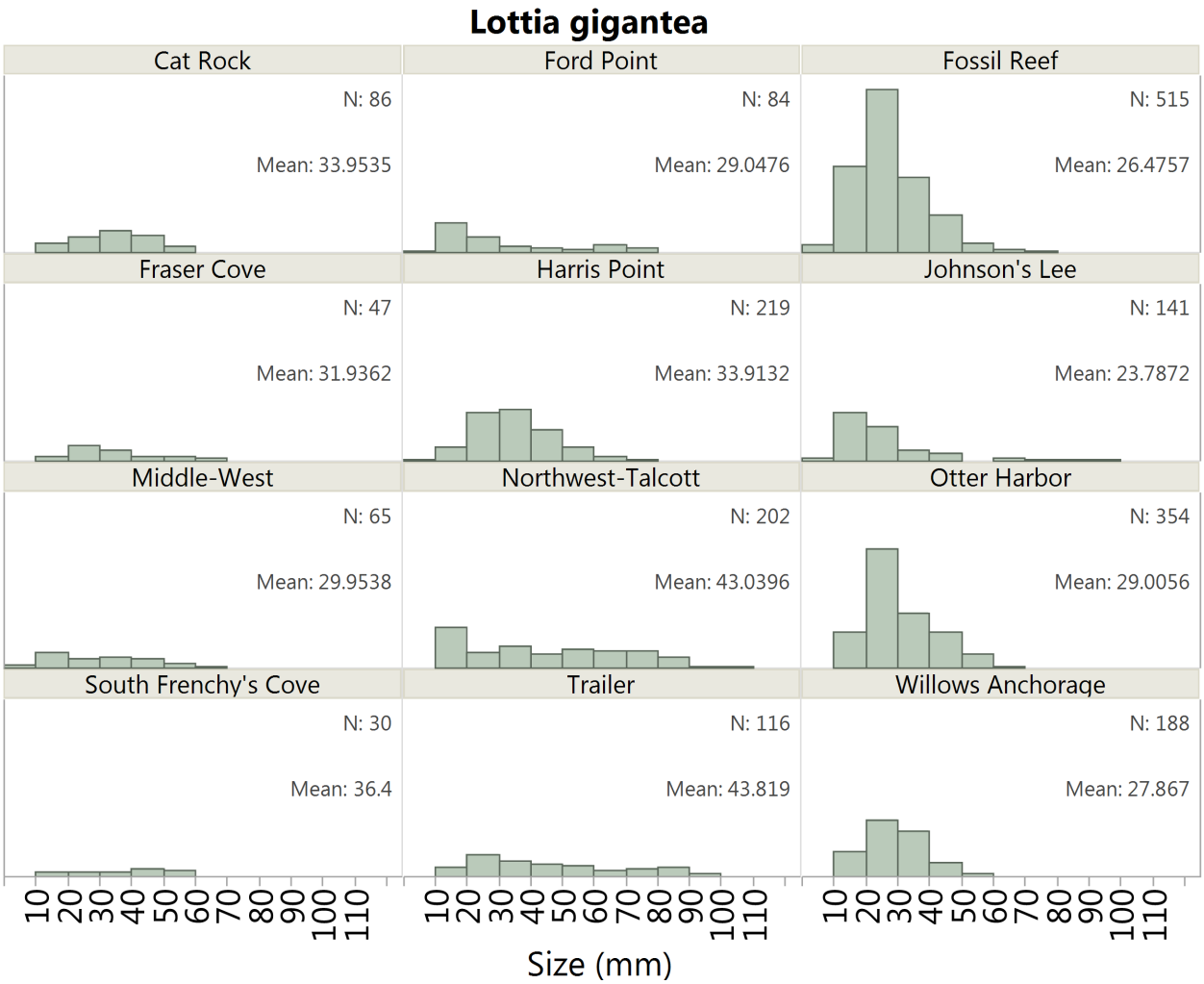


Figure 34. Owl limpet (*Lottia gigantea*) size distributions at each site measured in 2017–2018 in Channel Islands National Park. Bars indicate the number of individuals within each size bracket. Mean value indicates the mean size of *L. gigantea* at each site.

Temporally, the mean sizes of *L. gigantea* in 2017–2018 decreased below the cumulative mean for each island, particularly Santa Rosa (Figure 35). 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 36).

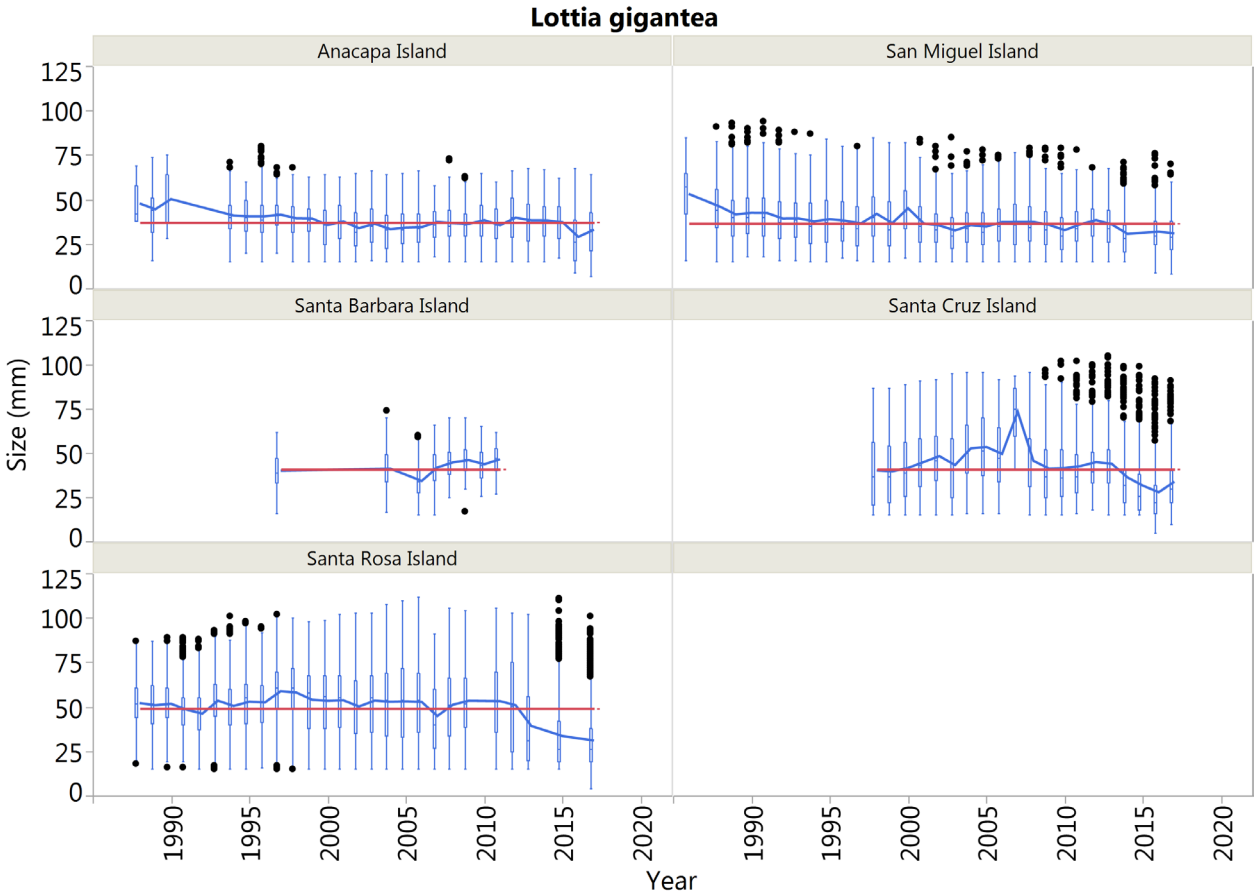


Figure 35. Box plots describing the spread of owl limpet, *Lottia gigantea*, sizes each year at each island in Channel Islands National Park. Blue way lines represent mean sizes of *L. gigantea* at each island pooled across fixed plots and sites, horizontal red lines represent the cumulative mean, and black dots represent outliers.

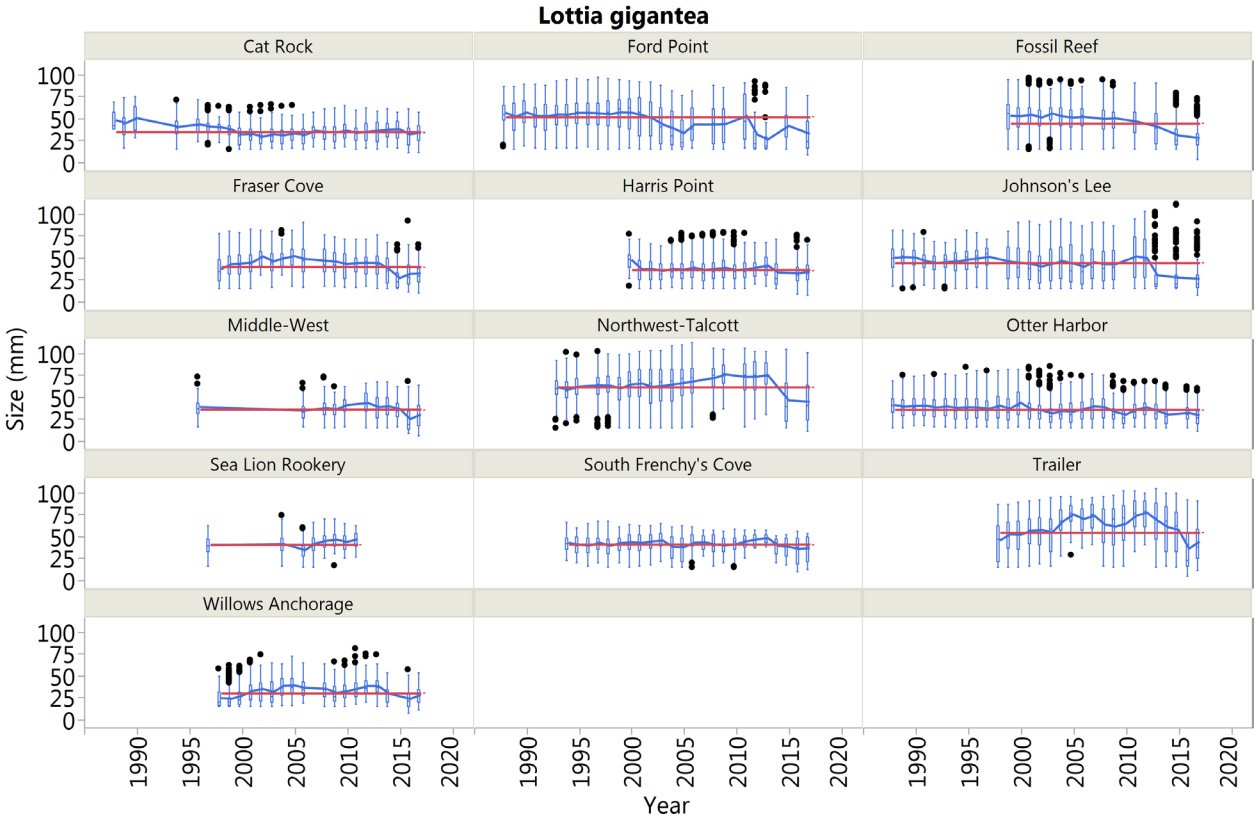


Figure 36. Box plots describing the spread of owl limpet (*Lottia gigantea*) sizes each year at each site in Channel Islands National Park. Blue wavy lines represent mean sizes of *L. gigantea* at each island pooled across fixed plots and sites, horizontal red lines represent the cumulative mean, and black dots represent outliers.

Pisaster ochraceus

Compared with previous years, sea star (*Pisaster ochraceus*) abundances have plummeted since 2014, including 2017–2018 at all islands and sites that were sampled (Figure 37). At various times during the past decade, extremely high abundances (about 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 0–28 individuals per site with all but four sites, Ford Point, East Point, Johnson's Lee, and Willows Anchorage, having fewer than 10 *P. ochraceus* seen during routine searches (Figures 38–39).

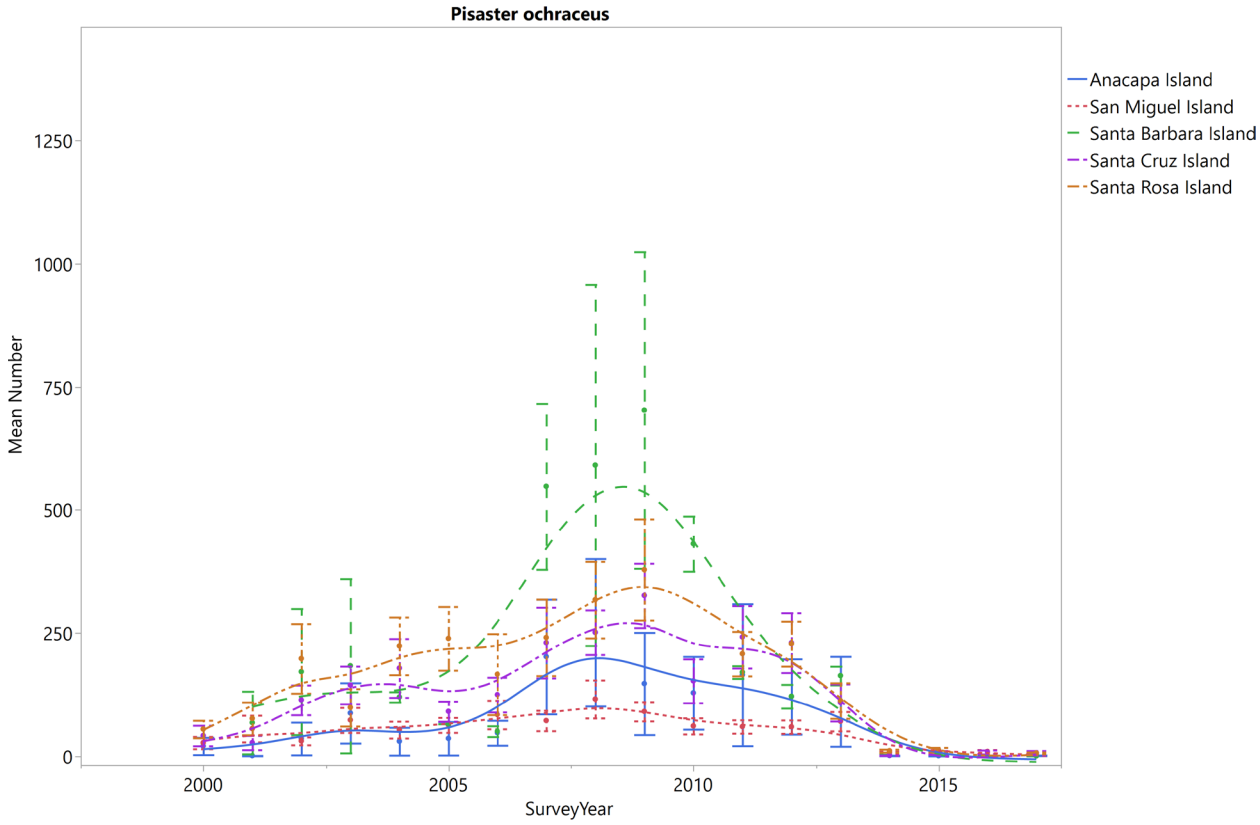


Figure 37. Sea star (*Pisaster ochraceus*) counts pooled across all sites at each island from 1999 to 2018 in Channel Islands National Park. Count data were obtained from 30-minute timed searches.

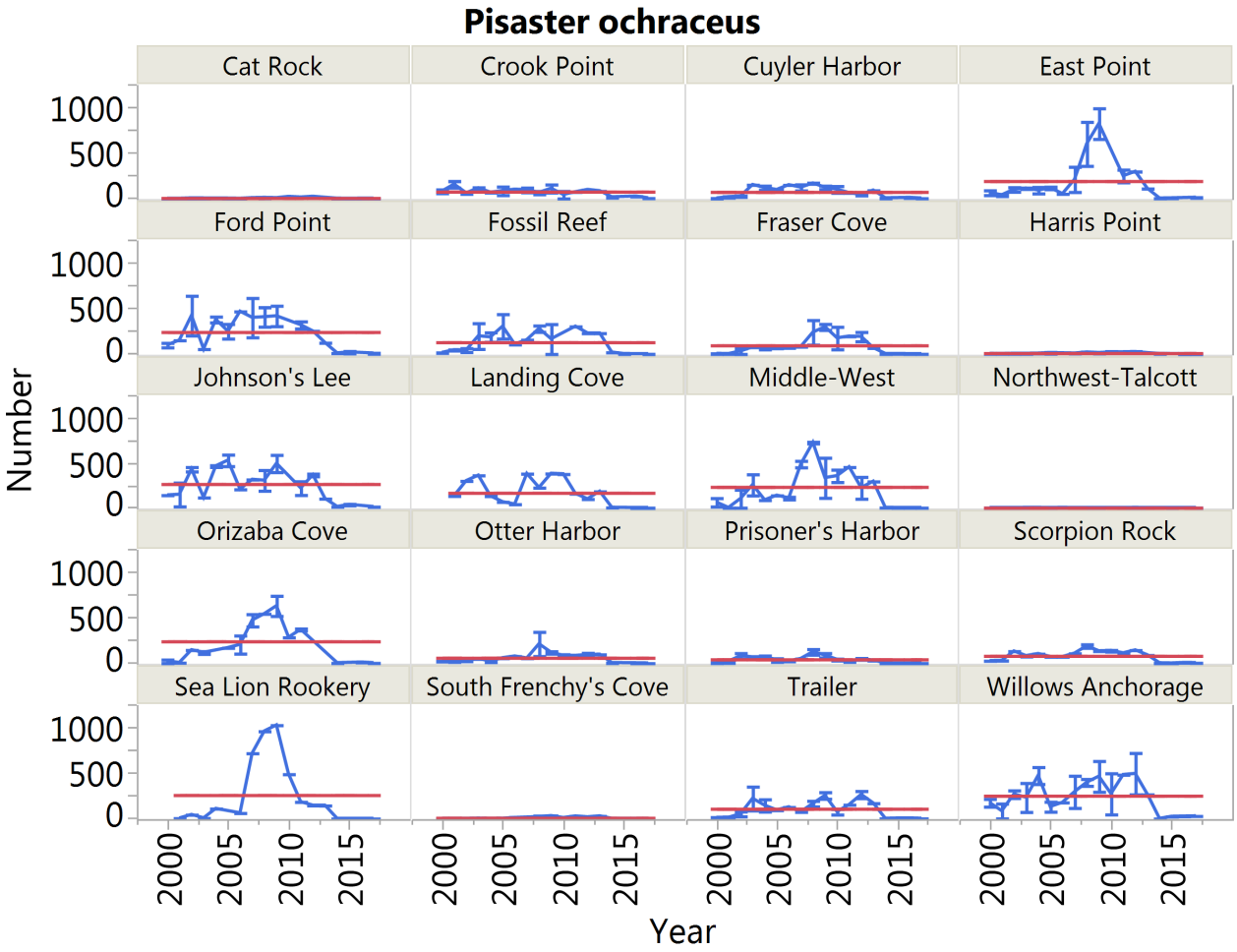


Figure 38. Sea star (*Pisaster ochraceus*) counts at each site from 1999 to 2018 in Channel Islands National Park. Count data were obtained from 30-minute timed searches. Blue wavy lines represent the number of *P. ochraceus* and horizontal red lines indicate the long-term mean number of *P. ochraceus* at each site.

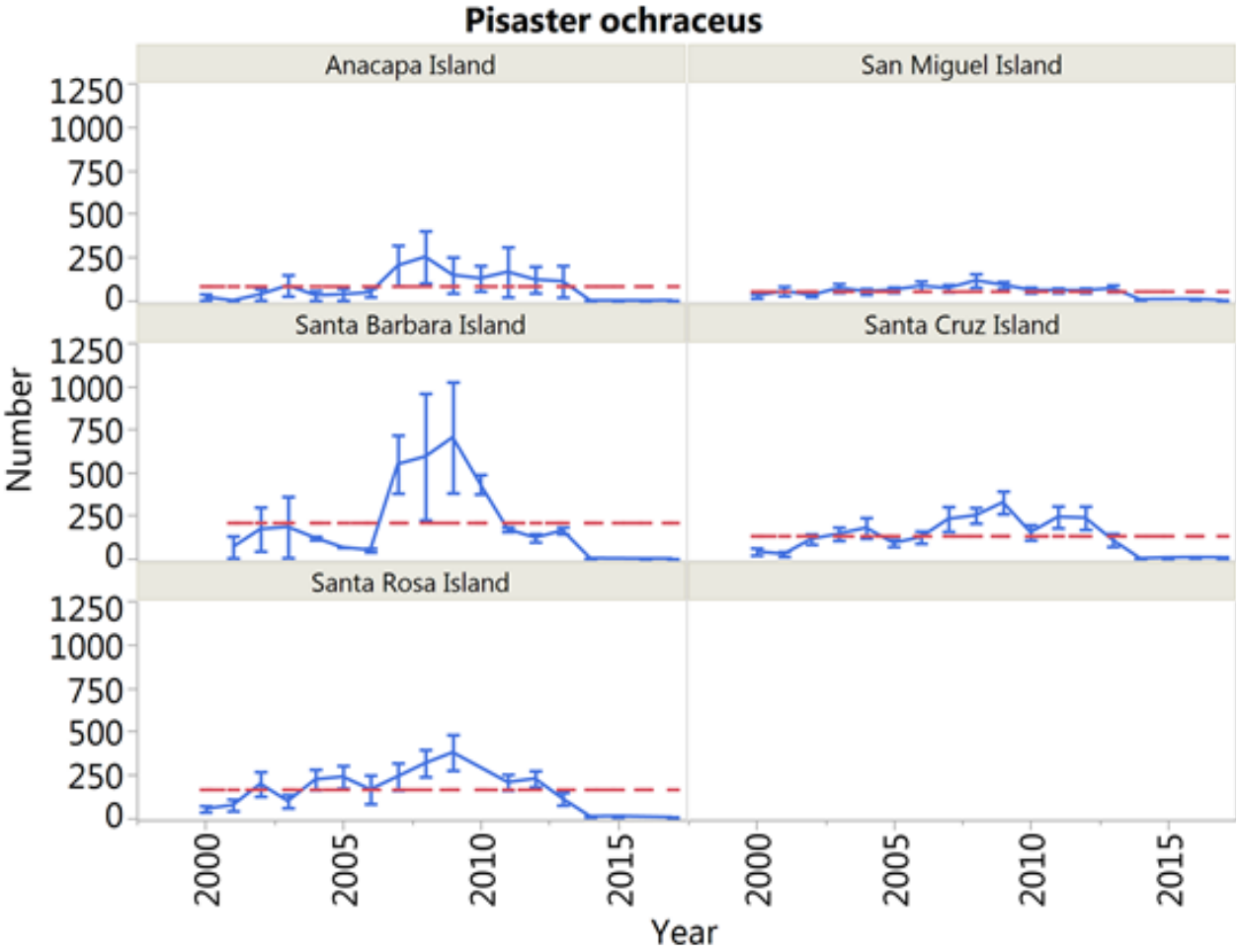


Figure 39. Sea star (*Pisaster ochraceus*) counts at each island from 2000 to 2018 in Channel Islands National Park. Count data were obtained from 30-minute timed searches. Wavy blue lines represent the number of *P. ochraceus* and horizontal red dashed lines indicate the long-term mean number of *P. ochraceus* at each site.

Beginning in June 2013, a disease event swiftly and significantly impacted *Pisaster ochraceus* and other species of sea star 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 was tied to sea star wasting syndrome (SSWS), also called sea star wasting disease (SSWD). The syndrome 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 sea star-associated 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, animals that appeared outwardly healthy 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 agent for the disease.

Size frequency measurements for *Pisaster ochraceus* were collected at all sites sampled in 2017–2018. 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 2017–2018, size data for each island and site are displayed in Figures 40–43. Note that sites are lumped across islands. Even though abundances were low, the presence of small juvenile (e.g., <50 mm) *P. ochraceus* was documented at many of the monitoring sites.

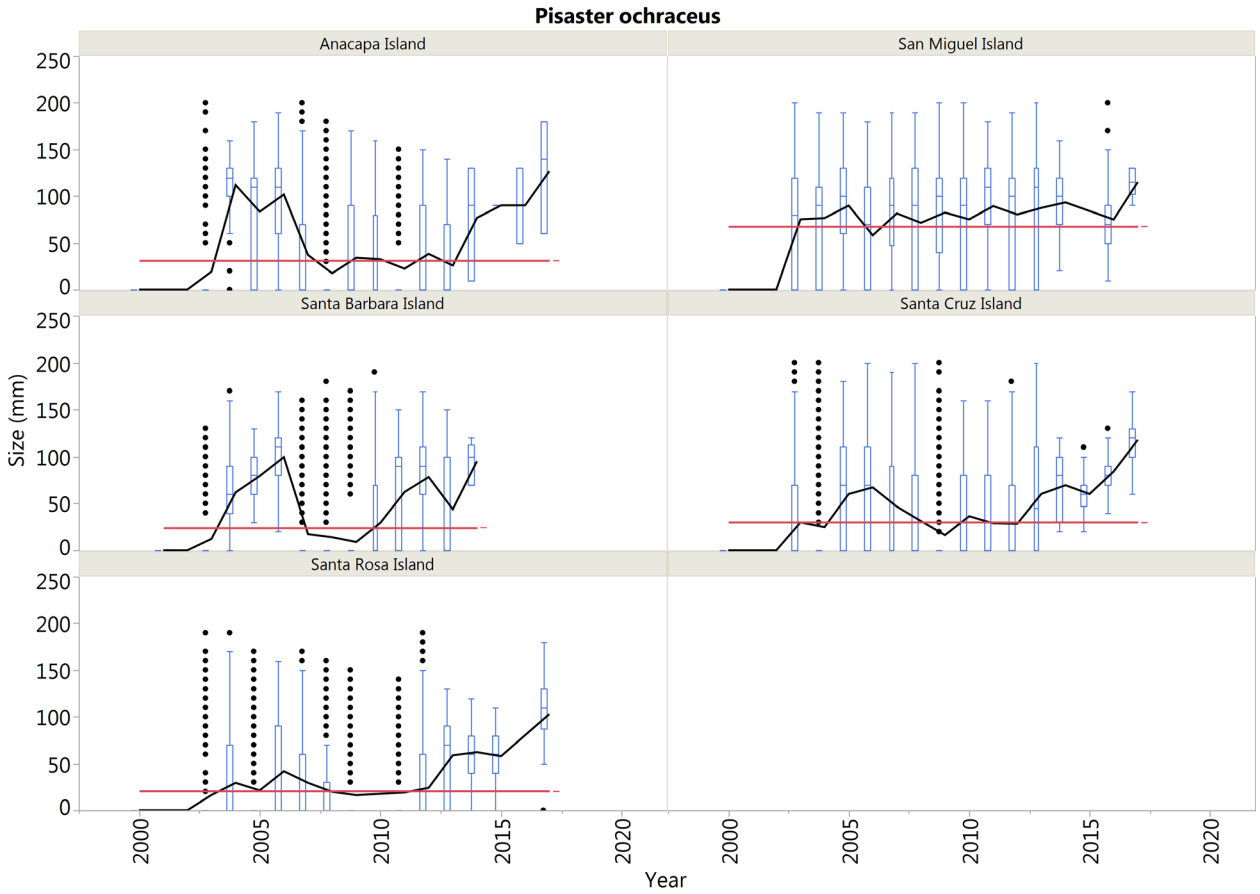


Figure 40. Box plots for annual size frequency distributions of sea stars (*Pisaster ochraceus*) at each island from 2000 to 2018 in Channel Islands National Park. Black lines represent mean sizes of *P. ochraceus* at each island pooled across sites. Horizontal red line represents the cumulative mean. Note that low abundances of *P. ochraceus* were observed at nearly all sites in 2017–2018.

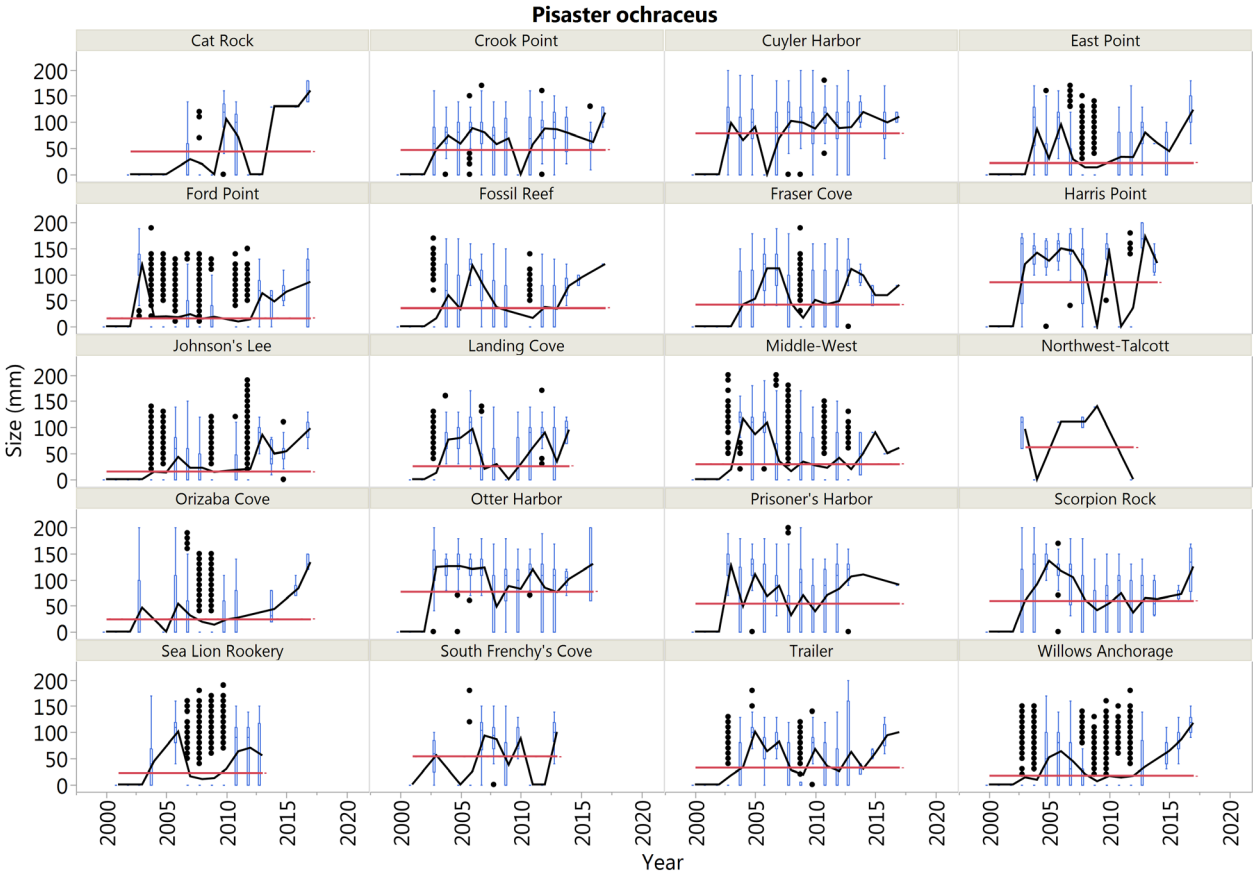


Figure 41. Box plots for annual size of sea star (*Pisaster ochraceus*) at each site from 2000 to 2018 in Channel Islands National Park. Wavy black lines represent mean sizes of *P. ochraceus* at each site. Horizontal red lines represent the cumulative mean.

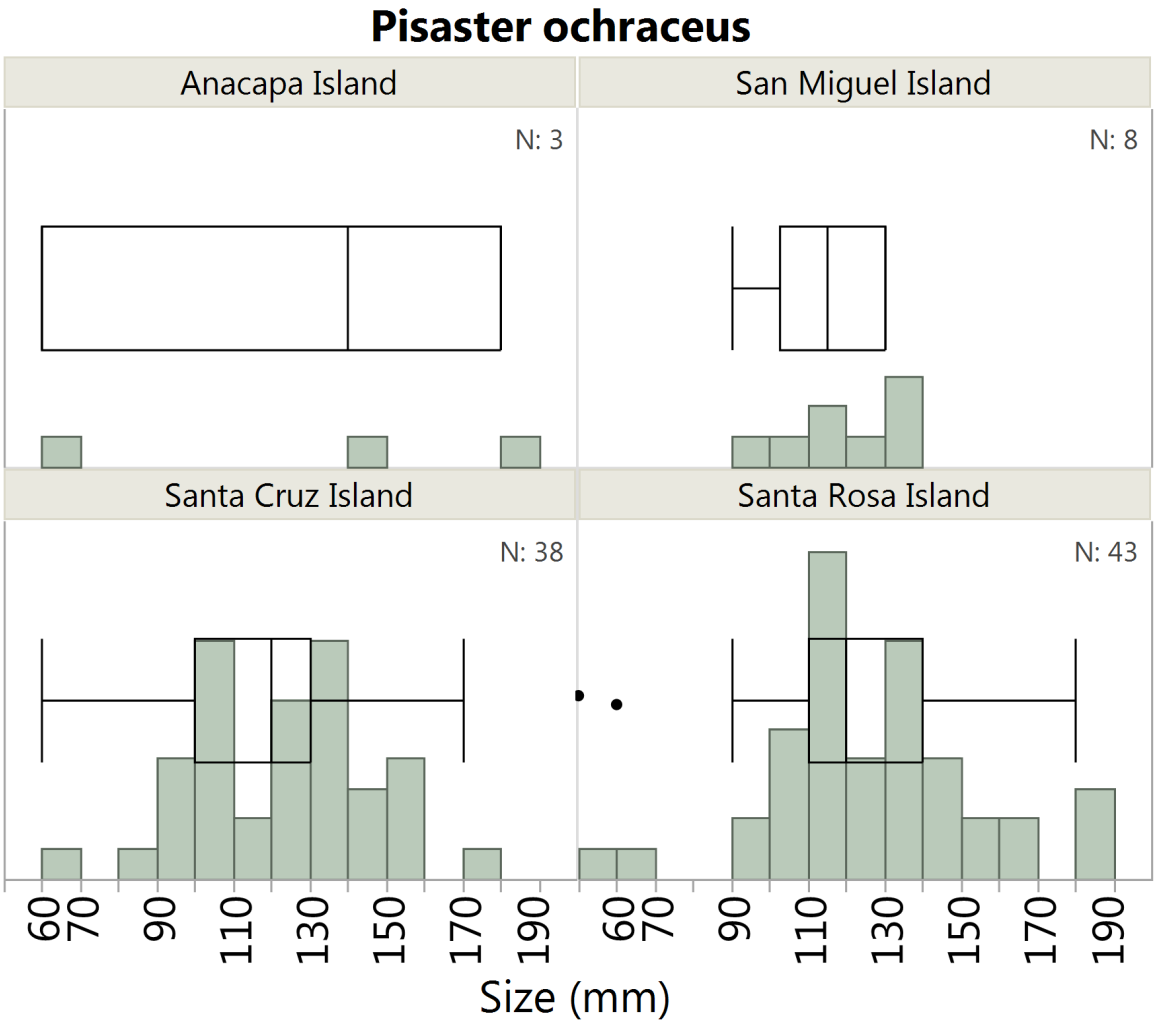


Figure 42. Sea star (*Pisaster ochraceus*) size distributions at each island measured in 2017–2018 in Channel Islands National Park. Box-and-whisker plots indicate the spread and degree of skewness of the size frequency data. The ends of the boxes represent the 25th and 75th quartiles, the vertical line 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.

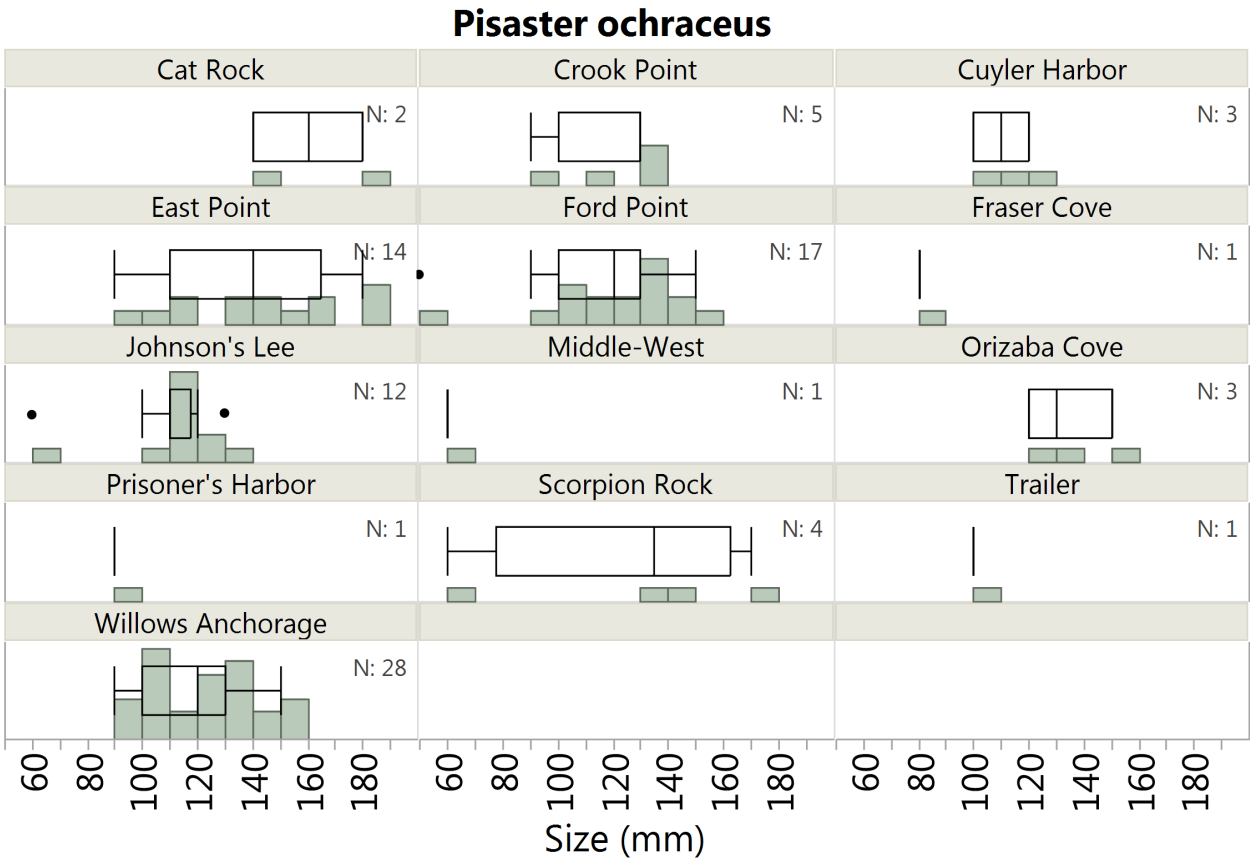


Figure 43. Sea star (*Pisaster ochraceus*) size distributions at each site measured in 2017–2018 in Channel Islands National Park. Box-and-whisker plots indicate the spread and degree of skewness of the size frequency data. The ends of the boxes represent the 25th and 75th quartiles, the vertical line 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 some sites are not displayed because they had zero *P. ochraceus* in 2017–2018.

Mytilus californianus *shell length and bed depth*

Mussels (*Mytilus californianus*) shell length and bed depth measurements were obtained at each site annually since 2014 (Figures 44–45). At the island level, in 2017–2018, the range and median sizes of mussels appeared comparable to 2014 measurements at all islands. Note that Santa Barbara Island data are not available. Median bed depth measurements in 2017–2018 also appeared similar to measurements obtained in previous years at all islands.

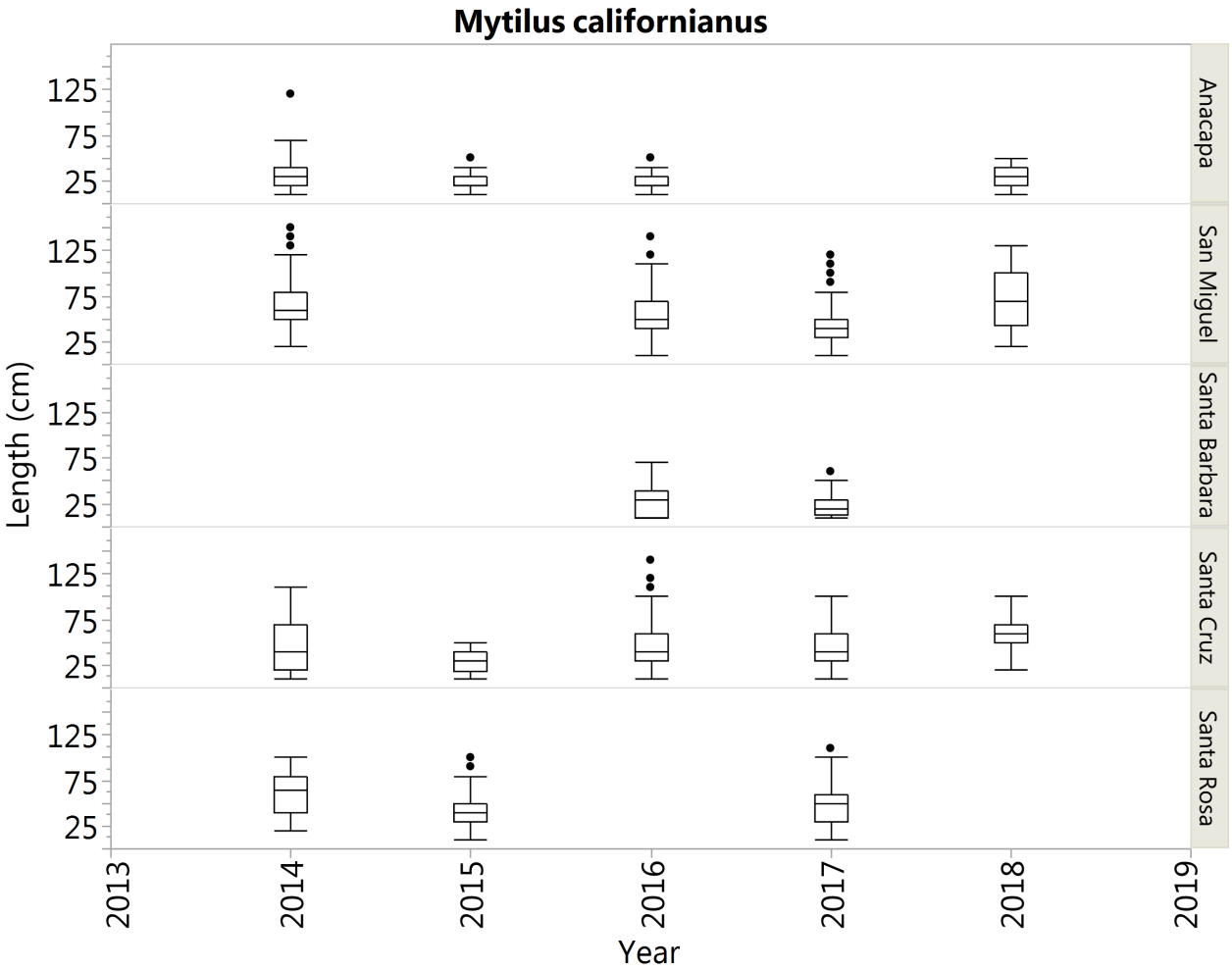


Figure 44. Shell length measurements for mussels (*Mytilus californianus*) summarized across plots and sites for each island from 2014 to 2018 in Channel Islands National Park.

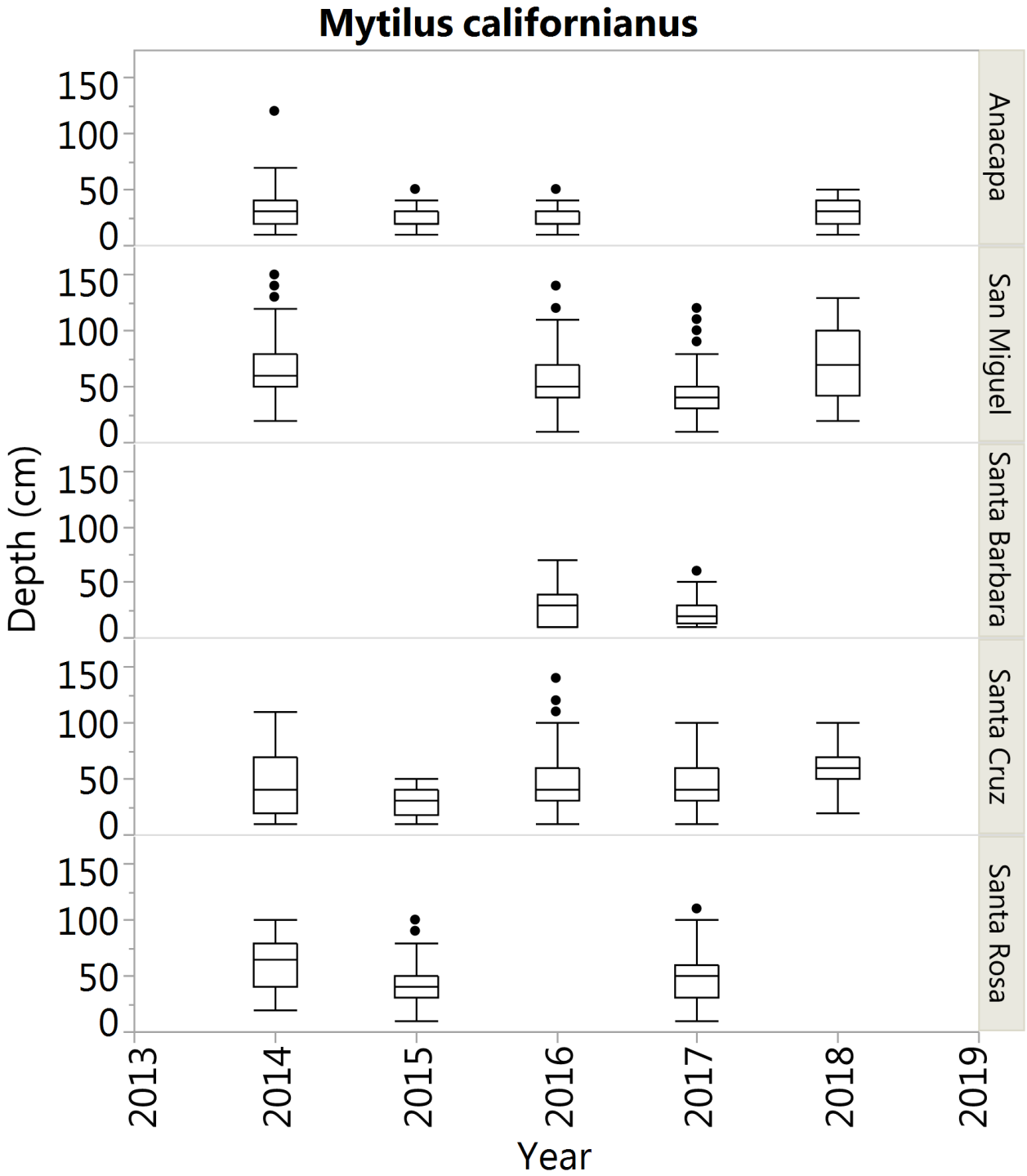


Figure 45. Bed depth measurements for mussels (*Mytilus californianus*) summarized across plots and sites from 2014 to 2018 for each island in Channel Islands National Park.

Phyllospadix spp.

Surfgrass (*Phyllospadix* spp.) 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 46–47). 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 *Phyllospadix 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 2017–2018, all transects were successfully sampled at all monitoring sites except East Point. Hazardous conditions due to large waves prevented us from safely sampling the transects at East Point.

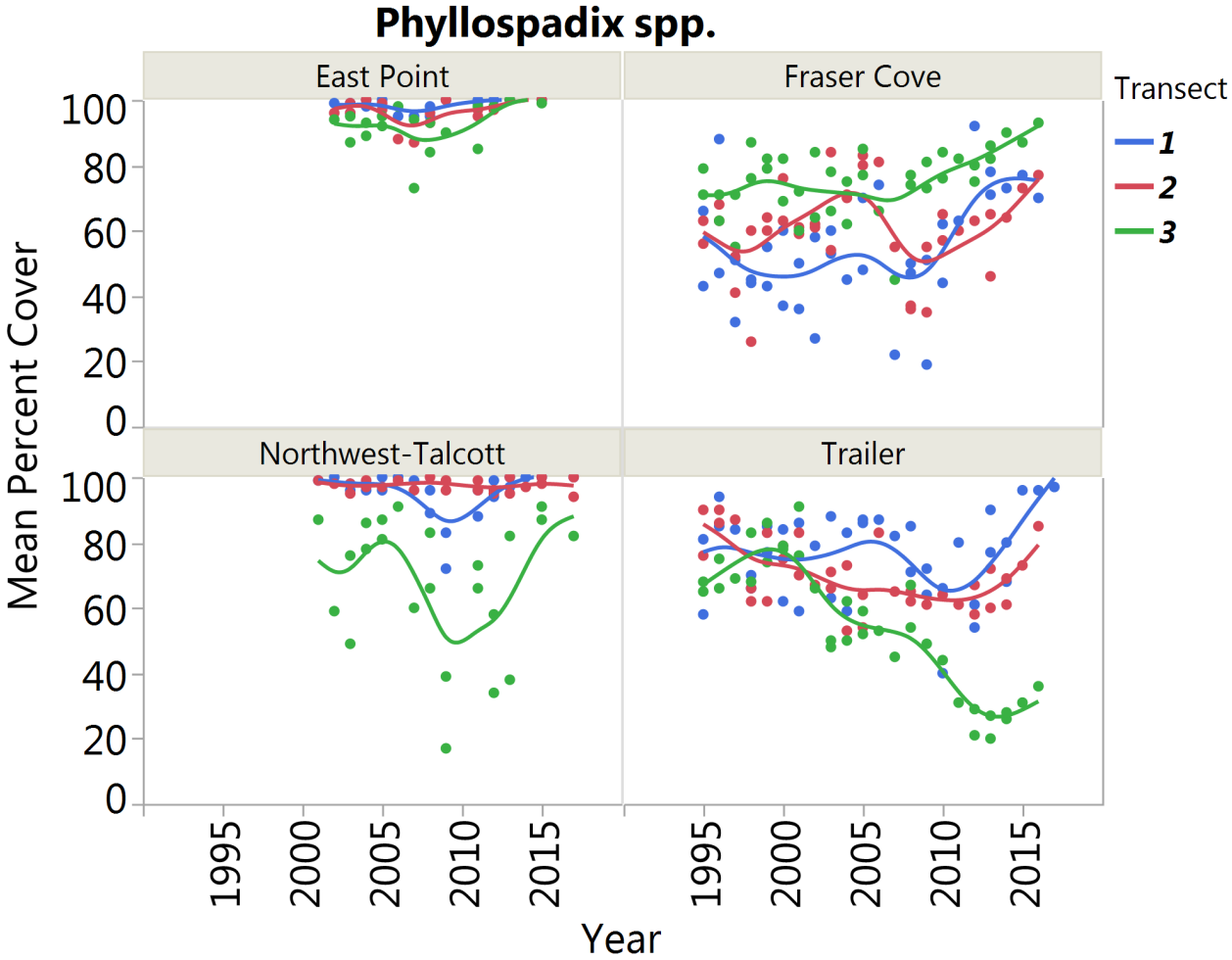


Figure 46. Mean percent cover of surfgrass (*Phyllospadix* spp.) at each site from 1995 to 2018 in Channel Islands National Park. Note that *Phyllospadix* was not monitored at East Point in 2017–2018.

Strong seasonal patterns have been observed over the years at the two Santa Cruz Island sites, where surfgrass overstory cover has routinely declined in spring and increased in fall. In 2017–2018, 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 fifth consecutive year. At Trailer, surfgrass cover has been below average since at least 2010. This year cover increased well above the long-term mean (Figure 47). 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 45–80% at Fraser Cove and approximately 50–75% at Trailer.

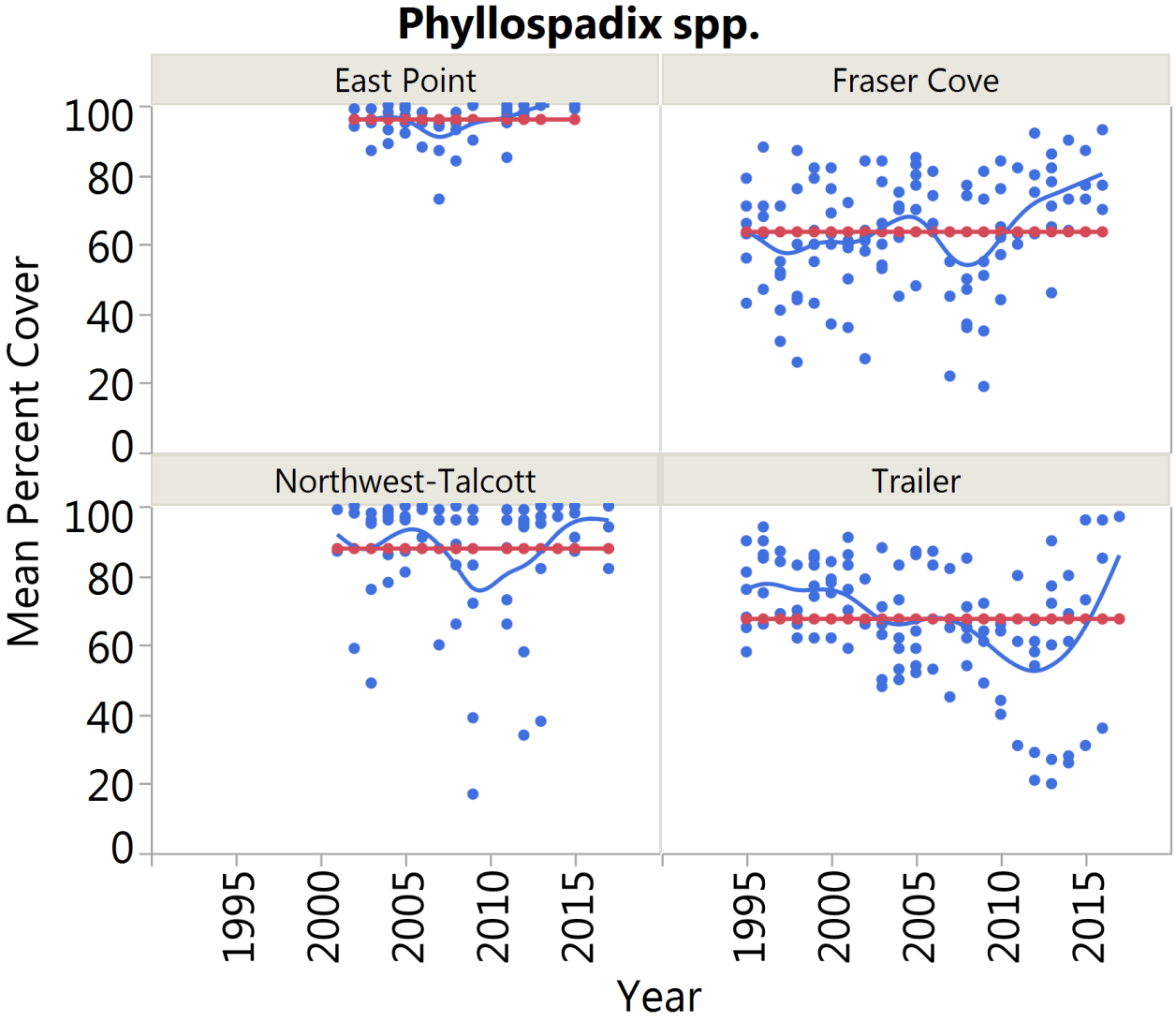


Figure 47. Mean percent cover of surfgrass (*Phyllospadix* spp.) pooled across transects at each site in Channel Islands National Park. Blue wavy lines represent the mean percent cover trend for *Phyllospadix* spp. and horizontal red lines indicate the long-term mean percent cover of *Phyllospadix* spp. at each site from 1995 to 2018.

Santa Rosa Island sites East Point and Northwest-Talcott typically have not displayed a strong seasonal pattern in *Phyllospadix* spp. abundances. Instead, surfgrass cover on all three transects at East Point and cover on two transects at Northwest-Talcott have remained relatively stable over time. Transect-3 surfgrass at the latter site has fluctuated markedly over the monitoring period, declining rapidly several times by as much as 40% followed by gradual increases in cover. In 2017–2018, surfgrass overstory cover at East Point was not quantitatively assessed but cover appeared to be 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.

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 2017–2018. Red algae abundances averaged across the three transects at the two sites was approximately 10% at both sites (Figure 48). 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.

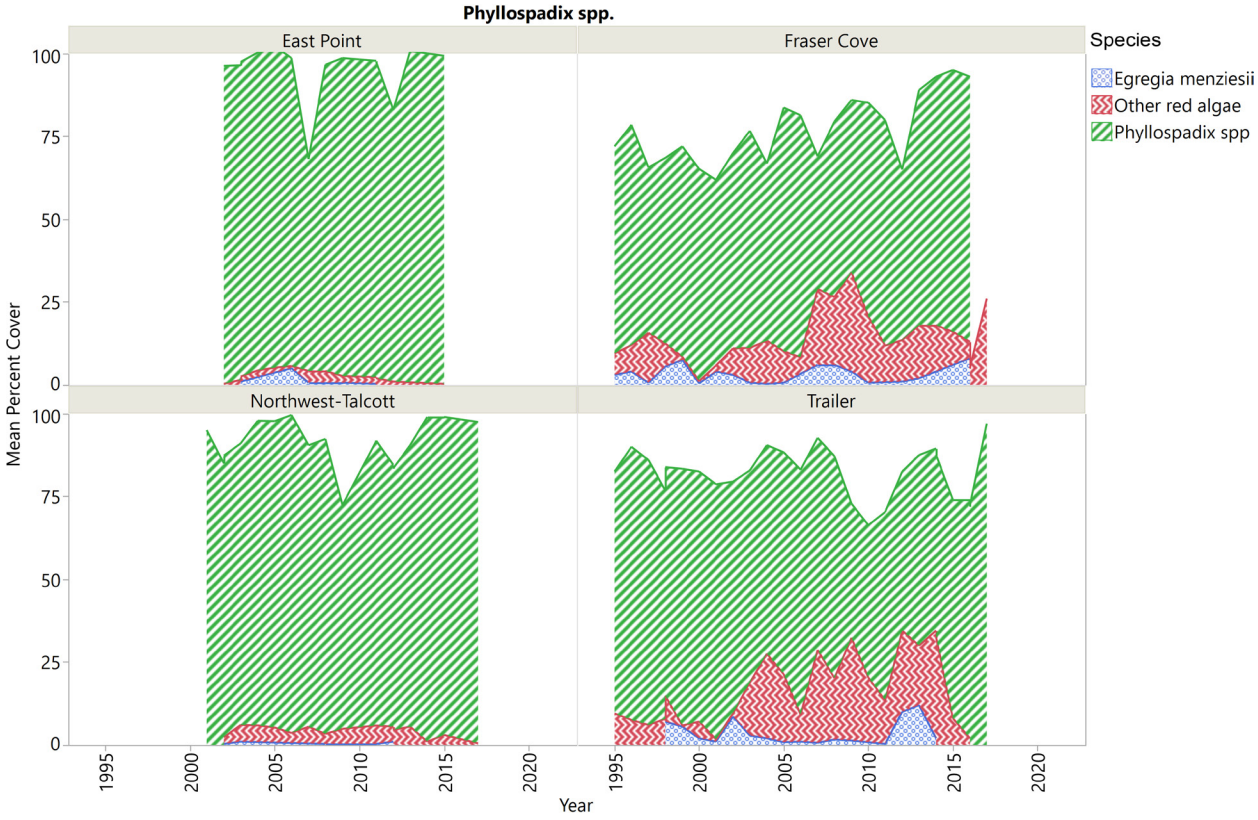


Figure 48. Surfgrass (*Phyllospadix* spp.) cover at all sites in Channel Islands National Park. Colored areas represent the mean percent cover for *Phyllospadix* spp. and other dominant taxa from 10 m point intercept transects.

The overall condition of surfgrass at the two sites on Santa Cruz Island 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 Island, 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 2017–2018 field season is summarized in Table 2. Overall, the abundances and diversity of shorebirds this year at all sites appeared similar to observations made in recent years with

the exception of slightly elevated numbers of cormorants (*Phalacrocorax* spp.) observed at Crook Point, East Point and Fossil Reef (Figure 49). Likewise, there were no marked changes to the abundances of pinnipeds observed in 2017–2018 (Figure 50). Although the number of California sea lions was higher relative to the counts in 2015 and 2016.

Table 2. Maximum number of shorebirds and pinnipeds observed at monitoring sites in 2017–2018, with the exception of sites where no birds or mammals were observed.

Site Name	Black Oyster-catcher (*Haematopus bachmani*)	Black Turn-stone (Arenaria melanocephala)	California Sea Lion (*Zalophus californianus*)	Cormorants (*Phalacrocorax* spp.)	Harbor Seal (*Phoca vitulina*)	Northern Elephant Seal (*Mirounga angustirostris*)	Western Gull (*Larus occidentalis*)
Cat Rock	1	–	–	–	–	–	–
Crook Point	3	–	1	36	–	–	–
Cuyler Harbor	2	–	2	–	–	–	–
East Point	–	–	–	40	–	–	–
Ford Point	4	–	–	–	–	1	–
Fossil Reef	4	–	–	50	–	3	–
Fraser Cove	5	–	–	–	–	–	–
Harris Point	3	–	1	–	3	–	–
Johnson's Lee	–	–	1	–	1	–	–
Landing Cove	2	6	140	–	–	–	–
Middle-West	–	–	–	–	1	–	–
Northwest-Talcott	–	–	–	–	–	–	3
Orizaba Cove	2	–	–	–	–	–	–
Otter Harbor	–	2	3	18	30	1	–
Prisoner's Harbor	8	–	–	–	1	–	–
Scorpion Rock	5	–	–	–	1	–	–
Sea Lion Rookery	2	1	175	–	–	–	6
Trailer	3	–	–	–	–	–	–

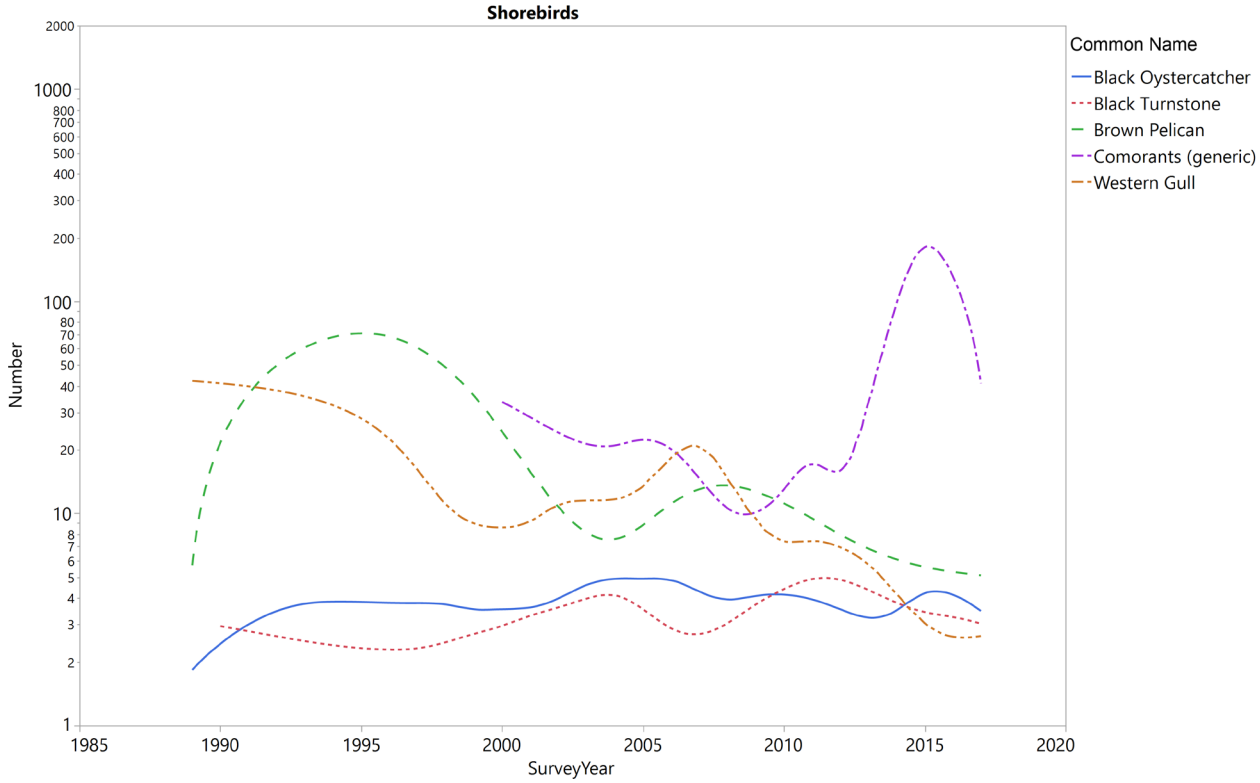


Figure 49. Maximum number of shorebirds pooled across sites at each of the five Channel Islands monitored. Note that data are displayed on a logarithmic scale.

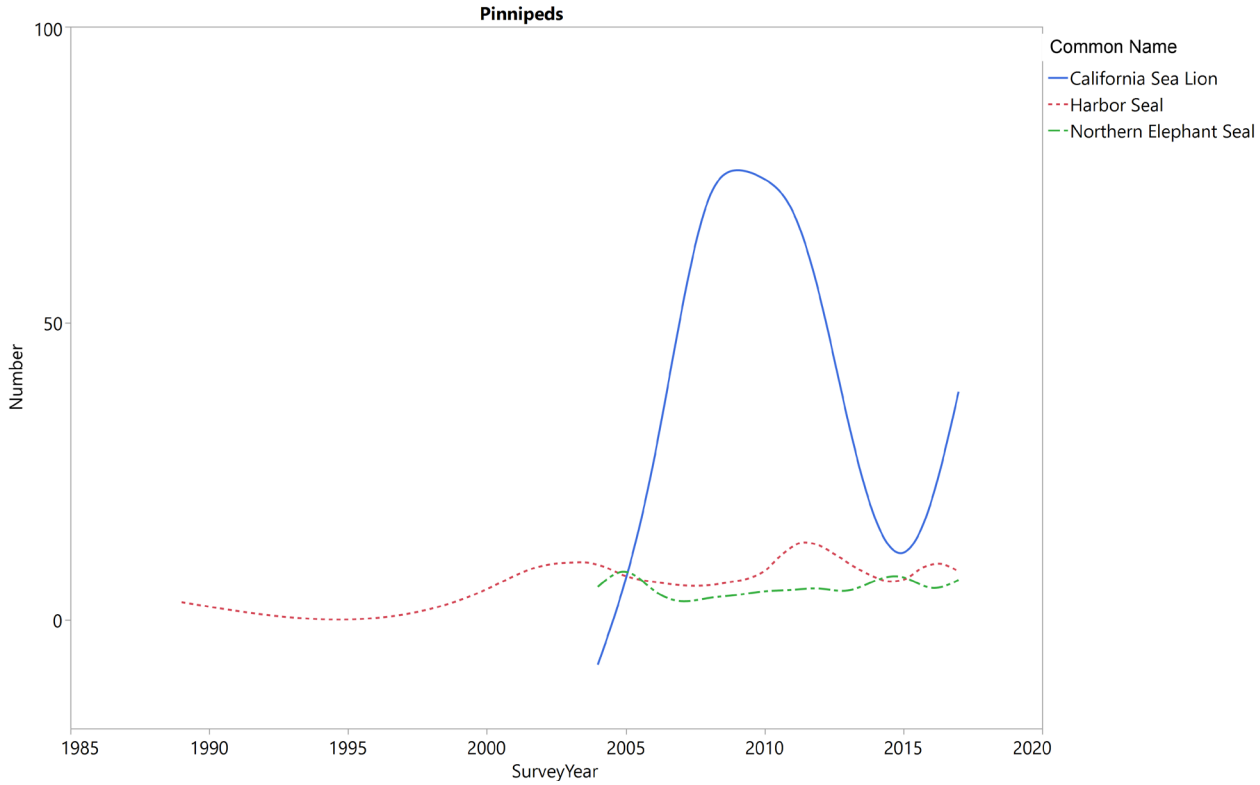


Figure 50. Mean number of pinnipeds pooled across sites at each of the five Channel Islands monitored.

Black oystercatchers were again the most ubiquitous shorebirds at the rocky intertidal sites. With the exception of five sites (Anacapa Middle West, East Point, Johnson's Lee, Northwest-Talcott and Otter Harbor), at least one black oystercatcher was present at each site. In contrast to past years, relatively large flocks of black oystercatchers were not observed at any of the sites this year.

American oystercatchers (*Haematopus palliates*) have gradually become more common at the islands in recent years. However, in 2017–2018, no American oystercatchers were sighted.

Black turnstones were not common in 2017–2018 compared with previous years. They were only seen at three sites (Landing Cove, Otter Harbor and Sea Lion Rookery); abundances ranged from 1 to 6 per site.

Less common shorebirds, such as wandering tattlers (*Tringa incana*) and willets (*Tringa semipalmata*), are occasionally seen on the reefs, while black-bellied plovers (*Pluvialis squatarola*) and snowy plovers (*Charadrius nivosus*) usually inhabit adjacent beaches. Seabirds such as cormorants, gulls, pelicans and occasionally pigeon guillemots (*Cepphus columba*), 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 2017–2018, gulls were less common than usual since they were only present at eight sites. Abundances ranged between 1 and 12 individuals per site at all locations where gulls were seen.

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 40 cormorants were seen at East Point. At Crook Point, 36 cormorants were observed roosting on the reef. Fifty cormorants were seen at Fossil Reef.

Harbor seals were observed at or within the immediate vicinity of six sites; abundances ranged from 1 to 30. The greatest number of seals was seen at Otter Harbor (a commonly used haul out for harbor seals). Abundances in 2017–2018 were comparable to counts obtained in past years.

Northern elephant seals 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 as adults coming ashore to molt. In 2017–2018, elephant seals were seen at three sites; abundances ranged from 1 to 3 individuals per site. The greatest number of elephant seals was seen at Fossil Reef. Abundances this year were comparable to counts obtained in past years at most locations except for San Miguel Island sites, which had slightly fewer seals relative to past years.

California sea lions (*Zalophus californianus*) were common (approximately 175) at the aptly named Sea Lion Rookery on Santa Barbara Island, as well as at the other site (Landing Cove) sampled on the island, where 140 individuals, mostly juveniles, were observed. One to two sea lions were also

seen nearby Crook Point, Cuyler Harbor, Harris Point, Johnson's Lee and Otter Harbor. At other locations, abundances this year were considered average relative to past years.

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Appendix A. Program Notes

Compared with the last several years, which were defined by the warm water phenomenon termed "the blob" followed by one of the strongest El Niño events on record, this year was relatively benign in terms of ecological stress. Qualitatively, the condition of biological communities appeared to have improved at most sites. Red algae such as *Endocladia muricata* and *Chondracanthus canaliculatus* along with the sessile invertebrates, *Mytilus californianus* and various species of barnacles were noted as abundant and healthy in appearance nearly everywhere. Even *Silvetia compressa*, which has declined significantly at most locations, appeared to improve as relatively high recruitment for the species was observed. This year was also a good one for the recovery of black abalone, *Haliotis cracherodii*. Nearly all but four sites experienced increases in the abundance of *H. cracherodii* relative to the long-term mean generated from post-1995 data and juveniles were present at all islands except Santa Barbara.

The monitoring effort also benefited from the relatively placid conditions. With below-average precipitation and few winter storm events, we were able to conduct most trips without failure or need for rescheduling. As a result, all sites were sampled this field season (2017–18). Rough conditions generated from swell and surge only affected site searches for black abalone and sea stars at a few sites. Additionally, we were unable to assess the three surfgrass transects at East Point due to hazardous sea conditions.

Time was secured on the CINMS NOAA Vessel Shearwater this year to assist with several of the monitoring sites that require vessel access. All three of the Anacapa Island sites were accessed via the Shearwater. We used the NPS vessel Sea Ranger II to access one of the other sites, Orizaba Cove, that traditionally has required a vessel. A combination of Island Packers and kayaks were used to access Scorpion Rock.

The annual MARINe workshop was held at Cabrillo Marine Aquarium in Los Angeles, CA, this year. Stephen Whitaker represented the NPS at the workshop and provided an update to the group regarding the recent intertidal related work accomplished and planned at the west coast-based parks. Discussions centered on sea star wasting disease and assessment of long-term protocols.

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. Last year, *C. ustulatus* appeared to have spread to other locations throughout Northwest-Talcott, along with areas east of the site where it occupied patches several square meters in area. *Caulacanthus* was also observed for the first time in 2015 at Fossil Reef. The invasive alga was seen within and nearby plot 610, encompassing an area approximately 1–2 square

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 California, Mexico, and around the following islands: San Clemente, Catalina, Santa Barbara, Anacapa, and Santa Cruz. *Sargassum 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, Associate Professor, California State Polytechnic University, Pomona, personal communication with S. Whitaker). 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 portion of several fixed photo plots and other areas in the mid and lower intertidal.

We did not receive any data requests in 2017.

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.

The Kelp Forest Monitoring (KFM) crew conducted several dives in shallow subtidal habitat around Platt's Point on the north side of Santa Cruz Island to search for black abalone presence. Notes (see below) regarding these surveys have been documented in the 2017 annual report for KFM:

> The coordinates for Platt's Point are N 34º 02.8949 W 119º 43.8341. On 9/28/2017 there were substantial populations of intertidal and subtidal *Haliotis cracherodii, Haliotis fulgens,* and *Haliotis rufescens* in the small cove at 34º 2'52.65"N, 119º 43'47.28"W. This was a small but deep cove that faces the northwest, that likely experiences much wave action. The calm conditions of the day were the reason we were able to survey the abalone populations. This cove was surveyed at about 1200 during a positive 3ft tide. David Kushner and Kenan Chan surveyed the entire cove. In the cove, we counted at least 250 *H. cracherodii* at a depth of 5 to 7 feet. These *H. cracherodii* ranged in size from 50 and 150mm. Subtidal *H. cracherodii* were counted in two groups. The first part of the cove before it narrows at a depth of 9 to 13 feet; we counted more than 30 mostly large (100–150mm and one individual between 65–100mm) *H. cracherodii* in aggregations of 3 to 6 individuals. In the second group, after the cove narrows, we counted 91 subtidal *H. cracherodii* between 70–150mm at a depth of 8 to 11 feet. In about 60 minutes of surveying in the shallows between 1 and 5 feet, at least 14 *H. cracherodii* in all sizes from 25 to 90mm were observed. In 5 to 15 feet, at least 20 medium sized *H. rufescens* were observed out in the open. From the Platt's site, we collected 60 *H. cracherodii* shells between 14 and 114mm with all sizes in-between. Most *H. cracherodii* shells were found at a depth of 1 to 15 feet. We

collected 10 *H. corrugata* shells between 17 and 92mm. We collected 5 *H. rufescens* between 27 and 113mm. The shells sizes are as follows in Table A1:

Table A1. Shell sizes observed at Platt's Point.

Species	Fresh shells in mm	Old shells in mm
Haliotis cracherodii	14, 19, 23, 24, 26, 27, 28, 28, 28, 29, 29, 30, 30, 31, 33, 33, 33, 34, 35, 35, 35, 35, 35, 36, 37, 37, 44, 47, 51, 56, 56, 63, 64, 65, 71, 72, 73, 74, 75, 84, and 97 (41 total)	31, 34, 36, 38, 40, 41, 48, 59, 61, 70, 70, 73, 73, 74, 81, 85, 86, 90, and 114 (19 total)
Haliotis rufescens	27, 66, 86, and 113 (4 total)	65 (1 total)
Haliotis corrugata	17, 25, 26, 29, 53, 61, 74, 78, and 92 (9 total	92 (1 total)
Haliotis fulgens	35 (1 total)	None found

On 9/28/2017 northeast of the Cavern Point KFM site on the inshore side, we completed a survey dive looking for subtidal abalone populations. Time was about 1535 and a tide of positive 4 feet. Conditions were not calm enough to conduct a thorough survey. In addition, there were very dense *Egregia menziesii* and *Eisenia arborea* making it difficult to adequately survey. We counted 37 *Haliotis cracherodii* between 150–180 mm, most had very clean, perfect shells. Two fresh *Haliotis fulgens* shells were found at 112 and 116 mm as well as one fresh *H. cracherodii* at 134 mm. At about 20 feet, Cullen Molitor observed one live *H. fulgens* at roughly 100 mm.

At Potato Pasture, SCI on 9/27/2017, Cullen Molitor and David Kushner swam to the *Haliotis cracherodii* spot east of the transect to look for subtidal *H. cracherodii*. Overall there appeared to be fewer *H. cracherodii* than past observations. We only observed several *H. cracherodii* in the low intertidal zone around 3 feet underwater during a 3 feet positive tide. None were observed any deeper. We did observe 4 live *Haliotis fulgens* (around 100 mm) at a depth of 8–10 feet. We also found three *H. fulgens* shells at 50, 102, and 102 mm. Several fresh and old *H. cracherodii* shells were observed.

Appendix B. Trip Reports

The following are trip reports from the rocky intertidal monitoring 2017–2018 field season (November 2017 through April 2018). 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.

Santa Barbara Island, November 2–3, 2017

(Event #2017-18-A)

Prepared by Stephen Whitaker

Personnel

- Stephen Whitaker, Marine Ecologist, Channel Islands National Park
- Luis Hernandez, Technician, UCSC
- Adri Sparks, Technician, UCSC
- Kenan Chan, VIP

Procedure and General Observations

Standard procedures were used for monitoring rocky intertidal sites. All plots (except for the red turf algal plots at Landing Cove) and site overviews were photographed with an Olympus Tough TG-5 digital camera. All photoplots were scored in the field. Counts were not made of motile invertebrates inside the photoplots. Searches were conducted to count sea stars and black abalone at both sites. The maximum number of shorebirds and pinnipeds observed at each site was recorded. We came out to the island on the Ocean Ranger in combination with a specially-scheduled trip to pump water onto the island for the seabird crew and to provide an opportunity for USFWS personnel to see the island and learn about the resources.

2 November 2017. Sea Lion Rookery.

Low tide 0.1 ft at 1456 hrs. For the first time in several years, the conditions during this trip were fantastic due to the reduced swell in the water and the light breeze. Despite the positive tide, the site was mostly dry the entire afternoon.

There were 2 black oystercatchers,1 black turnstone and 6 western gulls on the reef in addition to approx.175 sea lions (mostly juveniles) that stayed in the water close to shore. We were on site from 1315–1700 hrs.

Luis, Adri and Kenan photographed the plots. Most of the plots were located with relative ease since nearly all plots had three bolts marking the locations of corners. Unlike past recent years when *Mytilus* plots were challenging to locate due to high cover of *Mytilus* obscuring the locations of bolts, this year, *Mytilus* was significantly reduced allowing us to quickly and easily locate all five plots. Site panoramas were photographed by Luis.

Stephen scored all plots in the field. As in past years, many of the plots appeared to be heavily disturbed as a result of trampling from the sea lions and were composed largely of turf algae (*Gelidium, Chondracanthus, Mazzaella, Ulva*). There were no distinct biotic zones throughout the site, but the rockweed (*Silvetia compressa deliquescens*) beds appeared healthy and intact. As usual the site was dominated by *Ulva*.

Kenan searched for *Pisaster ochraceus* and abalone for 30 minutes throughout the site. Zero P. ochraceus were observed. N = 1 black abalone (134 mm) was located just outside black abalone plot 341. All five black abalone plots were surveyed. For reference, in November 2016 and January 2015, there were no abalone or sea stars (besides one *P. giganteus*) seen at the site either. In fall 2013, N = 144 *P. ochraceus* and zero abalone were observed. In fall 2012, N = 143 *P. ochraceus* were counted and N = 0 black abalone were seen.

The field log was completed by Stephen. Several plot repairs were made; all plots now have three bolts including all the *Mytilus* plots.

Barnacle plots only averaged 9% (7.6% measured in November 2016) *Balanus/Chthamalus* cover. The majority of point contacts in the five plots were bare rock and *Ulva* (mean = 25.8%). *Endocladia* plots had 14.4% (16.2% measured in November 2016) mean *Endocladia* cover along with 23.8% *Ulva* and 27.8% *Mazzaella* among other less common taxa. Rockweed plots averaged 42.4% (35.4% measured in November 2016) *Silvetia compressa deliquescens* and 13% *Mazzaella* along with scarce amounts of several other taxa. Mussel (*Mytilus californianus*) plots had 0.4% (0% measured in November 2016) mean cover. The majority of cover in the five plots was occupied by articulated corallines (mean = 27.4%) and *Halidrys* (mean = 27.8%).

Mussels were measured in the five *Mytilus* plots by Adri and Luis. Sizes of mussels ranged 10–40 mm and mussel bed depths ranged 1–3 cm; all plots were monolayers.

Sargassum horneri was abundant (100s of thalli seen) in the lower intertidal and within most pools. *S. muticum* was less abundant than *S. horneri* but still quite ubiquitous. *Silvetia* (subsp *deliquescens*) appeared healthy and reproductive with a moderate level (dozens of individuals) recruiment seen. *Endocladia* appeared healthy with only light bleaching. *Ulva* was abundant but perhaps reduced in cover relative to recent past years. *Chthamalus* and *Balanus* were relatively uncommon. *Tetraclita* was much more abundant relative to the other barnacle species abundances. Very few purple urchins (approx. 50) were observed. *Chondracanthus canaliculatus* may have been the most dominant alga at the site. A small patch (2 sq m) of *Phyllospadix torreyi* was noticed near the surge channel at the center of the site. One black abalone was found; it has been a number of years since any black abalone were found here. *Laurencia pacifica* was relatively abundant in the *Mytilus* plots. *Mytilus* was rare everywhere including areas outside of the plots. *Mytilus galloprovincialis* (several individuals) was very likely identified.

11 November 2017. Landing Cove.

Low tide -0.34 at 1537 hrs. We experienced excellent conditions due to minimal swell and wind which provided adequate time to complete all protocols and access the entire site safely and

effectively. Two black oystercatchers and 6 black turnstones were observed at the site at various times throughout the day. Additionally, there were approx. 140 juvenile California sea lions in the cove on the adjacent reefs and water.

Adri and Luis worked together to photograph the plots on the south side of the site. Most of the photo plots were located with relative ease with the exception of 326. Numerous plots were missing corner markers: A third bolt was added to plots 310–314 and 326. All plots should now have three bolts marking the locations of the plot corners.

Two temperature loggers were installed at the site: one above the site to record air temperature and another in the mid intertidal for sea surface temperature. The logger in the mid intertidal was installed in the Mytilus bed between plots 327 and 328. The other logger was installed directly above the site approx. 2m towards the ocean from the 4th fencepost counting from the left (south). The logger was placed under a small rock overhang approx. 7.8m towards the cove from the 1st fence post from south and 17.8m up the cliff from the LL corner of plot 315.

Stephen scored all the plots south of the pier. North of the pier, only the *Silvetia* plots were photographed and scored. The red algal turf plots are no longer sampled. The decision was made in 2015 during our second program review to stop monitoring the plots since they are considered "orphan plots" and are not replicated at other sites.

Adri and Luis searched for sea stars throughout the reef located south of the pier. Zero *Pisaster ochraceus* were seen throughout the site. For reference, in November 2016, N = 0 *P. ochraceus* were observed and in January 2015, N = 3 *P. ochraceus* were seen throughout the site. Sizes were estimated to be 100–120 mm. The visit prior, in October 2013, Dan Richards counted N = 182 sea stars throughout the reef located south of the pier.

A thirty-minute search was conducted for black abalone (*Haliotis cracherodii*) presence by Adri and Luis. Zero black abalone were seen. For reference, in November 2016, zero black abalone were seen, in January 2015, one black abalone (126 mm) was observed hanging onto the edge of the reef near plot 315. Surprisingly, no other abalone were seen at the site. During the past several years, we usually saw 1–2 individuals in the crevice near the sea star transect, but we have not encountered them the last couple years.

After completely monitoring the south side of the site, Stephen and Kenan crossed the chasm to the 10 remaining plots on the north side of the cove. Stephen scored the five *Silvetia* plots while Hillary and Emily photographed the plots then assisted Kenan with the task of installing bolts. The red algal turf plots were not scored or photographed.

Barnacle plots were again nearly depleted of *Balanus/Chthamalus* cover (mean = 5.6%) (1.6% measured in February 2016) and appear to be transitioning to a community more representative of the mid to lower intertidal zone. In the barnacle plots, *Tetraclita* mean cover was 19.2% and *Mytilus* mean cover was 14% among other less abundant taxa. *Silvetia* plots were devoid of Silvetia except for plot 310 (cover = 3%) (only 1-2% measured in two plots in February 2016, all other plots = 0%). The *Silvetia* plots were instead dominated by *Mazzaella* (mean = 18.2%), *Chondracanthus* (mean =

13%) and *Gelidium* (mean = 12.8%). Mussel cover in *Mytilus* plots averaged 73% (78.2% measured in February 2016). Red turf plots were not sampled this year and likely will not be sampled in the future since they have been dropped from the sampling program.

Mussels were measured in the five *Mytilus* plots by Kenan and Luis. Sizes of mussels ranged 10–70 mm and mussel bed depths ranged 2–5 cm; all plots were monolayers. For reference, last year, sizes of mussels ranged 10–60 mm and mussel bed depths ranged 2–7 cm; all plots were monolayers.

Silvetia at this site is the subspecies *deliquescens*. One zebra perch was observed in the pool near the rockweed plots. *Silvetia* was rare south of the pier and only slightly more abundant (several dozen thalli) north of the pier. *Mytilus* was highly abundant but all individuals were small (10–50 mm). *Chthamalus* and *Balanus* were relatively uncommon compared to *Tetraclita*. *Mazzaella leptorhyncus* was mixed in with *Endocladia* and *Gelidium* making it challenging to score the barnacle plots. *Endocladia* was common. No sea stars or black abalone were seen. *Eisenia* and *Egregia* were both abundant along with *Halidrys*, particularly at the center of the site. *Phyllospadix torreyi* was abundant on the lower shore of the north site.

Santa Rosa Island, November 15–19, 2017

Prepared by Stephen Whitaker

Purpose

To monitor rocky intertidal sites at Santa Rosa Island.

Personnel

- Stephen Whitaker, Marine Ecologist, Channel Islands National Park
- Adri Sparks, Technician, UCSC
- Luis Hernandez, Technician, UCSC
- Hillary Krumbholz, VIP

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 Tough TG-5 12 Megapixel 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 poor low tide conditions. *Lottia gigantea* were sampled at all of the monitoring sites that have fixed plots. Motile invertebrates are no longer sampled at any of the monitoring sites. The maximum number of shorebirds and pinnipeds observed at each site was recorded. The Hobotemp Tidbit temperature loggers were exchanged at Northwest-Talcott, Johnson's Lee and Fossil Reef, and loggers were placed above the upper intertidal at Johnson's Lee and East Point. Mussel sizes and mussel bed depths were measured at all monitoring sites. The UCSC Biodiversity team (Nate Fletcher and Laura Anderson) joined us on this trip so that they could sample sites at Johnson's Lee and Ford Point. They also set up new sites at China Camp and Carrington.

11/15/2017. Fossil Reef.

Low tide 0.3 ft at 1404 hrs. The conditions were excellent despite the mediocre tide; swell and surge were low which allowed us to safely and confidently access the entire site. Sky was clear all day and wind was moderate (15–20 mph). We dropped the UCSC researchers off at China Camp so that they could set up a new biodiversity site nearby. There were 2 gulls, approx. 50 cormorants and 4 black oystercatchers, 1 black phoebe along with 3 elephant seals at the site upon arrival. Eight elephant seals were observed on the beach located immediately adjacent to the site on the west side. No harbor seals were seen at the site at any time during the day. The site was monitored from 1100 to 1645.

Logger #2264348 was replaced by #20186754 at 1445. Temp logger #20186753 was installed above the site (on the bluff above staging area) at 15:10.

Plots were photographed by Luis and Adri. Site panoramas were photographed by Luis. All 20 photoplots were scored in the field by Stephen.

A thirty-minute search was conducted for black abalone (*Haliotis cracherodii*) presence by Adri and Luis. N = 42 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 25–146 mm, most individuals were 1–10cm apart). A flashlight was used during the abalone search. The fixed abalone plots were sampled; plots 1–5 had N = 0 black abalone. For reference, during the last survey in April 2017, N = 64 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 25–160 mm, most individuals were 1–10cm apart). A flashlight was not used during the abalone search. The fixed abalone plots were not sampled. In November 2015, N = 43 black abalone (sizes ranged 26–146 mm, most individuals were observed touching one-another) were observed site-wide.

A thirty-minute search was conducted for ochre star (*Pisaster ochraceus*) presence by Adri and Luis. N = 0 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. For reference, in April 2017, N = 1 ochre star (120 mm- 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. In February 2015, N = 2 ochre stars (80 mm and 100 mm- 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.

The *Lottia gigantea* plots were sampled by Hillary and Stephen. Plots 1–5 had N = 1, 13, 93, 116 and 291 *L. gigantea*, respectively. Sizes of owl limpets in all the plots combined ranged 8–70 mm. In April 2017, plots 1–5 had N = 1, 6, 112, 151 and 254 *L. gigantea*, respectively. Sizes of owl limpets in all the plots combined ranged <15–73 mm. In February 2015, 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.

The field log was completed by Stephen. N = 17 bolts were installed; all plots now have three bolts indicating the locations of the corners.

The barnacle (*Chthamalus* spp./ *Balanus* spp.) had 24.4% (25.8% measured last spring) mean barnacle cover. The majority of point contacts in the five plots were bare rock. *Endocladia* plots had 23% (29.4% measured last spring) mean *Endocladia* cover. The majority of point contacts in the five plots was bare rock, but *Silvetia* (mean = 32.4%) was also relatively abundant. The rockweed plots had 60.6% (62.6% measured last spring) mean *Silvetia* cover. Most of the cover within the rockweed zone was dominated by *Silvetia*. Mussel (*Mytilus californianus*) plots had 41% (35.6% measured last spring) mean cover. The majority of cover in the five plots was occupied by *Mytilus* followed closely by *Phragmatopoma* (mean = 25.6%).

Mussels were measured in the five original *Mytilus* plots by Stephen. Sizes of mussels ranged 10–70 mm and mussel bed depths ranged 3–8 cm; all plots were monolayers. In April 2017, sizes of mussels ranged 20–70 mm and mussel bed depths ranged 4–7 cm; all plots were monolayers. In November 2015, sizes of mussels ranged 20–60 mm and mussel bed depths ranged 2–6 cm; all plots were monolayers.

Silvetia recruitment appeared to highest (100s of recruits) ever observed. Most *Silvetia* appeared to be healthy and reproductive. Several thalli by the *Lottia* plots appeared orange. *Caulacanthus* appeared to have increased slightly in abundance. *Endocladia* appeared to be robust and healthy in most locations, but quite poor (low density and tattered) in other areas. *Mytilus* continued to increase in cover but only a scant amount of recruitment was observed for the species. *Chthamalus* was substantially more common than *Balanus* though neither species was particularly abundant. *Pisaster* was absent from the site.

11/16/2017. Northwest-Talcott.

Low tide 0.0 ft at 1440 hrs. The conditions were excellent since the tide was sufficiently-low and the moderate-sized (3–4') swell out of NW did not impact our ability to work the entire site. Sky was overcast and cloudy all day with brief periods of light drizzle. A large tree trunk was seen near the splash plots. A high density of wrack (mostly *Phyllospadix*) was on the beach near the access point. Several fishing vessels were working nearby. There were 3 gulls, 1 black phoebe and 5 black oystercatchers at the site upon arrival. No pinnipeds were observed. The site was monitored from 1230 to 1630.

The temperature logger # 2012084 was replaced by logger # 20186755 at 1620. Logger # 20186759 was installed on the bluff directly above the site.

Plots were photographed by Adri and Luis. Site panoramas were photographed by Adri. All photoplots except the splash plots were scored in the field by Stephen.

A thirty-minute search was conducted for black abalone (*Haliotis cracherodii*) presence by Adri and Luis. N = 38 black abalone were seen throughout the site; sizes ranged 39–186 mm, most individuals were spaced 11–50 cm apart from one another). The fixed abalone plots were sampled; plots 1–5 = 0. For reference, in April 2017, N = 14 black abalone were seen (an extended search resulted in a total of N = 21 throughout the site; sizes ranged 25–172 mm, most individuals were spaced 11–50 cm to one another). The fixed abalone plots were not sampled. In November 2015, N = 8 black abalone

were observed site-wide (sizes ranged approx. 59–188 mm, most individuals were 1–10 cm to one another). Note that the abundance of black abalone at this site increased markedly this visit relative to previous years (less than three abalone have been seen at this site each year since 2000).

A thirty-minute search was conducted for ochre star (*Pisaster ochraceus*) presence by Adri. Zero sea stars were observed. Likewise, in April 2017 and November 2015, zero sea stars were seen. 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 82%, respectively. *Phyllospadix* on the transects was lightly fouled with epiphytic algae and moderately bleached/browned. Flowers were observed on a small proportion of *Phyllospadix* on transect #2. For reference, in April 2017, transects 1–2 had *Phyllospadix* cover = 100 and 94%, respectively. Transect #3 was not sampled because it was not located. *Phyllospadix* on both transects was heavily fouled with epiphytic algae (appeared to be *Ulva intestinalis*) and was lightly bleached/browned. In November 2015, transects 1–3 had 100, 100 and 90% cover, respectively.

The *Lottia gigantea* plots were sampled by Hillary. Plots 1–5 had N = 51, 48, 66, 14 and 22 *L. gigantea*, respectively. Sizes of owl limpets in all the plots combined ranged <15–94 mm. For reference, in April 2017, plots 1–5 had N = 30, 40, 43, 18 and 17 *L. gigantea*, respectively. Sizes of owl limpets in all the plots combined ranged <15–94 mm. In November 2015, 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.

The field log was completed by Stephen.

Few repairs were completed during this visit. However, some plots could still use the addition of bolts in corners to aid in locating them. All plots were however located with relative ease. The following plots still require the addition of at least one bolt: 555–556, 559, 560–563, 566–567, 569. Bolts were installed in splash plots 4 and 5. Special attention should be placed on installing new bolts in the abalone plots.

The barnacle (*Chthamalus* spp./ *Balanus* spp.) had 11% (7.2% measured last spring) mean barnacle cover. The majority of point contacts in the five plots were bare rock, but *Silvetia compressa* occupied 36.2% cover. *Endocladia* plots had 14% (22.6% measured last spring) mean *Endocladia* cover. The majority of point contacts in the five plots were bare rock. The rockweed plots had 67% (58.4% measured last spring) mean *Silvetia* cover. Most of the cover within the rockweed zone was dominated by *Silvetia*. Mussel (*Mytilus californianus*) plots had 58% (51.8% measured last spring) mean cover. The majority of cover in the five plots was occupied by *Mytilus*. The splash plots were not sampled. For reference, in April 2017, the splash plots were devoid of biota aside from *Littorina*; plots 1–4 had N =13, 10, 40, 75 littorine snails, respectively. Splash plots 1–4 also had 18, 38, 3, 2 *Chthamalus*, respectively. Splash plot #5 was not located.

Mussels were measured in the five *Mytilus* plots by Stephen. Sizes of mussels ranged 20–90 mm and mussel bed depths ranged 3–7 cm; all plots were monolayers. In April 2017, sizes of mussels ranged

30–70 mm and mussel bed depths ranged 3–7 cm; all plots were monolayers. In November 2015, sizes of mussels ranged 20–90 mm and mussel bed depths ranged 2–6 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 Island since removal experiments have proven unsuccessful (J. Smith, Associate Professor, California State Polytechnic University, Pomona, personal communication with S. Whitaker). *Caulacanthus* has been seen each year since and was present again during this visit. The invasive appears to have increased markedly in abundance since we first observed it in 2013. It has spread to nearly all areas of the site and is particularly abundant on vertical surfaces.

Silvetia was extremely abundant and it appeared to be healthy and reproductive. Dozens of recruits were seen particularly within *Endocladia*. *Chthamalus* was substantially more common than *Balanus*. *Mytilus* appeared to be similar in abundance to what was observed in April 2017. Very few *Mytilus* recruits were seen. *Phyllospadix* was highly abundant and moderately bleached; *Ulva* and *Melobesia* covered a high proportion of the blades. Some flowers were seen. Rockweed gunnels were searched for but not located.

11/17/2017. East Point.

Low tide -0.2 ft at 1514 hrs. The conditions were good considering the positive low tide and moderate-sized swell and surge. Still, we were not able to sample the surfgrass transects, but all other protocols were completed and the abalone and sea star searches were not compromised. The swell was moderate-sized (3–5') and the wind was blowing 15–20 kt. There were 40 cormorants, 3 gulls, 6 brown pelicans, and 1 black oystercatcher at the site upon arrival. No pinnipeds were observed. The site was monitored from 1230 to 1630. We accessed the site by driving up Wreck Rd to Quemada then walking down to the lagoons and to the site.

Temperature logger #10021200 was replaced by logger #20186752 at 1615 above the staging area. Note that the logger was located fully exposed to sun and therefore data are not appropriate for use. Temperature logger #20186750 was installed in the mid intertidal at 1600 near *Mytilus* plot 2.

Plots were photographed by Adri and Luis. Site panoramas were photographed by Adri and Luis. All 25 photoplots were scored in the field by Stephen.

A 30-minute search was conducted for black abalone (*Haliotis cracherodii*) presence by Adri and Luis. N = 110 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. 58–172 mm, most individuals were spaced 1–10 cm apart from one another). The fixed abalone transect was not sampled. Note that a flashlight was used during the abalone search. For reference, in April 2017, N = 99 black abalone were observed site-wide from the sand channel on the north side of the site to plot 594 on the south end (N = 89 measured; sizes ranged approx. 23–180 mm, most individuals were close enough to touch one another). The fixed abalone transect was not sampled. In November 2015, 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).

A thirty-minute search was conducted for ochre star (*Pisaster ochraceus*) presence by Adri and Luis. N = 14 ochre stars were observed site-wide from the sand channel on the north side of the site to plot 594 on the south end; sizes ranged 90–180 mm and nearly all individuals appeared to be free of lesions (one appeared to be diseased and was identified as a stage 4). For reference, in April 2017, N = 9 ochre stars were observed site-wide from the sand channel on the north side of the site to plot 594 on the south end; sizes ranged 60–130 mm and all individuals appeared to be free of lesions. In November 2015, N = 4 ochre stars were observed site-wide (sizes ranged 30–80 mm). All four individuals appeared to be healthy.

Surfgrass transects were not sampled due to the relatively-high low tide combined with moderately-high waves.

The field log was completed by Stephen.

One bolt was installed and several existing bolts were shored up with additional epoxy. No other repairs were necessary during this visit since all plots were easy to locate and all have three bolts. A temperature logger was installed next to *Mytilus* plot 591.

The barnacle (*Chthamalus* spp./ *Balanus* spp.) had 45% (33.2% measured last spring) mean barnacle cover. The majority of point contacts in the five plots were bare rock. *Endocladia* plots had 32.8% (64.8% measured last spring) mean *Endocladia* cover. The majority of point contacts in the five plots were bare rock. The *Silvetia* plots had 35.8% (32.2% measured last spring) mean *Silvetia* cover. Most of the point contacts within the *Silvetia* zone were *Silvetia*. The *Hesperophycus* plots had 5.2% (8% measured last spring) mean *Hesperophycus* cover; in November 2015, there was 36.2% mean *Hesperophycus* cover. Most of the point contacts within the *Hesperophycus* zone were bare rock. A major decline in *Hesperophycus* cover occurred sometime after November 2015. Mussel (*Mytilus californianus*) plots had 65.6% (58.8% measured last spring) mean cover; in November 2015, there was 44.6% mean *Mytilus* cover. Unlike several years ago when only two plots (593 and 594) had mussels present, mussels have been present in all five plots during the last few years. The majority of cover in the five plots was occupied by *Mytilus*.

Mussels were measured in the five original *Mytilus* plots by Hillary. Sizes of mussels ranged 10–90 mm and mussel bed depths ranged 4–9 cm; all plots were monolayers. In spring 2017, ranged 10–100 mm and mussel bed depths ranged 3–10 cm; all plots were monolayers.

Mytilus was observed growing all the way up to the *Silvetia*. Very few recruits were observed for *Mytilus*. *Ulva* dominated the reef along with abundant tufts of *Cladophora*. *Silvetia* appeared healthy particularly on the east end of the site, but very few recruits were seen. *Hesperophycus* was markedly less abundant than *Silvetia*; several recruits were observed. A major decline in *Hesperophycus* cover occurred sometime after November 2015. *Endocladia* was quite common but appeared thin and trampled throughout most of the site. *Chthamalus* was abundant; an estimated 25% of tests were

empty. *Balanus* was comparatively rare. Both species of *Phyllospadix* were present. Unfortunately, the transects could not be sampled due to continuous swell. The surfgrass bed was mostly intact and only a small percentage was bleached or covered with *Melobesia*. Black abalone abundance increased again to N = 110. Sea stars were present (N = 14). One *P. ochraceus* was noticeably sick (see photos).

11/18/2017. Ford Point.
Low tide -0.2 ft at 1547 hrs. The conditions were good overall despite the moderate-sized (3–5 ft) ground swell that kept us alert the entire day. The UCSC crew sampled the biodiversity transects at the site. Wind was light (5–10 mph). There were four black oystercatchers at the site at various times throughout the day. One harbor seal was seen in the water. The site was monitored from 1145 to1745.

Plots were photographed by Adri and Luis. Site panoramas were photographed by Luis. All 15 photoplots were scored in the field by Stephen.

Temperature logger #20186757 was installed in the mid intertidal at 1700. It is located below plot 525 in a tidepool (see pictures). Another temperature logger #20186756 was installed at 1700 above the site 12.6 m inshore of plot 521 and 16.2 m inshore of Lottia 1 (600) and 31.1 m west of splash plot 1.

A thirty-minute search was conducted for black abalone (*Haliotis cracherodii*) presence by Adri and Luis. (N = 139) 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 24–178 mm, most individuals were located 1–10 cm apart). For reference, during the last visit in spring 2017, N = 85 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 of black abalone were not recorded due to the danger imposed by frequent and powerful waves). The conditions were not ideal for finding or measuring black abalone given the relatively large swell. In November 2015, N = 124 black abalone were observed site-wide (sizes ranged 28–183 mm, most individuals were located 1–10 cm apart from one another). The black abalone plots were not sampled. A flashlight was not used during the abalone search.

A thirty-minute search was conducted for ochre star (*Pisaster ochraceus*) presence by Adri and Luis. N = 17 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 50–150 mm; all appeared healthy except one that had one lesion). For reference, during the last visit (spring 2017), N = 6 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 of ochre stars were not recorded due to the danger imposed by frequent and powerful waves). All observed *P. ochraceus* appeared to be healthy. In November 2015, N = 32 sea stars were observed (sizes ranged 40–110 mm). All observed *P. ochraceus* appeared to be healthy.

The field log was completed by Stephen.

One bolt was installed in the *Lottia* 600 (new) plot. Two bolts (UL and LR) were installed in each of the splash plots. No other repairs were necessary.

The barnacle (*Chthamalus* spp./ *Balanus* spp.) had 15% (11% measured last spring) mean barnacle cover. The majority of point contacts in the five plots were bare rock. *Endocladia* plots had 17.8% (29% measured last spring) mean *Endocladia* cover. The majority of point contacts in the five plots were bare rock, although the plots were quite diverse with several species occupying substantial space including *Mytilus* (mean = 12.4%) and non-coralline crust (mean = 10.8%). Mussel (*Mytilus californianus*) plots had 66.6% (58.4% measured last spring) mean cover. The majority of cover in the five plots was occupied by *Mytilus*. All the splash plots except plot 2 (2% *Chthamalus*) were devoid of biota aside from littorine snails (abundances in plots 1–5 = 8, 57, 97, 5, 82, respectively), *Chthamalus* (abundances in plots 1–5 = 0, 215, 8, 41, 239, respectively) and cyanobacteria.

Mussels were measured in the five original *Mytilus* plots by Stephen. Sizes of mussels ranged 10–80 mm and mussel bed depths ranged 3–9 cm; all plots were monolayers, but several of the plots had the presence of numerous small Mytilus recruits attached to the upper surface of larger *Mytilus*. This information was noted on the field form. For reference, during the last visit (spring 2017), sizes of mussels ranged 30–90 mm and mussel bed depths ranged 3–9 cm; all plots were monolayers.

Owl limpets (*Lottia gigantea*) were counted and measured in the fixed plots by Hillary. Plots 600 (new) – 604 had N = 18, 2, 8, 39 and 17 owl limpets, respectively. Sizes throughout all five plots ranged 9–72 mm. Note that plot 600 (old) was not sampled because it was not located. For reference, in spring 2017, plots 600 (new) – 604 had N = 18, 1, 5, 7 and 18 owl limpets, respectively. Sizes throughout all five plots ranged <15–72 mm. In February 2015, 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.

Nemalion was surprisingly common. *Balanus* and *Chthamalus* appeared to be equally abundant; the former may have been slightly more abundant. *Endocladia* appeared lush and robust and quite abundant. *Mytilus* appeared to have increased in cover slightly relative to recent years, but new recruits were rare. Above average cover of GATGOR was observed on the high intertidal rocks. *Ulva* and *Cladophora* were observed in high abundance epiphytically growing on *Mytilus*. *Phyllospadix torreyi* was common on the east end of the site; it appeared to be healthy with only a moderate amount of fouling from *Melobesia*. *Phragmatopoma* was still common, particularly on the east end of the site, but it appeared to have declined in abundance relative to recent past years as *Mytilus* has gradually become more dominant. No rockweeds were observed. *Mazzaella affinus* was rare. *Mastocarpus pappilatus* was not seen. Patches of *Pollicipes* were common, particularly on the east end of the site. *Tetraclita* was not common.

11/19/2017. Johnson's Lee.

Low tide -0.2 ft at 1730 hrs. The conditions were good overall since the swell was relatively small and larger sets were infrequent. Sand was nearly completely absent from the beach and surge channel in the center of the site. There were no shorebirds observed at the site, but 1 California sea lion and 1 harbor seal were observed in the water immediately offshore of the site. The site was monitored from 1230 to 1730. The UCSC crew sampled the biodiversity transects at the site.

Temperature logger #2264349 located in the mid intertidal was replaced by #20186758 at 1645.

Plots were photographed by Adri and Luis. Site panoramas were photographed by Adri. All photoplots were scored in the field by Stephen.

A thirty-minute search was conducted for black abalone (*Haliotis cracherodii*) presence by Adri and Luis. N = 23 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 21–99 mm, most individuals were spaced 1–10 cm apart from one another). The black abalone plots were not searched. For reference, during the last visit (spring 2017), N = 21 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 42–163 mm, most individuals were spaced 1–10 cm apart from one another). The black abalone plots were not searched. In November 2015, N = 45 black abalone were observed site-wide (sizes ranged 24–174 mm, most individuals were spaced 11–50 cm apart from one another).

A thirty-minute search was conducted for ochre star (*Pisaster ochraceus*) presence by Adri. N = 13 ochre stars were observed site-wide (see area searched during black abalone search) (sizes ranged 60–130 mm). All but two individuals appeared to be healthy; two were stage 1 since they each had a lesion. For reference, during the last visit (spring 2017), N = 22 ochre stars were observed site-wide (see area searched during black abalone search) (N = 11 individuals measured, sizes ranged 60–110 mm). In November 2015, N = 44 ochre stars were observed site-wide (sizes ranged approx. 20–110 mm, all individuals appeared to be healthy and free of lesions).

Owl limpets (*Lottia gigantea*) were counted and measured in the fixed plots by Hillary. Plots 1–5 had N = 14, 6, 20, 33 and 66 owl limpets, respectively. Sizes throughout all five plots ranged 10–91 mm. For reference, during the last visit (spring 2017), plots 1–5 had N = 9, 4, 5, 29 and 39 owl limpets, respectively. Sizes throughout all five plots ranged 12–73 mm. In November 2015, plots 1–5 had N = 8, 48, 23, 94 and 70 *L. gigantea*, respectively. Sizes of owl limpets in all the plots combined ranged <15–111 mm.

Three bolts were placed in each of the splash plots. Two lower bolts were installed in plot 514. All abalone plots still require new bolts.

The barnacle (*Chthamalus* spp./ *Balanus* spp.) had 28.8% (23.8% measured last spring) mean barnacle cover. The majority of point contacts in the five plots were bare rock. *Endocladia* plots had 8.8% (22.4% measured last spring) mean *Endocladia* cover. The majority of point contacts in the five plots were bare rock. Mussel (*Mytilus californianus*) plots had 51.7% (42% measured last spring) mean cover overall including the four new plots. Without the additional plots the original five plots had 35.4% (21.8% measured last spring) mean mussel cover. The majority of cover in the five plots was occupied by *Mytilus*, but the original five Mytilus plots also had relatively high cover (mean = 36.8%) of *Phragmatopoma*. The splash plots were devoid of biota aside from *Littorina*; plots 1–5 had N = 13, 61, 17, 63 and 1 littorine snails, respectively. Splash plots 1–5 also had 0, 0, 16, 0 and 2 *Chthamalus*, respectively. For reference, in spring 2017, the splash plots were devoid of biota aside from *Littorina*; plots 1–5 had N = 1, 85, 9, 63 and 0 littorine snails, respectively. Splash plots 1–5 also had 0, 0, 10, 4 and 2 *Chthamalus*, respectively.

Mussels were measured in the five original *Mytilus* plots by Hillary. Sizes of mussels ranged 20–80 mm and mussel bed depths ranged 3–10 cm; all plots were monolayers. For reference, in spring 2017, sizes of mussels ranged 10–110 mm and mussel bed depths ranged 2–8 cm; all plots were monolayers. In November 2015, sizes of mussels ranged 10–70 mm and mussel bed depths ranged 1–7 cm; all plots were monolayers.

Zostera pacifica blades were seen washed up onto the site in several locations. Tufts of *Cladophora* and *Ulva* were common in the *Mytilus* beds. Also quite a bit of *Phyllospadix torreyi* wrack was observed. *Mytilus* appeared to be doing well as it continues to increase in abundance; moderate level of recruitment was noticeable, particularly in the lower zone. *Phragmatopoma*, in contrast, was less abundant relative to past years and appeared to have been outcompeted for space by *Mytilus*. *Anthopleura xanthogrammica* was common but substantially less abundant than *A. sola* and *A. elegantissima*. *Chthamalus* and *Balanus* appeared to be equally abundant; approx. 10% of tests were empty.

Santa Cruz Island, November 30–December 5, 2017

(Database event #2016/17-C)

Prepared by Stephen Whitaker

Purpose

To monitor rocky intertidal sites at Santa Cruz Island.

Personnel

- Stephen Whitaker, Marine Ecologist, Channel Islands National Park
- Adri Sparks, Technician, UCSC
- Luis Hernandez, Technician, UCSC

Procedure and General Observations

Island Packers transportation was utilized to access the island including the site at Orizaba Cove. Standard procedures were used for monitoring rocky intertidal sites. Plots and site overviews were photographed with an Olympus Stylus 1030SW and an Olympus Tough TG-5 12 Megapixel 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 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 and additional temperature loggers were installed at each of the sites to record air temperature. Mussel sizes and mussel bed depth were measured at all sites. CIA provided transportation off the island on 12/5. Note a large fire (later determined to be largest fire recorded in CA history) started on the evening of 12/4. On 12/5 the wind (Santa Ana) was gusting in excess of 50–60 mph and the sky was darkened with ash and smoke at SCI. We were fortunate enough to get picked up off the island by CIA from the runway closest to the main ranch.

11/30/2017. Orizaba Cove.

Low tide 0.26 ft at 1318 hrs. Similar to last year when we sampled this site, the conditions were not optimal for sampling due to the powerful ground swell out of the northwest. The large swell compromised our ability to adequately search the site for black abalone and sea stars but we have high confidence that the fixed plots were sampled adequately. The wind was moderate. Two black oystercatchers were seen at the site throughout the day. No pinnipeds were observed. The site was monitored from 1130 to 1415. We contracted Island Packers to skiff us onto the site and pick us up before they departed Prisoner's Harbor. We split the cost with the seabird program since they needed to do some work on Orizaba Rock.

Plots were photographed by Adri and Luis. Site panoramas were photographed by Adri and Luis. All of the photoplots (except the five *Mytilus* plots) were scored in the field by Stephen. The field log was completed by Stephen.

A site-wide search lasting approximately 30 minutes was conducted for black abalone (*Haliotis cracherodii*) presence by Adri and Luis. N = 25 black abalone were observed in the area of the site from plot Hes 1 to Myt 5 (sizes ranged 60–126 mm, most individuals were observed to be 11–50 cm apart from one another). Note that the conditions were quite poor for searching for black abalone since we were unable to access much of the lower intertidal due to steady bouts of incoming waves and surge. For reference, the last time this site was monitored in fall 2016, N = 30 black abalone were observed in the area of the site from plot Hes 1 to Myt 5 (sizes ranged 21–124 mm, most individuals were observed to be 1–5 m apart from one another). Before that, in fall 2014, 130 individuals were found and measured throughout the entire site (sizes ranged 12–124 mm, most individuals were observed to be 1–5 m apart from one another).

A 30-minute search was conducted for ochre star (*Pisaster ochraceus*) presence by Adri and Luis. N = 3 *P. ochraceus* were seen at the site; all appeared to be healthy (sizes ranged 120–150 mm). During the previous survey of this site in November 2016, N = 10 *P. ochraceus* were seen at the site; all appeared to be healthy (sizes ranged 70–110 mm). In November 2014, N = 3 *P. ochraceus* were seen at the site; all appeared to be healthy (sizes ranged 20–80 mm).

No plot repairs were necessary but *Mytilus* plots 1–5 had 1–2 bolts that were not located because they were overgrown with mussels. A metal detector should be used during the next visit to locate all bolts. We were able to find at least one bolt for each of the *Mytilus* plots allowing us to approximate the location of each plot. Cover was almost entirely *Mytilus* within each of the representative plots.

No temperature loggers have been installed at this site.

Mussels were not measured in the five *Mytilus* plots due to the poor conditions that were not only wet but potentially dangerous. For reference, in fall 2016, sizes of mussels ranged 20–80 mm and mussel bed depths ranged 3–9 cm; all plots were multilayers. The mussel beds were the thickest Whitaker has observed at this site for over five years.

The barnacle (*Chthamalus* spp./ *Balanus* spp.) plots had 46.4% mean barnacle cover (34.8% mean barnacle cover was measured in fall 2016); barnacle species were the most dominant taxa. The

Silvetia plots only had 9.4% mean *Silvetia* cover (only two plots [869–870] had *Silvetia* present) (6.6% mean *Silvetia* cover was measured in fall 2016). Most cover within the *Silvetia* zone was occupied by non-coralline crust, *Tetraclita, Mytilus* and *Ulva*. The *Hesperophycus* plots had 10.4% mean *Hesperophycus* cover (23% mean *Hesperophycus* cover was measured in fall 2016); the plots were relatively diverse with measurable amounts of numerous other species including *Endocladia*, *Chthamalus* spp./ *Balanus* spp. and *Silvetia*. Mussel (*Mytilus californianus*) plots had 97.4% mean cover (96.4% mean *Mytilus* cover was measured in fall 2016). The majority of cover in the five plots was occupied by *Mytilus*. *Tetraclita* plots had 35.8% mean cover of the representative species which was also the most common species encountered (43.4% mean *Tetraclita* cover was measured in fall 2016).

Mytilus abundance was extremely high and approximately the same as it was a year ago, but the mussels appear larger and fewer recruits were observed this year. Both rockweed species appeared to be healthy and robust and recruitment was elevated, particularly for *Hesperophycus* (at least around the *Hesperophycus* plots). *Balanus* appears to do well at this site; densities were much higher than *Chthamalus*. *Endocladia* was common throughout the site but not particularly abundant anywhere and not very lush. *Mazzaella* was present and not abundant either; it appeared diminutive. *Tetraclita*, as usual at this site, was quite abundant. *Septifer* was commonly seen particularly inside the cove. *Ulva* occurred in patches inside the *Mytilus* bed located outside the cove. Numerous *Haliotis cracherodii* were observed with eroded shells which is a bit out of the ordinary.

12/1/2017. Willows Anchorage.
Low tide -0.44 ft at 1359 hrs. The conditions were excellent for sampling since there was minimal swell to contend with and light wind. Sky was clear all day. No shorebirds or pinnipeds were seen around the site throughout the day, but one black phoebe was hanging around the site most of the day. The site was monitored from 1130 to 1645.

Plots were photographed by Adri and Luis. Site panoramas were photographed by Adri. All of the photoplots were scored in the field by Stephen. The field log was completed by Stephen. The temperature logger #2012090 in the mid intertidal was replaced at 1615 by logger #20186762. An additional logger # 20186766 was installed at 1630 above the staging area

A 30-minute search was conducted for black abalone (*Haliotis cracherodii*) presence by Adri and Luis. N = 125 black abalone were observed in the area of the site between the first *Hesperophycus* plot and the *Mytilus* plots (sizes ranged 25–145 mm, most individuals were either touching or located 1–10 cm apart from one another). For reference, in November 2016, N = 72 black abalone were observed in the area of the site between the first *Hesperophycus* plot and the *Endocladia* plots (sizes ranged 20–130 mm, most individuals were either touching or located 1–10 cm apart from one another). In January 2016, a search lasting approx. 90 minutes was conducted for black abalone, and N = 109 black abalone were observed in the area of the site between the first *Hesperophycus* plot and the *Endocladia* plots (sizes ranged 15–135 mm, most individuals were observed to be touching one another). In fall 2014, 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), and 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 Adri and Luis. N = 28 *P. ochraceus* were seen across the entire site from H1 to L5 (sizes ranged 90–150 mm, mode = 80–90 mm). All individuals appeared healthy with no lesions observed. For reference, in November 2016, N = 26 *P. ochraceus* were seen across the entire site from H1 to L5 (sizes ranged 40–130 mm, mode = 80–90 mm). All individuals appeared healthy with no lesions observed. In January 2016, N = 23 *P. ochraceus* were seen. In fall 2014 as well as fall 2013, zero sea stars were located.

No repairs were necessary aside from the removal of mussels around some of the bolts marking the locations of *Mytilus* plots, and a new bolt was installed next to the old one for *Lottia* plot 5. This plot has been problematic in the past.

The fixed owl limpet plots were sampled by Stephen. Plots 1–5 had N = 60, 28, 53, 34 and 13 *Lottia gigantea*, respectively. Throughout the five plots, sizes ranged 11–53 mm. For reference, in November 2016, plots 1–5 had N = 97, 63, 91, 39 and 11 *Lottia gigantea*, respectively. Throughout the five plots, sizes ranged 9–57 mm. In January 2016, plots 1–5 had N = 65, 72, 98, 44 and 13 *Lottia gigantea*, respectively. Throughout the five plots, sizes ranged <15–58 mm.

Endocladia plots had 50% (42.4% measured last November) mean *Endocladia* cover. The majority of cover in the five plots was occupied by *Endocladia*. The *Silvetia* plots only had 15% (12.6% measured last November) mean *Silvetia* cover (only plot 949 had *Silvetia* present [75%]). Most point contacts within the *Silvetia* zone were *Endocladia* (mean = 33.2%) and crustose corallines (mean = 17.8%). The *Hesperophycus* plots had 0.2% (0% measured last November) mean *Hesperophycus* cover (only plot 940 had *Silvetia* present [1%]). Most point contacts within the *Hesperophycus* zone were *Endocladia* (mean = 41.6%). Mussel (*Mytilus californianus*) plots had 50.4% (82.6% measured last November) mean cover. The majority of cover in the five plots was occupied by *Mytilus*.

Mussels were measured in the five original *Mytilus* plots by Adri. Sizes of mussels ranged 10–80 mm and mussel bed depths ranged 2–8 cm; all plots were primarily composed of monolayers. For reference, in November 2016, Sizes of mussels ranged 10–80 mm and mussel bed depths ranged 4–11 cm; all plots were primarily composed of monolayers.

Sargassum horneri was seen for the first time here. Approx. 5–10 thalli were observed in pools near the *Silvetia* plots. Red algae (*Endocladia*, *Mastocarpus pappilatus*, *Mazzaella affinus*, and *Chondracanthus canaliculatus*) appeared lush and robust and perhaps markedly more abundant than they have appeared in many years. The observations in the fixed plots support the site-wide observation that red algae have increased, particularly *Endocladia*. Dozens of small *Lithopoma undosum* were seen throughout the site. *Mytilus* was highly abundant; hundreds of new recruits were

observed near the surge channel between the *Hesperophycus* and *Endocladia* plots. *Silvetia* appeared healthy and reproductive; a moderate to high number (dozens) of recruits was seen. *Hesperophycus* appeared to be in fair shape overall but some thalli were tattered. N = 16 *Hesperophycus* thalli were counted; several were small and appeared to be new recruits. *S. muticum* was highly abundant, particularly in the surge channel near the *Endocladia* plots. Purple urchins were also highly abundant within the surge channel; no signs of disease were observed. A large octopus was seen in the tidepool near the temperature logger. Several *Aplysis* and one *Megathura* were observed.

12/2/2017. Prisoners Harbor.
Low tide -0.99 ft at 1443 hrs. The conditions were 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 every 10 minutes or so making it a bit wet, but generally, the swell/surge was only moderate and we were able to sample the entire site with no issues. Light wind (<5 kt) and overcast sky prevailed all day. No measurable precipitation was measured recently. There were 8 black oystercatchers on the site when we arrived and 1 harbor seal in the water immediately offshore towards the end of the day. The site was monitored from 1200 to 1700.

Plots were photographed by Adri and Luis. Site panoramas were photographed by Adri. 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 Luis and Adri. N = 1 black abalone was observed site-wide (129 mm). For reference, in fall 2016, N = 1 black abalone was observed site-wide (103 mm – individual was out in the open and foot appeared to be shrunken but the abalone held tightly to the substratum when tested, periostracum was nearly entirely removed). In fall 2015, N = 4 black abalone were observed site-wide, and N = 16 individuals were located in fall 2014. However, only four individuals were located in spring 2013, so it is not unusual to find relatively low numbers of abalone here.

A 30-minute search was conducted for ochre star (*Pisaster ochraceus*) presence by Luis and Adri. N = 1 *P. ochraceus* (healthy appearance, 90 mm) was located throughout the entire site. For reference, in November 2016, zero *P. ochraceus* were located throughout the entire site. In fall 2015, 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 and all plots are easy to locate, but some epoxy was placed around bolts that appeared to be loose. The plot(s) that do not have three bolts have two bolts plus epoxy that clearly indicate the location of the plots.

Two temperature loggers were installed at the site: one above the site to record air temperature and another in the mid intertidal for sea surface temperature. The logger in the mid intertidal was installed between plots 850 and 845. The other logger was installed in a nook within the staging rock that is located in the area of the reef above the *Endocladia* and *Hesperophycus* plots.

The barnacle (*Chthamalus* spp./*Balanus* spp.) plots had 6.6% (7.4% mean barnacle cover measured last fall) mean barnacle cover. The majority of point contacts in the five plots were *Septifer* (mean = 43.6%) followed by bare rock (mean =35.8%). *Endocladia* plots had 29.8% (40% measured last fall) mean *Endocladia* cover. The majority of point contacts in the five plots was *Chthamalus* spp./ *Balanus* spp. (mean = 36.6%) and bare rock (mean = 21.6%). The *Silvetia* plots had 0.0% (0.0% measured last fall) mean *Silvetia* cover. Within the *Silvetia* zone, there was a relatively diverse mix of species occupying space including the following most abundant species: *Mazzaella, Mytilus, Tetraclita* and particularly *Septifer* (mean = 18.4%). The *Hesperophycus* plots had 5.8% (5% measured last fall) mean *Hesperophycus* cover. Most of the point contacts within the *Hesperophycus* zone were *Chthamalus* spp./ *Balanus* spp. (mean = 30.8%), but bare rock (mean = 30%) and *Endocladia* (mean = 21.8%) were quite common. Mussel (*Mytilus californianus*) plots only had 2.8% (1.4% 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 *Chondracanthus canaliculatus* (mean = 56%) and articulated corallines (mean = 20%).

Mussels were measured in the five original *Mytilus* plots by Adri and Luis. Sizes of mussels ranged 20–60 mm and mussel bed depths ranged 2–4 cm; all plots were monolayers. *Mytilus* plot 4 had zero mussels observed in the plot. For reference, in fall 2016, sizes of mussels ranged 10–50 mm and mussel bed depths ranged 1–3 cm; all plots were monolayers. *Mytilus* plot 4 had zero mussels observed in the plot.

Numerous *Pseudochama* were seen in the vicinity of the *Hesperophycus* plots. *Watersipora* was observed on the side of the surge channel below *Mytilus* plot 5. *Endarachne* and *Scytosiphon* were highly abundant on the north reef. *Septifer* was extremely abundant throughout the site, particularly on the north reef. *Mytilus* is comparatively less abundant. Several *M. galloprovincialis* were seen. *Silvetia* and *Hesperophycus* appeared healthy and robust; recruits for both were numerous. Approximately 415 *Hesperophycus* thalli were counted with approx. 25% being small thalli (likely new recruits). *Sargassum muticum* was abundant in the channel between *Endocladia* plot 5 and *Hesperophycus* plot 1. *Endocladia* was abundant but it appeared thin and most was growing epiphytically on *Chthamalus*. *Balanus* was markedly less abundant than *Chthamalus*.

12/3/2017. Fraser Cove.

Low tide -1.34 ft at 1528 hrs. The conditions were poor due to a large ground swell out of the NW and relatively large wind swell that regularly washed the entire site. We managed to complete all protocols but it was wet and the searches were compromised. The wind was high. Black oystercatchers (N = 5) and one black phoebe were seen at the site throughout the day. No pinnipeds were observed. The site was monitored from 1230 to 1845. All plots at Fraser and Forney were scored during the same day.

Plots were photographed by Adri and Luis. Site panoramas were photographed by Adri. Nearly all 35 photoplots were scored in the field by Stephen; three *Pollicipes* plots were scored in the office.

A 30-minute search was conducted for black abalone (*Haliotis cracherodii*) presence by Adri and Luis. N = 10 black abalone (sizes ranged 66–140 mm) were observed site-wide from plot 891 to plot

905. All were 1–10 cm apart from one another. For reference, in November 2016, N = 4 black abalone (sizes ranged 67–106 mm) were observed site-wide from plot 891 to plot 905. All were 1–10 cm apart from one another. In fall 2015, N = 7 black abalone (sizes ranged 66–139 mm) were observed site-wide from plot 891 to plot 905.

A 30-minute search was conducted for ochre star (*Pisaster ochraceus*) presence by Adri and Luis. Only one *P. ochraceus* (80 mm) was observed site-wide from plot 891 to plot 905. The individual appeared to be healthy. For reference, in November 2016, only one *P. ochraceus* (60 mm) was observed site-wide from plot 891 to plot 905. The individual appeared to be healthy. In fall 2015, N = 2 ochre stars were observed site-wide.

Surfgrass transects were sampled by Stephen. Transects 1–3 had *Phyllospadix* cover = 82, 82 and 92%, respectively. Most of the surfgrass appeared to be in good shape overall with very minimal bleaching and a moderate level fouling from *Melobesia*. For reference, in fall 2016, transects 1–3 had *Phyllospadix* cover = 70, 77 and 93%, respectively. Most of the surfgrass appeared to be in good shape overall with very minimal bleaching and a moderate level fouling from *Melobesia*. In fall 2015, transects 1–3 had *Phyllospadix* cover = 79, 77 and 87%, respectively.

The fixed owl limpet plots were sampled by Adri and Luis. Plots 1–5 had N = 12, 2, 13, 15 and 5 *Lottia gigantea*, respectively. Throughout the five plots, sizes ranged 10–65 mm. For reference, in November 2016, plots 1–5 had N = 20, 8, 12, 21 and 6 *Lottia gigantea*, respectively. Throughout the five plots, sizes ranged 12–65 mm. In fall 2015, plots 1–5 had N = 13, 6, 11, 14 and 10 *Lottia gigantea*, respectively. Throughout the five plots, sizes ranged <15–65 mm.

One bolt was added to the UL corner of *Hesperophycus* plot 5. Temperature logger was installed above the staging area; unit was epoxied to the surface of the rock. Another temperature logger was installed in the mid intertidal west (approx. 1m) of *Pollicipes* plot 2.

The barnacle (*Chthamalus* spp./ *Balanus* spp.) plots had 25% (14% measured last fall) mean barnacle cover. The majority of point contacts in the five plots were bare rock. *Endocladia* plots had 20.4% (58.6% measured last fall) mean *Endocladia* cover. The majority of point contacts in the five plots were bare rock. The *Silvetia* plots had 19.6% (21.4% 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 and *Endocladia* was relatively abundant (mean = 14.8%). The *Hesperophycus* plots had 8% (6.8% measured last fall) mean *Hesperophycus* cover. Most of the point contacts within the *Hesperophycus* zone were bare rock; *Endocladia* cover was relatively high (mean = 32%). Mussel (*Mytilus californianus*) plots had 67% (64% measured last fall) mean mussel cover. The majority of cover in the five plots was occupied by *Mytilus californianus*. *Pollicipes* plots had 15.6% (15.2% measured last fall) mean *Pollicipes* cover. The majority of cover in the five plots was occupied by *Mytilus californianus* (mean = 47.8%). Tar plots had 49% (52.4% measured last fall) mean tar cover. Overall, in comparison to data collected for the all the photoplots at this site during the past two years, all target taxa appear to have remained relatively unchanged.

Mussels were measured in the five *Mytilus* plots by Adri. Sizes of mussels ranged 10–100 mm and mussel bed depths ranged 25–70 mm; all plots were essentially monolayers. For reference, in February 2016, sizes of mussels ranged 10–100 mm and mussel bed depths ranged 2–11 cm; all plots were essentially monolayers.

The site appeared to be in good condition with no obvious signs of disturbance. All focal spp. in photoplots appeared intact and relatively common. *Mytilus* was abundant throughout the site but very little recruitment was observed for the species. *Pollicipes* was not particularly abundant. Tar cover appeared higher than usual. *Endocladia* was lush and abundant. *Mastocarpus pappilatus* and *Mazzaella affinus* were common and reproductive. *Chthamalus* was far more common than *Balanus* but neither species was particularly abundant. Both species of *Phyllospadix* were present; *P. torreyi* was significantly more abundant than *P. scouleri*. Both surfgrass species appeared to be robust and healthy with minor fouling from epiphytes and low levels of bleaching. Both rockweed species were abundant and appeared to be healthy; recruitment was apparent for both spp. *Silvetia* was the subsp *deliquescens*.

12/4/2017. Trailer.
Low tide -1.46 ft at 1615 hrs. The conditions were decent given the exceptionally-low tide. However, if not for the low tide, it would have been a very wet day due to the constant influx of waves originating from the northwest from local windswell and groundswell. Working between the sets, we were able to complete all transects, plots and searches with high confidence. Swell/surge was moderate (4–5 ft), and wind was moderate (15–20 kt). There were 8 gulls and 3 black oystercatchers at the site throughout the day. East of the site, approx. 500 gulls were seen. The site was monitored from 1315 to 1800.

Plots were photographed by Adri and Luis. Site panoramas were photographed by Adri. 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 Adri and Luis. N = 330 black abalone (sizes ranged 27–165 mm, most individuals were located 1–10 cm apart from one another) 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. For reference, in November 2016, N = 140 black abalone (sizes ranged 20–149 mm, most individuals were located 1–10 cm apart from one another) 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. In fall 2015, N = 144 black abalone were observed site-wide (sizes ranged 19–147 mm, most individuals were located 1–10 cm apart from one another). In fall 2015, N = 61 black abalone were observed (sizes ranged 27–141 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 Adri. N = 1 *P. ochraceus* (presumably healthy) (100 mm) was seen at the site. For reference, in November 2016, N = 5 *P. ochraceus* (presumably healthy) (sizes ranged 60–130 mm) were seen at the site. In fall 2015, N = 4 *P. ochraceus* (appeared healthy) (sizes ranged 50–70 mm) were seen.

Surfgrass transects were sampled by Stephen. Transects 1–3 had *Phyllospadix* cover = 97, 86 and 35%, respectively. *Phyllospadix* was lightly fouled by *Melobeisa* and *Smithora*, and a low percentage of the beds appeared bleached and/or abraded. For reference, in November 2016, transects 1–3 had *Phyllospadix* cover = 96, 85 and 36%, respectively. *Phyllospadix* was lightly fouled by *Melobeisa* and *Smithora*, and a low percentage of the beds appeared bleached and/or abraded. In fall 2015, transects 1–3 had *Phyllospadix* cover = 95, 73 and 31%, respectively.

The fixed owl limpet plots were sampled by Stephen. Plots 1–5 had N = 31, 37, 18, 19 and 11 *Lottia gigantea*, respectively. Throughout the five plots, sizes ranged 12–91 mm. For reference, in November 2016, plots 1–5 had N = 31, 33, 29, 22 and 16 *Lottia gigantea*, respectively. Throughout the five plots, sizes ranged 5–92 mm. In fall 2015, plots 1–5 had N = 18, 20, 6, 9 and 1 *Lottia gigantea*, respectively.

Epoxy was placed around several bolts that required shoring up and a couple bolts were installed; all plots now have three bolts marking locations of corners. One temperature logger was installed in the mid intertidal near the center of the site between the *Mytilus* and *Chthamalus* plots. Another temperature logger intended to document air temperature was installed near the top of the rock located at the staging area.

The barnacle (*Chthamalus* spp./ *Balanus* spp.) had 39.4% (33.8% measured last fall) mean barnacle cover. The majority of point contacts in the five plots were bare rock. The *Silvetia* plots had 51% (52.2% measured last fall) mean *Silvetia* cover. Most of the cover within the *Silvetia* zone was dominated by *Silvetia*. The *Hesperophycus* plots had 2.4% (5.3% measured last fall) mean *Hesperophycus* cover. Most of the point contacts within the *Hesperophycus* zone were bare rock, but *Silvetia* cover was relatively high (mean = 46.2%). Mussel (*Mytilus californianus*) plots had 57.6% (63% measured last fall) mean cover. The majority of cover in the five plots was dominated by *Mytilus* though *Phragmatopoma* (mean = 10.6%) was also relatively dominant.

Mussels were measured in the five original *Mytilus* plots by Adri. Sizes of mussels ranged 10–100 mm and mussel bed depths ranged 20–75 mm; all plots appeared to be comprised largely of a monolayer of mussels. For reference, in November 2016, sizes of mussels ranged 10–90 mm and mussel bed depths ranged 2–15 cm; all plots appeared to be comprised largely of a monolayer of mussels.

A small octopus was seen near the center of the site in a tidepool. *Silvetia* and *Hesperophycus* appeared to be robust and abundant. Both species were reproductive and numerous recruits were seen for both species. Approximately 30% of the 410 *Hesperophycus* thalli appeared to be new recruits. *Mytilus* was highly abundant but few new recruits were seen. *Phragmatopoma* appeared to be declining in abundance. *Balanus* and *Chthamalus* appeared to be equally abundant. *Endocladia* was lush and abundant. Two *Patiria* and two *Pisaster ochraceus* were seen. A record number (N = 330) of black abalone was counted this visit. One black abalone shell was collected that appeared to have been predated by an otter. *Phyllospadix* was in high abundance and appeared healthy; only a small percentage was fouled with *Melobesia* and *Smithora*.

San Miguel Island, December 12–19, 2017

(Database event #2017-18-D)

Prepared by Stephen Whitaker

Purpose:

To monitor rocky intertidal sites at San Miguel Island.

Personnel

- Stephen Whitaker, Marine Ecologist, Channel Islands National Park
- Adri Sparks, Technician, UCSC
- Luis Hernandez, Technician, UCSC
- Doug Eernisse, VIP

Procedure and General Observations

Channel Islands Aviation 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 Tough TG-5 12 Megapixel digital camera. Photoplots were scored in the field at all four sampling sites. Sea stars and black abalone were counted and sized during timed (typically 30 min) site-wide searches at all four sampling sites. *Lottia gigantea* were sampled at the two sampling sites (Otter Harbor and Harris Point) that have fixed plots. Motile invertebrates are no longer sampled at any of the four sampling sites. The maximum number of shorebirds and pinnipeds observed at each site was recorded at all sites. Hobotemp Tidbit temperature loggers were downloaded at Otter Harbor and Crook Point and were replaced with fresh loggers. Additional temperature loggers were placed at all sites above the upper intertidal zone to record ambient air temperature. Mussel sizes and mussel bed depth were measured at all four sampling sites. Channel Islands Aviation provided transportation off the island.

<u>12/13/2017. Otter Harbor.</u>

Low tide 0.46 ft at 1324 hrs. The conditions were decent for sampling; tide was only minimally-low and swell was moderate-sized which made it seem like we had reduced time to work. We were able to complete all monitoring protocols but it required us getting soaked at the end of the day as the tide was incoming. Wind was light. There were 4 black oystercatchers, 1 hybrid American/Black oystercatcher, 18 cormorants, 2 black turnstones and 5 unidentified shorebirds (all appeared gray "willet like" without the black and white stripes on wings) at the site at various times throughout the day. Upon arrival, there were 3 California sea lions, 30 harbor seals and 1 elephant seal on the reef. Unfortunately, the charismatic harbor seal that we have encountered at the site during the past several visits was not present. No harbor seal pups were observed at the site. The site was monitored from 1045 to 1615.

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

No plot repairs were conducted during this visit since nearly all plots now have three bolts indicating the locations of the corners. All plots were easily located. Plot 376 needs an UR bolt and 378 has the wrong # etched in the bolt (currently #4 but should be #3).

A 60-minute search was conducted for black abalone (*Haliotis cracherodii*) presence by Luis and Adri. The search encompassed the area from R2 to the east end of the site near the surge channel. Abalone were counted first, then a subset was measured afterwards. N = 301 black abalone were observed site-wide (N = 95 measured, sizes ranged 30–178 mm, most individuals were either touching or were located 1–10 cm apart from one another). All five abalone fixed plots were sampled; plots 1–5 had N = 0, 2, 0, 0, 2 black abalone, respectively. For reference, in February 2017, N = 311 black abalone were observed site-wide (sizes ranged 26–165 mm, most individuals were either touching or were located 1–10 cm apart from one another). Numerous (approx. 25%) black abalone were small (20–40 mm), most of which were located on the east end of the site near the surge channel and tucked deep within rock crevices near *Lottia* plot 1. All five abalone fixed plots were sampled; plots 1–5 had N = 0, 1, 1, 0, 10 black abalone, respectively. N = 10 empty and clean black abalone shells were located at the site; sizes ranged 23–76 mm. In February 2016, 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).

A 60-minute search was conducted for ochre star (*Pisaster ochraceus*) presence by Adri and Luis. N = 0 ochre stars were observed site-wide from R2 to the east end near the surge channel. For reference, in February 2017 N = 1 ochre stars were observed site-wide from R2 to the east end near the surge channel (size = 200 mm). In February 2016, N = 2 *P. ochraceus* (sizes were 60 and 130 mm) were observed site-wide.

Owl limpets (*Lottia gigantea*) were counted and measured in the fixed plots by the entire crew. Plots 1–5 had N = 105, 71, 100, 32 and 49 owl limpets, respectively. Sizes of *L. gigantea* lumped across the five plots ranged 11–60 mm. For reference, last February plots 1–5 had N = 95, 103, 112, 87 and 54 owl limpets, respectively. Sizes of *L. gigantea* lumped across the five plots ranged 15–62 mm. In February 2016, plots 1–5 had N = 57, 77, 65, 63 and 98 owl limpets, respectively. Sizes of *L. gigantea* lumped across the five plots ranged <15–64 mm.

Mussel measurements were taken by Adri and Luis. Mussel lengths ranged 10–80 mm and bed depths ranged 25–65 mm in *Mytilus* plots 1–5. All plots appeared to be comprised of monolayers of *Mytilus*. For reference, last February, mussel lengths ranged 10–90 mm and bed depths ranged 10–70 mm in *Mytilus* plots 1–5. All plots appeared to be comprised of monolayers of *Mytilus*.

The barnacle (*Chthamalus* spp./ *Balanus* spp.) had 8.2% (8.4% measured last February) mean barnacle cover. The majority of point contacts in the five plots were bare rock. Plot 374 which has been dominated by red algae comprised primarily of *Chondracanthus* and *Mazzaella* for many years, was instead comprised solely of crustose forming algal species as if the majority of the area comprising the plot and surge channel had been scoured clean. *Endocladia* plots had 30.2% (47% measured last November) mean *Endocladia* cover. The majority of point contacts in the five plots were bare rock. The rockweed plots had 0.2% (0.2% measured last November) mean *Silvetia* cover

(1% measured in plot 356) and 0.2% mean *Pelvetiopsis hybrida* cover (1% measured in plot 358). Most of the point contacts within the rockweed zone were bare rock or *Endocladia* (mean = 12.4%). Mussel (*Mytilus californianus*) plots had 46% (54.4% measured last November) mean cover. The majority of cover in the five plots was occupied by mussels.

Last February, we observed that the wall that plot 374 is located on appeared to have been scoured from the base to a point approximately half way up whereby all the foliose algae (i.e., *Mazzealla*, *Chondracanthus*, etc.) have been removed. Left remaining are crustose algal species including *Ralfsia*, *Lithothamnion*, etc. Overall, the site appeared to be in fair condition. *Silvetia* was in low abundance and many thalli were tattered and appeared to be in poor condition, but most thalli were reproductive; very few recruits were seen. *Mytilus* was common but similar in abundance to observations from recent years and no recruitment was observed. Very few *Balanus* were observed. Most barnacles were *Chthamalus*, but these were not particularly abundant either. *Endocladia* was common to abundant but not robust and lush in appearance. The newly described rockweed species, *Pelvetiopsis hybrida*, was present (N = 32 thalli were counted; several of which were small recruits). The black abalone count was higher (N = 301) than usual, if not the highest that has been observed.

12/14/2017. Crook Point.

Low tide 0.08 ft at 1404 hrs. The conditions were less than ideal due to the constant wetting of the outer reef as a result of the relatively-large long-period swell out of the northwest. Even though the site faces predominantly towards the south, apparently it is still subject to west swells as they wrap around the island. Unfortunately, the large and frequent sets of waves significantly compromised our ability to adequately search for and measure black abalone and sea stars, but we were able to confidently sample all the fixed plots. The wind was light. There were 36 cormorants, 5 gulls, 3 black oystercatchers, 8 black belly plovers, 1 unidentified songbird and 1 black phoebe at the site upon arrival. One juvenile California sea lion was seen in the water near the site and 9 juvenile elephant seals were resting on the beach east of the site. The site was monitored from 1030 to 1530. There were two urchin commercial fishing vessels nearby offshore the entire day.

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

No plot repairs were necessary during this visit.

The temperature logger #10999078 located in the mid intertidal nearby the abalone plots was replaced with logger #10999088 at 1415. The temperature logger #10999076 that was deployed on 2/10/17 above the site near the staging area in a rock depression with a small grapefruit-sized red rock covering it was left in place. A GPS point was taken to mark the location.

A 30-minute search was conducted for black abalone (*Haliotis cracherodii*) presence by Adri and Luis. N = 57 black abalone (sizes ranged 30–137 mm) were observed site-wide from the east end excluding the offshore reef to the west end in line with plot 388. As mentioned, the large swell likely impacted our ability to confidently locate abalone particularly on the south side of the reef. Abalone were counted first and then a subset was measured afterwards. Only plot 393 was sampled for

abalone; N = 4 black abalone were seen inside the plot. All other fixed black abalone plots were not sampled. For reference, last February, N = 57 black abalone (sizes ranged 28–140 mm) were observed site-wide from the east end excluding the offshore reef to the west end in line with plot 388. In February 2016, N= 42 black abalone (sizes ranged 32–153 mm) were observed site-wide.

A 30-minute search was conducted for ochre star (*Pisaster ochraceus*) presence by Adri and Luis. N = 5 ochre stars were observed site-wide (from the east end excluding the offshore reef to the west end in line with plot 388) (sizes ranged 90–130 mm, mode = 130 mm). All sea stars appeared to be healthy with no visible lesions. Note that conditions were not optimal for conducting sea star or black abalone searches. For reference, last February, N = 23 ochre stars were observed site-wide (from the east end excluding the offshore reef to the west end in line with plot 388) (sizes ranged 40–130 mm, mode = 80 mm). All sea stars appeared to be healthy with no visible lesions. Note that conditions were not optimal for conducting sea star or black abalone searches. In February 2016, N = 15 *P. ochraceus* (sizes ranged 10–100 mm) were observed site-wide.

Mussel measurements were taken by Adri and Luis. Mussel lengths ranged 20–60 mm and bed depths ranged 20–80 mm in *Mytilus* plots 1–5. All plots appeared to be comprised of monolayers of *Mytilus*. For reference, last February, Mussel lengths ranged 10–70 mm and bed depths ranged 20–60 mm in *Mytilus* plots 1–5. All plots appeared to be comprised of monolayers of *Mytilus*.

The barnacle (*Chthamalus* spp./ *Balanus* spp.) plots had 28.8% (23% measured last February) mean barnacle cover. The majority of the point contacts in the five plots were bare rock. *Endocladia* plots had 17.2% (19.8% measured last February) mean *Endocladia* cover. The majority of the point contacts in the five plots were bare rock. *Endocladia* plot 389 had 54% mussels present. The rockweed plots had 0% (0% measured last February) *Hesperophycus* and *Silvetia* cover (the same was documented in February 2016). Most of the cover within the rockweed zone was dominated by mussels (mean = 31.6%). Mussel (*Mytilus californianus*) plots had 76% (76.6% measured last February) mean cover. The majority of cover in the five plots was occupied by mussels.

Green algae (*Ulva* and *Cladophora*) were highly abundant. *Mytilus* was also dominant; but nearly all mussels were small (30–50 mm). Three rockweed species (*Silvetia compressa*, *Pelvetiopsis hybrida, P. californicus*) were present in extremely low abundance. *Silvetia* and *P. californicus* appeared to be in poor condition. *P. hybrid* was in better condition and some recruitment was observed for the species but the population was low overall (N = 35 thalli counted). *Anthopleura xanthogrammica* and *A. sola* were highly abundant. *Mastocarpus pappilatus* was also abundant, particularly in comparison to *Mazzaella affinus*. *Balanus* and *Chthamalus* were common and approximately equal in abundance; very few empty tests were seen. *Analipus japonica* was observed along both sides of the surge channel.

12/15/2017. Cuyler Harbor.

Low tide -0.19 ft at 1439 hrs. The conditions were decent but wet due to the frequent sets of fairly large and powerful waves coming out of the NW. We accessed the site via the wind tunnel from the Cardwell trail, and then came back to housing on the beach. There were 2 black oystercatchers at the site upon arrival. Two juvenile California sea lions were in the water nearby the site. The site was

monitored from 1200 to 1615. Luis stayed back at housing due to an overuse injury made worse by hiking.

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

No plot repairs were necessary during this visit.

A temperature logger #10999075 above the site near the staging area in a sandstone outcrop (the largest one seen as you look backwards at the site) was replaced at 1600 by logger #10999078.

A 30-minute search was conducted for black abalone (*Haliotis cracherodii*) presence by Adri. N = 19 black abalone (sizes ranged 50–85 mm) were observed site-wide. The majority was observed under the large rock where R1 is located. This is the third consecutive year that black abalone have been observed at this site in perhaps 20 or more years. For reference, last February, N = 15 black abalone (sizes ranged 30–109 mm) were observed site-wide. The majority was observed under the large rock where R1 is located. In February 2016, N = 1 black abalone (86 mm) was observed site-wide.

A 30-minute search was conducted for ochre star (*Pisaster ochraceus*) presence by Adri. N = 3 ochre stars were observed site-wide (sizes ranged 100–120 mm); all individuals appeared healthy. For reference, last February, N = 12 ochre stars were observed site-wide (sizes ranged 60–170 mm, mode = 120 mm). Two sea stars appeared to have lesions. These were noted and photographed to obtain a second opinion. In February 2016, N = 6 *P. ochraceus* (sizes ranged 30–150 mm) were observed site-wide; all appeared to be healthy.

Mussel measurements were taken by Adri. Mussel lengths ranged 20–130 mm and bed depths ranged 35–110 mm in *Mytilus* plots 1–5. All plots appeared to be comprised of monolayers of *Mytilus*. For reference, last February, mussel lengths ranged 10–120 mm and bed depths ranged 20–90 mm in *Mytilus* plots 1–5. All plots appeared to be comprised of monolayers of *Mytilus*.

The barnacle (*Chthamalus* spp./*Balanus* spp.) plots had 30.4% (22.8% measured last February) mean barnacle cover. The majority of the point contacts in the five plots were bare rock. *Endocladia* plots had 17.6% (25.8% measured last February) mean *Endocladia* cover. The majority of the point contacts in the five plots were bare rock, but all five plots were relatively diverse with substantial cover of *Mytilus* (mean = 11.2%) and *Balanus/Chthamalus* (mean = 11.4%). The rockweed plots had 0% *Hesperophycus* and *Silvetia* cover (the same was documented last February). Most of the point contacts within the rockweed plots were bare rock, but like the Endocladia plots, the rockweed plots were fairly diverse with substantial amounts of *Mytilus* (mean = 9.4%), *Balanus/Chthamalus* (mean = 12.4%) and non-coralline crust (mean = 7.4%). Mussel (*Mytilus californianus*) plots had 74.2% (73.8% measured last February) mean cover. The majority of cover in the five plots was occupied by mussels.

Several *Cancer* sp. crabs (likely *antennarius*) were seen in the large tidepool located on the south side of the site. *Mytilus* was highly abundant and relatively recent recruitment was observed in the

lower zone with in the *Phragmatopoma*. *Silvetia* appeared to be slightly more abundant relative to last year and it was quite robust and healthy-appearing with a low percentage of new recruits. *Hesperophycus* also appeared robust with a slightly higher percentage of new recruits (approx. 26 thalli, 9 of which appeared to be juveniles). *Balanus* and *Chthamalus* were both common with few empty tests seen. *Endocladia* was low-lying and not particularly robust in appearance but it was widespread.

12/17/2017. Harris Point.

Low tide -0.45 ft at 1543 hrs. The conditions were only mediocre due to the large swell generated out of the northwest that made for wet and potentially dangerous conditions. Despite the borderline poor conditions, we were able to complete all protocols safely and conduct the site searches with moderate confidence. The wind was light. Three black oystercatchers, 1 sea lion and 3 adult harbor seals were at the site upon arrival (note that the pinnipeds were in the water). No pups were present. The site was monitored from 1200 to 1730.

Plots were photographed by Adri and Luis. Site panoramas were photographed by Adri. All 25 photoplots at the site were scored in the field by Stephen. The field log was completed by Stephen.

No repairs were made during this visit, but several plots require the addition of a third bolt – see photolog from February 2017 visit for details. A total of 17 bolts still needs to be deployed. However, all plots were easy to locate. Several of the barnacle plots were mislabeled with the incorrectly numbered bolt; all misidentified plots currently have an epoxy patch that correctly identifies them. The mislabeled barnacle plots were later fixed on 2/11.

The Hobotemp Tidbit temperature logger #10443594 located above the site was replaced at 1645 by logger #10999091.

A 30-minute search was conducted for black abalone (*Haliotis cracherodii*) presence by Adri and Luis. N = 103 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 20–160 mm, most individuals were located 1–10 cm more apart from one another). The five fixed plots were not sampled. Despite the marked increase in abundance of black abalone relative to past visits, we think our survey was likely hampered by the poor conditions caused by the large swell. For reference, last February, A 45-minute search (note that search time includes time spent measuring) was conducted for black abalone (*Haliotis cracherodii*) presence by Emily and Hillary. N = 44 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 52–150 mm, most individuals were located spaced 1–10 cm more apart from one another). All five fixed plots were sampled; all had N = 0 except plot 443 with N = 3 black abalone. In February 2016, N = 25 black abalone were seen at the site; sizes ranged 18–168 mm, most were spaced 1–10 cm apart from one another.

A 30-minute search was conducted for ochre star (*Pisaster ochraceus*) presence by Adri and Luis. 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). Three *Patiria* were observed ranging in size 18–36 mm. For reference, last February and February 2016, zero sea stars were observed.

Owl limpets (*Lottia gigantea*) were counted and measured in the fixed plots by Stephen. Plots 1–5 had N = 13, 33, 76, 82 and 15 owl limpets, respectively. Sizes of *L. gigantea* lumped across the five plots ranged 8–70 mm. For reference, last February plots 1–5 had N = 14, 27, 64, 76 and 31 owl limpets, respectively. Sizes of *L. gigantea* lumped across the five plots ranged 9–76 mm. In February 2016, 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.

Mussel measurements were taken by Adri and Luis. Mussel lengths ranged 10–90 mm and bed depths ranged 15–90 mm in *Mytilus* plots 1–5. All plots appeared to be comprised of monolayers of *Mytilus*. For reference, last February, mussel lengths ranged 10–80 mm and bed depths ranged 10–60 mm in *Mytilus* plots 1–5. All plots appeared to be comprised of monolayers of *Mytilus*.

The barnacle (*Chthamalus* spp./ *Balanus* spp.) plots had 13.4% (10.6% measured last February) mean barnacle cover. The majority of point contacts in the five plots were bare rock. *Endocladia* plots had 16.2% (46% measured last February) mean *Endocladia* cover. The majority of point contacts in the five plots were bare rock. The rockweed plots had 0.2% (0.2% measured last February) mean *Pelvetiopsis hybrida* cover and 0% *Hesperophycus* and *Silvetia* cover. Note that the only rockweed present at this site appears to be *Pelvetiopsis hybrida* – and all previous *Hesperophycus* cover data have been converted to *P. hybrida*. Most of the point contacts within the rockweed zone were bare rock. Mussel (*Mytilus californianus*) plots had 28.8% (29.6% measured last February) mean cover. The majority of point contacts in the five plots were bare rock. The *Tetraclita* zone had 14% (20.4% measured last February) mean *Tetraclita* cover. The majority of point contacts in the five plots were bare rock.

No *Silvetia* or *Hesperophycus* were seen anywhere at the site. Approximately 129 *Pelvetiopsis hybrida* thalli (approx. 10% new recruits) were counted; all were located on the north-facing side of the surge channel across from plot 435. *Endocladia* was ubiquitous but not highly robust in appearance. *Chthamalus* appeared less abundant than *Balanus*; both barnacle species were spotty in occurrence and not particularly abundant. *Mytilus* was widespread but recruitment was not apparent. *Tetraclita* and to a lesser degree, *Pollicipes*, were common in the *Mytilus* assemblages. *Lottia gigantea* was highly abundant in plots 3–4 but abundances were highly comparable to those last February. Black abalone abundance more than doubled from the count conducted last February despite the poor monitoring conditions.

Anacapa Island, January 27 and 30, 2018

Prepared by Stephen Whitaker

Purpose

To monitor rocky intertidal sites at Anacapa Island.

Personnel

- Stephen Whitaker, Marine Ecologist, Channel Islands National Park
- Adri Sparks, Technician, UCSC
- Luis Hernandez, Technician, UCSC

- Kenan Chan, VIP
- Ellie Ford, VIP
- Michael Ready, VIP

Procedure and General Observations

We utilized the R/V Shearwater to access the island as part of a scheduled trip to do surveys for the invasive alga, *Undaria pinnatifida*. The original trip was planned for three days in November but got rescheduled for January 27–29, 2018. Unfortunately, we lost two of the days in January due to strong Santa Ana winds that made for dangerous conditions, but we were able to make up one of the days on the 30th. Standard procedures were used for monitoring all three rocky intertidal sites. Photographs of plots were taken at all sites, and all plots were scored in the field at each site except South Frenchy's Cove. Plots and site overviews were photographed with an Olympus Tough TG-5 12 Megapixel 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 at any sites. The maximum number of shorebirds and pinnipeds observed was recorded. The Hobotemp Tidbit temperature loggers were replaced at all three sites. Mussel sizes and mussel bed depths were measured at all three sites.

1/27/2018. Middle West.

Low tide -0.41 ft at 1255 hrs. The conditions were perfect for sampling. The sky was overcast, wind was light (<5 kt) and swell/surge was minimal (<1 ft). Twelve gulls and one harbor seal (in water) were observed at the site. The site was monitored from 1000 to 1515. UCSC personnel (Nate Fletcher, Maya George and Laura Anderson) joined us to conduct a biodiversity survey. Additionally, Monique Navarro came along to photograph people working in the intertidal.

Plots were photographed by Adri and Luis. Site panoramas were photographed by Adri. Photoplots were scored in the field by Stephen.

A 30-minute search was conducted for black abalone (*Haliotis cracherodii*) presence by Luis and Kenan. N = 15 black abalone were observed site-wide. Most individuals were located 51–100 cm apart. Sizes ranged 40–129 mm. For reference, during the last visit (December 2016), N = 7 black abalone were observed site-wide. Most individuals were located 1–5 m apart. Sizes ranged 40–123 mm. In fall 2015, N = 17 black abalone were observed site-wide, and N = 34 were seen in fall 2014.

A 30-minute search was conducted for ochre star (*Pisaster ochraceus*) presence by Luis and Kenan. N = 1 ochre star (60 mm) and one *Patiria* were observed site-wide. The individual appeared to be healthy and free of lesions. For reference, during the last visit (December 2016) and in fall 2015, N = 1 ochre star was observed site-wide.

The field log was completed by Stephen.

Lottia gigantea were measured within the fixed plots by Kenan, Adri and Luis (and plots were then checked for accuracy by Nate Fletcher and Stephen Whitaker). Abundances in plots 1–3 were N = 48, 1 and 16, respectively. Sizes ranged 9–68 mm. For reference, in December 2016, abundances in

plots 1–3 were N = 82, 11 and 29, respectively. Sizes ranged 9–68 mm. In fall 2015, abundances in plots 1–3 were N = 31, 7 and 11, respectively. Sizes ranged <15–60 mm.

Two bolts were installed in plot 456. Plot 465 is missing the "5" on the epoxy number plate and needs to be added during the next visit. The temperature logger #10010340 located above the upper intertidal zone inshore of Lottia plot 2 (9.2 m) and 14 m inshore from L3 was replaced by logger #20186768 at 1415. The logger #10999084 in the mid intertidal was replaced by logger #10999092 at 1405.

Mussels were measured in the five original *Mytilus* plots by Adri and Luis. Sizes of mussels ranged 10–50 mm and mussel bed depths ranged 10–64 mm; all plots were monolayers. The mussel beds were noted as being fairly empty with the majority of mussels being very small and clustered in little patches. For reference, in December 2016, sizes of mussels ranged 10–40 mm and mussel bed depths ranged 1–6 cm; all plots were monolayers. The mussel beds were noted as being fairly empty with the majority of mussels being very small and clustered in little patches. In fall 2015, the mussel measurement protocol was attempted in the five *Mytilus* plots, but there were zero mussels in all plots.

The barnacle (*Chthamalus* spp./ *Balanus* spp.) had 21% (14.2% measured in December 2016) mean barnacle cover. The majority of point contacts in the five plots were bare rock, though the plots were relatively diverse for the barnacle zone. *Caulacanthus* comprised 10.2% (7.8% in December 2016) of the plots and was seen in plots 448–450. In fall 2015, *Caulacanthus* comprised 3% and 5% of plots 448 and 450, respectively. *Endocladia* plots had 6.2% (2.6% measured in December 2016) mean *Endocladia* cover. 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 and *Mazzaella* among less abundant taxa. *Caulacanthus* was measured in three of the Endocladia plots and ranged 1–12%. In December 2016, the invasive alga was measured in all five plots and ranged 2–19%. In fall 2015, the invasive alga comprised 3% of plots 457 and 458 and 1% of plot 460. The rockweed plots had 0% (0% measured in December 2016) 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 1–2% of plot 452, 454 and 455. In fall 2015, the invasive occupied 4% and 1% of plot 454 and 455, respectively. Mussel (*Mytilus californianus*) plots had 23.2% (8.2% measured in December 2016) mussels. The majority of cover in the five plots was occupied by *Mazzaella, Gelidium, Chondracanthus, Tetraclita* and articulated corallines.

Caulacanthus was observed along the entire reef from the high to mid intertidal. *Mytilus* and *Tetraclita* appeared healthy and common throughout the length of the reef in patches; new recruits were not observed for either of the species. *Chondracanthus canaliculatus* was by far the most dominant alga. *Endocladia* appeared robust and common but not particularly abundant. No rockweeds were seen. *Sargassum muticum* was common in pools and the lower intertidal. *S. horneri* was observed but abundances declined markedly from the last visit. Only two thalli were observed.

No zebra perch were observed this time in contrast to the last visit. *Balanus* was relatively rare. *Chthamalus* was comparably more abundant.

1/30/2018. Cat Rock.

Low tide -1.78 ft at 1508 hrs. The conditions were perfect for sampling given the phenomenally-low tide combined with virtually no swell and very light wind. The only limiting factor was working time due to the strict schedule that the CINMS crew had to return to the harbor before dark. We were dropped off at Scorpion Anchorage, SCI before the Shearwater continued to Ventura. One black oystercatcher and one gull were observed at the site upon arrival; one harbor seal was seen in the water near the adjacent reef when we departed. The site was monitored from 1215 to 1515. The crew was split between Cat Rock and South Frenchy's Cove to monitor two sites in one day since we had limited vessel time. Crew for Cat Rock consisted of Stephen Whitaker and Adri Sparks. Michael Ready (photographer from San Diego) and Monique Navarro also came out and stuck around Cat Rock to shoot photographs.

Note that in fall 2015, we reduced the number of plots at Cat Rock from 9 per zone to 5 per zone. Rationale for dropping plots was based on the results of a power analysis done by Raimondi et al. (2018) 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 Adri. All 20 photoplots were scored in the field by Stephen.

A 30-minute search was conducted for black abalone (*Haliotis cracherodii*) presence by Adri. N = 15 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 1–10 cm apart. Sizes ranged 54–148 mm. 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. For reference, last fall N = 17 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 1–10 cm apart. Sizes ranged 42–155 mm. In fall 2015, N = 41 black abalone were observed site-wide.

A 40-minute search was conducted for ochre star (*Pisaster ochraceus*) presence by Adri. N=2 ochre stars (140 and 180 mm) were observed site-wide (from *Lottia* plot #3 on the west end of the site to the abalone plots at the east end); both individuals appeared to be healthy. For reference, last fall, N =

1 ochre star (130 mm) was observed site-wide (from *Lottia* plot #3 on the west end of the site to the abalone plots at the east end). In fall 2015, N = 0 *P. ochraceus* was seen at this site.

The field log was completed by Stephen.

Lottia gigantea were measured within the fixed plots by Adri and Stephen. Abundances in plots 1–3 were N = 39, 39 and 7, respectively. Sizes of limpets in the three plots ranged 12–58 mm. For reference, last fall, abundances in plots 1–3 were N = 44, 48 and 16, respectively (sizes ranged 11–61 mm). In fall 2015, abundances in plots 1–3 were N = 19, 29 and 6, respectively (sizes ranged 17–57 mm).

No plot repairs were necessary this visit. All plots were easy to locate even though there are numerous other plots present that are no longer monitored. The only plots that have bolts are the subset 20 that will be monitored in perpetuity.

Mussels were measured in the five *Mytilus* plots by Adri. Sizes of mussels ranged 10–40 mm and mussel bed depths ranged 15–68 mm; all plots were monolayers. For reference, last fall, sizes of mussels ranged 10–40 mm and mussel bed depths ranged 2–4 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 57% (39.6% measured in December 2016) mean barnacle cover. The majority of point contacts in the five plots were *Chthamalus* spp./ *Balanus* spp. *Endocladia* plots had 14.4% (19.2% measured in December 2016) mean *Endocladia* cover. The majority of space in the five plots was bare rock, but the plots were fairly diverse with moderate levels of cover for *Tetraclita, Mytilus*, non-coralline crust and other less common taxa. The rockweed plots had 2.6% (2.4% measured in December 2016) mean *Silvetia* cover and 12.6% (14.8% measured in December 2016) *Hesperophycus* cover. Most of the space within the rockweed zone was bare rock. Mussel (*Mytilus californianus*) plots had 37.2% (33.6% measured in December 2016) mean cover. The majority of cover in the five plots was occupied by *Mytilus*.

Most of the *Chondracanthus canaliculatus* appeared bleached along with some of the *Endocladia* and many of the lower tide algal species. *Balanus* was rare compared to *Chthamalus* abundances; few empty tests were seen for either species. *Mytilus* was highly abundant but few new recruits were seen. *Tetraclita* was highly common with a low level of recruitment present. *Silvetia* (subsp. *deliquescens*) formed expansive beds on the inner reef (refer to site pictures). *Silvetia* was reproductive throughout most of the bed; recruits were not observed in abundance but little effort was placed on searching for recruitment. *Silvetia* was slightly discolored (orangish) throughout approx. half the population. *Hesperophycus* was less abundant than *Silvetia* but still quite abundant (more so than most other monitoring sites). *Phyllospadix* was bleached and fouled (mostly by *Melobesia*) throughout approx. 25% of the population.

<u>1/30/2018. South Frenchy's Cove.</u>
Low tide -1.78 ft at 1508 hrs. The conditions were perfect for sampling given the phenomenally-low tide combined with virtually no swell and very light wind. The only limiting factor was working time

due to the strict schedule that the CINMS crew had to return to the harbor before dark. No shorebirds or pinnipeds were observed at the site upon arrival. The site was monitored from 1230 to 1445. The crew was split between Cat Rock and South Frenchy's Cove to monitor two sites in one day since we had limited vessel time. Crew for South Frenchy's consisted of Hillary Krumbholz and Luis Hernandez.

Plots were photographed by Luis and Hillary. Site panoramas were photographed by Luis. All the photoplots were scored in the office by Stephen. Note that plot 257 was not photographed or scored.

A 30-minute search was conducted for black abalone (*Haliotis cracherodii*) presence by Luis. N = 0 black abalone were observed site-wide (from sand channel to sand channel on both sides of the site). Note that black abalone have not been seen at this site for numerous years. For reference, last fall, N = 0 black abalone were observed site-wide (from sand channel to sand channel on both sides of the site).

A 30-minute search was conducted for ochre star (*Pisaster ochraceus*) presence by Adri. N = 0 ochre stars were observed site-wide (from sand channel to sand channel on both sides of the site). Note that ochre sea stars have not been seen at this site for numerous years. For reference, last fall, N = 0 ochre stars were observed site-wide (from sand channel to sand channel on both sides of the site).

The field log was not completed.

Lottia gigantea were measured within the fixed plots by Hillary. Abundances in plots 1–3 were N = 6, 18 and 6, respectively. Sizes ranged 13–54 mm. For reference, last fall, abundances in plots 1–3 were N = 8, 19 and 7, respectively. Sizes ranged 10–56 mm. In fall 2015, abundances in plots 1–3 were N = 2, 17 and 5, respectively. Sizes ranged 18–51 mm.

Numerous plot repairs were conducted in 2014. No repairs were necessary this year. All plots were easily located. The temperature logger located above the upper intertidal zone was not located and therefore not downloaded or replaced. The logger #10999086 in the mid intertidal was replaced by logger #10999083 at 1415.

The barnacle (*Chthamalus* spp./*Balanus* spp.) plots had 38.4% (11.8% measured in December 2016) mean barnacle cover. The majority of point contacts in the five plots were bare rock. *Endocladia* plots had 31.25% (note that plot 257 was not photographed or scored – mean is calculated using 4 plots) (33.6% measured in December 2016) mean *Endocladia* cover. The majority of point contacts in the four plots was bare rock. The rockweed plots had 62% (55.4% measured in December 2016) mean *Silvetia* cover. Most of the cover within the rockweed zone was dominated by *Silvetia*. Mussel (*Mytilus californianus*) plots had 51.2% (59.2% measured in December 2016) mean cover. The majority of cover in the five plots was occupied by *Mytilus*.

Mussels were measured in the five *Mytilus* plots by Hillary. Sizes of mussels ranged 10–50 mm and mussel bed depths ranged 1–6 cm; all plots were monolayers. For reference, last fall, sizes of mussels ranged 10–50 mm and mussel bed depths ranged 1–4 cm; all plots were monolayers. In fall 2015, 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 high but all of the plots were free of sand. *Silvetia* appeared robust, common and reproductive. *Endocladia* also appeared to be healthy with only slight bleaching. *Mytilus* was common but individuals were not particularly large and recruitment was not seen. *Hesperophycus* was common (approx. 100 thalli were counted).

Santa Cruz Island, January 31, 2018

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
- Luis Hernandez, UCSC Technician
- Adri Sparks, UCSC Technician
- Michael Ready, VIP

Procedure and General Observations

The CINMS Shearwater was used to access the island following completion of monitoring at the Anacapa sites. Standard procedures were used for monitoring the rocky intertidal site. Plots and site overviews were photographed with an Olympus Tough TG-5 12 Megapixel digital camera. Photoplots were scored in the field at Sites A and B. Black abalone were counted and measured during timed site-wide searches at Site A and Site B; sea stars were counted and measured 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 Site A was recorded. Hobotemp Tidbit temperature loggers are not present at Scorpion Rock. Mussel sizes and mussel bed depth were measured at Site A. Island Packers provided transportation off the island.

1/31/2018. Scorpion Rock (Sites A and B).

Low tide -1.77 ft at 1549 hrs. The conditions were spectacular with an extremely-low tide, minimal swell and light wind. Sky was clear and sunny all day. The night before, the moon was both “super” and “blue”, and it was eclipsed in the early morning hours. There were no shore birds at Site A upon arrival, but there were approx. 5 black oystercatchers at Site B. One harbor seal was seen in the water nearby Site A. The site was monitored from 1215 to 1730.

Plots were photographed by Adri. Site panoramas were photographed by Adri. All 25 photoplots at Sites A and B were scored in the field by Stephen.

A 30-minute search was conducted for black abalone (*Haliotis cracherodii*) presence at Site A by Adri. N = 14 black abalone were observed site-wide at Site A (sizes ranged 34–155 mm, most individuals were located 1–10 cm apart or were touching one another). For reference, last fall, N = 25 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). In fall 2015, N = 35 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). In fall 2014, 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).

A 60-minute search was conducted for black abalone (*Haliotis cracherodii*) presence at Site B by Adri and Luis. N = 556 black abalone were observed from the bedrock reef located at the north end of the beach to the reef located at the south end of the cove including the boulders in the center. An estimated 100–200 additional abalone were not included in the count due to lack of time to adequately search the site. Many boulders had dozens if not >100 black abalone under them. Most abalone were located in the boulder field, particularly the boulders within the northwest portion of the cove. Due to time limitations, only a small subset was measured for size frequency; sizes ranged 58–131 mm. For reference, in October 2016, a 30-minute search was conducted for black abalone (*Haliotis cracherodii*) presence across the southern half (middle of site to the south including small raised reef that we typically land on when skiffing) of Site B by Kenan. N = 37 black abalone were observed. Kenan then spent an additional 35 minutes surveying black abalone presence in the area comprising the northern half (middle of the site to the northern end of the boulder field including the small finger reef connected to the Little Scorpion Island) of the site. N = 236 black abalone were observed. Sizes of individuals across the entire area ranged 44–139 mm and most individuals were either touching or within 1–10 cm of one another.

A 30-minute search was conducted for ochre star (*Pisaster ochraceus*) presence at Site A by Adri. N = 4 ochre stars (sizes ranged 60–170 mm) were observed site-wide; all appeared to be healthy. For reference, last fall, N=5 ochre stars (sizes ranged 64–88 mm) were observed site-wide; all appeared to be healthy. In fall 2015, N = 0 ochre stars were observed site-wide. In fall 2014, 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.

No repairs were necessary, but plot 823 was noted as missing etch marks on the head of the upper-left bolt which indentify the plot. Sensor housings were surprisingly clean of fouling organisms.

The barnacle (*Chthamalus* spp./*Balanus* spp.) had 26.2% (35% measured during the last visit in October 2016) mean barnacle cover. The majority of point contacts in the five plots were bare rock. *Endocladia* plots had 28.6% (23.2% measured during the last visit in October 2016) mean *Endocladia* cover. The majority of point contacts in the five plots were *Endocladia*. Mussel (*Mytilus californianus*) plots had 84.6% (58.8% measured during the last visit in October 2016) mean mussel cover. The majority of cover in the five plots was occupied by Mytilus and *Tetraclita* (mean = 8.4%). The *Tetraclita* plots had 34.6% (34.4% measured during the last visit in October 2016) mean *Tetraclita* cover. The majority of cover in the five plots was occupied by *Tetraclita*. The *Hesperophycus* plots had 12.8% (24.4% measured during the last visit in October 2016) mean

Hesperophycus cover. Most of the point contacts within the *Hesperophycus* zone were bare rock (mean = 41.6%).

Mussels were measured in the five *Mytilus* plots by Luis. Sizes of mussels ranged 20–100 mm and mussel bed depths ranged 20–131 mm; all plots except plot 1 were monolayers. For reference, last year, sizes of mussels ranged 20–80 mm and mussel bed depths ranged 1–5 cm; all plots except plot 1 were monolayers. In fall 2015, mussels measured 10–50 mm and mussel bed depths ranged 1–5 cm; all plots were monolayers.

Brachydontes was highly common along with *Septifer*. Dozens of *Norrisia* were observed. Several *Megathura* were present. Several *Strongylocentrotus franciscanus* were seen. *Mytilus* and *Tetraclita* appear to be the two most ubiquitous species at Site A. Both species are highly abundant and appear healthy with very few open tests/ shells in the upper intertidal. *Endocladia* and *Chthamalus* were relatively abundant and appeared healthy. *Balanus* occurred in lower abundance than *Chthamalus*. *Pollicipes* was not abundant and most individuals were quite small. At Site B, *Hesperophycus* appeared robust and relatively abundant (approx. 80 *thallii* counted). *Silvetia* (subsp. *deliquescens*) also looked healthy and abundant. Both rockweed species had low levels of recruitment. One green abalone was observed.

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

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