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Channel Islands National Park
Kelp Forest Monitoring Program

Annual Report 2015

Natural Resource Report NPS/MEDN/NRR—2022/2354



ON THE COVER

Pyrosome amongst giant kelp (*Macrocystis pyrifera)* at Channel Islands National Park.
Photograph by: Shaun Wolfe, National Park Service, Our World Underwater Scholarship Society

Channel Islands National Park
Kelp Forest Monitoring Program

Annual Report 2015

Natural Resource Report NPS/MEDN/NRR—2022/2354

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Executive Summary

Channel Islands National Park (CHIS) has conducted long-term ecological monitoring of the kelp forests around San Miguel, Santa Rosa, Santa Cruz, Anacapa and Santa Barbara Islands since 1982, this being the 34th year of monitoring. The original permanent transects were established at 16 sites between 1981 and 1986 with the first sampling beginning in 1982. An additional site, Miracle Mile, was established at San Miguel Island in 2001 by a commercial fisherman with assistance from the park. Miracle Mile was partially monitored from 2002-2004, and then fully monitored (using all KFM protocols) since 2005. In 2005, 16 additional permanent sites were established to collect baseline data from inside and adjacent to four marine reserves that were established in 2003. Sampling results from all 33 sites mentioned above are included in this report. Funding for the Kelp Forest Monitoring Program (KFM) in 2015 was provided by the National Park Service (NPS).

The 2015 monitoring efforts utilized 53 days of vessel time to conduct 956 dives for a total of 1005 hours of bottom time. Population dynamics of a select list of 71 "indicator species" (consisting of taxa or categories of algae, fish, and invertebrates) were measured at the 33 permanent sites. In addition, population dynamics were measured for all additional species of fish observed at the sites during the roving diver fish count. Survey techniques follow the CHIS Kelp Forest Monitoring Protocol Handbooks (Davis et al., 1997, and Kushner and Sprague, in progress). The techniques utilize SCUBA and surface-supplied-air to conduct the following monitoring protocols: 1 m^2 quadrats, 5 m^2 quadrats, band transects, random point contacts, fish transects, roving diver fish counts, video transects, size frequency measurements, and artificial recruitment modules. Hourly temperature data were collected using remote temperature loggers at 32 sites, the exception being Miracle Mile where there is no temperature logger installed. This annual report contains a brief description of each site including any notable observations or anomalies, a summary of methods used, and monitoring results for 2015.

All the data collected during 2015 can be found in the appendices and in an Excel workbook on IRMA. Roving diver fish count (RDFC), fish size frequency, natural habitat size frequency, and Artificial Recruitment Module (ARM) size frequency data are now stored on IRMA at https://irma.nps.gov/DataStore/Reference/Profile/2259652.

The status of kelp forests was notably different between the five Park Islands. This is a result of a combination of factors including but not limited to, oceanography, biogeography and associated differences in species abundance and composition, as well as sport and commercial fishing pressure. All 33 permanent sites were established in areas that had or were historically known to have had kelp forests in the past.

In 2015, 17 of the 33 sites monitored were characterized as developing kelp forest, kelp forest or mature kelp forest. In addition, four sites were in a state of transition. One site was part kelp forest and part dominated by *Ophiothrix spiculata*. One site was dominated by *Sargassum horneri*. Seven sites were dominated by echinoderms which were down from 10 sites in the previous year. The remaining three sites were characterized as barren areas, two if which had moderate to high abundances of *Strongylocentrotus* spp. Overall, the number of sites characterized as kelp forests

increased two from last year, and the number of sites characterized as being dominated by echinoderms decreased.

There have been dramatic changes at several Santa Barbara Island sites occurring over the last three years. The changes occurring at Graveyard Canyon and Southeast Sea Lion last year continued this year, with both sites continuing to have kelp forests, as well as noticeable decreases in *Strongylocentrotus* spp. Additionally, Webster's Arch has transitioned into kelp forests. Arch Point is in a state of transition and has an abundance of *Sargassum horneri* present. *Macrocystis pyrifera* density was higher at Southeast Sea Lion than we have documented in over two decades, and the thick carpet of *Ophiothrix spiculata* that has been present for many years continues to decrease. In addition to an abundance of *M. pyrifera, Sargassum horneri* is very abundant throughout the site. Graveyard Canyon continued to have a dense kelp forest with an abundance of understory algae present this year. In addition, *S. horneri* was abundant and was over 2 meters tall in many areas. Webster's Arch, which was dominated by echinoderms in 2013 and a state of transition in 2014, was a kelp forest with an abundance of other algae present. That site had more *Macrocystis pyrifera* present than we have documented there since it was established in 2005. Southeast Reef continued to be a mature kelp forest, similar to what has been present since the site was established in 2005. The remaining sites continued to be dominated by echinoderms with little algae present. The entire area around Southeast Sea Lion continues to have notably more kelp than since the mid-1990s. Overall, there was more kelp present at Santa Barbara than have been documented in the last two decades. The monitoring sites here appear to represent well the overall conditions of this island. While there is noticeably more kelp and algae at the sites inside the no-take MPA at this Island, we did see dramatic increases in algae outside the MPA.

Several Anacapa Island sites continue to be dominated by echinoderms. However, two sites had notably more *Macrocystis pyrifera* present and is likely due to decreased densities of *Strongylocentrotus* spp. The two sites in the Anacapa State Ecological Reserve that was established in 1978 continued to be kelp forests (Landing Cove and Cathedral Cove). Both Black Seabass Reef and Keyhole have more kelp present than in past years, though most of it is the non-native alga, *S. horneri*. The three remaining sites, which are all on the south side of the island not in an MPA, continued to be mostly dominated by echinoderms. The monitoring sites here appear to represent the overall conditions of this island well. Though there are patches of kelp surrounding the Island, there are notably more and larger patches of kelp on the North side of East and Middle Anacapa inside the MPA.

Most Santa Cruz Island sites remained similar to last year, but several sites located within the Scorpion MPA have noticeably changed. *Strongylocentrotus franciscanus* and *Ophiothrix spiculata* densities at Gull Island decreased and *Macrocystis pyrifera* increased, returning the site back to its more common kelp forest state. Fry's Harbor remains in a state of transition and difficult to determine which direction it is going. Scorpion Anchorage had a kelp forest over part of the site, and the invasive algae *Sargassum muticum* continues to be the dominant algal species at the site. Potato Pasture continued to have more *M. pyrifera* present than we have observed since this site was established and this site exhibits similarities of a well-established MA with many large fish and

lobsters. *Strongylocentrotus* spp. continued to dominate four of the 10 sites at this island, a decrease from five in 2014, and six in 2013. Though the KFM sites as a group appropriately represent the status of kelp forests at most of the eastern two-thirds of the Island, the sites do under-represent the western third of the island where only one site is present. At the western portion of this Island there are notably more kelp forests than at the eastern portion.

Kelp forests continued to be abundant around Santa Rosa and San Miguel Islands. Similar to last year, mature kelp forests were present at seven of the 10 sites at these two islands and *Strongylocentrotus franciscanus* was moderately abundant to abundant at the remaining three sites. Densities of *S. purpuratus* on Santa Rosa Island increased overall. The monitoring sites here appear to represent the conditions of these islands well with kelp forests present over much of these Islands.

As in previous years, temperature data were collected throughout the field season (May-October); therefore, we look at annual water temperatures from May 2014 to April 2015. The region continued to experience above average water temperatures this year. This warm water event has persisted since October 2013. Mean monthly benthic water temperatures from June 2014 through April 30th, 2015, which is the end of the time period covered for water temperatures in this annual report, were above average and most monthly mean temperatures were at or near record highs at all sites.

Acknowledgments

Funding for the kelp forest monitoring program in 2015 was entirely provided by the U.S. National Park Service (NPS) with most funding coming from the Stewardship of New Marine Protected Areas and some from the Inventory and Monitoring Program. The monitoring program is conducted in cooperation with the California Department of Fish and Wildlife (CDFW) and the U.S. Department of Commerce, National Oceanographic and Atmospheric Administration (NOAA), Marine Sanctuary Program.

We are deeply indebted to the many divers who have participated in this program in 2015 (Table 8). All volunteer divers were trained and/or certified with other agencies such as NOAA, CDFW, Aquariums and/or Universities. Without this other agency and/or volunteer base of well-trained and qualified divers it would be impossible to conduct this program at its current funding level. We also greatly appreciate the efforts of our Captain Keith Duran and our Park Dive Officer Kelly Moore for ensuring that all our operations run safely and successfully. In addition, to Park Dive Officer, Kelly Moore is an essential component to all aspects of the KFM program. We would like to especially thank our incredible NPS Seasonal Kelp Forest Monitoring Biological Technicians: Ben Grime, Michael Civiello, and Amanda Bird.

List of Acronyms

ARM:	Artificial Recruitment Module
CDFW:	California Department of Fish and Game (changed in 2012 to CDFW)
CDFW:	California Department of Fish and Wildlife
CDIP:	Coastal Data Information Program
CHIS:	Channel Islands National Park
CINMS:	Channel Islands National Marine Sanctuary
ENSO:	El Niño Southern Oscillation
KFM:	Kelp Forest Monitoring Program
KGB:	Kelp/Gopher/Copper/Black and Yellow Rockfish Complex young of the year
MEDN:	Mediterranean Coast Network
NOAA:	National Oceanic and Atmospheric Administration
NPS:	National Park Service
NRPP:	Natural Resources Preservation Program
SMR:	State Marine Reserve
SMCA:	State Marine Conservation Area
PISCO:	Partnership for Interdisciplinary Studies of Coastal Oceans
RPC:	Random Point Contact
UCSB:	University of California, Santa Barbara
YOY:	Young of the Year

Introduction

The waters of Channel Islands National Park (CHIS) and Channel Islands National Marine Sanctuary (CINMS) contain one third of southern California's kelp forests (CDFW 2004). Giant kelp, *Macrocystis pyrifera*, is the primary constituent of the southern California kelp forest, and over 1,000 species of macro flora and fauna live in this community (Woodhouse 1981, Engle pers. comm.). The kelp forest serves as food, shelter, substrate, and nursery to resident and migratory species. Many species, while not residents of the kelp forest, also depend upon their existence and productivity, as detrital flux from kelp forests provides an important source of nutrients to nearby rocky shore, sandy beach and estuary communities. Additionally, kelp forests are essential to California's commercial and sport fisheries as well as its recreation and tourism industries.

Channel Islands National Park consists of five of the eight California Channel Islands (San Miguel, Santa Rosa, Santa Cruz, Anacapa, and Santa Barbara) and the submerged lands and waters within one nautical mile of each of the islands. The CINMS overlaps the subtidal portions of the park, and its boundary extends six miles seaward from the park islands. The CHIS also bears the designation of International Biosphere Reserve and that of the State of California Area of Special Biological Significance. The State of California maintains jurisdiction over the living marine resources three miles from shore and manages them through CDFW.

The KFM is part of the long-term ecological monitoring conducted by the Mediterranean Coast Network of the NPS Inventory and Monitoring Program, which is designed to measure the health of the Park's ecosystems (Davis and Halvorson 1988). Kelp forests are considered a "Vital Sign" of ecosystem health for CHIS (Davis and Halvorson 1988). Funding for KFM in 2015 was entirely provided by the NPS with most funding coming from the Stewardship of New Marine Protected Areas and some from the Inventory and Monitoring Program. The objectives of KFM are as follows:

- Identify trends in ecosystem health
- Determine limits of variability
- Diagnose abnormal conditions
- Suggest potential remedial treatments

Following a five-year design study that began in 1982, KFM was fully implemented in 1987 by the park's resource management division using the protocol established during this phase (Davis and Halvorson, 1988). Preliminary results and specific design considerations can be found in reports written by Davis (1985, 1986). The KFM annual reports listed in Table 1 describe monitoring efforts and results for years 1982-2014. A review of KFM was conducted in 1995 (Davis et al., 1996, Schroeter et al., 1994), and the Kelp Forest Monitoring Handbook (Davis et al., 1997) was updated. An additional update to the handbook is in progress.

Table 1. Summary of Kelp Forest Monitoring Reports

Report Type	**Reference**
Evaluation of Sampling Design for Kelp Forest Monitoring Program	Schroeter et al. 1994
Kelp Forest Monitoring Design Review	Davis et al. 1996
Annual Report 1982-89	Richards et al. 1997
Annual Report 1990	Richards et al. 1993a
Annual Report 1991	Richards et al. 1993b
Annual Report 1992	Richards et al. 1994
Annual Report 1993	Kushner et al. 1995a
Annual Report 1994	Kushner et al. 1995b
Annual Report 1995	Kushner et al. 1997a
Annual Report 1996	Kushner et al. 1997b
Annual Report 1997	Kushner et al. 1998
Annual Report 1998	Kushner et al. 2000
Annual Report 1999	Kushner et al. 2001a
Annual Report 2000	Kushner et al. 2001b
Annual Report 2001	Kushner et al. 2004
Annual Report 2002	Kushner et al. 2007a
Annual Report 2003	Kushner et al. 2007b
Annual Report 2004	Kushner et al. 2007c
Annual Report 2005	Kushner et al. 2012
Annual Report 2006	Kushner et al. 2013a
Annual Report 2007	Moore et al. 2013
Annual Report 2008	Sprague et al. 2013a
Annual Report 2009	Kushner et al. 2013b
Annual Report 2010	Sprague et al. 2012
Annual Report 2011	Sprague et al. 2013b
Annual Report 2012	Sprague et al. 2013c
Annual Report 2013	Sprague et al. 2020
Annual Report 2014	Sprague et al.*in press*

Though KFM was fully implemented as an Inventory & Monitoring Program prototype "vital sign" in 1987 (Davis and Halvorson 1988), monitoring began at 14 sites in 1982 and two additional sites in 1986. An additional site, Miracle Mile, was established in an area of high *Haliotis rufescens* abundance at San Miguel Island in 2001 and was partially monitored from 2002-2004, and then fully monitored (using all KFM protocols) since 2005. In 2005, an additional 16 permanent sites were established to collect baseline data from inside and adjacent to four of 11 new MPAs that were established in 2003. Sampling results from all 33 sites are included in this report. For additional

information on protocol modifications, data management, database corrections, and additional projects information see Appendix A.

The 16 sites established in 2005 were located inside or adjacent to the following four State MPAs or State Marine Conservation Areas: Santa Barbara Island MPA, Anacapa Island MPA, Scorpion Anchorage MPA at Santa Cruz Island, and the South Point MPA at Santa Rosa Island. Only four of the 11 newly established MPAs were selected because of limited funding and the logistical constraints of conducting this type of monitoring. These four MPAs were chosen for the following reasons: accessibility, subjected to high fishing pressure prior to MPA implementation, and to make the best use of the KFM Program's existing baseline data. New sites were established to complement existing sites so that three sites were inside, and three sites were adjacent to each of the four MPAs, the exception being Anacapa Island which has four sites inside the MPA. This extra site was selected because it is inside a State Marine Conservation Area, which allows for take of pelagic finfish and lobster. The remaining 12 MPA reference sites are no-take MPAs, providing equal pairing with the 12 adjacent outside MPA reference sites.

This report summarizes the monitoring efforts and results from 2015, our 34th consecutive year of monitoring. It is anticipated that this report, and others, will provide some insight into kelp forest dynamics and stimulate further research into the long-term trends and changes in this near-shore ecosystem. We have highlighted some of the most important observations and tried to provide a characterization for each site. Organisms are referred to by genus and species, except when non-indicator species are mentioned, then both scientific and common names are used. Common names for the indicator species are cross-referenced to their scientific names in Table 2. Since the design of KFM, several genera and species names have been changed; these new names are cross referenced in Table 3.

Table 2. Regularly monitored species and associated monitoring technique(s)

Taxa	Common Name	Scientific Name	Technique*
Algae	Miscellaneous green algae	–	R
	Miscellaneous red algae	–	R
	Articulated coralline algae	–	R
	Encrusting coralline algae	–	R
	Agar weed	*Gelidium* spp.	R
	Sea tongue	*Gigartina* spp.	R
	Miscellaneous brown algae	–	R
	Acid weed	*Desmarestia* spp.	R
	Oar weed	*Laminaria farlowii*	R,Q
	Bladder chain kelp	*Cystoseira* spp.	R
	Giant kelp	*Macrocystis pyrifera*	R,Q,M

*Technique codes: Q= 1m^2 quadrats, M= 5m^2 quadrats, B= Band Transects, R= Random Point Contacts, S= Size Frequency Measurements, F= Roving Diver Fish Count, V= Visual Fish Transect.

Table 2 (continued). Regularly monitored species and associated monitoring technique(s)

Taxa	Common Name	Scientific Name	Technique*
Algae (continued)	California sea palm	*Pterygophora californica*	R,Q
	Southern sea palm	*Eisenia arborea*	R,Q
	Sargassum	*Sargassum horneri*	R,Q,M,B
	Miscellaneous plants	–	R
Invertebrates	Miscellaneous sponges	–	R
	Orange puffball sponge	*Tethya aurantia*	B,S
	Southern staghorn bryozoan	*Diaperoecia californica*	R
	Miscellaneous bryozoans	–	R
	California hydrocoral	*Stylaster californica*	B,S
	White-spotted rose anemone	*Tealia lofotensis*	B
	Red gorgonian	*Lophogorgia chilensis*	B,S
	Brown gorgonian	*Muricea fruticosa*	B,S
	Californian golden gorgonian	*Muricea californica*	B,S
	Strawberry anemone	*Corynactis californica*	R
	Orange cup coral	*Balanophyllia elegans*	R
	Cup coral	*Astrangia lajollaensis*	R
	Ornate tube worm	*Diopatra ornata*	R
	Colonial sand-tube worm	*Phragmatopoma californica*	R
	Scaled-tube snail	*Serpulorbis squamigerus*	R
	Chestnut cowrie	*Cypraea spadicea*	Q
	Wavy turban snail	*Megastraea undosa*	Q,S
	Red turban snail	*Astraea gibberosa*	Q,S
	Bat star	*Patiria miniata*	Q,S
	Giant-spined sea star	*Pisaster giganteus*	Q,S,M
	Ochre sea star	*Pisaster ochraceus*	M
	Sunflower star	*Pycnopodia helianthoides*	B,S
	White sea urchin	*Lytechinus anamesus*	B,S
	Red sea urchin	*Strongylocentrotus franciscanus*	Q,S
	Purple sea urchin	*Strongylocentrotus purpuratus*	Q,S
	Coronado urchin	*Centrostephanus coronatus*	Q
	Warty sea cucumber	*Parastichopus parvimensis*	Q
	Aggregated red sea cucumber	*Pachythyone rubra*	R
	Red abalone	*Haliotis rufescens*	B,S

*Technique codes: Q= 1m2 quadrats, M= 5m2 quadrats, B= Band Transects, R= Random Point Contacts, S= Size Frequency Measurements, F= Roving Diver Fish Count, V= Visual Fish Transect.

Table 2 (continued). Regularly monitored species and associated monitoring technique(s)

Taxa	Common Name	Scientific Name	Technique*
Invertebrates (continued)	Pink abalone	*Haliotis corrugata*	B,S
	Green abalone	*Haliotis fulgens*	B,S
	Kellett's whelk	*Kelletia kelletii*	B,S
	Giant keyhole limpet	*Megathura crenulata*	B,S
	California brown sea hare	*Aplysia californica*	B
	Rock scallop	*Crassedoma giganteum*	B,S
	California spiny lobster	*Panulirus interruptus*	B
	Tunicates	–	R
	Stalked tunicate	*Styela montereyensis*	Q
	Miscellaneous invertebrates	–	R
Fish	Bluebanded goby	*Lythrypnus dalli*	Q, F
	Blackeye goby	*Coryphopterus nicholsii*	Q, F
	Island kelpfish	*Alloclinus holderi*	Q, F
	Blacksmith	*Chromis punctipinnis*	V, F
	Señorita	*Oxyjulis californica*	V, F
	Blue rockfish	*Sebastes mystinus*	V, F
	Olive rockfish	*Sebastes serranoides*	V, F
	Kelp rockfish	*Sebastes atrovirens*	V, F
	Kelp bass	*Paralabrax clathratus*	V, F
	California sheephead	*Semicossyphus pulcher*	V, F
	Black surfperch	*Embiotoca jacksoni*	V, F
	Striped surfperch	*Embiotoca lateralis*	V, F
	Pile perch	*Damalichthys vacca*	V, F
	Garibaldi	*Hypsypops rubicundus*	V, F
	Opaleye	*Girella nigricans*	F
	Rock Wrasse	*Halichoeres semicinctus*	V, F
Substrate	Bare substrate	–	R
	Substrate: Rock	–	R
	Substrate: Cobble	–	R
	Substrate: Sand	–	R

*Technique codes: Q= 1m2 quadrats, M= 5m2 quadrats, B= Band Transects, R= Random Point Contacts, S= Size Frequency Measurements, F= Roving Diver Fish Count, V= Visual Fish Transect.

Table 3. Changes in scientific nomenclature

Current Name	**Former Name**
Patiria miniata	*Asterina miniata*
Chondracanthus spp.	*Gigartina* spp.
Megastraea undosa	*Lithopoma undosum / Astraea undosa*
Lithopoma gibberosa	*Astraea gibberosa*
Crassedoma giganteum	*Hinnites giganteum*
Stylaster californica	*Allopora californica*
Telia lofotensis	*Urticina lofotensis*
Coryphopterus nicholsii	*Rhinogobiops nicholsii*
Rhacochilus vacca	*Damalichthys vacca*

Methods

Abundances, and in some cases size structure, of 71 taxa or categories of algae, fish, and invertebrates (Table 2 & Table 3) were measured at 33 permanent sites (Table 4) around the five park islands (Figure 1). Additionally, we counted and measured all species of fish that were positively identified during Roving Diver Fish Count and Fish Size Frequency protocols. Sites were monitored between May 11th and October 16th, 2015 using the NPS vessel "Sea Ranger". Site and species selection criteria and the sampling protocols are described in the Kelp Forest Monitoring Handbook (Davis et al., 1997, and Kushner and Sprague, in progress). Data management and entry procedures are also described in the Kelp Forest Monitoring Handbook. Although the handbooks are in the process of being updated, an older version is available online at http://science.nature.nps.gov/im/units/medn/monitor/kelpforest.cfm.

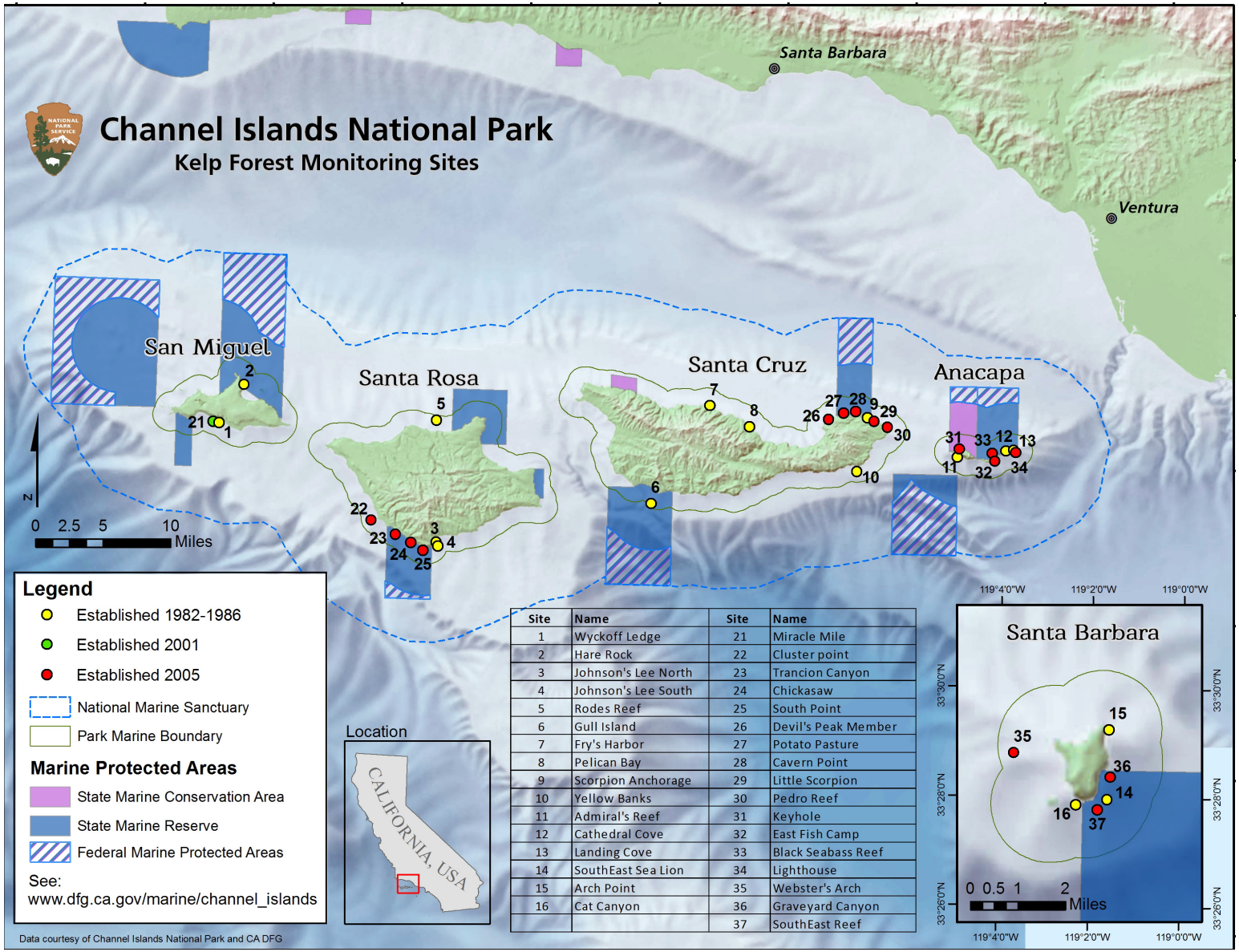
Kelp Forest Monitoring Program data usage history and request for information contact details are given in Appendix B.

Table 4. Site information

Island	Site Location	Site Abbreviation	Depth Meters	Year Site Established	Year MPA Established
San Miguel	Miracle Mile	SMMM	13-15	2001	n/a
San Miguel	Hare Rock	SMHR	6-9	1982	2003
San Miguel	Miracle Mile	SMMM	7-10	2001	n/a
Santa Rosa	Johnson's Lee North	SRJLNO	9-11	1982	n/a
Santa Rosa	Johnson's Lee South	SRJLSO	14-16	1982	n/a
Santa Rosa	Rodes Reef	SRRR	13-15	1983	n/a
Santa Rosa	Cluster Point	SRCP	12-15	2005	n/a
Santa Rosa	Trancion Canyon	SRTC	9-15	2005	2003
Santa Rosa	Chickasaw	SRCSAW	10-13	2005	2003
Santa Rosa	South Point	SRSP	11-13	2005	2003
Santa Cruz	Gull Island South	SCGI	14-16	1982	2003
Santa Cruz	Fry's Harbor	SCFH	12-13	1982	n/a
Santa Cruz	Pelican Bay	SCPB	6-8	1982	n/a
Santa Cruz	Scorpion Anchorage	SCSA	5-6	1982	2003
Santa Cruz	Yellowbanks	SCYB	14-15	1986	n/a
Santa Cruz	Devil's Peak Member	SCDPM	10-13	2005	n/a
Santa Cruz	Potato Pasture	SCPP	9-12	2005	2003
Santa Cruz	Cavern Point	SCCVP	12-13	2005	n/a
Santa Cruz	Little Scorpion	SCLS	9-14	2005	n/a
Santa Cruz	Pedro Reef	SCPRF	7-10	2005	n/a

Table 4 (continued). Site information

Island	Site Location	Site Abbreviation	Depth Meters	Year Site Established	Year MPA Established
Anacapa	Admiral's Reef	ANAR	13-15	1982	n/a
Anacapa	Cathedral Cove	ANCC	6-11	1982	1979
Anacapa	Landing Cove	ANLC	5-12	1982	n/a
Anacapa	Keyhole	ANKH	7-10	2005	2003
Anacapa	East Fish Camp	ANEFC	9-14	2005	n/a
Anacapa	Black Sea Bass Reef	ANBSBR	15-16	2005	2003
Anacapa	Lighthouse	ANLH	7-9	2005	n/a
Santa Barbara	Southeast Sea Lion Rookery	SBSESL	12-14	1982	2003
Santa Barbara	Arch Point	SBAR	7-8	1982	n/a
Santa Barbara	Cat Canyon	SBCAT	7-9	1986	n/a
Santa Barbara	Webster's Arch	SBWA	14-16	2005	n/a
Santa Barbara	Graveyard Canyon	SBGC	10-12	2005	2003
Santa Barbara	Southeast Reef	SBSER	10-15	2005	2003



Site	Name	Site	Name
1	Wyckoff Ledge	21	Miracle Mile
2	Hare Rock	22	Cluster point
3	Johnson's Lee North	23	Trancion Canyon
4	Johnson's Lee South	24	Chickasaw
5	Rodes Reef	25	South Point
6	Gull Island	26	Devil's Peak Member
7	Fry's Harbor	27	Potato Pasture
8	Pelican Bay	28	Cavern Point
9	Scorpion Anchorage	29	Little Scorpion
10	Yellow Banks	30	Pedro Reef
11	Admiral's Reef	31	Keyhole
12	Cathedral Cove	32	East Fish Camp
13	Landing Cove	33	Black Seabass Reef
14	SouthEast Sea Lion	34	Lighthouse
15	Arch Point	35	Webster's Arch
16	Cat Canyon	36	Graveyard Canyon
		37	SouthEast Reef

Figure 1. Kelp Forest Monitoring Locations at Channel Islands National Park

Each site is marked by a 100 m long transect line permanently affixed to the seabed. Sampling techniques for collecting abundance and age structure data are summarized in Table 5. At each site, the following methods were performed to determine densities and distribution of discrete benthic organisms: 24 paired 1 m x 1 m quadrats systematically arranged along the transect with a random start, 40 continuous 1 m x 5 m quadrats along the transect, and 24 paired 3 m x 10 m band transects systematically arranged along the transect with a random start. To determine percent cover of encrusting invertebrates, algae, and substrate composition, 600 random non-adjacent points (random point contacts - RPCs) were performed.

Table 5. Summary of sampling techniques

Technique	Area or Time Sampled	# of Replicates (per site)
1 m^2 Quadrat	1 m x 2 m	12
5 m^2 Quadrat	1 m x 5 m	40
Band Transect	3 m x 20 m	12
Random Point Contact	40 points (0.5x3)	15
Visual Fish Transect	2 m (w) x 3 m (h) x 50 m (l)	4
Fish Size Frequency	30 minutes minimum	1 (minimum)
Roving Diver Fish Count	30 minutes	4-8
Video Transect	100 m, 5 minutes	2
Natural Habitat Size Frequency	individual	30-200 per species
Artificial Recruitment Module	module, time variable	7-20
Species Checklist	30-90 minutes	1
Temperature	hourly	all sites

To determine fish density, four 2 m x 3 m x 50 m fixed transects were surveyed. To determine fish abundance and diversity, timed roving diver fish counts with a time component were performed. Roving Diver Fish Counts (RDFC) are conducted using three to seven expert observers for each site. An expert observer is defined as someone who can confidently identify and accurately count all species of fishes that commonly occur at the Channel Islands. Each of the three to seven observers collects replicate data. To estimate fish population size structure, size frequencies of all fish observed within 10 m of the transect, and from surface to benthos, were visually measured, excluding schooling baitfish and cryptic species. All fish transects, fish size frequencies, and RDFC surveys were conducted between 0900 and 1500 hours unless otherwise noted.

Population data for fishes are collected using the four protocols listed in Table 6. Briefly, these are quadrats for several small benthic cryptic species, visual fish transect for a select group of indicator species, roving diver fish counts for all species and size frequencies for most species. See the Kelp Forest Monitoring Handbook (Davis et al., 1997, and Kushner and Sprague, in progress) for detailed descriptions of the different protocols. In the database if indicator species were not observed during the 1 m^2 quadrat, roving diver fish count, or visual fish transect protocols, those species are given

zeros. All non-indicator species are given null values. Data for non-indicator species are only included in this report if the species was observed.

Table 6. List of fish monitoring protocols

Protocol	Fish Species Monitored	Fish Species Excluded
1 m^2 quadrats (density)	*Coryphopterus nicholsii*, *Alloclinus holderi* and *Lythrypnus dalli*	All others
Roving diver fish count (count/abundance)	All species of fish	None
Visual fish transects (density)	Indicator species only	Non-indicator species
Fish size frequencies (size distribution)	Most species of fish	Gobies, cryptic/benthic species, and *Girella nigricans*

Note that visual fish transects are performed before the other three fish protocols. Following visual fish transects, the roving diver fish count and fish size frequencies protocols are performed simultaneously. Lastly, the benthic fishes for the 1 m^2 quadrat protocol are sampled.

Videotaped transects were performed to document site appearance. Size frequency measurements were collected to determine age structure and recruitment cohorts (Table 7). All animals measured for the natural habitat size frequency distributions were located using a band transect type search method. If there is less than the minimum sample size at a site, an effort is made to measure as many individuals as can be located. Artificial recruitment modules (ARMs) were in place at 12 sites to measure recruitment and population structure of indicator species within the ARMs. A general species list was established for each site, noting presence/absence and relative abundance for all positively identified species (Appendix C). A description of all monitoring protocols, including schematics can be found in Davis et al., 1997 and in Kushner and Sprague, in progress.

Table 7. Size frequency measurement dimensions

Scientific Name	Sample Size	Measurement
Macrocystis pyrifera	100	Stipe count (1 m above bottom)
Tethya aurantia	60	Max. diameter, mm
Stylaster (Allopora) californica	60	Max. height and width, mm
Lophogorgia chilensis	60	Max. width, mm
Muricea spp.	60	Max. width, mm
Megathura crenulata	60	Max. shell length, mm
Haliotis spp.	60	Max. shell length, mm
Megastraea (Lithopoma/Astraea) undosa	60	Max. shell diameter, mm
Astraea (Lithopoma) gibberosa	60	Max. shell diameter, mm
Kelletia kelletii	60	Max. shell length, mm
Crassedoma (Hinnites) giganteum	60	Max. shell length, mm
Tegula regina	60	Max. shell length, mm
Strongylocentrotus spp.	200	Max. shell diameter, mm
Lytechinus anamesus	200	Max. shell diameter, mm
Pycnopodia helianthoides	60	Length of longest ray, mm
Asterina (Patiria) miniata	60	Length of longest ray, mm
Pisaster giganteus	60	Length of longest ray, mm

Hourly temperature data were collected using remote temperature loggers (TIDBIT® made by Onset Computer Corporation) at 32 sites, the exception being Miracle Mile where no temperature logger installed. Loggers were encased in underwater housings and attached to stainless steel thread rods cemented to the bottom at each site. At least two temperature loggers per site were deployed. The temperature data have been collected continuously since 1994/95, except a few instances where loggers malfunctioned or were lost or stolen. A comparison of temperature data from both loggers was conducted to ensure that the loggers were recording within their specifications (± 0.2° C).

When visiting KFM sites multiple times in one season, we attempt to complete all of the abundance estimate techniques (1 m^2 quadrats, 5 m^2 quadrats, band transects, random point contacts, roving diver fish counts, fish transects and fish size frequencies) and retrieve/deploy temperature loggers during the same visit. During the remaining sampling trips, we sometimes conducted size frequency sampling, transect line repair and the fish protocol a second time if time allowed. On rare occasions the abundance techniques are not completed during our first visit and are completed at subsequent visits as soon as possible. If this happens, it is documented under the site information appendix. If there appears to be large changes in abundance between visits within a sampling season, an additional sampling may be conducted to document these changes, but this is a rare occurrence.

Results/Discussion

All prescribed sampling was completed at all 33 monitoring sites in 2015. ARMs were monitored at all 12 sites where they are present. Nineteen divers (Table 8) collected data on nine five-day cruises and two four-day cruises between May and October (Table 9). KFM divers logged 956 dives for a total of 1005 hours of bottom time.

Table 8. 2015 Kelp Forest Monitoring participant list

Participants	Affiliation	Cruises Participated
Bailey, Dawn	California State University-VIP	4, 9
Bird, Amanda	Channel Islands National Park	1, 2, 3, 4, 5, 8, 9, 10, 11
Canestro, Don	UC Santa Cruz	9
Centoni, Jonathan	Humboldt State University	7
Civiello, Michael	National Park Service	All Cruises
Duran, Keith	Channel Islands National Park	All Cruises
Goldstein, Jeffrey	Death Valley National Park	7
Grime, Ben	Channel Islands National Park	All Cruises
Kidd, Ashley	Aquarium of the Pacific	3
Kushner, David	Channel Islands National Park	All Cruises
McCauley, Merrill	Channel Islands National Park	8
McClain, Jaime	Channel Islands National Park	All Cruises
Moore, Kelly	Channel Islands National Park	1,2,4,5, 6,7,8,11,12
Osorio, David	California Department of Fish and Wildlife	6
Parnell, Ed	UC San Diego	10
Spector, Michael	National Park Service – OWUSS	3
Sprague, Joshua	Channel Islands National Park	All Cruies
Whitaker, Steve	Channel Islands National Park	1, 2
Witting, David	National Oceanic and Atmospheric Administration	5

Table 9. 2015 Kelp Forest Monitoring cruise list

Cruise #	Cruise Dates	KFM Sites Visited
Cruise #1	05/11 – 05/15	SBAP, SBGC, SBSESL, SBWA, ANCC
Cruise #2	05/26 – 05/29	SBWA, ANCC, SCCVP, SCDPM
Cruise #3	06/08 – 06/12	SRRR, SMHR, SRJLSO, SCGI, ANLC
Cruise #4	06/22 – 06/26	SCYB, ANEFC, ANLH, ANKH, ANCC, ANLC
Cruise #5	07/13 – 07/17	SCPRF, SBSER, SBCAT, SBSESL, SBWA, SBGC, SBAP, ANAR
Cruise #6	07/27 – 07/31	SCLS, SCFH, ANBSBR, ANLC
Cruise #7	08/10 – 08/14	SCGI, SRCSAW, SRTC, SRJLNO, SCPRF, SCSA
Cruise #8	08/24 – 08/28	SCPP, SMMM, SRCP, SRSP, SCPB
Cruise #9	09/14 – 09/18	SRJLSO, SMWL, SMMM, SRSP, SRJLNO, SCSA, ANLC
Cruise #10	09/28 – 10/02	SCPB, SCYB, ANEFC, ANLH, ANAR, SCPP, SCCVP, SCSA
Cruise #11	10/13 – 10/16	SBWA, SBSER, SBSESL, SBGC, SBAP, ANAR

* See Table 4 for site information, including a key to site names.

Mean densities for 1 m^2 quadrats represent average counts obtained from 24 paired 1 m x 1 m quadrats or otherwise described as twelve 2 m^2 quadrats (Appendix E. 1 Meter Quadrat Data). Mean densities for 5 m^2 quadrats represent average counts obtained from 40 continuous and adjacent 1 m x 5 m quadrats (Appendix F. 5 Meter Quadrat Data). Mean densities for band transects represent average counts obtained from 24 paired 3 m x 10 m transects or otherwise described as twelve 3 m x 20 m transects (Appendix G. Band Transect Data). Mean percent cover for random point contacts represent average percent cover obtained from 600 points obtained from 15 quadrats of 40 points each (Appendix H. Random Point Contact Data). Percent cover for all categories combined may total more than 100% due to layering (Davis et al. 1997). Only currently sampled species are described. Species that were monitored in past years, but not for the current year are not described. For a complete record of sampling history, refer to the Kelp Forest Monitoring Handbook (Davis et al. 1997, and Kushner and Sprague, in progress).

Summary data from fish transects, RDFCs, and fish size frequency measurements are provided by Sprague and Kushner (2020) on IRMA (https://irma.nps.gov/DataStore/Reference/Profile/2259652).

Summary data from natural habitat size frequency measurements for all indicator species were collected from all sites unless very rare or absent at a site and are provided on IRMA (https://irma.nps.gov/DataStore/Reference/Profile/2259652). Measurement dimensions and minimum sample size for each species are listed in Table 7.

ARM size frequency measurement data were collected for the same species listed in Table 7, if present, at all sites where ARMs are deployed. These data are summarized in the workbook on IRMA (https://irma.nps.gov/DataStore/Reference/Profile/2259652). *Parastichopus parvimensis* found in the ARMs are counted and grouped into size classes of greater than or less than 10 cm.

Video transects were completed for all locations and are stored on the park's resource management server in Ventura, California. Additional information on individual sites, species observed, and temperature data can be found in the appendices. For details on survey dives see Appendix K.

The purpose of the discussion section in this report is to summarize and condense our general observations at the monitoring sites for this year. We would like to emphasize that we present only general trends and observations. A statistical trend analysis for each of the indicator species is beyond the scope of this report.

Kelp Forests

The status of kelp forests was notably different between the five Park Islands. This is a result of a combination of factors including but not limited to, oceanography, biogeography and associated differences in species abundance and composition, as well as sport and commercial fishing pressure. All 33 permanent sites were established in areas that had or were historically known to have had kelp forests in the past.

In 2015, 17 of the 33 sites monitored were characterized as developing kelp forest, kelp forest or mature kelp forest. In addition, four sites were in a state of transition. One site was part kelp forest and part dominated by *Ophiothrix spiculata*. One site was dominated by *Sargassum horneri*. Seven sites were dominated by echinoderms which were down from 10 sites in the previous year. The remaining three sites were characterized as barren areas, two if which had moderate to high abundances of *Strongylocentrotus* spp. Overall, the number of sites characterized as kelp forests increased from last year, and the number of sites characterized as being dominated by echinoderms decreased. Those echinoderm species are listed in Table 10, as well as comparisons to site status from 2014.

Table 10. 2015 Kelp Forest Monitoring site status with 2014 status for comparison

Island	Site	2015 Status	2014 Status
San Miguel Island	Wyckoff Ledge	Mature kelp forest	Mature kelp forest
	Hare Rock	Dominated by *Strongylocentrotus* spp.	Dominated by *Strongylocentrotus* spp.
	Miracle Mile	Mature kelp forest	Mature kelp forest
Santa Rosa Island	Johnson's Lee North	State of transition	Mature kelp forest
	Johnson's Lee South	Mature kelp forest	Mature kelp forest
	Rodes Reef	Barren area dominated by *Strongylocentrotus* spp.	Open area with a moderately high density of *S. franciscanus*
	Cluster Point	Mature kelp forest	Mature kelp forest
	Trancion Canyon	Mature kelp forest	State of transition
	Chickasaw	Mature kelp forest with a moderately high abundance of *Strongylocentrotus* spp.	Mature kelp forest
	South Point	Mature kelp forest	Mature kelp forest

Table 10 (continued). 2015 Kelp Forest Monitoring site status with 2014 status for comparison

Island	Site	2015 Status	2014 Status
San Miguel Island	Wyckoff Ledge	Mature kelp forest	Mature kelp forest
	Hare Rock	Dominated by *Strongylocentrotus* spp.	Dominated by *Strongylocentrotus* spp.
	Miracle Mile	Mature kelp forest	Mature kelp forest
Santa Rosa Island	Johnson's Lee North	State of transition	Mature kelp forest
	Johnson's Lee South	Mature kelp forest	Mature kelp forest
	Rodes Reef	Barren area dominated by *Strongylocentrotus* spp.	Open area with a moderately high density of *S. franciscanus*
	Cluster Point	Mature kelp forest	Mature kelp forest
	Trancion Canyon	Mature kelp forest	State of transition
	Chickasaw	Mature kelp forest with a moderately high abundance of *Strongylocentrotus* spp.	Mature kelp forest
	South Point	Mature kelp forest	Mature kelp forest
Santa Cruz Island	Gull Island South	Mature kelp forest	Half mature kelp forest and half dominated by *O. spiculata*
	Fry's Harbor	State of transition	State of transition
	Pelican Bay	Barren area	Dominated by *Strongylocentrotus* spp.
	Scorpion Anchorage	Developing kelp forest	Dominated by *S. purpuratus* with 30% a developing kelp forest
	Yellow banks	Dominated by *S. purpuratus*	Mature kelp forest
	Devil's Peak Member	Barren area with a moderate amount of *Strongylocentrotus* spp.	Dominated by *S. purpuratus*
	Potato Pasture	Kelp forest	Developing kelp forest
	Cavern Point	Mature kelp forest	Mature kelp forest
	Little Scorpion	Dominated by *S. franciscanus*	Dominated by *Strongylocentrotus* spp.
	Pedro Reef	Dominated by *S. purpuratus*	Dominated by *S. purpuratus*
Anacapa Island	Admiral's Reef	50% kelp forest, 50% dominated by *O. spiculata*	Dominated by *O. spiculata* with 40% a developing kelp forest
	Cathedral Cove	Mature kelp forest	Mature kelp forest
	Landing Cove	Mature kelp forest	Mature kelp forest
	Keyhole	Dominated by *Sargassum horneri*	Dominated by *S. purpuratus*
	East Fish Camp	Dominated by S. purpuratus and *O. spiculata*	Dominated by *S. purpuratus* and *O. spiculata*
	Black Sea Bass Reef	State of Transition	Half dominated by *O. spiculata* and half mature kelp forest
	Lighthouse	Dominated by *S. purpuratus*	Dominated by *S. purpuratus*

Table 10 (continued). 2015 Kelp Forest Monitoring site status with 2014 status for comparison

Island	Site	2015 Status	2014 Status
Santa Barbara Island	Southeast Sea Lion Rookery	Kelp forest	Kelp forest
	Arch Point	State of transition	Dominated by *S. purpuratus*
	Cat Canyon	Dominated by *S. purpuratus*	75% Dominated by *S. purpuratus* and 25% kelp forest
	Webster's Arch	Kelp forest	State of transition
	Graveyard Canyon	Kelp forest	Kelp forest
	Southeast Reef	Mature kelp forest	Mature kelp forest

There have been dramatic changes at several Santa Barbara Island sites occurring over the last three years. The changes occurring at Graveyard Canyon and Southeast Sea Lion last year continued this year, with both sites continuing to have kelp forests, as well as noticeable decreases in *Strongylocentrotus* spp. Additionally, Webster's Arch has transitioned into kelp forests. Arch Point is in a state of transition and has an abundance of *Sargassum horneri* present. *Macrocystis pyrifera* density was higher at Southeast Sea Lion than we have documented in over two decades, and the thick carpet of *Ophiothrix spiculata* that has been present for many years continues to decrease. In addition to an abundance of *M. pyrifera, Sargassum horneri* is very abundant throughout the site. Graveyard Canyon continued to have a dense kelp forest with an abundance of understory algae present this year. In addition, S. horneri was abundant and was over 2 meters tall in many areas. Webster's Arch, which was dominated by echinoderms in 2013 and a state of transition in 2014, was a kelp forest with an abundance of other algae present as well. That site had more *Macrocystis pyrifera* present than we have documented there since it was established in 2005. Southeast Reef continued to be a mature kelp forest, similar to what has been present since the site was established in 2005. The remaining sites continued to be dominated by echinoderms with little algae present. The entire area around Southeast Sea Lion continues to have notably more kelp than since the mid-1990s. Overall, there was more kelp present at Santa Barbara than have been documented in the last two decades. The monitoring sites here appear to represent well the overall conditions of this island.

Several Anacapa Island sites continue to be dominated by echinoderms. However, two sites had notably more *Macrocystis pyrifera* present. This is likely due to decreased densities of *Strongylocentrotus* spp. The two sites in the Anacapa State Ecological Reserve that was established in 1978 continued to be kelp forests (Landing Cove and Cathedral Cove). Both Black Seabass Reef and Keyhole have more kelp present than in past years, though most of it is *S. horneri*. The three remaining sites, which are all on the south side of the island not in an MPA, continued to be mostly dominated by echinoderms. The monitoring sites here appear to represent the overall conditions of this island well. Though there are patches of kelp surrounding the Island, there are notably more and larger patches of kelp on the North side of East and Middle Anacapa in the MPA.

Most Santa Cruz Island sites remained similar to last year, but several sites located within the Scorpion MPA have noticeably changed. *Strongylocentrotus franciscanus* and *Ophiothrix spiculata*

densities at Gull Island decreased and *Macrocystis pyrifera* increased, returning the site back to its more common state. Fry's Harbor remains in a state of transition and difficult to determine which direction it is going. Scorpion Anchorage had a kelp forest over part of the site, and the invasive algae *Sargassum muticum* continues to be the dominant algal species at the site. Potato Pasture continued to have more *M. pyrifera* present than we have observed since this site was established. *Strongylocentrotus* spp. continued to dominate four of the 10 sites at this island, a decrease from five in 2014 and six in 2013. Though the KFM sites as a group appropriately represent the status of kelp forests at most of the eastern two-thirds of the Island, the sites do under-represent the western third of the island where only one site is present. At the western portion of this Island there are notably more kelp forests than at the eastern portion.

Kelp forests continued to be abundant around Santa Rosa and San Miguel Islands. Similar to last year, mature kelp forests were present at seven of the 10 sites at these two islands and *Strongylocentrotus franciscanus* was moderately abundant to abundant at the remaining three sites. Densities of *S. purpuratus* on Santa Rosa Island increased overall. The monitoring sites here appear to represent the conditions of these islands well with kelp forests present over much of these Islands.

Algae

Green algae cover increased overall at Santa Barbara and Santa Cruz Islands and decreased at Anacapa Island. Cover of green algae remained low at Santa Rosa and San Miguel Islands sites, where little to no green algae cover were recorded during sampling.

Overall, adult and subadult *Macrocystis pyrifera* densities changed little at the five park islands. The two San Miguel Island sites on the south side continued to have mature kelp forests, with few subadults. Hare Rock, on the north side of the island, continued to be devoid of algae. Southern Santa Rosa Island sites continued to have mature kelp forests, except for one site. Johnson's Lee North was transitioning from kelp forest to being dominated by Strongylocentrotus spp. This site has transitioned between kelp forest and urchin barren several times in the last three decades, usually following ENSO events. The Santa Rosa Island site on the north side continued to be devoid of algae.

There were a few notable changes in *M. pyrifera* abundance at Santa Cruz Island. Cavern Point continued to have the highest and most stable abundance of *M. pyrifera* of all KFM sites at that Island. Potato Pasture had an increase in subadult density, but few mature plants were present, similar to past years. For a second year in a row Scorpion Anchorage continued to have the highest density of subadults in recorded in over two decades subadults, but few adults. Yellowbanks, which was in a state of transition last year, but still had adult *M. pyrifera* present, was now dominated by urchins and devoid of algae.

At Anacapa Island, Cathedral Cove had a decrease in subadult density but continued to have a stable, high abundance of mature *M. pyrifera*, similar to the past decade. Landing Cove had an increase in subadult density, but few adults, similar to past years. Both Landing Cove and Cathedral Cove continue to be the only KFM site on Anacapa Islands with persistent kelp forests for the last ten years. Both sites are also in a no-take MPA that was established in 1979. Admiral's Reef had the highest adult *M. pyrifera* density recorded at Anacapa Island, and the highest density recorded at that

site in over two decades. The remaining four Anacapa Island sites continued to have little to no *M. pyrifera*.

Similar to last year, several Santa Barbara Island sites had notable changes in *M. pyrifera* abundance. Prior to 2013, Southeast Reef was the only site to have a kelp forest since 2005, when it and two other sites were established. The three original KFM sites were dominated by urchins since before the 1997/98 ENSO event. Last year, Southeast Sea Lion and Graveyard Canyon transitioned from urchin dominated areas to kelp forest. Adult and subadult densities continued to increase at Southeast Sea Lion well as at another site, Webster's Arch, which had transitioned to a kelp forest since last year. Graveyard Canyon continued to have adult and subadult *M. pyrifera* present, though densities did decrease. Southeast Reef had a decrease in both adult and subadult densities but remained a healthy-looking mature kelp forest. Like last year, the entire area around Southeast Sea Lion had notably more kelp than since the mid-1990s.

Adult *Eisenia arborea* densites remained similar to past years at San Miguel and Santa Rosa Islands. Miracle Mile, the only site on San Miguel Island with a moderate abundance of this species present, remained at a relatively low density compared to 5-10 years ago. There was little change at Santa Rosa Island sites. Several Santa Cruz and Anacapa Island sites had notable changes in abundance. Potato Pasture on Santa Cruz Island had the highest recorded density of any site since KFM was established. Cavern Point, Santa Cruz Island, continued to have a gradual increase in abundance for the fourth consecutive year. Fry's Harbor, Santa Cruz Island, used to have the highest abundance on this island. Most disappeared last year, and this year none were counted in quadrats. At Anacapa Island, density and Landing Cove continued to gradually increase, silimar to the past 10 plus years, and had the highest density recorded since at least 1993.At Santa Barbara Island, Webster's arch, which had zero *E. arborea* in all past years, increased to 0.5/m^2, the highest of any site at this island.

Pterygophora californica percent cover changed little overall at the five park islands. At San Miguel Island, Wyckoff Ledge and Miracle Mile, cover and density remained low, similar to last year. At Santa Rosa Island, Cluster Point remained at low abundance compared to 2008-2012. Another four sites at Santa Rosa Islands had decreases in cover. *Pterygophora californica* continued to be rare at Santa Cruz Island and had no change in abundance. This species remained abundant and near record high density at Landing Cove, Anacapa Island.

Laminaria farlowii adult and juvenile densities remained highest at Cathedral Cove, Anacapa Island and Landing Cove, Anacapa Island, similar to the past 11 years. There was little change at other sites. While not an indicator species, we do document any *L. setchellii* observations. In past years several have sometimes been observed at Miracle Mile, San Miguel Island as well as Cluster Point and Chickasaw, Santa Rosa Island. However, no observations were recorded this year. This is a cooler water species that is rarely observed South of Point Conception.

In 2009, the first observation of the non-native invasive alga *Sargassum horneri* in CHIS was documented. *Sargassum horneri* is native to Asia (Japan, Korea, China and Viet Nam) was first observed in California at Long Beach Harbor in October 2003 (Miller et al. 2007). It has rapidly spread in southern California and in Baja, where it primarily occupies rocky habitat from 3 - 18 m.

At the California Channel Islands, it was first observed at Catalina Island in April of 2006, then San Clemente Island in May of 2007 (Jack Engle and Kathy Ann Miller, personal communication). In April of 2009, it was first observed within Channel Islands National Park at West Anacapa Island. Small plants were observed around Rat Rock at the west end of Anacapa Island and by October, it was well established with a notably higher density of both small and large plants, some at or near maturity. We conducted additional surveys in October 2009 and *S. horneri* was observed at six out of nine survey locations at Anacapa Island (Kushner et. al, 2009). At that time, there appeared to be a higher prevalence and abundance on the north side of the Island which has fewer *Strongylocentrotus* spp. than on the south side and this area is within the State MPA or Conservation Area.

In 2010, KFM added *Sargassum horneri* to the four core density sampling methods to begin collecting consistent information on this new invasive alga. We were initially unsure of how successful this species would be, which is why it was sampled on all density protocols. Its abundance increased significantly at many sites this year. As of this year, juveniles are no longer be sampled on band transects due to very high abundances. Adults continue to be sampled on band transects but beginning this year high density bands are being subsampled. If more than 150 individuals are counted on the first half of a band, only that half is sampled for *S. horneri*. Though very abundant at several sites and rapidly increasing in abundance, we continue to sample this species on band transects because this protocol is the best one to document and map out the initial colonization of this species as it spreads to other KFM sites. Below we report the density data for 1 m^2 quadrats, 5 m^2 quadrats, band transects and percent cover from random point contacts.

Sargassum horneri is an annual species. The alga seems to be recruiting in late Summer when KFM has completed much of its monitoring, and peak growth appears to be in fall and winter. By May, when the KFM monitoring season begins, the alga has typically begun to senesce. This apparent rapid growth in fall, with mature plants developing in winter and spring, will mostly be missed by the monitoring program. In the summer, when most of the monitoring is conduced, the alga has already senesced.

We observed more *Sargassum horneri* this year than in the previous years since its introduction. *Sargassum horneri* was observed at a total of 19 KFM sites this year, an increase from 13 in 2014, nine sites in 2013, four sites in 2012, five sites in 2011, and seven sites in 2010. Overall, *S. horneri* adult abundances increased in density substantially at several Santa Cruz and Anacapa Island sites. Adults are most abundant at Southeast Sea Lion on Santa Barbara Island, where it has a density of 15/m^2. All other sites where this species is present have densities of 5/m^2 or less. Juvenile densities increased at all sites where present. The highest density was recorded at Keyhole on Anacapa Island at 309/m^2, and mean cover of 47%. Last year, the highest juvenile density observed at any KFM site was 64/m^2 (7.2% cover) at Black Seabass Reef.

Cover of *Cystoseira* spp. increased overall at Santa Barbara, Anacapa, and Santa Rosa Islands. There continued to be little change in the small amount of cover at the remaining sites. *Desmarestia* spp. category that is used for the RPC protocol is typically all *Desmarestia ligulata*. This is a fast growing ephemeral alga that is highly variable from year to year. *Desmarestia* spp. cover decreased at the

only two sites where there was a notable amount present, South Point on Santa Rosa Island and Webster's Arch on Santa Barbara.

Cover of miscellaneous brown algae remained rare, similar to recent years, at San Miguel and Santa Rosa Island sites. At Santa Cruz and Santa Barbara Islands, several sites had record high covers. At Arch Point, Santa Barbara Island, *Sargassum muticum* comprised 70% of this category. On Anacapa Island, there was an increase at one site, with little change at the remaining six sites.

Cover of *Gelidium* spp. remained similar to past years. The only site with notable abundance continued to be Landing Cove, Anacapa Island. *Gigartina* spp. decreased at Santa Rosa Island and is rare at where it was common several years ago. The only site where *Gigartina* spp. increased was Landing Cove, Anacapa Island.

Cover of miscellaneous red algae decreased at all Santa Rosa Island sites. There was little change at San Miguel Island. There were decreases at two sites and increases at one at Santa Cruz Island. At Anacapa Island, on site increased, five decreased, and one changed little. At Santa Barbara Island, all sites except Southeast Reef decreased from last year. Cover at Southeast Reef increased for the third consecutive year.

Cover of articulated coralline algae increased at San Miguel Island, Anacapa, and Santa Barbara Islands overall. There was little change at Santa Rosa Island. Cover at Santa Cruz Island sites remains rare. Cover of encrusting coralline algae remained similar to recent years.

Invertebrates

Porifera

Tethya aurantia densities decreased at 32 of the 33 sites. Miracle Mile on San Miguel Island was the only site with a relatively high abundance of *T. aurantia* and no change since last year. The greatest decreases occurred at Santa Cruz Island sites. Gull Island, which for the last three years had the highest recorded densities of any KFM site, decreased from $0.61/m^2$ to $0.28/m^2$. Prior to this year, the abundance of *T. aurantia* had been steadily increasing for the last decade at all five park islands. This was likely due to the cold-water regime that the region has been experiencing. Beginning in the 2014 winter, the region has experienced abnormally high sea temperatures.

At San Miguel Island, sponge cover increased at miracle mile from a record low last year. Cover remained low at the other two sites on that island, similar to the past years. Sponge cover increased at one Santa Rosa Island site, decreased at two and remained similar to recent years at the rest. Like last year, South Point has the highest sponge cover recorded this year. At Santa Cruz Island, sponges increased at Cavern Point, decreased at Yellowbanks, and changed little at the remaining sites at the island. At Anacapa Island, cover decreased at Black Seabass Reef, and Cathedral Cove, and changed little at the remaining sites at the island. Like recent years, Landing Cove continues to have the highest abundance of sponges at Anacapa Island. There was little change in sponge abundance at Santa Barbara Island. Southeast Reef had the highest recorded sponge cover for Santa Barbara Island sites in 2012 (6.5%) and has decreased every year since. This year sponge cover was 0.8% which is similar to the Santa Barbara Island sites.

Anthozoa/Hydrozoa

Urticina lofotensis had gradually increased in density at Santa Rosa and San Miguel Islands over the last decade and are at or near record high densities. While densities continued to increase at San Miguel Island, they decreased at Santa Rosa Island overall. This is a cooler water species that we expect to do well in cooler water regimes. *Corynactis californica* cover increased overall at San Miguel and Santa Rosa Islands and decreased at the three eastern islands. Gull Island, the western-most site on Santa Cruz Island was the only site on that island where cover increased. Every site on Anacapa and Santa Barbara decreased in cover. *Balanophyllia elegans* cover remained low, similar to recent years. The cover of this species has remained low compared to 1985-1996, when many sites had record high cover of this species. *Astrangia lajollaensis* continued to be abundant at Fry's Harbor on Santa Cruz Island, where it increased to 20% cover, the highest recorded at any site this year. Two other sites decreased on the island, with the rest changing little since last year. Rodes Reef, Santa Rosa Island, continued to have high cover compared to the sites on the southern side of the islands, though it decreased from 14% to 7%. The other islands remained similar to recent years.

Density of *Stylaster californica* continued to be high at Gull Island, Santa Cruz Island compared to the years before 2007. There was little change from last year at this site. Last year, *S. californica* was observed at a second KFM site, Webster's Arch at Santa Barbara Island. We did not observe it there this year.

Lophogorgia chilensis abundance increased overall at Santa Cruz Island sites. At Anacapa and Santa Barbara Island sites it remained rare compared to recent years. At Johnson's Lee South, the only Santa Rosa Island site where always present, this species remained at low density compared to past three decades. *Muricea californica* densities were similar to last year. The only site with a high abundance of this species remains Lighthouse, Anacapa Island. *Muricea fruticosa* densities were similar to last year with no notable trends. Overall, this species remained less abundant during the past decade than during the 1980s and 1990s. The only KFM site with a relatively high abundance, Lighthouse on Anacapa Island, continued to have a record low density compared to when the site was established in 2005.

Annelida/Polychaeta

Diopatra ornata cover declined overall at San Miguel, Santa Rosa, and Santa Cruz Islands. There were increases overall at Anacapa. Cathedral Cove continues to have the highest abundance at that island, similar to recent years. Both Lighthouse and Keyhole continued to have low cover compared to when those sites were established in 2005. This species is often highly variable in abundance and often has patchy distribution, which can result in sampling artifacts depending on where the random meter numbers end up along the site transect. Overall, *Phragmatopoma californica* cover remained low following decreases at Santa Barbara and Santa Rosa Islands last year. They remained rare at Anacapa and Santa Cruz Islands, and decreased slightly at San Miguel Island. *Serpulorbis squamigerus* abundances continue to be relatively rare compared to the 1983-1994 time period. However, there have been increases at several sites. Overall this species increased across all islands except San Miguel, where it remained rare.

Bryozoa

Diaperoecia californica abundance remained low, similar to last year. Miscellaneous bryozoan cover (excluding *Diaperoecia californica)* increased at the two San Miguel Island sites on the south side of the island. There were notable decreases at four Santa Rosa Island sites, an increase at one, and other two sites continued to have very little bryozoan cover. At Santa Cruz and Anacapa Islands, there were four increases, four decreases and little change at nine sites compared to last year. Overall cover decreased at Anacapa Island. At Santa Barbara Island, Southeast Reef continues to have the highest cover at that island, but further decreased from the record high in 2013 (39%) to 14% this year.

Arthropoda/Crustacea

In recent years we have observed a trend of increasing lobster abundance at the monitoring sites inside the MPAs established in 2003. Even though the monitoring sites were not selected for prime daytime (den) lobster habitat, we have seen increasing densities lobster as they spill over into less optimal den habitat found at many KFM sites. Also, while KFM does not monitor lobster size, it is obvious that they are now significantly larger inside the MPAs. Like recent years*, P. interruptus* densities continued to be more abundant inside the MPAs at Anacapa and Santa Cruz islands than outside. There were increases in density at all three KFM sites in the no-take MPA on Anacapa Island (Cathedral Cove, Landing Cove, and Black Seabass Reef). Black Seabass Reef had the highest recorded density of any site since the KFM program began in 1982. The previous record was Cathedral Cove in 1993 at 0.114/m^2. This year Black Seabass Reef had a density of 0.253/m^2. However, we should note that we often visit this site more than once per year and lobster abundance varies greatly from visit to visit. Densities at Santa Barbara and Santa Rosa islands were too low to discern any notable difference inside versus outside the MPAs at our monitoring sites, similar to recent years. However, off-site observations suggest that they are more abundant inside the MPAs at these Islands as well.

Mollusca

Megastraea undosa densities remained at or near record low abundances at KFM sites since monitoring began. However, there was an increase in abundance this year, mostly small individuals. This is a warmer water species whose densities cycle with warmer water conditions. The pattern in density changes we have observed in *M. undosa* of increasing abundance post the 1997/98 El Niño, and decrease in mean size, followed by a decline in abundance and increase in mean size, is similar to what was observed post the 1982/83 El Niño (Zacharias and Kushner, 2006). We have not observed a widespread significant recruitment event since 1997/1998. We expect to see more recent recruits of this species in the next year or two from the warm water event the region has been experiencing since last fall. Typically, there is a one- or two-year lag between recruitment events for this species and when the monitoring protocols detect emergent recruits.

Lithopoma gibberosa continued to be common at only a few sites. This species is most common at San Miguel Island sites, where it increased at Rodes Reef. However, in recent years, *L. gibberosa* has increased at sites where it had been rare since those sites were established. Rodes Reef on Santa Rosa Island, Yellowbanks on Santa Cruz Island, and Webster's Arch on Santa Barbara Island had relatively high abundances compared to pat years, though Webster's Arch decreased from last year's record high density.

Tegula regina continues to be common mostly at Santa Barbara Island sites. There were increases at two sites, decreases at two, and continued to be rare at the other two sites. Webster's Arch which had the highest recorded density of any KFM site last year, decreased but remained relatively abundant. This is a warmer water species and is usually more abundant at the warmer water sites.

Megathura crenulata densities remained low compared to the relatively high abundances recorded at Santa Cruz and Anacapa Islands prior to 2012. At the northern islands, most individuals were larger; at the southern islands, individuals were smaller. Inversely, they are more abundant at the southern islands and less abundant at the northern islands. *Megathura crenulata* density in the ARMs was similar to recent years. We continued to see low-level, but regular recruitment of juveniles in them.

Overall, *Crassedoma gigantea* abundances increased from recent years at most San Miguel, Santa Rosa, and Santa Cruz Island sites. Most of the San Miguel and Santa Rosa sites where increases were observed had the highest densities recorded since they were established. There was little change at Anacapa Island. At Santa Barbara Island, one site increased, one decreased, while remaining rare at the other four sites. Overall, mean size decreased indicative of recent recruitment.

Kelletia kelletii densities increased at the four northern/western islands. The greatest increases were at several Santa Cruz Island sites. Wyckoff Ledge, San Miguel Island had an increase in density and continued to have the highest density of all the monitoring sites. Similar to last year, at Santa Cruz Island sites smaller individuals were more common than we have documented at most of those sites. A total of 206 juveniles (≤ 50 mm) were measured at Santa Cruz Island sites during natural habitat size frequencies, an increase from last year's high of 63. This is the largest recruitment that KFM has documented for this species. A high number of juvenile *Kelletia kelletii* were in the ARMs this year at Yellow Banks, Scorpion Anchorage, and Pelican Bay at Santa Cruz Island as well as Landing Cove and Cathedral Cove on Anacapa Island, though less abundant at the two Anacapa Island sites. Landing Cove is the only site where we consistently see juveniles of this species. This was the third year in a row where there has been a record high number of juvenile *K. kelletii* found in the ARMs at several of these sites. The total number of Kelletia juveniles (≤ 50 mm) found in all ARMs combined was 242, an increase from last year's high of 92 in the ARMs.

Cypraea spadicea densities increased at Santa Rosa Island overall. The remaining islands changed little from last year, though Devil's Peak Member, Santa Cruz Island increased to one of the highest densities recorded for that island. *Cypraea spadicea* densities in the ARMs at Santa Rosa, Santa Cruz, and Anacapa Islands were similar to recent years, and continued to be abundant.

Overall densities of *Aplysia californica* increased at all five islands though there were several sites on Santa Cruz, Anacapa and Santa Barbara Islands where density declined. At Hare Rock, San Miguel Island, density increased to a record high for that island. Most were less than 50 cm at that site. All sites at Santa Rosa Island increased or remained similar to last year. At Santa Cruz Island, the three sites adjacent to Scorpion MPA had notable increases, while the sites inside Scorpion MPA decreased or remained at much lower abundance compared to the three adjacent non-MPA sites. There was little change at Anacapa and Santa Barbara Islands. Though not an indicator species, *Aplysia vaccaria* were observed at Johnson's Lee North on Santa Rosa Island, Admiral's Reef,

Landing Cove, Keyhole, and Lighthouse on Anacapa Island, and Southeast Sea Lion, Arch Point and Cat Canyon on Santa Barbara Island.

All species of abalone continue to be below historic abundances where data are available. At the sites where *Haliotis rufescens* have been present in the last 11 years, densities were similar to recent years. Most *H. rufescens* observations continued to be at San Miguel and Santa Rosa Islands. Miracle Mile, San Miguel Island, the site adjacent to Wyckoff Ledge that was installed in 2001 specifically to monitor *H. rufescens,* continued to have a high density (Figure 2). This site was purposely established in an area of high density, which is why it is graphed separately from the remaining 32 KFM sites. Also, this is the most likely reason that the density decreased following the establishment of this site. Areas selected for the highest density possible are more likely to decrease in density than increase. The density at this site has been relatively stable for the past seven years.

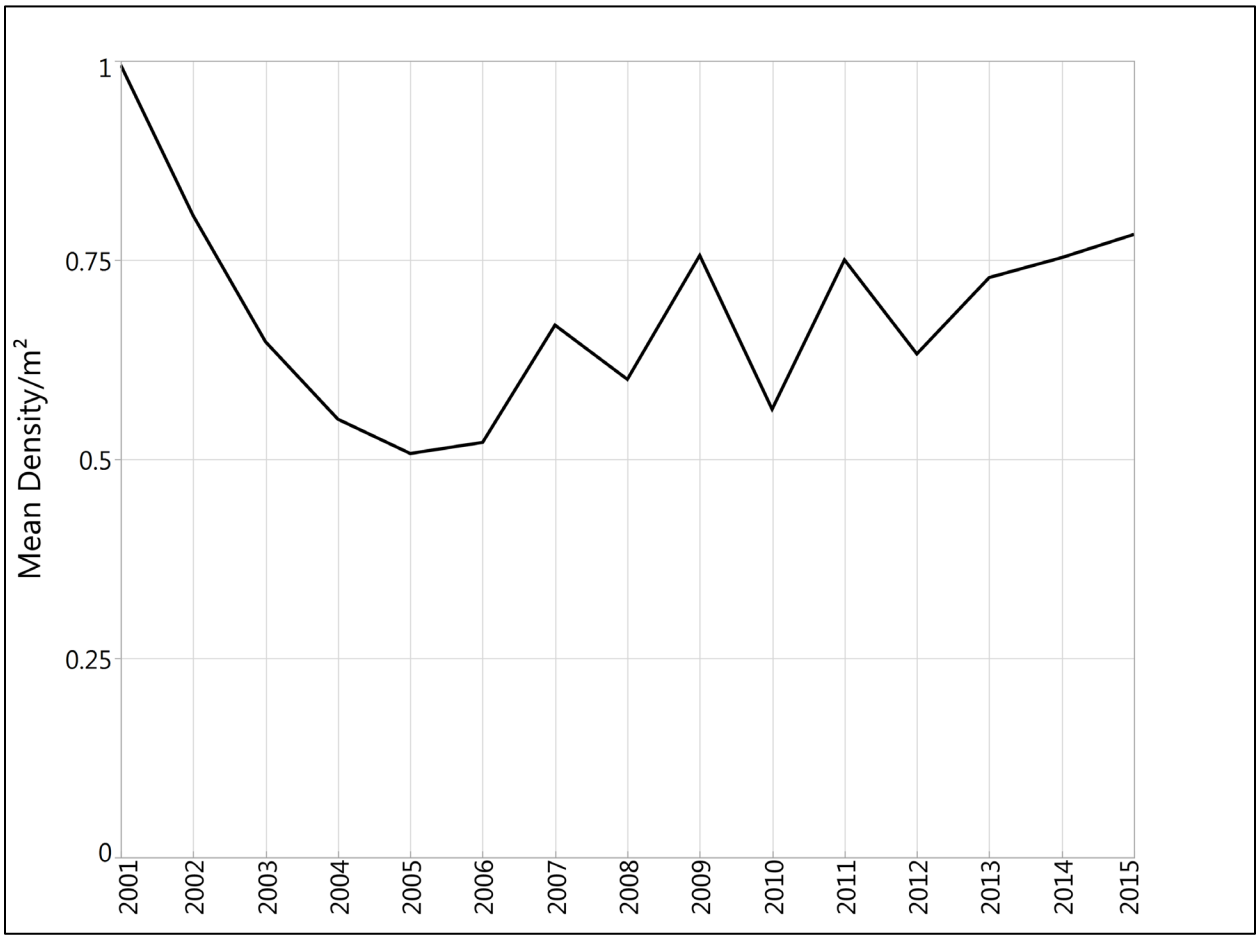


Figure 2. *Haliotis rufescens* density at Miracle Mile, San Miguel Island. This site was purposely established in an area of high density, which is why it is graphed separately from the remaining 32 KFM sites.

Wyckoff Ledge, San Miguel Island had lower densities relative to Miracle Mile, San Miguel Island. However, similar to recent years, the density at this site remained relatively high compared to the 1980s and 1990s and appears to be trending upwards since the fishery was closed in 1997. Densities

increased at three sites, Johnson's Lee North, South Point, and Cluster Point. At Johnson's Lee North, *H. rufescens* were out in the open looking for food since this site is transitioning into an urchin barren and had no macroalgae.

At Cluster Point and South Point, more juvenile *H. rufescens* (≤ 50 cm) were found and measured than we have ever documented at Santa Rosa Islands Sites before. There were 18 found at Cluster Point and 13 at South Point. The previous record was in 1990 at Johnson's Lee North when six were measured. Hare Rock on San Miguel Islands is the only site where more juveniles are found regularly. There were 12 this year, but the highest number of juveniles found there were 23 in 1990. We continue to see few *H. rufescens* on Santa Cruz Island, though they remain present.

Since at least 1990, we have conducted very thorough searches for abalone for size frequency measurements to find all that may be present at each site. The exception is Miracle Mile on San Miguel Island where they are too abundant to measure all we can find at the site. This year, as with the past several years, we performed our searches for abalone, at the sites where they are common, while conducting band transects. As part of the band transect protocol where we search for abalone, we also search between each band transect and out to 10 meters using the band transect tape for reference, covering the entire length of the permanent transect and out ten meters on either side to total 2000 m^2. This thorough search allows us to locate all or nearly all abalone present at a site with a consistent search effort. The number of abalone we encountered in this method was similar to recent years. Because we are relatively consistent in our search effort, we believe that the sample size for size frequencies is an additional proxy of density for the sites represented as the number per 2000 m^2. See the natural habitat size frequency appendix for number of individuals measured per site.

Adult and juvenile *Haliotis* spp. continued to be in low abundances in the ARMs. For the purpose of this report, we consider abalone ≤ 50 mm to be juveniles. Most of the juvenile *H. rufescens* observed this year were in the ARMs at Yellow Banks, Santa Cruz Island, similar to past years. However, their numbers in the ARMs at Yellowbanks decreased from 11 individuals in 2012-2014 to five individuals. While Yellow Banks continued to have a relatively high abundance (though still low) of *H. rufescens*, it is very far away from any known large adult population of abalone. This suggests it is likely these recruits are coming from a relatively far distance away, such as western Santa Cruz Island, Santa Rosa Island, or San Miguel Island or perhaps there are significant populations of adult abalone we are unaware of, but we believe this is unlikely.

Haliotis corrugata continued to be rare or nonexistent at KFM sites. This is a warmer water species that even before their decline was rare at Santa Rosa and San Miguel Islands. We observed *H. corrugata* on band transects at four sites (Landing Cove, Cathedral Cove, and Admiral's Reef on Anacapa Island, Cat Canyon on Santa Barbara Island). *Haliotis corrugata* are commonly observed at Landing Cove and Cathedral Cove, but this is the first time since 1999 that one was found at Admiral's Reef during band transects. Abundances were low at all sites where observed, similar to recent years. A total of 16 *H. corrugata* were found and measured for size frequencies, more than have been measured since 2004. Several juvenile *H. corrugata* were observed in the ARMs at Santa Cruz and Anacapa Islands. In the ARMs, a total of 13 *H. corrugata* were found at four sites.

No *Haliotis fulgens* was recorded this year on band transects. This species, like *H. corrugata,* prefers warmer water and originally was common at Santa Barbara, Anacapa Islands and Eastern Santa Cruz Island prior to the decline of the abalone fisheries. Three *H. fulgens* were found this year, all found at Cat Canyon on Santa Barbara Island and all less than 50 cm. These observations imply a low level of *H. fulgens* recruitment had recently occurred. We only know of one or two adult individual *H. fulgens* on Anacapa and East Santa Cruz Island from recent years and know of no aggregations. It is likely that these smaller abalone recruited from larvae that were transported from further South where *H. fulgens* are more abundant and aggregated off Palos Verdes, Catalina Island and further South at La Jolla, San Diego. No *H. fulgens were* found in the ARMs.

One *Haliotis assimilis* was observed this year, a 23 mm juvenile in an ARM at Yellowbanks, Santa Cruz Island. One fresh 128 mm shell was found at Yellowbanks, Santa Cruz Island, and another 33 mm fresh shell at Graveyard Canyon, Santa Barbara Island.

No live or fresh shells were observed this year for *Haliotis sorenseni.*

Echinodermata

Centrostephanus coronatus increased in abundance at all sites where present. Most of those sites had the highest densities documented since we began monitoring this species in 1996. This is a warmer water species and significant recruitment within the park usually occurs during/after warm water events. Three juveniles were documented at Hare Rock, San Miguel Island for the first time, and may be the first time this species has ever been documented at this island. This species was documented for the first time at many Santa Rosa Island KFM sites as well. Overall, most individuals at these two northern islands were in the 10-15 mm size class, with fewer in the 20-23 mm size class. Adults continue to be present and mostly rare at Santa Cruz, Anacapa, and Santa Barbara Islands. It is likely we will continue to see more record high densities next year as additional juveniles become emergent. Due to the difficulty in handling and measuring this species without damaging them since they typically reside deep in crevices, we do not collect size data except for ones found in the ARMs. A record number of *Centrostephanus coronatus* were found in ARMs this year at several sites. Juveniles were present in the ARMs at all sites where ARMs are present except Miracle Mile, San Miguel Island. At the sites where below record high abundances in ARMs were observed, the number of juveniles recorded in ARMs was the highest since the 1997/98 ENSO event.

Lytechinus anamesus densities remained low overall, similar to the past 12 years. This species was more abundant in the 1980s and 1990s compared to the last decade. Overall, mean size of *L. anamesus* decreased at several Santa Cruz Island sites, most notably Yellowbanks and Pedro Reef, indicative of recent recruitment. Similar to last year, most *L. anamesus* at Gull Island were less than 20 cm.

Strongylocentrotus franciscanus abundances increased at all Santa Rosa Island sites. Several of these sites had record high densities. Most of the increases resulted from a high abundance of juveniles. Crevice habitat is increasingly dominated by urchins, possibly resulting in less being available for *Haliotis rufescens*, at Chickasaw on Santa Rosa Island. Densities at San Miguel Island sites changed little, with continued near record high density at Hare Rock, and low, stable densities at Wyckoff

Ledge and Miracle Mile. We hypothesize that this increase at the cooler northern Channel Islands is due in part to the absence of *Pycnopodia helianthoides.*

At Santa Cruz, Anacapa, and Santa Barbara Islands, most sites decreased in density. The sites with no increase changed little from last year. Santa Barbara and Anacapa Island had the lowest overall densities observed since 2004/05, continuing the trend of decreasing abundance from the last several years. The three original Santa Barbara Island sites currently have the lowest recorded densities since they were established in the early 1980s. This is a remarkable departure from the last two decades, which is also reflected in the increased abundance of macroalgae at several of these sites. This is a continuation of the trend of decreasing density documented in 2013. Similarly, Anacapa sites have the lowest recorded *S. franciscanus* densities at every site since they were established. All Santa Cruz Island sites decreased in density from last year, with Potato Pasture, Pedro Reef, and Scorpion Anchorage at record low densities. Whole, fresh *S. franciscanus* tests were present at several eastern sites, indicative of a recent wasting and/or black-spot disease event.

Grouping the 24 MPA references sites by protection status (3 inside & 3 outside at Santa Barbara Island, Anacapa Island, Scorpion Santa Cruz Island, and South Point Santa Rosa Island MPAs), densities of *Strongylocentrotus franciscanus* are lower inside the Scorpion/Santa Cruz, Anacapa, Santa Barbara Islands MPAs compared to reference sites adjacent to the MPAs. For Santa Rosa Island, densities were higher outside of the South Point SMR compared to reference sites inside. Similarly, size distributions also differed by protection status. Overall, mean sizes were greater inside all four MPAs compared to the outside MPA reference sites.

Strongylocentrotus franciscanus recruitment in the ARMs remained similar to last year. Juvenile *S. franciscanus* are defined in this report as having a test diameter of greater than or equal to 15 mm. Juvenile *S. franciscanus* were common at Santa Cruz, Anacapa, and Santa Barbara Islands, similar to past years. There was notably more recruitment of *S. franciscanus* at Santa Cruz Island compared to the other Islands, similar to past years.

Similar to *Strongylocentrotus franciscanus, S. purpuratus* abundances increased at all Santa Rosa Island sites. While rare at most San Miguel Island sites, *S. purpuratus* increased at Hare Rock. *Strongylocentrotus purpuratus* densities decreased at nearly all Santa Cruz, Anacapa, and Santa Barbara Island sites. The most dramatic decreased occurred at Arch Point, Santa Barbara Island, which decreased from the highest density ever recorded at any site by KFM of 224/m^2 last year to 29/m^2 this year.

Grouping the 24 MPA references sites by protection status (3 inside & 3 outside at Santa Barbara Island, Anacapa Island, Scorpion Santa Cruz Island, and South Point Santa Rosa Island MPAs), densities of *Strongylocentrotus purpuratus* are lower inside the Scorpion/Santa Cruz, Anacapa, Santa Barbara Islands MPAs compared to reference sites adjacent to the MPAs. For Santa Rosa Island, densities were higher outside of the South Point MPA compared to reference sites inside. Size distributions also differed by protection status. Overall, mean sizes were greater inside the Santa Barbara Island, Anacapa Island, Scorpion Santa Cruz Island MPAs compared to the outside MPA reference sites. There was no difference inside/outside of the South Point Santa Rosa Island MPA.

Strongylocentrotus purpuratus recruitment in the ARMs remained similar to last year with moderate densities. Juvenile *S. purpuratus* are defined in this report as having a test diameter of ≤ 15 mm. Juvenile *S. purpuratus* were common at Santa Cruz, Anacapa, and Santa Rosa Islands, similar to past years. There were increases in abundance at Johnson's Lee South, Santa Rosa Island, Admiral's Reef, Anacapa Island, and Gull Island, Santa Cruz Island.

Multiple sea star species experienced significant declines in abundance in the past year. *Pycnopodia helianthoides, Pisaster giganteus*, and *Pisaster ochraceus* all experienced declines of greater than 97% between the 2013 and 2014 KFM season. The declines were attributed to a widespread wasting disease event that was first documented in Washington State in the winter of 2013 (Hewson et al. 2014). Similar die-offs have occurred before in the 1970s, 80s, and the 90s, but previously had not been documented at this magnitude and over such a wide geographic area (Lafferty and Kushner, 1999, and Richards and Kushner, 1992). This recent widespread (Alaska to Baja) disease event is referred to as "wasting syndrome" for this report. This widespread wasting syndrome event was different from past disease events which were localized and associated with warmer water conditions. With past warm water disease events, infected sea stars would be observed only after sea temperatures of greater than about 20° C persisted for several weeks, which typically occurs no earlier than July. In addition, we typically only observed diseased sea stars in the upper 60 ft. of the water column (above the thermocline) and the cooler deeper waters appeared to act as a refuge. With this disease event, *Pycnopodia helianthoides, Pisaster giganteus,* and *Pisaster ochraceus* had already died off before the KFM field season began in May, and it appeared there was no deep cooler water refuge as has was observed with all previous sea star disease events at the Island. As a result, we strongly believe this wasting disease is not directly associated with warm water.

A second disease event was documented in the Park in the summer of 2014 once benthic temperatures of greater than 70° F persisted; similar to what has been observed in past years. Similar to past years, there was a deeper water refuge present for species affected by this second warm water wasting disease event, where water temperatures were cooler and the rate of infection was much lower for *P. miniata*, which may result in a quicker recovery in abundance compared to the other sea star species affected by the wasting syndrome where there did not appear to be a deeper water refuge. Sea urchin wasting disease was observed at 11 sites this year, compared to 10 sites in 2014, and 11 sites in 2013 (Table 11). There were several sites where large numbers, sometimes literally piles, of whole urchin tests present which appeared to be from recent disease die-offs. These sites were Pelican Bay, Scorpion Anchorage, Devil's Peak Member on Santa Cruz Island and Landing Cove on Anacapa Island. During survey dive on the west end of Anacapa Island (north side of the island), there were piles of fresh urchin tests found, indicating that this extended beyond just the KFM site Landing Cove for Anacapa Island.

It should be noted that Santa Barbara Island sites are almost always sampled during the month of May every year. Sampling of the remaining sites/islands varies each year depending on weather. We may observe fewer occurrences of warm water-associated echinoderm diseases as a result.

Table 11. 2015 Echinoderm wasting disease observations. None = Not observed at this site during our visits in 2014. Date = Date(s) disease/syndrome was observed. Note: Urchins appearing to have black spot disease were not included in table. Look in site write-up for these observations.

Island	Island/Site	Sea Urchin Wasting Disease		Sea Urchin Black Spot Disease	
		Species[1] Observed	Date(s) of Observation	Species[1] Observed	Date(s) of Observation
San Miguel Island	Wyckoff Ledge	None	–	None	–
	Hare Rock	6(5-10%)	6/9	2(<1%), 6(1%)	6/9
	Miracle Mile	None	–	None	–
Santa Rosa Island	Johnson's Lee North	None	–	None	–
	Johnson's Lee South	None	–	2(<1%)	9/14
	Rodes Reef	6(3%)	6/8	6(~1%)	6/8
	Cluster Point	None	–	None	–
	Trancion Canyon	None	–	6(<1%)	8/12
	Chickasaw	None	–	None	–
	South Point	None	–	None	–
Santa Cruz Island	Gull Island South	None	–	None	–
	Fry's Harbor	2(5%), 6(3%)	7/28	2(<1%), 6(1%)	7/28
	Pelican Bay	2,3,6(15%)	9/28	2(2%), 6(5%)	9/28
	Scorpion Anchorage	2(20-30%)	9/17	2,6(~1%)	10/2
	Yellow banks	3,6(>5%)	9/29	2(~1%),6(>5%)	9/29
	Devil's Peak Member	6(10%)	5/29	None	–
	Potato Pasture	None	–	None	–
	Cavern Point	None	–	None	–
	Little Scorpion	2(20%), 6(10%)	10/15	None	–
	Pedro Reef	3(1%), 6(1%)	7/13	None	–
Anacapa Island	Admiral's Reef	None	–	6(<1%)	10/15
	Cathedral Cove	None	–	None	–
	Landing Cove	None	–	2,6(1-2%)	9/18
	Keyhole	None	–	None	–
	East Fish Camp	2(2%), 6(2%)	9/30	None	–
	Black Sea Bass Reef	None		None	–
	Lighthouse	2(<1%),6(<1%)	6/24	None	–

[1] Species Legend: 1 = *Patiria (Asterina) miniat*; 2 = *Strongylocentrotus purpuratus*; 3 = *Lytechinus anamesus*; 4 = *Pisaster giganteus*; 5 = *Astrometis sertulifera*; 6 = *Strongylocentrotus franciscanus*; 7 = *Parastichopus parvimensis*; 8 = *Dermasterias imbricata*; 9 = *Mediaster aequalis*; 10 = *Pycnopodia helianthoides*; 11 = *Pisaster ochraceus*; 12 = *Astropecten armatus*

Table 11 (continued). 2015 Echinoderm wasting disease observations. None = Not observed at this site during our visits in 2014. Date = Date(s) disease/syndrome was observed. Note: Urchins appearing to have black spot disease were not included in table. Look in site write-up for these observations.

Island	Island/Site	Sea Urchin Wasting Disease		Sea Urchin Black Spot Disease	
		Species[1] Observed	Date(s) of Observation	Species[1] Observed	Date(s) of Observation
Santa Barbara Island	SE Sea Lion Rookery	None	–	None	–
	Arch Point	None	–	None	–
	Cat Canyon	None	–	None	–
	Webster's Arch	None	–	None	–
	Graveyard Canyon	None	–	None	–
	Southeast Reef	None	–	None	–

[1] Species Legend: 1 = *Patiria (Asterina) miniat*; 2 = *Strongylocentrotus purpuratus*; 3 = *Lytechinus anamesus*; 4 = *Pisaster giganteus*; 5 = *Astrometis sertulifera*; 6 = *Strongylocentrotus franciscanus*; 7 = *Parastichopus parvimensis*; 8 = *Dermasterias imbricata*; 9 = *Mediaster aequalis*; 10 = *Pycnopodia helianthoides*; 11 = *Pisaster ochraceus*; 12 = *Astropecten armatus*

Pycnopodia helianthoides densities declined over 99% from the 2013 KFM field season. This species had the highest mortality rate due to the wasting syndrome of all sea star species monitored in Channel Islands National Park. Six *P. helianthoides* were observed during the entire 2015 field season. Three (< 35 mm) were at Rodes Reef on Santa Rosa Island, two (≤ 40 mm) were at Miracle Mile on San Miguel Island, and one (30 mm) at Hare Rock on San Miguel Island. Last year only one was sampled on band transects (Hare Rock, San Miguel Island). *Pycnopodia helianthoides* are one of the most ecologically important invertebrate predators in the kelp forests at the Channel Islands, especially at the cooler water San Miguel, Santa Rosa and Santa Cruz Islands. With sea otters extirpated from the Park islands, *P. helianthoides* are the main urchin predator at the three northern islands. Urchin abundances are likely to increase at the northern islands as a result of their continued absence since 2014. One *Pycnopodia helianthoides* was observed in the ARMs this year (Miracle Mile, San Miguel Island). This is the lowest density found in the ARMs since they were installed at KFM sites in the early 1990s.

Patiria miniata densities decreased at all sites with densities greater than zero. The one exception, Southeast Reef on Santa Barbara Island, had a slight increase, but similar to last year, is at near record low density. *Patiria miniata* densities in the ARMs decreased from near record-high abundances observed in the ARMs in recent years, though they remained abundant. Sites in the Anacapa MPA and Scorpion MPA, where ARMs are present, had some of the lowest *P. miniata* densities in the ARMs, and may be indicative of predation by the large, abundant lobsters present near those sites (Scorpion Anchorage on Santa Cruz Island, Landing Cove and Cathedral Cove on Anacapa Island).

Pisaster giganteus densities decreased significantly since the 2013 field season across all KFM sites. By 2014, density decreased over 97% at KFM sites. Prior to 2014 year, there had not been a large,

widespread die-off of *P. giganteus* since the 1997/98 El Niño. In 2015, density decreased an additional 48% from 2014. *Pisaster giganteus* has been sampled on 1 m^2 quadrats since KFM began collecting data in 1982. After a program review was conducted in 1996, it was determined that the power to detect changes in this species was too low and the 5 m^2 quadrat protocol was implemented to obtain better density estimates. This species continues to be sampled on 1 m^2 quadrats to maintain comparability with data collected in the years prior to 1996. Due to very low densities following the wasting disease event, *Pisaster giganteus* were sampled on band transects this year in addition to 1 m^2 quadrat and 5 m^2 quadrat protocols (Table 12).

Table 12. *Pisaster giganteus* density estimates obtained from 1 m^2 quadrat, 5 m^2 quadrat, and band transect protocols. The total area sampled per site is 24 m^2 (1 m^2 quadrat), 200 m^2 (5 m^2 quadrat), and 720 m^2 (band transect).

		Mean Density/m2			Standard Error		
Island	**Site**	**1 m^2 Quadrat**	**5 m^2 Quadrat**	**Band Transect**	**1 m^2 Quadrat**	**5 m^2 Quadrat**	**Band Transect**
San Miguel Island	Wyckoff Ledge	0	0	0.0083	0	0	0.0048
	Hare Rock	0	0.025	0.0097	0	0.025	0.0056
	Miracle Mile	0	0	0.0125	0	0	0.0042
Santa Rosa Island	Johnson's Lee North	0	0	0.0014	0	0	0.0014
	Johnson's Lee South	0	0.005	0.0014	0	0.005	0.0014
	Rodes Reef	0	0.005	0.0028	0	0.005	0.0028
	Cluster Point	0	0	0.0083	0	0	0.0048
	Trancion Canyon	0	0.010	0.0083	0	0.010	0.0038
	Chickasaw	0	0.010	0.0042	0	0.007	0.0022
	South Point	0	0	0.0028	0	0	0.0019
Santa Cruz Island	Gull Island South	0	0	0	0	0	0
	Fry's Harbor	0	0.010	0.0028	0	0.007	0.0028
	Pelican Bay	0	0	0	0	0	0
	Scorpion Anchorage	0	0	0	0	0	0
	Yellow banks	0	0	0	0	0	0
	Devil's Peak Member	0	0	0.0014	0	0	0.0014
	Potato Pasture	0	0	0	0	0	0
	Cavern Point	0.0042	0	0	0.0042	0	0
	Little Scorpion	0	0	0	0	0	0
	Pedro Reef	0.0042	0.005	0.0056	0.0042	0.005	0.0031

Table 12 (continued). *Pisaster giganteus* density estimates obtained from 1 m^2 quadrat, 5 m^2 quadrat, and band transect protocols. The total area sampled per site is 24 m^2 (1 m^2 quadrat), 200 m^2 (5 m^2 quadrat), and 720 m^2 (band transect).

Island	Site	Mean Density/m2			Standard Error		
		1 m^2 Quadrat	5 m^2 Quadrat	Band Transect	1 m^2 Quadrat	5 m^2 Quadrat	Band Transect
Anacapa Island	Admiral's Reef	0	0	0.0014	0	0	0.0014
	Cathedral Cove	0	0	0	0	0	0
	Landing Cove	0	0.005	0	0	0.005	0
	Keyhole	0	0	0.0014	0	0	0.0014
	East Fish Camp	0	0	0	0	0	0
	Black Sea Bass Reef	0	0	0	0	0	0
	Lighthouse	0	0	0.0028	0	0	0.0019
Santa Barbara Island	SE Sea Lion Rookery	0	0	0	0	0	0
	Arch Point	0	0	0	0	0	0
	Cat Canyon	0	0	0	0	0	0
	Webster's Arch	0	0	0	0	0	0
	Graveyard Canyon	0	0	0	0	0	0
	Southeast Reef	0	0	0.0014	0	0	0.0014

Pisaster giganteus juvenile (≤ 40 mm) densities in the ARMs were greatest at Anacapa and Santa Cruz Islands. Yellowbanks at Santa Crus Island had a near record high density with a total of 89 in the ARMs there. Overall juvenile densities in the ARMs were similar to past years.

In 2012, KFM began sampling *Pisaster ochraceus* densities on 5 m^2 quadrats. This sea star is an intertidal species, but they have become more prevalent at several KFM sites in recent years. This species was one of the several sea star species significantly impacted by the 2013/14 winter sea star wasting disease event. Due to very low densities following the sea star wasting disease event, *Pisaster* spp. were sampled on band transects this year in addition to the 5 m^2 quadrat protocol (Table 13).

Table 13. *Pisaster ochraceus* density estimates obtained from 5 m^2 quadrat and band transect protocols. The total area sampled per site is 200 m^2 (5 m^2 quadrat) and 720 m^2 (band transect).

		Mean Density/m2		Standard Error	
Island	**Island/Site**	**5 m2 Quadrat**	**Band Transect**	**5 m2 Quadrat**	**Band Transect**
San Miguel Island	Wyckoff Ledge	0	0	0	0
	Hare Rock	0	0	0	0
	Miracle Mile	0	0	0	0
Santa Rosa Island	Johnson's Lee North	0	0	0	0
	Johnson's Lee South	0	0	0	0
	Rodes Reef	0	0	0	0
	Cluster Point	0	0	0	0
	Trancion Canyon	0	0	0	0
	Chickasaw	0	0	0	0
	South Point	0	0	0	0
Santa Cruz Island	Gull Island South	0	0	0	0
	Fry's Harbor	0	0	0	0
	Pelican Bay	0	0	0	0
	Scorpion Anchorage	0	0.0014	0	0.0014
	Yellow banks	0	0	0	0
	Devil's Peak Member	0	0.0042	0	0.0022
	Potato Pasture	0	0	0	0
	Cavern Point	0	0	0	0
	Little Scorpion	0	0	0	0
	Pedro Reef	0	0	0	0
Anacapa Island	Admiral's Reef	0	0	0	0
	Cathedral Cove	0	0	0	0
	Landing Cove	0	0	0	0
	Keyhole	0	0.0014	0	0.0014
	East Fish Camp	0	0	0	0
	Black Sea Bass Reef	0	0	0	0
	Lighthouse	0	0	0	0
Santa Barbara Island	SE Sea Lion Rookery	0	0	0	0
	Arch Point	0	0	0	0
	Cat Canyon	0	0	0	0
	Webster's Arch	0	0	0	0
	Graveyard Canyon	0	0	0	0
	Southeast Reef	0	0	0	0

Ophiothrix spiculata abundances decreased at all Santa Barbara, Anacapa, and Santa Cruz sites where present. This is the first time we have documented such a dramatic decline in this species since it was added to the monitoring protocol in 2003. They continued to be rare at Santa Rosa and San Miguel Islands.

Parastichopus parvimensis abundances declined overall at Santa Barbara, Anacapa, and Santa Cruz Islands, while remaining unchanged at Santa Rosa and San Miguel Islands. Densities at all Santa Cruz Island sites decreased. *Parastichopus parvimensis* densities continued to be higher at sites inside the Santa Barbara, Santa Cruz, Santa Rosa, and Anacapa Island MPAs compared to sites outside**.** However, there were notable decreases inside the Santa Cruz/Scorpion and Anacapa MPAs, which have some of the highest abundances in the Park. In the ARMS at Scorpion Anchorage, two *P. parvimensis* < 10 cm had wasting disease, which is rarely observed in this species.

Pachythyone rubra cover increased overall at Santa Rosa Island. The highest cover continues to be at South Point, Santa Rosa Island, where *P. rubra* continued to increase from last year's high of 18% cover to 25% this year. Cluster Point at Santa Rosa Island increased from 0% to 3% this year, though they were present in high density patches from meters 70-100 along the main transect. Abundance at Potato Pasture, Santa Cruz Island remained similar to last year. The remaining sites remained similar to recent years.

Tunicates

Overall, tunicate cover decreased at Santa Rosa, Anacapa, and Santa Barbara Islands, while remaining similar to recent years at San Miguel Island. At Santa Cruz Island, two, sites increased, two decreased, and the remaining sites continued to have very low tunicate cover. *Styela montereyensis* were observed mostly at Santa Rosa and San Miguel Island sites, though their abundances were low. There was little change in abundance at San Miguel Island sites, but *S. montereyensis* continued to decrease for the fifth consecutive year overall at Santa Rosa Island.

Fish

Overall, *Coryphopterus nicholsii* densities continued to decrease for the third consecutive year and are at some of the lowest densities recorded since 1998 at several sites. Most of the decreases occurred at Santa Cruz and Anacapa Islands, as well as a small decrease at Santa Barbara Island. Densities remained similar to recent years at San Miguel and Santa Rosa Islands. These densities are from the $1m^2$ quadrat protocol. Beginning this year, *C. nicholsii* were removed from the Roving Diver Fish Count Protocol since they are sampled on $1m^2$ quadrats.

Alloclinus holderi densities changed little and remained relatively low, similar to the last five years. However, there were increases at one site each on Santa Cruz, Anacapa, and Santa Barbara Islands. One site decreased on Santa Cruz Island. This is a warmer water species and what we would expect from the past ten years of relatively cooler water temperatures. However, there has been a notably persistent warm water event since the fall of 2014. It is likely that there will be an increase in density next year in the form of recruits.

Lythrypnus dalli abundances increased at five Santa Cruz and one Anacapa Island sites and remained low or not present at the remaining sites. There was a dramatic increase to the highest density ever recorded at any KFM site at Pelican Bay, Santa Cruz Island. This is a warm water species and experiences increases in abundance following warm water events like El Niño, such as this year.

Oxylebius pictus abundances declined at all Santa Rosa, Santa Cruz, Anacapa, and Santa Barbara Island sites overall. Every site at Santa Cruz, Anacapa, and Santa Barbara Islands decreased in density. There was little change at San Miguel Island.

Male *Semicossyphus pulcher* abundances increased overall at San Miguel and Santa Rosa Islands, and decreased at Santa Cruz, Anacapa, and Santa Barbara Islands. Female abundances increased at Santa Rosa, Santa Cruz, Anacapa, and Santa Barbara Islands, and remained similar to recent years at San Miguel Islands. Juvenile *S. pulcher* abundances increased to some of the highest densities we have observed. Out of 33 KFM sites, all but one increased from last year. It is common to observe recruitment pulses of this species following El Niño events, such as occurred this year.

Adult *Oxyjulis californica* increased in abundance for at Santa Barbara, Santa Rosa and San Miguel Islands. At Anacapa Island, three sites increased, three decreased, and one remained similar to last year. At Santa Cruz Island, one site increased, one decreased, and eight remained similar to last year. *Oxyjulis californica* juveniles increased at Santa Rosa Island, and changed little at San Miguel Islands. At the remaining three islands (23 sites), nine sites increased, seven decreased, and the remaining sites were similar to last year.

Male and female *Halichoeres semicinctus* notably increased in abundance at Santa Rosa, Santa Cruz, Anacapa, and Santa Barbara Island sites overall. None were observed at San Miguel Island, similar to past years. This was the greatest increase observed by KFM since at least 2005. Similar to last year, there were 10 sites where YOY *H. semicinctus* were observed following a recruitment event. YOY were more abundant at Pelican Bay, Santa Cruz Island than we have documented before at any site (720), surpassing last year's record of 73 at Keyhole, Anacapa Island. This is another warm water species that tends to recruit more during warmer years. Note that the visual fish transects lump juveniles into the female category.

Adult *Chromis punctipinnis* abundances continued to increase to some of the highest abundances we have documented in over a decade at Santa Cruz, Anacapa and Santa Barbara Islands. Abundances also increased overall at Santa Rosa Island, and remained similar to past years at San Miguel Island. *Chromis punctipinnis* juveniles, which are unusual to see at Santa Rosa Island sites, were observed at 6 of 7 sites there, as well as two San Miguel Island sites. At many sites, juveniles consisted of YOY from this year as well as last year's recruits since they were still under 10 cm in length. *Chromis punctipinnis* YOY were observed as early as July 14th this year, which is earlier than usual for this species. No notes were taken on the presence of skin ulcers, usually caused by the marine bacterium *Vibrio damsela*, (Love, 1981) this year. These skins ulcers are usually observed on a few *C. punctipinnis* at one or two sites, especially during or after persistent warm water events.

Hypsypops rubicundus adult abundances increased at Santa Barbara and Anacapa Islands and decreased at Santa Cruz Island. At Santa Rosa and San Miguel Islands, abundances remained unchanged, similar to past years. For the second year in a row, juvenile *H. rubicundus* increased to the highest abundances that KFM has documented. Juveniles were observed around the Johnson's Lee area, which is rare for this warm water species. The first YOY *H. rubicundus* were observed on May 12th at Graveyard Canyon on Santa Barbara Island.

Adult *Paralabrax clathratus* abundances increased overall for the third year in a row at Santa Barbara, Anacapa, and Santa Cruz Islands and are at some of the highest recorded densities at many of the sites. Black Seabass Reef and Keyhole on Anacapa Island had the highest densities recorded at any KFM site. Juvenile *P. clathratus* increased overall at Santa Barbara and Santa Cruz Islands, and decreased at Anacapa Island. It should be noted that most years, our fish counts are often completed at many sites before juvenile *P. clathratus* recruit, which typically happens in late summer or early fall. Due to the persistent warn water the region has been experiencing since 2014, YOYs were observed much earlier this year.

Adult *Embiotoca jacksoni* abundances decreased overall at Santa Barbara and Santa Cruz Islands. Juvenile *E. jacksoni* decreased in abundance at San Miguel, Santa Rosa, Santa Cruz, and Anacapa Island sites, and remained similar to last year at Santa Barbara Island. *Embiotoca lateralis* increased at San Miguel Island sites, decreased at Santa Cruz and Anacapa Island, and remained similar to recent years at the remaining islands with the exception of a decrease at Cluster Point on Santa Rosa Island. Juvenile *E. lateralis* abundances decreased overall across the five park islands. Adult *Rhacochilus vacca* decreased at Santa Rosa, Santa Cruz, and Anacapa Islands overall. Juvenile abundances decreased across all five park islands, following an increase last year. Similar to last year, adult *Girella nigricans* increased at Santa Barbara and Anacapa Islands. Santa Cruz and Santa Rosa Islands remained similar to last year. Note that juveniles are not graphed since they are primarily found in the intertidal in tide pools.

Sebastes spp. abundance and diversity declined from recent years. There was a decrease in recruitment of most species common to KFM sites, and a fewer number of non-indicator *Sebastes* spp. juveniles observed this year.

Adult *Sebastes mystinus* abundances remained at or near record high abundances at Santa Rosa and San Miguel Islands, decreased at Santa Cruz Island, and remained similar to recent years at Anacapa and Santa Barbara Islands. Similar to last year, juvenile *S. mystinus* abundances continued to decrease at all five park islands following the recruitment pulse in 2013. Adult *Sebastes serranoides* increased at Santa Rosa Island, decreased at Santa Barbara, Anacapa, and Santa Cruz Islands, and changed little at San Miguel Island. Similar to last year, juvenile *S. serranoides* decreased at all five park islands. This is following record high densities observed at most sites in 2013. Adult and juvenile *Sebastes serriceps* abundances changed little from recent years. Adult *Sebastes atrovirens* increased overall at Santa Rosa and San Miguel Islands and decreased at the remaining islands. Juvenile abundances increased at three sites, decreased at three sites, and remained similar to last year at the remaining sites. Abundances of KGBs were similar to last year. There were overall

decreases at Anacapa Island as well. Abundances at the remaining islands changed little. KGBs were observed at six sites this year, down from 13 in 2014.

Juvenile *Sebastes paucispinis,* bocaccio, were recorded at four sites, a decrease from nine last year. Adult *S. caurinus,* copper rockfish, were observed at seven sites, a decrease from 13 sites last year. Juveniles were observed at three sites, a decrease from 10 in 2014. Adult *S. miniatus,* vermillion rockfish, remained similar to previous years with observations at three sites. Juvenile *S. miniatus* abundances decreased from nine sites in 2014 to one site this year. Adult *S. chrysomelas*, black and yellow rockfish, abundance was similar to recent years, and was observed at 22 sites compared to 24 last year. Adult *S. carnatus*, gopher rockfish, were observed at 12 sites, similar to recent years. Adult *S. auriculatus*, brown rockfish, were observed at two Santa Cruz Island sites, similar to last year, a decrease from three sites on Santa Cruz Island and one on ANI las year. Juvenile *S. auriculatus* were not observed, similar to recent years. Adult *S. melanops*, black rockfish, were observed at two sites, similar to recent years. Adult *S. rastrelliger,* grass rockfish, were observed at five sites.

Adult *Ophiodon elongatus,* lingcod, were observed at 11 sites, similar to recent years. Adult and juvenile *Scorpaena guttata,* California scorpionfish, were observed at five and 10 sites, respectively. Adult *Scorpaenichthys marmoratus*, cabezon, were observed at 10 sites. Adult *Caulolatilus princeps*, ocean whitefish, were observed at nine sites, similar to last year. Adult *Stereolepis gigas,* giant black sea bass, were not observed during fish counts. However, afterwards we observed them at two Anacapa Island sites, two individuals at Black Seabass Reef, and one individual at Admiral's Reef. One *Squatina californica*, Pacific angel shark, was observed during the fish counts at Southeast Sea Lion, Santa Barbara Island, similar to past years.

Artificial Recruitment Modules (ARMs)

ARMs were monitored at all 12 sites where they are present. In 2012, three ARMs were installed at Santa Barbara Island at Southeast Reef. These are the only ARMs at this island due to its high exposure to south swell. The three ARMs were bolted to the substrate to prevent them from being damaged or destroyed. The original plan was that if these three ARMs survive several years, more may be deployed at this island. However, only one was able to be sampled this year. The second one was repaired, but the third was destroyed and not replaced. At this point, there are no plans to deploy more at this island.

At Cathedral Cove, Anacapa Island, ARM #2350 lost its lid and the number tag was changed to 2482.

At Pelican Bay, Santa Cruz Island, barnacles covered the bricks in the ARMs, similar to the last two years.

At Scorpion Anchorage, Santa Cruz Island, *Arbacia incisa* at 16 mm and 20 mm were in the ARMs. One mantis shrimp, *Hemisquilla ensigera*, was also in an ARM. These are rarely observed at our sites, although common in flat, sediment-covered areas offshore of Pelican Bay.

Summary information on general trends for indicator species in ARMs is described in the discussion for each individual species.

Invasive Species

Refer to the algae section of the discussion for information on the invasive indicator species *Sargassum horneri.*

Sargassum muticum appeared to be more abundant than in recent years or maybe even a few decades at some of the monitoring sites this year. This invasive species was originally added as an indicator species the KFM program in 1982. Due to low abundances at the time, sampling was discontinued in 1984 and it has not been monitored since.

The non-native bryozoan *Watersipora subtorquata* was observed in 2011 for the first time at KFM sites. No notes were taken this year on this species, though it was present at Fry's Harbor.

Temperature

Two Tidbit® temperature loggers were deployed at every site except for Miracle Mile, which has no temperature logger stake because of the site's proximity to the Wyckoff Ledge site. Hourly temperature data were successfully retrieved from all 32 sites. The data are downloaded from the temperature loggers beginning in middle of summer each season; therefore, we look at annual water temperatures from May 2014 to April 2015. Refer to Appendix J for temperature summary graphs by site.

The region continued to experience above average water temperatures this year. This warm water event has persisted since October 2013. Mean monthly benthic water temperatures from June 2014 through April 30th, 2015 (the end of the period covered for water temperatures in this report) were above average and most monthly mean temperatures were at or near record highs at all sites.

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Appendix A. Protocol Modifications, Data Management, Database Corrections, and Additional Projects Information

Protocol Changes

Holdfast diameter measurement for *Macrocystis pyrifera* size frequencies was discontinued. Stipe count (> 1 m tall) continues to be collected.

Maximum height dimension measurement was discontinued for the three indicator species of gorgonians (*Lophogorgia chilensis*, *Muricea californica*, *M. fruticosa*). The maximum width dimension measurement continues to be collected.

Coryphopterus nicholsii, blackeye goby, was removed from the core RDFC indicator species since density data are obtained on 1 m^2 quadrats.

Sargassum horneri juveniles were removed from the band transect protocol because of very high densities present at many sites now and the amount of effort required to sample them on this protocol. Juveniles continue to be sampled on the 5 m^2 quadrat and 1 m^2 quadrat protocols.

Subsampling of *Sargassum horneri* adults on band transects began this year due to very high densities. If over 150 adults are counted during the first half of any band, only half of that particular band is surveyed. A check box will be marked for any band where this occurs and the count is doubled for simplicity of data management. The data for the subsampled bands are entered same as the rest of the bands. The only indicator that subsampling occurred is on the datasheets, where the subsample box is marked.

Sampling Difficulties

All proposed data collection was completed this year.

Database changes/corrections

No corrections were made to data in the database this year.

Additional Projects

Wave Sensors

Wave sensors were deployed at 26 KFM sites to quantify wave energy exposure relative to CDIP forecasts in order to create a model for hindsight forecasts going back 20+ years at KFM sites. This creates an opportunity to look for statistical patterns between wave energy and kelp forests after controlling for other potential covariates.

White Abalone Surveys in Santa Barbara

Several divers from CHIS made dives in August along the mainland coast in front of Isla Vista too look for *Haliotis sorenseni*. See Appendix K for more information on those dives.

Appendix B. Kelp Forest Monitoring Program Data Usage and Information Requests for 2015

Publications

No scientific papers using KFM data were published in 2015.

Data Requests

There were seven formal data requests from outside NPS. All requests were fulfilled.

Katie Davis from UCSB was sent all urchin size frequency data for 2003-2014 for all KFM sites to be published as part of a coastal-wide urchin size frequency dataset.

Lindsay Marks from UCSB was sent all *Sargassum horneri* data.

Christy Juhasz from CDFW was sent ARMs data for *Haliotis rufescens* from the KFM site Miracle Mile, San Miguel to compare red abalone recruitment to their Mendocino ARMs settlement rates. They will be presenting these data at the International Abalone Symposium in Korea in Oct 2015.

Derek Stein from CDFW was sent all *Strongylocentrotus franciscanus* density and size frequency data. The data were to be used for an exercise in a data-poor modeling toolkit to determine the best model to use for red sea urchin management. They also hope to use these data to look at the trends in size frequency and density compared to sea urchin harvest since 1982. Additional analysis may compare size and density between MPA and non-MPA sites. The extents of how they might use these data were still being explored.

Lisa Crosson, a PhD student at the University of Washington working with Glenn VanBlaricom and Carolyn Friedman was given *Haliotis* spp. data to use on an abalone withering syndrome project.

Jayson Marks at Cal Poly was provided size frequency and density data for urchin species to look at potential declines in urchins over the past year. Examining the time series of urchin populations over the course of the monitoring program would help to determine if the declines that have been observed and reported anecdotally by others more recently are an anomalous event. In addition, it will help to determine whether there are spatial patterns in declines across the monitoring locations.

Jean Davis, an environmental scientist with CDFW was provided *Paralabrax clathratus* data. They are creating a fishery model for that species.

Information Requests

The kelp forest monitoring handbooks and annual reports are available in PDF format on the web at: https://www.nps.gov/im/medn/kelp-forest-communities.htm

To obtain raw data collected by the Kelp Forest Monitoring Program, please contact Joshua_Sprague@nps.gov or David_Kushner@nps.gov, or write to:
Superintendent, Channel Islands National Park, 1901 Spinnaker Drive, Ventura, CA 93001

Appendix C. Species List

Introduction

The species list contains presence/absence and relative abundance data for all indicator species that could be found and identified during the site visits between May and November. The overall effort varies from site to site with the water conditions and available time. Relative abundance values are subjective, and generally based on opinions of several divers viewing the overall site. When identification is tentative, we either do not mark it or place a question mark on the list.

Abundance Ratings

X - present, no relative abundance rating given

4 - abundant, organism present in higher than normal densities

3 - common, organism found over most of site or in high density patches

2 - present, organism found in moderate numbers

1 - rare, few organisms found

0 - noticeably absent, an effort was made to look for an organism that was not found.

? - unknown

Notes

j - juvenile

s - shell only

#/J# - (e.g. 2/J3 - adult abundance 2, juvenile abundance 3)

Site Codes by Island

Sites #1–16

SMWL = San Miguel Island, Wyckoff Ledge

SMHR = San Miguel Island, Hare Rock

SRJLNO = Santa Rosa Island, Johnson's Lee North

SRJLSO = Santa Rosa Island, Johnson's Lee South

SRRR = Santa Rosa Island, Rodes Reef

SCGI = Santa Cruz Island, Gull Island South

SCFH = Santa Cruz Island, Fry's Harbor

SCPB = Santa Cruz Island, Pelican Bay

SCSA = Santa Cruz Island, Scorpion Anchorage

SCYB = Santa Cruz Island, Yellowbanks

ANAR = Anacapa Island, Admiral's Reef

ANCC = Anacapa Island, Cathedral Cove

ANLC = Anacapa Island, Landing Cove

SBSESL = Santa Barbara Island, Southeast Sea Lion Rookery

SBAP = Santa Barbara Island, Arch Point

SBCAT = Santa Barbara Island, Cat Canyon

Sites #21–37

SMMM = San Miguel Island, Miracle Mile

SRCP = Santa Rosa Island, Cluster Point

SRTC = Santa Rosa Island, Trancion Canyon

SRCSAW = Santa Rosa Island, Chickasaw

SRSP = Santa Rosa Island, South Point

SCDPM = Santa Cruz Island, Devil's Peak Member

SCPP = Santa Cruz Island, Potato Pasture

SCCVP = Santa Cruz Island, Cavern Point

SCLS = Santa Cruz Island, Little Scorpion

SCPRF = Santa Cruz Island, Pedro Reef

ANKH = Anacapa Island, Keyhole

ANEFC = Anacapa Island, East Fish Camp

ANBSBR = Anacapa Island, Black Sea Bass Reef

ANLH = Anacapa Island, Lighthouse

SBWA = Santa Barbara Island, Webster's Arch

SBGC = Santa Barbara Island, Graveyard Canyon

SBSER = Santa Barbara Island, Southeast Reef

Indicator Species

The 2015 indicator species list for the kelp forest monitoring sites is contained in tables C1 (sites #1-16) and C2 (sites #21-37). Abundance rating, note, and site codes are defined above.

Table C1. 2015 Indicator Species List for Channel Islands National Park's Kelp Forest Monitoring Sites (sites #1-16). See code definitions in the text above.

		Location (Site #)															
Taxa	**Species**	**SMWL (1)**	**SMHR (2)**	**SRJLNO (3)**	**SRJLSO (4)**	**SRRR (5)**	**SCGI (6)**	**SCFH (7)**	**SCPB (8)**	**SCSA (9)**	**SCYB (10)**	**ANAR (11)**	**ANCC (12)**	**ANLC (13)**	**SBSESL (14)**	**SBAP (15)**	**SBCAT (16)**
Chlorophyta	*Codium* spp.	1	1	2	2	0	2	2	1	2	1	2	1	2	2	2	1
	Derbestia spp.	0	0	0	0	0	0	1	–	–	0	1	–	X	3	1	1
	Ulva spp.	1	1	0	0	0	0	0	–	0	1	1	1	1	0	1	0
	other green algae	1	1	1	2	0	1	1	1	1	1	2	1	3	1	1	1
Phaeophyta	*Agarum fimbriatum*	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
	Colpomenia spp.	0	0	0	0	0	1	1	0	2	0	1	3	–	3	2	1
	Cystoseira spp.	2	0	1/j1	1	0	J2	0	0	1	0	1	3	2	2	0	2
	Desmarestia spp.	0	1/j1	0	1	0	1	1	0	0	0	0	1	0	1	0	1
	Dictyoneuropsis	2	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
	Dictyota/Pachydictyon	0	0	1	1	0	1	1	0	1	1	1	3	1	1	3	1
	Eisenia arborea	1/j0	0/j1	0/j1	3/j3	0	2/j3	1/j2	0	1/j1	0	2/j1	2/j2	3/j2	1/j1	1/j1	1/j0
	Laminaria farlowii	0	0	2/j2	2/j3	0	2/j1	1	0	2/j1	0	0	4/j3	3/j2	1/j0		0
	Macrocystis pyrifera	3/j1	0/j1	3/j2	3/j3	0/j1	3/j3	1	0	3/j2	0/j1	3/j2	3/j4	3	3/j3	1/j2	1/j1
	Pterygophora californica	2/j1	0	2/j1	1/j1	0	0	0	0	0	0	0	0/j1	3/j2	0		0
	Sargassum muticum	0	0	0	0	0	1	0	1	0/j4	11	2	3	2	1	3	3
	Sargassum horneri	0	0	0	0	0	1	0	0	1/j4	00	2/j3	3/j3	0/j2	4/j2	2/j1	0/j3
	other brown algae	2	1	1	1	0	1	2	1	4	1	2	3	2	3	3	1
Rhodophyta	*Callophyllis* spp.	X	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
	Cryptopleura spp.	2	0	0	–	0	0	0	0	0	0	0	0	0	0	0	0
	Gelidium spp.	0	0	0	0	0	1	1	0	2	0	1	2	3	1	1	1
	Gigartina spp.	2	0	2	2	0	1	2	0	1	0	1	1	3	1	1	0
	Laurencia spp.	0	2	0	–	2	1	1	0	0	1	1	–	0	1	1	1

Table C1 (continued). 2015 Indicator Species List for Channel Islands National Park's Kelp Forest Monitoring Sites (sites #1-16). See code definitions in the text above.

Taxa	Species	Location (Site #)															
		SMWL (1)	SMHR (2)	SRJLNO (3)	SRJLSO (4)	SRRR (5)	SCGI (6)	SCFH (7)	SCPB (8)	SCSA (9)	SCYB (10)	ANAR (11)	ANCC (12)	ANLC (13)	SBSESL (14)	SBAP (15)	SBCAT (16)
Rhodophyta (continued)	*Plocamium* spp.	0	0	0	0	0	0	0	0	0	0	0	3	X	1	0	0
	Rhodymenia spp.	2	1	2	2	X	2	2	0	0	0	–	–	–	0	–	–
	Articulated *coralline*	2	1	2	1	1	2	1	1	2	1	1	3	3	1	1	1
	Encrusting *Coralline*	2	3	3	2	4	3	3	2	3	3	3	2	2	3	3	3
	Other red algae	3	1	2	3	2	2	2	2	1	1	3	3	2	2	1	1
Misc. Plant	*diatom film* or *Phyllospadix* spp.	1	1	2	1	1	2	1	2	2	2	3	2	2	1	1	3
Bare Rock	–	1	2	1	1	–	1	2	3	2	2	1	1	2	1	3	3
Porifera	*Haliclona* sp.		X	–	–	0	0	0	0	0	1	–	–	X	?	–	0
	Hymenamphiastra (Acanthancora) cyanocrypta	0	0	x	x	0	x	–	0	0	0011	x	–	x	0	–	0
	Polymastia pacifica	3	0	3	2	0	0	0	0	0	0	–	–	0	1	0	0
	Tethya aurantia	2/j1	1/j1	3	3	2	3	3	1	1	2	2	1	1	2	0	1
	Other sponges	2	1	3	2	1	2	2	1	1	2	3	2	2	2	1	1
Anthozoa	*Anthopleura* spp.	2	1	2	0	1	1	X	1	1	0	–	1	2	?	2	2
	Astrangia lajollaensis	1	3	2	1	3	2	4	3	2	2	1	2	2	0	1	2
	Balanophyllia elegans	1	2	2	2	2	2	1	1	1	2	–	0	–	0	–	1
	Corynactis californica	1	3	2	2	2	2	2	1	1	1	1	2	2	1	1	1
	Eugorgia rubens	0	0	0	0	0	0	3	0	0	0	2	0	0	0	0	0
	Lophogorgia chilensis	0	0	0	2	1	2	3	2	1	2/j2	2	1	1	1	1	1
	Metridium spp.	0	1	0	0	0	0	3	0	0	0	0	0	0	0	0	0
	Muricea californica	0	0	0	1	0	0	0	0	0	2	2	0	1	2	1	1
	Muricea fruticosa	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0
	Sagartia/Cactosoma spp.	0	0	X	–	0	–	1	0	1	0	1	X	–	1	1	2
	Urticina lofotensis	4/j1	2	2	2	2	1	1	0	0	0	0	0	0	0	0	0
	Urticina spp.	X	2	2	1	2	2	1	–	1	1	2	1	1	2	X	1

Table C1 (continued). 2015 Indicator Species List for Channel Islands National Park's Kelp Forest Monitoring Sites (sites #1-16). See code definitions in the text above.

Taxa	Species	Location (Site #)															
		SMWL (1)	SMHR (2)	SRJLNO (3)	SRJLSO (4)	SRRR (5)	SCGI (6)	SCFH (7)	SCPB (8)	SCSA (9)	SCYB (10)	ANAR (11)	ANCC (12)	ANLC (13)	SBSESL (14)	SBAP (15)	SBCAT (16)
Hydrozoa	*Hydroids* spp.	3	2	3	3	2	3	2	2	1	1	3	2	2	2	2	2
	Stylaster californicus	0	0	0	0	0	3/j2	0	0	0	0	0	0	0	0	0	0
Annelida	*Chaetopterus* sp.	X	1	2	X	X	1	X	2	3	1	X	X	2	2	1	2
	Diopatra ornata	2	1	2	3	1	1	2	0	1	1	1	2	1	1	1	1
	Dodecaceria fewkesi	X	2	X	–	X	0	2	1	X	1	–	0	X	–	X	1
	Phragmatopoma californica	2	0	2	1	0	1	1	0	1	1	1	1	1	1	0	1
	Salmacina tribranchiata	0	1	2	1	1	2	X	–	0	0	X	0	X	1	0	1
	Spirobranchus spinosus	0	1	0	1	1	1	1	1	2	1	2	1	1	1	1	1
Arthropoda/ Crustacea	*Balanus* spp.	3	3	2	2	2	2	4	3	3	1	1	1	2	2	X	2
	Cancer spp.	3	2	0	1	X	0	2	0	0	0	1	0	0	0	0	0
	Panulirus interruptus	0	0	0	0	0	2	1	1	3	1	1	3	2	2	2	2
Bryozoa	*Bugula californica*		X	X	1	–	1	1	–	–	0	2	3	–	2	2	1
	Watersipora spp.	0	0	0	0	0	0	1	0	0	0	0	–	–	0	0	0
	Diaperoecia (Diaperoforma) californica	1	1	2	2	1	2	2	1	1	1	2	1	2	2	1	1
	Membranipora spp.	3	1	2	2	1	2	2	1	1	1	2	2	2	2	X	1
	Other bryozoans	3	1	3	2	1	2	2	1	2	1	3	2	2	1	2	1
Tunicates	*Tunicates*	2	1	2	–	2	3	1	1	1	1	2	2	2	2	1	1
	Styela montereyensis	2/j2	0	2/j2	1	0	1	0	0	0	0	0	0	0	0	0	0
	Misc. Invertebrate	2	2	2	3	2	3	3	2	2	1	3	2	3	2	2	2
Mollusca	*Aplysia californica*	0	4	2	3	2	1	1	1	1	0	0	2	0	1	3	2
	Bursa californica	4	0	0	11	0	1	0	1	0	1/j1	1	0	0	1	5	1
	Crassedoma gigantea	2	1/j1	3	3	1	2	3/j2	3	2	1	2	2	2/j2	2	2	2
	Cryptochiton stelleri	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Cypraea spadicea	1	2	2	2	3	3	2	2	2	2	1	1	1	2	1	2
	Haliotis assimilis	0	0	0	0	0	0	0	0	0	0/j1	0	0	0	0	0	0

Table C1 (continued). 2015 Indicator Species List for Channel Islands National Park's Kelp Forest Monitoring Sites (sites #1-16). See code definitions in the text above.

Taxa	Species	Location (Site #)															
		SMWL (1)	SMHR (2)	SRJLNO (3)	SRJLSO (4)	SRRR (5)	SCGI (6)	SCFH (7)	SCPB (8)	SCSA (9)	SCYB (10)	ANAR (11)	ANCC (12)	ANLC (13)	SBSESL (14)	SBAP (15)	SBCAT (16)
Mollusca (continued)	*Haliotis corrugata*	0	0	0	0	0	0	0	0	1	0/j1	1	1	1	0/s1	0	1
	Haliotis fulgens	0	0	0	0	0	0	0	0	0	–	0	0	0	0	0	1
	Haliotis rufescens	3	0/j2	3	1	1	1	1/j1	3	0	0/j1	0	0/s	0	0	0	S
	Haliotis sorenseni	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Kelletia kelletii	4/j1	1/j2	1/j0	2/j1	2/j2	1	3/j1	1/j2	0/j2	2/j4	1	1	2	1	0	0/j1
	Lithopoma gibberosa	3/j1	2/j3	0	1	3/j3	2/j0	1	1	0	3/j1	1	0	0	1	0	1
	Megastraea undosa	0	0/j1	1	1	0/j1	2/j0	3/j2	3	3	3/j2	1	3/j2	2	2	2/j3	4/j3
	Megathura crenulata	1/j0	0	2/j1	1	1	0	2	1	1	2/j1	1	1	1	0	1	1
	Octopus spp.	X	1	1	1	1	X	1	3	3	1	2	2	X	0	1	2
	Serpulorbis squamigerus	1	1	3	1	1	1	2	3	3	1	1	2	2	2	2	3
	Tegula regina	0	0	0	0	0	1	1	1	0	1	2	1	1	2	3	3
Echinodermata	*Centrostephanus coronatus*	0	0/j1	1	0/j1	0/j1	1/j2	2/j2	3/j2	2/j2	2/j3	2/j1	1/j?	2/j3	2/j2	2/j4	1/j4
	Cucumaria spp.	2	2	2	2	2	2	2	2	2	1	2	2	3	1	2	1
	Dermasterias imbricata	2	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0
	Linckia sp.	0	0	0	0	0	1	1	0	0	0	1	0	2	1	0	0
	Lytechinus anamesus	0	1	2/j1	0	3/j1	2	1/j1	1/j1	0	1/j3	0	0	0	1	2/j2	1
	Ophiothrix spiculata	0	2	1	1	1	2	1	1	–	2	4	1	1	2	1	1
	Pachythyone rubra	0	0	0	0	0	0	3	2	0	0	0	0	0	0	0	0
	Parastichopus californicus	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	Parastichopus parvimensis	1	1	2/j1	1	1	2	1	1	2	1	3	3	1	2	1	1
	Patiria miniata	3	3/j3	2	2/j2	3/j3	2/j1	2	1	1	1	2	0	0	1	1	0
	Pisaster giganteus	1/j1	1/j0	1	1	1	1	1	1	0	0	1	0	1	1	0	0
	Pisaster ochraceus	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0
	Pycnopodia helianthoides	0	0/j1	0	0	0/j1	0	0	0	0	0	0	0	0	0	0	0
	S. purpuratus	2/j1	3/j0	4/j3	3/j2	3/j1	2/j3	2/j1	3/j0	2/j1	4/j1	1	1/j1	1/j1	2/j2	3/j1	3/j1
	S. francsicanus	2/j2	3/j1	3/j2	2/j2	3/j1	2/j3	2/j1	2/j0	2/j0	2/j1	1	2/j1	2/j1	1/j1	2/j0	2/j1

Table C1 (continued). 2015 Indicator Species List for Channel Islands National Park's Kelp Forest Monitoring Sites (sites #1-16). See code definitions in the text above.

Taxa	Species	Location (Site #)															
		SMWL (1)	SMHR (2)	SRJLNO (3)	SRJLSO (4)	SRRR (5)	SCGI (6)	SCFH (7)	SCPB (8)	SCSA (9)	SCYB (10)	ANAR (11)	ANCC (12)	ANLC (13)	SBSESL (14)	SBAP (15)	SBCAT (16)
Fish	*Lythrypnus dalli*	0	0	0	0	0	2	3	4	2	1	1	0	3	1	0	0
	Coryphopterus (Rhinogobiops) nicholsii	1	2	2	1	1	3	3	2	2	2	1/j1	1	2	1	1	1
	Alloclinus holderi	0	0	0	0	0	1	2	1	1	0	0	1	2	1	1	2

Table C2. 2015 Indicator Species List for Channel Islands National Park's Kelp Forest Monitoring Sites (Sites # 21-37). See code definitions in the text above.

Taxa	Species	Location (Site #)																
		SMMM (21)	SRCP (22)	SRTC (23)	SRCSAW (24)	SRSP (25)	SCDPM (26)	SCPP (27)	SCCVP (28)	SCLS (29)	SCPRF (30)	ANKH (31)	ANEFC (32)	ANBSBR (33)	ANLH (34)	SBWA (35)	SBGC (36)	SBSER (37)
Chlorophyta	*Codium* spp	1	1	1	1	1	1	2	1	2	1	2	2	2	1	4	1	2
	Derbestia spp.	0	1	0	0	0	1	1	2	X	1	1	1	0	2	2	1	X
	Ulva spp.	1	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	1
	other green algae	1	1	1	1	1	1	1	1	1	1	2	1	1	2	1	–	1
Phaeophyta	*Agarum fimbriatum*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Colpomenia spp.	0	0	1	1	X	1	0	1	–	1	3	2	1	1	2	2	2
	Cystoseira spp.	2/j2	1	2	2/j2	3	0	1/j0	–	0	0	0/j2	0	1	0/j1	1	3	2/j2
	Desmarestia spp.	1/j1	0	1	1	0	1	1	1	0	1	1	0	1	0	1	1	1
	Dictyoneuropsis	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Dictyota/Pachydictyon	2	2	2	2	1	1	3	2	1	0	2	1	2	1	0	1	2
	Eisenia arborea	2/j2	3/j2	1	1/j1	2/j1	1/j2	4/j4	3/j2	1/j0	1/j1	1/j2	0/j1	1/j1	1/j1	2/j2	1/j1	2/j3
	Laminaria farlowii	0	1/j0	0	1	2/j2	0	0/j1	0	0	0	0/j1	0	1/j1	0	0	1	1/j1
	Macrocystis pyrifera	4/j2	3/j2	3/j1	3/j2	3/j2	0/j1	4/j3	4/j4	0	1/j0	1/j3	1/j1	2/j2	1/j1	2/j2	2/j2	3/j2
	Pterygophora californica	2/j1	3/j2	2/j1	2/j1	4/j1	0	0	0	0	0	0	0	0	0	0	0	0
	Sargassum muticum	0	0	0	0	0	0	0/j2	0/j2	0	0	3	0	0	1	0	3/j1	3
	Sargassum horneri	0	0	0	0	0	0	1/j4	3/j2	0/j1	1/j1	4/j4	1/j3	1/j4	1/j2	1/j1	3/j1	1/j3
	other brown algae	1	2	1	2	1	1	3	3	1	1	3	1	2	1	1	3	2
Rhodophyta	*Callophyllis* spp.	2	X	–	X	–	0	0	0	0	0	0	0	0	0	0	0	0
	Cryptopleura spp.	2	3	–	X	0	0	0	0	0	0	0	0	0	0	0	0	0
	Gelidium spp.	0	0	–	0	0	1	1	2	0	0	0	0	0	1	1	0	2
	Gigartina spp.	2	2	2	3	2	0	1	1	–	0	1	0	0	1	1	0	1
	Laurencia spp.	0	–	0	0	0	1	–	–	1	1	1	1	1	2	1	2	X
	Plocamium spp.	0	–	0	0	0	0	–	–	0	0	0	0	0	0	–	1	2
	Rhodymenia spp.	2	3	2	2	3	X	2	2	0	0	0	1	1	–	X		X
	Articulated coralline	3	2	2	2	2	1	1	1	1	1	1	1	2	1	1	2	3

Table C2 (continued). 2015 Indicator Species List for Channel Islands National Park's Kelp Forest Monitoring Sites (Sites # 21-37). See code definitions in the text above.

Taxa	Species	Location (Site #)																
		SMMM (21)	SRCP (22)	SRTC (23)	SRCSAW (24)	SRSP (25)	SCDPM (26)	SCPP (27)	SCCVP (28)	SCLS (29)	SCPRF (30)	ANKH (31)	ANEFC (32)	ANBSBR (33)	ANLH (34)	SBWA (35)	SBGC (36)	SBSER (37)
Rhodophyta (continued)	Encrusting Coralline	2	3	3	3	2	3	2	2	3	2	2	3	3	3	3	2	3
	Other red algae	2	3	2	2	3	1	2	2	1	1	1	1	2	1	2	2	3
Misc. Plant	diatom film or *Phyllospadix* spp.	0	1	1	2	1	1	1	2	1	1	3	1	3	2	4	1	4
Bare Rock	–	1	2	1	2	1	2	1	1	1	2	1	2	2	2	1	1	1
Porifera	*Haliclona* sp.	2	X		X	2	0	X	1	0	0	0	0	0	1	–	0	?
	Hymenamphiastra (Acanthancora) cyanocrypta	2	2	1	1	1	–	0	0	–	0	0	0	1	0	X	?	0
	Polymastia pacifica	2	1	X	2	3	0	0	0	0	0	0	0	0	0	0	0	0
	Tethya aurantia	3	3	4	2/j2	2	2	2	2	1	1	0	1	2	1	1	2	1
	Other sponges	2	2	2	2	2	2	2	3	2	2	1	1	2	1	2	1	2
Anthozoa	*Anthopleura* spp.	3	0	2	2	3	2	1	1	2	1	1	1	–	2	–	2	1
	Astrangia lajollaensis	1	2	1	1	–	3	2	2	3	3	2	2	1	2	2	1	1
	Balanophyllia elegans	2	3	3	2	1	2	2	2	2	1	1	1	1	1	2	0	0
	Corynactis californica	2	2	3	1	2	1	2	2	2	3	1	2	1	2	2	1	1
	Eugorgia rubens	0	0	0	0	0	0	0	0	–	0	2	0	0	0	0	0	0
	Lophogorgia chilensis	0	0	0	0	0	3	3	3/j1	3	3	3	1	1	2	1	2	1
	Metridium spp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Muricea californica	0	0	0	0	0	1	1	1	1	1	2	1	1	3	2	2	1
	Muricea fruticosa	0	0	0	0	0	1	–	1	0	0	1	1	1	2	1	0	1
	Sagartia/Cactosoma spp.	–	0	0	0	–	–	–	X	–	1	2	–	0	2	2	3	1
	Urticina lofotensis	3	1	3	2	2	0	0	0	0	0	0	0	0	0	0	0	0
	Urticina spp.	2	1	2	2	2	1	1	X	2	2	1	1	2	2	3	2	1
Hydrozoa	Hydroids	3	2	2	2	3	2	2	3	2	2	2	1	1	1	2	2	3
	Stylaster californicus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table C2 (continued). 2015 Indicator Species List for Channel Islands National Park's Kelp Forest Monitoring Sites (Sites # 21-37). See code definitions in the text above.

Taxa	Species	Location (Site #)																
		SMMM (21)	SRCP (22)	SRTC (23)	SRCSAW (24)	SRSP (25)	SCDPM (26)	SCPP (27)	SCCVP (28)	SCLS (29)	SCPRF (30)	ANKH (31)	ANEFC (32)	ANBSBR (33)	ANLH (34)	SBWA (35)	SBGC (36)	SBSER (37)
Annelida	*Chaetopterus* sp.	0	3	X	X	2	2	1	2	X	3	3	2	1	3	X	2	1
	Diopatra ornata	1	3	2	3	2	1	2	2	1	1	1	1	1	1	1	0	2
	Dodecaceria fewkesi	X	0	1	0	1	2	–	–	2	2	1	2	0	1	2	?	1
	Phragmatopoma californica	2	1	3	2	3	0	–	1	–	1	0	1	2	1	0	1	1
	Salmacina tribranchiata	0	1	X	0	0	1	X	3	–	1	0	0	0	1	1	0	2
	Spirobranchus spinosus	1	1	–	0	1	2	2	1	2	1	1	2	2	2	1	1	1
Arthropoda/ Crustacea	*Balanus* spp.	3	3	2	2	2	3	3	1	2	2	1	1	1	1	2	1	1
	Cancer spp.	2	1	1	1	0	1	0	–	M	M	0/j1	1	0	0	0	0	1m
	Panulirus interruptus	0	0	2	1	1	1	2	2	1	M	1	1	4	0	1	1	2
Bryozoa	*Bugula californica*	X	2	2	1	2	1	–	2	1	2	3	1	1	1	2	3	2
	Watersipora spp.	0	0	0	0	0	0	0	–	0	0	0	0	0	0	0	0	0
	Diaperoecia (Diaperoforma) californica	1	1	2	2	2	1	2	2	1	1	2	1	1	1	2	1	2
	Membranipora spp.	2	3	2	2	2	1	2	3	1	1	1	2	1	1	2	2	2
	Other bryozoans	2	2	2	3	3	1	2	3	1	2	2	1	1	1	2	1	2
Tunicates	Tunicate	3	2	2	2	2	1	1	3	1	1	1	1	1	1	3	1	2
	Styela montereyensis	2/j2	2/j1	1/j1	1	2/j2	0	0	0	0	0	0	0	0	0	0	0	0
Misc. Invertebrate	–	3	3	2	3	2	3	3	4	2	2	2	1	1	1	2	2	2
Mollusca	*Aplysia californica*	1	2	2	2	2	3	2	–	2	4	2	3	0	2	3	1	1
	Bursa californica	0	1	0	0	0	0	0	0	2	3	0	2	0	1	2	0	1
	Crassedoma gigantea	3	4	4	3	2	2	2/j3	3/j2	3/j2	2/j1	2	2	1	2	3	1	4
	Cryptochiton stelleri	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Cypraea spadicea	1	2	3	2	2	3	2	1	2	2	2	3	1	2	2	2	2
	Haliotis assimilis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	S	0
	Haliotis corrugata	0	0	0	0	0	0	0	S	0	0	0	0	0	0	0	S	0

Table C2 (continued). 2015 Indicator Species List for Channel Islands National Park's Kelp Forest Monitoring Sites (Sites # 21-37). See code definitions in the text above.

Taxa	Species	Location (Site #)																
		SMMM (21)	SRCP (22)	SRTC (23)	SRCSAW (24)	SRSP (25)	SCDPM (26)	SCPP (27)	SCCVP (28)	SCLS (29)	SCPRF (30)	ANKH (31)	ANEFC (32)	ANBSBR (33)	ANLH (34)	SBWA (35)	SBGC (36)	SBSER (37)
Mollusca (continued)	*haliotis fulgens*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Haliotis rufescens	4/j2	1/j2	1	2	3/j1	1	0	0	S	S	0	0	0	0	0	0	0
	Haliotis sorenseni	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Kelletia kelletii	2	1/j1	1	0	0	2/j2	1/j2	1/j1	2/j2	3/j2	3/j1	3	1	1	1/j1	1	0/j1
	Lithopoma gibberosa	2	1	1	0	0	1	1	1	1	1/j0	0	0	0	0	4/j0	0	1
	Megastraea undosa	0	1	1	0	1	3/j2	3	2/j1	3/j2	3/j4	1/j1	2	2/j1	2/j1	3/j0	2	2/j2
	Megathura crenulata	1	2	2	1	2	4	1	0	3	1	0	1	0	1	2	0	1
	Octopus spp.	1	1	1	1	1	X	X	2	2	2	2	2	1	3	1	1	2
	Serpulorbis squamigerus	1	2	2	2	1	2	2	2	3	2	2	1	1	2	2	2	3
	Tegula regina	0	0	0	0	0	1	2	2	2	1	2	2	1	2	3/j0	0	3
Echinodermata	*Centrostephanus coronatus*	0	0	1	1	0	2/j3	2/j2	2	2/j1	2/j3	3/j3	2/j3	2/j2	2/j3	2/j3	1/j3	2/j3
	Cucumaria spp.	2	3	2	2	2	2	3	3	2	2	2	2	1	2	2	0	2
	Dermasterias imbricata	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Linckia sp.	0	0	0	0	0	1	–	3	1	0	2	0	0	0	0	0	1
	Lytechinus anamesus	1	1	1	1	1	1	0/j1	–	2/j1	2/j3	1	1/j1	1/j1	1	1	0	1
	Ophiothrix spiculata	1	–	–	0	1	1	1	1	2	2	2	3	4	2	3	1	1
	Pachythyone rubra	0	3	3	2	4	2	3	–	0	1	0	0	0	0	0	0	0
	Parastichopus californicus	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Parastichopus parvimensis	2	2	2	2	1	2	3	3	1	1	3	2/j1	2	2	1	2	2
	Patiria miniata	2/j2	3	3	3	3	2	1	1	2	1/j1	2	2	1	1	2	1	1
	Pisaster giganteus	1	1	1	1	1	1	0	1	1	1	1	0	1	1	1	1	1
	Pisaster ochraceus	0	0	0	0	0	1	0	1	0	0	1	0	0	1	0	0	0
	Pycnopodia helianthoides	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	S. purpuratus	2/j1	3/j3	3/j1	3/j1	3/j2	3/j0	2/j1	2/j1	2/j1	4/j1	2/j1	3/j1	1/j1	3/j1	2/j1	2/j1	2/j1
	S. francsicanus	2/j1	2/j1	3/j1	3/j1	3/j2	3/j0	2/j?	2/j1	3/j0	3/j1	2/j1	2/j1	1/j0	2/j0	2/j1	2/j1	2/j1

Table C2 (continued). 2015 Indicator Species List for Channel Islands National Park's Kelp Forest Monitoring Sites (Sites # 21-37). See code definitions in the text above.

Taxa	Species	Location (Site #)															
		SMMM (21)	SRCP (22)	SRTC (23)	SRCSAW (24)	SRSP (25)	SCDPM (26)	SCPP (27)	SCCVP (28)	SCLS (29)	SCPRF (30)	ANKH (31)	ANEFC (32)	ANBSBR (33)	ANLH (34)	SBWA (35)	SBGC (36)	SBSER (37)
Fish	*Lythrypnus dalli*	0	0	0	0	0	3	3/j3	3	3	3	2	1	3	1	0	1	1
	Coryphopterus (Rhinogobiops) nicholsii	1	1	2	2	2	2	2	1	3	4	3	2	2	2	1	1	1
	Alloclinus holderi	0	0	0	0	0	3	3	2	1	1	2	1	3	1	1	1	3

Appendix D. Site Field Notes

Site #1, Wyckoff Ledge, San Miguel Island

2015 status

Mature kelp forest

Sampling Dates and Work Completed

09/15/2015

Fish transects, video transects, roving diver fish counts, fish size frequencies, 1 m^2 quadrats, 5 m^2 quadrats, band transects, random point contacts and size frequencies for *Strongylocentrotus purpuratus, Strongylocentrotus franciscanus, Patiria miniata, Pisaster giganteus, Lithopoma gibberosa, Crassedoma giganteus, Megathura crenulata, Kelletia kelletii, Tethya aurantia, Haliotis rufescens* and *Macrocystis pyrifera* were completed. The temperature loggers and wave meter were retrieved and deployed.

Site Notes

The site was a mature kelp forest with mostly large, widely spaced *Macrocystis pyrifera*. Juvenile *M. pyrifera* were rare. The understory algae were less abundant than in past years. There were fewer *Pterygophora californica*, *Eisenia arborea*, and *Cystoseira osmundacea* than in past years. *Cystoseira* sp. were mostly small. Over half of the *P. californica* individuals were stipes with few to no blades. Many of these algal species were senescing and had a heavy load of epiphytic bryozoans and hydroids. The bottom appeared scoured, not unlike past visits.

The most common miscellaneous invertebrates recorded during RPCs were *Balanus* sp. and hydroids. Adult *Tethya aurantia* were common while juveniles were rare. *Urticina lofotensis* were patchy but abundant in some areas. *Balanus* sp. were less abundant than last year when they covered 90% of the site. Some of the *Balanus* sp. appeared to have been preyed upon but we could not determine what had been eating them. The high-relief areas seemed to have fewer encrusting invertebrates. *Flustrellidra corniculata* (leather bryozoan) were moderately abundant. Tunicates were common with *Polymastia pacifica* occurring mostly in small clumps. All sizes of *Styela montereyensis* were observed.

One small, fresh *Leopecten diegensis* shell was found which is rare for San Miguel Island. *Bursa californica* were mostly medium size and *Crassedoma gigantea* were mostly small. One medium size (~13 cm) *Cryptochiton stelleri* was observed. All sizes of *Kelletia kelletii* were present; however, smaller individuals (<50 mm) were rare.

One *Dermasterias imbricata* was observed with what appeared to be wasting disease. *Parastichopus parvimensis* were rare and individuals were mostly medium in size. Two *Patiria miniata* were observed with wasting disease. *Pisaster giganteus* were rare overall but more common than at our eastern sites. Adult *Strongylocentrotus franciscanus* were less abundant than in recent years but juveniles were still common. Adult *Strongylocentrotus purpuratus* were common while juveniles were rare.

Coryphopterus nicholsii individuals were large. One *Squatina californica* (Pacific angel shark) was observed. *Trachurus symmetricus* (Pacific jack mackerel) were more abundant than usual for San Miguel Island, similar to what we have observed at other sites this year.

Site #2, Hare Rock, San Miguel Island

2015 status

Dominated by Strongylocentrotus franciscanus and S. purpuratus

Sampling Dates and Work Completed

06/09/2015

Fish transects, fish size frequencies, video transects, roving diver fish counts, 1 m^2 quadrats, 5 m^2 quadrats, band transects, random point contacts and size frequencies for *Strongylocentrotus purpuratus, Strongylocentrotus franciscanus, Lytechinus anamesus, Patiria miniata, Pisaster giganteus, Pycnopodia helianthoides, Lithopoma undosum, Lithopoma gibberosum, Crassedoma giganteus, Kelletia kelletii, Tethya aurantia*, and *Haliotis rufescens* were completed. The temperature loggers and wave meter were retrieved and deployed.

Site Notes

Like recent years, this site was nearly devoid of macroalgae. There was a small amount of *Desmarestia* sp. at the east end and *Laurencia* sp. were common throughout. *Ulva* sp. were also less abundant than recent years. Green algae were less abundant than previous years.

The most common miscellaneous invertebrates recorded on RPCs were *Balanus* sp. Most *Balanus* sp. seemed to be last year's recruits. Mysids were abundant throughout and were located near the bottom in large clouds. *Corynactis californica* were mostly large and healthy-looking individuals, seemingly more robust and abundant than recent years. This observation was a bit surprising as densities of *C. californica* have decreased along with higher numbers of sick individuals located at other sites. *Diopatra ornata* appeared less abundant than in past years. *Thelepus crispus* were not as abundant as in recent years.

Aplysia californica were abundant and most measured less than 50 mm with some individuals as small as 15 mm. *Cypraea spadicea* were large and common. Four *Megastraea undosa* were observed and all were juveniles. *Megathura crenulata* were not observed. A total of twelve *Haliotis rufescens* were found and all were less than 50 mm in size. Fresh shells were common, but less abundant than in past years. We collected 103 fresh *H. rufescens* in 2014 and only 23 in 2015. Two *Octopus* spp. were observed.

Parastichopus parvimensis were rare but the individuals present were particularly large. All sizes of *Patiria miniata* were observed including juveniles, which were found throughout the site. One *Pycnopodia helianthoides* was observed on band transects. The site continued to be dominated by *Strongylocentrotus* spp. *Strongylocentrotus purpuratus* densities have increased dramatically from past years. This year had the highest densities recorded in many years. *Strongylocentrotus purpuratus* densities have increased over the past ten plus years. Previously, this species was only common in the shallowest areas of this site. With the decrease in *P. helianthoides* densities, we hypothesize that

S. purpuratus may be moving from the shallow areas where *P. helianthoides* were not typically present to deeper water. This is supported by the fact that we have seen little to no evidence of sea urchin recruitment in the past several years. The lack in recruitment can be seen with the absence of juvenile *S. purpuratus*. Several *S. franciscanus* were observed with sea urchin wasting disease. David Kushner believes this was the first time sea urchin wasting disease has been documented at this site. At least ten *Centrostephanus coronatus* were observed. This may be the first time *C. coronatus* has been documented at the site/island and this observation may mean a range extension for the species. *Lytechinus anamesus* were more abundant than in past years but still rare.

Several hundred larval fish that could not be identified were observed in the water column at numerous time periods throughout the day.

Site #3, Johnson's Lee North, Santa Rosa Island

2015 status

State of transition

Sampling Dates and Work Completed

08/12/2015

All eight ARMs were monitored for all indicator species. A wave meter was retrieved.

08/13/2015

Fish transects, fish size frequencies, video transects, roving diver fish counts, 1 m^2 quadrats, 5 m^2 quadrats, band transects, random point contacts and size frequencies for *Strongylocentrotus purpuratus, Strongylocentrotus franciscanus, Lytechinus anamesus, Patiria miniata, Pisaster giganteus, Lithopoma undosum, Kelletia kelletii, Megathura crenulata, Crassedoma giganteus, Haliotis rufescens Tethya aurantia*, and *Macrocystis pyrifera* were completed. The temperature loggers were retrieved and deployed.

Site Notes

The site is on the verge of transitioning to an urchin barren. There was already a high density patch of urchins from 0 – 20 m on the transect tape. Urchins were devouring many *Macrocystis pyrifera* holdfasts, *Pterygophora californica* stipes, and any drift kelp that was present. *Codium setchellii* were present in moderate numbers. *Eisenia arborea* adults were not observed; however, juveniles were present and very rare. Just inshore and offshore of the site, the substrate was completely denuded of kelp with high densities of urchins and bare or encrusting coralline-covered rock. Bare *P. californica* stipes were scattered about the site. All sizes of *M. pyrifera* were observed. *Pterygophora californica* appeared healthy on the 60-100 m end of the transect tape but dead elsewhere. Adult *Cystoseira* sp. looked unhealthy.

The most common miscellaneous invertebrates recorded during RPCs were hydroids and *Balanus* sp. All sizes of *Tethya aurantia* were observed. We observed *Cliona* sp. on many abalone shells. *Astrangia lajollaensis* were patchy and found in moderate numbers throughout. *Urticina lofotensis* were mostly skinny and looked unhealthy. Hydroids were not as abundant as in past years. *Polyclinum planum* were common but not as abundant as in past years.

One *Aplysia vaccaria* was observed. *Aplysia californica* individuals were small to medium in size. *Navanax inermis* were common to moderately abundant at nearly every site this year from Anacapa Island to San Miguel Island. *Crassedoma gigantea* were mostly small and moderately abundant. *Haliotis rufescens* were out in the open looking for food. Several large, fresh *H. rufescens* shells were found. At least 105 individuals were observed, which is a relatively high number for the past two decades. *Megastraea undosa* individuals were mostly large.

Parastichopus parvimensis individuals were mostly large. All sizes of *Patiria miniata* were present but were difficult to find. Outside of the ARMs, only three *Pisaster giganteus* were observed. They were more common in the ARMs. No *Pycnopodia helianthoides* were observed. Feeding fronts of *Strongylocentrotus purpuratus* surrounded the site. *Strongylocentrotus franciscanus* and *S. purpuratus* were both abundant. Approximately 5% of *S. purpuratus* were spawning. Juvenile *S. purpuratus* were abundant and were present under the spine canopy of many of the adults. High urchin densities could be due to recruitment from warm water conditions combined with an absence of *P. helianthoides*. We have observed this same scenario 1-2 years following the 1982/83 and 1997/98 El Niño event. *Centrostephanus coronatus* juveniles were observed in two distinct size classes. Most were in the 10-15 mm size class and a few were in the 20-23 mm size class. This is more than we have ever documented here. All sizes of *Lytechinus anamesus* were observed. Urchins were out in the open and in crevices. Most of the crevices that used to have *H. rufescens* are now full of urchins. No sea urchin or sea star wasting disease was observed. Both this year and last year's *Chromis punctipinnis* recruits were abundant at western KFM sites, such as Chickasaw, Trancion Canyon, and Johnson's Lee North. These are some of the highest abundances recorded at these sites since they were established.

There were some distinct changes in the ARMs this year. There were fewer tunicates and sponges covering the bricks. The ARMs were also covered in *Balanus* sp. There were hundreds (maybe thousands) of small hermit crabs in the ARMs.

Site #4, Johnson's Lee South, Santa Rosa Island

2015 status

Mature kelp forest

Sampling Dates and Work Completed

06/10/2015

Quadrats, 5 m^2 quadrats, band transects, random point contacts and size frequencies for *Patiria miniata, Pisaster giganteus, Crassedoma giganteus, Tethya aurantia. Kelletia kelletii, Megathura crenulata, Lophogorgia chilensis, Muricea californica* and *Macrocystis pyrifera* were completed. The temperature loggers and wave meter were retrieved and deployed.

09/14/2015

Fish transects, fish size frequencies, video transects, roving diver fish counts, 1 m^2 quadrats, and size frequencies for *Crassedoma gigantea, Tethya aurantia, Kelletia kelletii, Lytechinus anamesus, Strongylocentrotus purpuratus* and *Strongylocentrotus franciscanus*. All six ARMs were sampled for everything.

Site Notes

Overall, the site was similar to past years as a mature kelp forest with diverse understory algae. However, there appeared to be slightly less algal cover on the bottom than in past years. Other green algae were mostly *Codium setchellii.* During our September visit, the *Macrocystis pyrifera* had thinned out and it appeared that there were a few more areas where *Strongylocentrotus* spp. were dominating. But overall, the *M. pyrifera* seemed surprisingly healthy. *Eisenia arborea* adults and juveniles were moderately abundant. *Laminaria farlowii* adults were common while juveniles were moderately abundant.

Similar to past years, the most common miscellaneous invertebrates recorded on RPCs were hydroids, especially *Aglaophenia* sp. *Craniella arb* were also common. There was an abundance of encrusting invertebrates. A moderate number of large *Balanus nubilus* were observed, similar to past years. No *Phyllolithodes papillosus* (heart crab) were observed, which is somewhat unusual in recent years. All sizes of *Styela montereyensis* were observed. Large *S. montereyensis* individuals looked unhealthy in June but appeared to be healthier in September.

Aplysia californica were larger than the individuals at Hare Rock on San Miguel Island. *Crassedoma gigantea* were mostly small (<60 mm). A total of fourteen *Haliotis rufescens* were found for size frequencies, and during our second visit there seemed to be more *H. rufescens* out in the open. One 75 mm *H. rufescens* was recorded. One large *Megastraea undosa* was observed. *Megathura crenulata* were rare and all individuals observed were large.

At least six large *Dermasterias imbricata* were observed, which is less than before the 2014/15 sea star wasting disease events. One *Parastichopus californicus* was observed. A few *Parastichopus parvimensis* were observed. Six or seven *Pisaster giganteus* were observed including one small individual. *Strongylocentrotus purpuratus* densities increased and were the most noticeable change. This is similar to what we are observing at all the western sites, presumably a result of the decrease in *Pycnopodia helianthoides* predation. Juvenile *Strongylocentrotus* spp. were common, but patchy. One *S. purpuratus* was observed with a black spot disease. At least four *Centrostephanus coronatus* were observed; however, more were likely present. All *C. coronatus* individuals were between 10-14 mm in size. There was an abundance of fish.

Juvenile *Chromis punctipinnis* were observed during the September visit, but were rare. No *Brosmophycis marginata* (red brotula) were observed.

In the ARMs, small *Strongylocentrotus* spp. were common and *Balanus* sp. were moderately abundant.

Site #5, Rodes Reef, Santa Rosa Island

2015 status

Barren area dominated by *Strongylocentrotus franciscanus* and *S. purpuratus*

Sampling Dates and Work Completed

06/08/2015

Quadrats, 5 m^2 quadrats, band transects, random point contacts and size frequencies for *Strongylocentrotus purpuratus, Strongylocentrotus franciscanus* and *Lytechinus anamesus,* were completed. The temperature loggers were retrieved and deployed, and a wave meter was retrieved (none deployed).

06/09/2015

Fish transects, fish size frequencies, video transects, roving diver fish counts and size frequencies for *Patiria miniata, Pisaster giganteus, Pycnopodia helianthoides, Lithopoma undosum, Lithopoma gibberosum, Crassedoma giganteus, Megathura crenulata, Kelletia kelletii, Lophogorgia chilensis, Tethya aurantia* and *Haliotis rufescens* were completed.

Site Notes

There was no kelp forest in the immediate area. The site appeared similar to how it has looked many times over the past 25 years. Only one juvenile *Macrocystis pyrifera* was observed. Encrusting coralline algae were abundant over the whole site.

The most common miscellaneous invertebrates recorded on RPCs were *Balanus* sp. and hydroids. *Tethya aurantia* were observed being consumed by sea urchins and dorids, and were less abundant than in recent years. *Corynactis californica* were common and looked healthy. *Urticina lofotensis* densities were split evenly for large and small size classes and seemed less abundant than in past years. Like the previous year, only one *Lophogorgia chilensis* was observed. Only a few *Diopatra ornata* were observed, fewer than last year. The low-lying area between 0 - 50 meters had few invertebrates such as *Diopatra ornata* or *Chaetopterus* sp., similar to recent years. The rocky 50 - 100 meter end also had less encrusting invertebrates than in recent years. A few live *Balanus nubilus* were observed but fewer compared to recent years. Three *Cancer* sp. were observed. A few small patches of the bright orange encrusting tunicate *Didemnum carnulentum* were observed, as well as *Pycnoclavella stanleyi*.

Aplysia californica were mostly small. Few *Crassedoma gigantea* were observed. Small *Haliotis rufescens* shells were common. No observations of *Haliotis assimilis* were made although they have been observed in 2011 and 2014. All sizes of *Kelletia kelletii* were present. *Megathura crenulata* were rare and in similar abundance to last year.

Several small *Henricia leviuscula* were observed. One large *Dermasterias imbricate* was observed. *Parastichopus parvimensis* were large. *Patiria miniata* were more abundant compared to other sites to the east. There was an abundance of small individuals, but large ones were also present. Six *Pisaster giganteus* were observed and all sizes present. Three *Pycnopodia helianthoides* (all < 35 mm) were found under rocks. The site was mostly a barren area dominated by *Strongylocentrotus franciscanus* and *S. purpuratus* and devoid of all macroalgae. *Strongylocentrotus* spp. densities increased, in particular *S. purpuratus*. We hypothesize that this increase is due to the absence of *Pycnopodia helianthoides,* similar to other sites on San Miguel and Santa Rosa Islands. Both *Strongylocentrotus* spp. were moderately abundant but juveniles were rare, similar to nearby sites

this year. About 3% of *S. franciscanus* were observed with wasting disease, some nearly bald/ devoid of spines and some had black spot legions. Some *S. franciscanus* were near death. No *S. purpuratus* or *Lytechinus anamesus* were observed with wasting disease. *Lytechinus anamesus* were mostly large but all sizes were present. Four small *Centrostephanus coronatus* were observed, which is a very unusual occurrence for this site.

Site #6, Gull Island, Santa Cruz Island

2015 status

Mature Kelp Forest

Sampling Dates and Work Completed

06/11/2015

Fish transects, fish size frequencies, video transects, roving diver fish counts, 1 m^2 quadrats, 5 m^2 quadrats, band transects, random point contacts and size frequencies *Patiria miniata, Pisaster giganteus, Lithopoma undosum, Lithopoma gibberosum, Crassedoma giganteus, Tegula regina, Kelletia kelletii, Lophogorgia chilensis, Tethya aurantia, Haliotis rufescens,* and *Macrocystis pyrifera* were completed. The temperature loggers were retrieved and deployed.

08/10/2015

All 14 ARMs were monitored for all indicator species. Size frequencies for *Allopora californica, Strongylocentrotus franciscanus* and *Strongylocentrotus purpuratus* were completed.

Site Notes

Overall the site was more in its "normal" state as a mature kelp forest with a diverse understory along with a high diversity and abundance of encrusting invertebrates. *Macrocystis pyrifera* seemed more abundant than it has been in many years with a dense canopy, unlike last year when no canopy was observed directly over the site. *Codium setchellii* were common. Juvenile *Macrocystis pyrifera* and *Eisenia arborea* were moderately abundant. *Laminaria farlowii* were common but juveniles were rare. *Agarum fimbriatum* were less abundant than in recent years. *Cystoseira* sp. were present and all individuals were under 20 cm. Four small *Sargassum horneri* were observed. During the second visit, the water had been warm (66-69° F); however, it was quite green for the temperature. *Macrocystis pyrifera* were more abundant and thicker than during our June visit, and this seemed true for the entire area around Gull Island.

The most common miscellaneous invertebrates recorded on RPCs were hydroids, *Balanus* sp. and amphipod tube mats. *Tethya aurantia* were moderately abundant. Several very small *Lophogorgia chilensis* were observed. The low-lying area inshore of the transect was mostly sand with few *Diopatra ornata.* About twenty *Panulirus interruptus* were observed. Most were large with a few huge individuals. This is an increase in *P. interruptus* from last year.

Megastraea undosa were common and medium to large sized. No *Megathura crenulata* were observed. One live *Haliotis rufescens* was observed. Three *Tegula regina* were found.

Parastichopus parvimensis were common and mostly large. Only one *Pisaster giganteus* was observed. One *Linkia* sp. was observed. *Ophiothrix spiculata* were common. Unlike other sites this year, *Strongylocentrotus purpuratus* were not as abundant as expected in the absence of *Pycnopodia helianthoides*. Some giant *Strongylocentrotus franciscanus* were observed, similar to the sizes observed in the Landing Cove off Anacapa Island. Small 10-13 mm *Centrostephanus coronatus* were relatively common. Large adult *C. coronatus* were rare and found mostly in the deep rocky area. All *Lytechinus anamesus* were small. No sign of sea urchin or sea star wasting disease was observed during either visit.

At least twelve *Sebastes paucispinis* (Bocaccio) ranging from 8-9 cm were observed on this visit. Also several juvenile *Sebastes atrovirens* (kelp rockfish) ranging from 7-9 cm and a few other *Sebastes* spp. were observed.

All fourteen ARMs were sampled for all indicator species. There were some differences in the ARMs from group to group. The most distinct of these differences was the lack of *Cypraea spadicea* in the ARMs at the south group, while they were abundant as usual in the north and middle groups. Also, the north group ARMs had an abundance of juvenile *Strongylocentrotus* spp. while the other two groups had only a few. This high abundance of juveniles was what David Kushner was expecting to see more of this year in many of the ARMs, because of warm water conditions for the past year, but this was the first observation of it.

Site #7, Fry's Harbor, Santa Cruz Island

2015 status

State of Transition

Sampling Dates and Work Completed

07/28/2015

Fish transects, fish size frequencies, video transects, roving diver fish counts, 1 m^2 quadrats, 5 m^2 quadrats, band transects, random point contacts and size frequencies for *Strongylocentrotus purpuratus, Strongylocentrotus franciscanus, Lytechinus anamesus, Patiria miniata, Pisaster giganteus, Lithopoma undosum, Lithopoma gibberosum, Crassedoma giganteus, Tegula regina, Megathura crenulata, Kelletia kelletii, Lophogorgia chilensis, Haliotis rufescens, Tethya aurantia* and *Macrocystis pyrifera* were completed. The temperature loggers were retrieved and deployed.

07/29/2015

All five ARMs were sampled for all indicator species.

Site Notes

This site continues to be in what we call a "state of transition" and it is difficult to determine which direction it is going. Overall, there was little macroalgae except on the extremely high relief areas. *Codium fragile* were common, similar to past years. Several dead *Macrocystis pyrifera* holdfasts were present. Three *M. pyrifera* were observed on top of the large rock/ reef. One adult *Laminaria farlowii* was observed on top of the reef.

The most common miscellaneous invertebrate recorded was *Balanus* spp. *Tethya aurantia* were mostly small. *Astrangia lajollaensis* were abundant. *Lophogorgia chilensis* were mostly on the deeper areas along the transect tape. Most *L. chilensis* were large with a few small individuals observed as well, similar to last year. *Mesochaetopterus* spp. were abundant and completely covered large areas in the sand. Many *Pista elongata* were observed. Several live *Cancer* spp. were observed as well as several molts, similar to last year. One live *Panulirus interruptus* was observed. *Diaperoecia californica* were common and other bryozoans in general were also common. As with most sites this year, there was an abundance of *Pleuroncodes planipes* (pelagic red crab).

Aplysia californica were all large and looked unhealthy; some dead ones were observed. One small (56 mm) fresh *Haliotis corrugata* shell was found just off the site. One large (190 mm) live *Haliotis rufescens* was found just off the site. Adult *Kelletia kelletii* were moderately abundant but juveniles were rare. *Megastraea undosa* were mostly small, although a few very large ones were present in the deeper areas along the transect. *Megathura crenulata* were mostly medium to large in size. Only one small *Tegula regina* was observed. Another unusual observation was the presence of nine fresh *Argonauta* sp. shells (two additional shells were found off the site). Divers located these shells all throughout the day.

Pachythyone rubra were observed in small high-density patches scattered throughout particularly at the inshore side of the 0 meter; however, none were observed on RPCs. David Kushner thinks these patches were smaller than in the 1980s and 1990s. *Parastichopus parvimensis* were all large. *Patiria miniata* were mostly large but all sizes were present with some looking rather skinny. At least four *Pisaster giganteus* were observed between 60-65 mm. *Strongylocentrotus* spp. were not particularly abundant and no high-density patches were observed. Black spot disease was present in both *Strongylocentrotus purpuratus* and *S. franciscanus,* as well as advanced wasting disease in about 5% of both species. Another unusual observation was of a black urchin, *Arbacia incisa,* at 39 mm that was large enough to have settled out probably one to three years ago. *Centrostephanus coronatus* were more abundant than usual.

All sizes of *Lythrypnus dalli* were present and 1- cm individuals were common. This is the highest abundance of this species that has ever been seen here. *Alloclinus holderi* were mostly small. At least seven *Gymnothorax mordax* (California moray eel) were observed on the onshore side.

Site #8, Pelican Bay, Santa Cruz Island

2015 status

Barren Area

Sampling Dates and Work Completed

08/28/2015

All six ARMs were sampled for all indicator species. Wave meters were retrieved and deployed.

09/28/2015

Fish transects, fish size frequencies, video transects, roving diver fish counts, 1 m^2 quadrats, 5 m^2 quadrats, band transects, random point contacts and size frequencies for *Strongylocentrotus*

purpuratus, Strongylocentrotus franciscanus, Kelletia kelletii, Lithopoma gibberosa, Patiria miniata, Pisaster giganteus, Crassedoma giganteus, Megathura crenulata, Tethya aurantia, Lophogorgia chilensis, Tegula regina, Megastraea undosa, Patiria miniata and *Lytechinus anamesus* were completed. The temperature loggers were retrieved and deployed.

Site Notes

The site was drastically different from last year as well as the most barren David Kushner can remember seeing it. Not only is the site completely devoid of macroalgae (other than a small amount of juvenile *Sargassum muticum*), but it had a relatively low abundance of sea urchins. This is the lowest abundance that David Kushner has observed since the site was classified as a "barren." *Codium setchellii* were rare. Filamentous green algae were present. Adult *Eisenia arborea* were common in the very shallow area along the onshore wall. *Sargassum muticum* were mostly found on top of rocks and was rare. One *Sargassum horneri* was observed in shallow but not within the actual site. Other red algae were primarily filamentous. There were a few small patches of senescing *Zostera* sp. at about 30 ft depth.

The most common miscellaneous invertebrate recorded on RPCs was *Balanus* sp. Overall, encrusting invertebrates were low in abundance. The encrusting invertebrates (filter and particle feeders) were unhealthy looking in general. Again, the site was a barren. After sampling, divers swam around the bay and the entire area was also similarly barren. *Tethya aurantia* individuals were mostly small. Both *Astrangia lajollaensis* and *Balanophyllia elegans* looked unhealthy and there were many recently deceased individuals. *Corynactis californica* also looked unhealthy and were found only on high-relief areas. Hydroid spp. were common and found primarily on tops of rocks. Of the three *Panulirus interruptus* observed, all were sub-legal. *Diaperoecia californica* were rare and unhealthy looking. *Mesochaetopterus* sp. were observed in the sand.

Bulla gouldiana were abundant throughout and shells were all over. Several *Aplysia californica* were observed. Only a few *Bursa californica* were observed. Mostly small *Crassedoma californica* were observed. Small fresh and old *Haliotis rufescens* shells were observed. *Kelletia kelletii* were mostly small with a few large and old individuals. Several *Lithopoma gibberosa* were observed. All sizes of *Megastraea undosa* were observed, mostly in shallower areas. Several *Megathura crenulata* were observed but were generally rare. *Octopus* sp. were moderately abundant and were mostly large. *Simnia* sp. were observed frequently feeding on the polyps of *Lophogorgia chilensis*.

There was a moderate size sand dollar bed in the middle of the bay at around 20-25 ft depth. The sand dollars appeared healthy. *Pachythyone rubra* were small and unhealthy looking. Most of the *P. rubra* were found towards the 100 m end of the transect. Several *Parastichopus parvimensis* were observed, most were small. *Patiria miniata* were found mostly under rocks and in crevices. We estimated that about 15% showed signs of sea star wasting disease. Only one healthy *Pisaster giganteus* was observed. No juvenile *Strongylocentrotus purpuratus* or *Strongylocentrotus franciscanus* were observed. Groups of *S. purpuratus* tests from recent wasting and/or black-spot disease were present at the base of the wall on the onshore side. *Strongylocentrotus franciscanus* tests were also relatively abundant. There were many whole sea urchin tests and about 30% had evidence of black spot and wasting disease. Of the live *Strongylocentrotus* spp. about 15% showed

signs of wasting disease and/or black spot. Fewer juvenile C*entrostephanus coronatus* were observed as we had expected. Large and small *Lytechinus anamesus* were observed. Wasting disease was observed in about 15% of *L. anamesus* individuals and fresh whole tests were common.

Most fish were low in abundance except for juvenile *Chromis punctipinnis* which were present in three different size classes between 2 – 7 cm. Juvenile *Halichoeres semicinctus* and all sizes of *Lythrypnus dalli* were extremely abundant. Juvenile (1-4 cm) *Semicossyphus pulcher* were moderately abundant. Only two *Alloclinus holderi* were observed. A total of two *Gymnothorax mordax* (California moray eel) were observed. One small (~2-5 cm) *Seriola lalandi* (California yellowtail) was observed. On the second visit, a school of 20-22 *Anisotremus davidsonii* (sargo) was observed.

The ARMs cages were in fair condition, but they felt unsecure.

Site #9, Scorpion Anchorage, Santa Cruz Island

2015 status

Developing Kelp forest

Sampling Dates and Work Completed

09/17/2015

Fish transects, fish size frequencies, video transects, roving diver fish counts, 1 m^2 quadrats, 5 m^2 quadrats, band transects, random point contacts and size frequencies for *Strongylocentrotus purpuratus, Strongylocentrotus franciscanus, Megastraea undosa, Tethya aurantia, Haliotis corrugata, Megathura crenulata, Crassedoma gigantea, Kelletia kelletii*, and *Macrocystis pyrifera*. All seven ARMs were sampled. The temperature loggers were retrieved and deployed.

10/02/2015

The remaining size frequencies for *Strongylocentrotus purpuratus* and *S. franciscanus* were completed.

Site Notes

Unfortunately, we sampled this site later than usual for our first visit. Similar to last year, most of the *Macrocystis pyrifera* was present from 50 - 100 m along the transect tape. *Ulva* sp. were abundant. Understory algae consisted primarily of juvenile *Sargassum muticum* and *S. horneri*. These two algae carpeted the bottom, with *S. muticum* being the more abundant. Offshore of the transect tape, *S. horneri* have taken over, especially below 25 ft. depth. Many of the algae and invertebrate species looked unhealthy. While the larger *M. pyrifera* plants were somewhat healthy (although slightly tattered from the warm water), the juveniles looked pale and tattered. *Cystoseira* spp. appeared unhealthy and were covered in diatoms. *Laminaria farlowii* were common but also appeared tattered and unhealthy. The 'other brown algae' category on RPCs consisted entirely of *S. muticum*. Articulated coralline were more abundant than David Kushner remembers observing.

The most common miscellaneous invertebrate on RPCs was *Balanus* sp. All *Tethya aurantia* appeared unhealthy and were completely covered with sediment and diatoms. *Astrangia lajollaensis*

appeared unhealthy. *Corynactis californica* were less abundant than in past years. One *Lophogorgia chilensis* was observed. All sizes of *Panulirus interruptus* were present but most were large; a few small ones were noted. There were many recent lobster molts observed on and around the site, perhaps associated with the full moon. On the second trip to the site, we observed large numbers of *Strongylocentrotus franciscanus* that were likely predated upon by *P. interruptus*. *Panulirus interruptus* were noticeably more abundant than two weeks ago. *Diaperoecia californica* were rare and appeared unhealthy. The 'other bryozoan' category consisted mostly of *Thalamoporella californica,* which were very common.

Serpulorbis squamigerus appeared more abundant than in past years and were abundant in ARMs. Recent predation on *Cypraea spadicea* was evident by fresh, broken shells. *Kelletia kelletii* were very abundant in ARMs. Most seemed to be in the 2 and 3 year size class but a few smaller 1-year size classes were present. *Megastraea undosa* were moderately abundant and small to medium in size. Several 2-4 mm individuals were observed that were not included in size frequencies. Only one unhealthy-looking *Megathura crenulata* was observed. Octopus sp. were moderately abundant.

Parastichopus parvimensis were nearly all medium in size and appeared "skinny"; fewer than normal were observed. During the October visit, *P. parvimensis* were observed offshore and appeared healthier looking. One *Patiria miniata* was observed in the open on the site and this is the first year that none have been observed in ARMs. We speculate that individuals may be located primarily in crevices. At least ten *P. miniata* individuals with wasting disease were observed. One *Pisaster ochraceus* was observed at 117 mm. *Strongylocentrotus purpuratus* densities were patchy and less abundant than in recent years. Whole, fresh *S. purpuratus* tests were common. There were many individuals that were white and looked near death likely due to wasting disease. It was estimated that 20-30% were affected in some patches within the transect area, mostly between 0 – 50 m. *Strongylocentrotus franciscanus* appeared distinctly large on the 100-meter end. Unfortunately, all the sea urchin size frequencies were collected in that one area. *Centrostephanus coronatus* were not as abundant as expected based upon the higher abundances seen at other sites. No *Lytechinus anamesus* were observed.

Lythrypnus dalli were mostly small so abundance was likely underestimated on roving diver fish counts due to the difficultly in locating the smaller individuals effectively. Three *Alloclinus holderi* were observed. Four *Anisotremus davidsonii* (sargo) were observed; one had juvenile coloration. We observed YOY *Halichoeres semicinctus* (rock wrasse). There was also a large group of *Chromis punctipinnis* juveniles. During an offshore snorkel near several drifting kelp patties on 9/17/2015, juvenile *Medialuna californiensis* (halfmoon) and *Seriola lalandi* (California yellowtail) were observed. Since the first visit there had been a huge amount of warm water fish recruitment during the weeks in-between. Most noticeable from this event were the 1-5 cm *Semicossyphus pulcher*, 2-4 cm *Hypsypops rubicundus,* and very tiny *Lythrypnus dalli* recruits. This is similar to other recent observations along the front side of Santa Cruz Island. Some of these observations are the highest densities David Kushner has ever seen.

All seven ARMs were sampled. *Cypraea spadicea, K. kelletii*, and *P. parvimensis* were all very abundant in the ARMs. *Parastichopus parvimensis* were mostly medium in size and the smaller

individuals were just under 10 cm. All the *P. parvimensis* were "deflated" and looked unhealthy. ARMs bricks were covered with *Balanus* sp. and *Serpulorbis squamigerus*.

Site #10, Yellow Banks, Santa Cruz Island

2015 status

Dominated by *Strongylocentrotus purpuratus*

Sampling Dates and Work Completed

06/22/2015

All 15 ARMs were monitored for all indicator species. Wave meter was retrieved.

09/29/2015

Fish transects, fish size frequencies, video transects, roving diver fish counts, 1 m^2 quadrats, 5 m^2 quadrats, band transects, random point contacts and size frequencies for *Strongylocentrotus purpuratus, Strongylocentrotus franciscanus, Kelletia kelletii, Lithopoma gibberosa, Tegula regina, Megastraea undosa, Lytechinus anamesus, Patiria miniata, Crassedoma giganteus, Megathura crenulata, Tethya aurantia, Muricea californica* and *Lophogorgia chilensis* were completed. The temperature loggers were retrieved and deployed.

Site Notes

The site was devoid of macroalgae and understory algae, unlike last year when large, widely spaced *Macrocystis pyrifera* were still present. On high-relief areas both inshore and offshore of the site there were small patches of *M. pyrifera* forming small kelp forests. In these areas, urchins were encroaching. Kelp canopy cover was 0% on both visits. *Codium fragile* were observed. One piece of *Ulva* sp. was observed. Two *M. pyrifera* juveniles were observed. Few *Sargassum muticum* individuals were observed. *Sargassum horneri* were present inshore of the site. *Laurencia* sp. were observed throughout, even in sandy areas. Diatoms were observed on several dense mounds of silt and sand. Encrusting coralline were moderately abundant throughout.

The most common miscellaneous invertebrates were gorgonians, *Paracyathus stearnsii*, and *Balanus* sp. *Tethya aurantia* were less abundant than in past years going from an estimated total of 540 in 2014 to 20 in 2015 (based on band densities); some appeared freshly eaten. *Diopatra ornata* were rare. At least a dozen *Panulirus interruptus* were observed and all were sub-legal.

One small (~10 mm) *Bursa californica* was observed. This is the smallest *B. californica* observed at this site. *Crassedoma gigantea* were more abundant than last year. One fresh *Haliotis assimilis* shell (128 mm) was found, which could be from a live individual observed in past years. Another fresh *H. assimilis* shell (122 mm) was located in September on a reef slightly west of the site. We believe this shell may have been alive during our visit in June. *Megastraea undosa* were mostly small, but all sizes were present. *Megathura crenulata* were mostly medium in size, but small ones were also present. Nine *Tegula regina* were found and measured for sizes.

It was estimated that at least 5% of the *Lytechinus anamesus* had wasting disease. Two *Parastichopus parvimensis* were observed. All *Patiria miniata* observed were large and tucked way

back in cracks. Twenty-five percent showed signs of wasting disease in September. Remnants of dead *P. miniata* were common. *Strongylocentrotus purpuratus* dominated the transect and abundance was among the highest recorded, making it about the most "barren" we have ever seen. *Strongylocentrotus purpuratus* were abundant and *Strongylocentrotus franciscanus* were common. Juveniles of both *Strongylocentrotus* spp. were rare. In September, it was estimated that greater than 5% of *S. franciscanus* showed signs of black spot disease and greater than 3% showed signs of wasting disease.

About fifteen *Lythrypnus dalli* were observed and all were small. Other fish observed include flying fish (possibly *Cheilopogon pinnatibarbatus*), juvenile and adult *Seriola lalandi* (California yellowtail), juvenile *Medialuna californiensis* (halfmoon), *Sarda chiliensis* (Pacific bonito), *Scomber japonicas* (Pacific mackerel), and *Trachurus symmetricus* (Pacific jack mackerel).

All ARMs were in good condition. There was an extremely high number of *Centrostephanus coronatus*. There were few *S. purpuratus* and *S. franciscanus* recruits. Several *S. purpuratus* had black spots. Small *Pisaster* spp. and *P. miniata* were abundant. Small *Haliotis* spp. were common. We observed three *Haliotis corrugata*, five *Haliotis rufescens*, and five questionable *Haliotis assimilis/H. corrugata* individuals. The shells of these individuals looked like a *H. corrugata* but the pores and epipodium were yellowish, which is a distinct feature of *H. assimilis*. In addition, Amanda Bird observed banding on the cephalic tentacles while the animals were still underwater. The questionable individual abalone were collected and sent to Dr. Ron Burton at Scripps Institute of Oceanography and positively identified as *H. corrugata.* Doug Bush at Cultured Abalone and Buzz Owen were also consulted on these identifications and agree that they are *H. corrugata.*

Site #11, Admiral's Reef, Anacapa Island

2015 status

50% Dominated by *Ophiothrix spiculata* and 50% kelp forest

Sampling Dates and Work Completed

07/16/2015

Fish transects, fish size frequencies, video transects, roving diver fish counts, 1 m^2 quadrats, 5 m^2 quadrats, band transects, random point contacts and size frequencies for *Patiria miniata, Pisaster giganteus, Lophogorgia chilensis, Muricea californica, Muricea fruticosa, Haliotis corrugata,* and *Macrocystis pyrifera* were completed. The temperature loggers were retrieved and deployed.

10/01/2015

Fish transects, fish size frequencies, video transects, roving diver fish counts were completed. All six ARMs were sampled for all species.

10/15/2015

Size frequencies for *Strongylocentrotus purpuratus, Strongylocentrotus franciscanus, Tethya aurantia, Megathura crenulata, Tegula regina, Kelletia kelletii, Crassedoma gigantea, Megastraea undosa,* and *Lithopoma gibberosa* were completed.

Site Notes

This site has changed dramatically in the last two years, even more so this past year. We observed very few sea urchins and a patchy but dense canopy forming *Macrocystis pyrifera* forest. In July, canopy cover was estimated at 25%. The entire south side of Anacapa Island has more canopy forming *M. pyrifera* than we have observed in what seems like over a decade. Overall, there were more brown algae than had ever been present since 1995. There was an abundance of *M. pyrifera* adults and sub-adults over much of the site, especially on the high-relief areas. *Sargassum horneri* juveniles were abundant. Adult *S. horneri* were common and most were senescing. We continue to count the dead or near dead *S. horneri* adults in the sampling protocol. Other red algae were common and mostly filamentous. Miscellaneous plants were common, mostly observed on the filamentous red algae. During a survey dive around the Admiral's Reef area, the reefs showed a surprising increase in *M. pyrifera* with an abundance of smaller individuals as well as a few large ones. The third visit had no signs of any significant changes. The tops of the reef had an abundance of subadult *M. pyrifera* that appeared healthy. *Sargassum horneri* were nearly 0.5 meters tall on top of the reef.

The most common miscellaneous invertebrate recorded on RPCs were hydroids. Encrusting invertebrates were more abundant and diverse than in recent years. *Tethya aurantia* was present but difficult to see since they were covered by *Ophiothrix spiculata*. On the third visit, several *Tethya aurantia* looked unhealthy and several were observed with fungus/mold/bacteria growing over them. On the 100 meter end, tiny (< 5 cm) *Eugorgia rubens* (purple gorgonian) were moderately abundant. Three or four *Cancer* spp. were observed and four large *Loxorhynchus grandis* (sheep crab) were observed.

A few *Aplysia vaccaria* were observed. All sizes of *Crassedoma gigantea* were observed. One *Haliotis corrugata* at 70 mm was observed.

Parastichopus parvimensis were mostly small to medium but surprisingly abundant. They seemed too small to be harvested by the local commercial fishery. *Patiria miniata* were mostly large. One *Pisaster giganteus* was observed. Even though *O. spiculata* was less abundant than last year, it was still present with a high percent cover over much of the offshore side and low-lying areas of the transect. This makes it difficult to classify the site as kelp forest or dominated by *O. spiculata* since it appears to overlap those two categories. The thick layer of *O. spiculata* present on a high percentage of cover, made sampling band transects difficult as most *Tethya aurantia*, for example, were completely hidden. On a secondary survey dive, *O. spiculata,* while still abundant in most areas, had noticeably declined in density. *Strongylocentrotus purpuratus* and *S. franciscanus* were rare, with far fewer numbers than last year. It took significant effort to measure sea urchins for size frequencies. There were fewer *Centrostephanus coronatus* juveniles than at other sites. These were found mostly in crevice habitat occupied by *O. spiculata*.

Three *Lythrypnus dalli* were observed. With all the warm water this past year, we would have expected higher densities of *L. dalli* than we have been seeing at most of these warmer water sites. So far at Santa Cruz Island and Anacapa Island, it seems *Oxylebius pictus* densities are low and juveniles have been rare. At least six *Gymnothorax mordax* (California moray eel) were observed and some were small. On the second visit, most fish were small, but more abundant than in recent years.

Most noticeable was the increase in small or often tiny *Semicossyphus pulcher*, small *Paralabrax clathratus,* and *Halichoeres semicinctus*. Several small schools of *Sphyraena argentea* (Pacific barracuda) were observed as well as one large *Stereolepis gigas* (giant black sea bass) and several small *Seriola lalandi* (California yellowtail). On the third visit to the reef, at least ten *Gymnothorax mordax* were observed. Very high recruitment of juvenile *Semicossyphus pulcher* was observed, more than David Kushner has ever seen anywhere. Juvenile *Paralabrax clathratus* ranging from 4-7 cm were moderately abundant in the kelp canopy.

Site #12, Cathedral Cove, Anacapa Island

2015 status

Mature kelp forest

Sampling Dates and Work Completed

05/15/2015

Fish transects, fish size frequencies, roving diver fish counts and size frequencies for Strongylocentrotus purpuratus, *Strongylocentrotus franciscanus*, *Lithopoma undosum*, *Crassedoma giganteus*, *Tegula regina*, *Megathura crenulata*, *Kelletia kelletii* and *Tethya aurantia* were completed.

05/27/2015

Video transects, 1 m^2 quadrats, 5 m^2 quadrats, band transects, random point contacts and size frequencies for *Haliotis corrugata* were completed. The temperature loggers were retrieved and deployed.

06/26/2015

All seven ARMs were monitored for all indicator species. Wave meter was deployed.

Site Notes

The most noticeable change was the huge increase in *Sargassum muticum* and *Sargassum horneri* that covered much of the site making it difficult to sample for invertebrates and fish. It was about 1.2 meters tall. Several juvenile *S. horneri* were also present. Overall*,* algae were more abundant than in many years. *Codium fragile* were rare. *Macrocystis pyrifera* continued to be moderately abundant with juveniles abundant as well. This visit, some *S. muticum* were up to three meters tall. It was more abundant than David Kushner had ever seen here. *Cystoseira* spp. appeared more abundant than in previous years. *Hydroclathrus clathratus* were common. *Coilodesme californica* were moderately abundant. Other brown algae were moderately abundant in the following order: *Dictyopteris* sp.*, S. muticum, Pachydictyon* sp., *Dictyota* sp.*, Colpomenia* sp., *and Zonaria* sp. There were few miscellaneous plants observed on the reef but were common in the sandy regions. On the third visit we noticed that the macroalgae here dramatically increased and was some of the thickest David Kushner believes we have ever observed at this site. This observation is similar to that of the changes at Landing Cove.

The most common miscellaneous invertebrates recorded on RPCs were hydroids. There were more dead *Balanus* sp. observed than live ones and were less abundant than last year. *Corynactis*

californica mostly looked unhealthy. One *Lophogorgia chilensis* was observed. On the first visit, *Panulirus interruptus* were twice as abundant just two weeks prior. Most of the large *P. interruptus* that were abundant on 05/15 were gone by 05/27. There were also more small/tiny *P. interruptus* than Kushner had ever seen here. Tunicates were less abundant than usual.

Several *Aplysia californica* were observed that were less than 5 cm but most were small to medium in size. *Aplysia vaccaria* were common (about six individuals) and were medium in size. *Mexichromis* sp. were common. *Crassedoma gigantea* appeared less abundant then recent years. Most *C. gigantea* were smaller and there were fewer on the wall at the zero end of the transect tape. Four live *Haliotis corrugata* were observed, two were observed during band transects. One small (72 mm) fresh *Haliotis rufescens* shell was found. Two juvenile *Kelletia kelletii* were observed. All *Megastraea undosa* sizes were present. One *Megathura crenulata* was observed. *Octopus rubescens* and *Octopus bimaculoides* were observed.

Parastichopus parvimensis were abundant in 16-20 feet of water; just above the main transect line where they are counted. Most *P. parvimensis* were medium size. Large *Paralabrax clathratus* and *Sebastes atrovirens* were not as common as past years. Three *Cephaloscyllium ventriosum* (swell shark) eggs were found.

On the second visit all seven ARMs were sampled for all indicator species. All ARMs cages were re-anchored with sand anchors because on 05/15/15 we observed one ARM with an open lid and some bricks missing and three other ARMs cages were upside down. The only major observation from sampling the ARMs was that there were relatively few *Strongylocentrotus* spp. in the ARMs compared to past years and that the juveniles were rare.

Site #13, Landing Cove, Anacapa Island

2015 status

Mature kelp forest

Sampling Dates and Work Completed

06/12/2015

All six ARM's were monitored for all indicator species.

06/26/2015

Wave meter was deployed and retrieved.

07/31/2015

Fish transects, fish size frequencies, video transects, roving diver fish counts and size frequencies for *Strongylocentrotus purpuratus, Strongylocentrotus franciscanus, Tethya aurantia, Megathura crenulata, Tegula regina, Kelletia kelletii, Crassedoma giganteus, Lithopoma undosum,* and *Pisaster giganteus* were completed.

09/18/2015
Video transects, band transects, 1 m^2 quadrats, 5 m^2 quadrats, random point contacts, and size frequencies for *Strongylocentrotus purpuratus, Haliotis corrugata, Lophogorgia chilensis, Muricea californica,* and *Macrocystis pyrifera*.

Site Notes

On the second visit in July, there were more of all species of charismatic macroalgae than on the first visit in June. Some algae, especially the subadult *Macrocystis pyrifera* in the cobble area, were so abundant and thick it made sampling difficult. After the second trip, other than the smaller adult *M. pyrifera*, other charismatic algae had thinned out but were still abundant. The other green algae category consisted mostly of filamentous species. *Eisenia arborea*, *Laminaria farlowii, and Pterygophora californica* were all moderately abundant and juveniles were common. *Gelidium* spp. and *Gigartina* spp. were abundant on the shallow parts of the reef.

The most common miscellaneous invertebrates recorded on RPCs were hydroids and barnacles. Only a few *Tethya aurantia* were observed. All *Corynactis californica* were healthy looking. One *Muricea californica* was observed. *Panulirus interruptus* were common and both small and large sizes were observed. *Diaperoecia californica* were mostly small. At least twenty huge *Aplysia vaccaria* with egg masses were observed. One small (50 mm) fresh *Haliotis cracherodii* shell was found. Six live *Haliotis corrugata* were observed. All sizes of *Kelletia kelletii* were observed, but most were 1-3 years old. All sizes of *Megastraea undosa* were observed. *Parastichopus parvimensis* were rare, but they were tucked back in crevices and mostly small. Three *Pisaster giganteus* were observed. Both *Strongylocentrotus purpuratus* and *Strongylocentrotus franciscanus* densities declined and are likely the lowest David Kushner has seen in years here. *Strongylocentrotus franciscanus* tests were common with evidence of black spot disease.

Several very tiny (<2 cm) juvenile *Hypsypops rubicundus* (Garibaldi) and *Semicossyphus pulcher* (California sheephead) were observed on the second visit in July. On the third visit in September, large *Lythrypnus dalli* were common and very tiny (~5 mm) individuals were moderately abundant. Over 40 small (1 cm or less) juvenile *S. pulcher* were observed. Several tiny *Halichoeres semicinctus* (rock wrasse) and *Chromis punctipinnis* (blacksmith) were observed as well.

All six ARMs were sampled. One *Arbacia incisa* was found in the ARMs along with several *Centrostephanus coronatus* urchins. We observed the fewest juvenile *S. purpuratus* and *S. franciscanus* David Kushner can remember in the ARMs at this site.

Site #14, Southeast Sea Lion Rookery, Santa Barbara Island

2015 status

Kelp forest

Sampling Dates and Work Completed

01/28/2015
Wave meter was retrieved and deployed.

05/13/2015
Fish transects, video transects, roving diver fish counts, fish size frequencies, 1 m^2 quadrats, 5 m^2 quadrats, band transects, random point contacts and size frequencies for *Strongylocentrotus purpuratus, Strongylocentrotus franciscanus, Patiria miniata, Pisaster giganteus, Lithopoma undosum, Crassedoma giganteus, Tegula regina, Kelletia kelletii, Lophogorgia chilensis, Muricea californica* and *Macrocystis pyrifera* were completed. The temperature loggers were retrieved and deployed.

10/13/2015
Wave meter was deployed.

Site Notes
This site has changed significantly in recent years with considerable declines in *Ophiothrix spiculata* and *Strongylocentrotus* spp. abundances. *Centrostephanus coronatus* densities are up. Along with the decreases in abundances, the site has transitioned to a kelp forest of *Macrocystis pyrifera* and *Sargassum horneri.* Both adult and subadult *M. pyrifera* and *S. horneri* were present throughout. *Macrocystis pyrifera* was healthy and dense and had hardly any bryozoan growth. A very dense carpet of *Sargassum horneri* was observed and no adults or reproductive individuals were observed. Understory brown algae, mostly *Dictyopteris* sp. and *Zonaria* sp., were moderately abundant. The increased abundance of *S. horneri* made sampling difficult and considerably less efficient. Most of the adult *M. pyrifera* plants were about 3-4 meters from the surface and there was little canopy. The area around the Southeast Sea Lion Rookery site also appeared to have kelp. *Codium* sp. included mostly *C. setchellii* as well as some *C. fragile*.

The most common miscellaneous invertebrates recorded on RPCs were amphipod tube mats; however, they still were not highly abundant overall. Sponges and tunicates were more abundant and diverse than has been observed for many years. *Astrangia lajollaensis* were actively looked for but none were observed. *Corynactis californica* were rare and looked unhealthy; like other Santa Barbara Island sites this year. *Muricea californica* appeared unhealthy looking. *Phragmatopoma californica* were very rare. *Balanus* sp. were small. At least ten *Panulirus interruptus* were observed.

Juvenile *Aplysia californica* were observed. Five medium sized *Aplysia vaccaria* were observed. *Crassedoma gigantea* were mostly small. One fresh *Haliotis corrugata* shell measuring 34 mm was found. One large and one small *Kelletia kelletii* were observed. *Megastraea undosa* medium to large in size were observed.

Ophiothrix spiculata were significantly less abundant than in past years and were mostly confined to crevices and holdfasts. *Parastichopus parvimensis* were mostly large. Sea stars were extremely rare, but several *Henricia* sp. were observed. Three *P*atiria *miniata* and three *Pisaster giganteus* were observed; significantly less than last year. Several *Linkia* sp. were located by one observer. *Centrostephanus coronatus* adults and juveniles (<15 mm) were common. *Centrostephanus coronatus* were in every crevice and were the most abundant urchin species on the site. Only about 10-20 *Lytechinus anamesus* were observed, and most were about 10 cm in size. *Strongylocentrotus franciscanus* were rare; it took two dives to find 100 for size frequency measurements.

One *Lythrypnus dalli* was observed. Several large and small *Coryphopterus nicholsii* were observed and were rare. At least two *Alloclinus holderi* were observed during sampling. At least fifty *Paralabrax clathratus* (kelp bass) were observed, ranging from 7-8 cm & 14-16 cm. There were also only a few larger individuals seen.

Notes from 1/28/2015: The site dramatically changed since our last visit in 2014. The entire site with rocky bottom had a mix of large subadult and small *Macrocystis pyrifera* on it. Most plants just reached the surface and canopy was thin. *Sargassum horneri* were large, mostly 2 meters tall and covered the entire site, intermixed with the *M. pyrifera*. White reproductive receptacles were common. Small *Panulirus interruptus* were unusually abundant with 12 observed. Only two legal *P. interruptus* were observed. *Ophiothrix spiculata* densities declined. No other sea stars were found, though a low search effort was used. *Parastichopus parvimensis* were common and small. Señoritas were notably abundant and small (about 10 cm average). Juvenile rock wrasse and garibaldi were common. Several sheephead YOY were observed.

Site #15, Arch Point, Santa Barbara Island

2015 status

State of Transition

Sampling Dates and Work Completed

05/11/15

Fish transects, fish size frequencies, video transects, roving diver fish counts, 1 m^2 quadrats, 5 m^2 quadrats, band transects, random point contacts and size frequencies for *Strongylocentrotus purpuratus, Strongylocentrotus franciscanus, Lytechinus anamesus, Patiria miniata, Lithopoma undosum, Crassedoma giganteus, Tegula regina* and *Megathura crenulata* were completed. The temperature loggers were retrieved and deployed. Repairs to the lead line were made.

07/15/2015

Wave meter was retrieved.

10/13/2015

Wave meter was deployed.

Site Notes

There was only one *Macrocystis pyrifera* adult, which was down from the 33 on the last year. All the juveniles *M. pyrifera* were small. Some of the juveniles grew epiphytically on *Sargassum muticum.* We noticed more *other* algae than in previous years. The invasive algae *S. muticum* were the most abundant algae, followed by *Dictyota/Pachydictyon/Dictyopteris* and then *Sargassum horneri.* Like past years, *S. muticum* were the most abundant at the 100-meter end but according to David Kushner's accounts, the algae was more abundant this year than he had observed since 1990. Although *S. horneri* was senescing, *S. muticum* seemed to have a more drastic impact this year. *Sargassum muticum* was abundant and composed about 70% of the other brown algae on RPCs. Most of the adult *S. horneri* was senescing while the juveniles appeared unhealthy and small in size. On the last visit, *S. horneri* were more abundant than our earlier visits and covered much of the site

as well as the tops of rocks. *Dictyota/ Pachydictyon* were also more abundant on the last visit. *Gelidium* sp. was less abundant than recent years. *Laurencia* sp. was less abundant than past years. *Codium setchellii* was present and found in moderate numbers.

The most common miscellaneous invertebrate recorded on RPCs were barnacles. There were no *Tethya aurantia* observed. *Corynactis californica* were small and rare. *Sagartia/Cactosoma* spp. were less abundant than recent years. *Spirobranchus spinosus* were relatively rare. Five *Panulirus interruptus* were observed, four of which were of legal size. On the last visit, two lobster traps were found, one had nine and the other had three *P. interruptus* inside. All were at least legal size and averaged 3 lbs. with a few 1 ½ - 2 lbs. individuals. Three other pots were located; however, we did not look closely at them. *Bugula californica* were common in small clumps.

All sizes of *Aplysia californica* were observed and two large *Aplysia vaccaria* were observed, down from the four seen last year. *Crassedoma gigantea* were mostly small. There were many small *Megastraea undosa* and considered abundant. One *Megathura crenulata* was observed (64 mm), down from the three observed last year.

Ophioderma sp. were common, large and out in the open. Sea stars were rare and mostly small with only a few observed. One *Astropecten armatus* was observed in the sand. One *Pisaster ochraceus* was observed at 120 mm. No *Linkia* sp. were seen. Five medium *Parastichopus parvimensis* were observed. There was a dramatic change since last year, with a decline in *Strongylocentrotus franciscanus* and *Strongylocentrotus purpuratus* (except for a few patches of high abundance) and a dramatic increase in small *Centrostephanus coronatus* (~<15mm) that were in seemingly every small crevice. David Kushner suspects that as the urchins grow, the larger crevice habitat will become a limiting factor in their survival. David Kushner measured *Centrostephanus coronatus* and collected some additional measurements from individuals under rocks. They were abundant under small rocks and it was common to find about ten small individuals under a hand-sized rock. One *Arbacia incisa* (17 mm) was found and was the first recruit of these sea urchins since 1998/1999, we expect to see more in the coming years. One individual may have been seen last year; however, it was not confirmed. On the last visit, we were diving near night fall and using flashlights, it was extremely shocking how abundant *Centrostephanus coronatus* were. *Strongylocentrotus purpuratus* and *S. franciscanus* seemed rare.

Overall, there was low fish diversity. Small *Paralabrax clathratus,* in the ~10-15 cm size range, were abundant and presumed to be last year's recruitment. Larger adults were rare. *Oxyjulis californica* YOY (< 5 cm) were abundant at the 50-100 meter end and adult, approximately two-year-old individuals were abundant. No juvenile *Chromis punctipinnis* were observed but several small size classes were present from last year's recruitment. Juvenile *Semicossyphus pulcher* were common. David Kushner has never seen so many two-year-old *Hypsypops rubicundus* in his life. All sizes of *Coryphopterus nicholsii* were present. One *Alloclinus holderi* was observed. One *Torpedo torpedo* (Pacific electric ray) was observed under the boat just off the transect tape. At least four large *Gymnothorax mordax* (California moray eel) were observed. Four olive colored unknown fish were observed that were about 10 cm long, they looked like flattened *C. punctipinnis* with a forked tail. Later were conformed as *Azurina hirundo* (swallowtail damselfish).

Site #16, Cat Canyon, Santa Barbara Island

2015 status

Dominated by *Strongylocentrotus purpuratus*

Sampling Dates and Work Completed

01/28/2015

Wave meter was retrieved and deployed.

07/15/2015

Fish transects, fish size frequencies, video transects, roving diver fish counts, 1 m^2 quadrats, 5 m^2 quadrats, band transects, random point contacts and size frequencies for *Strongylocentrotus purpuratus, Strongylocentrotus franciscanus, Lytechinus anamesus, Lithopoma undosum, Lithopoma gibberosum, Crassedoma giganteus, Tegula regina, Megathura crenulata, Kelletia kelletii, Lophogorgia chilensis, Tethya aurantia, Haliotis corrugate, Haliotis fulgens,* and *Macrocystis pyrifera* were completed. The temperature loggers were retrieved and deployed. Wave meter was retrieved.

Site Notes

There were about one hundred *Macrocystis pyrifera* individuals of all sizes, and all healthy. Smaller individuals were not canopy-forming but there were more at the site than last year. *Codium setchellii* and *C. fragile* were rare. *Cystoseira* spp. were present and some of the individuals were covered with diatoms. *Sargassum muticum* looked mostly old and senescing with patchy abundance. *Sargassum muticum* were small and mostly unhealthy looking in mostly high density patches. We observed more *Sargassum horneri* than we ever have in previous years. Juveniles were in small, high-density patches. Diatom film was covering much algae.

The most common miscellaneous invertebrate recorded on RPCs were barnacles. There was only one *Balanophyllia elegans* observed. A single small *Lophogorgia chilensis* was observed. Several *Muricea californica* were observed. *Panulirus interruptus* were more abundant than in recent years. All sizes were observed including two 6-7 lbs. individuals.

Medium sized *Aplysia vaccaria* were common. *Crassedoma gigantea* were mostly small. Four juvenile *Haliotis corrugata* were observed on band transects. Three juvenile *Haliotis fulgens* were observed including one old and one fresh shell. One small old *Haliotis rufescens* shell was found. Only two juvenile *Kelletia kelletii* were observed. *Megastraea undosa* were abundant over the entire transect. Three small *Megathura crenulata* were observed. All sizes of *Tegula regina* were observed.

Parastichopus parvimensis individuals were mostly small to medium in size. The vast majority (90%) of the *Centrostephanus coronatus* were recruits which were abundant under rocks and therefore not picked up by our density monitoring protocols since we do not perform invasive sampling. Only one *Lytechinus anamesus* was observed. Similar to the previous year, *Strongylocentrotus franciscanus* densities were low and their sizes appeared larger overall. *Strongylocentrotus* spp. were mostly found in crevice habitat. *Lythrypnus dalli* were surprisingly not

observed. All sizes of *Alloclinus holderi* were present and more common than observed during roving diver fish count. One small *Gymnothorax mordax* (California moral eel) was observed.

Notes from 1/28/2015: Small *Eisenia arborea* adults were common. Small *Macrocystis pyrifera* adults were common to moderately abundant. There were many senescing adult *Sargassum muticum* plants. There were 12 large reproductive *Sargassum horneri* plants. Three to four yellow sponges were seen. Small colonies of *Diaperoecia californica* were rare. Several dead *Cypraea spadicea* shells were present. One *Haliotis fulgens* at about 3 cm in length was observed. All sizes of *Megastraea undosa* were present. Large *Octopus bimaculoides* were observed. *Tegula regina* were medium to large. *Strongylocentrotus purpuratus* were common to moderately abundant and all were small. Juvenile garibaldis were moderately abundant, more than in previous six years at about 6-9 cm. Juvenile rock wrasse were moderately abundant at about 8-13 cm.

Site #21, Miracle Mile, San Miguel Island

2015 status

Mature kelp forest

Sampling Dates and Work Completed

08/25/2015

Fish transects, fish size frequencies, video transects, roving diver fish counts, 1 m^2 quadrats, 5 m^2 quadrats, band transects, random point contacts and size frequencies for *Strongylocentrotus purpuratus, Strongylocentrotus franciscanus, Lytechinus anamesus, Patiria miniata, Pisaster giganteus, Crassedoma giganteus, Megathura crenulata, Haliotis rufescens, Tethya aurantia* and *Macrocystis pyrifera* were completed. The temperature loggers were retrieved and deployed. Five ARMs were sampled for everything. One ARM (#2470) was not sampled because it was buried and needs to be rebuilt and bolted. Two ARMs were replaced but not bolted into place. Wave meters were retrieved and deployed. Three repairs were made to the lead line.

Site Notes

Overall, the site was like past years with an abundance of *Macrocystis pyrifera* and understory algae. Understory brown algae (*Eisenia arborea,* some *Pterygophora californica*, *Dictyota/Pachydictyon* sp., and *Cystoseira* sp.) were moderately abundant as were red algae including *Callophyllis* sp. *Codium setchellii* were observed. Adult *Cystoseira* spp. were present and large. *Dictyota/Pachydictyon* were unusually abundant. Very large, mature *M. pyrifera* plants were present; 104 stipes were counted for one individual. Adult *Pterygophora californica* were small.

The most common miscellaneous invertebrate were hydroids. All sizes of *Tethya aurantia* were present including very large ones. *Corynactis californica* were present on high relief areas. *Balanus* sp. were patchy; some areas were completely covered. *Crassedoma gigantea* were mostly small. One *Cryptochiton stelleri* was observed. Many *Kelletia kelletii* eggs were present. All *Megathura crenulata* were huge. *Haliotis* spp. were abundant as usual but there were noticeably more small ones ranging in size from about 25 mm to 150 mm.

All *Parastichopus parvimensis* observed were huge. Few *Henricia* sp. were observed. The most distinct change, as with all northern sites, was the low abundance of *Pycnopodia helianthoides* and *Pisaster giganteus* over the last two years. However, *P. giganteus* were present in larger numbers than most of our other sites. Fifteen *Pisaster giganteus* were observed. Two *Pycnopodia helianthoides* were observed. One individual at 34 mm was measured on band transects and one 40 mm individual was in an ARM. At least two *Lytechinus anamesus* were observed.

Several *Orthonopias triacis* (snubnose sculpin) and *Artedius corallinus* (coralline sculpin) were observed.

Site #22, Cluster Point, Santa Rosa Island

2015 status

Mature kelp forest

Sampling Dates and Work Completed

06/10/2015

Wave meters were retrieved and deployed.

08/26/2015

Fish transects, fish size frequencies, video transects, roving diver fish counts, 1 m^2 quadrats, 5 m^2 quadrats, band transects, random point contacts and size frequencies for *Strongylocentrotus purpuratus, Strongylocentrotus franciscanus, Patiria miniata, Pisaster giganteus, Lithopoma undosum, Lithopoma gibberosa, Kelletia kelletii, Megathura crenulata, Crassedoma giganteus, Haliotis rufescens Tethya aurantia,* and *Macrocystis pyrifera* were completed. The temperature loggers were retrieved and deployed. The temperature logger thread rod was reinforced with Z-spar. One repair was made to the lead line.

Site Notes

Codium setchellii were observed. No *Dictyoneuropsis* were observed along the line but were rare with few individuals seen during the sampling. Only one adult *Laminaria farlowii* was observed. Large *Pterygophora californica* adults were observed in the sandy areas. Other brown algae consisted primarily of *Dictyota* sp. and were found throughout. *Rhodymenia* sp. were abundant on the tops of the boulders.

The most common miscellaneous invertebrates were *Cucumaria* spp. and barnacles. All sizes of *Tethya aurantia* were present and in high abundance. *Balanophyllia elegans* were observed throughout. *Diopatra ornata* were abundant in low-lying sandy areas. Miscellaneous invertebrates consisted primarily of *Cucumaria* sp.

One *Bursa californica* was observed. Only one *Cryptochiton stelleri* was observed and was located traversing though sand. Twenty-six *Haliotis rufescens* were observed with twenty-two individuals measuring less than 100mm in shell length. Most of the small *H. rufescens* were located on the medium- and high-relief boulders in shallow urchin holes. Many were observed to be partially covered by urchins. Several small fresh shells were observed. Seven *Lithopoma gibberosa* were

measured for size frequencies. Two *Megastraea undosa* were observed. One *Megathura crenulata* was observed eating *Pachythyone rubra*.

Pachythyone rubra were mostly present from 70 – 100 m in seemingly high percentage cover. All *Parastichopus parvimensis* were large sized. Six *Pisaster giganteus* were observed, two of which were very small and showed signs of sickness. Ten *Lytechinus anamesus* were observed and were mostly small.

Both male and female *Hexagrammos decagrammus* (kelp greenling) were observed. Unlike previous years, no *Anarrhichthys ocellatus* (wolf eel) were observed.

Site #23, Trancion Canyon, Santa Rosa Island

2015 status

Mature Kelp Forest

Sampling Dates and Work Completed

08/12/2015

Fish transects, fish size frequencies, video transects, roving diver fish counts, 1 m^2 quadrats, 5 m^2 quadrats, band transects, random point contacts and size frequencies for *Strongylocentrotus purpuratus, Strongylocentrotus franciscanus, Lytechinus anamesus, Patiria miniata, Pisaster giganteus, Lithopoma undosum, Lithopoma gibberosa, Kelletia kelletii, Megathura crenulata, Crassedoma giganteus, Haliotis rufescens Tethya aurantia*, and *Macrocystis pyrifera* were completed. The temperature loggers were retrieved and deployed.

Site Notes

The site continues to gradually change. There are more areas dominated by sea urchins and less understory algae. Most of the *Macrocystis pyrifera* were large and widely spaced but occurred in patches interspersed with high-density patches of urchins. The latter were out in the open in many areas. There were less “other red algae” and *Pterygophora californica* than in past years. *Codium setchellii* were observed. *Macrocystis pyrifera* consisted of mature, widely-spaced individuals. Bare stipes were present on *M. pyrifera*.

The most common miscellaneous invertebrates on RPCs were barnacles. *Halcampa* sp. were abundant. One *Cancer* sp. was observed along with several molts. At least seven *Panulirus interruptus* were observed. *Styela montereyensis* were mostly small.

Aplysia californica were mostly medium in size. *Crassedoma gigantea* were mostly small. Many *Cypraea spadicea* were out in the open. Two small *Haliotis rufescens* were observed. Several *Kelletia kelletii* were observed. *Lithopoma gibberosa* and *Megastraea undosa* individuals were mostly small. Several *Navanax inermis*, *Hermissenda* sp., and *Phidiana hiltoni* were observed.

One *Parastichopus californicus* was observed. *Parastichopus parvimensis* individuals were mostly large. One *Dermasterias imbricata* was observed. All sizes of *Patiria miniata* were present. *Strongylocentrotus franciscanus* were larger than in previous years. Two *Centrostephanus coronatus* juveniles (~11 mm) were observed.

Chromis punctipinnis were the most abundant we have seen in years. Juveniles consisted of both last year and this year's recruits. A school of about five hundred *Scomber japonicus* (Pacific mackerel) mixed with *Trachurus symmetricus* (Pacific jack mackerel) were observed after the fish count.

Site #24, Chickasaw, Santa Rosa Island

2015 status

Mature kelp forest with a moderately high abundance of *Strongylocentrotus* spp.

Sampling Dates and Work Completed

06/10/2015

Wave meter was retrieved and deployed.

08/11/2015

Fish transects, fish size frequencies, video transects, roving diver fish counts, 1 m^2 quadrats, 5 m^2 quadrats, band transects, random point contacts and size frequencies for *Strongylocentrotus purpuratus, Strongylocentrotus franciscanus, Lytechinus anamesus, Patiria miniata, Pisaster giganteus, Crassedoma giganteus, Megathura crenulata, Haliotis rufescens, Tethya aurantia* and *Macrocystis pyrifera* were completed. The temperature loggers were retrieved and deployed.

Site Notes

There was more sand covering the bottom this year. The high relief areas and tops of the reefs still had a moderate amount of understory algae, but less than the previous year. Encrusting invertebrates were moderately abundant in these high relief and reef areas. *Macrocystis pyrifera* were mostly large and widely spaced but there were two patches consisting of small sub-adults. *Codium setchellii* were rare. The *Cystoseira sp.* were mostly adults covered with *Membranipora spp.* Other red algae were less abundant than in previous years.

The most common miscellaneous invertebrates recorded on RPCs were barnacles and hydroids. All sizes of *Tethya aurantia* were present. Similar to previous years, other sponges were mostly *Spheciospongia* sp. The majority of *Urticina lofotensis* were smaller and more slender individuals. Hydroids were less abundant than previous years. *Diopatra ornata* were found predominantly in dense patches and many individuals were large. *Phragmatopoma californica* were observed in large patches as well as scattered around within holdfasts. At least four large *Panulirus interruptus* were observed (3-4 lbs.). Other bryozoans were highly diverse, comprising of *Membranipora spp., Phidolopora pacifica,* and a variety of others. *Styela montereyensis* were mostly small with several larger individuals observed. Miscellaneous invertebrates were common on steep areas.

Several large aggregations of *Aplysia californica* were observed. *Crassedoma gigantea* were mostly small. Four *Mexichromis* sp. were observed as well as several *Navanax inermis. Megathura crenulata* were mostly large. It appears that the *Haliotis rufescens* have increased in size and moved offshore towards the edge of the reef at the sand/rock interface where there were fewer urchins. Huge *Pachythyone rubra* were observed at the west end near the 100 meter end of the transect tape. *Parastichopus parvimensis* were mostly large. Three small *Pisaster giganteus* were observed under *Strongylocentrotus franciscanus* and five were found out in the open. *Strongylocentrotus*

franciscanus and medium sized *Strongylocentrotus purpuratus* continued to expand over the site. They have now taken over most of the crevices that abalone used to be in and also have localized urchin barren areas in the lower relief areas. Juveniles of both *S. purpuratus* and *S. franciscanus* were rare, but both were more abundant than last past year. Both species were commonly observed out in the open. *Strongylocentrotus purpuratus* were mostly medium sized. A few of the *S. franciscanus* were remarkably large, with several over 130 mm. The *S. franciscanus* seem to be increasing in size each year. Three *Centrostephanus coronatus* were observed on quadrats, one at 10 mm and two at ~15-20 mm. This is the first time we have observed *C. coronatus* at this site. Only one small *Lytechinus anamesus* was observed.

Chromis punctipinnis were more abundant than recent years and most were small juveniles from last year's recruits as well as some from this year. This increase in abundance of *Chromis punctipinnis* could be the highest since monitoring began. One *Scorpaenichthys marmoratus* (cabezon) was observed. There were two *Rhacochilus toxotes* (rubberlip surfperch) observed, one medium sized individual as well as one large individual. On RDFC, *Sebastes chrysomelas* (black and yellow rockfish) juveniles and *Sebastes carnatus* (gopher rockfish) juveniles were grouped together. David Kushner believes that these juveniles observed were actually all *Sebastes chrysomelas* juveniles.

Site #25, South Point, Santa Rosa Island

2015 status

Mature kelp forest

Sampling Dates and Work Completed

08/27/2015

Fish transects, fish size frequencies, video transects, roving diver fish counts, 1 m^2 quadrats, 5 m^2 quadrats, band transects, random point contacts and size frequencies for *Strongylocentrotus purpuratus, Strongylocentrotus franciscanus, Patiria miniata, Haliotis rufescens, Pisaster giganteus, Macrocystis pyrifera, Tethya aurantia, Megathura crenulata*, and *Crassedoma giganteus*. The temperature loggers and wave meters were retrieved and deployed.

09/16/2015

Fish size frequencies and roving diver fish counts.

Site Notes

The site continues to be a mature kelp forest with thick understory algae. *Macrocystis pyrifera* appeared healthy with few bryozoans growing epiphytically on them. *Codium setchellii* were observed. *Cystoseira* sp. were mostly large and looked in healthy condition. *Cystoseira* sp. were also more abundant than in past years. *Pterygophora californica* individuals were very large with tall stipes. They were similar in size to Cluster Point.

The most common miscellaneous invertebrate on RPCs were hydroids. Most *Tethya aurantia* were medium to large in size. *Corynactis californica* were found on boulders and looked in healthy condition. Hydroids were mostly *Plumularia* spp. *Phragmatopoma californica* was observed in holdfasts as well as on large boulders. Both large and small *Balanus* sp. were observed. Four sub-

legal *Panulirus interruptus* were observed. During the second visit, at least four individuals were observed, three of which were greater than the legal size. *Hippodiplosia insculpta* were common. *Polyclinum planum* were common.

Several *Octopus* spp. were observed. At least two *Aplysia californica* mating congregations were observed. *Crassedoma gigantea* were mostly small to medium in size. *Haliotis rufescens* were most abundant near the zero-meter end of the transect tape on the onshore side. Two-hundred-thirty-five *Haliotis rufescens* were measured for size frequencies on and in-between bands. Only one large *Megastraea undosa* was observed. The *Megathura crenulata* observed were large in size. One individual that was observed appeared to be eating some *Hymenamphiastra cyanocrypta*. *Pachythyone rubra* was more abundant than in previous years and have expanded.

Parastichopus parvimensis were all large. All sizes of *Patiria miniata* were present. Four *Pisaster giganteus* were observed. It appeared that urchins may have increased in abundance since last year. Both *Strongylocentrotus purpuratus* and *Strongylocentrotus franciscanus* were present in patches of high density and mostly found within crevice habitat. One small (7 mm) *Lytechinus anamesus* was observed.

Coryphopterus nicholsii were mostly large in size. A large school of baitfish was observed (~3000 individuals). The school was composed of about 90% *Trachurus symmetricus* (Pacific jack mackerel), 9% *Sardinops sagax* (Pacific sardine), and 1% *Scomber japonicas* (Pacific mackerel). The school of *Trachurus symmetricus* had at least two distinct size classes (10-14 cm and 15-20 cm).

Site #26, Devil's Peak Member, Santa Cruz Island

2015 status

Barren area with moderate amount of *Strongylocentrotus* spp.

Sampling Dates and Work Completed

05/29/2015

Fish transects, video transects, roving diver fish counts, fish size frequencies, 1 m^2 quadrats, 5 m^2 quadrats, band transects, random point contacts and size frequencies for *Patiria miniata, Pisaster giganteus, Lithopoma undosum, Crassedoma giganteus, Megathura crenulata, Kelletia kelletii, Lophogorgia chilensis, Muricea californica, Tethya aurantia, Haliotis rufescens, Strongylocentrotus purpuratus, Strongylocentrotus franciscanus, Lytechinus anamesus* and *Macrocystis pyrifera* were completed. The temperature loggers were retrieved and deployed.

Site Notes

Overall there were few changes from previous years. The site was mostly devoid of macroalgae except for on the tops of rocks where few adult and/or juvenile *Eisenia arborea* were present. Other brown algae were mostly *Colpomenia* sp.

The most common miscellaneous invertebrates recorded on RPCs were barnacles. All sizes of *Tethya aurantia* were present. *Lophogorgia chilensis* were abundant on the eastern end. One *Muricea fruticosa* was observed. *Balanus* sp. were mostly large adults. There were no observed indications of

new barnacle recruitment; however, there were more barnacles present here than at other sites. Only one *Panulirus interruptus* was observed.

Several *Mexichromis* sp. were observed as well as small *Flabellinopsis* spp. which were moderately abundant. Two small *Simnia avena* were observed on *L. chilensis*. Two live *Haliotis rufescens* were observed and measured 55 mm and 57 mm. *Megathura crenulata* had the highest abundance we saw seen this year.

The *Parastichopus californicus* observed were large. Only two *Pisaster giganteus* were observed. One was located along the band transects. Three *Pisaster ochraceus* were observed with all three located on band transects. Urchins seemed to be on the decline. Wasting disease was found in *Strongylocentrotus franciscanus* with active mortality as could be seen by nearly dead urchins and whole tests.

Lythrypnus dalli and *Chromis punctipinnis* abundances increased this year. All sizes of *Alloclinus holderi* were observed.

Site #27, Potato Pasture, Santa Cruz Island

2015 status

Kelp forest

Sampling Dates and Work Completed

08/24/2015

Fish transects, fish size frequencies, video transects, roving diver fish counts, 1 m^2 quadrats, 5 m^2 quadrats, band transects, random point contacts and size frequencies for *Macrocystis pyrifera, Tethya aurantia, Tegula regina, Kelletia kelletii, Crassedoma gigantean, Megastraea undosa, Lytechinus anamesus, Strongylocentrotus purpuratus* and *Strongylocentrotus franciscanus.* The temperature loggers were retrieved and deployed.

10/02/2015

Size frequencies for *Muricea californica, Lophogorgia chilensis, Crassedoma gigantea, Kelletia kelletii, Strongylocentrotus purpuratus, Strongylocentrotus franciscanus, Tethya aurantia, Megastraea undosa, Tegula regina,* and *Megathura crenulata* were completed.

Site Notes

Things have noticeably changed from previous years, with greatly increased algal cover and decreased abundance in sea urchins. *Macrocystis pyrifera* were present throughout and most plants were small. *Eisenia arborea* adults were abundant with many small plants densely packed together. These dense patches created a shading effect that seemed like it was having negative effects on *Sargassum horneri*. Small juvenile *Sargassum muticum* were common. *Sargassum horneri* were abundant in distinct patches. Small *S. horneri* adults were rare and typically less than 20 cm. *Codium fragile* and *Codium setchellii* were both present. *Dictyota/Pachydictyon* were abundant throughout. The majority of the *M. pyrifera* were small; however a few large individuals were observed.

The most common miscellaneous invertebrate recorded on RPCs were barnacles. *Corynactis californica* looked unhealthy. The *Lophogorgia chilensis* observed were predominately smaller and looked unhealthy. *Diopatra ornata* were mostly small. *Panulirus interruptus* were found in deep ledges. They were medium to large in size and moderately abundant throughout. The *P. interruptus* population seems to be continuing to increase in abundance from year-to-year.

One *Argonauta* sp. (paper nautilus) shell was observed. Several *Mexichromis* sp. and *Navanax inermis* were observed. All sizes of *Aplysia californica* were observed. All sizes of *Crassedoma gigantea* were observed. One old and one small (27 mm) *Haliotis corrugata* shells were found. One *Lithopoma gibberosa* was observed. All sizes of *Megastraea undosa* were observed but most were in the 45-55 mm size class.

Pachythyone rubra were mostly found on the zero meter end of the transect tape but were observed throughout. *Parastichopus parvimensis* were predominately medium-sized. Both *Strongylocentrotus purpuratus* and *Strongylocentrotus franciscanus* abundance seems to have declined from past years. All individuals observed were found in crevices. Small (<10 mm) *S. purpuratus* were observed but were rare overall. All sizes of *Centrostephanus coronatus* were observed, this includes many small recruits.

Two noticeable size classes of *Lythrypnus dalli* were present as well as several very tiny recruits. *Alloclinus holderi* were all noticeably large. Many more *A. holderi* were observed after the fish count. Both small and large *Paralabrax clathratus* were abundant. There were fewer *Sebastes mystinus* than in recent years. *Oxylebius pictus* were less abundant than in past years; only a few were observed during the sampling. *Neoclinus stephensae* (yellowfin fringehead) were moderately abundant. Small *Scorpaena guttata* (California scorpionfish) were observed. Small to medium *Sebastes serranoides* were more common just offshore of the transect tape.

Site #28, Cavern Point, Santa Cruz Island

2015 status

Mature kelp forest

Sampling Dates and Work Completed

05/28/2015

Fish transects, video transects, roving diver fish counts, fish size frequencies, 1 m^2 quadrats, 5 m^2 quadrats, band transects, random point contacts and size frequencies for *Strongylocentrotus purpuratus, Strongylocentrotus franciscanus, Patiria miniata, Pisaster giganteus, Lithopoma gibberosa, Lithopoma undosum, Crassedoma giganteus, Tegula regina, Tethya aurantia. Kelletia kelletii, Lophogorgia chilensis, Muricea californica* and *Macrocystis pyrifera* were completed. The temperature loggers were retrieved and deployed.

10/02/2015

Wave meter was retrieved and deployed.

Site Notes

This site continues to be a diverse mature kelp forest. Every year it seems to look more and more like Landing Cove and Cathedral Cove and perhaps now has even higher diversity. Other green algae were mostly *Cladophora* sp. *Dictyota/Pachydictyon* were present and *Dictyopteris* sp. were moderately abundant. Few *Macrocystis pyrifera* subadults were present. Most plants were notably large and widely spread, all looked to be in very healthy condition. Some *Sargassum horneri* individuals ~0.5 meters tall were senescing and were counted as adults. An overall <10% were like this. In general nearly all of the plants looked unhealthy and were senescing. There was less *S. horneri* than what we had expected. Due to high densities, half of two band transects were sampled for *S. horneri*. The counts were then doubled for database entry. David Kushner estimated that counting the *S. horneri* increased the total bottom time by at least 25% in order to fully sample.

The most common miscellaneous invertebrates recorded on RPCs were hydroid spp. Encrusting invertebrates covered nearly all the rock surface. For other sponges, *Clathria* sp. were common and *Leucosolenia* sp. were moderately abundant. The *Corynactis californica* observed looked to be in healthy condition. Most of the *Panulirus interruptus* observed were of legal size. The following tunicates were present: *Pycnoclavella, Didemnum/ Tridemnum, Aplidium*, and an unidentified encrusting grey tunicate. Miscellaneous invertebrates covered nearly all the rock surfaces and were composed of sponges, worms and hydroids.

Small *Flabellina* sp. and *Mexichromis* sp. were common. The *Crassedoma gigantea* observed were mostly small. At least eight large *C. gigantea* had signs of recent poaching; likely over the holiday weekend. The fronts of all the shells had an array of cracks committed through blunt force similar to that of a knife. The shell sizes were 143, 144, 111, 115, 149, 151, 134, and 71 mm. Several fresh, dead *Cypraea spadicea* shells were found. One small *Haliotis corrugata* was found.

Twenty-one *Linkia* sp. were counted on one side during the 5 meter quadrat sampling. *Parastichopus parvimensis* were mostly medium-sized. About ten *Patiria miniata* were observed and most were relatively small. One *Pisaster giganteus* was observed at 110 mm. One *Pisaster ochraceus* was observed at 90 mm. The *Strongylocentrotus franciscanus* and *Strongylocentrotus purpuratus* were more scattered and were larger compared to adjacent areas outside the MPAs. *Strongylocentrotus purpuratus* juveniles were rare. *Strongylocentrotus franciscanus* adults were large similar to nearby sites.

The *Lythrypnus dalli* observed were mostly medium-sized. All size classes of *Coryphopterus nicholsii* were observed. *Alloclinus holderi* were more common than other sites, but only thirteen individuals were observed, with all sizes were present. Several *Lythrypnus zebra* were observed and all were quite small.

Site #29, Little Scorpion, Santa Cruz Island

2015 status

Dominated by Strongylocentrotus franciscanus

Sampling Dates and Work Completed

07/27/2015

Fish transects, fish size frequencies, video transects, roving diver fish counts, 1 m^2 quadrats, 5 m^2 quadrats, band transects, random point contacts and size frequencies for *Strongylocentrotus purpuratus, Strongylocentrotus franciscanus, Lytechinus anamesus, Patiria miniata, Pisaster giganteus, Lithopoma undosum, Lithopoma gibberosum, Crassedoma giganteus, Tegula regina, Megathura crenulata, Kelletia kelletii, Lophogorgia chilensis, Muricea californica* and *Tethya aurantia* were completed. The temperature loggers were retrieved and deployed.

10/15/2015

Survey dive.

Site Notes

The site looked similar to past years in that it was devoid of all charismatic macroalgae except for a single *Eisenia arborea* individual that was observed. *Codium fragile* were small but still observed. Only several very tiny juvenile *Sargassum horneri* were observed measuring less than 10 cm.

The most common miscellaneous invertebrates recorded on RPCs were *Spirobranchus spinosus*, barnacles and *Paracyathus stearnsii* (brown cup coral). The *Corynactis californica* present looked healthy. Many *Balanus* sp. were dead. Three *Panulirus interruptus* of legal size were observed.

All sizes of *Aplysia californica* were present. One fresh *Haliotis rufescens* shell was found. Similar to past years, all sizes of *Megathura crenulata* were observed and in high abundance. Two *Argonaut* sp. (paper nautilus) shells were found.

Parastichopus parvimensis were all larger individuals. There were not many *Patiria miniata* observed in the quadrat sampling, but they were common throughout. All sizes of *P. miniata* were present and about half were distinctly thinner but showed no signs wasting disease. Only one *Pisaster giganteus* was observed at 112 mm. Only one large live *Pisaster ochraceus* was observed on the onshore side of the transect tape. *Centrostephanus coronatus* were of medium size with the two-year-old individuals being most common. *Lytechinus anamesus* were mostly ranging from the medium to large size classes. The most noticeable change was the decrease in abundance of *Strongylocentrotus purpuratus*; however, the individuals present looked larger than in past years. *Strongylocentrotus franciscanus* remained moderately abundant, similar to past years. For a warm water year*, Centrostephanus coronatus* juveniles were not as abundant as we would have expected.

Lythrypnus dalli were moderately abundant as we would expect for a warm water year. Several tiny *Alloclinus holderi* were observed, although they were not as common as expected in a warm water year. At least eight *Gymnothorax mordax* (California moray eel) were observed on the inshore side. Approximately ten juvenile *Semicossyphus pulcher* were present that measured 1-2 cm. David Kushner thinks these juveniles were some of the smallest we have ever observed. Pelagic red crabs (*Pleuroncodes planipes*) were very abundant throughout. Juvenile *Caulolatilus princeps* (ocean whitefish) were observed at many sites this season from Santa Cruz, Santa Barbara, and Anacapa Islands. The individuals observed at Little Scorpion ranged from 13-16 cm in size, while those

observed earlier in the season were either smaller or about the same size. Large groups of over twenty have been common.

Site #30, Pedro Reef, Santa Cruz Island

2015 status

Dominated by *Strongylocentrotus purpuratus*

Sampling Dates and Work Completed

07/13/15

Fish transects, fish size frequencies, video transects, roving diver fish counts, 1 m^2 quadrats, 5 m^2 quadrats, band transects, random point contacts and size frequencies for *Strongylocentrotus purpuratus, Strongylocentrotus franciscanus, Lytechinus anamesus, Patiria miniata, Pisaster giganteus, Lithopoma undosum, Lithopoma gibberosum, Crassedoma giganteus, Tegula regina, Megathura crenulata, Kelletia kelletii, Lophogorgia chilensis, Muricea californica, Tethya aurantia,* and *Macrocystis pyrifera* were completed. The temperature loggers were retrieved and deployed.

08/14/2015

Wave meter retrieved and deployed.

Site Notes

Overall, it was similar to recent years and was mostly devoid of macroalgae. *Colpomenia* spp. were mostly found in gorgonians. At the high relief reef about 25 meters inshore along the transect tape, there were approximately nine large canopy-forming *Macrocystis pyrifera*, but no juveniles or small plants were located on this reef. Two adult *Sargassum horneri* were observed. These two individuals were very small, being less than 15 cm, but they were both reproductive. Juvenile *S. horneri* were rare and scattered around the transect tape. Just off the 100-meter end of the transect tape, there was a small high-density patch of juvenile *S. horneri*. There were several adult *Eisenia arborea* as well as a few juveniles.

The most common miscellaneous invertebrates recorded on RPCs were barnacles. *Corynactis californica* were not dense and appeared unhealthy. *Urticina* sp. were distinctly small, measuring less than 3 cm. Two *Panulirus interruptus* molts were observed.

While all sizes were observed, *Aplysia californica* were mostly small and unusually pale in color. Some of the *Bursa californica* observed were immense. *Kelletia kelletii* were more abundant than in past years and adults were very large. Small *Megastraea undosa* juveniles were abundant over most of the site. *Megathura crenulata* were rare overall and while most were smaller in size, the larger ones were more common in shallow areas.

The *Pachythyone rubra* observed were mostly single individuals. *Parastichopus parvimensis* were rare, but those observed were mostly large. *Patiria miniata* were low in abundance with only fifteen individuals observed for all sizes. Six *Pisaster giganteus* were observed, with five of these being similar in size. *Centrostephanus coronatus* juvenile recruits were abundant, like what we have observed at other warm water sites this year. There were an unusually high number of *Lytechinus*

anamesus juveniles. The site was dominated by small *Strongylocentrotus purpuratus*. *Strongylocentrotus franciscanus* adults seemed less abundant than in recent years. Both *S. purpuratus and S. franciscanus* juveniles were rare, similar to other sites this year.

Only one small *Alloclinus holderi* was observed. One Rainbow scorpionfish (*Scorpaenodes xyris)* and one medium-size California moray eel (*Gymnothorax mordax)* were observed.

Site #31, Keyhole, Anacapa Island

2015 status

Dominated by *Sargassum horneri*

Sampling Dates and Work Completed

06/25/2015

Fish transects, video transects, roving diver fish counts, fish size frequencies, 1 m^2 quadrats, 5 m^2 quadrats, band transects, random point contacts and size frequencies for *Strongylocentrotus purpuratus, Strongylocentrotus franciscanus, Lytechinus anamesus, Patiria miniata, Pisaster giganteus, Lithopoma undosum, Crassedoma giganteus, Tegula regina, Kelletia kelletii, Lophogorgia chilensis, Muricea californica, Muricea fruticosa,* and *Macrocystis pyrifera* were completed. The temperature loggers were retrieved and deployed.

Site Notes

Codium fragile were common and *Aplysia californica* were observed eating it. *Dictyoneurum* sp. was common. *Sargassum muticum* was mostly senesced as were *S. horneri* adults. *Hydroclathrus clathratus* (Swiss cheese algae), classified as "other brown algae", were common. There was little bare cobble present.

The most common miscellaneous invertebrates on RPCs were hydroids, barnacles and gorgonians. No *Tethya aurantia* were observed despite thorough searching. The *T. aurantia* may have been covered by *Sargassum horneri*, which blanketed many areas and was much more abundant than in previous years. All *Corynactis californica* observed looked unhealthy. Similarly, all *Eugorgia rubens* looked unhealthy and were fewer in abundance and smaller than last year. None of the *Lophogorgia chilensis* looked to be in exceptional health and most were overgrown with *S. horneri* and diatoms. *Simnia arcuata* (*Delonovolva aequalis*) were common on the *Lophogorgia chilensis* and some were distinctly small. All *Muricea fruticosa* observed looked healthy. The same gorgonian observed from previous years was still covered in *Parazoanthus* sp. Three *Panulirus interruptus* were observed.

At least seven *Aplysia vaccaria* were observed. *Crassedoma giganteum* were mostly medium to large individuals. Only twenty-one *C. giganteum* were measured for size frequencies. Many empty *Kelletia kelletii* shells were seen throughout. The site was so densely covered with juvenile *S. horneri,* the question was raised if *T. aurantia* were present and obscured or if they were not present. Along the same lines with the *T. aurantia* concern, searching for other species such as *Megastraea undosa* was more challenging than usual. The majority of *M. undosa* were very cryptic and covered with brown algae. It is likely that they were more abundant but may have been too well camouflaged to observe

with complete certainty. Some smaller *Tegula regina* individuals were observed and covered by brown algae.

Three to four *Henricia* sp. and one *Astropecten* sp. were observed. The *Parastichopus parvimensis* observed were mostly large. All sizes of *Patiria miniata* were present; they were tucked under rocks and looked thin. Two *Pisaster giganteus* and two *Pisaster ochraceus* were observed.

Several *Gymnothorax mordax* (California moray eel) juveniles were observed. Several juvenile *Scorpaena guttata* (California scorpionfish) were observed. *Alloclinus holderi* ranged from medium to large size classes. *Lythrypnus zebra* (zebra goby) was abundant and many were small in size. This was the largest number of *Lythrypnus zebra* David Kushner had ever observed. The *Paralabrax clathratus* juveniles recorded were last year's recruits and were all less than 10 cm. Tiny juvenile *Semicossyphus pulcher* were present ranging from 2 to 3 cm.

Site #32, East Fish Camp, Anacapa Island

2015 status

Dominated by *Ophiothrix spiculata* and *Strongylocentrotus purpuratus*

Sampling Dates and Work Completed

06/23/2015

Fish transects, video transects, roving diver fish counts, fish size frequencies, 1 m^2 quadrats, 5 m^2 quadrats, band transects, random point contacts and size frequencies for *Strongylocentrotus purpuratus, Strongylocentrotus franciscanus, Lytechinus anamesus, Patiria miniata, Lithopoma undosum, Crassedoma giganteus, Tegula regina, Megathura crenulata, Kelletia kelletii, Lophogorgia chilensis, Muricea californica, Muricea fruticosa, Tethya aurantia,* and *Macrocystis pyrifera* were completed. The temperature loggers were retrieved and deployed. Wave meters were retrieved and deployed.

09/30/2015

Fish transects, fish size frequencies, video transects, roving diver fish counts, and size frequencies for *Muricea fruticosa* and *Muricea californica* were completed.

Site Notes

The site remained dominated by echinoderms. There were more brown algae observed than since monitoring began. A total of ten adult/subadult *Macrocystis pyrifera* were present. There were a few patches of *M. pyrifera* juveniles and *Eisenia arborea* juveniles on high relief rocks. Most *Sargassum horneri* adults were senesced and only a few plants had reproductive receptacles. The juvenile *S. horneri* seemed to be fresh and just beginning to grow.

The most common miscellaneous invertebrates recorded on RPCs were hydroids.

Of the *Aplysia californica* observed, most were medium-sized although smaller-sized individuals were present. *Kelletia kelletii* were distinctly large, but small ones were present as well. Most of the *Megathura crenulata* observed were small. Approximately seven *Octopus* spp. were observed.

Ophiothrix spiculata seemed less abundant than last year, but further on the offshore of the transect tape (~20 meters). *Ophiothrix spiculata* were more abundant; they covered the entire reef. One juvenile *Parastichopus parvimensis* was observed. Juvenile *Centrostephanus coronatus* composed 50 – 75% of that species seen in 1-meter quadrats. Juvenile *Strongylocentrotus purpuratus* were rare; which seems to be similar to the other nearby sites.

Site #33, Black Sea Bass Reef, Anacapa Island

2015 status

State of Transition

Sampling Dates and Work Completed

07/30/2015

Fish transects, fish size frequencies, video transects, roving diver fish counts, 1 m^2 quadrats, 5 m^2 quadrats, band transects, random point contacts and size frequencies for *Strongylocentrotus purpuratus, Strongylocentrotus franciscanus, Lytechinus anamesus, Patiria miniata, Pisaster giganteus, Lithopoma undosum, Crassedoma giganteus, Tegula regina, Lophogorgia chilensis, Muricea californica, Muricea fruticosa, Tethya aurantia,* and *Macrocystis pyrifera* were completed. The temperature loggers were retrieved and deployed.

Site Notes

Codium fragile was present. Other green algae consisted of the filamentous type, mostly covered in diatoms. *Dictyota/Pachydictyon* were present and mostly small. Only three healthy reproductive *Sargassum horneri* adults observed, all other individuals were senescing and were not counted on band transects since they were either dead or dying. Articulated coralline was mostly thin. *Sargassum horneri* was covering much of the encrusting coralline on the first 30 meters of the transect tape. Miscellaneous plants covered much sampling area.

The most common miscellaneous invertebrates recorded on RPCs were hydroids. *Corynactis californica* and *Astrangia lajollaensis* were less abundant. The lessening in abundance of both species is most likely due to increased *S. horneri* cover. The *Lophogorgia chilensis* observed looked to be in unhealthy condition. *Urticina* spp. were mostly small. All sizes of *Panulirus interruptus* were present. This was the highest abundance observed, so much so that they were crammed into every sizeable crevice on the reef. The *P. interruptus* have dropped nearly all their eggs and only a few smaller individuals still had clutches present. This is unusually early for late July and likely due to warm water.

Only two *Kelletia kelletii* were observed. *Megastraea undosa* were mostly large. One *Octopus* spp. was observed.

Only a few *Henricia* sp. were observed. *Ophiothrix spiculata* were less abundant than last year and had less coverage and thinner patches. Every *Parastichopus parvimensis* observed was large. Only one *Patiria miniata* was observed. Only one *Pisaster giganteus* was observed. *Centrostephanus coronatus* were the most abundant urchin. *Strongylocentrotus purpuratus* and *Strongylocentrotus franciscanus* had the lowest abundance recorded for this site.

All size classes of *Lythrypnus dalli* were present with the large and small individuals being newly settled. All sizes of *Alloclinus holderi* were present. Several very small *Semicossyphus pulcher* were observed. There were at least nine small individuals that ranged from 1-2 cm. Two *Stereolepis gigas* (giant sea bass) were observed after all the fish count protocols were completed.

Site #34, Lighthouse, Anacapa Island

2015 status

Dominated by *Strongylocentrotus purpuratus*

Sampling Dates and Work Completed

06/24/2015

Fish transects, video transects, roving diver fish counts, fish size frequencies, 1 m^2 quadrats, 5 m^2 quadrats, band transects, random point contacts and size frequencies *Strongylocentrotus purpuratus, Strongylocentrotus franciscanus, Lytechinus anamesus, Patiria miniata, Pisaster giganteus, Lithopoma undosum, Crassedoma giganteus, Tegula regina, Megathura crenulata, Kelletia kelletii, Lophogorgia chilensis, Muricea californica, Muricea fruticosa, Tethya aurantia,* and *Macrocystis pyrifera* were completed. The temperature loggers were retrieved and deployed. Wave meter was retrieved and deployed.

09/30/2015

Fish transects, fish size frequencies, video transects, roving diver fish counts were completed.

Site Notes

The site was similar to past years. While it is dominated by *Strongylocentrotus purpuratus*, the densities are not extreme, and the tops of large rocks have a few *Macrocystis pyrifera and Eisenia arborea* plants on them. *Sargassum horneri* were more prevalent and *Aplysia vaccaria* were observed eating it. One juvenile *Cystoseira* spp. was growing epiphytically on a gorgonian. *S. horneri* was in distinct patches. There were old senesced plants of both species of *Sargassum* spp., with the juveniles just starting to grow.

The most common miscellaneous invertebrates recorded on RPCs were *Sagartia/Cactosoma* spp. and gorgonians. One small *Haliclona* sp. sponge was observed. *Muricea fruticosa* was present, with a total of ten to fifteen individuals observed.

There were *Aplysia californica* juveniles present. Two *A. vaccaria* were observed. *Crassedoma gigantea* were mostly large. At least ten *Octopus* spp. were observed.

About 2/3 of *Centrostephanus coronatus* observed on quadrats were juveniles. Three *Pisaster giganteus* were observed. One *Pisaster ochraceus* was observed. Few sea stars were present with only several *Patiria miniata* observed. Adult *Strongylocentrotus franciscanus* seemed less abundant than in recent years.

Fish observed outside of the RDFC or fish transects protocols include one juvenile (~4 cm) *Azurina hirundo* (Swallowtail damselfish), several *Heterodontus francisci* (horn sharks), and one *Myliobatis californica* (bat ray).

Site #35, Webster's Arch, Santa Barbara Island

2015 status

Kelp forest

Sampling Dates and Work Completed

01/28/2015

Wave meter were retrieved and deployed. 1 old fishing weight was found.

05/14/2015

Fish transects, video transects, roving diver fish counts, fish size frequencies, 1 m^2 quadrats, 5 m^2 quadrats, band transects, random point contacts and size frequencies for *Patiria miniata, Pisaster giganteus, Lithopoma undosum, Lithopoma gibberosum, Crassedoma giganteus, Tegula regina, Megathura crenulata, Kelletia kelletii, Lophogorgia chilensis, Muricea californica, Tethya aurantia* and *Macrocystis pyrifera* were completed. The temperature loggers were retrieved and deployed.

05/26/2015

Fish transects, fish size frequencies, roving diver fish counts, size frequencies for *Strongylocentrotus purpuratus, Strongylocentrotus franciscanus* and *Lytechinus anamesus* were completed.

10/13/2015

Wave meter was deployed.

Site Notes

It has noticeably changed since last year. Algal cover increased. There were more *Macrocystis pyrifera*. *Codium setchellii* were in high abundance and have never been seen at any site since at least 1990. Nearly all of *C. setchellii* was covered with diatoms and both were observed on RPCs. Only a few adult and juvenile *Sargassum horneri* plants were observed. Miscellaneous plants were highly abundant and were located primarily on top of the *C. setchellii.*

The most common miscellaneous invertebrates recorded on RPCs were hydroids. Only twelve *Tethya aurantia* were found. Similar to past years, *Spheciospongia confoederata* (gray moon sponge) were common. *Myxicola* sp. continued to decline in abundance and were rare. Encrusting tunicates were common.

Aplysia californica were mostly medium sized and looked greenish in color. *Crassedoma gigantea* were mostly small. There were very few *Megathura crenulata* present and those that were observed were large and looked unhealthy.

Only a few *Parastichopus parvimensis* were observed. Several *Henricia* sp. were observed. *Ophiothrix spiculata* were less abundant than the last years. While *O. spiculata* were still present in areas of moderate cover in the low-lying areas, they were small and appeared to be much lower in density overall. *Patiria miniata* were mostly large. One *Pisaster giganteus* was observed. The most obvious changes were the decrease in *Strongylocentrotus purpuratus* and *Ophiothrix spiculata* abundance. Tiny juvenile *Centrostephanus coronatus* were present in small crevices and holes. *Lytechinus anamesus* were very small and only several were observed.

Notes from 1/28/2015: *Codium setchellii* were abundant while only 2 *Codium fragile* were observed. Several *Dictyota/Pachydictyon* were observed. Adult *Eisenia arborea* were common. Three new *Macrocystis pyrifera* adults were common and new since May 2014. One reproductive *Sargassum horneri* adult was observed. *Laurencia* sp. were present near 0-meter end. Filamentous red algae were common. Diatoms covered high spots. *Corynactis californica* were common near the 100 m end. Several *Muricea californica* and *Muricea fruticosa* had epiphytes. *Megathura crenulata* were medium sized. Many *Tegula regina* of all sizes were observed. 12 medium-sized *Patiria miniata* were observed. Most *Strongylocentrotus purpuratus* were near the 0-meter end. *Strongylocentrotus franciscanus* were common in holes and crevices.

Site #36, Graveyard Canyon, Santa Barbara Island

2015 status

Kelp forest

Sampling Dates and Work Completed

01/28/2015

Wave meter was retrieved and deployed.

05/12/2015

Fish transects, video transects, fish size frequencies, roving diver fish counts, 1 m^2 quadrats, 5 m^2 quadrats, band transects, random point contacts and size frequencies for *Strongylocentrotus purpuratus, Strongylocentrotus franciscanus, Patiria miniata, Pisaster giganteus, Lithopoma undosum, Crassedoma giganteus, Lophogorgia chilensis, Muricea californica, Tethya aurantia* and *Macrocystis pyrifera* were completed. The temperature loggers were retrieved and deployed.

10/13/2015

Wave meter was deployed.

Site Notes

This site continued to change dramatically from previous years. There are very few scoured surfaces present. *Ophiothrix spiculata* and *Desmarestia* sp. were noticeably rare. *Macrocystis pyrifera* adults and subadults were present throughout the site. *Cystoseira* sp. were also present throughout, along with several other species of brown algae (*Zonaria* sp.*, Dictyopteris* sp.*, Sargassum muticum, Sargassum horneri, Colpomenia* spp*). Macrocystis pyrifera* were more abundant than when we began monitoring in 2005, though 2014 had higher abundances. *Sargassum muticum* and *Cystoseira* spp. were the most abundant algae. All of the *S. horneri* were senescing so our density estimates are likely much lower than their peak abundance for the adult and juvenile algae. Similar to Arch Point (and our survey dive in landing cove) *S. muticum* was in high abundance, more than David Kushner has observed since he began working for the park in 1990. There was also more *Cystoseira* spp. than we have observed since 2005. *Codium* spp. was rare both for *C. setchellii & C. fragile*. No *Desmarestia* spp. less than 10 cm were observed. One adult *Laminaria farlowii* was observed. *Dictyopteris* sp. were present in moderate numbers. On the second visit to the site, it was a mature kelp forest with no canopy cover. *Sargassum horneri* and *Dictyota/Pachydictyon* were the dominant understory algae. The *Macrocystis pyrifera* was tattered at the surface. There was not as much *S.*

horneri as expected, it was only scattered around. The plants were mostly small with most being under 20 cm.

The most common miscellaneous invertebrates recorded on RPCs were *Sagartia/ Cactosoma.* All sizes of *Tethya aurantia* were present. *Corynactis californica* were small, unhealthy looking and very rare. Most *Lophogorgia chilensis* and *Muricea californica* appeared either unhealthy and/or dying and covered with algae/invertebrates/diatoms. Patches of *Sagartia/ Cactosoma* sp. were observed in the reef and sand. *Urticina coriacea* were all small. Two large *Panulirus interruptus* (one legal and one nearly legal size) were observed. Inshore of the site there were at least fifteen large *P. interruptus*, some very large individuals were estimated at 10+ pounds. *Diaperoecia californica* were rare. Large *Panulirus interruptus* molts were common on the second visit.

A single large *Aplysia californica* and two <5 cm were observed. *Cypraea spadicea* were common in crevices; however, there was little crevice habitat available. One fresh 33 mm *Haliotis* shell was found. One fresh 43 mm *Haliotis corrugata* shell was found. One small *Kelletia kelletii* was observed. All sizes of *Megastraea undosa* including several large individuals were present.

Ophiothrix spiculata were scattered throughout the site in crevice habitat. *Parastichopus parvimensis* were common overall, but still less abundant than at many other Marine Protected Areas. One *Parastichopus parvimensis* was observed with lesions, which could have been signs of wasting disease. Two juvenile *Pisaster giganteus* were observed. *Centrostephanus coronatus* were abundant only in the crevice habitat. There was a large *C. coronatus* recruitment event recently and many will outgrow the crevices they are in due to a lack of good habitat present. *Strongylocentrotus franciscanus* and *Strongylocentrotus purpuratus* juveniles were noticeably rare and all individuals were only located in crevice habitat. *S. purpuratus* and *S. franciscanus* were rare and the most abundant urchin was *Centrostephanus coronatus*.

One *Lythrypnus dalli* was observed. One *Alloclinus holderi* was observed. Small adult *Halichoeres semicinctus* and *Paralabrax clathratus* were all abundant, the most we have observed at this site. Large *Paralabrax clathratus* (kelp bass) were common. The small *P. clathratus* individuals fell within two size classes (~7-8 cm and ~15-17 cm) and were in high abundance. Several small YOY for *Semicossyphus pulcher* and *Hypsypops rubicundus* were observed.

Notes from 1/28/2015: David Kushner and Stephen Whittaker dove to install wave meter #64 near the 0-meter bolt next to the temperature logger. The lead line was not attached to the 0-meter bolt. There were some notable changes at the site since our last visit. It was very much like Southeast Sea Lion Rookery and most of the rocky bottom had large subadult or small adult *Macrocystis pyrifera* with the highest amount of large *Sargassum horneri* mixed in that we have observed. Much of the *S. horneri* was up to 2 meters tall. *Cystoseira* sp. was common. *Cystoseira* sp. and *Dictyota/Pachydictyon* sp. cover was estimated at about 50%. David Kushner estimated a 75% decline in *Ophiothrix spiculata* which was mostly present on 0-25 m of reef. The sand patch between 20-40 meters was notably smaller by an estimated 5 meters. Sea urchins were rare. Several legal sized *Panulirus interruptus* were observed within the transect area and at least 10 more were seen nearby. No sea stars other than one *Henricia* sp. were observed. Kelp bass were moderately

abundant, and all sizes and the recent recruitment were noticeable. Señoritas were abundant and most were 5-11 cm. Halfmoon were abundant. Several juvenile garibaldi were observed.

Site #37, Southeast Reef, Santa Barbara Island

2015 status

Mature kelp forest

Sampling Dates and Work Completed

01/28/2015

Wave meter was retrieved and deployed.

07/14/2015

Fish transects, fish size frequencies, video transects, roving diver fish counts, 1 m^2 quadrats, 5 m^2 quadrats, band transects, random point contacts and size frequencies for *Strongylocentrotus purpuratus, Strongylocentrotus franciscanus, Lytechinus anamesus, Pisaster giganteus, Lithopoma undosum, Lithopoma gibberosum, Crassedoma giganteus, Tegula regina, Megathura crenulata, Kelletia kelletii, Lophogorgia chilensis, Muricea californica, Tethya aurantia,* and *Macrocystis pyrifera* were completed. The temperature loggers were retrieved and deployed.

10/13/2015

Wave meters we retrieved and deployed.

Site Notes

It was a kelp forest with an understory of mixed red and brown algae, mostly of smaller species. While most of the kelp plants were not reaching the surface, there was a thick canopy of *Macrocystis pyrifera*. The kelp was all healthy with few bryozoans and hydroids growing epiphytically on the kelp although it looked like it was growing rapidly. Most of the *M. pyrifera* plants were of all sizes with deeper plants being a bit larger. Overall the *M. pyrifera* looks very healthy. *Codium setchellii* and *Codium fragile* were present. *Dictyota/Pachydictyon* as well as *Dictyopteris* sp. were common. *Sargassum muticum* were mostly senescing and more abundant than has been observed previously at this site. *Sargassum horneri* were in small, high-density patches of juveniles and only several small adult plants were present. This is the highest abundance of *S. horneri* that we have ever seen here. Red algae were diverse and abundant. Other red algae were composed primarily of filamentous reds and were common. Miscellaneous plants were covering much of the 0-70 meter along the transect tape.

The most common miscellaneous invertebrate recorded on RPCs were hydroids. Other sponges were common and mostly consisted of an encrusting red sponge. *Lophogorgia chilensis* looked unhealthy and was covered in diatoms with several dead individuals observed. *Sagartia/Cactosoma spp*. were less abundant than in previous years. One *Cancer spp.* molt was observed. *Panulirus interruptus* were common and the 'crack' had about 100 individuals with all sizes present. One medium-sized lobster was observed trying to eat an *Aplysia californica*. Several minutes later, the same lobster was eating an old, dead urchin test. Tunicates were less abundant at the shallow end than when the site was established.

Crassedoma gigantea were mostly small and were in high abundance. Five *Lithopoma gibberosa* were observed. Some smaller *Tegula regina* individuals were present.

All sizes of *Parastichopus parvimensis* were present. Only one *Patiria miniata* was found in an ARM. At least two *Pisaster giganteus* were observed. Approximately 90% of the *C. coronatus* in quadrats were recent recruits. *Lytechinus anamesus* were all small (< 10 mm).

All sizes of *Alloclinus holderi* were present. One *Balistes polylepis* (finescale triggerfish) was observed. Two *Azurina hirundo* (swallowtail damselfish) were observed. At least two *Gymnothorax mordax* (California moray eel) were present. Juvenile *Chromis punctipinnis* were observed. On the second visit, it continued to look healthy as a mature kelp forest with minimal senescence of *Macrocystis pyrifera* or bryozoan growth. Juvenile *Hypsypops rubicundus* were in high abundance as well as *Paralabrax clathratus* ranging 15-25 cm being moderately abundant.

Notes from 1/28/2015: The site was about 60% mature kelp forest. The first 40 meters of shallow area had little *Macrocystis pyrifera* and was more scoured than the 2014 sampling. The deeper areas looked similar. Only one *Sargassum horneri* plant was observed at about 4 feet, there may have been more but we did not see them. Similar to other visits, large *Panulirus interruptus* were moderately abundant. The large crevice on the reef off the transect had hundreds of small lobster and other ledges had very large *P. interruptus*. No sea stars were found, though a low search effort was used. Small adult *Chromis punctipinnis* were the most abundant I have ever observed. Garibaldi juveniles were notably abundant small kelp bass and sheephead of all sizes were abundant. Only 2 ARMs were observed and both were severely damaged. We did not have time to repair them.

Appendix E. 1 Meter Quadrat Data

Figures E-1 through E-24 show the one meter square quadrat data.

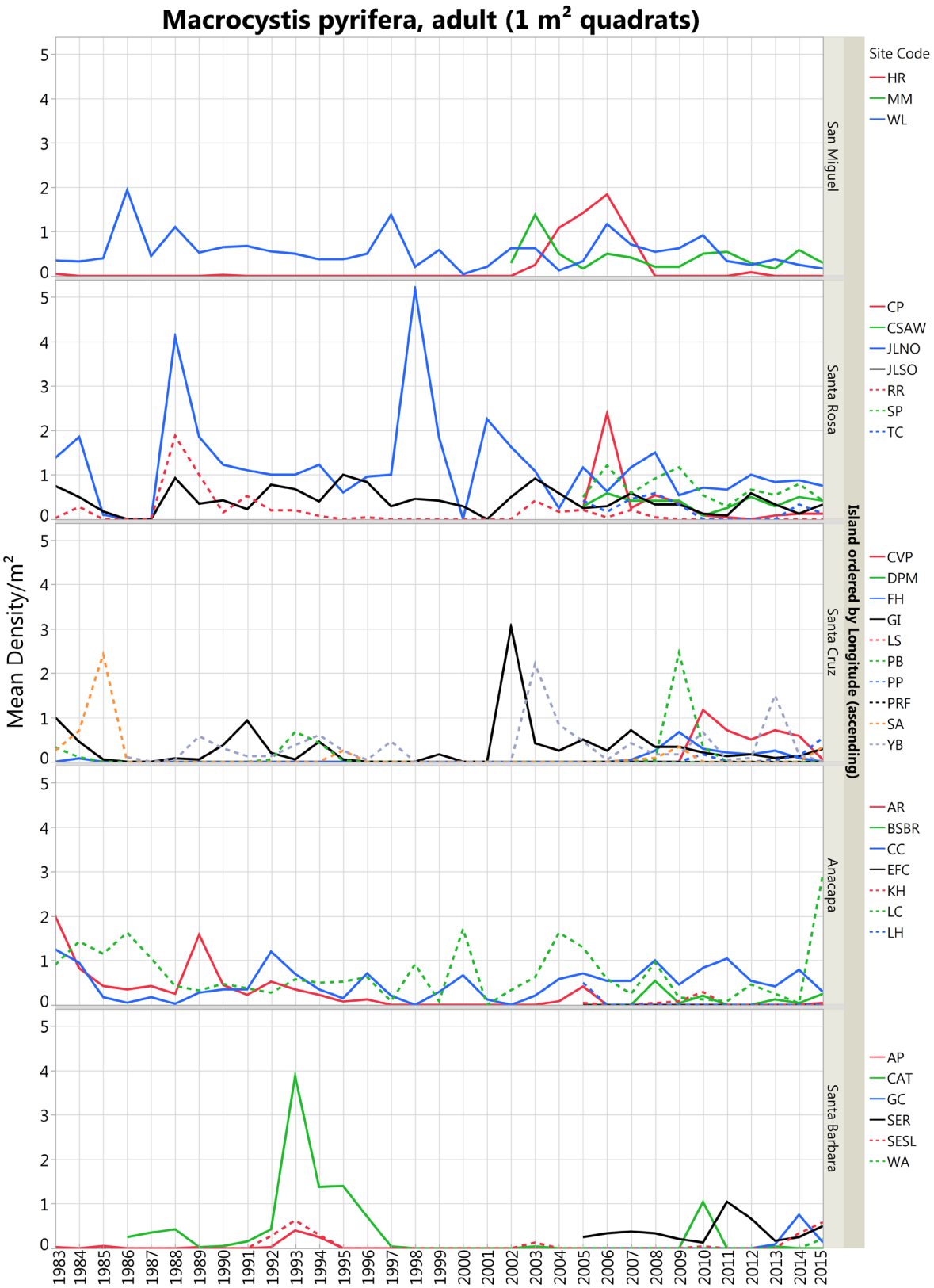


Figure E-1. Mean density of adult *Macrocystis pyrifera* by site and island at Channel Islands National Park between 1983 and 2015.

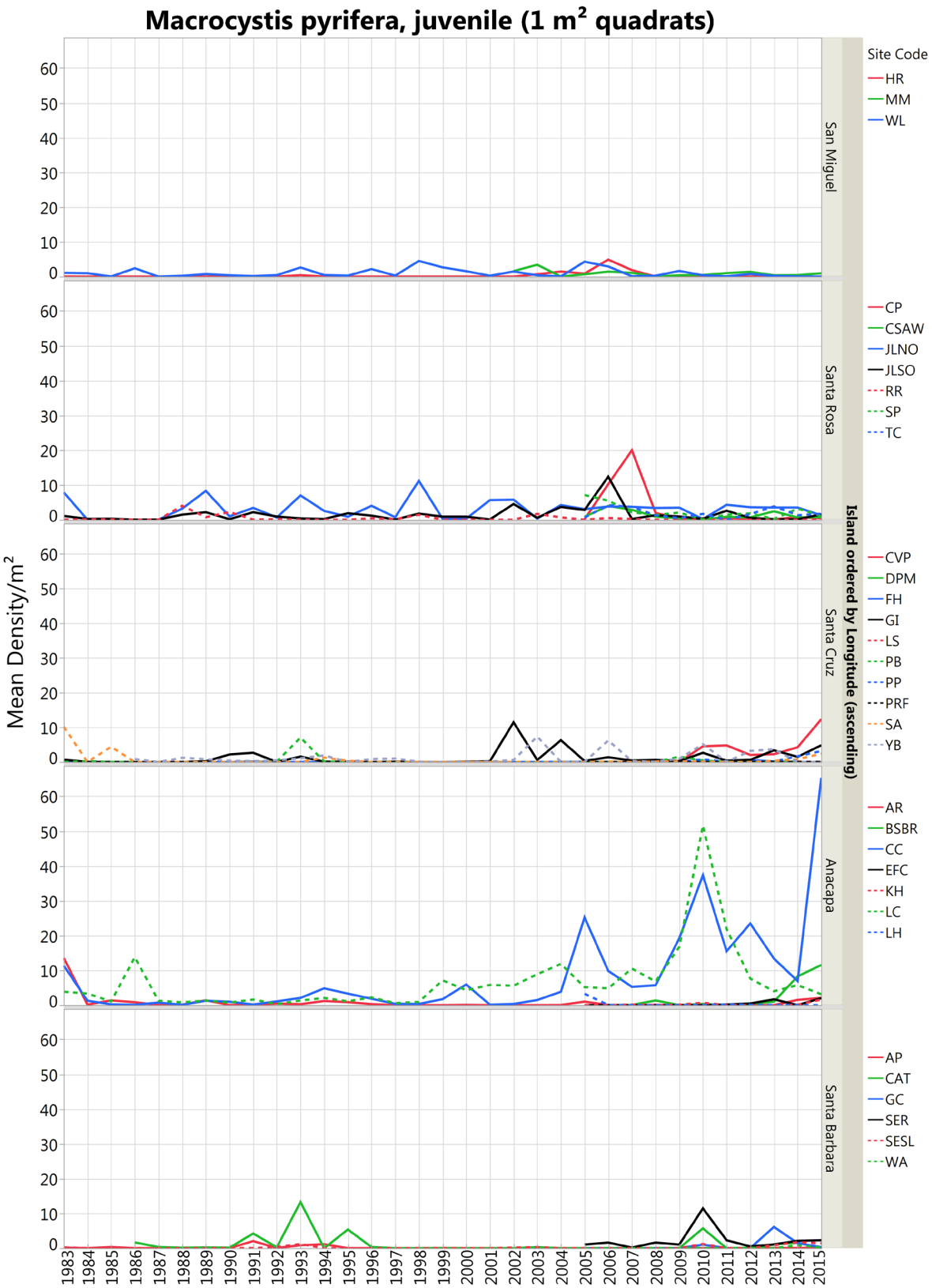


Figure E-2. Mean density of juvenile Macrocystis pyrifera by site and island at Channel Islands National Park between 1983 and 2015.

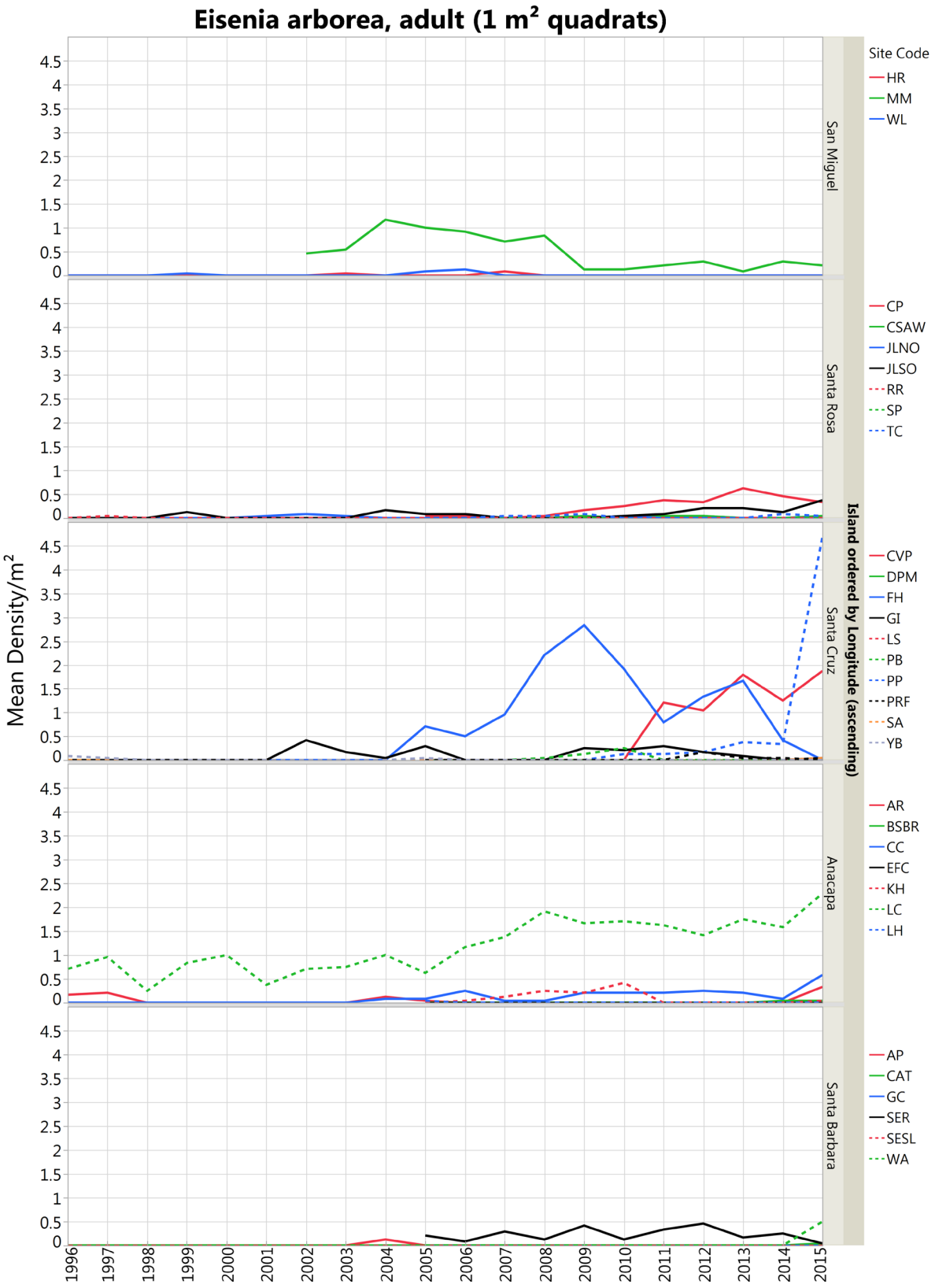


Figure E-3. Mean density of adult Eisenia arborea by site and island at Channel Islands National Park between 1996 and 2015.

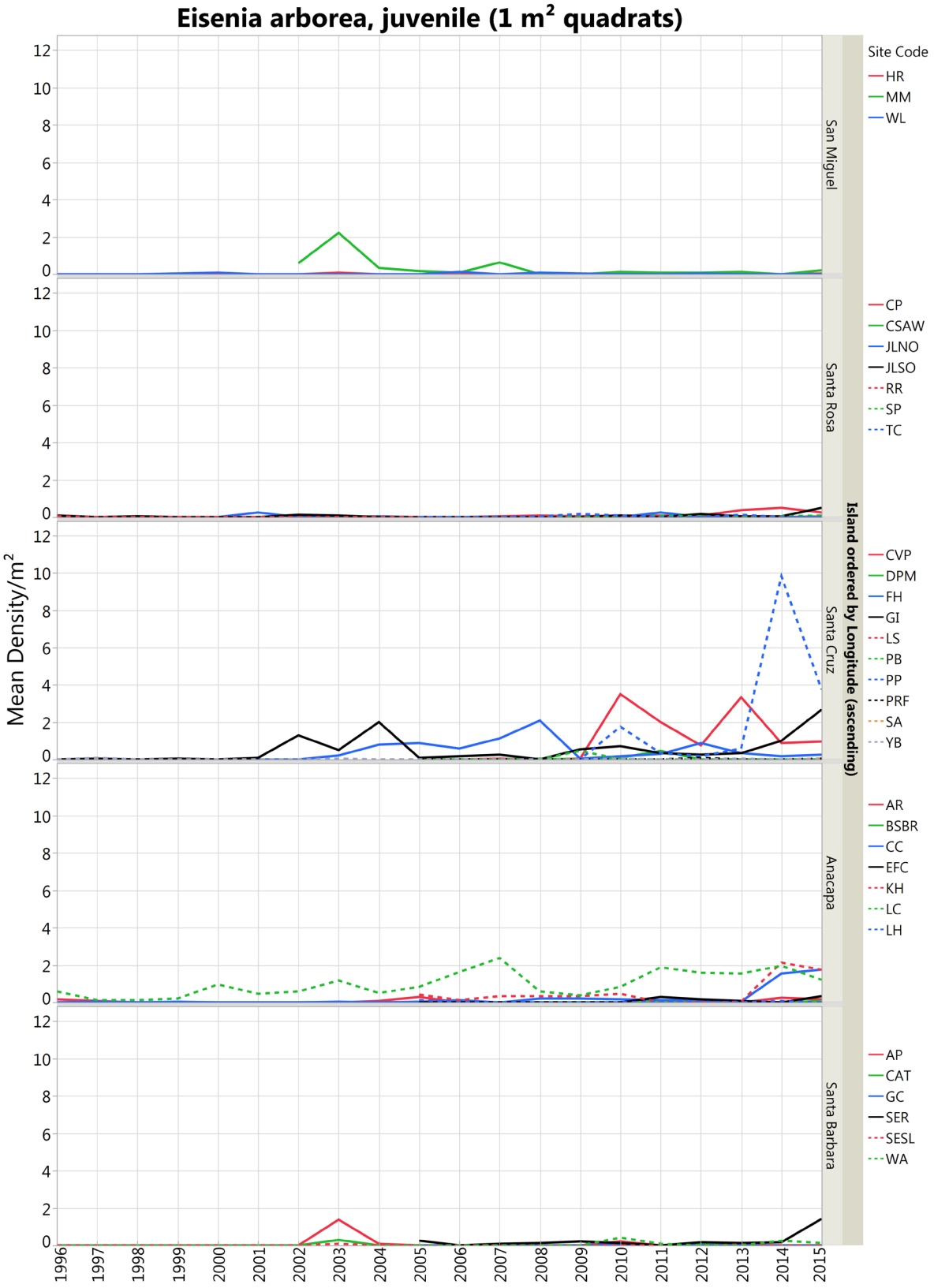


Figure E-4. Mean density of juvenile Eisenia arborea by site and island at Channel Islands National Park between 1996 and 2015.

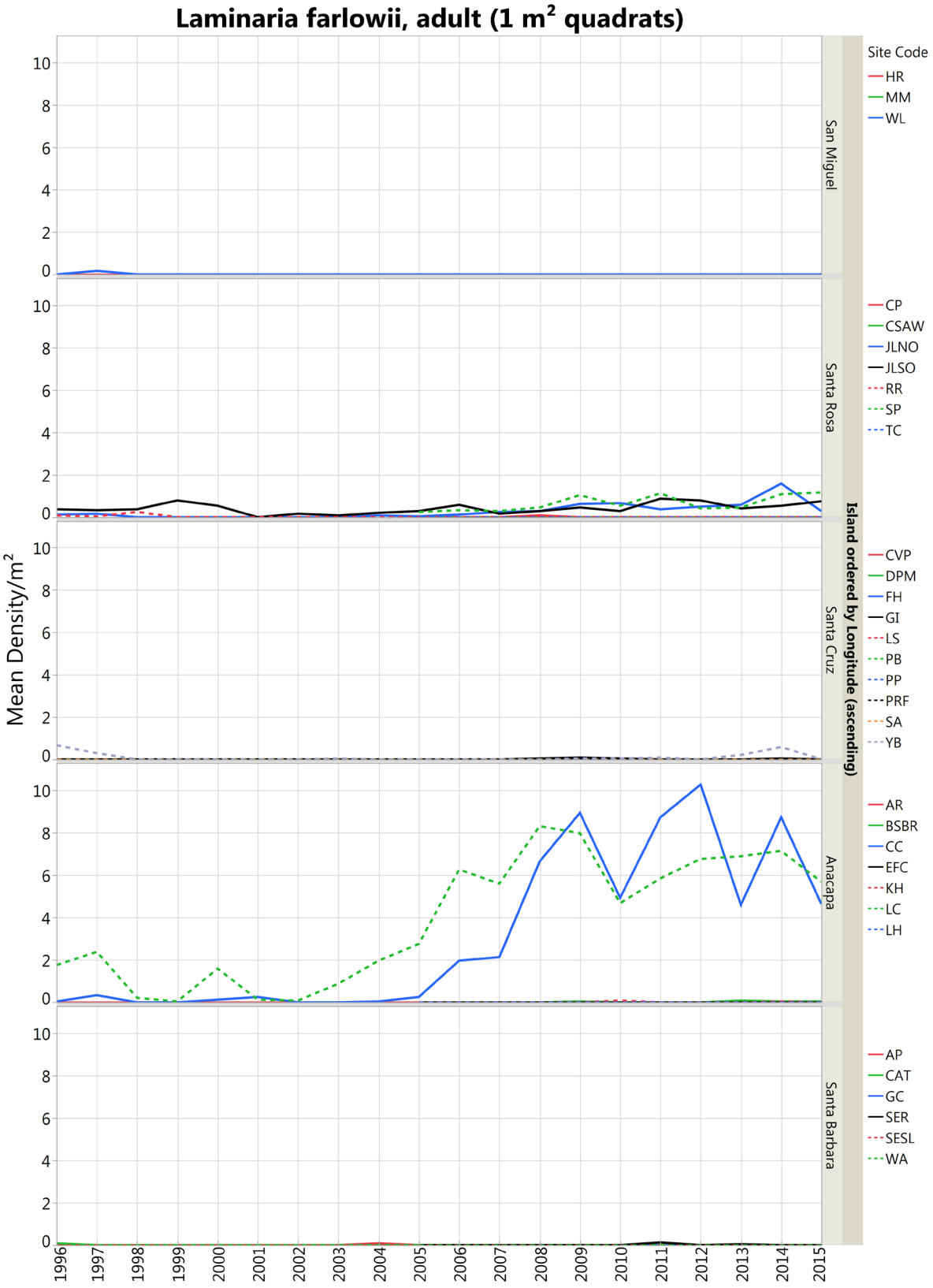


Figure E-5. Mean density of adult Laminaria farlowii by site and island at Channel Islands National Park between 1996 and 2015.

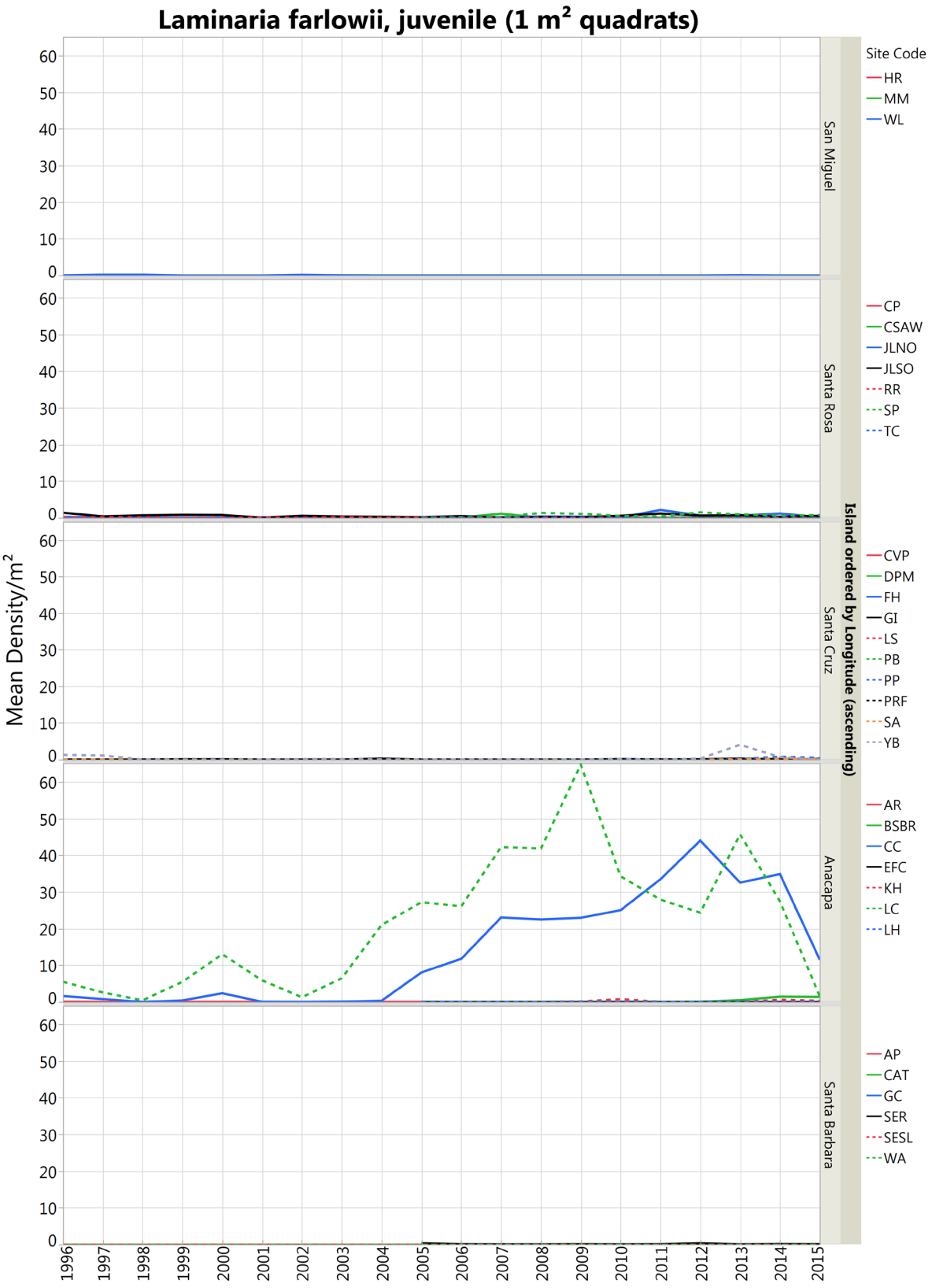


Figure E-6. Mean density of juvenile Laminaria farlowii by site and island at Channel Islands National Park between 1996 and 2015.

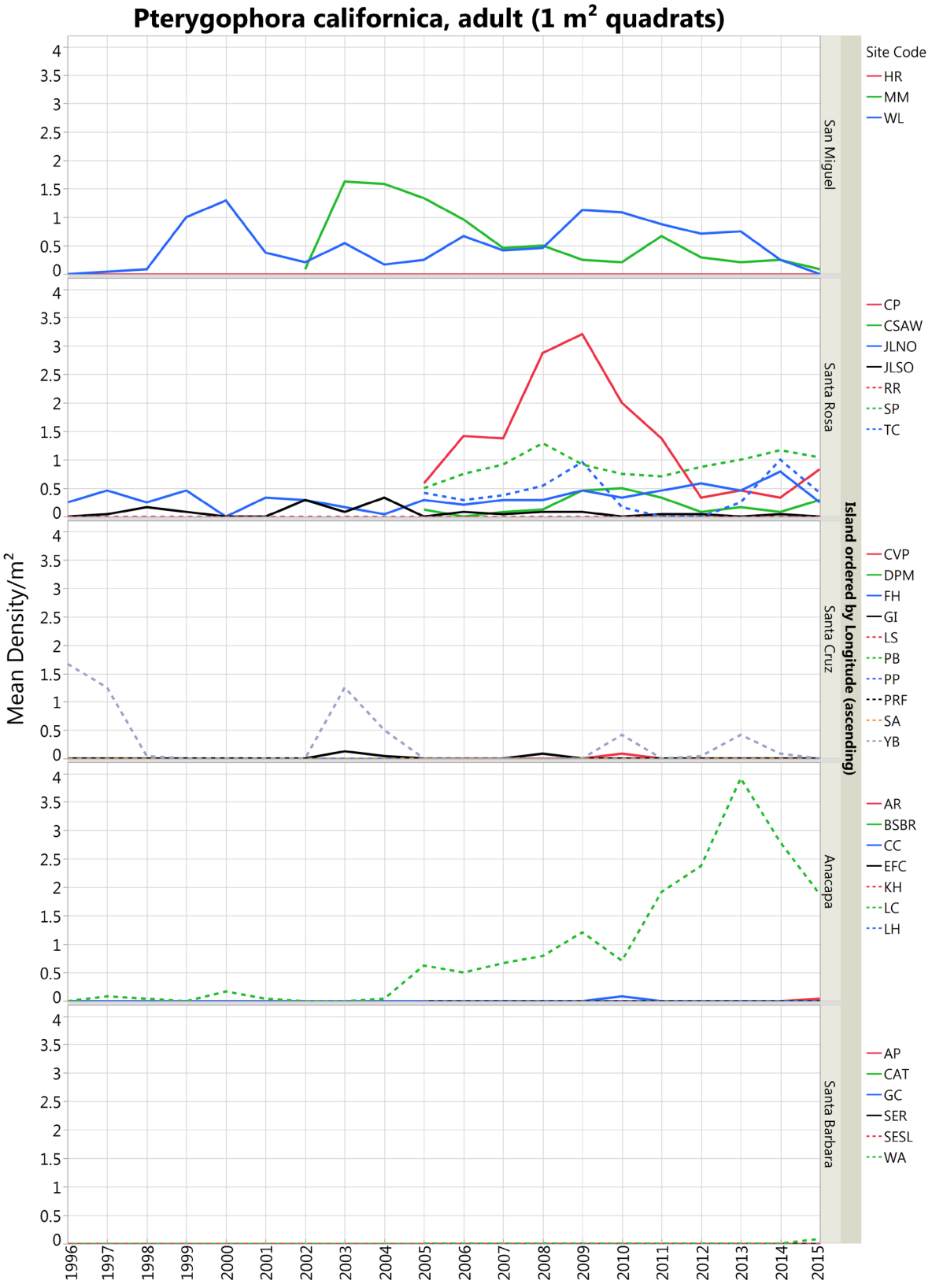


Figure E-7. Mean density of adult Pterygophora californica by site and island at Channel Islands National Park between 1996 and 2015.

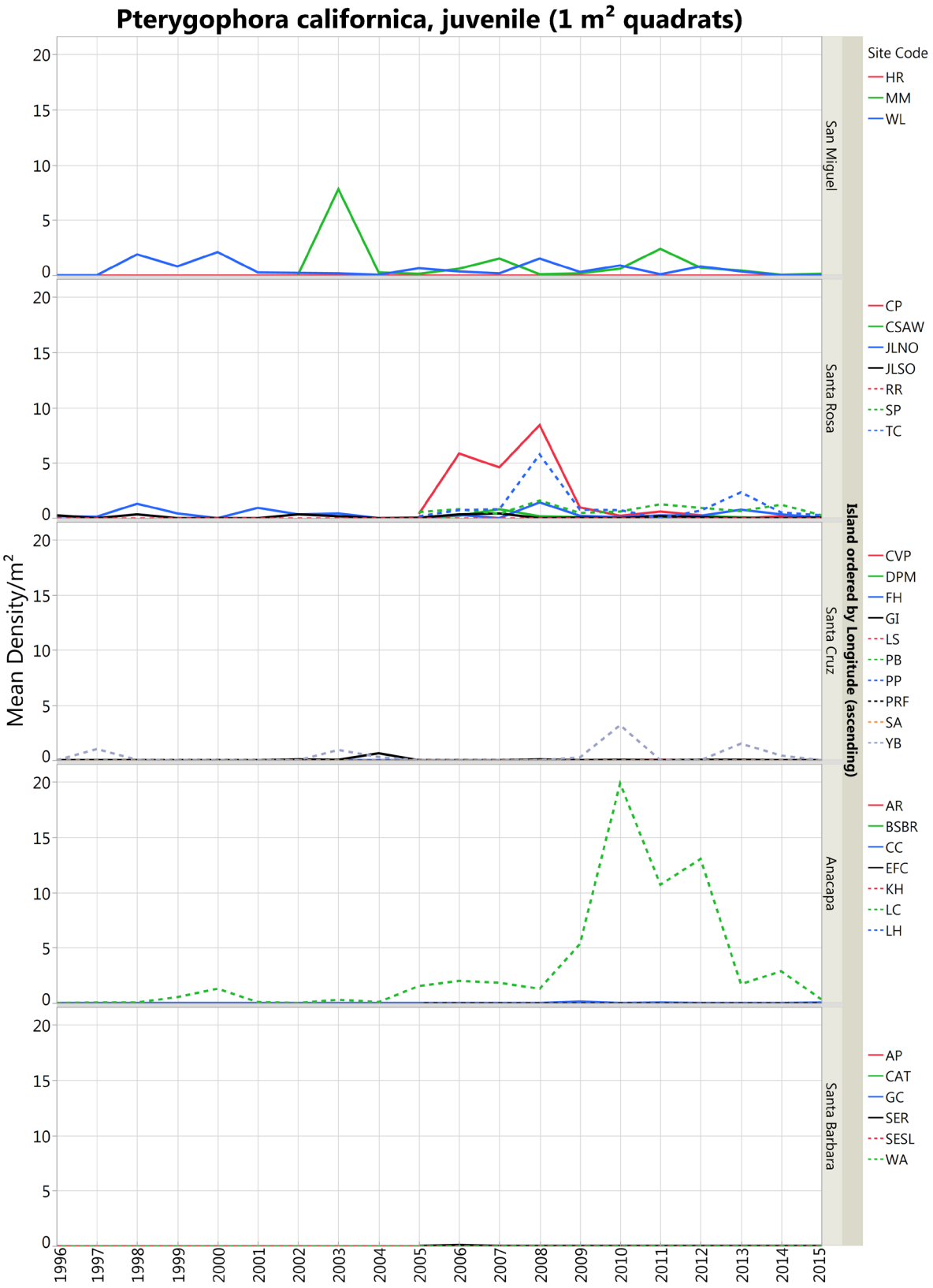


Figure E-8. Mean density of juvenile Pterygophora californica by site and island at Channel Islands National Park between 1996 and 2015.

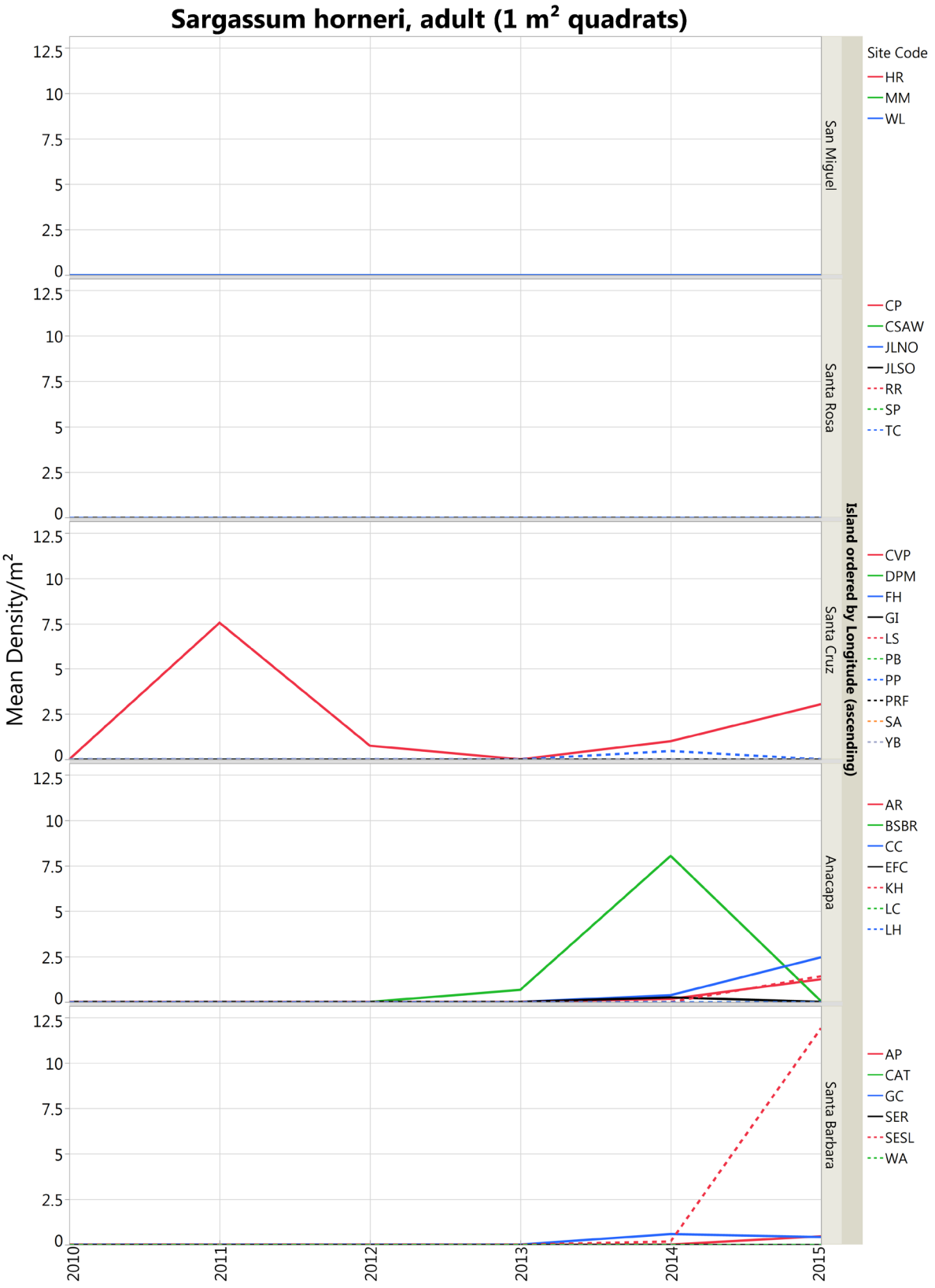


Figure E-9. Mean density of adult Sargassum horneri by site and island at Channel Islands National Park between 2010 and 2015.

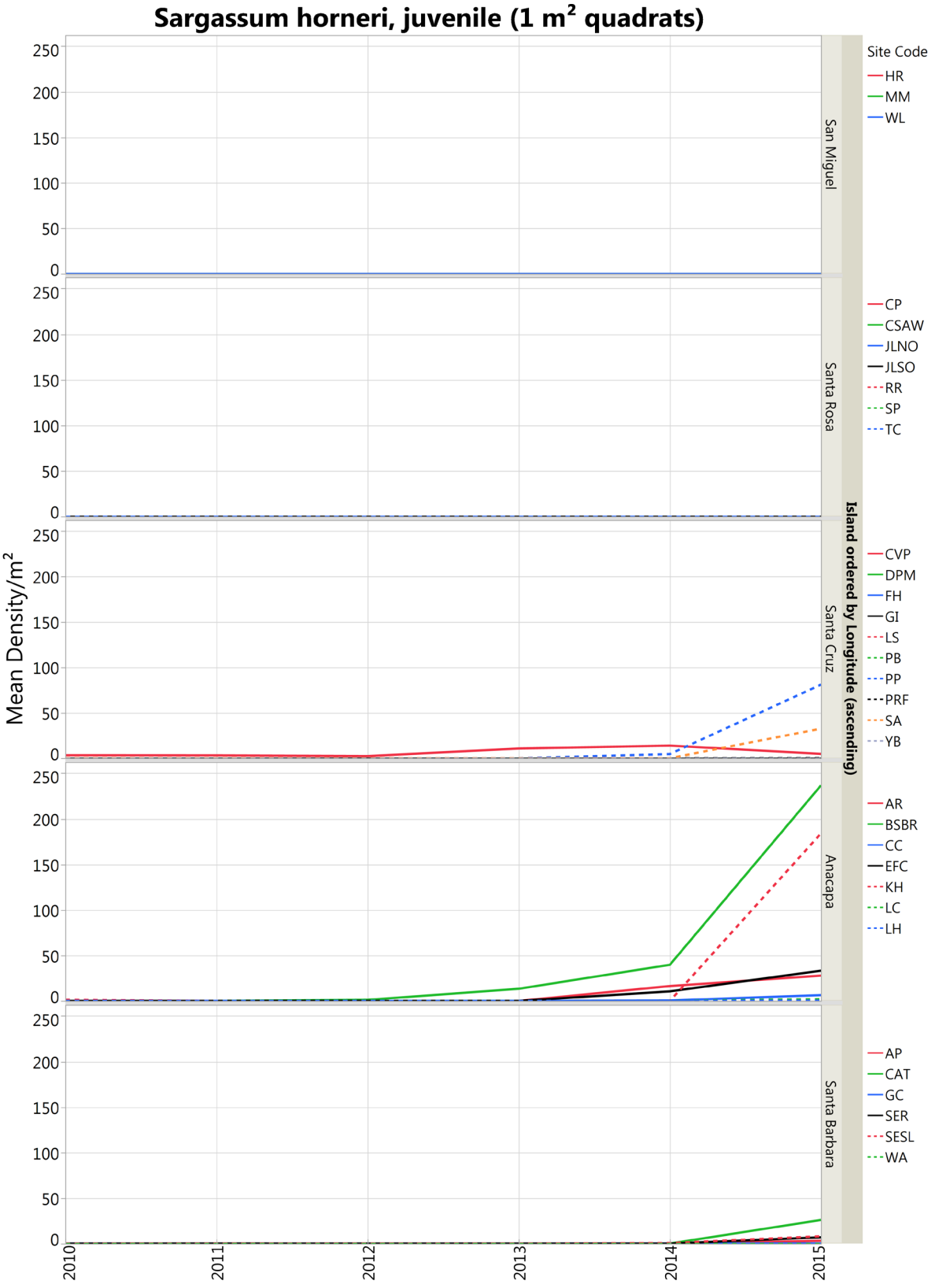


Figure E-10. Mean density of juvenile Sargassum horneri by site and island at Channel Islands National Park between 2010 and 2015.

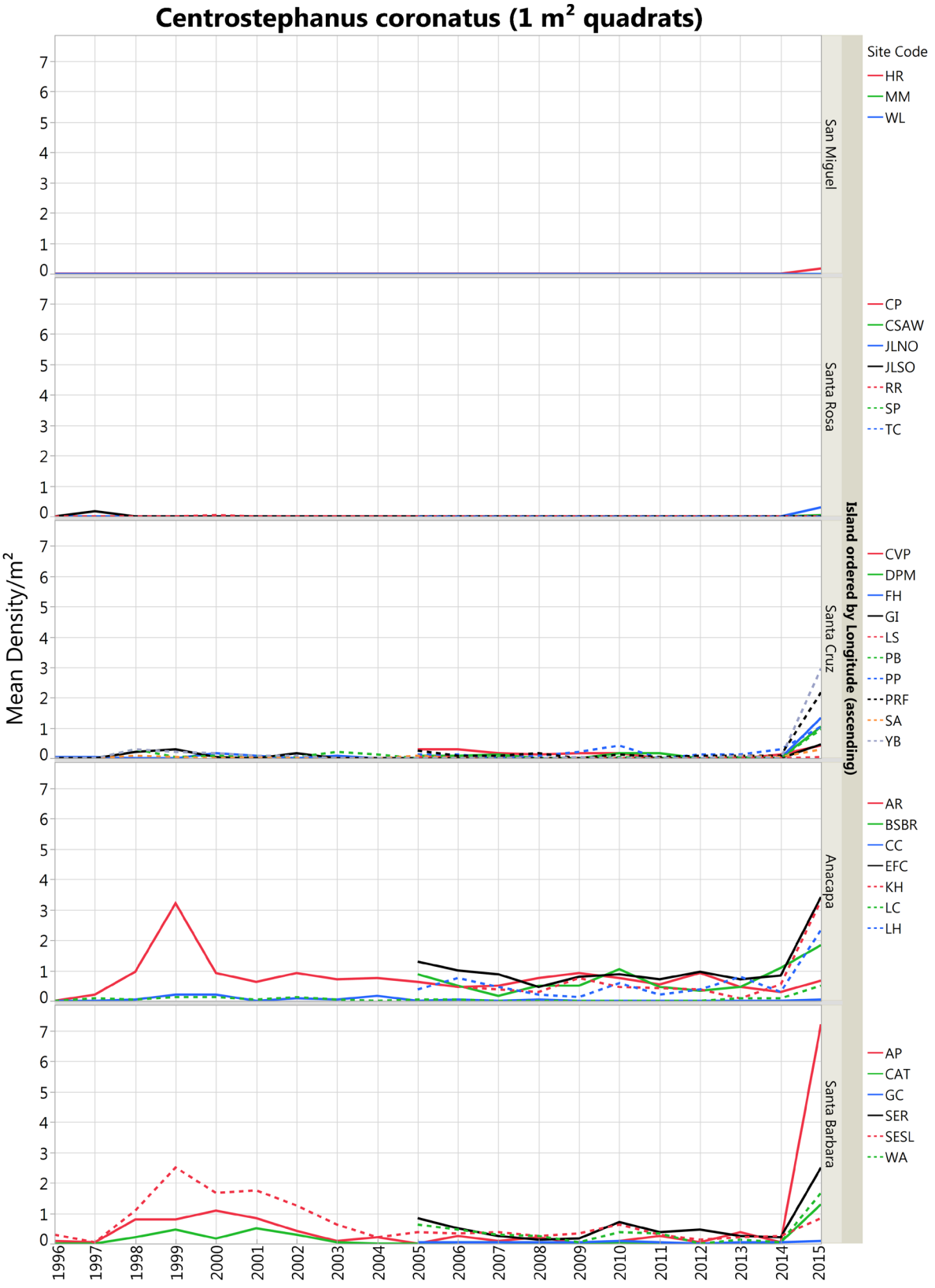


Figure E-11. Mean density of Centrostephanus coronatus by site and island at Channel Islands National Park between 1996 and 2015.

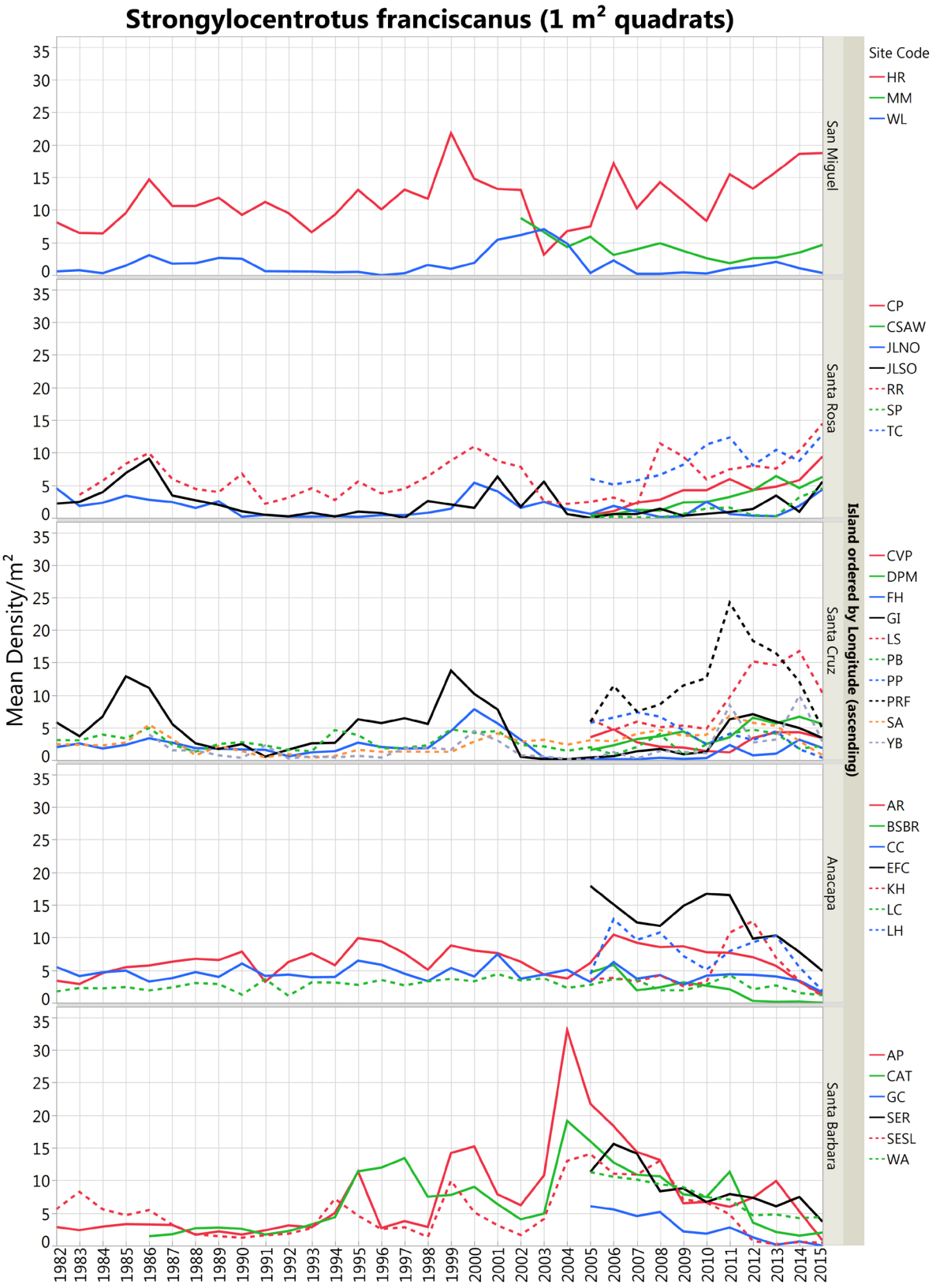


Figure E-12. Mean density of Strongylocentrotus franciscanus by site and island at Channel Islands National Park between 1982 and 2015.

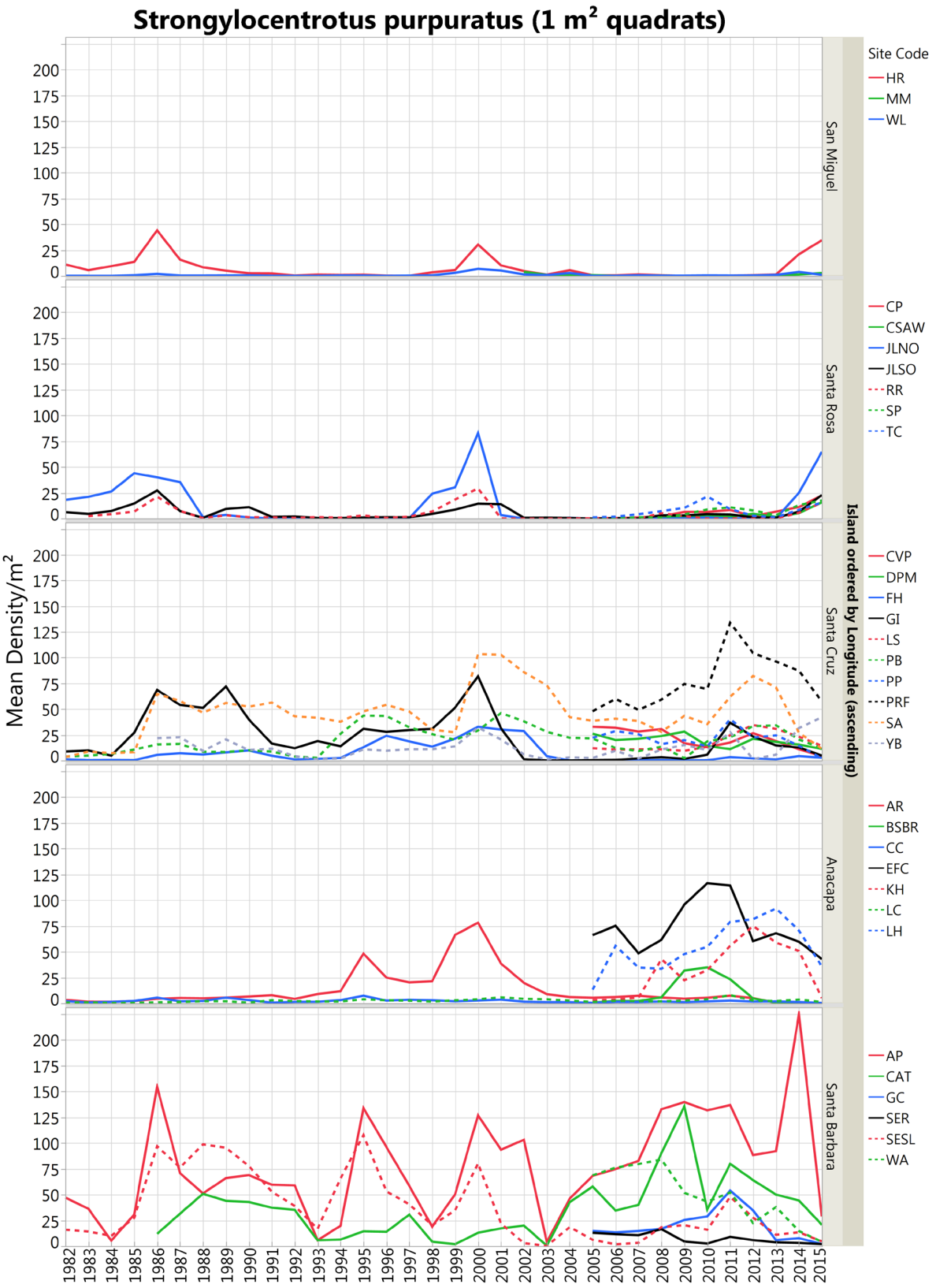


Figure E-13. Mean density of Strongylocentrotus purpuratus by site and island at Channel Islands National Park between 1982 and 2015.

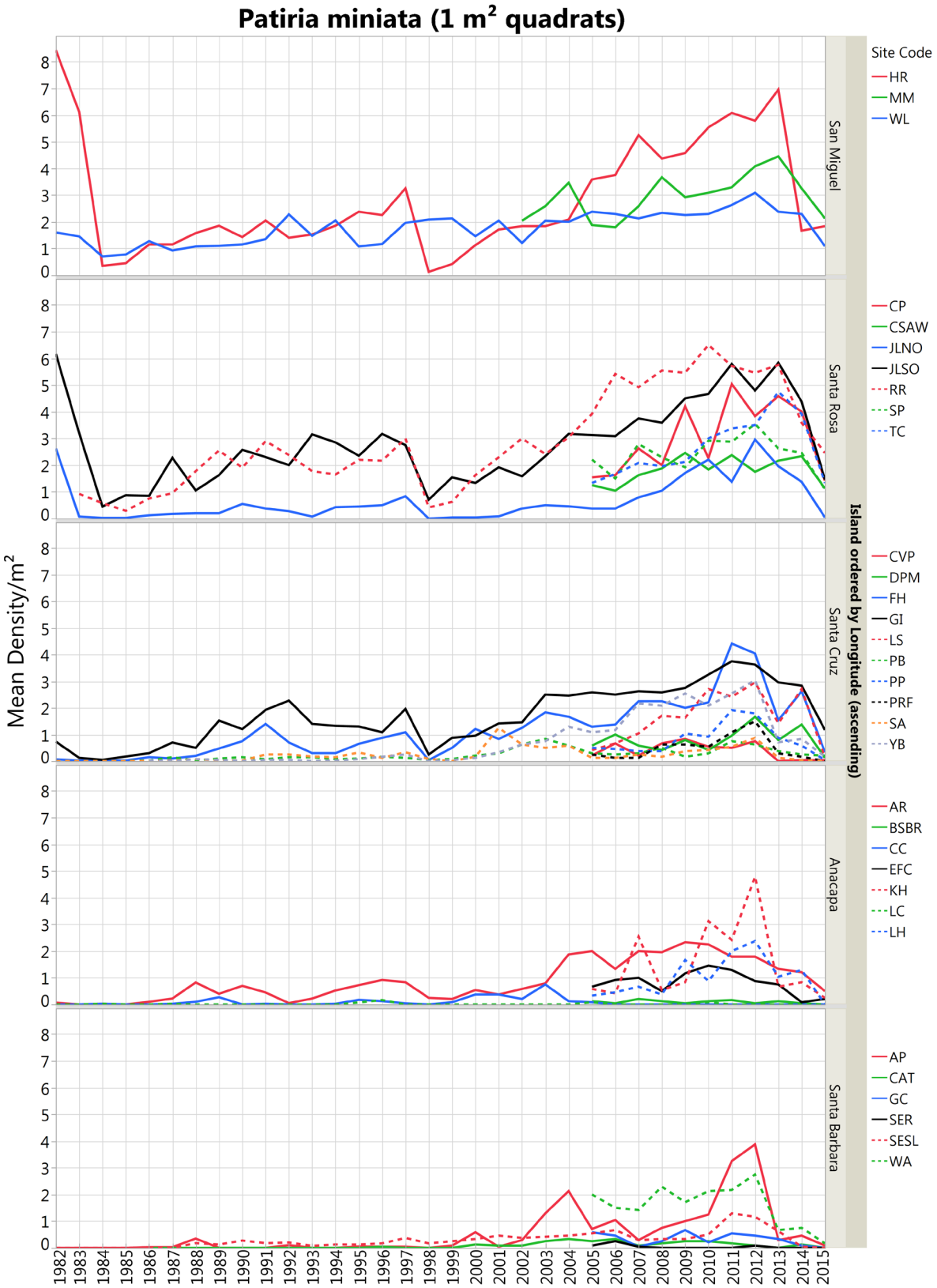


Figure E-14. Mean density of Patiria miniata by site and island at Channel Islands National Park between 1982 and 2015.

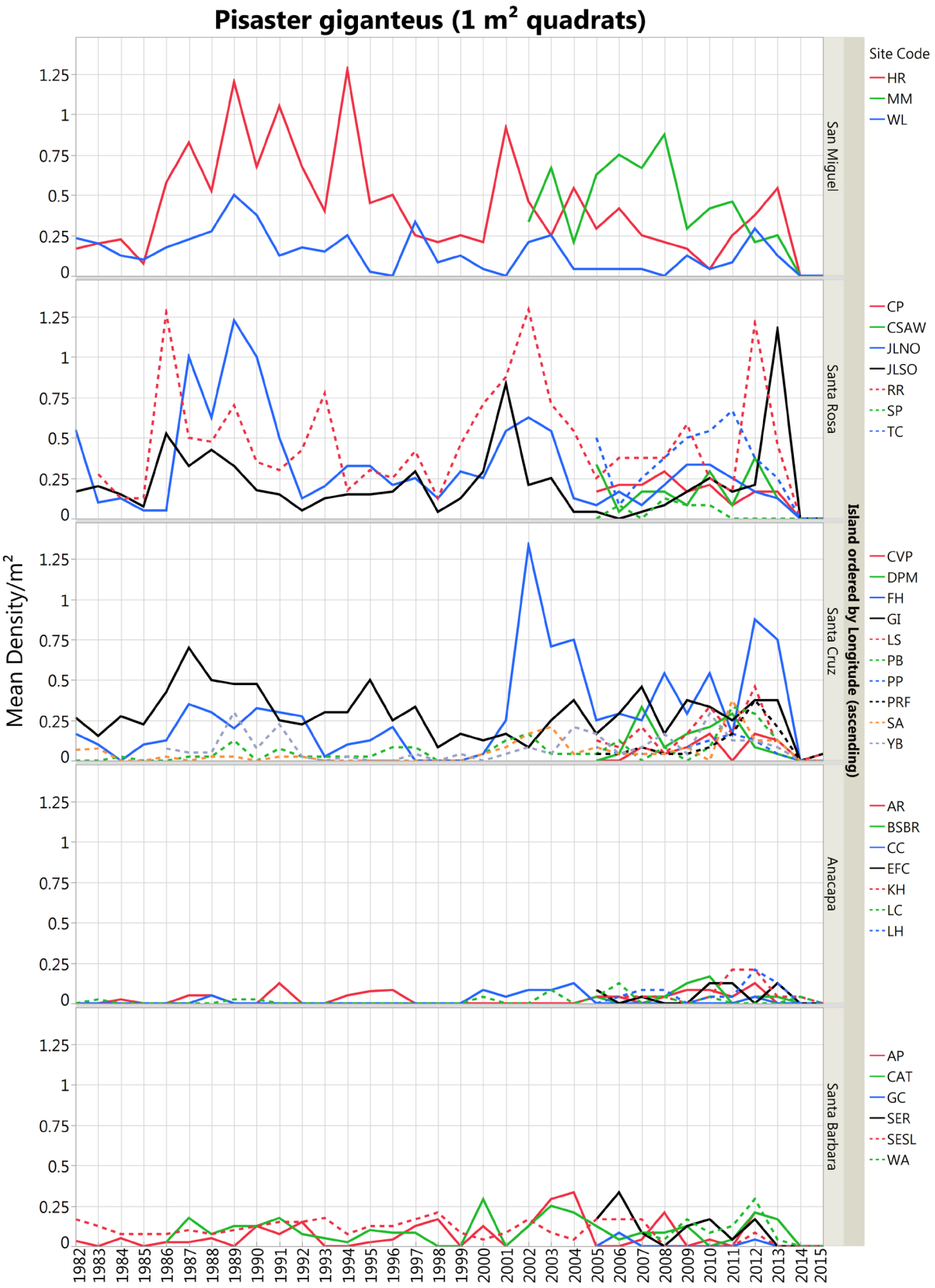


Figure E-15. Mean density of Pisaster giganteus by site and island at Channel Islands National Park between 1982 and 2015.

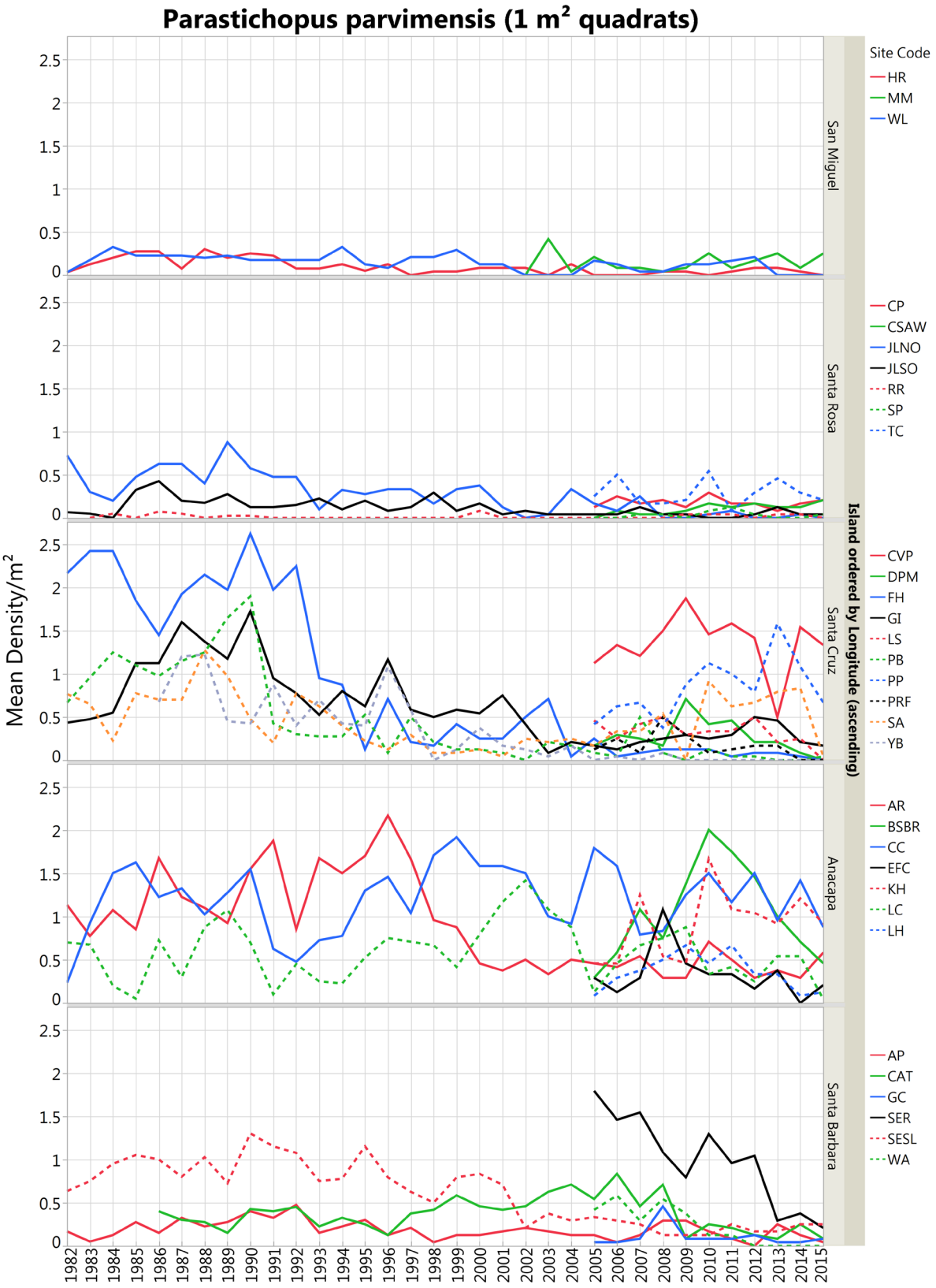


Figure E-16. Mean density of *Parastichopus parvimensis* by site and island at Channel Islands National Park between 1982 and 2015.

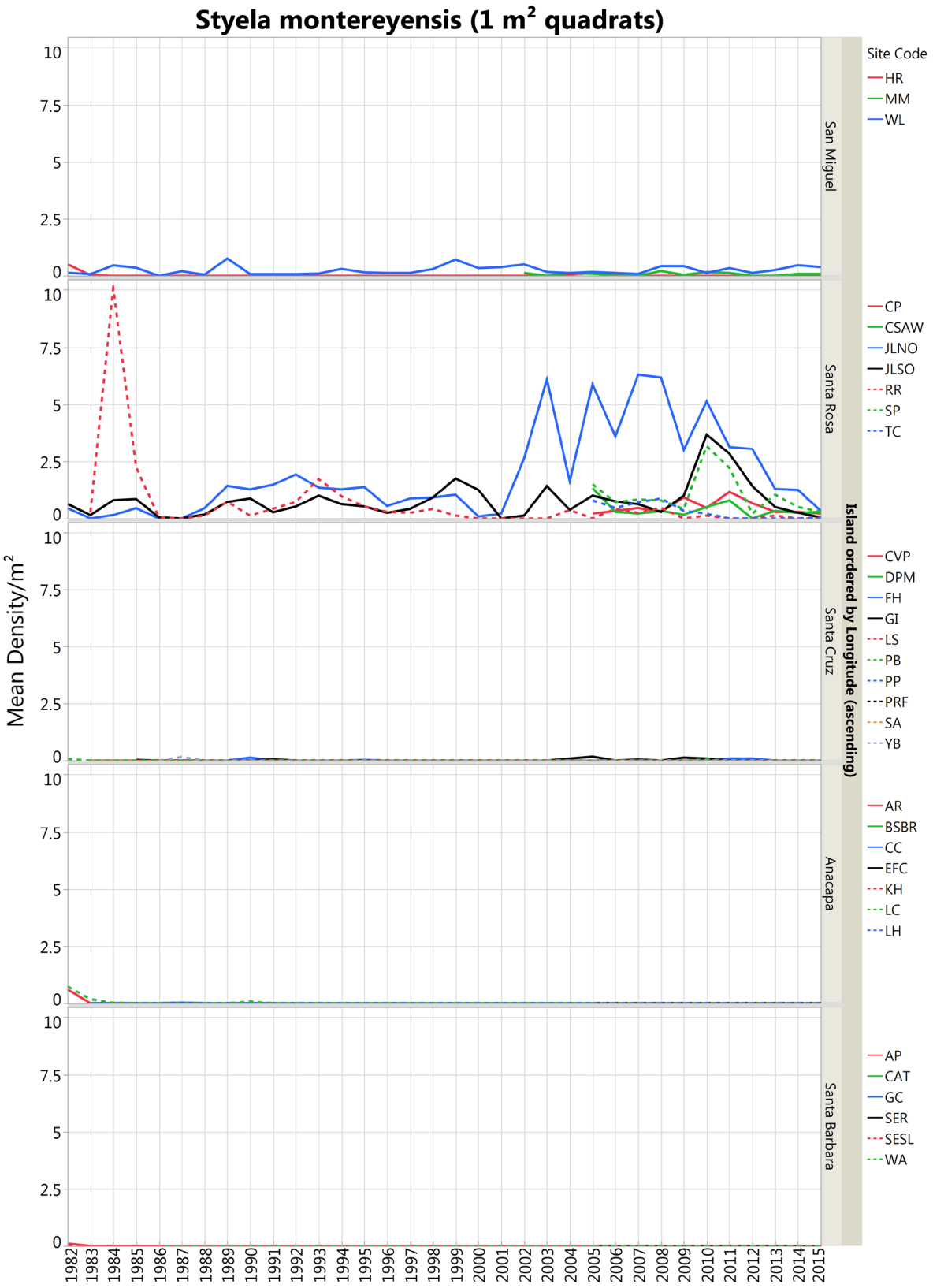


Figure E-17. Mean density of *Styela montereyensis* by site and island at Channel Islands National Park between 1982 and 2015.

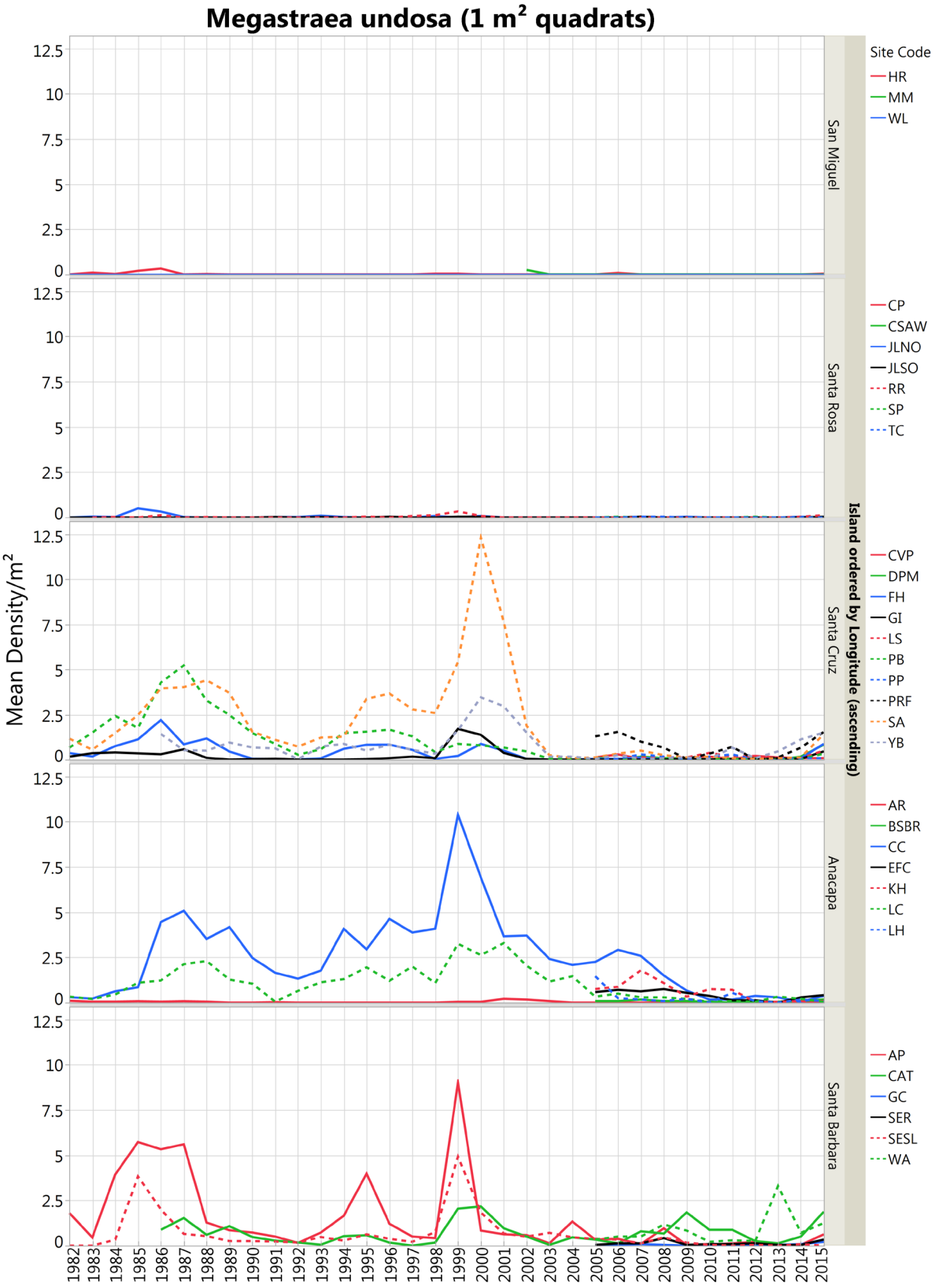


Figure E-18. Mean density of *Megastraea undosa* by site and island at Channel Islands National Park between 1982 and 2015.

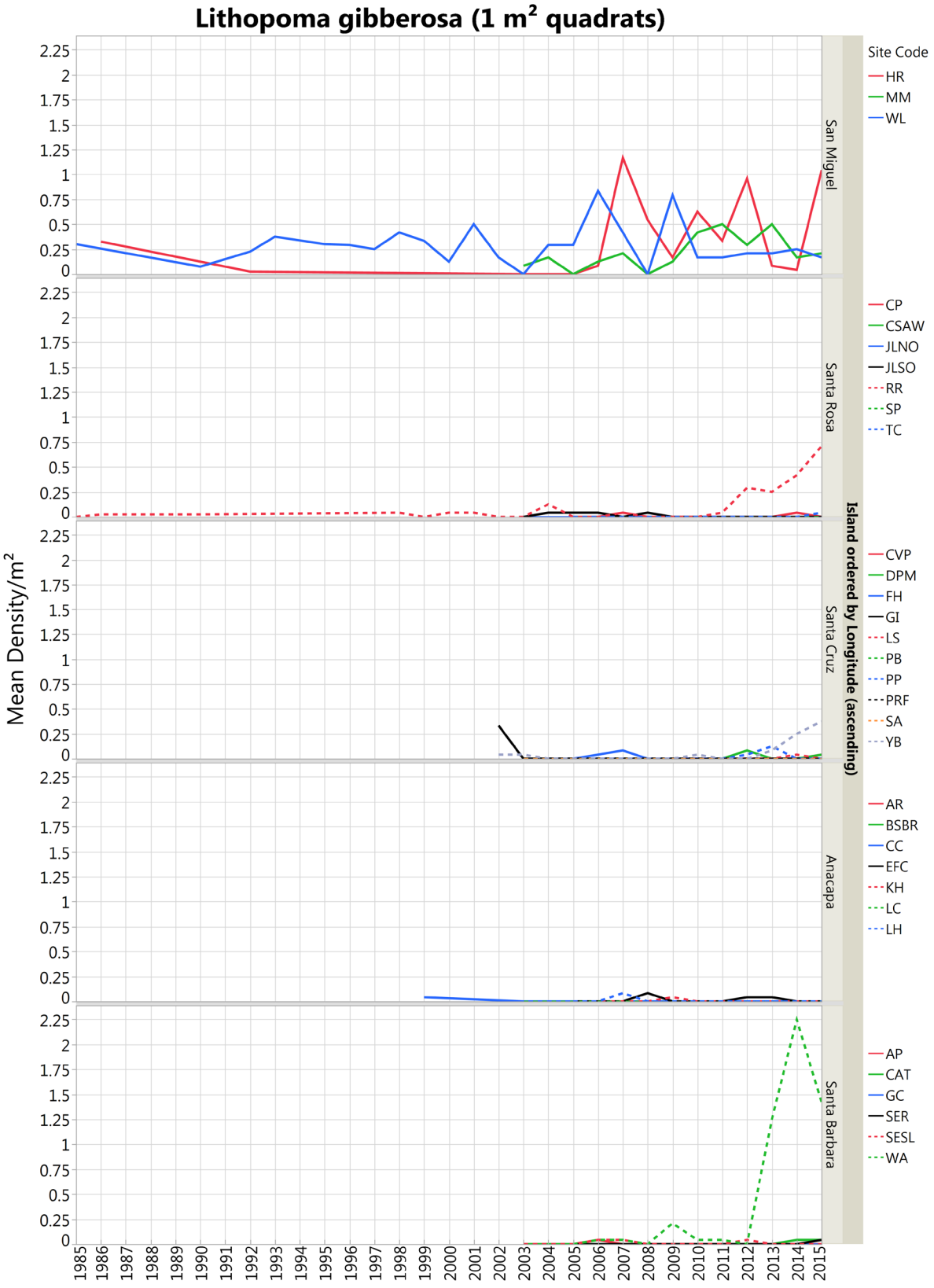


Figure E-19. Mean density of *Lithopoma gibberosa* by site and island at Channel Islands National Park between 1985 and 2015.

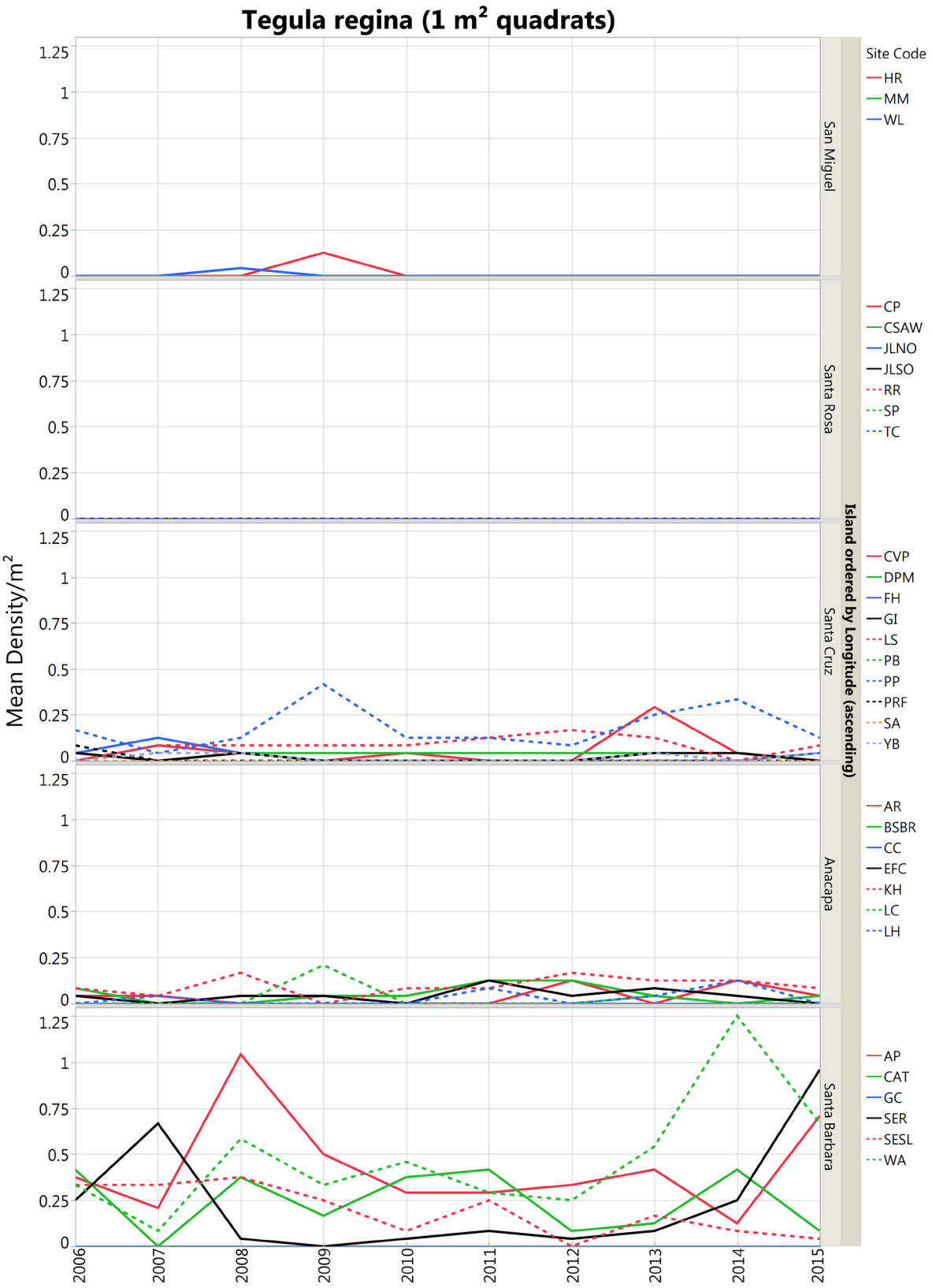


Figure E-20. Mean density of *Tegula regina* by site and island at Channel Islands National Park between 2006 and 2015.

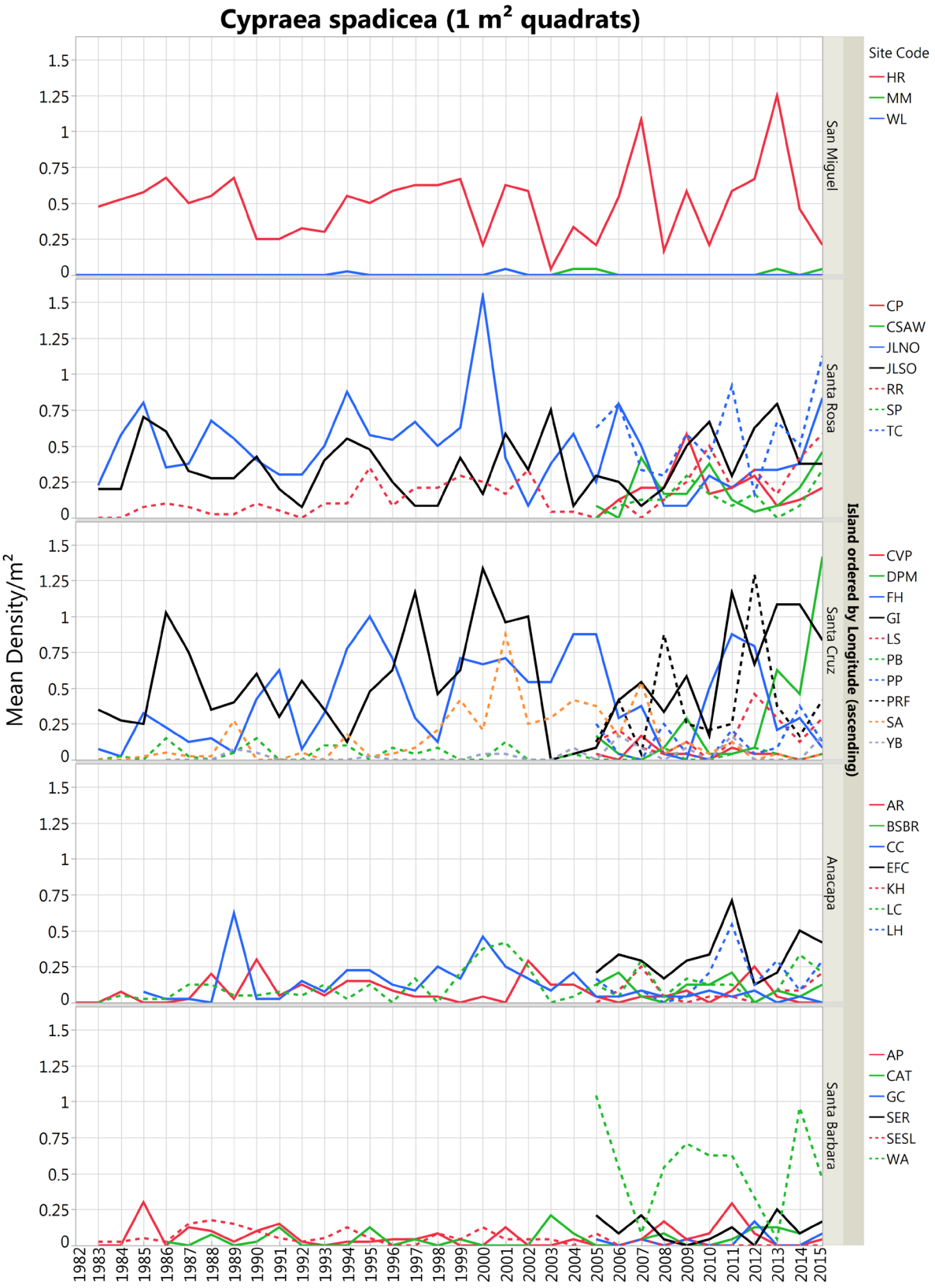


Figure E-21. Mean density of *Cypraea spadicea* by site and island at Channel Islands National Park between 1982 and 2015.

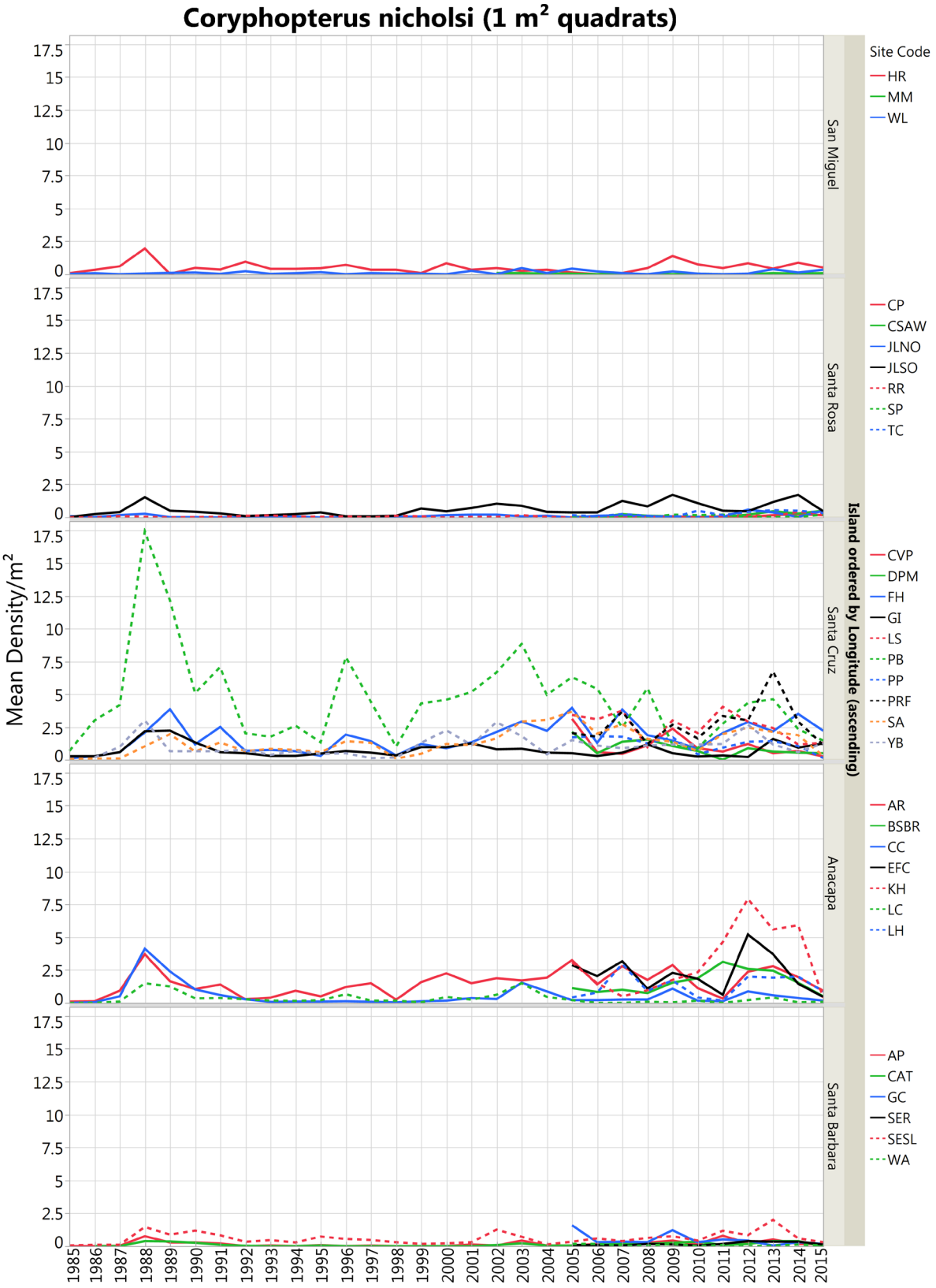


Figure E-22. Mean density of *Coryphopterus nicholsii* by site and island at Channel Islands National Park between 1985 and 2015.

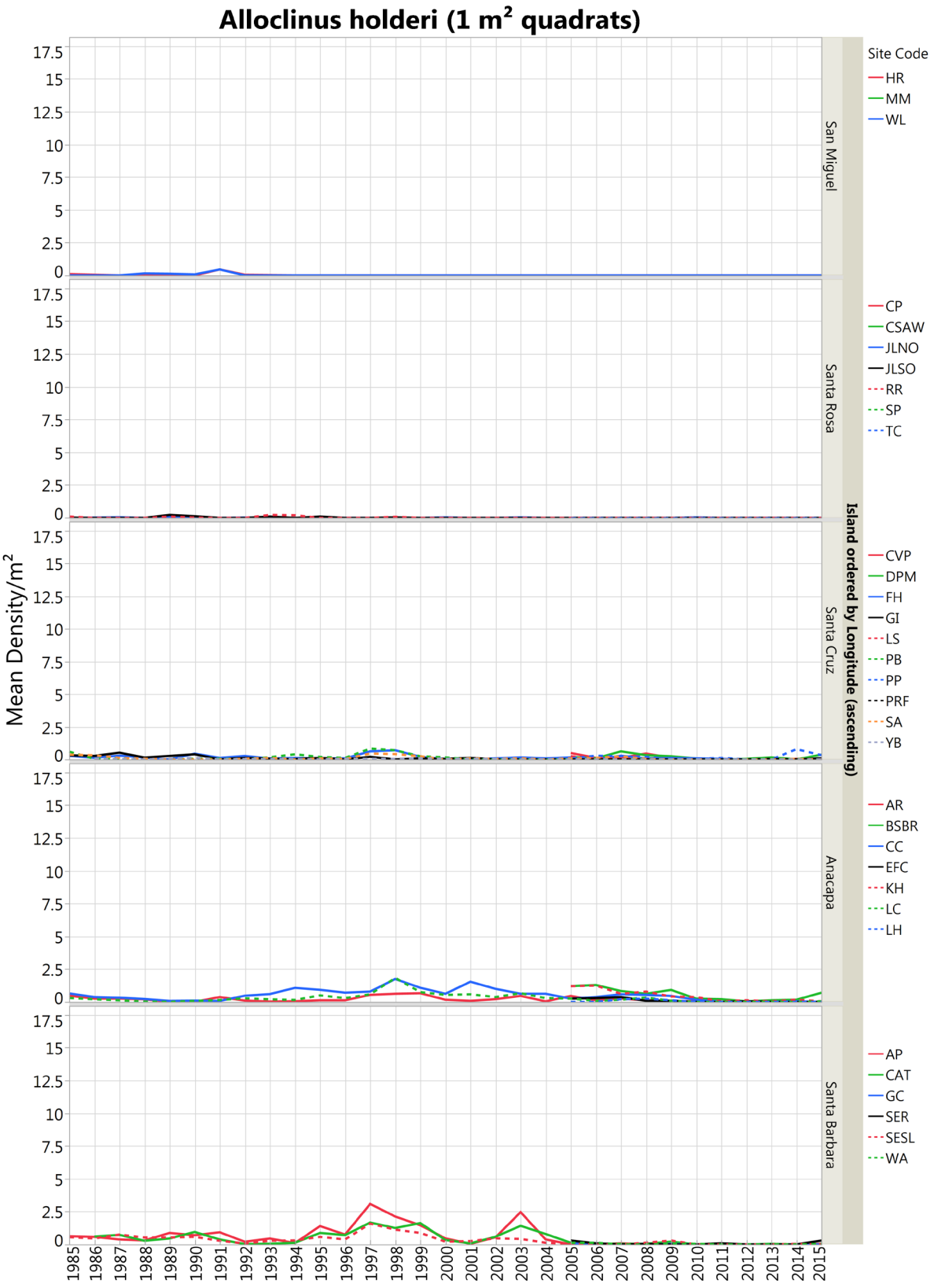


Figure E-23. Mean density of *Alloclinus holderi* by site and island at Channel Islands National Park between 1985 and 2015.

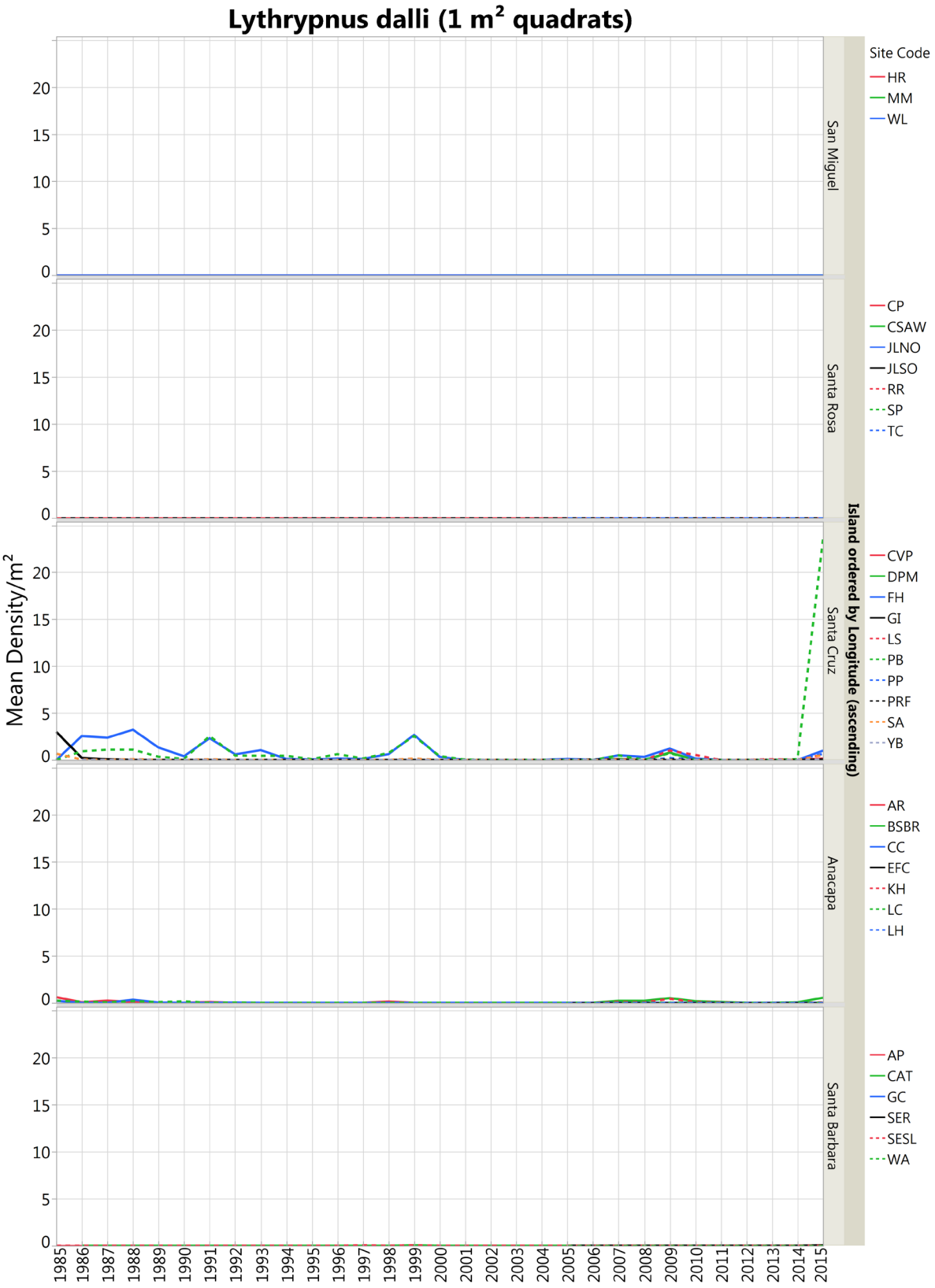


Figure E-24. Mean density of *Lythrypnus dalli* by site and island at Channel Islands National Park between 1985 and 2015.

Appendix F. 5 Meter Quadrat Data

Figures F-1 through F-6 show the five meter square quadrat data.

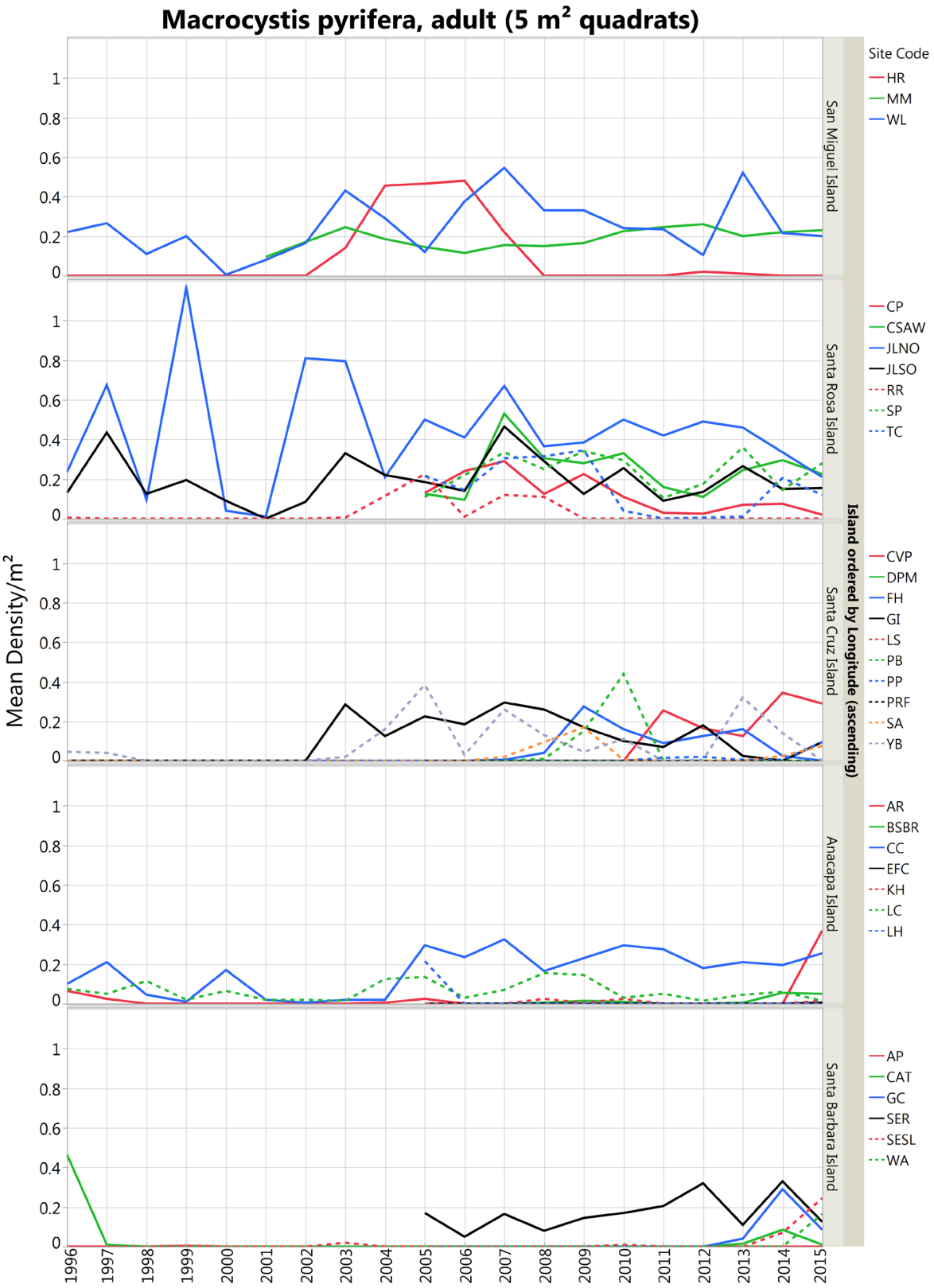


Figure F-1. Mean density of adult *Macrocystis pyrifera* by site and island at Channel Islands National Park between 1996 and 2015.

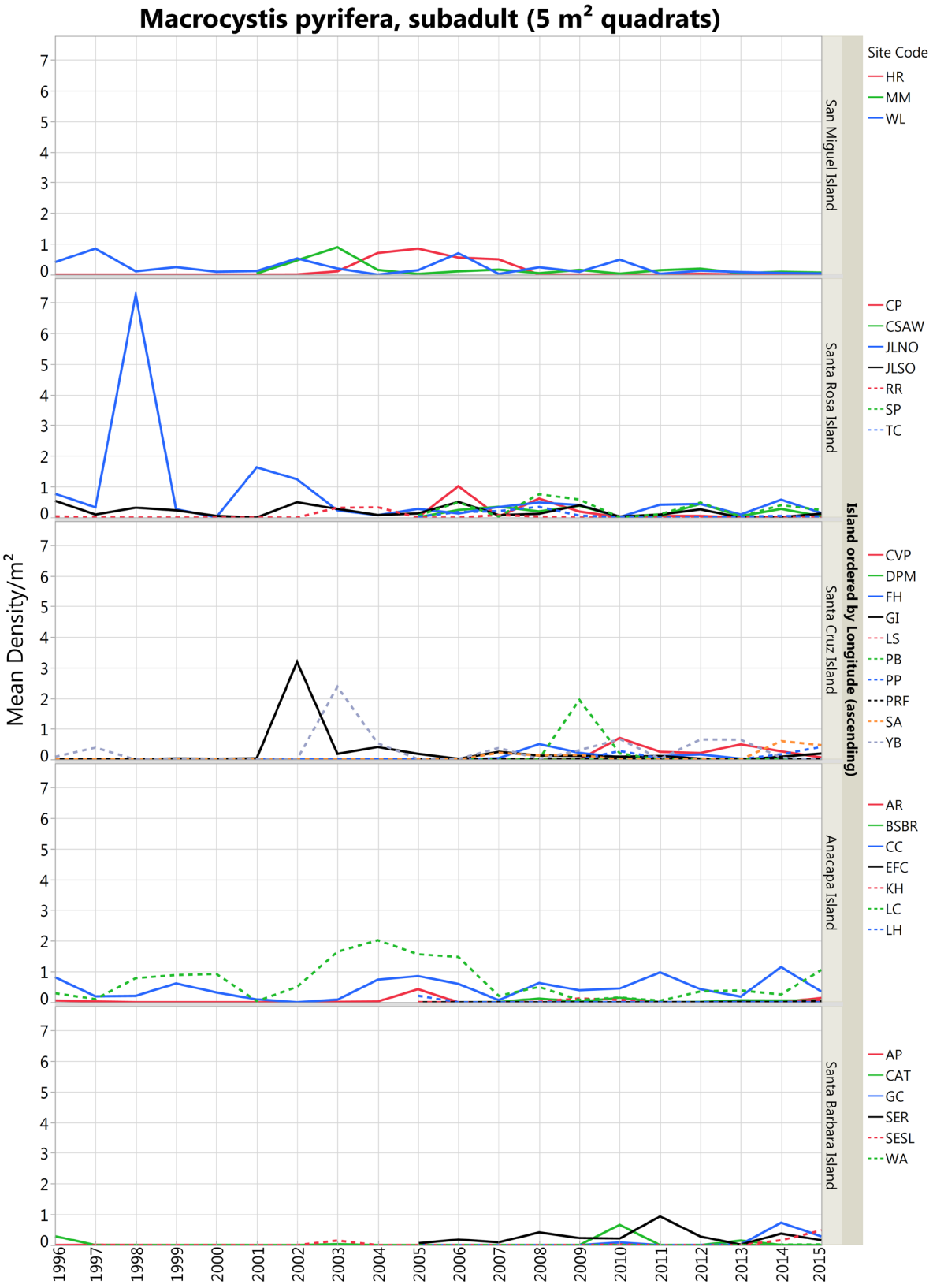


Figure F-2. Mean density of subadult *Macrocystis pyrifera* by site and island at Channel Islands National Park between 1996 and 2015.

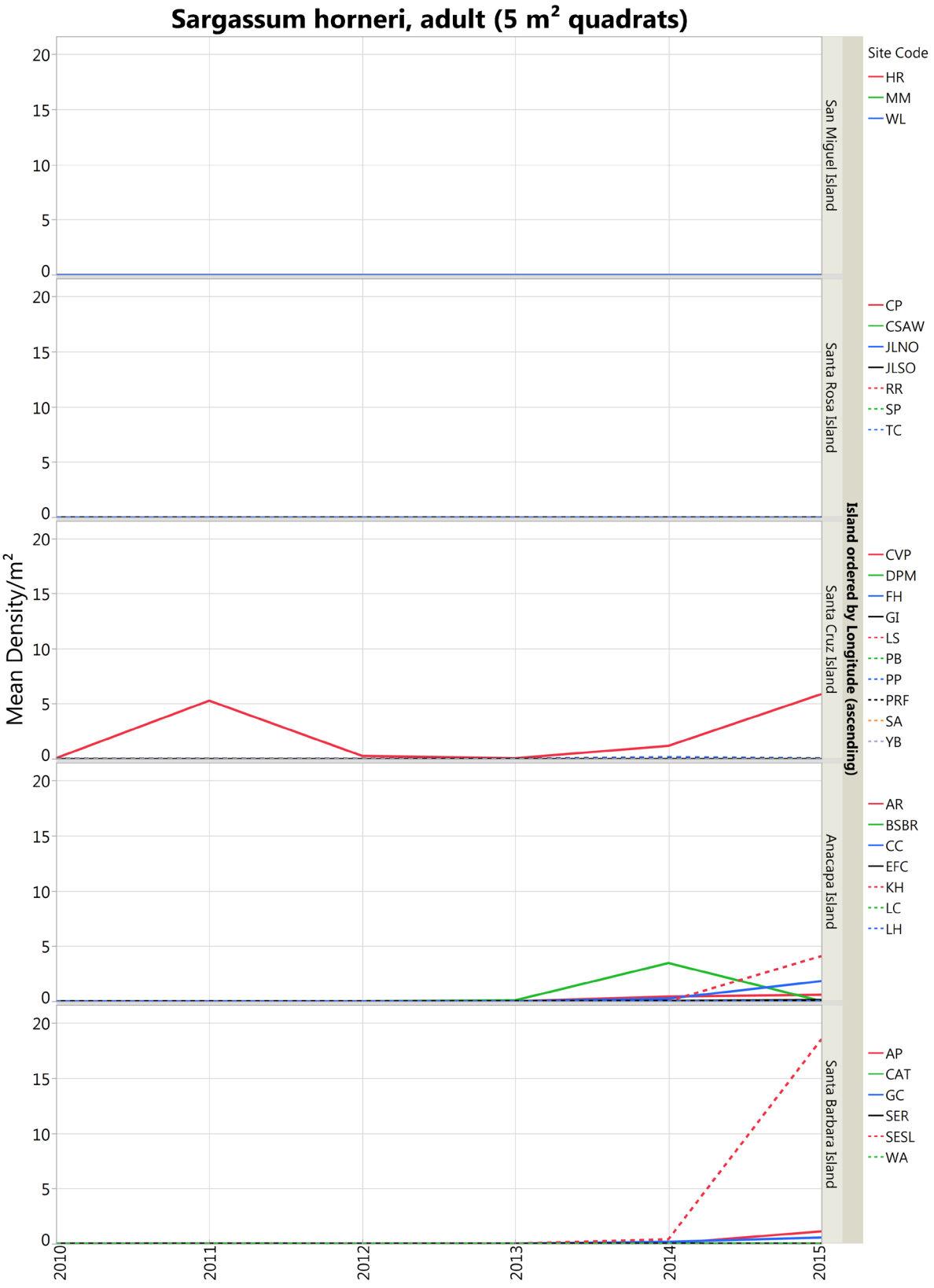


Figure F-3. Mean density of adult *Sargassum horneri* by site and island at Channel Islands National Park between 2010 and 2015.

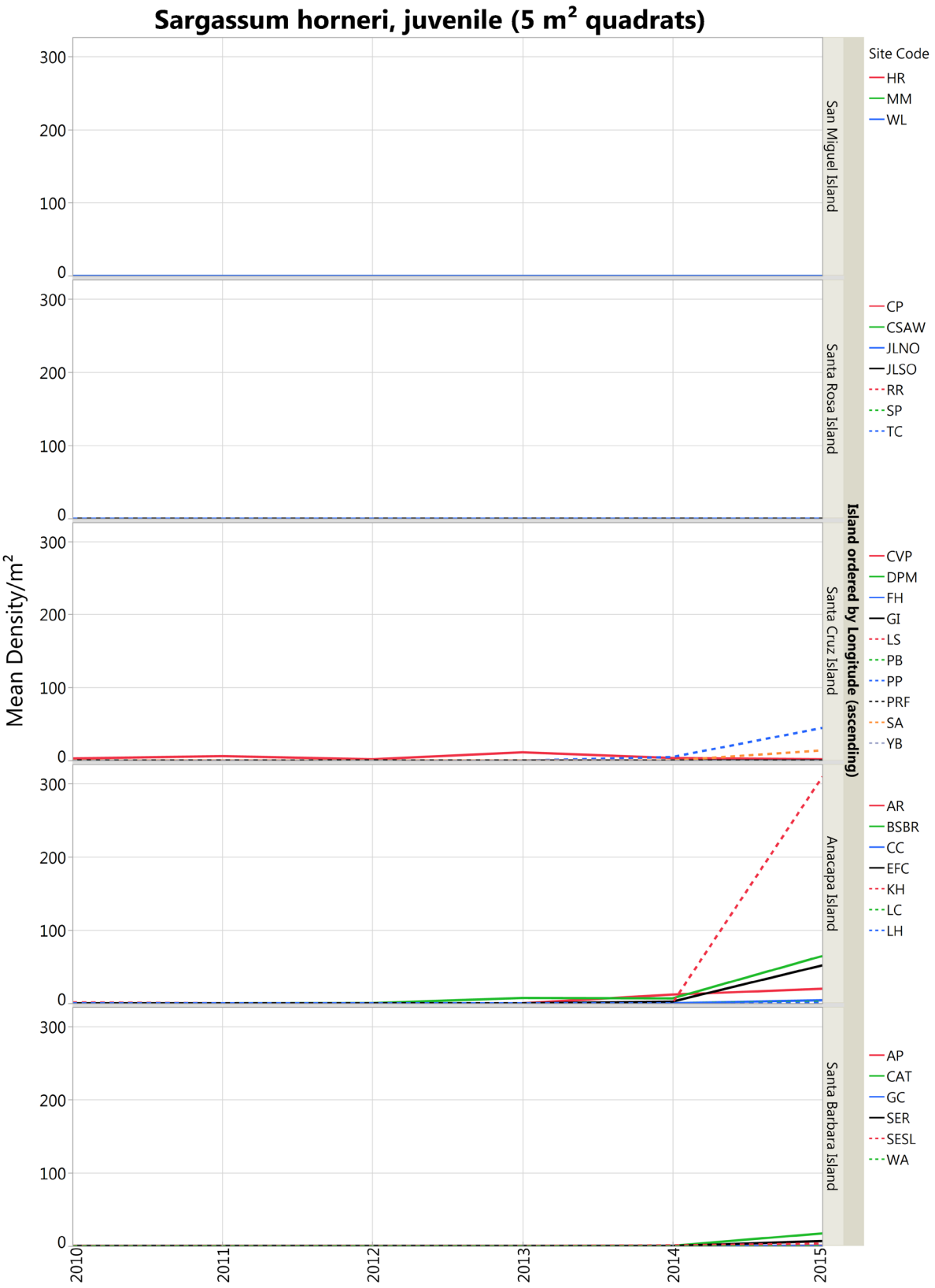


Figure F-4. Mean density of juvenile *Sargassum horneri* by site and island at Channel Islands National Park between 2010 and 2015.

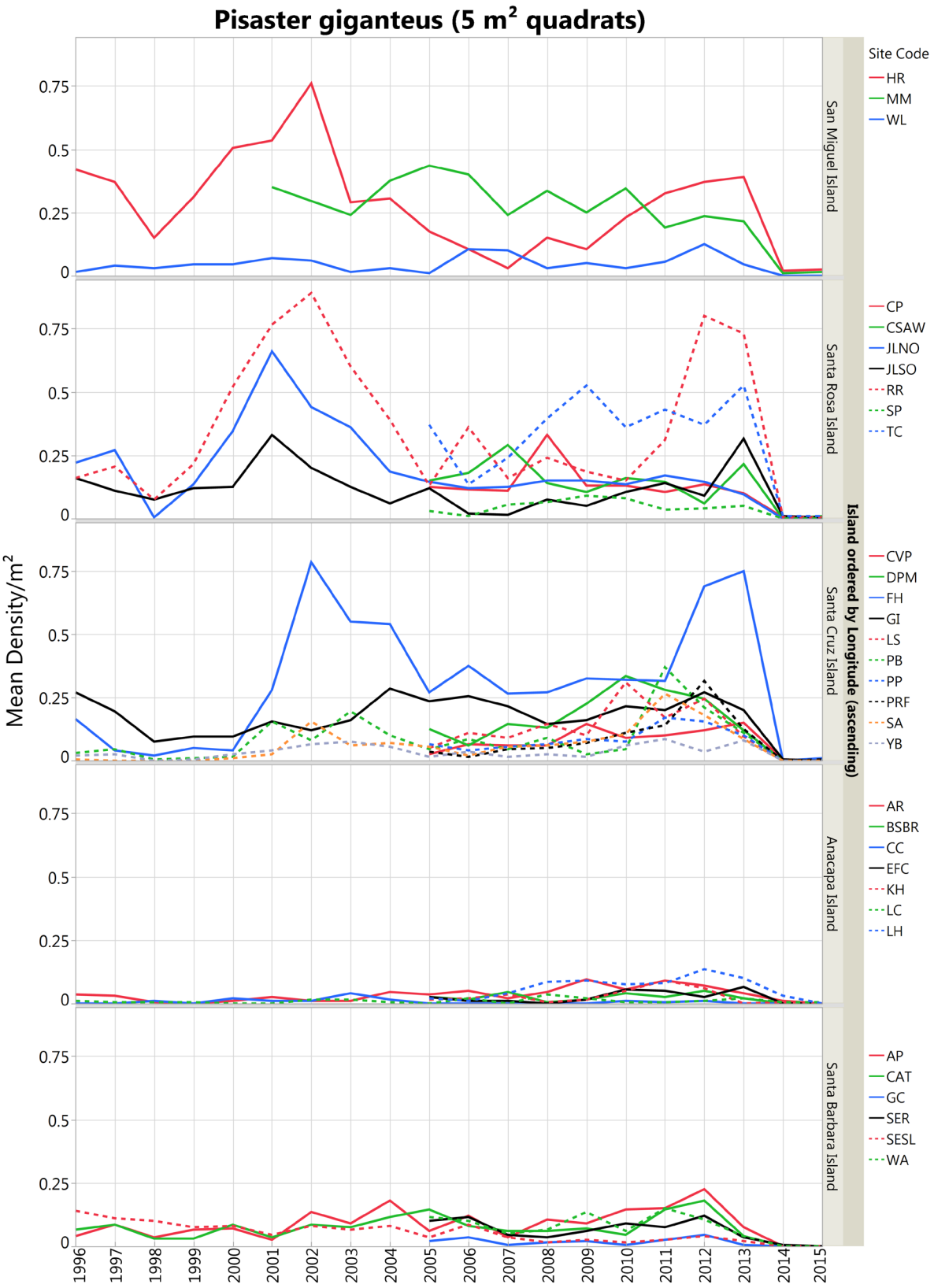


Figure F-5. Mean density of *Pisaster giganteus* by site and island at Channel Islands National Park between 1996 and 2015.

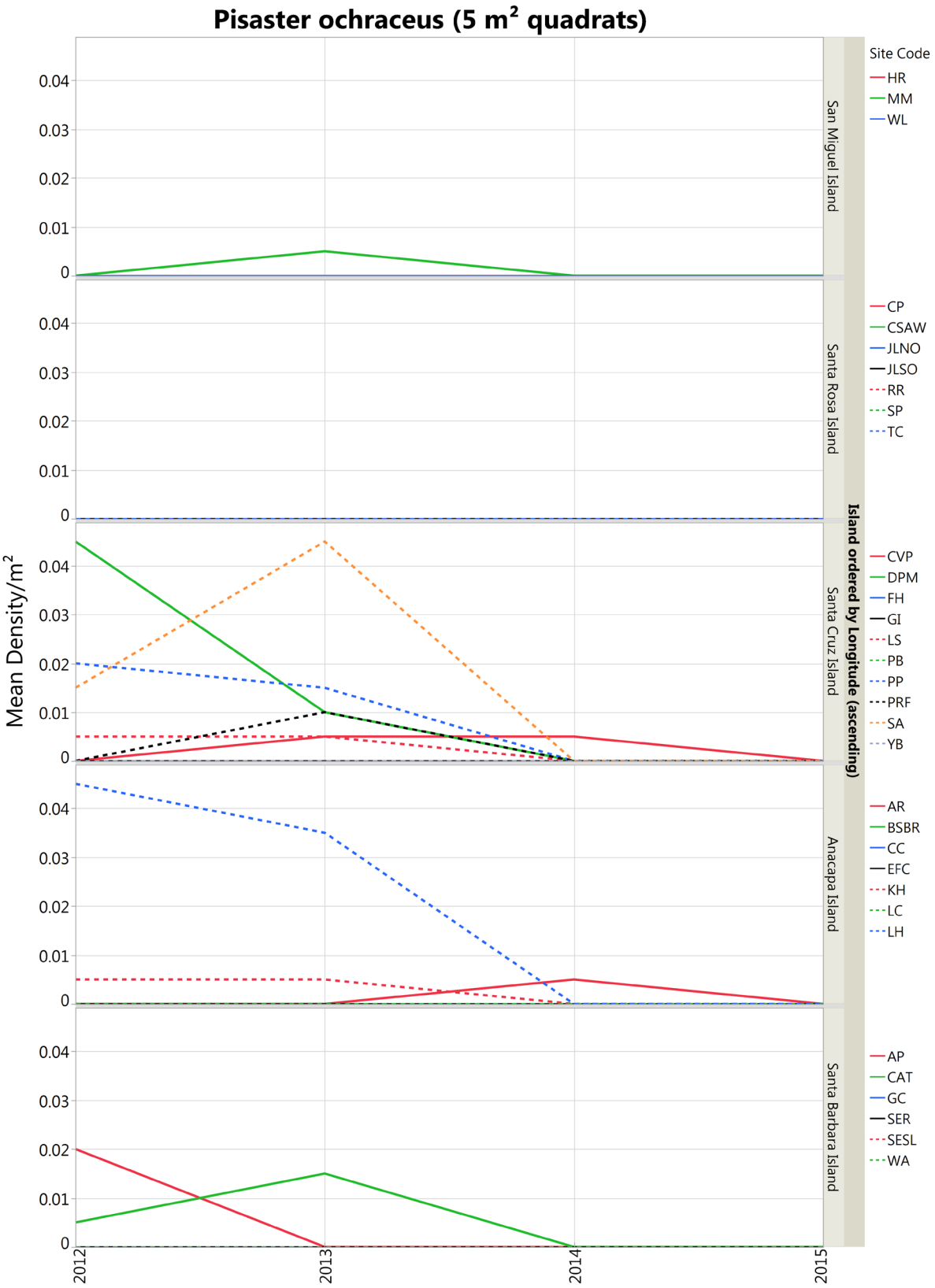


Figure F-6. Mean density of *Pisaster ochraceus* by site and island at Channel Islands National Park between 2012 and 2015.

Appendix G. Band Transect Data

Figures G-1 through G-18 show the band transect data.

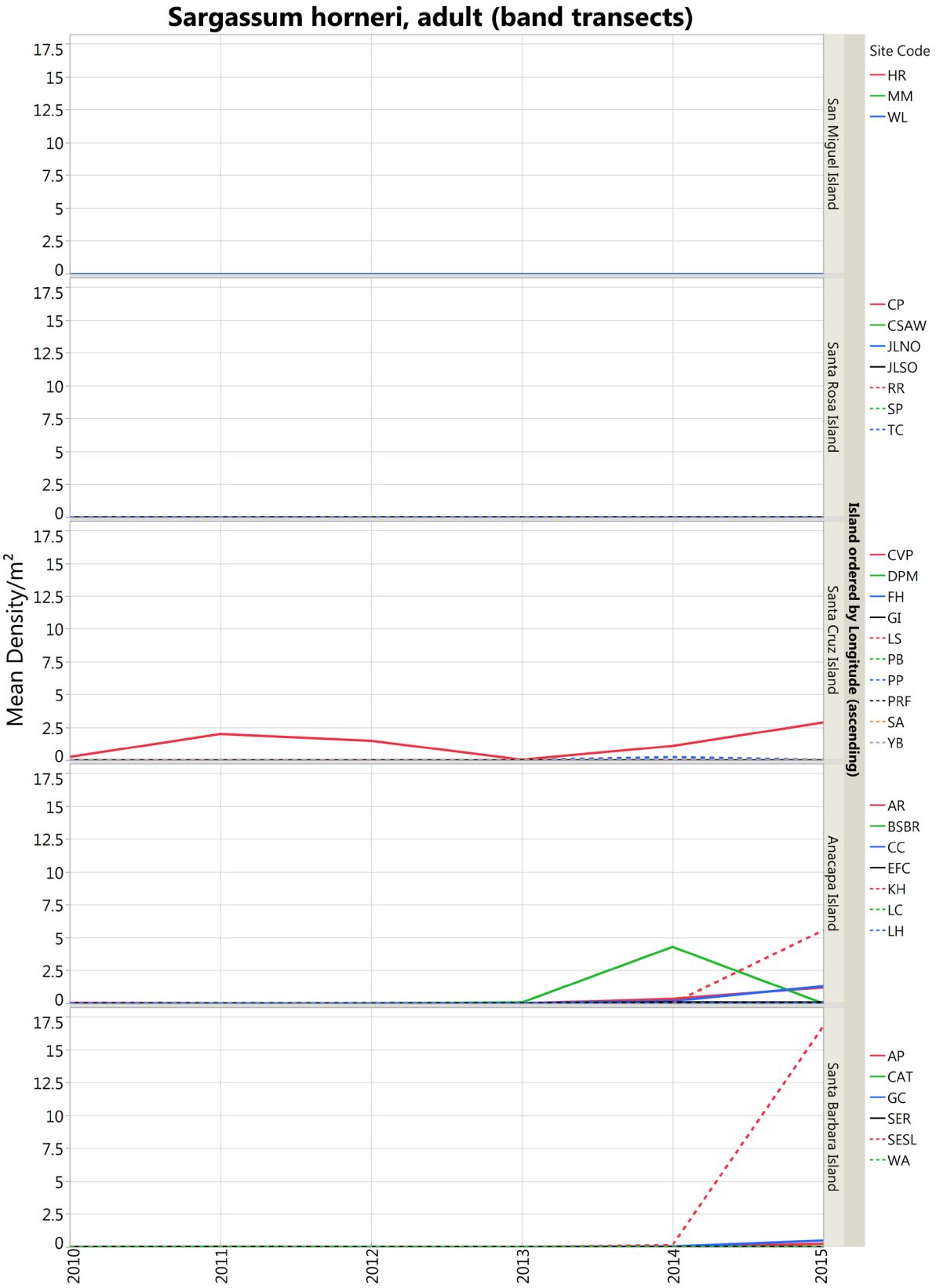


Figure G-1. Mean density of adult *Sargassum horneri* by site and island at Channel Islands National Park between 2010 and 2015.

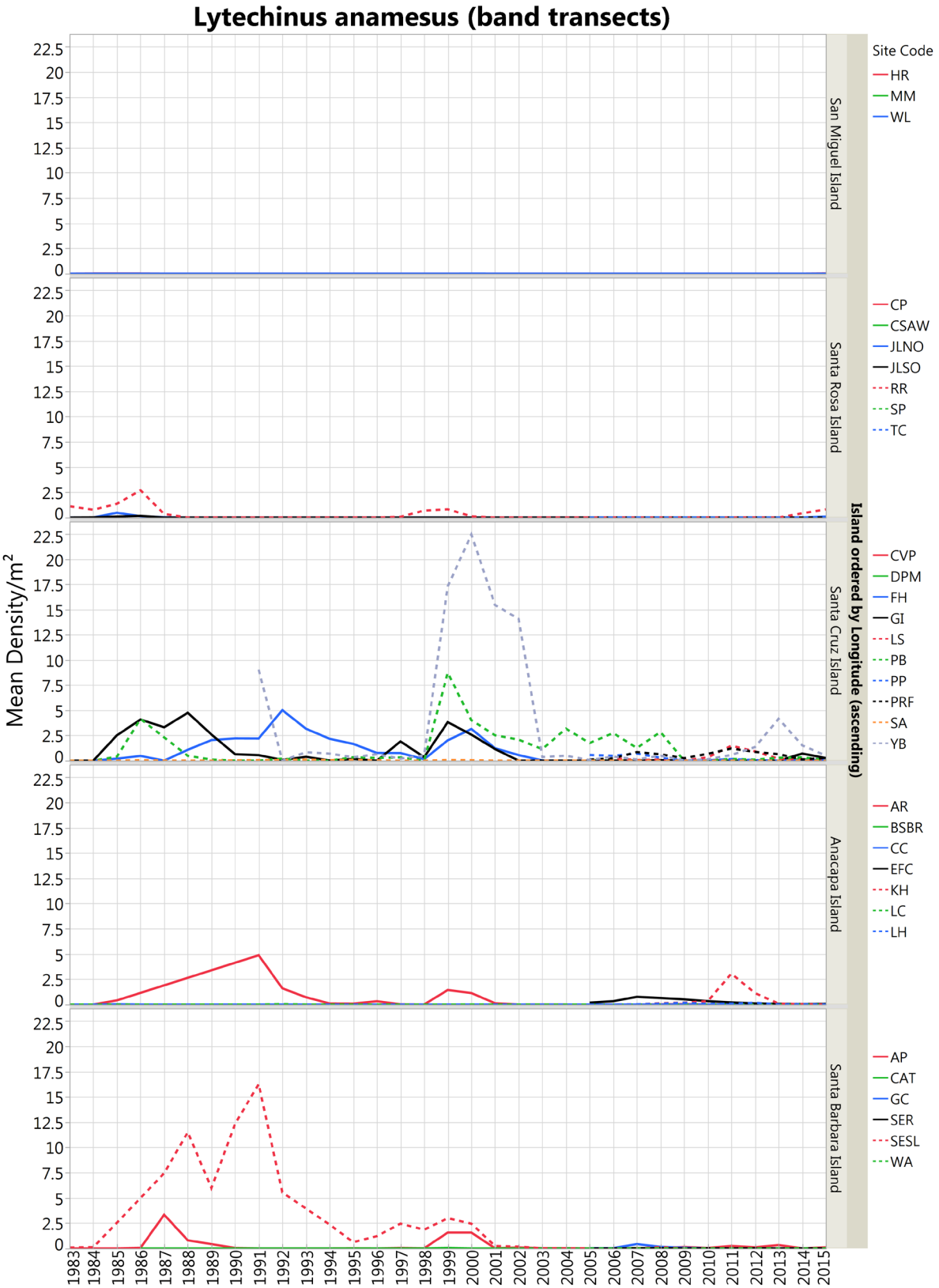


Figure G-2. Mean density of *Lytechinus anamesus* by site and island at Channel Islands National Park between 1983 and 2015.

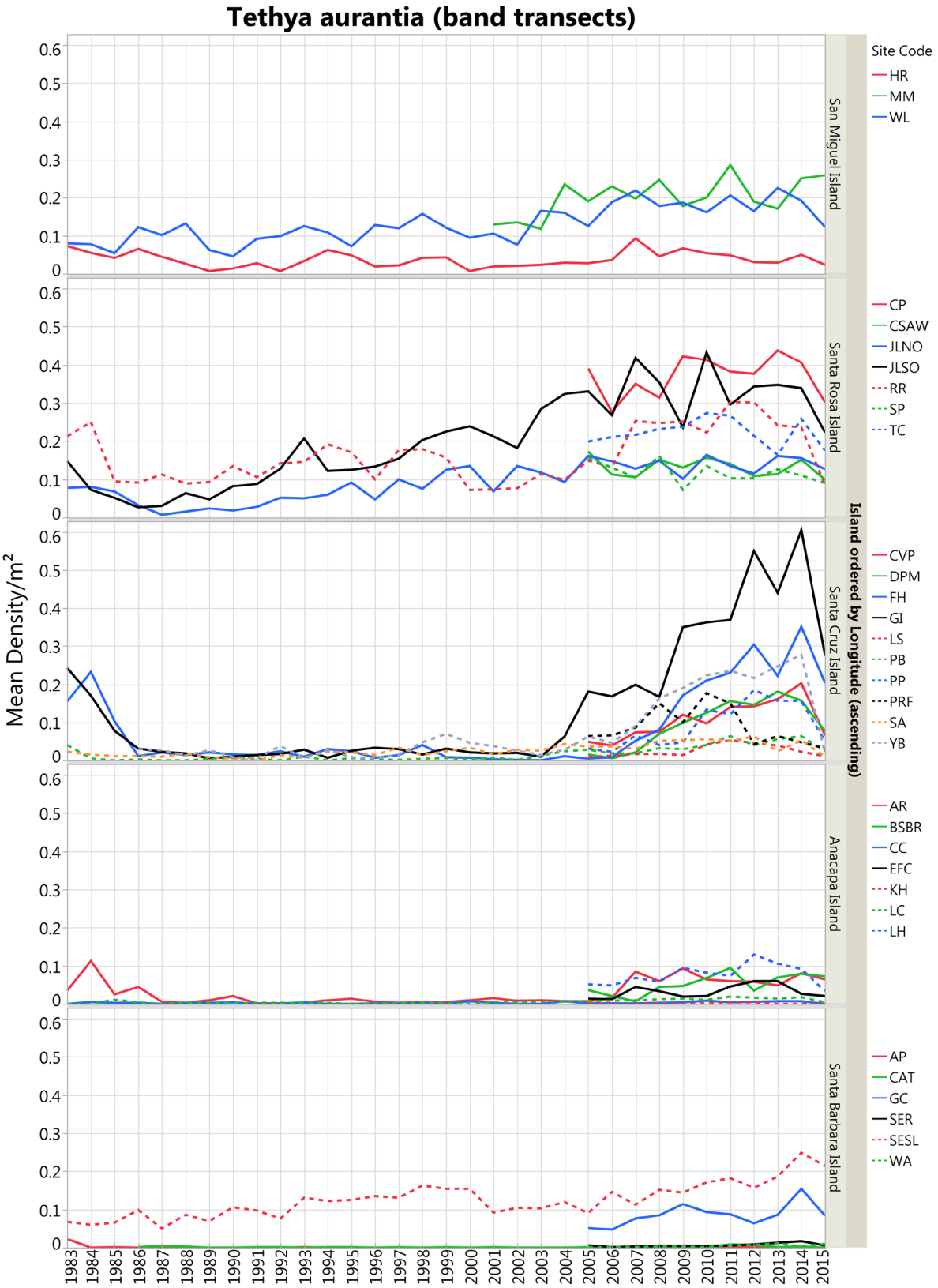


Figure G-3. Mean density of *Tethya aurantia* by site and island at Channel Islands National Park between 1983 and 2015.

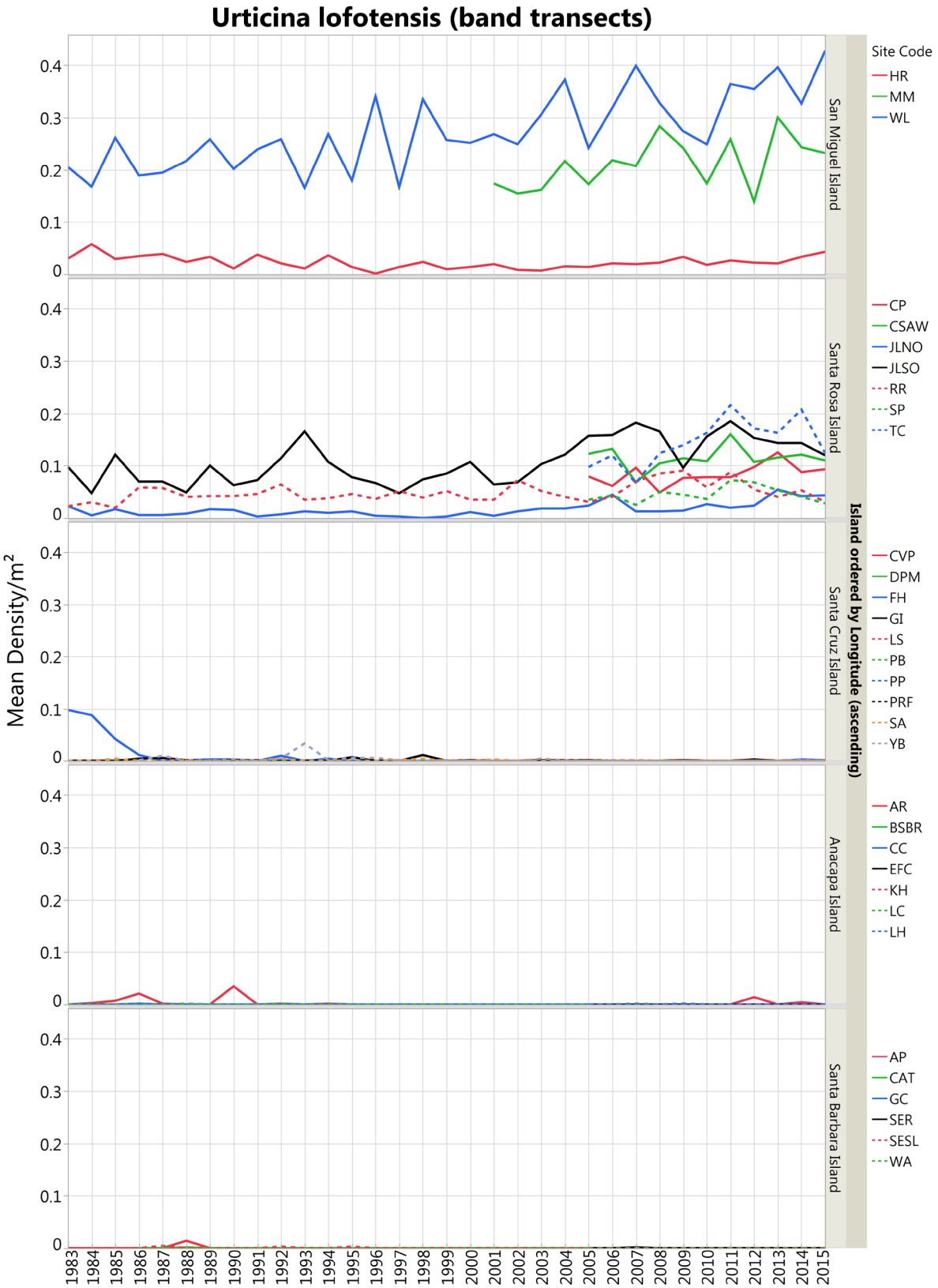


Figure G-4. Mean density of *Urticina lofotensis* by site and island at Channel Islands National Park between 1983 and 2015.

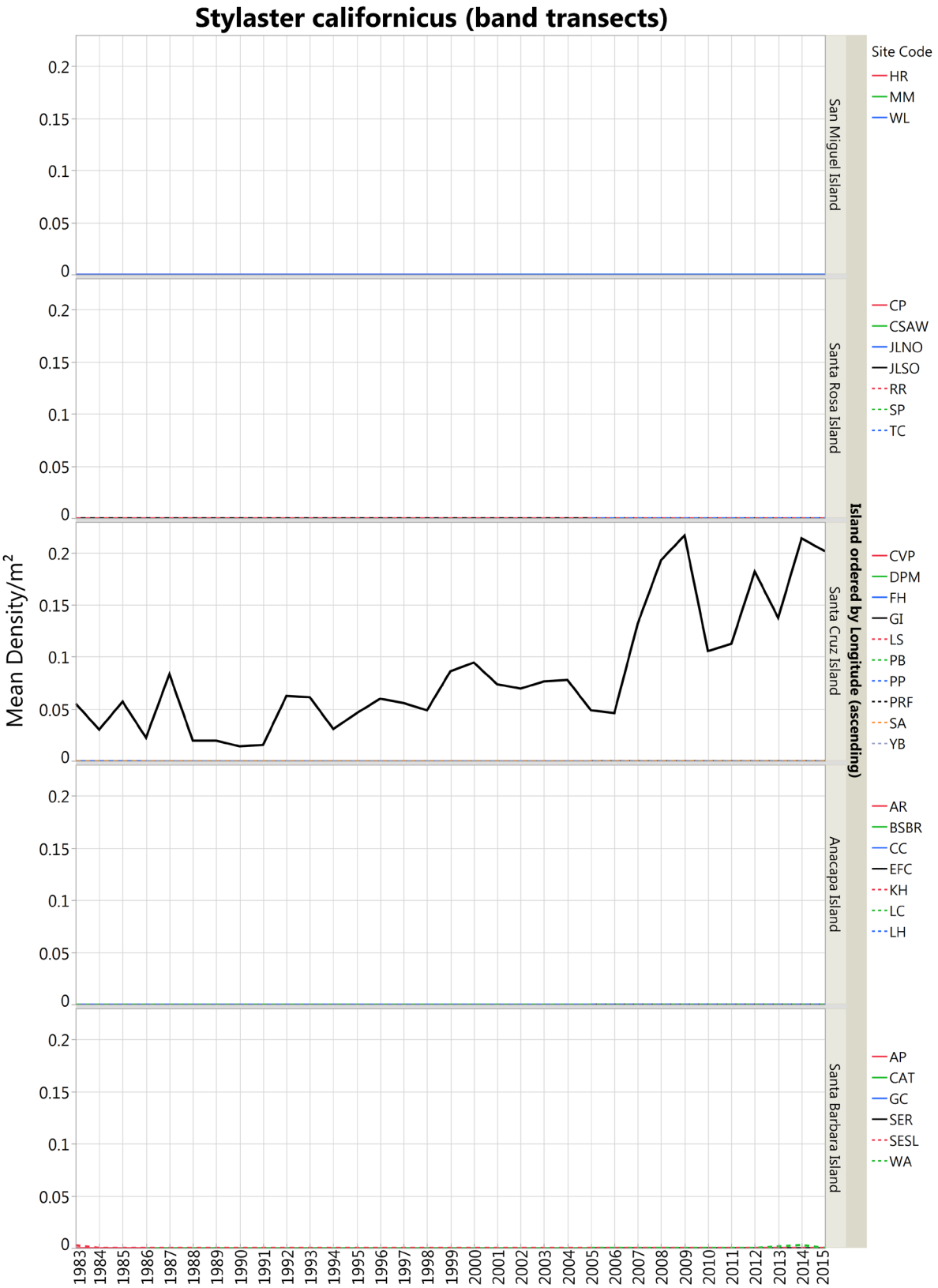


Figure G-5. Mean density of *Stylaster californicus* by site and island at Channel Islands National Park between 1983 and 2015.

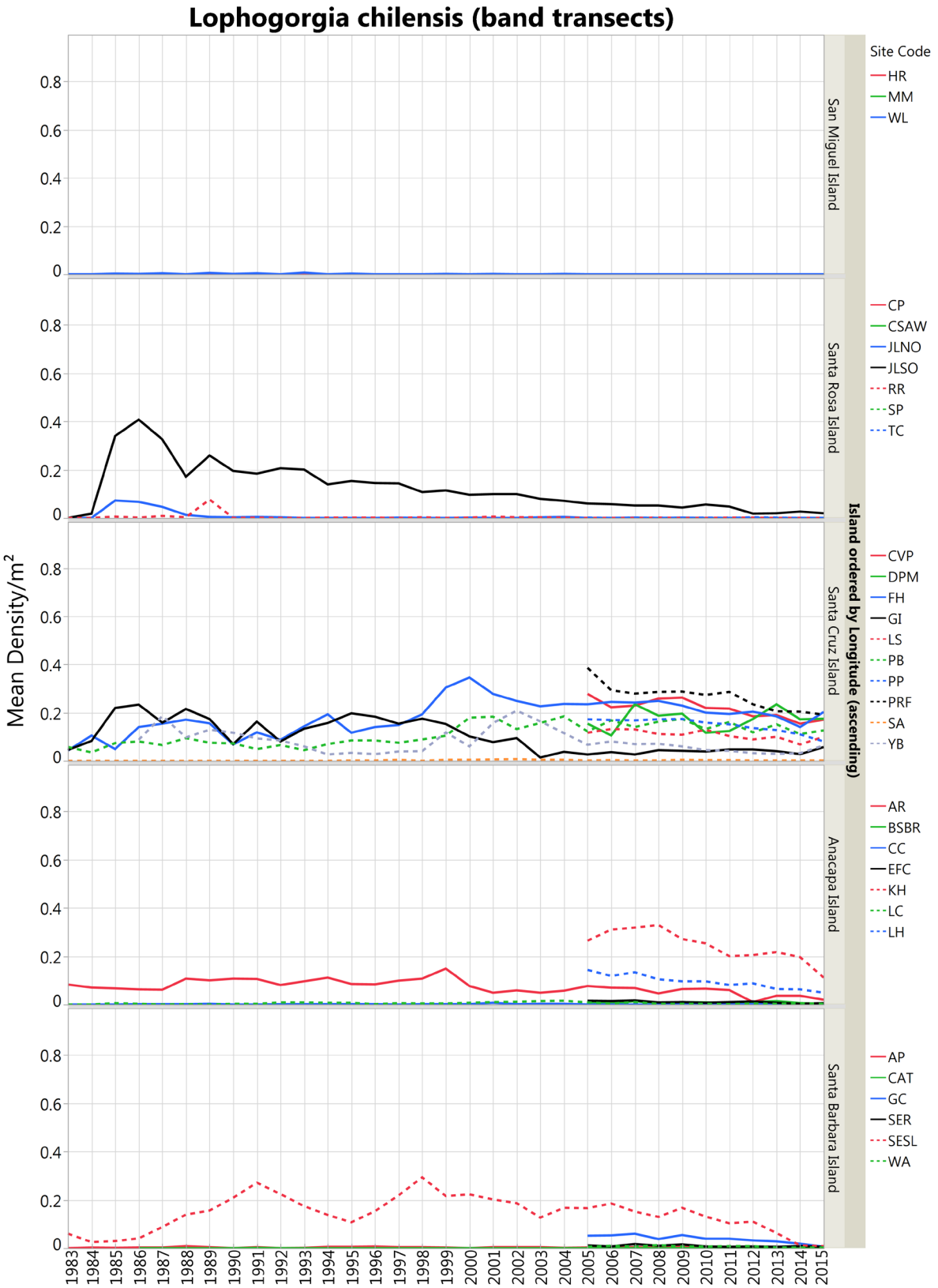


Figure G-6. Mean density of *Lophogorgia chilensis* by site and island at Channel Islands National Park between 1983 and 2015.

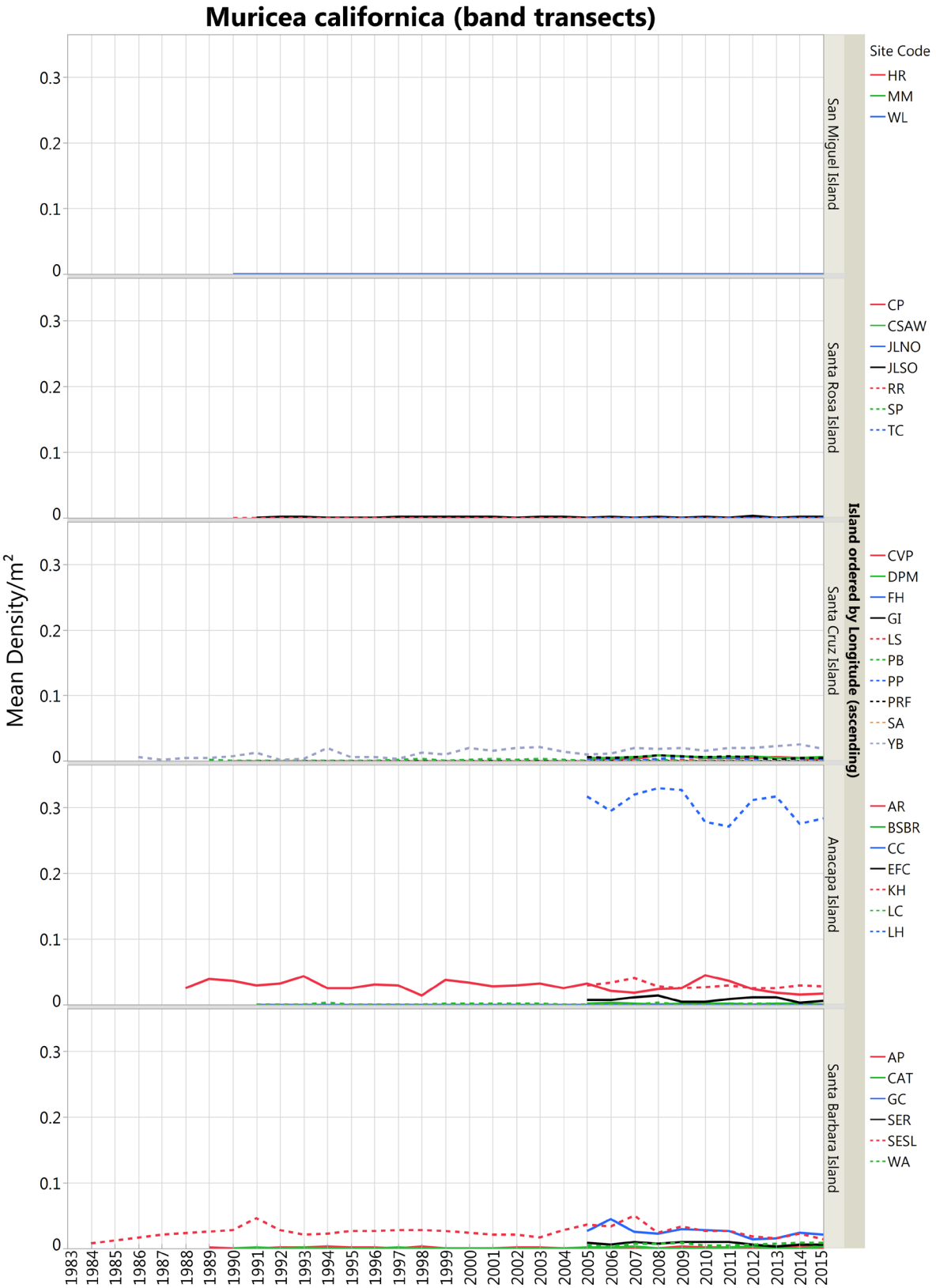


Figure G-7. Mean density of *Muricea californica* by site and island at Channel Islands National Park between 1983 and 2015.

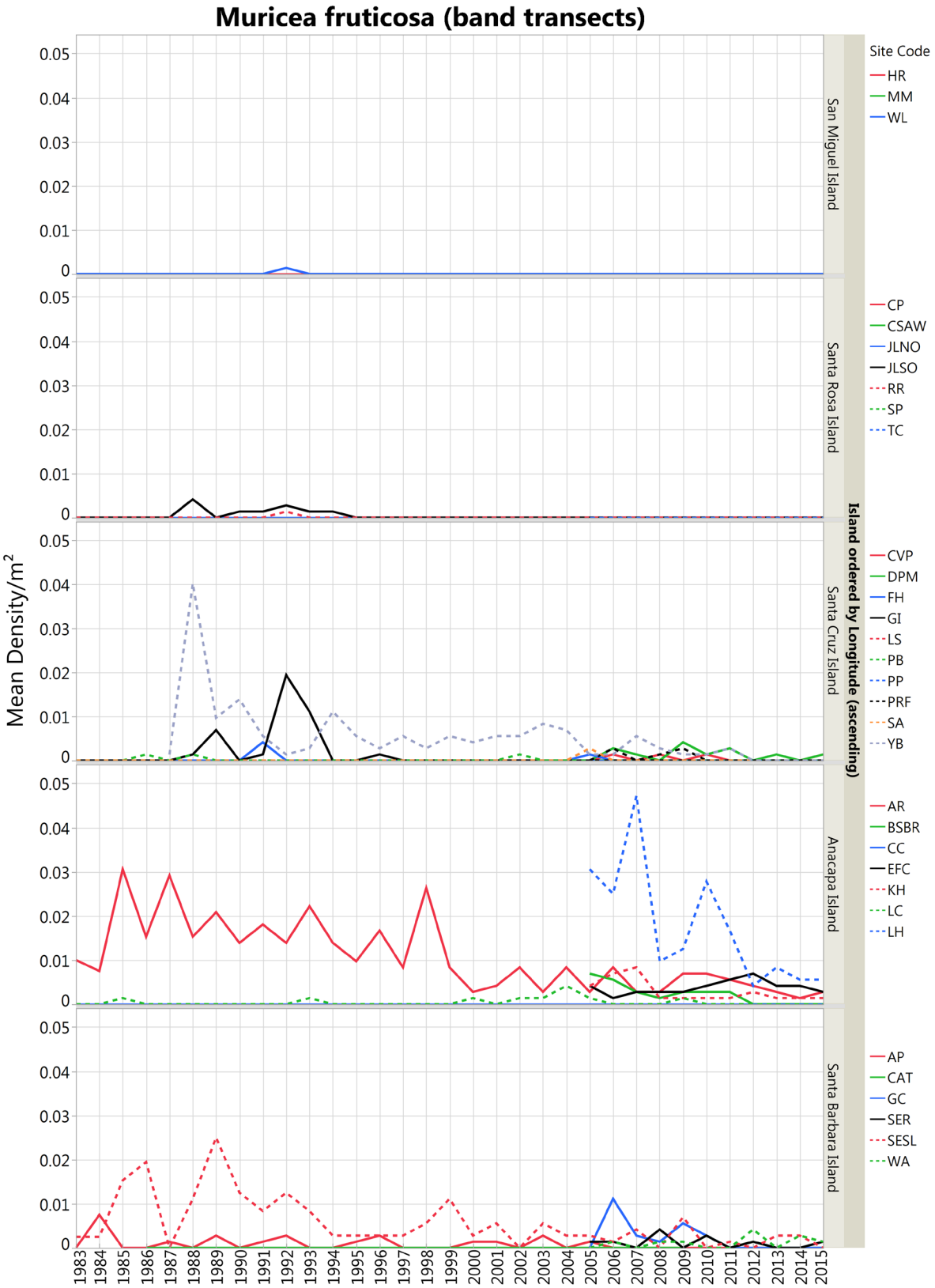


Figure G-8. Mean density of *Muricea fruticosa* by site and island at Channel Islands National Park between 1983 and 2015.

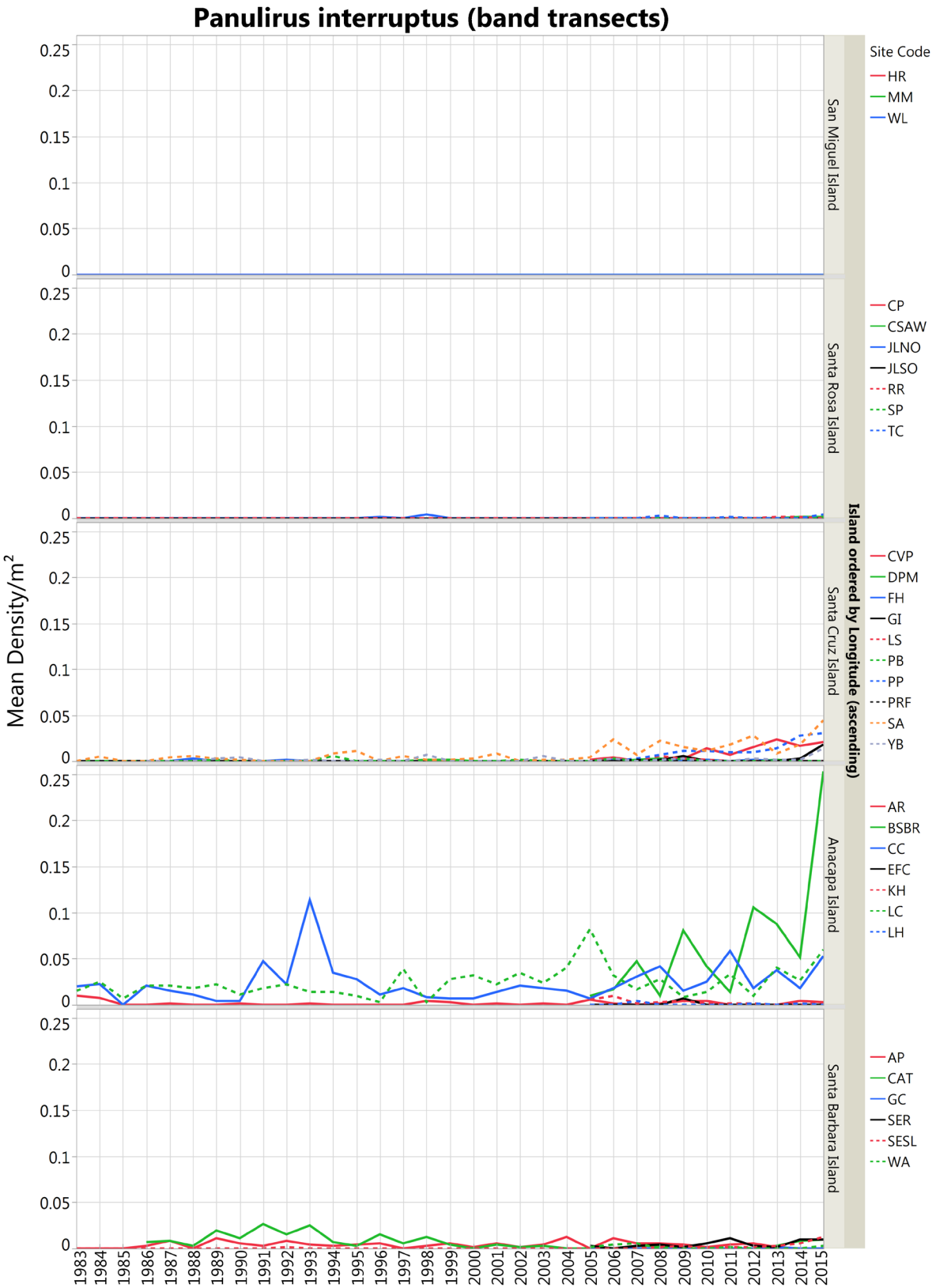


Figure G-9. Mean density of *Panulirus interruptus* by site and island at Channel Islands National Park between 1983 and 2015.

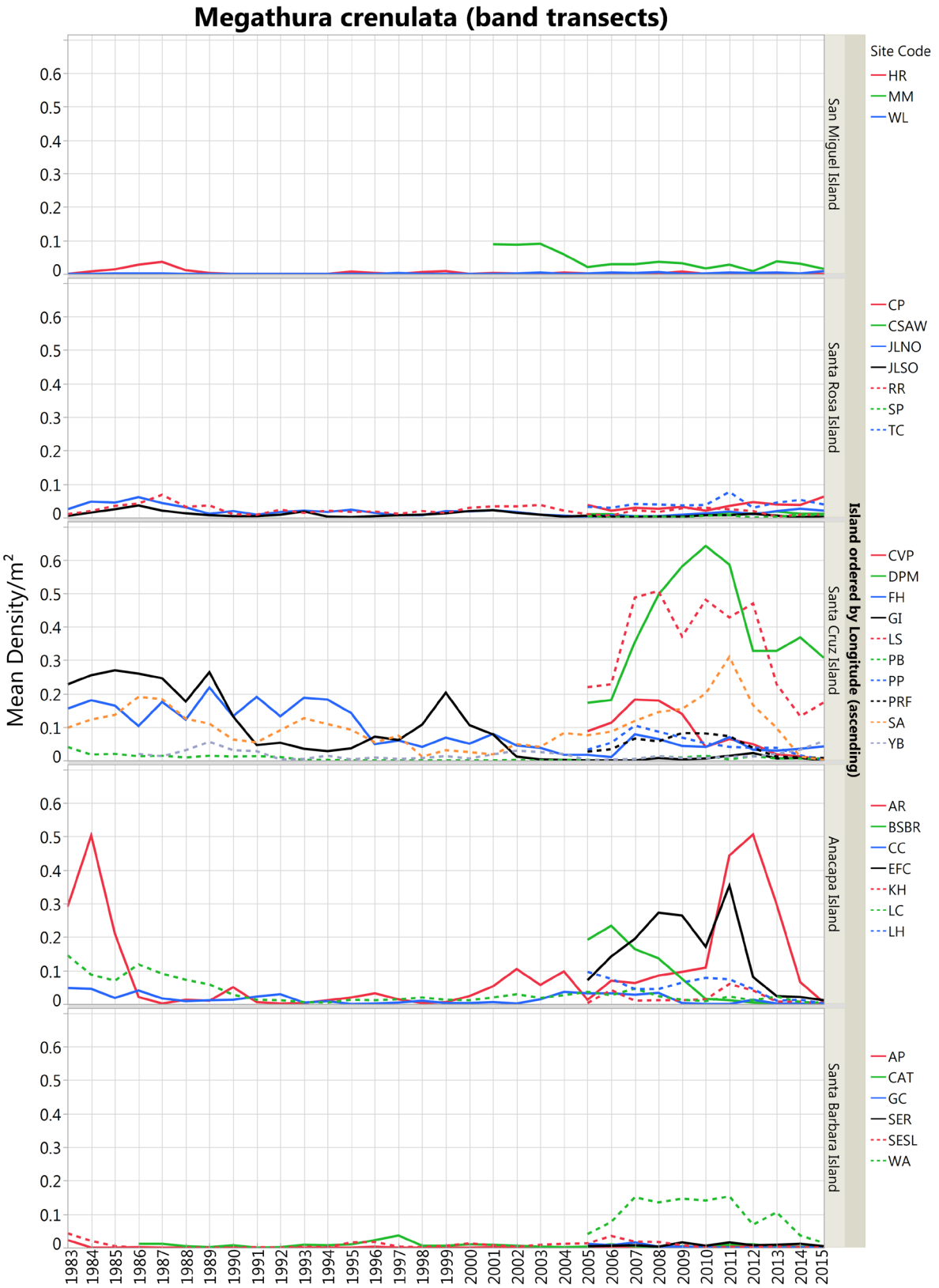


Figure G-10. Mean density of *Megathura crenulata* by site and island at Channel Islands National Park between 1983 and 2015.

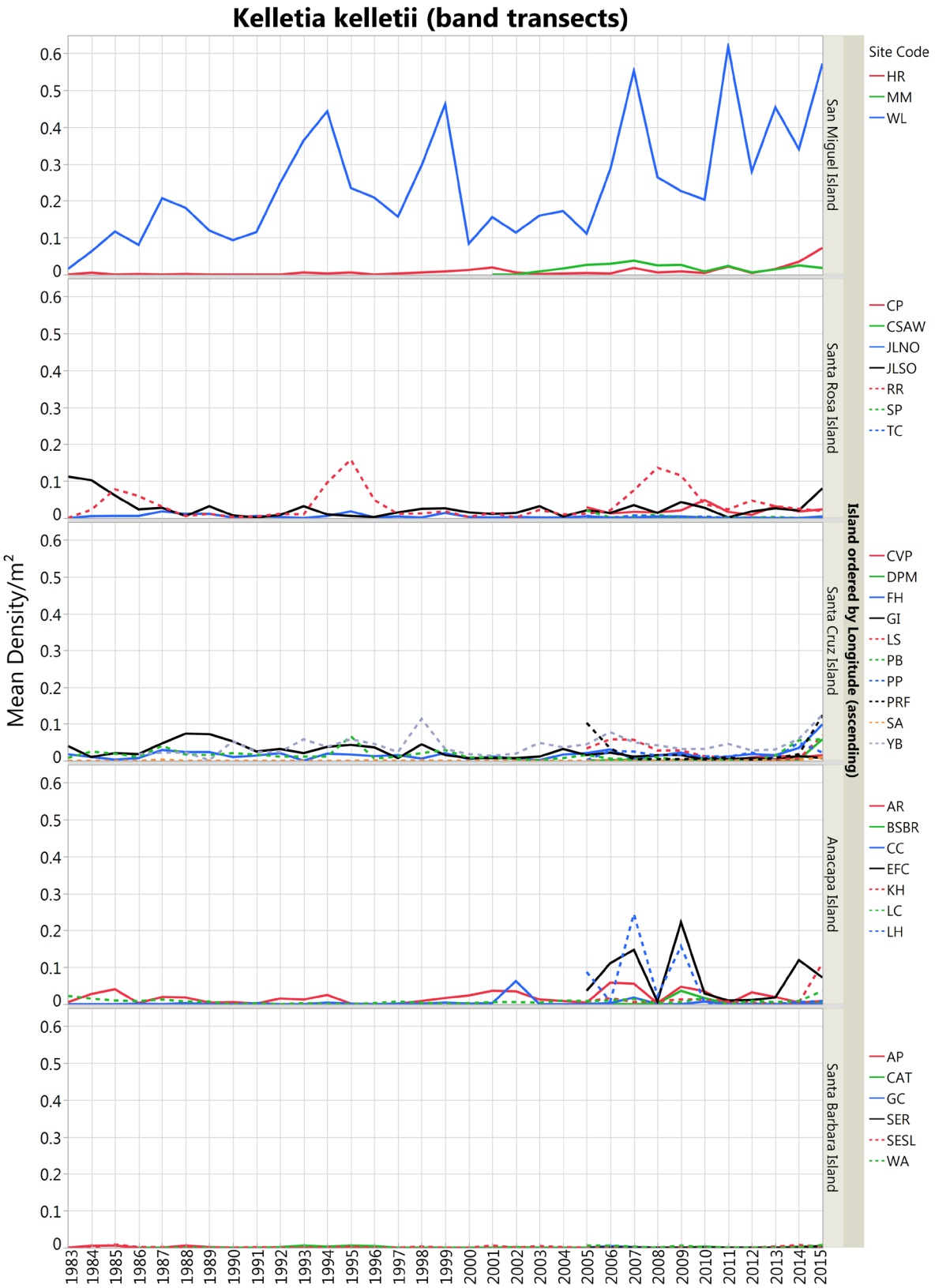


Figure G-11. Mean density of *Kelletia kelletii* by site and island at Channel Islands National Park between 1983 and 2015.

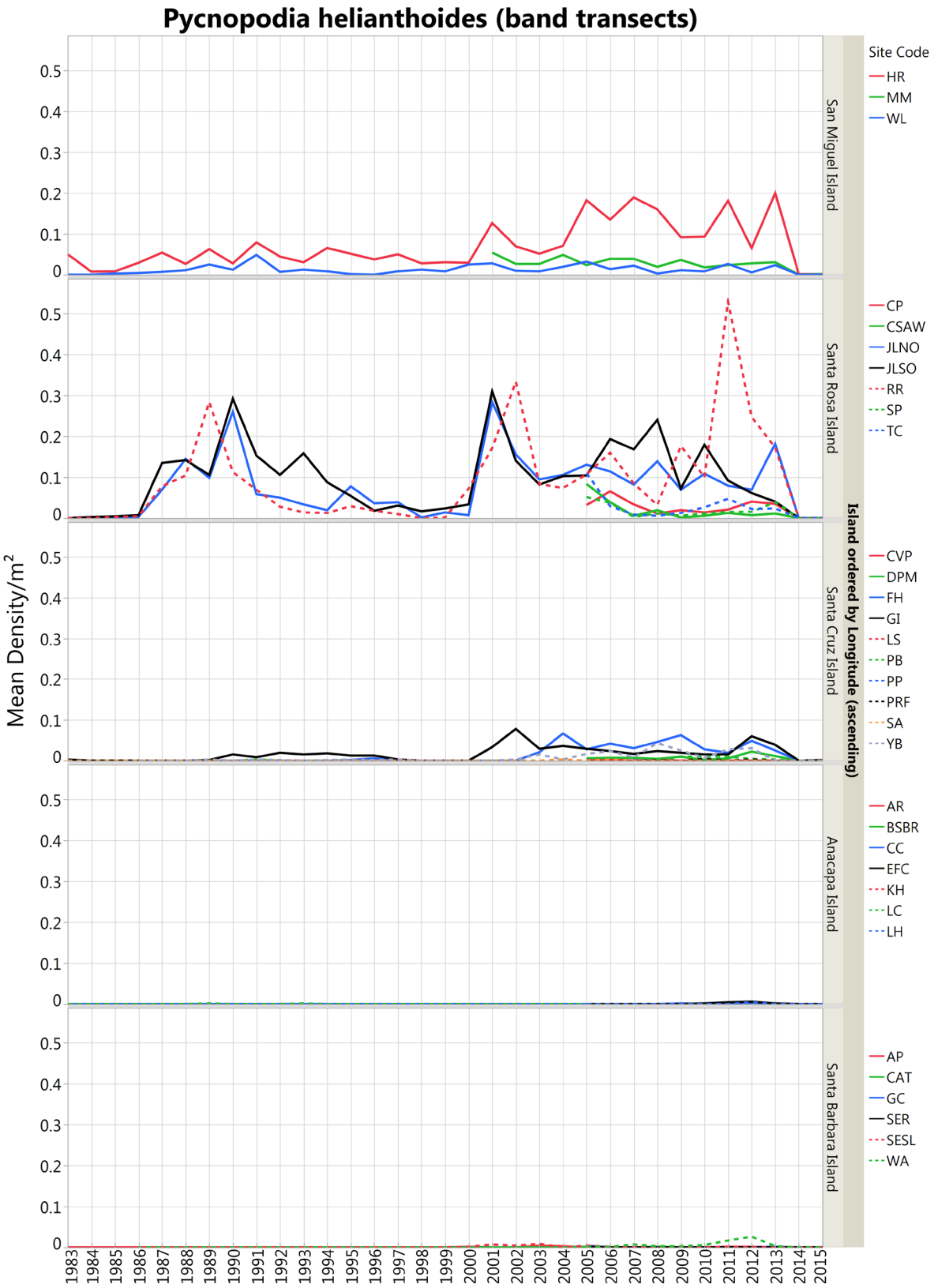


Figure G-12. Mean density of *Pycnopodia helianthoides* by site and island at Channel Islands National Park between 1983 and 2015.

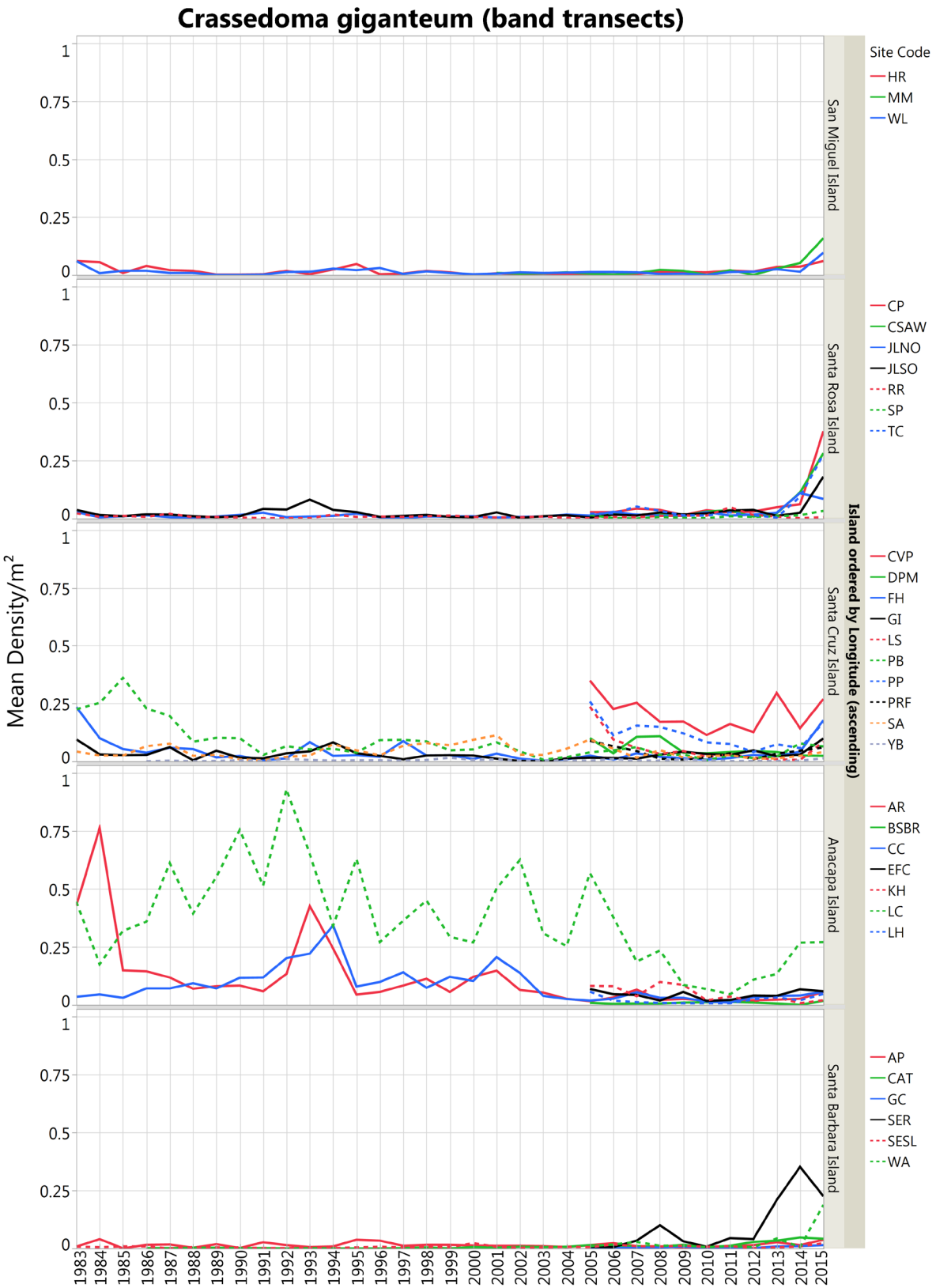


Figure G-13. Mean density of *Crassedoma giganteum* by site and island at Channel Islands National Park between 1983 and 2015.

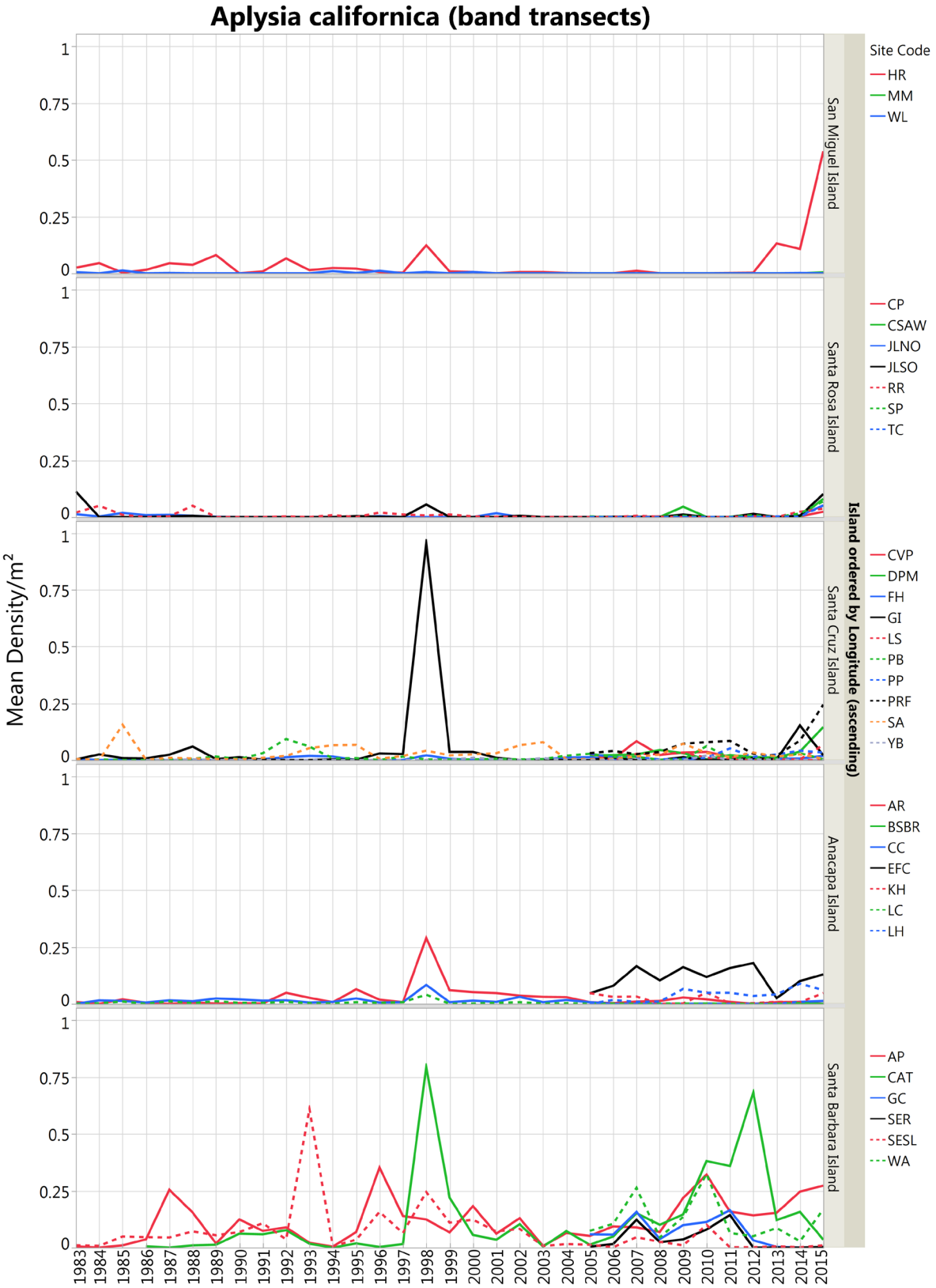


Figure G-14. Mean density of *Aplysia californica* by site and island at Channel Islands National Park between 1983 and 2015.

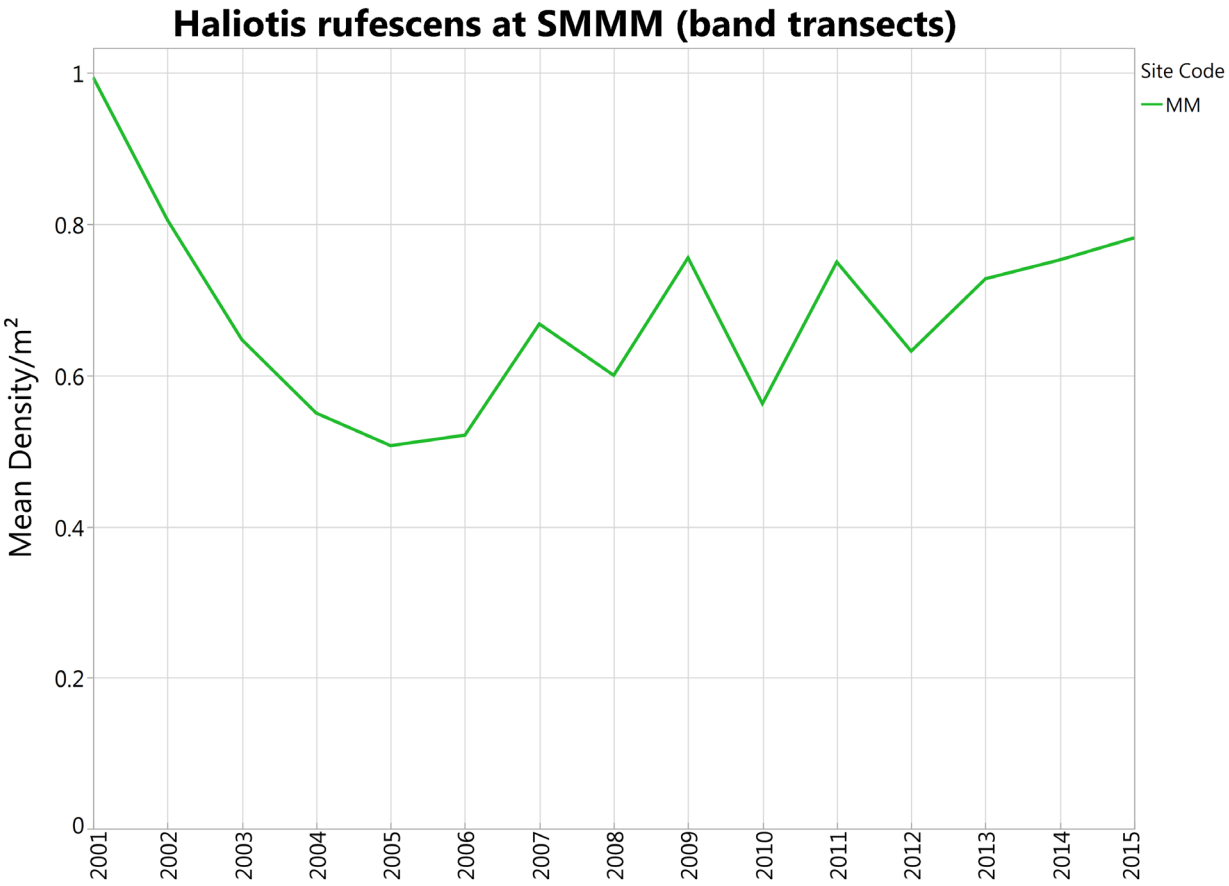


Figure G-15. Mean density of *Haliotis rufescens* at Miracle Mile, San Miguel Island, at Channel Islands National Park between 2001 and 2015.

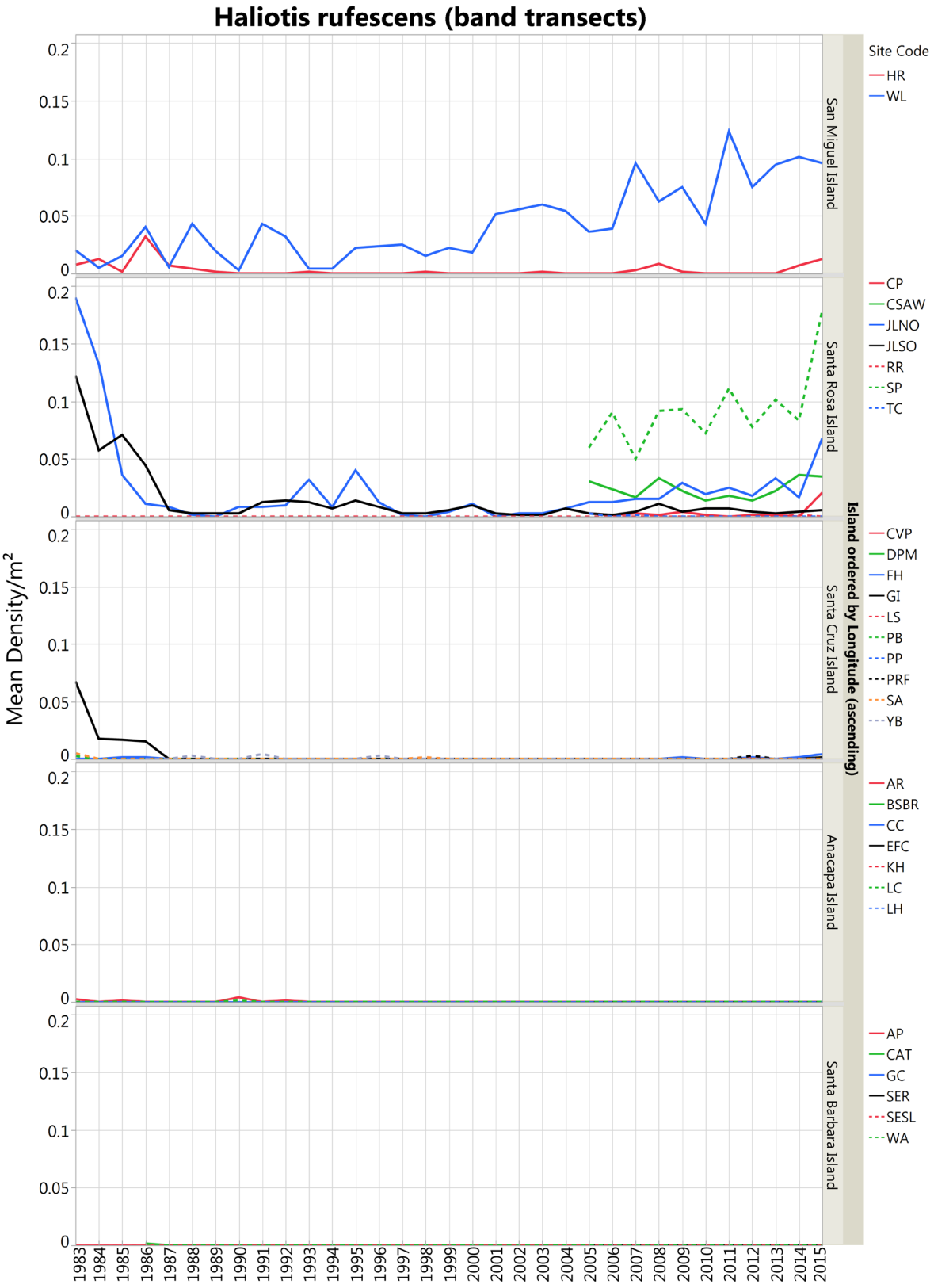


Figure G-16. Mean density of *Haliotis rufescens* by site and island at Channel Islands National Park between 1983 and 2015.

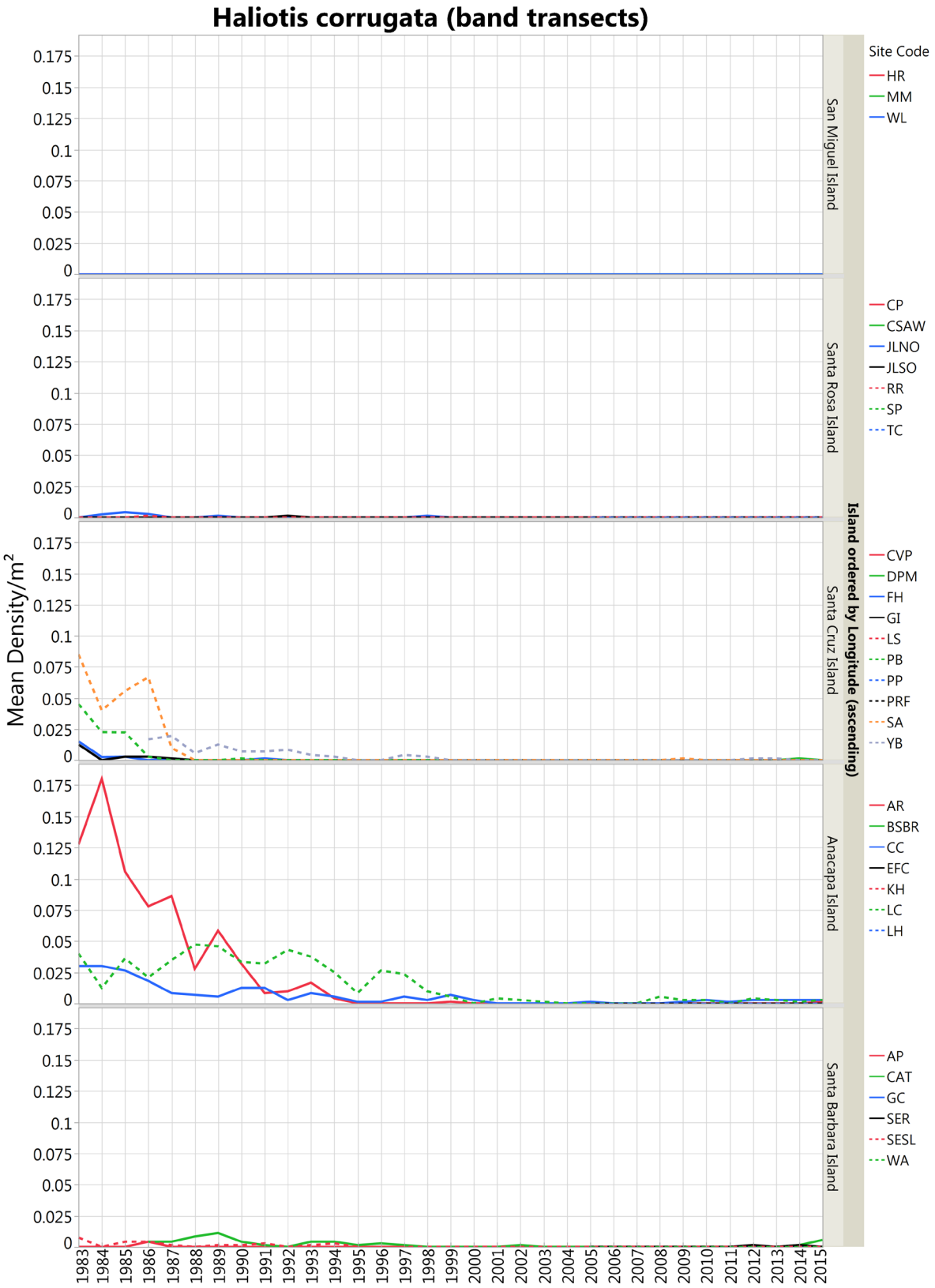


Figure G-17. Mean density of *Haliotis corrugata* by site and island at Channel Islands National Park between 1983 and 2015.

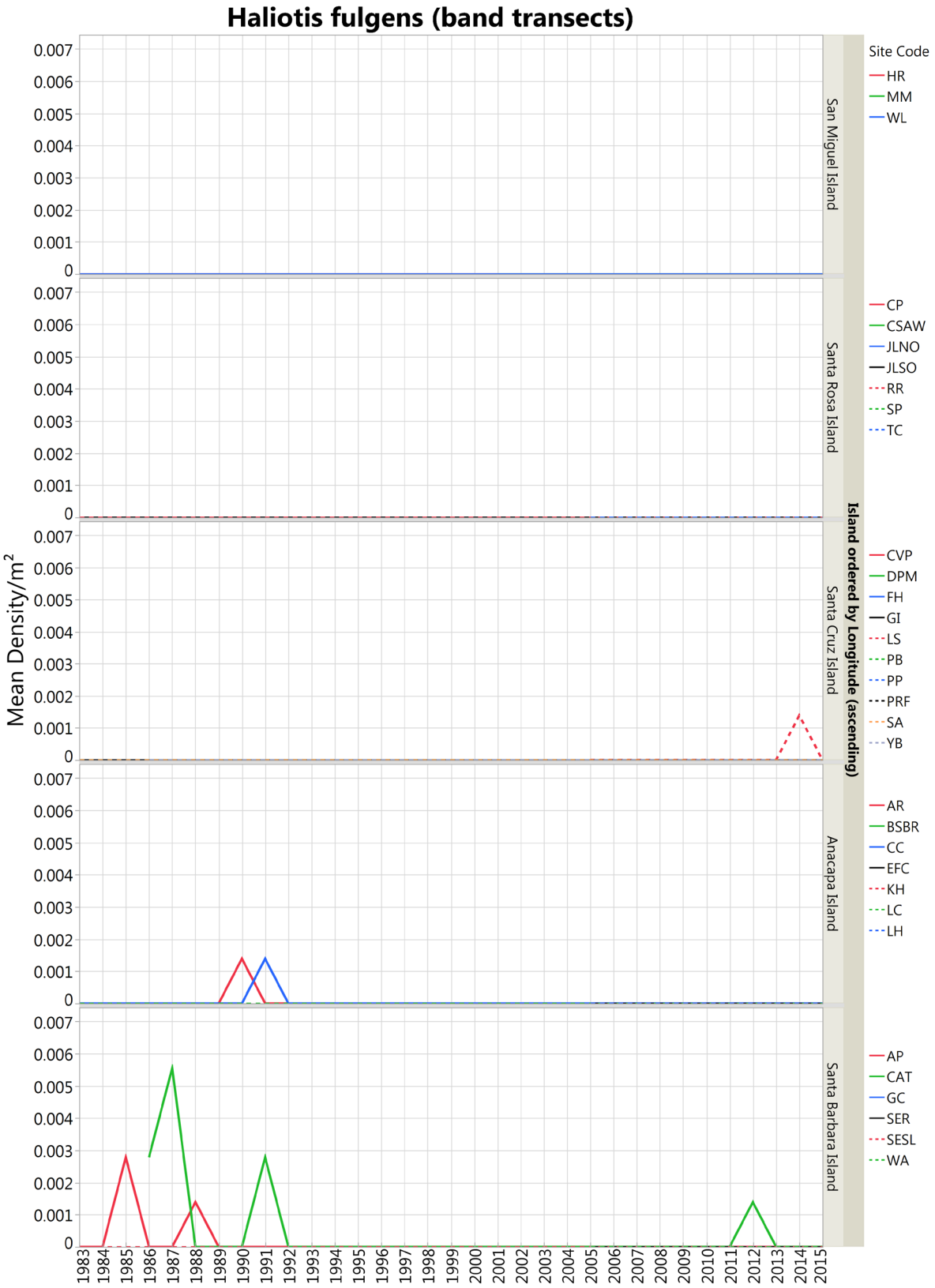


Figure G-18. Mean density of *Haliotis fulgens* by site and island at Channel Islands National Park between 1983 and 2015.

Appendix H. Random Point Contact Data

Figures H-1 through H-32 show the random point contact data.

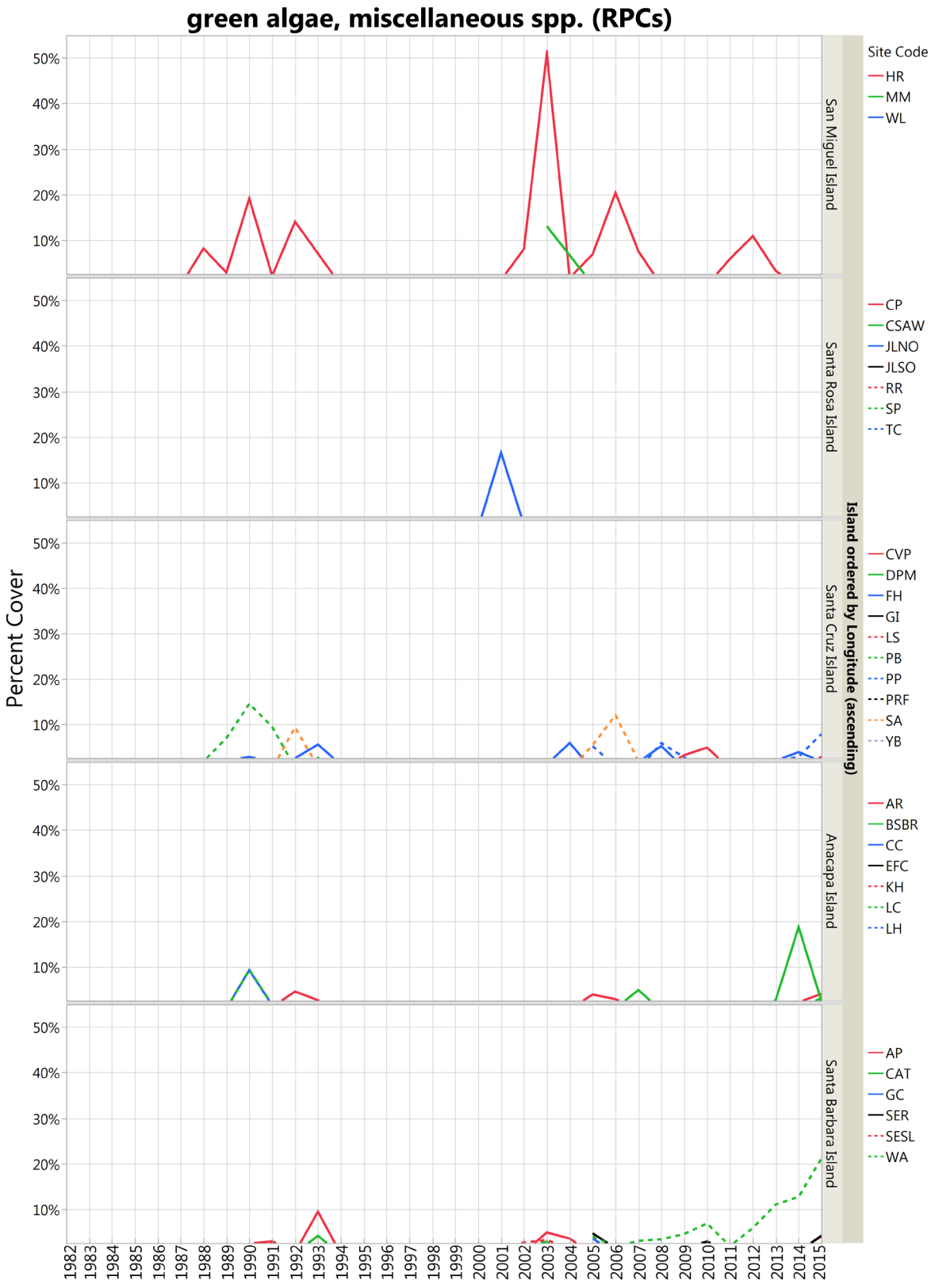


Figure H-1. Percent cover of green algae, miscellaneous species, by site and island at Channel Islands National Park between 1982 and 2015.

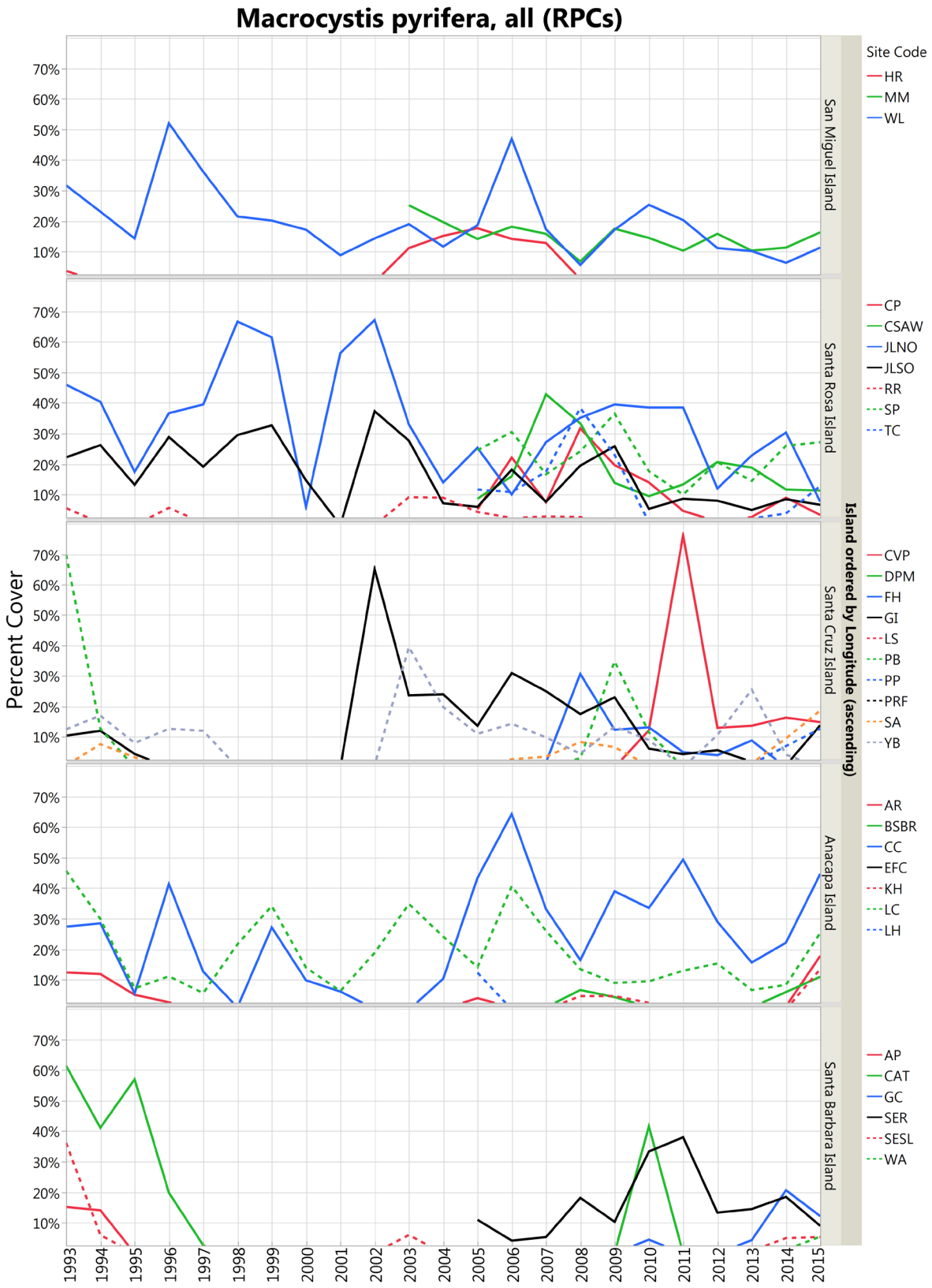


Figure H-2. Percent cover of *Macrocystis pyrifera* by site and island at Channel Islands National Park between 1993 and 2015.

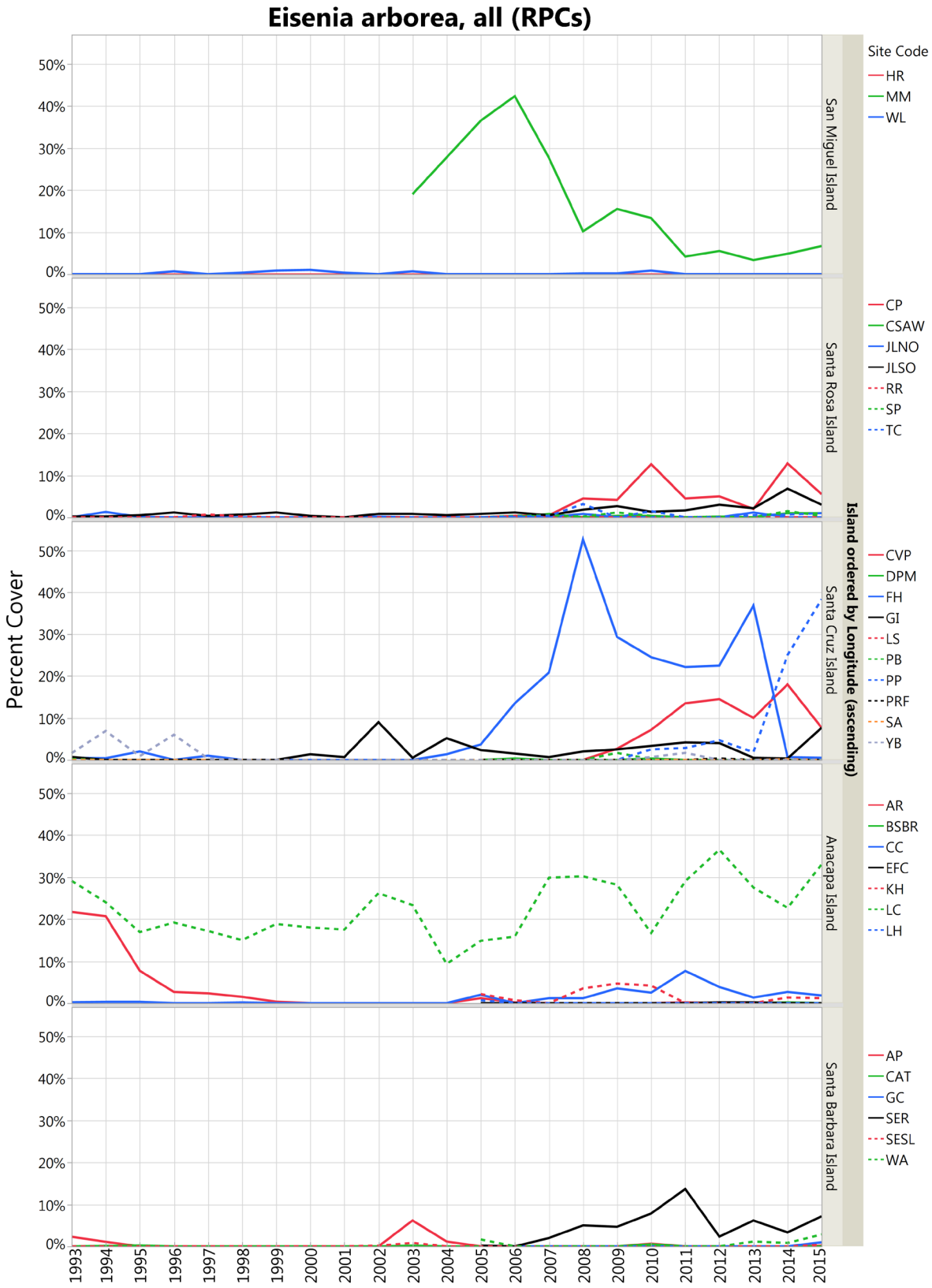


Figure H-3. Percent cover of *Eisenia arborea* by site and island at Channel Islands National Park between 1993 and 2015.

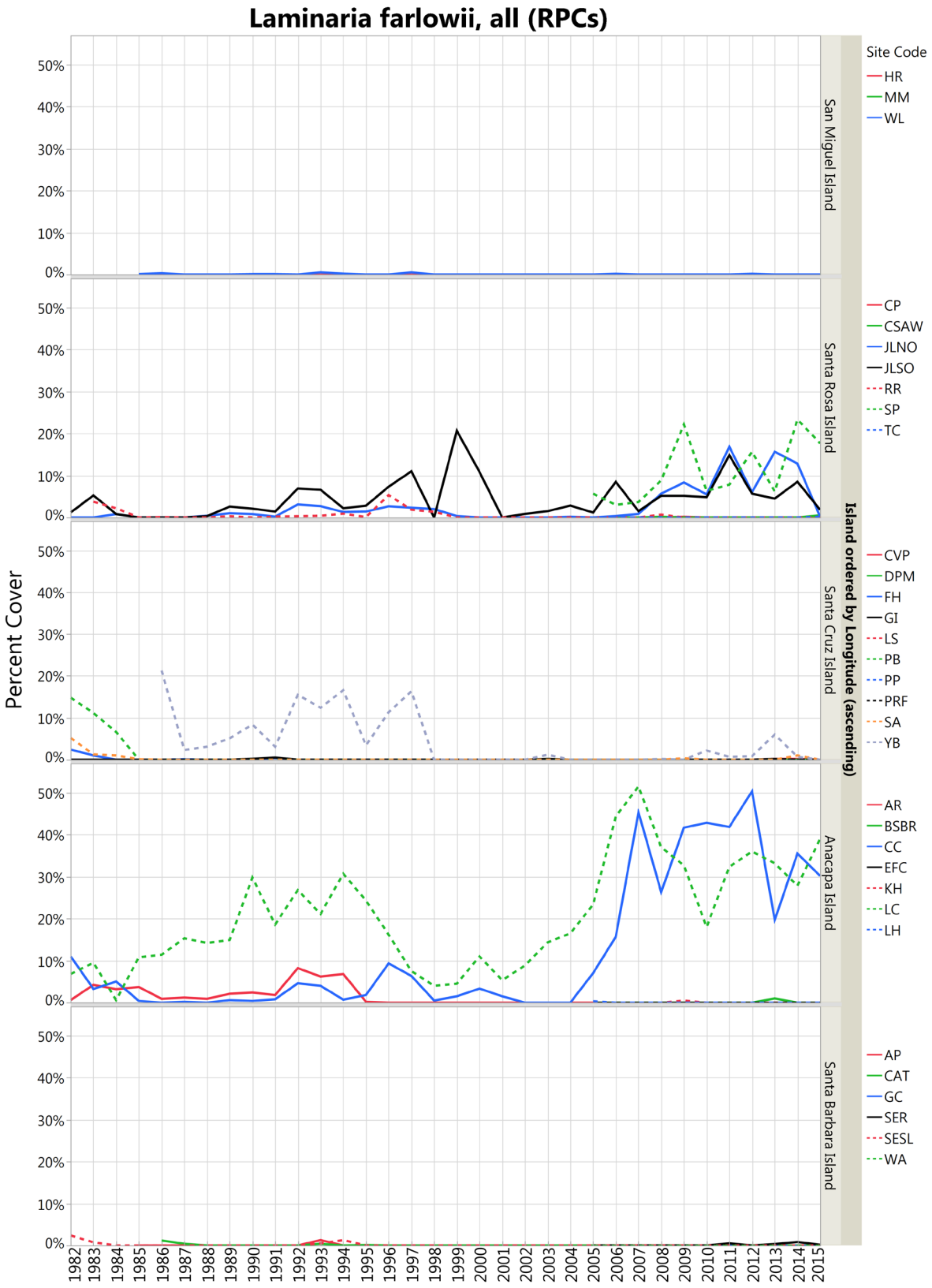


Figure H-4. Percent cover of *Laminaria farlowii* by site and island at Channel Islands National Park between 1982 and 2015.

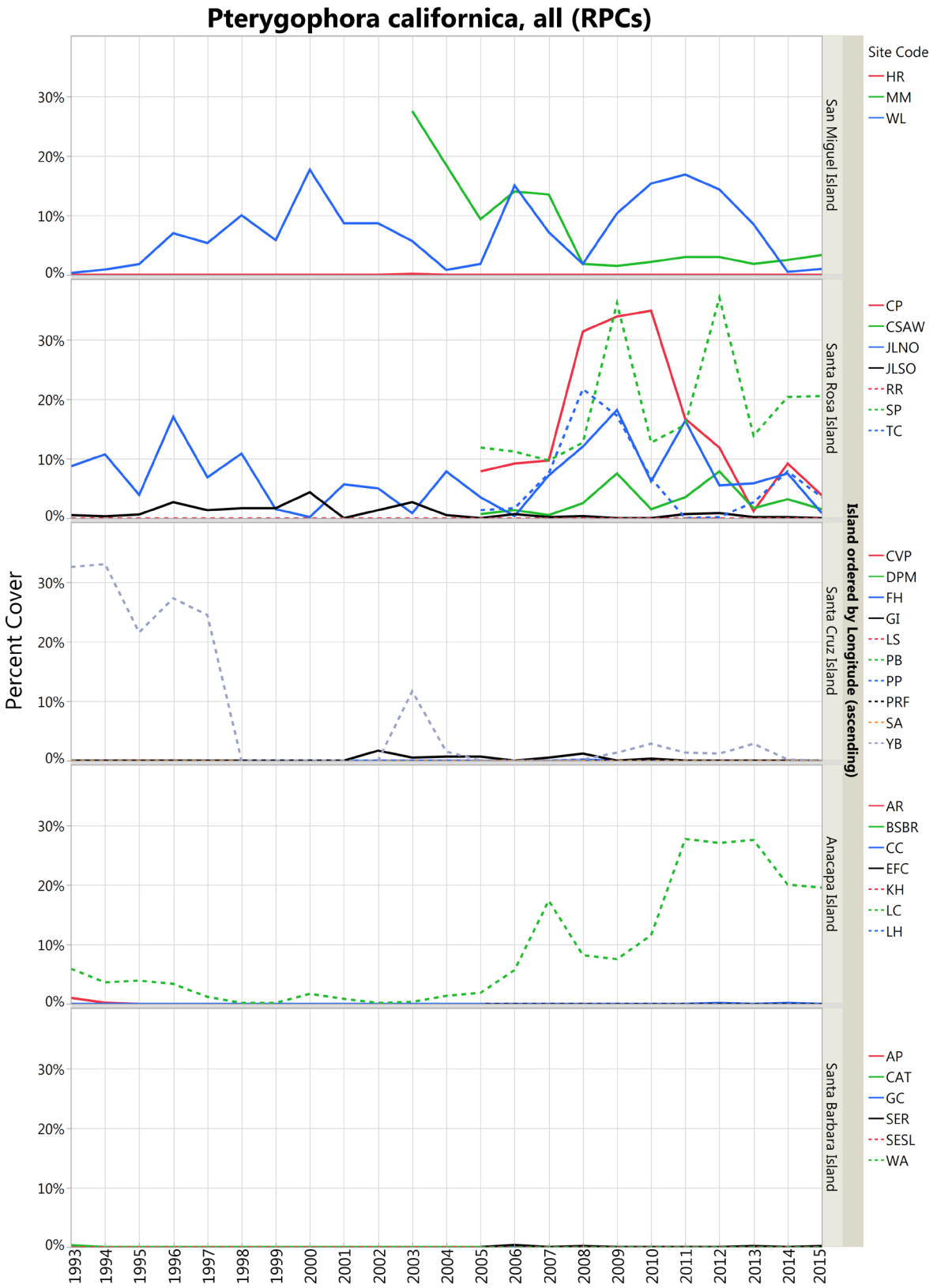


Figure H-5. Percent cover of *Pterygophora californica* by site and island at Channel Islands National Park between 1993 and 2015.

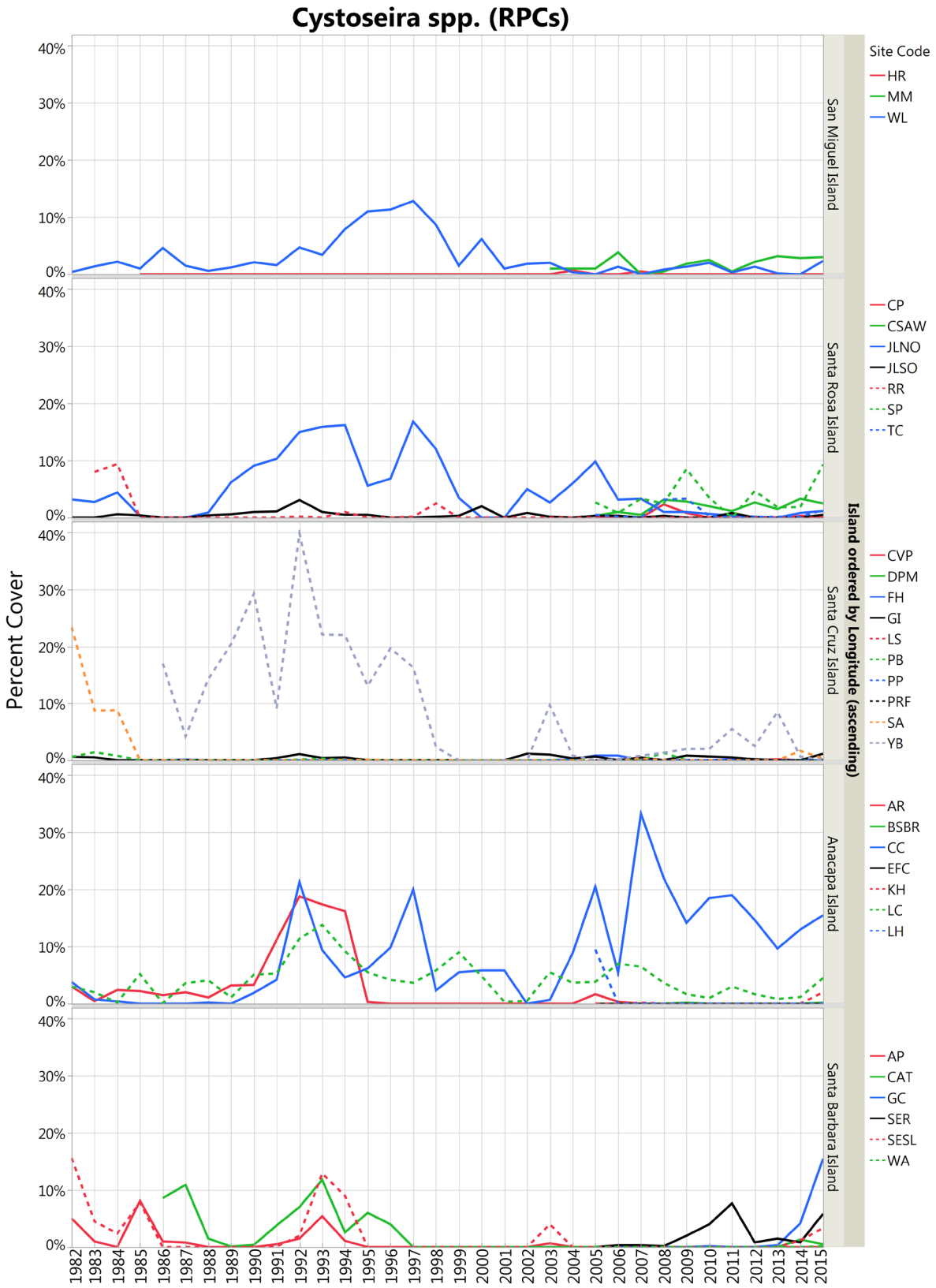


Figure H-6. Percent cover of *Cystoseira* species by site and island at Channel Islands National Park between 1982 and 2015.

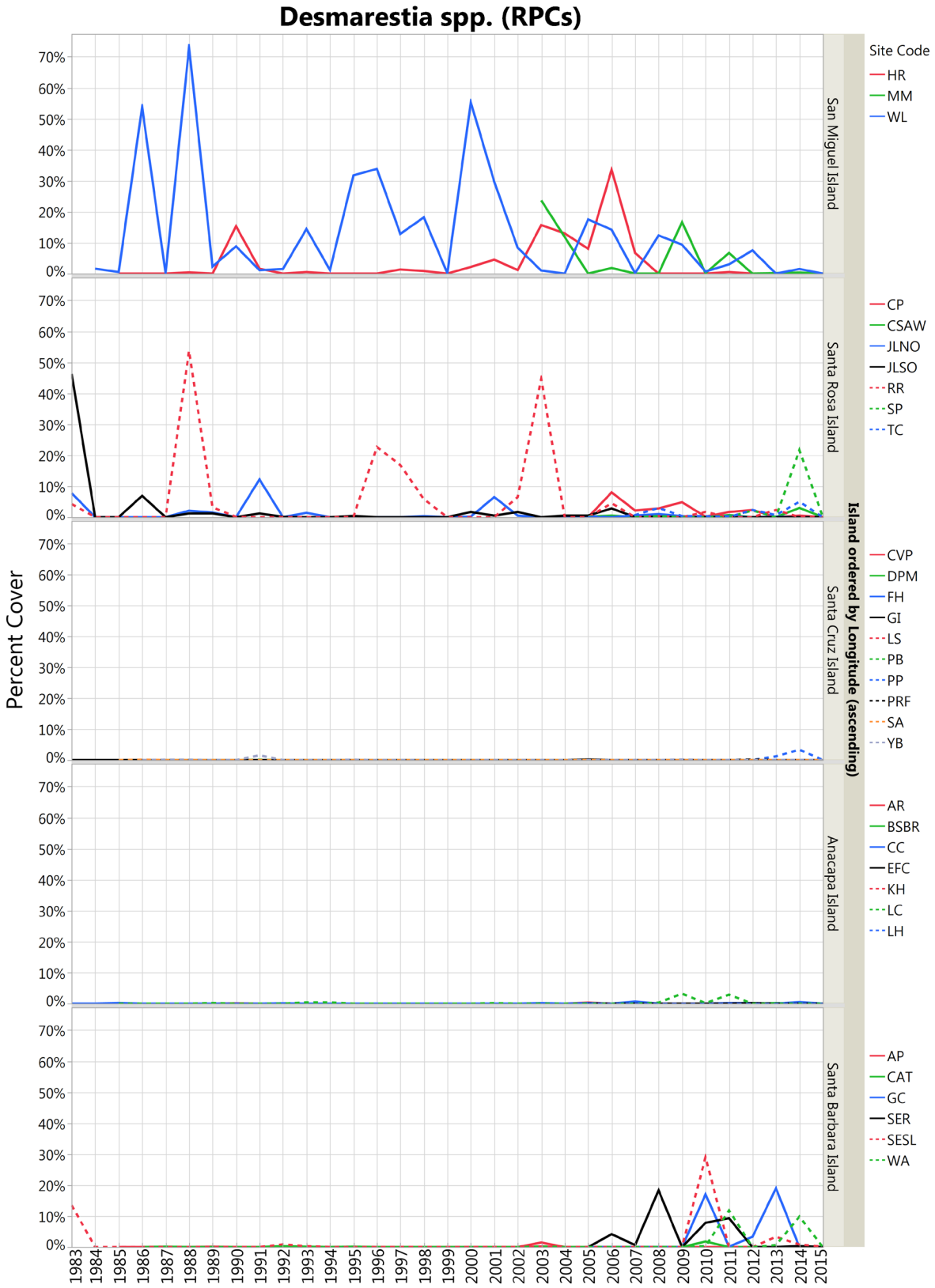


Figure H-7. Percent cover of *Desmarestia* species by site and island at Channel Islands National Park between 1983 and 2015.

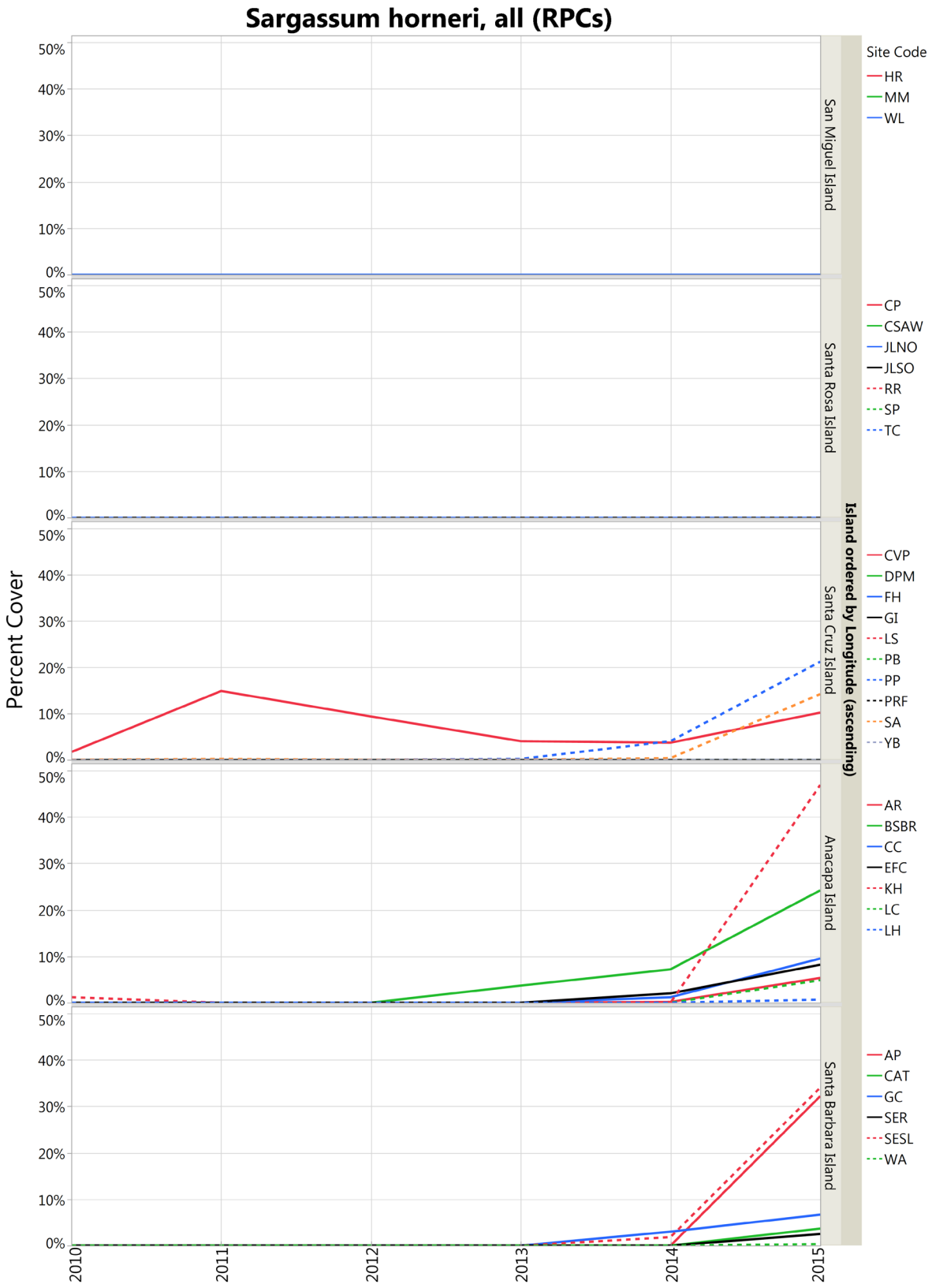


Figure H-8. Percent cover of all *Sargassum horneri* by site and island at Channel Islands National Park between 2010 and 2015.

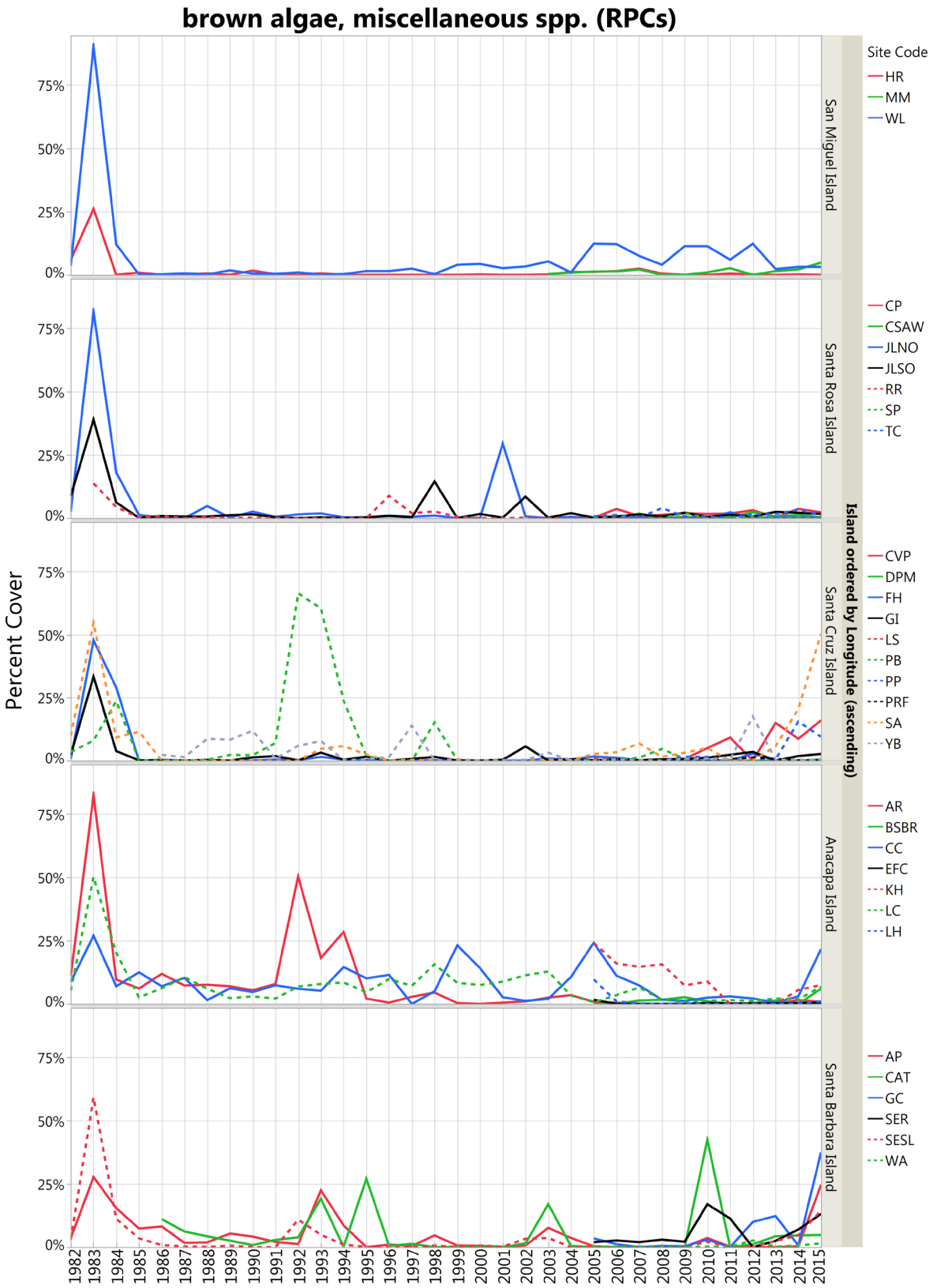


Figure H-9. Percent cover of brown algae, miscellaneous species, by site and island at Channel Islands National Park between 1982 and 2015.

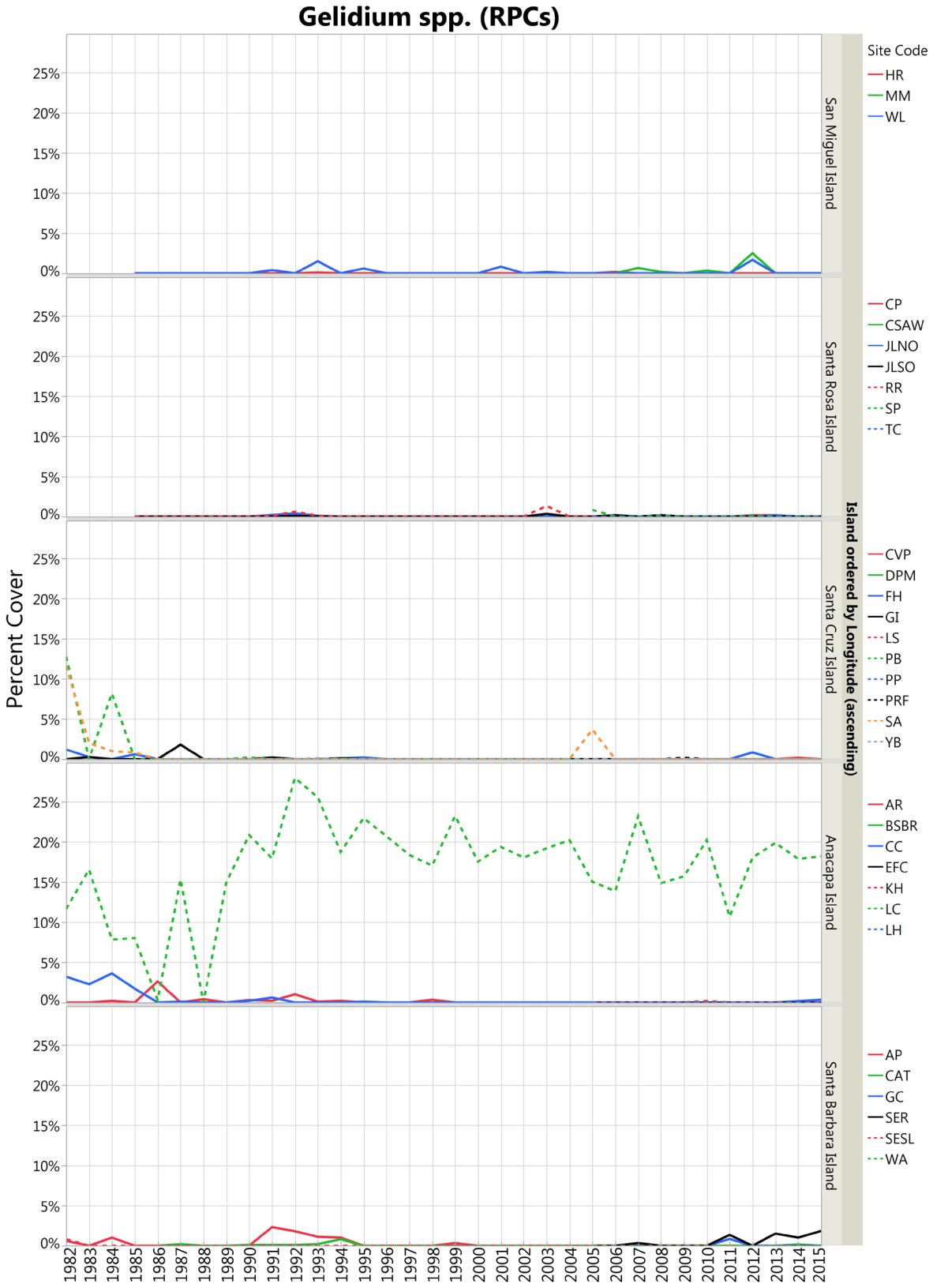


Figure H-10. Percent cover of *Gelidium* species by site and island at Channel Islands National Park between 1982 and 2015.

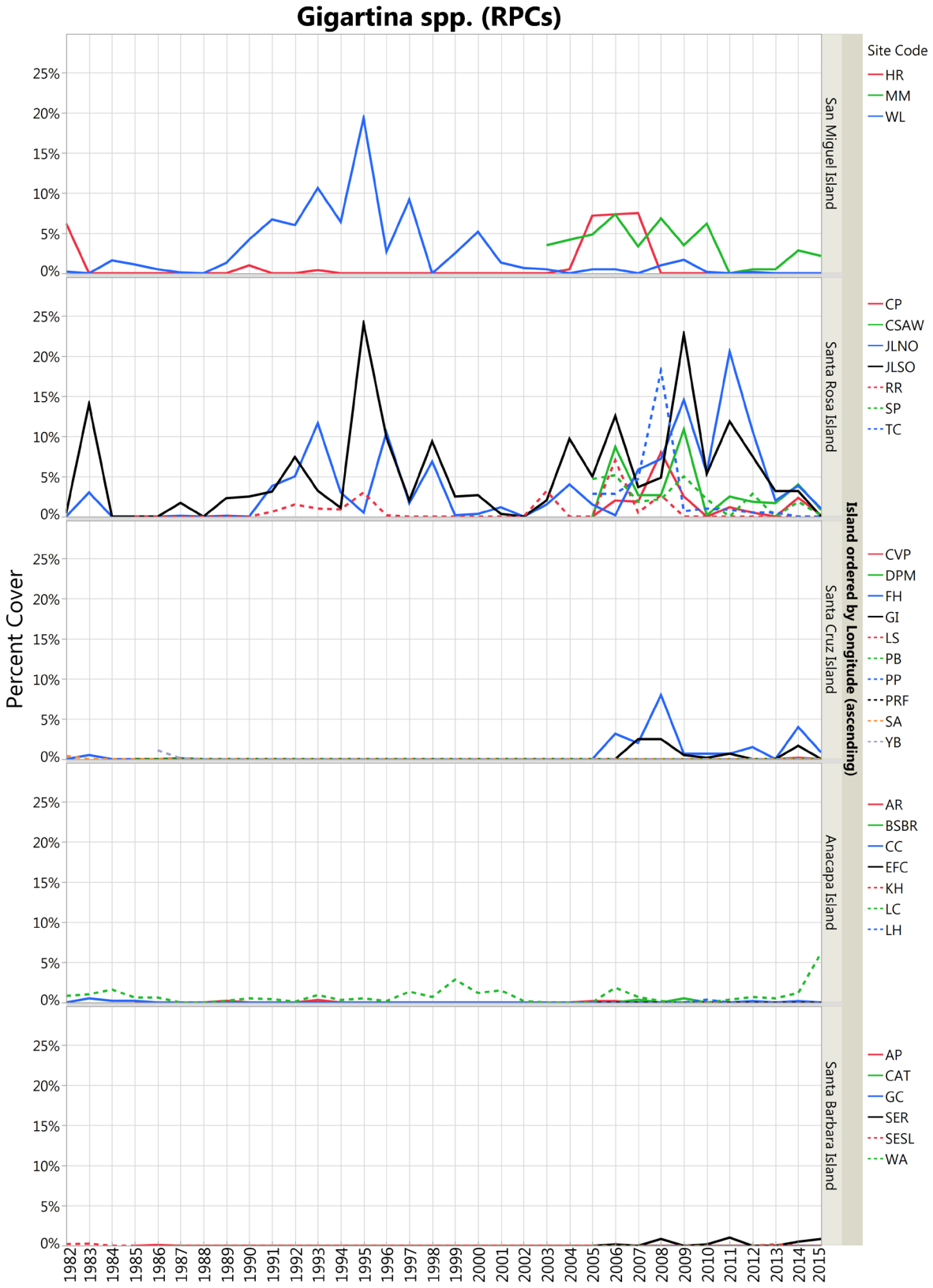


Figure H-11. Percent cover of *Gigartina* species by site and island at Channel Islands National Park between 1982 and 2015.

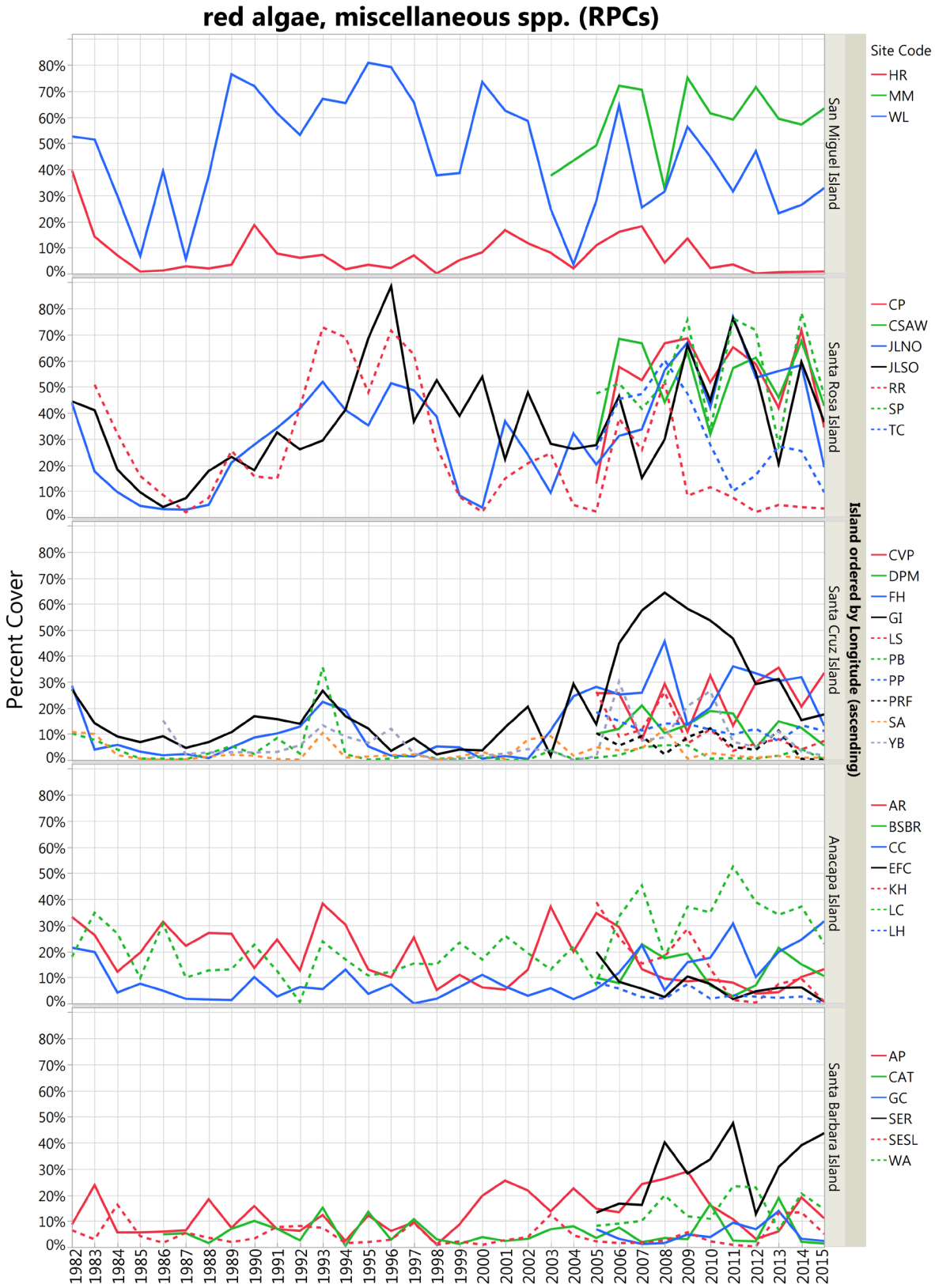


Figure H-12. Percent cover of red algae, miscellaneous species, by site and island at Channel Islands National Park between 1982 and 2015.

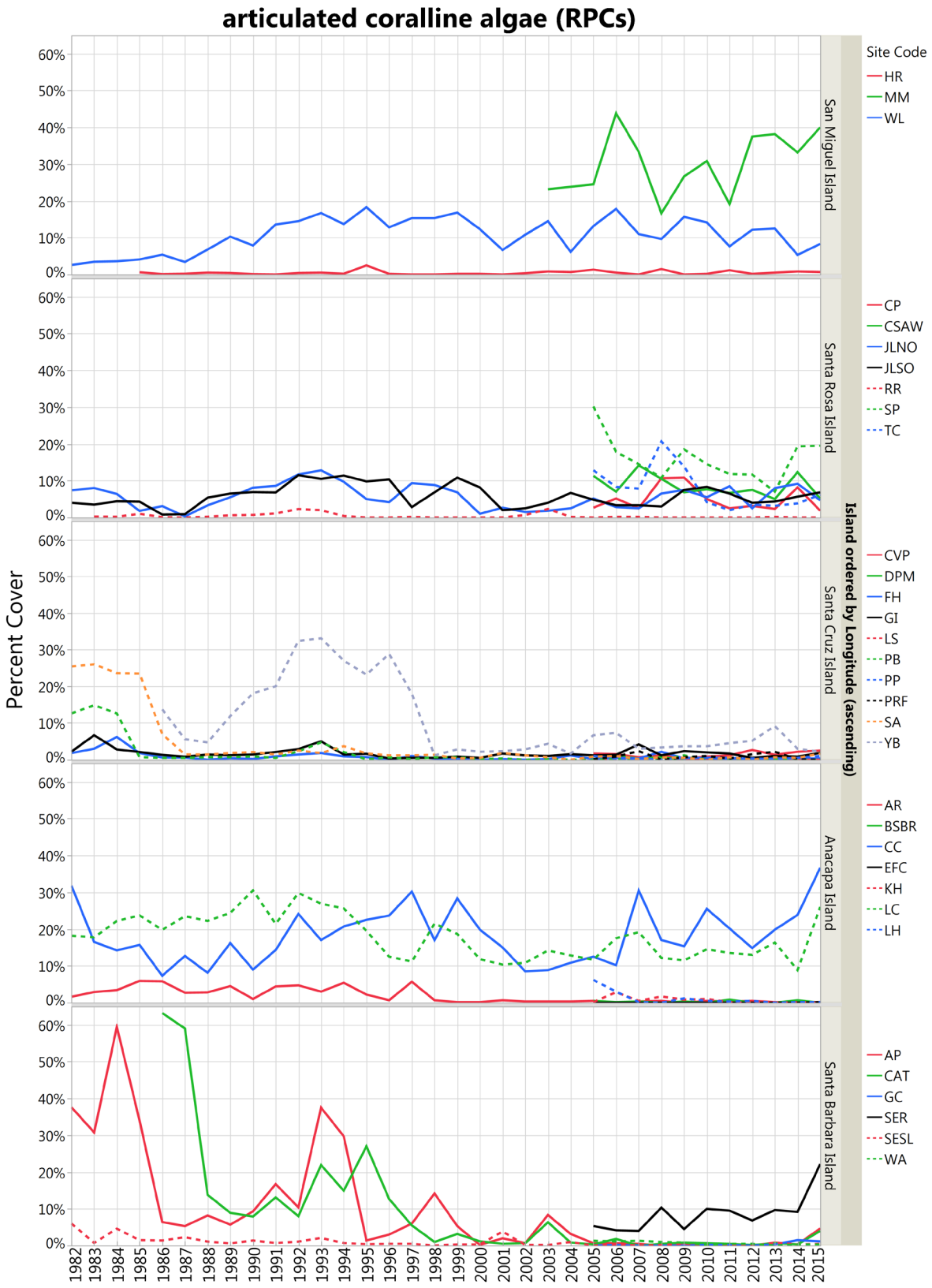


Figure H-13. Percent cover of articulated coralline algae by site and island at Channel Islands National Park between 1982 and 2015.

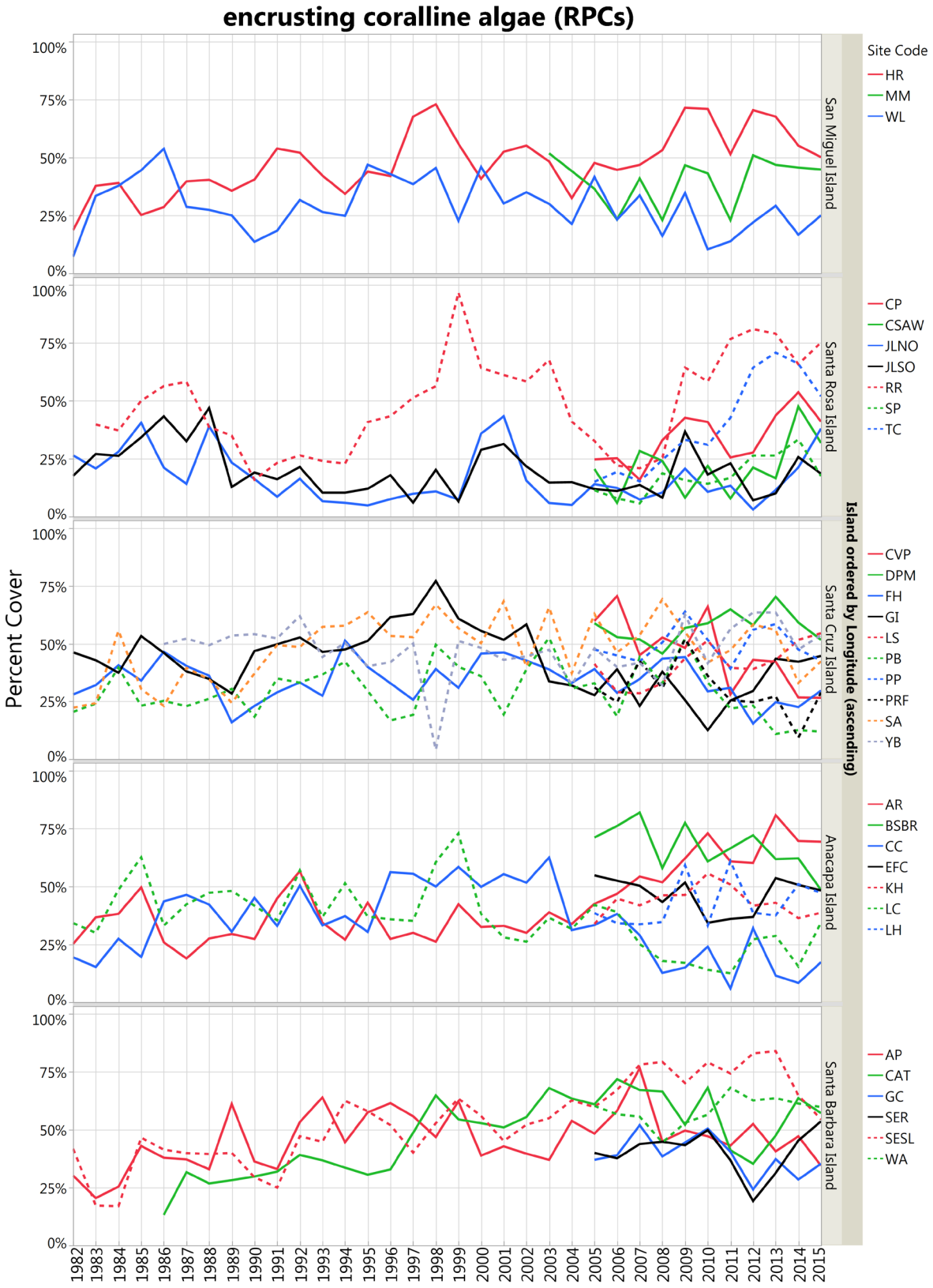


Figure H-14. Percent cover of encrusting coralline algae by site and island at Channel Islands National Park between 1982 and 2015.

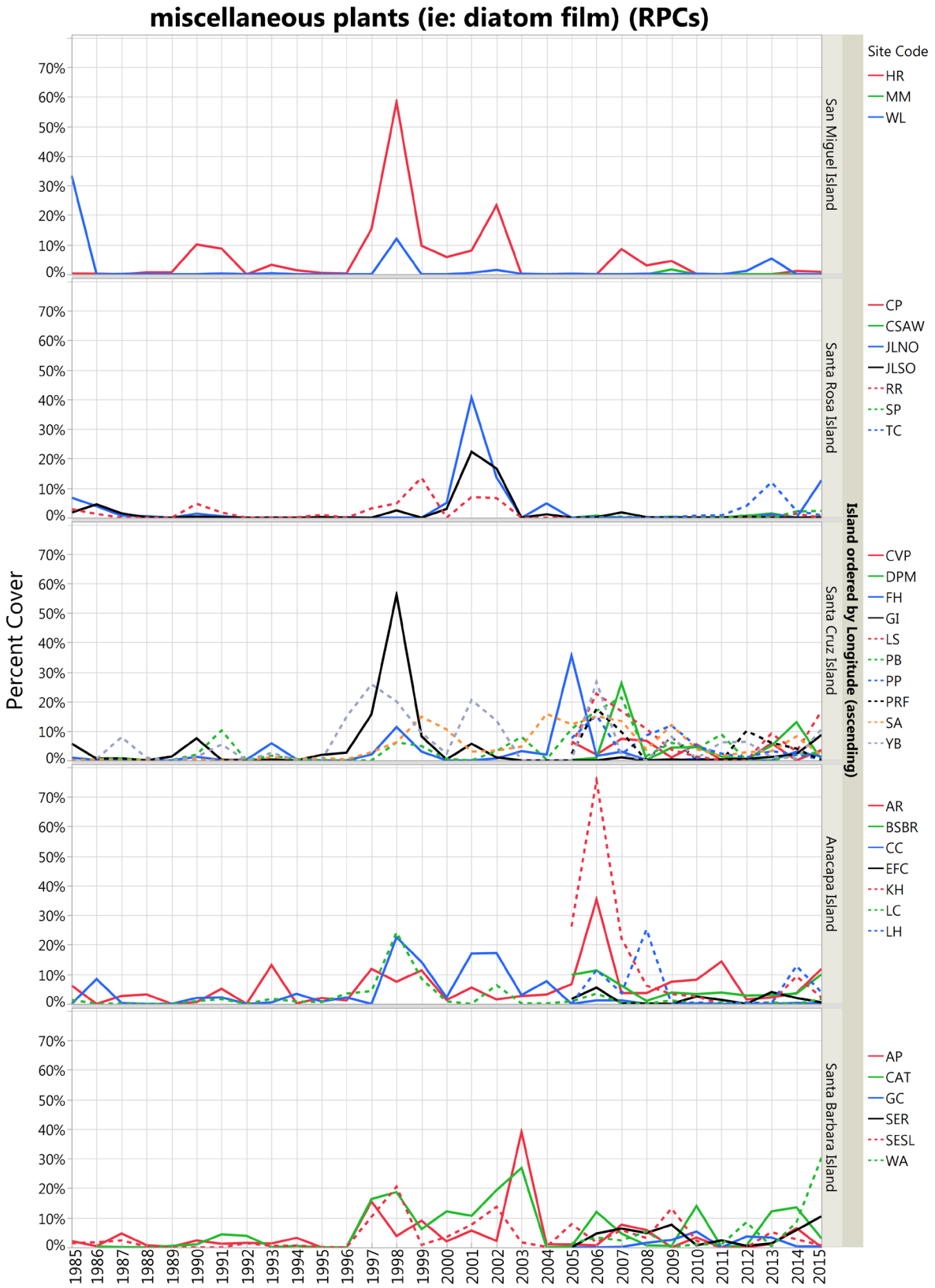


Figure H-15. Percent cover of miscellaneous plants (diatom film) by site and island at Channel Islands National Park between 1985 and 2015.

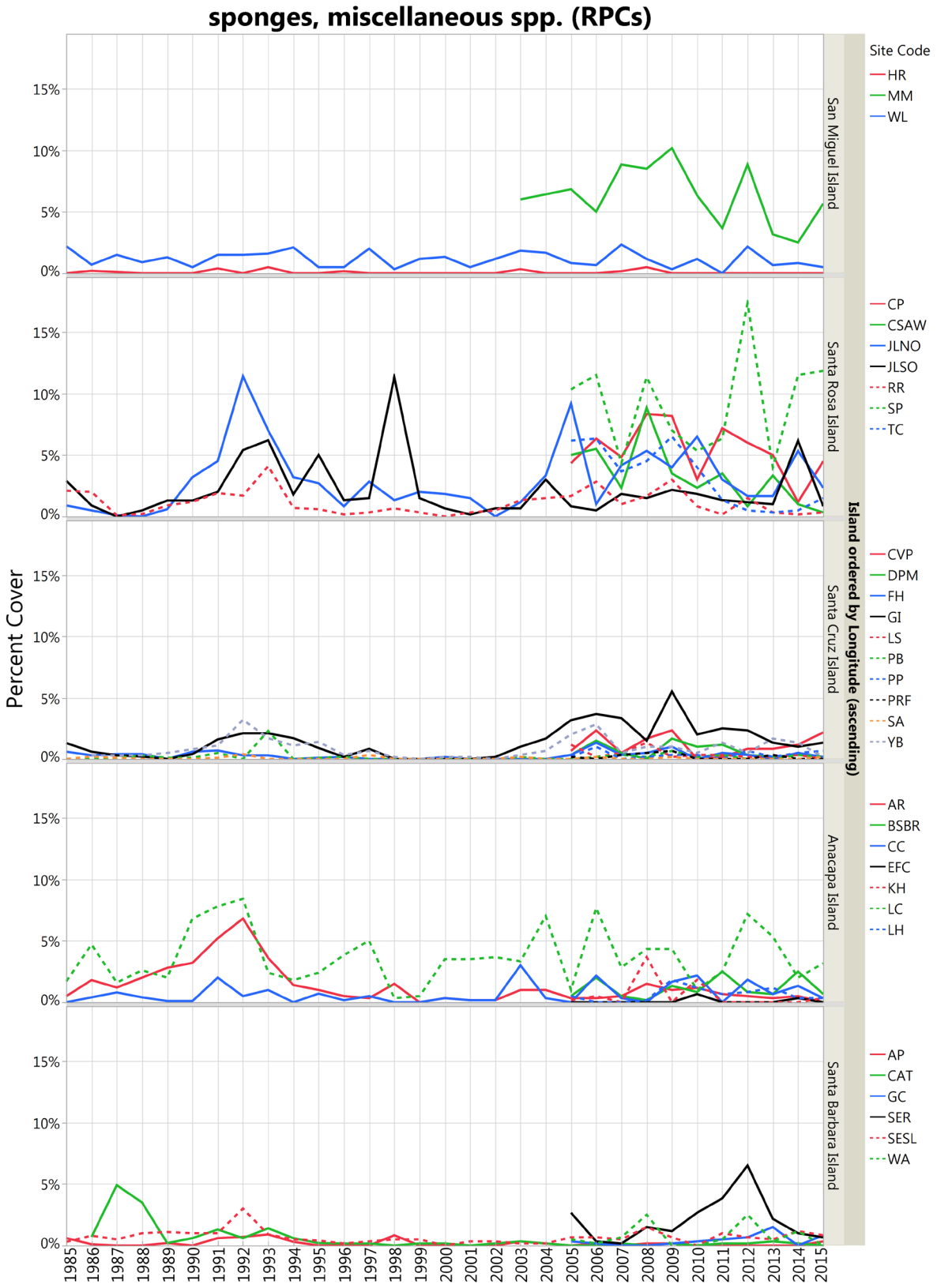


Figure H-16. Percent cover of sponges, miscellaneous species, by site and island at Channel Islands National Park between 1985 and 2015.

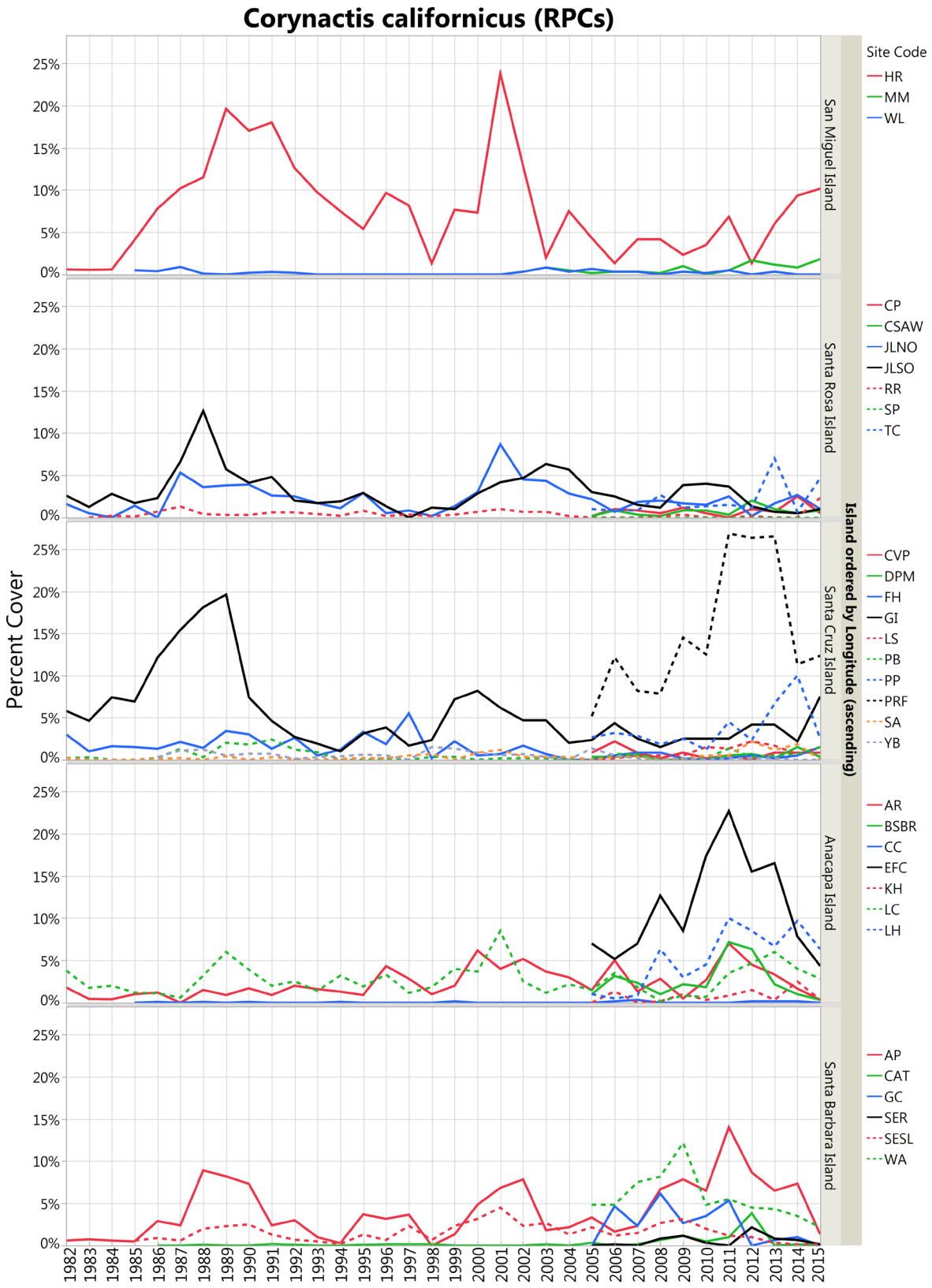


Figure H-17. Percent cover of *Corynactis californica* by site and island at Channel Islands National Park between 1982 and 2015.

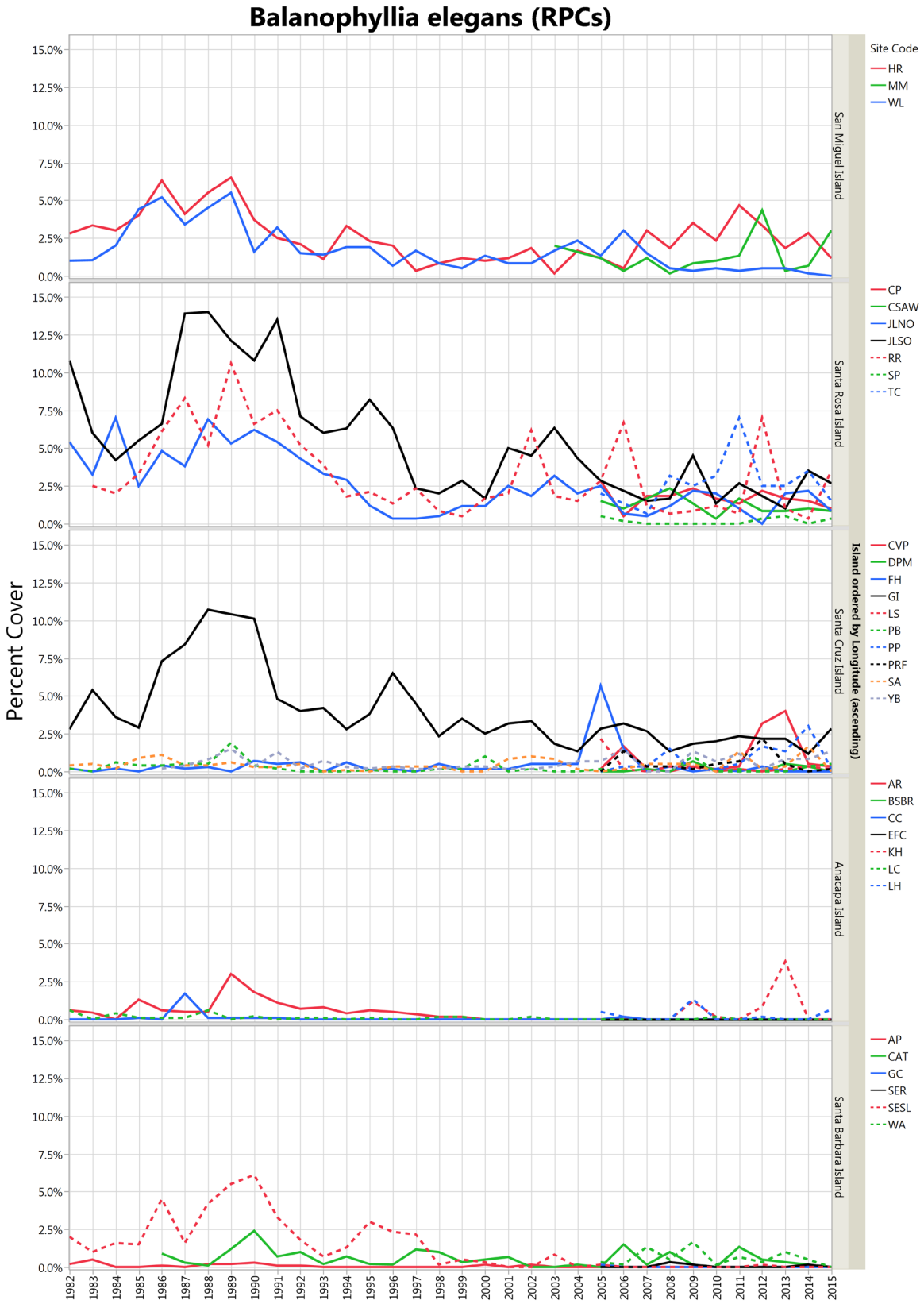


Figure H-18. Percent cover of *Balanophyllia elegans* by site and island at Channel Islands National Park between 1982 and 2015.

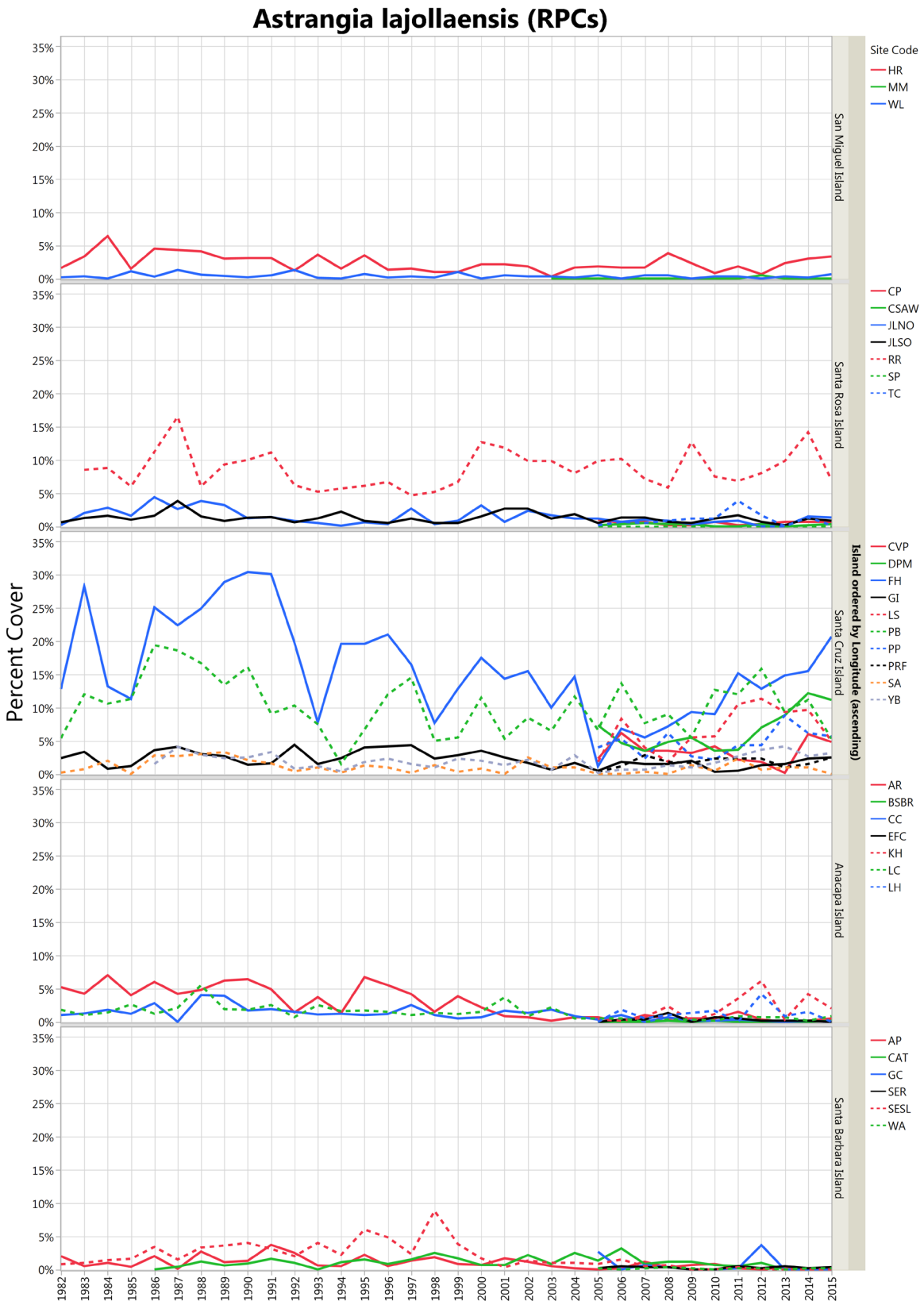


Figure H-19. Percent cover of *Astrangia lajollaensis* by site and island at Channel Islands National Park between 1982 and 2015.

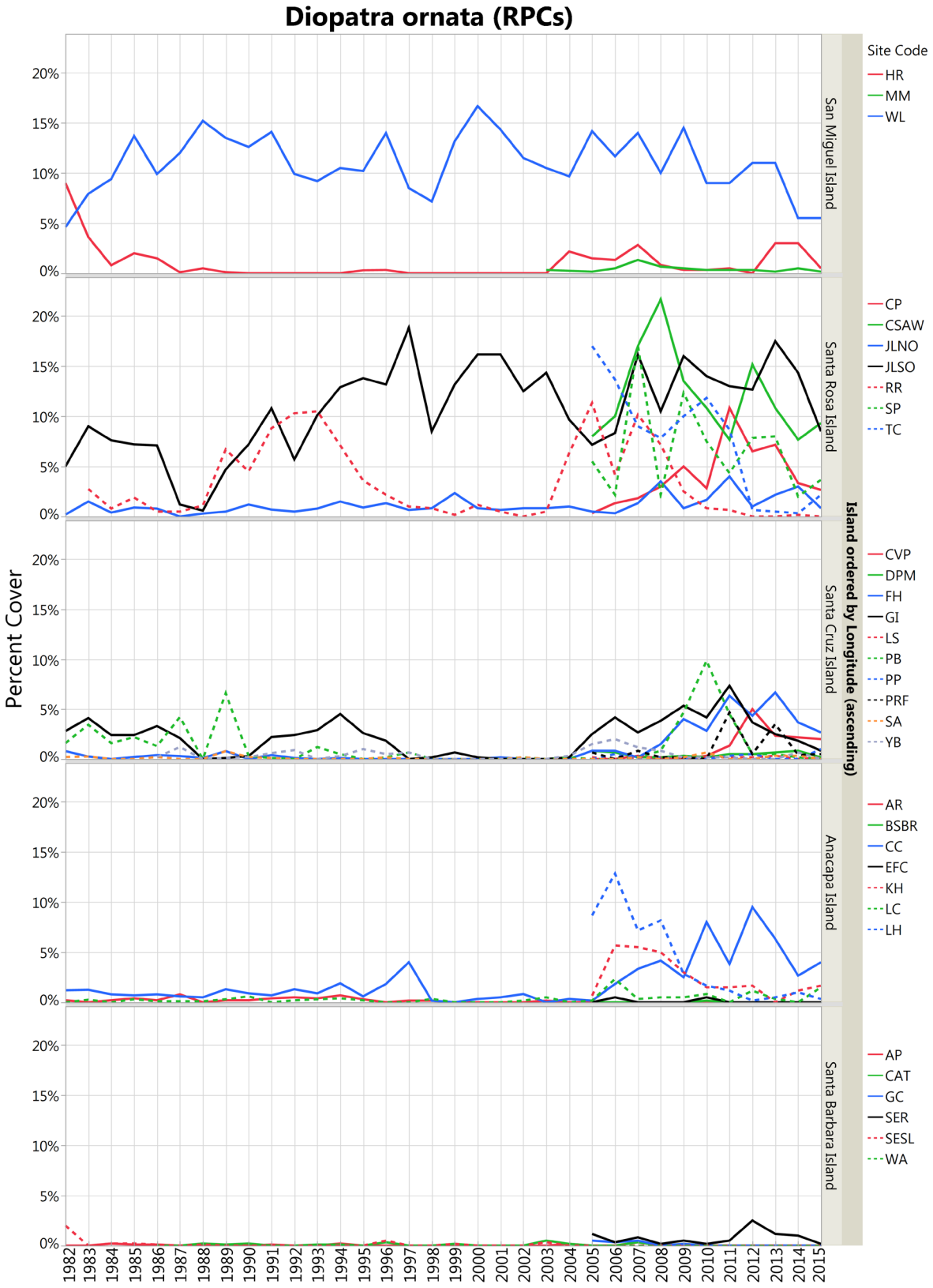


Figure H-20. Percent cover of *Diopatra ornate* by site and island at Channel Islands National Park between 1982 and 2015.

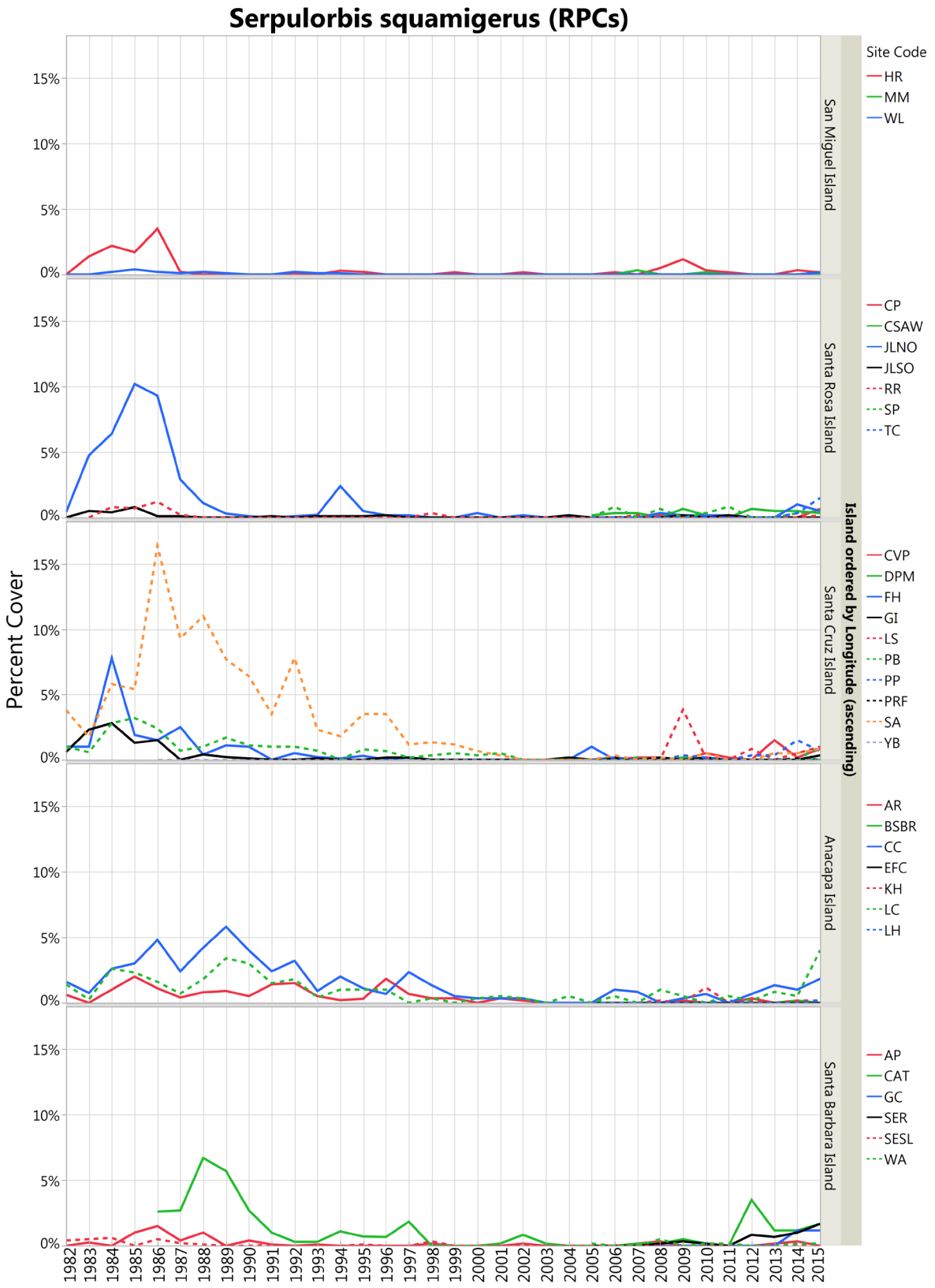


Figure H-21. Percent cover of *Serpulorbis squamigerus* by site and island at Channel Islands National Park between 1982 and 2015.

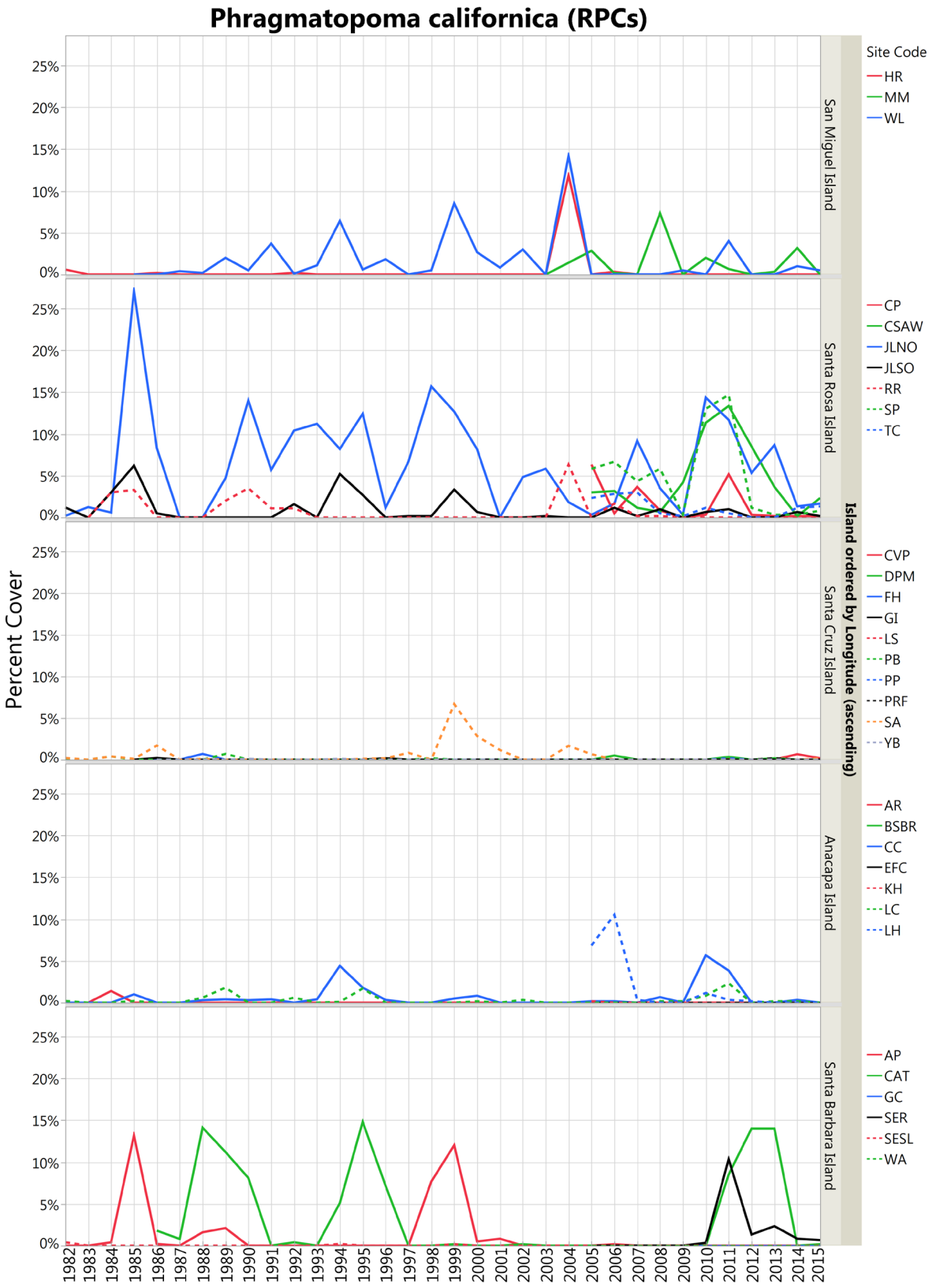


Figure H-22. Percent cover of *Phragmatopoma californica* by site and island at Channel Islands National Park between 1982 and 2015.

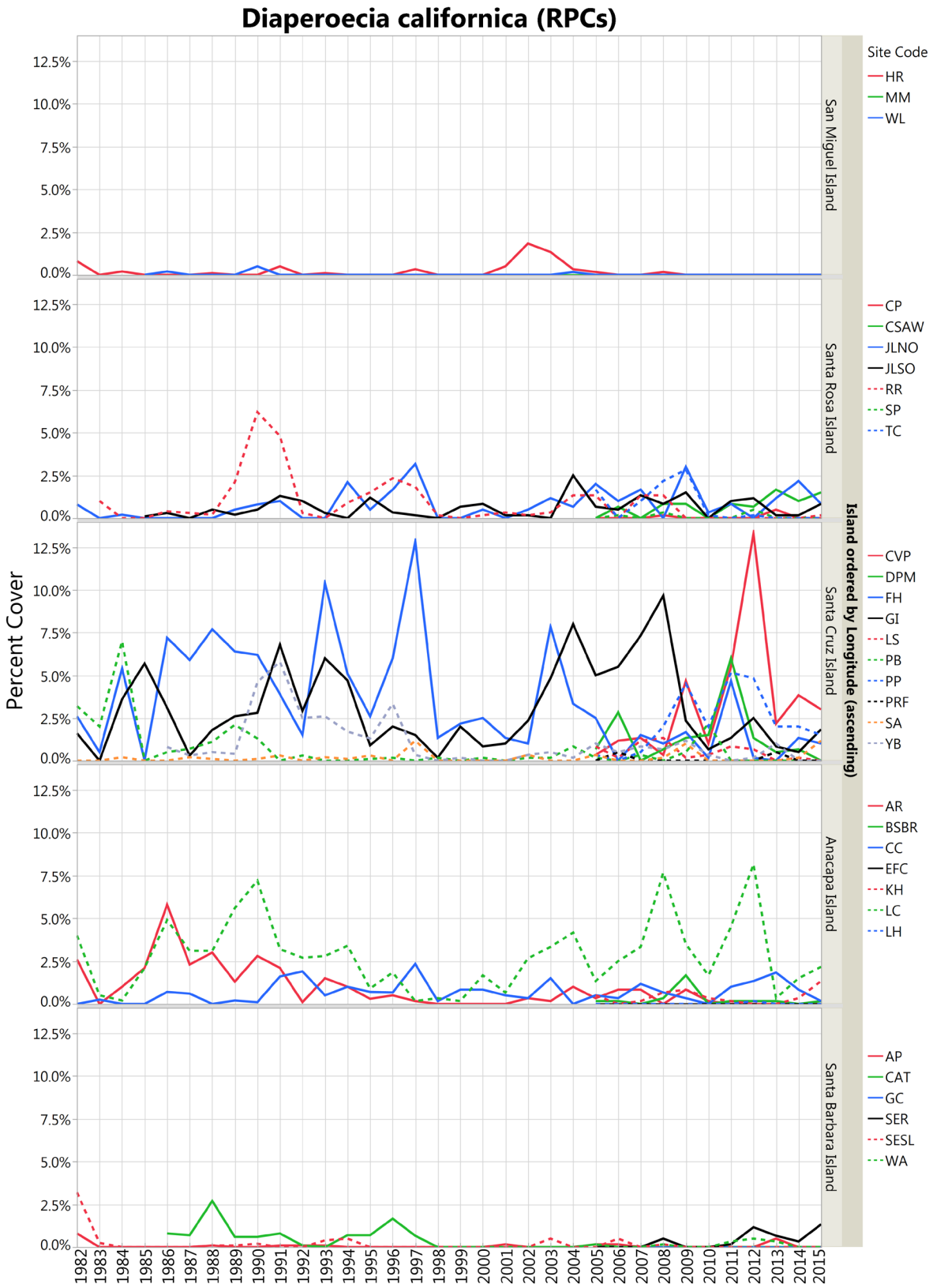


Figure H-23. Percent cover of *Diaperoecia californica* by site and island at Channel Islands National Park between 1982 and 2015.

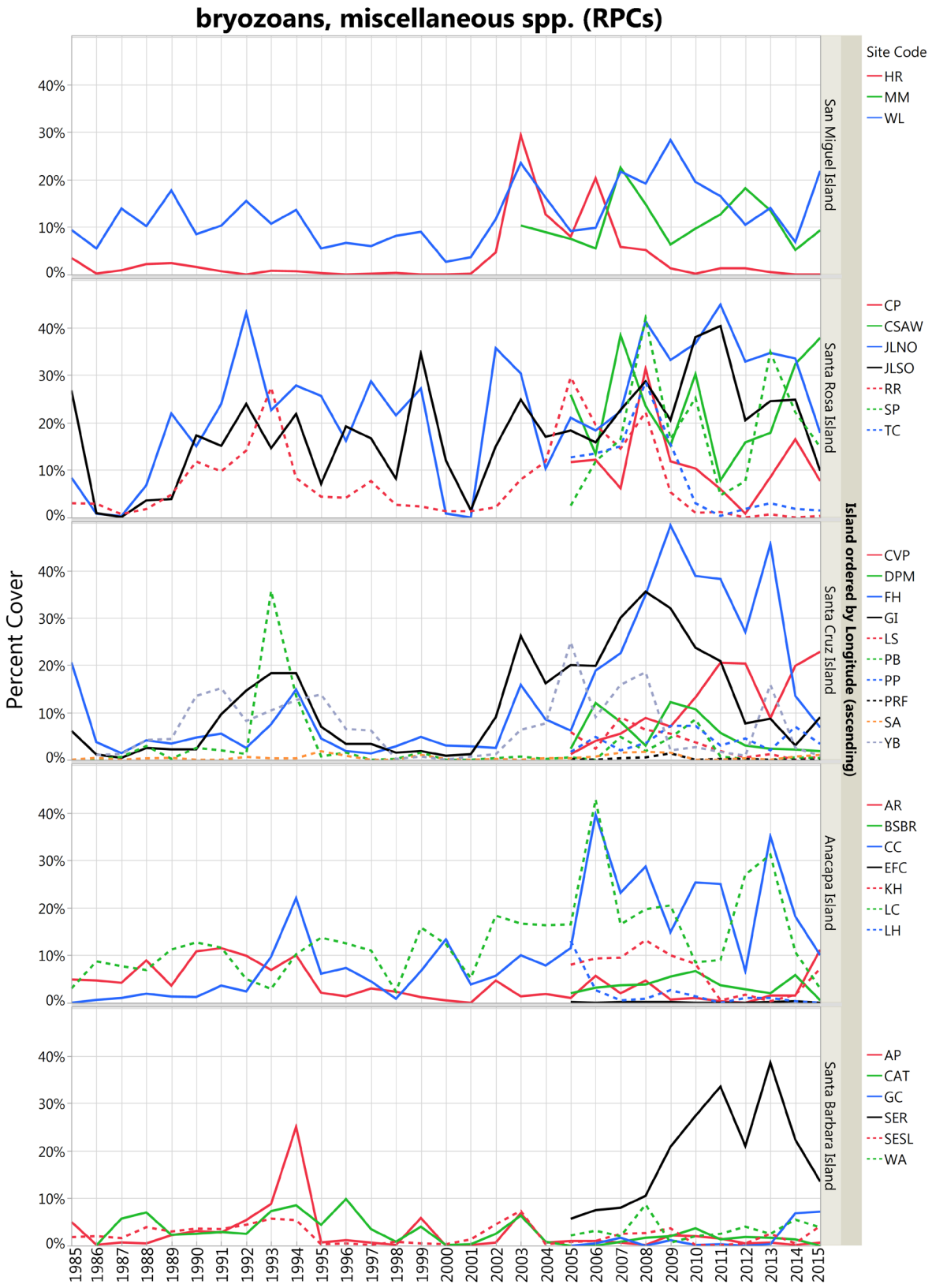


Figure H-24. Percent cover of bryozoans, miscellaneous species, by site and island at Channel Islands National Park between 1985 and 2015.

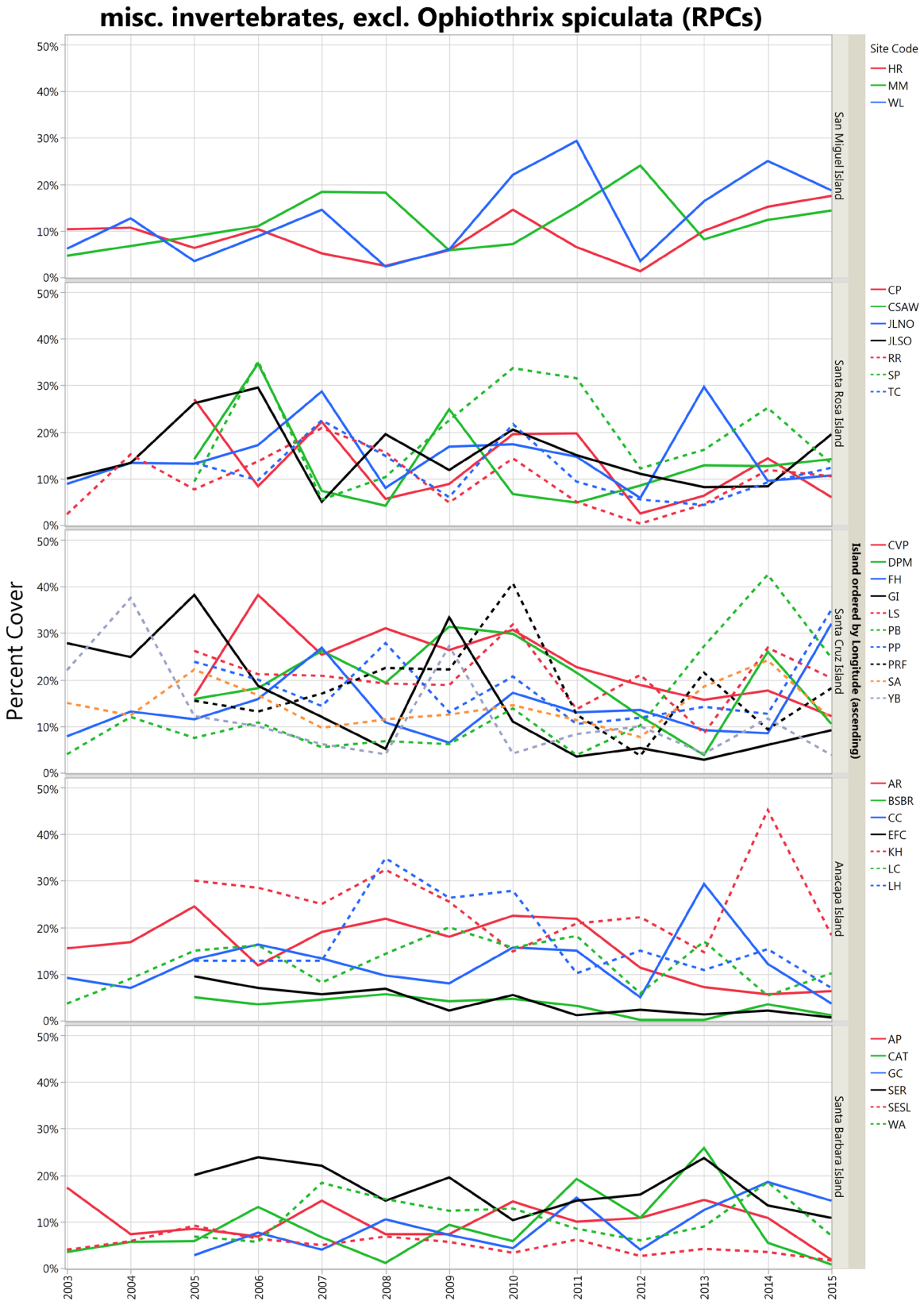


Figure H-25. Percent cover of miscellaneous invertebrates, excluding *Ophiothrix spiculata,* by site and island at Channel Islands National Park between 2003 and 2015.

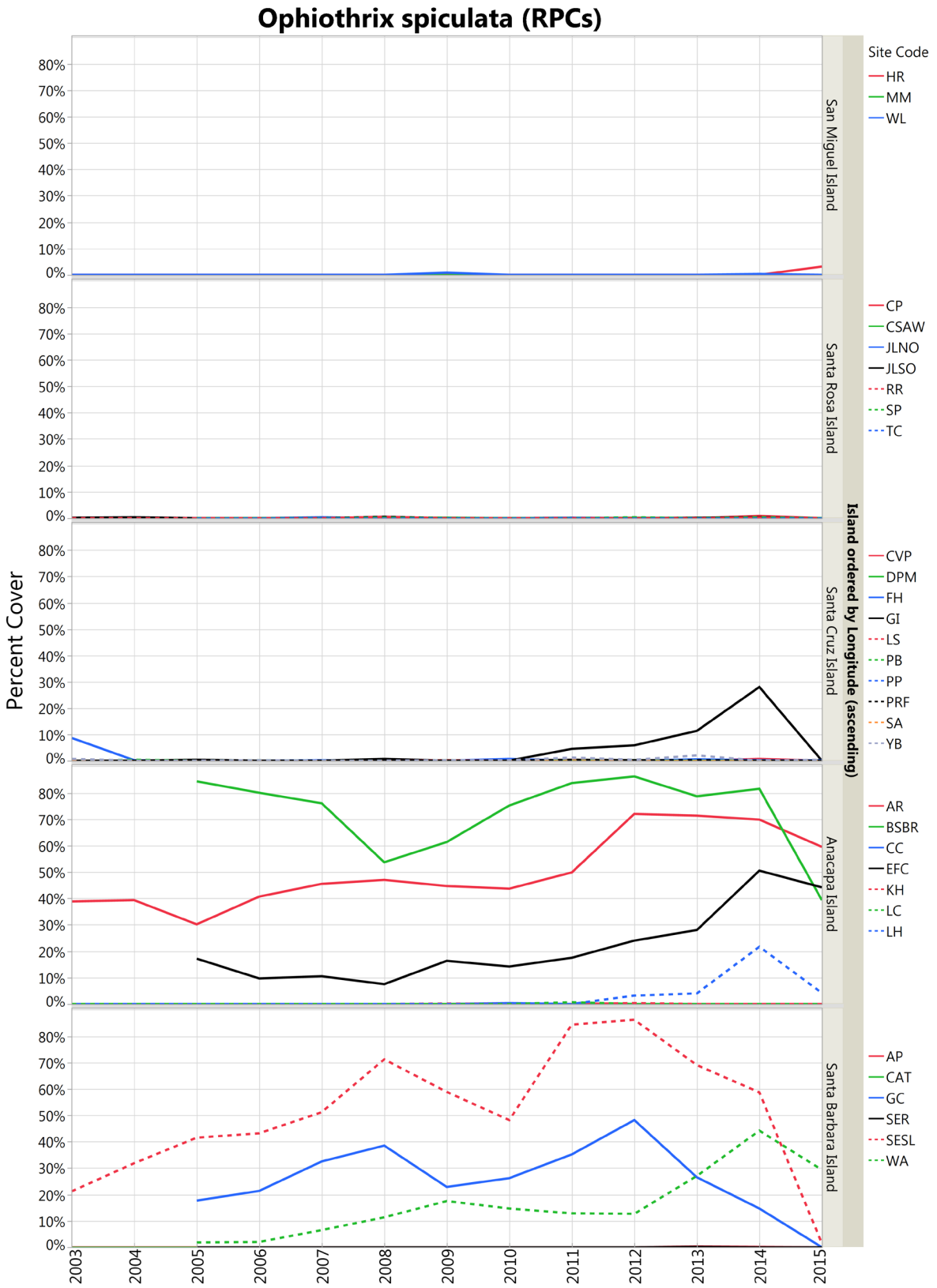


Figure H-26. Percent cover of *Ophiothrix spiculata* by site and island at Channel Islands National Park between 2003 and 2015.

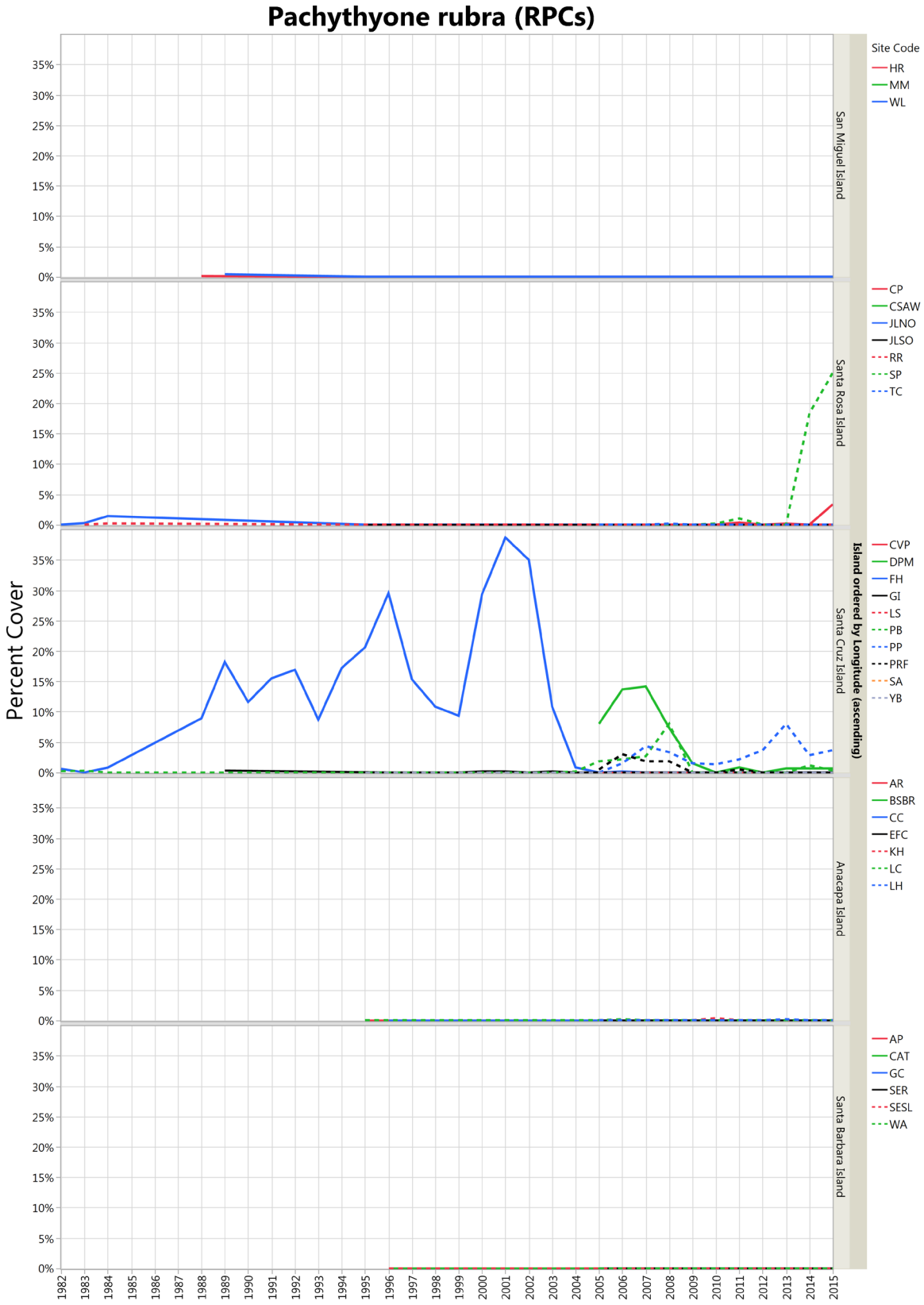


Figure H-27. Percent cover of *Pachythyone rubra* by site and island at Channel Islands National Park between 1982 and 2015.

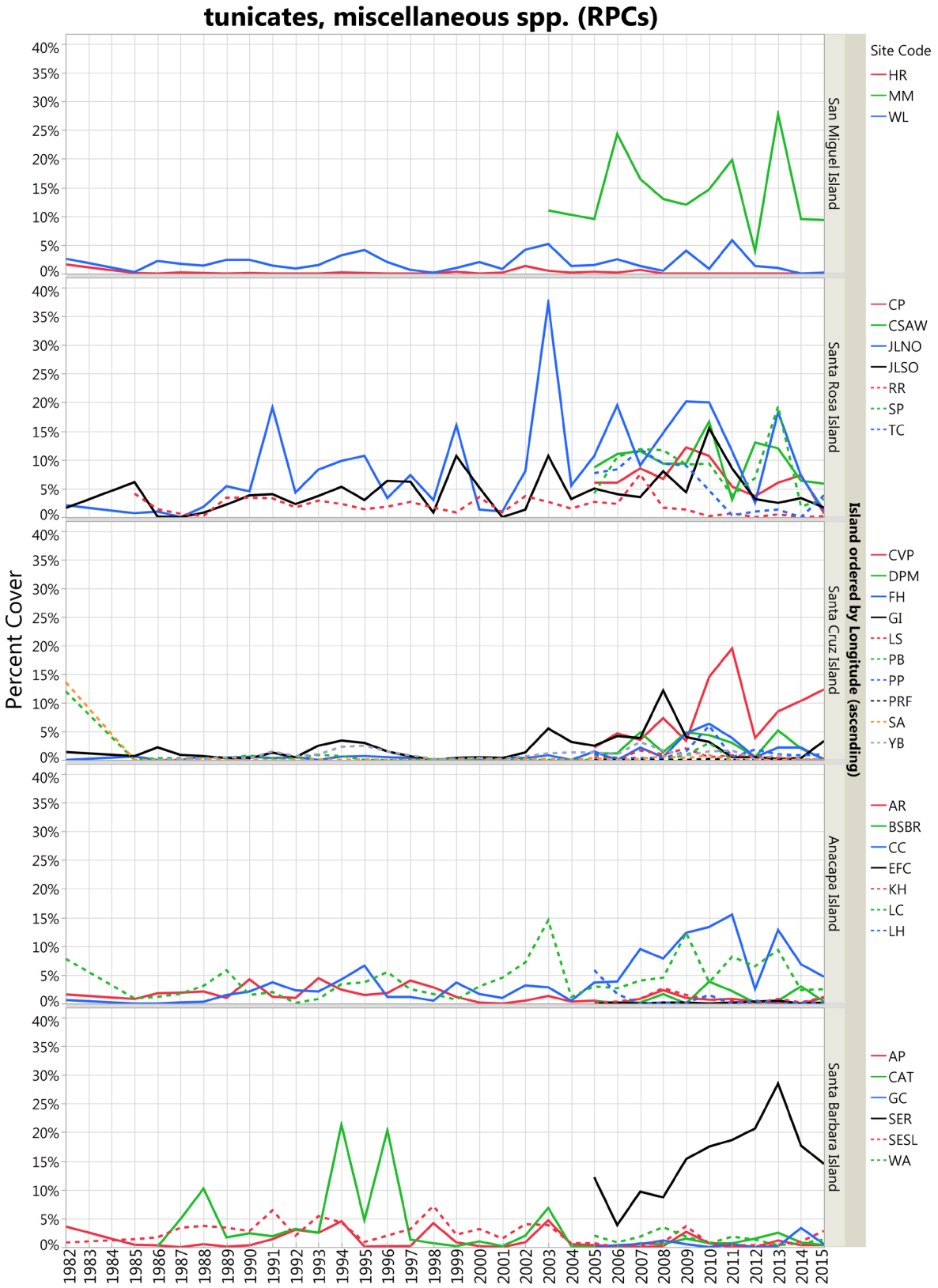


Figure H-28. Percent cover of tunicates, miscellaneous species, by site and island at Channel Islands National Park between 1982 and 2015.

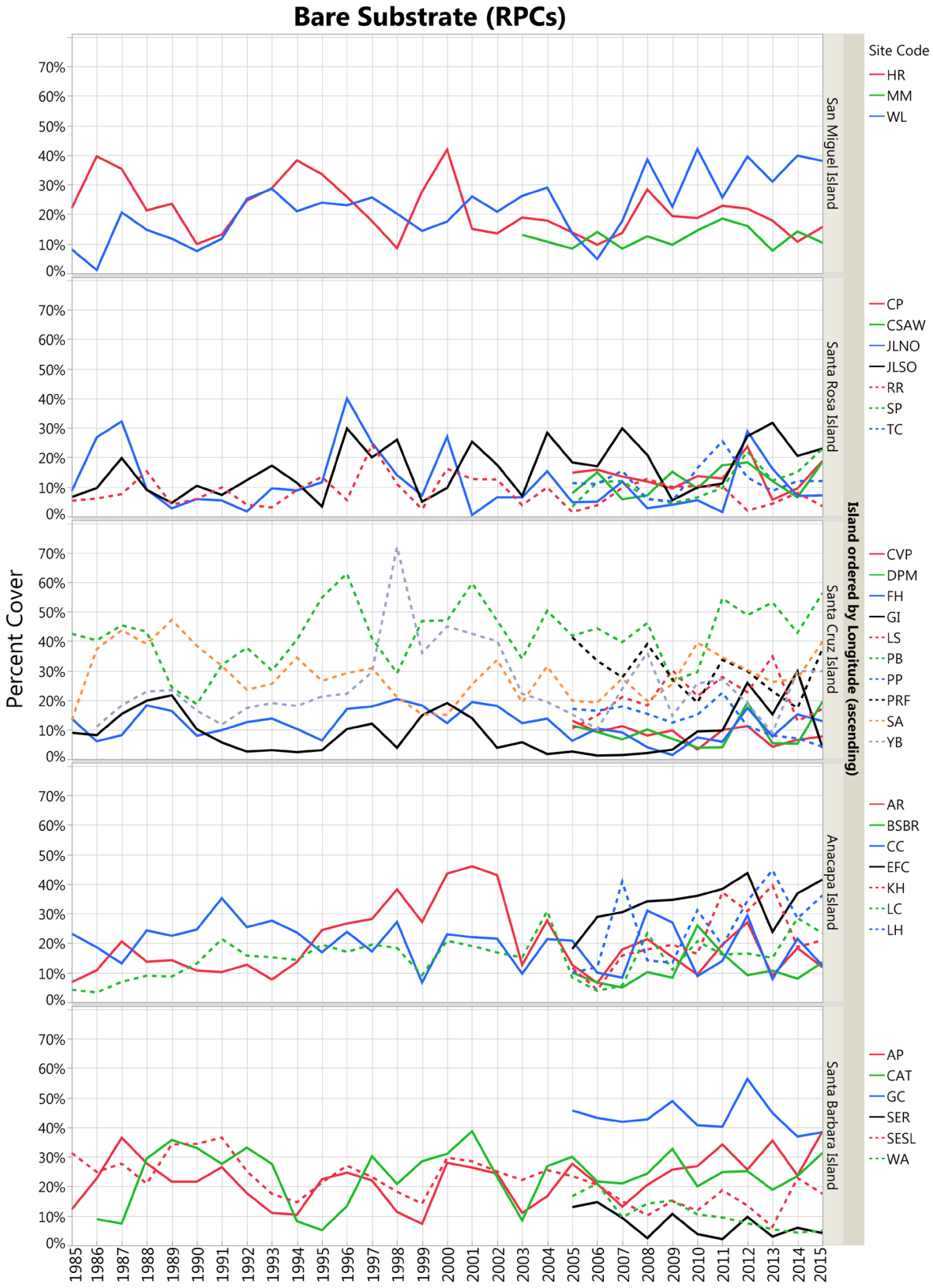


Figure H-29. Percent cover of bare substrate by site and island at Channel Islands National Park between 1985 and 2015.

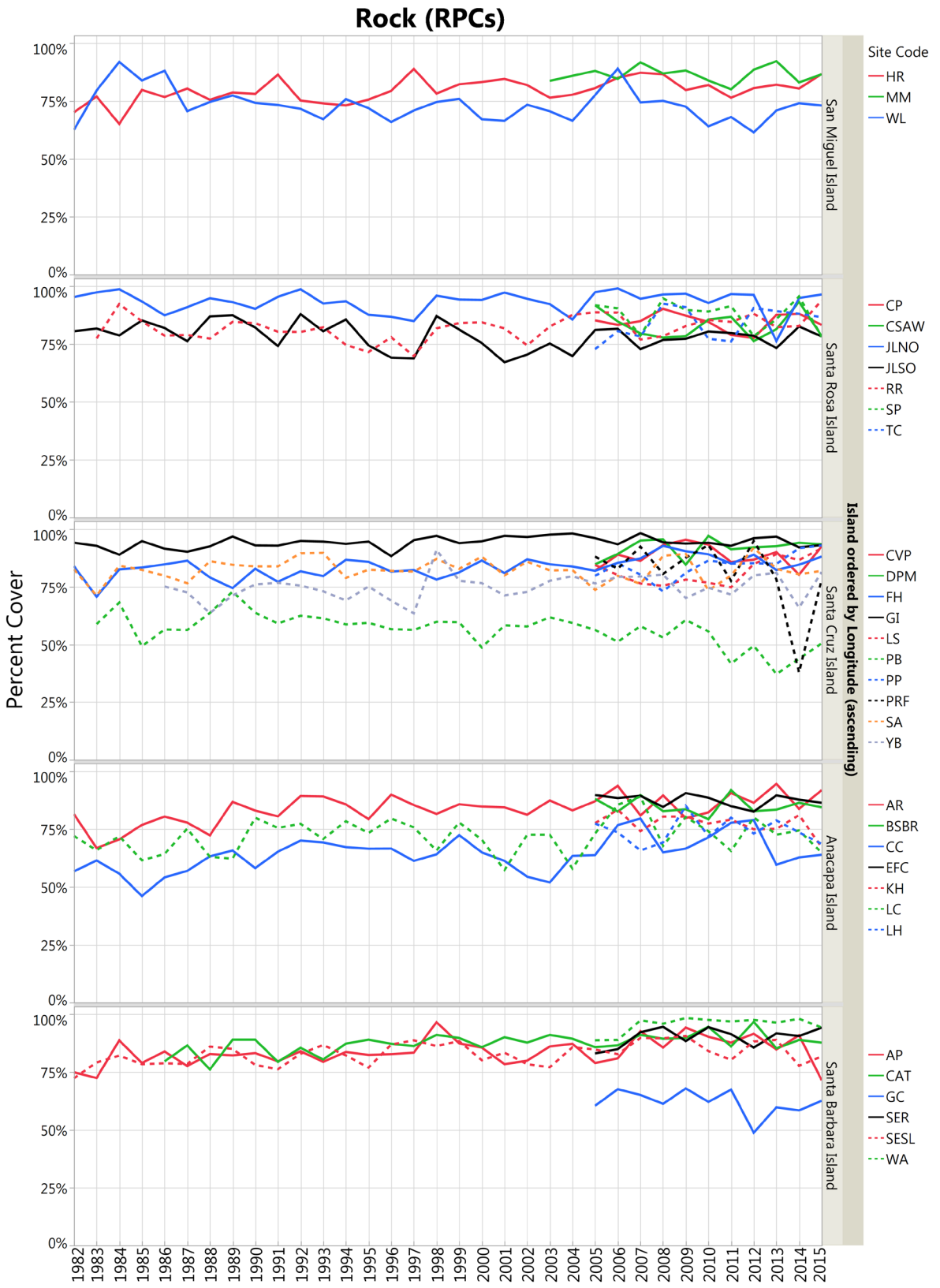


Figure H-30. Percent cover of rock by site and island at Channel Islands National Park between 1982 and 2015.

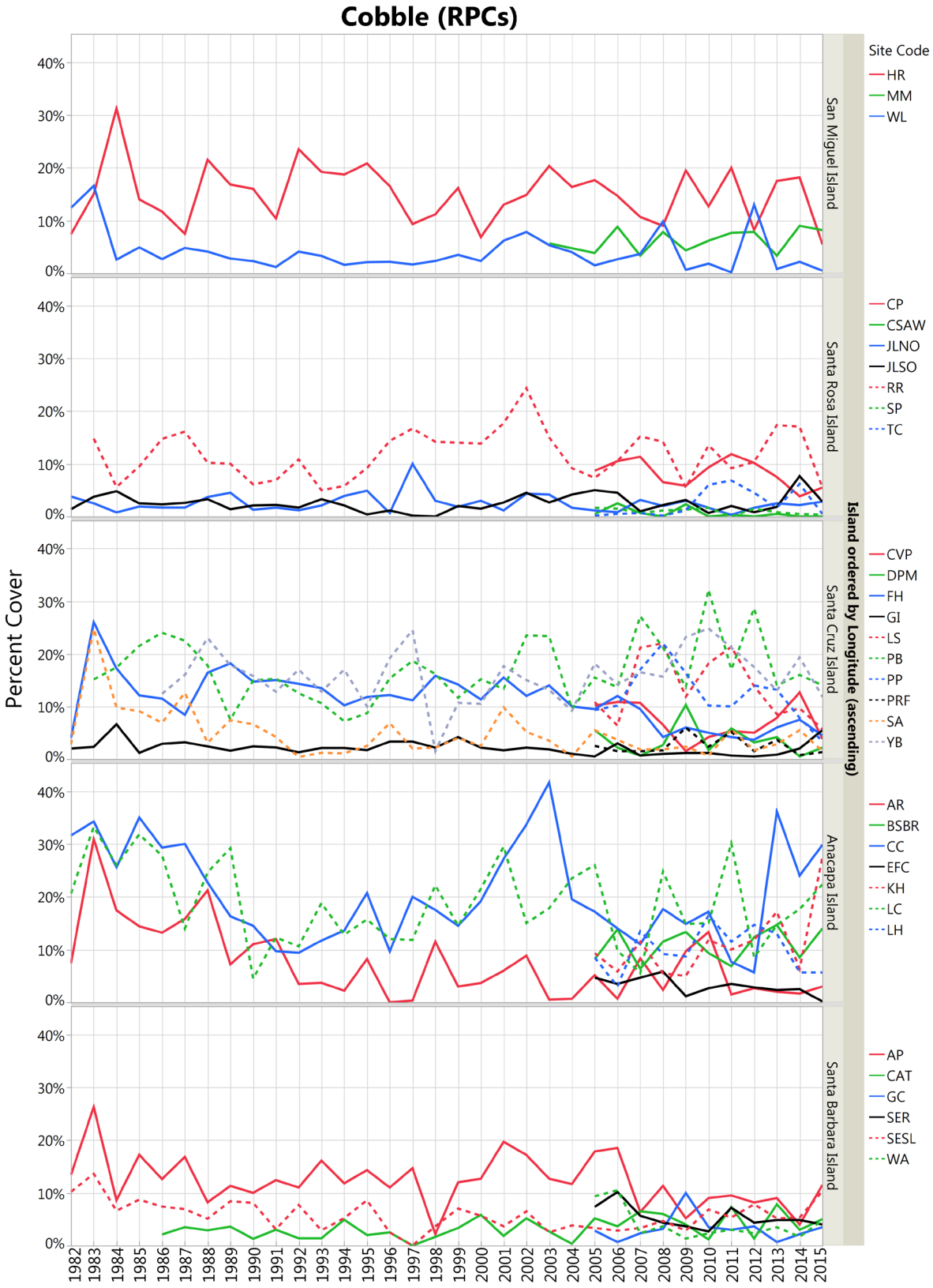


Figure H-31. Percent cover of cobble by site and island at Channel Islands National Park between 1982 and 2015.

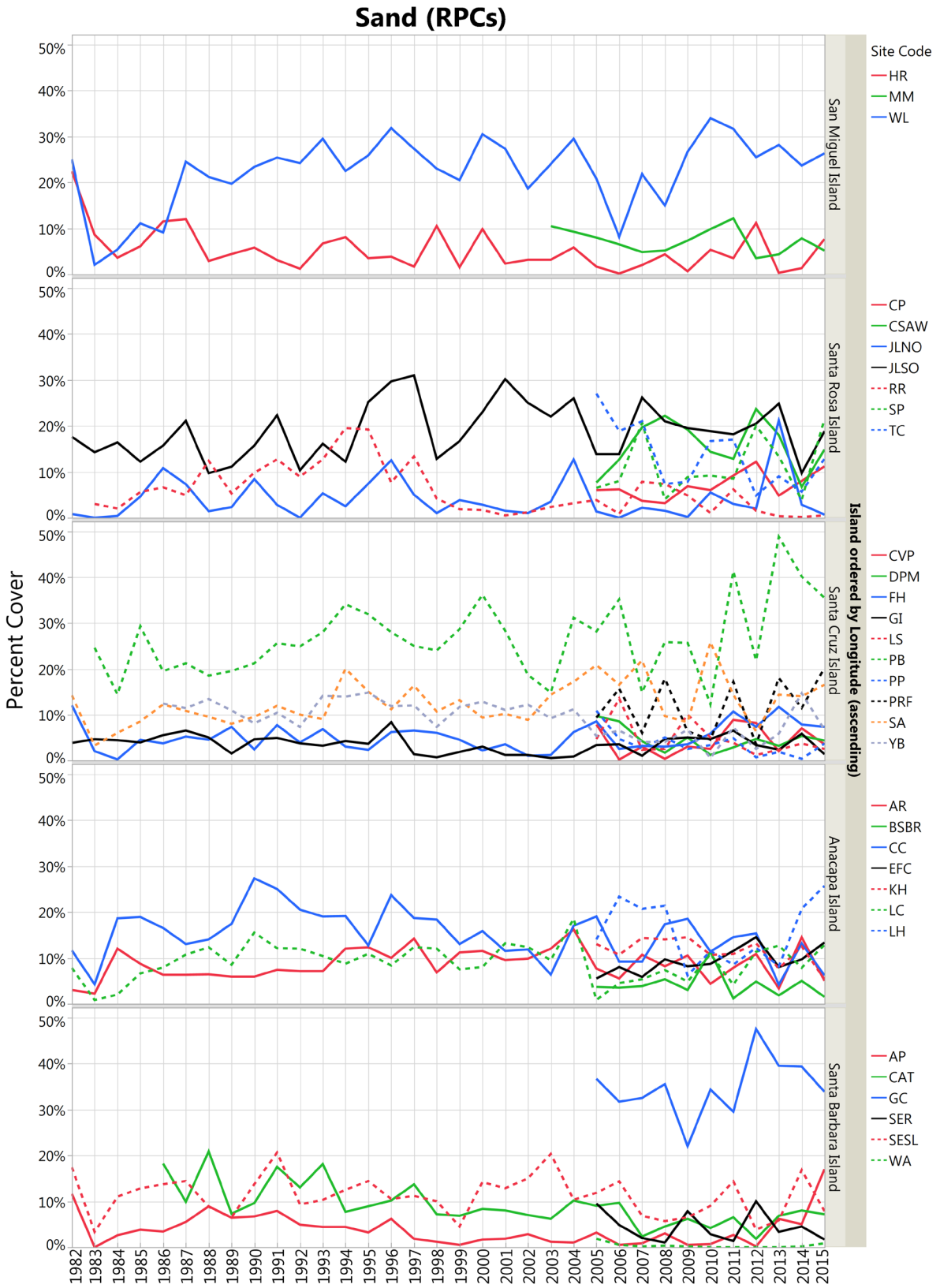


Figure H-32. Percent cover of sand by site and island at Channel Islands National Park between 1982 and 2015.

Appendix I. Fish Transect Data

Figures I-1 through I-26 show the fish transect data.

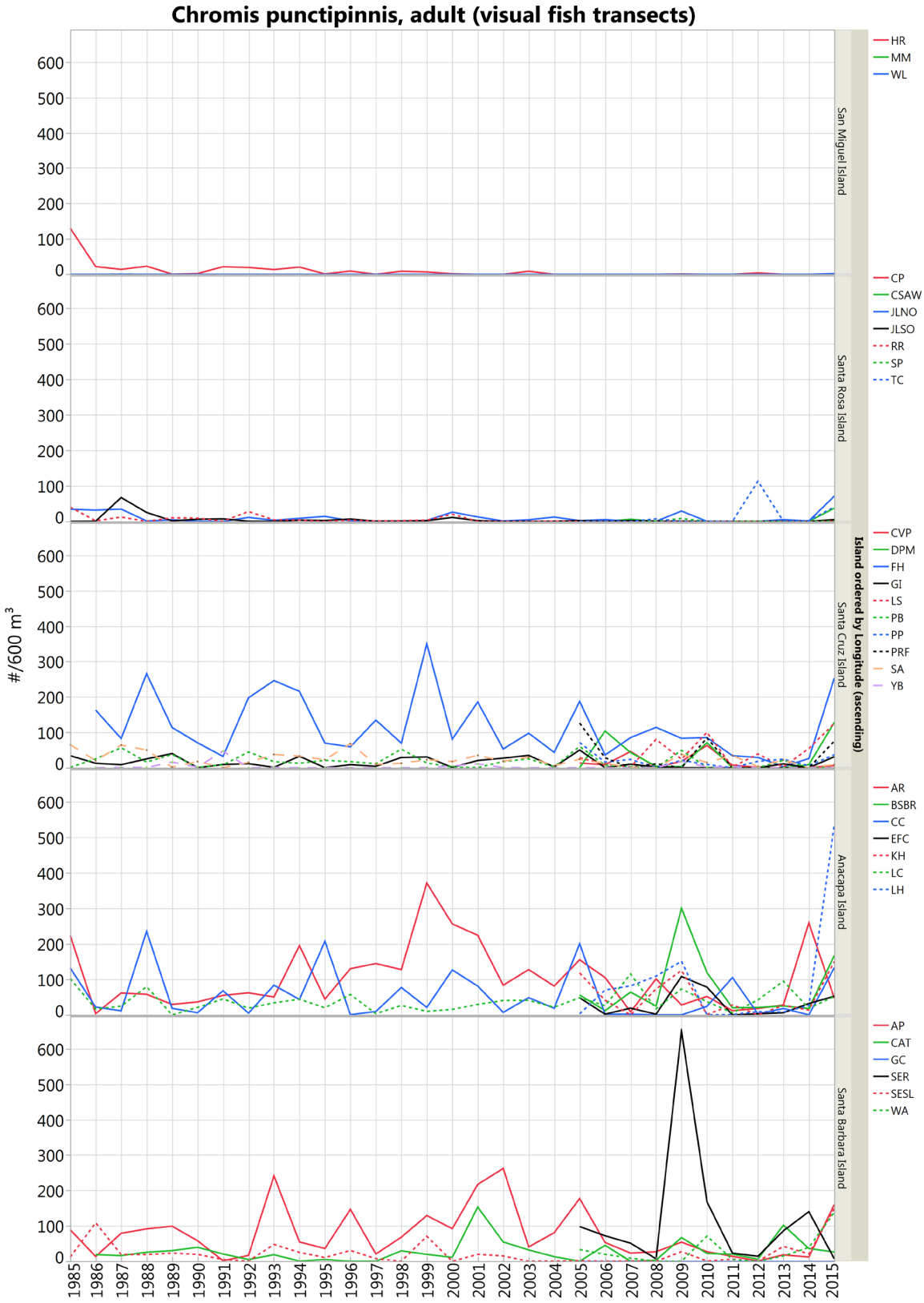


Figure I-1. Density of adult *Chromis punctipinnis* by site and island at Channel Islands National Park between 1985 and 2015.

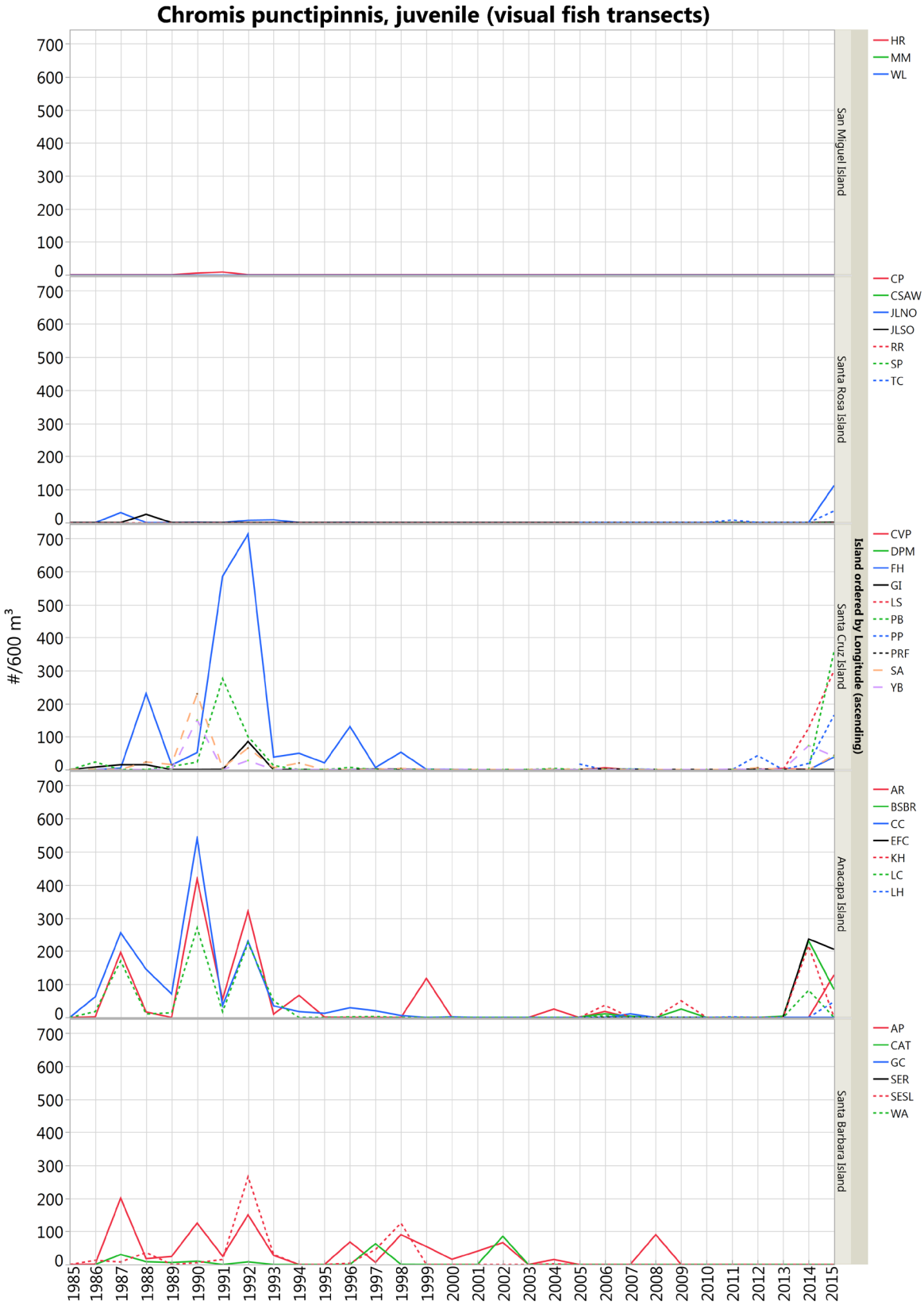


Figure I-2. Density of juvenile *Chromis punctipinnis* by site and island at Channel Islands National Park between 1985 and 2015.

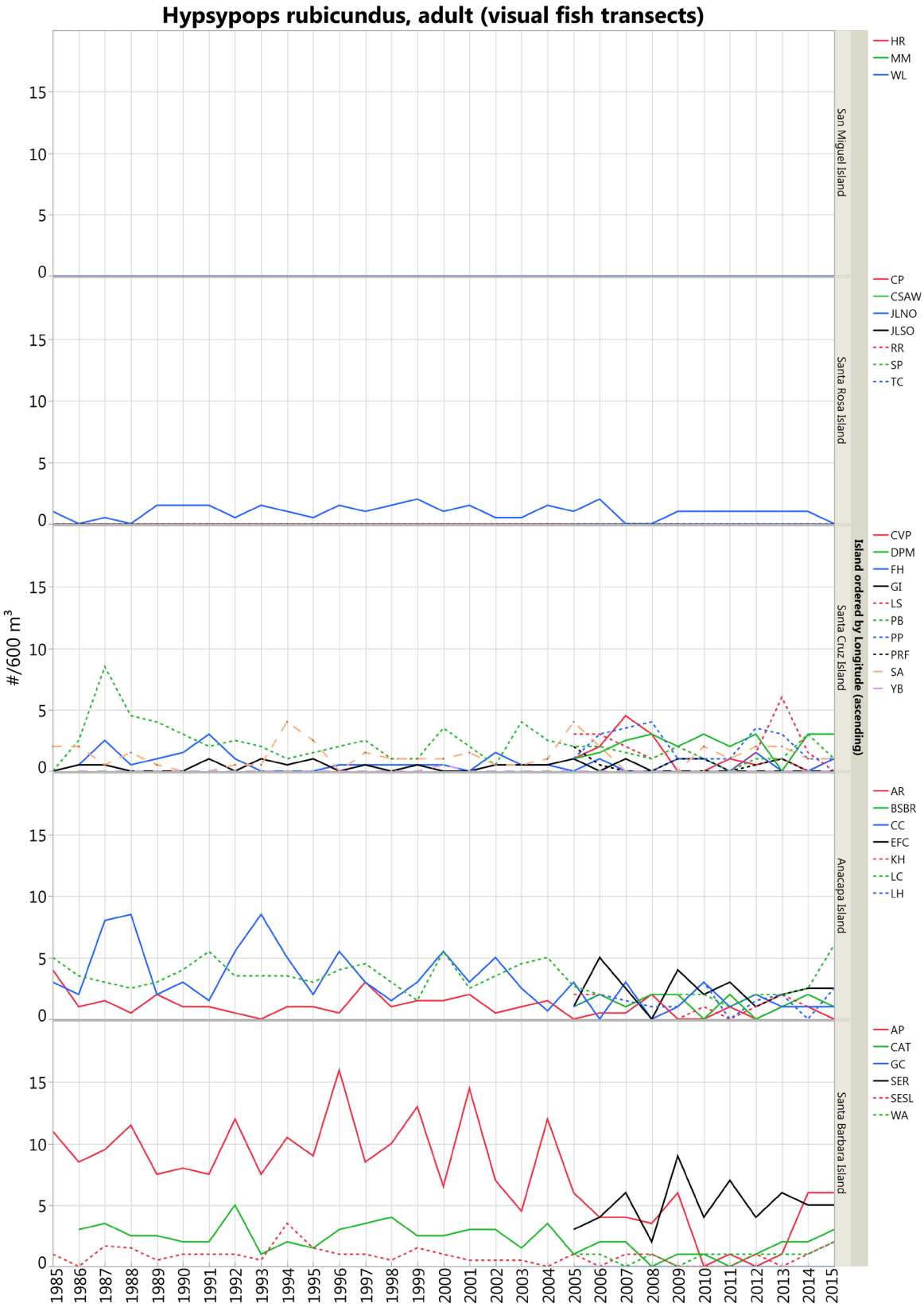


Figure I-3. Density of adult *Hypsypops rubicundus* by site and island at Channel Islands National Park between 1985 and 2015.

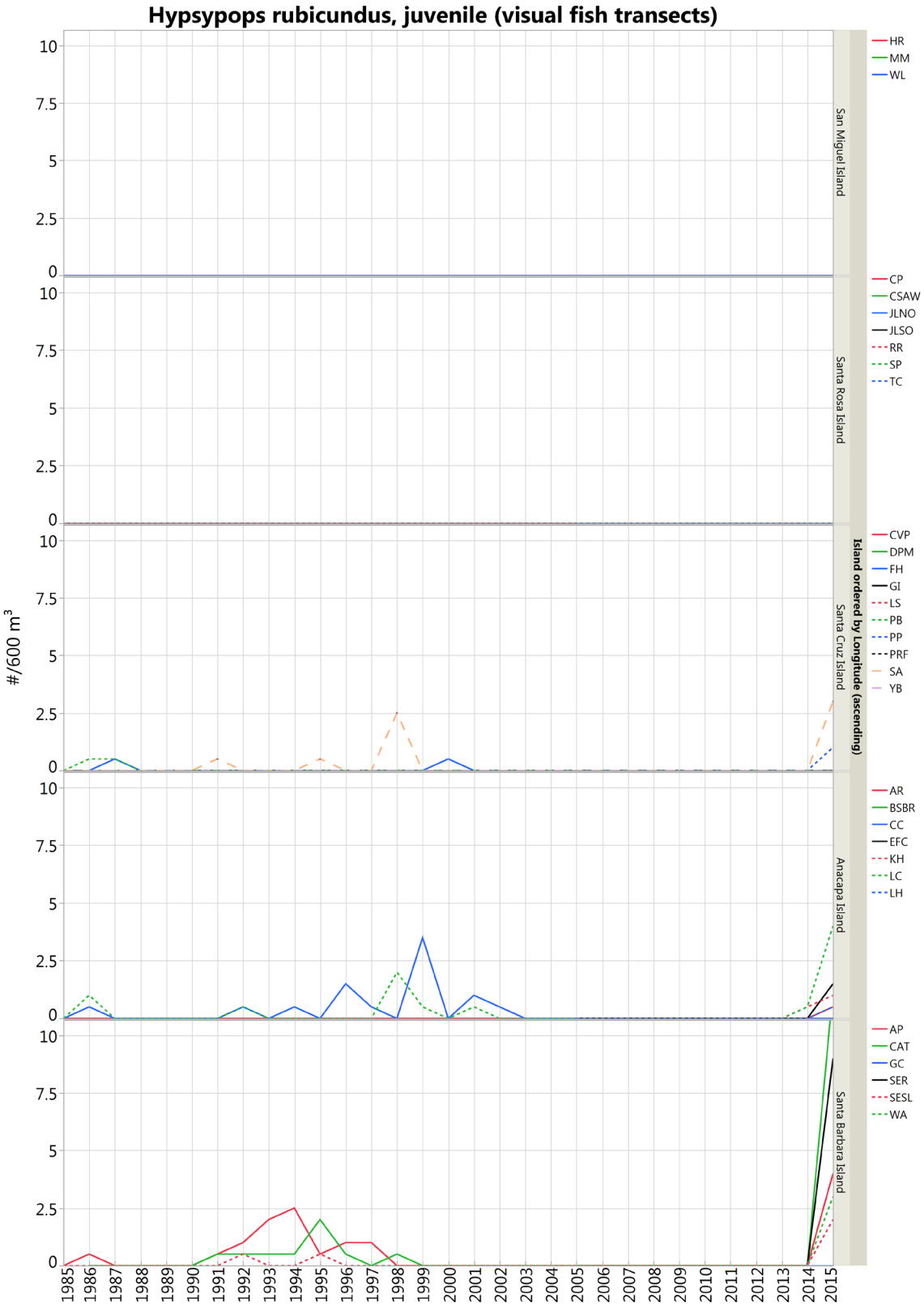


Figure I-4. Density of juvenile *Hypsypops rubicundus* by site and island at Channel Islands National Park between 1985 and 2015.

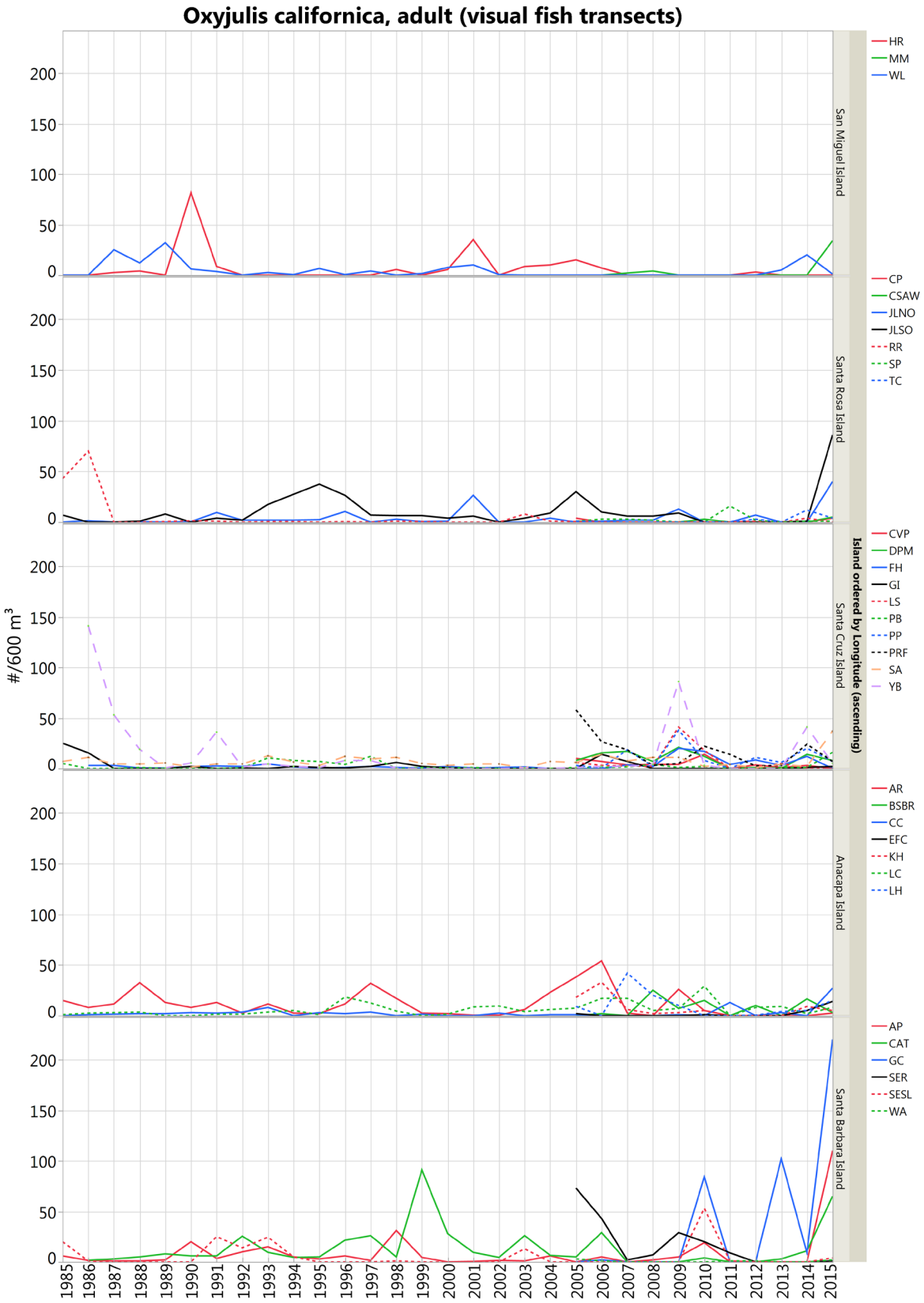


Figure I-5. Density of adult *Oxyjulis californica* by site and island at Channel Islands National Park between 1985 and 2015.

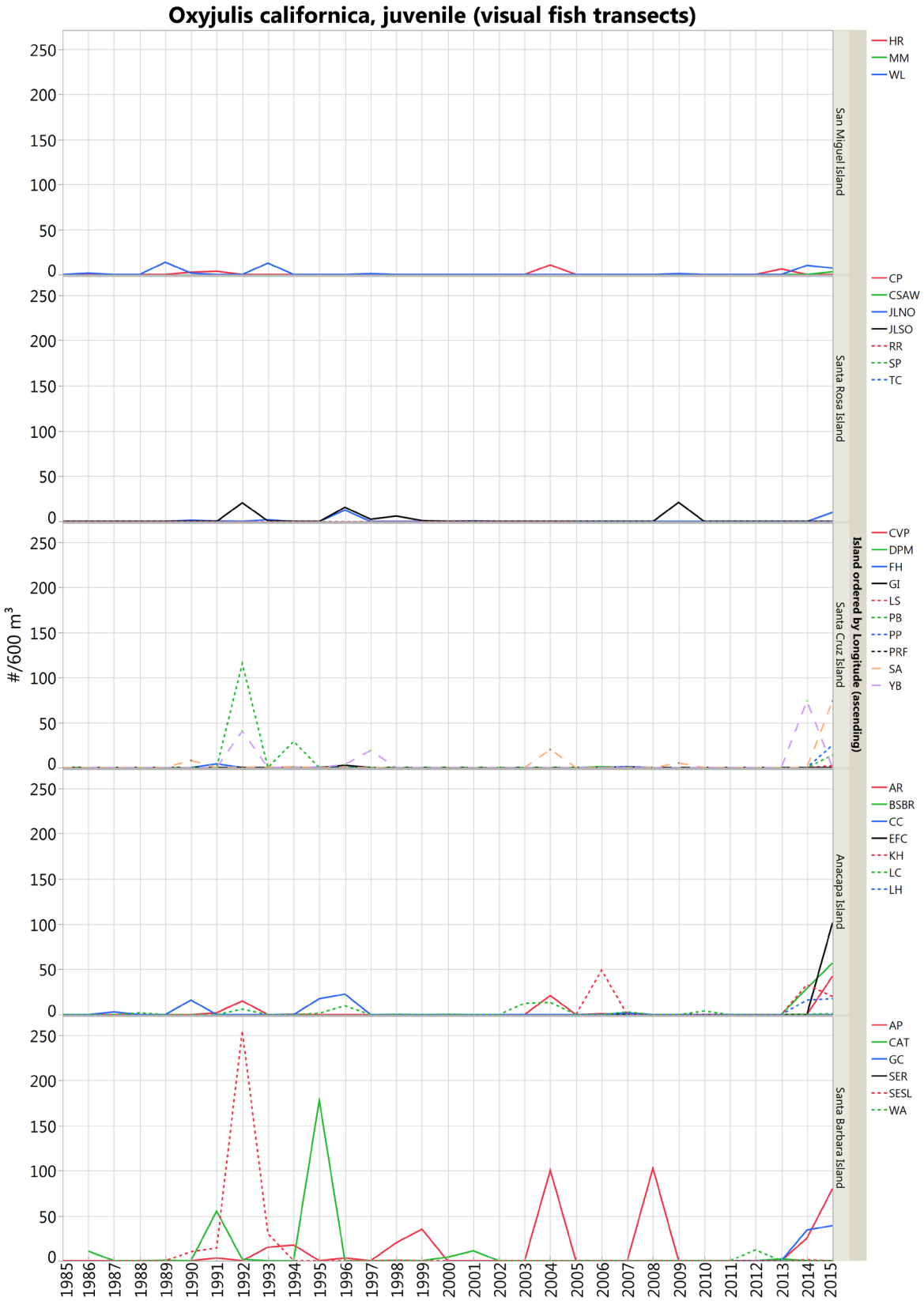


Figure I-6. Density of juvenile *Oxyjulis californica* by site and island at Channel Islands National Park between 1985 and 2015.

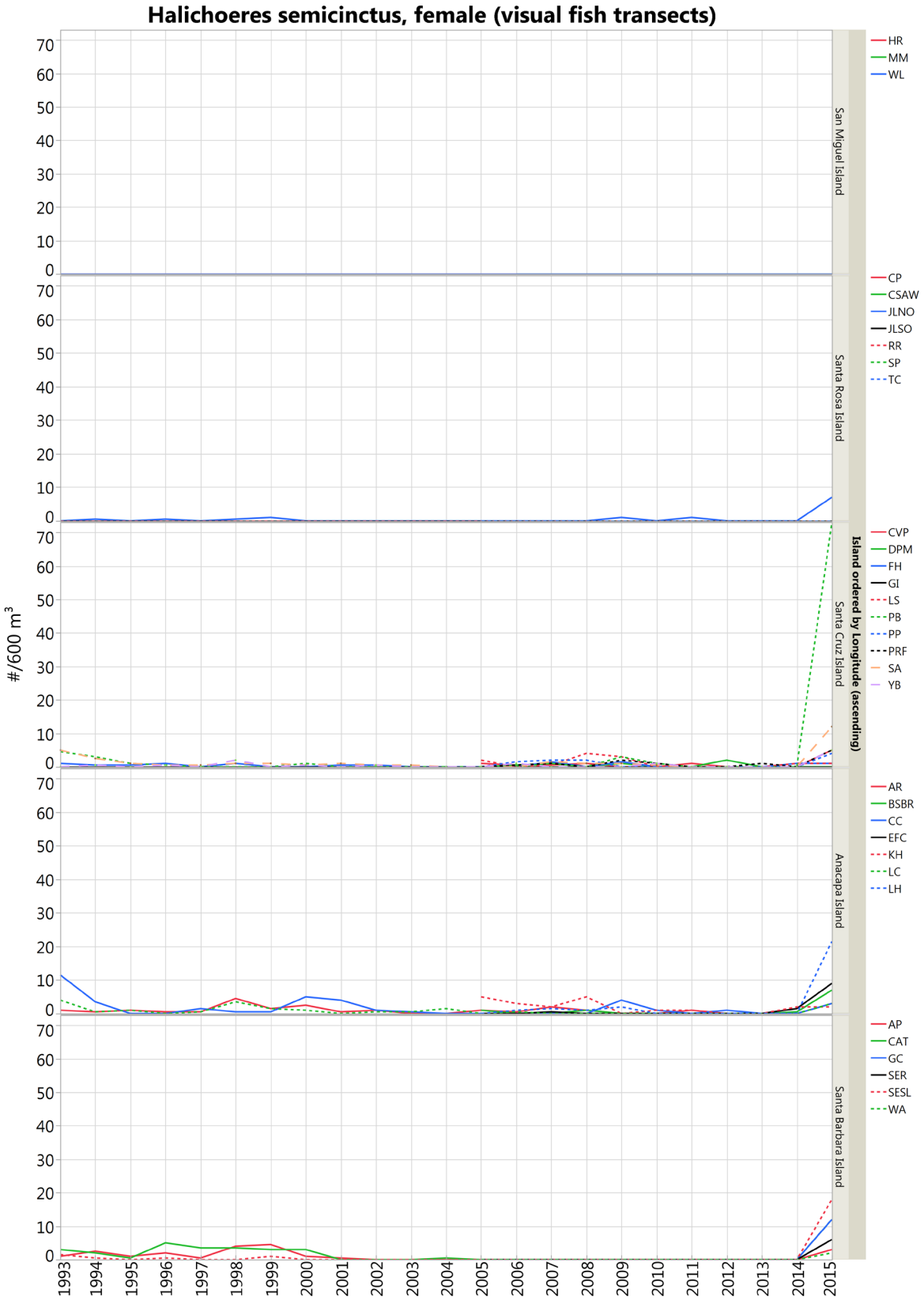


Figure I-7. Density of female *Halichoeres semicinctus* by site and island at Channel Islands National Park between 1993 and 2015.

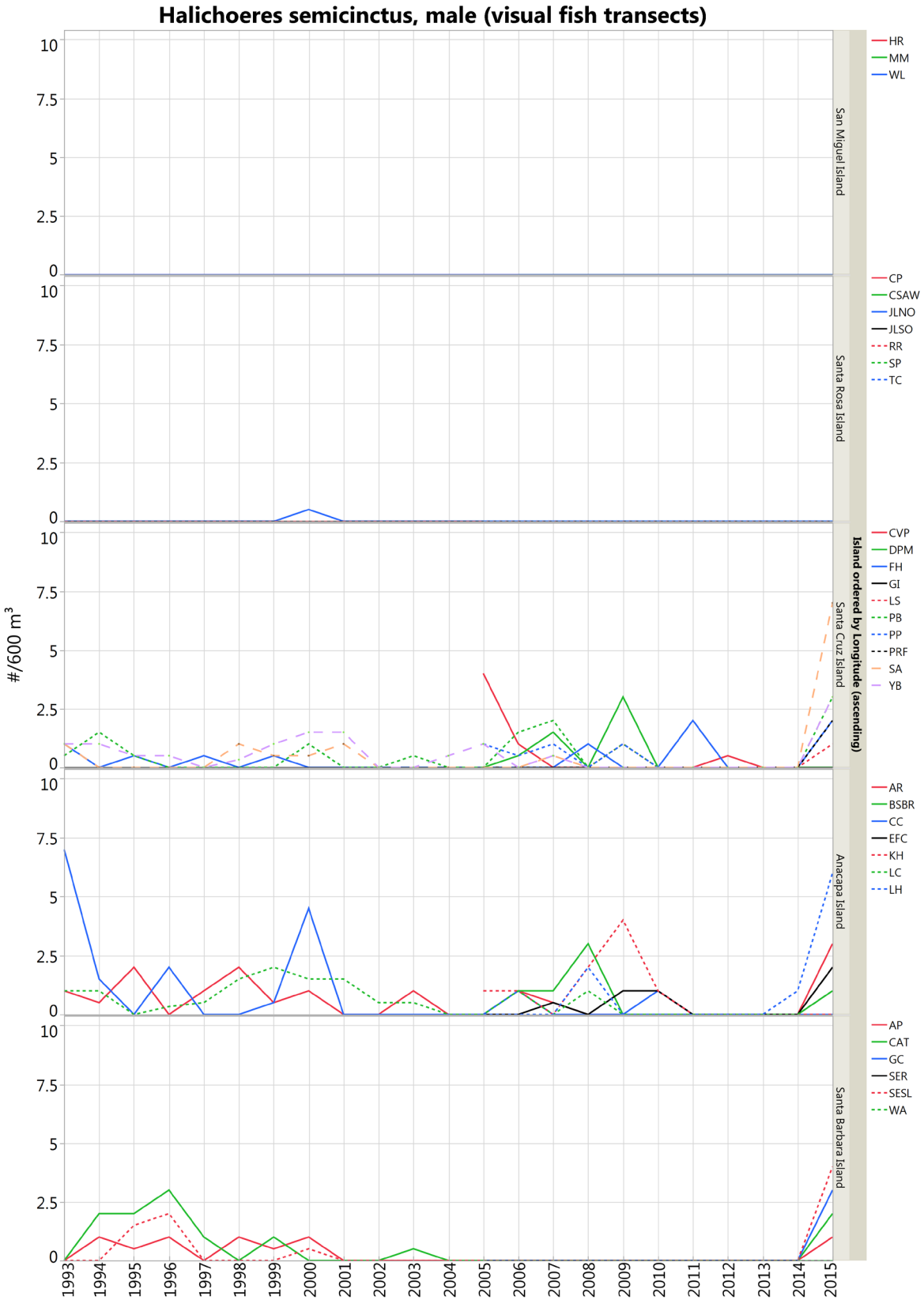


Figure I-8. Density of male *Halichoeres semicinctus* by site and island at Channel Islands National Park between 1993 and 2015.

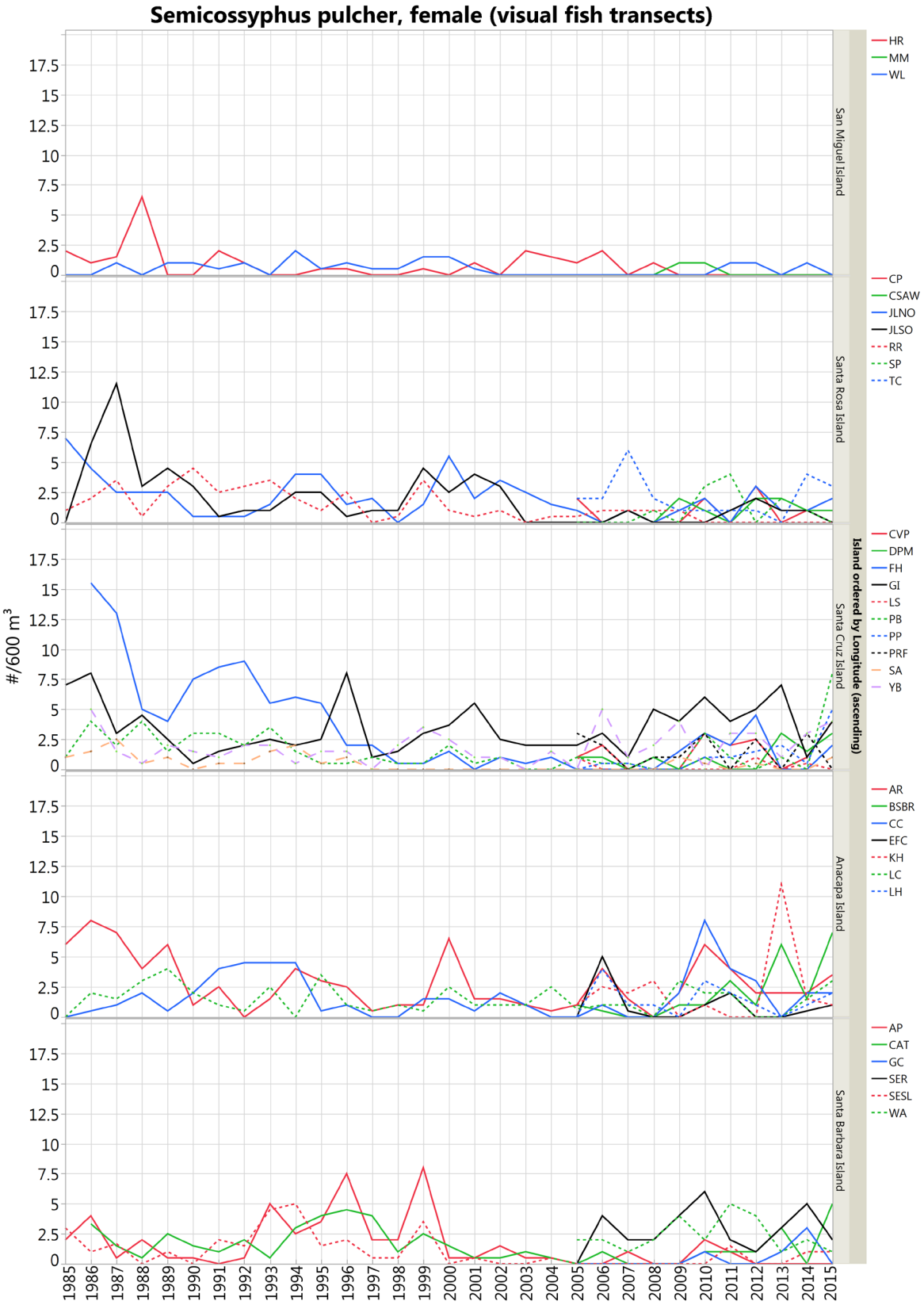


Figure I-9. Density of female *Semicossyphus pulcher* by site and island at Channel Islands National Park between 1985 and 2015.

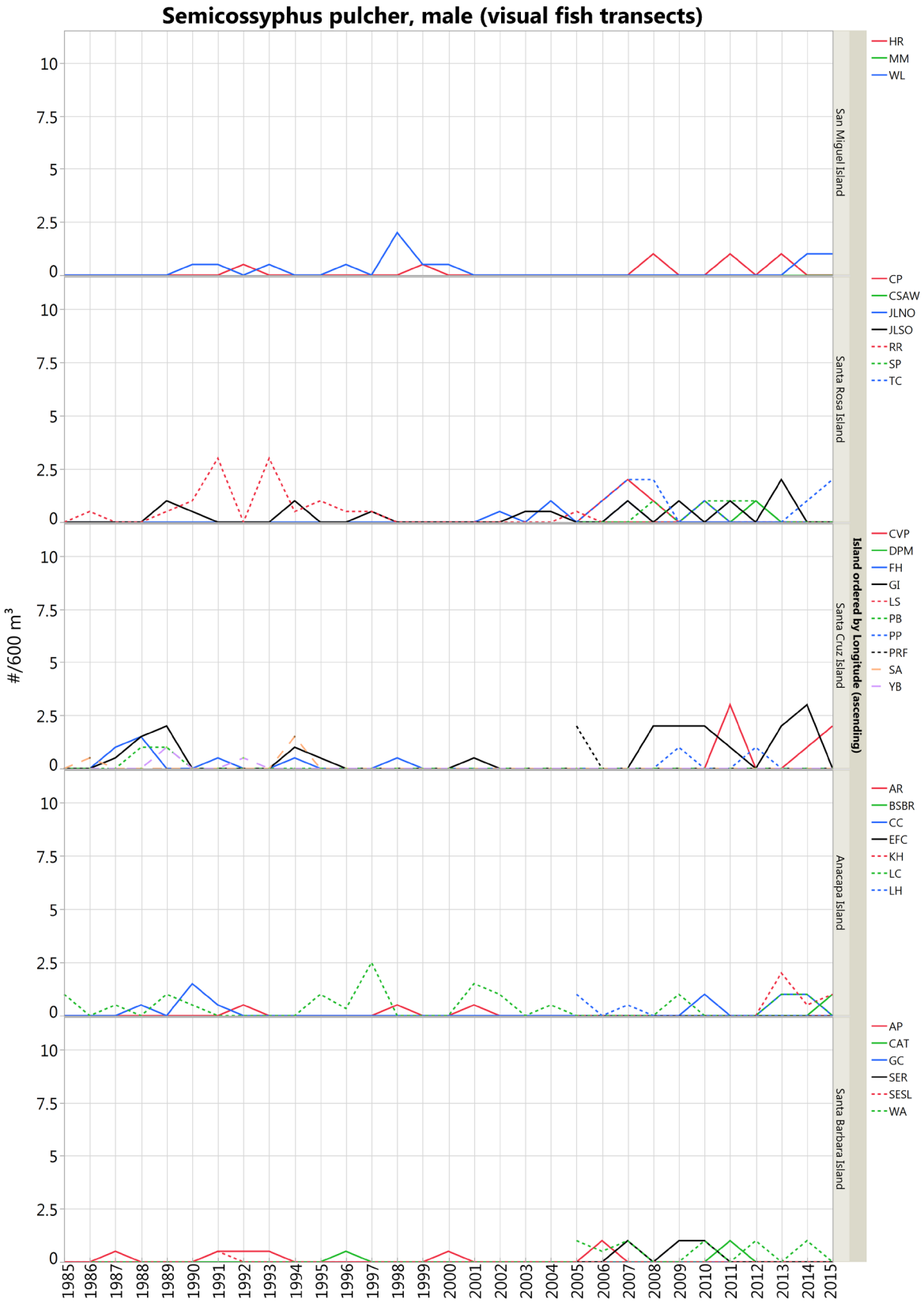


Figure I-10. Density of male *Semicossyphus pulcher* by site and island at Channel Islands National Park between 1985 and 2015.

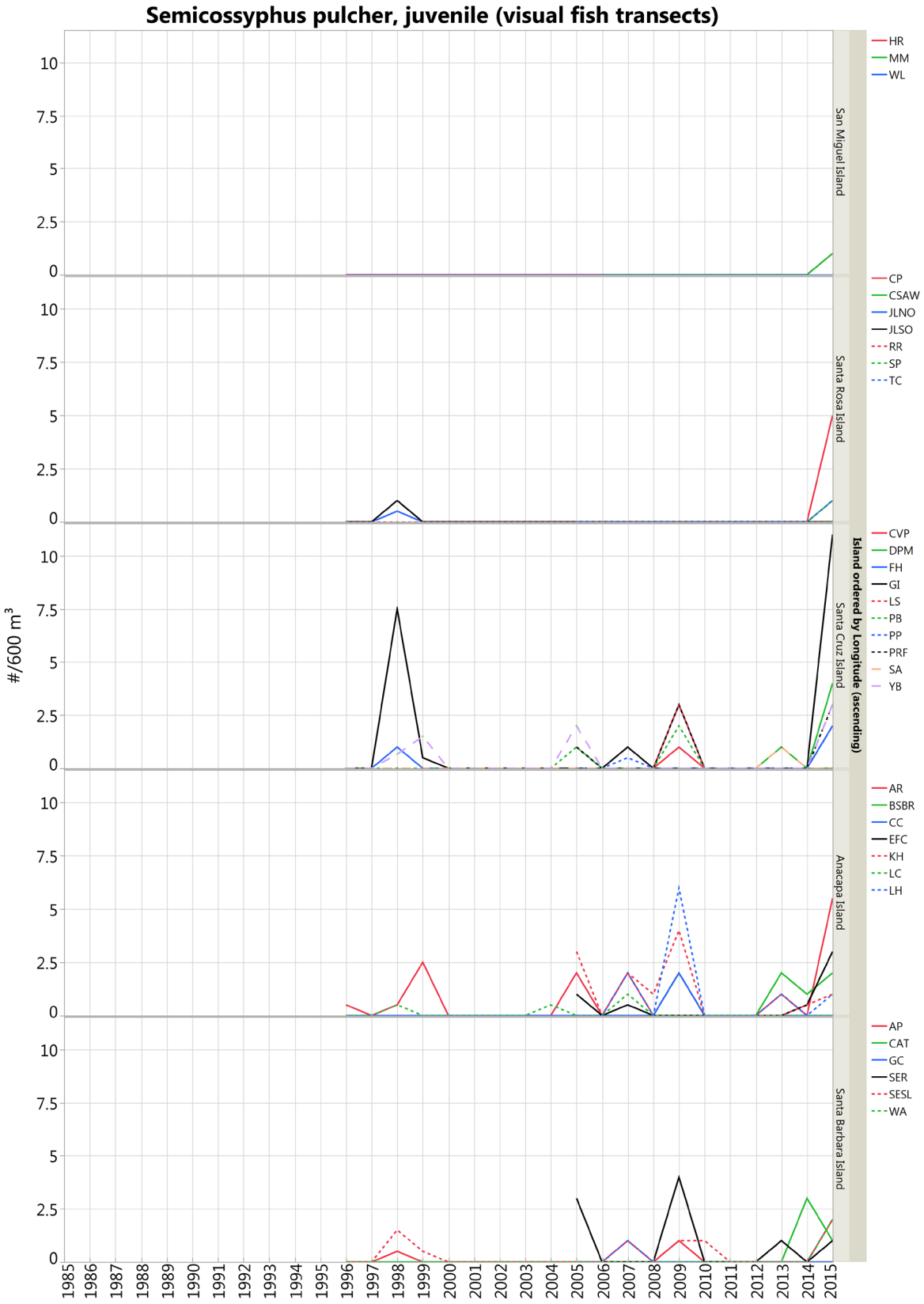


Figure I-11. Density of juvenile *Semicossyphus pulcher* by site and island at Channel Islands National Park between 1985 and 2015.

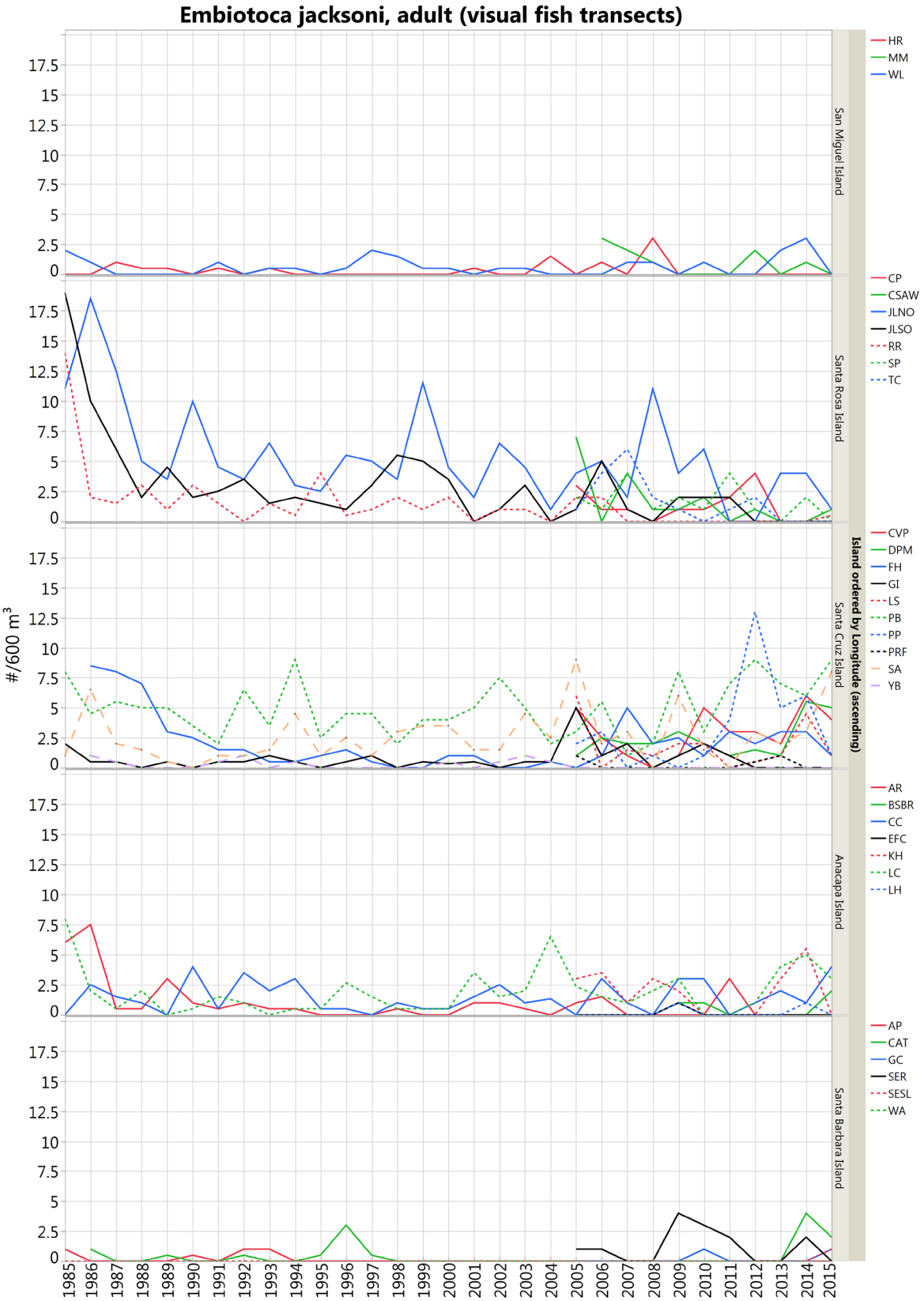


Figure I-12. Density of adult *Embiotoca jacksoni* by site and island at Channel Islands National Park between 1985 and 2015.

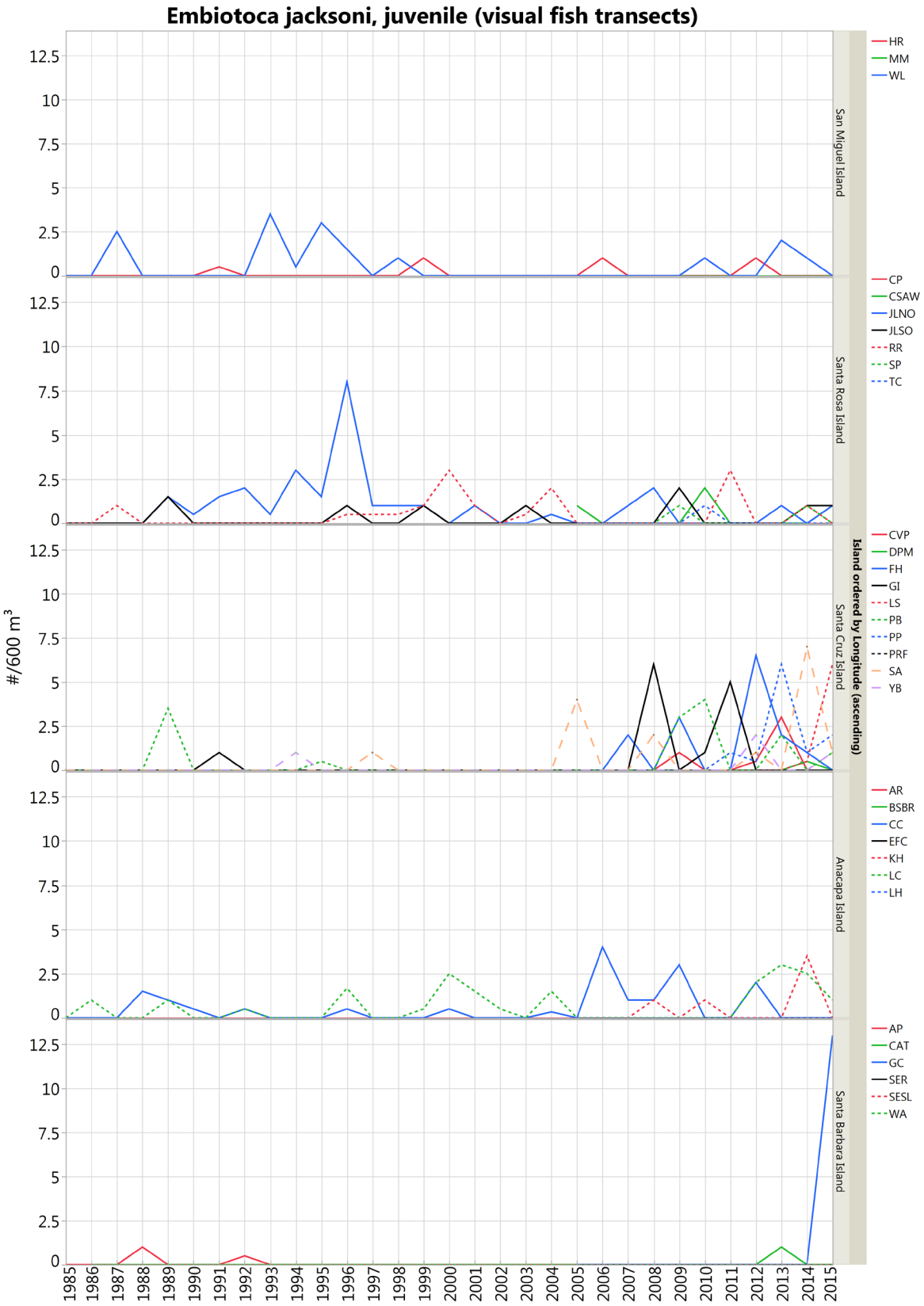


Figure I-13. Density of juvenile *Embiotoca jacksoni* by site and island at Channel Islands National Park between 1985 and 2015.

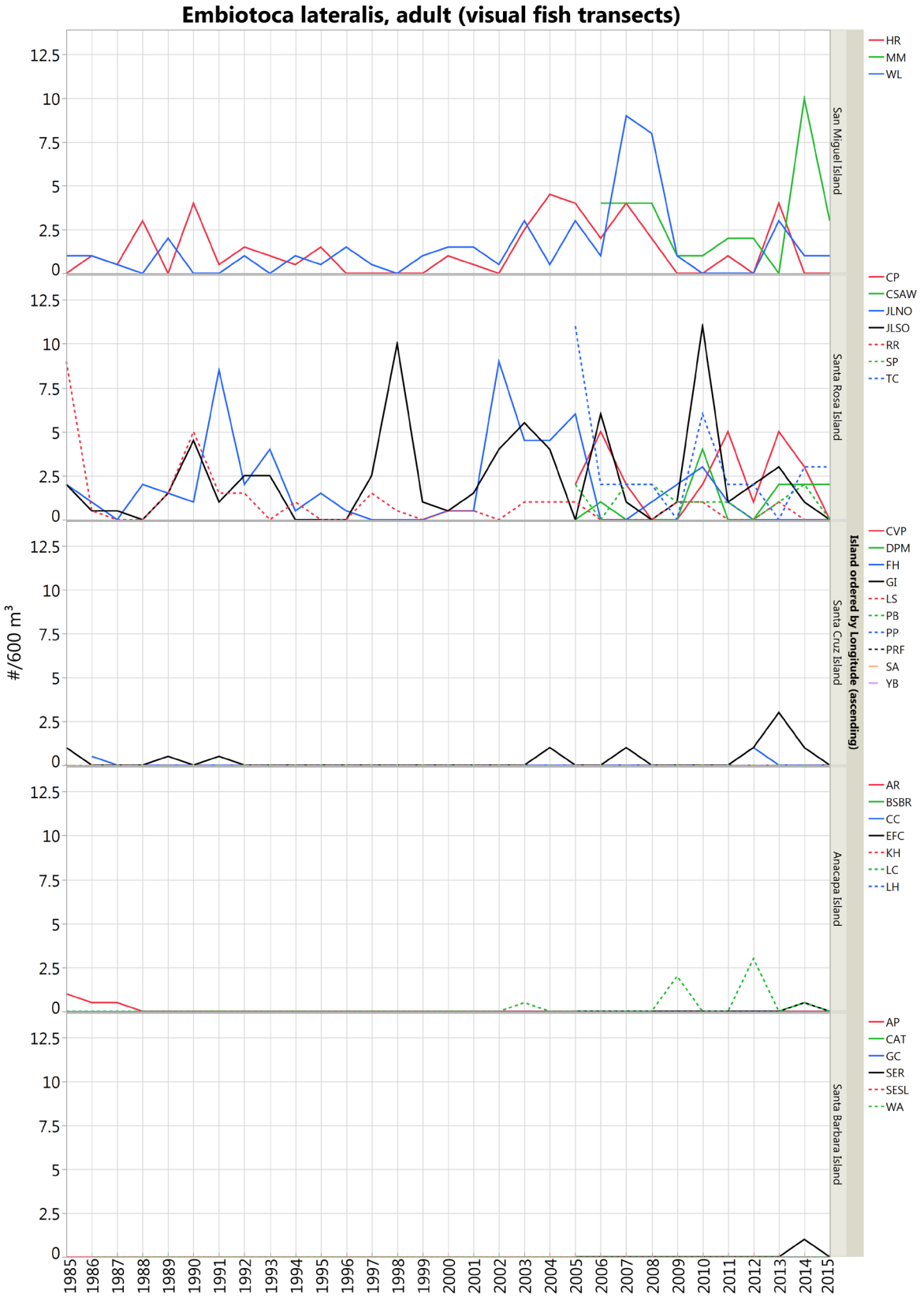


Figure I-14. Density of adult *Embiotoca lateralis* by site and island at Channel Islands National Park between 1985 and 2015.

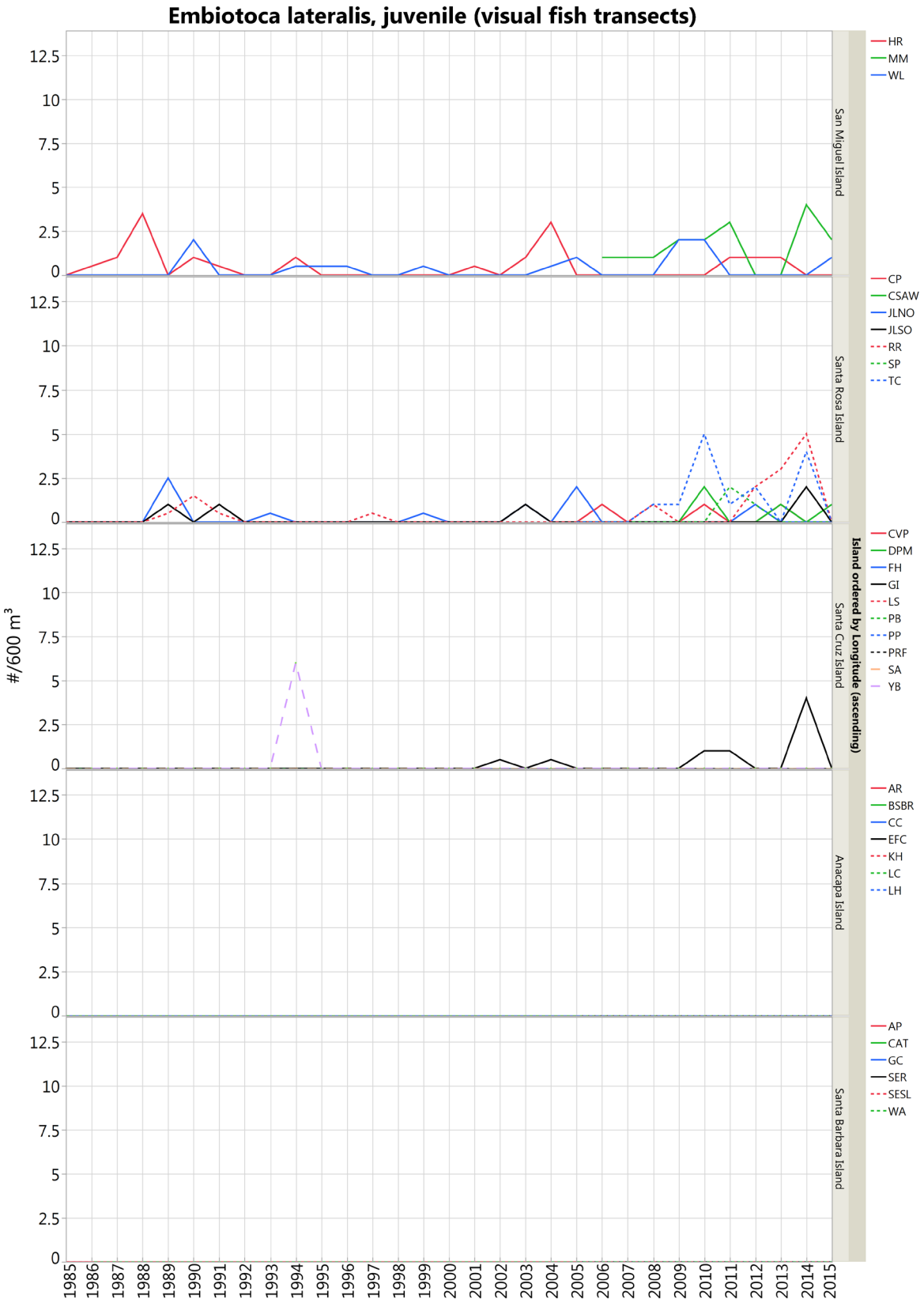


Figure I-15. Density of juvenile *Embiotoca lateralis* by site and island at Channel Islands National Park between 1985 and 2015.

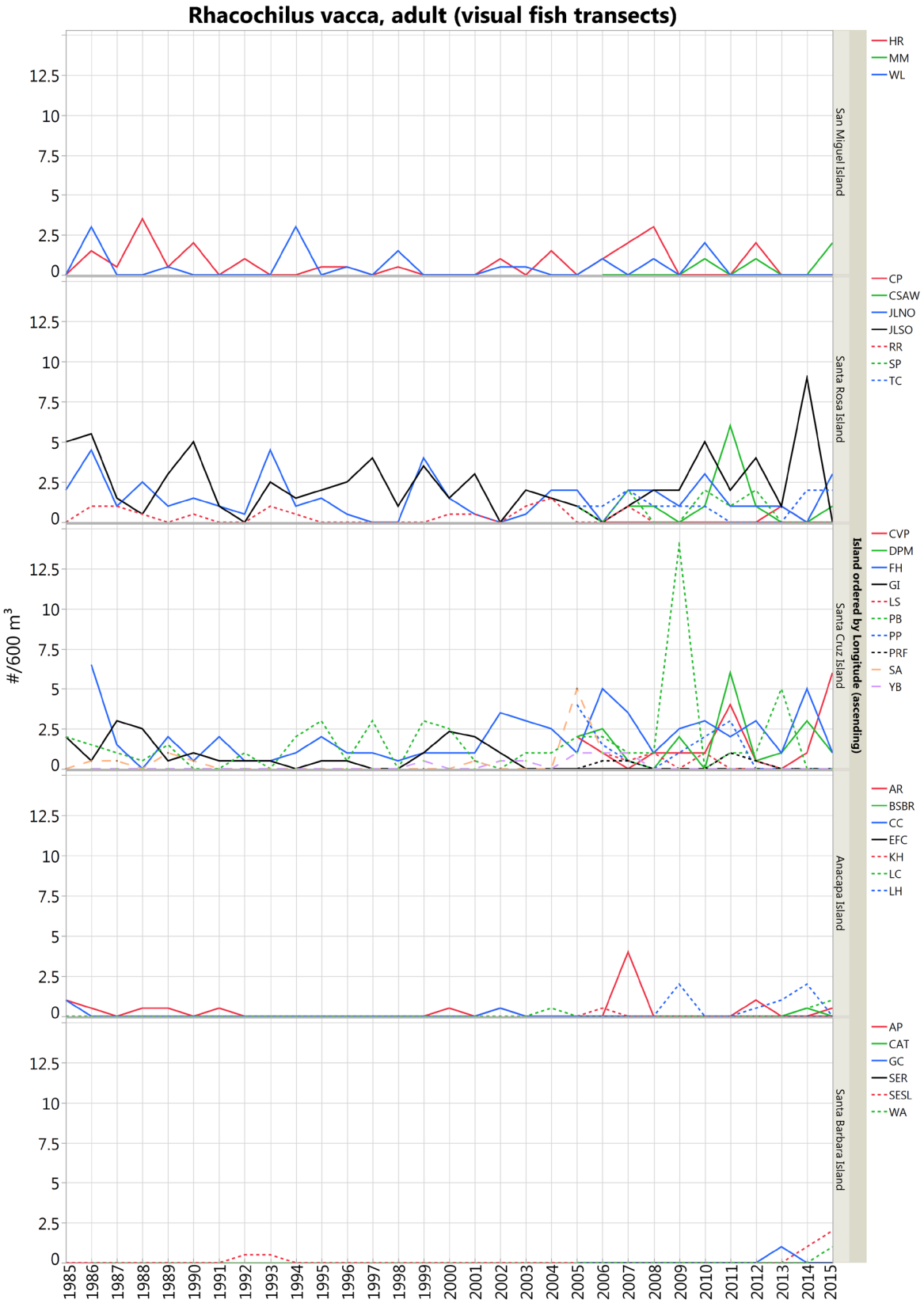


Figure I-16. Density of adult *Rhacochilus vacca* by site and island at Channel Islands National Park between 1985 and 2015.

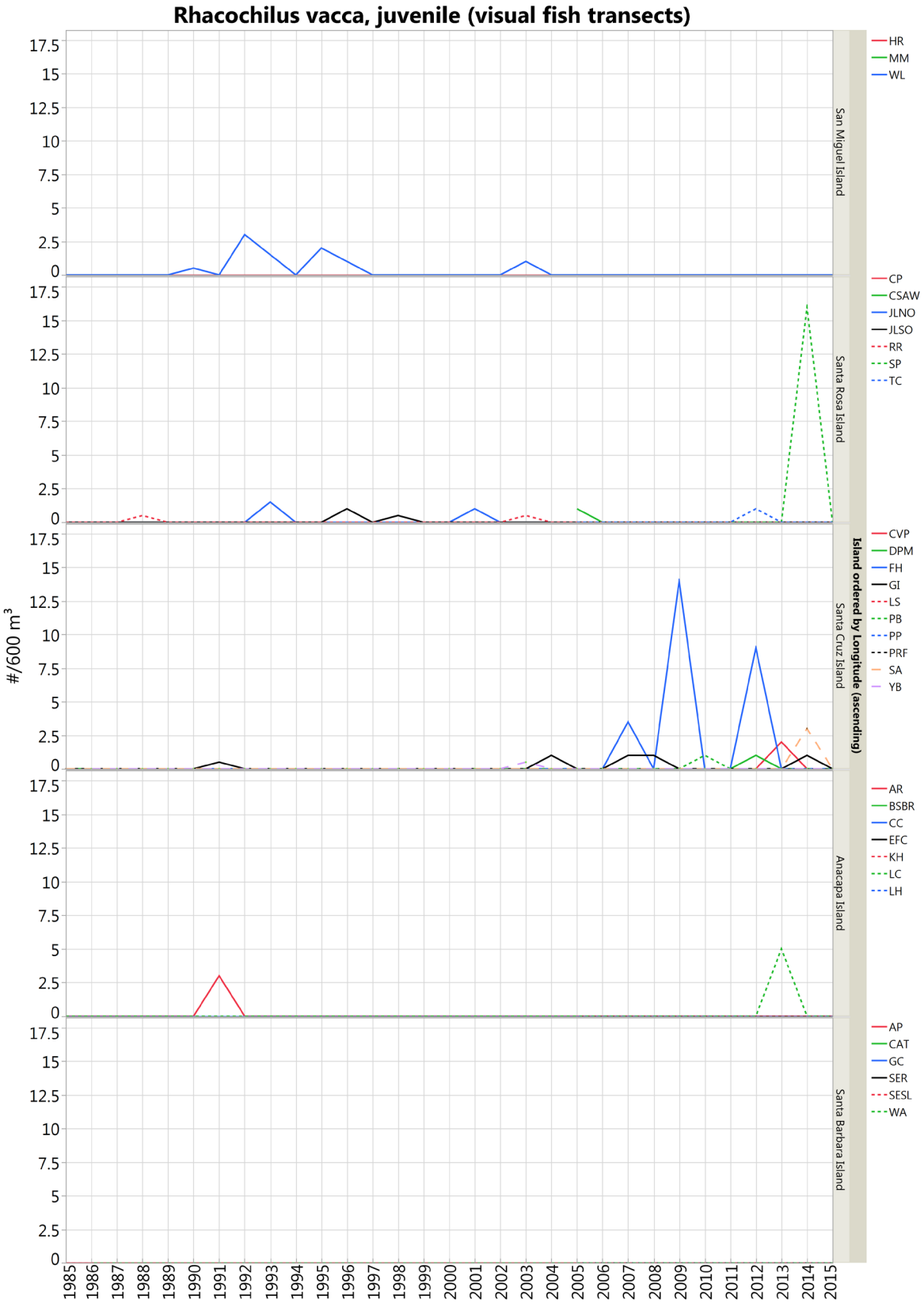


Figure I-17. Density of juvenile *Rhacochilus vacca* by site and island at Channel Islands National Park between 1985 and 2015.

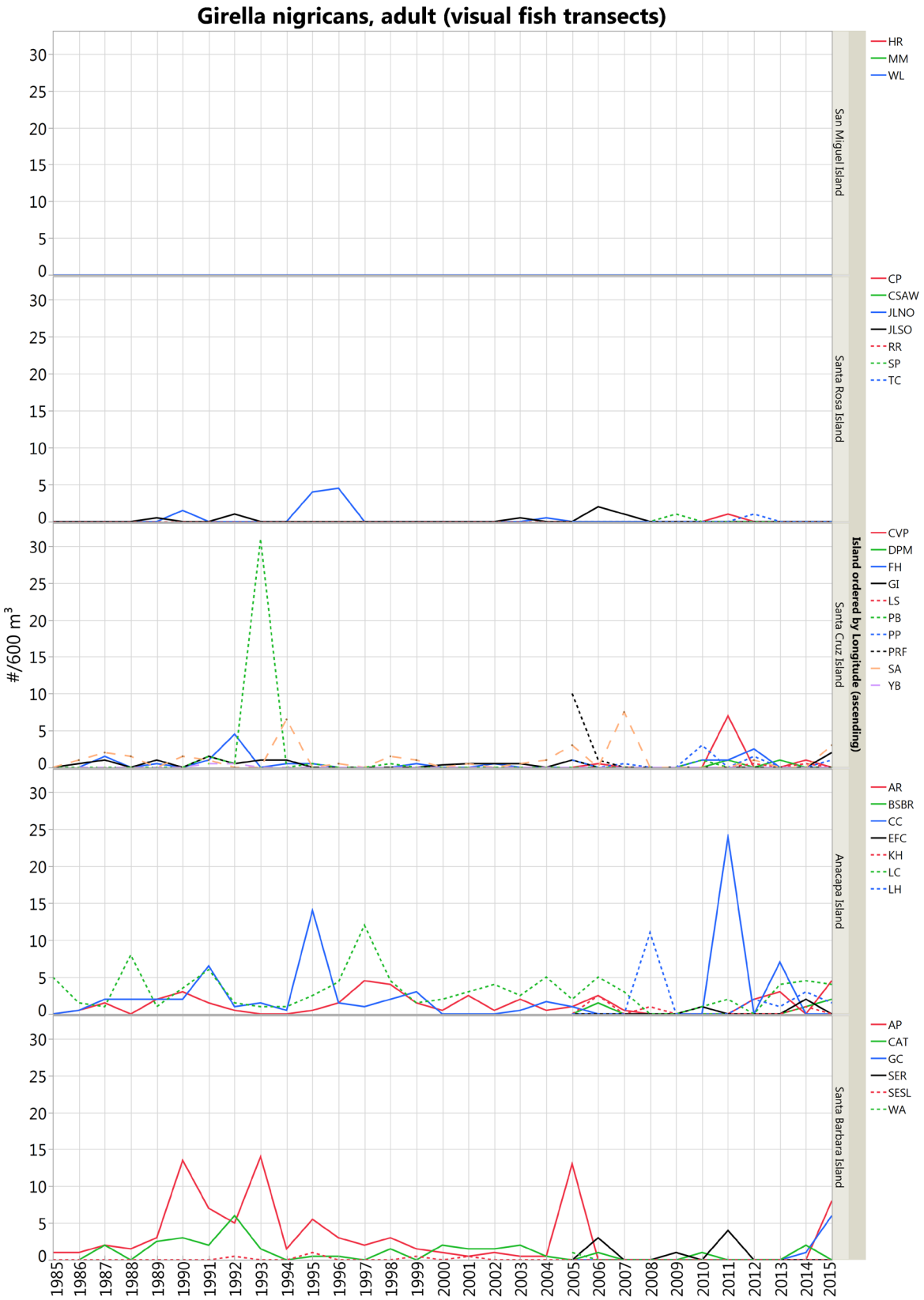


Figure I-18. Density of adult *Girella nigricans* by site and island at Channel Islands National Park between 1985 and 2015.

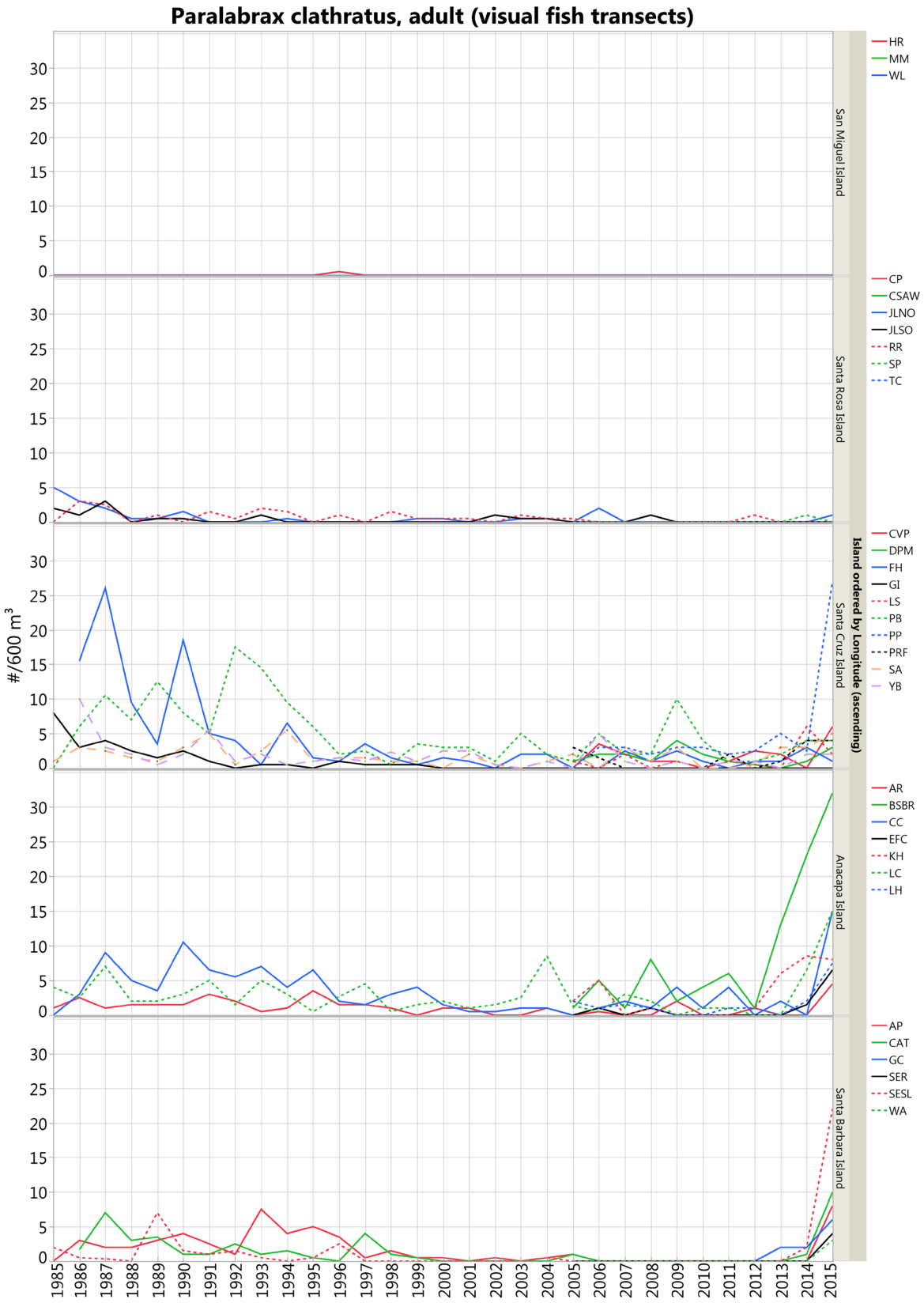


Figure I-19. Density of adult *Paralabrax clathratus* by site and island at Channel Islands National Park between 1985 and 2015.

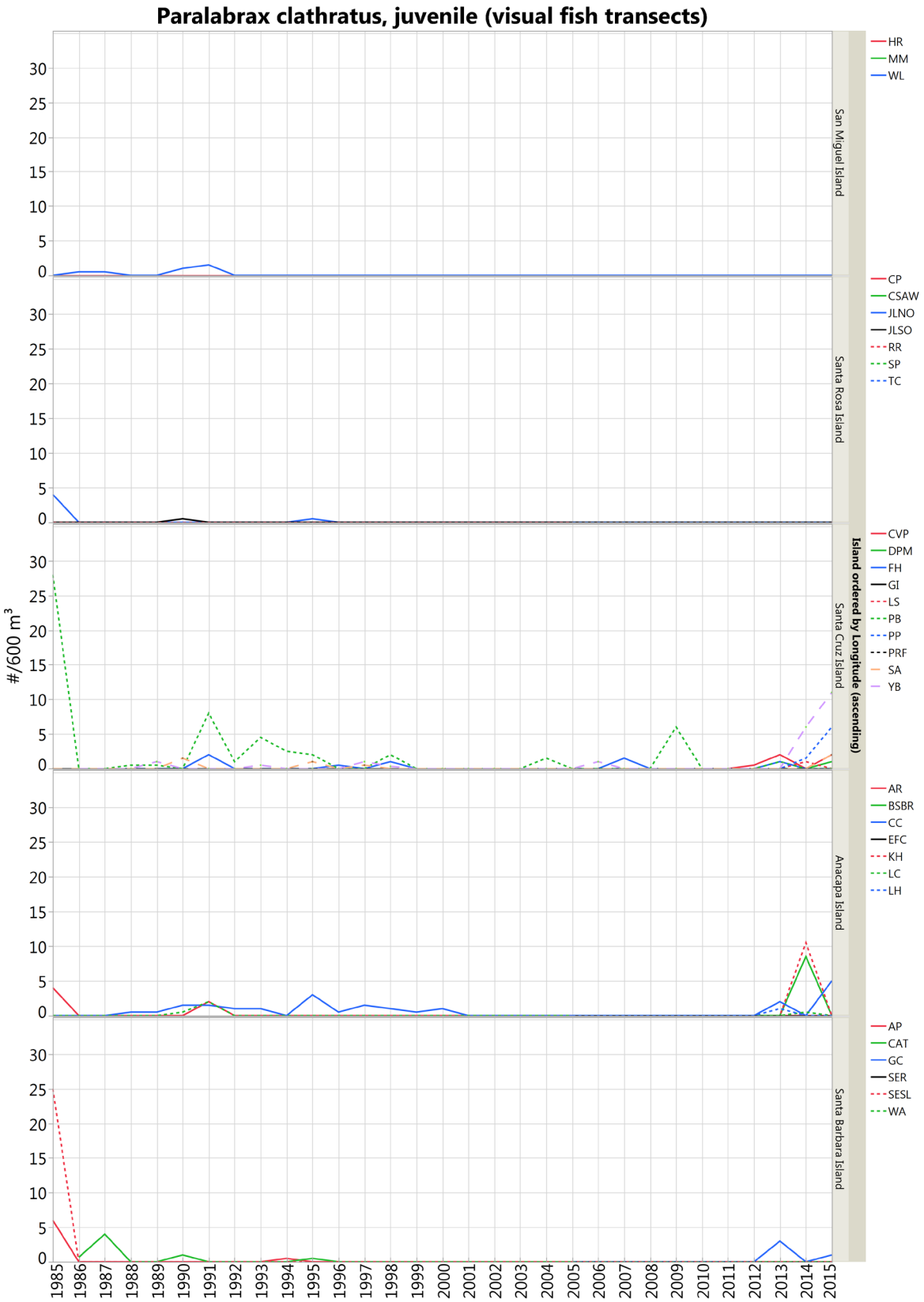


Figure I-20. Density of juvenile *Paralabrax clathratus* by site and island at Channel Islands National Park between 1985 and 2015.

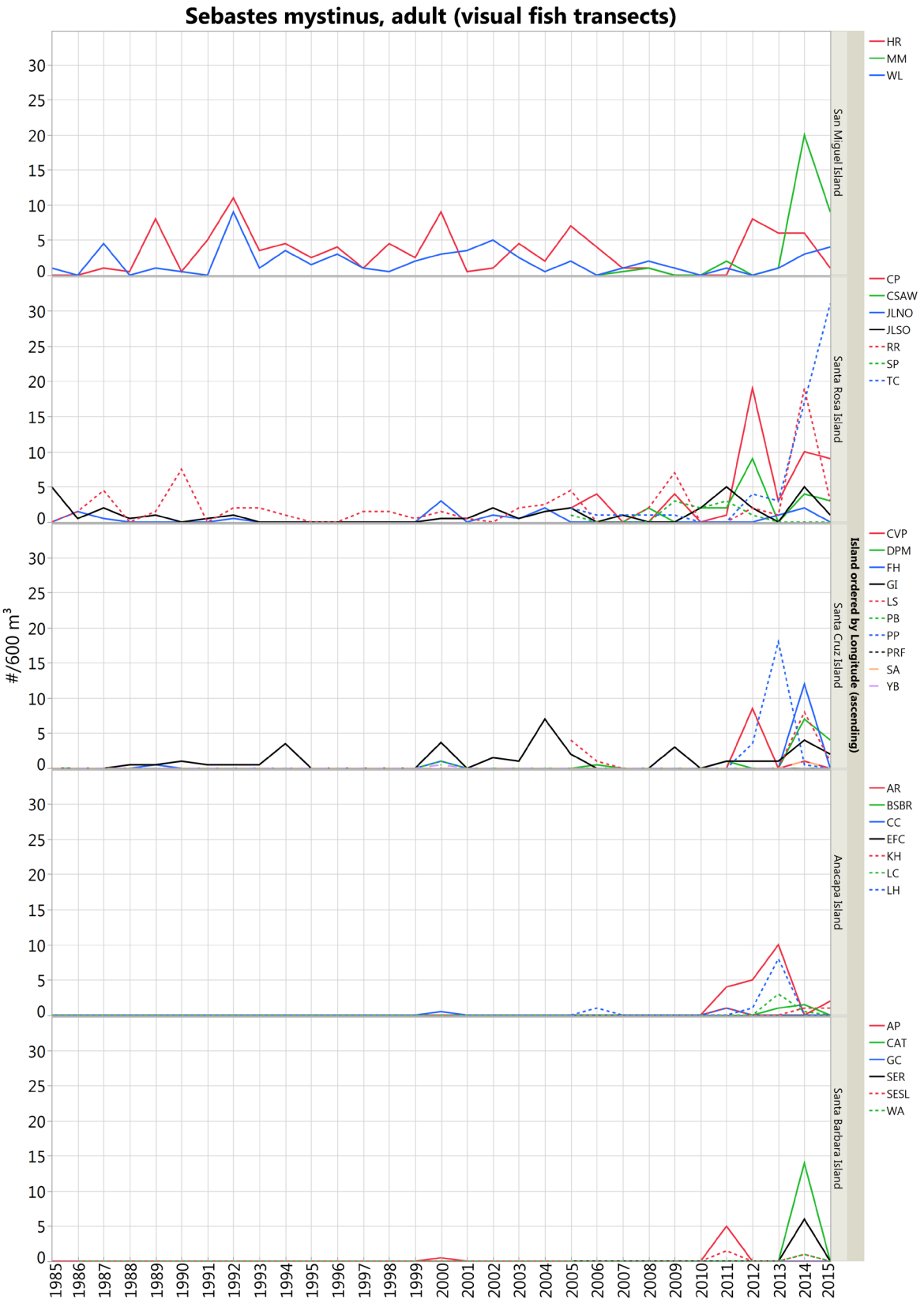


Figure I-21. Density of adult *Sebastes mystinus* by site and island at Channel Islands National Park between 1985 and 2015.

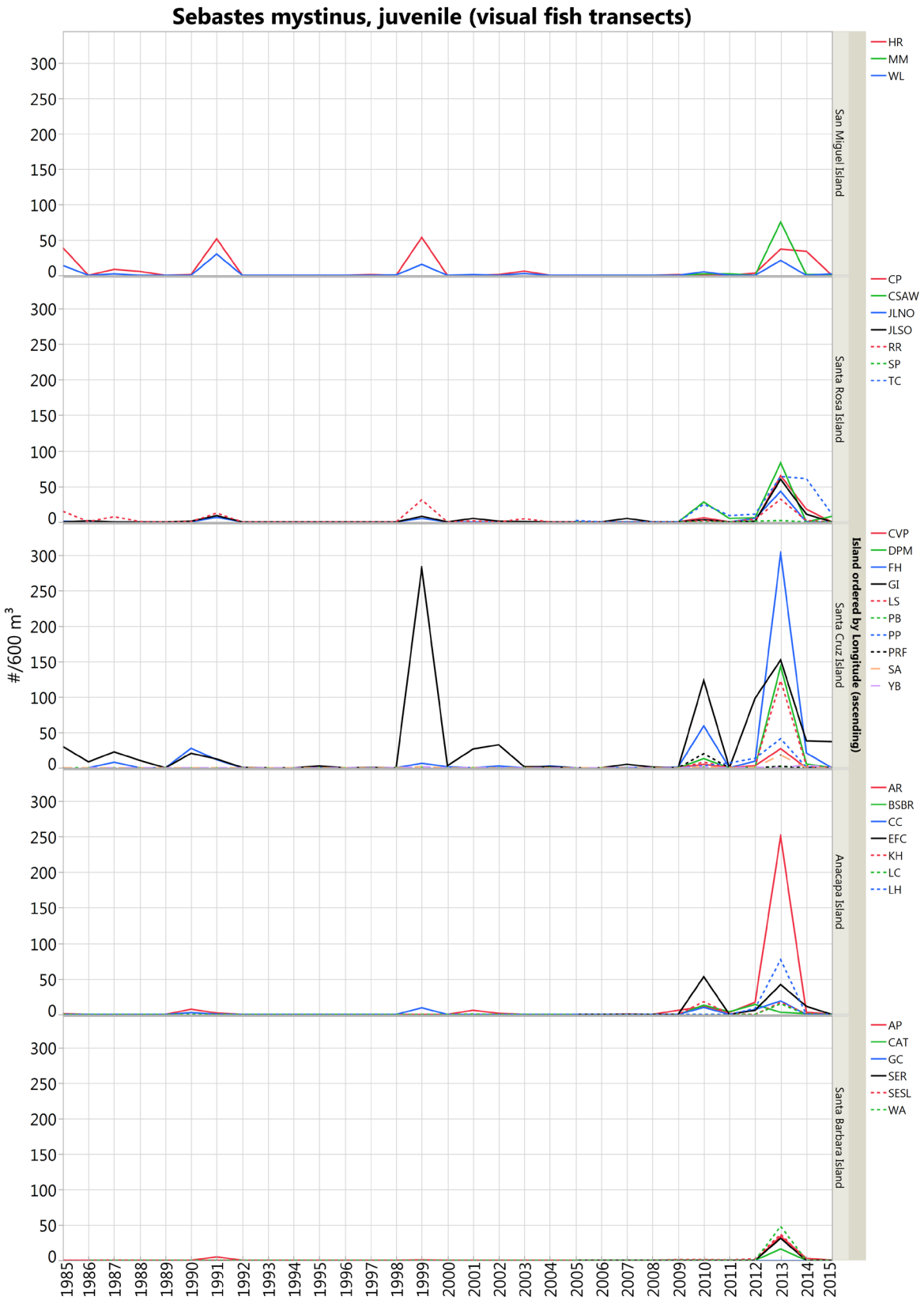


Figure I-22. Density of juvenile *Sebastes mystinus* by site and island at Channel Islands National Park between 1985 and 2015.

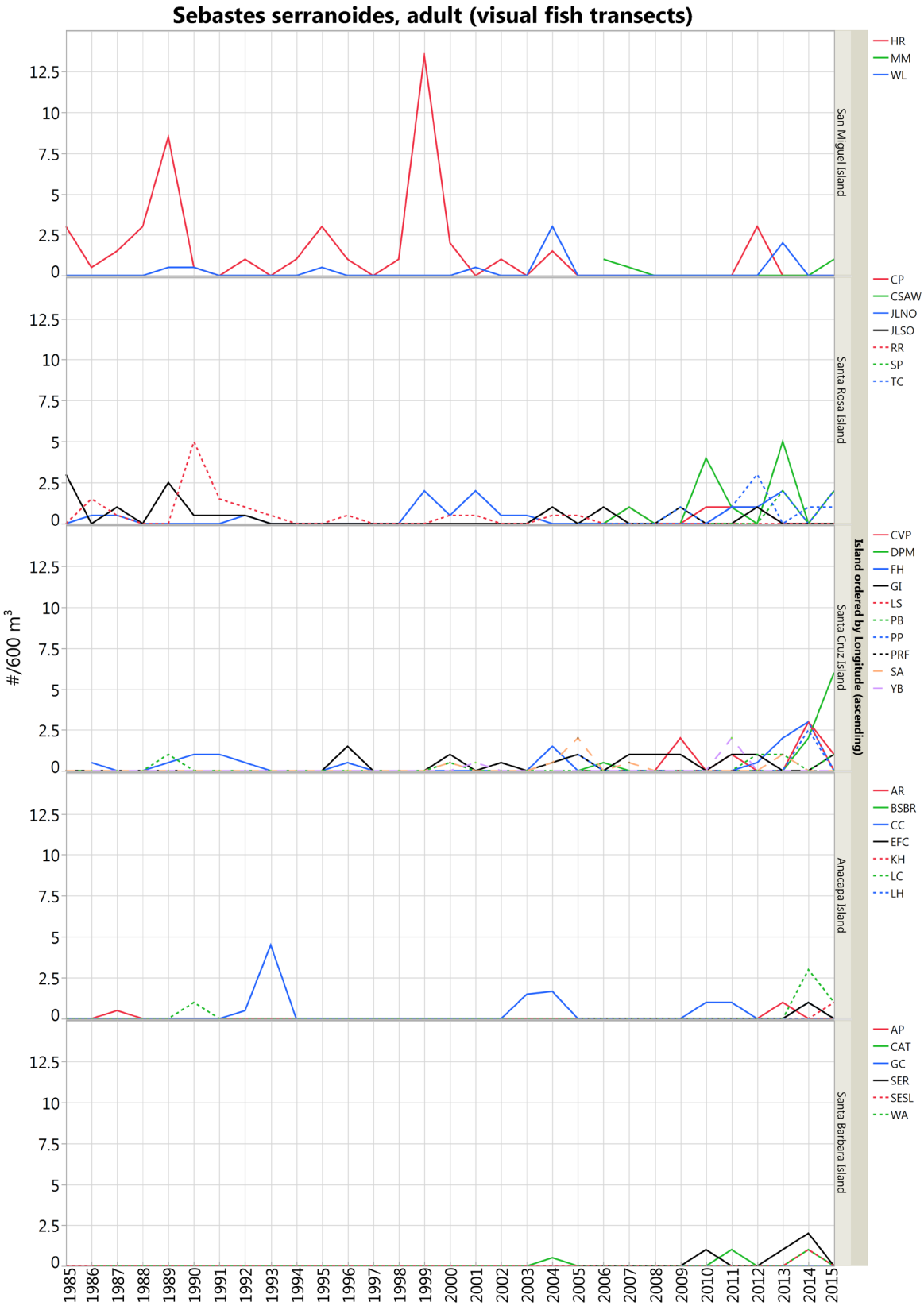


Figure I-23. Density of adult *Sebastes serranoides* by site and island at Channel Islands National Park between 1985 and 2015.

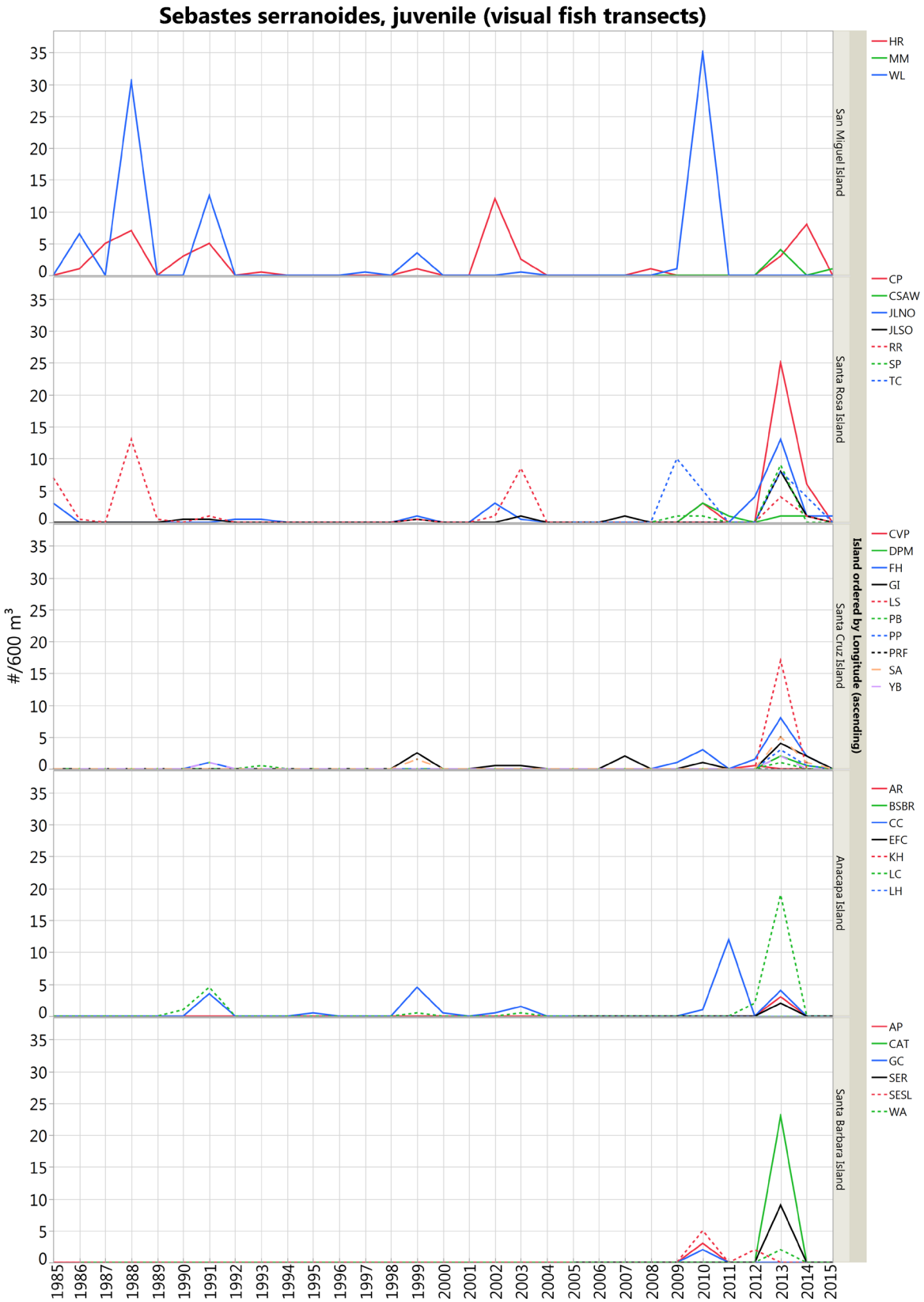


Figure I-24. Density of juvenile *Sebastes serranoides* by site and island at Channel Islands National Park between 1985 and 2015.

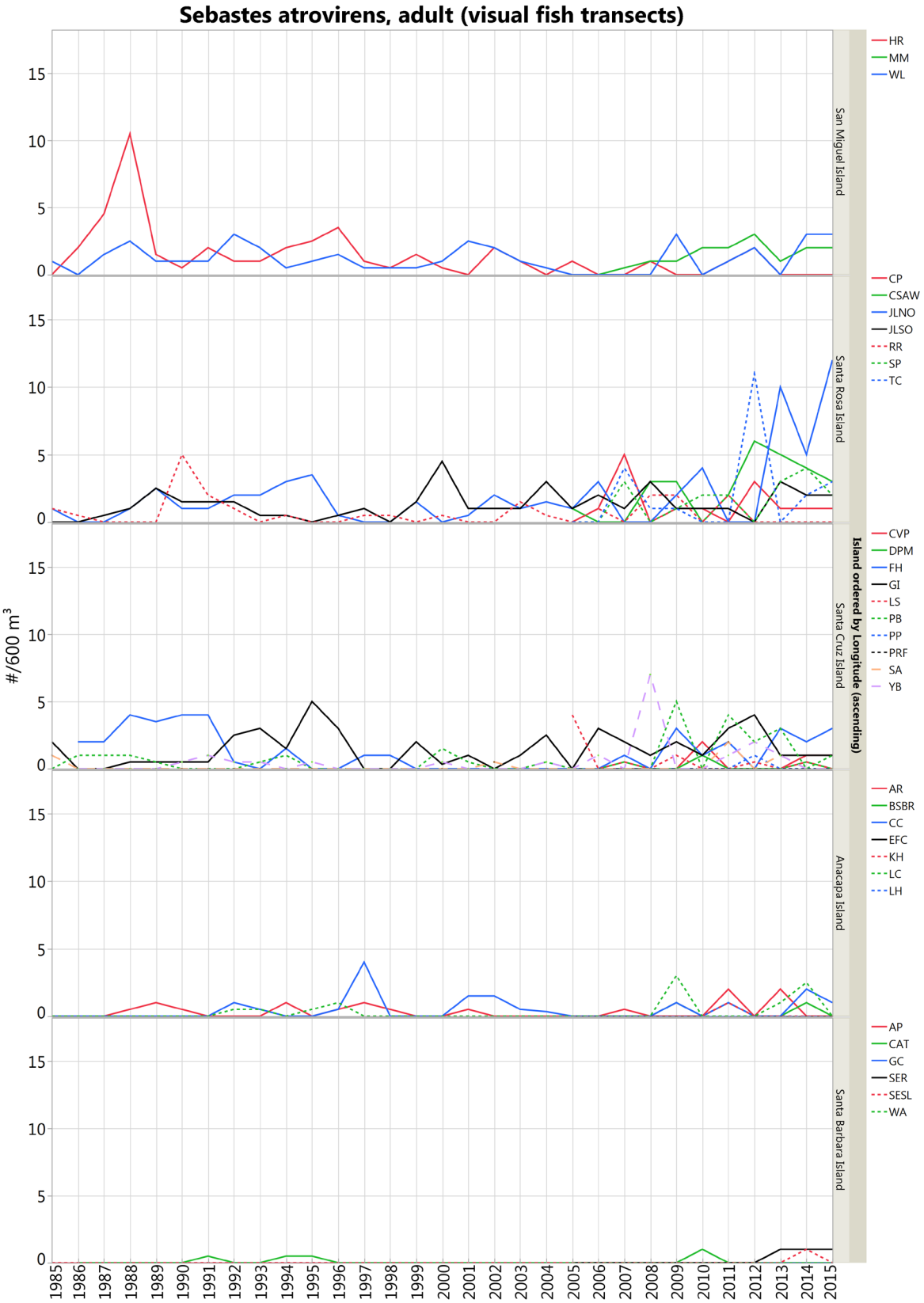


Figure I-25. Density of adult *Sebastes atrovirens* by site and island at Channel Islands National Park between 1985 and 2015.

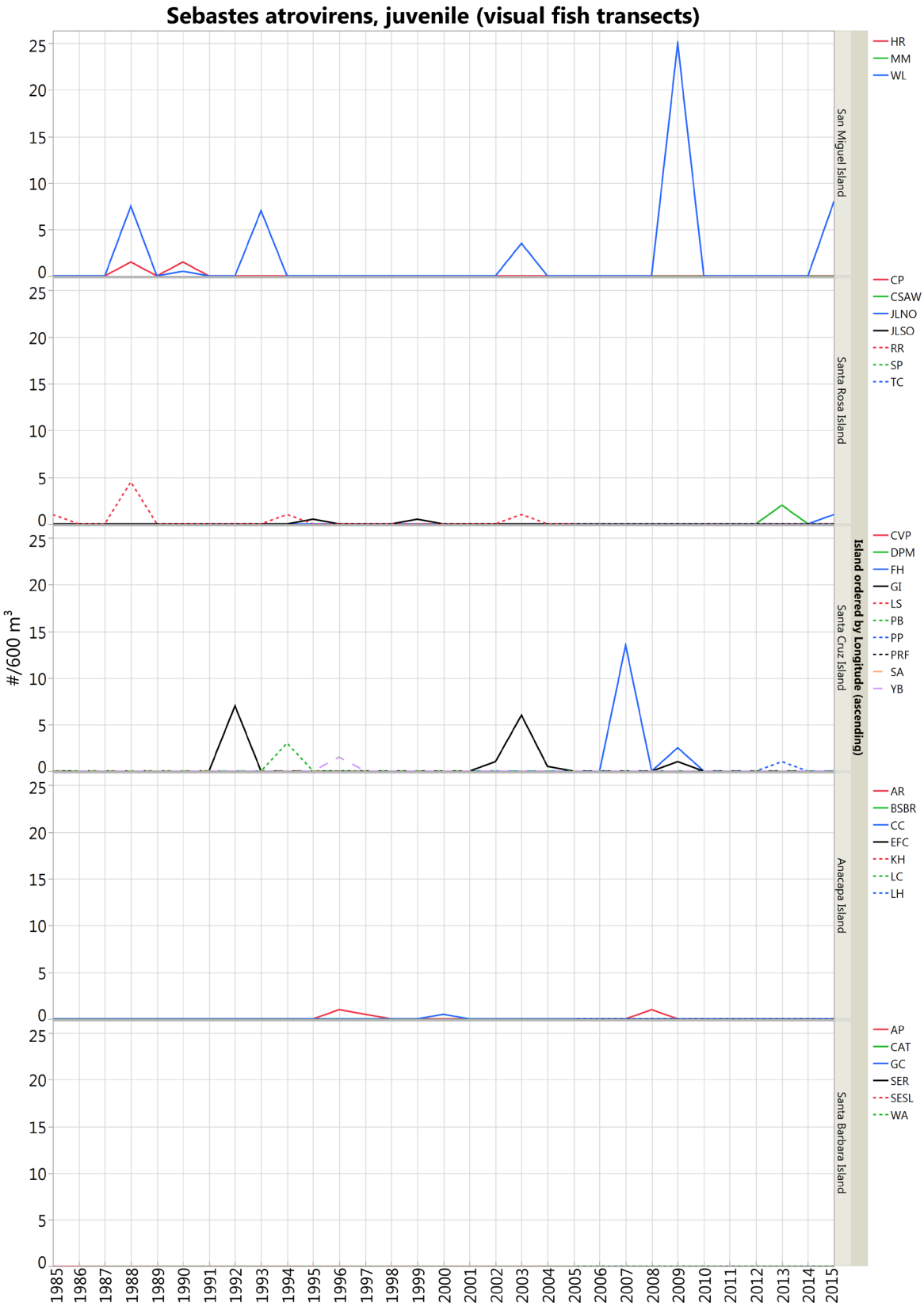


Figure I-26. Density of juvenile *Sebastes atrovirens* by site and island at Channel Islands National Park between 1985 and 2015.

Appendix J. Temperature Data by Site

Figures J-1 through J-32 show the temperature data by site.

The temperature graphs are divided into a right graph and left graph. The left graph displays the mean daily temperature, as well as the daily temperature range, for the current year. The violin plots on the right display monthly mean temperature values for the current year compared to past years. Blue diamonds indicate mean monthly temperatures for the current year. If more than seven days of temperature values are missing from any month, due to instrument loss or failure, all temperature values for that particular month/year are excluded. Graphs are ordered by site longitude, from west to east.

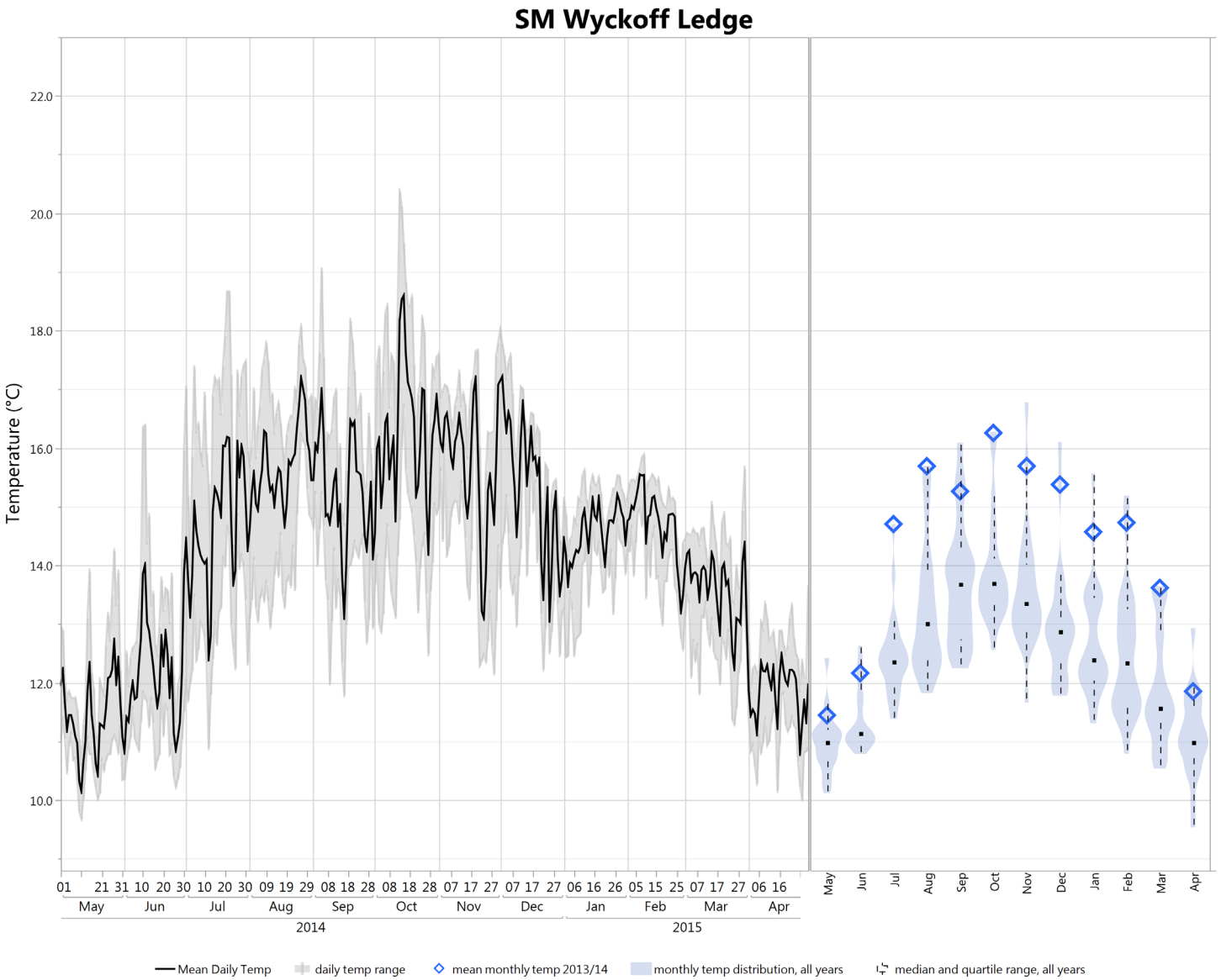


Figure J-1. Temperature at SM Wyckoff Ledge between May 2014 and April 2015 at Channel Islands National Park.

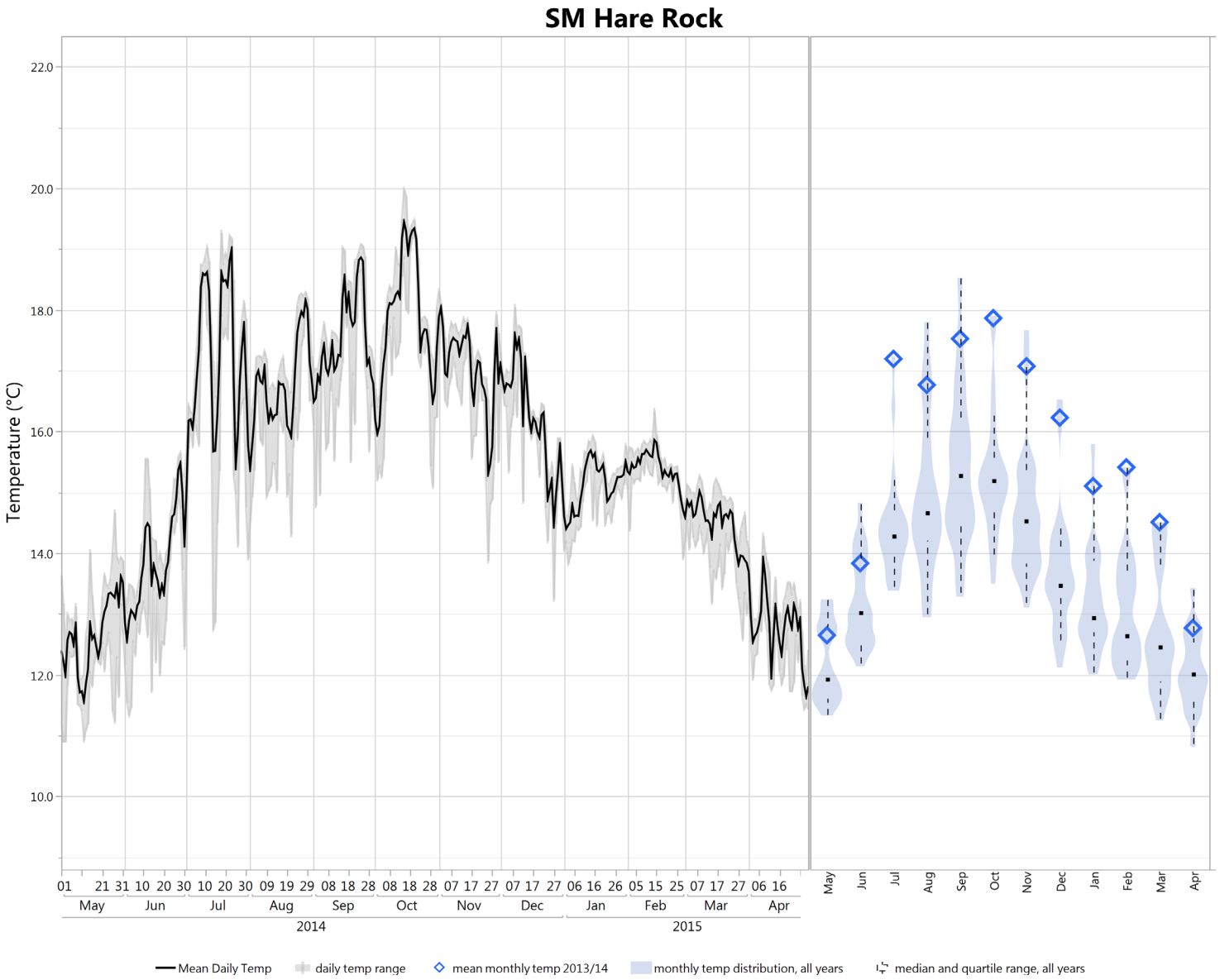


Figure J-2. Temperature at SM Hare Rock between May 2014 and April 2015 at Channel Islands National Park.

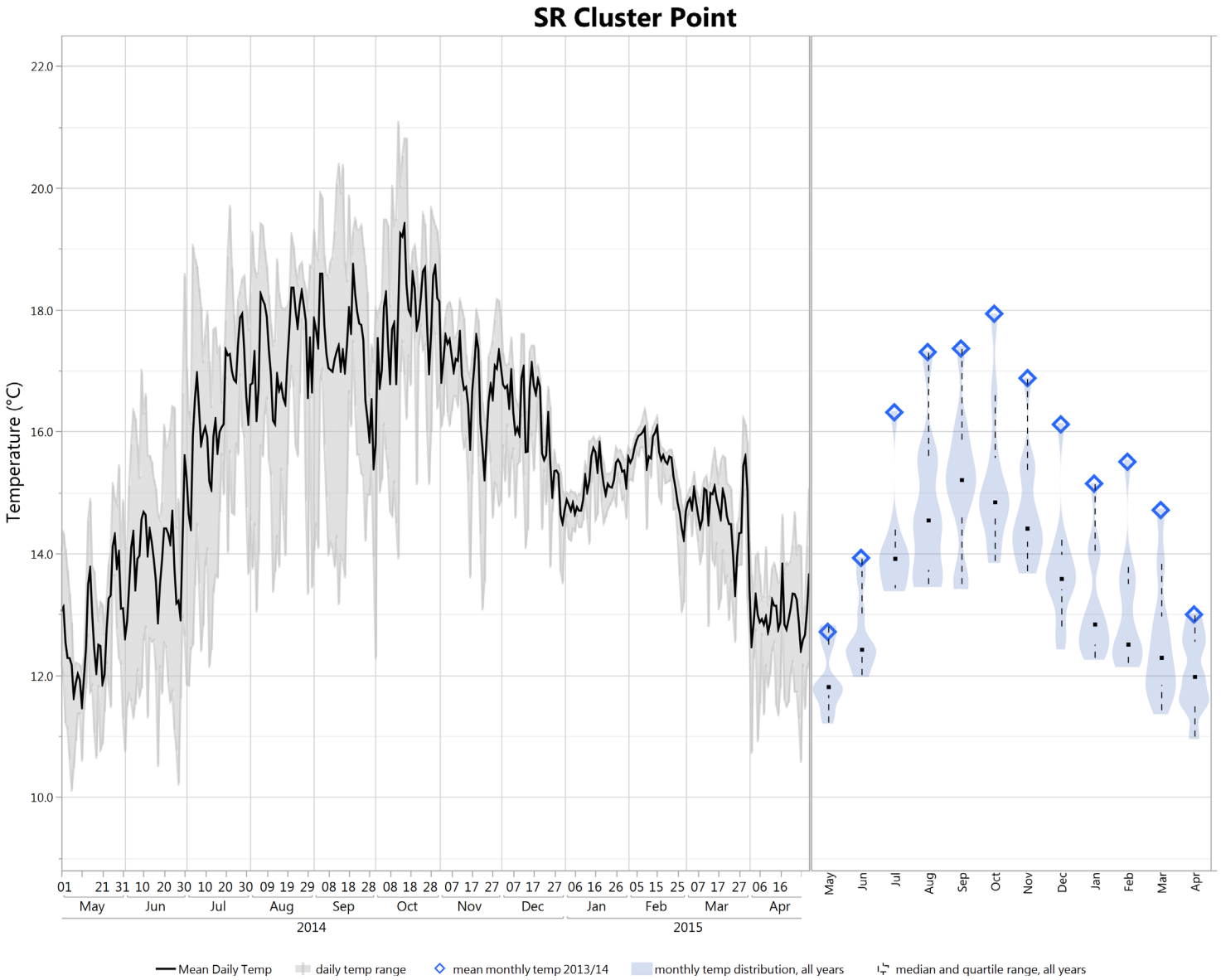


Figure J-3. Temperature at SR Cluster Point between May 2014 and April 2015 at Channel Islands National Park.

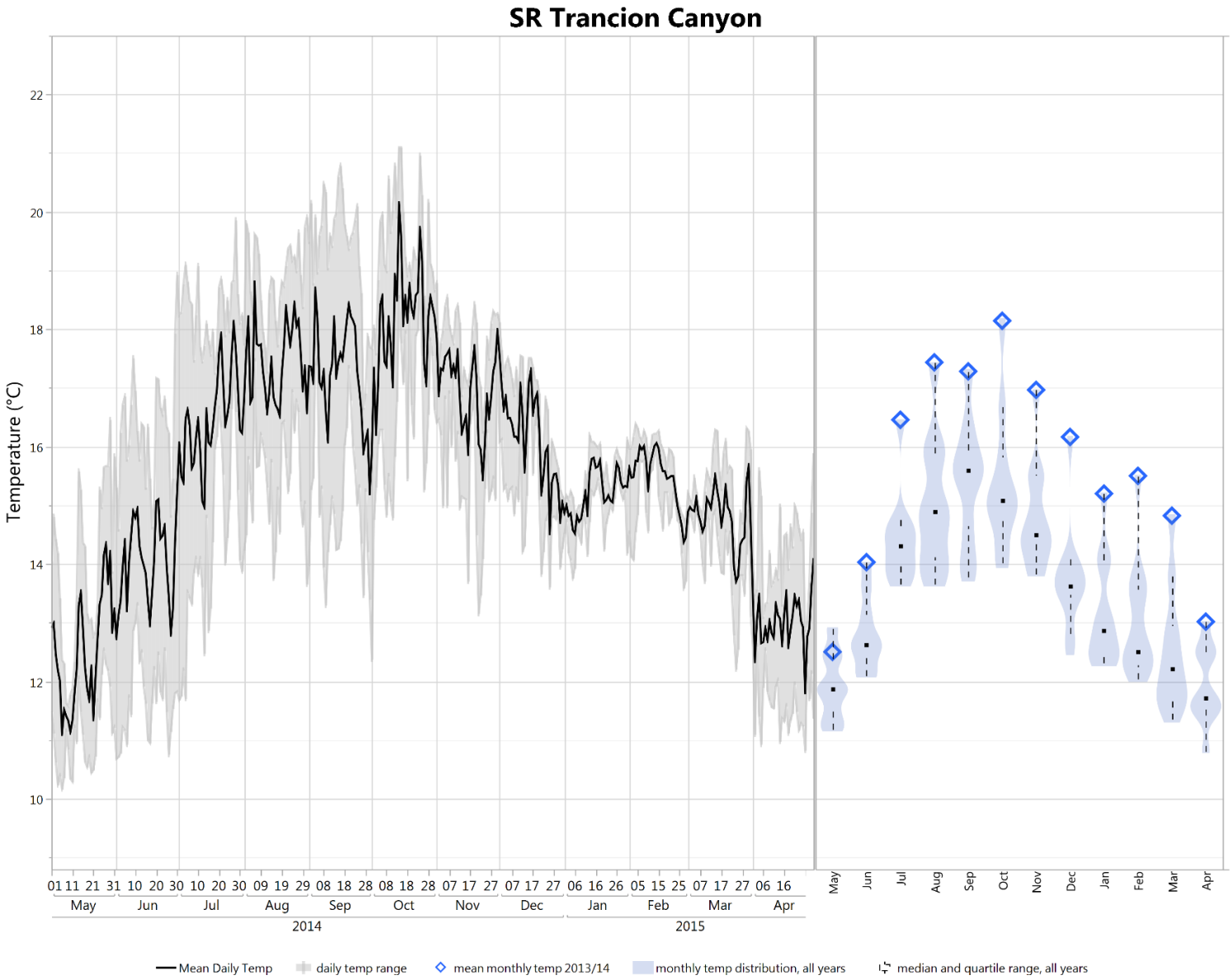


Figure J-4. Temperature at SR Trancion Canyon between May 2014 and April 2015 at Channel Islands National Park.

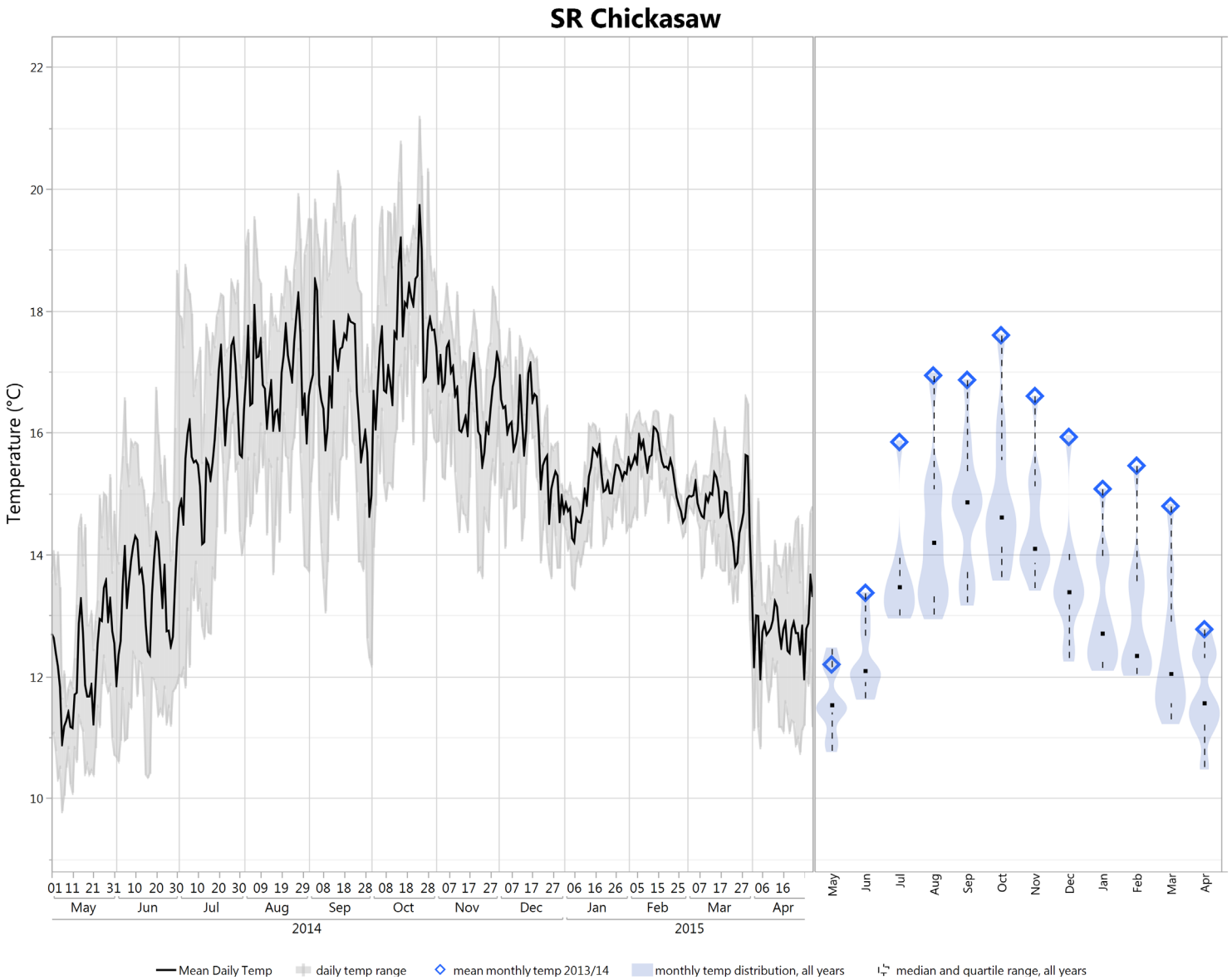


Figure J-5. Temperature at SR Chickasaw between May 2014 and April 2015 at Channel Islands National Park.

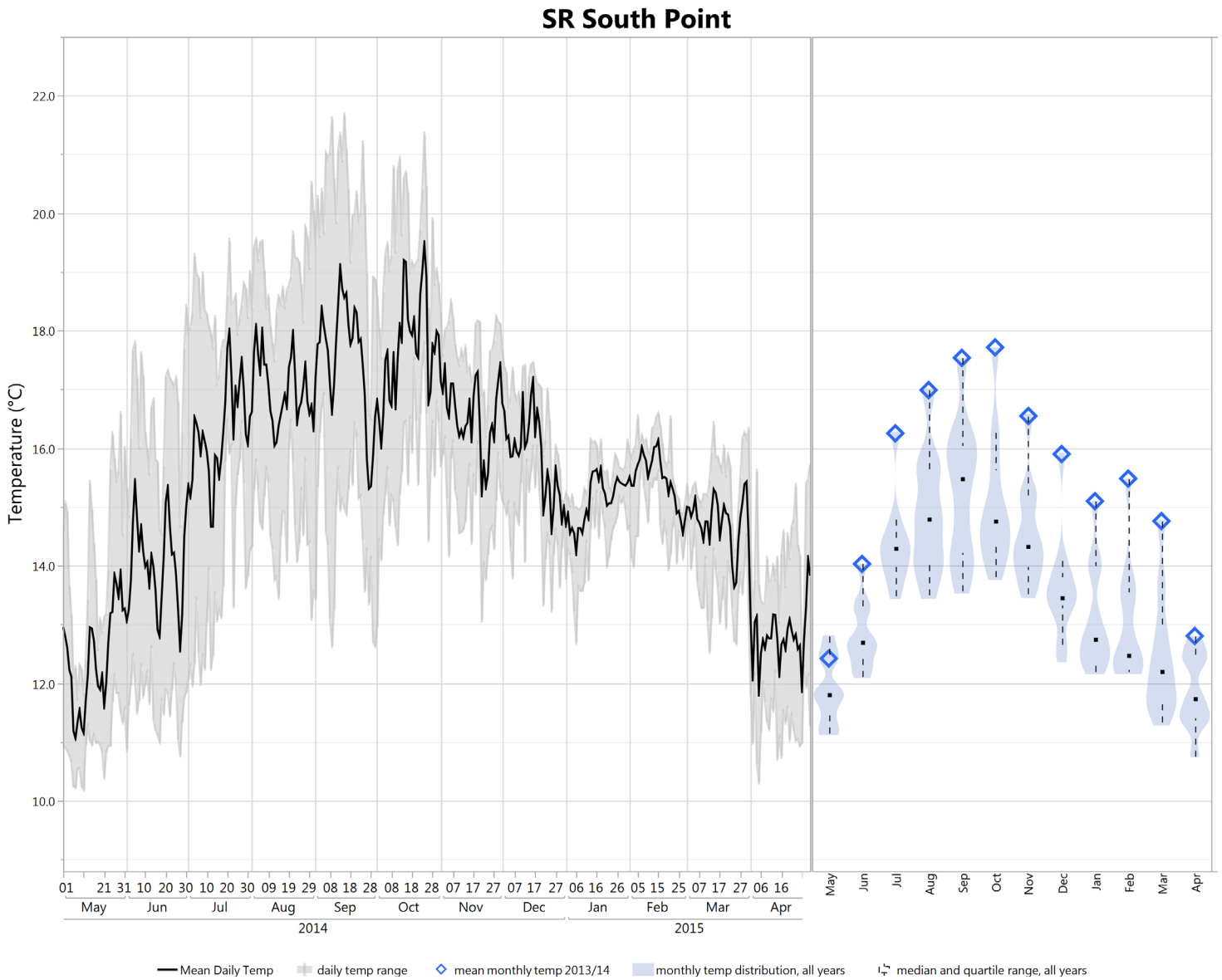


Figure J-6. Temperature at SR South Point between May 2014 and April 2015 at Channel Islands National Park.

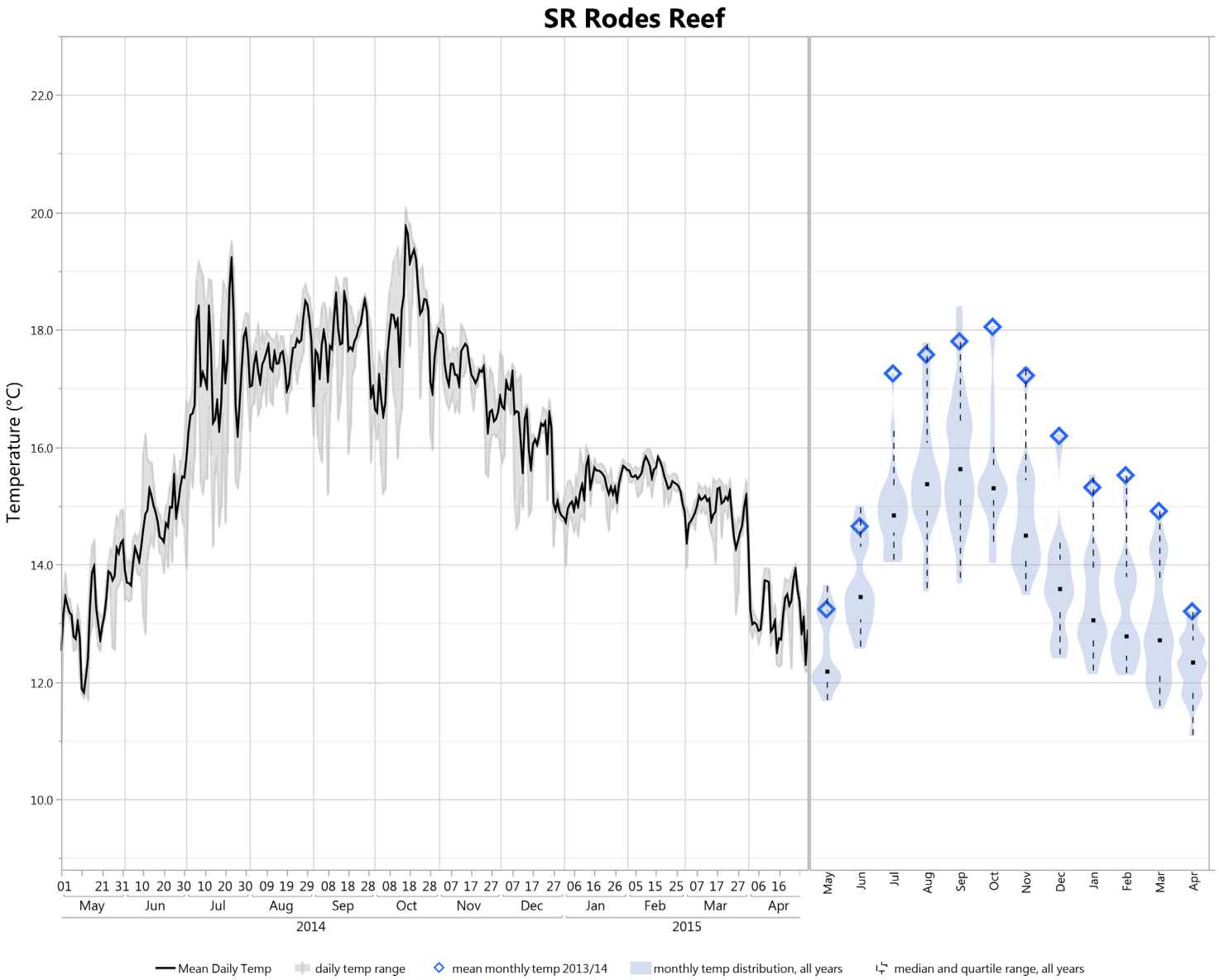


Figure J-7. Temperature at SR Rodes Reef between May 2014 and April 2015 at Channel Islands National Park.

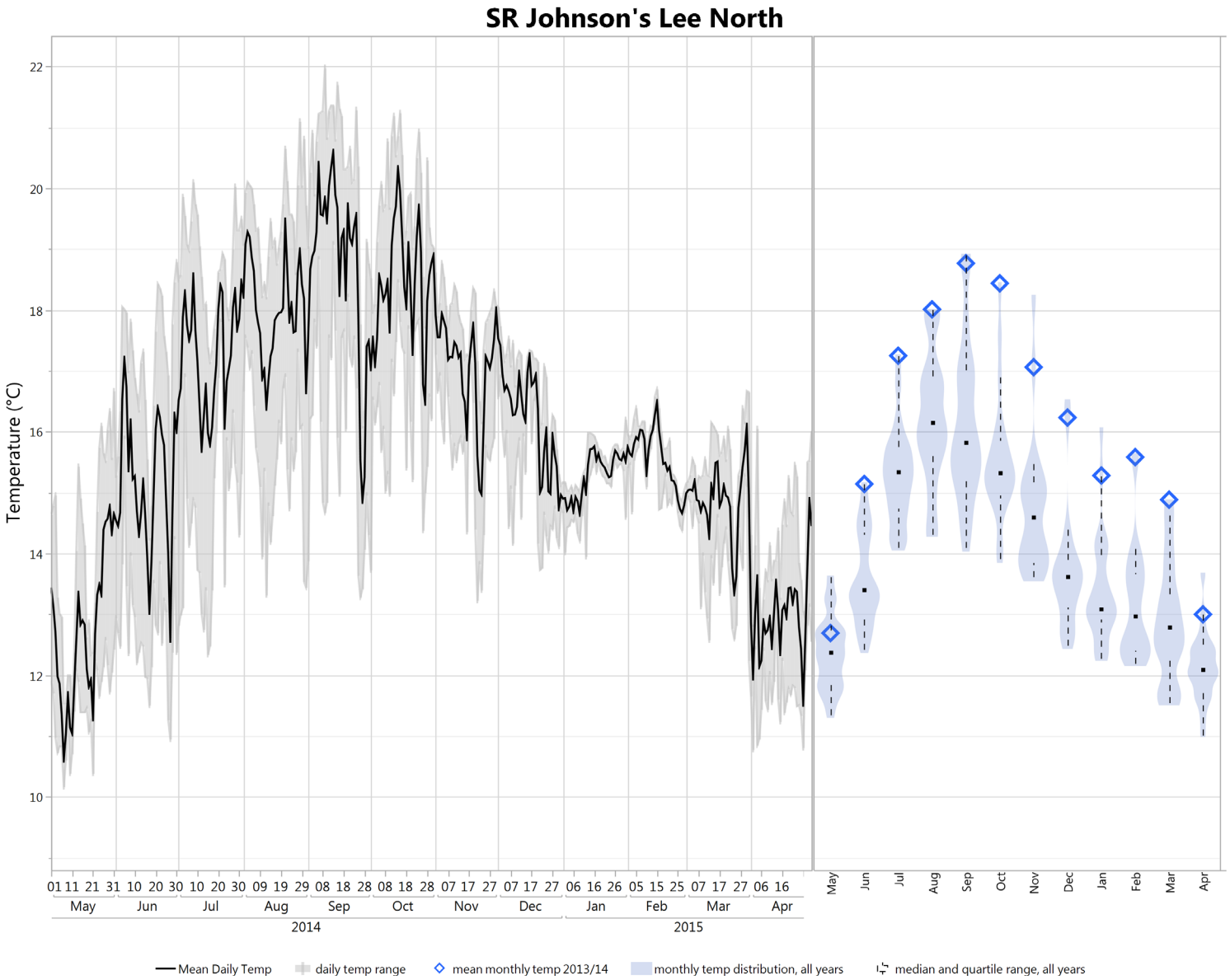


Figure J-8. Temperature at SR Johnson's Lee North between May 2014 and April 2015 at Channel Islands National Park.

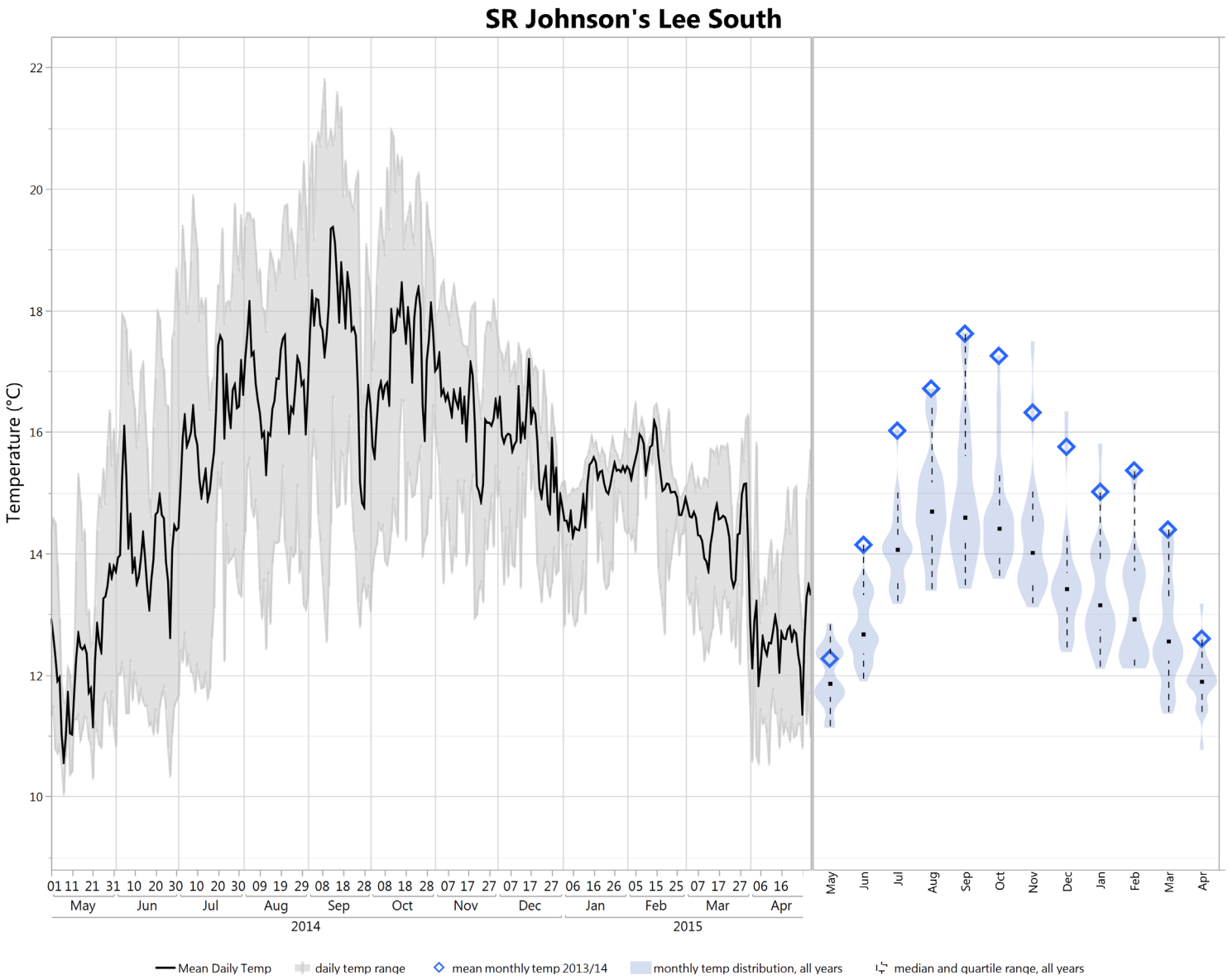


Figure J-9. Temperature at SR Johnson's Lee South between May 2014 and April 2015 at Channel Islands National Park.

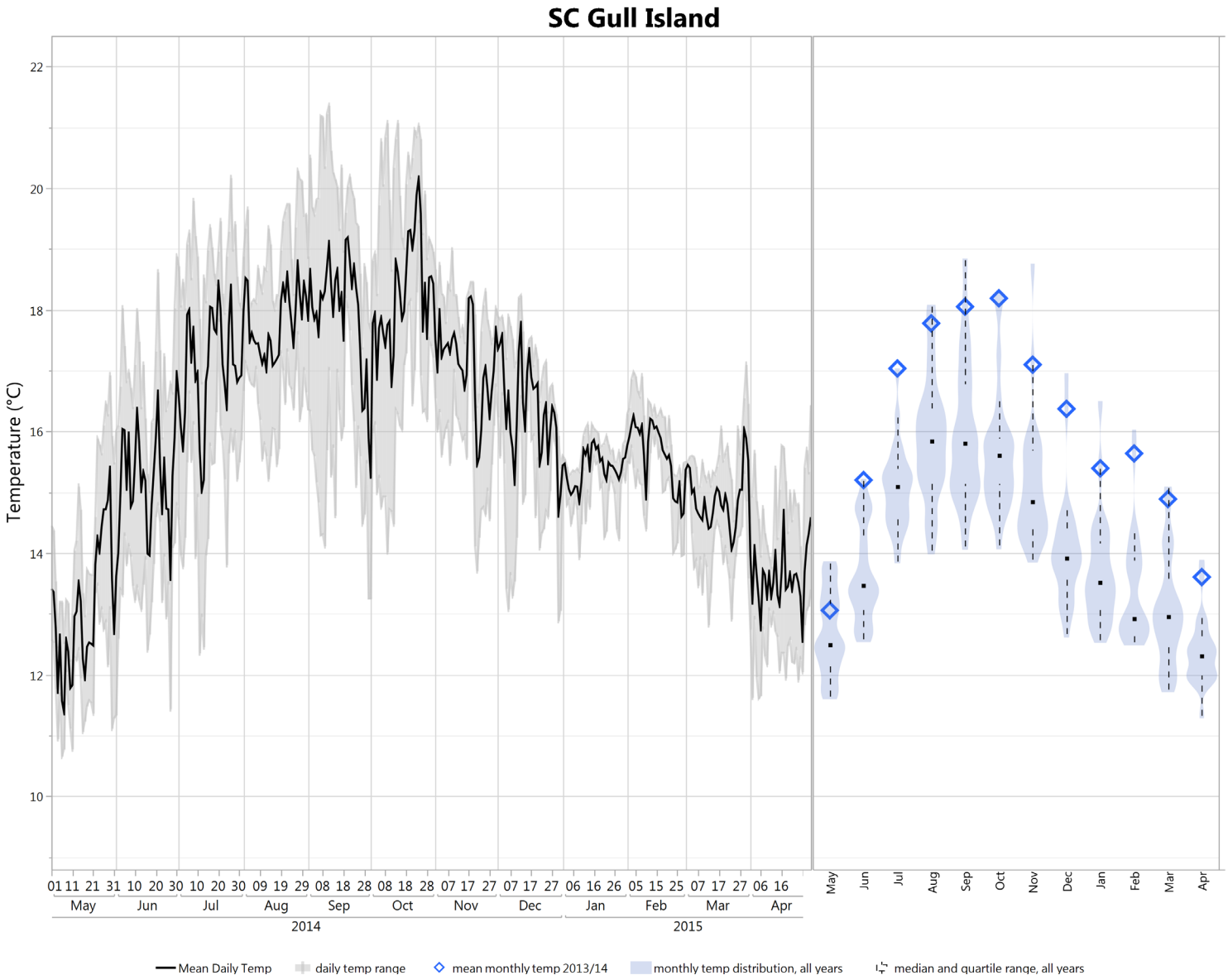


Figure J-10. Temperature at SC Gull Island between May 2014 and April 2015 at Channel Islands National Park.

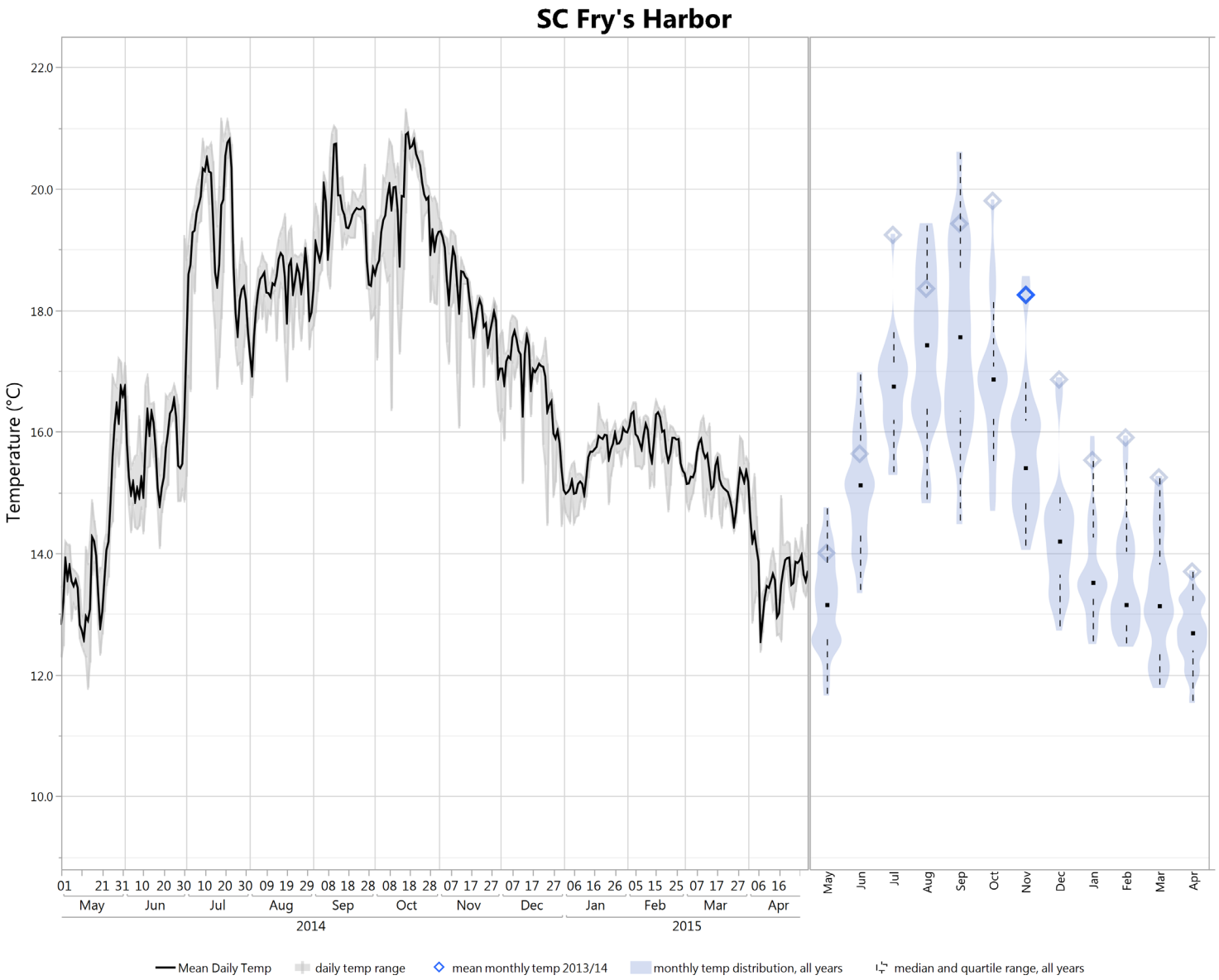


Figure J-11. Temperature at SC Fry's Harbor between May 2014 and April 2015 at Channel Islands National Park.

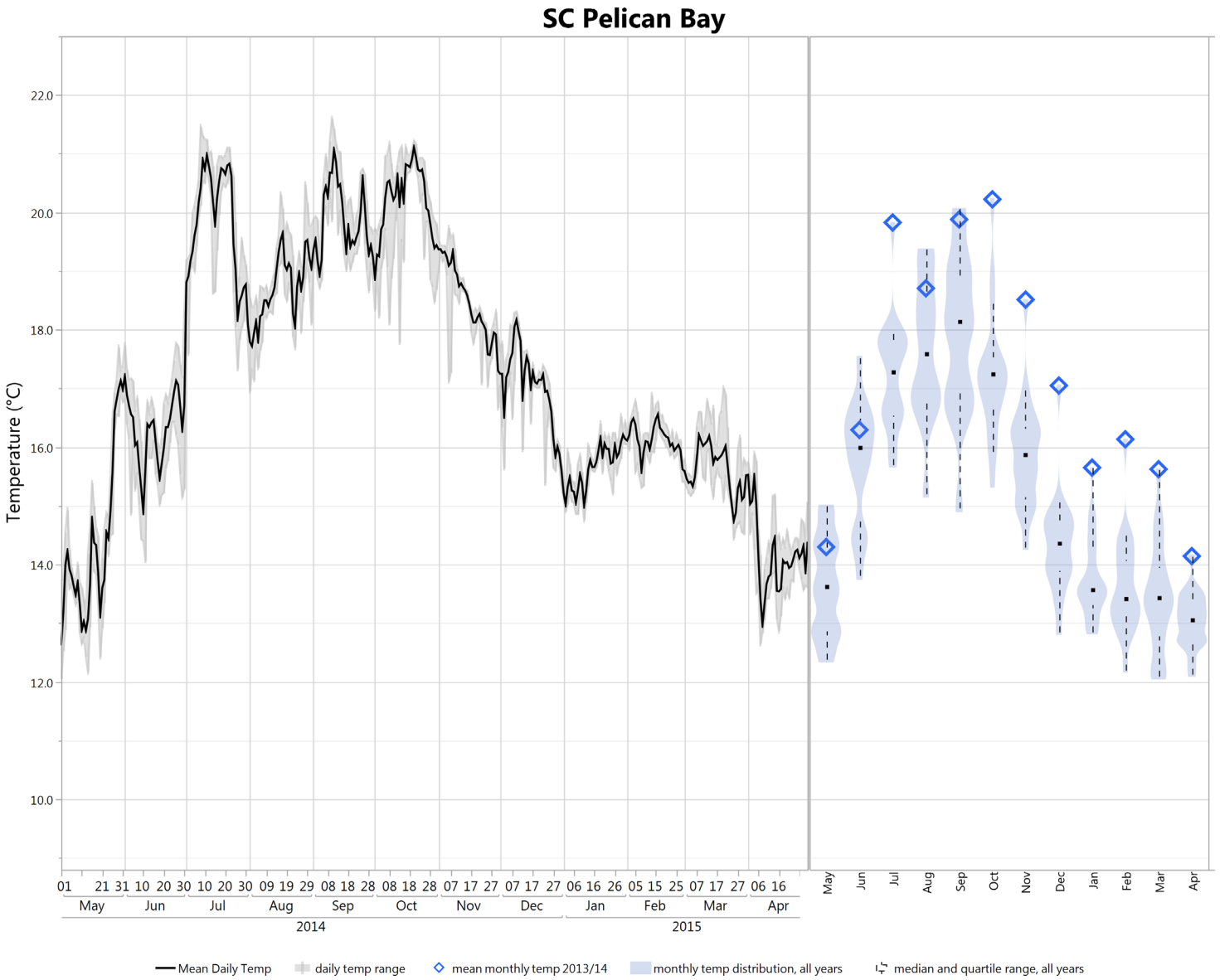


Figure J-12. Temperature at SC Pelican Point between May 2014 and April 2015 at Channel Islands National Park.

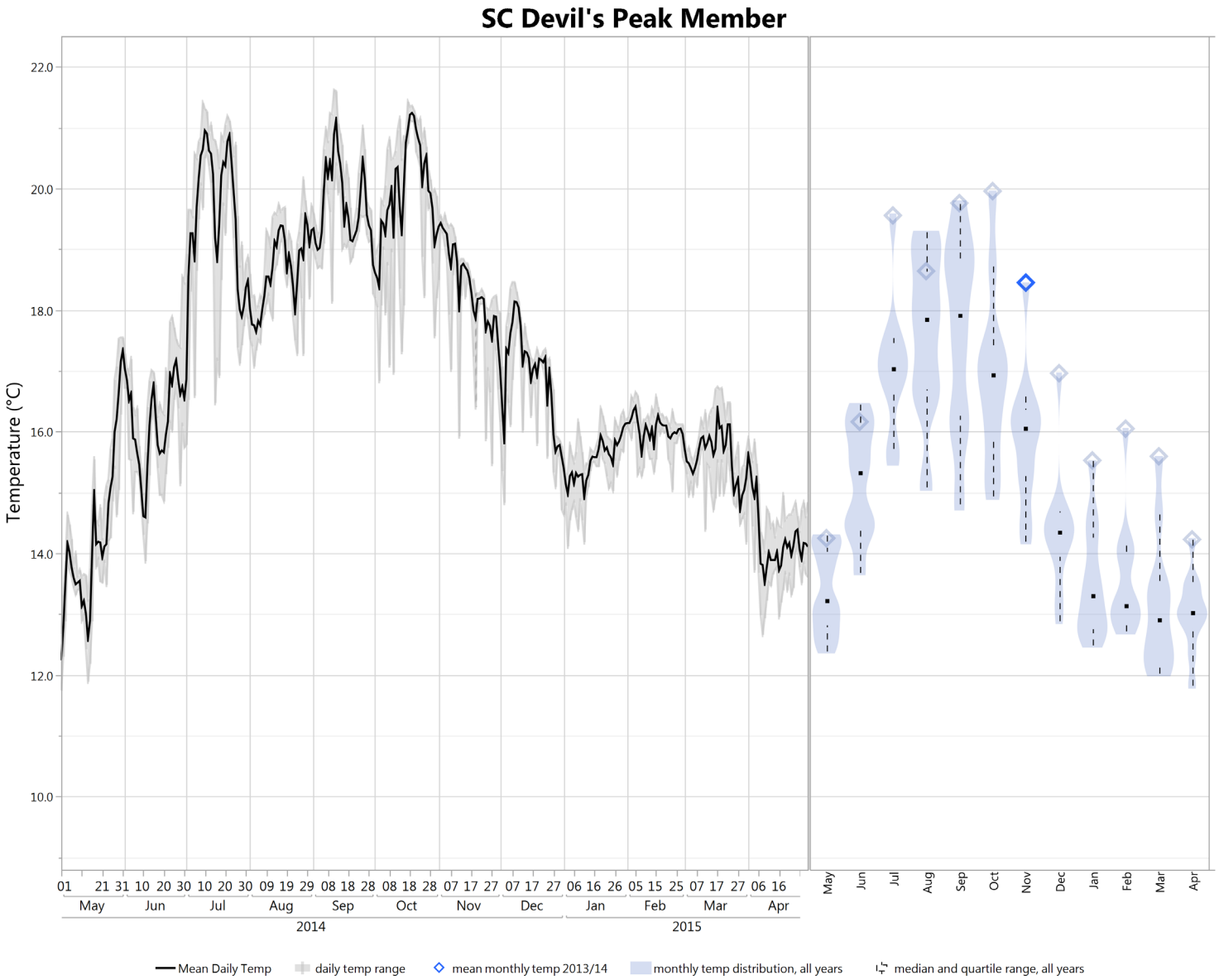


Figure J-13. Temperature at SC Devil's Peak Member between May 2014 and April 2015 at Channel Islands National Park.

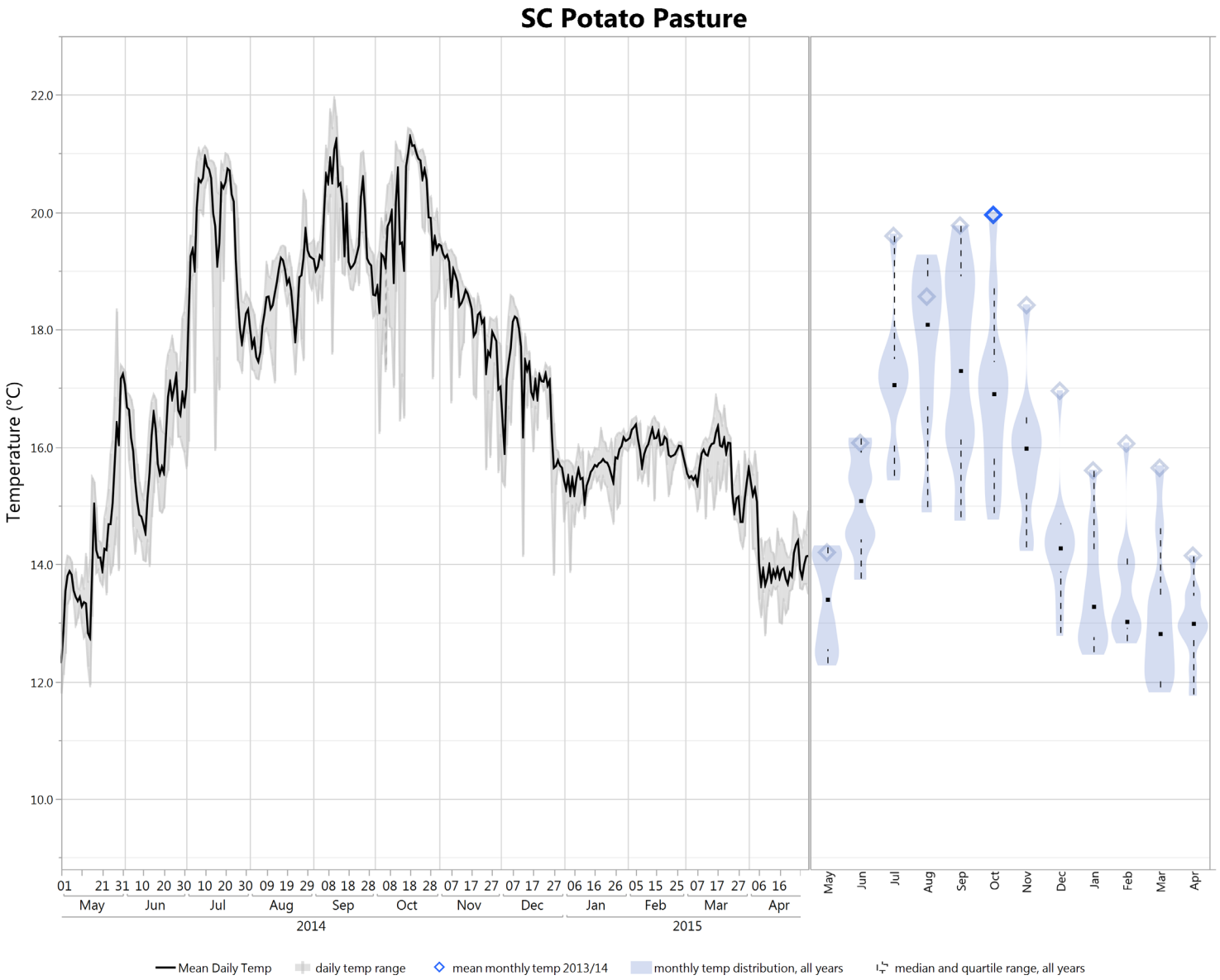


Figure J-14. Temperature at SC Potato Pasture between May 2014 and April 2015 at Channel Islands National Park.

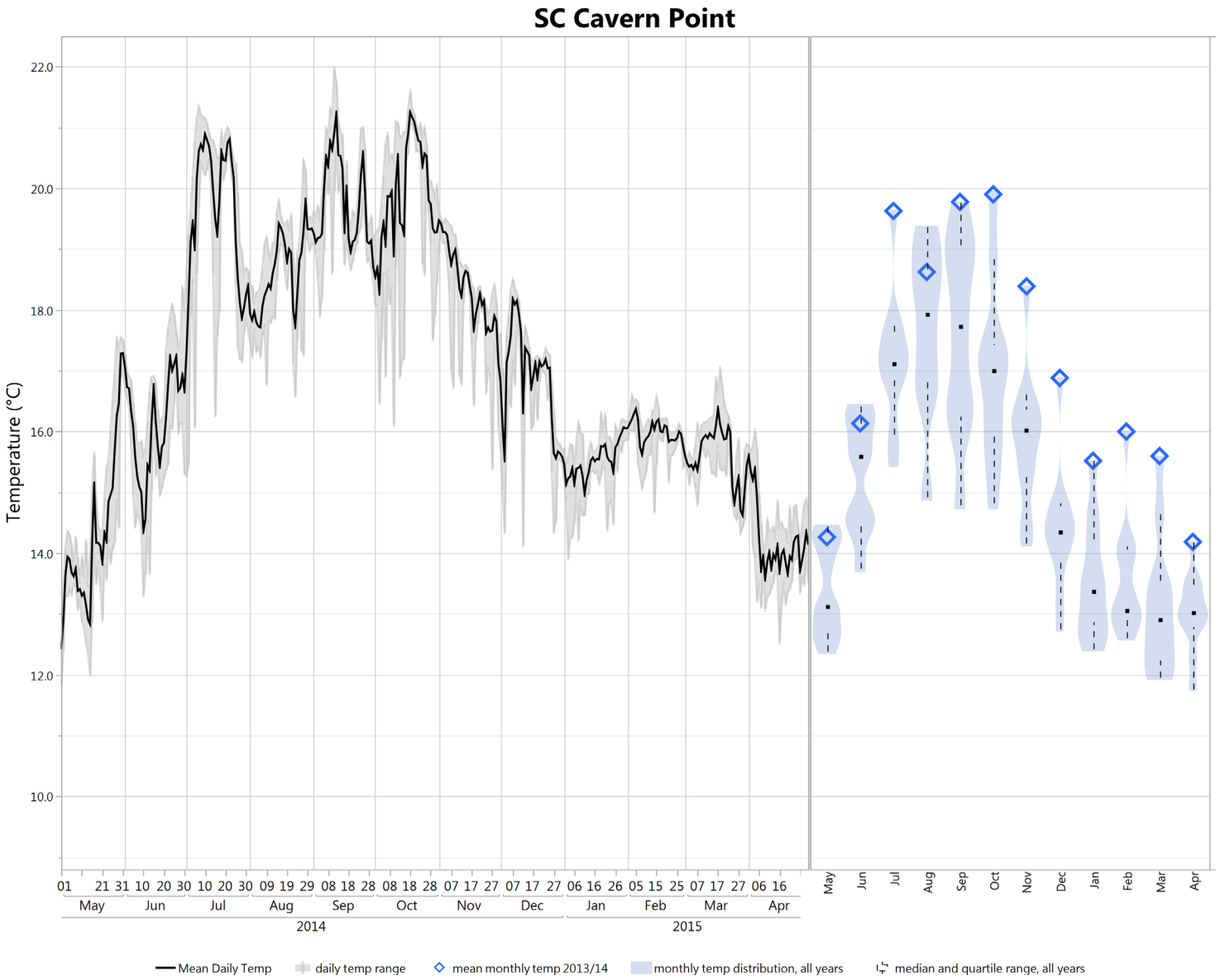


Figure J-15. Temperature at SC Cavern Point between May 2014 and April 2015 at Channel Islands National Park.

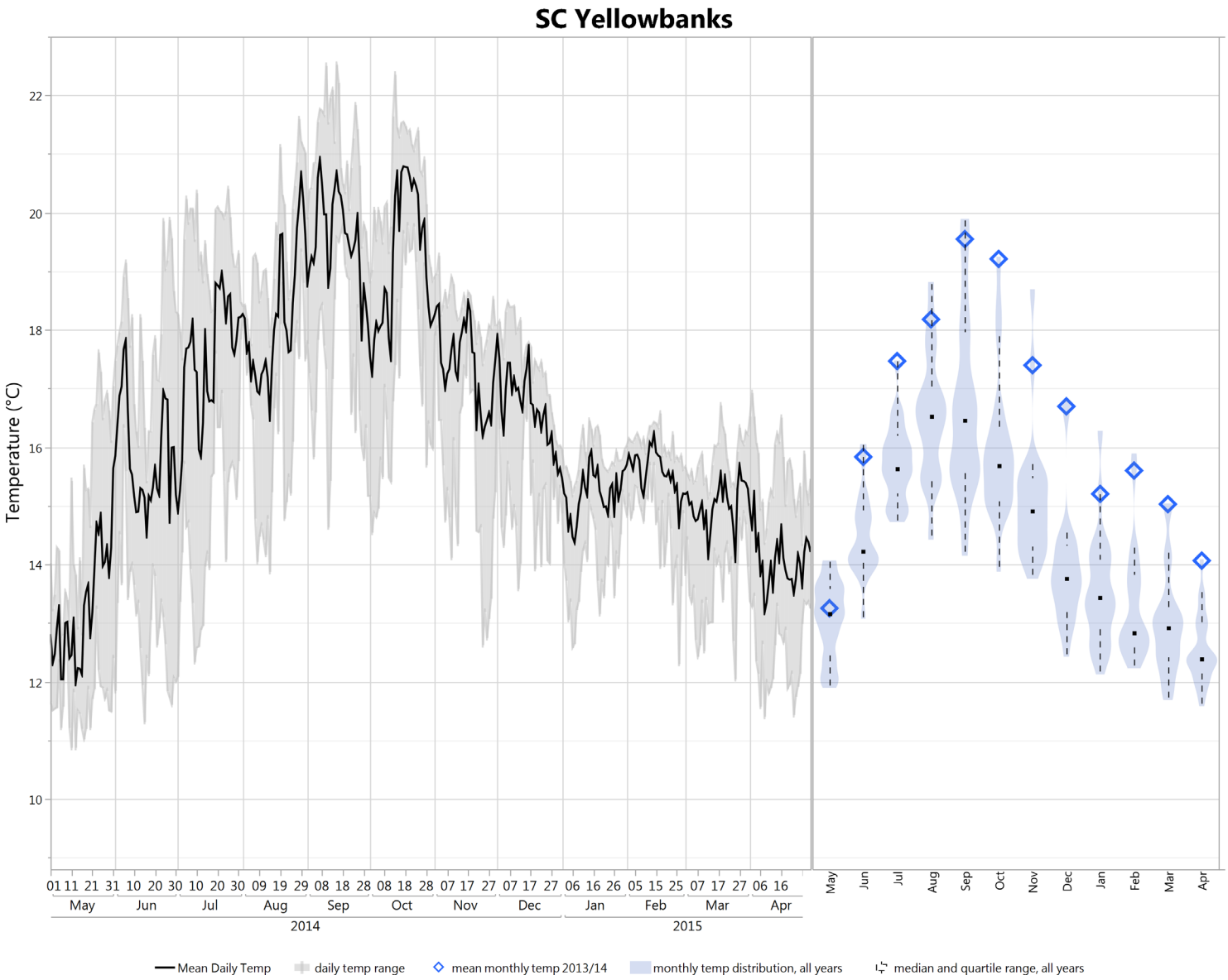


Figure J-16. Temperature at SC Yellowbanks between May 2014 and April 2015 at Channel Islands National Park.

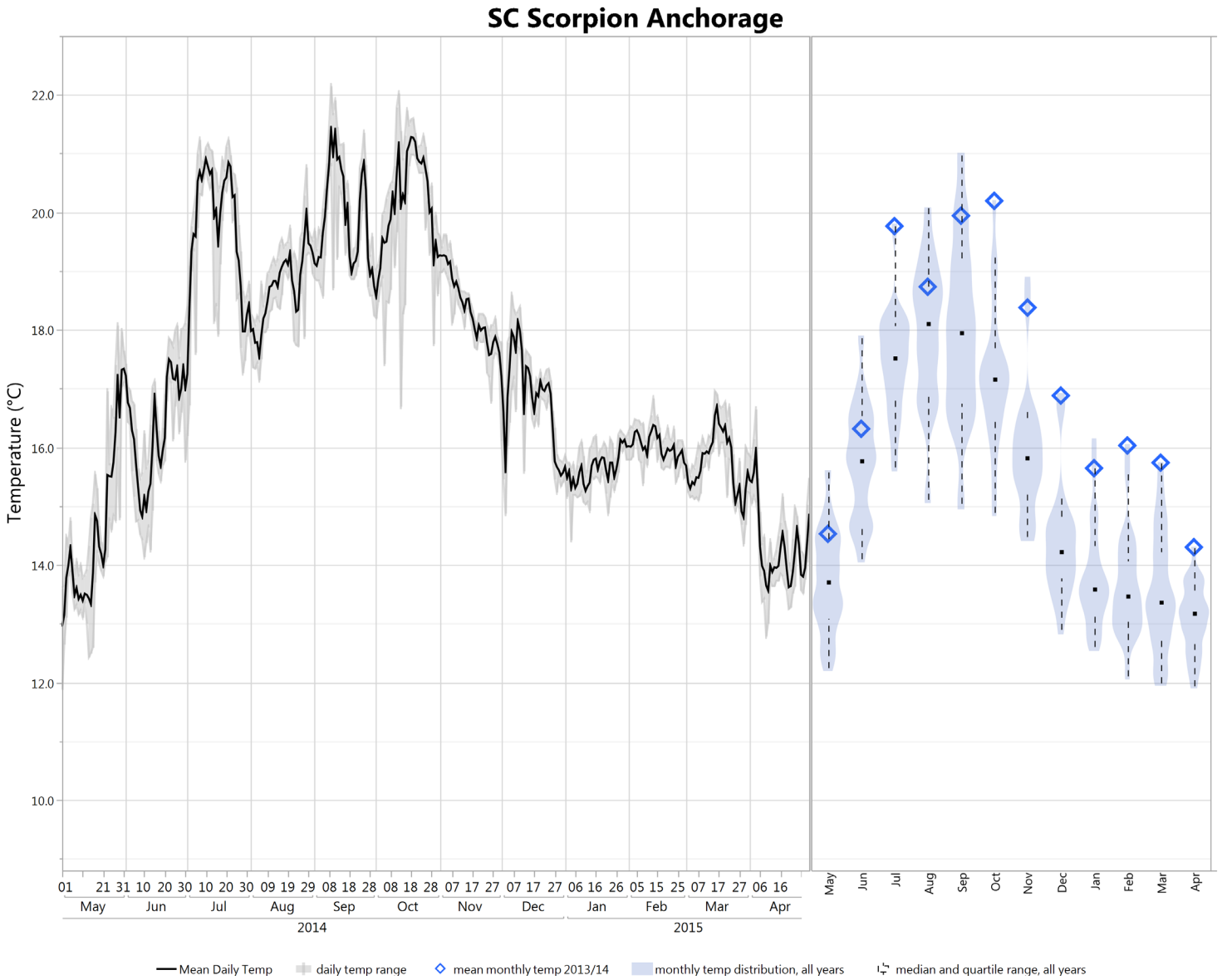


Figure J-17. Temperature at SC Scorpion Anchorage between May 2014 and April 2015 at Channel Islands National Park.

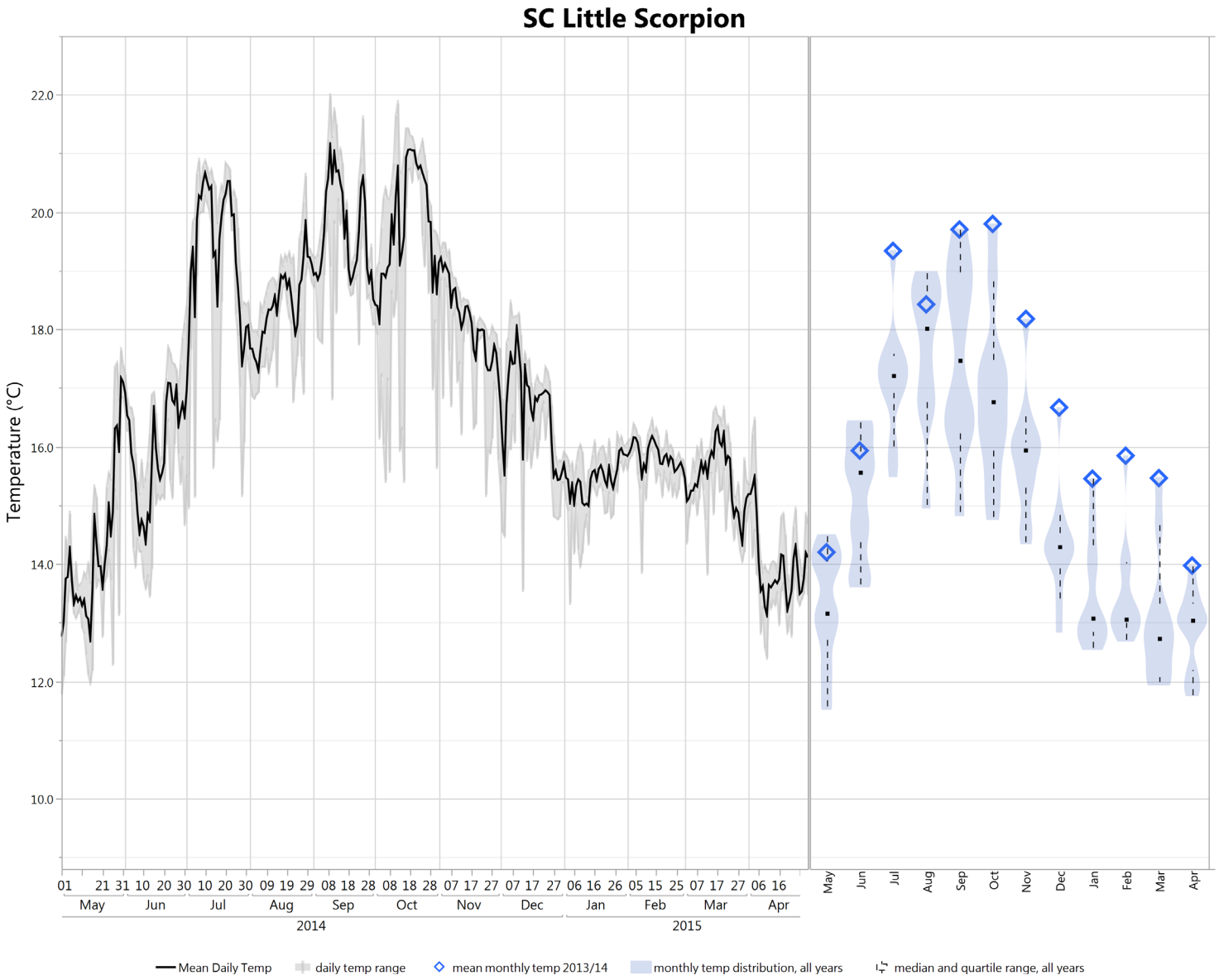


Figure J-18. Temperature at SC Little Scorpion between May 2014 and April 2015 at Channel Islands National Park.

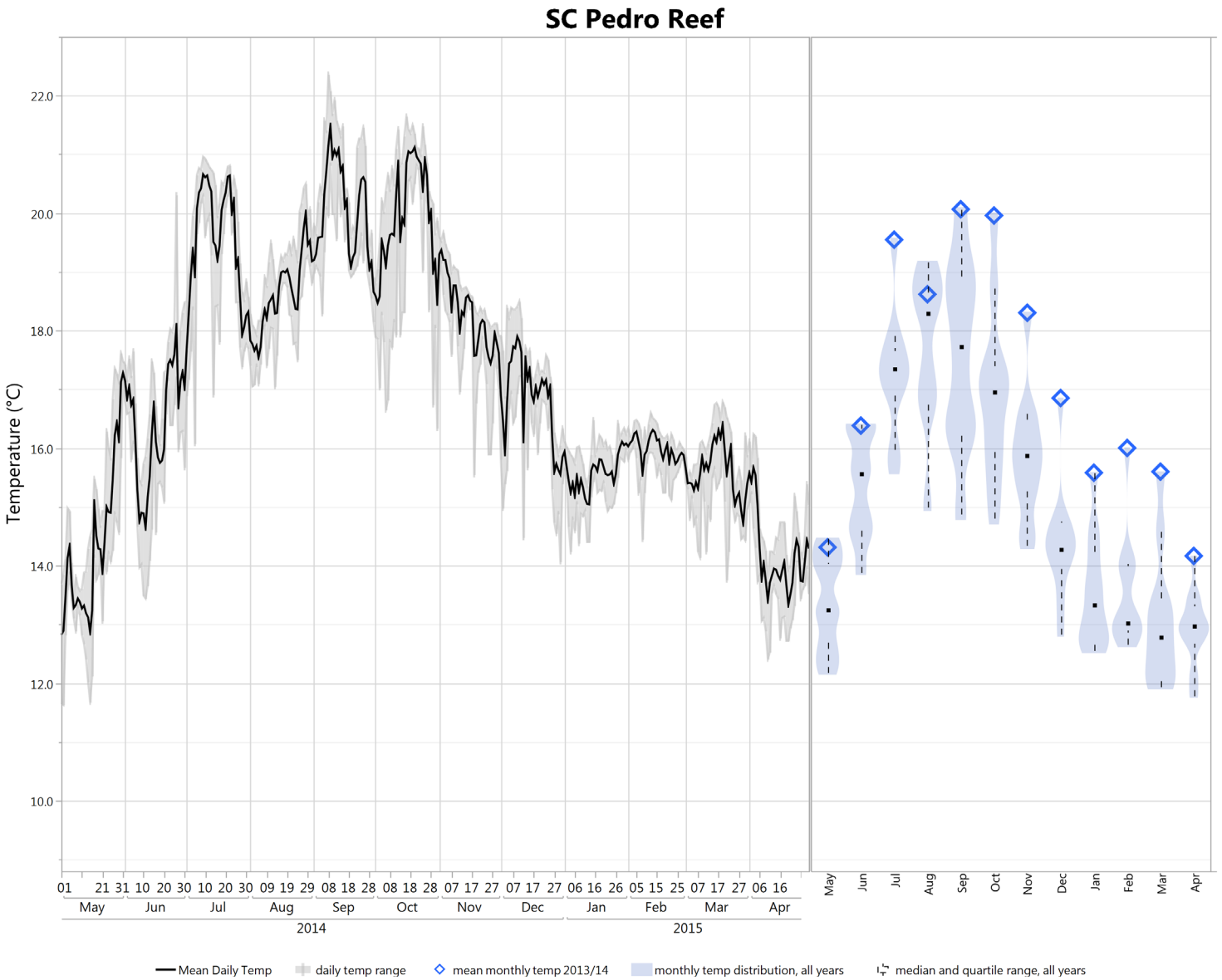


Figure J-19. Temperature at SC Pedro Reef between May 2014 and April 2015 at Channel Islands National Park.

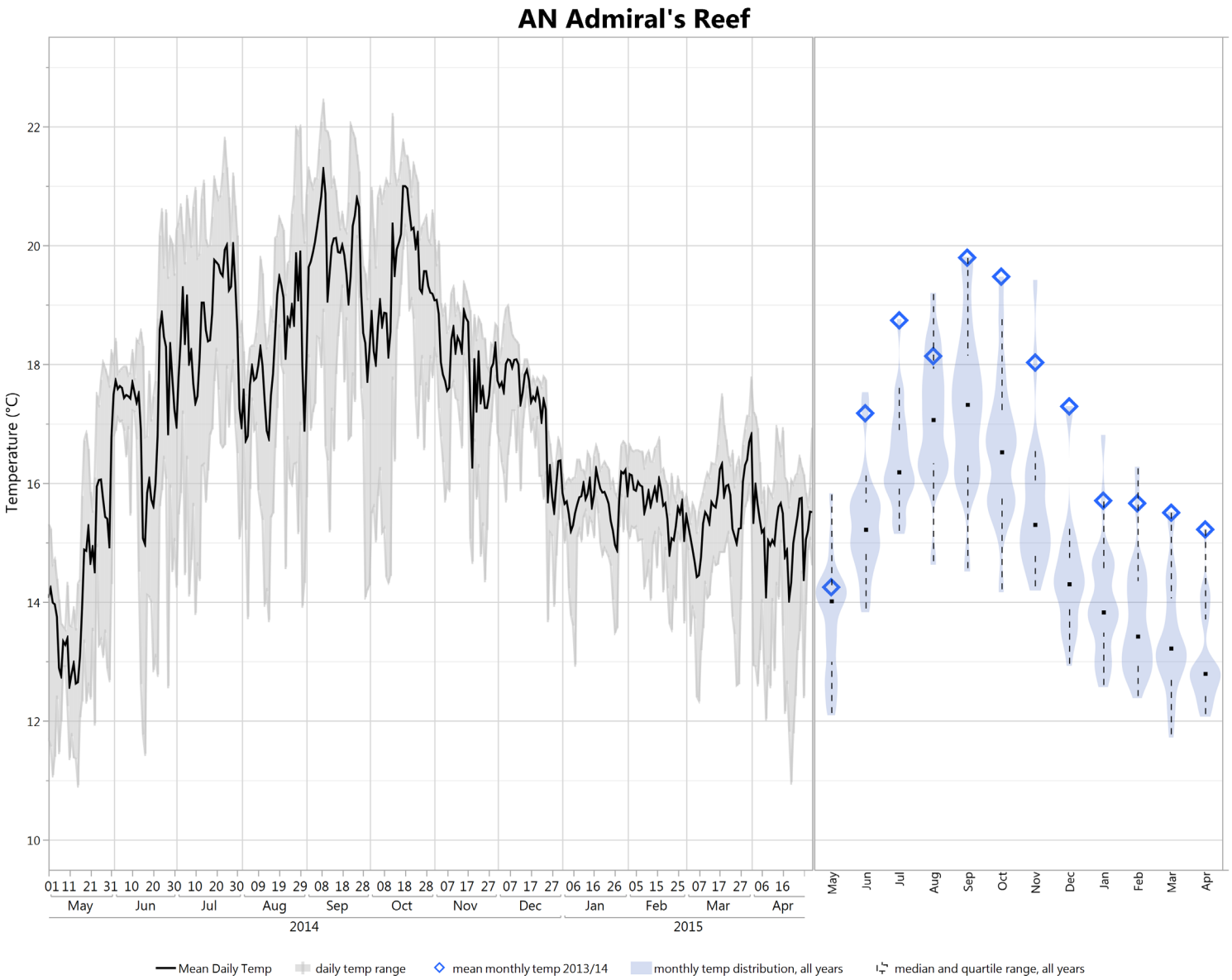


Figure J-20. Temperature at AN Admiral's Reef between May 2014 and April 2015 at Channel Islands National Park.

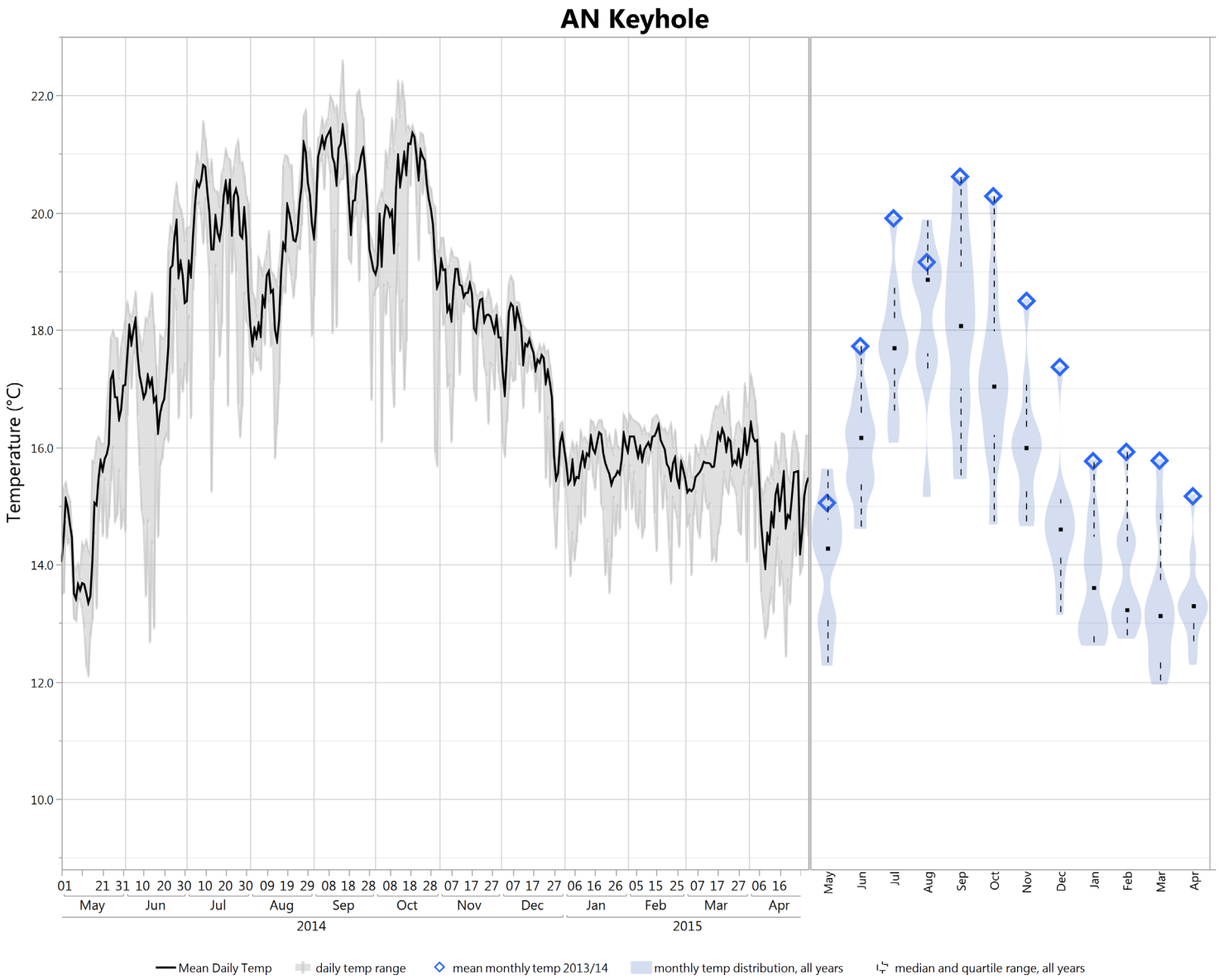


Figure J-21. Temperature at AN Keyhole between May 2014 and April 2015 at Channel Islands National Park.

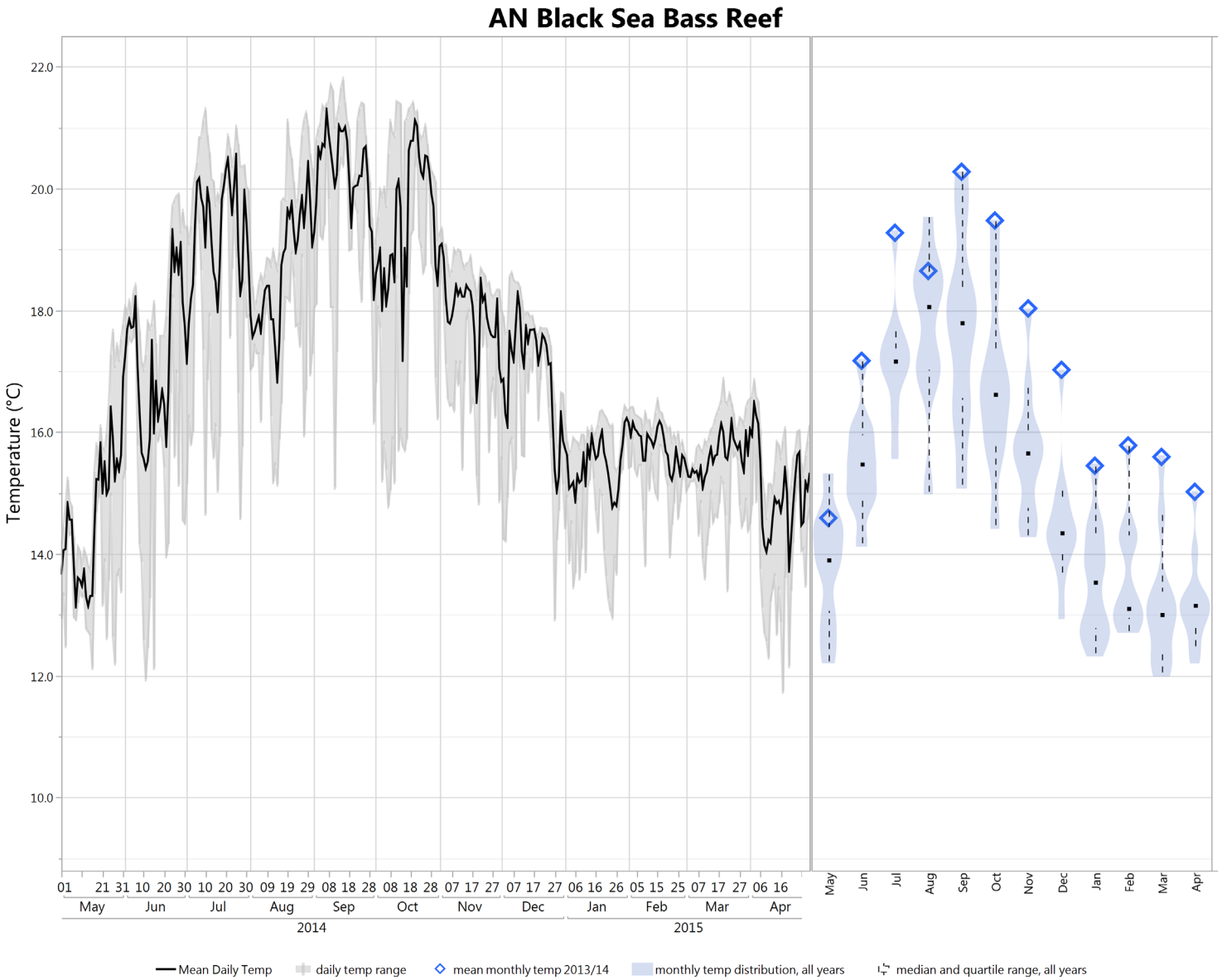


Figure J-22. Temperature at AN Black Sea Bass Reef between May 2014 and April 2015 at Channel Islands National Park.

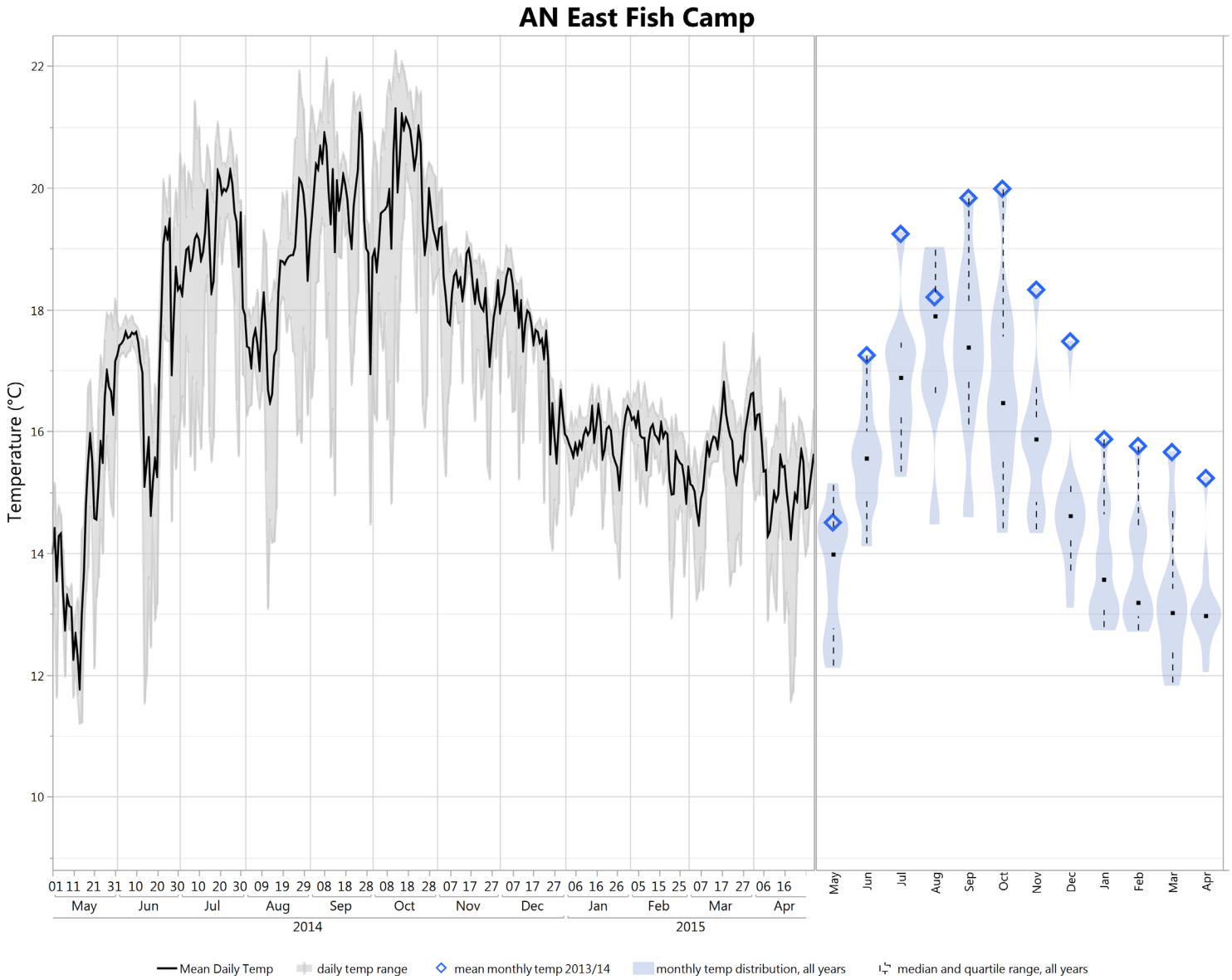


Figure J-23. Temperature at AN East Fish Camp between May 2014 and April 2015 at Channel Islands National Park.

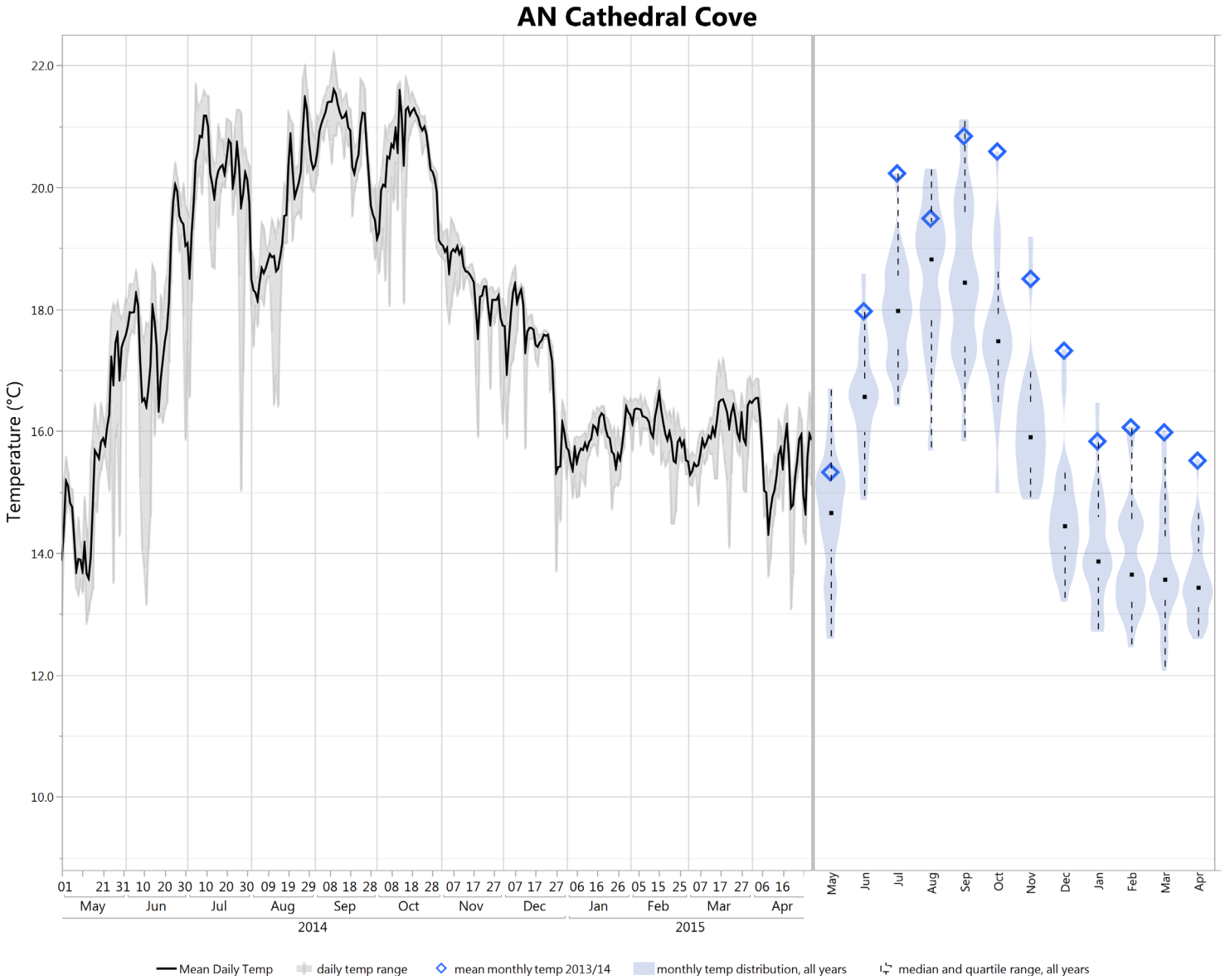


Figure J-24. Temperature at AN Cathedral Cove between May 2014 and April 2015 at Channel Islands National Park.

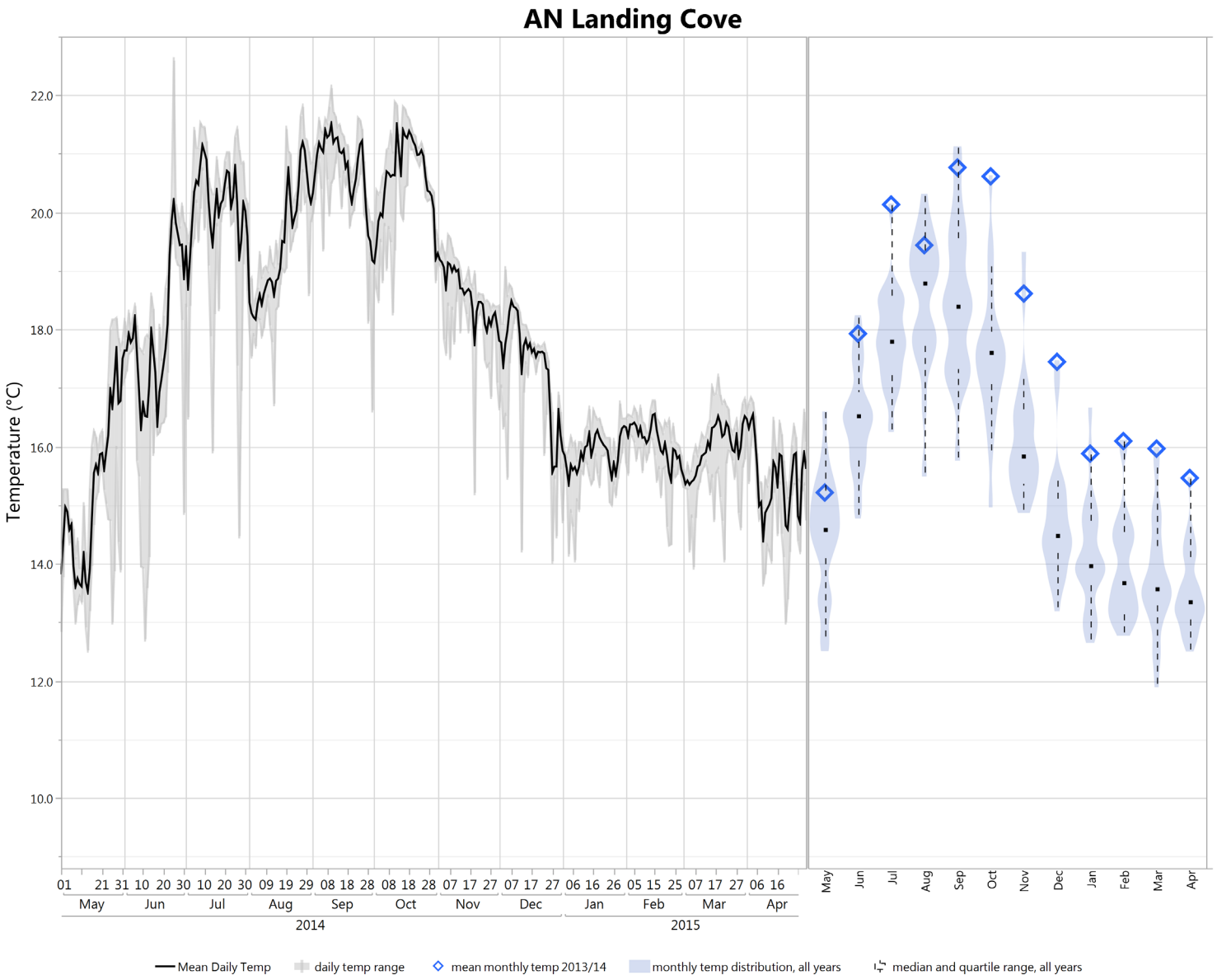


Figure J-25. Temperature at AN Landing Cove between May 2014 and April 2015 at Channel Islands National Park.

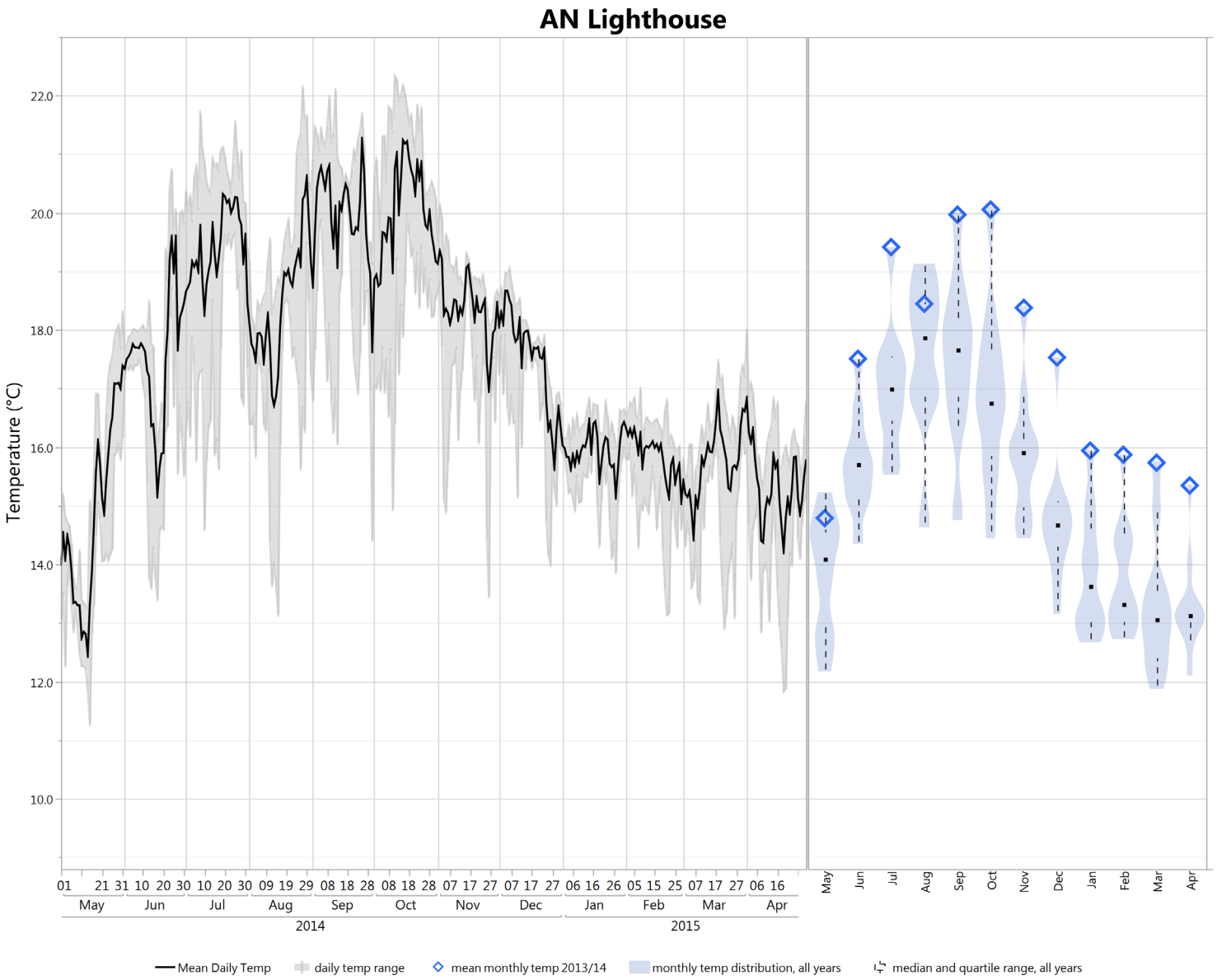


Figure J-26. Temperature at AN Lighthouse between May 2014 and April 2015 at Channel Islands National Park.

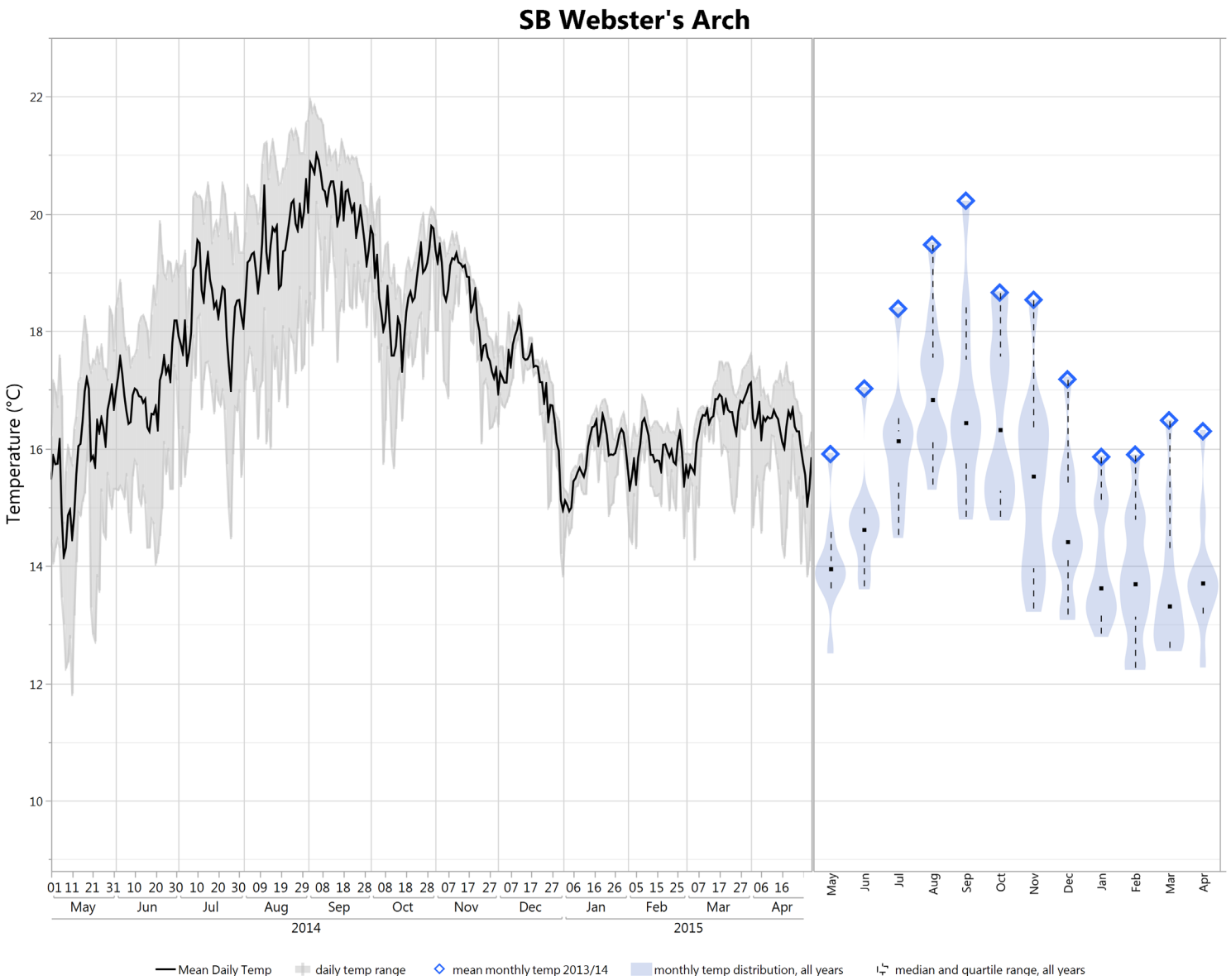


Figure J-27. Temperature at SB Webster's Arch between May 2014 and April 2015 at Channel Islands National Park.

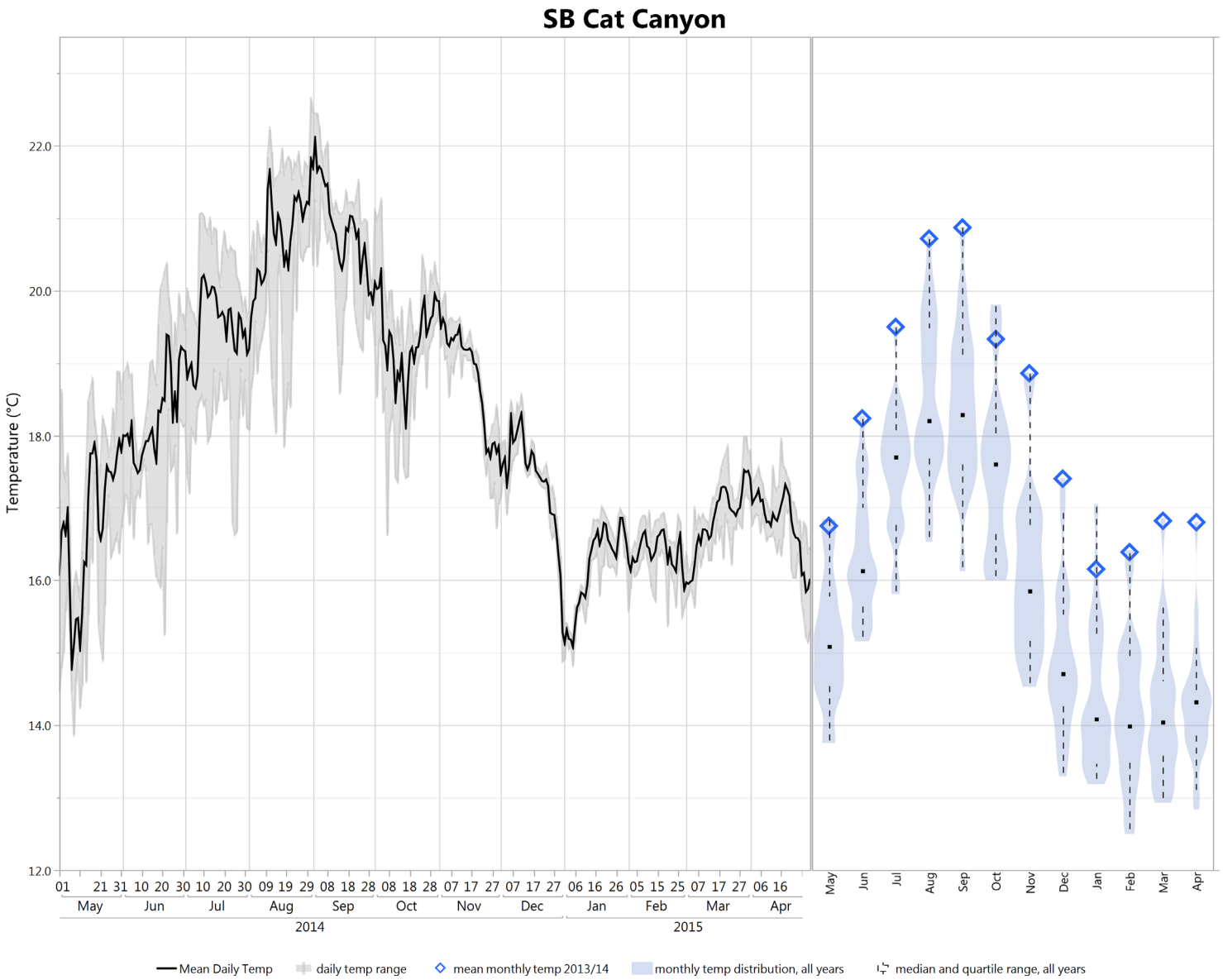


Figure J-28. Temperature at SB Cat Canyon between May 2014 and April 2015 at Channel Islands National Park.

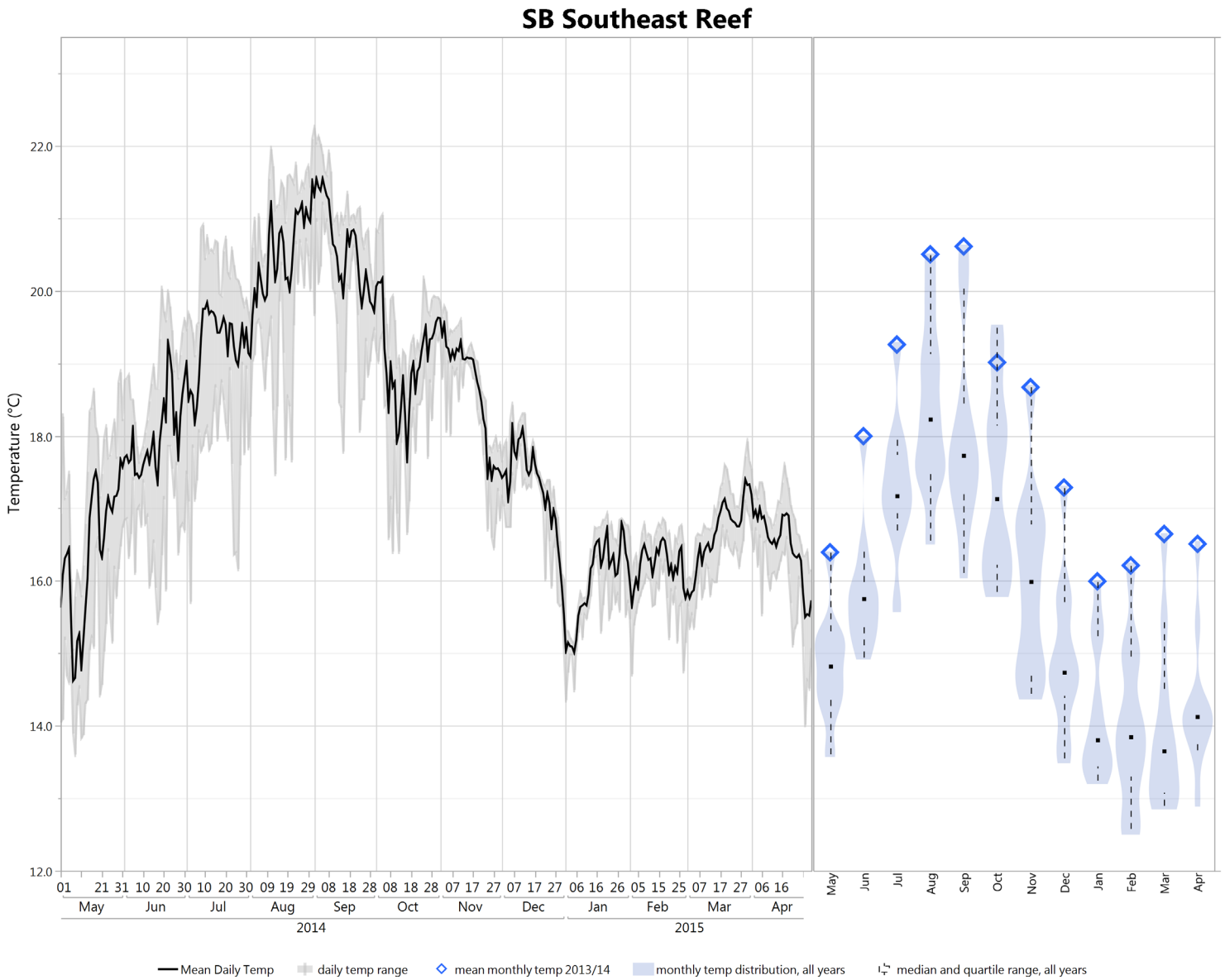


Figure J-29. Temperature at SB Southeast Reef between May 2014 and April 2015 at Channel Islands National Park.

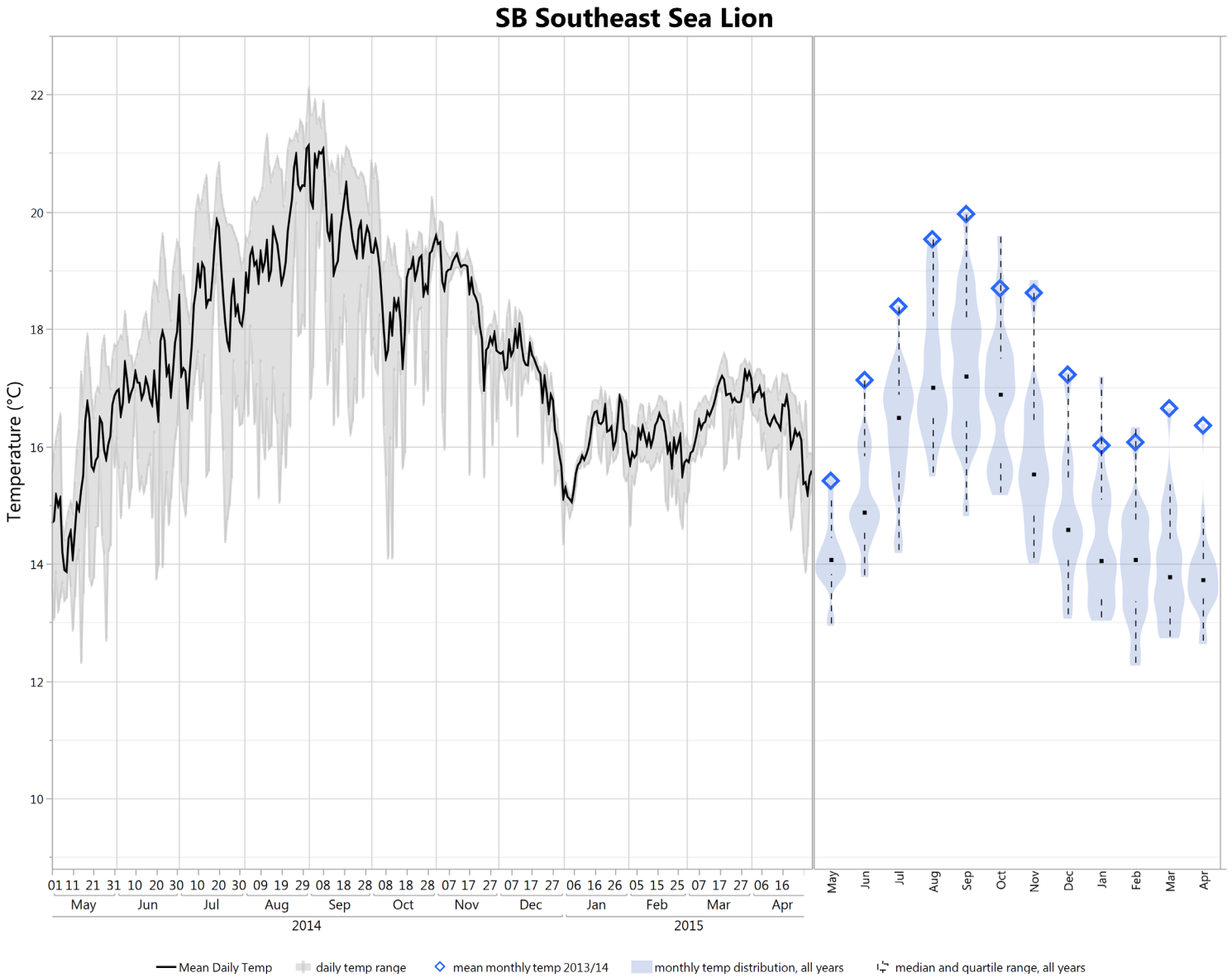


Figure J-30. Temperature at SB Southeast Sea Lion between May 2014 and April 2015 at Channel Islands National Park.

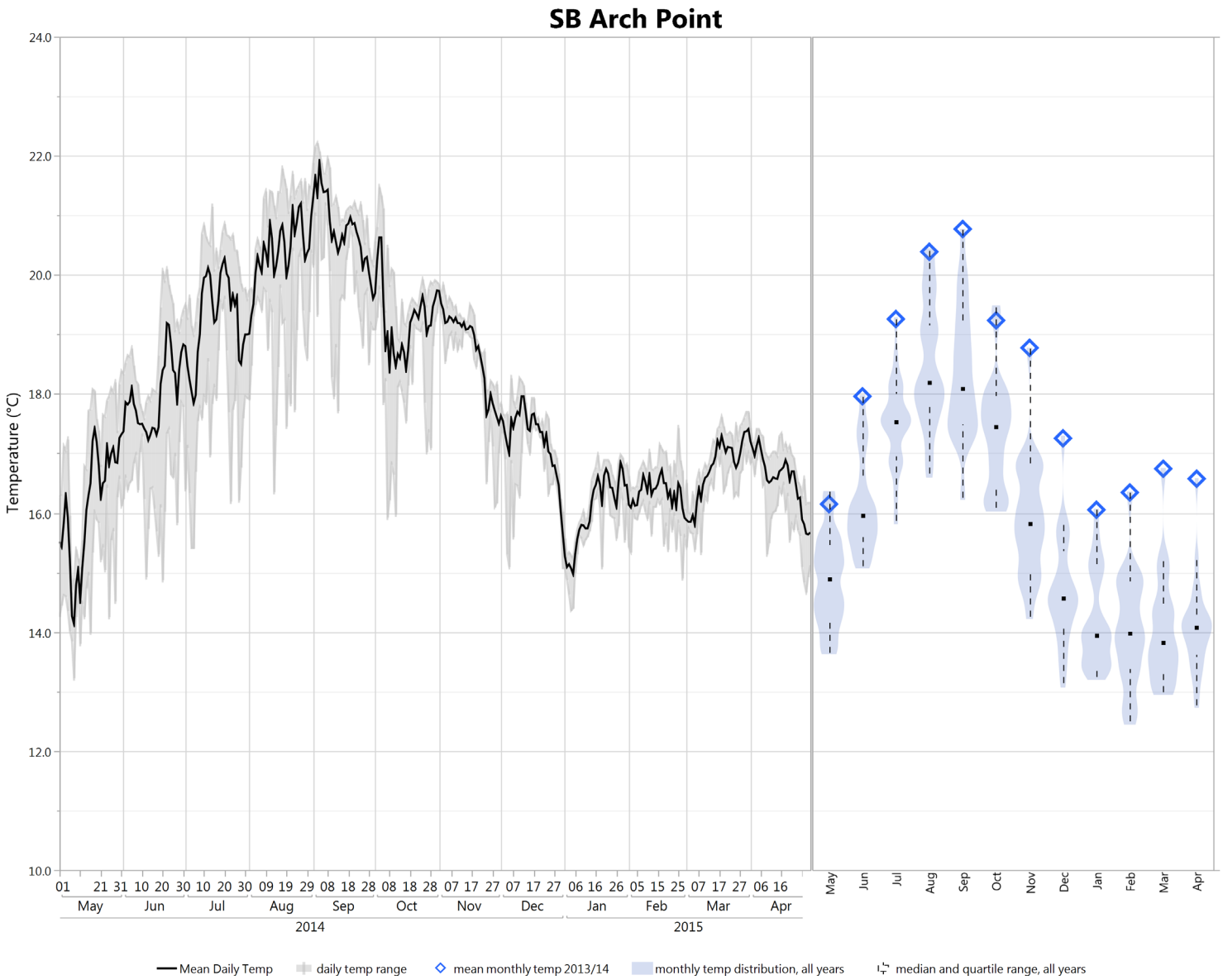


Figure J-31. Temperature at SB Arch Point between May 2014 and April 2015 at Channel Islands National Park.

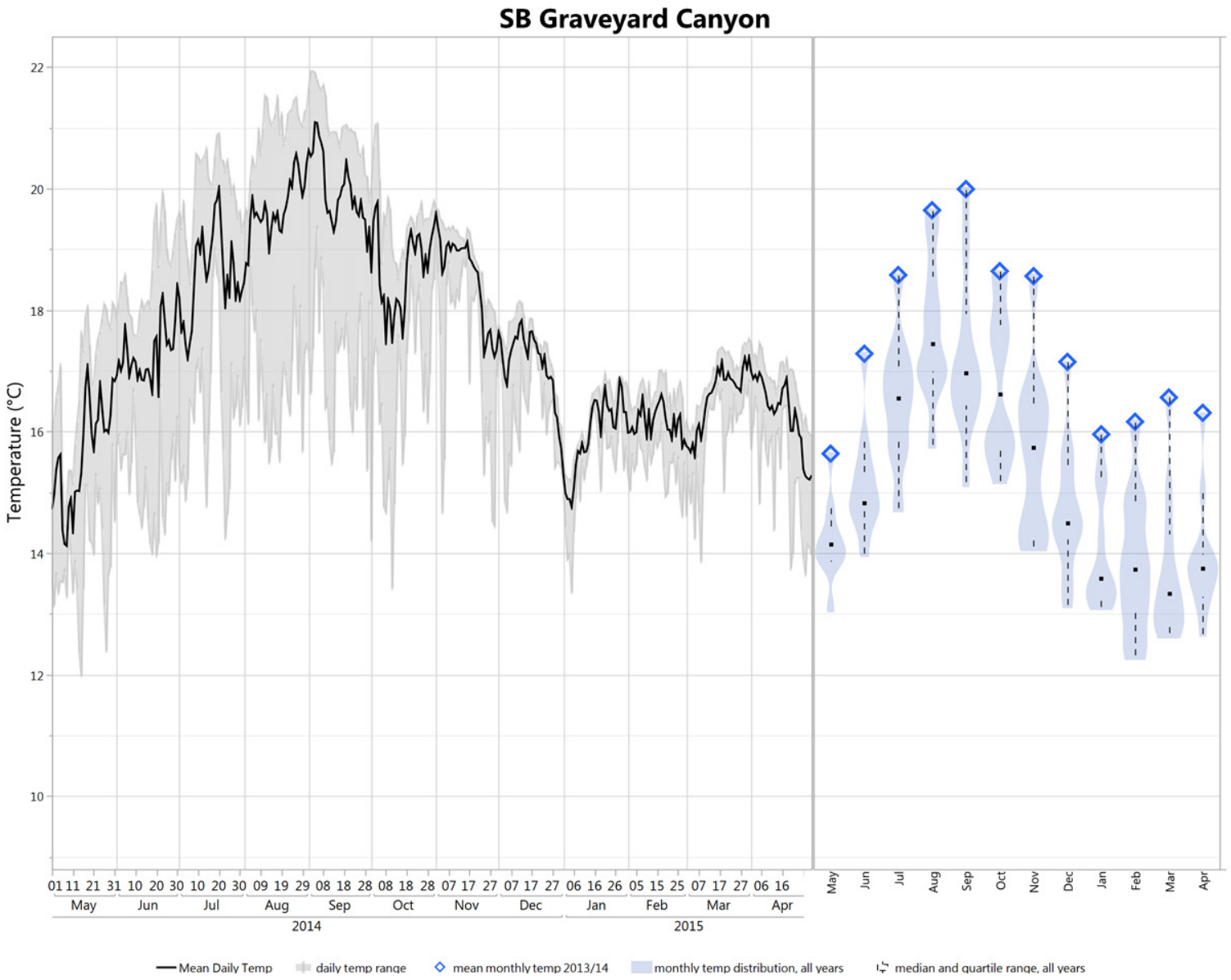


Figure J-32. Temperature at SB Graveyard Canyon between May 2014 and April 2015 at Channel Islands National Par

Appendix K. Survey Dives

2015 Preseason Survey Dives

January Survey Dives

1/30/2015, Survey 1, Survey 2, and Survey 3, Santa Barbara Island

No notes from Dave Witting and James Grunden survey dives were written from the three dives between Webster's Arch and Sutil Island.

1/30/2015, Northwest Sites, Santa Barbara Island

(33° 32.3331 N 119° 03.5269 W) This site was at a depth of 60-80 feet and was mostly low-lying relief with a few small ledges that were 1-2 meters on other relief combination of bed rock and small boulders and cobble. The area was all kelp forest with large subadult plants that were widely spaced. Most of the bottom was encrusting coralline algae. There was a small amount of *Gigartina* sp. and *Sargassum horneri*. Most of the latter were small plants, unlike what we observed at southeast sea lion. Red and purple urchins were mostly small and were relatively uncommon, but common under rows. *Lytechinus anamesus* were large and common. Ophiothrix were common but far from being an area dominated by them. In short there were not enough echinoderms to dominate the area. One small lobster was observed. Patiria were common, present in all sizes, and looked healthy. Fish were notably rare. Small sheephead, few juveniles, small rock wrasse, *Chromis punctipinnis* and señoritas, six electric rays were observed. An additional one was observed on the bottom with its tail missing. Small pelagic red crabs were present, and seagulls were feeding on them. We observed crab in gull poo on island.

1/30/2015, Northwest Sites, Santa Barbara Island

(33° 29.2725 N 119° 03.5949 W) This dive was also at about 60-80 feet deep and was just west of the 1st dive. It was also similar in bottom except perhaps a bit rockier relief with less low lying area. Both areas we felt good potential white, threaded, and pink habitat. The bottom was similar and the site was kelp forest like the other site with small adult and subadult *Macrocystis* plants. There were more *Eisenia* and *Pterygophora* and *Agarum* present as well as small *Cystoseira*. Sargassum Horneri was less abundant than the first site with none observed. Tegula regina were common and Megastraea gibberosum were abundant. No lobsters were observed. Purple urchins were common and were more abundant than dive one. Red urchins were not particularly common similar to dive 1. Tethya were abundant. Fish were again noticeably rare with a few garibaldi, rock wrasse, kelp bass, and sheephead. Fish were small and medium sized. Three yellowtail were observed. 3 Electric rays were observed. Several ocean whitefish, small to medium sized. One Fresh Haliotis assimilis shell at 47 mm was found. The area seemed to be good abalone habitat. Several red crabs were observed. Two Patiria miniata appeared to have wasting disease.

2015 KFM Survey Dives

Cruise 1

5/12/15, Landing Cove, Santa Barbara Island

A survey dive was made in Landing Cove by Kushner and Grime. Offshore there were a surprisingly large number of small sand stars *Astropectin* spp., one large one was observed. There were 100's of small ones. At the reef at ~40 ft large *Patiria miniata* were common, one with wasting disease was observed. *Ophiothrix* were abundant below ~40 ft. Inshore just North of the dock, *Sargassum muticum* was abundant and the most notable also on the reef similar to Graveyard Canyon and Arch Point. There were huge patches of tall healthy *S. muticum* and *S. horneri* was scattered around but not very abundant.

Cruise 2

5/26/15, North of Shag Rock, Santa Barbara Island

In less than 20 feet of water there were ~35 angel sharks observed by David Kushner and Steve Whitaker. There was no notable *Sargassum horneri*. One electric ray was observed and were notably few other fish and all were small.

05/28/15, Cavern Point, Santa Cruz Island

At least nine large scallops showed signs of poaching, all nine shells were freshly killed and eight of them were cracked on the front edge by something similar to the blunt edge of a large knife or abalone iron. The sizes were: 143, 144, 115, 111, 127, 149, 151, 134, 79 mm. It appears that at all sites visited so far that painted greenlings abundance is notably low. This should show up well in the fish counts. However, Kushner wonders that since we discontinued counting blackeye gobies during the RDFC that perhaps we may be observing less painted greenlings since they share nearby benthic habitat.

Cruise 4

6/23/15, *Pelagophycus porra* Forest, Santa Cruz Island

Training dive to maintain/obtain 130-foot depth certification for all divers and survey dive for abalone. No current or thermocline (64°F on bottom). Found a ghost lobster trap with five lobsters in it, two with eggs. Trap opened and lobsters released. Found one red abalone >250 mm. *Lytechinus anamesus* were abundant at the deeper edges of the reef. *Lytechinus* were found primarily directly on sandy substratum and *Agarum* blades. David Kushner recorded photo of these dense aggregations.

6/24/15, Smugglers Cove, Santa Cruz Island

Kushner found a ghost trap while free diving off Smuggler's Cove. There were 16 lobsters inside, including a Southern kelp crab (*Taliepus nuttallii*). Later that afternoon, around 7pm or so, Kushner speared a 28 lb white sea bass in the kelp off Smuggler's Cove. In addition, Jaime McClain saw a Paper nautilus (*Argonauta* sp.) while spearfishing on the same kelp bed and just after Kushner caught the White sea bass. She observed it attached to a floating piece of eelgrass. It was approximately 60mm in length! This is the first time we have observed these!

Cruise 5

7/13/15, Smugglers Cove, Santa Cruz Island

During the survey dive at Smuggler's Cove at (34° 04.2654 N, 119° 15.6598 W), there was a deep *Zostera sp*. bed at 48-55ft offshore. There was an amazing number of kelp bass above the seagrass bed. In shallow areas, on the reef area near where there was kelp, *S. muticum* juveniles were abundant. At depth there were several tall adult *S. muticum* plants.

7/17/15, Pelagophycus Forest/North side of Anacapa Island

Two very old white abalone shells were found. One was 100 m and the second was 180 mm. There were large schools of Blue rockfish. Juvenile California sheephead were common while the other fish species were mostly smaller (Sheephead, kelp bass, lingcod, etc.). Pelagic red crabs were observed at the site. On the north side of eastern Anacapa (33° 01.0551N, 119° 26.4735W) we observed 4 or 5 Black sea bass. Most were smaller (estimated in the 150lb range with one at approximately 200lb).

Cruise 6

7/29/15, 34° 04.678 N, 119° 55.037 W, Santa Cruz Island

This was a rugose area with a steep drop off from the island in spots. The tops of shallow rocks were covered in *Eisenia* and *Anthopleura*. Down lower ~15 feet was a layer of *Pachythyone rubra*. *Haliotis rufescens* (estimated 125-175 mm) were common and in the large boulder fall there was small aggregations of them with 10-15 near each other. Kushner counted ~50 abalones in the area. Surprisingly there were not that many large fish.

7/29/15, 34° 02.974 N, 119° 43.956 W, Santa Cruz Island

In the sand at ~25-30 feet there were some dense patches of sand dollars. Large and smaller *Navanax inermis* were abundant with dozens observed. *Astropecten verrilli* and Pa*tiria* miniata were observed with warm water wasting disease. There was a bit of kelp on top of the reef. Five more paper nautilus shells were found at Fry's Harbor and two at plats (Dive #2). Red crabs were observed at the west end of SCI, Fry's and the kelp bass at plats that were speared for size frequencies ground truth-ing had red crabs in its gut.

Cruise 7

8/14/15, Between Pedro Point and Hungryman Gulch, Santa Cruz Island

At the survey dive today, a site between Pedro Point and Hungryman Gulch, there were a moderate (likely several hundred) *Haliotis cracherodii* in the southwest corner of the cove. They seemed a bit larger than the last time we observed them. They also seemed hungry and there was little food around. The area could be characterized as a barren dominated by *S. purpuratus*.

Cruise 8

8/28/15, Tinker's Cove, Santa Cruz Island

Hundreds of very small (~1 cm) *Paralabrax clathratus* were observed on a UCSB SMURF instrument in the area. ~ 60 *Haliotis cracherodii* were observed between 1 and 5ft depth. Half were large and half were less than 30 mm in shell length. *S. horneri* and *S. muticum* were common on the tops of rocks just east of Pelican Bay. A few hundred dead/dying *Aplysia californica* and egg masses

were everywhere. *Lythrypnus dalli* of all sizes (especially very small ones) were observed everywhere to a depth of 70ft.

Cruise 9

09/16/15, Wyckoff Ledge, San Miguel Island
A dive was conducted just offshore of the site, closer to the ledge.

9/17/15, Yellowbanks, Santa Cruz Island
We snorkeled around kelp patties that were drifting offshore of Yellowbanks and saw juvenile halfmoon (*Medialuna californiensis*) and yellowtail, which were abundant around several different kelp patties in the area.

Cruise 10

9/29/15, Smugglers Cove, Santa Cruz Island
One green sea turtle was observed while snorkeling after hours at Smugglers. About 80 smaller yellowtail were also observed schooling on the reef.

9/30/15, East Fish Camp, Anacapa Island
During a snorkel survey from East Fish Camp to Lighthouse, we observed three different green sea turtles. All were in about 30ft of water and appeared healthy with little growth on their shells. A school of 15-30 medium-sized yellowtail were observed as well.

9/30/15, Smugglers Cove, Santa Cruz Island
During black abalone surveys, two zebra perch (~15 cm) were observed.

Cruise 11

10/13/15, Santa Barbara Island
On cruising to the island we observed a pod of Risso's dolphins. Kelp bass shockingly and dramatically increased. 7-8 cm were common and 15- 18 cm were abundant at several SBI sites. *Macrocystis* circumnavigated more of the island than we have observed in decades. Most notable was its persistence throughout this very warm water summer. It was moderately healthy in most areas but tattered near the surface some. *Sargassum horneri* and *Dictyota/ Pachydictyon* notably increased at most locations (GC, AP, SESL) *S. purpuratus* and *S. franciscanus* notably declines/ continued to decline. They are common to rare at the KFM sites. *Ophiothrix* seems to continue to decline. The tiny juvenile *Centrostephanus* urchins were observed under rocks and in crevices earlier in the year are notably larger. *Centrostephanus* were the most abundant Kushner had ever observed anywhere. Arch Point was shocking at dusk as they were common and out of there crevices and foraging.

10/14/15, ¼ mile reef, Santa Barbara Island
The site was a mature kelp forest with a moderate amount of *Ophiothrix* throughout. We were surprised how much kelp there was along with a large amount of *Ophiothrix*. Sea urchins were rare except for *Centrostephanus* urchins. Blue banded gobies were common in the deeper areas.

10/14/15, North edge of reserve, Santa Barbara Island
Pretty barren area with lots of traps along the boundary- most were empty. Several large lobster were observed. One octopus was observed with a seemingly alive lobster in its grasp. This area was mostly a barren area with a bit of *Ophiothrix*. An abundance of *Sargassum horneri* covered the bottom about half the lobster traps had 1-5 large lobster in them and several had molts.

10/14/15, East of Sutil Island, Santa Barbara Island
The site was a kelp forest with *Sargassum horneri* common throughout. Most *Sargassum* was ~25 cm tall and a few were reproductive. *Patiria miniata* were common with ~25% showing signs of wasting disease. Many were already dead. The site was about 60-70 feet deep. Blue banded gobies and juvenile California sheephead were common.

10/14/15, west of Webster's Arch, Santa Barbara Island
(33 28.9200 W 119 04.0700 N) Much of the reef was around 60 feet but the offshore edge sloped down to 130 feet + with a beautiful *Pelagophycus porra* forest. The shallower areas were a mature kelp forest with a healthy shaded bottom with little understory algae. No *Sargassum* was noted. The bottom was rugose and mostly coralline algae and encrusting invertebrates.

10/14/15, Santa Barbara Island
Kelp forest continued to expand at Santa Barbara Island surprisingly and notable, even with warm water. The kelp blades were tattered near the surface with a thinning canopy. *Sargassum horneri* continues to expand especially in shallow 15-35 feet. Blue banded gobies were common in most places. There were more kelp bass than Kushner recalls observing in 25 years. Large ones in the reserve, but most notable were the 6-8 cm recruits from this year and the 15-18 cm smaller adults from last year. Small *Centrostephanus* urchins were abundant especially in shallow and with the huge disease driven die off of *S. purpuratus* and *S. franciscanus* that are now common to even rare. *Centrostephanus* are now the most abundant urchin at the island!!!

Except for some large *S. franciscanus* urchins out deep that looked healthy there were few *S. purpuratus* and *S. franciscanus* urchins that looked healthy and there was a lot of active mortality especially in the few *S. purpuratus* urchins. The temperature on the surface was mostly around 71 degrees with a thermocline at about 75 feet. *Patiria miniata* were common, some were observed with wasting disease and some others looked unhealthy.

10/15/15, Rat Rock, Anacapa Island
Some areas had ~70% cover of *Sargassum horneri*, most were ~25 cm tall. Few were reproductive and about 50% of the *S. horneri* had a thick layer of diatoms.

10/16/15, *Pelagophycus porra* Forest, Santa Cruz Island
(33 59.443 W 119 31.305 N) Nearly all the Pelagophycus was small and no *Macrocystis* was observed. There was a thick understory of *Eisenia, Laminaria* and *Agarum* and no red algae. Blue banded gobies were common. Large red urchins were common and all healthy, Coronado urchins were common. Large *Patiria miniata* were common and no sick ones were observed. Two small pelagic red crabs were observed. Several small lobster and one legal one was observed. Small

Chromis were abundant as were larger ones. One ~140 mm red abalone and one live 150 mm + *Haliotis assimilis* were observed.

10/16/15, Rat Rock/Goldfish Bowl, Anacapa Island
(34 00.872 W 119 26.582 N) One fresh green abalone shell at 54 mm was found. It looked like mortality may have been from an octopus. The reef was covered in *Sargassum horneri* and sub-adult *Macrocystis*. The *S. horneri* cover was ~70 % and half of the *S. horneri* was covered in filamentous diatoms. *Lythrypnus dalli* were present, but not very abundant. Juvenile Garibaldi were common. Lobsters were rare and several dozen traps were present. Fresh red urchin tests were abundant and were piled up in some areas. Dying red urchins were common and most appeared to have black spot disease rather than wasting disease since they still had large spines attached. One Tropicbird was observed. Patiria were rare and diseased individuals were observed. *O. spiculata* was common but patchy.

2015 White Abalone Survey Dives

August Dives

8/19/15, Jackpot Seep, Isla Vista, Santa Barbara
(34 24.148 W 119 52.683 N) Five pinto abalones were found within a 30 x 15 meter area 118, 129, 130, 130, and 128 mm.

8/19/15, 2700 block of DP, Isla Vista, SB
Sandy area with no habitat and no abalone were found.

8/19/15, 6500 block of Isla Vista, SB
(34 20.079 W 1119 51.656 N) The habitat was good, but no abalones were found. Each dive site was surveyed by four dive teams. Kushner was impressed by the number and size of both fish and lobster. Large male and female California sheephead and medium sized kelp bass were moderately abundant. Several large ocean whitefish were observed.

Kelly Moore

Personal Trip

7/24/15, Winfield Scott, Anacapa Island
Kelly Moore collected a fresh green abalone (*H. fulgens)* shell at Winfield Scott wreck in 20 feet of water. The shell measured 77 mm.

Appendix L. General Comments, Suggestions, Unusual Species, and Interesting Observations

We did not observe *Pteria sterna*, pearl oyster, at any of our sites this year. Sightings of this species have been tapering off during the last decade. We believe this species most recently recruited primarily during the 1997/1998 El Niño, have been senescing since, and now are very rare.

Azurina hirundo, swallowtail damselfish, were seen at Arch Point and Southeast Reef on Santa Barbara Island, as well as Lighthouse on Anacapa Island.

A school of 20-22 *Anisotremus davidsonii* (sargo) was observed at Pelican Bay, Santa Cruz Island. Four *A. davidsonii* were observed at Scorpion Anchorage, Santa Cruz Island; one had juvenile coloration.

At Scorpion Anchorage, Santa Cruz Island, *Arbacia incisa* at 16 mm were in the ARMs.

Aplysia vaccaria were observed at Cat Canyon, Arch Point, and Southeast Sea Lion on Santa Barbara Island, Admiral's Reef, Cathedral Cove, Keyhole, and Lighthouse on Anacapa Island, as well as Johnson's Lee North. It is not uncommon to see this species at Anacapa, Santa Barbara, or Santa Cruz Island sites, although it is usually only seen at a few sites most years. It is very rare to see it at northern Islands like Santa Rosa.

No *Laminaria setchellii* were observed this year. We usually note its presence at a few sites, such as Miracle Mile, San Miguel Island, or Chickasaw and Cluster Point, Santa Rosa Island.

Pleuroncodes planipes, pelagic red crabs, were observed at the Channel Islands. The last time this species was documented by Park staff was during the 1997/98 ENSO event.

Similar to the last several years, there continued to be high recruitment of *Balanus* spp. at many San Miguel, Santa Rosa, and Santa Cruz Island sites.

Argonauta sp. shells were found at several sites this year. One live *Argonauta* sp. was observed on a survey dive at smugglers cove, Santa Cruz Island (6/24/2015).

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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