National Park Service
U.S. Department of the Interior

Natural Resource Stewardship and Science

Channel Islands National Park Kelp Forest Monitoring Program

Annual Report 2014

Natural Resource Report NPS/MEDN/NRR—2022/2437





ON THIS PAGE
Spiny lobster (*Panulirus interruptus*) inside the Anacapa Island SMR
Photograph by: Brett Seymour, Submerged Resources Center, NPS

ON THE COVER
Sunflower star (*Pycnopodia helianthoides)* which suffered a major disease event in 2013/2014
Photograph by: Dave Whitting, NOAA

Channel Islands National Park Kelp Forest Monitoring Program

Annual Report 2014

Natural Resource Report NPS/MEDN/NRR—2022/2437

Joshua L. Sprague, David J. Kushner, James R. Grunden, Jaime A. McClain, Benjamin Grime, and Cullen D. Molitor

National Park Service
Channel Islands National Park
1901 Spinnaker Drive
Ventura, CA 93001

August 2022

U.S. Department of the Interior
National Park Service
Natural Resource Stewardship and Science
Fort Collins, Colorado

The National Park Service, Natural Resource Stewardship and Science office in Fort Collins, Colorado, publishes a range of reports that address natural resource topics. These reports are of interest and applicability to a broad audience in the National Park Service and others in natural resource management, including scientists, conservation and environmental constituencies, and the public.

The Natural Resource Report Series is used to disseminate comprehensive information and analysis about natural resources and related topics concerning lands managed by the National Park Service. The series supports the advancement of science, informed decision-making, and the achievement of the National Park Service mission. The series also provides a forum for presenting more lengthy results that may not be accepted by publications with page limitations.

All manuscripts in the series receive the appropriate level of peer review to ensure that the information is scientifically credible and technically accurate.

Views, statements, findings, conclusions, recommendations, and data in this report do not necessarily reflect views and policies of the National Park Service, U.S. Department of the Interior. Mention of trade names or commercial products does not constitute endorsement or recommendation for use by the U.S. Government.

This report is available in digital format from the Mediterranean Inventory and Monitoring Network and the Natural Resource Publications Management website. If you have difficulty accessing information in this publication, particularly if using assistive technology, please email irma@nps.gov.

Please cite this publication as:

Sprague, J. L., D. J. Kushner, J. R. Grunden, J. A. McClain, B. Grime, and C. D. Molitor. 2022. Channel Islands National Park Kelp Forest Monitoring Program: Annual report 2014. Natural Resource Report NPS/MEDN/NRR—2022/2437. National Park Service, Fort Collins, Colorado. https://doi.org/10.36967/2293855

NPS 159/182965, August 2022

Contents

Page

Figures....iv

Tables....iv

Appendices....v

Executive Summary....vi

Acknowledgments....ix

List of Acronyms....x

Introduction....1

Methods....7

Results/Discussion....13

- Kelp Forests....15
- Algae....18
- Invertebrates....20
  - Porifera....20
  - Anthozoa/Hydrozoa....20
  - Annelida/Polychaeta....21
  - Bryozoa....21
  - Arthropoda/Crustacea....21
  - Mollusca....21
  - Echinodermata....26
  - Tunicates....35
- Fish....36
- Artificial Recruitment Modules (ARMs)....39
- Invasive Species....39
- Temperature....40

Literature Cited....41

Figures

Page

Figure 1. Kelp forest monitoring locations at Channel Islands National Park. 9

Figure 2. *Haliotis rufescens* density at Miracle Mile, San Miguel Island. 24

Tables

Page

Table 1. Summary of Kelp Forest Monitoring Program reports. 2

Table 2. Regularly monitored species, substrate, and associated monitoring technique(s). 3

Table 3. Changes in scientific nomenclature. 6

Table 4. Kelp Forest Monitoring Program sampling sites information. 7

Table 5. Summary of sampling techniques. 10

Table 6. List of fish monitoring protocols. 11

Table 7. Size frequency measurement dimensions. 12

Table 8. 2014 Kelp Forest Monitoring Program participant list. 13

Table 9. 2014 Kelp forest monitoring cruise list. 14

Table 10. 2014 kelp forest monitoring site status with 2013 status for comparison. 16

Table 11. Echinoderm wasting disease observations in 2014: 29

Table 12. *Pisaster giganteus* density estimates obtained from 1 m^2 quadrat, 5 m^2 quadrat, and band transect protocols.* 32

Table 13. *Pisaster ochraceus* density estimates obtained from 5 m^2 quadrat and band transect protocols.* 34

Table 13. *Pisaster ochraceus* density estimates obtained from 5 m^2 quadrat and band transect protocols.* **Error! Bookmark not defined.**

Appendices

Page

Appendix A. Protocol Modifications, Data Management, Database Corrections, and Additional Projects Information....45

Appendix B. KFM Program Data Usage and Information Requests for 2014....47

Appendix C. Species List....48

Appendix D. Site Field Notes....58

Appendix E. 1 Meter Quadrat Data....97

Appendix F. 5 Meter Quadrat Data....122

Appendix G. Band Transect Data....129

Appendix H. Random Point Contact Data....148

Appendix I. Fish Transect Data....180

Appendix J. Survey Dives....207

Appendix K. General Comments, Suggestions, Unusual Species, and Interesting Observations....213

Appendix L. Temperature Data by Site....214

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. The original permanent transects were established at 16 sites between 1981 and 1986 with the first sampling beginning in 1982, this being the 33rd year of monitoring. 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 to 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 2014 was provided by the National Park Service (NPS).

The 2014 monitoring efforts utilized 49 days of vessel time to conduct 1,040 dives for a total of 1,059 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 Handbook (Davis et al. 1997) and an update to the sampling protocol handbook currently being developed (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 2014.

All the data collected during 2014 can be found in the appendices and in an Excel workbook on the NPS Integrated Resource Management Applications (IRMA) portal. In the 2013 annual report (Sprague et al. 2020) several changes were made to the appendices. Previously, annual report density and percent cover data tables only included the current year's data. Now, density and percent cover data are presented in graphical format and include all years of available monitoring data. 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/2259651. The temperature data graphs in Appendix L include the same graphs that were used in past reports, but include additional violin plot sections that compare monthly means from the current year to past years. In addition to the changes listed above, the layout of the discussion section was reordered by species instead of by site.

The status of kelp forests differed among 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 2014, 15 of the 33 sites monitored were characterized as developing kelp forest, kelp forest or mature kelp forest. In addition, three sites were in a state of transition. Two sites were part kelp forest and part dominated by *Strongylocentrotus purpuratus.* Three sites were part kelp forest and part dominated by *Ophiothrix spiculata*. The remaining 10 sites were mostly dominated by echinoderms, which decreased from 17 sites in the previous year. This is the lowest number of sites dominated by echinoderms since 2003, which had 4 out of 17. Overall, the number of sites characterized as kelp forests increased from 2013, 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 two years. The changes occurring at Graveyard Canyon and Southeast Sea Lion last year continued this year, with both sites now having kelp forests but also a high abundance of the invasive alga *Sargassum horneri*. *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 was approximately 50% of what was present last year. Graveyard Canyon, which was in a state of transition last year, had a dense kelp forest with an abundance of understory algae present this year. Webster's Arch, dominated by echinoderms last year, was now in a state of transition. That site had more *Macrocystis pyrifera* present than we have documented since it was established in 2005, and it could transition into a kelp forest soon. Southeast Reef continued to be a mature kelp forest, similar to what has been present since the site was established in 2005. The remaining three sites continued to be dominated by echinoderms with little algae present. Overall, there was more kelp present at Santa Barbara than has been documented in the last two decades. The condition of the island is well represented by the monitoring sites, with about half the island covered with kelp and the other half dominated by echinoderms.

Although Anacapa Island remains mostly barren and dominated by echinoderms, we have observed some recent changes that appear to be positive for kelp forest recovery, similar to Santa Barbara Island. The two sites in the Anacapa State Ecological Reserve that was established in 1978 continued to be kelp forests (Landing Cove and Cathedral Cove) as they have for nearly all of the past 33 years. The five remaining sites continued to be mostly dominated by echinoderms, though two of those five sites had developing or mature kelp forests covering 40-50% of the site. These two sites had more *Macrocystis pyrifera,* which is likely due to the decrease in *Strongylocentrotus* spp. Though there are patches of kelp surrounding the Island, there are more and larger patches of kelp on the north side of East and Middle Anacapa in the Marine Protected Area. The seven monitoring sites here appear to represent the overall conditions of this island well.

Most Santa Cruz Island sites remained similar to last year, but several sites had noticeably changed. Three sites had kelp forests, one was in a state of transition, and six had high densities of echinoderms. *Strongylocentrotus franciscanus* and *Ophiothrix spiculata* densities at Gull Island continued to increase while *Macrocystis pyrifera* decreased. Fry's Harbor changed dramatically since last year with almost all of the *M. pyrifera* and *Eisenia arborea* from last year gone. Scorpion

Anchorage had a developing kelp forest over part of the site, though the invasive algae *Sargassum muticum* was now the dominant algal species. Potato Pasture had more *M. pyrifera* present than we have observed since this site was established. *Strongylocentrotus* spp. continued to dominate five of the 10 sites at this island, a decrease from six last year. 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 were 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.

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 sea star wasting disease event that was first documented in Washington State in the winter of 2013 and extended from Alaska to Baja (Hewson et al. 2014). Similar sea star wasting events have occurred (Eckert et al. 1999), but never at this magnitude and over such a wide geographic area.

As in previous years, temperature data were collected from May 2013 to April 2014. The region experienced above average water temperatures from October 2013 through the winter. Mean monthly benthic water temperatures for February, March and April were some of the highest recorded since we installed loggers at KFM sites in the early 1990s. Temperatures remained anomalously warm up to April 30th 2014, which is the end of the time period covered for water temperatures in this annual report.

Acknowledgments

Funding for the kelp forest monitoring program in 2014 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 2014. 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 of 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.

List of Acronyms

ARM:	Artificial Recruitment Module
CDFG:	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
MPA:	Marine Protected Area
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 (CDFG 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). 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.

The CHIS consist 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 bear 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 the California Department of Fish and Wildlife (CDFW).

The Kelp Forest Monitoring Program (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 2014 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 Davis (1985, 1986). The KFM annual reports listed in Table 1 describe monitoring efforts and results for years 1982-2013. 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; contact Channel Islands National Park for information about the update.

Table 1. Summary of Kelp Forest Monitoring Program 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, Avery, and Kushner 1993
Annual Report 1991	Richards, Kushner, and Avery 1993
Annual Report 1992	Richards and Kushner. 1994
Annual Report 1993	Kushner, Walder, et al. 1995
Annual Report 1994	Kushner, Lerma, and Richards 1995
Annual Report 1995	Kushner, Lerma, et al. 1997
Annual Report 1996	Kushner, Morgan, et al. 1997
Annual Report 1997	Kushner et al. 1998
Annual Report 1998	Kushner et al. 2000
Annual Report 1999	Kushner, Lerma, et al. 2001
Annual Report 2000	Kushner, Lerma, and Donahue 2001
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, Rich, and Sprague 2007
Annual Report 2005	Kushner et al. 2012
Annual Report 2006	Kushner et al. 2013
Annual Report 2007	Moore et al. 2013
Annual Report 2008	Sprague, Kushner, and Moore 2013
Annual Report 2009	Kushner et al. 2013
Annual Report 2010	Sprague et al. 2012
Annual Report 2011	Sprague, Traiger, et al. 2013
Annual Report 2012	Sprague, Civiello, et al. 2013
Annual Report 2013	Sprague et al. 2019

Though KFM was fully implemented as an Inventory and 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 Marine Protected Areas (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 2014, our 33rd 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, substrate, and associated monitoring technique(s).

Group	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

* 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. Monitoring techniques are described in Davis et al. (1997) and in an update to the sampling protocol currently in progress by D. Kushner and J. Sprague.

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

Group	Taxa/Common Name	Scientific Name	Technique*
Algae (continued)	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
	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

* 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. Monitoring techniques are described in Davis et al. (1997) and in an update to the sampling protocol currently in progress by D. Kushner and J. Sprague.

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

Group	Taxa/Common Name	Scientific Name	Technique*
Invertabrates (continued)	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
	Warty sea cucumber	*Parastichopus parvimensis*	Q
	Aggregated red sea cucumber	*Pachythyone rubra*	R
	Red abalone	*Haliotis rufescens*	B, S
	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	*Panuluris interruptus*	B
	Tunicates	–	R
	Stalked tunicate	*Styela monteryensis*	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

* 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. Monitoring techniques are described in Davis et al. (1997) and in an update to the sampling protocol currently in progress by D. Kushner and J. Sprague.

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

Group	Taxa/Common Name	Scientific Name	Technique*
Fish (continued)	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	–	R
	Rock	–	R
	Cobble	–	R
	Sand	–	R

* 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. Monitoring techniques are described in Davis et al. (1997) and in an update to the sampling protocol currently in progress by D. Kushner and J. Sprague.

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	*Damalychthys vacca*

Methods

Abundances, and in some cases size structure, of 71 taxa or categories of algae, fish, and invertebrates (Tables 2, 3) were measured at 33 permanent sites (Table 4) around the five park islands (Figure 1). Additionally, all species of fish that were positively identified while the Roving Diver Fish Count and Fish Size Frequency protocols were being conducted were counted and measured. Sites were monitored between May 12th and October 3rd, 2014 using the NPS vessel "Sea Ranger." Site and species selection criteria and sampling protocol are described in the Kelp Forest Monitoring Handbook (Davis et al. 1997) and in an update to the sampling protocol handbook currently being developed (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 from the NPS Integrated Resource Management Applications (IRMA) portal at https://irma.nps.gov/DataStore/Reference/Profile/68421.

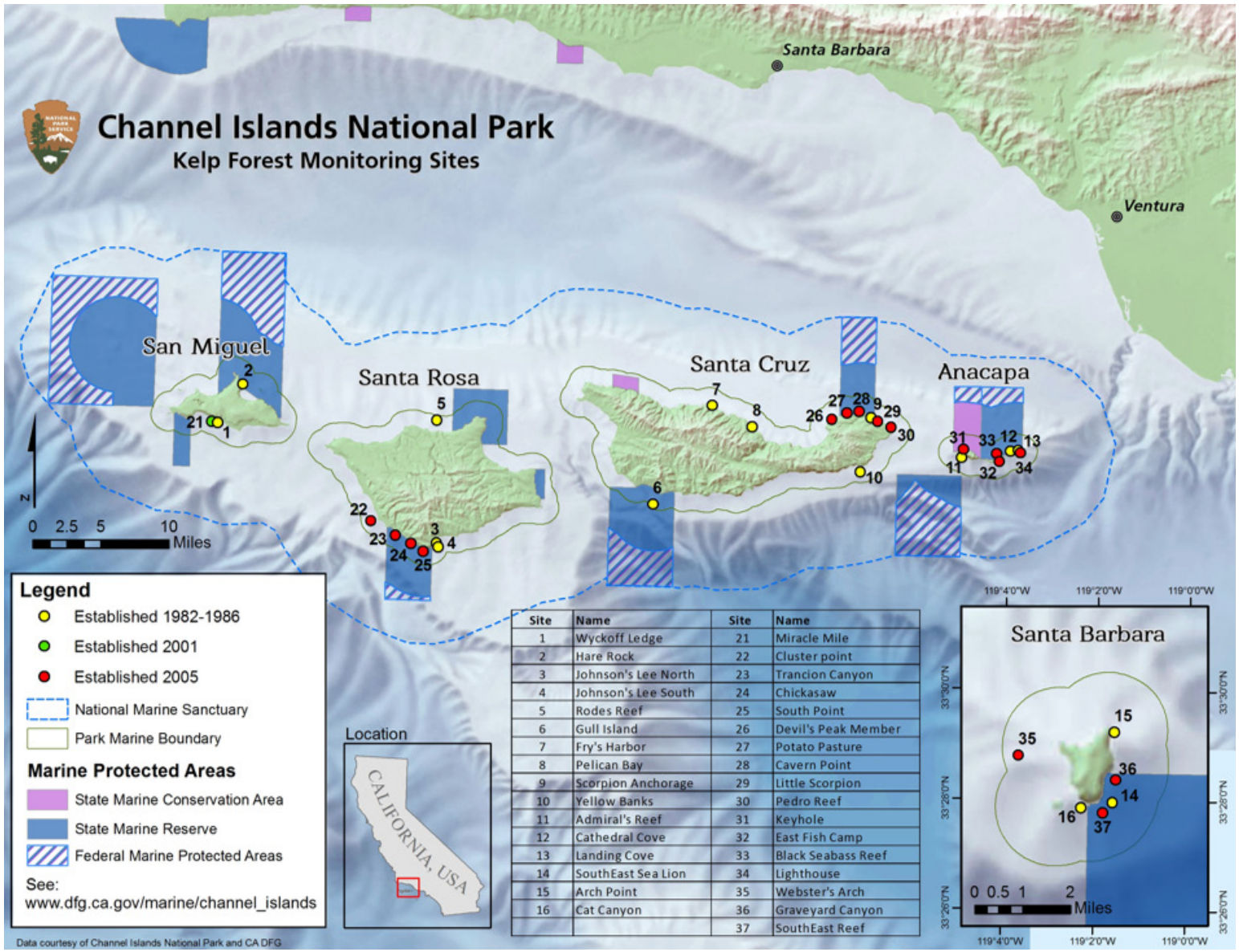
Kelp Forest Monitoring Program data usage history and request for information contact details are given in Appendix B.

Table 4. Kelp Forest Monitoring Program sampling sites information.

Island	Site Location-#	Site Abbreviation	Depth (m)	Year Established	Year Marine Protected Area Established
San Miguel	Wyckoff Ledge-1	SMWL	13–15	1982	N/A
	Hare Rock-2	SMHR	6–9	1982	2003
	Miracle Mile-21	SMMM	7–10	2001	N/A
Santa Rosa	Johnson's Lee North-3	SRJLNO	9–11	1982	N/A
	Johnson's Lee South-4	SRJLSO	14–16	1982	N/A
	Rodes Reef-5	SRRR	13–15	1983	N/A
	Cluster Point-22	SRCP	12–15	2005	N/A
	Trancion Canyon-23	SRTC	9–15	2005	2003
	Chickasaw-24	SRCSAW	10–13	2005	2003
	South Point-25	SRSP	11–13	2005	2003
Santa Cruz	Gull Island South-6	SCGI	14–16	1982	2003
	Fry's Harbor-7	SCFH	12–13	1982	N/A
	Pelican Bay-8	SCPB	6–8	1982	N/A
	Scorpion Anchorage-9	SCSA	5–6	1982	2003

Table 4 (continued). Kelp Forest Monitoring Program sampling sites information.

Island	Site Location-#	Site Abbreviation	Depth (m)	Year Established	Year Marine Protected Area Established
Santa Cruz (continued)	Yellowbanks-10	SCYB	14–15	1986	N/A
	Devil's Peak Member-26	SCDPM	10–13	2005	N/A
	Potato Pasture-27	SCPP	9–12	2005	2003
	Cavern Point-28	SCCVP	12–13	2005	2003
	Little Scorpion-29	SCLS	9–14	2005	N/A
	Pedro Reef-30	SCPRF	7–10	2005	N/A
Anacapa	Admiral's Reef-11	ANAR	13–15	1982	N/A
	Cathedral Cove-12	ANCC	6–11	1982	1979
	Landing Cove-13	ANLC	5–12	1982	1979
	Keyhole-31	ANKH	7–10	2005	2003
	East Fish Camp-32	ANEFC	9–14	2005	N/A
	Black Sea Bass Reed-33	ANBSBR	15–16	2005	2003
	Lighthouse-34	ANLH	7–9	2005	N/A
Santa Barbara	Southeast Sea Lion Rookery-14	SBSESL	12–14	1982	2003
	Arch Point-15	SBAR	7–8	1982	N/A
	Cat Canyon-16	SBCAT	7–9	1986	N/A
	Webster's Arch-35	SBWA	14–16	2005	N/A
	Graveyard Canyon-36	SBGC	10–12	2005	2003
	Southeast Reef-37	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. The sampling techniques employed to gather patterns of abundance and age structure 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 directly 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 (0.5 x 3)	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 observers
Video Transect	100 m, 5 minutes	2
Natural Habitat Size Frequency	Individual	30–200 per select 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 transect surveys were performed. To determine fish abundance and diversity, timed roving diver fish counts (RDFC) were performed. The RDFC are conducted using from 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 different 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 an update to the sampling protocol

handbook currently being developed (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. If a non-indicator species was not observed at any sites this year no graph is included in this year's report.

Table 6. List of fish monitoring protocols.

Protocol (and metric measured)	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 of the 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 an update to the sampling protocol handbook currently being developed (Kushner and Sprague, in progress).

Hourly temperature data were collected using remote temperature loggers at 32 sites, the exception being Miracle Mile where there is no temperature logger installed. The temperature data have been collected continuously since 1994/95, except a few instances where loggers malfunctioned or were lost or stolen. Remote temperature loggers, TIDBIT®, made by Onset Computer Corporation, were deployed at each site. 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. A comparison of temperature data from both loggers were conducted to ensure that the loggers were recording within their specifications (± 0.2° C).

Table 7. Size frequency measurement dimensions.

Scientific Name	Sample Size	Measurement
Macrocystis pyrifera	100	Stipe count (1 m above bottom), max. holdfast diameter, mm
Tethya aurantia	60	Max. diameter, mm
Stylaster (Allopora) californica	60	Max. height and width, mm
Lophogorgia chilensis	60	Max. height and width, mm
Muricea californica	60	Max. height and 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

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 visits, we sometimes conducted size frequency sampling, transect line repair and 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 site information in Appendix D. 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 2014. All ARMs were monitored at all 12 sites where they are present. Twenty-one divers (Table 8) collected data on nine five-day cruises, one four-day cruise, and two two-day cruises between May and October (Table 9). KFM divers logged 1,040 dives for a total of 1,059 hours of bottom time.

Table 8. 2014 Kelp Forest Monitoring Program participant list.

Participant	Affiliation	Cruises
Altstatt, Jessie	University of California Santa Barbara	6
Bailey, Dawn	California State University-VIP	4
Cox, Gery	Tenera Environmental	10
Duran, Keith	Channel Islands National Park	All Cruises
Gaines, Bailey	Death Valley National Park	10
Grime, Ben	Channel Islands National Park	All Cruises
Grunden, James	Channel Islands National Park	1,2,3,4,5,6,7,8,9,10
Kushner, David	Channel Islands National Park	All Cruises
Lamb, Robert	Brown University	11
Lonhart, Steve	National Oceanic and Atmospheric Administration	11
McClain, Jaime	Channel Islands National Park	All Cruises
Mireles, Carlos	California Department of Fish and Wildlife	9
Moore, Kelly	Channel Islands National Park	1,2,3,4,6,7,8,11,12
Osorio, Dave	California Department of Fish and Wildlife	12
Simpson, Douglas	National Park Service-VIP	12
Smalley, Yasmeen	OWUSS Intern	8
Sprague, Joshua	Channel Islands National Park	1,2,3,4,5,6,7,8,10,11,12
Stephenson, Ryan	Channel Islands National Park	1,2,3,4,5,6,7,8,10,11,12
Taniguchi, Ian	California Department of Fish and Wildlife	2
Whitaker, Steve	Channel Islands National Park	1
Witting, David	National Oceanic and Atmospheric Administration	7

Table 9. 2014 Kelp forest monitoring cruise list.

Cruise #	Cruise Dates	KFM Sites Visited*
Cruise #1	05/12 – 05/16	SCLS, SBAP, SBWA, SBSER, ANCC
Cruise #2	05/27 – 05/30	ANAR, ANKH, SCLS, ANCC, ANLH
Cruise #3	06/19 – 06/13	SBCAT, SBGC, SBSESL, SCDPM, ANLC
Cruise #4	06/23 – 06/27	SCFH, SCCVP, ANLC, ANBSBR, ANEFC
Cruise #5	07/09 – 07/10	SCPP, ANLH,
Cruise #6	07/14 – 07/18	SCGI, SRCP, SRTC, SRJLSO, SCFH
Cruise #7	07/28 – 08/01	SCGI, SRCSAW, SRJLNO, SRSP,
Cruise #8	08/11 – 08/15	SRRR, SMHR, SMMM, SCPB, SCDPM, SCCVP
Cruise #9	08/20 – 08/21	ANCC, ANAR, SCYB
Cruise #10	08/25 – 08/27	SCPRF, SCSA, SCDPM, SCPP, SCPB
Cruise #11	09/15 – 09/17	ANEFC, SCYB, SCLS
Cruise #12	09/29 – 10/03	ANLC, ANBSBR, ANKH, SCYB, SCGI, SRJLNO, SMWL, SRSP

* 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 an update to the sampling protocol handbook currently being developed (Kushner and Sprague, in progress).

Summary data from fish transects are provided in Appendix I. Summary data for RDFCs, and fish size frequency measurements are provided by Sprague and Kushner (2020) on IRMA at https://irma.nps.gov/DataStore/Reference/Profile/2259651.

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 at https://irma.nps.gov/DataStore/Reference/Profile/2259651.

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/2259651). *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 J.

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.

Additional information on unusual and non-indicator species is presented in Appendix K.

Kelp Forests

The status of kelp forests was different among 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 2014, 15 of the 33 sites monitored were characterized as developing kelp forest, kelp forest or mature kelp forest. In addition, three sites were in a state of transition. Two sites were part kelp forest and part dominated by *Strongylocentrotus purpuratus.* Three sites were part kelp forest and part dominated by *Ophiothrix spiculata*. The remaining 10 sites were mostly dominated by echinoderms which decreased from 17 sites in the previous year. 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. Site status including which echinoderm species dominated a site are listed in Table 10, as well as comparisons to site status from 2013.

There have been dramatic changes at several Santa Barbara Island sites occurring over the last two years. The changes occurring at Graveyard Canyon and Southeast Sea Lion last year continued this year, with both sites now having kelp forests but also a high abundance of the invasive alga *Sargassum horneri*. *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 was approximately 50% of what was present last year. Graveyard Canyon, which was in a state of transition last year, had a dense kelp forest with an abundance of understory algae present this year. Webster's Arch, dominated by echinoderms last year, was now in a state of transition. That site had more *Macrocystis pyrifera* present than we have documented since it was established in 2005, and it could transition into a kelp forest soon. Southeast Reef continued to be a mature kelp forest, like what has been present since the site was established in 2005. The remaining three sites continued to be dominated by echinoderms with little algae present. Overall, there was more kelp present at Santa Barbara than have been documented in the last two decades. The

condition of the island is well represented by the monitoring sites with about half the island covered with kelp and the other half dominated by echinoderms.

Table 10. 2014 kelp forest monitoring site status with 2013 status for comparison.

Island	Site	2014 Status	2013 Status
San Miguel	Wyckoff Ledge	Mature kelp forest	Mature kelp forest
	Hare Rock	Dominated by *Strongylocentrotus* spp.	Dominated by *S. franciscanus*
	Miracle Mile	Mature kelp forest	Mature kelp forest
Santa Rosa	Johnson's Lee North	Mature kelp forest	Mature kelp forest
	Johnson's Lee South	Mature kelp forest	Mature kelp forest
	Rodes Reef	Open area with moderately high density of *S. franciscanus*	Open area with moderately high density of *S. franciscanus*
	Cluster Point	Mature kelp forest	Mature kelp forest
	Trancion Canyon	State of transition	State of transition
	Chickasaw	Mature kelp forest	Mature kelp forest
	South Point	Mature kelp forest	Mature kelp forest
Santa Cruz	Gull Island South	Half mature kelp forest and half dominated by *O. spiculata*	Half mature kelp forest and half dominated by *O. spiculata*
	Fry's Harbor	State of transition	Mature kelp forest
	Pelican Bay	Dominated by *Strongylocentrotus* spp.	Dominated by *Strongylocentrotus* spp.
	Scorpion Anchorage	Dominated by *S. purpuratus* with 30% a developing kelp forest	Dominated by Dominated. by *S. purpuratus*
	Yellowbanks	Mature kelp forest	Kelp forest
	Devil's Peak Member	Dominated by *S. purpuratus*	Dominated by *Strongylocentrotus* spp
	Potato Pasture	Developing kelp forest	Dominated by *S. purpuratus*
	Cavern Point	Mature kelp forest	Kelp forest
	Little Scorpion	Dominated by *Strongylocentrotus* spp	Dominated by *Strongylocentrotus* spp
	Pedro Reef	Dominated by *S. purpuratus*	Dominated by *Strongylocentrotus* spp
Anacapa	Admiral's Reef	Dominated by *O. spiculata* with 40% a developing kelp forest	Dominated by *O. spiculata*
	Cathedral Cove	Mature kelp forest	Mature kelp forest

Table 10 (continued). 2014 kelp forest monitoring site status with 2013 status for comparison.

Island	Site	2014 Status	2013 Status
Anacapa (continued)	Landing Cove	Mature kelp forest	Kelp forest
	Keyhole	Dominated by *S. purpuratus*	Dominated by *S. purpuratus*
	East Fish Camp	Dominated by *Strongylocentrotus* spp. and *O. spiculata*	Dominated by *Strongylocentrotus* spp. and *O. spiculata*
	Black Sea Bass Reed	Half dominated by *O. spiculata* and half mature kelp forest	Dominated by *O. spiculata*
	Lighthouse	Dominated by *S. purpuratus*	Dominated by *S. purpuratus*
Santa Barbara	Southeast Sea Lion Rookery	Kelp forest	Dominated by *O. spiculata*
	Arch Point	Dominated by *S. purpuratus*	Dominated by *S. purpuratus*
	Cat Canyon	75% Dominated by *S. purpuratus* and 25% kelp forest	Dominated by *S. purpuratus*
	Webster's Arch	State of transition	Dominated by *S. purpuratus* and *O. spiculata*
	Graveyard Canyon	Kelp forest	State of transition
	Southeast Reef	Mature kelp forest	Mature kelp forest

Anacapa Island remains mostly barren and dominated by echinoderms, we have observed some recent changes that appear to be positive for kelp forest recovery, similar to Santa Barbara Island. The two sites in the Anacapa State Ecological Reserve that was established in 1978 continued to be kelp forests (Landing Cove and Cathedral Cove) as they have for nearly all of the past 33 years. The five remaining sites continued to be mostly dominated by echinoderms, though two of those five sites had developing or mature kelp forests covering 40-50% of the site. These two sites had more *Macrocystis pyrifera* which is likely due to the decrease in *Strongylocentrotus spp.* Though there are patches of kelp surrounding the Island, there are more and larger patches of kelp on the North side of East and Middle Anacapa in the MPA. The seven monitoring sites here appear to represent the overall conditions of this island well.

Most Santa Cruz Island sites remained similar to last year, but several sites had noticeably changed. Overall, three sites had kelp forests, one was in a state of transition and six had high densities of echinoderms. *Strongylocentrotus franciscanus* and *Ophiothrix spiculata* densities at Gull Island continued to increase while *Macrocystis pyrifera* decreased. Fry's Harbor changed dramatically since last year with almost all the *M. pyrifera* and *Eisenia arborea* from last year gone. Scorpion Anchorage had a developing kelp forest over part of the site, though the invasive algae *Sargassum muticum* was now the dominant algal species at the site. Potato Pasture had more *M. pyrifera* present than we have observed since this site was established. *Strongylocentrotus* spp. continued to dominate five of the 10 sites at this island, a decrease from six last year. 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 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 remained similar to last year at most sites except at Black Seabass Reef, Anacapa Island which experienced a significant increase. Green algae cover at that site was greater than has been recorded at any sites on Santa Barbara, Anacapa, Santa Cruz, or Santa Rosa Island sites. Most of the green algae present there consisted an ephemeral algae *Cladophora* sp. Cover of green algae remained low at Santa Rosa and San Miguel Islands sites, where little to no green algae cover was recorded.

Adult *Macrocystis pyrifera* densities remained similar to recent years at all islands except for Santa Barbara Island, which experienced an increase at several sites. Graveyard Canyon and Southeast Sea Lion, Santa Barbara Island both transitioned into kelp forests. Both of these sites are inside the State Marine Protected Area. The entire area around Southeast Sea Lion had more kelp than since the mid-1990s. Subadult densities increased at Santa Rosa and Santa Barbara Islands overall, as well as at Cathedral Cove, Anacapa Island and Scorpion Anchorage, Santa Cruz Island. The remaining islands/sites were similar to recent years for subadult densities. Percent cover of *M. pyrifera* (on RPCs) remained like recent years. It should be noted that the area has been experiencing anomalously warm water conditions which have persisted throughout the current calendar year since spring, with temperatures 1-2° C above average. The persistent warm water conditions appeared to have not had a noticeable impact on *M. pyrifera* abundances.

Adult *Eisenia arborea* densities remained similar to past years, with the exception of Fry's Harbor and Cavern Pont, Santa Cruz Island where it decreased. However, it should be noted that percent cover (which includes both adult and juvenile *E. arborea*) increased at Cavern Point. At Fry's Harbor, percent cover was the lowest recorded since 2003. Percent cover increased to a record high at Potato Pasture, Santa Cruz Island, while remaining similar to recent years for the remaining sites. Potato Pasture, Santa Cruz Island had the highest juvenile density recorded of any site since the monitoring program began ($9.8/m^2$).

Pterygophora californica adult and juvenile densities remained similar to past years. This species remained abundant and near record high density at Landing Cove. Cover of *P. californica* continued to decline at Wyckoff Ledge, San Miguel Island for the third consecutive year. Overall, cover decreased at San Miguel Island sites, increased at Santa Rosa Island sites, and remained similar to recent years at the remaining sites.

Laminaria farlowii adult and juvenile densities remained highest at Cathedral Cove, Anacapa Island and Landing Cove, Anacapa Island, similar to the past 10 years. Adult and juvenile densities and

percent cover at Johnson's Lee North and South Point, Santa Rosa Island remained high, similar to recent years. While not an indicator species, several *L. setchellii* were observed at Miracle Mile, San Miguel Island as well as Cluster Point and Chickasaw, Santa Rosa Island. This is a cooler water species that is rarely observed South of Point Conception.

We observed more *Sargassum horneri* this year than in the previous years since it was first documented within the park in 2009. *Sargassum horneri* was observed at a total of 13 KFM sites this year, an increase from nine sites last year, 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 Island and Anacapa Island sites. It is apparent that *Sargassum horneri* is well established at Santa Barbara Island. Juvenile densities increased with the exception of Cavern Point, Santa Cruz Island, which experienced a decrease of over 50%. This was the first time that KFM had documented a decrease of this magnitude for *S. horneri* at any KFM site. This could mean a stabilization of the population or perhaps just the timing of monitoring and/or growing conditions for this alga. The largest increases in *S. horneri* cover occurred at East Fish Camp and Admiral's Reef, on Anacapa Island, as well as Potato Pasture, Santa Cruz Island. At Admiral's Reef, densities up to 285/m^2 juveniles were recorded in one of the 1m^2 quadrats but these high-density congregations were patchy. Decreases in percent cover occurred at multiple sites, including Keyhole, Anacapa Island, Arch Point, Santa Barbara Island, as well as Potato Pasture and Cavern Point on Santa Cruz Island. This species has not been documented at Santa Rosa or San Miguel Islands; however, it continues to become more abundant at the southern Channel Islands. During a survey dive, *S. horneri* was observed as deep as 110 ft. on the northeast side of Santa Barbara Island (see Appendix J.).

Overall cover of *Cystoseira* spp. was similar to past years, with the exception of Graveyard Canyon, Santa Barbara Island, which experienced a large increase in cover.

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 Graveyard Canyon, Santa Barbara Island from last year's record high. Cover increased at South Point, Santa Rosa Island to a record high at that site, and remained similar to recent years at the remaining sites.

Cover of miscellaneous brown algae remained similar to recent years with a few exceptions. There were increases at Scorpion Anchorage and Potato Pasture on Santa Cruz Island, and a decrease from last year's record high at Graveyard Canyon on Santa Barbara Island.

Cover of *Gelidium* spp. remained similar to past years. The only site with abundance continued to be Landing Cove, Anacapa Island in the shallow high relief rocky areas. Santa Rosa Island was the only island with a notable amount of *Gigartina* spp. All other sites changed little though overall cover remained lower at Santa Rosa and San Miguel Islands compared to past years. Cover of miscellaneous red algae increased at most Santa Rosa Islands, particularly at Johnson's Lee South, South Point, Cluster Point and Chickasaw. Cover also increased at Southeast Reef, Cat Canyon, Graveyard Canyon, Santa Barbara Island, similar to the previous year. There were decreases at Gull Island and Cavern Point on Santa Cruz Island. The remaining sites changed little from recent years. Cover of articulated coralline algae decreased at San Miguel Island, mostly at Wyckoff Ledge, and

increased at several Santa Rosa Island site. Cover at the remaining sites was similar to past years. Cover of encrusting coralline algae remained like recent years.

Invertebrates

Porifera

Tethya aurantia densities averaged by island, remained at or near all-time highs at all five park islands. The abundance of *T. aurantia* has steadily increased over the last decade, likely due to the cold-water regime that the region has been experiencing over that same time period. Density at Gull Island on Santa Cruz Island was the highest recorded of any KFM site in over 30 years of monitoring. Fry's Harbor density continued to increase to the highest recorded at that site. Overall, the greatest increases in density occurred at Santa Cruz Island sites.

Overall, sponge cover increased at Santa Rosa Island from last year, and remained similar to recent years at remaining sites. The sites with the highest abundance and diversity of sponges were Johnson's Lee North, Santa Rosa Island, and Cavern Point Santa Cruz Island.

Anthozoa/Hydrozoa

Urticina lofotensis has gradually increased in density at Santa Rosa and San Miguel islands over the last decade, and are at or near record high densities, similar to recent years. This is a cooler water species that we expect to do well in cooler water regimes. *Corynactis californica* decreased overall in coverage but there were both decreases and increases at sites. There were noticeable decreases in *C. californica* cover at Pedro Reef, Santa Cruz Island as well as East fish camp, Anacapa Island. Last year, cover of *C. californica* at Pedro Reef was the highest recorded for any KFM site, and this year there was a decrease of over 50%. *Balanophyllia elegans* cover was 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* remained similar to recent years.

The only KFM site that historically maintained a population of *Stylaster californica* is Gull Island, Santa Cruz Island. The density continued to remain relatively high since 2007 and has increased since 2005. This is a protected species but previously was often taken as a collectable/souvenir from the Gull Island. We believe this population has slowly been rebuilding as take is no longer occurring and this area is now inside of the Gull Island SMR. The only other site where we observed this *S. californica* this year was at Webster's Arch, Santa Barbara Island. Here we observed and measured three small colonies, two were picked up by the band transect monitoring protocol for an increased density over previous years. There is a larger population of *S. californica* several hundred meters to the north of Webster's Arch.

Overall, *Lophogorgia chilensis* continued a trend of declining densities at many Santa Rosa, Santa Cruz, Santa Barbara, and Anacapa island sites, reaching record low densities at several sites this year. The abundance of this species has been declining at many KFM sites for at least a decade and even longer at sites such as Johnson's Lee South at Santa Rosa Island, Gull Island at Santa Cruz Island, and Southeast Sea Lion at Santa Barbara Island. *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 at most sites from last year, overall. This species is often highly variable in abundance which can be caused by its patchy distribution of habitat. Overall, *Phragmatopoma californica* was relatively abundant the past several years at both Santa Rosa and Santa Barbara Islands, and cover notably declined at most sites at these Islands. *Phragmatopoma californica* remained rare at Anacapa and Santa Cruz Islands, and increased slightly at San Miguel Island.

Bryozoa

Overall, *Diaperoecia californica* abundance remained similar to last year, which followed decreases at several sites such as Cavern Point and Potato Pasture on Santa Cruz Island, and Landing Cove on Anacapa Island. Overall, miscellaneous bryozoan cover (excluding *Diaperoecia californica)* decreased at San Miguel, Santa Cruz, Anacapa, and Santa Barbara Islands, and increased at Santa Rosa Island. The greatest decreases occurred at Fry's Harbor on Santa Cruz Island, and Cathedral Cove and Landing Cove on Anacapa Island. Those three sites all had record high or near record high cover last 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 there are more, larger lobster inside the MPAs compared to outside. Similar to recent years*, P. interruptus* densities continued to be more abundant inside the MPAs at Anacapa and Santa Cruz islands than outside. There were declines in density at three KFM sites in the no-take MPA on Anacapa Island (Cathedral Cove, Landing Cove, and Black Seabass Reef). However, densities remained significantly greater at these sites than compared to KFM sites outside of the Anacapa MPA. Black Sea Bass Reef on Anacapa Island decreased in density from the record high last year. Even with decreasing densities the last two years, Black Seabass Reef continued to have the highest density of all KFM sites this year. Densities at Santa Barbara and Santa Rosa islands were too low to discern any 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

Serpulorbis squamigerus abundance was similar to last year, and remained relatively rare overall compared to the 1983-1994 time period.

Megastraea undosa densities remained at or near record low abundances at KFM sites since monitoring began. 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. However, we expect to see recent recruits of this species in the next year or two from this year's warm water event. Typically, there is a one- or two-year lag between recruitment events for this species and when the monitoring protocols detect emergent recruits. Overall, their sizes were higher than average but there is high variability between sites. Several Santa Cruz Island sites did have an increase in small individuals (Yellow Banks, Scorpion Anchorage, Pedro Reef, Pelican Bay, and Potato Pasture).

Lithopoma gibberosa continued to be common at only a few KFM sites. In 2012, there was a recruitment event. In the two years following, abundances have increased at a few sites, though the increase was not high enough to be detected by the KFM monitoring protocols at most of those sites. In 2014, *L. gibberosa* remained relatively abundant at Rodes Reef on Santa Rosa Island, Yellow Banks on Santa Cruz Island, Wyckoff Ledge on San Miguel Island, and Webster's Arch on Santa Barbara Island. Webster's Arch, Santa Barbara Island continued to have the highest density of this species recorded of all KFM sites since the program was implemented. It is rare to observe this many *L. gibberosa* at the southern islands but we have observed many of these on the northwest side of Santa Barbara Island.

Aside from an increase in density at Webster's Arch on Santa Barbara Island, there were no trends for *Tegula regina* abundances. This year, Webster's Arch had the highest recorded density of any KFM site since this species was added to the monitoring protocols in 2006. This is a warmer water species and is usually more abundant at the warmer water sites. It is interesting to note that Websters Arch has both the highest density of *T. regina*, a warmer water species and at the same time has the highest density of the cooler water species of snail *L. gibbersa*.

Megathura crenulata densities continued to decline for the third consecutive year from the relatively high abundances recorded at Santa Cruz and Anacapa Islands prior to 2012. Some recruitment was observed but was at a low level similar to past years. 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 Santa Rosa, Anacapa, and Santa Barbara Islands, decreased at Santa Cruz Island, and remained similar to recent years at San Miguel Island. Densities at Southeast Reef, Santa Barbara Island, increased to the highest density recorded at that island since monitoring began.

Kelletia kelletii densities remained similar at all sites compared to recent years. Wyckoff Ledge, San Miguel Island continued to have the highest density of all the monitoring sites. Juveniles were common to abundant at many sites this year which has been rarely observed since at least 1990. Juveniles were observed at three Anacapa Island sites (East Fish Camp, Landing Cove, and Keyhole), six Santa Cruz Island sites (Pelican Bay, Pedro Reef, Potato Pasture, Little Scorpion, Devil's Peak Member, and Cavern Point) and at Rodes Reef, Santa Rosa Island. This was one of the

largest recruitment events that KFM has documented for this species. A record number of small *Kelletia kelletii,* less than 40 mm, were in the ARMs this year at Pelican Bay, Scorpion Anchorage, Yellowbanks on Santa Cruz Island as well as Cathedral Cove and Landing Cove on Anacapa Island. Landing Cove is the only site where we consistently see juveniles of this species though they were more abundant this year than in past years.

Cypraea spadicea densities overall were similar to last year. *Cypraea spadicea* densities in the ARMs overall were similar to last year.

Overall densities of *Aplysia californica* remained similar to recent years at Santa Rosa, Santa Barbara, and San Miguel Islands, similar to past years. There was an overall increase at Santa Cruz Island. *Aplysia californica* remained relatively abundant at Hare Rock, San Miguel Island, where most of those observed were juveniles. Though not an indicator species, *Aplysia vaccaria* were observed at Fry's Harbor, Santa Cruz Island and Arch Point, Santa Barbara Island. This species is commonly observed at Cathedral Cove, Anacapa Island and we overall these seemed more common than in recent years.

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. This site was purposely established in an area of high density, which is why it is graphed separately (Figure 2) from the remaining 32 KFM sites, which can be found in Appendix G. Areas selected for the highest density possible are more likely to decrease in density than increase. The density at this site initially declined but then has been relatively stable high density for the past seven years.

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 of *H. rufescens* at Santa Rosa Island were lower than at San Miguel Island and overall remained similar to the past nine years. On Santa Rosa Island, the sites Chickasaw, South Point, and Johnson's Lee North had higher *H. rufescens* densities compared to the other sites on the Island, similar to past years. *Haliotis rufescens* continue to remain rare on most of Santa Cruz Island, though they are more common on the west end of this Island where there are no KFM sites.

Size frequencies at sites with high abundances of *H. rufescens* show that mean size has steadily been increasing (Miracle Mile and Wyckoff Ledge on San Miguel Island; Chickasaw, Johnson's Lee North, and South Point of Santa Rosa Island). All of these sites have mean sizes for *H. rufescens* greater than 177 mm consistently for the last four years, and are at or at near record highs. This is to be expected since the harvesting of *Haliotis* spp. stopped in 1997 with a moratorium on the fishery. Prior to 1997, legal-sized abalone were rare due to high fishing pressure. These data do not necessarily indicate poor recruitment, and increasing abundance suggests there is recruitment occurring that our monitoring protocols are unable to detect. A total of four *H. rufescens* <50 mm was found at Fry's Harbor at Santa Cruz Island which is the greatest number of juveniles recorded at

that site. Additionally, 16 *H. rufescens* less than 50 mm were recorded at Hare Rock, San Miguel Island, which is the greatest number of juveniles documented at that site, or any other KFM site, since 1996. There were also many fresh shells at Hare Rock, San Miguel Island, and Rodes Reef, Santa Rosa Island, indicative of a large recent recruitment event. We have made similar observations at Hare Rock in past years as this area seems to have a lot of *H. rufescens* recruits some years.

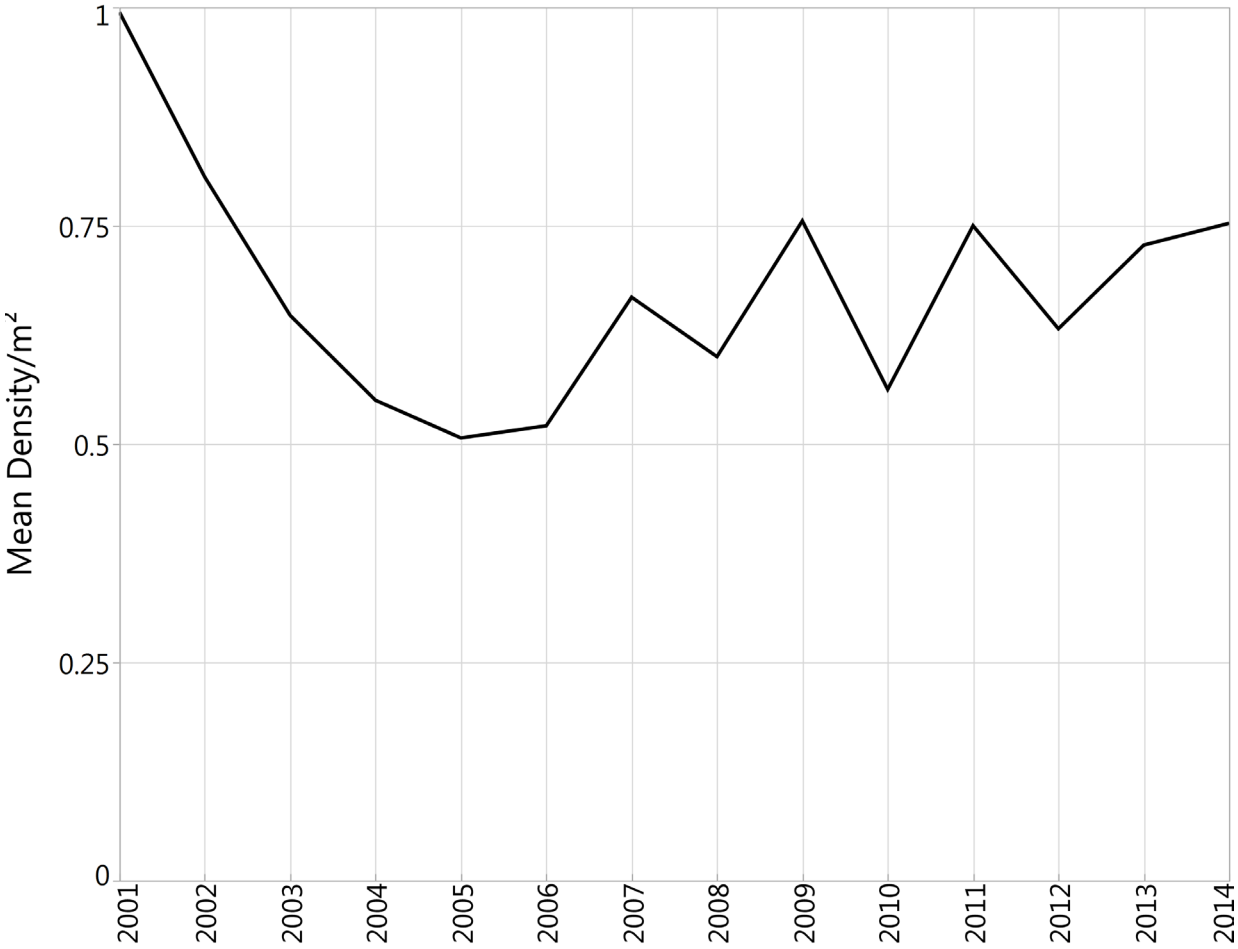


Figure 1. *Haliotis rufescens* density at Miracle Mile, San Miguel Island.

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 were too abundant to measure all. 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 monitor for abalone on the bands, 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 utilizing the band transects for reference. Only the abalone found on band transects are used for that protocol, but all abalone are measured for size frequencies. 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.

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. While Yellow Banks continued to have a relatively high abundance *of H. rufescens* for that site in recent decades, it is very far away (about 40 km) 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. There are small aggregations of several (2-5) large adult *H. rufescens* just offshore of Yellow Banks in deeper water within several km from the site (Kushner pers. coms.). It is possible that this small population of abalone are all that is needed as a source for this recruitment.

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 five sites (Landing Cove and Cathedral Cove on Anacapa Island, Southeast Reef and Cat Canyon on Santa Barbara Island, and Devil's Peak Member on Santa Cruz Island). This was the first time that *H. corrugata* were observed on band transects at Devil's Peak Member and Southeast Reef though only one at each site and both were small 46mm and 36mm respectively. However, *H. corrugata* are commonly observed at the other two sites, Landing Cove and Cathedral Cove, and these were mostly larger adult abalone. Abundances were low at all sites where observed, similar to recent years. For natural habitat size frequencies, a total of 10 *H. corrugata* were found and measured, similar to the past five years. We also found a total of eight fresh *H. corrugata* shells across five sites, five of which were < 50 mm. These observations imply a low level of *H. corrugata* recruitment has occurred recently, similar to the last five years. On a survey dive east of Cluster Point, Santa Rosa Island, Kelly Moore observed two *H. corrugata* (125 cm, 150 cm). James Grunden observed one *H. corrugata* (~ 175 mm) off the La Jolla Vieja, Santa Rosa Island on a survey dive. Several juvenile *H. corrugata* were observed in the ARMs at Anacapa Island. In the ARMs, a total of five *H. corrugata* were found at three sites.

One juvenile (30 mm) *Haliotis fulgens* was recorded on band transects (Little Scorpion, Santa Cruz Island). 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. Another 31 mm *Haliotis* sp., which was believed to be *H. fulgens* but wasn't positively identified, was observed at Cat Canyon. 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. No *H. fulgens* were found in the ARMs.

A total of four *Haliotis assimilis* were measured for size frequencies (Yellow Banks on Santa Cruz Island, Rodes Reef on Santa Rosa Island, and Hare Rock on San Miguel Island) with three of those measuring approximately 60 mm in size, indicative of a recent recruitment.

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

Echinodermata

Overall, *Centrostephanus coronatus* remained at low densities and was most abundant at Anacapa Island, similar to recent years. We have observed little change in the abundance of this species in the last 12 years. In 1 m Quadrats they were observed at 16 sites and in ARMs at four sites. Less were observed in the ARMs with 12 this year compared to 26 in 2013. Abundances increased at some sites (Black Sea Bass Reef, Keyhole at Anacapa Island and at Potato Pasture, Santa Cruz Island), declined at other sites (Arch Point at Santa Barbara Island and Admirals Reef at Anacapa Island), and remained about the same at the remaining sites. None were observed at Santa Rosa or San Miguel Islands similar to recent years. We expect to see additional numbers of this species next year due to the persistent warm water event the region has been experiencing. This is a warmer water species and recruitment within the park usually occurs during/after warm water events.

Lytechinus anamesus densities remained low overall, similar to the past 11 years. This species was more abundant in the 1980s and 1990s compared to the last decade. Overall, mean size of *L. anamesus* remained similar to recent years at KFM sites.

On Santa Rosa and San Miguel Islands *Strongylocentrotus franciscanus* abundances increased at three sites, decreased at one site and remained about the same at five sites. At Santa Cruz Island abundance increased at three sites, decreased at three sites and remained about the same at four sites. At Anacapa Island, abundances at four sites declined and the remaining three sites remained the same. At Santa Barbara Island abundances decreased at one site and remained about the same at five sites. Overall, this is a continuation of this same trend observed last year. Santa Barbara and Anacapa Island had the lowest overall densities observed since 2004/05. Similarly, Santa Rosa Island had the highest overall densities observed since 2004/05. Cat Canyon and Southeast Sea Lion on Santa Barbara Island had the lowest densities recorded at those sites since they were established in 1986 and 1982, respectively. This is a continuation of the trend of decreasing density at many sites documented in 2013. Additionally, at Southeast Sea Lion Rookery and Graveyard Canyon at Santa Barbara Island, there was an abundance of brown algae and urchins were in crevice habitat instead of out in the open at both of these sites which has typically occurred in the past when densities were high and algae rare.

At Yellowbanks, Santa Cruz Island, *S. franciscanus* had the highest density recorded at that site since it was established in 1986. At Anacapa Island, all sites experienced declines except for Black Sea Bass Reef, Cathedral Cove and Landing Cove. Since established in 1982, those sites maintained low but stable densities relative to other Anacapa Island sites. Cathedral Cove and Landing Cove have been designated MPAs since 1978 and Black Sea Bass Reef since 2003.

Grouping the 24 MPA references sites by protection status (3 inside and 3 outside at Santa Barbara Island, Anacapa Island, Scorpion Santa Cruz Island, and South Point Santa Rosa Island MPAs), densities of *S. 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 MPA 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 at Santa Rosa Island sites, increased at Gull Island, Santa Cruz Island, and Miracle Mile, San Miguel Island, and decreased at the remaining sites. There were noticeably fewer *S. franciscanus* in the ARMs at southern/warmer water sites. Juvenile *S. franciscanus* are defined in this report as having a test diameter of greater than or equal to 15 mm.

Strongylocentrotus purpuratus densities remained similar to recent years at Santa Barbara Island with the exception of Arch Point, which experienced an increased to the highest density recorded at any KFM site since the program was established. Overall, densities at Santa Cruz and Anacapa islands decreased, remained about the same at Santa Barbara but increased at Santa Rosa and San Miguel Islands.

Grouping the 24 MPA references sites by protection status (3 inside and 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 at Gull Island, Scorpion Anchorage, and Yellowbanks on Santa Cruz Island. Juveniles decreased in abundance in the ARMs at all three Anacapa Island sites where ARMs are present. Juvenile *S. purpuratus* are defined in this report as having a test diameter of ≤ 15 mm.

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 sea star wasting disease event that was first documented in Washington State in the winter of 2013 and extended from Alaska to Baja (Hewson et al. 2014). Similar sea star wasting events have occurred (Eckert et al. 1999), but never at this magnitude and over such a wide geographic area. This specific disease event is referred to as "wasting syndrome" for this report. This wasting syndrome event was different from past sea star disease events that KFM had documented. All previous sea star wasting disease events documented by KFM were associated with warm water events (Eckert et al. 1999). These warm water sea star wasting events typically occur when sea temperatures of greater than approximately 20° C persisted for at least several weeks. With this disease event, *Pycnopodia helianthoides, Pisaster giganteus,* and *Pisaster ochraceus* had already died off before the KFM field season began in May. In the past, when KFM documented warm water sea star wasting disease events, sea stars had a cold-water refuge at depth, so the entire population was not affected by the disease. This recent event was observed affecting sea stars at all depths, again indicating that the disease event was not related to water temperature. The long-term Intertidal Monitoring Program at

CHIS first documented this disease event in the Park and the resulting decline in *Pisaster ochraceus* during the 2013/2014 field season (Whitaker 2020). Though the KFM field season did not start until May, CDFW divers conducted subtidal surveys at KFM sites Devil's Peak Member and Cavern Point at Santa Cruz Island and observed multiple *P. giganteus* and *P. ochraceus* with wasting syndrome as well as fresh carcasses (pers. comm. with Carlos Mireles).

A second disease event was documented once benthic temperatures of greater than about 20° C persisted, similar to what has been observed in past years. In 2014, the first observation of what we believe was warm water sea star wasting disease was on July 9th at Potato Pasture. *Patiria miniata*, which were still in relatively high abundances when the 2014 field season began, appeared to be the only species impacted by the second disease event again believed to be associated with warm water. In past warm water events, *P. miniata* are typically the first to be observed with this disease (Kushner, pers. com.). Also similar to past years, *P. miniata* appeared to be affected less in cooler/deeper areas.

Prior to the detection of both of these sea star wasting diseases, abundances of several sea star indicator species were at or near record high densities since the KFM Program was established in 1982. This is mainly due to a cold-water regime shift that occurred in 1999, when the Pacific Decadal Oscillation switched to the negative phase (Swartzman et al. 2003), resulting in fewer and less severe warm water wasting disease events. Sea urchin wasting disease was observed at 10 sites this year, compared to 11 sites in 2013 and 10 sites in 2012 (Table 11). The prevalence of the disease was estimated less than 8%. The prevalence was likely much higher prior to the beginning of the 2014 field season since *Pycnopodia helianthoides, Pisaster giganteus,* and *Pisaster ochraceus* declined at all KFM sites.

Pycnopodia helianthoides densities declined over 99% from the 2013 KFM field season. This species had the highest mortality rate presumably due to the west coast wasting syndrome of all sea star species monitored by the KFM program. Only four small (all less than 15 mm) *P. helianthoides* were observed during the entire 2014 field season (Hare Rock, San Miguel Island) outside of the ARMs and three. *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 where they are typically most abundant in the Channel Islands. With sea otters extirpated from the Park islands, *P. helianthoides* are the main urchin predator at the three northern islands. In past *P. helianthoides* declines, we have observed subsequent large increases in sea urchin abundances. We will expect sea urchin abundances to likely increase at the northern islands as a result of their absence. Four *P. helianthoides* were observed in the ARMs this year, the lowest number since 1999, following the 1998/1999 El Niño. Two (5 and 9 mm) were found at Yellowbanks, Santa Cruz Island and two (12 and 15 mm) at Miracle Mile, San Miguel Island.

Patiria miniata densities remained relatively high at the northern islands (San Miguel and Santa Rosa). However, density either remained about the same or decreased at these Islands. At the southern islands (Santa Cruz, Anacapa, and Santa Barbara), densities were mostly similar to last year.

Table 11. Echinoderm wasting disease observations in 2014: species and prevalence (%) of disease at each site. Urchins appearing to have black spot disease were not included in the table. Look in site write-up for these observations (Appendix D).

Island	Site	Sea Star Species [a]	Sea Star Observation Date [b]	Sea Urchin Species [a]	Sea Urchin Observation Date [b]
San Miguel	Wyckoff Ledge	1(1%)	10/1	None	–
	Hare Rock	1(2%)	8/12	None	–
	Miracle Mile	None	–	None	–
Santa Rosa	Johnson's Lee North	None	–	None	–
	Johnson's Lee South	None	–	None	–
	Rodes Reef	1(<1%)	8/11	3(3%), 6(<1%)	8/11
	Cluster Point	None	–	None	–
	Trancion Canyon	None	–	None	–
	Chickasaw	None	–	None	–
	South Point	1(~5%), 8(2%)	10/2	None	–
Santa Cruz	Gull Island South	1(5%)	7/28	3(3%)	7/28
	Fry's Harbor	None	–	None	–
	Pelican Bay	1(25%), 12(25%)	8/14	None	–
	Scorpion Anchorage	1(<1%)	8/26	2(<1%)	8/26
	Yellowbanks	1(50%)	9/30	3(8%), 2(<1%)	9/16
	Devil's Peak Member	None	–	6(1%)	6/12
	Potato Pasture	1(5%)	7/9	None	–
	Cavern Point	None([c])	–	None	–
	Little Scorpion	None	–	2(2%), 6(2%)	9/17
	Pedro Reef	1(10%), 12(10%)	8/25	2(2%), 3(5%)	8/25

a Species codes: None = Not observed at this site during our visits in 2014; 1 = *Patiria (Asterina) miniata*, 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.* Note that not all these species were observed in 2014.

b Date = Date disease/syndrome was observed.

c None were observed, likely due to mortality from sea star wasting disease.

Table 11 (continued). Echinoderm wasting disease observations in 2014: species and prevalence (%) of disease at each site. Urchins appearing to have black spot disease were not included in the table. Look in site write-up for these observations (Appendix D).

Island	Site	Sea Star Species [a]	Sea Star Observation Date [b]	Sea Urchin Species [a]	Sea Urchin Observation Date [b]
Anacapa Island	Admiral's Reef	1(3%)	8/20	None	–
	Cathedral Cove	None	–	None	–
	Landing Cove	None	–	None	–
	Keyhole	None	–	2(<1%), 6(<1%)	2(9/29), 6(5/28)
	East Fish Camp	1(20%)	9/15	2(<2%), 6(<2%)	9/15
	Black Sea Bass Reef	None	–	None	–
	Lighthouse	1(2%)	7/10	2(1%)	7/10
Santa Barbara Island	SE Sea Lion Rookery	None	–	None	–
	Arch Point	None	–	None	–
	Cat Canyon	None	–	None	–
	Webster's Arch	None	–	2(<1%), 6(<1%)	5/14
	Graveyard Canyon	None	–	None	–
	Southeast Reef	None	–	None	–

a Species codes: None = Not observed at this site during our visits in 2014; 1 = *Patiria (Asterina) miniata*, 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.* Note that not all these species were observed in 2014.

b Date = Date disease/syndrome was observed.

c None were observed, likely due to mortality from sea star wasting disease.

Patiria miniata densities in the ARMs remained similar to last year at nine sites, decreased at one site, and increased at one site.

Pisaster giganteus densities decreased significantly since the 2013 field season across all KFM sites. Overall, density decreased over 97% at KFM sites. Prior to this year, there had not been a large, widespread die-off of *P. giganteus* since the 1997/98 El Niño. *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. Additionally, due to very low densities as from 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).

Pisaster giganteus juvenile (≤ 40 mm) densities in the ARMs were similar to recent years at seven sites, decreased overall at three sites, and increased at one site. Overall juvenile densities in the ARMs were similar to past years, but there has been a slow gradual decline at Santa Cruz Island over the past four years.

In 2012, KFM began sampling *Pisaster ochraceus* densities on 5 m^2 quadrats. This sea star is typically considered 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, *P. ochraceus* were also sampled on band transects this year in addition to the 5 m^2 quadrat protocol (Table 13).

Table 12. *Pisaster giganteus* density estimates obtained from 1 m^2 quadrat, 5 m^2 quadrat, and band transect protocols.*

		Mean Density/m^2			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	Wyckoff Ledge	0	0.000	0.0042	0.00	0.000	0.0022
	Hare Rock	0	0.010	0.0100	0.00	0.010	0.0047
	Miracle Mile	0	0.010	0.0083	0.00	0.007	0.0032
Santa Rosa	Johnson's Lee North	0	0.000	0.0000	0.00	0.000	0.0000
	Johnson's Lee South	0	0.100	0.0014	0.00	0.007	0.0014
	Rodes Reef	0	0.005	0.0056	0.00	0.005	0.0031
	Cluster Point	0	0.005	0.0028	0.00	0.005	0.0019
	Trancion Canyon	0	0.010	0.0200	0.00	0.007	0.0043
	Chickasaw	0	0.000	0.0000	0.00	0.000	0.0000
	South Point	0	0.000	0.0000	0.00	0.000	0.0000
Santa Cruz	Gull Island South	0	0.005	0.0056	0.00	0.005	0.0031
	Fry's Harbor	0	0.000	0.0042	0.00	0.000	0.0030
	Pelican Bay	0	0.000	0.0042	0.00	0.000	0.0022
	Scorpion Anchorage	0	0.000	0.0000	0.00	0.000	0.0000
	Yellowbanks	0	0.000	0.0014	0.00	0.000	0.0014
	Devil's Peak Member	0	0.000	0.0000	0.00	0.000	0.0000
	Potato Pasture	0	0.000	0.0028	0.00	0.000	0.0028
	Cavern Point	0	0.005	0.0083	0.00	0.005	0.0032

* The total areas sampled per site are 24 m^2 (1 m^2 quadrat), 200 m^2 (5 m^2 quadrat), and 720 m^2 (band transect).

Table 12 (continued). *Pisaster giganteus* density estimates obtained from 1 m^2 quadrat, 5 m^2 quadrat, and band transect protocols.*

		Mean Density/m^2			Standard Error		
Island	**Site**	**1 m^2 Quadrat**	**5 m^2 Quadrat**	**Band Transect**	**1 m^2 Quadrat**	**5 m^2 Quadrat**	**Band Transect**
Santa Cruz (continued)	Little Scorpion	0	0.000	0.0000	0.00	0.000	0.0000
	Pedro Reef	0	0.000	0.0014	0.00	0.000	0.0014
Anacapa	Admiral's Reef	0	0.010	0.0083	0.00	0.007	0.0044
	Cathedral Cove	0	0.000	0.0028	0.00	0.000	0.0019
	Landing Cove	0.04	0.005	0.0014	0.04	0.005	0.0014
	Keyhole	0.04	0.005	0.0028	0.04	0.005	0.0019
	East Fish Camp	0	0.000	0.0000	0.00	0.000	0.0000
	Black Sea Bass Reef	0	0.000	0.0028	0.00	0.000	0.0019
	Lighthouse	0	0.020	0.0042	0.00	0.010	0.0030
Santa Barbara	SE Sea Lion Rookery	0	0.000	0.0014	0.00	0.000	0.0014
	Arch Point	0	0.000	0.0028	0.00	0.000	0.0019
	Cat Canyon	0	0.000	0.0000	0.00	0.000	0.0000
	Webster's Arch	0	0.000	0.0000	0.00	0.000	0.0000
	Graveyard Canyon	0	0.000	0.0000	0.00	0.000	0.0000
	Southeast Reef	0	0.005	0.0100	0.00	0.005	0.0059

* The total areas sampled per site are 24 m^2 (1 m^2 quadrat), 200 m^2 (5 m^2 quadrat), and 720 m^2 (band transect).

Table 13. *Pisaster ochraceus* density estimates obtained from 5 m^2 quadrat and band transect protocols.*

		Mean Density/m^2		Standard Error	
Island	**Site**	**5 m^2 Quadrat**	**Band Transect**	**5 m^2 Quadrat**	**Band Transect**
San Miguel	Wyckoff Ledge	0.000	0.0000	0.000	0.0000
	Hare Rock	0.000	0.0000	0.000	0.0000
	Miracle Mile	0.000	0.0000	0.000	0.0000
Santa Rosa	Johnson's Lee North	0.000	0.0000	0.000	0.0000
	Johnson's Lee South	0.000	0.0000	0.000	0.0000
	Rodes Reef	0.000	0.0000	0.000	0.0000
	Cluster Point	0.000	0.0000	0.000	0.0000
	Trancion Canyon	0.000	0.0000	0.000	0.0000
	Chickasaw	0.000	0.0000	0.000	0.0000
	South Point	0.000	0.0000	0.000	0.0000
Santa Cruz	Gull Island South	0.000	0.0000	0.000	0.0000
	Fry's Harbor	0.000	0.0000	0.000	0.0000
	Pelican Bay	0.000	0.0000	0.000	0.0000
	Scorpion Anchorage	0.000	0.0000	0.000	0.0000
	Yellowbanks	0.000	0.0000	0.000	0.0000
	Devil's Peak Member	0.000	0.0014	0.000	0.0014
	Potato Pasture	0.000	0.0000	0.000	0.0000
	Cavern Point	0.005	0.0014	0.005	0.0014
	Little Scorpion	0.000	0.0000	0.000	0.0000
	Pedro Reef	0.000	0.0000	0.000	0.0000
Anacapa	Admiral's Reef	0.005	0.0000	0.005	0.0000
	Cathedral Cove	0.000	0.0000	0.000	0.0000
	Landing Cove	0.000	0.0000	0.000	0.0000
	Keyhole	0.000	0.0000	0.000	0.0000
	East Fish Camp	0.000	0.0000	0.000	0.0000
	Black Sea Bass Reef	0.000	0.0000	0.000	0.0000
	Lighthouse	0.000	0.0000	0.000	0.0000
Santa Barbara	SE Sea Lion Rookery	0.000	0.0000	0.000	0.0000

* The total areas sampled per site are 200 m^2 (5 m^2 quadrat) and 720 m^2 (band transect).

Table 13 (continued). *Pisaster ochraceus* density estimates obtained from 5 m^2 quadrat and band transect protocols.*

Island	Site	Mean Density/m^2		Standard Error	
		5 m^2 Quadrat	Band Transect	5 m^2 Quadrat	Band Transect
Santa Barbara (continued)	Arch Point	0.000	0.0000	0.000	0.0000
	Cat Canyon	0.000	0.0000	0.000	0.0000
	Webster's Arch	0.000	0.0000	0.000	0.0000
	Graveyard Canyon	0.000	0.0000	0.000	0.0000
	Southeast Reef	0.000	0.0000	0.000	0.0000

* The total areas sampled per site are 200 m^2 (5 m^2 quadrat) and 720 m^2 (band transect).

Ophiothrix spiculata abundances overall increased with high densities at eight of the 33 monitoring sites. Four sites increased to their highest cover recorded, Gull Island at Santa Cruz Island, East Fish Camp and Lighthouse at Anacapa Island, and at Websters Arch, Santa Barbara Island. Their cover at these sites were 28%, 51%, 22% and 44% respectively. At Admirals Reef and Black Sea Bass Reef at Anacapa Island densities cover remained high at 70% and 82% respectively. The two sites that declined in cover were Southeast Sea Lion and Graveyard Canyon at Santa Barbara Island with cover of 59% and 15% respectively near record high at two sites, and decreased at two sites. Percent cover remained at or near zero at the remaining 15 sites at Santa Cruz, Anacapa and Santa Barbara Islands. Percent cover remained at or near zero for all Santa Rosa and San Miguel Island sites, similar to past years. We began separately collecting abundance data on this species in 2003 since we observed them becoming more prevalent and a dominant species at some of the sites.

Parastichopus parvimensis densities continued to be higher at sites inside the Santa Cruz, Santa Rosa, and Anacapa Island MPAs compared to sites outside**.** However, at Santa Barbara Island densities are similar inside and outside the MPA, similar to past years. At San Miguel and Santa Rosa Island sites, *P. parvimensis* were relatively rare and large, which is normal for these islands. Santa Cruz and Anacapa Islands continued to have higher abundances of this species overall, but remained lower than pre-fishery abundances. One *P. parvimensis* at Yellow Banks, Santa Cruz Island, was covered with white lesions and similar observations have been reported from elsewhere.

Pachythyone rubra cover changed little this year, with the exception of two sites. South Point at Santa Rosa Island had an increase from 0% cover last year to 18% this year. Potato Pasture at Santa Cruz Island had a decrease from last year's record high of 8% to 2.8%. *Pachythyone rubra* were common and appeared more abundant than in past years at Trancion Canyon. However, few were directly along the transect where RPCs are conducted so cover was recorded at 0% for that site.

Tunicates

Overall, tunicate cover decreased at all five park islands. Miracle Mile on San Miguel Island, which had record high cover last year, experienced the largest decline. Similarly, Southeast Reef on Santa

Barbara Island also experienced a large decline this year from that site's record high cover last year. *Styela montereyensis* remained common at Santa Rosa Island, though they continued to decrease for the fourth consecutive year from record high or near record high densities in 2010. Most of the declines occurred at Johnson's Lee North and Johnson's Lee South, Santa Rosa Island, similar to last year.

Fish

Overall, *Coryphopterus nicholsii* densities decreased at Santa Cruz and Anacapa Islands while remaining similar to recent years at San Miguel, Santa Rosa, and Santa Barbara Islands.

Alloclinus holderi densities remained relatively low, similar to the last four years. 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 recent warm water event, so there were some changes. Potato Pasture, Santa Cruz Island, was the only site that had a change in density compared to recent years. Potato Pasture had an increase in density to the highest recorded at that site since it was established in 2005. While all sizes were present at Potato Pasture, many small ones were observed indicating recent recruitment. All other sites had little to no change in *A. holderi* density compared to the previous four years. One juvenile was observed at South Point, Santa Rosa Island.

Lythrypnus dalli abundances remained low at all sites, similar to last year. This is a warm water species and experiences increases in abundance following warm water events, such as an El Niño. Proceeding El Niño events, their abundance typically tapers off over the next year or two. Though a highly anticipated 2014-15 El Niño event failed to materialize, the region did experience a prolonged warm water event that began in spring and persisted through the rest of the year. We expect to see an increase in *L. dalli* densities next year as a result. We observed juvenile *Oxylebius pictus* at Little Scorpion, Santa Cruz Island, Pedro Reef, Santa Cruz Island, and Webster's Arch, Santa Barbara Island.

Male *Semicossyphus pulcher* abundances remained high compared to earlier year, similar to last year. Female abundance remained similar to recent years. Juvenile *S. pulcher* abundances were similar to last year. When averaged across all sites, juvenile *S. pulcher* had the highest recorded mean density since 2009. The first YOY *S. pulcher* we observed this year was on June 26, 2014 (one 5 cm individual), at Black Seabass Reef, Anacapa Island).

Adult *Oxyjulis californica* increased in abundance for the second year, with a mean of 158/site. *Oxyjulis californica* YOY were first observed in 2014 on August 20. Juveniles were more abundant at all five park islands compared to last year.

Male and female *Halichoeres semicinctus* abundances remained low, similar to last year. Juvenile *H. semicinctus* continued to be rare, though there was an increase at Anacapa Island late in the season after a recruitment event. Near the end of the season, in late September, YOY were more abundant at Keyhole, Anacapa Island than we have documented before at any site. This is another warm water species that tends to recruit more during warmer years. Note that the visual fish transects combine juveniles into the female category.

Adult *Chromis punctipinnis* abundances increased to some of the highest abundances we have documented in over a decade at Anacapa and Santa Barbara Islands. Abundances also increased at Santa Cruz Island, and remained similar to past years at Santa Rosa and San Miguel Islands. *Chromis punctipinnis* YOY were observed as early as July 30 this year, which is earlier than usual for this species. *Chromis punctipinnis* YOY, which are less common at Santa Rosa Island sites, were observed at Johnson's Lee North. Skin ulcers, usually caused by the marine bacterium *Vibrio damsela*, (Love 1981) were observed on several *C. punctipinnis* at Admiral's Reef, Anacapa Island. It has been very common to observe *Vibrio damsela* at this particular site, but David Kushner believes this was either the highest or one of the highest prevalences observed. One *C. punctipinnis* was observed with skin ulcers at Keyhole, Anacapa Island. These skins ulcers are usually observed on a few *C. punctipinnis* at this particular site, especially during or after persistent warm water events.

Hypsypops rubicundus adult abundances increased at the three southern islands: Santa Barbara, Anacapa, and Santa Cruz Island. At Santa Rosa and San Miguel Islands, abundances remained unchanged, similar to past years. Overall, juvenile *H. rubicundus* increased to the highest abundances that KFM has documented. The first YOY *H. rubicundus* were observed on August 20 at Admiral's Reef and Cathedral Cove on Anacapa Island. YOY were observed around the Johnson's Lee area, which is rare for this warm water species. Juvenile *H. rubicundus* were more abundant this year than we have ever documented. During a dive at Keyhole, Anacapa Island on September 29 juveniles (> 7 cm) were so abundant (100+ per dive) that we were observing interspecific competition/aggression towards each other as it appeared these fish were already starting to set up territories.

Adult *Paralabrax clathratus* abundances increased overall for the second year in a row at Santa Barbara, Anacapa, and Santa Cruz Islands. The greatest increase was at Black Seabass Reef, Anacapa Island, which had the highest density recorded at any KFM site. Juvenile *P. clathratus* increased for the second year in a row at Anacapa and Santa Cruz Islands. It should be noted that our fish counts are often completed at many sites before juvenile *P. clathratus* recruit, which typically happens in late summer or early fall. We typically miss *P. clathratus* recruitment at Santa Barbara Island due to the timing of our sampling season. The first YOY were observed on July 30 at Johnson's Lee North, which is earlier than usual.

Adult *Embiotoca jacksoni* abundances increased overall at Santa Barbara, Anacapa, and Santa Cruz Islands, similar to last year. Juvenile *E. jacksoni* increased in abundance across all five park islands to some of the highest abundances recorded in the last decade. Adult *Embiotoca lateralis* decreased at San Miguel Island sites and remained similar to recent years at the remaining islands. Juvenile *E. lateralis* increased at Santa Rosa and San Miguel Island sites overall to some of the highest abundances recorded in the last decade at those islands. Abundances remained similar to recent years at the remaining islands. Adult *Rhacochilus vacca* increased at Santa Rosa and Anacapa Islands overall. Juvenile abundances increased at Santa Rosa Island, with a record high density at South Point, Santa Rosa Island. Adult *Girella nigricans* increased at Santa Barbara, Anacapa, Santa Cruz and Santa Rosa Islands overall.

Sebastes spp. remained relatively abundant and diverse this year, similar to the last two years. Overall, there continued to be relatively high recruitment of most species common to KFM sites, and a record number of *Sebastes* spp. juveniles recorded at Santa Barbara Island. Many could not be properly identified. See section on *Sebastes* spp. below, as well as Santa Barbara Island Site notes, for more information in Appendix D.

Adult *Sebastes mystinus* abundances remained similar to recent years at Anacapa Island sites and increased overall at the remaining four islands to some the highest densities recorded in at least the past decade. Juvenile *S. mystinus* abundances decreased at all 33 sites. This is following last year's record high densities at many sites. Adult *Sebastes serranoides* increased at all Santa Barbara, Anacapa, and Santa Cruz Islands, changed little at San Miguel Island, and decreased overall at Santa Rosa Island. Juvenile *S. serranoides* decreased at all five park islands. This is following last year's record high densities observed at most sites. Adult and juvenile *Sebastes serriceps* abundances changed little from recent years. Adult *Sebastes atrovirens* decreased overall at Santa Rosa and San Miguel Islands, and changed little at the remaining islands. Juvenile abundances remained similar to last year. At Santa Barbara Island, KGBs decreased from the record high abundances observed last year. There were overall decreases at Anacapa Island as well. Abundances at the remaining islands changed little. KGBs were observed at 13 sites. Overall, there was significantly less juvenile Sebastes spp. compared to last.

Juvenile *Sebastes paucispinis,* bocaccio, were recorded at nine sites, similar to recent years. Adult *S. caurinus,* copper rockfish, decreased at San Miguel Island sites and changed little at the remaining sites. They were observed at 13 sites. Juveniles remained rare. Adult *S. miniatus,* vermillion rockfish, remained similar to previous years with observations at three sites. Juvenile *S. miniatus* abundances decreased from last year's recruitment event at Santa Barbara Island and were observed at a total of nine sites. Adult *S. chrysomelas*, black and yellow rockfish, abundance was similar to past years, and was observed at 24 sites. Adult *S. carnatus*, gopher rockfish, were observed at 14 sites, similar to recent years. Adult *S. auriculatus*, brown rockfish, were observed at three Santa Cruz Island sites, similar to last year, as well as one site at Anacapa Island. Juvenile *S. auriculatus* were not observed, similar to last year. Adult *S. melanops*, black rockfish, were observed at three sites, similar to recent years. Adult *S. rastrelliger,* grass rockfish, were observed at six sites. One juvenile *S. entomelas*, widow rockfish, was observed at Anacapa Island. This species is rarely seen at KFM sites. Another rare species observed this year was *S. hopkinsi*, squarespot rockfish. A juvenile was observed at two Santa Cruz Island sites.

Adult *Ophiodon elongatus,* lingcod, were observed at 12 sites, similar to recent years. A total of 18 adult *Scorpaenichthys marmoratus*, cabezon, were observed at 18 sites. One juvenile was observed at Anacapa Island. Adult *Caulolatilus princeps*, ocean whitefish, were observed at eight sites, similar to last year. Adult *Stereolepis gigas,* giant black sea bass, were observed at two Anacapa Island sites, with one observed at each site. However, we observed *S. gigas* at several other sites after the fish counts were conducted. One *Squatina californica*, Pacific angel shark, was observed this year during the fish counts at two sites, similar to past years. Soupfin sharks, *Galeorhinus galeus*, were observed at two Santa Rosa Island sites.

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. If these three ARMs survive several years, more may be deployed at this island. A description of ARMs recruitment data can be found in the discussion section for each monitored species.

At Cathedral Cove, Anacapa Island, ARM #2476 was damaged and not sampled. The ARM was repaired.

At Admiral's Reef, Anacapa Island, the ARMs were covered in *Ophiothrix spiculata* and also had moderately high cover of *Balanus* sp. on the ARMs bricks.

At Johnson's Lee North, on 7/30/14, ARM #2398 from the middle group was changed to #2481 due to missing number tag. On 9/30/14, the cage from ARM #2481 was found inshore 170 m. The bricks were scattered around the site. Nine of the bricks were intact and were moved to the middle group for possible reuse. The two ARMs in the north group (2449 and 2477) were found upside down and one had moved about 10 ft. One ARM in the south group was missing the lid/ tag number.

At Johnson's Lee South, Santa Rosa Island, one *Brosmophycis marginata*, red brotula, was observed in one of the ARMs, same as last year. Eight heart crabs, *Phyllolithodes papillosus,* were found in the ARMs. Six were measured (9 mm, 12 mm, 14 mm, 29 mm, 31 mm, 31 mm). ARM 2417 needed repairs and was not sampled.

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

At Scorpion Anchorage, Santa Cruz Island, barnacles covered the bricks in the ARMs.

At Yellow Banks, Santa Cruz Island, nine ARMs were sampled for all indicator species and six ARMs were sampled for all indicator species except for *Strongylocentrotus franciscanus* and *S. purpuratus*. There was a high prevalence of diseased *Strongylocentrotus* spp. in several of the ARMs; both black spot disease and wasting disease.

Invasive Species

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

Sargassum muticum has become abundant at many KFM sites. This year it appeared more abundant than has been observed at KFM sites in several decades. This invasive species was originally added as an indicator species when the KFM program began in 1982. Due to low abundances at the time, sampling was discontinued in 1984.

The non-native bryozoan *Watersipora subtorquata* was observed in 2011 for the first time at KFM sites Fry's Harbor on Santa Cruz Island and Cathedral Cover on Anacapa Island. No notes were taken this year on this species.

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 close 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 2013 to April 2014. Refer to Appendix L for temperature summary graphs by site.

The region experienced above average water temperatures from October 2013 through the winter. Mean monthly benthic water temperatures for February, March and April were some of the highest recorded since we installed loggers at KFM sites in the early 1990s. Temperatures remained anomalously warm up to April 30th 2014, which is the end of the time period covered for water temperatures in this annual report.

Literature Cited

California Department of Fish and Game, Marine Region (CDFG). 2004. Annual status of the fisheries report through 2003, Page 1–5. Available at http://www.dfg.ca.gov/marine/status/ (accessed 24 April 2012).

Davis, G. E. 1985. Kelp forest monitoring program: preliminary report on biological sampling design. Univ. of Cal. Davis Coop. National Park Resources Studies Unit. Tech. Rept. No. 19.

Davis, G. E. 1986. Kelp forest dynamics in Channel Islands National Park, California, 1982–85. Channel Islands National Park and National Marine Sanctuary Natural Science Study Reports. CHIS-86-001.

Davis, G. E., and W. L. Halvorson. 1988. Inventory and monitoring of natural resources in Channel Islands National Park California. Channel Islands National Park Natural Science Reports, Ventura, California.

Davis, G. E., D. J. Kushner, J. M. Mondragon, J. E. Mondragon, D. Lerma, and D. Richards. 1997. Kelp forest monitoring handbook: Channel Islands National Park. Volume 1: Sampling Protocol. Channel Islands National Park, Ventura, California.

Davis, G. E., D. V. Richards, and D. J. Kushner. 1996. Kelp forest monitoring design review. Technical Report CHIS-96-01.

Eckert, G. L., J. M. Engle, and D. J. Kushner. 1999. Sea star disease and population declines at the Channel Islands. Proc. 5th California Island Sym. 5, 390–393. Engle, J. M. (Personal Communication). Tatman Foundation, Santa Barbara, California.

Hewson, I., J. Button, B, Gudenkauf, B. Miner, A. Newton, J. K. Gaydos, J. Wynne, C. Groves, G. Hendler, M. Murray, S. Fradkin, M. Breitbart, E. Fahsbender, K. D. Lafferty, A. M. Kilpatrick, C. M. Miner, P. Raimondi, L. Lahner, C. S. Friedman, S. Daniels, M. Haulena, J. Maliave, C. A. Burge, M. E. Eisenlord, and C. D. Harvell. 2014. Densovirus associated with sea-star wasting disease and mass mortality. Proceedings of the National Academy of Sciences. 111(48):17278-83. Doi: 10.1073/pnas.1416625111.

Kushner, D. J., D. Lerma, S. Alesandrini, and J. Shaffer. 2000. Kelp forest monitoring, 1998 annual report. Technical Report-CHIS-99-01.

Kushner, D. J., D. Lerma, and M. Donahue 2001. Kelp forest monitoring, 2000 annual report. Technical Report-CHIS-01-07.

Kushner, D. J., D. Lerma, J. Mondragon, and J. Morgan. 1997. Kelp forest monitoring, 1995 annual report. Technical Report-CHIS-97-01.

Kushner, D. J., D. Lerma, and P. Rich. 2007a. Kelp forest monitoring, 2002 annual report. Technical Report-CHIS-07-01.

Kushner, D. J., D. Lerma, and P. Rich. 2007b. Kelp forest monitoring, 2003 annual report. Technical Report-CHIS-07-02.

Kushner, D. J., D. Lerma, and D. V. Richards. 1995. Kelp forest monitoring, 1994 annual report. Technical Report-CHIS-95-03.

Kushner, D. J., D. Lerma, J. Shaffer, and B. Hajduczek. 2001. Kelp forest monitoring, 1999 annual report. Technical Report-CHIS-01-05.

Kushner, D. J., D. Lerma, and K. Ugoretz. 2004. Kelp forest monitoring, 2001 annual report. Technical Report-CHIS-03-02.

Kushner, D. J., K. J. Moore, E. A. Mooney, S. N. Ibarra, J. R. Grunden, and J. R. Metzger. 2013. Kelp forest monitoring: Annual report 2009. Natural Resources Data Series NPS/MEDN/NRDS-2013/581. National Park Service, Fort Collins, Colorado.

Kushner, D. J., J. Morgan, J. Mondragon, and D. Lerma. 1997. Kelp forest monitoring, 1996 annual report. Technical Report-CHIS-97-04.

Kushner, D. J., J. Morgan, J. Mondragon, and D. Lerma. 1998. Kelp forest monitoring, 1997 annual report. Technical Report-CHIS-98-05.

Kushner, D. J., M. Moss, J. L. Sprague, and K. J. Moore. 2012. Channel Islands National Park kelp forest monitoring program: Annual report 2005. Natural Resource Data Series NPS/MEDN/NRDS—2012/376. National Park Service, Fort Collins, Colorado.

Kushner, D. J., M. D. Moss, J. L. Sprague, and K. J. Moore. 2013. Kelp forest monitoring: Annual report 2006. Natural Resource Data Series NPS/MEDN/NRDS—2013/478. National Park Service, Fort Collins, Colorado.

Kushner, D. J., P. Rich, and J. Sprague. 2007. Kelp forest monitoring, 2004 annual report. Technical Report-CHIS-07-03.

Kushner, D. J., and J. Sprague. In Progress. Kelp forest monitoring handbook, Volume 1: sampling protocol. Channel Islands National Park, Ventura, California. Contact Channel Islands National Park for more information.

Kushner, D., R. Walder, L. Gorodezky, D. Lerma, and D. V. Richards. 1995. Kelp forest ecological monitoring, Channel Islands National Park (1993 annual report). Technical Report CHIS-95-02.

Love, M., D. Teebken-Fisher, J. E. Hose, J. J. Farmer, III, F. W. Hickman, and G. R. Fanning. 1981 *Vibrio damsela*, a marine bacterium, causes skin ulcers on the damselfish *Chromis punctipinnis*. Science 214:1139–1140.

Moore, K. J., D. J. Kushner, J. L. Sprague, and M. Moss. 2013. Kelp forest monitoring: Annual report 2007. Natural Resource Data Series NPS/MEDN/NRDS—2013/547. National Park Service, Fort Collins, Colorado.

Richards D., W. Avery, and D. Kushner. 1993. Kelp forest monitoring, Channel Islands National Park: 1990 annual report. Technical report (Cooperative National Park Resources Studies Unit) no. 52. NPS/WRUC/NRTR 93-05. Cooperative National Park Resource Studies Unit, Univ. of California, Institute of Ecology, Davis, California.

Richards, D. V., C. Gramlich, G. E. Davis, and M. McNulty. 1997. Kelp forest ecological monitoring, 1982–1989. Channel Islands National Park, Ventura, California. Technical Report-CHIS-97-05.

Richards, D. V., and D. Kushner. 1994. Kelp forest monitoring, 1992 annual report. Channel Islands National Park, Ventura, California. Technical Report-CHIS-94-01.

Richards D., D. Kushner, and W. Avery. 1993. Kelp forest monitoring, Channel Islands National Park: 1991 annual report. Technical report (Cooperative National Park Resources Studies Unit) no. 53. NPS/WRUC/NRTR 93-06. Cooperative National Park Resource Studies Unit, Univ. of California, Institute of Ecology, Davis, California.

Schroeter, S. C., J. D. Dixon, and R. O. Smith. 1994. Evaluation of the sampling design for the kelp forest monitoring program, Channel Islands National Park – Volume I analysis & discussion. Ecometrics, Carlsbad, California.

Sprague, J. L., M. A. Civiello, D. J. Kushner, K. J. Moore, S. N. Carter, J. J. Centoni, and S. M. Fejtek. 2013. Channel Islands National Park kelp forest monitoring program: Annual report 2012. Natural Resource Data Series NPS/MEDN/NRDS—2013/479. National Park Service, Fort Collins, Colorado.

Sprague, J., and D. Kushner. 2020. Channel Islands National Park: 2014 Kelp Forest Monitoring Results. Tabular dataset. National Park Service, Mediterranean Coast Network, Ventura, California. Available from https://irma.nps.gov/DataStore/Reference/Profile/2259651.

Sprague, J. L., D. J. Kushner, J. R. Grunden, J. A. McClain, and D. Simpson. 2020. Channel Islands National Park kelp forest monitoring program: Annual report 2013. Natural Resource Data Series NPS/MEDN/NRDS—2020/2146. National Park Service, Fort Collins, Colorado.

Sprague, J. L., D. J. Kushner, and K. J. Moore. 2013. Kelp forest monitoring: Annual report 2008. Natural Resource Data Series NPS/MEDN/NRDS—2013/572. National Park Service, Fort Collins, Colorado.

Sprague, J. L., K. J. Moore, J. R. Grunden, S. N. Ibarra, E. A. Mooney, G. Scheer, and D. J. Kushner. 2012. Channel Islands National Park kelp forest monitoring program: Annual report 2010. Natural Resource Data Series NPS/MEDN/NRDS—2012/334. National Park Service, Fort Collins, Colorado.

Sprague, J. L., S. B. Traiger, J. R. Grunden, S. N. Ibarra, E. A. Mooney, K. J. Moore, and D. J. Kushner. 2013. Channel Islands National Park kelp forest monitoring program: Annual report 2011. Natural Resource Data Series NPS/MEDN/NRDS—2013/480. National Park Service, Fort Collins, Colorado.

Swartzman, G., and B. Hickey. 2003. Evidence for a regime shift after the 1997–1998 El Niño, based on 1995, 1998, and 2001 acoustic surveys in the Pacific Eastern Boundary Current. Estuaries 26(4):1032–1043. Retrieved from http://www.jstor.org/stable/1353382.

Whitaker, S. G. 2020. Rocky intertidal community monitoring at Channel Islands National Park: 2014 annual report. Natural Resource Data Series NPS/MEDN/NRDS—2020/1306. National Park Service, Fort Collins, Colorado.

Woodhouse, C. D. (Principle Investigator). 1981. Literature review of the resources of Santa Cruz and Santa Rosa Islands and the marine waters of Channel Islands National Park, California. Santa Barbara Museum of Natural History Contract Rep. Nat. Park Serv. CX 8000-0-0028. 2 Vol.

Zacharias, M. A., and D. J. Kushner. 2006. Sea temperature and wave height as predictors of population size structure and density of *Megastraea* (*Lithopoma*) *undosa*: Implications for fishery management. Bulletin of Marine Science 79(1):71–82.

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

Protocol Changes

No protocol changes were made this year.

Sampling Difficulties

All proposed data collection was completed this year.

Database Changes/Corrections

In 1989, at Admiral's Reef on Anacapa Island, we believe that it is possible that *Eugorgia rubens* (purple gorgonian) were recorded as *Lophogorgia chilensis* on band transects due to the record high density that year. Between 1985 and 1999, the mean density for *L. chilensis* was approximately $0.1/m^2$, except 1989 where it increased to $0.7/m^2$ and then returned to $0.1/m^2$ the following year. Size frequencies indicate that only adult *L. chilensis* were present, indicating no recruitment event occurred, so it was determined that the observer/s incorrectly counted *E. rubens*, which are abundant at this site, instead of *L. chilensis*. To correct the error, the mean density per transect for count A+B combined was calculated from 1983-1990, excluding 1989. Those values were used to replace the original values (Table A-1).

Table A-1. Corrected conts for mean density per transect.

Transect #	Original Count A+B	Corrected Count A+B
1	48	4
2	35	4
3	23	5
4	44	5
5	36	6
6	13	5
7	36	5
8	70	5
9	109	5
10	33	3

Table A-1 (continued). Corrected conts for mean density per transect.

Transect #	Original Count A+B	Corrected Count A+B
11	24	4
12	33	4

Additional Projects

Cucumber Survey with CDFW

California Department of Fish and Wildlife conducted surveys of *Parastichopus parvimensis* to get density data at several of the KFMP sites. Divers from CHIS participated in these surveys. This data will be used to inform the management of the cucumber fishery in California. Information regarding these dives can be found in Appendix J – Survey Dives.

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. This wave project was conducted by Kevin Lafferty with the United States Geological Survey (USGS) and funded by the Bureau of Ocean Energy Management (BOEM).

Submerged Resource Center Photography Cruise

On October 28th-31st, the Submerged Resources team conducted a photo shoot for stock park footage along with several KFM divers. The locations visited and the site summaries were included in Appendix J – Survey Dives.

Appendix B. KFM Program Data Usage and Information Requests for 2014

Publications

The following scientific paper using KFM data was published in 2014:

NMFS. 2014. Status Review Report for Pinto Abalone (*Haliotis kamtschatkana*). Prepared by the Status Review Team for the NMFS West Coast Region, Long Beach, CA 264 pp.

Data Requests

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

Robin Elahi, postdoctoral scholar from Hopkins Marine Station at Stanford University, downloaded summary data from the ecological archives data paper, http://dx.doi.org/10.1890/13-0562R.1, as part of a synthesis asking how local marine biodiversity has changed over the last five decades. The synthesis covers a variety of taxa and ecosystems from across the globe, and includes a total of 439 time-series from 189 sites.

Christy Juhasz from CDFW was sent ARMs data for Haliotis rufescens from the KFM site Miracle Mile, San Miguel Island to compare densities with their Van Damme State Park site. She was also sent temperature for all KFM sites to assess habitat suitability for H. sorenseni.

Ian Taniguchi from CDFW was sent ARMs and Band Transect data for Haliotis assimilis.

David Witting from NOAA was sent Band Transect data for Haliotis spp. to be used in a presentation on abalone populations.

Jim Marshall from the California Abalone Association was sent site mapping data to compare species densities to substrate type and rugosity.

Nick Shears, a professor from the University of Auckland, was sent Parastichopus parvimensis data for 1 m^2 quadrats. He was examining differences in abundances inside versus outside of Channel Islands MPAs.

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 (Table C-1 and Table C2). 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

Table C-1. Sites #1–16.

Taxon	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	X	0	1	0	–	1	1	2	0	2	X	X	1	1	1
	Derbestia spp.	0	X	X	–	0	–	1	1	1	0	–	–	X	2	X	0
	Ulva spp.	0	X	1	–	0	X		0	0	0	2	–	1	1	X	0
	other green algae	1	1	1	–	0	–	1	–	1	–	2	X	X	1	–	0
PHAEOPHYTA	*Agarum fimbriatum*	0	0	0	1	0	2/j1	0	0	0	1	0	0	0	0	0	0
	Colpomenia spp.	–	0	0	0	0	1	1	2	2	0	3	X	X	X	1	0
	Cystoseira spp.	2	0	2	1	0	–	0	0	1	2	0	3/j2	2	2	1	2
	Desmarestia spp.	2	1	2	2	1	1	0	0	0	0	2/j2	2/j2	2	2	2	0
	Dictyoneuropsis	3	0	0	2	0	0	0	0	0	0	1	0	0	0	1	0
	Dictyota/Pachydictyon	0	0	1	2	0	2	0	0	1	1	1	2	2	2	2	3
	Eisenia arborea	2/j0	0/j1	0/j0	2/j1	0	2/j2	2/jd	0	1	?	2/j2	2/j3	3/j2	1/j	2/j1	1/j0
	Laminaria farlowii	0	0	3/j2	2/j1	0	1/j1	0	0	1/j2	2/j2	0	3/j3	4/j3	0	0/j0	0/j1
	Macrocystis pyrifera	3/j1	0/j1	3/j3	4/j1	0/j1	2/j2	2/j1	0	2/j2	2/j1	2/j2	3/j3	3/j2	3/j2	1/j1	2/j3
	Pterygophora californica	3/j0	0	3/j3	1/j1	0	0/j1	0	0	0	1/j1	0	1/j0	3/j2	0	0/j0	0
	Sargassum muticum	0	0	0	0	0	0	0	0	3	0	0	2	1	1	1	2
	Sargassum horneri	0	0	0	0	0	0	0	0	1	0	3/j3	2/j2	1/j1	2/j2	0	1
	other brown algae	1	1	1	1	1	2	1	1	2	1	X	2	2	1	1	2
RHODOPHYTA	*Callophyllis* spp.	2	0	–	X	0	0	0	0	0	0	0	–	0	0	0	–
	Cryptopleura spp.	–	0	–	X	0	0	0	0	0	0	0	–	–	0	0	–
	Gelidium spp.	0	0	0	0	0	–	1	0	1	0	1	2	3	1	2	–
	Gigartina spp.	1	0	2	2	1	1	3	0	1	0	1	1	2	1	0	–
	Laurencia spp.	0	2	0	0	2	X	0	1	2	1	X	2	–	X	2	2
	Plocamium spp.	–	0	0	0	0	0	0	0	0	0	0	3	2	?	0	–
	Rhodymenia spp.	2	1	2	X	X	2	4	0	–	–	X	X	2	0	0	–
	Articulated coralline	2	2	2	2	1	2	1	1	1	2	1	2	2	1	1	2
	Encrusting Coralline	2	4	2	2	4	2	2	3	3	3	4	2	2	3	3	3
	Other red algae	2	1	3	3	1	2	3	1	1	2	2	2	2	X	2	1
MISC.PLANT	(diatom film or *Phyllospadix* spp.)	1	1	1	1	1	2	3	1	2	1	3	X	1	2	2	3
BARE ROCK	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2

Table C-1 (continued). Sites #1–16.

Taxon	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
PORIFERA	*Haliclona* sp.	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	Hymenamphiastra (Acanthancora) cyanocrypta	–	–	–	–	–	–	–	–	–	–	X	X	X	–	0	–
	Polymastia pacifica	–	–	–	2	–	–	–	–	–	–	0	0	–	0	0	0
	Tethya aurantia	4	2	3	3	3	4	3	1	2	3	2	1	1	3	0	1
	Other sponges	1	2	4	3	2	2	2	1	1	1	2	2	3	2	2	1
ANTHOZOA	*Anthopleura* spp.	2	2	2	–	X	–	1	1	1	1	X	2	X	2	2	1
	Astrangia lajollaensis	1	3	2	2	3	2	3	3	2	2	2	2	1	0	1	1
	Balanophyllia elegans	1	2	2	3	2	2	2	2	2	2	?	?	1	0	2	1
	Corynactis californica	2	2	2	2	2	2	2	2	2	1	2	2	2	1	3	2
	Eugorgia rubens	0	0	0	0	0	0	2	1	0	0	3	0	0	0	0	0
	Lophogorgia chilensis	0	0	0	2	1	2	3	2	1	1	2	1	1	2	1	0
	Metridium spp.	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Muricea californica	0	0	0	1	0	0	0	0	0	1	2	0	0	2	1	1
	Muricea fruticosa	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0
	Sagartia/Cactosoma spp.	1	1	1	0	1	–	–	0	–	1	–	2	–	1	1	2
	Urticina lofotensis	3	1	2	2	2	0	1	0	0	0	0	0	0	0	0	0
	Urticina spp.	X	2	2	1	2	X	1	1	1	1	2	1	X	2	2	–
HYDROZOA	Hydroids spp.	2	1	3	3	1	2	3	1	1	1	2	3	3	1	2	1
	Stylaster californicus	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0
ANNELIDA	*Chaetopterus* sp.	X	X	2	3	2	2	X	2	2	1	X	–	X	X	X	2
	Diopatra ornata	2	1	3	3	2	3	2	1	1	2	–	2	1	1	2	2
	Dodecaceria fewkesi	X	2	X	X	X	X	–	1	1	–	1	X	–	X	3	2
	Phragmatopoma californica	2	0	2	1	0	0	0	–	1	1	0	1	1	1	0	2
	Salmacina tribranchiata	–	X	2	2	X	X	0	1	1	–	X	–	X	1	X	–
	Spirobranchus spinosus	0	1	1	1	–	1	2	1	2	1	2	2	–	1	2	2
ARTHROPODA/ Crustacea	*Balanus* spp.	4	3	3	2	3	2	3	4	4	3	2	2	2	1	3	2
	Cancer spp.	4	2	3	2	1	1	3	1	1	0	2	0	–	1	1	0
	Panulirus interruptus	0	0	1	0	1	1	0	0	3	1	1	2	3	1	0	2

Table C-1 (continued). Sites #1–16.

Taxon	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
BRYOZOA	*Bugula californica*	2	–	2	2	–	1	2	0	1	1	1	3	2	2	2	2
	Costazia costazi	X	–	X	X	–	X	X	–	–	–	–	–	–	–	–	–
	Diaperoecia (Diaperoforma) californica	1	1	2	2	1	2	2	1	1	1	2	2	3	2	1	1
	Membranipora spp.	2	2	2	3	1	2	3	1	1	1	X	3	3	2	X	2
	Other bryozoans	2	1	4	3	1	2	3	1	1	1	X	3	3	X	X	X
TUNICATES	Tunicates	1	–	–	2	–	2	2	1	1	1	1	2	3	1	1	1
	Styela montereyensis	2/j1	0	2/j1	1	0	0	1	0	0	1	0	0	0	0	0	0
Misc. Invertebrate	–	–	2	3	3	–	3	3	2	–	2	2	–	2	1	–	2
MOLLUSCA	*Aplysia californica*	1	3	1	1	2	2	1	2	2	0	1	2	1	1	3	3
	Bursa californica	3	1	0	1	0	0	0	1	0	1	1	–	0	1	0	0
	Crassedoma gigantea	2/j2	1	2/j2	1/j2	1	1	2/j1	2	1	1	2	2/j2	3/j3	1	1	2
	Cryptochiton stelleri	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Cypraea spadicea	1/j1	2	2	2	2	4	3	1	2	2	2	1	2	2	2	2
	Haliotis assimilis	0	1	0	0	1	S	0	0	0	1	0	0	0	0	0	?
	Haliotis corrugata	0	0	0	0	0	0	0	0	0	1	0	1	1	0	S	1
	Haliotis fulgens	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	?
	Haliotis rufescens	3/j0	1/j2	2/j0	1/j1	1	0	1	0/s	S	1	0	0	0	0	0	0
	Haliotis sorenseni	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Kelletia kelletii	4	1/j2	0	1/j1	2	1	2/j0	1/j3	1/j2	1/j3	1	–	2/j2	1/j1	0	0/j1
	Lithopoma gibberosa	2/j0	2/j1	0	1	3	1	0	1	0	3	0	0	1	1	0	2
	Megastraea undosa	0	0	1	0	0/j1	1/j1	1/j1	1/j3	1/j3	4	1	2	2/j0	2	2/j2	3/j2
	Megathura crenulata	1	1	2	1	1	1	2	1	1	1	2	1	1	1	1	1
	Octopus spp.	1	X	X	X	3	X	X	1	X	1	X	1	X	1	2	2
	Serpulorbis squamigerus	X	2	2	1	–	2	2	2	2	1	X	2	2	2	2	2
	Tegula regina	0	0	0	0	0	1	1	1	0	0	2	1	1	2	3	4
ECHINODERMATA	*Centrostephanus coronatus*	0	0	0	0	0	1	0	1	1	1	2	2	2	2	1	1
	Cucumaria spp.	2	1	2	2	1	2	2	2	2	1	2	2	2	–	2	1
	Dermasterias imbricata	2	1	2	4	2	0	0	0	0	0	0	0	0	–	0	0

Table C-1 (continued). Sites #1–16.

Taxon	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
ECHINODERMATA (continued)	*Linckia* sp.	0	0	0	0	0	0	2	1	1	0	2	2	2	1	?	?
	Lytechinus anamesus	0	0	1	0	2/j1	3	1	2	0	2	1	0	0	0	1	1
	Ophiothrix spiculata	1	2	1	1	2	3+	1	1	1	1	4	1	1	3	2	1
	Pachythyone rubra	0	0	0	0	0	0	2	2	0	0	0	0	0	0	0	0
	Parastichopus californicus	1	0	0	1	0	1	1	0	0	0	0	0	0	0	0	0
	Parastichopus parvimensis	2	1	0	1	1	2	1	1	3	1	2	3	3/j1	2	2	2
	Patiria miniata	3/j0	4	2/j1	3	4	3	4	2	1	3	2	1	1	2	2	1
	Pisaster giganteus	1	2	1/j1	1	1	1	1	1	1	1	1	1	1/j2	1	1	0
	Pisaster ochraceus	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0
	Pycnopodia helianthoides	0	0/j1	0	0	0/j1	0	0	0	0	0	0	0	0	0	–	0
	Strongylocentrotus. purpuratus	2/j1	3/j1	3/j1	2/j1	2/j1	2/j2	2/j1	3/j1	3/j1	3/j1	2/j0	2/j1	2/j1	2/j0	4/j4	3/j0
	Strongylocentrotus. franciscanus	2/j1	4/j1	2/j1	2/j1	3/j1	2/j2	2/j1	2/j0	2/j1	3/j1	2/j0	2/j1	2/j1	1/j0	2/j2	2/j0
FISH	*Lythrypnus dalli*	0	0	0	0	0	0	1	0/j2	0	0	0	0	1	0	0	0
	Coryphopterus (Rhinogobiops) nicholsii	1	3	2	2	2	2	3	3	3	2	3	2	2	2	2	2
	Alloclinus holderi	0	0	0	0	0	0	1	1	1	0	0	1	1	1	0	2

Table C-2. Sites #21–37.

Taxon	Species	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	–	0	1	1	0	1	2	2	0	2	1	2	1	1	4	1	–
	Derbestia spp.	–	0	–	0	0	X	1	2	1	0	0	2	3	0	1	2	1
	Ulva spp.	X	0	1	2	1	–	1	1	0	0	0	0	0	1	–	0	–
	other green algae	1	0	1	–	1	–	1	2	?	0	–	2	4	1	–	0	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	0	1	0	–	3	?	1	1	2	–	0	2	1	–	X
	Cystoseira spp.	1	1	2	2	3	0	1	2	0	1	1	1	1	1	1	3	2
	Desmarestia spp.	1	2	2	2	3	1	3	1	0	1	2	0/j1	1	0	2/j2	2	0
	Dictyoneuropsis	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	–	0

Table C-2 (continued). Sites #21–37.

Taxon	Species	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
PHAEOPHYTA (continued)	*Dictyota/Pachydictyon*	2	2	2	2	1	1	3	2	?	1	3	2	2	1	2	3	2
	Eisenia arborea	2/j2	3/j2	2/j1	1/j1	0	1/j2	3/j4	2/j2	0/j1	1/j2	1/j3	1/j0	1/j1	1/j1	2/j2	0/j1	2/j2
	Laminaria farlowii	0	1/j0	0	1/j0	3/j2	0	0/j1	0/j1	0	0	1/j2	0	1/j2	0	0	1/j0	0/j1
	Macrocystis pyrifera	4/j1	3/j2	3/j2	3/j2	3/j2	0/j1	2/j2	3/j2	0/j1	1/j1	0/j1	1/j1	2/j2	1/j1	1/j2	3/j2	3/j2
	Pterygophora californica	2/j1	2/j1	2/j2	2/j2	3/j2	0	0	0	0	0	0	0	0/j0	0	0/j0	0/j1	0
	Sargassum muticum	0	0	0	0	0	0	2	1	0	0	1	1	1	1	0	2	0
	Sargassum horneri	0	0	0	0	0	0	2/j2	2/j3	0	1	1/j2	1/j2	3/j3	0	0	2/j2	0
	other brown algae	2	2	2	2	1	–	2	2	1	1	2	1	2	1	–	2	X
RHODOPHYTA	*Callophyllis* spp.	X	3	X	2	2	0	0	0	0	0	0	0	–	0	0	0	0
	Cryptopleura spp.	3	3	X	2	2	0	0	–	0	0	0	0	–	0	0	0	0
	Gelidium spp.	0	1	–	0	0	1	2	2	0	0	0	0	0	1	–	1	2
	Gigartina spp.	2	2	2	2	2	–	1	2	0	0	0	0	1	1	0	1	2
	Laurencia spp.	–	0	2	0	0	3	2	1	2	1	2	1	–	2	2	1	X
	Plocamium spp.	0	0	0	0	0	0	0	–	0	0	–	0	0	0	–	2	X
	Rhodymenia spp.	2	3	X	3	2	X	1	X	X	0	X	1	–	0	2	0	X
	Articulated coralline	3	3	2	3	2	1	1	2	1	2	1	1	1	1	1	2	1
	Encrusting Coralline	2	3	3	2	2	3	2	2	3	3	3	3	3	3	3	2	2
	Other red algae	3	3	2	3	3	2	2	3	2	1	2	1	3	1	2	–	2
MISC.PLANT	(diatom film or *Phyllospadix* spp.)	1	1	1	1	1	2	2	X	3	2	2	1	2	1	2	1	1
BARE ROCK	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
PORIFERA	*Haliclona* sp.	–	–	X	–	–	X	?	–	–	0	0	–	–	–	0	–	–
	Hymenamphiastra (Acanthancora) cyanocrypta	–	X	X	2	1	–	0	–	X	0	0	1	–	–	–	–	2
	Polymastia pacifica	–	2	2	2	2	0	0	–	0	0	0	0	–	–	1	–	1
	Tethya aurantia	3	4	3	2	2	3	2	2	2	2	1	2	2	2	1	3	1
	Other sponges	2	–	2	2	4	2	1	3	2	1	1	1	–	1	3	2	2
ANTHOZOA	*Anthopleura* spp.	X	2	–	2	2	2	1	1	X	1	2	1	0	2	2	2	2
	Astrangia lajollaensis	1	1	2	1	0	3	2	3	3	2	2	1	–	2	1	1	2
	Balanophyllia elegans	2	2	3	2	1	3	2	2	2	1	1	0	1	1	2	1	1

Table C-2 (continued). Sites #21–37.

Taxon	Species	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
ANTHOZOA (continued)	*Corynactis californica*	2	2	3	2	2	2	2	2	2	3	2	3	2	2	2	2	2
	Eugorgia rubens	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0
	Lophogorgia chilensis	0	0	0	0	0	3	2	3	3	2	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	2	1	2	1
	Muricea fruticosa	0	0	0	0	0	1	1	1	0	0	1	1	1	1	1	0	1
	Sagartia/Cactosoma spp.	1	0	0	2	1	X	0	0	1	1	2	1	0	3	–	3	1
	Urticina lofotensis	3	2	3	2	2	0	0	0	0	0	0	0	0	0	0	0	0
	Urticina spp.	2	2	2	2	2	2	1	1	–	1	2	1	1	2	4	2	X
HYDROZOA	*Hydroids*	2	3	2	2	2	2	3	3	3	2	2	1	1	1	2	2	3
	Stylaster californicus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
ANNELIDA	*Chaetopterus* sp.	2	3	X	2	3	2	1	X	X	3	3	2	1	2	1	2	X
	Diopatra ornata	1	3	2	3	2	2	1	2	1	2	1	1	1	2	0	1	2
	Dodecaceria fewkesi	X	2	X	2	2	2	2	1	–	1	1	1	–	2	0	1	0
	Phragmatopoma californica	2	2	2	2	2	0	0	1	0	0	0	0	0	0	0	1	2
	Salmacina tribranchiata	–	2	X	2	2	2	2	2	–	1	0	0	–	1	0	0	
	Spirobranchus spinosus	1	1	1	1	1	1	2	1	1	2	2	2	1	2	2	1	1
ARTHROPODA/ Crustacea	*Balanus* spp.	3	2	3	3	3	4	2	3	3	4	4	2	1	2	2	1	2
	Cancer spp.	2	1	1	2	2	1	0	1	1	0	1	0	1	1	1	1	0
	Panulirus interruptus	0	0	0	1	1	0	3	2	0	1	1	0	3	1	1	1	2
BRYOZOA	*Bugula californica*	0	2	X	1	2	1	1	3	X	1	2	0	2	2	2	3	3
	Costazia costazi	–	–	–	2	–	–	–	X	–	0	–	0	–	X		0	X
	Diaperoecia (Diaperoforma) californica	1	2	1	2	1	2	2	3	2	1	1	1	1	1	2	1	2
	Membranipora spp.	2	2	2	2	3	X	2	2	X	1	2	1	3	1	2	2	X
	Other bryozoans	2	3	2	2	2	2	2	3	2	1	1	1	2	1	1	–	2
TUNICATES	Tunicate	–	2	2	2	2	2	1	3	1	1	–	1	1	1	2	2	3
	Styela montereyensis	1	2	2	2	2	0	0	0	0	0	0	0	0	0	0	0	0
Misc. Invertebrate	–	–	3	2	2	3	4	3	3	–	3	–	1	1	–	–	–	2

Table C-2 (continued). Sites #21–37.

Taxon	Species	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	*Aplysia californica*	0	1	1	1	1	2	2	0	1	2	1	3/j3	1	2	2	1	0
	Bursa californica	0	0	0	0	0	0	0	0	1	2	1	1	0	2	3	0	1
	Crassedoma gigantea	1/j2	2	2	3	1	1	3/j1	3/j3	2	2	1/j1	2/j2	1	2	1	1	2/j3
	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	2	2	2	2	2	1	2	1	2	2	2	2
	Haliotis assimilis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Haliotis corrugata	0	0	0	0	0	1	0	0	0	0	S	0	0	0	0	0	1
	Haliotis fulgens	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
	Haliotis rufescens	4/j1	1	S	2/j1	3/j1	0/s	0	0	0	0	S	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	0	0	1	1	2/j2	2/j1	1/j1	2	1	3/j1	0	1	1	0	0
	Lithopoma gibberosa	2/j1	1	1	0	1	1	2	1	2	1	0	0	0	1	4	0	1
	Megastraea undosa	0	1	0	0	1	2	2/j1	2	2/j2	3	1	1/j2	2	1	2	2	2
	Megathura crenulata	2	2	2	2	1	4	1	1	2	1	1	0/j1	0	1	2	1	1
	Octopus spp.	X	X	–	1	1	1	1	1	1	3	X	1	X	X	1	1	2
	Serpulorbis squamigerus	2	2	2	2	2	2	2	2	2	2	X	2	1	2	2	2	2
	Tegula regina	0/j1	1	1	0	0	2	2	2	2	1	2	2	1	1	3	0	3
ECHINODERMATA	*Centrostephanus coronatus*	0	0	0	0	0	1	2	1	2	2	2	3	3	2	2	1	2
	Cucumaria spp.	X	2	2	2	3	3	2	4	3	2	2	2	2	2	2	1	2
	Dermasterias imbricata	1	2	2	1	2	0	0	0	0	0	0	0	0	0	0	0	0
	Linckia sp.	0	0	0	0	0	2	0	3	–	–	2	0	1	?	2	0	2
	Lytechinus anamesus	0	0	1	0	0	2/j1	1	1	2	2	2/j2	1	0	1	1	0	0
	Ophiothrix spiculata	1	2	1	1	1	1	1	1	2	2	2	3	4	3	3	3	1
	Pachythyone rubra	0	1	2	0	3	2	3	0	0	2	0	0	0	0	0	0	0
	Parastichopus californicus	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
	Parastichopus parvimensis	1	1	2	2	2	2	3	3	2	2	3	1	3	1	2	2	2
	Patiria miniata	3	3	3	3	3	2	2	1	3	2	2/j2	2	1	2	2	2	1
	Pisaster giganteus	1/j2	1	1	1	1	0	1	1	0	1	1	1	1	1	1	1	1
	Pisaster ochraceus	0	0	0	0	0	1	0	1	1	0	1	0	0	1	0	0	0

Table C-2 (continued). Sites #21–37.

Taxon	Species	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
ECHINODERMATA (continued)	*Pycnopodia helianthoides*	0/j1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Strongylocentrotus purpuratus	2/j1	3/j2	2/j1	2/j1	2/j1	3/j1	3/j1	3/j1	3/j	4/j1	3/j0	3/j1	1/j1	4/j1	2/j1	2/j1	2/j1
	Strongylocentrotus francsicanus	3/j1	2/j1	3/j1	3/j1	2/j1	2/j0	2/j1	2/j1	3/j	3/j1	2/j2	2/j1	1/j0	3/j1	2/j1	2/j1	3/j2
FISH	*Lythrypnus dalli*	0	0	0	0	0	1	1	0	1	1	1	1	1	0	0	0	0
	Coryphopterus (Rhinogobiops) nicholsii	2	1	2	1	1	2	2	2	3	4	3	3	2	2	2	1	1
	Alloclinus holderi	0	0	0	0	1	2/j2	2/j3	1	0	1	1	1	2	1	1	0	1

Appendix D. Site Field Notes

Site summaries are listed in order of site number. Refer to Figure 1 for list of sites and their locations. Refer to Table 4 for site information. These site summaries are essentially the written field notes with some relevant edits and are not formally processed.

Site #1, Wyckoff Ledge, San Miguel Island

2014 Status

Mature kelp forest

Sampling Dates and Work Completed

10/01/14: 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, S. franciscanus, Patiria miniata, Pisaster giganteus, Lithopoma gibberosa, Crassedoma gigantea, Megathura crenulata, Kelletia kelletii, Tethya aurantia, Haliotis rufescens* and *Macrocystis pyrifera* were completed. The temperature loggers were retrieved and deployed and a wave meter was deployed.

Site Notes

This is a late sampling date for this site due to poor weather conditions on previous cruises. Canopy cover was estimated at 40% and appeared thin. This site remains a mature kelp forest with a variety in the sizes of algae. Many of the large *Macrocystis pyrifera* had few stipes and appeared to be senescing, but there was new growth and smaller plants present. Juvenile *M. pyrifera* were rare. Understory red and brown algae were common, but less abundant than usual. Only one juvenile *Macrocystis pyrifera* was observed.

The most common miscellaneous invertebrate recorded during RPCs were *Balanus* sp. *Balanus* sp. were mostly tiny and covered the entire site making sampling for invertebrates difficult. Any hard substrate, including abalone and turban snails, were about 90% covered with small *Balanus* sp. *Balanus* sp. cover was the most notable change/event at this site. Mysids were abundant and thick on the bottom, obscuring video transects and sampling. There were two types - large black and smaller opaque individuals. The latter were more abundant. There were also an abundance of mysids and *Idotea* sp. in the kelp canopy. *Tethya aurantia* were abundant and small. *Cancer* sp. were abundant at the site and most abundant were both *C. antennarius* and *C. productus*. *Diaperoecia californica* were rare and in small patches. *Styela montereyensis* were scattered around the site and not very abundant.

Three *Aplysia californica* were observed and two were large. *Bursa californica* were more abundant than usual at the site. *Cryptochiton stelleri* were rare with only two large individuals observed at the site; none on band transects. *Haliotis rufescens* were moderately abundant and one 204 mm individual with withering foot syndrome, confirmed by David Kushner, was found at the southeast end of the transect. *Lithopoma gibberosa* were less abundant than in recent years and all were covered in *Balanus* sp. One large *Megathura crenulata* was observed at the site. Several large individuals were observed just off the site.

Dermasterias imbricata were common, but appeared less abundant than in recent years. *Patiria miniata* were moderately abundant and mostly very large; no small ones were observed. Some looked deflated (possibly early stage of wasting disease) and three large ones had warm water wasting disease. These were collected for potential disease studies. The large number of *Patiria miniata* and little indication of wasting disease at this colder site is indicative of *P. miniata* dying at the islands as being a result of warm water wasting disease and not the sea star wasting syndrome occurring along the entire west coast which does not appear to be related to warm water temperatures. Four *Pisaster giganteus* were observed. One small piece of a wasted individual was also observed. *Pisaster giganteus* were rare for this site, and were sampled on band transects with a density of 0.0042/m^2. *Pycnopodia helianthoides* were not observed.

One *Scorpaenichthys marmoratus* was observed guarding a clutch of eggs.

Site #2, Hare Rock, San Miguel Island

2014 Status

Dominated by *Strongylocentrotus franciscanus* and *S. purpuratus*

Sampling Dates and Work Completed

08/12/14: 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, S. franciscanus, Patiria miniata, Pisaster giganteus, Pycnopodia helianthoides, Lithopoma gibberosa, Crassedoma gigantea, Megathura crenulata, Kelletia kelletii, Tethya aurantia, Haliotis rufescens* and *Haliotis assimilis* were completed. The temperature loggers were retrieved and deployed, and a wave meter was deployed.

Site Notes

Though the site was similar to the past 30+ years, there were some changes. No kelp canopy cover was present. Other than a small amount of *Desmarestia* sp., the site was devoid of brown macroalgae. Only one juvenile *Macrocystis pyrifera* and one juvenile *Eisenia arborea* were observed. Green algae were rare and less abundant than recent years. *Laurencia* sp. were the most common red algae.

The most common miscellaneous invertebrates recorded during RPCs were *Balanus* sp., followed by terebellid worms.

Aplysia californica were moderately abundant and small; very few large individuals were observed. One 63 mm *Haliotis assimilis* was recorded during band transects. It was located seven meters inshore from the transect at meter #2. Two large *Haliotis rufescens* measuring 202 mm and 186 mm were observed. Small (< 37 mm), fresh, *H. rufescens* shells were abundant with a total of 107 found.

Most notable were the decreases in *Pycnopodia helianthoides* and *Pisaster giganteus* densities and the dramatic increase in *Strongylocentrotus purpuratus*. *Strongylocentrotus purpuratus* were present over the entire site. In recent years, they had been absent in most locations except in the shallow areas near the temperature logger. *Strongylocentrotus franciscanus* also were more abundant, similar to other KFM sites this year. Juveniles of both species were rare. *Parastichopus parvimensis* were

rare and large. *Patiria miniata* were abundant with all sizes present. Five *P. miniata* were observed with sea star wasting disease. *Pisaster giganteus* were recorded during band transects at a density of 0.011/m^2. Only one *Pycnopodia helianthoides* was observed (20 mm).

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

2014 Status

Mature kelp forest

Sampling Dates and Work Completed

07/30/14: 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, S. franciscanus, Patiria miniata, Pisaster giganteus, Megastraea undosa, Crassedoma gigantea, Megathura crenulata, Tethya aurantia, Haliotis rufescens* and *Macrocystis pyrifera* were completed. The temperature loggers were retrieved and deployed, and a wave meter was deployed. Four ARMs were sampled for all indicator species in the north and middle groups.

09/30/14: Four ARMs from the south group were sampled for all indicator species. One ARM from the north group was repaired.

Site Notes

Overall this site was similar to past years and was a mature kelp forest with large, widely spaced *Macrocystis pyrifera* plants. The kelp canopy was noticeably thinner than the last time we passed by the site in mid-July. Even with the warm water that the area has been experiencing, *M. pyrifera* appeared relatively healthy and had relatively little bryozoan growth on the fronds. Canopy cover was estimated at 65% on the first visit and only 20% on the second visit. There was a moderate amount of understory algae. Red algae were common in most areas. Brown algae were moderately abundant, and consisted mostly of *Laminaria* spp. *Pterygophora californica* were patchy in the appropriate habitat and juveniles were common. *Cystoseira* spp. were present and mostly small. *Eisenia arborea* were common on the tops of the reef but none were recorded during sampling.

The most common miscellaneous invertebrates recorded during RPCs were hydroids and *Balanus* sp. Sponges were abundant and diverse. Hydroids were moderately abundant and diverse and consisted mostly of *Obelia* sp., *Aglaophenia* sp., and *Sertularella/Sertularia* sp. *Phragmatopoma californica* were common and present in all holdfasts. *Balanus* sp. were abundant, which is unusual at this site, but similar to other KFM sites this year. *Cancer* sp. were moderately abundant with 15 observed. Bryozoans were abundant and diverse, and consisted mostly of *Thalamoporella* sp., *Hippodiplosia* sp., *Bugula* sp., and *Membranipora* sp. *Polyclinum planum* were less abundant than in recent years, and large, similar to nearby sites. Several *Panulirus interruptus* were observed at the site and the surrounding area.

One *Aplysia californica* was observed. Overall, the *Haliotis rufescens* population appeared to be doing well. *Haliotis rufescens* sizes seemed a bit larger this year. There were similar numbers of *H. rufescens* observed just inshore of the site. One *H. rufescens* appeared to have a slightly shrunken

foot. *Megastraea undosa* were rare and all were large; at least 100 mm and some were as large as 152 mm.

The most noticeable change at the site was the continued increase in abundance of *Strongylocentrotus purpuratus* and *S. franciscanus*. No *Pycnopodia helianthoides* were observed. Two *Patiria miniata* were found that appeared damaged; this may have been warm water sea star wasting disease but their appearance was suspect so we decided not to label them as such. *Dermasterias imbricata* were common and all were very large. *Lytechinus anamesus* were rare with only two to three observed at the north end of the transect. There were more *Strongylocentrotus purpuratus* present in cracks.

After the fish count there were 12 juvenile *Chromis punctipinnis* that were observed. These are unusual for this site and even more unusual for the month of July. Juvenile *Chromis punctipinnis* and *Oxyjulis californica* were moderately abundant on our second visit. *Chromis punctipinnis* YOY usually recruit in late summer. Similarly, one YOY *Paralabrax clathratus* was observed. Fish were out and more abundant at 17:00 as opposed to when the fish counts were conducted (10:00).

The two ARMs in the north group were found upside down and one had moved about 10 ft. One ARM in the south group was missing the lid/ tag number. One of the ARMs cages from the middle group (#2481) was found inshore 170 m. The bricks were scattered around the site. Nine of the bricks were intact and were moved to the middle group for possible reuse.

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

2014 Status

Mature kelp forest

Sampling Dates and Work Completed

07/17/14: 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, S. franciscanus, , Patiria miniata, Pisaster giganteus, Pycnopodia helianthoides, Megastraea undosa, Lithopoma gibberosa, Crassedoma gigantea, Megathura crenulata, Kelletia kelletii, Tethya aurantia, Haliotis rufescens* and *Macrocystis pyrifera* were completed. Seven ARMs were sampled for all indicator species. The temperature loggers were retrieved and deployed, and a wave meter was deployed.

Site Notes

Overall this site was similar to past years. The kelp canopy, estimated at 90% cover, was slightly thicker and larger than usual. As a result, there were lower than normal light conditions on the bottom, likely the cause of decreased understory algae this year. *Laminaria farlowii* adults were common and juveniles were rare; both were less abundant than in recent years. *Macrocystis pyrifera* were abundant with large and widely spaced plants. Some plants had large holdfasts with only several stipes attached.

The most common miscellaneous invertebrates observed during RPCs were hydroids. Several *Spheciospongia* sp. were observed at the site. *Aglaophenia* sp. were common, but not as abundant as

past years. *Phragmatopoma californica* were rare and were scattered in the kelp holdfasts. *Balanus* spp. were common with some high density patches. The giant *Balanus nubilus* were mostly gone. These were abundant a few years ago. *Membranipora* spp. were moderately abundant on the kelp. Other bryozoans were moderately abundant, with *Heteropora* sp. being common.

Aplysia californica were rare and mostly large. *Crassedoma gigantea* were rare and mostly small. Fourteen adult *Haliotis rufescens* were found. Three juvenile *H. rufescens* were found underneath the spine canopy of red urchins, and were about 20-22 mm in length. The huge red abalone at the 90 meter mark on the small rock was still present as it has been for many years. It was difficult to measure due to barnacle growth but was estimated at 260 mm. Six *H. rufescens* were found 11 meters off the transect and therefore off the site. They were measured at 174, 180, 189, 199, 205, and 209 mm.

Dermasterias imbricata were abundant at the site and large. *Parastichopus parvimensis* were rare and large. *Parastichopus californicus* were rare with only one small individual observed. *Patiria miniata* were moderately abundant and large with some small individuals present as well. Six *Pisaster giganteus* were found at the site. We sampled this species on band transects at a density of 0.0014/m^2. *Strongylocentrotus* spp. were confined to crevice habitat, though there were more *S. purpuratus* than had been observed in recent years.

Several large *Caulolatilus princeps*, ocean whitefish, were observed. The ARMs had high cover of barnacles and *Hymenamphiastra cyanocrypta,* cobalt blue sponge, on the bricks.

Three of the six ARMs sampled had *Phyllolithoides papillosus*, heart crabs. One *Brosmophycis marginata*, red brotula, was found in an ARM. One ARM was not sampled because it was found on its side with the bricks spilled out.

Site #5, Rodes Reef, Santa Rosa Island

2014 Status

Open area with moderate densities of *Strongylocentrotus franciscanus*

Sampling Dates and Work Completed

08/11/14: 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, S. franciscanus, Lytechinus anamesus, Patiria miniata, Pisaster giganteus, Pycnopodia helianthoides, Megastraea undosa, Lithopoma gibberosa, Megathura crenulata, Kelletia kelletii, Lophogorgia chilensis, Tethya aurantia* and *Haliotis assimilis* were completed.

08/12/14: Band transects were completed, temperature loggers were retrieved and deployed, a wave meter was deployed, and line repairs were made.

Site Notes

While this site was similar to past years there were some changes. The site was nearly devoid of macroalgae except for an occasional very small tuft of filamentous red algae and some *Laurencia*

pacifica. Also, one small juvenile *Macrocystis pyrifera* was observed as was a small amount of *Desmarestia* spp. No canopy cover was present. The rest of the bottom consisted of coralline algae, cobble or encrusting invertebrates (*Corynactis californica*, *Astrangia lajollaensis*, and *Balanus* spp.). *Desmarestia* spp. were very rare and all were tiny. *Laurencia pacifica* were common. Other red algae were the most abundant algae and were still rare.

The most common miscellaneous invertebrates recorded during RPCs were barnacles. *Tethya aurantia* were moderately abundant with all sizes present. One *Lophogorgia chilensis* was observed. *Urticina lofotensis* were skinny and most were smaller and retracted. *Chaetopterus* sp. were common with many dead ones observed. *Diopatra ornata* were common, though low in abundance for this site. *Diopatra ornata* and *Chaetopterus* sp. were of low abundance in the cobble area between 0-60 meters of the transect. David Kushner does not remember seeing so few *Diopatra ornata* at this site before. *Balanus* spp. were abundant growing on many of the shells, most were small. Amphipod tube mats were rare.

Aplysia californica were common and all were small. Only several *Crassedoma gigantea* were observed, noticeably fewer than in recent years. Two *Haliotis assimilis* were observed and both were recorded during the band transect surveys, resulting in a high recorded density for this species. They were measured at 57 and 60 mm and were located 0.5 m south of meter #10. They were about 20 cm apart and covered with barnacles. During our visit the second day, one of the *H. assimilis* was in the exact same place while the other had moved to the other side of the rock exactly 95 cm away from its original position. These two *H. assimilis* were very close to where a 55 mm *H. assimilis* was observed in 2011. Two live *Haliotis rufescens* were observed and measured at 29 and 30 mm. However, 46 fresh *H. rufescens* shells measuring between 19 and 43 mm were found on the site. Towards the high spot of the actual Rodes Reef (off of the KFM site), David Kushner made a survey dive in that area a few weeks prior to the 8/11/14 visit and found that there was plenty of bottom habitat similar to the KFM site (bare and with urchins) over most of the area. Also observed in this area were many small (<35 mm), fresh *H. rufescens* shells indicating recruitment in the area, similar to what was documented at the KFM site. *Kelletia kelletii* were common with some small ones present. *Lithopoma gibberosa* were moderately abundant and had size cohort. The most notable cohort first was detected by KFM in 2011. Two small *Megastraea undosa* were observed. *Octopus* spp. were moderately abundant and consisted of mostly small *Octopus rubescens*.

Dermasterias imbricata were common and large. *Parastichopus parvimensis* were rare and large. *Patiria miniata* were abundant with all sizes present. Four *P. miniata* were observed with what David Kushner believes to be warm water wasting disease, but water temperature was 63° F. While lower than the temperature we usually start to see wasting disease (approximately 70° F, persistent for a week), water temperatures have been at or near record high for this site since July. Four *Pisaster giganteus* were recorded during band transects for a density of 0.0056/m^2. Five small *Pycnopodia helianthoides* were found under rocks. These were the first *P. helianthoides* observed this entire year during sampling.

Strongylocentrotus spp. were out in the open and there were noticeably more *Strongylocentrotus purpuratus* scattered over most of the site. Most urchins were small and had algae, rocks or other

debris attached to them. *Strongylocentrotus franciscanus* were moderately abundant and also not in crevice habitat, but scattered around the site. *Lytechinus anamesus* were noticeably more abundant in the cobble areas than they have been in recent years, most were small and covered with debris making them difficult to see. Juvenile *S. franciscanus* and *S. purpuratus* were very rare, similar to all the other sites this year. An estimated 3% of *Lytechinus anamesus,* and less than 1% *Patiria miniata* (five individuals total) showed signs of wasting disease on 8/11/14. One *Strongylocentrotus franciscanus* showed similar signs during the 8/12/14 visit.

Overall there were fewer fish at the site than usual. Small *Sebastes mystinus* were the most abundant fish observed. Several small ronquils were observed. One *Icelinus tenuis*, spotfin sculpin, was observed.

Site #6, Gull Island, Santa Cruz Island

2014 Status

Dominated by *Ophiothrix spiculata* from 0-50 m; mature kelp forest from 50-100 meters offshore of the transect

Sampling Dates and Work Completed

07/14/14: Fish transects, fish size frequencies, video transects, roving diver fish counts, $1m^2$ quadrats, $5m^2$ quadrats, band transects, random point contacts and size frequencies for *Strongylocentrotus purpuratus, S. franciscanus, Lytechinus anamesus, Pisaster giganteus,* and *Macrocystis pyrifera* were completed. The temperature loggers were retrieved and deployed.

07/28/14: Size frequencies for *S. purpuratus, S. franciscanus, Lytechinus anamesus, Patiria miniata, Pisaster giganteus, Lithopoma undosa, Lithopoma gibberosa, Crassedoma gigantea, Tegula regina, Megathura crenulata, Kelletia kelletii* and *Stylaster californicus* were completed. All 14 ARMs were sampled for all indicator species. The wave meter was retrieved and deployed.

09/30/14: Video transects were conducted.

Site Notes

The site has changed since last year, with the most obvious being less *Macrocystis pyrifera,* less understory algae*,* and more *Ophiothrix spiculata*. Most of the *M. pyrifera* was on the offshore side, from 50-100 m along the transect which has the area has the most relief at the site. The *M. pyrifera* consisted mostly of large, mature plants, but also included subadults and juveniles. Though the *M. pyrifera* seemed healthy there was no kelp canopy over the site. There was notably more *M. pyrifera* canopy to the east as well as the north of the site. *Eisenia arborea* were common, but also in lower abundance compared to last year and were found in the same areas as *M. pyrifera*. *Agarum* spp., while common, was again less abundant than in recent years. This is also similar with the rest of the algae. During our subsequent visit, *Macrocystis pyrifera* seemed more tattered than the previous visit. No kelp canopy cover was present. On the third visit there were more *Macrocystis pyrifera* on the 0-50 meter side of the transect with approximately 40-50 plants, mostly subadults.

Diopatra ornata were abundant in the low lying areas but patchy and not as abundant as recent years. The most common miscellaneous invertebrate recorded during RPCs were *Chaetopterus* sp. Crabs of

the genus *Cancer* were rare with only one observed. *Panulirus interruptus* were rare with at least six legal sized individuals on the site.

The small purple cowries that live on the hydrocoral, *Pedicularia californica,* were common, but not particularly abundant. *Aplysia californica* were common with all sizes present. One old *Haliotis assimilis* shell was found. *Stylaster californicus* were moderately abundant and appeared similar to last year. The colonies did not look healthy.

From 0-50 m, *O. spiculata* dominated the site and were more abundant. The holdfasts had an abundance of *O. spiculata* in them. David Kushner was a bit surprised to see the increase in *O. spiculata* abundance. In addition both *Strongylocentrotus purpuratus* and *S. franciscanus* were more abundant and often out of their crevice habitat. Most of the *S. franciscanus* were large while *S. purpuratus* were medium to small. Two *Centrostephanus coronatus* were found in the ARMs. *Pisaster giganteus* were sampled during band transects for a density of 0.0055/m^2. *Lytechinus anamesus* were patchy in the low lying areas and small. *Parastichopus parvimensis* were rare with at least four observed. One small *Pisaster giganteus* adult and several 5 mm individuals were observed. At least four *Patiria miniata* were observed with warm water wasting disease, but it appears this had just begun within the past several days with only small lesions present on the stars. On the second visit ten *Lytechinus* and >5% of *Patiria miniata* had warm water wasting disease. On the third visit, approximately 1% of *Patiria miniata* were observed with wasting disease. *Strongylocentrotus purpuratus* were more abundant this year. *Strongylocentrotus franciscanus* were huge adults with more individuals out in the open.

One ARM cage was replaced in the middle group.

Approximately 10 juvenile *Paralabrax clathratus*, 200 juvenile *Chromis punctipinnis*, two juvenile *Oxyjulis californica*, and one juvenile *Semicossyphus pulcher* were observed.

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

2014 Status

State of transition

Sampling Dates and Work Completed

06/23/14: Fish transects, fish size frequencies, video transects, roving diver fish counts, 1m^2 quadrats, 5m^2 quadrats, band transects, random point contacts and size frequencies for *Strongylocentrotus purpuratus, S. franciscanus, Lytechinus anamesus, Patiria miniata, Pisaster giganteus, Megastraea undosa, Crassedoma gigantea, Tegula regina, Megathura crenulata, Kelletia kelletii, Tethya aurantia, Haliotis rufescens,* and *Macrocystis pyrifera* were completed. The temperature loggers were retrieved and deployed.

07/18/14: All 5 ARMs were sampled for all indicator species. Size frequencies for *Crassedoma gigantea and Lytechinus anamesus* were completed. A wave meter was retrieved and deployed.

Site Notes

This site had drastically changed since last year and the changes seemed very recent. Nearly all of the *Macrocystis pyrifera* from last year were gone and dead old holdfasts were common. Most of the live *M. pyrifera* were unhealthy with tattered fronds and heavily covered with bryozoans and hydroids. Similarly, nearly all live *Eisenia arborea* were gone, but the entire site had dead stipes scattered around indicating recent mortality. Similar to the *M. pyrifera,* there were a large amount of bryozoan and hydroids on the few live *E. arborea*. Red algae were abundant and consisted mostly of *Rhodymenia* spp. With nearly all of the *M. pyrifera* and *E. arborea* gone the site was much easier to monitor than the last several years. However, there was still a large amount of red algae cover on the bottom. Canopy cover was estimated at 5%. This made benthic species easier to see. A possible explanation for the kelp die off is that there was an extremely high loading of bryozoans (*Membranipora* sp.) and hydroids on the kelp plants. The site really did appear as a dead *Eisenia arborea* forest with a stipe or more per square meter over the entire site. Green algae were rare and consisted mostly of *Cladophora* sp. *Rhodymenia* sp. were abundant over much of the transect and were mostly large. Other red algae were abundant. The site had changed since the last visit three weeks ago, appearing more barren. No canopy cover was present. The *Eisenia* stipes that were present last visit were still present, but appeared more denuded.

The most common miscellaneous invertebrate recorded during RPCs were barnacles and hydroids. *Tethya aurantia* were abundant on the deep side of the transect with lots of small individuals present. *Eugorgia rubens* were common, and patchy on the deep end. *Lophogorgia chilensis* were abundant on the offshore side of the transect as usual. Hydroids were abundant on the few kelp blades present. Cancer crabs were unusually abundant for the site, with over 10 observed. No *Panulirus interruptus* were observed. *Diaperoecia californica* were common and mostly consisted of small colonies. *Membranipora* sp. were abundant on the *Macrocystis* blades and other kelp species. *Thalamoporella* sp. were common. *Hippodiplosia* sp. were abundant and counted on RPCs at 2.5% cover. One *Styela montereyensis* was observed.

Aplysia californica were large with no small ones observed, and at least five large dead ones present. Approximately 10 medium-sized *Aplysia vaccaria* were observed with several in small mating aggregations. *Cypraea spadicea* were moderately abundant and large. Several *Haliotis rufescens* were observed and varied in size. *Kelletia kelletii* were common and adults were small. *Navanax inermis* were common.

Pachythyone rubra were common with small, high density patches present, as well as individuals scattered around the site. One *Parastichopus californica* was observed. *Parastichopus parvimensis* were rare. *Patiria miniata* were abundant. One *P. miniata* was observed with wasting disease. We checked the water temperature and it has not yet been above 65^{o} F and there are no other sea stars with any indication of disease. As a result it is difficult to confirm if this is a disease or just mortality. No lesions or disease spotting were observed on this star. Only three *Pisaster giganteus* was observed at the site. Three *Pisaster giganteus* were recorded during band transects for a density of 0.0042/m^2. No *Pisaster ochraceus* were observed at the site. However, three were observed at a depth of about 2 ft., just inshore of the site. *Strongylocentrotus purpuratus* and *S. franciscanus* were

common, but juveniles were rare, similar to other KFM sites. *Strongylocentrotus purpuratus* and *S. franciscanus* were common and scattered around the site, and still mostly confined to crevice habitat and in small groups.

Lythrypnus dalli were rare with about 10-15 observed. Only one *Alloclinus holderi* was observed. One *Gymnothorax mordax* was observed. Ronquils were common. One *Gibbonsia* sp. was also observed.

The ARMs had relatively few organisms in them except for the shallow one which had many *Strongylocentrotus* spp. inside. Five *Haliotis rufescens* were found in the ARMs. On a survey dive just east of Fry's Harbor, 10 *H. rufescens* were observed and ranged in size from roughly 50-125 mm.

Site #8, Pelican Bay, Santa Cruz Island

2014 Status

Dominated by *Strongylocentrotus purpuratus* and *S. franciscanus*

Sampling Dates and Work Completed

08/14/14: All six ARMs were sampled for all indicator species. A wave meter was deployed.

08/27/14: Fish transects, fish size frequencies, video transects, roving diver fish counts, quadrats, 5-meter quadrats, band transects, random point contacts and size frequencies for *Strongylocentrotus purpuratus, S. franciscanus, Lytechinus anamesus, Patiria miniata, Pisaster giganteus, Lithopoma undosa, Lithopoma gibberosa, Megathura crenulata, Kelletia kelletii, Lophogorgia chilensis, Crassedoma gigantea* and *Tethya aurantia* were completed. Temperature loggers were retrieved and deployed and several repairs to the lead line were made.

Site Notes

The site was similar to past years, though it was even more barren than in recent years. There was no canopy cover present. Red algae present consisted mostly of filamentous types.

Tethya aurantia were mostly small and nearly all covered with diatoms/algae and difficult to see. One large *Panulirus interruptus* molt was found. Miscellaneous invertebrates on RPCs consisted mostly of *Balanus* sp., but also some *Mesochaetopterus* sp., terebellid worms and *Chaetopterus* sp. *Balanus* sp. had at least two size classes: one from an estimated four years ago and one of recent recruits.

Crassedoma gigantea were mostly small but several very large ones were observed present. *Cypraea spadicea* were rare. Three small, fresh *Haliotis rufescens* shells were observed.

Approximately 25% of *Patiria miniata* and *Astropecten* sp. had wasting disease. Urchins appeared less abundant. There was an increase in sand and the lead line was buried in several places. *Lytechinus anamesus* mean size was the highest documented at this site since 2008. Up to six *Parastichopus parvimensis* were observed, and all were large. Two adult and two juvenile *Pisaster*

giganteus were observed. Three were recorded on band transects for a density of 0.0042/m^2. *Strongylocentrotus purpuratus* had low recruitment, similar to other sites.

All *Lythrypnus dalli* observed were 1-2 cm long. *Coryphopterus nicholsii* were large. Only two *Alloclinus holderi* were observed.

Site #9, Scorpion Anchorage, Santa Cruz Island

2014 Status

Dominated by *Strongylocentrotus purpuratus* from 0-70 meters, and a developing kelp forest from 70-100 meters

Sampling Dates and Work Completed

08/26/14: 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 *S. purpuratus, S. franciscanus, Patiria miniata, Pisaster giganteus, Megastraea undosa, Crassedoma gigantea, Megathura crenulata, Kelletia kelletii, Tethya aurantia,* and *Macrocystis pyrifera* were completed. All six ARMs were sampled for all indicator species. The temperature loggers were retrieved and deployed, and all data were successfully downloaded. A wave meter was deployed.

Site Notes

The site has noticeably changed since last year. From 70-100 meters, there were more *Macrocystis pyrifera.* Nearly all *M. pyrifera* were subadult plants and a few reached the surface. Canopy cover was estimated at 2%. There was noticeably more sediment over most of the site and this had to be brushed away for RPCs. Small *Sargassum muticum,* less than 10 cm tall, were the most abundant algae. The *S. muticum* were found in high density patches, mostly from 50-100 meters where fewer urchins were present. After *S. muticum, M. pyrifera* were the next most abundant algae. *Sargassum horneri* juveniles, all less than 5 cm tall, were common from 70-100 meters and more abundant than recent years. *Cystoseira* sp. were only present around the 100 meter end.. There was a moderate amount of bare rock from 0-50 meters.

Balanus sp. continue to be extremely abundant as we have observed all year and at nearly all the sites. Two different size classes of *Balanus* sp. were present. The most common miscellaneous invertebrate recorded on RPCs were *Balanus* sp., and accounted for over 95% of the cover in that category. *Tethya aurantia* were mostly small and covered with algae and diatom film. Most of the *Corynactis californica* present appeared deflated and unhealthy looking. Several *Cancer* sp. were observed.

Few *Cypraea spadicea* were found at the site. *Cypraea spadicea* were abundant, and mostly small, in the ARMs. There was some evidence of *C. spadicea* predation. Four fresh *Haliotis rufescens* shells were found, ranging from 32-44 mm. Juvenile *Kelletia kelletii* were common in the ARMs and around the site.

Parastichopus parvimensis were medium to large and more abundant than KFM sites outside the Scorpion MPA. Remains of dead *Patiria miniata* were observed, likely from warm water wasting disease. Only one *Pisaster giganteus* was seen at the site and another one was found in the ARMs.

Pisaster giganteus were sampled on band transects and had a density of 0.0/m^2. There were urchin tests from a moderate number of preyed upon *S. purpuratus* from 70-100 meters; most looked like lobster predation. Two *Patiria miniata* and approximately 1% of *Strongylocentrotus purpuratus* had wasting disease.

Two *Alloclinus holderi* were observed. Two *Hypsypops rubicundus* measuring less than 2 cm were observed. One flying fish (*Cypselurus californicus*) was observed at Scorpion Rock. For an MPA site, there were few large fish observed. One fishing weight that looked a year or two old was collected (we called this new), indicating the presence of poaching activity inside the Scorpion MPA.

Site #10, Yellow Banks, Santa Cruz Island

2014 Status

Mature kelp forest

Sampling Dates and Work Completed

08/21/14: Five ARMs were sampled for all indicator species, and four ARMs were sampled for all indicator species except for *Strongylocentrotus franciscanus* and *S. purpuratus.* A wave meter was retrieved and deployed.

09/16/14: 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, S. franciscanus, Lytechinus anamesus, Patiria miniata, Pisaster giganteus, Megastraea undosa, Lithopoma gibberosa, Tegula regina, Megathura crenulata, Crassedoma gigantea, Kelletia kelletii, Tethya aurantia, Haliotis assimilis, Lophogorgia chilensis, Muricea californica,* and *Macrocystis pyrifera* were completed. The temperature loggers were retrieved and deployed, and all data were successfully downloaded.

09/30/14: Three ARMs were sampled for all indicator species, and two ARMs were sampled for all indicator species except for *S. franciscanus* and *S. purpuratus.* Size frequencies for *Patiria miniata, Pisaster giganteus, Crassedoma gigantea, Megathura crenulata, Kelletia kelletii, Lophogorgia chilensis, Muricea californica,* and *Macrocystis pyrifera* were completed.

Site Notes

09/16/14: Overall, the site looked similar to recent years. There were more algae when we visited earlier in the season on 8/21/14, but there were still a moderate amount of mostly large and widely spaced *Macrocystis pyrifera* plants. Kelp canopy cover appeared to have thinned since earlier in the season, and was estimated at 10%. Many *M. pyrifera* fronds were senescing. Surprisingly, it looks the large swell event from 9/3/14 caused little noticeable impact, other than having moved a bit of sand around. *Laminaria farlowii* was common but sparse. *Cystoseira* sp. looked unhealthy.

Tethya aurantia was mostly small and covered in sediment. Several individuals looked deformed. *Balanus* sp. were moderately abundant and appeared to be one size class; 3-4 mm. The most common miscellaneous invertebrates on RPCs were *Balanus* sp. At least five *Panulirus interruptus* were observed, and none were of legal size. At least three *Styela montereyensis* were observed.

One 124 mm *Haliotis assimilis* was found at meter 94, about three meters inshore from the transect. *Haliotis corrugata* and *H. rufescens* were not observed around the site, but were present inside the ARMs. All sizes of *Lithopoma gibberosa* and *Megastraea undosa* were present. Several *Megathura crenulata* were observed feeding on dead *Patiria miniata*.

Lytechinus anamesus was noticeably larger than in recent years. There was a continued increase in *Strongylocentrotus franciscanus* and *S. purpuratus* in the cracks and crevices, both in size and abundance. All sizes of *S. purpuratus* and *S. franciscanus* were present. *Parastichopus parvimensis* were extremely rare with only two observed. One *P. parvimensis* was covered with white lesions (possibly infected with wasting disease) and the other one appeared healthy. *Patiria miniata* was still relatively abundant, even though many dead ones were scattered around the site, likely from wasting disease. Most other ones looked deflated and unhealthy. *Pisaster giganteus* were rare, and sampled on band transects at a density of 0.0014/m^2. Several dead *Astropecten* sp. were observed, likely from wasting disease. On the third visit, approximately 50% of *Patiria miniata* had wasting disease, twice as many as during the 09/16/14 visit.

Chromis punctipinnis and *Oxyjulis californica* juveniles/recruits were common, but not as abundant as at other nearby sites. When RDFC and fish transects were conducted, the water was murky and it was very silty on the bottom. These were not optimal conditions for counting fish, but we thought possibly the best we could get for the remainder of the season. Small Pacific bonito, *Sarda chiliensis*, and yellowtail, *Seriola lalandi*, were observed, as well as one very large giant black sea bass, *Stereolepis gigas*, at approximately 180 cm. Juvenile *Paralabrax clathratus* were moderately abundant. Kushner observed a bat ray, *Myliobatis californica*, feeding on *S. purpuratus*. One non-fishing lobster trap was observed at the site, as well as a lobster frame trap.

Strongylocentrotus franciscanus and *S. purpuratus* were abundant in the ARMs. *Haliotis rufescens* were common in the ARMs and light in shell color. *Octopus* sp. were also common in ARMs. Tiny *Pisaster giganteus* were common in ARMs, indicating recruitment, though no adults were found. The ARMs in the middle group bounced around a little bit from the 09/03/14 swell event, as well as the one in the West end group. Four ARMs that we sampled on 08/21/14 were repaired from south swell damage several weeks ago. Nine broken bricks were replaced with new ones in the middle group ARMs. The east end group ARMs are scattered around and need to be moved back together.

Site #11, Admiral's Reef, Anacapa Island

2014 Status

60% Dominated by *Ophiothrix spiculata*, 40% developing kelp forest

Sampling Dates and Work Completed

5/27/14: 1m^2 quadrats, 5m^2 quadrats, band transects, random point contacts, fish transects, video transects, fish size frequencies, roving diver fish counts, and size frequencies for *S. purpuratus, S. franciscanus,* and *Macrocystis pyrifera* were completed. The temperature loggers were retrieved and deployed, and all data were successfully downloaded. A wave meter was deployed.

8/20/14: Six ARMs were sampled for all indicator species. Video transects were conducted, as well as size frequencies for *Crassedoma gigantea, Kelletia kelletii, Megathura crenulata, Tegula regina, Megastraea undosa, Tethya aurantia, Patiria miniata, and Pisaster giganteus.*

Site Notes

Overall the site was similar to recent years, but there were some changes. The site had approximately 2% canopy cover. The highest relief area starting at meter 65 had noticeably more algae, but much of this was juvenile and adult *Sargassum horneri*. *Sargassum horneri* carpeted some areas of the bottom with up to 285/m^2. *Eisenia arborea* were scattered around the high relief areas. A total of 29 adult and subadult *Macrocystis pyrifera* were found for size frequencies; more than have been present in recent years. *Sargassum horneri* were mostly between meters 65 and 85, and moderately abundant only in some patches. Filamentous red algae were present. There were some dramatic and surprising changes at this site between visits. Kushner counted over 150 subadult *Macrocystis* plants mostly between meters 35 and 100, with most from meters 65 and 100 in the high relief areas of the site. This much kelp growth and increase in abundance is rare for this time of year and the abnormally high water temperatures. Canopy cover was estimated at 0%. The subadult kelp patches were often dense and plants were about 3-12 m high. In the areas of high kelp abundance there was often 75% or more coverage of juvenile *Sargassum horneri*. *Sargassum horneri* was also more abundant on the high relief areas. While most *S. horneri* were juveniles, several less than 20 cm plants were just beginning to become reproductive. There were also several old plants that appeared like they were re-growing and were reproductive.

At least five *Cancer* sp. were observed. This is more than Kushner has seen here. Several *Loxorhynchus grandis* were observed. A total of 3-5 *Panulirus interruptus* were observed and several were legal size. *Megathura crenulata* were common and all were small. The most common miscellaneous invertebrates recorded on RPCs were gorgonians.

Most of the site remains dominated by *Ophiothrix spiculata.* These were extremely abundant everywhere except the high relief areas, similar to past years. *Parastichopus parvimensis* were in the rocky areas and all were small to medium. At least nine *Pisaster giganteus* were observed at the site. *Pisaster giganteus* were recorded during band transects for a density of 0.0083/m^2. On 8/20 only four *P. giganteus* were found for size frequencies. On the second visit, three *Patiria miniata* had signs of warm water wasting disease. Juvenile warm water fish were abundant. One *Hypsypops rubicundus* less than 3 cm was observed. Nine *Gymnothorax mordax*, California moray eels, were observed including one very small (< 50 cm) individual. Juvenile *Oxyjulis californica* and *Chromis punctipinnis* were abundant.

Chromis punctipinnis were very abundant with all sizes present, especially very small and very large ones. In addition there was a high prevalence of *C. punctipinnis* infected with *Vibrio* sp. Possibly more than Kushner has ever observed.

The ARMs were covered in *Ophiothrix spiculata* and also had moderately high cover of *Balanus* sp. on the ARMs bricks. Video transects were re-done due to the original video being slightly out of focus. However, since the site had changed considerably since the first visit, the video is not

representative of the conditions that were present when the core sampling protocols were performed on 5/27. The most changes were the increase in *Macrocystis pyrifera* and juvenile fish abundances. Both video transects were archived.

Site #12, Cathedral Cove, Anacapa Island

2014 Status

Mature kelp forest

Sampling Dates and Work Completed

05/16/14: Size frequencies for *Strongylocentrotus purpuratus* and *S. franciscanus* were completed.

05/29/14: Fish transects, video transects, roving diver fish counts, fish size frequencies, $1m^2$ quadrats, $5m^2$ quadrats, band transects, random point contacts and size frequencies for *Macrocystis pyrifera*, *Tethya aurantia, Haliotis corrugata, Crassedoma gigantea, Megastraea undosa, Tegula regina*, *Patiria miniata, Pisaster giganteus* were completed. The temperature loggers were retrieved and deployed, and all data were successfully downloaded. A wave meter was deployed.

08/20/14: Six ARMs were sampled for all indicator species.

Site Notes

Overall the site was similar to recent years and remained a lush kelp forest with a high diversity of algae, invertebrates and fish. Most of the *Macrocystis pyrifera* were smaller adult and subadult plants. Canopy cover was estimated at 70%. There was a lush understory of *Laminaria farlowii*, *Cystoseira* sp., *Sargassum muticum* and some patches of *Sargassum horneri*. *Sargassum horneri* was the most abundant it had ever been at this site. It was also unhealthy looking with small adult plants up to one meter tall. Juveniles did not look healthy either. There seems to be a lot of competition between all the algae. Many algae were covered with hydroids and bryozoans. *Plocamium* sp. were noticeably more abundant than in recent years. Overall the site was similar to the last visit. The kelp looked relatively healthy for this time of year. Canopy cover was estimated at 70%.

One *Lophogorgia chilensis* was observed. *Panulirus interruptus* were large with few smaller than legal sized ones; not as many as in past years. *Tegula regina* were rare. The most common miscellaneous invertebrate recorded on RPCs were hydroids; primarily *Hydractinia* sp.

A total of four adult *Haliotis corrugata* were observed. All sizes of *Megastraea undosa* were present. *Megathura crenulata* were rare. At least one *Octopus* sp. was observed. The nudibranchs *Flabellina iodinea* and *Hopkinsia rosacea* were common.

Parastichopus parvimensis were common with all sizes present. Only one *Patiria miniata* and two *Pisaster giganteus* were observed. *Pisaster giganteus* were sampled on band transect for a density of $0.0028/m^2$. Juvenile *Strongylocentrotus purpuratus* and *Strongylocentrotus franciscanus* were rare.

Only one *Coryphopterus nicholsii* was observed. One small *Sebastes caurinus* was observed. There was warm water fish recruitment since the previous visit. Young of year (< 6 cm) *Hypsypops*

rubicundus and *Halichoeres semicinctus* were common. Juvenile *Paralabrax clathratus, Oxyjulis californica*, and *Chromis punctipinnis* were abundant.

One ARM (#2476) cage was replaced and we replaced eight broken bricks with new ones. Two ARMs only had 4 layers (16 bricks) (#2346 and 2349). We added enough bricks to make 5 layers. One ARM (#2476) had eight bricks removed from the ARM. This ARM was not sampled. ARM #2349 will need a new lid next year.

Site #13, Landing Cove, Anacapa Island

2014 Status

Mature kelp forest

Sampling Dates and Work Completed

06/13/14: Fish transects, fish size frequencies, video transects, roving diver fish counts, and size frequencies for *Strongylocentrotus purpuratus* and *S. franciscanus* were completed. Lead line repairs were made.

06/25/14: $1m^2$ quadrats, $5m^2$ quadrats, band transects, random point contacts and size frequencies for *Macrocystis pyrifera, Tethya aurantia, Megathura crenulata, Haliotis corrugata, Kelletia kelletii, Crassedoma gigantea, Megastraea undosa, Lithopoma gibberosa, Tegula regina and Pisaster giganteus* were completed. The temperature loggers were retrieved and deployed, and all data were successfully downloaded. Six ARMs were sampled for all indicator species.

09/29/14: Fish transects, fish size frequencies, video transects, and roving diver fish counts were redone to try to capture this huge warm water recruitment event that occurred since we last sampled these sites. A wave meter was deployed.

Site Notes

Canopy cover was estimated at 25%. Overall this site appeared similar to past years, with the shallow reef around 0-35 meters having *Macrocystis pyrifera,* an abundance of thick *Gelidium* sp. with some *Gigartina* sp. and other red algae, and an abundance of *Eisenia arborea*. This composition was also similar from about 80-100 meters. From 35-80 meters, in the deeper part of the transect, there was *M. pyrifera* adults and subadults and a very thick understory of *Laminaria farlowii*, *Pterygophora californica* and *Eisenia arborea*. Canopy cover was estimated at 20%. *Pterygophora californica* appeared more abundant than the past several years. Adults were moderately abundant and juveniles were common. *Sargassum horneri* were rare with one small reproductive plant and few juveniles observed. These individuals were initially missed on the 5 m^2 quadrat surveys and later added. Canopy cover was estimated at 15% on the third visit.

One *Murcia californica* was seen near the transect, but off of the site. Hydroids were moderately abundant, more than usual. The most common miscellaneous invertebrate recorded during RPCs were hydroids.

Aplysia californica were rare with only two observed. Five *Haliotis corrugata* were found; they were searched for in between band transects as well. Only one *Lithopoma gibberosa* was observed. Similar

to past years, several small *Kelletia kelletii* were observed and tiny ones were common in the ARMs. It is surprising that we see constant recruits of *K. kelletii* at this site, but not many adults.

Pisaster giganteus were rare and were sampled on band transects at a density of 0.0014/m^2. In addition, small ones of various size classes were common in the ARMs, similar to past years. Juvenile urchins were rare including in the ARMs, similar to other sites this year. This was the fewest juveniles Kushner remembers seeing since 1990.

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

2014 Status

Kelp forest

Sampling Dates and Work Completed

06/11/14: Fish transects, video transects, fish size frequencies, roving diver fish counts, 1m^2 quadrats, 5m^2 quadrats, band transects, random point contacts and size frequencies for *Macrocystis pyrifera, Tethya aurantia, Megathura crenulata, Kelletia kelletii, Crassedoma gigantea, Megastraea undosa, Lithopoma gibberosa, Tegula regina, Strongylocentrotus purpuratus, S. franciscanus, Patiria miniata* and *Pisaster giganteus* were completed. The temperature loggers were retrieved and deployed, and all data were successfully downloaded. A wave meter was deployed.

Site Notes

The site has changed dramatically since the last year, from being carpeted with *Ophiothrix spiculata* to a kelp forest with many thick, healthy *Macrocystis pyrifera* that had fronds that reached the surface. Canopy cover was estimated at 40%. . Brown algae were more abundant than in at least the past decade. Much of the drift algae were partially decomposing or sloughed *M. pyrifera* fronds, like what we have observed kelp to do during warm water conditions. However, most of the *M. pyrifera* looked healthy but with sloughed blade tips. *Sargassum horneri* were patchy. There were several patches of 1 m tall individuals. This invasive alga was more abundant than it ever had been seen at this site. Many of the *S. horneri* were highly reproductive. Note: the decrease in abundance of *O. spiculata*, urchins, and increase in algal cover was similar to the nearby Graveyard Canyon site. The entire area around Southeast Sea Lion had more kelp than since the mid-1990s.

The most common miscellaneous invertebrates recorded on RPCs were anemones, though there were not many. *Phragmatopoma californica* were seen on *M. pyrifera* holdfasts, but not in open areas. Two *Cancer* sp. were seen at the 0 m end of the transect, on the offshore side. At least six *Panulirus interruptus* were observed. Most were surprisingly small, especially for an MPA site, with only one above legal size.

Aplysia californica were mostly small. All *Megastraea undosa* individuals observed were large. Two *Megathura crenulata* were observed.

Ophiothrix spiculata, which still maintained a high percentage of bottom cover, was approximately 50% less abundant than in previous years. Urchins were located in crevice habitat, instead of out in the open, as drift algae was plentiful at the site. A cohort of ~25 mm *Centrostephanus coronatus* was present. Approximately 25% of *Patiria miniata* appeared to be regrowing missing arms. Three

Pisaster giganteus were observed on the site. *Pisaster giganteus* were sampled on band transects for a density of 0.0014/m^2. The entire site was searched for *Patiria miniata* and only 62 were found.

One *Alloclinus holder*i was observed. One *Gymnothorax mordax*, California moray eel, was observed. The temperature logger stake needs replacement soon.

Site #15, Arch Point, Santa Barbara Island

2014 Status

Dominated by *Strongylocentrotus purpuratus*

Sampling Dates and Work Completed

05/13/14: Fish transects, fish size frequencies, video transects, roving diver fish counts, 1m^2 quadrats, 5m^2 quadrats, band transects, random point contacts and size frequencies for *Megathura crenulata, Crassedoma gigantea, Megastraea undosa, Tegula regina, Lytechinus anamesus, Strongylocentrotus purpuratus, S. franciscanus, Patiria miniata, Pisaster giganteus,* and *Macrocystis pyrifera* were completed. The temperature loggers were retrieved and deployed, and all data were successfully downloaded.

Site Notes

The site is mostly devoid of macro algae except for a small patch of *Macrocystis pyrifera* located at the 100 meter end of the transect, and a small patch inshore, near the zero end. Canopy cover was estimated at less than 1%. At least 33 *M. pyrifera* plants were present and several adult *Eisenia arborea* were scattered throughout the site.

The most common miscellaneous invertebrates recorded during RPCs were Balanus sp. *Lophogorgia chilensis* were rare with only three individuals observed. *Murcia californica* were also rare with three individuals observed. *Sagartia/Cactosoma* sp. were less abundant than in recent years. Several tiny *Urticina* sp. were observed. *Dodecaceria fewkesi* were moderately abundant. *Spirobranchus spinosus* were common but seemed to continue to decline.

Four *Aplysia vaccaria* were observed. *Aplysia californica* were moderately abundant with all sizes present. *Crassedoma gigantea* were rare with all sizes present. One small, fresh *Haliotis corrugata* shell was found and measured 42 mm. *Megathura crenulata* were rare with only three observed. *Octopus* spp. were common with at least seven observed during band transects.

This site remained similar to recent years and continued to be dominated by *Strongylocentrotus purpuratus*. *Pisaster ochraceus* and *P. giganteus* were less abundant this year with only three and two observed, respectively. *Patiria miniata* were common. *Ophiothrix spiculata* were more abundant on the periphery of the site, but not actually on the site itself. They were more abundant offshore and north of the site. They were dense where these patches occurred. However, *O. spiculata* did appear more abundant than last year. There was less fine sand on the deeper side of the transect, perhaps due to the large swell event in February. Most of the substrate was covered with encrusting coralline algae and S. *purpuratus*. *Strongylocentrotus purpuratus* had increased in abundance to the highest density documented at this site and most were small. *Centrostephanus coronatus* were rare and appeared to have declined in density. No *Linckia* sp. were observed. *Lytechinus anamesus* were rare

with about 15-20 observed. Two *Pisaster giganteus* were observed; both were measured at 59 mm and 72 mm. Three *P. ochraceus* were observed and measured 150 mm, 97 mm, and 129 mm.

Not many *Coryphopterus nicholsii* were present compared to previous years. *Pisaster giganteus* and *P. ochraceus* were sampled during band transects for a density of 0.0014/m^2 each. Heteropods (*Carinaria* sp.) were common as well as comb jellies, *Corolla* sp., pteropods and salps.

Site #16, Cat Canyon, Santa Barbara Island

2014 Status

75% Dominated by *Strongylocentrotus purpuratus*, 25% kelp forest

Sampling Dates and Work Completed

06/09/14: Fish transects, video transects, roving diver fish counts, fish size frequencies, 1m^2 quadrats, 5m^2 quadrats, band transects, random point contacts and size frequencies for *Tethya aurantia, Megathura crenulata, Haliotis corrugata, Kelletia kelletii, Crassedoma gigantea, Megastraea undosa, Lithopoma gibberosa, Tegula regina, Lytechinus anamesus, Strongylocentrotus purpuratus, S. franciscanus, Patiria miniata,* and *Macrocystis pyrifera* were completed. The temperature loggers were retrieved and deployed, and all data were successfully downloaded. A wave meter was deployed.

Site Notes

This site has changed since last year. This year there were patches of healthy-looking kelp forests that were estimated to be 100-400 m^2 in size. There were both large and small adult *Macrocystis pyrifera* present. Patches of high density juvenile *M. pyrifera* were common. In addition most of the sandy areas with boulders had *Cystoseira* spp. and *Dictyota/Pachydictyon* sp. growing on them. Canopy cover was estimated at 20% and the canopy appeared thin. Adult E*isenia arborea* were rare. *Dictyota/Pachydictyon* were patchy but abundant, more than seen in recent years. *Sargassum horneri* were rare, though small reproductive adults were scattered around the site. These were often mixed in with *Cystoseira* spp., making them difficult to see. Juvenile *S. horneri* were rare, but one patch was present. Kushner swam inshore to about 15 ft. of depth and offshore to about 45 ft. of depth and confirmed that the *S. horneri* were scattered around the area but no different in abundance than what was observed at the site. One 105 cm tall *S. horneri* was observed inshore with no reproductive receptacles and only air bladders, yet a 30 cm plant was found with receptacles. This is a good example of what we are observing at the northern islands with the small reproductive plants and what others are observing in the south with tall reproductive plants. Photos of these were taken. *Laurencia pacifica* were common and appeared less abundant than in recent years. Miscellaneous plants, Diatoms, were moderately abundant and covered much of the site.

Overall encrusting invertebrates on the bottom were common, but not abundant. There was a moderate amount of bare substrate, similar to recent years. *Tethya aurantia* were rare with a few small ones around. The most common miscellaneous invertebrates recorded during RPCs were *Spirobranchus spinosus* and *Sagartia/Cactosoma* sp. *Panulirus interruptus* were common with eight observed at the site. Two were sub legal size and the other six were well above legal size. On Kushner's survey dive shallow inshore, he did not notice many more lobster. Tunicates were rare and

consisted mostly of *Pycnoclavella* spp. *Aplysia californica* were mostly small and moderately abundant.

Crassedoma gigantea were common with small and large individuals present. *Cypraea spadicea* were common and large. One *Haliotis* sp. measuring 31 mm was observed. It was likely a *Haliotis fulgens*, but was not positively identified. One small *Haliotis corrugata* was observed. Two juvenile *Kelletia kelletii* were observed. Only two or three *Megathura crenulata* were observed. *Tegula regina* were abundant with all sizes present.

Sea urchins, mainly *Strongylocentrotus purpuratus*, were patchier than last year. They were also larger. They were observed in small fronts around the areas with kelp forests. *Strongylocentrotus franciscanus* were common and scattered around the site, but also present in small patches. They were also larger. Inshore of the site there were patches of *S. franciscanus* that were of commercially legal size. At least one small *Centrostephanus coronatus* was observed. *Patiria miniata* were extremely rare, even inshore of the site. No *Pisaster giganteus* were found inshore of the site either. There were a few small *Strongylocentrotus* spp., but no juvenile recruits were observed. The adults were larger than in recent years, and more in crevice habitat but still mostly out in the open.

Four *Squatina californica*, Pacific angel shark, were observed at the site along with several others off the site as well. Large *Myliobatis californica*, bat ray, were present and Kushner observed a large one pick up and consume a ~50 mm purple urchin. This is the first observation of this interaction that Kushner has heard of or observed. One *Caulolatilus princeps* (ocean whitefish), *Orthonopias triacis* (snubnose sculpin), *Artedius corallinus* (coralline sculpin), *Gymnothorax mordax* (California moray eel) and *Gibbonsia* sp. (kelpfish sp.), were also observed.

Site #21, Miracle Mile, San Miguel Island

2014 Status

Mature kelp forest

Sampling Dates and Work Completed

08/13/14: Fish transects, video transects, roving diver fish counts, fish size frequencies, $1m^2$ quadrats, $5m^2$ quadrats, band transects, random point contacts and size frequencies for *Tethya aurantia, Megathura crenulata, Haliotis rufescens, Kelletia kelletii, Crassedoma gigantea, Lithopoma gibberosa, Strongylocentrotus purpuratus, S. franciscanus, Patiria miniata, Pisaster giganteus* and *Macrocystis pyrifera* were completed. Six ARMs were sampled for all indicator species. The temperature loggers were retrieved and deployed, and all data were successfully downloaded. A wave meter was deployed.

Site Notes

Overall the site was similar to past years and was a mature kelp forest with large, widely spaced plants and a lush and diverse understory of red and brown algae. Canopy cover was estimated at 95%. Several *Laminaria setchellii* were observed.

The most common miscellaneous invertebrates recorded during RPCs were barnacles followed by the proliferating anemone *Epiactis* sp. *Phragmatopoma californica* were common and located mostly in kelp holdfasts. *Balanus* sp. were abundant.

Small *Crassedoma gigantea* were common and mostly < 60 mm. Two *Cryptochiton stelleri* were observed. *Haliotis rufescens* were abundant as usual with smaller ones being common. Fresh *H. rufescens* shells were collected and measured. Fourteen were found and were mostly large. Several had shells in very bad condition due to the sponge *Cliona* sp. *Megathura crenulata* were common and mostly large. One *Tegula regina* recruit was observed in the ARMs.

Parastichopus parvimensis were rare and large. *Pisaster giganteus* were rare with seven or eight observed at the site, but small ones were moderately abundant in the ARMs. *Pisaster giganteus* were recorded during band transects for a density of 0.0083/m^2. Two *Pycnopodia helianthoides* juveniles were observed in the ARMs.

Strongylocentrotus purpuratus were more abundant than recent years.

Site #22, Cluster Point, Santa Rosa Island

2014 Status

Mature kelp forest

Sampling Dates and Work Completed

07/15/14: Fish transects, video transects, roving diver fish counts, fish size frequencies, 1m^2 quadrats, 5m^2 quadrats, band transects, random point contacts and size frequencies for *Tethya aurantia, Megathura crenulata, Haliotis rufescens, Kelletia kelletii, Megastraea undosa, Lithopoma gibberosa, Strongylocentrotus purpuratus, S. franciscanus, Patiria miniata, Pisaster giganteus,* and *Macrocystis pyrifera* were completed. The temperature loggers were retrieved and deployed, and all data were successfully downloaded. A wave meter was deployed.

Site Notes

This site was similar to last year and remained a mature kelp forest with large, widely spaced, plants and a moderate understory of red algae. *Macrocystis pyrifera* appeared healthy, similar to the south side of Santa Rosa Island. *Macrocystis pyrifera* was abundant and had more canopy than last year. Canopy cover was estimated at 30%. *Laminaria farlowii* were rare with one individual observed. *Pterygophora californica* were common but less abundant in the low lying areas where it has typically been present. *Laminaria setchellii* were present but not as abundant as it has been in past years.

Spheciospongia sp. were common on the tops of the high relief areas and had a high abundance of *Balanus* sp. on them. *Tethya aurantia* were abundant with all sizes present. The most abundant miscellaneous invertebrates recorded during RPCs were *Cucumaria* spp. followed by *Balanus* sp. Bryozoans were moderately abundant and very diverse, but no one species were especially abundant. *Styela montereyensis* were common and consisted of mostly large individuals.

Crassedoma gigantea were common and mostly small. At least three *Cryptochiton stelleri* were observed. One live *Haliotis rufescens* was observed along with two fresh shells. *Kelletia kelletii* were rare and all were large. *Megastraea undosa* were rare and consisted of very large individuals. *Megathura crenulata* were rare and consisted of mostly large individuals. One *Tegula regina* was observed.

At least six *Pisaster giganteus* were observed at the site and all were mostly small. *Pisaster giganteus* were sampled on band transects for a density of 0.0028/m^2. *Dermasterias imbricata* were common and large. *Pachythyone rubra* were rare with only one observed. James Grunden observed one *Patiria miniata* with lesions, possibly due to a wasting disease. No *Pycnopodia helianthoides* were observed at the site. Both *Strongylocentrotus purpuratus* and *S. franciscanus* increased, but particularly *S. purpuratus*. These were mostly in crevice habitat, but seemed to be more out in the open than usual. If these continue to increase Kushner would expect barrens here.

Sebastes chrysomelas (black and yellow rockfish), and *S. atrovirens* (kelp rockfish), were abundant from the 0-40 meter section of the transect, but were difficult to see during the RDFC since they were hidden. The meter tape was laid backwards, but we discovered this before we sampled protocols and sampled in appropriate intervals.

Site #23, Trancion Canyon, Santa Rosa Island

2014 Status

State of transition

Sampling Dates and Work Completed

07/16/14: Fish transects, video transects, roving diver fish counts, fish size frequencies, 1m^2 quadrats, 5m^2 quadrats, band transects, random point contacts and size frequencies for *Tethya aurantia, Lithopoma gibberosa, Megathura crenulata, Crassedoma gigantea, Lytechinus anamesus, Strongylocentrotus purpuratus, S. franciscanus, Patiria miniata, Pisaster giganteus*, and *Macrocystis pyrifera* were completed. The temperature loggers were retrieved and deployed, and all data were successfully downloaded.

Site Notes

This site was similar to last year. Half of the site was a mature kelp forest and half of the site was dominated *Strongylocentrotus* spp., mostly by large *S. franciscanus*. Canopy cover was estimated at 75%. *Macrocystis pyrifera*, although a dominant feature on approximately half of the site, was mostly present only on the tops of the high relief areas. Overall the *M. pyrifera* looked healthy, especially compared to SCI at this same time. There was some *Membranipora* sp. growing on the kelp.

The most common miscellaneous invertebrate recorded during RPCs were *Balanus* spp. *Tethya aurantia* were moderately abundant and mostly large, though all sizes were present. *Balanophyllia elegans* were abundant in the appropriate habitat. *Phragmatopoma californica* were common and mostly in the kelp holdfasts. *Balanus* spp. were abundant; more abundant than has ever been observed at this site since we began monitoring.

Aplysia californica were rare with only one observed. Several fresh small *Haliotis rufescens* shells were found. *Megathura crenulata* were common and mostly large. Only one *Tegula regina* was observed at the site.

Low lying rocky reef sections had relatively high densities of urchins. With the abundance of *S. franciscanus* and *S. purpuratus* being high and increasing, it appeared as though this site could turn into an urchin dominated area except for in the high relief areas. Much of the low lying areas were already *S. franciscanus* barrens. Inshore of the site there was also an abundance of *S. franciscanus* and *S. purpuratus*. Fourteen *Pisaster giganteus* were observed at the site. *Pisaster giganteus* were recorded during band transects for a density of 0.0222/m^2. *Pachythyone rubra* were common and appeared more abundant than in past years. There were large patches of *P. rubra* at the zero end and the hundred end of the transect. However, cover was recorded at 0%. *Parastichopus parvimensis* were common and consisted mostly of very large individuals. *Patiria miniata* were moderately abundant and were mostly large in size. Urchin densities (*Strongylocentrotus* spp.) were similar to past years. However, over most of the site many urchins were out of crevice habitat and in the open. The *S. franciscanus* were noticeably larger at this site inside the reserve compared to Cluster Point outside of the reserve. However, there was also a smaller size cohort present at this site that was not present at Cluster point. *Strongylocentrotus purpuratus* were mostly small. Juveniles of both species were rare. Offshore of the site, in urchin barrens, several *S. purpuratus* were observed with wasting disease.

Site #24, Chickasaw, Santa Rosa Island

2014 Status

Mature kelp forest

Sampling Dates and Work Completed

07/29/14: Fish transects, video transects, roving diver fish counts, fish size frequencies, 1m^2 quadrats, 5m^2 quadrats, band transects, random point contacts and size frequencies for *Tethya aurantia, Megathura crenulata, Haliotis rufescens, Crassedoma gigantea, Strongylocentrotus purpuratus, S. franciscanus, Patiria miniata, Pisaster giganteus,* and *Macrocystis pyrifera* were completed. The temperature loggers were retrieved and deployed, and all data were successfully downloaded. One eye bolt at 80 m was replaced.

Site Notes

The site continued to be a mature kelp forest with widely spaced *Macrocystis pyrifera* plants. *Macrocystis pyrifera* appeared healthy. Canopy cover was estimated at 80%. Understory red algae were abundant and diverse. *Laminaria setchellii* were common. *Pterygophora californica* were common and located mostly on the offshore side of the transect.

Tethya aurantia were common, mostly large, and some were huge. The most common miscellaneous invertebrates recorded during RPCs were *Balanus* spp., followed by anemones and hydroids. *Balanus* spp. were more abundant than had been observed at this site since monitoring began. *Phragmatopoma californica* were common and some of the patches form previous years were

destroyed. Two *Panulirus interruptus* were observed and both were of legal size. Tunicates were common and diverse.

Two large *Aplysia californica* were observed. *Crassedoma gigantea* were moderately abundant and most were under 60 mm in size. *Megathura crenulata* were common and mostly large, similar to past years.

There were occasional patches of rock denuded of algae with higher densities *Strongylocentrotus franciscanus* than the surrounding substrate. These *S. franciscanus* created localized urchin barrens over much of the site. The *S. franciscanus* were mostly large. *Dermasterias imbricata* were rare but large. *Parastichopus parvimensis* were common and all were large. Three *Pisaster giganteus* were observed. Fish seemed to be less abundant than in recent years.

Site #25, South Point, Santa Rosa Island

2014 Status

Mature kelp forest

Sampling Dates and Work Completed

07/31/14: Video transects, fish size frequencies, roving diver fish counts, $1m^2$ quadrats, $5m^2$ quadrats, band transects, random point contacts and size frequencies for *Tethya aurantia, Megathura crenulata, Haliotis rufescens, Kelletia kelletii, Crassedoma gigantea, Megastraea undosa, Lithopoma gibberosa, Strongylocentrotus purpuratus, S. franciscanus, Patiria miniata, Pisaster giganteus,* and *Macrocystis pyrifera* were completed. The temperature loggers were retrieved and deployed, and all data were successfully downloaded.

10/02/14: Fish transects, fish size frequencies, and roving diver fish counts were completed.

Site Notes

The site was similar to last year. It was a mature kelp forest with large, widely spaced *Macrocystis pyrifera* plants. Canopy cover was estimated at 80%. There was an increase in understory brown algae such as *Pterygophora californica*, *Desmarestia* spp., and *Cystoseira* spp. The bottom was almost completely covered in brown algae over most of the transect. Even with the warm water event that the region has been experiencing, the *Macrocystis pyrifera* appeared healthy and with few epiphytes.

The most common miscellaneous invertebrate recorded during RPCs were *Cucumaria* spp. and *Eupentacta quinquesemita. Balanus* spp. were moderately abundant and almost all were small. Two *Panulirus interruptus* were observed. *Polyclinum* sp. were common and large. However, similar to what we observed at Johnson's Lee North, there abundance was less than in recent years.

Crassedoma gigantea were rare, and all sizes were present. *Styela montereyensis* were common, and all sizes were present. *Haliotis rufescens* appeared to continue to increase in abundance. Two *H. rufescens* were observed to have slightly shrunken foots. One large *Kelletia kelletii* and one *Lithopoma gibberosa* were observed. One large individual *Megastraea undosa* was observed, similar to past years.

There were several bare areas with high densities of large *Strongylocentrotus franciscanus*. *Strongylocentrotus purpuratus* also appeared more abundant. *Cucumaria* spp. were not as abundant as in past years. *Pachythyone rubra* were more abundant. *Parastichopus parvimensis* were common and all were large. *Patiria miniata* were moderately abundant and one was observed with possible wasting disease. *Strongylocentrotus purpuratus* juveniles were very rare similar to other sites. *Strongylocentrotus* spp. in general have noticeably increased at this site similar to Johnson's Lee North. On the second visit, at least nine *Patiria miniata* and four *Dermasterias imbricata* were observed with wasting disease.

Due to high surge conditions at time of sampling the bottom was stirred up it seemed that many of the fish were gone, deep in holes. One juvenile *Alloclinus holderi* was observed by Dave Witting. This is unusual for this site, but not surprising for a warm water year.

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

2014 Status

Dominated by *Strongylocentrotus purpuratus*

Sampling Dates and Work Completed

06/12/14: Fish transects, fish size frequencies, video transects, roving diver fish counts, $1m^2$ quadrats, $5m^2$ quadrats, band transects, random point contacts and size frequencies for *Tethya aurantia, Kelletia kelletii, Megastraea undosa, Megathura crenulata, Crassedoma gigantea, Tegula regina, Strongylocentrotus purpuratus, S. franciscanus, Lytechinus anamesus,* and *Patiria miniata* were completed. The temperature loggers were retrieved and deployed, and all data were successfully downloaded. Size frequencies for *Lophogorgia chilensis, Muricea californica, and Muricea fruticosa* were completed.

08/15/14: Size frequencies for *Lophogorgia chilensis, Muricea californica, and Muricea fruticosa* were completed.

08/27/14: Fish transects, fish size frequencies, video transects, and roving diver fish counts were completed.

Site Notes

No canopy cover was present. *Sargassum horneri* were looked for extensively on the site, as well as inshore, but none were found.

The site continues to have a moderate amount of encrusting and sessile invertebrates. *Lophogorgia chilensis* were moderately abundant and mostly concentrated at the 0-25 m end of the transect. Many *L. chilensis* appeared unhealthy and several appeared dead. One *Murcia fruticosa* was observed. Miscellaneous invertebrates were abundant. The most abundant miscellaneous invertebrate on RPCs were *Balanus* sp., which accounted for most of the cover in that category. *Spirobranchus spinosus* and hydroids such as *Clavularia* sp. were common in the miscellaneous invertebrates category.

Aplysia californica were common and all sizes were present but consisted mostly of large individuals. *Crassedoma gigantea* were rare for this site. One *Haliotis corrugata* was observed

during band transects and was measured at 36 mm. Several fresh *Haliotis rufescens* shells were found at the site. In addition, six shells measuring between 20 and 38 mm were found just inshore of the site, indicating that a *H. rufescens* recruitment had occurred. *Megathura crenulata* were abundant and all sizes were present. One *Octopus* sp. was observed. *Kelletia kelletii* were rare and all individuals observed were small. One paper nautilus shell, *Argonauta* sp., was found.

This site was similar to last year and continued to be dominated by *Strongylocentrotus purpuratus*. *Pachythyone rubra* were common but patchy. *Parastichopus parvimensis* were common and mostly large. *Patiria miniata* were common with all sizes present. *Pisaster ochraceus* were rare with three observed at 125 mm, 135 mm and 137 mm. *Pisaster ochraceus* were sampled on band transects for a density of 0.0014/m^2. During a survey dive near the site no *P. giganteus* or *P. ochraceus* were observed. Juvenile *Strongylocentrotus purpuratus* were rare.

Two *Lythrypnus dalli* were observed. *Alloclinus holderi* were common with all sizes present, including recent recruits. One large *Porichthys notatus,* plainfin midshipman, measuring about 50 cm was observed. *Lythrypnus dalli* recruits were observed on the second visit.

Site #27, Potato Pasture, Santa Cruz Island

2014 Status

Developing kelp forest

Sampling Dates and Work Completed

07/09/14: Fish transects, video transects, roving diver fish counts, fish size frequencies, 1m^2 quadrats, 5m^2 quadrats, band transects, random point contacts and size frequencies for *Tethya aurantia, Lophogorgia chilensis, Muricea fruticosa, Muricea californica, Megathura crenulata, Kelletia kelletii, Crassedoma gigantea, Megastraea undosa, Lithopoma gibberosa, Tegula regina, Lytechinus anamesus, Strongylocentrotus purpuratus, S. franciscanus, Patiria miniata, Pisaster giganteus,* and *Macrocystis pyrifera* were completed. The temperature loggers were retrieved and deployed, and all data were successfully downloaded.

08/27/14: Fish transects, video transects, roving diver fish counts, and fish size frequencies were completed.

Site Notes

Overall the site was similar to past years, but there were some changes. Though mostly subadult plants, there was more *Macrocystis pyrifera* then we have observed in the past. Canopy cover was estimated at 30%. Most of the *Macrocystis pyrifera* were subadults and most looked tattered with bryozoan cover and seemed to be senescing. It was patchy and mostly in the lower lying areas where there were more *Strongylocentrotus purpuratus*. There was also an abundance of ephemeral algae in the low lying areas consisting of very large *Desmarestia* spp. and *Dictyota*/*Pachydictyon* sp. *Desmarestia* spp. were moderately abundant and mostly large and mostly in the low lying areas. The tops of the large reefs/rocks were covered in large, healthy *Eisenia arborea* plants and also had an abundance of juveniles. *Dictyota*/*Pachydictyon* sp. continued to increase in abundance from 0-15 meters on the transect. *Dictyota/Pachydictyon* sp. were moderately abundant and large. *Sargassum*

horneri increased in abundance. There were reproductive adults and juveniles scattered over the entire transect. Most patches were low density, but there were a few high density patches. Most of the mature reproductive adults were larger (~0.5 meters) than what we have seen at other sites. *S. horneri* seemed a bit more abundant in the low lying areas offshore of the transect. *Codium fragile* were common. *Colpomenia* sp. were moderately abundant and in noticeably high density patches. Most of the reproductive *Sargassum horneri* were larger than the reproductive ones at Santa Barbara and Anacapa Islands. Other red algae were common and in relatively high density. On the second visit there were more *M. pyrifera* and *E. arborea. Sargassum horneri* were larger.

Encrusting invertebrates were abundant on the large rocky outcrops similar to last year. The most common miscellaneous invertebrate recorded during RPCs were hydroids. *Panulirus interruptus* were moderately abundant with all sizes present; some very large and some less than legal size.

Aplysia californica were common with all sizes present. *Navanax inermis* were moderately abundant. *Crassedoma gigantea* were moderately abundant; most were large and juveniles were rare. No abalone shells were observed. *Lithopoma gibberosa* were common and mostly small to medium in size. *Megathura crenulata* were scattered around the transect and most were large.

Two *Pisaster giganteus* were recorded during band transects for a density of 0.0028/m^2. *Centrostephanus coronatus* were common and small. *Linckia* sp. were absent. *Pachythyone rubra* were moderately abundant from the 0-20 m section of the transect. This area also had an abundance of ephemeral algae. The *Pachythyone rubra* were small in size and did not appear healthy-looking. Encrusting invertebrates were abundant on the large rocky outcrops similar to last year. *Parastichopus parvimensis* were mostly medium to large in size. *Patiria miniata* were common and approximately 5% were observed with wasting disease from the warm water event. This is the first day we have observed warm water associated sea star wasting disease this year. Several sea stars were completely wasted down to a pile of ossicles, while several others were in various stages of wasting disease. *Strongylocentrotus purpuratus* seemed to have decreased in abundance, and were patchy with some out in the open while others were in crevices.

At least six *Lythrypnus dalli* were observed. All sizes of *Alloclinus holderi* were present. Many *A. holderi* juveniles were observed, especially after the RDFC. There were more here than we have observed at any other site. Four *Porichthys notatus,* plainfin midshipman, were observed and had nests. They were all actively burrowing. Approximately 10 medium-sized *Medialuna californiensis*, halfmoon, were observed. Two large *Lythrypnus Dalli* were observed, as well as 17 recruits.

The transect tape was laid several meters off the line from meter 40-50. This should have minimal impact on the data/quadrats.

Site #28, Cavern Point, Santa Cruz Island

2014 Status

Mature kelp forest

Sampling Dates and Work Completed

06/24/14: Fish transects, video transects, fish size frequencies, roving diver fish counts, $1m^2$ quadrats, $5m^2$ quadrats, band transects, random point contacts and size frequencies for *Strongylocentrotus purpuratus, S. franciscanus, Lytechinus anamesus, Pisaster giganteus, Megastraea undosa, Lithopoma gibberosa, Crassedoma gigantea, Tegula regina, Megathura crenulata, Kelletia kelletii, Tethya aurantia* and *Macrocystis pyrifera* were completed. The temperature loggers were retrieved and deployed, and all data were successfully downloaded.

08/15/14: Size frequencies for *Patiria miniata, Lytechinus anamesus, Lophogorgia chilensis, Muricea californica* and *Muricea fruticosa* were completed.

Site Notes

This site continued to be a mature kelp forest with an understory of red algae and encrusting invertebrates. Canopy cover was estimated at 85%. This site continues to be an icon of an MPA site with increasingly large fish, including *Paralabrax clathratus* and *Semicossyphus pulcher*, and high diversity and abundance of encrusting invertebrates that cover much of the substrate. One juvenile *Laminaria farlowii* was observed. This site had the highest density of juvenile *Sargassum horneri* of all KFM sites last year. We expected to see more juvenile *S. horneri* this year, but there were less. This was the only site to experience a decrease in juvenile densities this year. Adults did increase slightly. While plants were abundant in distributed patches around the site, they were noticeably small compared to past years at this site. It was common to see plants less than 10 cm with receptacles. It appears that *S. horneri* prefers primary substrate (rock or often lead line) and does not settle well on other organisms. This in combination with low light conditions from a dense canopy may be inhibiting this alga. Red algae covered much of the site, growing on top of the array of encrusting invertebrates. *Sargassum horneri* appeared much less abundant during the second visit.

Sponges were extremely abundant and diverse. Many were unidentifiable. *Lophogorgia chilensis* were moderately abundant and mostly on the offshore side of the transect. One *Muricea fruticosa* was observed. *Salmacina tribranchiata* were common and mostly in small colonies. Two *Cancer* sp. were observed. *Panulirus interruptus* were common and mostly on the inshore side of the transect, and were mostly medium to large in size.

Cypraea spadicea were common. There was evidence of predation on *C. spadicea*, such as fresh crushed shells. *Kelletia kelletii* were common, while juveniles were rare. Their shells were clean and white. Two juvenile *Lithopoma gibberosa* were observed. *Megastraea undosa* were common and all sizes present. *Megathura crenulata* were rare and consisted only of large individuals.

Centrostephanus coronatus were rare with several medium sized individuals observed. *Lytechinus anamesus* were rare with only several observed. *Parastichopus parvimensis* were moderately abundant with all sizes present. *Patiria miniata* were uncommon on the first visit and rare on the second, likely having senesced from warm water wasting disease. No size frequencies for this *P. miniata* were collected during the first visit; therefore very few size frequencies were collected this year. *Pisaster giganteus* were rare with at least six or more observed on the first visit and only 2 on the second. *Pisaster giganteus* were sampled during band transects for a density of $0.0083/m^2$.

Piaster ochraceus were rare with two observed. *Pisaster ochraceus* were sampled during band transects for a density of 0.0014/m^2. *Strongylocentrotus purpuratus* were moderately abundant with high density patches scattered around the site.

Very large *Alloclinus holderi* were common and recruits were common as well. No *Gymnothorax mordax*, California moray eel, were observed. *Sebastes atrovirens, Oxyjulis californica, Chromis punctipinnis*, and juvenile *Paralabrax clathratus* were common. *Halichoeres semicinctus* juveniles were observed.

Site #29, Little Scorpion, Santa Cruz Island

2014 Status

Dominated by *Strongylocentrotus* spp.

Sampling Dates and Work Completed

05/12/14: Fish transects, video transects, fish size frequencies, roving diver fish counts, 1m^2 quadrats, 5m^2 quadrats, band transects, random point contacts and size frequencies for *Strongylocentrotus purpuratus, S. franciscanus, Patiria miniata, Tegula regina, Megathura crenulata, Kelletia kelletii, Tethya aurantia* and *Haliotis fulgens* were completed. The temperature loggers were retrieved and deployed, and all data were successfully downloaded.

05/28/14: Video transects and size frequencies for *Patiria miniata, Megastraea undosa, Lithopoma gibberosa, Crassedoma gigantea, Tegula regina, Megathura crenulata, Kelletia kelletii, Tethya aurantia* and *Haliotis rufescens* were completed.

09/17/14: Fish transects, video transects, roving diver fish counts and fish size frequencies were done for a second time to capture the warm water fish recruitment late in the summer.

Site Notes

Other than a few juvenile *Macrocystis pyrifera* and *Eisenia arborea*, this site was devoid of macroalgae. Several juvenile *Eisenia arborea* were observed. There was no canopy cover present. Many of the tops of rocks were completely covered with filamentous diatoms. There were some *Laurencia pacifica* present. This was the third most common algae. Other than the increase in diatom cover and the decrease in *Pisaster giganteus* abundance, the site seemed similar to last year.

At least four large *Loxorhynchus grandis* were observed. Small mysids were moderately abundant. The most common miscellaneous invertebrate observed during RPCs were barnacles, hydroids and *Cucumaria* spp.

Small *Crassedoma gigantea* were common. *Aplysia californica* were rare with several observed. One small *Haliotis fulgens* at 30 mm was observed on a band transects, about 2 meters off the transect line. Small *Lithopoma gibberosa* were common on the offshore side of the transect.

Sea stars other than *Patiria miniata* were absent. *Parastichopus parvimensis* were common, and were small to medium in size. *Patiria miniata* were moderately abundant with all sizes present; most were medium sized and all appeared healthy. No *Pisaster giganteus* were observed. Only one *Pisaster*

ochraceus was observed with two of the arms appearing to be recovering from disease. It measured 167 mm and appeared skinny. *Strongylocentrotus franciscanus* were moderately abundant, and 1% of the population showed signs of wasting disease. No juvenile urchins were observed, but we did not turn over any rocks. On the second visit, approximately 2% of *Strongylocentrotus purpuratus* and *S. franciscanus* appeared diseased.

There was a large school of 4-6 cm *Chromis punctipinnis* indicating recruitment last year. Small and medium sized *Sebastes mystinus* were abundant. Small *Lythrypnus dalli* were common. Small *Oxylebius pictus* were common. At least seven *Gymnothorax mordax*, California moray eel, were observed. Later on in the afternoon, around 1700, fish were more abundant especially *Sebastes atrovirens* and *S. chrysomelas*. This was a very fishy site, but most fish were small. On the second visit, *Lythrypnus dalli* were more common. On the second visit, video transects, fish transects and roving diver fish counts were conducted again to capture the warm water fish recruitment.

Temperature logger stake needs reinforcement.

Site #30, Pedro Reef, Santa Cruz Island

2014 Status

Dominated by *Strongylocentrotus purpuratus*

Sampling Dates and Work Completed

08/25/14: Fish transects, fish size frequencies, video transects, roving diver fish counts, $1m^2$ quadrats, $5m^2$ quadrats, band transects, random point contacts and size frequencies for *Strongylocentrotus purpuratus, S. franciscanus, Lytechinus anamesus, Patiria miniata, Pisaster giganteus, Lithopoma undosa, Lithopoma gibberosa, Megathura crenulata, Kelletia kelletii, Lophogorgia chilensis, Muricea californica, Crassedoma gigantea, Tethya aurantia* and *Macrocystis pyrifera* were completed. The temperature loggers were retrieved and deployed, and all data were successfully downloaded.

Site Notes

08/25/14: This site was similar to past years; however there were some changes. The largest changes were the increase in *Balanus* sp. which covered much of the site, the decrease in *Ophiothrix spiculata* abundance on the offshore side of the transect, and the increase in *Macrocystis pyrifera* in the one high relief area at meter 25-30. There was no kelp canopy present. Also, there were some juvenile *Eisenia arborea* on the offshore side. Most of the high density *Desmarestia* sp. patches were just offshore of the transect line in greater than 35 feet of depth. *Codium fragile* were more abundant and noticeably larger in size than in past years. One juvenile *Cystoseira* sp. was observed. A large bed of *Desmarestia ligulata* was at meter 60-100 on the offshore side of the transect. *Eisenia arborea* adults were small and appeared more abundant than in past years. *Sargassum horneri* was rare with only one found along the transect. *Laurencia pacifica* were less abundant than in past years.

The most common miscellaneous invertebrates recorded during RPCs were *Balanus* sp. *Tethya aurantia* were mostly small and completely covered with algae/diatom film. *Corynactis californica* were abundant both in high relief and low lying areas. Many patches appeared unhealthy.

Chaetopterus sp. were observed spawning across the entire site. The spawning was observed only for the second half of the first dive. During this time, the visibility decreased due to the amount of spawning occurring in the water column. By the time we started our second dive no more spawning occurred and visibility cleared up. Small *Balanus* sp. individuals were moderately abundant throughout the site. One *Panulirus interruptus* of about legal size was observed. Five large *Loxorhynchus grandis*, sheep crab, skeletons were found. One live individual was observed.

Aplysia californica of all sizes were present. Small mating aggregations were observed. *Crassedoma gigantea* were mostly small. *Kelletia kelletii* were mostly juveniles. Also juvenile *Megathura crenulata* and *Lithopoma undosa* were abundant. *Megastraea undosa* were mostly juveniles; only one or two adults were observed. On the shallow side of the site, 10 meters off of the transect, juvenile *M. undosa* were also moderately abundant and adults were more common than directly along the transect. At least eight large *Octopus bimaculoides* were observed. Only several *Tegula regina* were observed.

With the high abundance of *Strongylocentrotus* spp. we expected the site to remain dominated by urchins, which it did. *O. spiculata* were less abundant in this area compared to past years. Kushner thinks the *D. ligulata* out competes and displaces areas from *O. spiculata* physically through the sweeping action of this low-lying algae from surge. *Lytechinus anamesus* were large. *Pachythyone rubra* were scattered around the site in low density patches. *Parastichopus parvimensis* were large and more common on the offshore side of the transect. Approximately 15 were observed. *Patiria miniata* were less abundant than past years, likely due to the warm water wasting disease event. Most looked a deflated and unhealthy. *Astropecten* sp. were observed with wasting disease. Three *Pisaster giganteus* were observed at the site. *Pisaster giganteus* were sampled on band transects for a density of 0.0014/m^2. Overall *Strongylocentrotus purpuratus* and *S. franciscanus* were rare, similar to other sites this year. Approximately 5% of *Lytechinus anamesus*, 2% of *Strongylocentrotus purpuratus*, 10% of *Patiria miniata,* and 10% of *Astropecten* sp. had wasting disease.

Four large and six juvenile *Lythrypnus dalli* were observed. *Coryphopterus nicholsii* juveniles were observed. One *Alloclinus holderi* was observed. Most of the *Oxylebius pictus* present were YOY. Six to eight *Seriola lalandi,* yellowtail, were observed at the 100 meter end of the transect. One small *Caulolatilus princeps*, ocean whitefish, was observed.

Approximately five or more years ago, we documented an abandoned lobster trap just off the transect at the 100 meter end. Kushner has been watching this trap degrade over the years. This year most of the wire was corroded away and scattered around except for the bottom layer and metal frame. There was still a moderate amount of nylon line attached to the trap. One more old trap was present inshore of the transect also with nylon line.

Site #31, Keyhole, Anacapa Island

2014 Status

Dominated by *Strongylocentrotus purpuratus*

Sampling Dates and Work Completed

05/28/14: Fish transects, video transects, roving diver fish counts, fish size frequencies, $1m^2$ quadrats, $5m^2$ quadrats, band transects, random point contacts and size frequencies for *Strongylocentrotus purpuratus, S. franciscanus, Lytechinus anamesus, Patiria miniata, Pisaster giganteus, Megastraea undosa, Crassedoma gigantea, Tegula regina, Megathura crenulata, Kelletia kelletii, Lophogorgia chilensis, Muricea californica, Muricea fruticosa*, and *Tethya aurantia* were completed. The temperature loggers were retrieved and deployed, and all data were successfully downloaded. A wave meter was deployed.

09/29/14: Fish transects, fish size frequencies, video transects, and roving diver fish counts were redone to try to capture this huge warm water recruitment event that occurred since we last sampled these sites.

Site Notes

Overall the site remained dominated by *Strongylocentrotus purpuratus*; however there were more algae on the tops of rocks and even in the low-lying sand-cobble areas than in recent years. This algae consisted of a mix of juvenile *Eisenia arborea,* juvenile *Laminaria farlowii, Dictyota/ Pachydictyon, Sargassum muticum,* and *Sargassum horneri*. No kelp canopy was present. *Desmarestia* sp. were present and all were small. With all of the juvenile macroalgae present, this area could transition into a developing kelp forest. *Sargassum horneri* were most abundant inshore of the 0 m end of the transect, where we observed them in high abundance several years ago. All of the reproductive adult plants were small, less than 50 cm tall, and these as well as juveniles were present from 18- 45 ft. of depth. Several juvenile *Egregia menziesii* were observed. On the second visit, *Sargassum horneri* adults were common and juveniles were moderately abundant and covered about 35% in high density patches. It was more abundant than during our earlier visit in May. Few plants were reproductive.

Tethya aurantia were observed. Only five *Muricea fruticosa* were observed. *Chaetopterus* sp. were abundant on the deep side of the transect. Terebellid worms were present. *Balanus* sp. were abundant. The most common miscellaneous invertebrates recorded on RPCs were *Balanus* sp. One *Cancer* sp. was observed as well as one fresh molt. Only one *Panulirus interruptus* was observed, and it was near legal size.

Only several *Kelletia kelletii* were observed. *Megastraea undosa* were present and most were large.

Less than 1% of *Strongylocentrotus franciscanus* were observed with wasting disease. *Centrostephanus coronatus* were present and all were large. *Parastichopus parvimensis* were abundant and mostly medium to large in size. Juvenile *Patiria miniata* were common under rocks. Five *Pisaster giganteus* were found. *Pisaster giganteus* were sampled during band transects for a density of $0.0028/m^2$. One *Pisaster ochraceus* was observed on the site, but inshore from the site (less than 20ft deep) there were five others observed. All appeared healthy. *Strongylocentrotus purpuratus* were common but no juveniles were observed. Few large *Strongylocentrotus franciscanus* were observed but no juveniles were found.

Only very small, recently recruited *Lythrypnus dalli* were observed. No adults were present. *Coryphopterus nicholsii* were common with all sizes present. Recent recruits were moderately abundant. Up to six *Alloclinus holderi* were observed. *Chromis punctipinnis* became very abundant later in the day with 2000- 3000 observed, most medium sized. Only one *C. punctipinnis* was observed with *Vibrio* sp. This is very different to what we observed at Admirals Reef. *Paralabrax clathratus* were large and abundant just inshore of the site where there was better and more rugose habitat. On the second visit, one *Patiria miniata*, one *Pisaster giganteus*, and one *P. ochraceus* were observed. There has been much warm water and wasting disease observed recently. Less than 1% of *Strongylocentrotus purpuratus* were observed with wasting disease. On the second visit, there was a large recruitment of *Chromis punctipinnis, Oxyjulis californica, Paralabrax clathratus*, and *Halichoeres semicinctus*. There was also a high abundance of *Hypsypops rubicundus* in shallower (<15ft) water inshore of the transect. There were more *H. rubicundus* and *H. semicinctus* than Kushner has ever observed.

Site #32, East Fish Camp, Anacapa Island

2014 Status

Dominated by *Strongylocentrotus purpuratus* and *Ophiothrix spiculata*

Sampling Dates and Work Completed

05/30/14: One wave meter was deployed.

06/27/14: Fish transects, fish size frequencies, and roving diver fish counts were completed.

09/15/14: Fish transects, fish size frequencies, video transects, roving diver fish counts, $1m^2$ quadrats, $5m^2$ quadrats, band transects, random point contacts and size frequencies for *Strongylocentrotus purpuratus, S. franciscanus, Lytechinus anamesus, Patiria miniata, Pisaster giganteus, Megastraea undosa, Megathura crenulata, Kelletia kelletii, Lophogorgia chilensis, Muricea californica, Muricea fruticosa, Crassedoma gigantea,* and *Tethya aurantia* were completed. The temperature loggers were retrieved and deployed, and all data were successfully downloaded.

Site Notes

This site was similar to past years. This visit was two weeks after the longest south swell event in decades. We had also visited the site earlier in the season. There was some noticeable sand movement and medium size boulder/cobble movement (from loose rocks). No canopy cover was present. Other green algae consisted mostly of turf algae. Two *Cystoseira* sp. plants were observed. One small *Desmarestia* sp. was observed. Three *Eisenia arborea* were observed. One *Sargassum muticum* was observed. There was one patch of ~0.5 m tall reproductive *Sargassum horneri* on the transect line at meter 40. In addition, there were small juveniles scattered around the transect. They were a bit more abundant in this area. *Sargassum horneri* appeared healthy and robust. Few were reproductive, but many were approaching reproductive size. Most were less than 20 cm tall and were located at meters 45-60.

Corynactis californica were most abundant on the tops of rocks. Many appeared unhealthy looking. Most *Urticina* sp. present were *Urticina Columbiana.* The most common miscellaneous invertebrates

recorded on RPCs were *Balanus* sp., followed by *Spirobranchus spinosus. Balanus* sp. were mostly small and there appeared to be only one size class present. This is very different from other sites this year where there were multiple cohorts present. These were recruiting only on rocks not covered with *O. spiculata*. *Diaperoecia californica* were rare.

Several huge clams (Kushner is pretty sure they were gaper clams) were exposed, likely dug up from the south swell event. All sizes of *Aplysia californica* were present, including very small juveniles. Several juveniles were observed in crevices and sometimes covered with *O. spiculata*. Only large *Bursa californica* were observed. All sizes of *Crassedoma gigantea* were present. *Kelletia kelletii* increased in abundance, and had the highest density recorded since 2009.

Despite the swell event, there appeared to be little change in *Ophiothrix spiculata* cover, or of anything else. One small *Parastichopus californicus* observed. At least three *Parastichopus parvimensis* were observed. Approximately 20% of *Patiria miniata* that were measured for size frequencies had signs of wasting disease. Less than 2% of *Strongylocentrotus franciscanus* and *S. purpuratus* had wasting disease. One *Pisaster giganteus* was observed.

One *Lythrypnus dalli* was observed. *Coryphopterus nicholsii* were less abundant during the second visit. The decrease in counts between RDFC performed on 6/27 and 9/15 could be due to the high swell event that hit the area on 8/27/14. There was an abundance of juvenile *Chromis punctipinnis, Oxyjulis californica*, and *Hypsypops rubicundus*.

Site #33, Black Sea Bass Reef, Anacapa Island

2014 Status

Half dominated by *Ophiothrix spiculata* and half mature kelp forest

Sampling Dates and Work Completed

06/26/14: Fish transects, video transects, roving diver fish counts, fish size frequencies, $1m^2$ quadrats, $5m^2$ quadrats, band transects, random point contacts and size frequencies for *Strongylocentrotus purpuratus, S. franciscanus, Patiria miniata, Pisaster giganteus, Lithopoma undosa, Crassedoma gigantea, Tegula regina, Tethya aurantia* and *Macrocystis pyrifera* were completed. The temperature loggers were retrieved and deployed, and all data were successfully downloaded.

09/24/14: Fish transects, fish size frequencies, video transects, and roving diver fish counts were redone to try to capture this huge warm water recruitment event that occurred since we last sampled these sites.

Site Notes

Although most of this site is still dominated with a thick layer of *Ophiothrix spiculata*, there was more kelp at this site than had been observed since it was established. Most of the kelp is present at the 0-40 meter side of the transect and consisted of *Macrocystis pyrifera* and *Sargassum horneri*. Very little *O. spiculata* cover was present at that area of the site. Canopy cover was estimated at 3%. There were also a few small adult and juvenile *Laminaria farlowii* plants present. Other green algae consisted almost entirely of *Cladophora* spp., which was present under the *O. spiculata*. The *M.*

pyrifera looked unhealthy and tattered with high loading of epiphytic *Membranipora* sp. Most of the *M. pyrifera* were medium to large in size. A total of 150 were found for size frequencies. While most were located around 0-40 meters, others were scattered around most of the site. Only one adult *Eisenia arborea* was observed. *Sargassum horneri* adults and juveniles were moderately abundant. Most of the reproductive *S. horneri* were greater than 50 cm tall, appeared unhealthy, and were well on their way to senescing. Very few plants under 50 cm had reproductive receptacles. This is very different from the other sites that have *S. horneri* present where individuals as small as 5-10 cm have reproductive receptacles. The adult *S. horneri* were mostly around 1 m tall but not much taller. This differs from observations at Catalina Island and other locations in Southern California. Other red algae were moderately abundant and consisted mostly of filamentous species under the *O. spiculata*. There was very little foliose red algae present. On the second visit, *Sargassum horneri* were more abundant and healthy than during the previous visit. No senescing plants were observed. Reproductive *S. horneri* were rare with only a few small plants observed.

Tethya aurantia were common and hard to see due to the *O. spiculata* cover, but most were large. *Astrangia lajollaensis* were likely present in small numbers but we did not have time to look for them. Most gorgonians appeared unhealthy and there continued to be a decline in abundance since we began monitoring this site. Observations suggest this is due to smothering from *O. spiculata*. The most common miscellaneous invertebrate recorded during RPCs were gorgonians. At least eight large *Loxorhynchus grandis* were observed. *Loxorhynchus grandis* were sampled during band transects for a density of 0.0069/m^2. Kushner observed one *Loxorhynchus grandis* eating a *Parastichopus parvimensis*. *Panulirus interruptus* appeared slightly less abundant, however almost all suitable habitat had lobster. Also, all were large in size. Almost all individuals appeared to be legal size. *Membranipora* sp. covered much of the algae. On the second visit, Lobsters were more abundant and larger than Kushner had ever observed at this site.

Aplysia californica were rare with only one small individual observed. No *Bursa californica* were observed *Megastraea undosa* were common and all were large and located along the 0-40 m section of the transect, where algae were abundant. We observed juvenile *S. horneri* on many of the *M. undosa*. As the plants become larger this could become a burden for this species. *Megathura crenulata* were absent from the site. This is the first time we have not observed any at the site, though only several were observed in 2012 and 2013. Prior to 2012, *M. crenulata* were common.

Centrostephanus coronatus were more abundant than at any other site. These were the most dominant sea urchin at this site. *Ophiothrix spiculata* were less abundant from 0-30 meters where kelp is growing, but very thick along the rest of the transect. *Parastichopus parvimensis* were moderately abundant and consisted of medium to large individuals. *Patiria miniata* were rare and mostly large in size. Only three were found for size frequencies. Four *Pisaster giganteus* were observed, and were sampled on band transect for a density of 0.0028/m^2. *Strongylocentrotus purpuratus* and *S. franciscanus* continued to decrease in abundance and are becoming increasingly hard to find with less than 200 for each species at the site. There were fewer *S. purpuratus* than there were *S. franciscanus* present. The mean size for both species was the highest recorded at this site.

Coryphopterus nicholsii were less abundant than in recent years. *Alloclinus holderi* remained at near record low density for this site, similar to the last three years, and similar to the other Anacapa Island sites. Many more were observed after the fish count was conducted. A school of at least 800 large *Sphyraena argentea*, Pacific barracuda, measuring approximately 100-113cm in length, was observed. Several *Seriola lalandi*, yellowtail, were observed on a regular basis throughout the day. Juvenile *Paralabrax clathratus* were common. Juvenile *Oxyjulis californica* and *Chromis punctipinnis* were abundant. No *Patiria miniata* or *Pisaster giganteus* were observed.

Site #34, Lighthouse, Anacapa Island

2014 Status

Dominated by *Strongylocentrotus purpuratus*

Sampling Dates and Work Completed

05/29/14: A wave meter was deployed.

07/10/14: Fish transects, video transects, fish size frequencies, roving diver fish counts, $1m^2$ quadrats, $5m^2$ quadrats, band transects, random point contacts and size frequencies for *Strongylocentrotus purpuratus, S. franciscanus, Lytechinus anamesus, Patiria miniata, Pisaster giganteus, Megastraea undosa, Lithopoma gibberosa, Crassedoma gigantea, 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, and all data were successfully downloaded.

Site Notes

The site remained similar to recent years. No canopy cover was present.

The most common miscellaneous invertebrates recorded during RPCs were *Sagartia/Cactosoma* and *Spiochaetopterus* sp. Two *Panulirus interruptus* were observed, and one was of legal size.

No fresh abalone shells were observed. *Kelletia kelletii* were rare and all individuals observed were large. *Megastraea undosa* were rare and consisted of mostly small individuals. *Megathura crenulata* were rare with all sizes present.

Lytechinus anamesus were rare and all sizes were present. *Patiria miniata* were common and mostly large. Approximately 2% of *Patiria miniata* were observed to have sea star wasting disease. At least seven *Pisaster giganteus* were observed at the site. *Pisaster giganteus* were sampled during band transects for a density of $0.0042/m^2$. Approximately 1% of *Strongylocentrotus purpuratus* and 2% of *S. franciscanus* had sea urchin wasting disease. One *Pisaster ochraceus* was observed and was measured at 102 mm.

Two *Alloclinus holderi* were observed. One *Scorpaena guttata*, California scorpionfish, was observed.

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

2014 Status

State of transition

Sampling Dates and Work Completed

05/14/14: Fish transects, video transects, roving diver fish counts, fish size frequencies, $1m^2$ quadrats, $5m^2$ quadrats, band transects, random point contacts and size frequencies for *Strongylocentrotus purpuratus, S. franciscanus, Lytechinus anamesus, Patiria miniata, Pisaster giganteus, Megastraea undosa, Lithopoma gibberosa, Crassedoma gigantea, Tegula regina, Megathura crenulata, Lophogorgia chilensis, Muricea californica, Muricea fruticosa, Stylaster californicus, Tethya aurantia* and *Macrocystis pyrifera* were completed. The temperature loggers were retrieved and deployed, and all data were successfully downloaded.

Site Notes

The site had more kelp this year than in previous years. Approximately 151 adult and subadult *Macrocystis pyrifera* were present, mostly between meters 70 and 100. No canopy cover was present. The tops of rocks had as much if not more algae and juvenile *Eisenia arborea* and *M. pyrifera* than past years. It appeared that with fewer urchins and more *Macrocystis pyrifera* juveniles the site could transition into a kelp forest soon. The area just west of the site had a kelp forest and there was a kelp forest north and east of the underwater arch, similar to last year. *Codium setchellii* were the most abundant algae and appeared more abundant than in previous years. David Kushner had never seen it so abundant before. It covered large areas of the bottom from 60 to 85 meters and was patchy around the site. *Cystoseira* sp. were rare with only one individual observed. *Desmarestia ligulata* were present in small patches over much of the site.

The most common miscellaneous invertebrate recorded during RPCs were amphipod tube mats followed by anemones. Three *Stylaster californicus* colonies were observed this year, up from one in 2012 and 2013. This species was first documented at this site in 2012. Two of the colonies were picked up by the band transect sampling protocol, for an increased density compared to the last two years it has been present. David Kushner looked for *Myxicola infundibulum* but could not find any. This species recruited in large numbers several years ago and had been declining since. Only one *Panulirus interruptus* was observed.

Aplysia californica were common with all sizes present. *Kelletia kelletii* were rare and large in size. *Lithopoma gibberosa* were abundant and most were small in size. Most if not all were of the same size cohort that we have been following for 2 to 3 years.

Strongylocentrotus franciscanus and *S. purpuratus* were still abundant in some areas, but were noticeably less abundant than in recent years. *Lytechinus anamesus* were rare with few observed; all sizes present in the low-lying cobble areas. *Parastichopus parvimensis* were common and all were large in size; several small aggregations were observed. One *Pisaster giganteus* was observed and it appeared healthy. Less than 1% of *Strongylocentrotus purpuratus* and *S. franciscanus* appeared diseased.

Coryphopterus nicholsii were common; juveniles were present. Juvenile *Oxylebius pictus* were common. There were more *Sebastes chrysomelas* present this year.

Site #36, Graveyard Canyon, Santa Barbara Island

2014 Status

Kelp forest

Sampling Dates and Work Completed

06/10/14: Fish transects, video transects, roving diver fish counts, fish size frequencies, $1m^2$ quadrats, $5m^2$ quadrats, band transects, random point contacts and size frequencies for *Strongylocentrotus purpuratus, S. franciscanus, Patiria miniata, Pisaster giganteus, Megastraea undosa, Crassedoma gigantea, Megathura crenulata, Lophogorgia chilensis, Muricea californica, Tethya aurantia* and *Macrocystis pyrifera* were completed. The temperature loggers were retrieved and deployed, and all data were successfully downloaded.

Site Notes

This site has changed dramatically in recent years. In 2012 the site had little brown algae. Last year *Desmarestia* spp. became abundant and *Ophiothrix spiculata* began decreasing in abundance. This year the site was a dense kelp forest with an abundance of understory brown algae. Understory algae consisted mostly of *Dictyota/Pachydictyon* sp. and *Cystoseira* spp. Canopy cover of *Macrocystis pyrifera* was estimated at 70%. Understory red algae were uncommon. Surprisingly, even with the high cover of *O. spiculata* there was an abundance of *Macrocystis pyrifera*. One small *Laminaria farlowii* adult was observed. *Sargassum horneri* were more abundant than had previously been observed at this site, similar to what we observed at Cat Canyon. Other brown algae were common and consisted mostly of *Zonaria* sp.

The most common miscellaneous invertebrates recorded during RPCs were *Sagartia/Cactosoma* sp. *Chaetopterus* sp. were common and more abundant on the reef near the zero end of the transect. One large *Cancer* sp. crab was observed. One large *Panulirus interruptus* was observed.

Only one *Aplysia californica* was observed. *Megastraea undosa* were common and all were large and covered with encrusting invertebrates. One small *Megathura crenulata* was observed.

Even though the site was a kelp forest now there was still an abundance of *Ophiothrix spiculata* covering the bottom, mostly from 40 to 100 meters. *Ophiothrix spiculata* remained at or near 100% cover at the end of the reef, 0-20 meters before the sand patch. *Ophiothrix spiculata* were less abundant and continued to decrease dramatically from last year's decrease. Most of the decrease occurred on the 40-100 meter end of the transect. *Parastichopus parvimensis* were common and mostly large. Only two tiny juvenile *Pisaster giganteus* individuals were observed. Urchins were common but in crevice habitat, which is limited at this site.

Paralabrax clathratus were very large, like what would be expected in an MPA. A new-looking 2 oz. fishing weight with monofilament line attached was found indicating recent poaching activity in the MPA.

Site #37, Southeast Reef, Santa Barbara Island

2014 Status

Mature kelp forest

Sampling Dates and Work Completed

05/15/14: Fish transects, video transects, roving diver fish counts, fish size frequencies, $1m^2$ quadrats, $5m^2$ quadrats, band transects, random point contacts and size frequencies for *S. purpuratus, S. franciscanus, Patiria miniata, Pisaster giganteus, Megastraea undosa, Lithopoma gibberosa, Crassedoma gigantea, Tegula regina, Megathura crenulata, Tethya aurantia, Haliotis corrugata* and *Macrocystis pyrifera* were completed. Sampling of all three ARMs were conducted. The temperature loggers were retrieved and deployed, and all data were successfully downloaded.

Site Notes

Overall the site remained a mature kelp forest similar to previous years. *Macrocystis pyrifera* were present over the entire site with both subadults and widely spaced adults present. Canopy cover was estimated at 80%. There were less *Cystoseira* spp. and *Eisenia arborea* on the shallow part of the reef. Overall, understory algae were noticeably less abundant. *Eisenia arborea* were common, but there were less adult plants than last year.

Lophogorgia chilensis were rare with only a few small individuals observed. *Sagartia/Cactosoma* sp. were rare and less abundant compared to recent years. Hydroids growing epiphytically on kelp were abundant. *Phragmatopoma californica* were common in *M. pyrifera* holdfasts. Amphipod tube mats were common. The most common miscellaneous invertebrates recorded during RPCs were hydroids. *Panulirus interruptus* were not as abundant as last year, but remained abundant in the rocky reef area south of the site. Several were large and all ones observed were above legal size. Tunicates were abundant on the 0-50 meter section of the transect, similar to past years.

One small *Haliotis corrugata* was observed during band transects and was measured at 46 mm. *Megastraea undosa* were common and large. *Tegula regina* were abundant in the rocky areas. *Crassedoma gigantea* were abundant, and had the highest density recorded at any site since 2005.

Centrostephanus coronatus were common and smaller individuals were observed with test sizes of approximately 25 mm. *Patiria miniata* were rare with three observed at the site and two observed in the ARMs. *Pisaster giganteus* were rare with eight observed total. *Pisaster giganteus* were sampled during band transects for a density of $0.011/m^2$. There were fewer *Strongylocentrotus purpuratus* this year and juveniles were rare.

Alloclinus holderi were rare with three observed. At least 12 *Gymnothorax mordax*, California moray eel, were observed while conducting band transects.

Appendix E. 1 Meter Quadrat Data

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

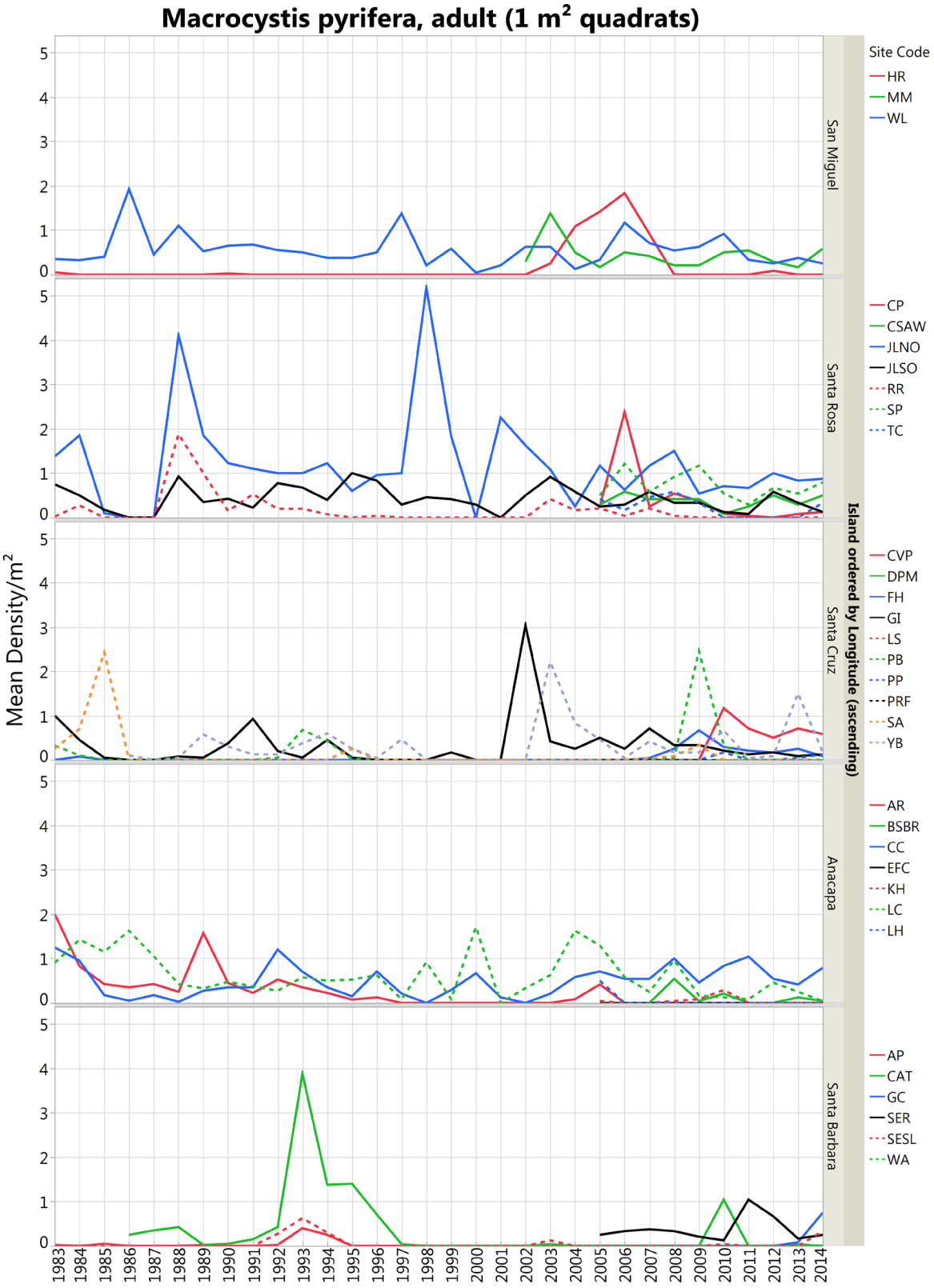


Figure E-1. Mean density of adult *Macrocystis pyrifera* by site and island at Channel Islands National Park between 1983 and 2014.

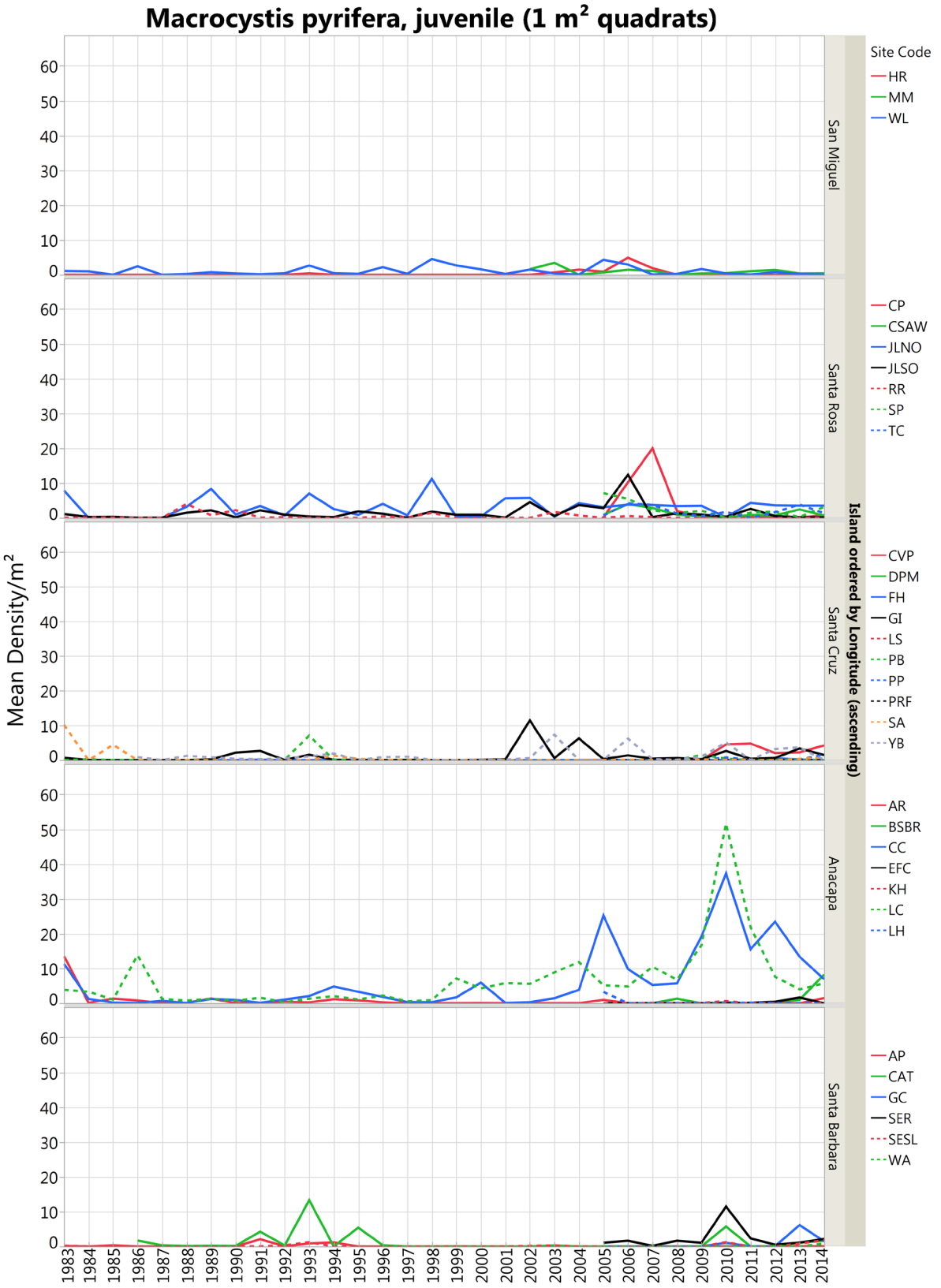


Figure E-2. Mean density of juvenile *Macrocystis pyrifera* by site and island at Channel Islands National Park between 1983 and 2014.

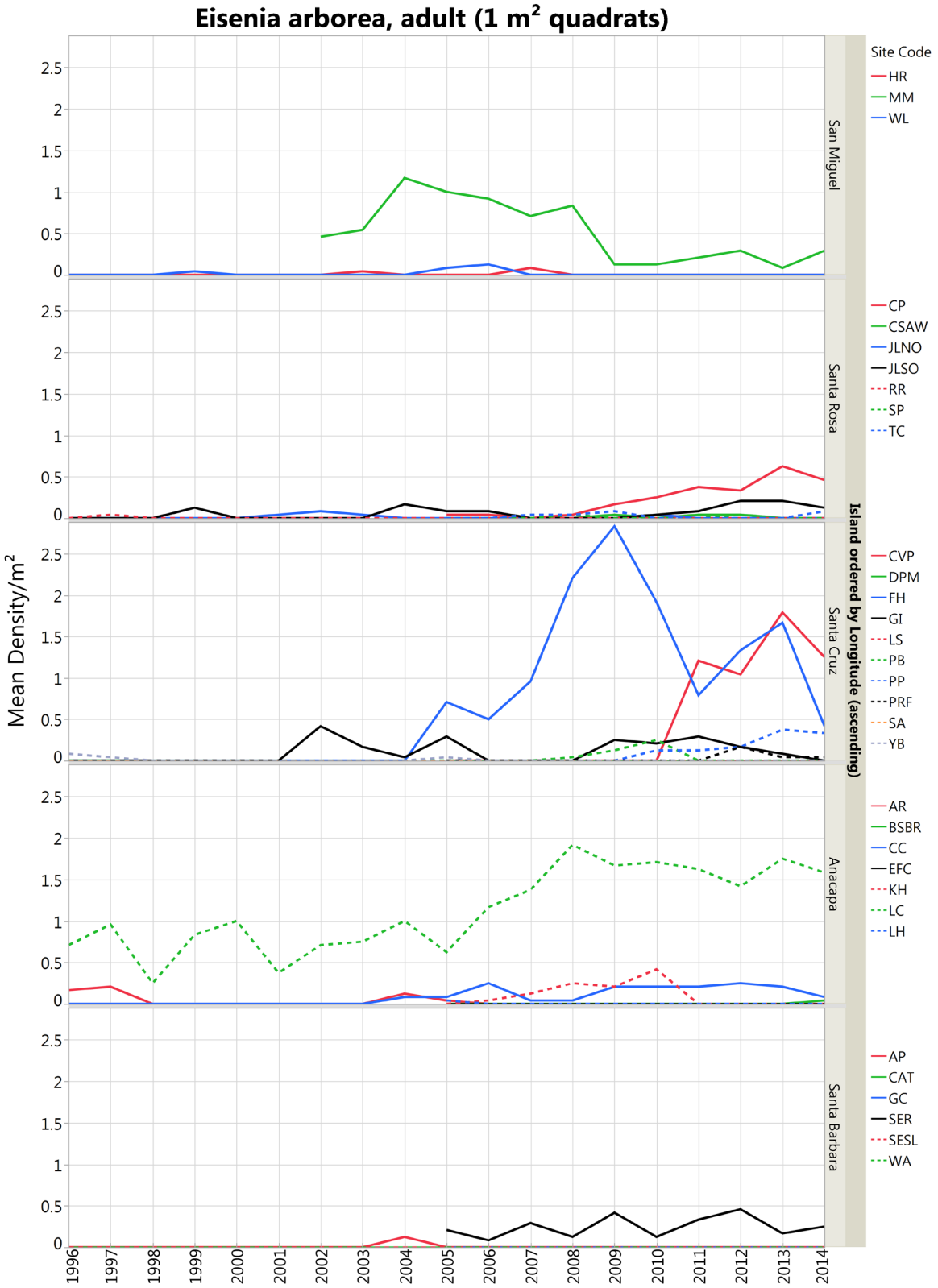


Figure E-3. Mean density of adult *Eisenia arborea* by site and island at Channel Islands National Park between 1996 and 2014.

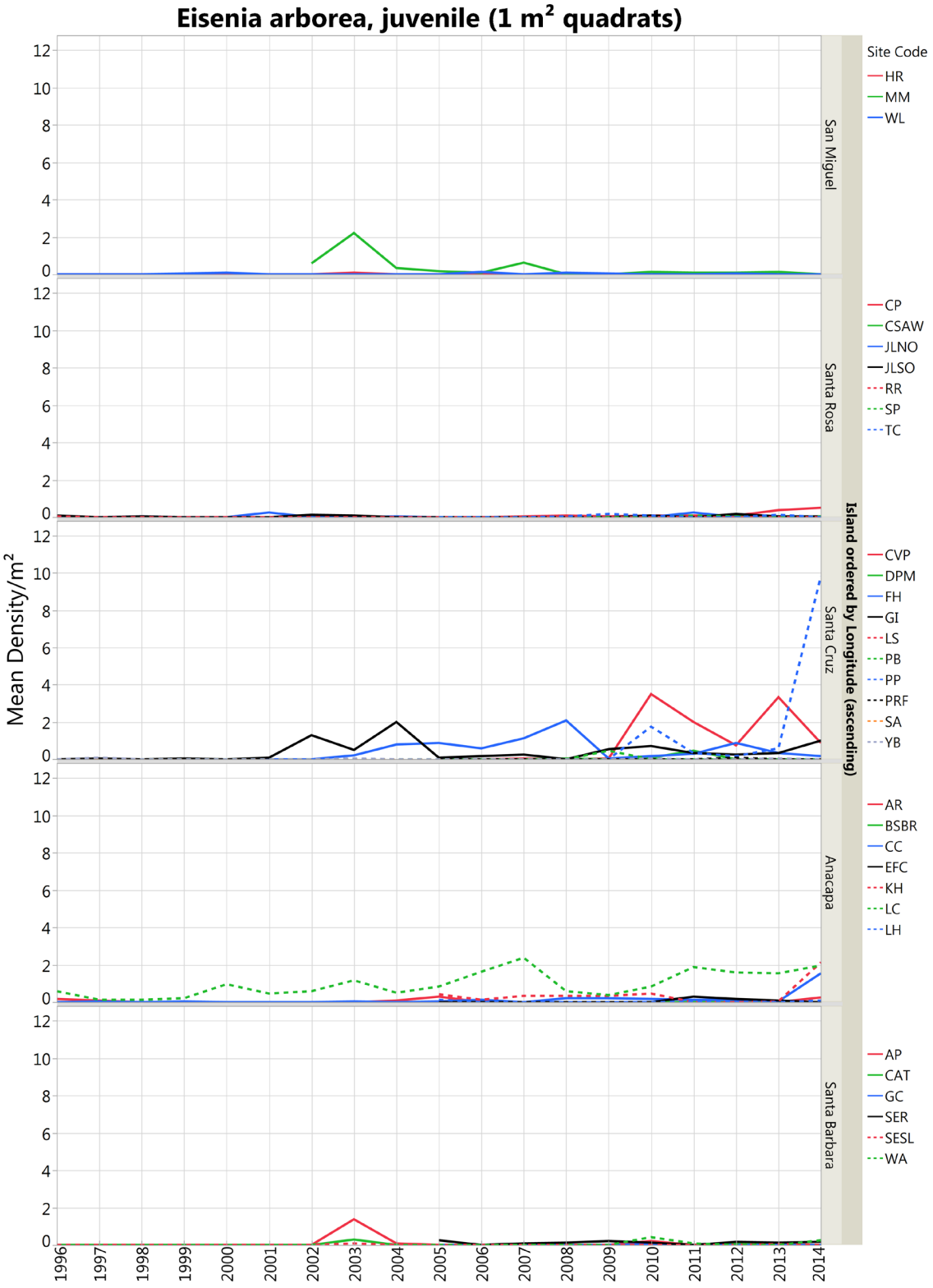


Figure E-4. Mean density of juvenile *Eisenia arborea* by site and island at Channel Islands National Park between 1996 and 2014.

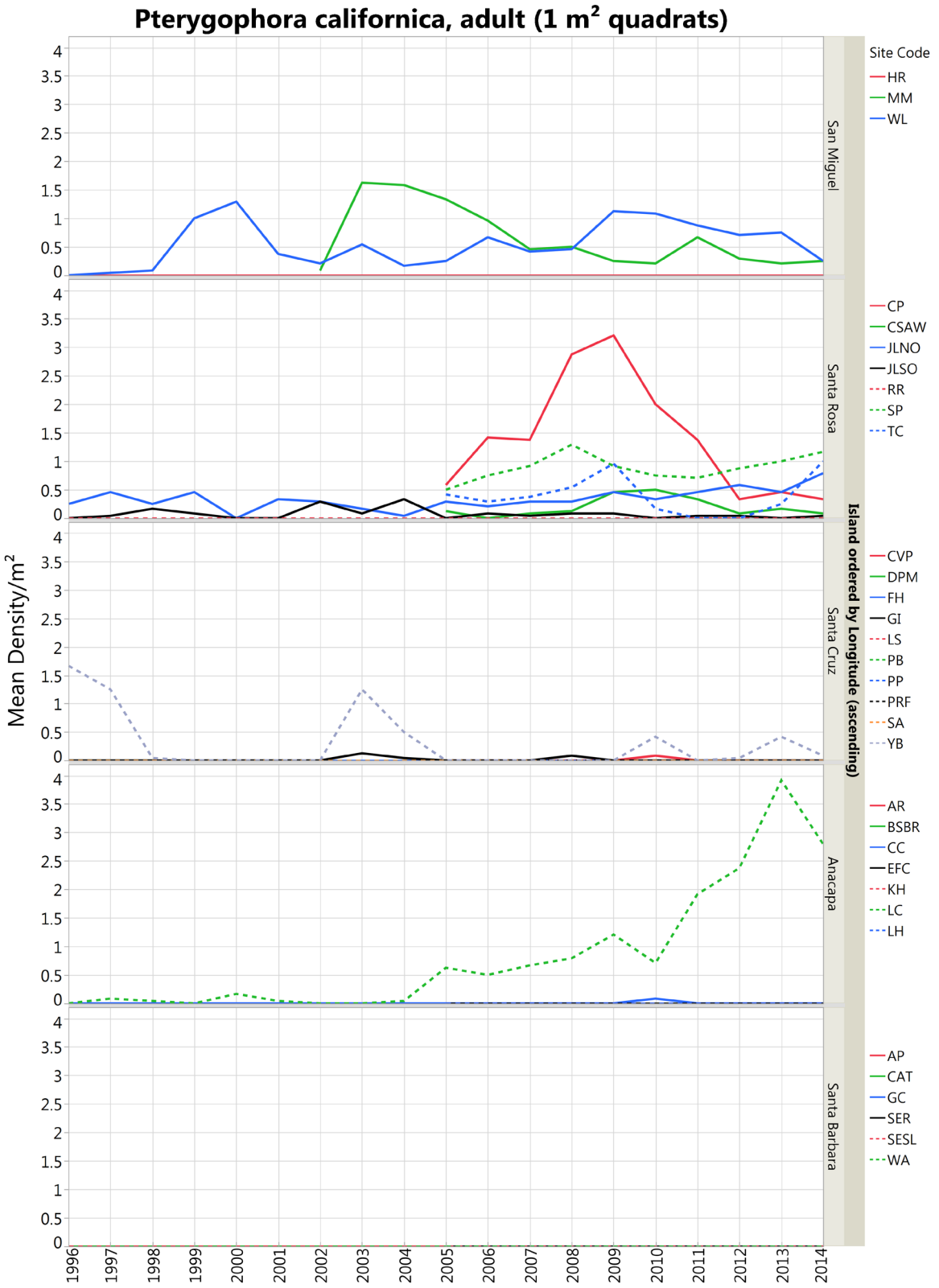


Figure E-5. Mean density of adult *Pterygophora californica* by site and island at Channel Islands National Park between 1996 and 2014.

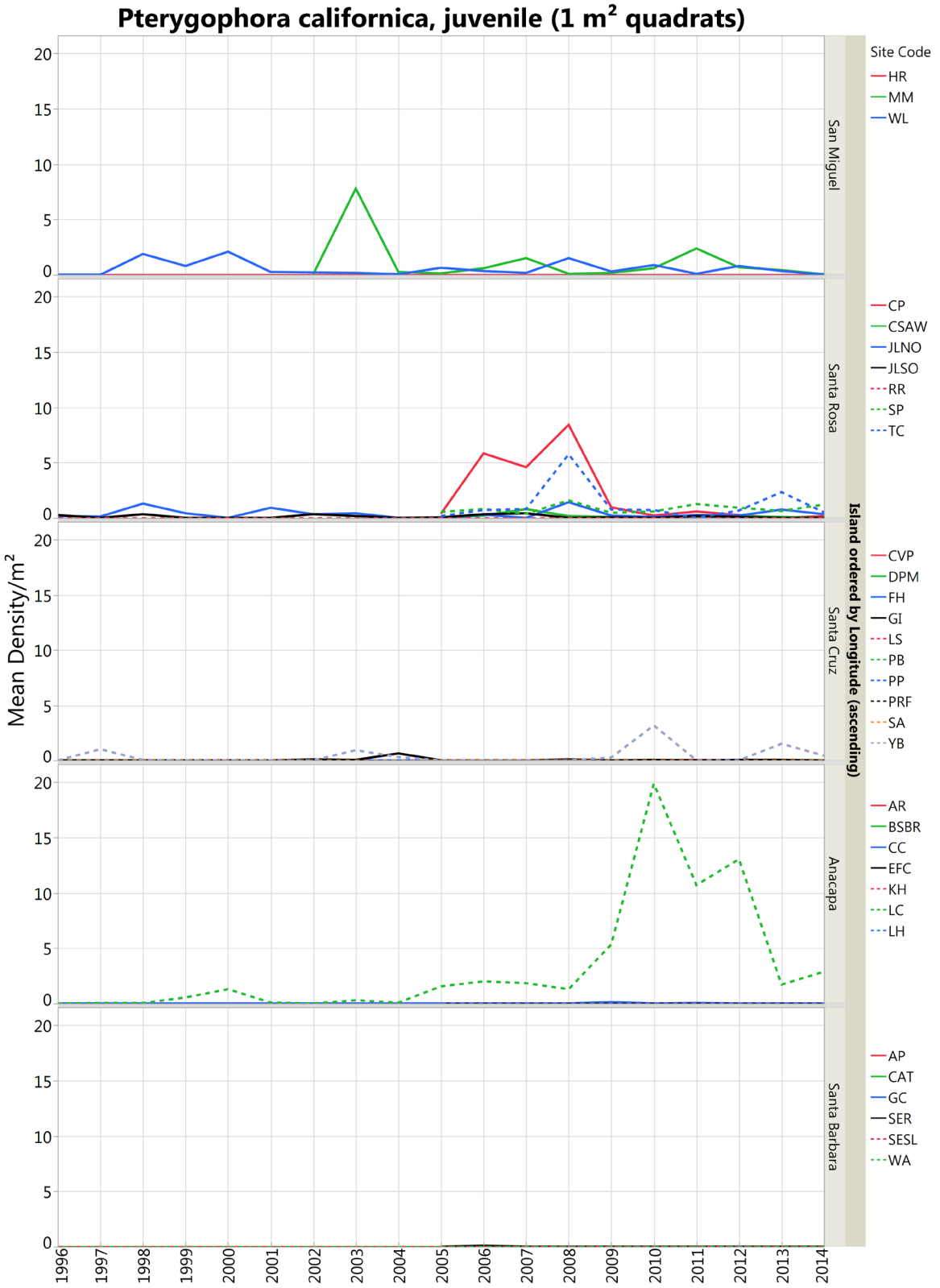


Figure E-6. Mean density of juvenile *Pterygophora californica* by site and island at Channel Islands National Park between 1996 and 2014.

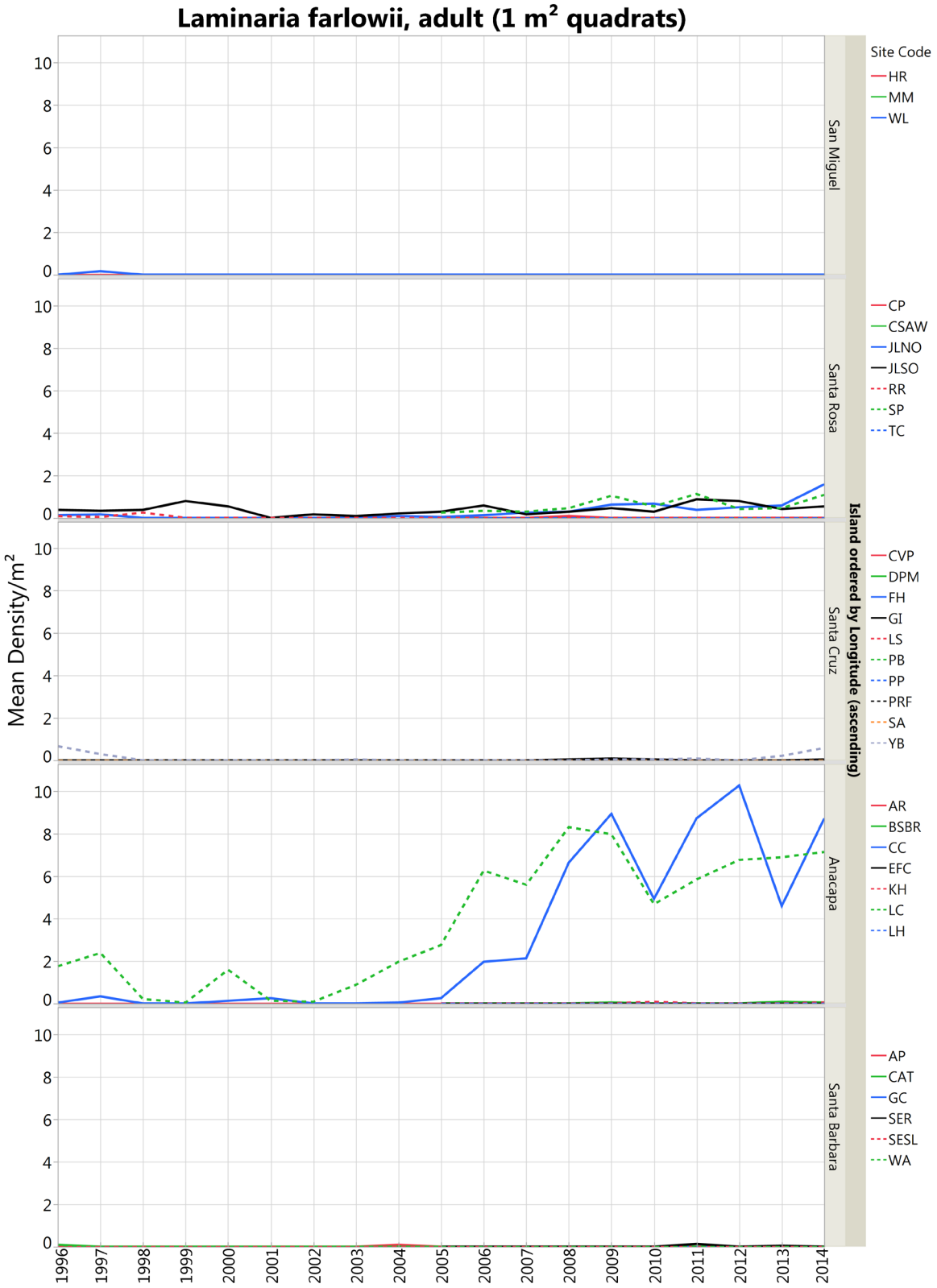


Figure E-7. Mean density of adult *Laminaria farlowii* by site and island at Channel Islands National Park between 1996 and 2014.

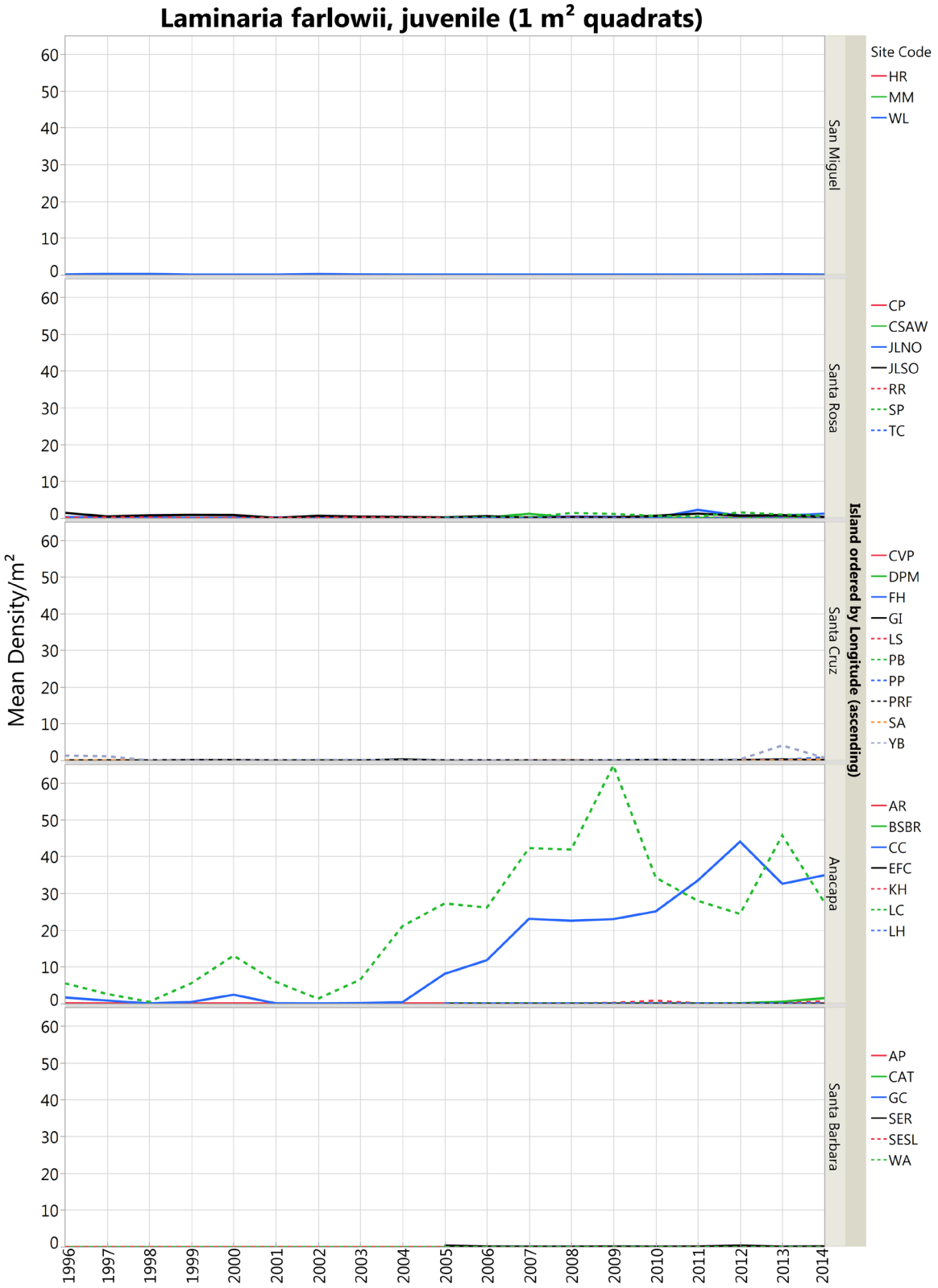


Figure E-8. Mean density of juvenile *Laminaria farlowii* by site and island at Channel Islands National Park between 1996 and 2014.

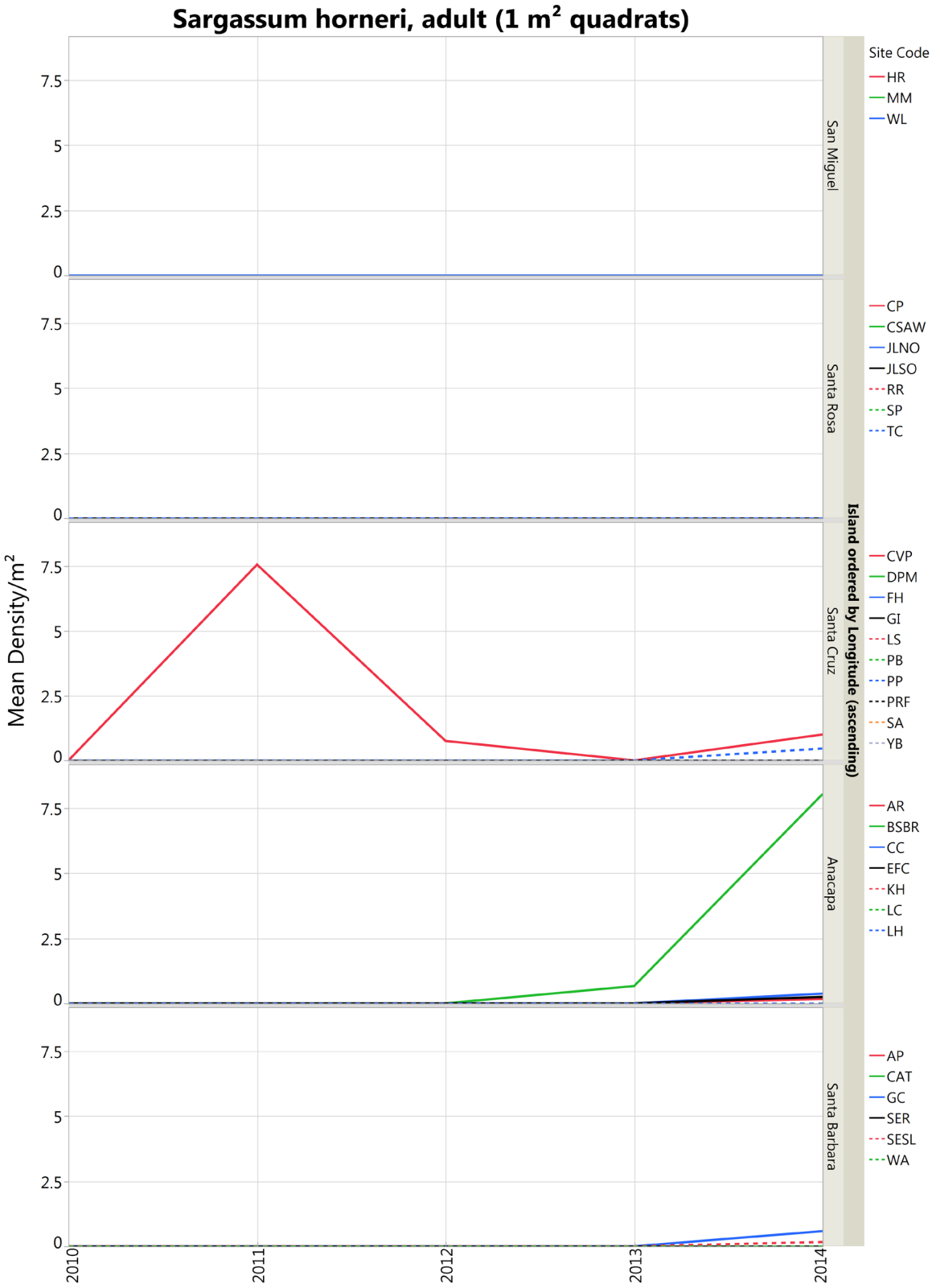


Figure E-9. Mean density of adult *Sargassum horneri* by site and island at Channel Islands National Park between 2010 and 2014.

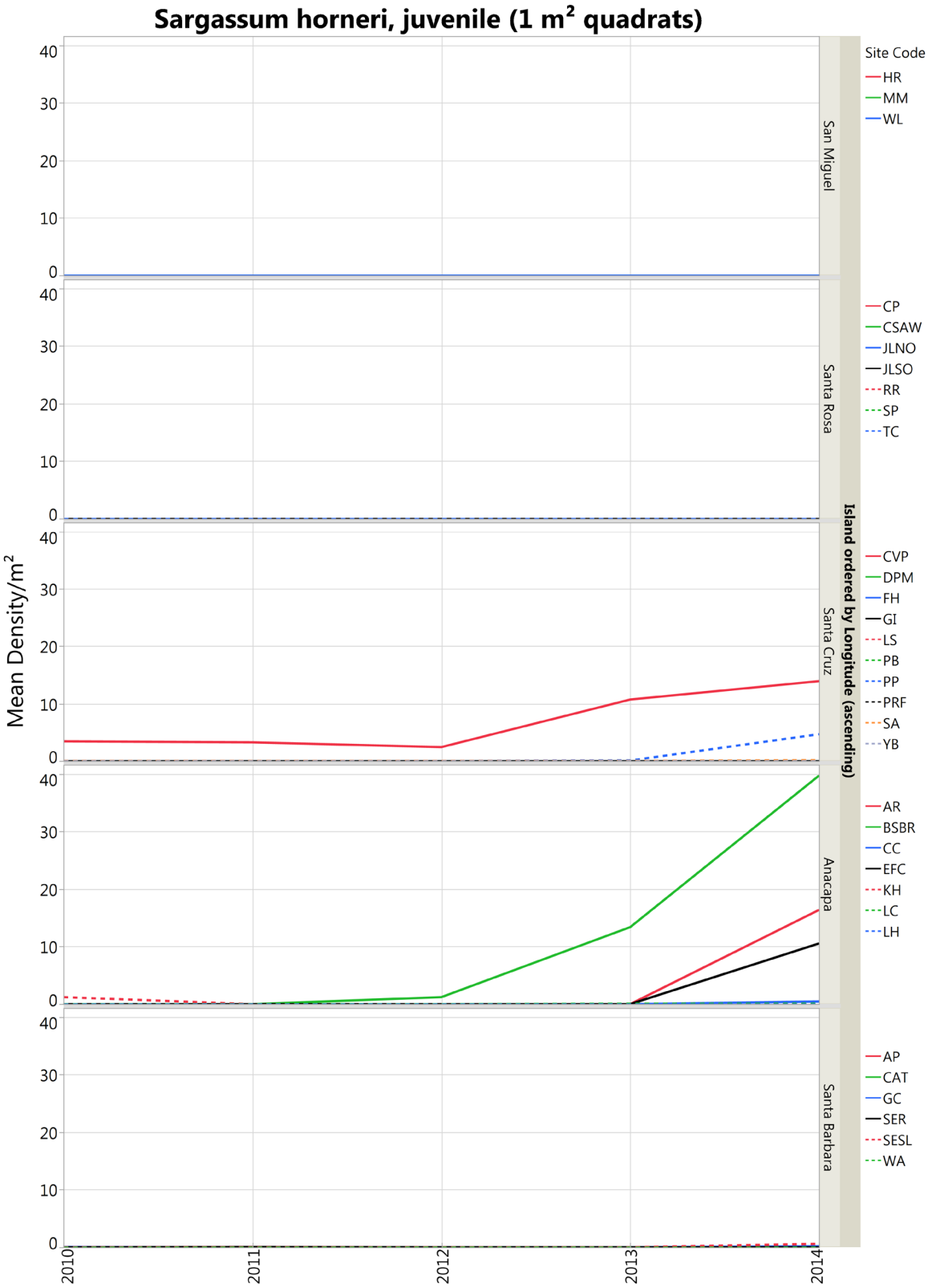


Figure E-10. Mean density of juvenile *Sargassum horneri* by site and island at Channel Islands National Park between 2010 and 2014.

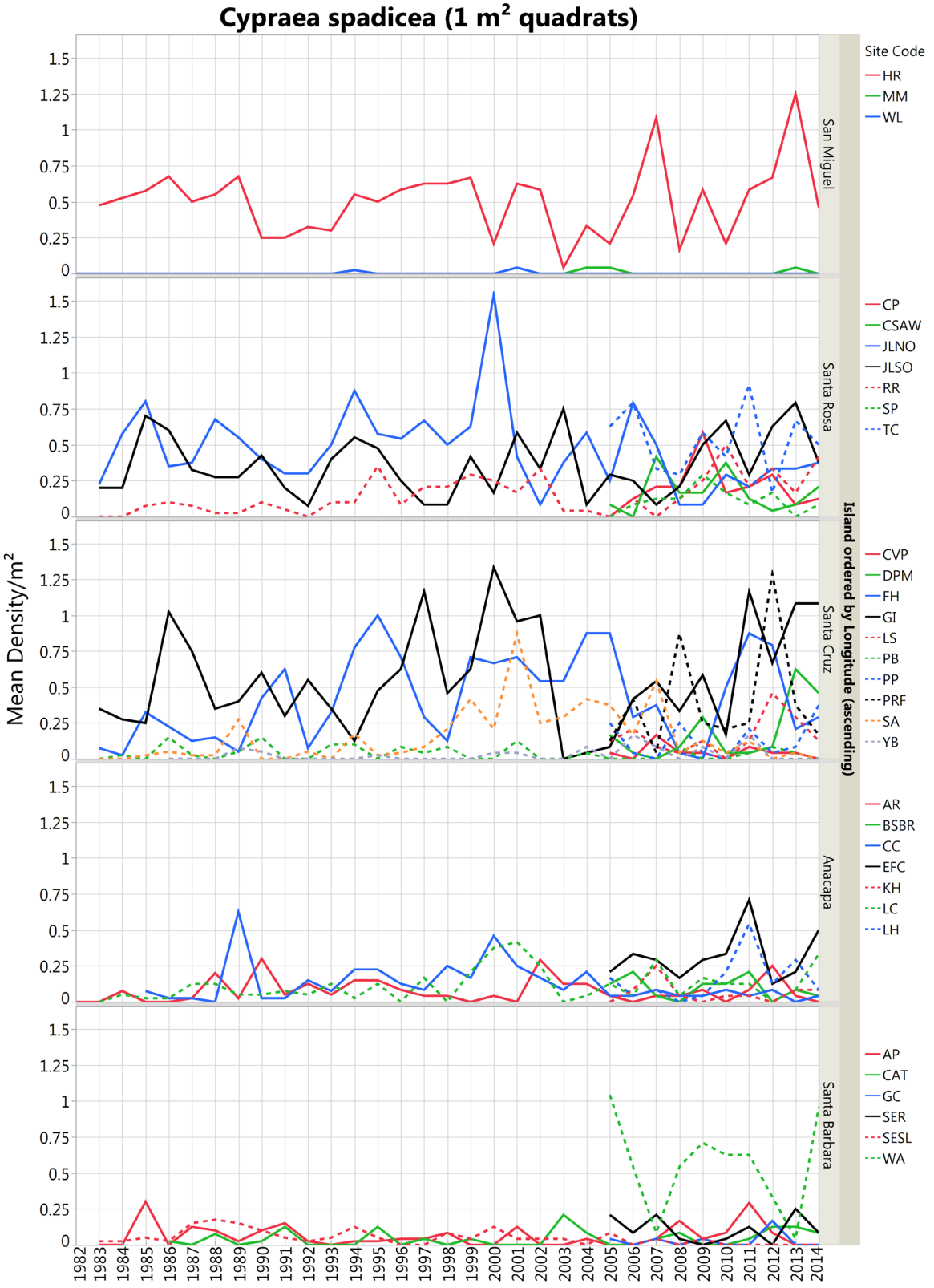


Figure E-11. Mean density of *Cypraea spadicea* by site and island at Channel Islands National Park between 1982 and 2014.

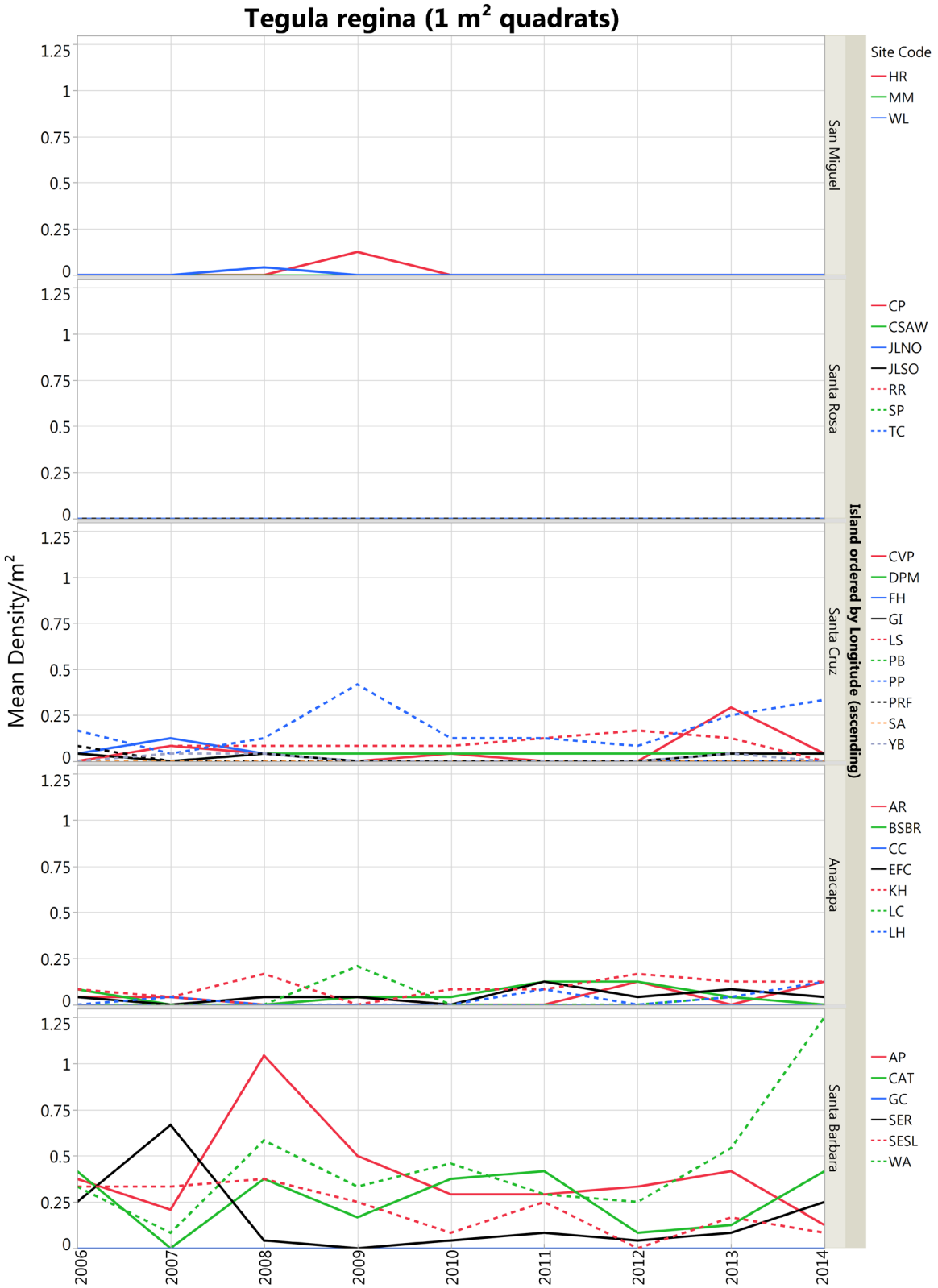


Figure E-12. Mean density of *Tegula regina* by site and island at Channel Islands National Park between 2006 and 2014.

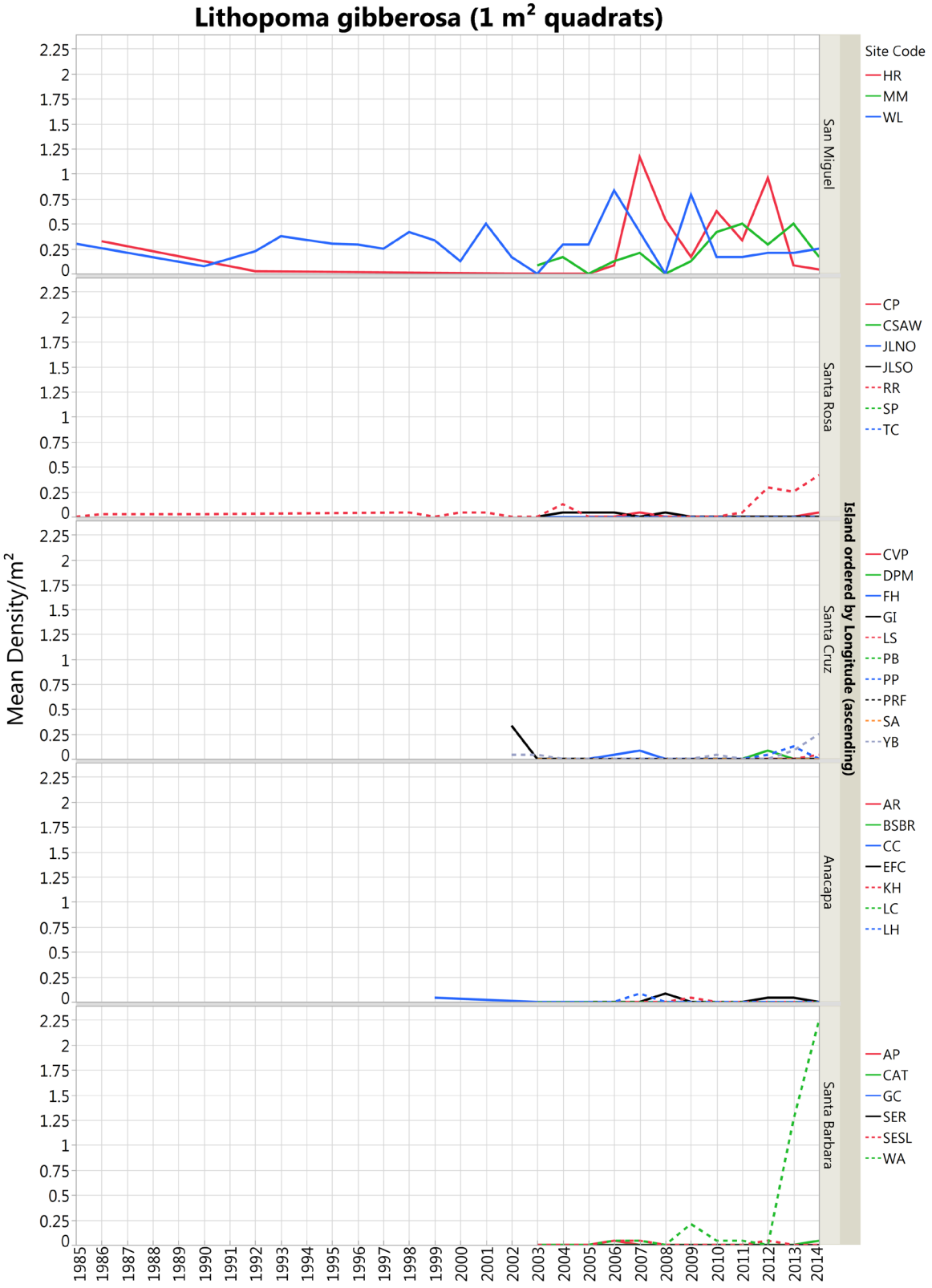


Figure E-13. Mean density of *Lithopoma gibberosa* by site and island at Channel Islands National Park between 1985 and 2014.

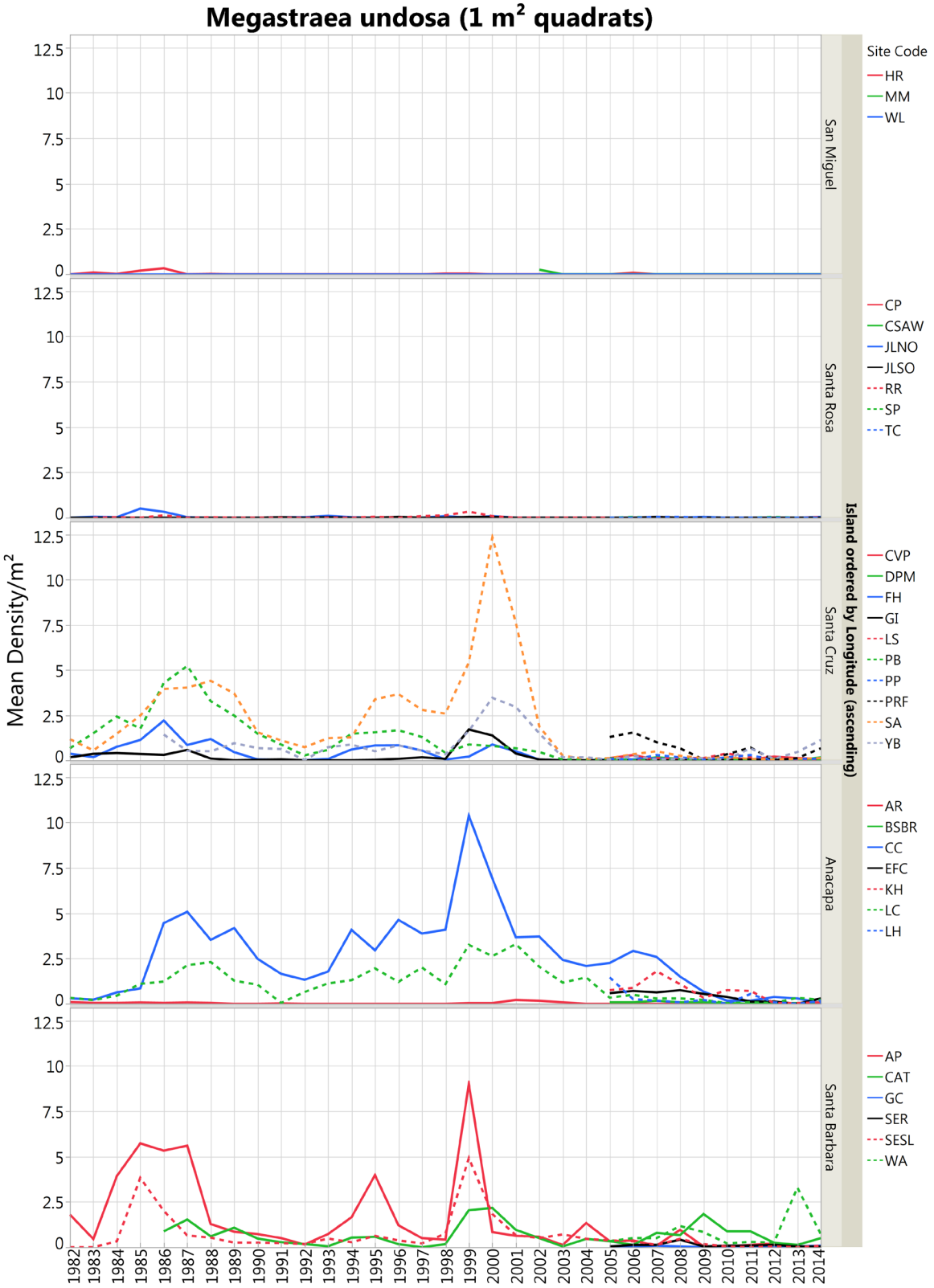


Figure E-14. Mean density of *Megastraea undosa* by site and island at Channel Islands National Park between 1982 and 2014.

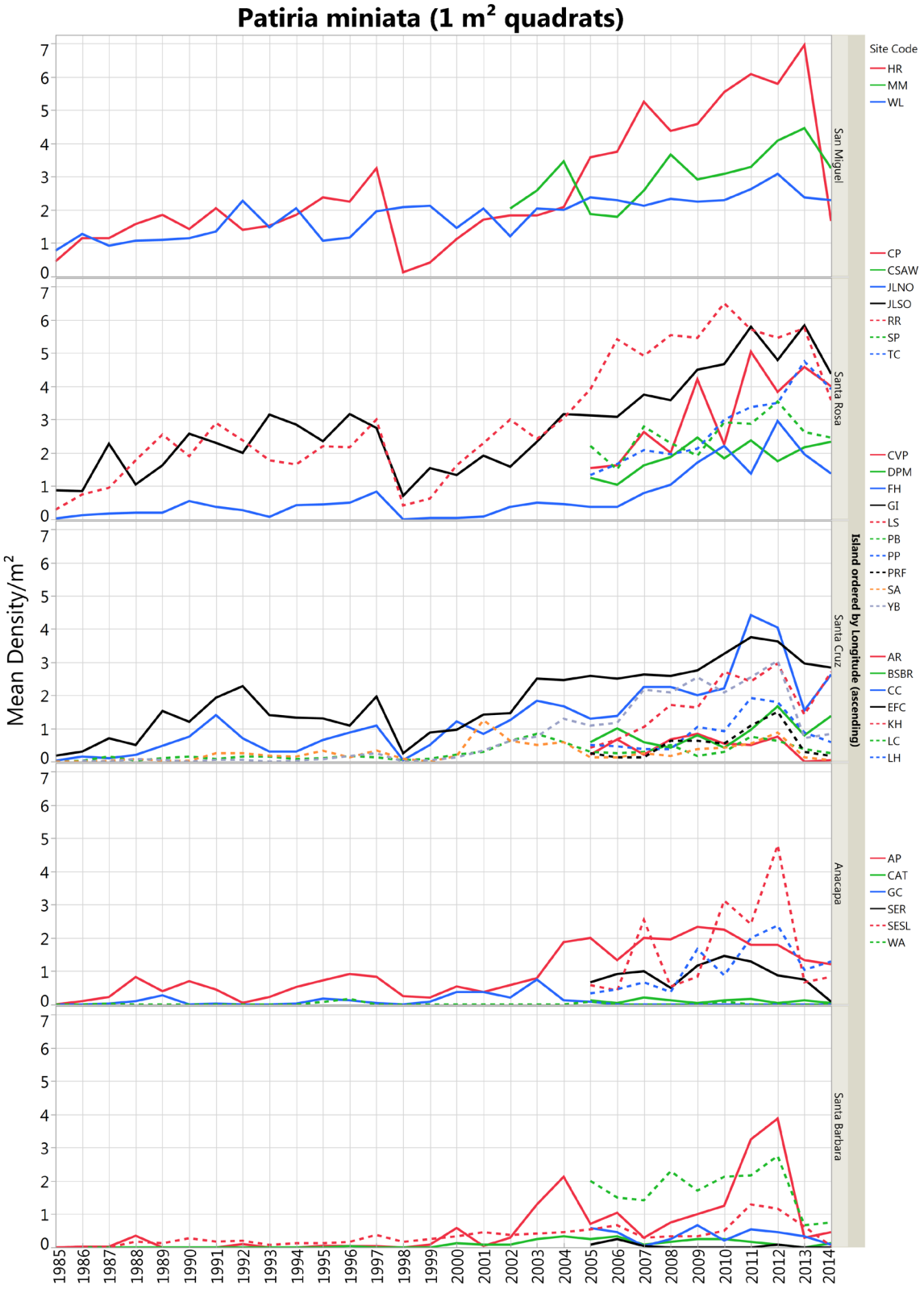


Figure E-15. Mean density of *Patiria miniata* by site and island at Channel Islands National Park between 1985 and 2014.

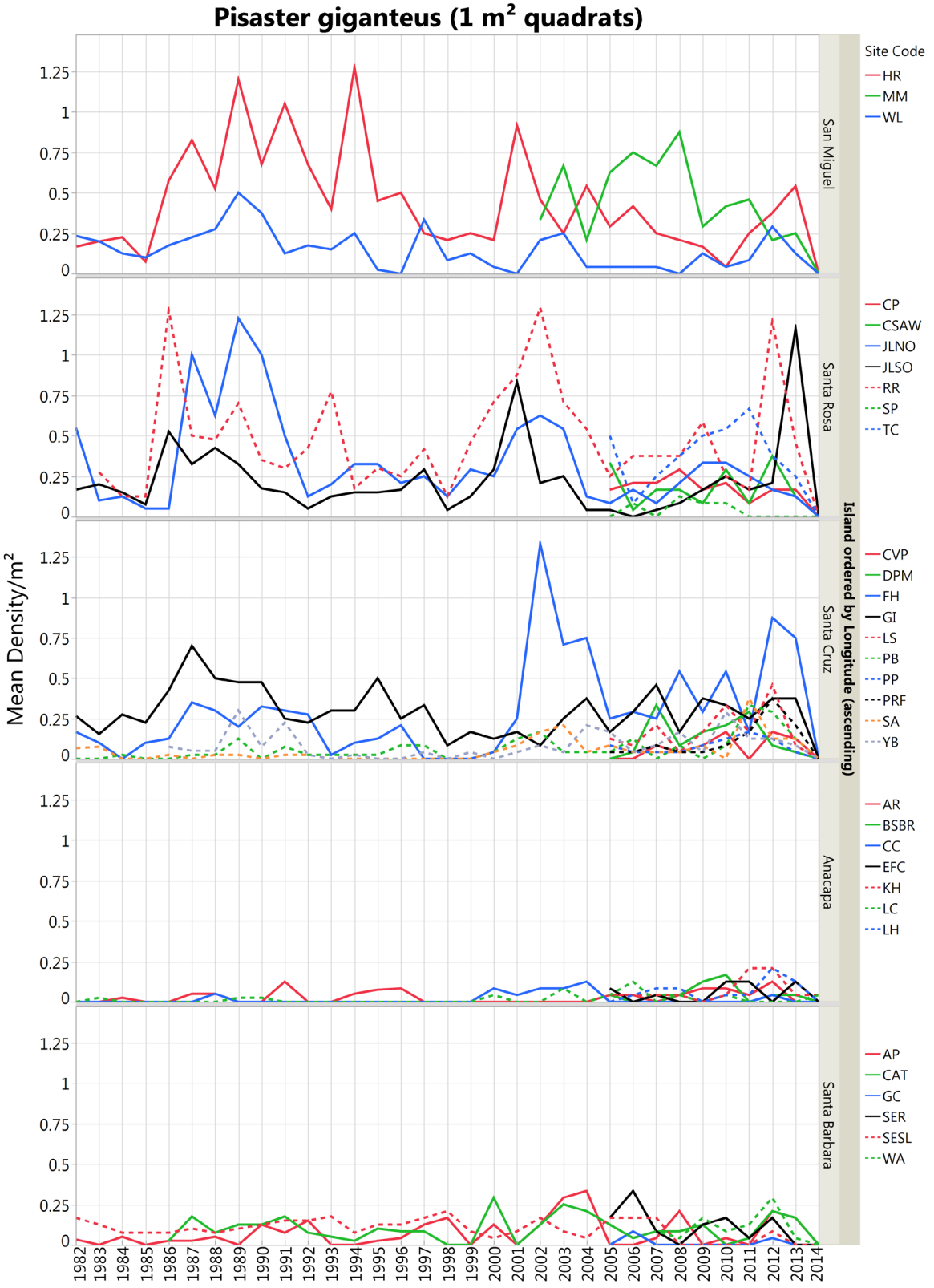


Figure E-16. Mean density of *Pisaster giganteus* by site and island at Channel Islands National Park between 1982 and 2014.

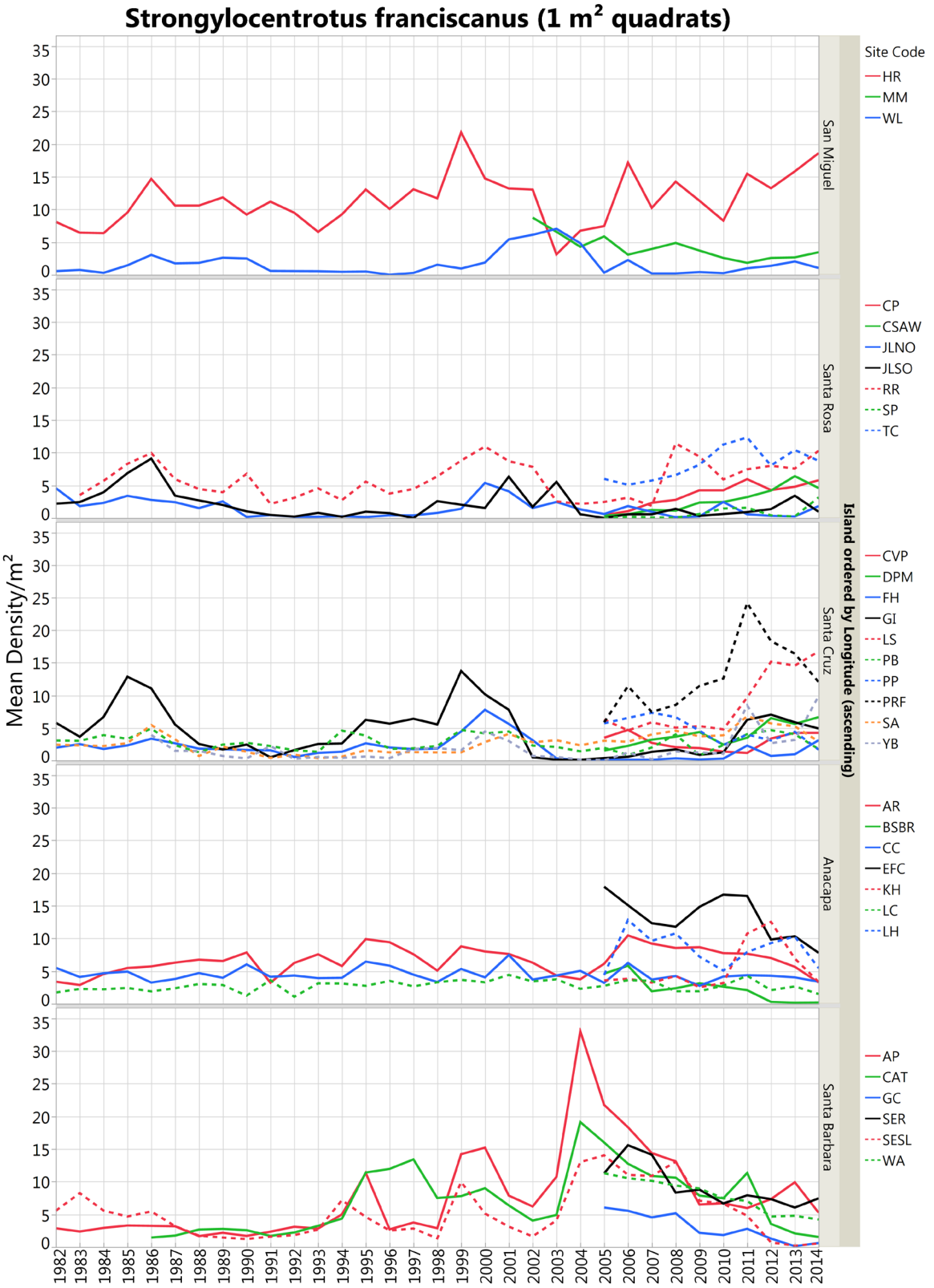


Figure E-17. Mean density of *Strongylocentrotus franciscanus* by site and island at Channel Islands National Park between 1982 and 2014.

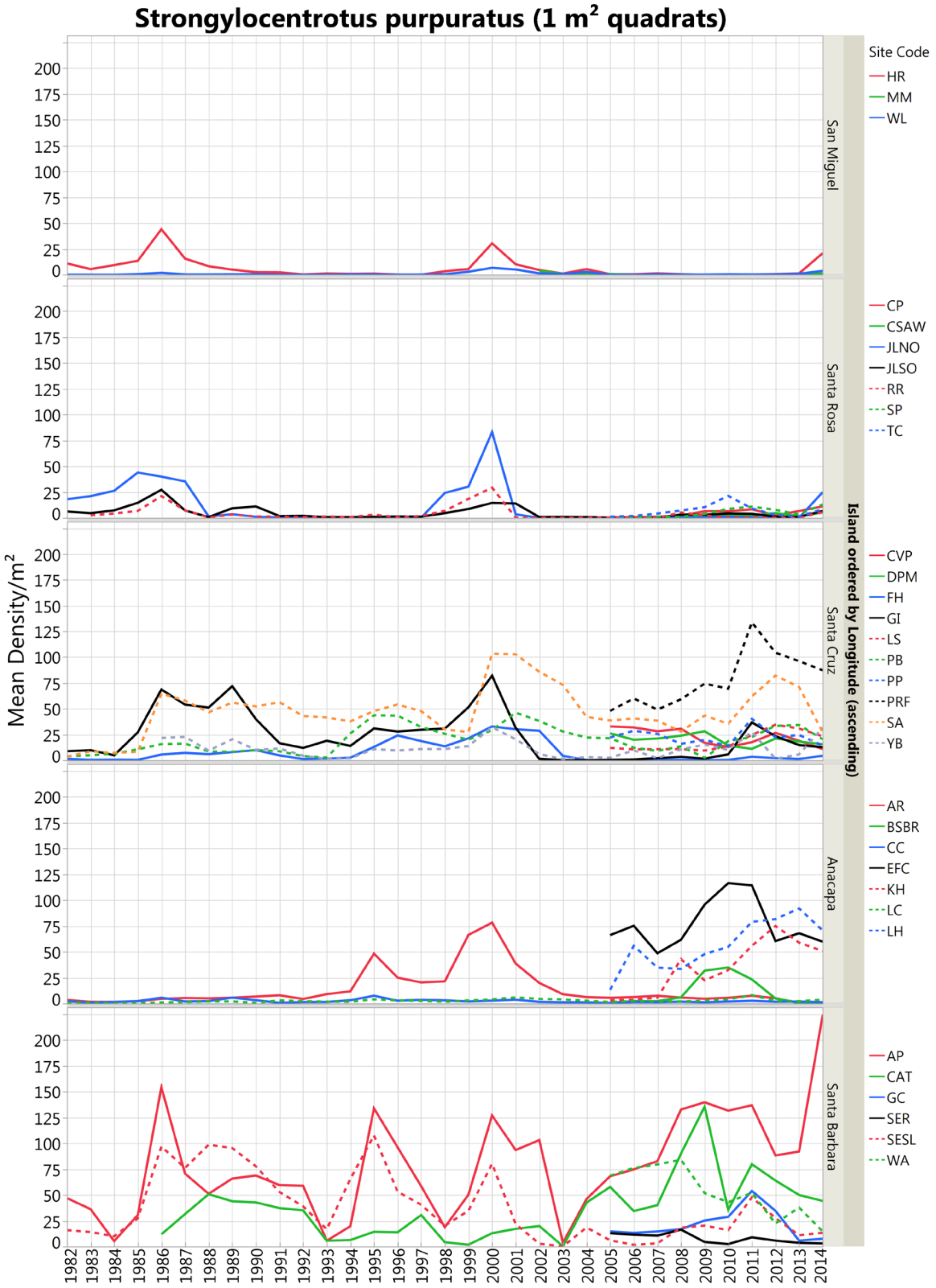


Figure E-18. Mean density of *Strongylocentrotus purpuratus* by site and island at Channel Islands National Park between 1982 and 2014.

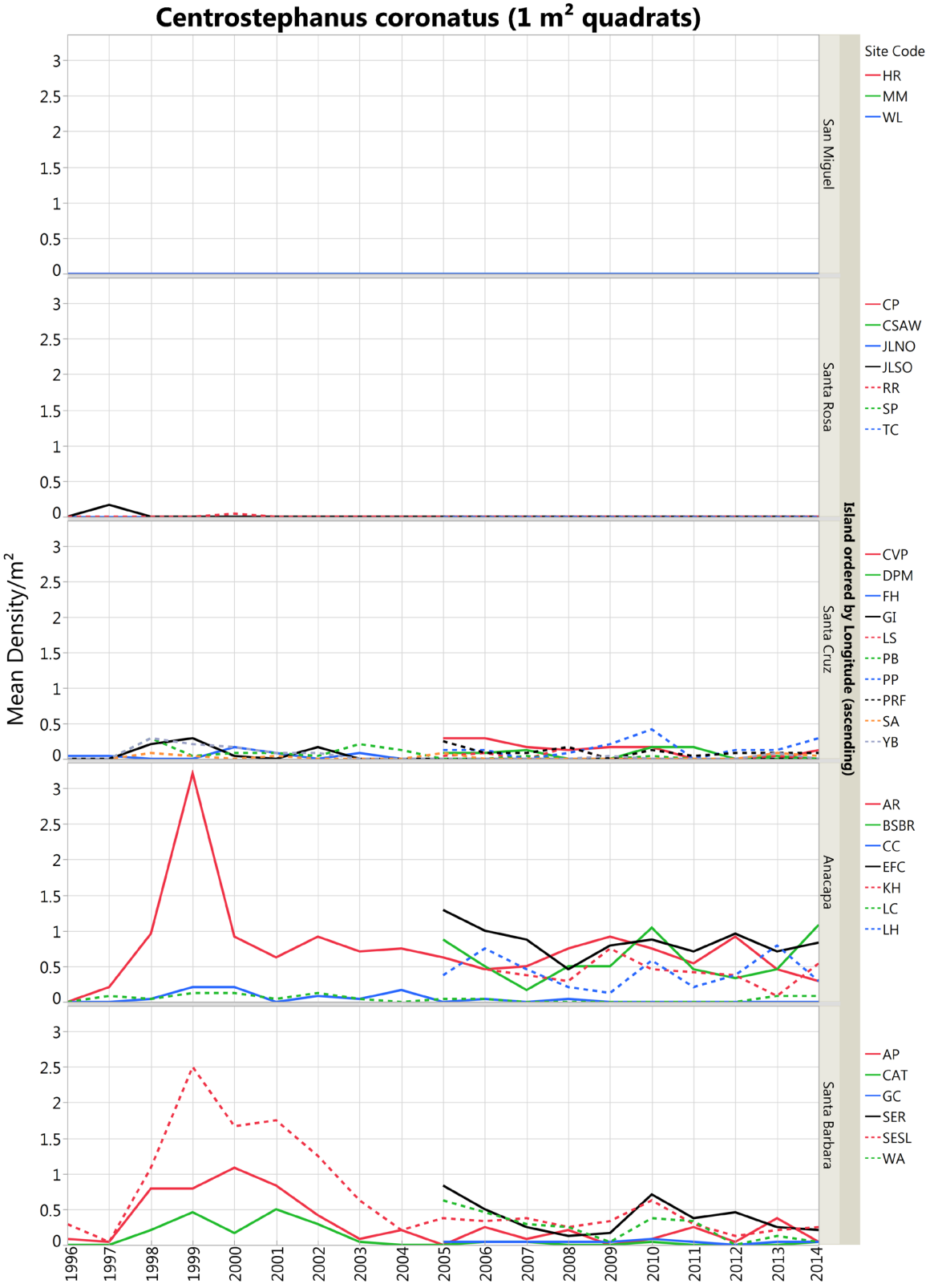


Figure E-19. Mean density of *Centrostephanus coronatus* by site and island at Channel Islands National Park between 1996 and 2014.

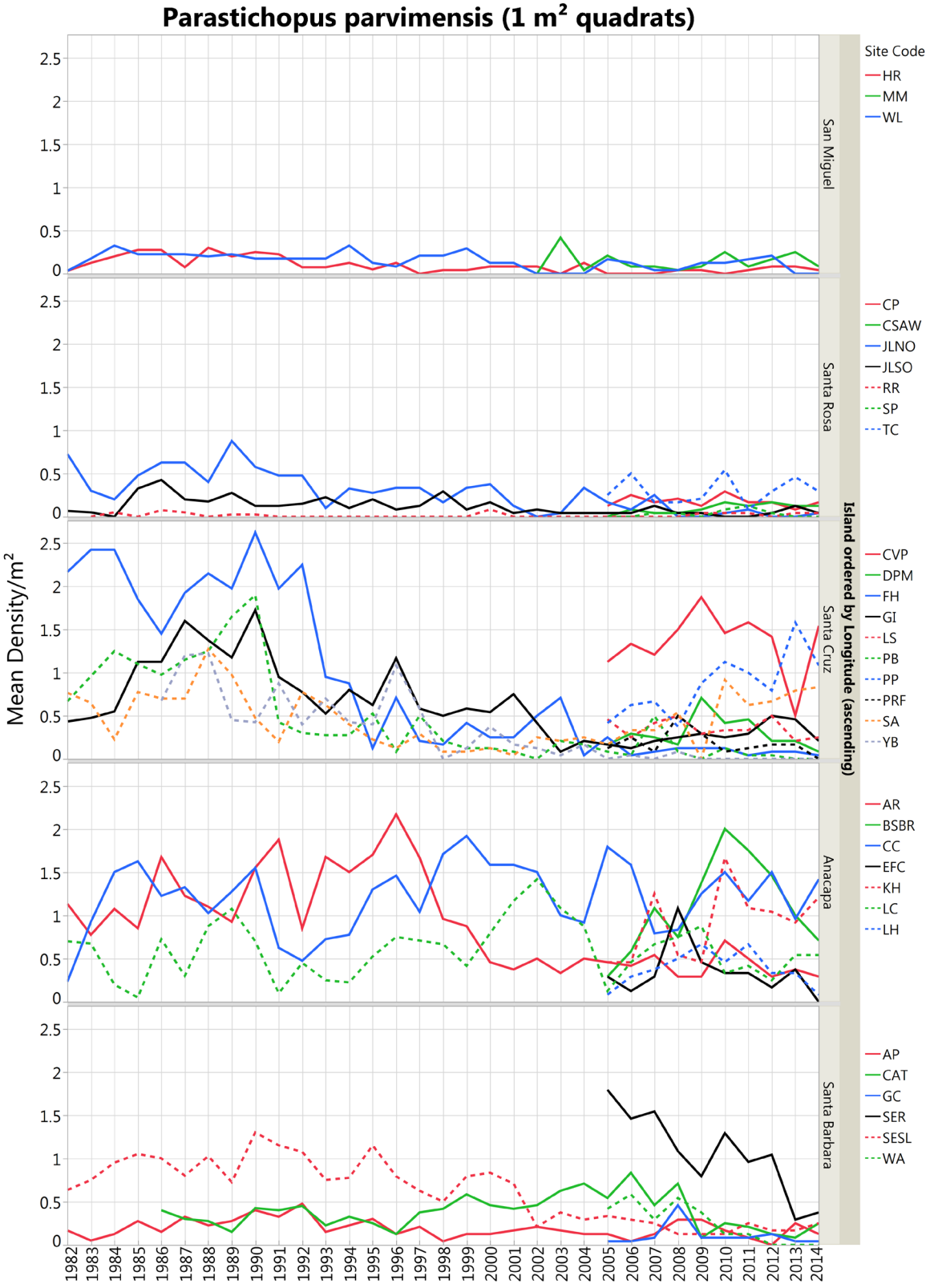


Figure E-20. Mean density of *Parastichopus parvimensis* by site and island at Channel Islands National Park between 1982 and 2014.

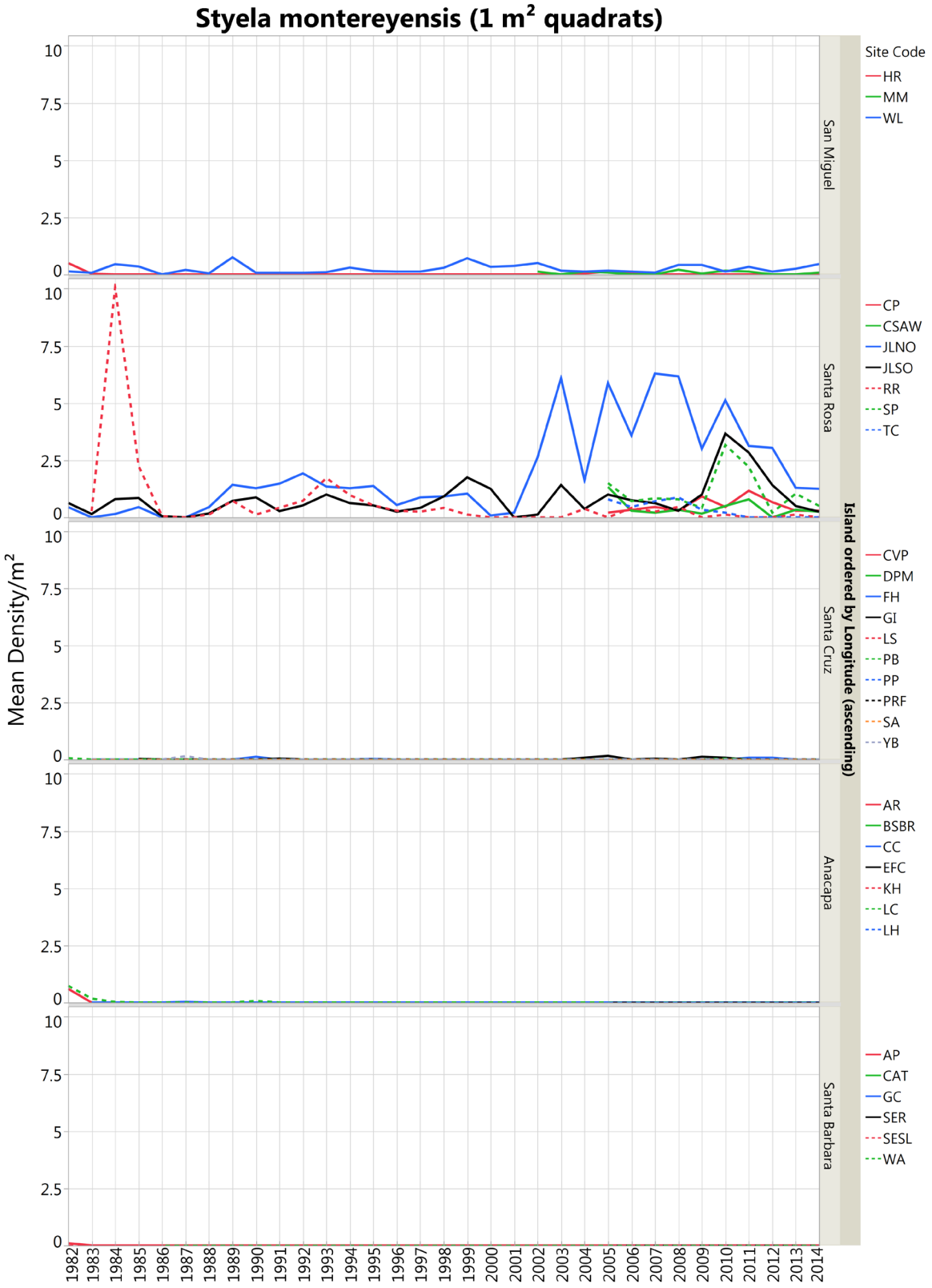


Figure E-21. Mean density of *Styela montereyensis* by site and island at Channel Islands National Park between 1982 and 2014.

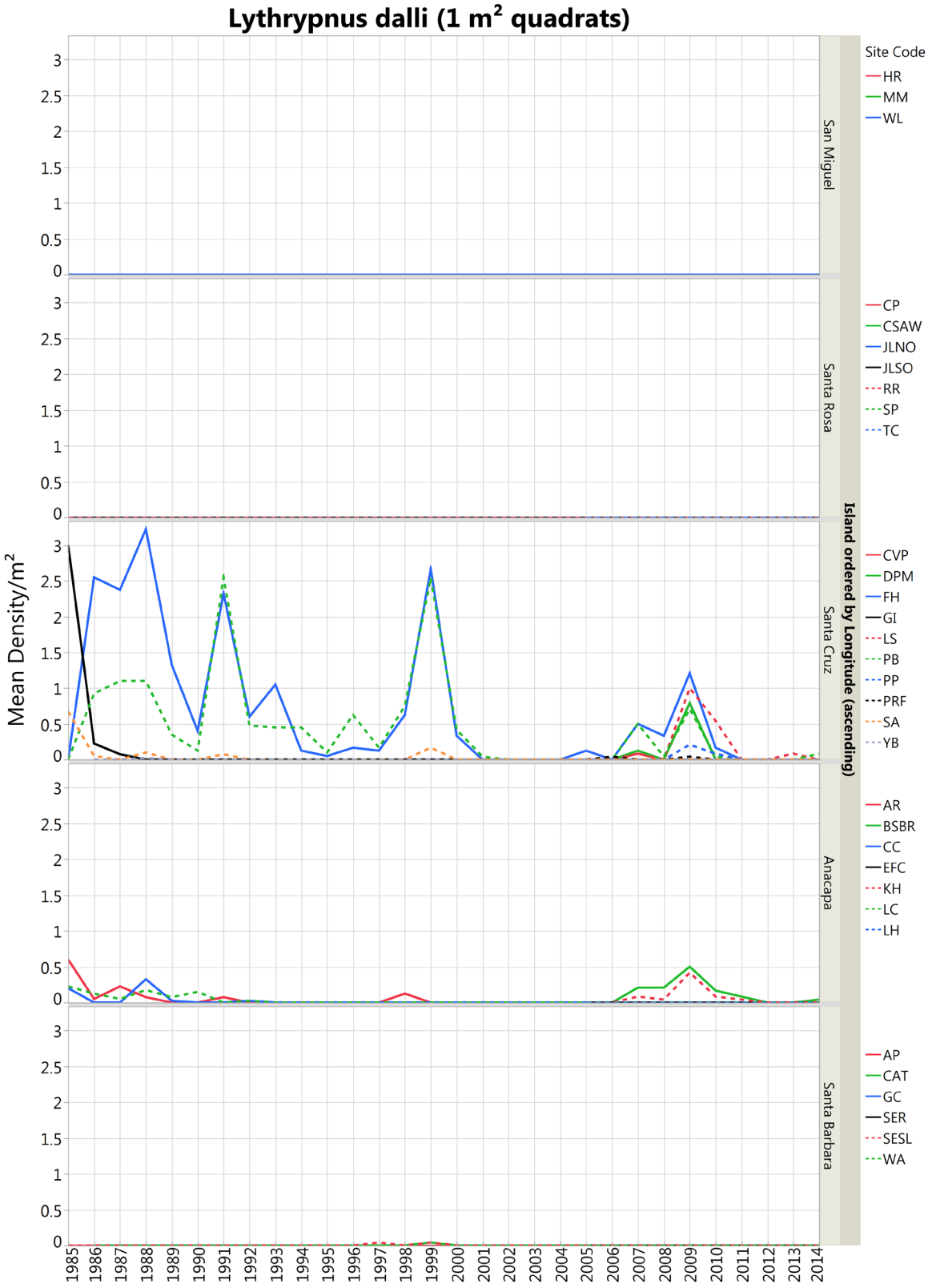


Figure E-22. Mean density of *Lythrypnus dalli* by site and island at Channel Islands National Park between 1985 and 2014.

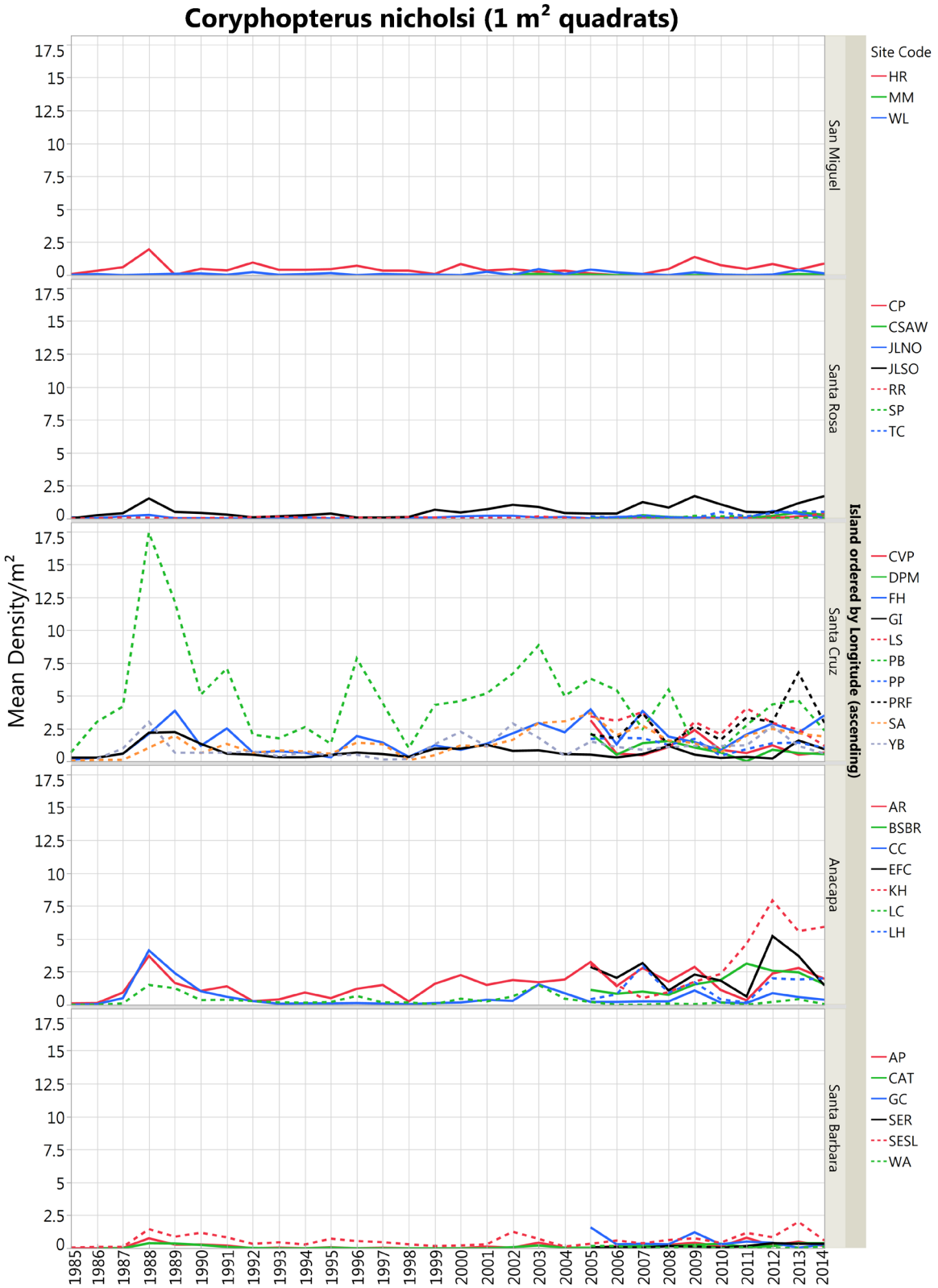


Figure E-23. Mean density of *Coryphopterus nicholsi* by site and island at Channel Islands National Park between 1985 and 2014.

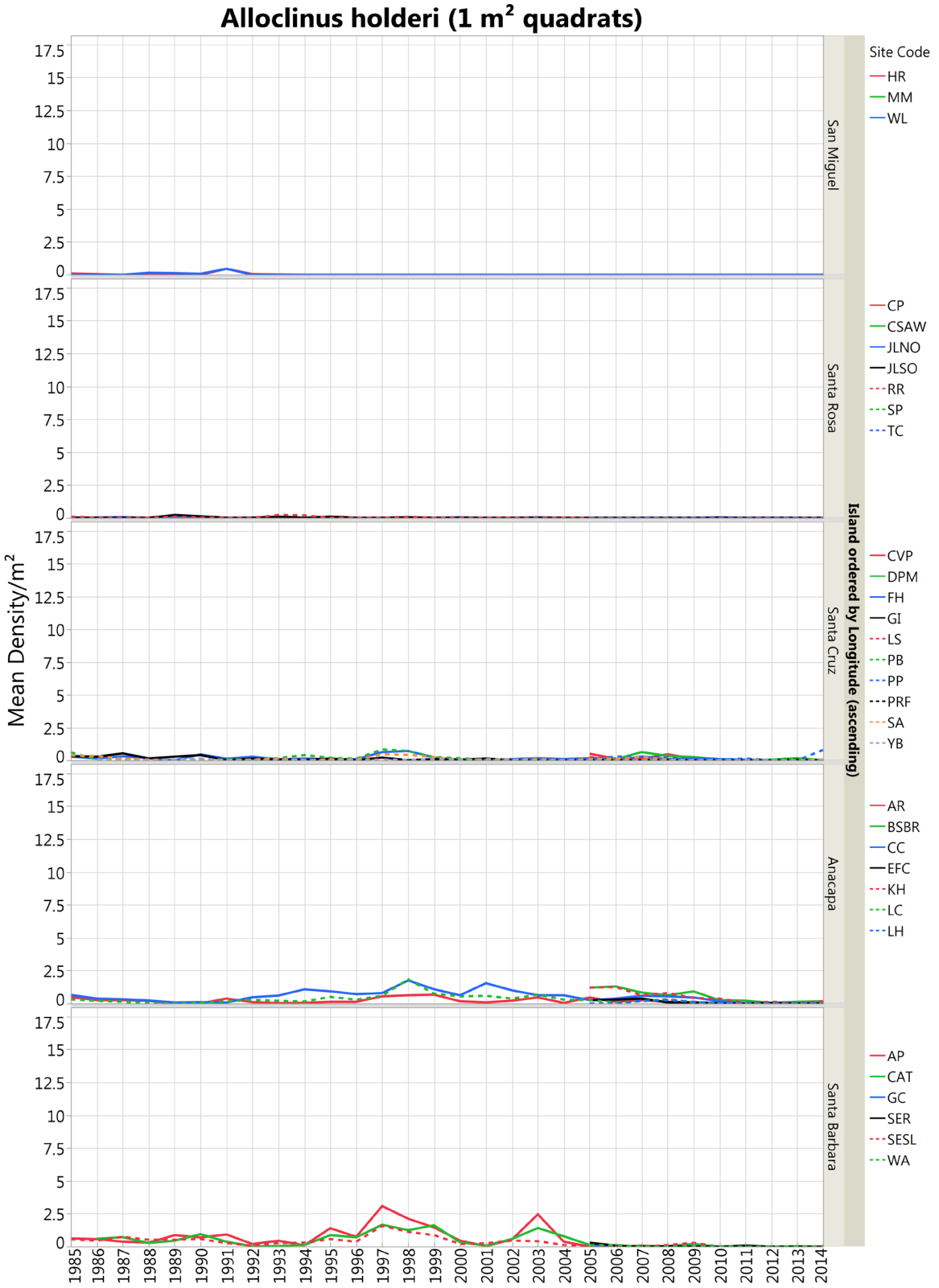


Figure E-24. Mean density of *Alloclinus holderi* by site and island at Channel Islands National Park between 1985 and 2014.

Appendix F. 5 Meter Quadrat Data

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

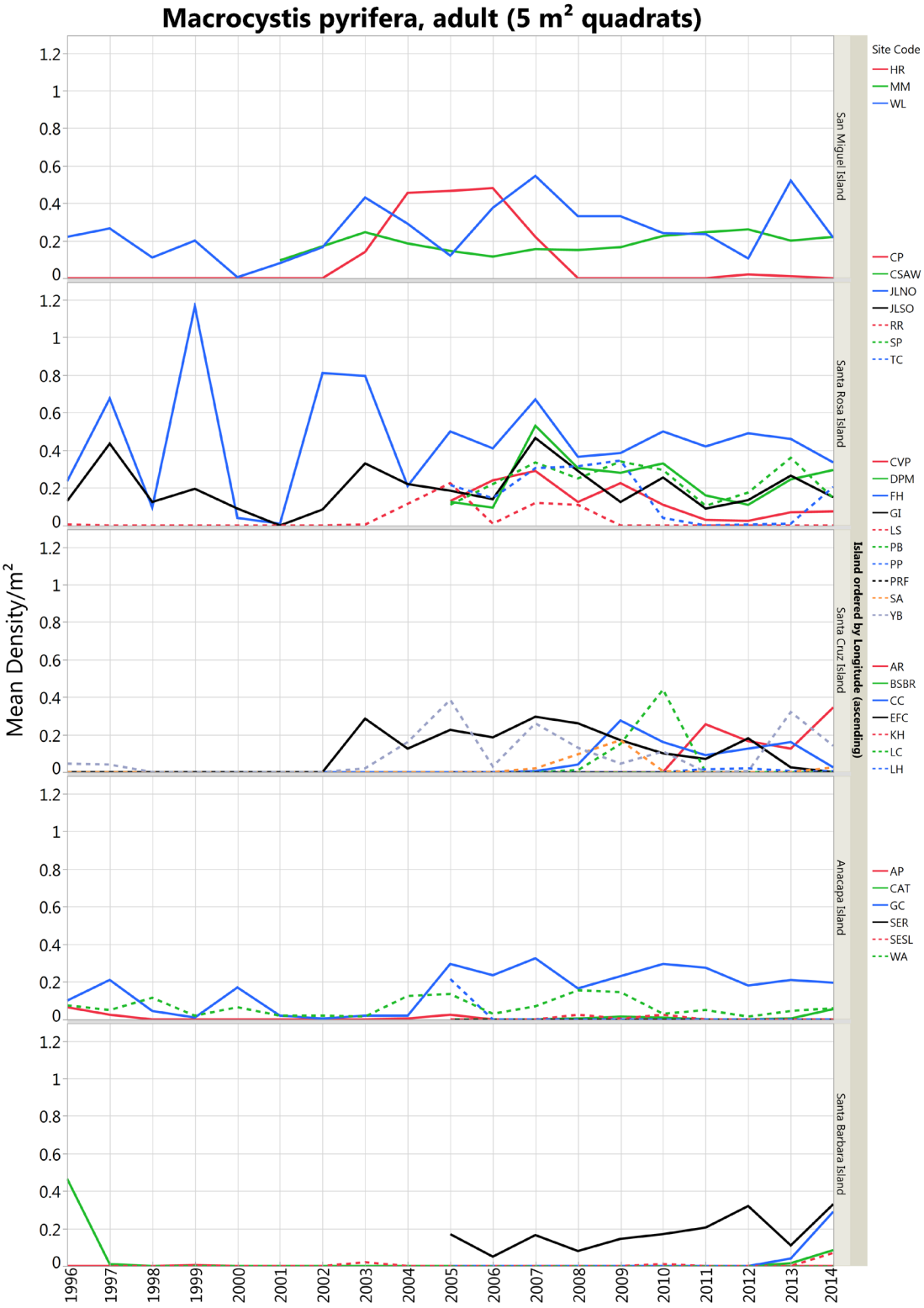
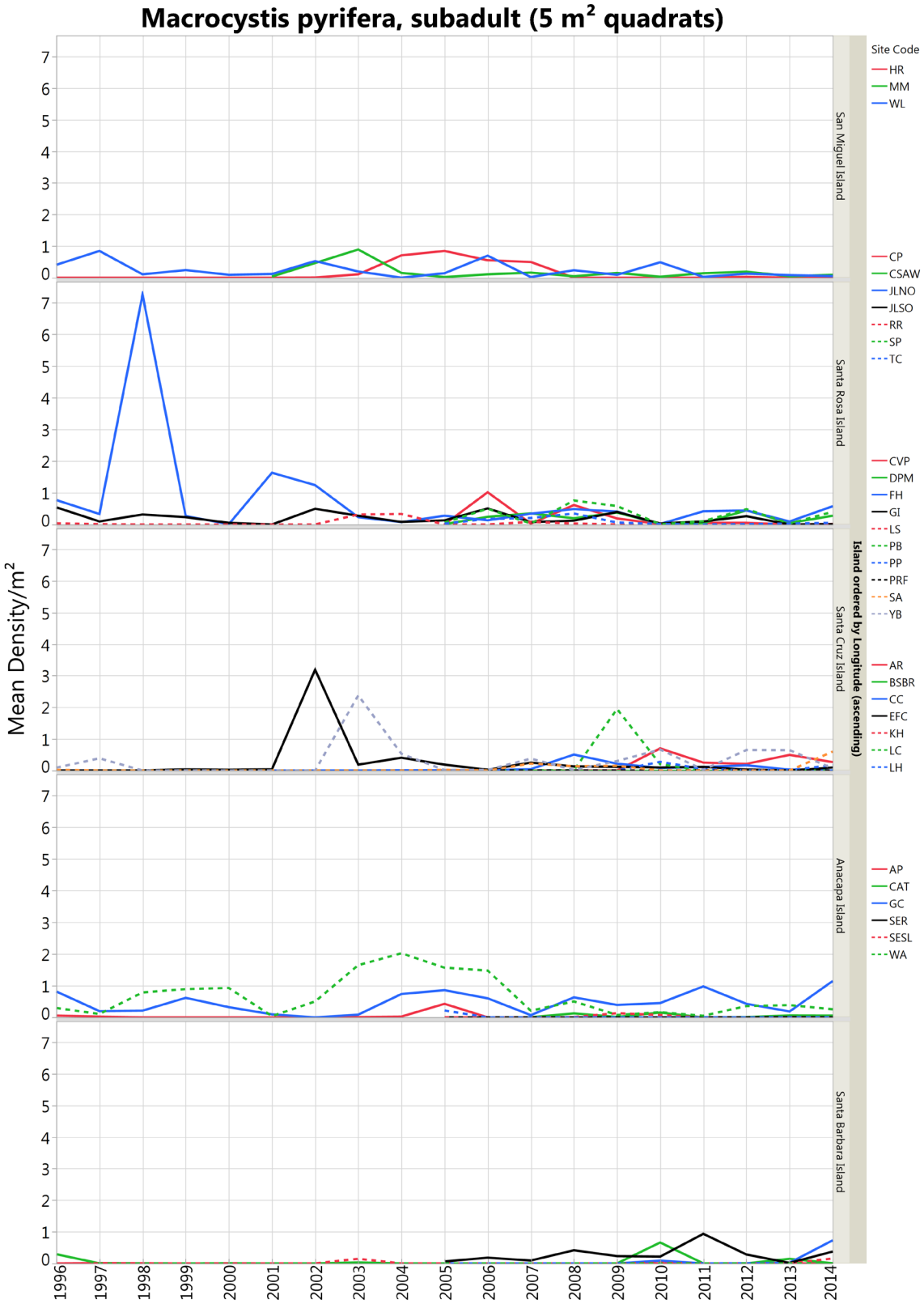


Figure F-1. Mean density of adult *Macrocystis pyrifera* by site and island at Channel Islands National Park between 1996 and 2014.



.

Figure F-2. Mean density of subadult *Macrocystis pyrifera* by site and island at Channel Islands National Park between 1996 and 2014.

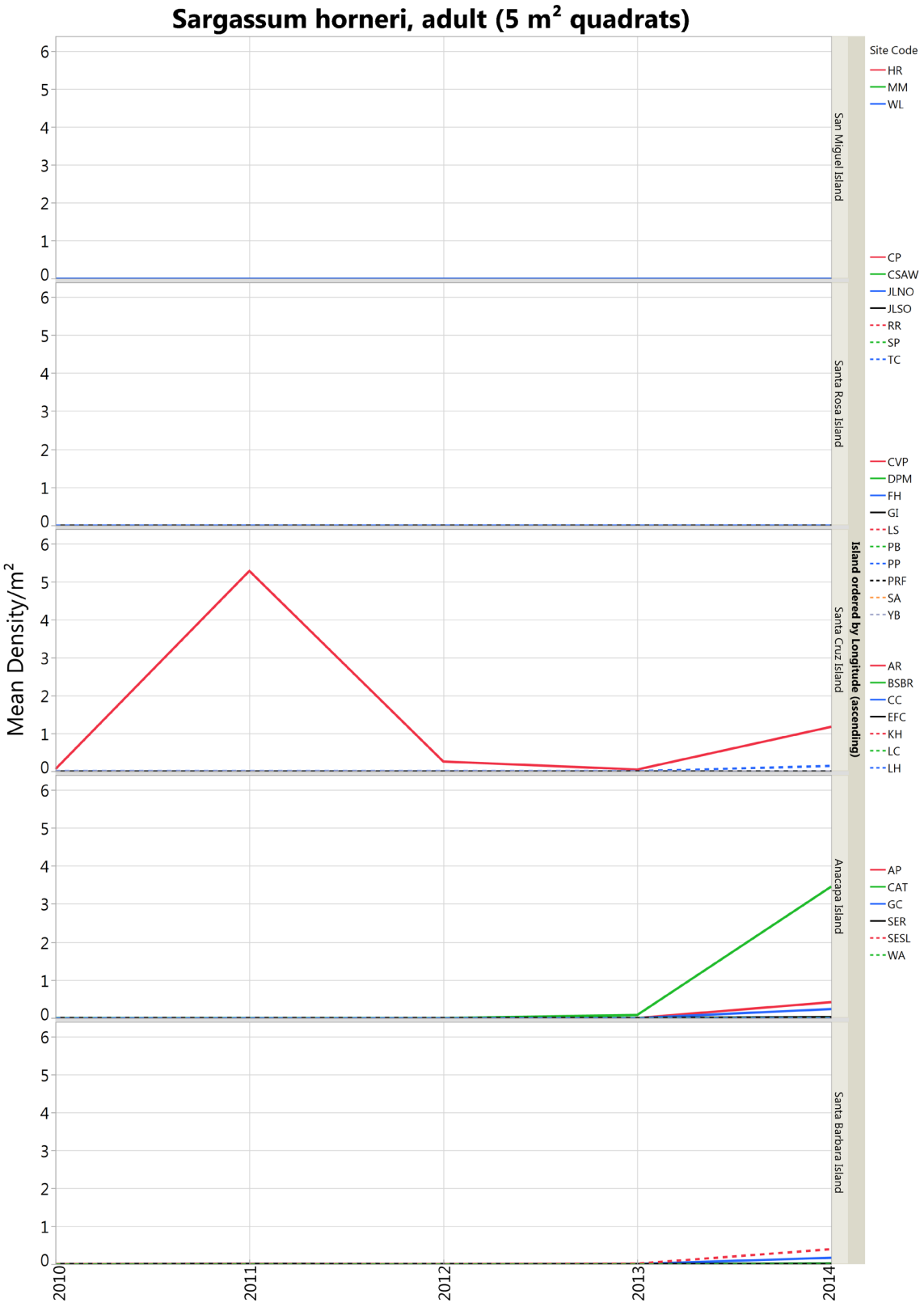


Figure F-3. Mean density of adult *Sargassum horneri* by site and island at Channel Islands National Park between 2010 and 2014.

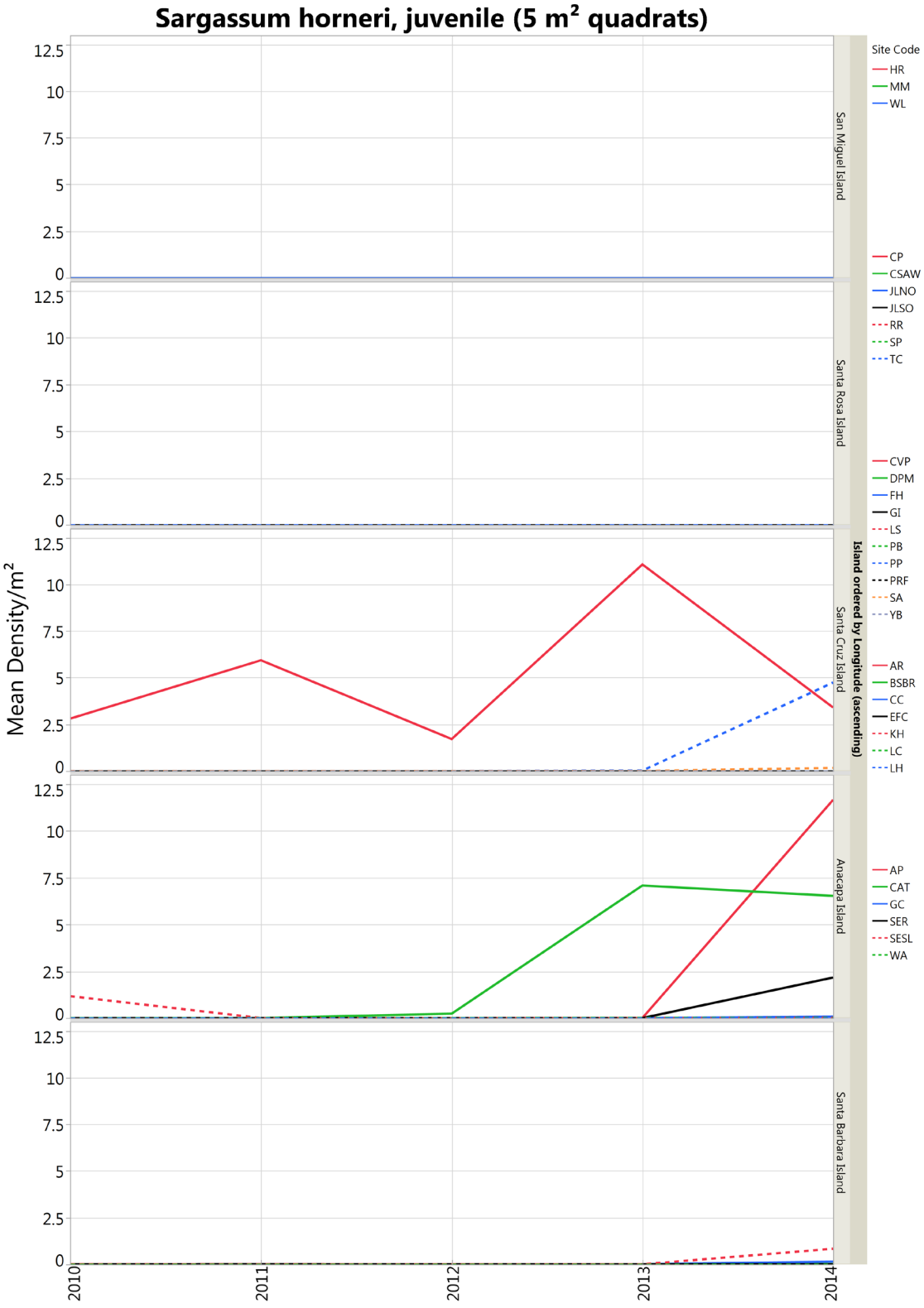


Figure F-4. Mean density of juvenile *Sargassum horneri* by site and island at Channel Islands National Park between 2010 and 2014.

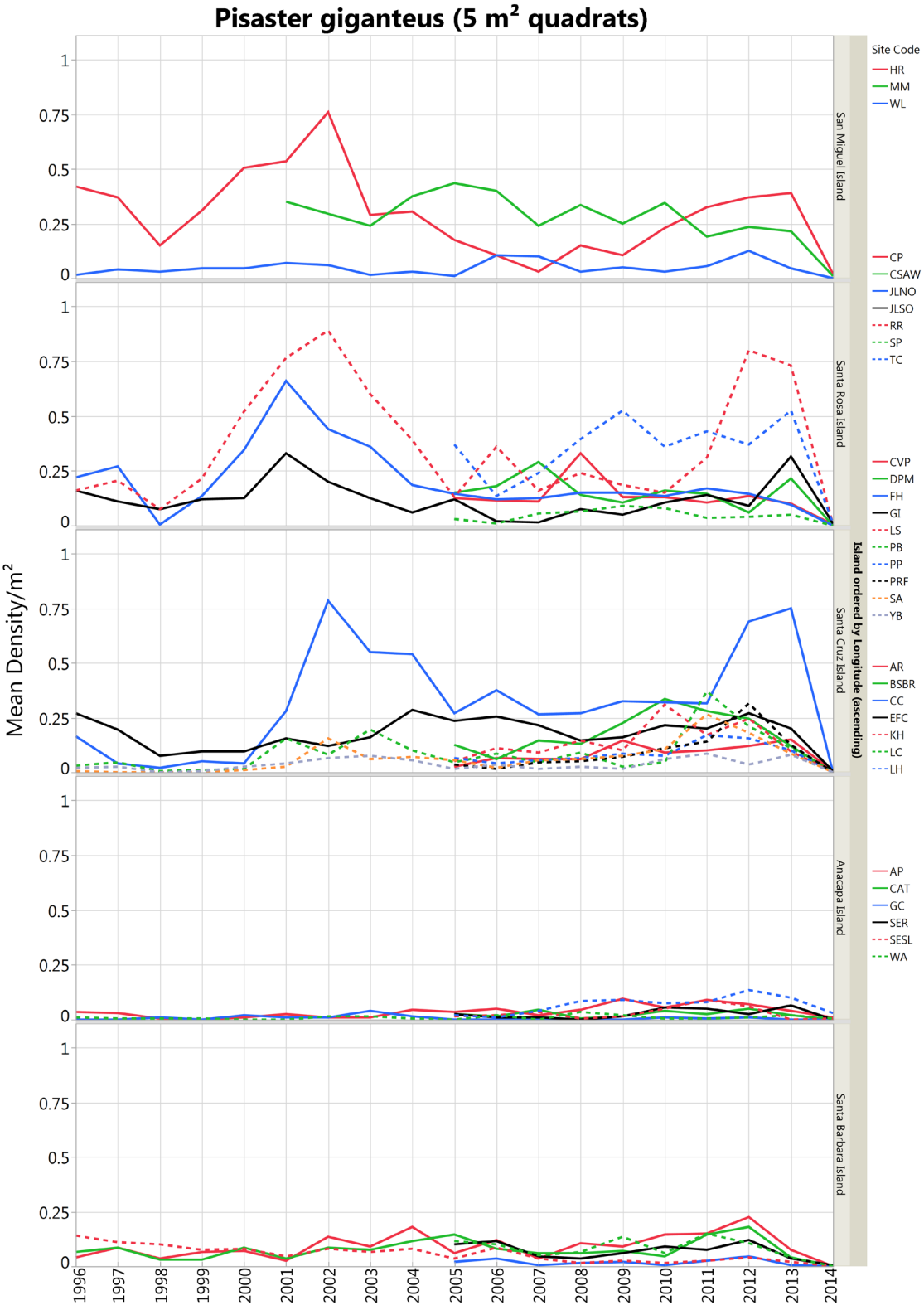


Figure F-5. Mean density of *Pisaster giganteus* by site and island at Channel Islands National Park between 1996 and 2014.

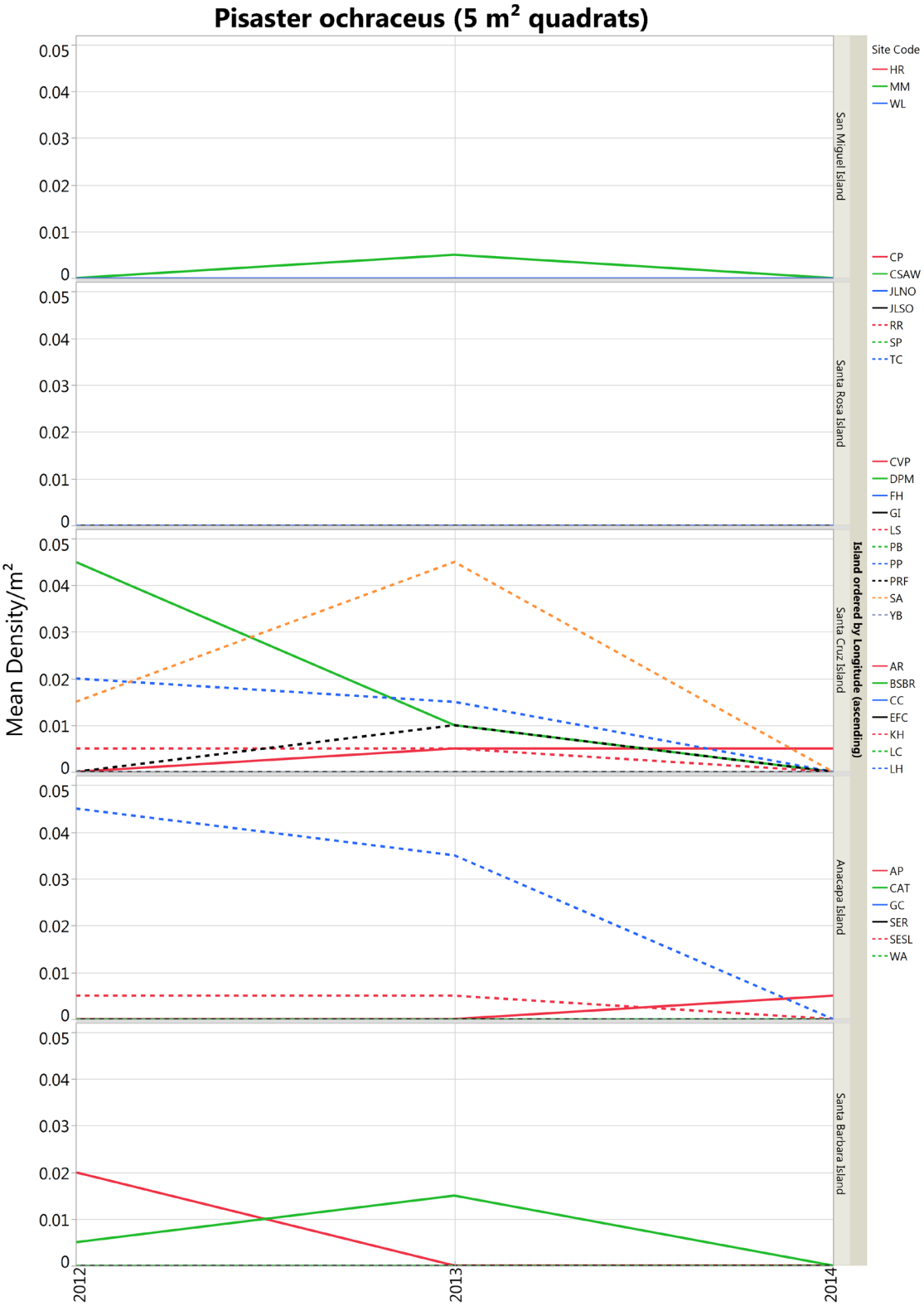


Figure F-6. Mean density of *Pisaster ochraceus* by site and island at Channel Islands National Park between 2012 and 2014.

Appendix G. Band Transect Data

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

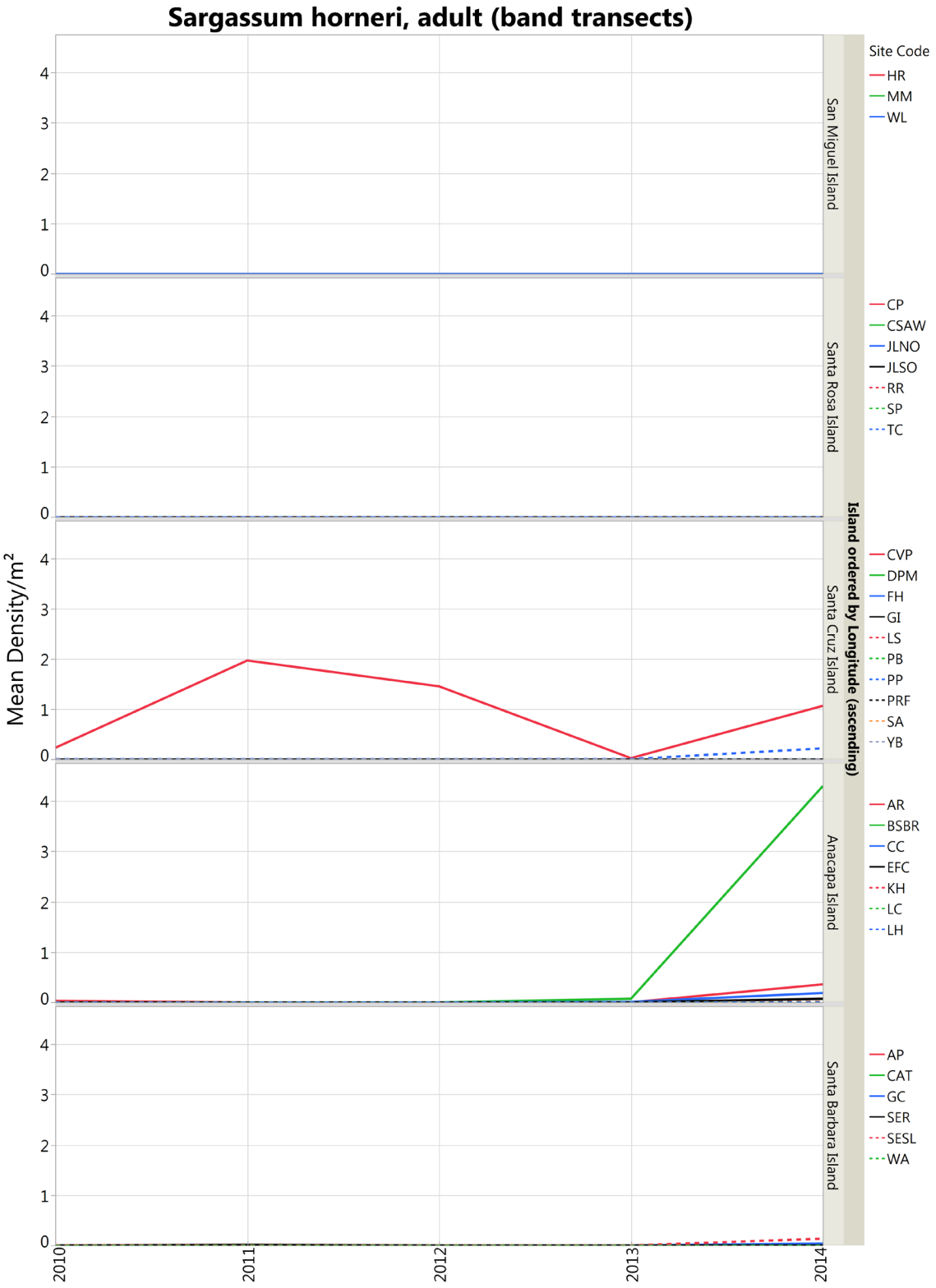


Figure G-1. Mean density of adult *Sargassum horneri* by site and island at Channel Islands National Park between 2010 and 2014.

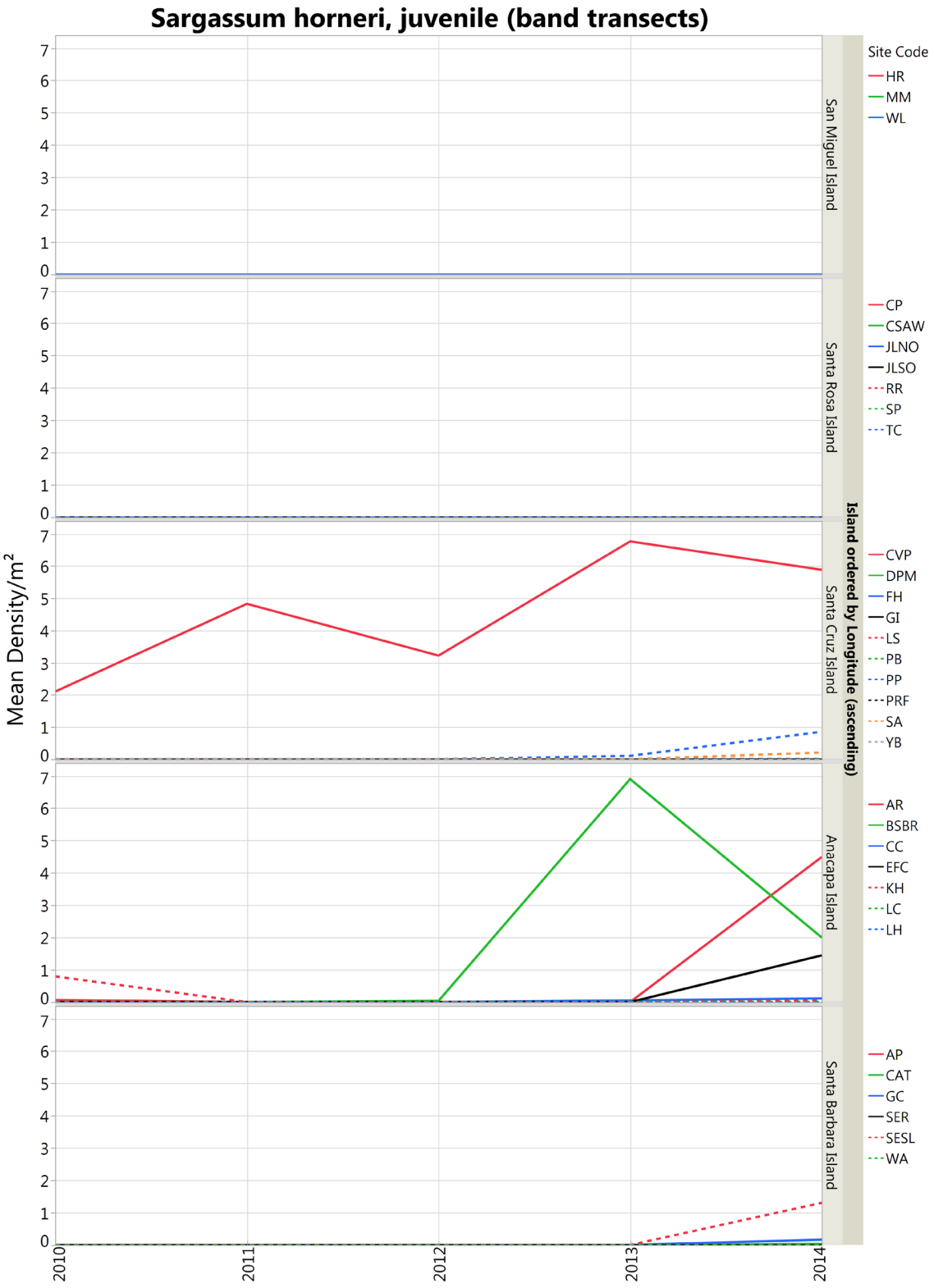


Figure G-2. Mean density of juvenile *Sargassum horneri* by site and island at Channel Islands National Park between 2010 and 2014.

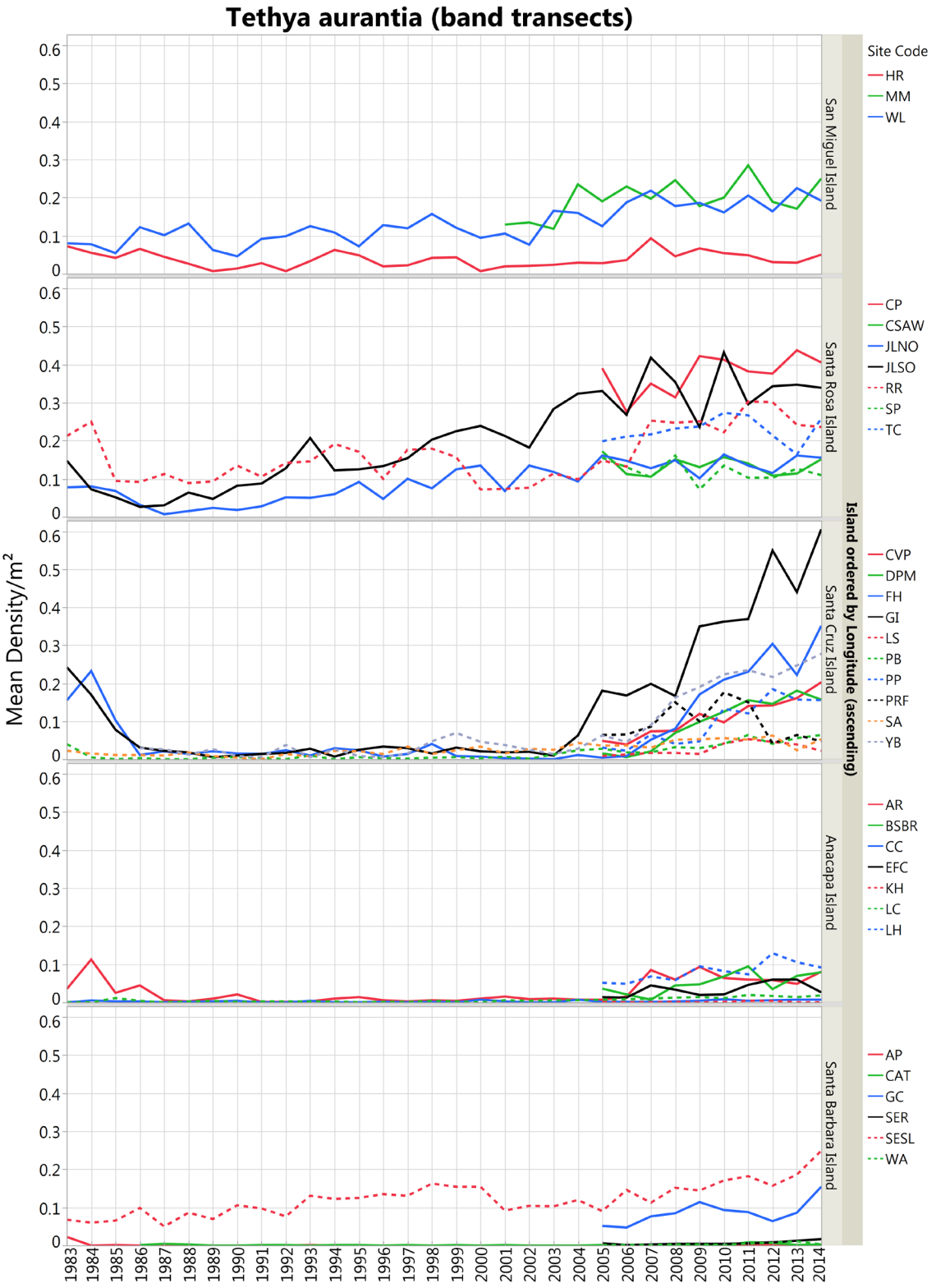


Figure G-3. Mean density of *Tethya aurantia* by site and island at Channel Islands National Park between 1983 and 2014.

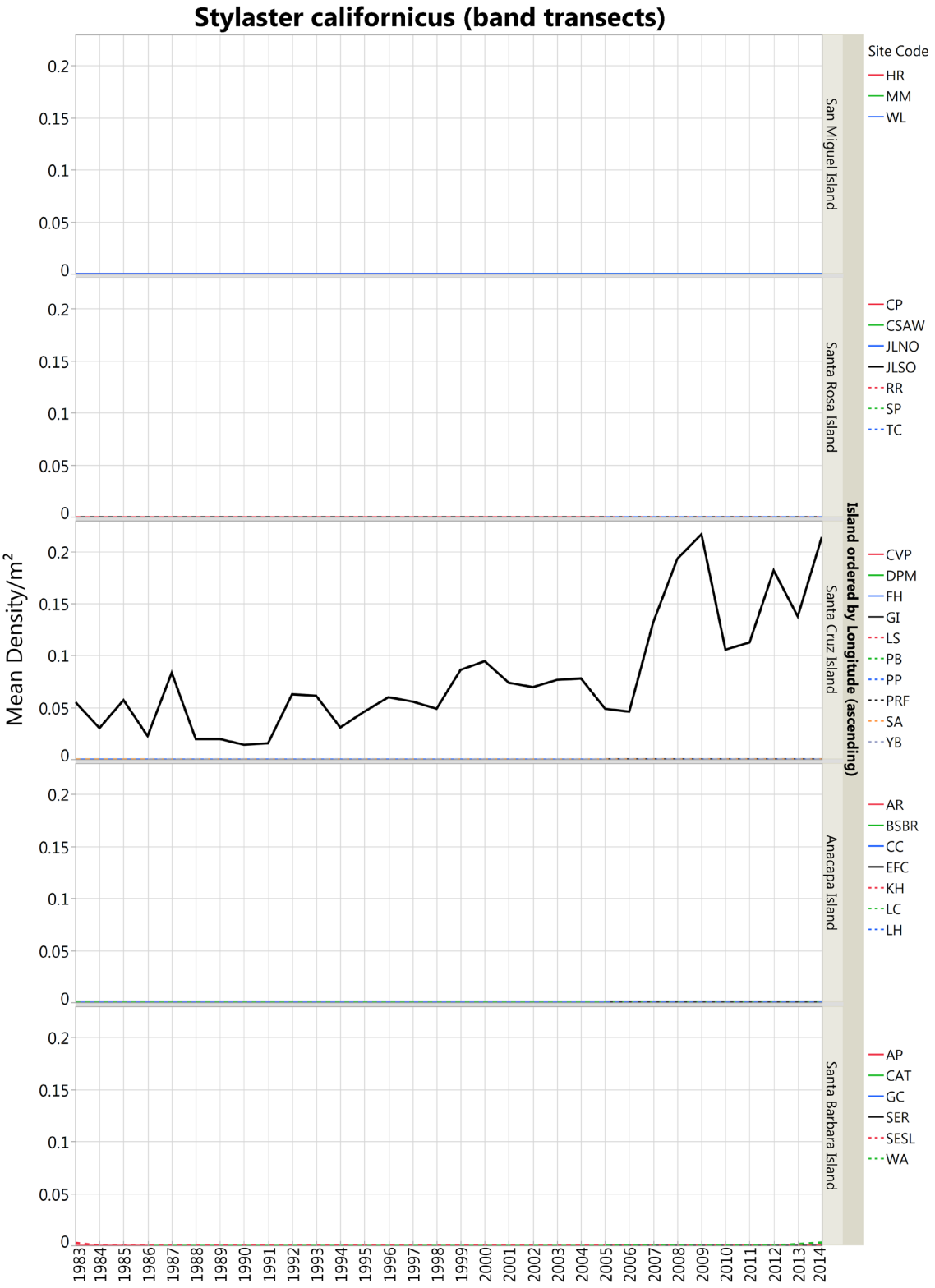


Figure G-4. Mean density of *Stylaster californicus* by site and island at Channel Islands National Park between 1983 and 2014.

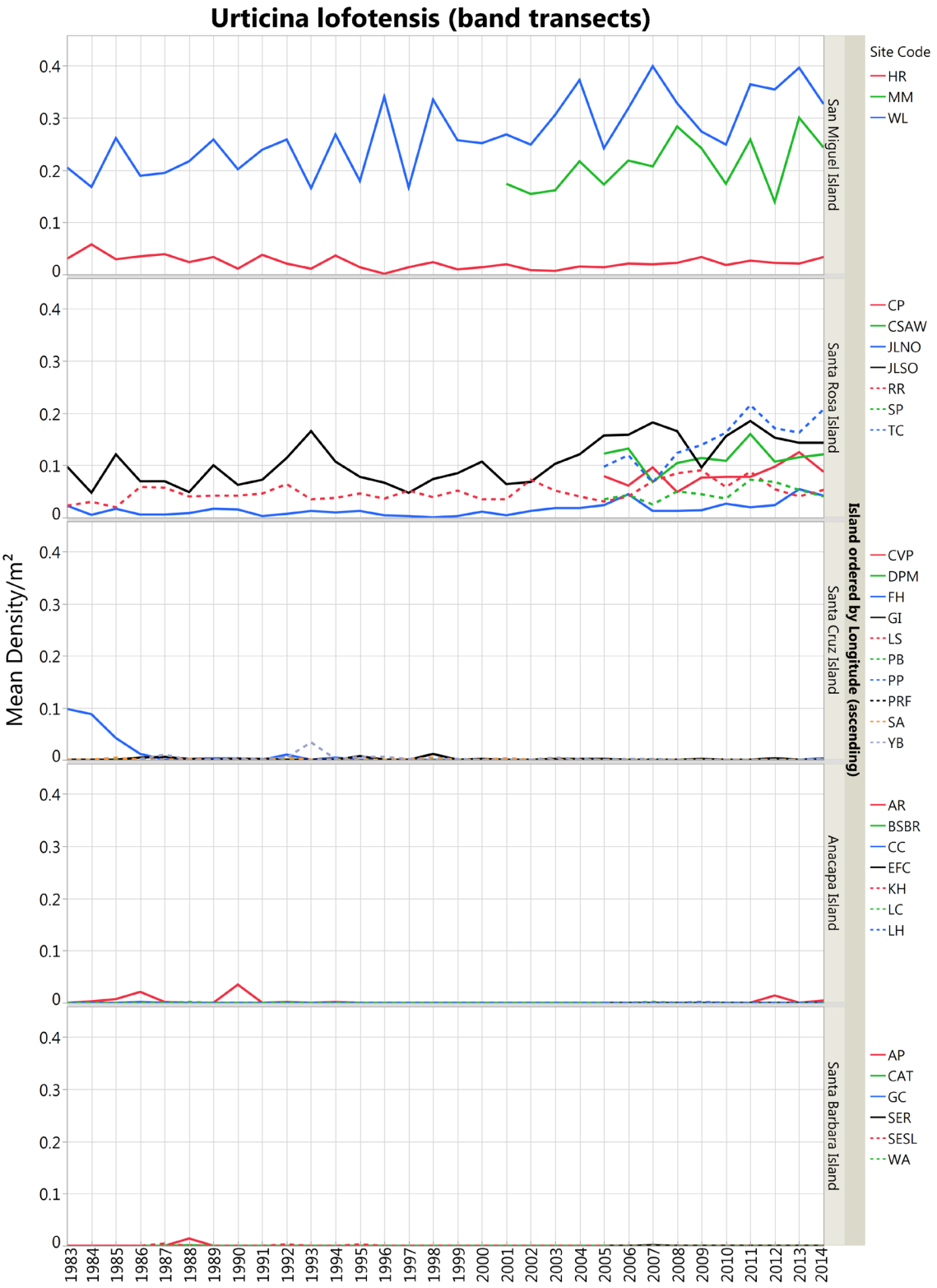


Figure G-5. Mean density of *Urticina lofotensis* by site and island at Channel Islands National Park between 1983 and 2014.

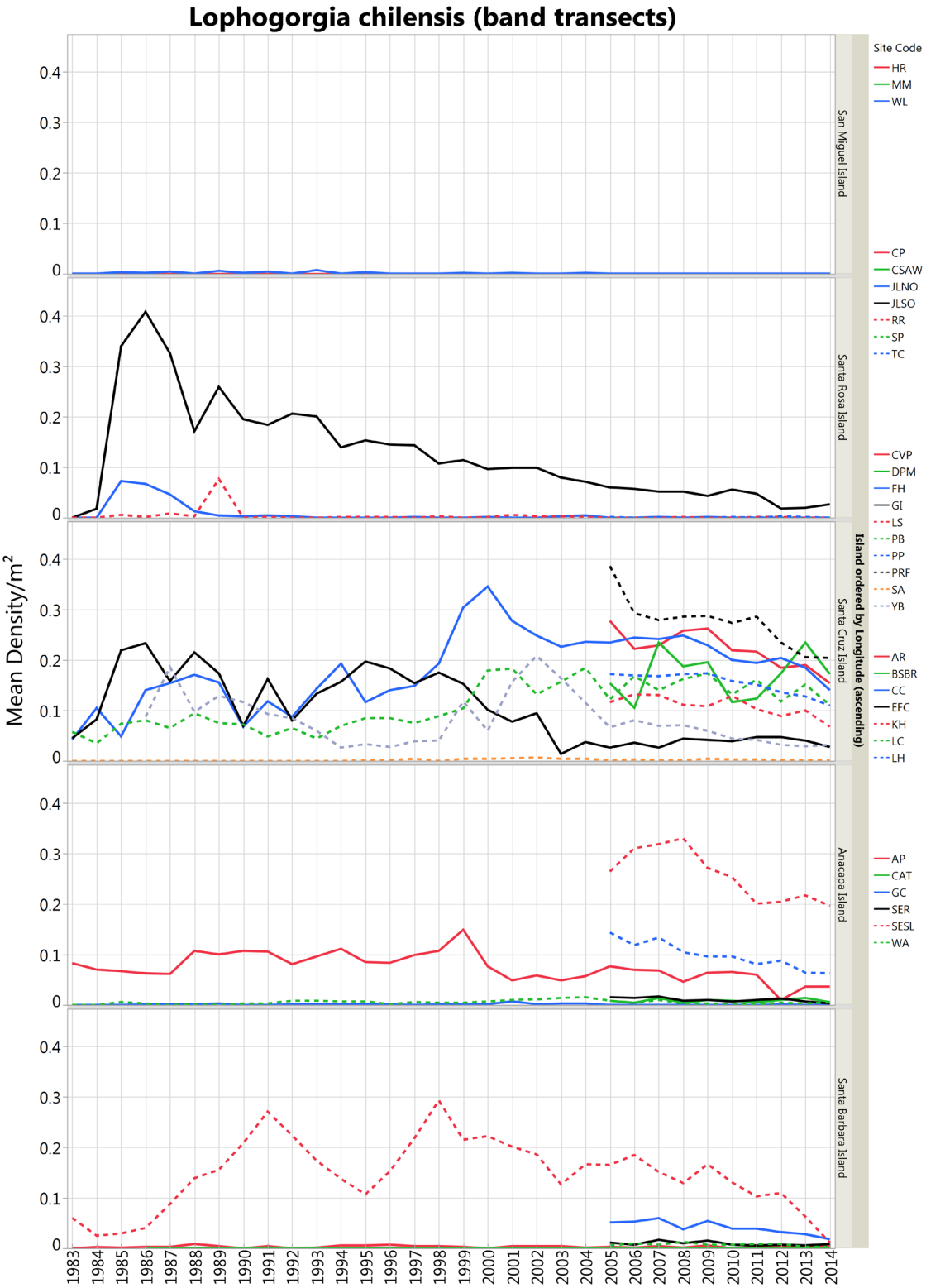


Figure G-6. Mean density of *Lophogorgia chilensis* by site and island at Channel Islands National Park between 1983 and 2014.

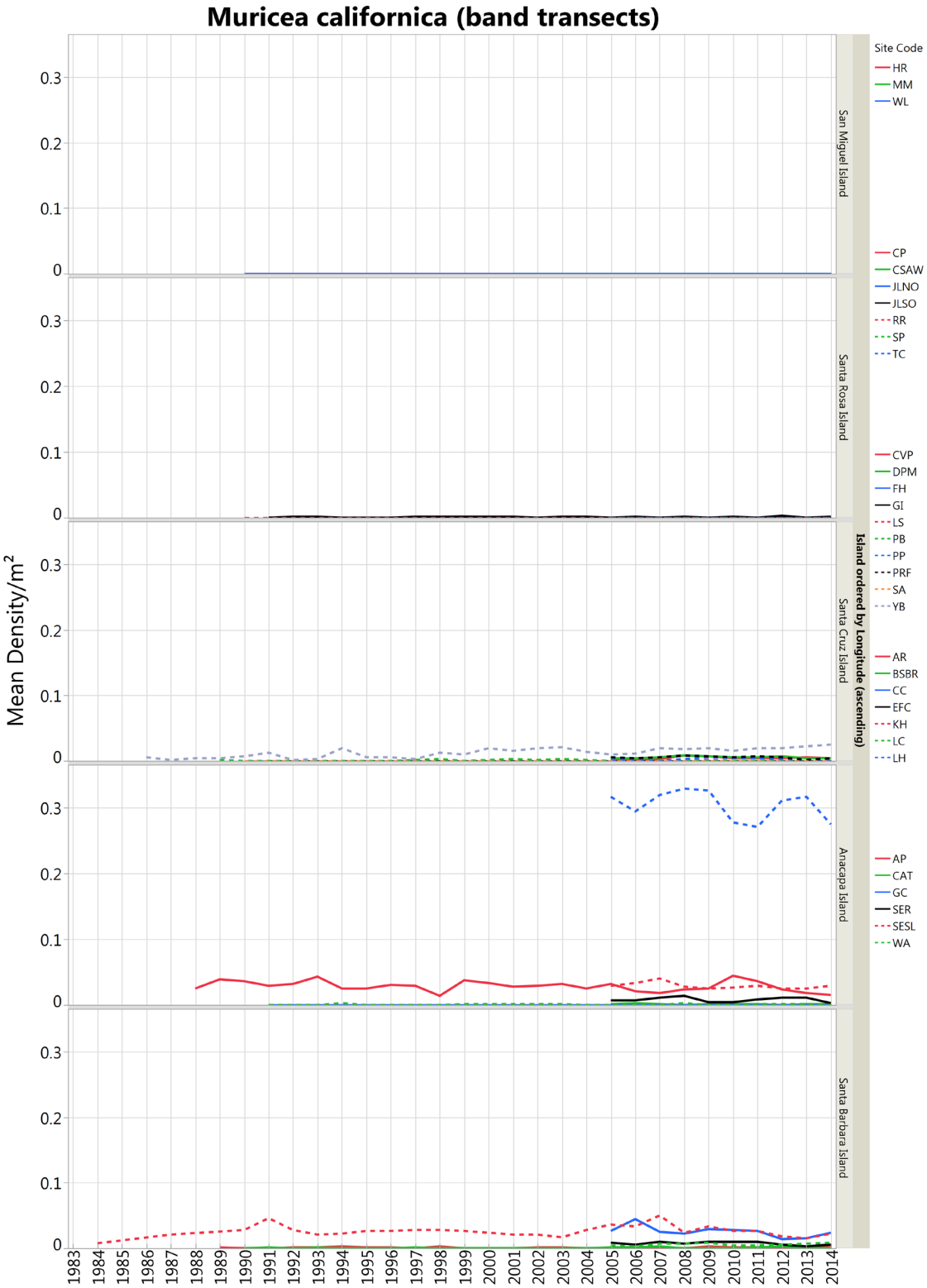


Figure G-7. Mean density of *Muricea californica* by site and island at Channel Islands National Park between 1983 and 2014.

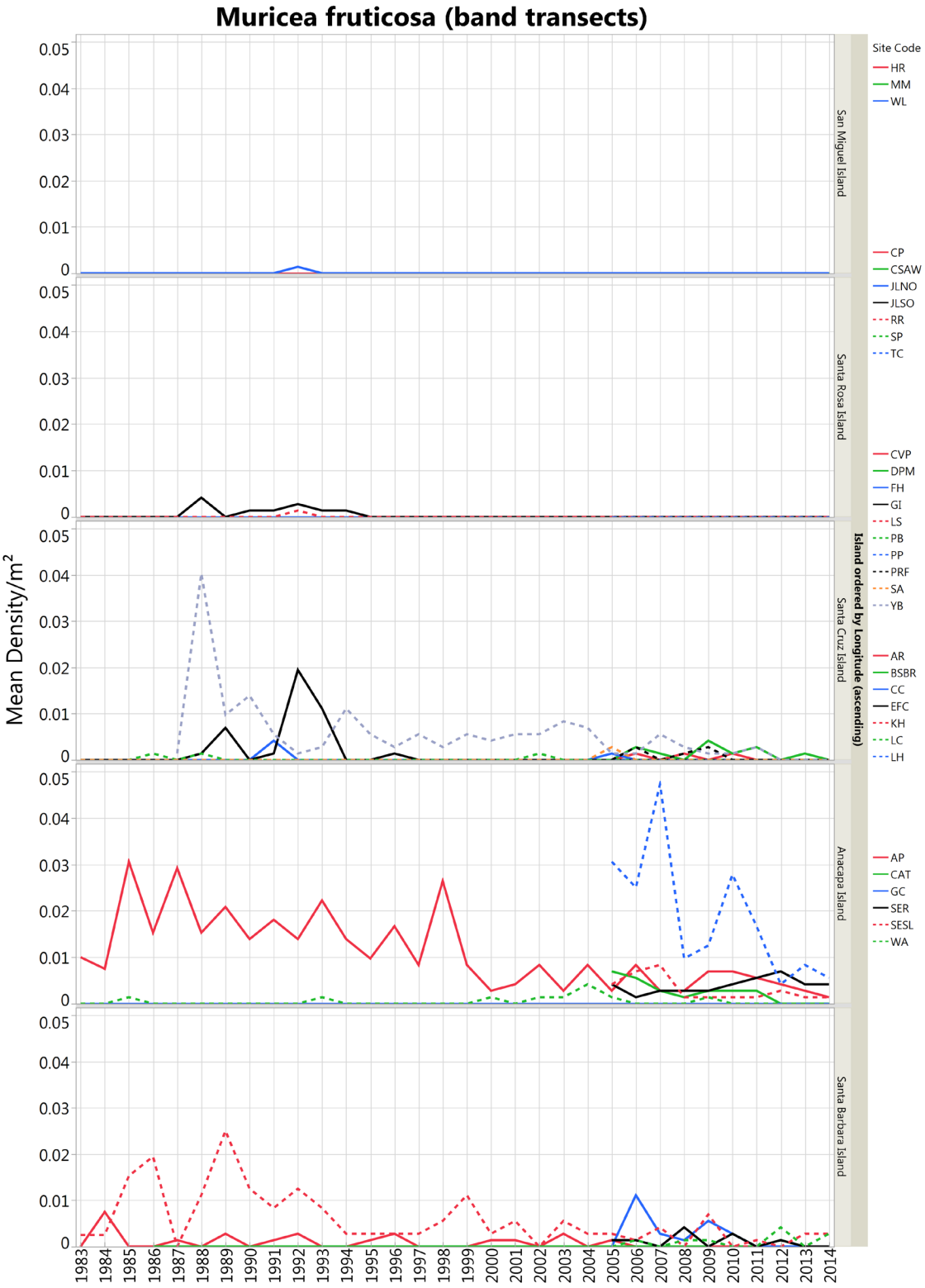


Figure G-8. Mean density of *Muricea fruticosa* by site and island at Channel Islands National Park between 1983 and 2014.

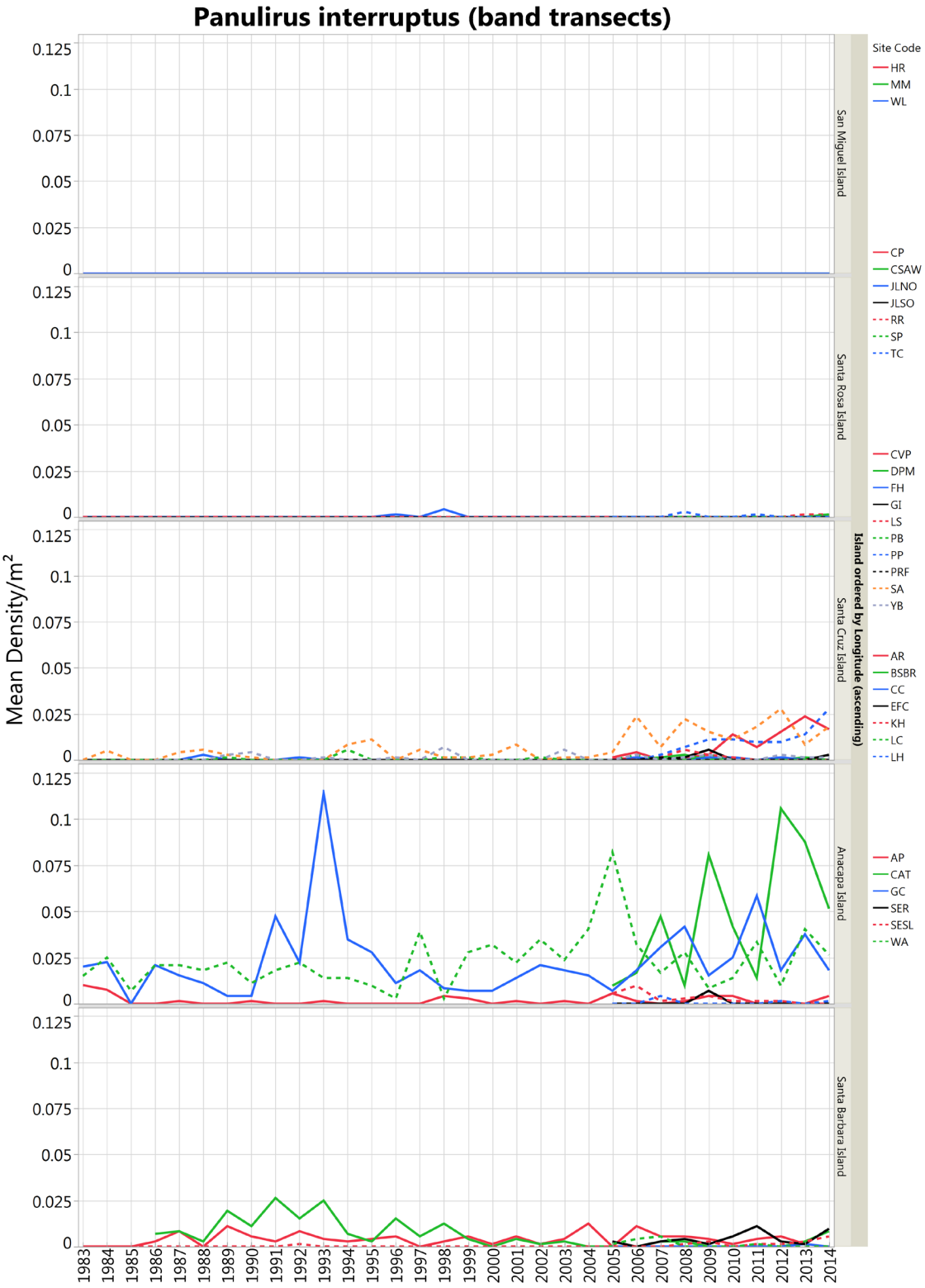


Figure G-9. Mean density of *Panulirus interruptus* by site and island at Channel Islands National Park between 1983 and 2014.

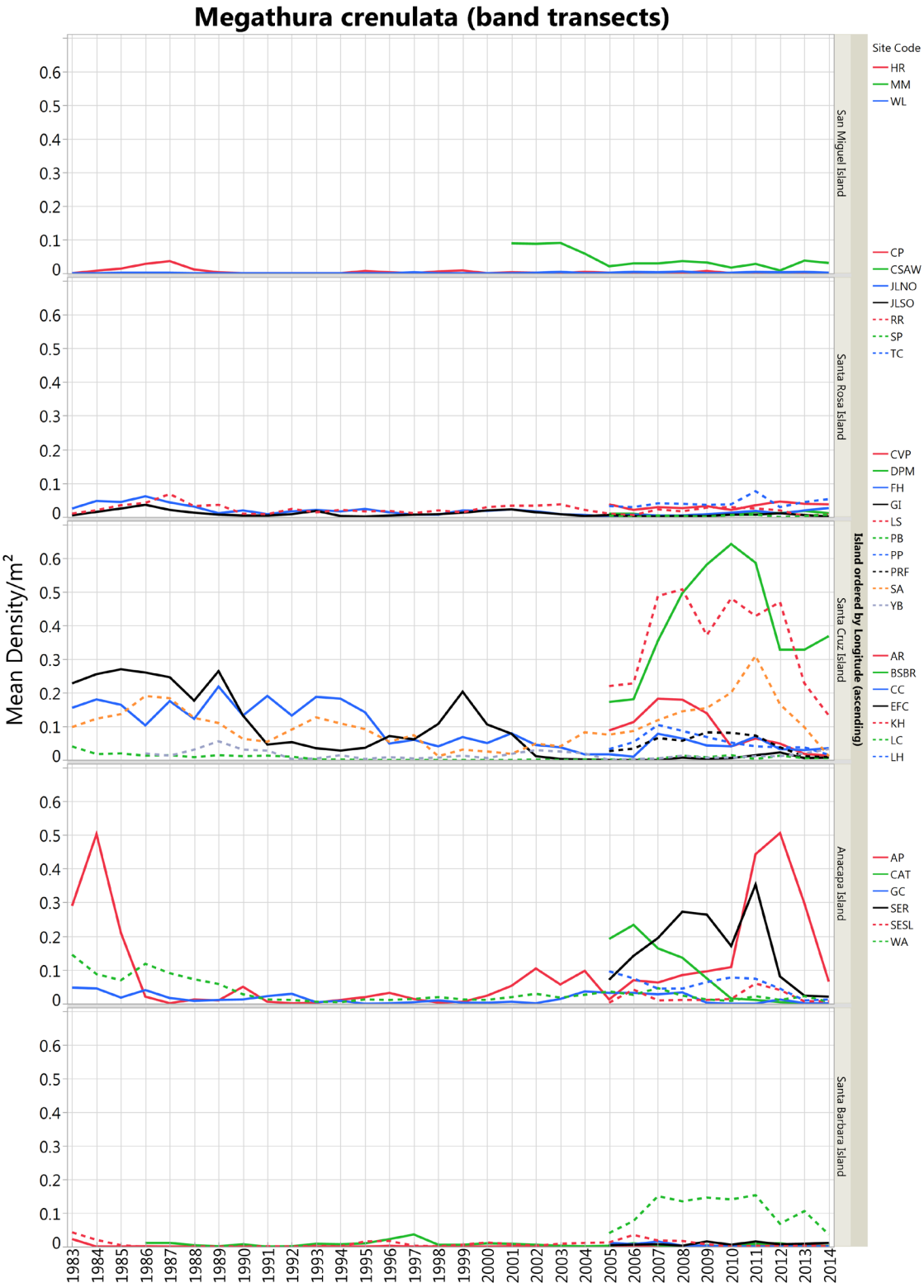


Figure G-10. Mean density of *Megathura crenulata* by site and island at Channel Islands National Park between 1983 and 2014.

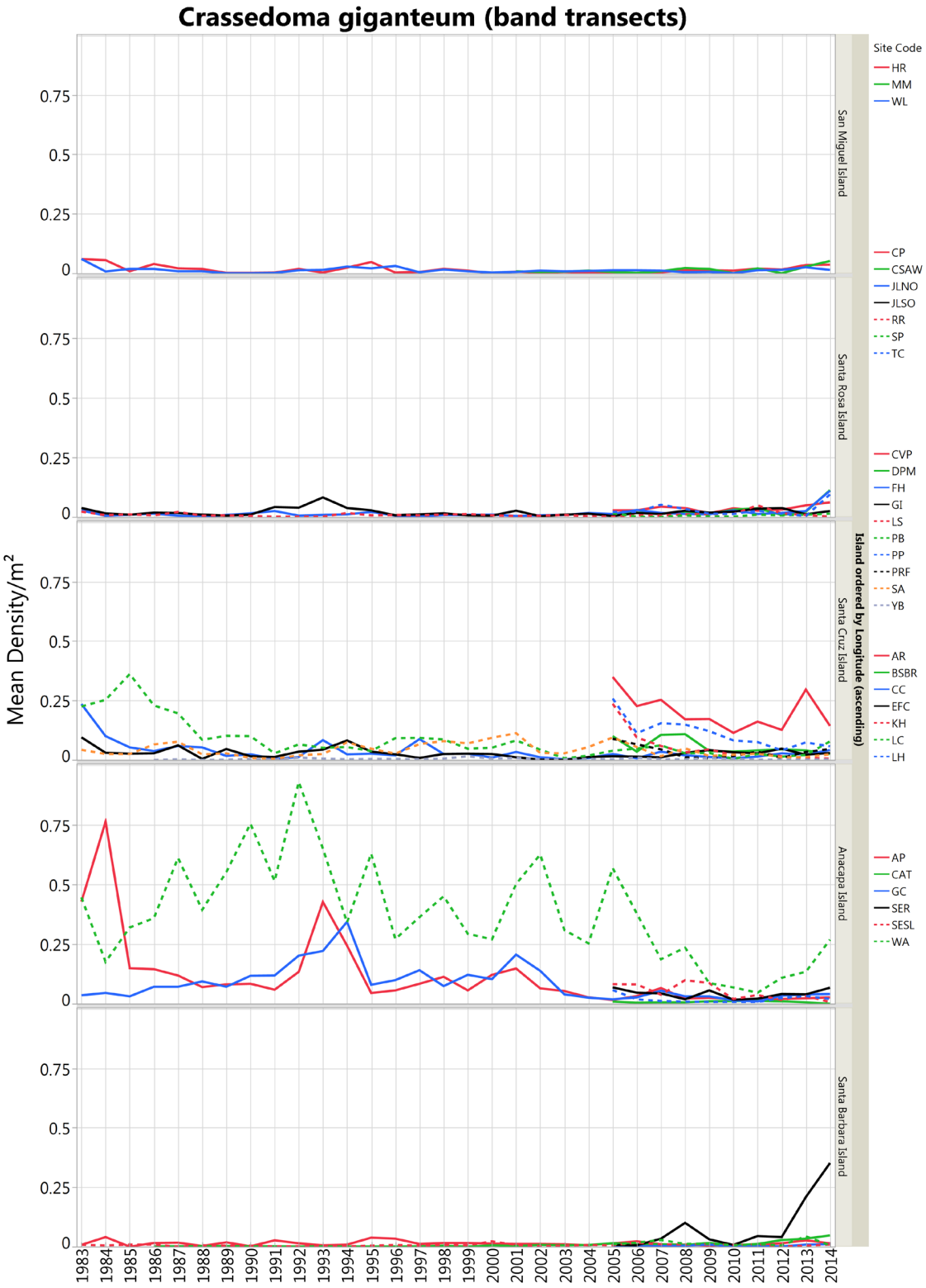


Figure G-11. Mean density of *Crassedoma giganteum* by site and island at Channel Islands National Park between 1983 and 2014.

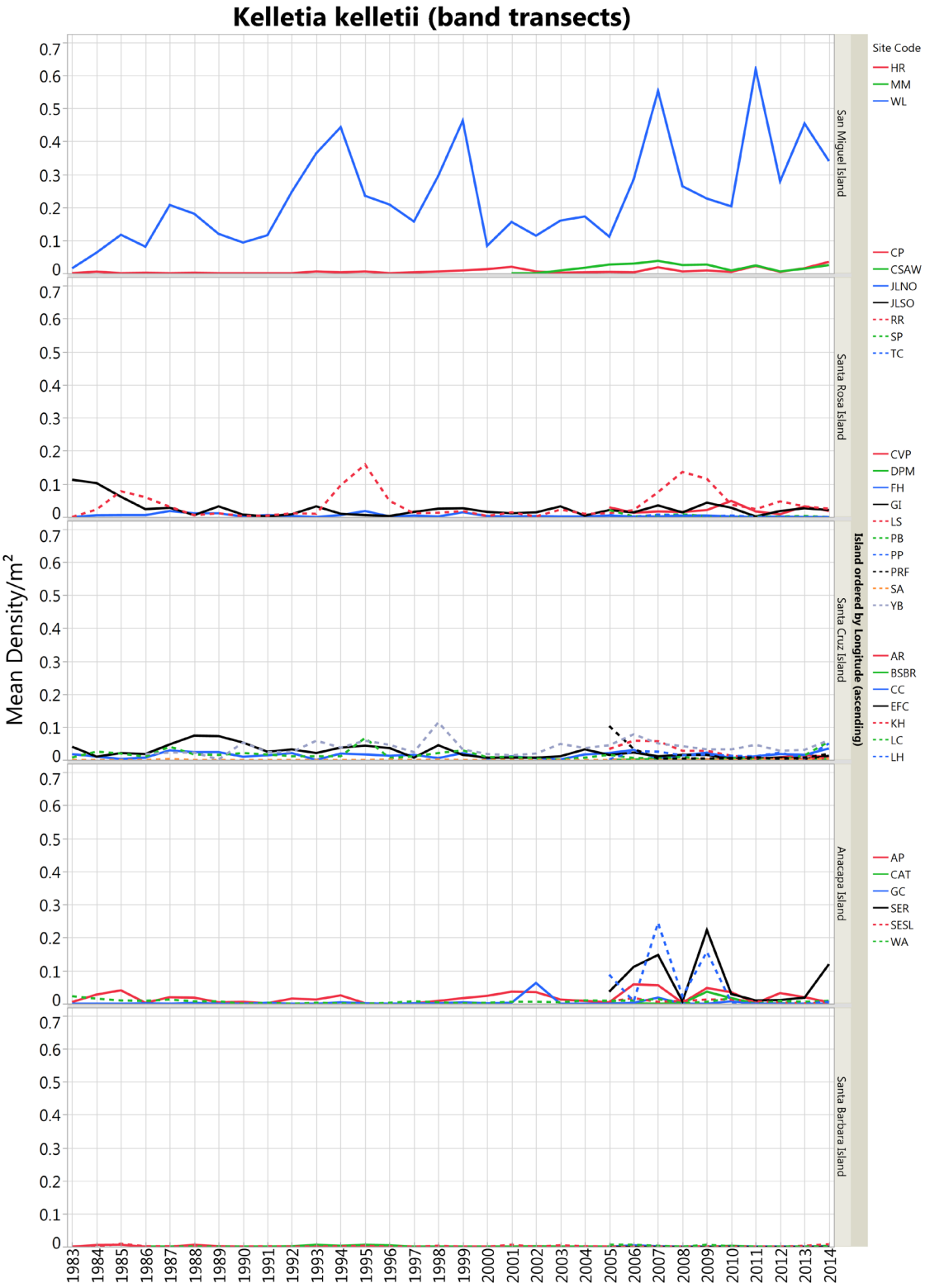


Figure G-12. Mean density of *Kelletia kelletii* by site and island at Channel Islands National Park between 1983 and 2014.

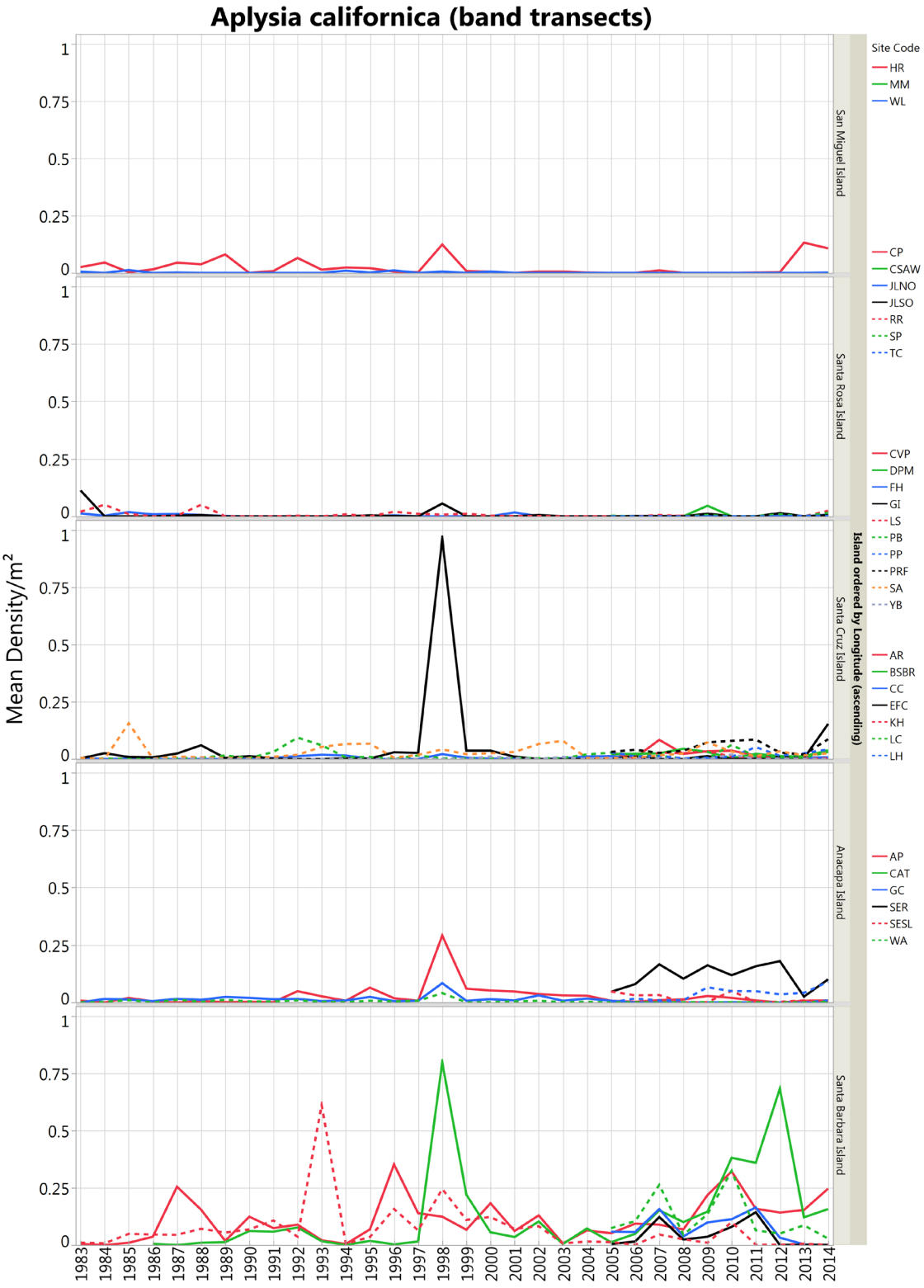


Figure G-13. Mean density of *Aplysia californica* by site and island at Channel Islands National Park between 1983 and 2014.

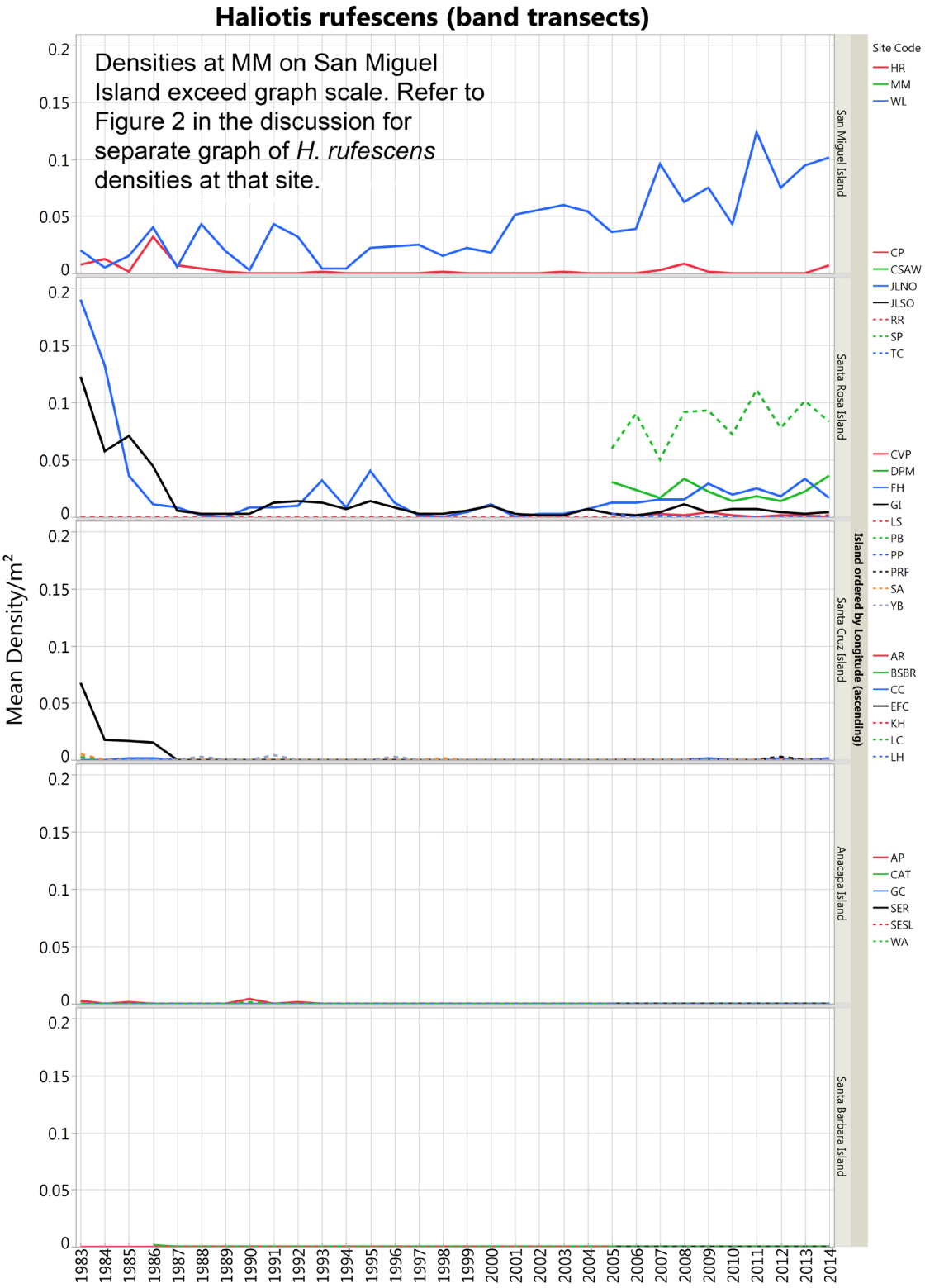


Figure G-14. Mean density of *Haliotis rufescens* by site and island at Channel Islands National Park between 1983 and 2014.

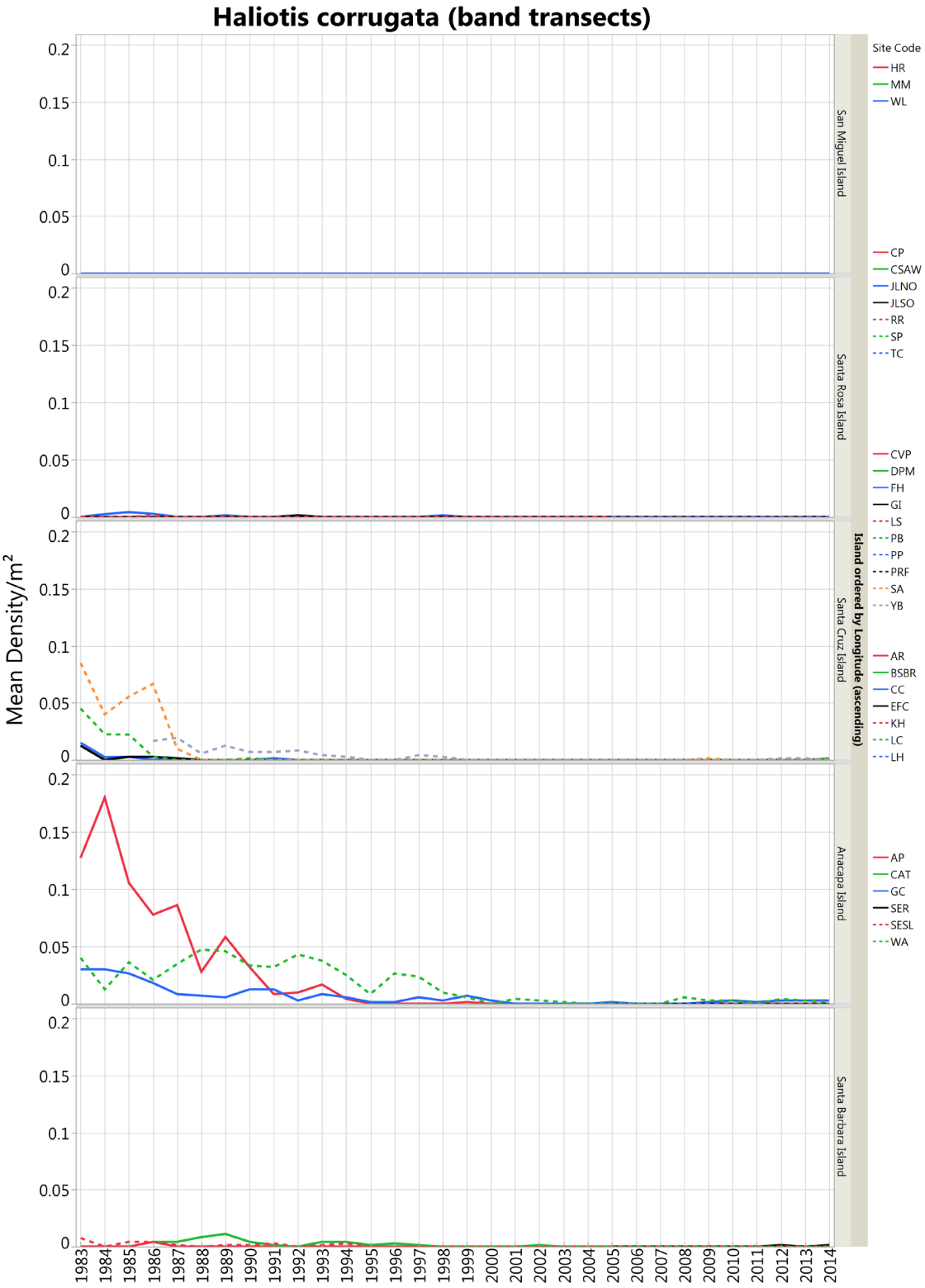


Figure G-15. Mean density of *Haliotis corrugata* by site and island at Channel Islands National Park between 1983 and 2014.

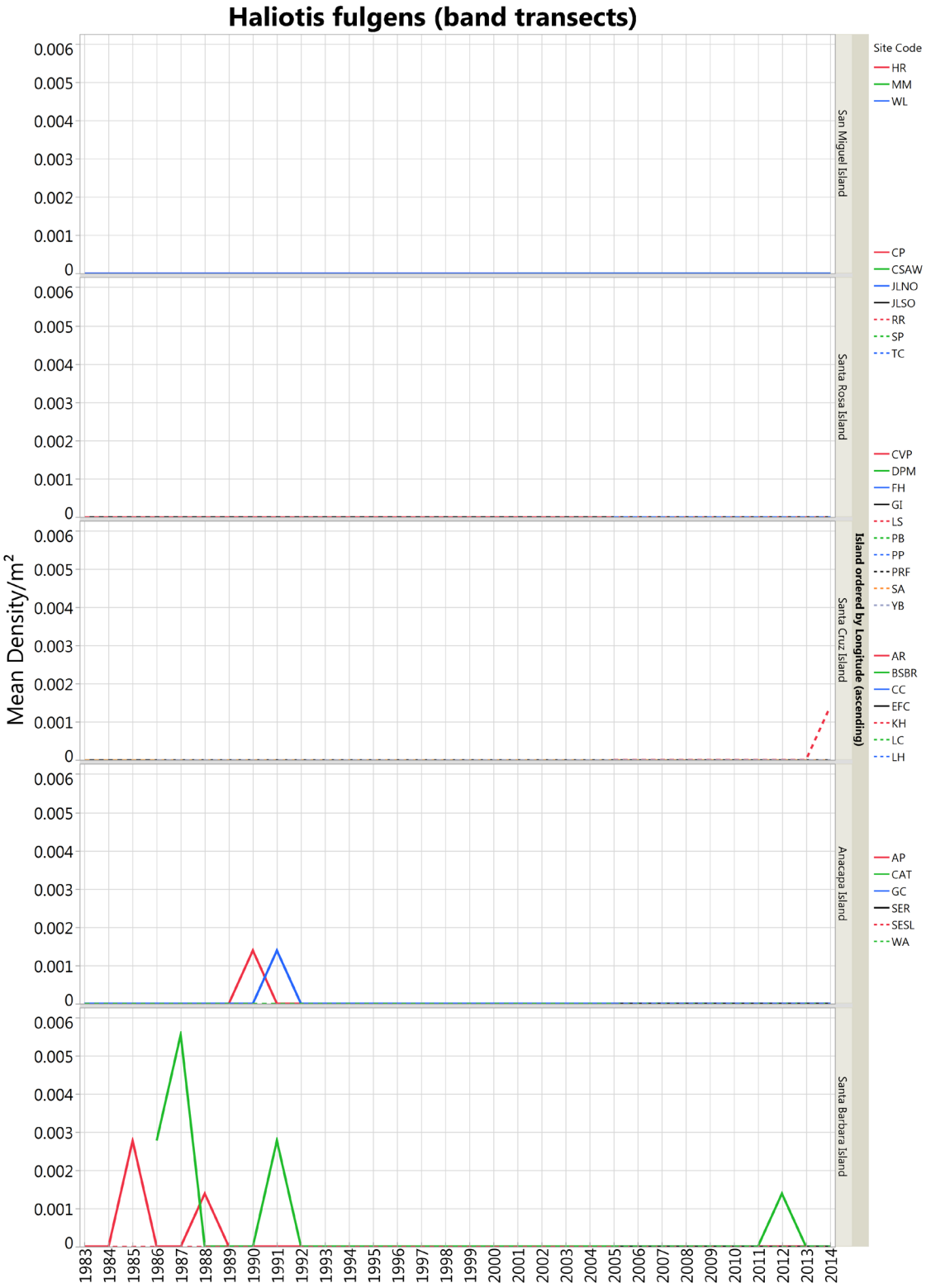


Figure G-16. Mean density of *Haliotis fulgens* by site and island at Channel Islands National Park between 1983 and 2014.

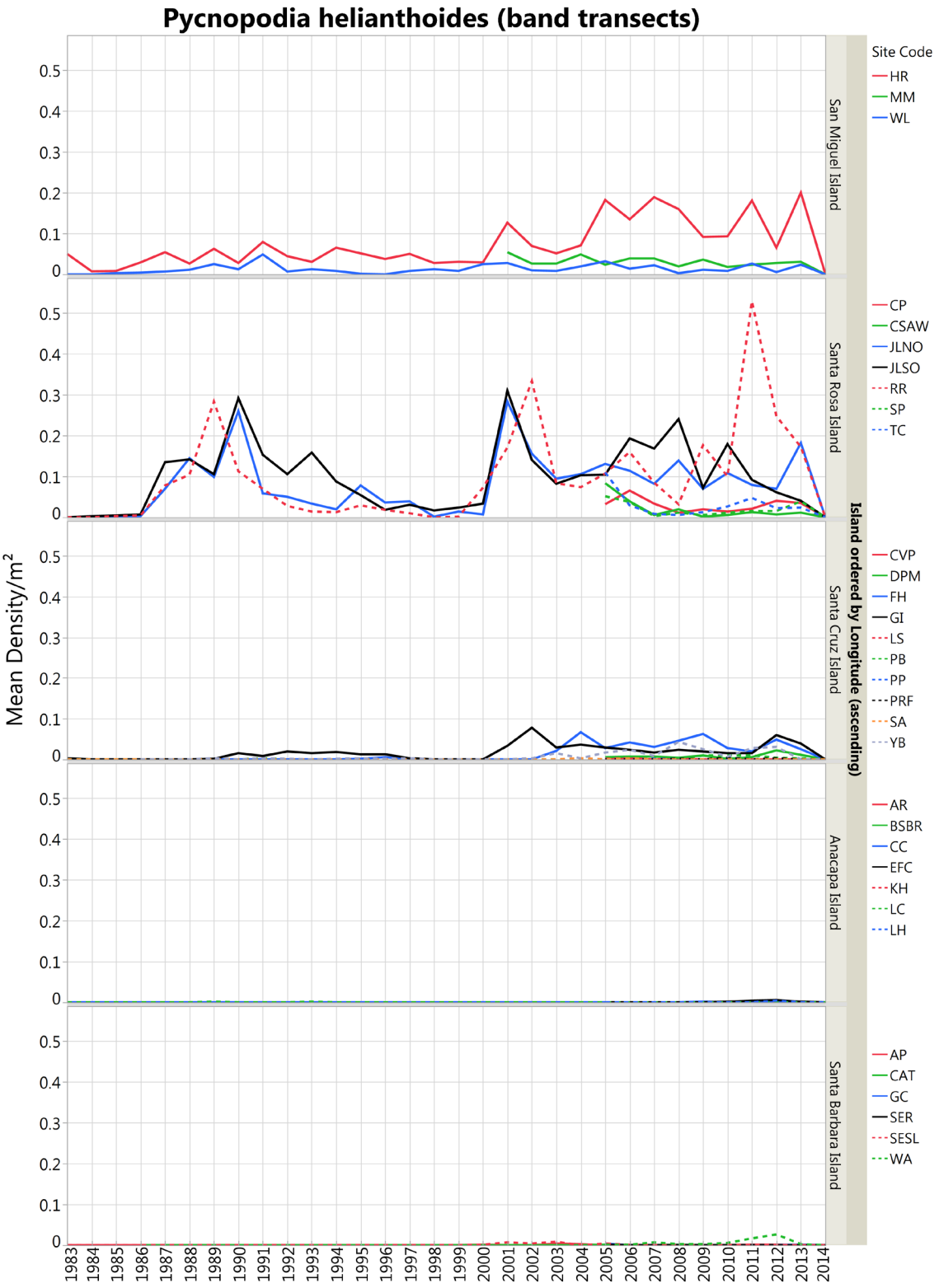


Figure G-17. Mean density of *Pycnopodia helianthoides* by site and island at Channel Islands National Park between 1983 and 2014.

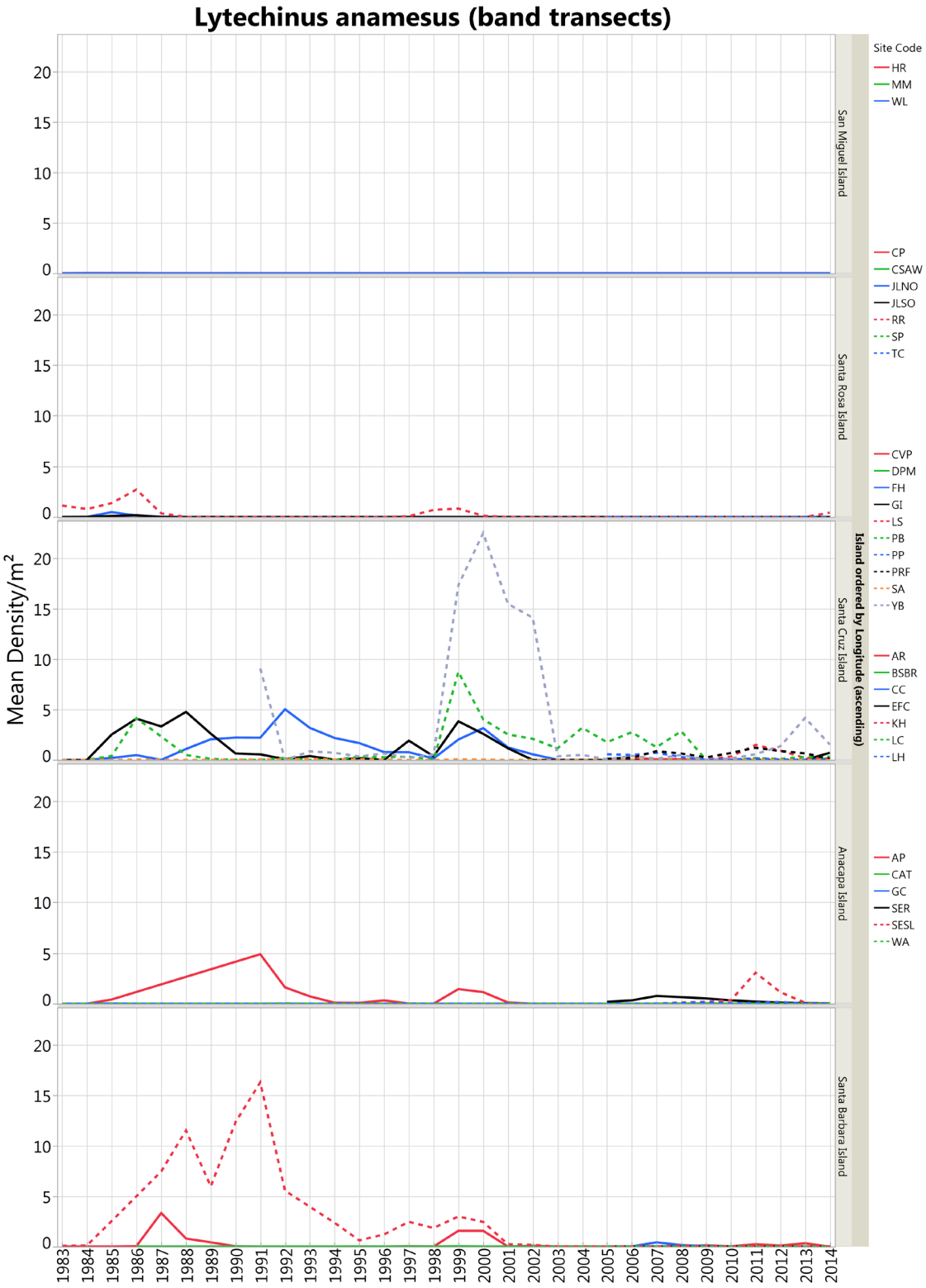


Figure G-18. Mean density of *Lytechinus anamesus* by site and island at Channel Islands National Park between 1983 and 2014.

Appendix H. Random Point Contact Data

Figures H-1 through H-31 show the random point contact data.

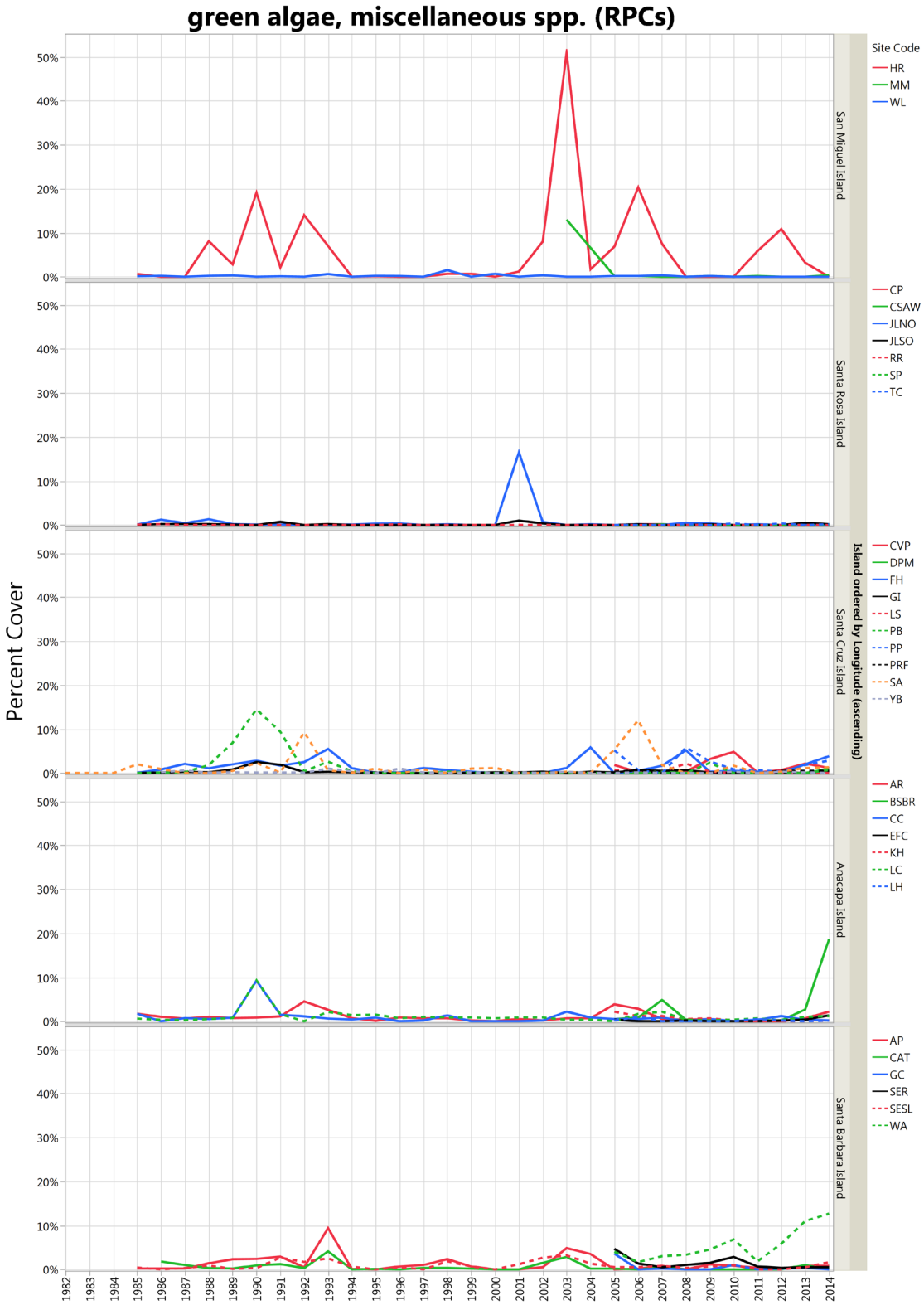


Figure H-1. Percent cover of green algae, miscellaneous species, by site and island at Channel Islands National Park between 1982 and 2014.

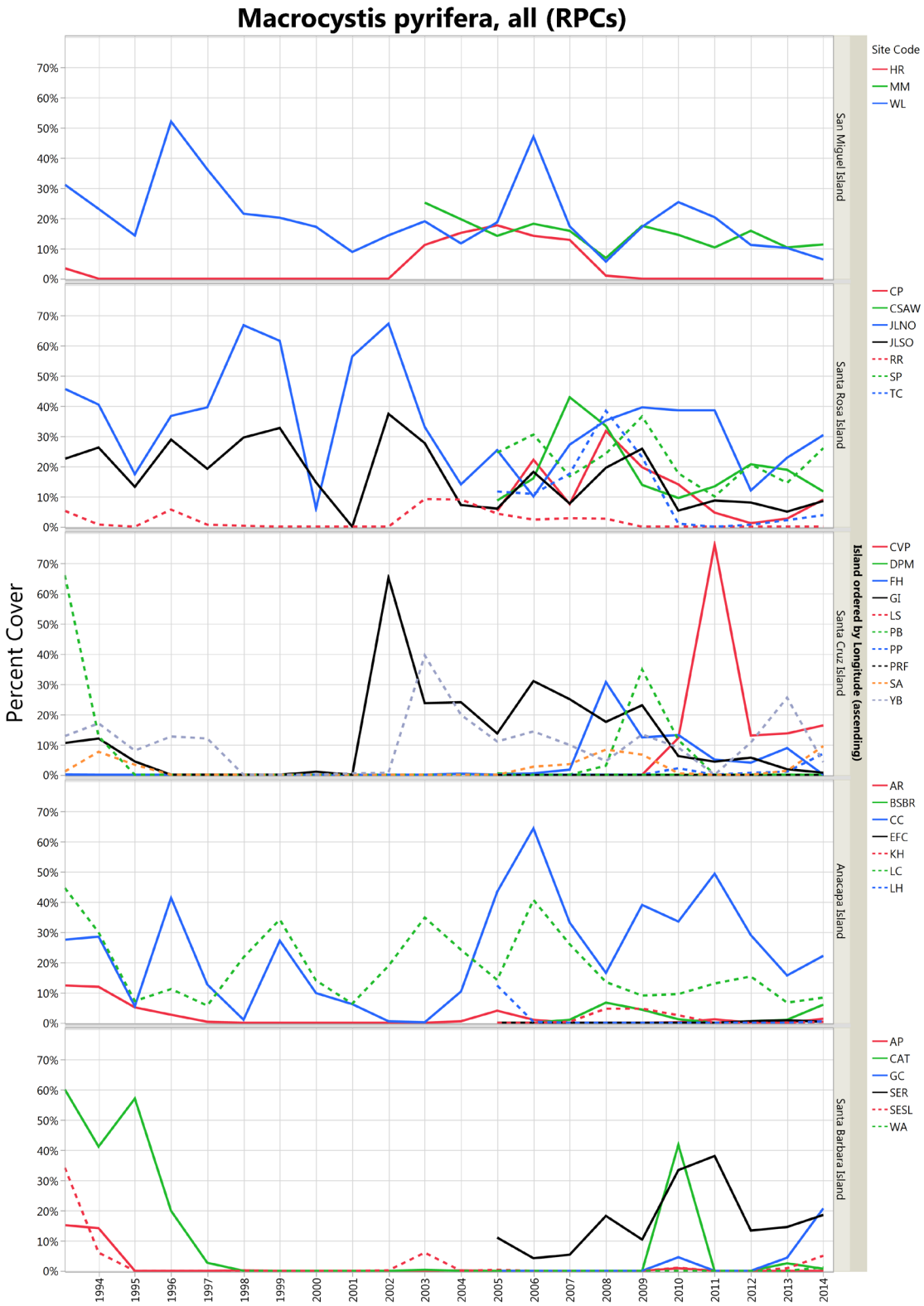


Figure H-2. Percent cover of *Macrocystis pyrifera* by site and island at Channel Islands National Park between 1993 and 2014.

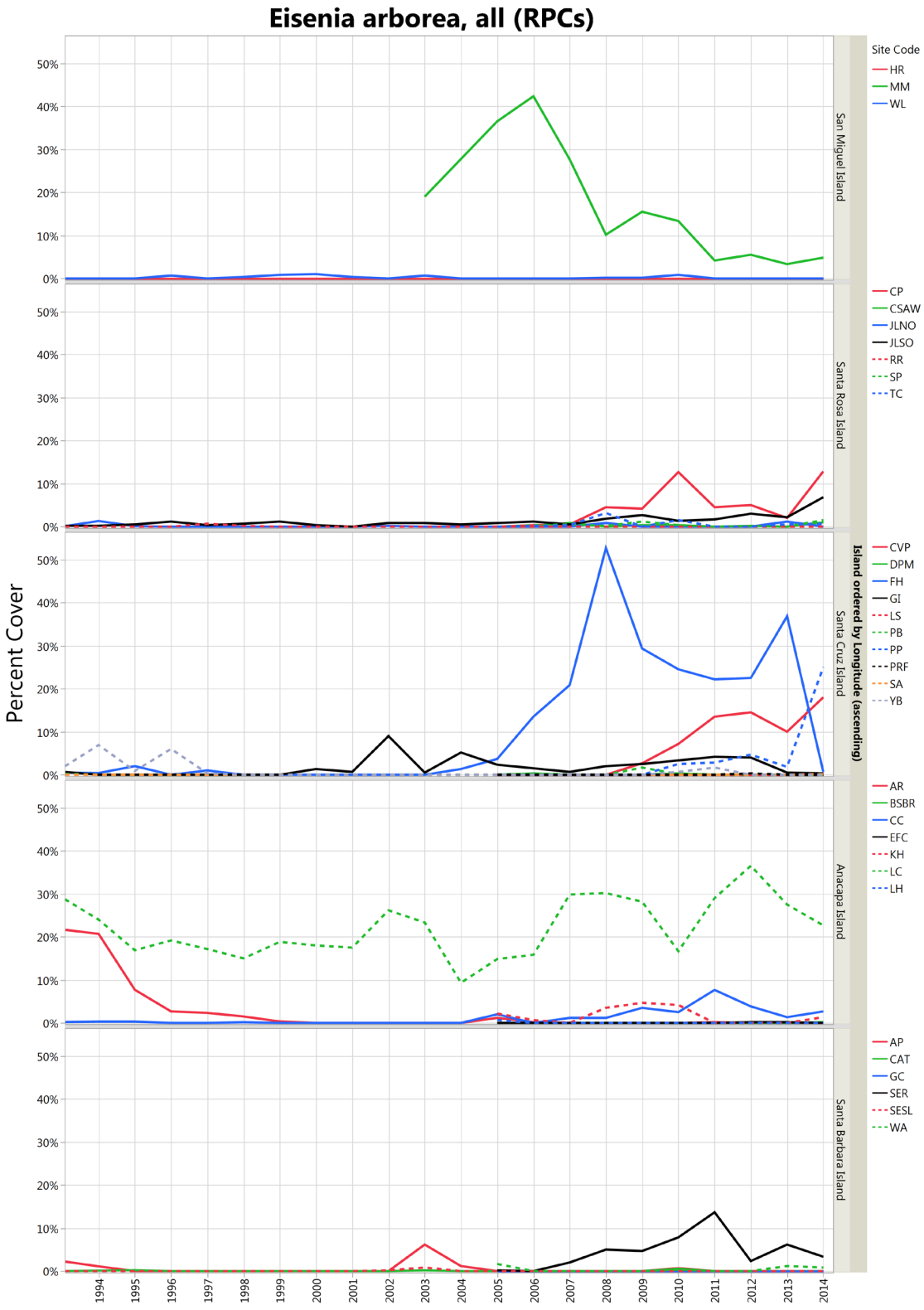


Figure H-3. Percent cover of *Eisenia arborea* by site and island at Channel Islands National Park between 1993 and 2014.

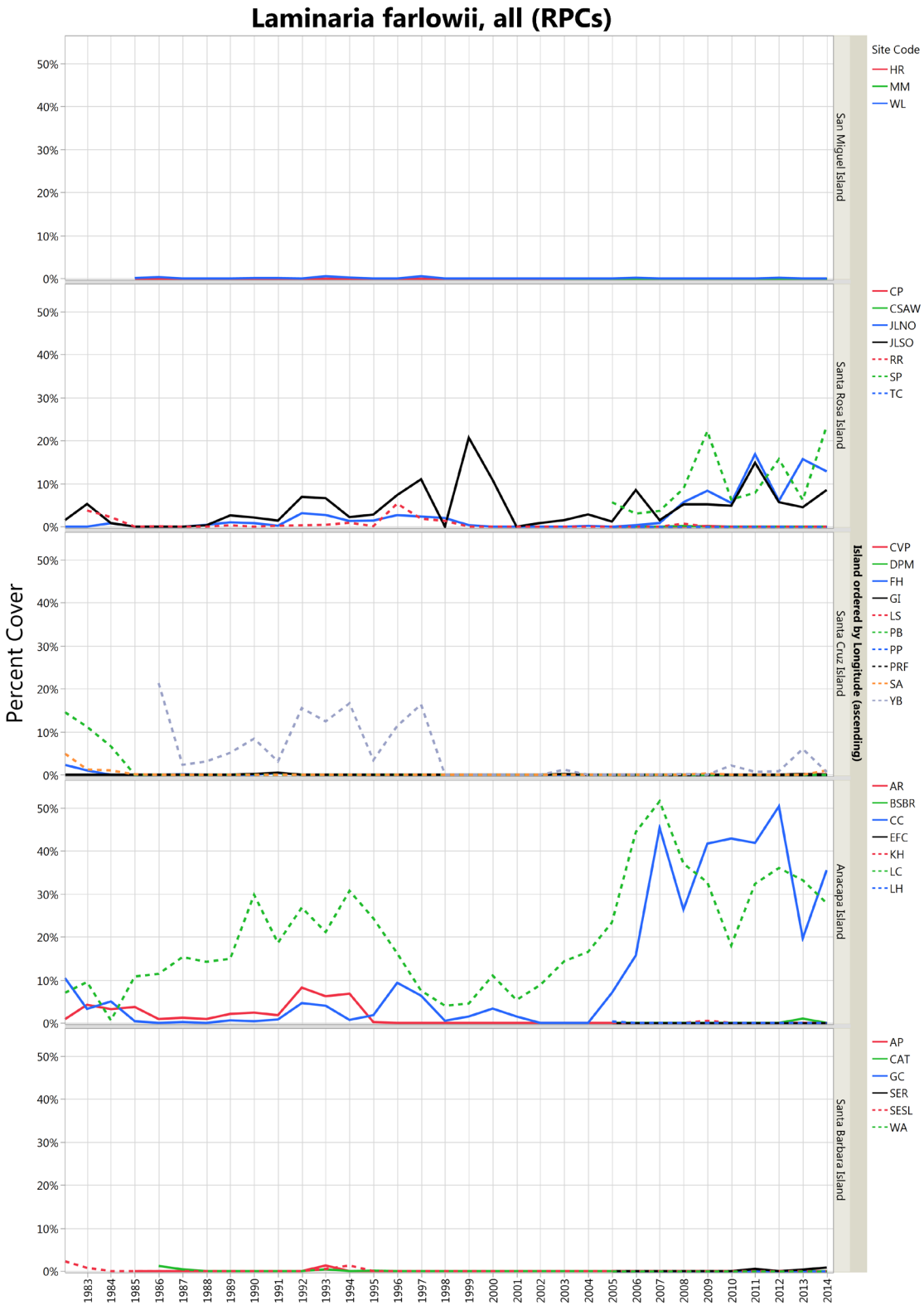


Figure H-4. Percent cover of *Laminaria farlowii* by site and island at Channel Islands National Park between 1982 and 2014.

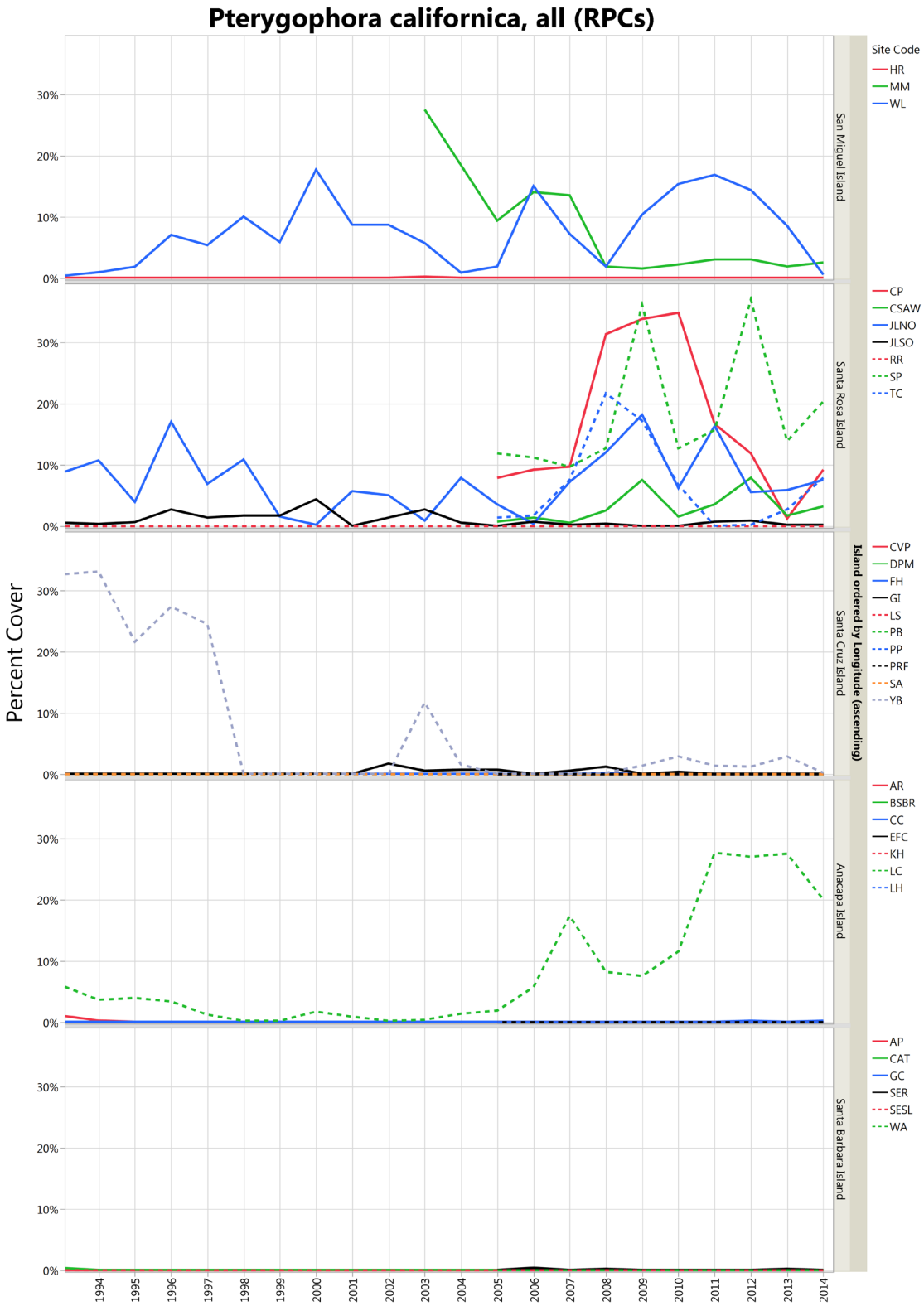


Figure H-5. Percent cover of *Pterygophora californica* by site and island at Channel Islands National Park between 1993 and 2014.

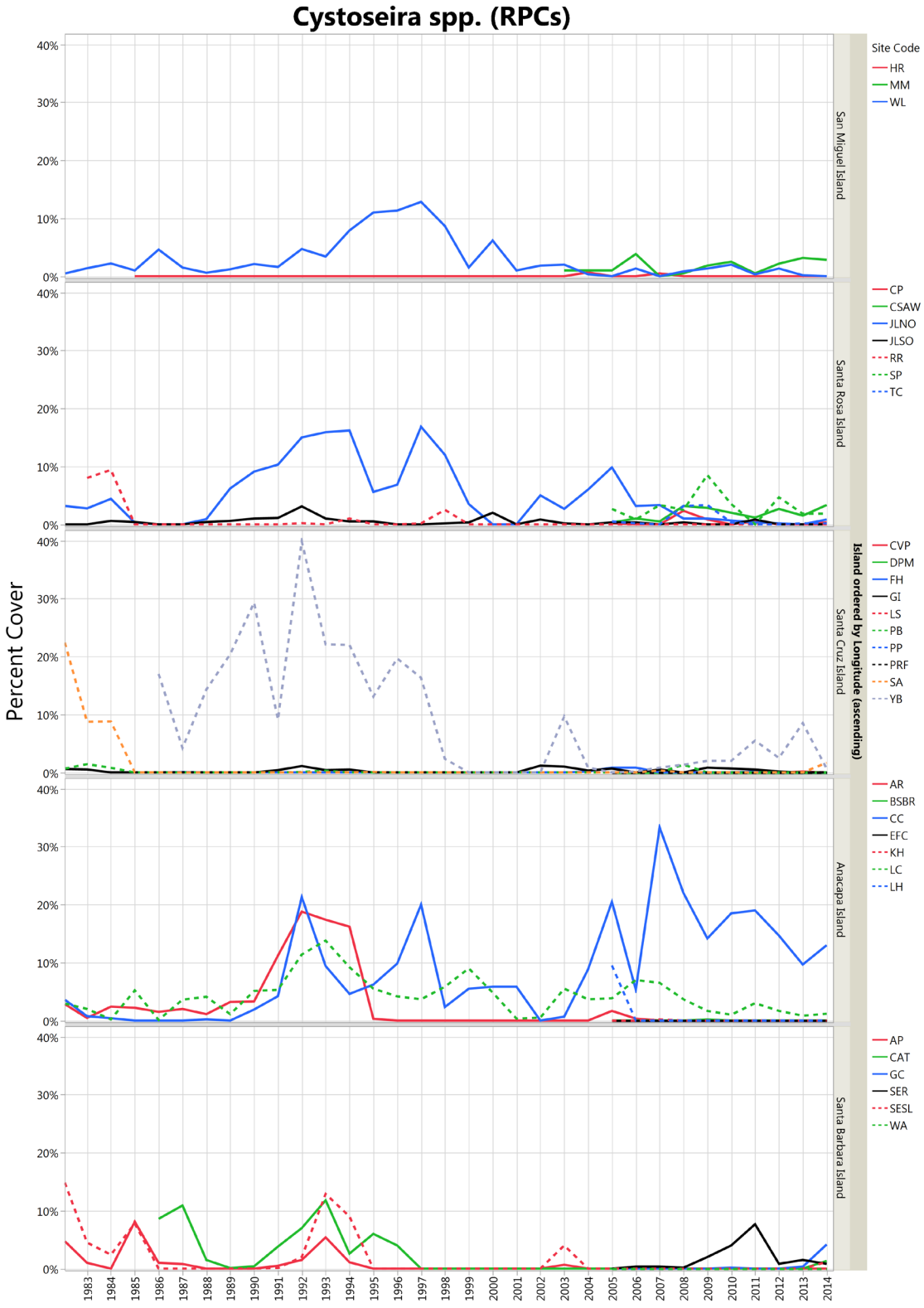


Figure H-6. Percent cover of *Cystoseira* species by site and island at Channel Islands National Park between 1982 and 2014.

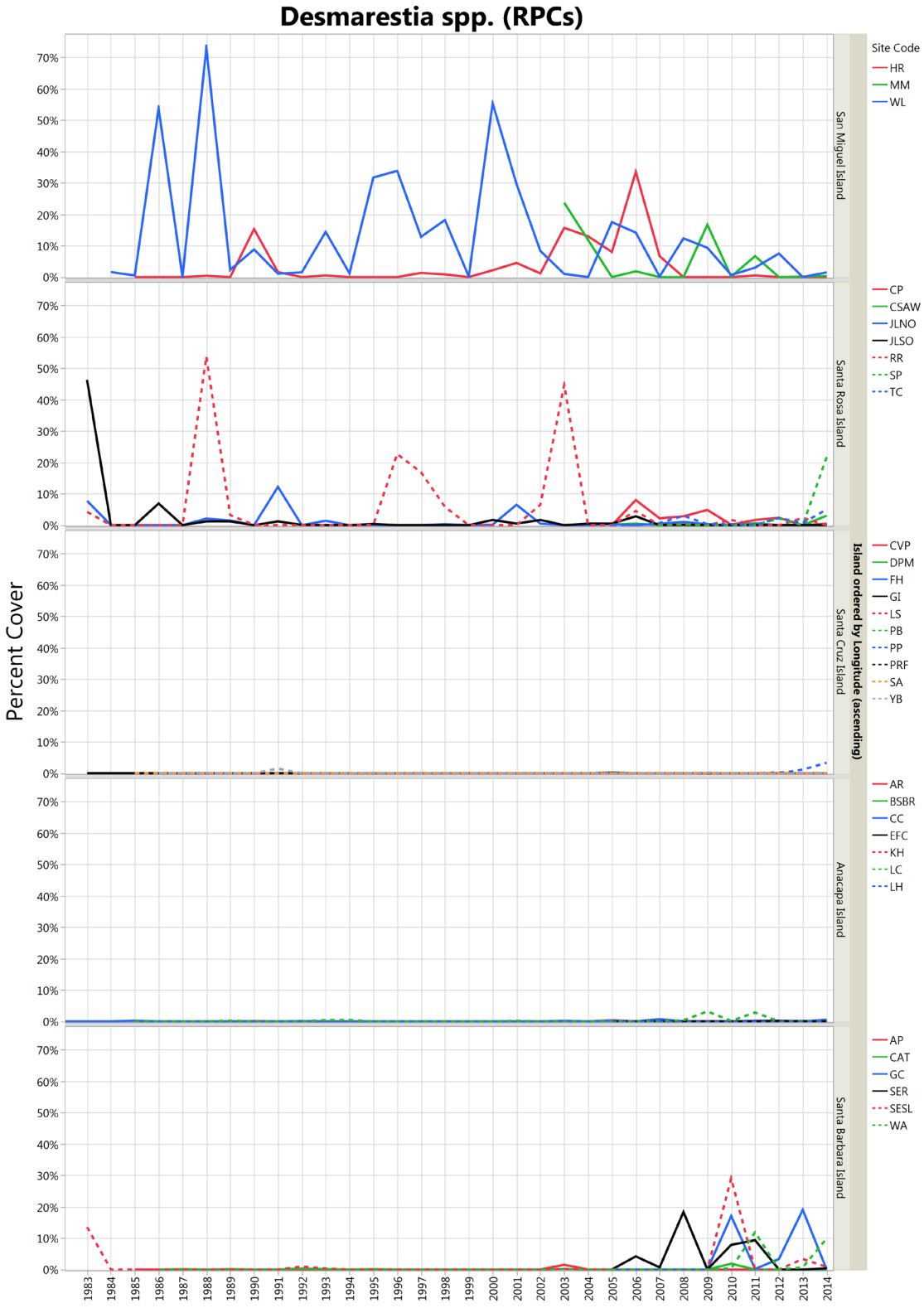


Figure H-7. Percent cover of *Desmarestia* species by site and island at Channel Islands National Park between 1983 and 2014.

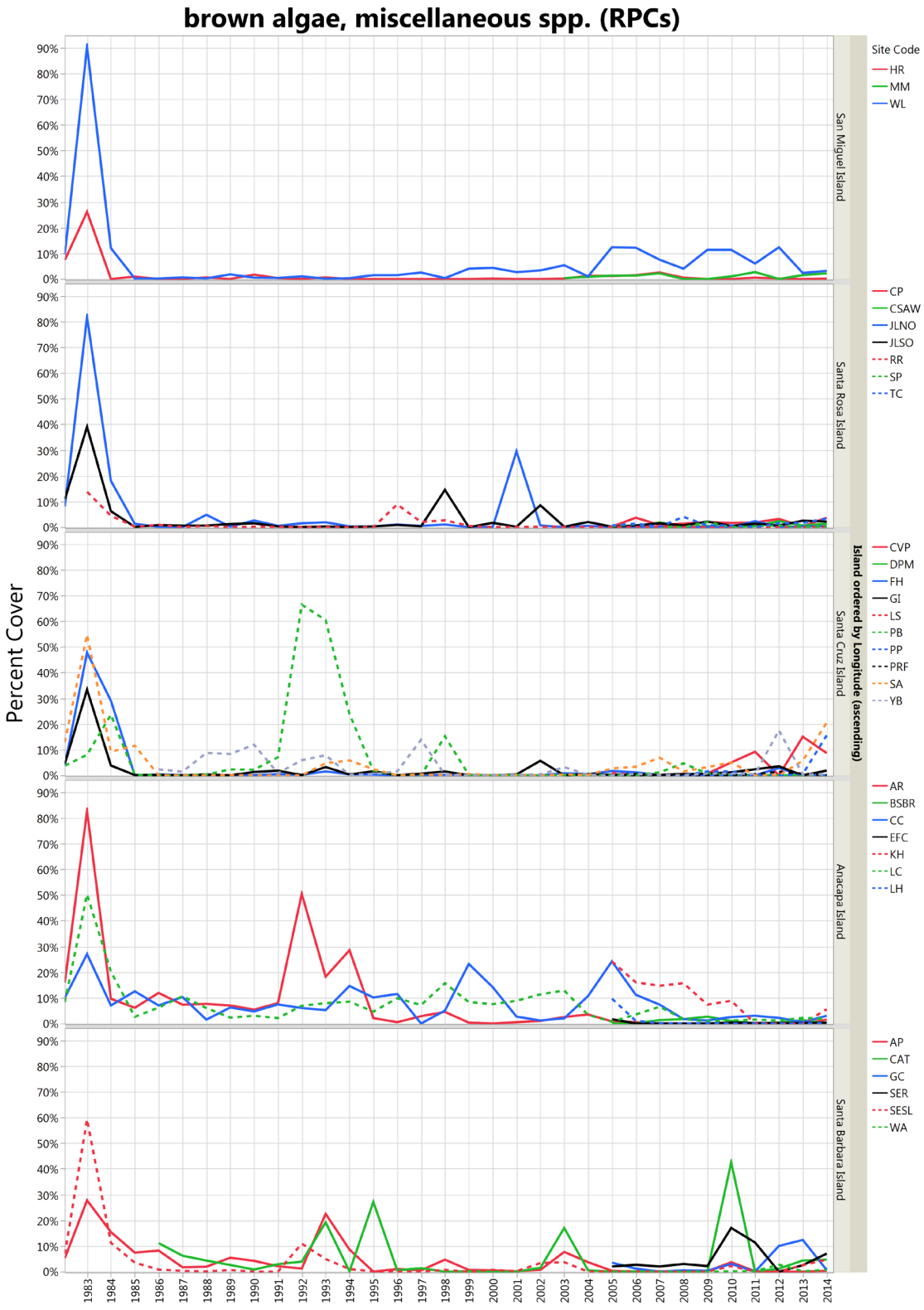


Figure H-8. Percent cover of brown algae, miscellaneous species, by site and island at Channel Islands National Park between 1982 and 2014.

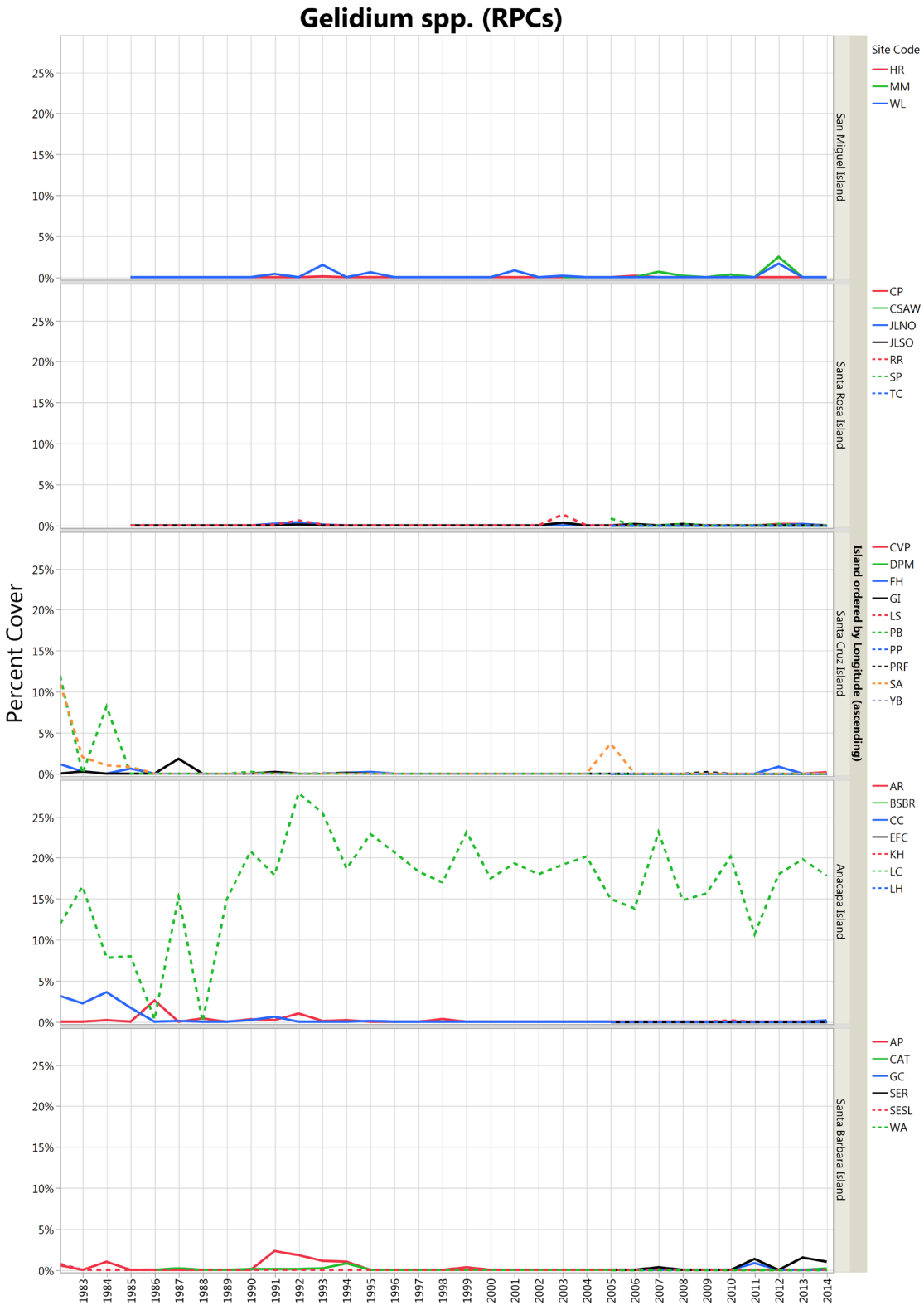


Figure H-9. Percent cover of *Gelidium* species by site and island at Channel Islands National Park between 1982 and 2014.

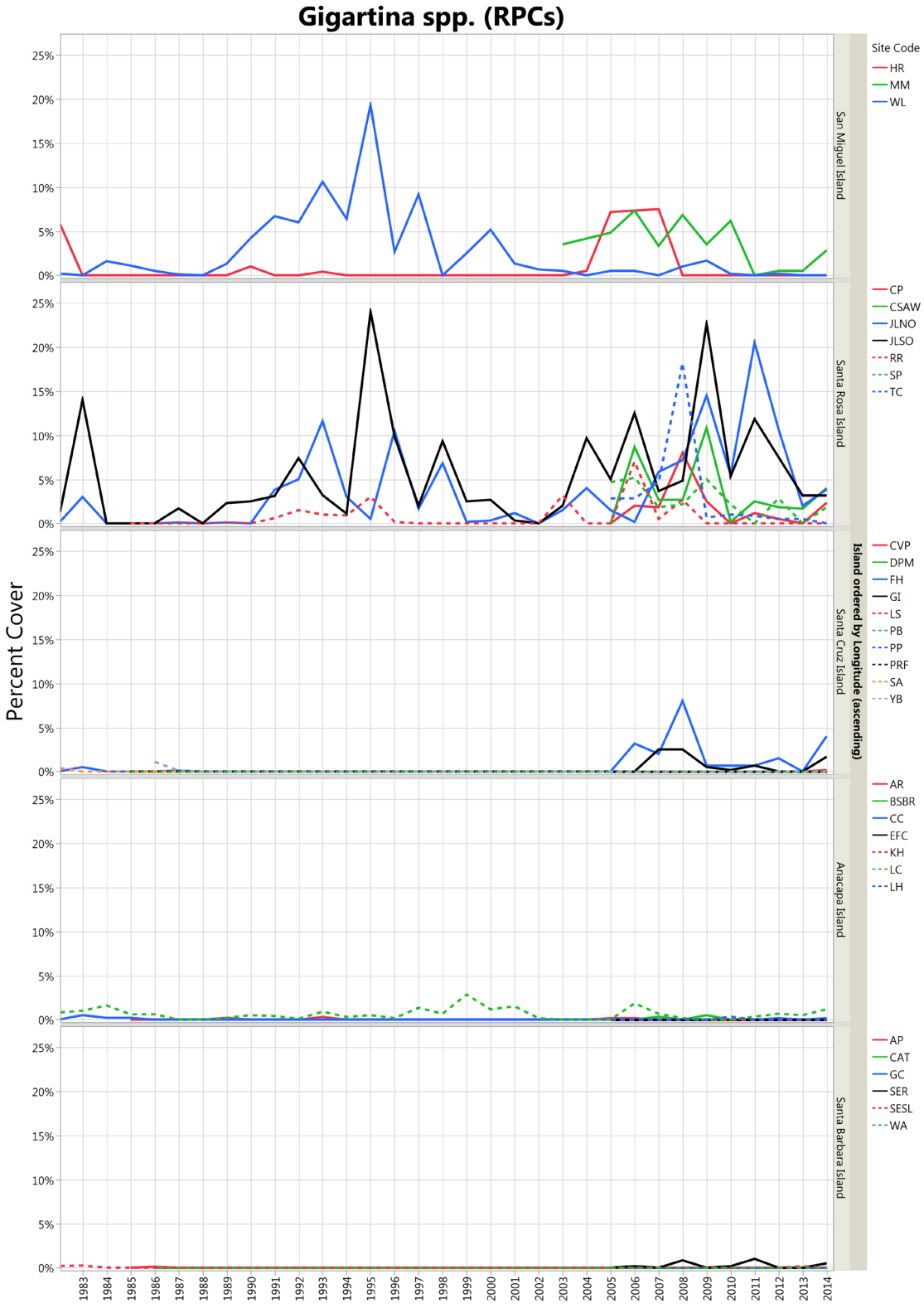


Figure H-10. Percent cover of *Gigartina* species by site and island at Channel Islands National Park between 1982 and 2014.

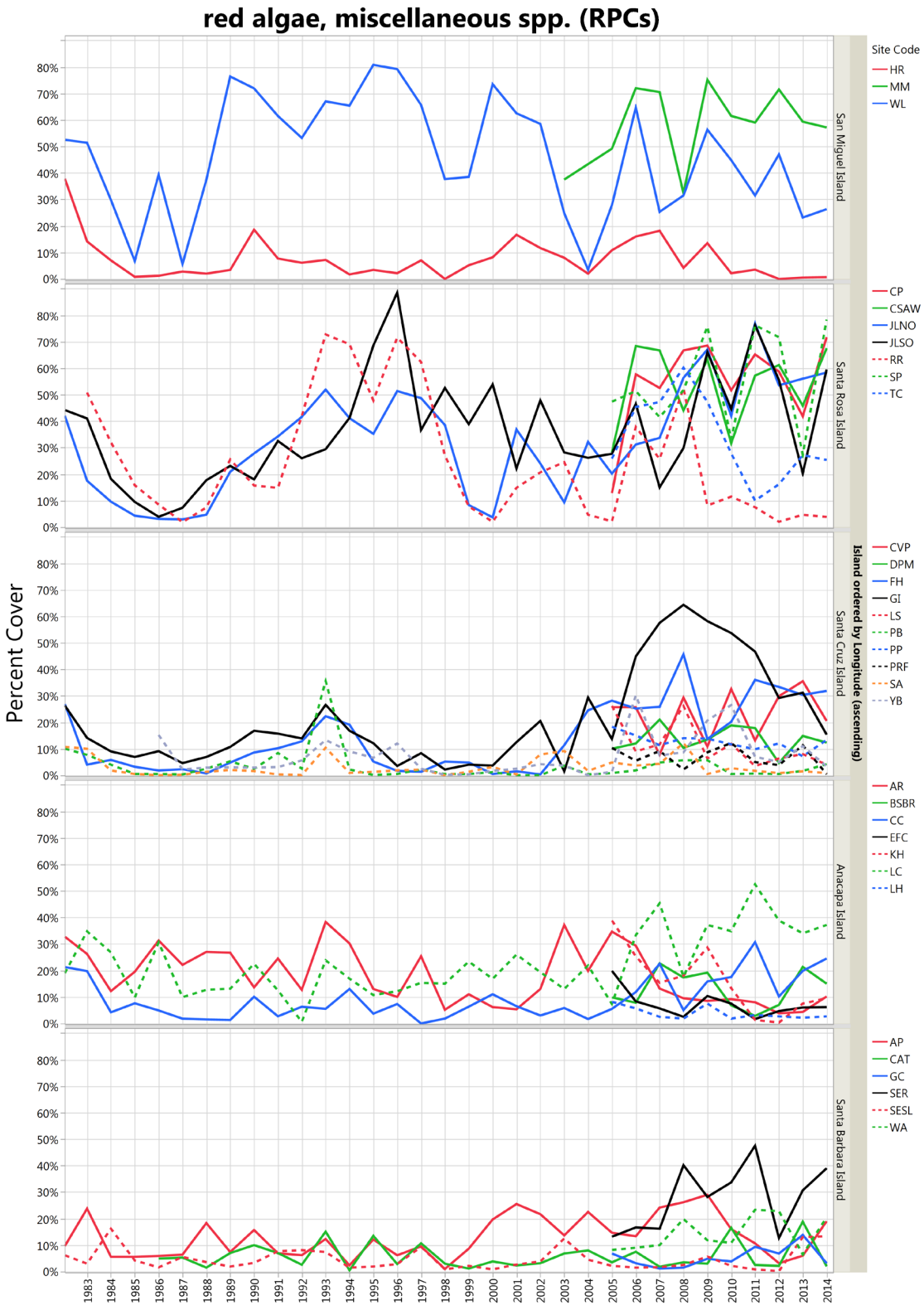


Figure H-11. Percent cover of red algae, miscellaneous species, by site and island at Channel Islands National Park between 1982 and 2014.

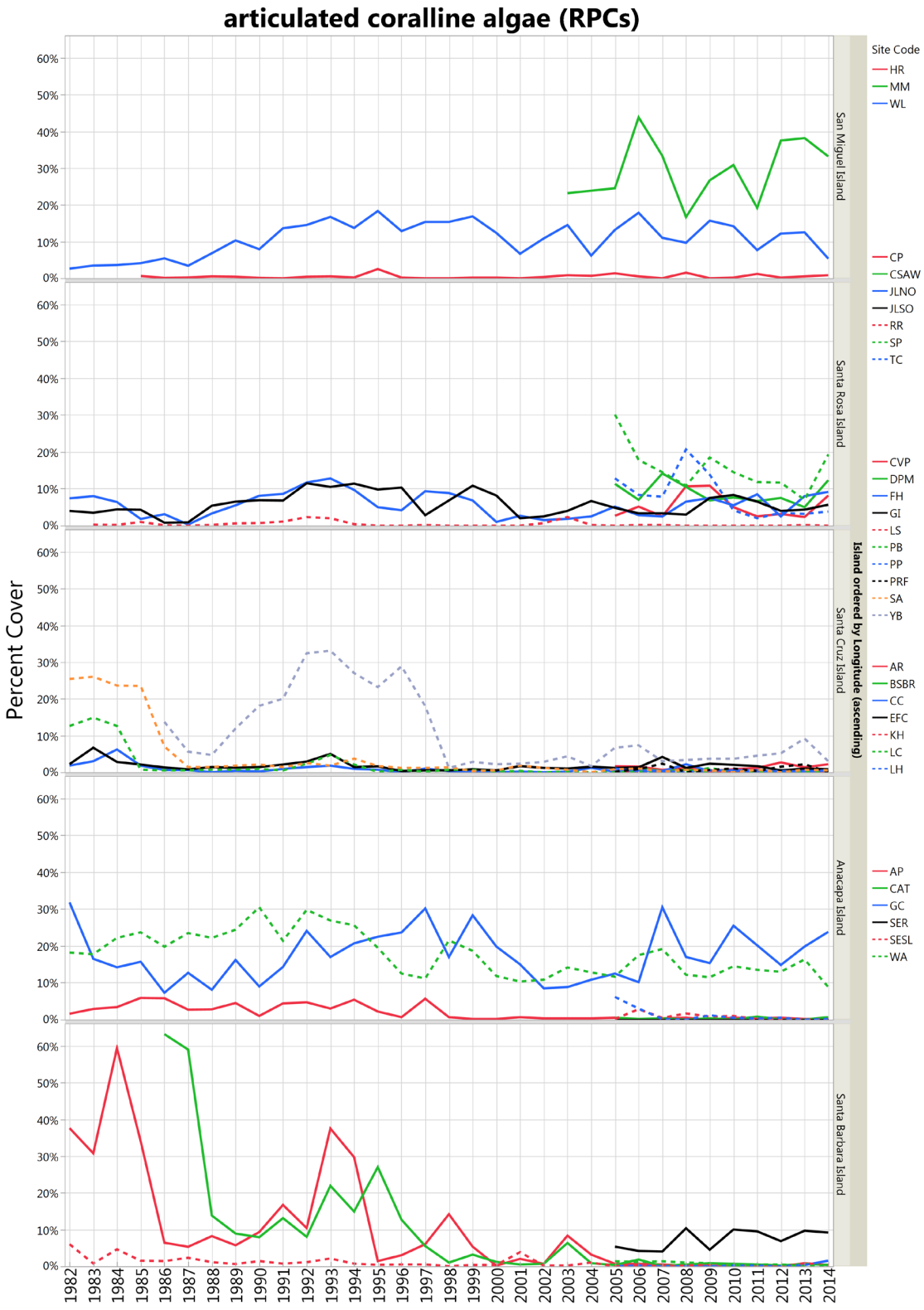


Figure H-12. Percent cover of articulated coralline algae by site and island at Channel Islands National Park between 1982 and 2014.

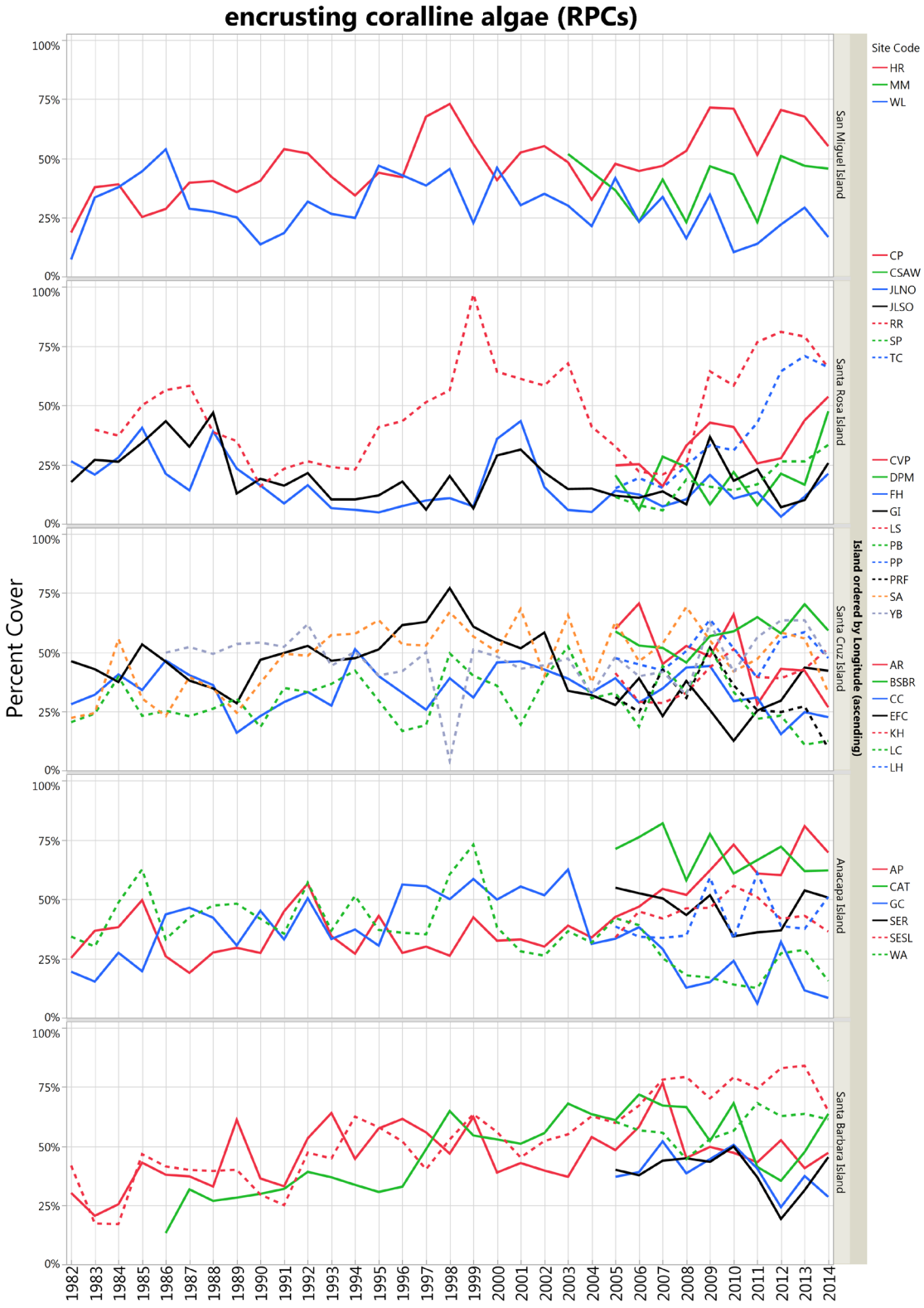


Figure H-13. Percent cover of encrusting coralline algae by site and island at Channel Islands National Park between 1982 and 2014.

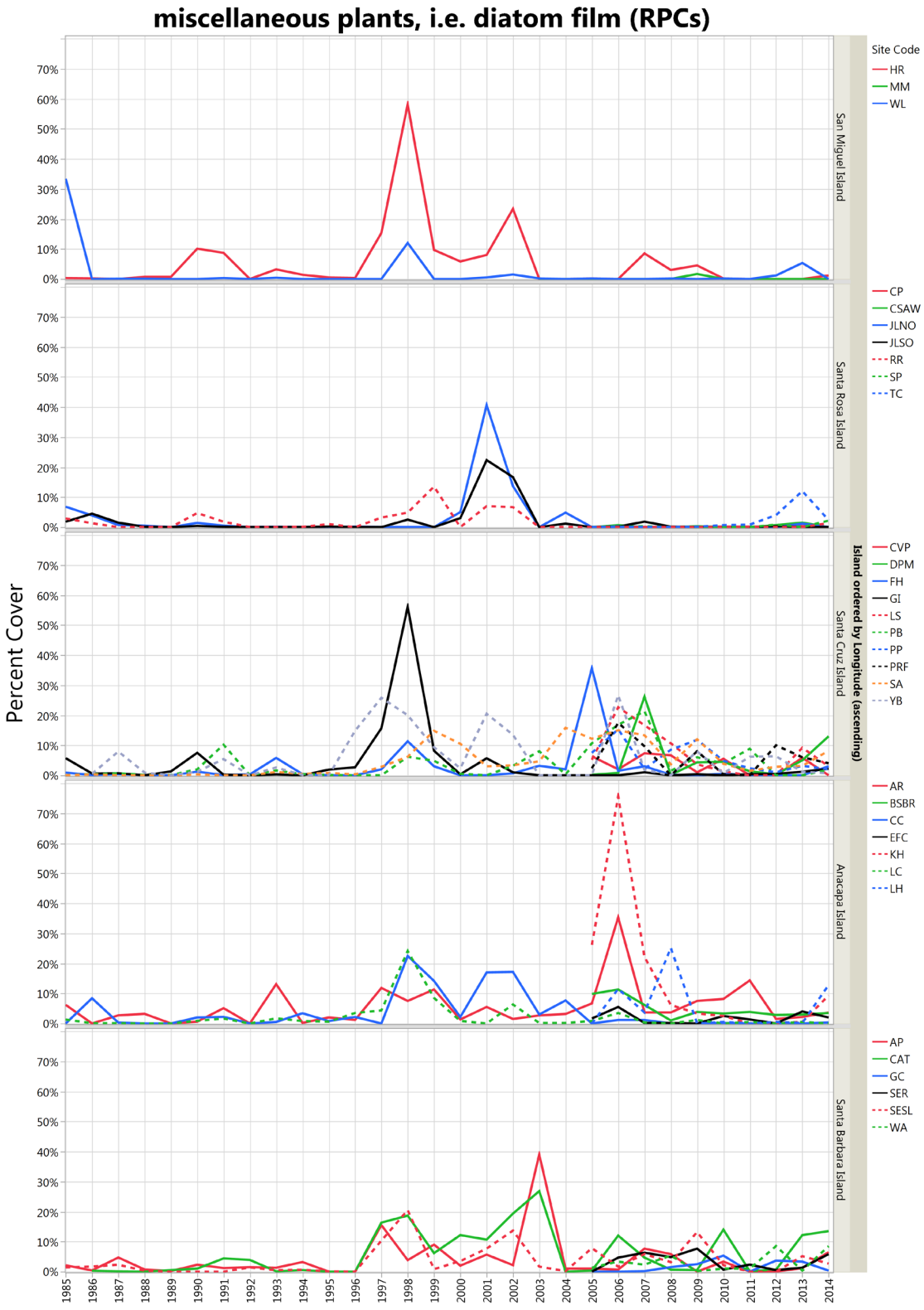


Figure H-14. Percent cover of miscellaneous plants (diatom film) by site and island at Channel Islands National Park between 1985 and 2014.

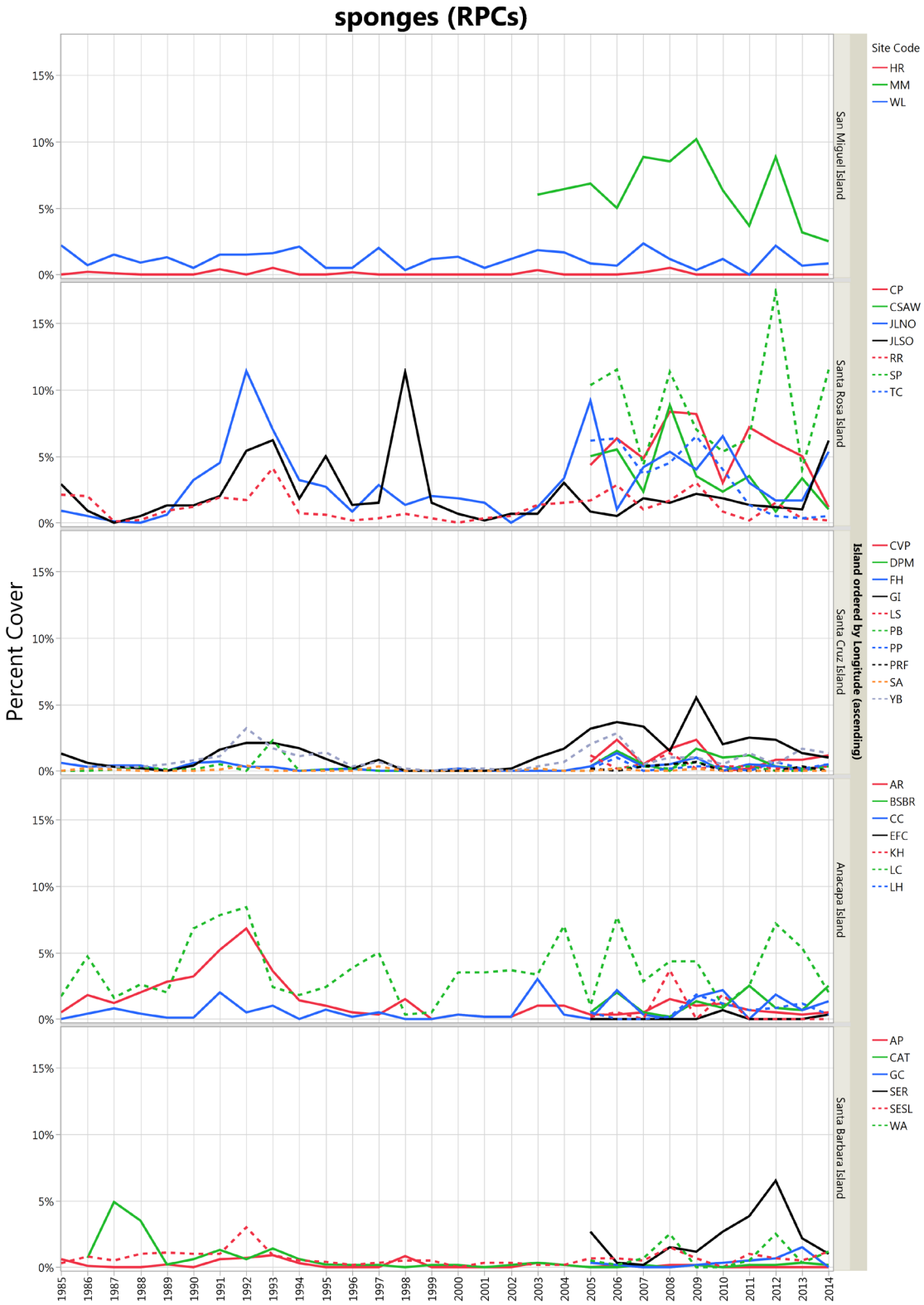


Figure H-15. Percent cover of sponges, miscellaneous species, by site and island at Channel Islands National Park between 1985 and 2014.

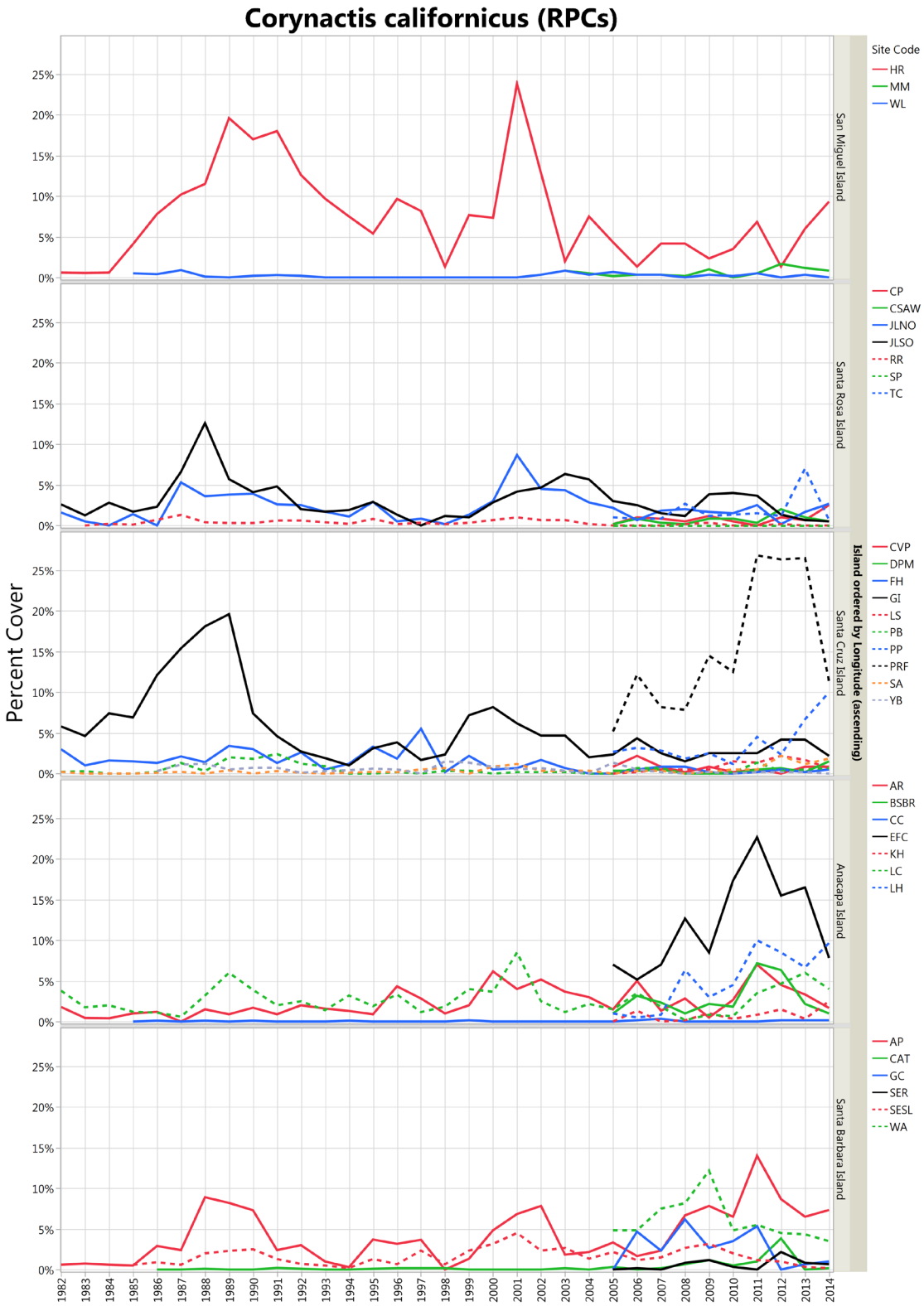


Figure H-16. Percent cover of *Corynactis californica* by site and island at Channel Islands National Park between 1982 and 2014.

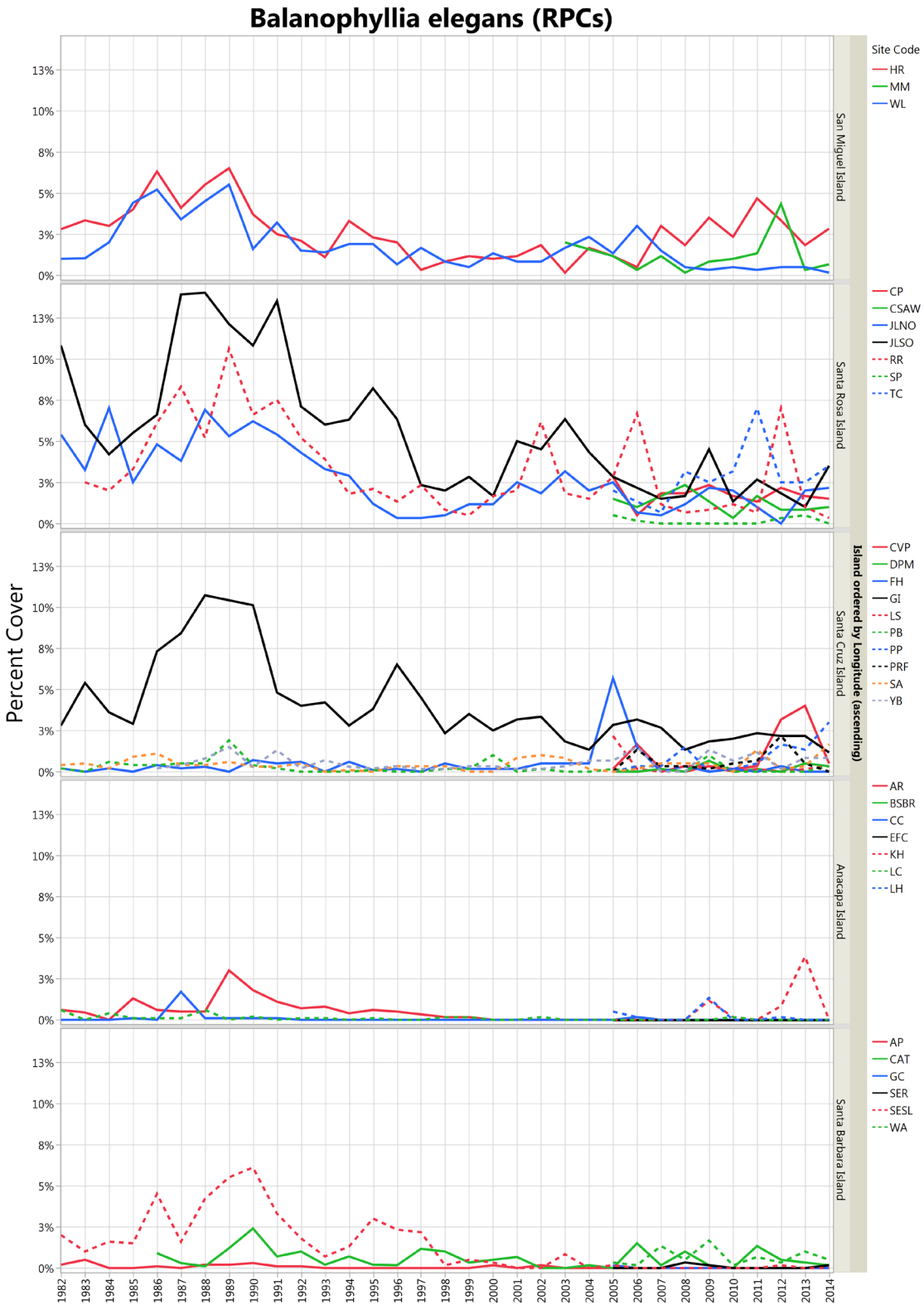


Figure H-17. Percent cover of *Balanophyllia elegans* by site and island at Channel Islands National Park between 1982 and 2014.

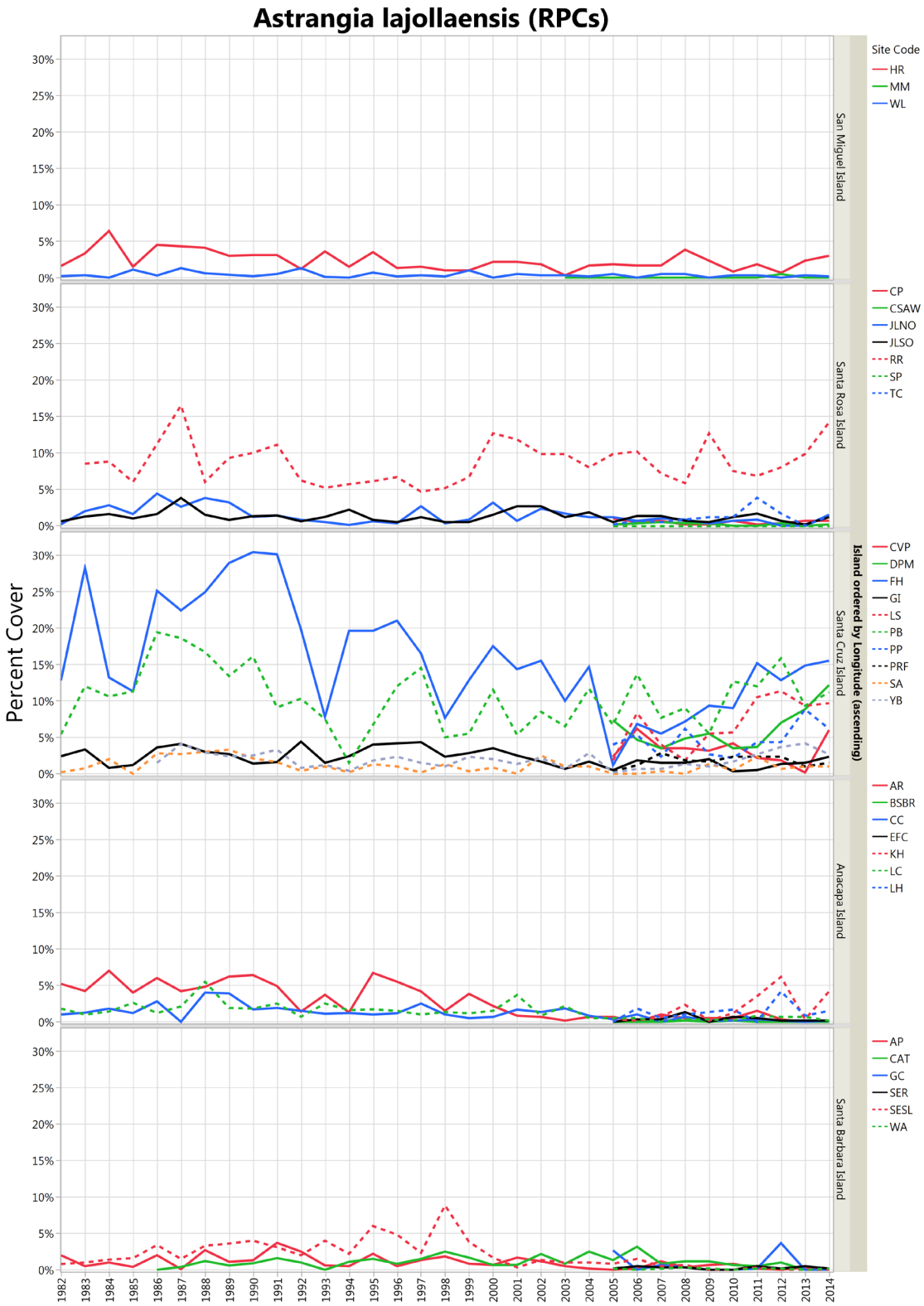


Figure H-18. Percent cover of *Astrangia lajollaensis* by site and island at Channel Islands National Park between 1982 and 2014.

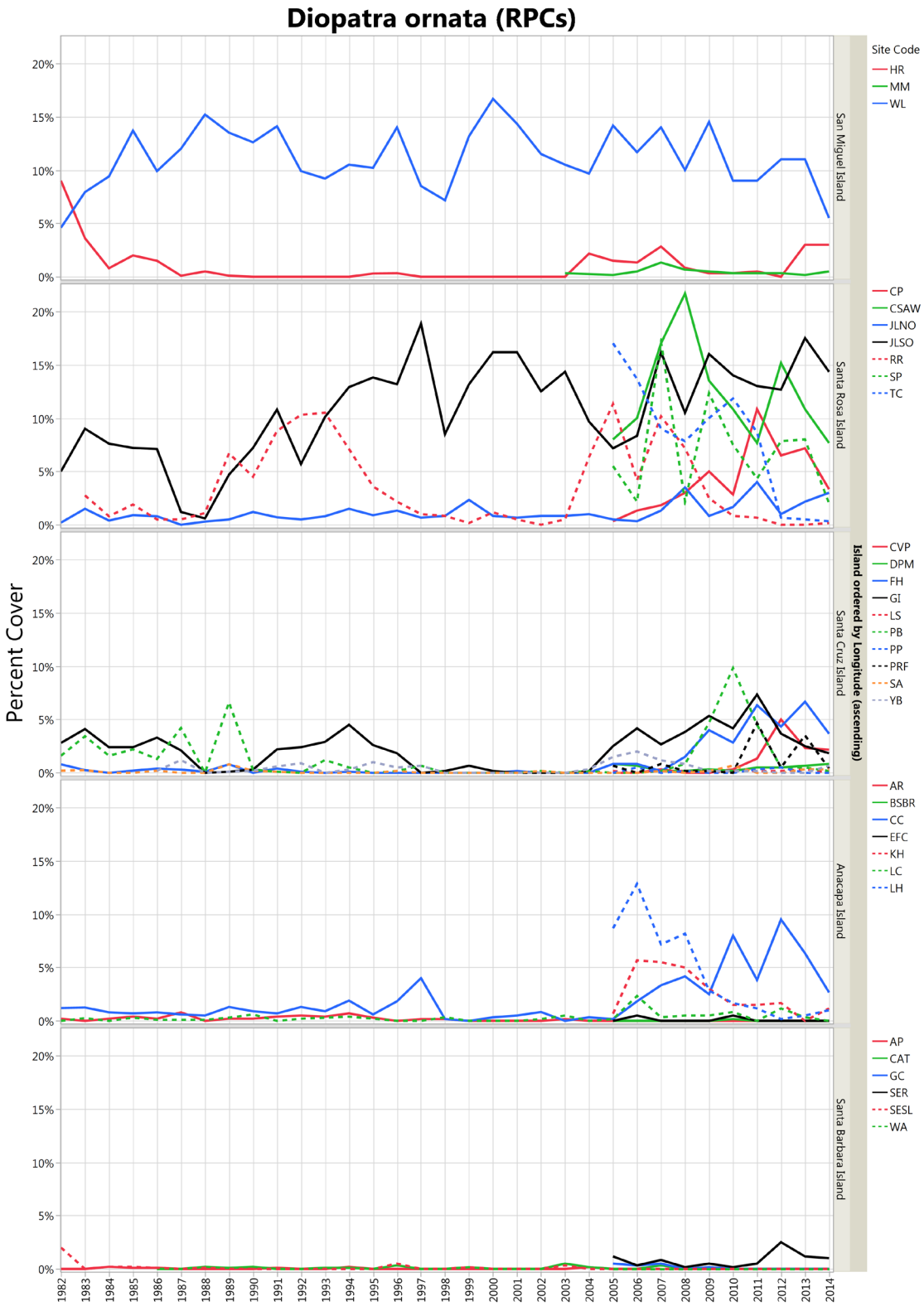


Figure H-19. Percent cover of *Diopatra ornate* by site and island at Channel Islands National Park between 1982 and 2014.

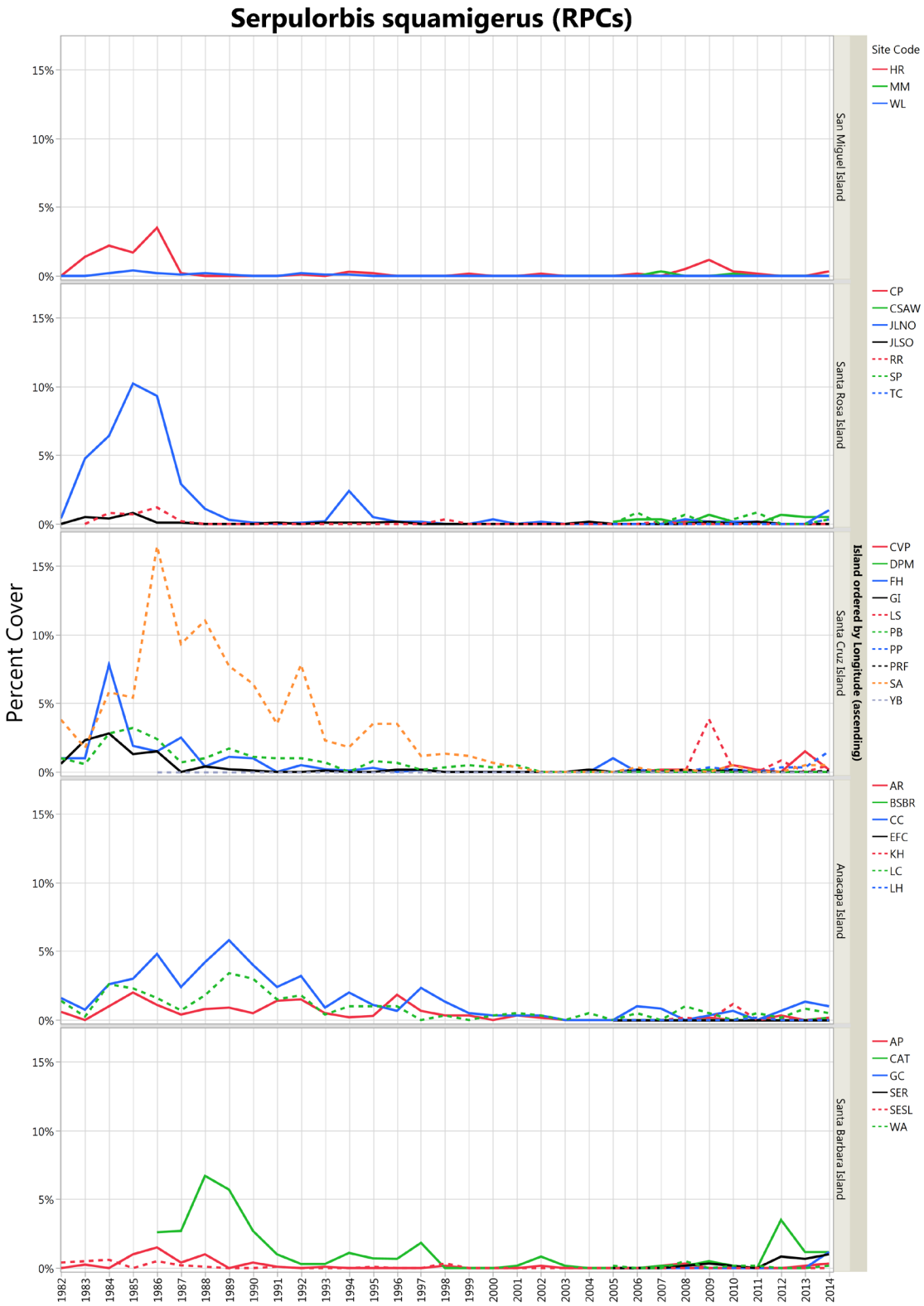


Figure H-20. Percent cover of *Serpulorbis squamigerus* by site and island at Channel Islands National Park between 1982 and 2014.

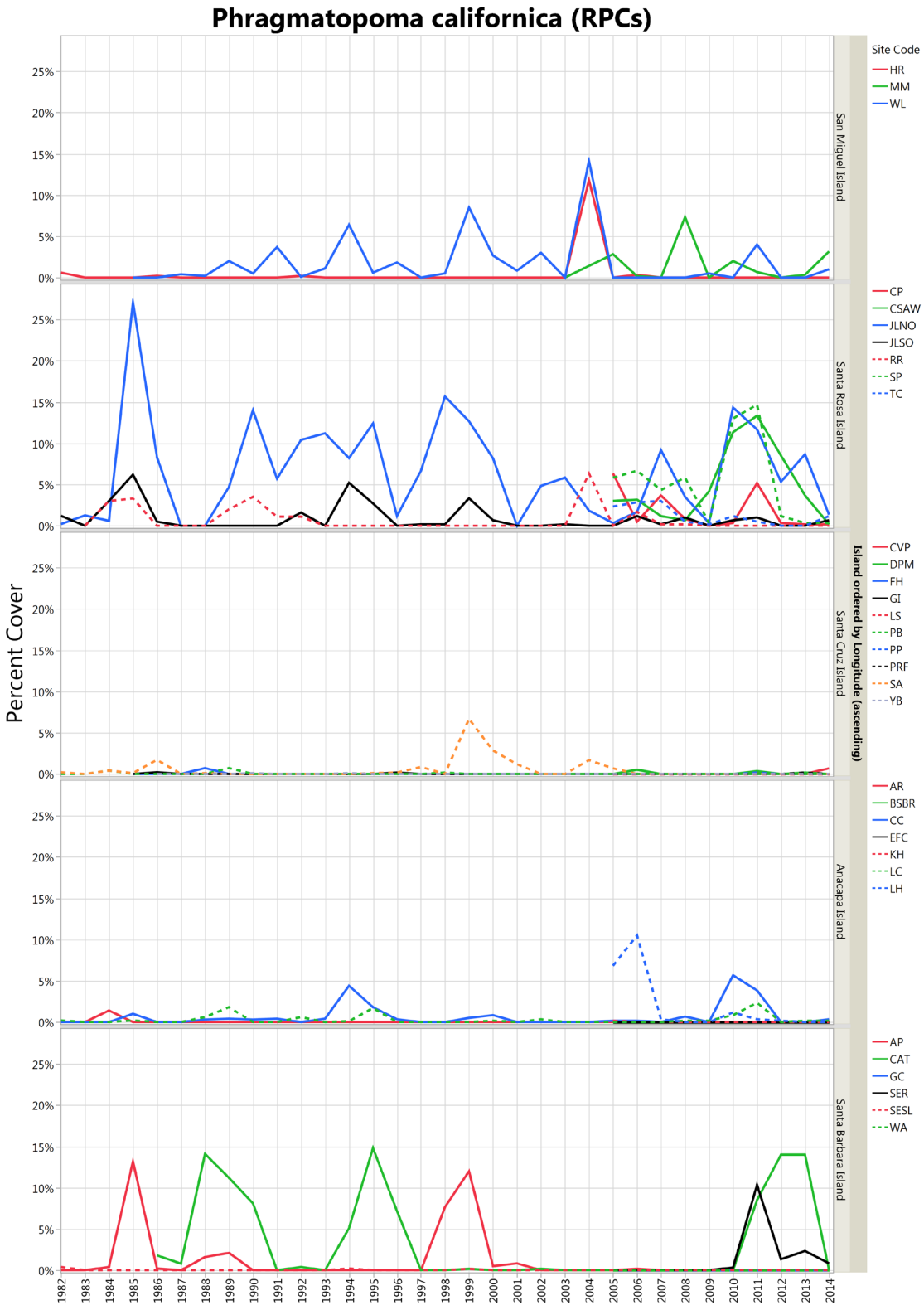


Figure H-21. Percent cover of *Phragmatopoma californica* by site and island at Channel Islands National Park between 1982 and 2014.

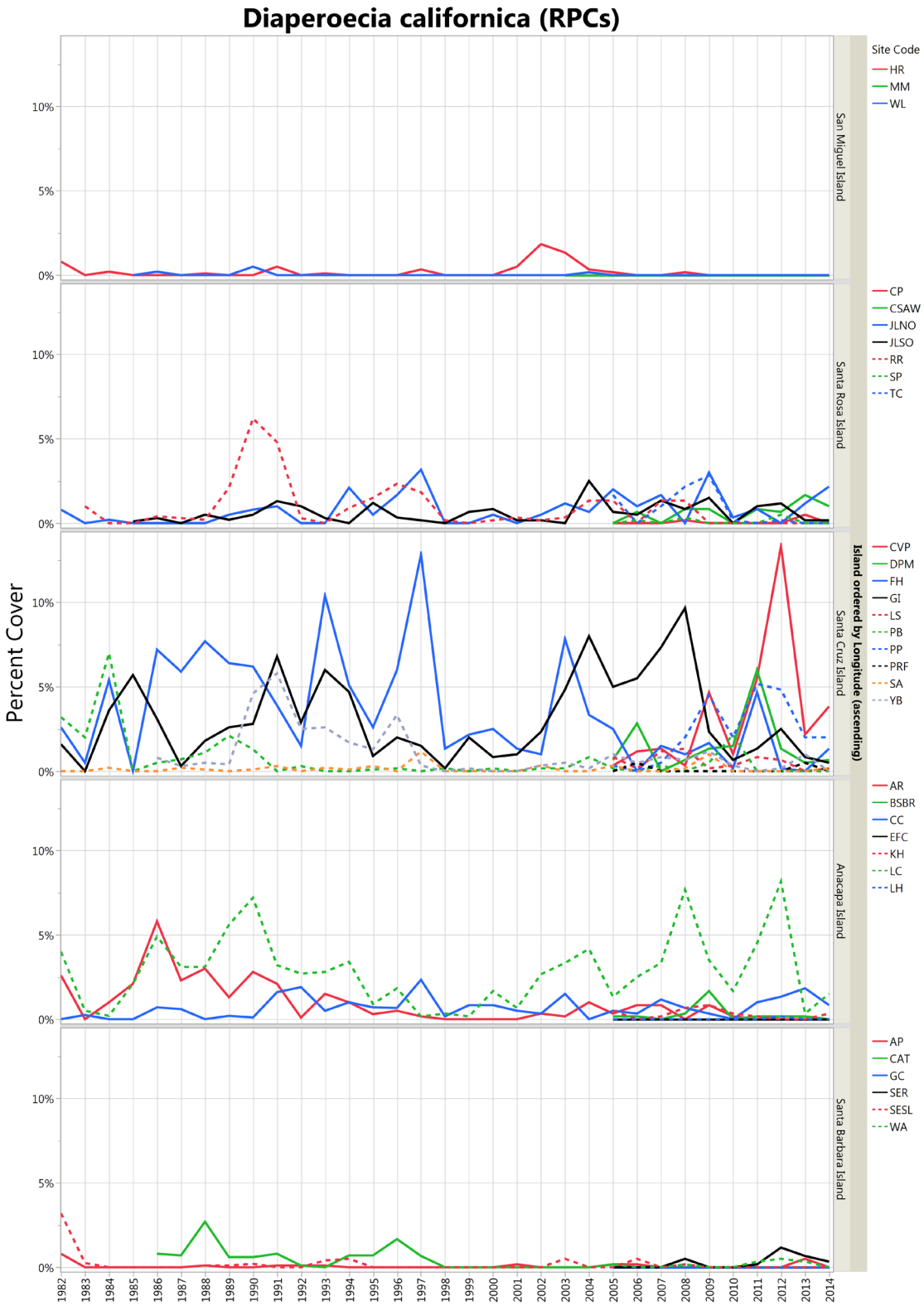


Figure H-22. Percent cover of *Diaperoecia californica* by site and island at Channel Islands National Park between 1982 and 2014.

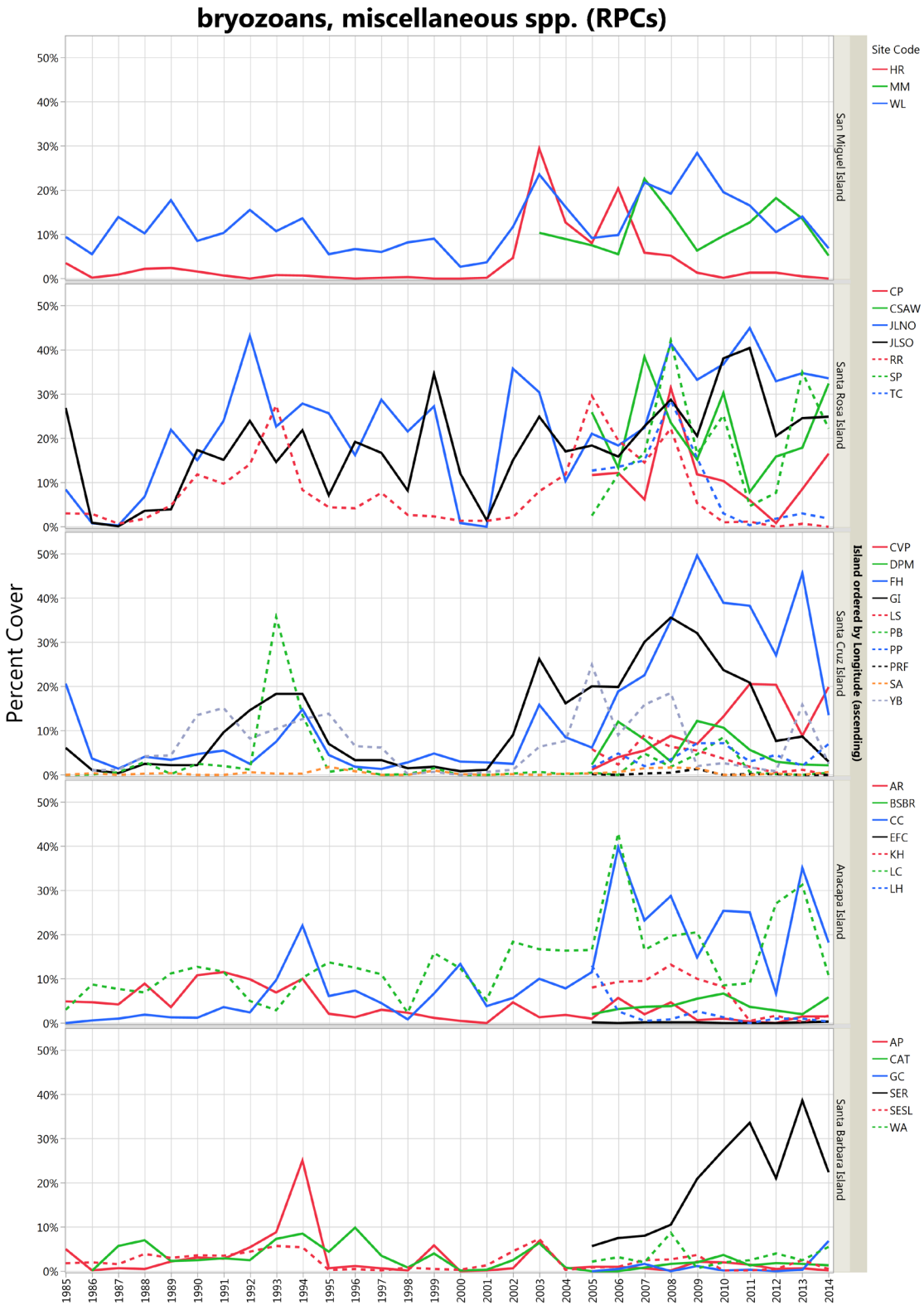


Figure H-23. Percent cover of bryozoans, miscellaneous species, by site and island at Channel Islands National Park between 1985 and 2014.

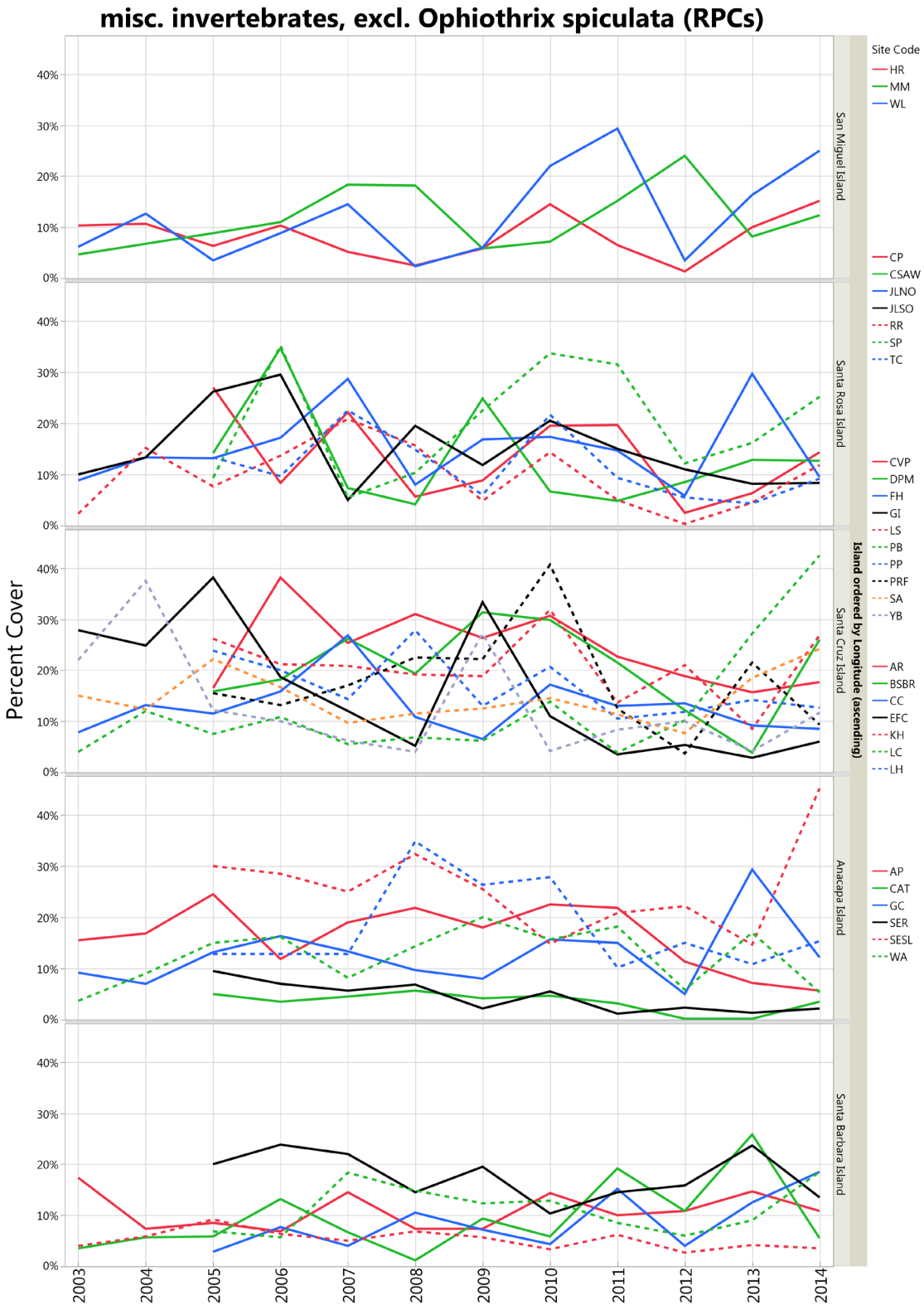


Figure H-24. Percent cover of miscellaneous invertebrates, excluding *Ophiothrix spiculata,* by site and island at Channel Islands National Park between 2003 and 2014.

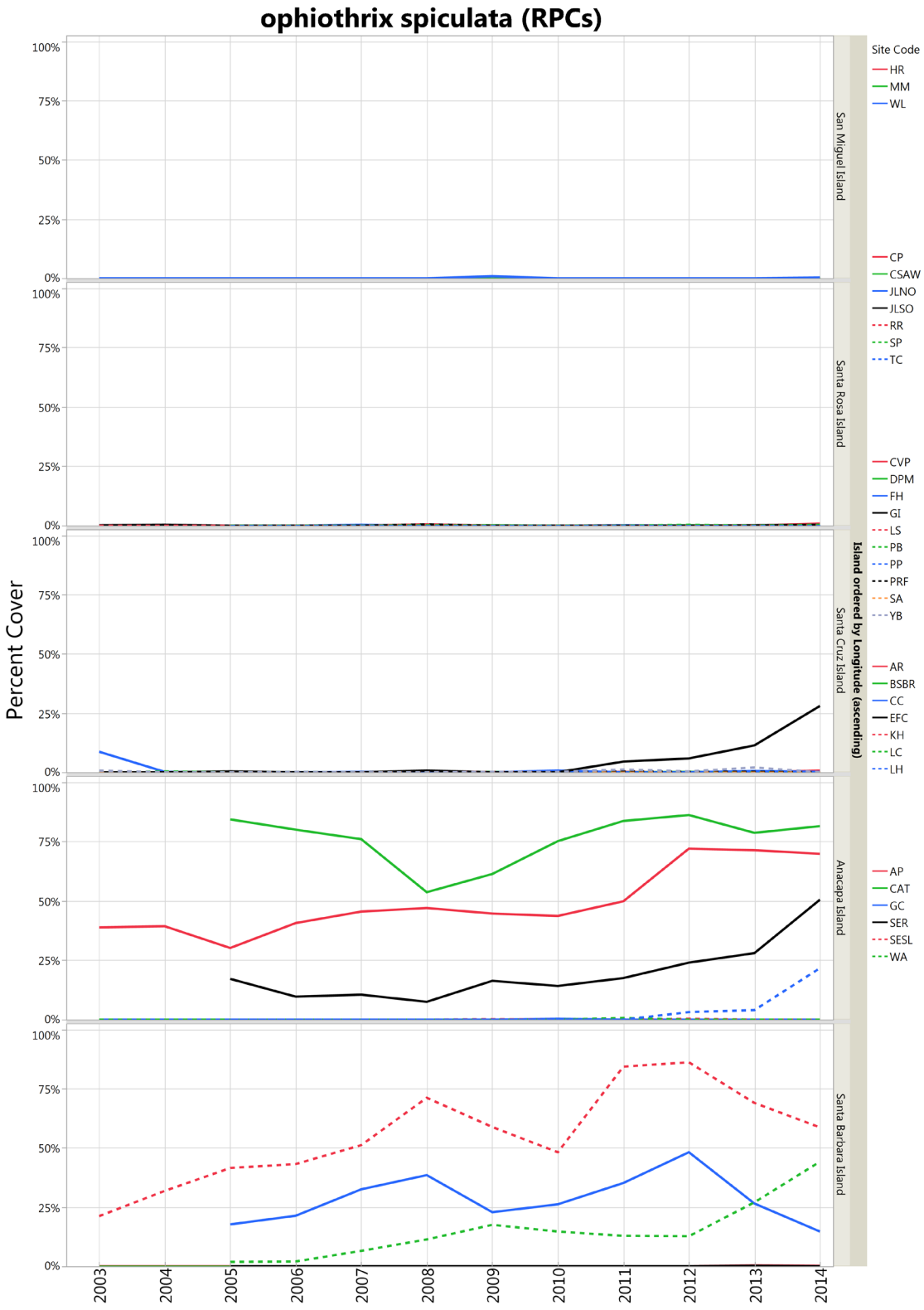


Figure H-25. Percent cover of *Ophiothrix spiculata* by site and island at Channel Islands National Park between 2003 and 2014.

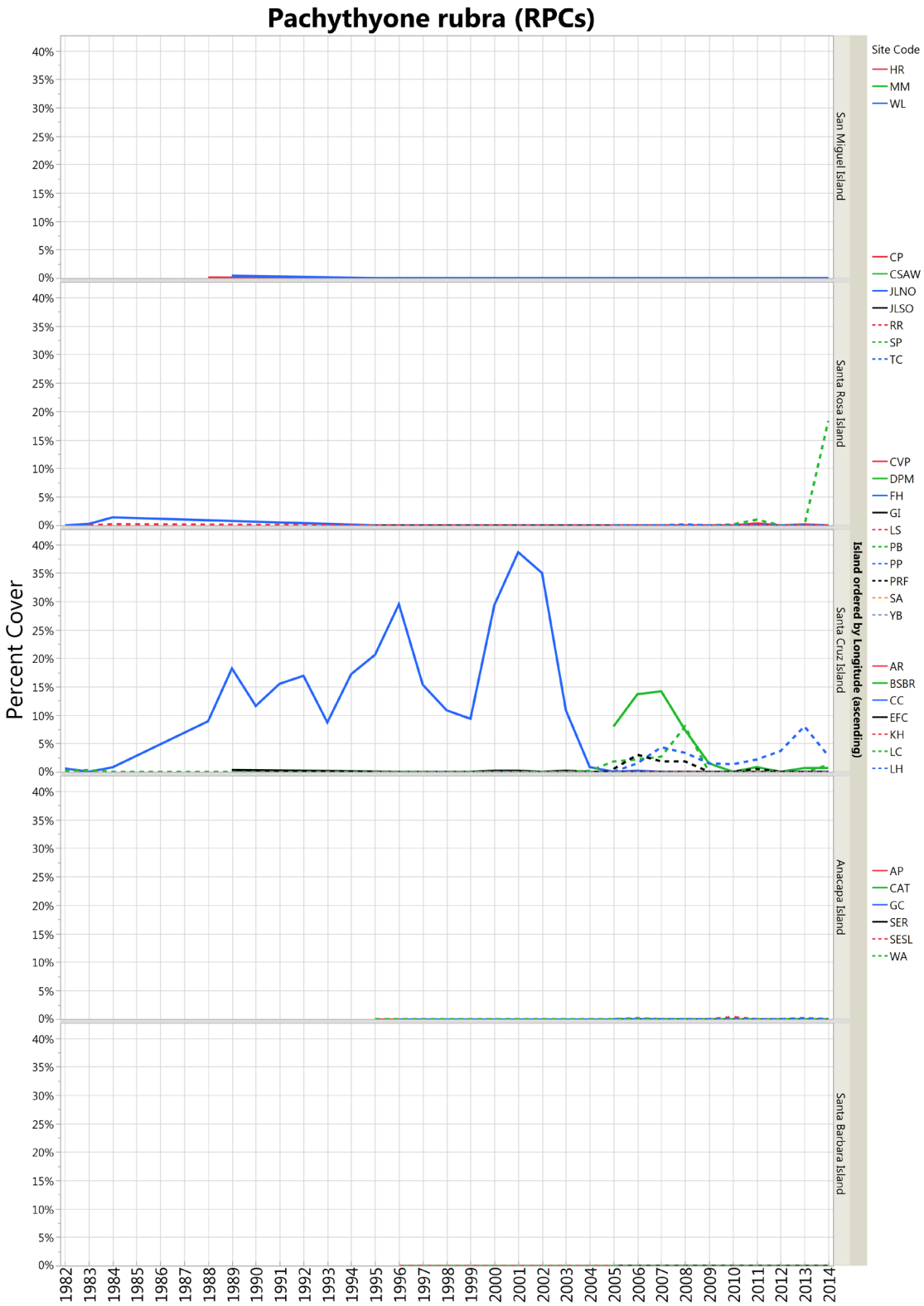


Figure H-26. Percent cover of *Pachythyone rubra* by site and island at Channel Islands National Park between 1982 and 2014.

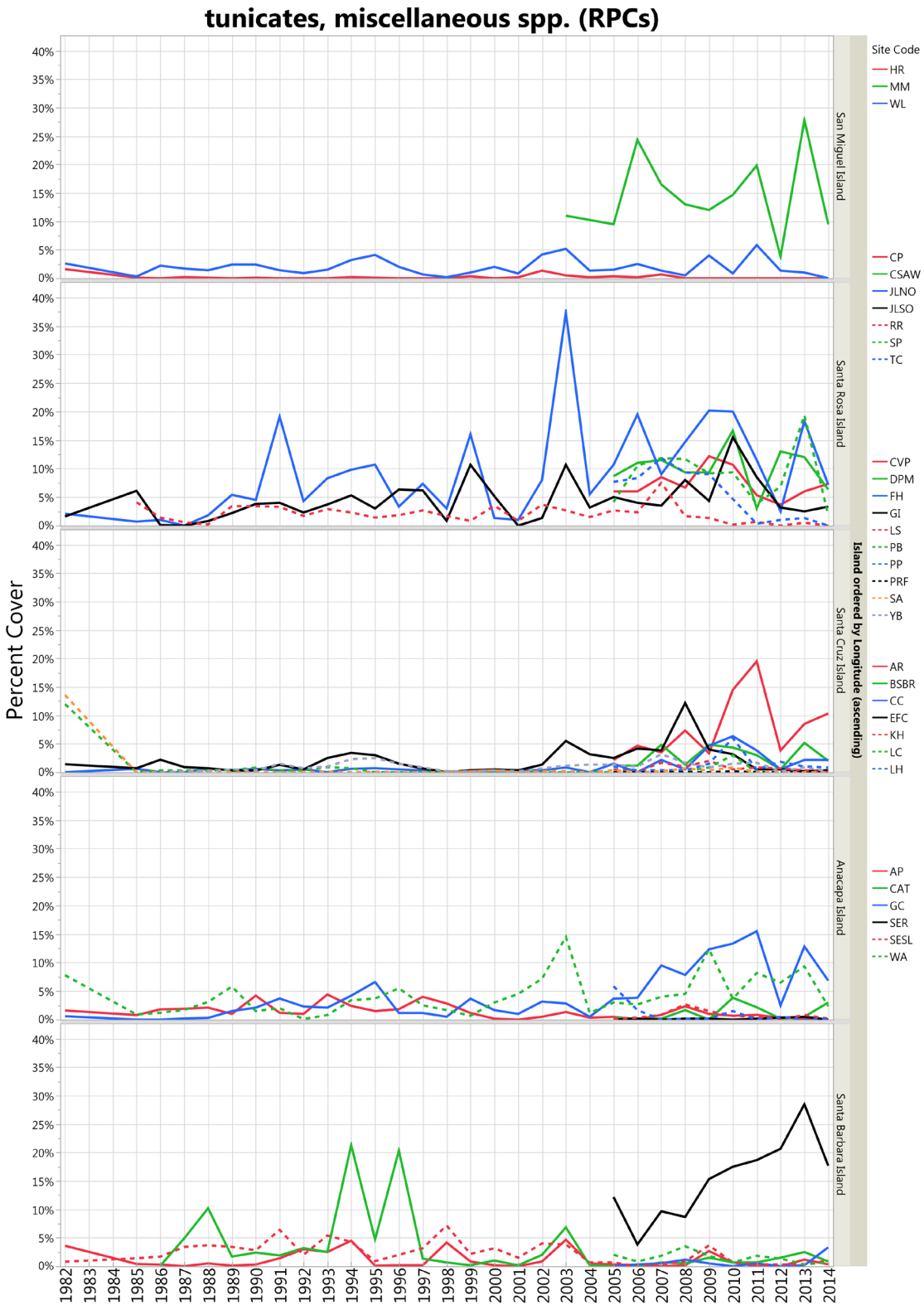


Figure H-27. Percent cover of tunicates, miscellaneous species, by site and island at Channel Islands National Park between 1982 and 2014.

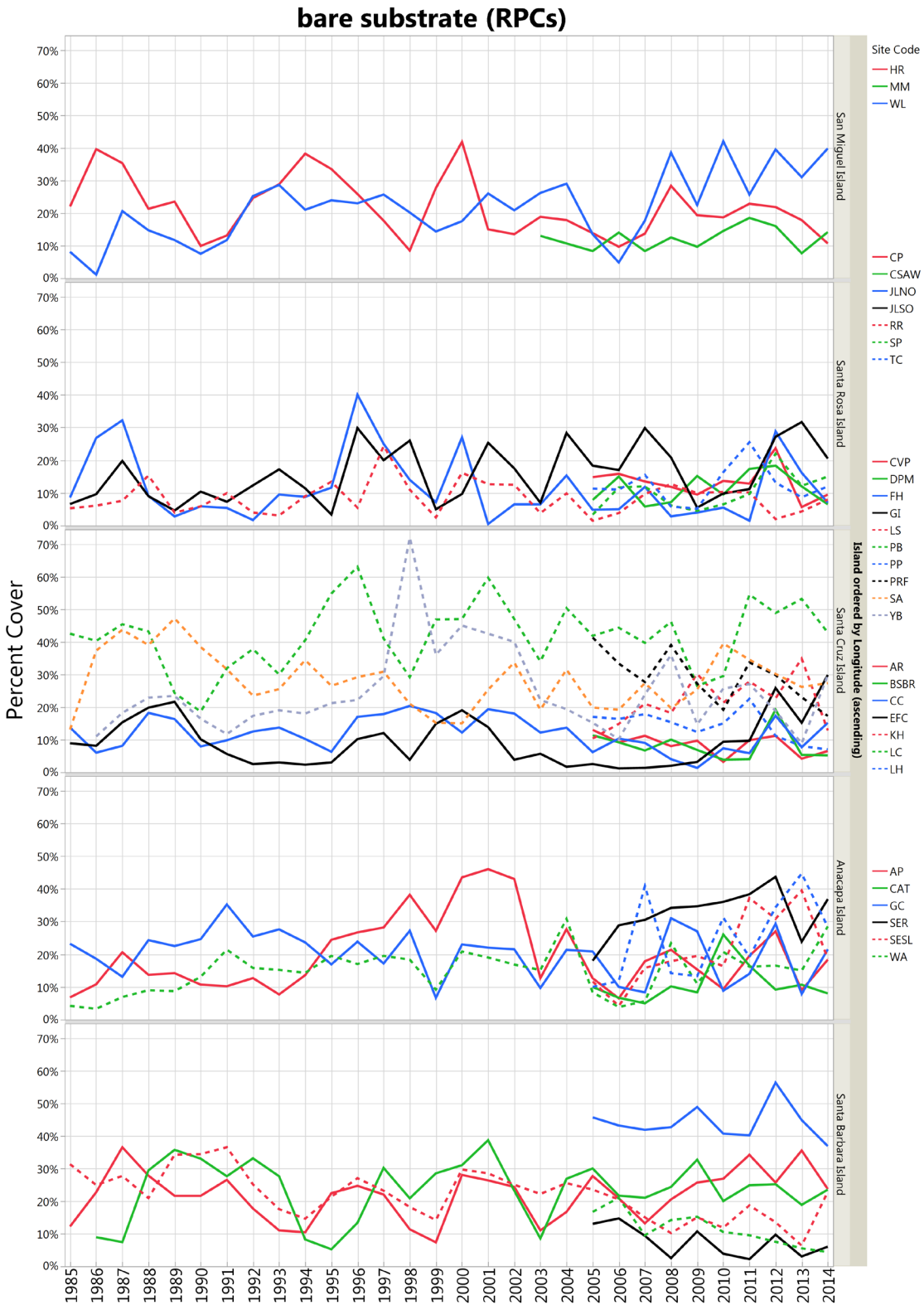


Figure H-28. Percent cover of bare substrate by site and island at Channel Islands National Park between 1985 and 2014.

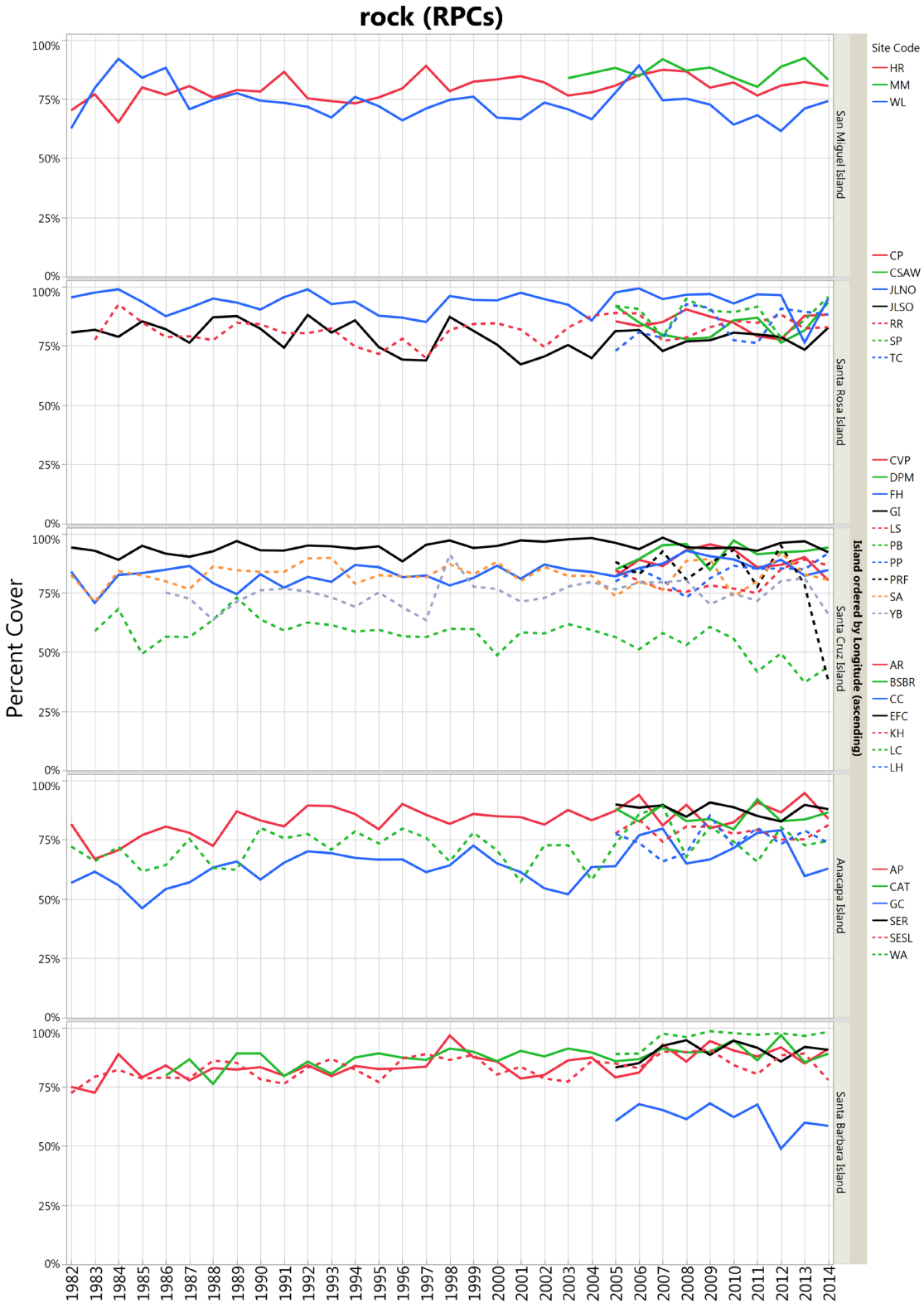


Figure H-29. Percent cover of rock by site and island at Channel Islands National Park between 1982 and 2014.

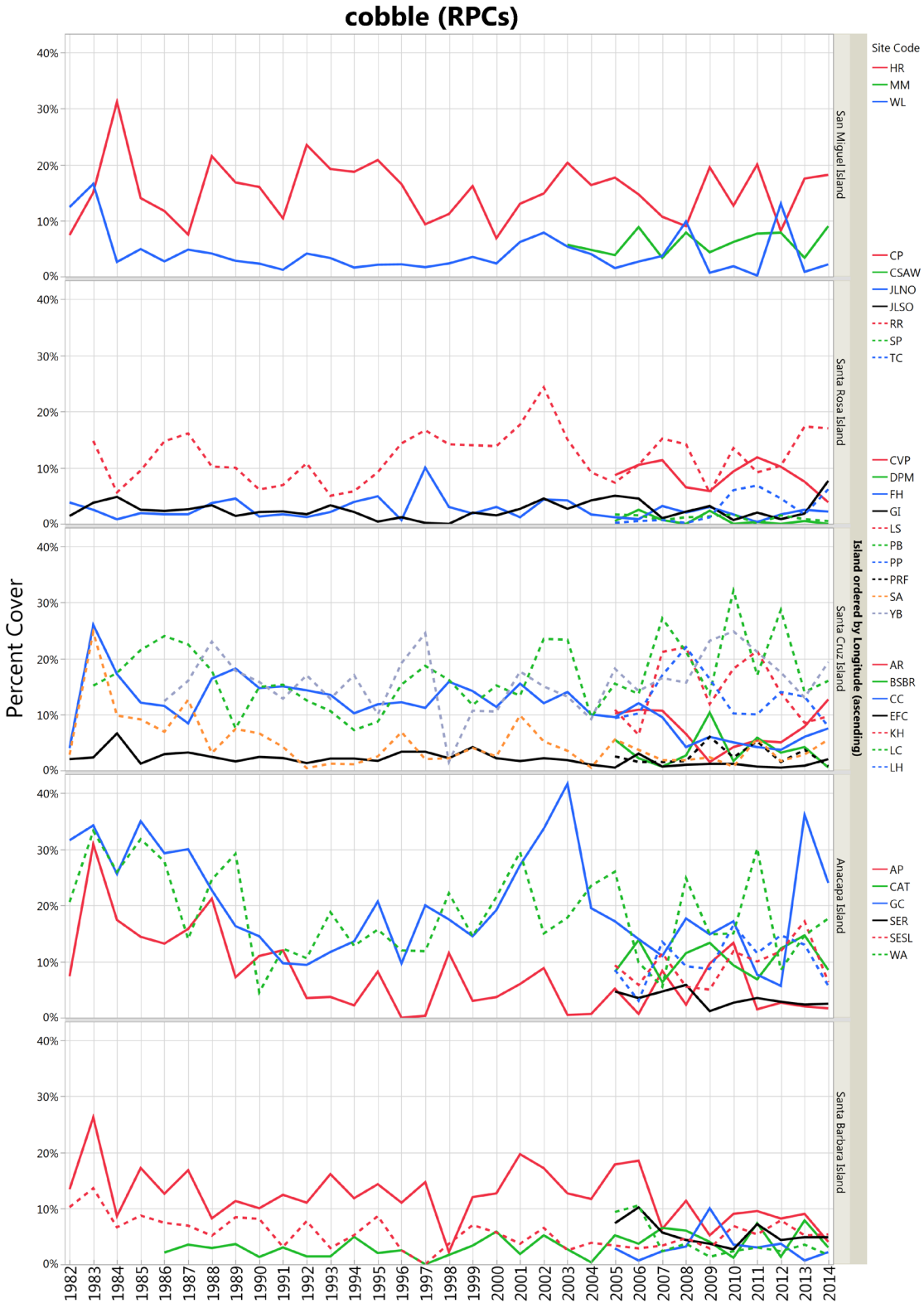


Figure H-30. Percent cover of cobble by site and island at Channel Islands National Park between 1982 and 2014.

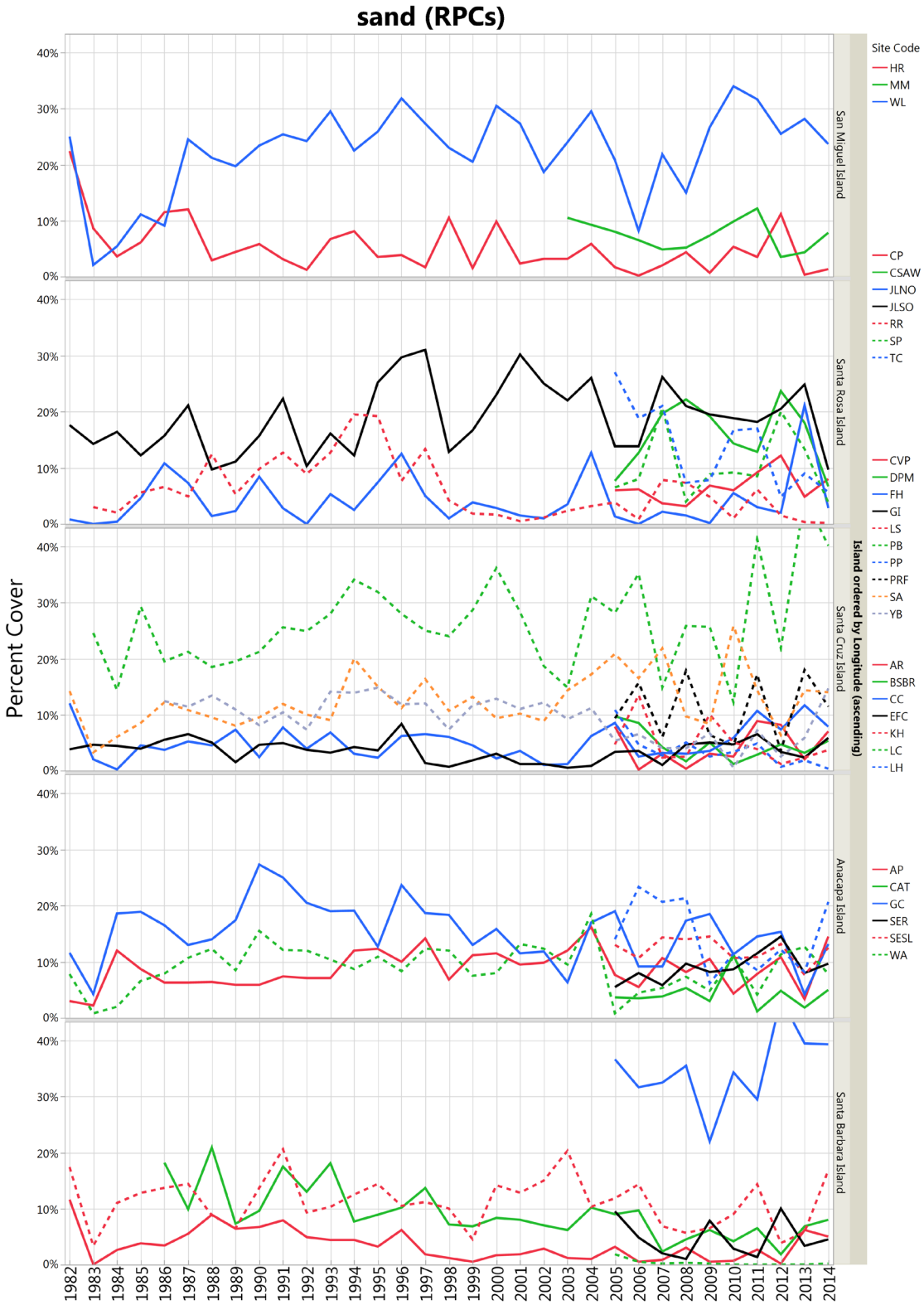


Figure H-31. Percent cover of sand by site and island at Channel Islands National Park between 1982 and 2014.

Appendix I. Fish Transect Data

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

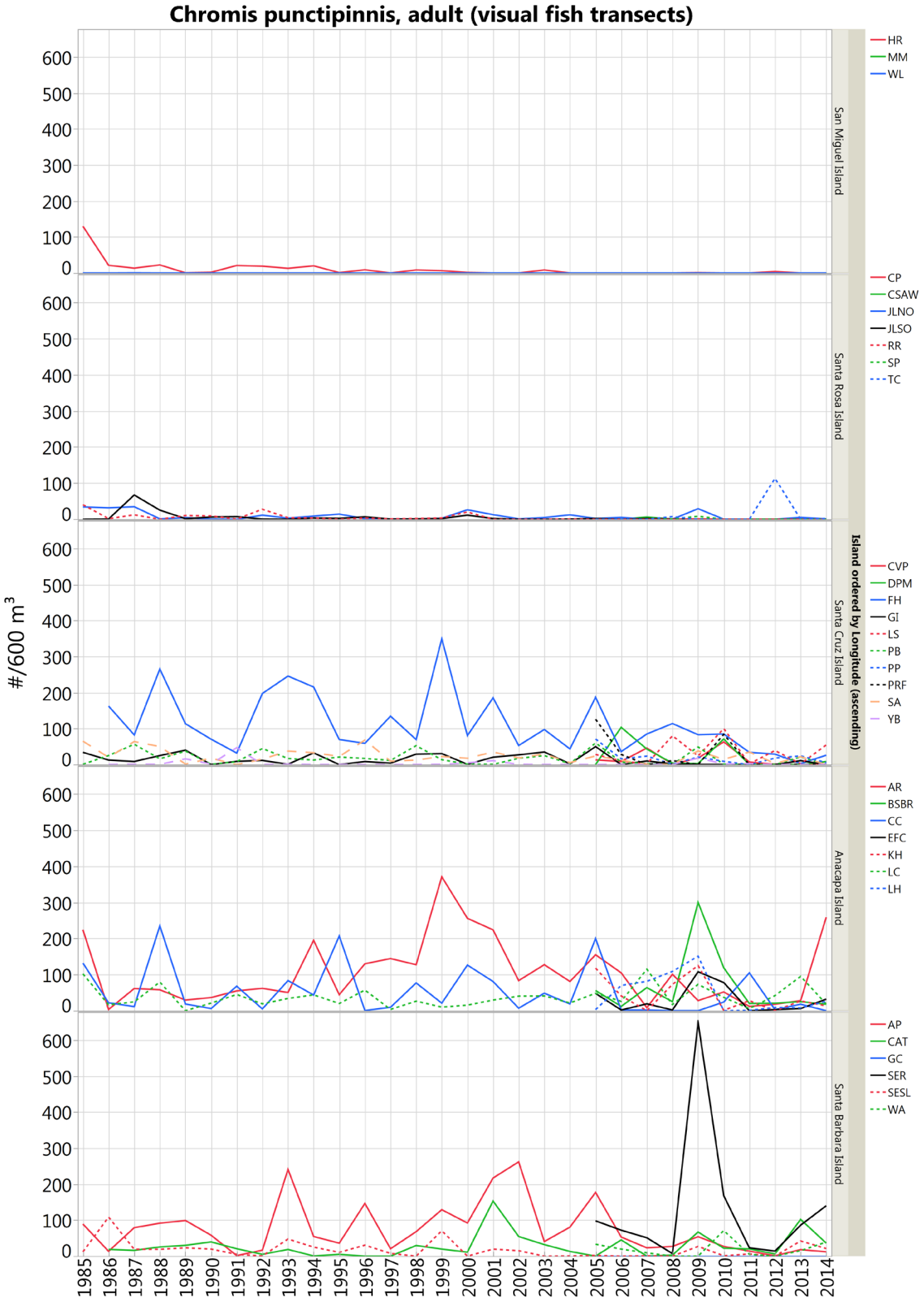


Figure I-1. Density of adult *Chromis punctipinnis* by site and island at Channel Islands National Park between 1985 and 2014.

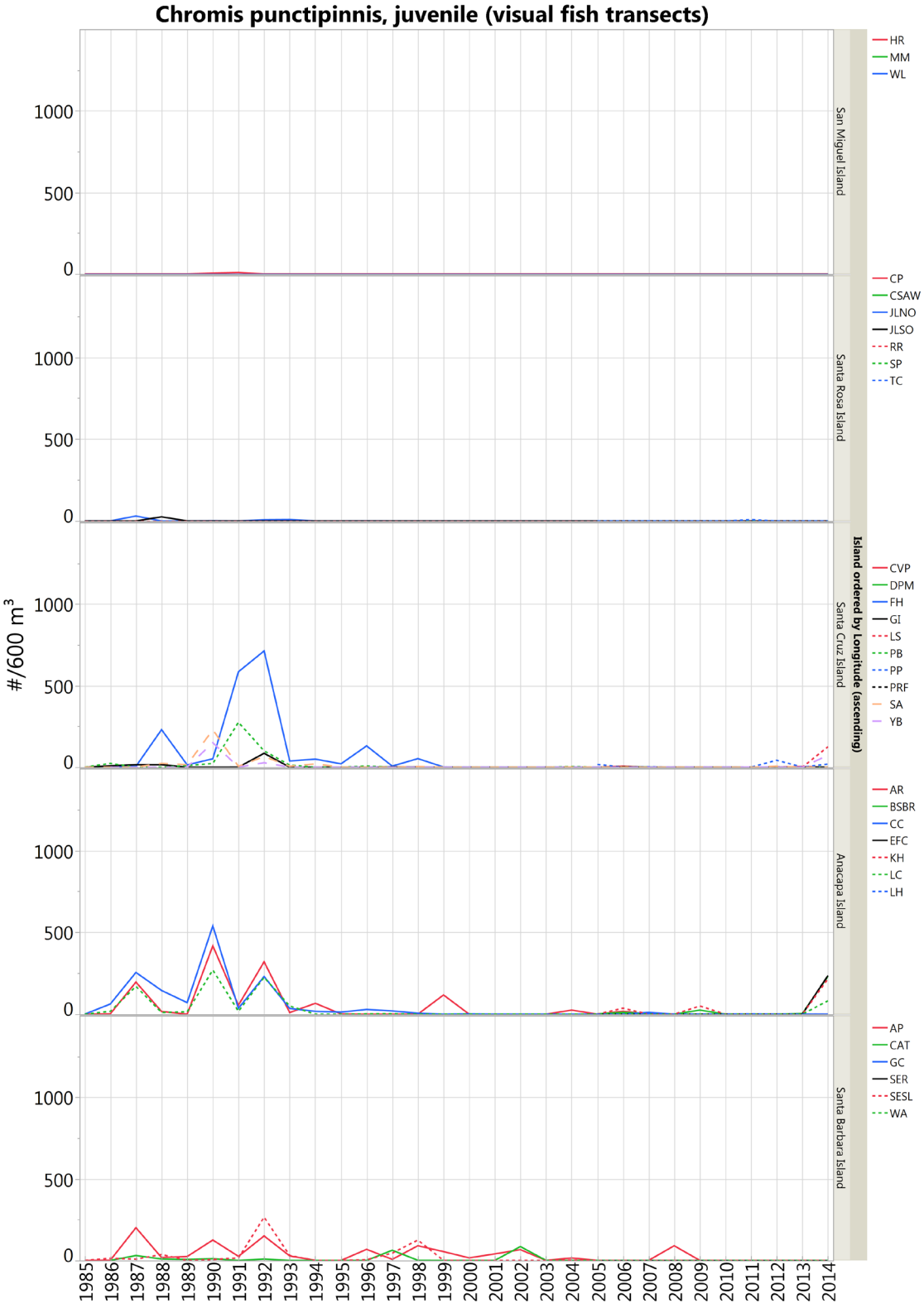


Figure I-2. Density of juvenile *Chromis punctipinnis* by site and island at Channel Islands National Park between 1985 and 2014.

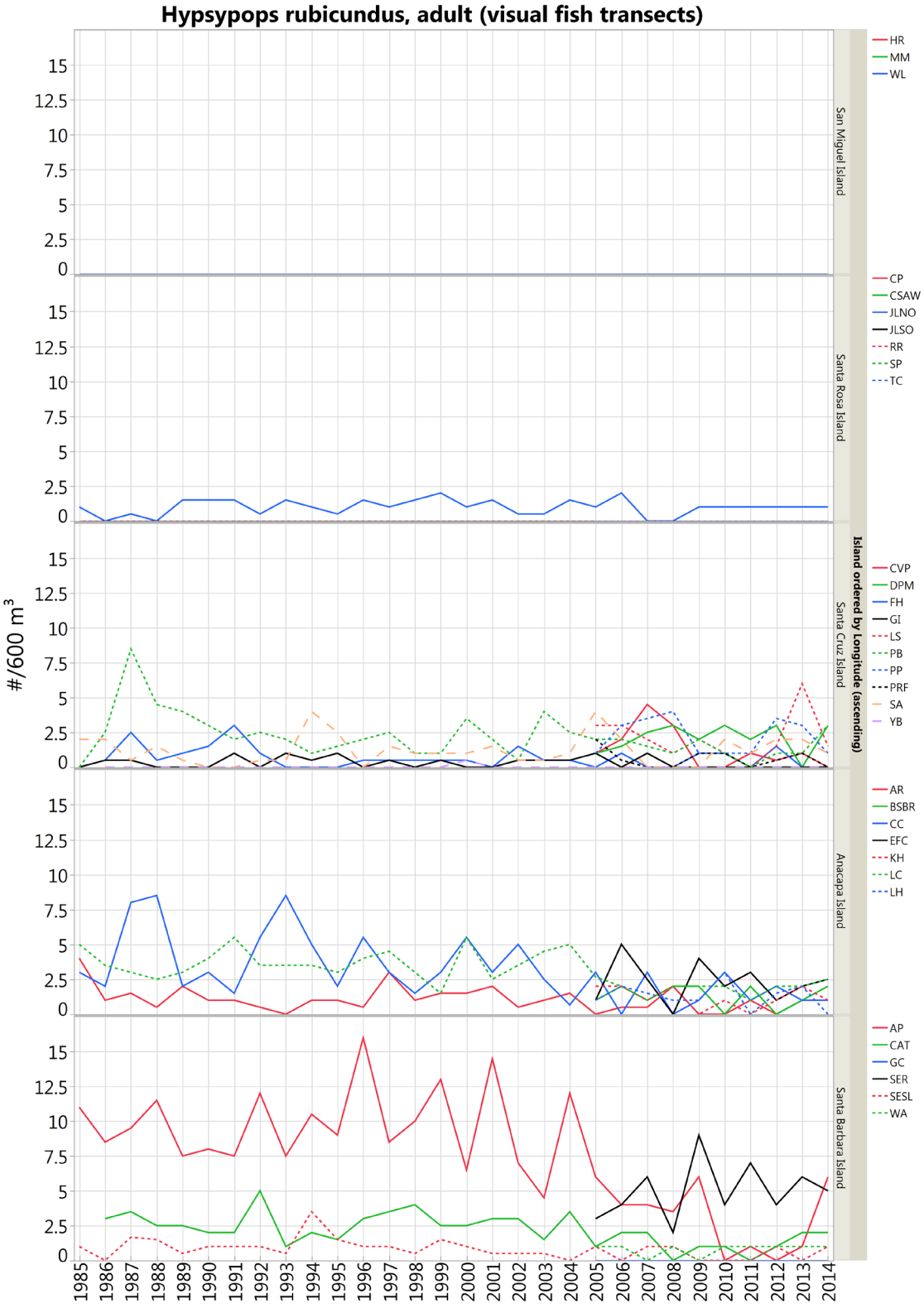


Figure I-3. Density of adult *Hypsypops rubicundus* by site and island at Channel Islands National Park between 1985 and 2014.

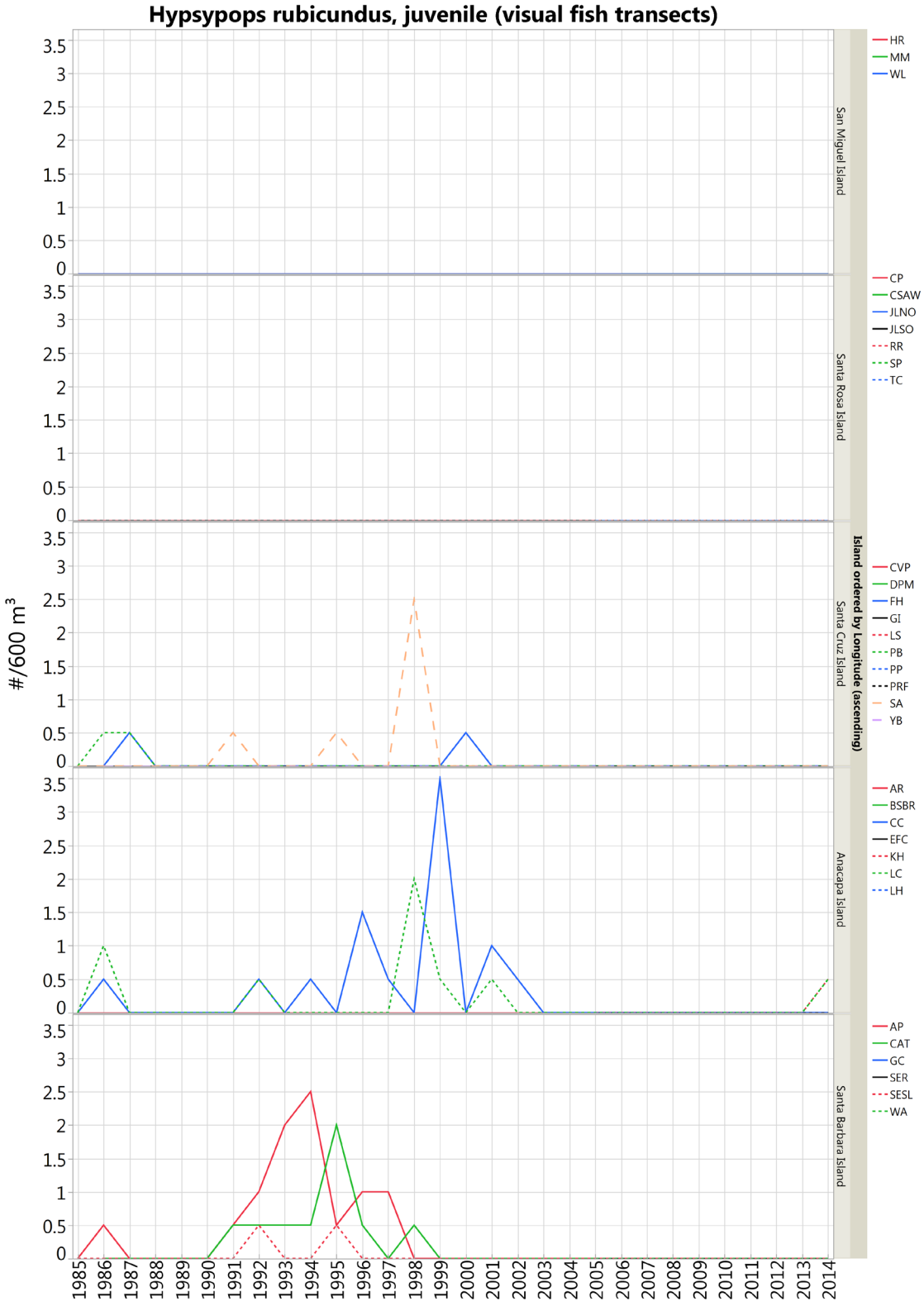


Figure I-4. Density of juvenile *Hypsypops rubicundus* by site and island at Channel Islands National Park between 1985 and 2014.

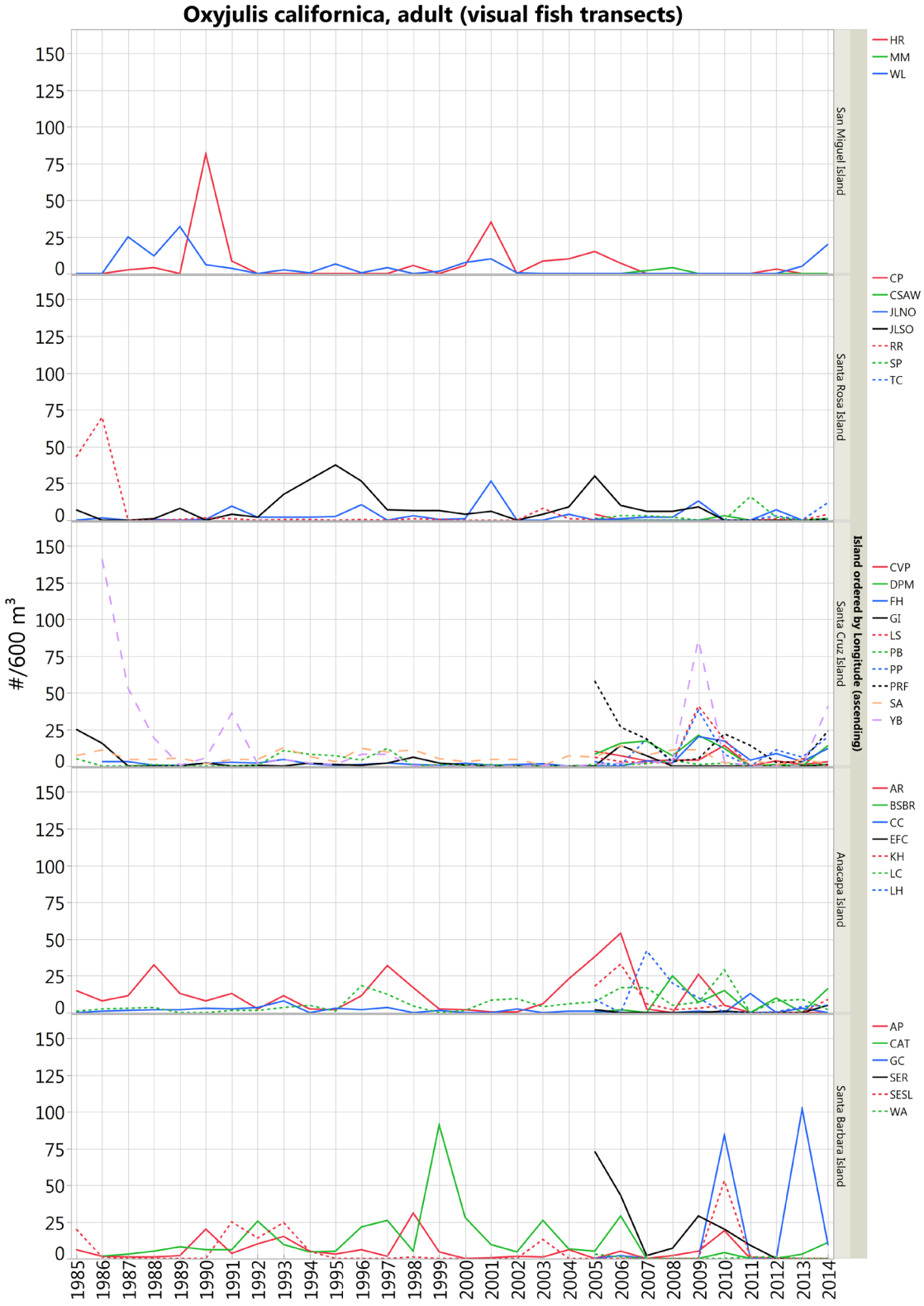


Figure I-5. Density of adult *Oxyjulis californica* by site and island at Channel Islands National Park between 1985 and 2014.

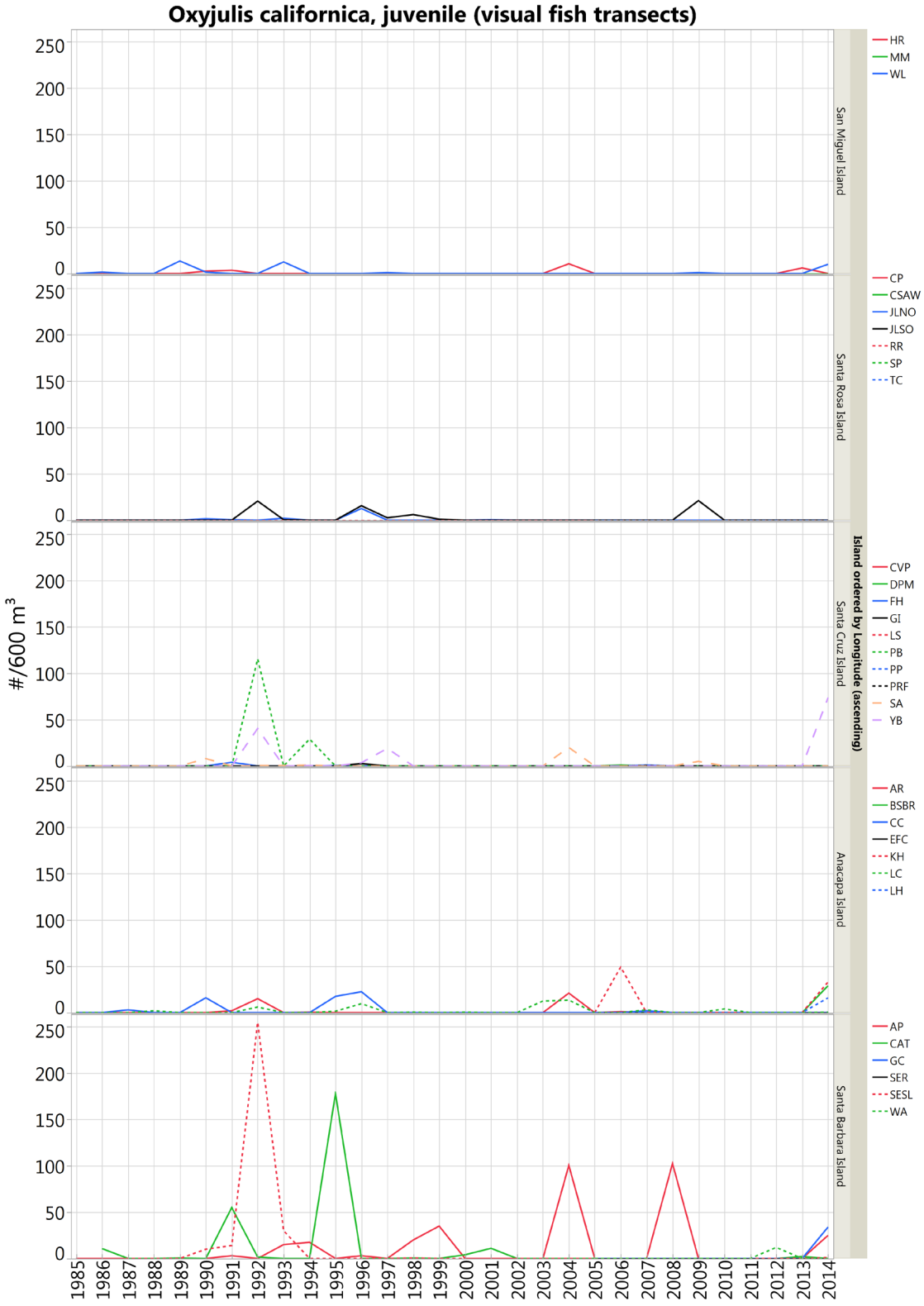


Figure I-6. Density of juvenile *Oxyjulis californica* by site and island at Channel Islands National Park between 1985 and 2014.

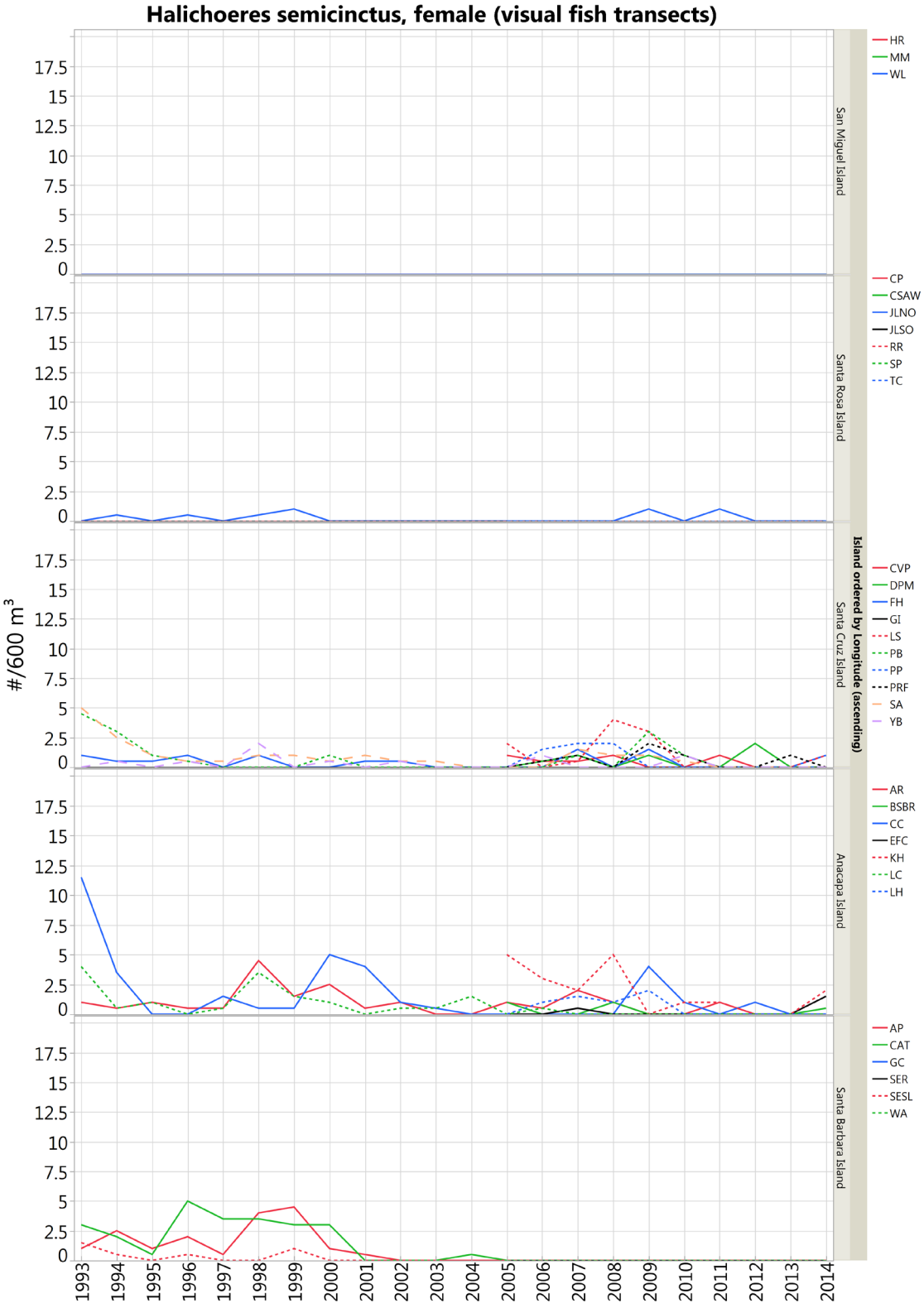


Figure I-7. Density of female *Halichoeres semicinctus* by site and island at Channel Islands National Park between 1993 and 2014.

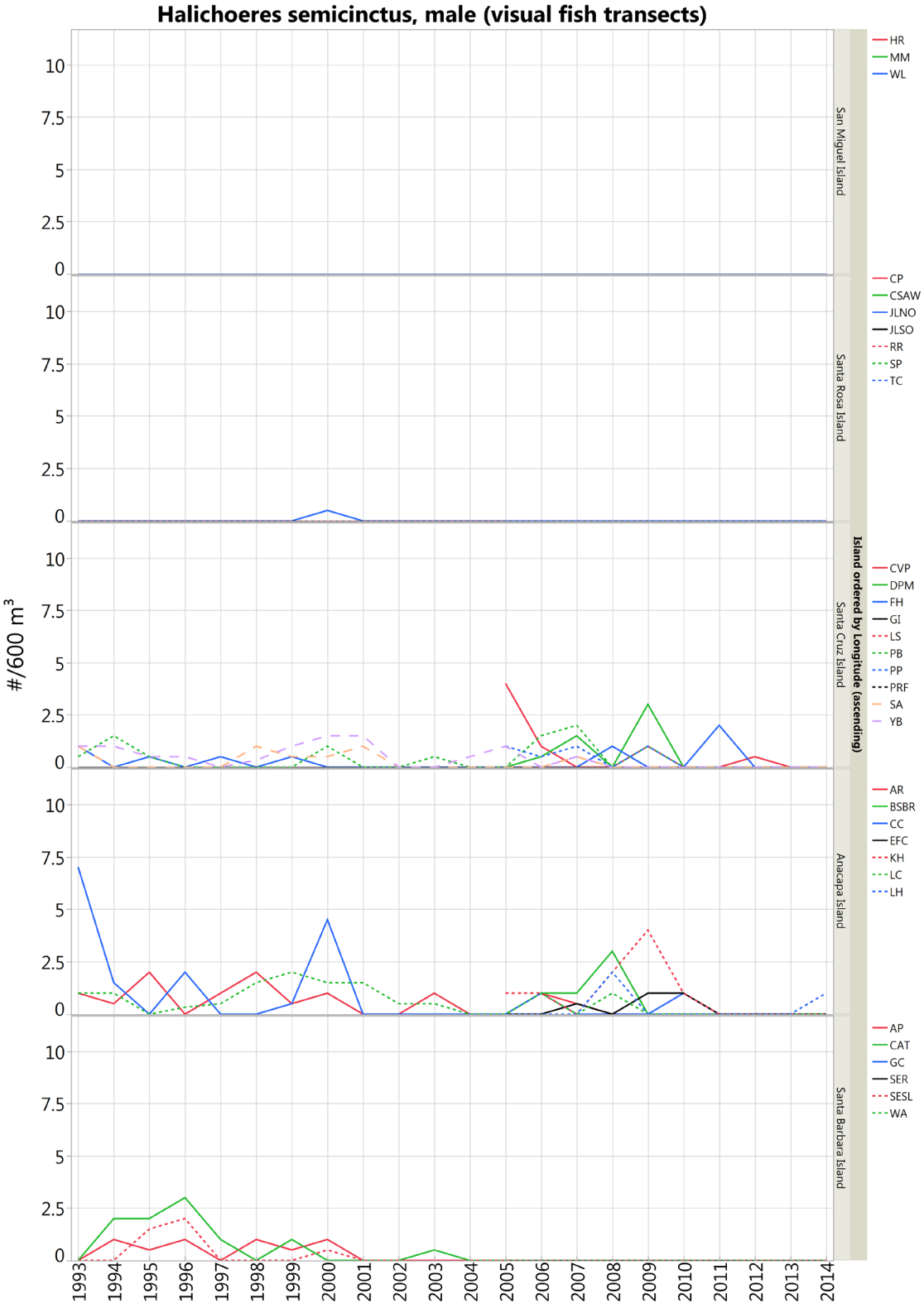


Figure I-8. Density of male *Halichoeres semicinctus* by site and island at Channel Islands National Park between 1993 and 2014.

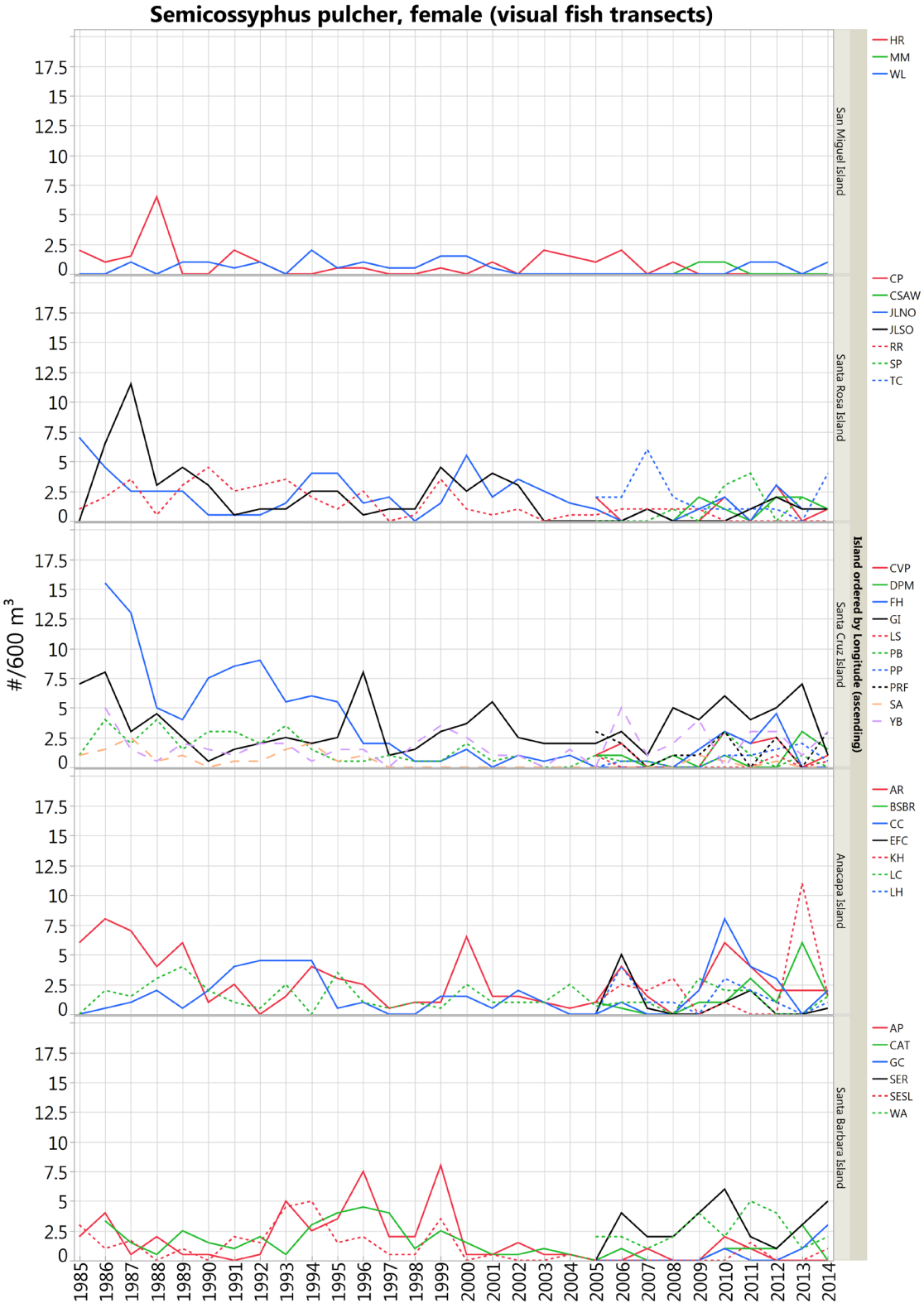


Figure I-9. Density of female *Semicossyphus pulcher* by site and island at Channel Islands National Park between 1985 and 2014.

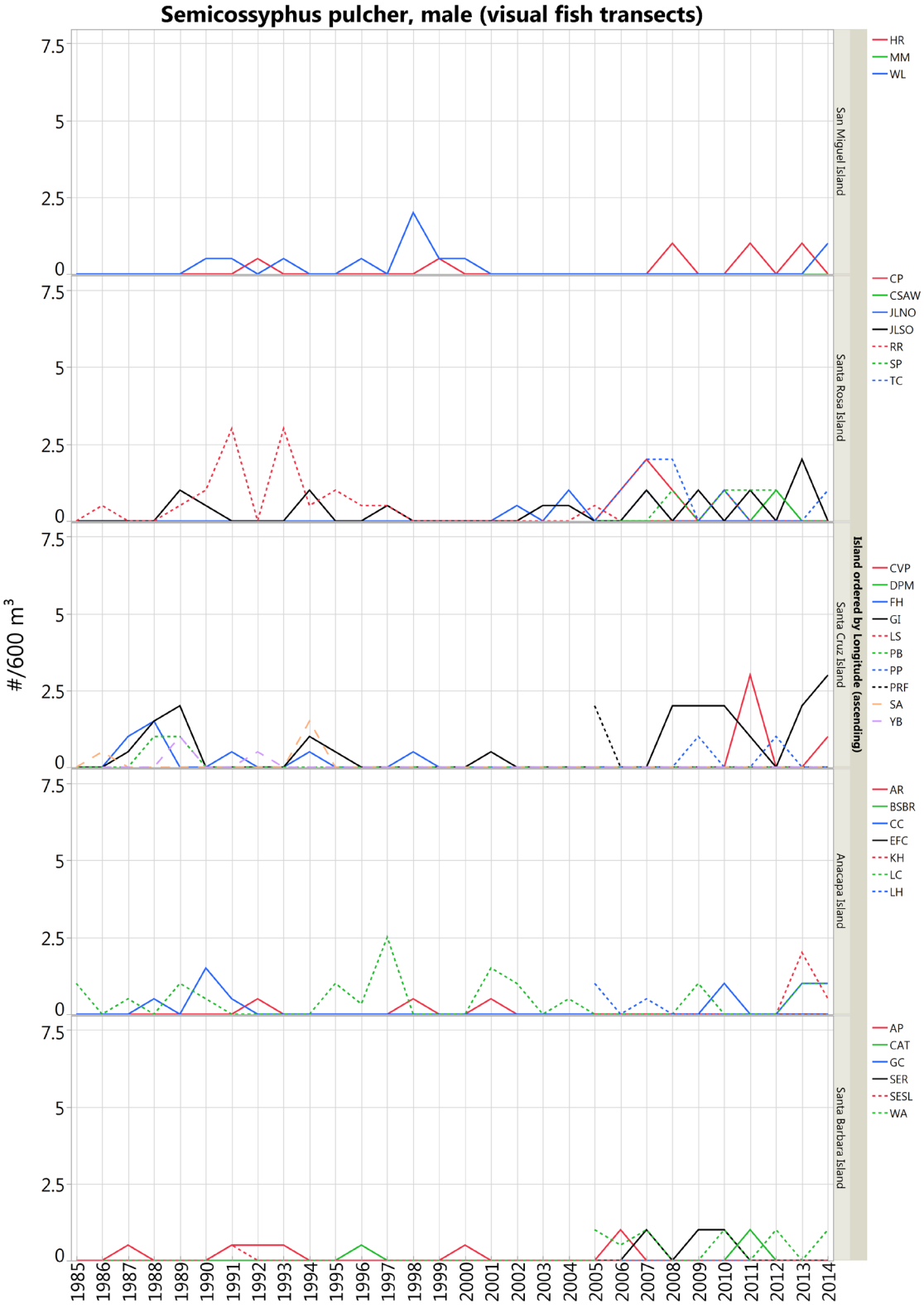


Figure I-10. Density of male *Semicossyphus pulcher* by site and island at Channel Islands National Park between 1985 and 2014.

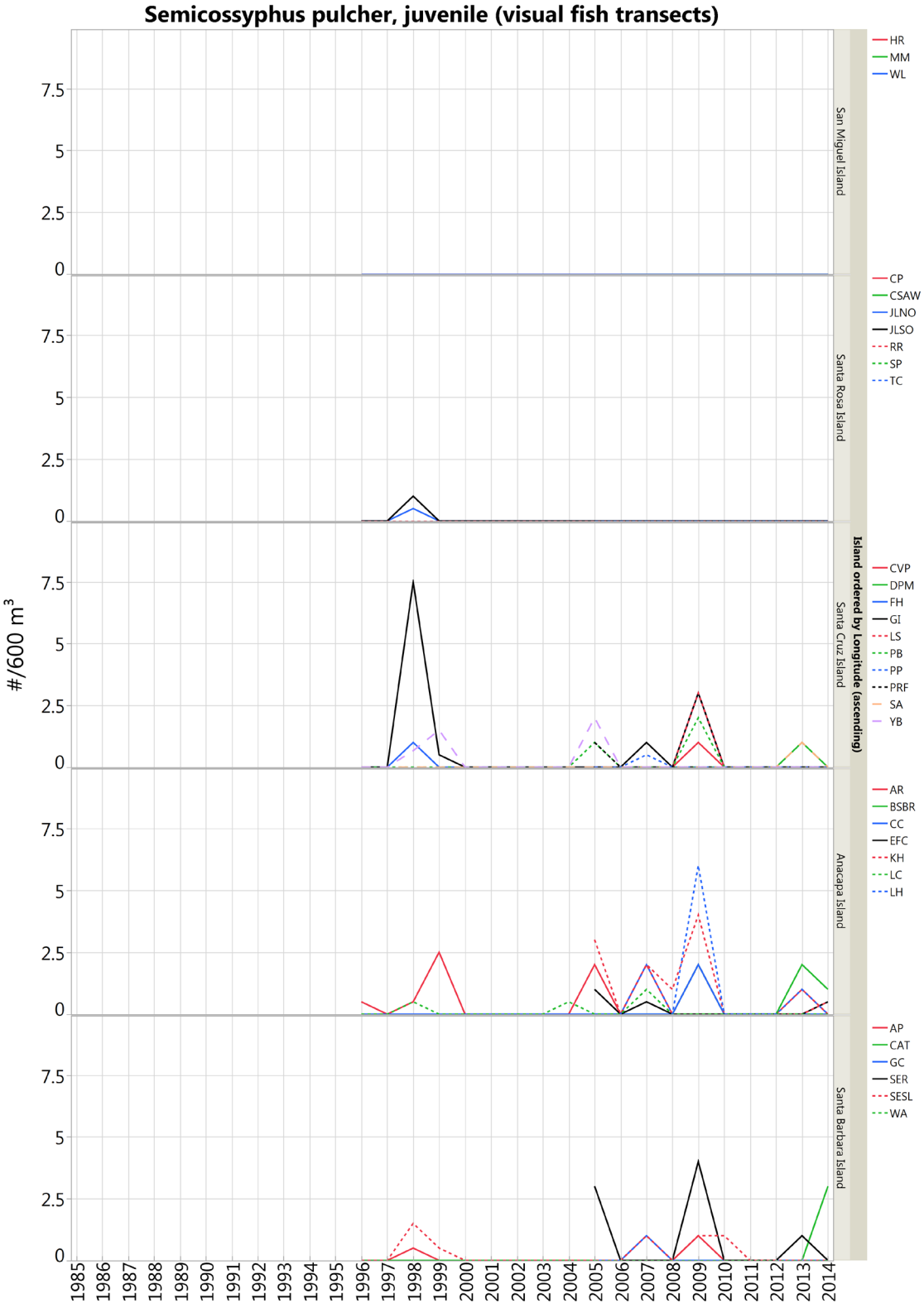


Figure I-11. Density of juvenile *Semicossyphus pulcher* by site and island at Channel Islands National Park between 1985 and 2014.

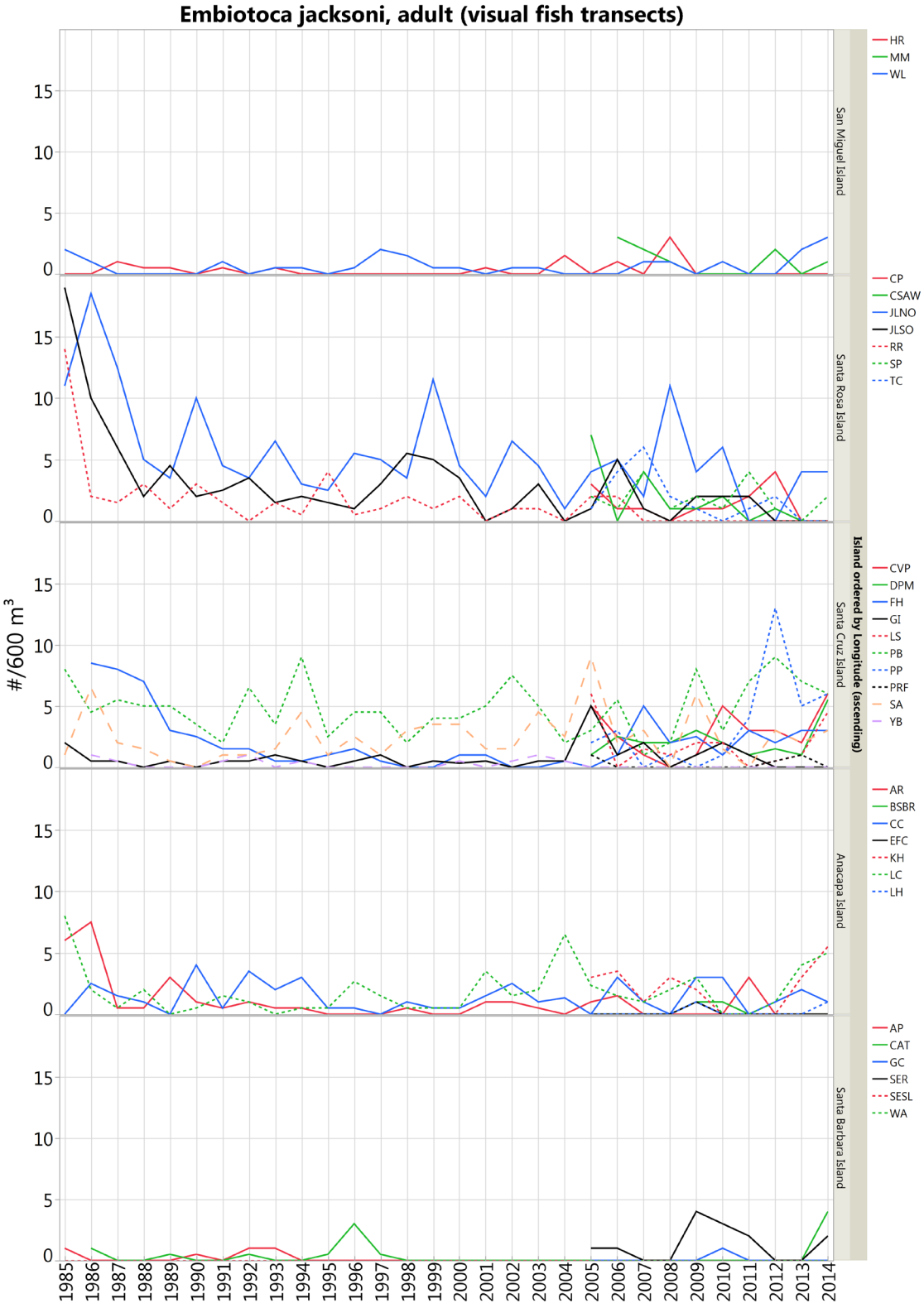


Figure I-12. Density of adult *Embiotoca jacksoni* by site and island at Channel Islands National Park between 1985 and 2014.

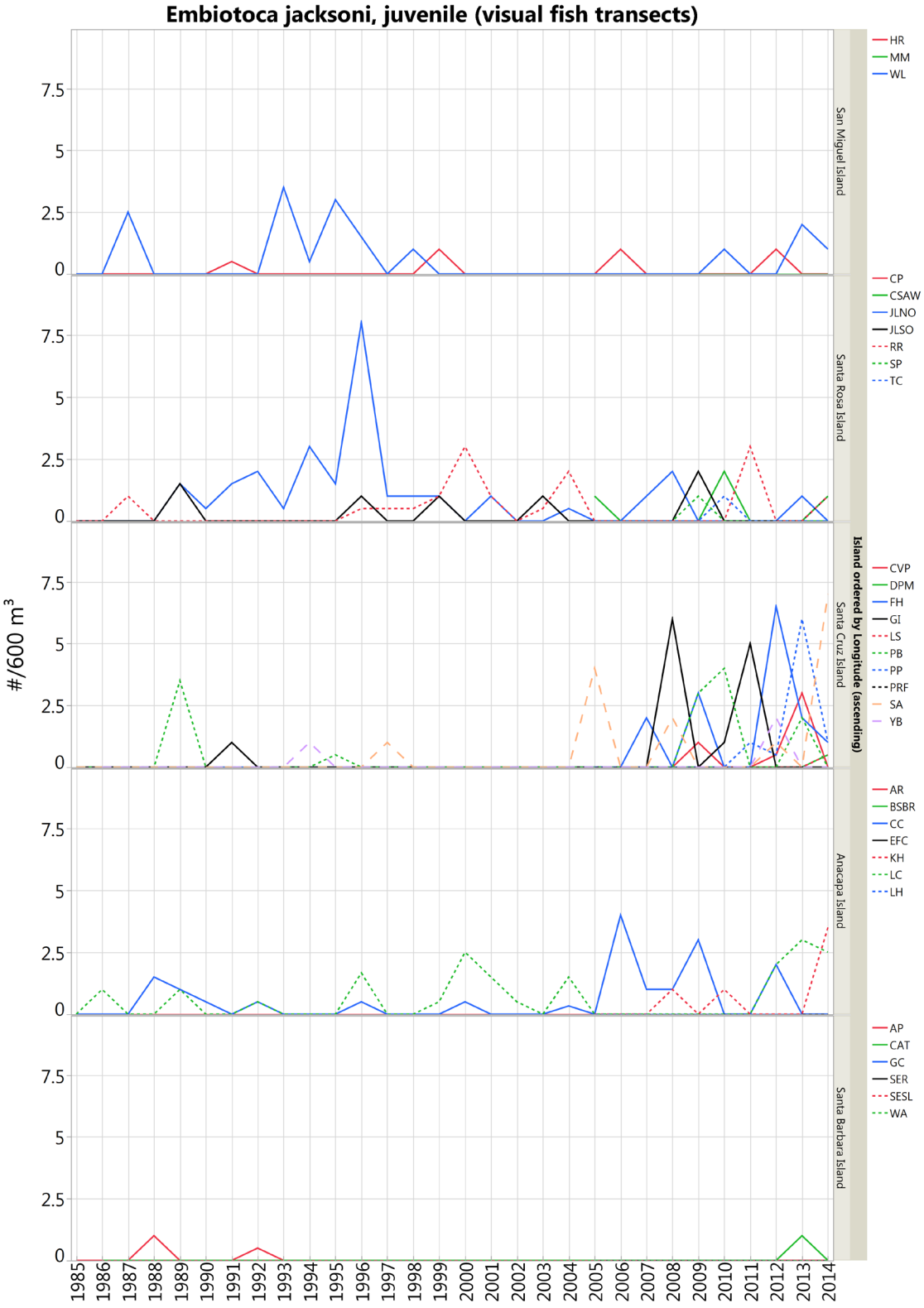


Figure I-13. Density of juvenile *Embiotoca jacksoni* by site and island at Channel Islands National Park between 1985 and 2014.

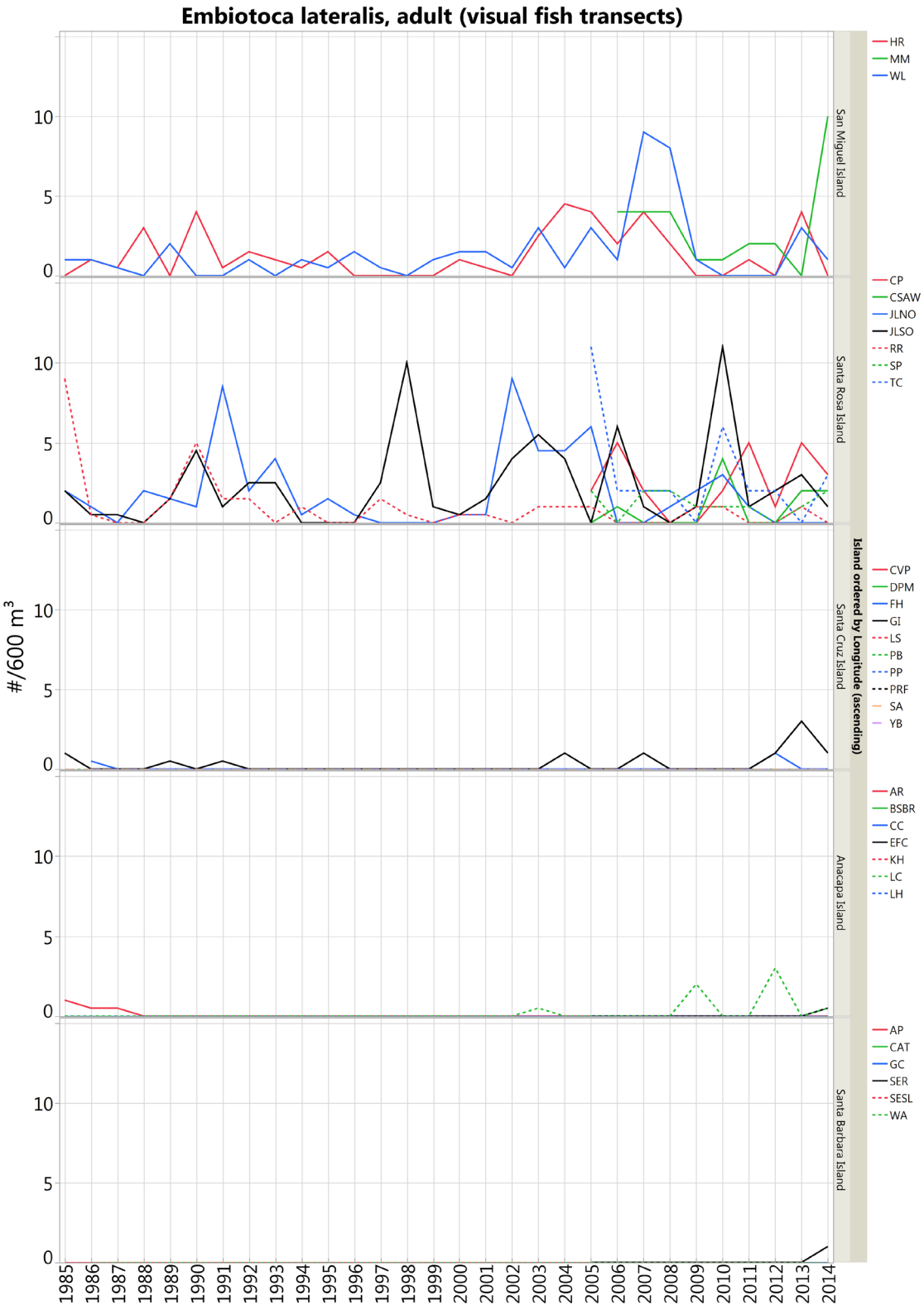


Figure I-14. Density of adult *Embiotoca lateralis* by site and island at Channel Islands National Park between 1985 and 2014.

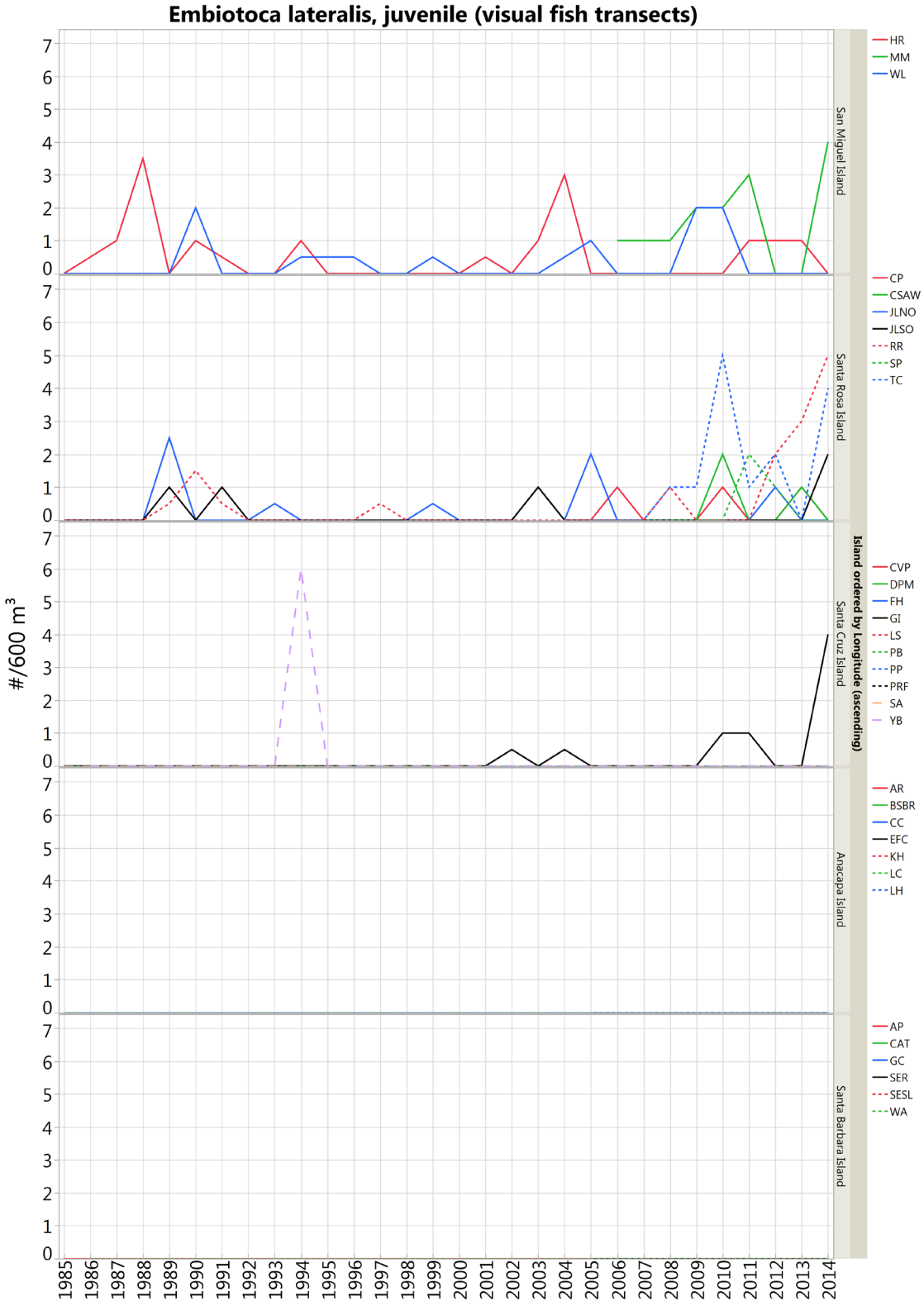


Figure I-15. Density of juvenile *Embiotoca lateralis* by site and island at Channel Islands National Park between 1985 and 2014.

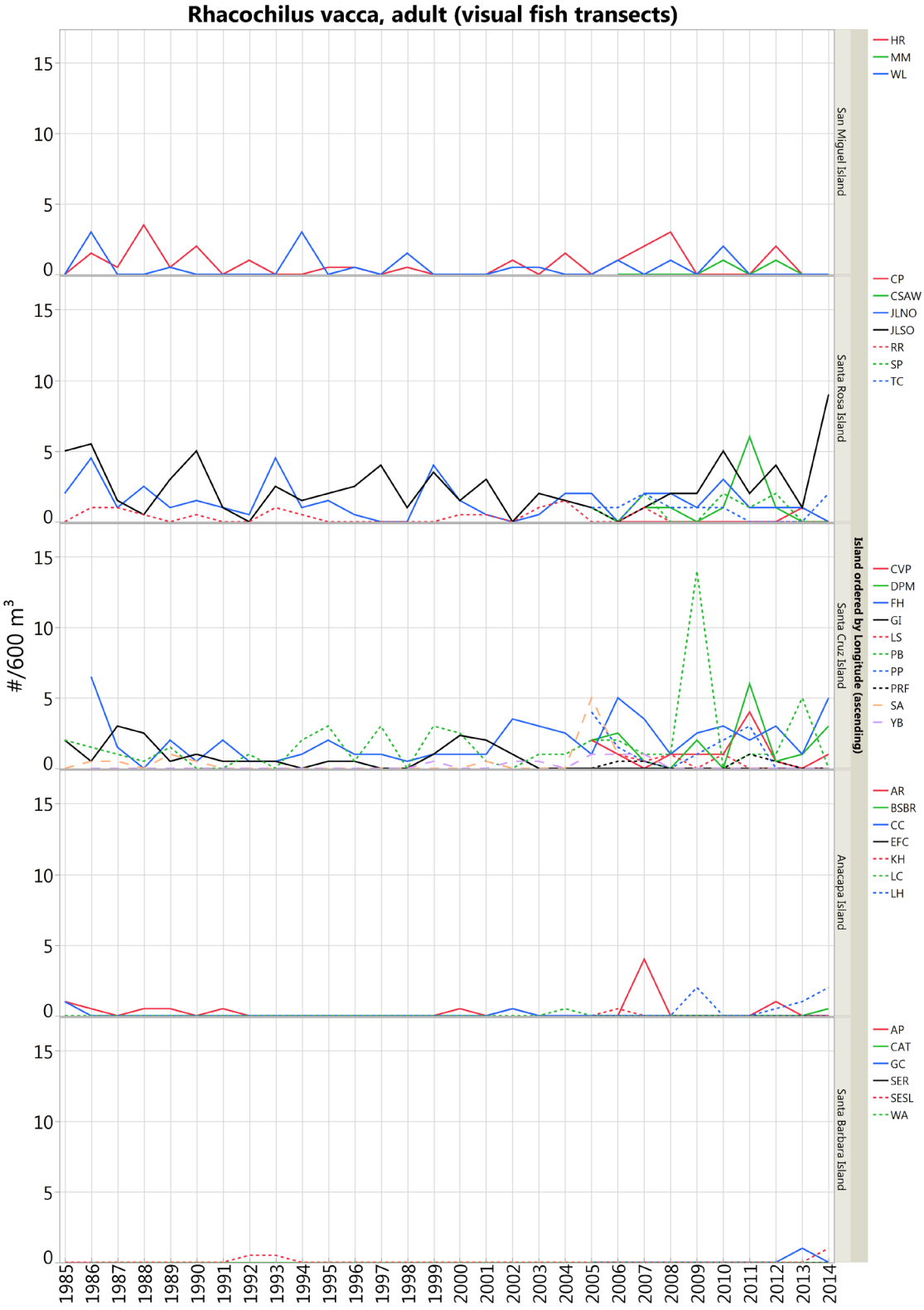


Figure I-16. Density of adult *Rhacochilus vacca* by site and island at Channel Islands National Park between 1985 and 2014.

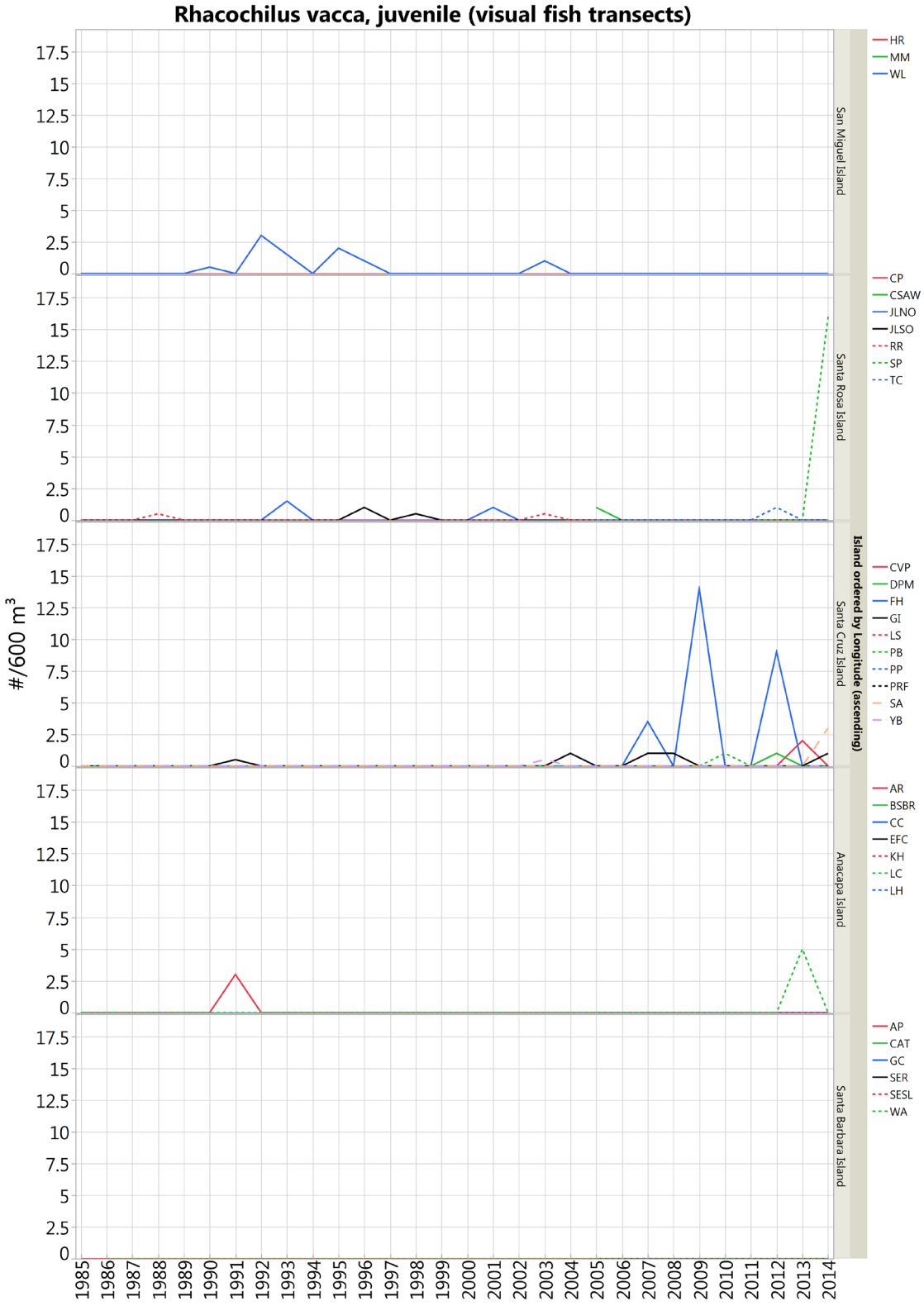


Figure I-17. Density of juvenile *Rhacochilus vacca* by site and island at Channel Islands National Park between 1985 and 2014.

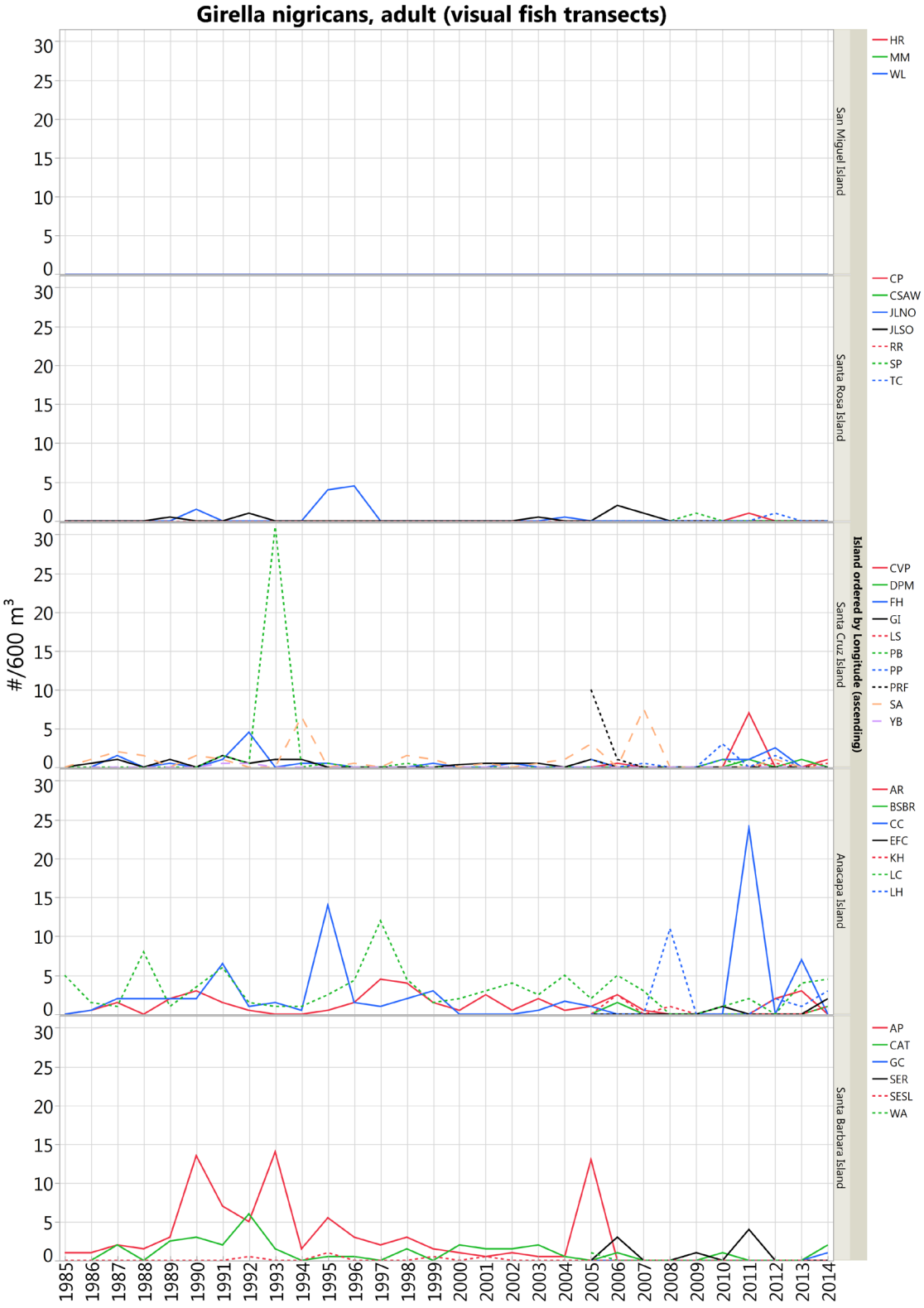


Figure I-18. Density of adult *Girella nigricans* by site and island at Channel Islands National Park between 1985 and 2014.

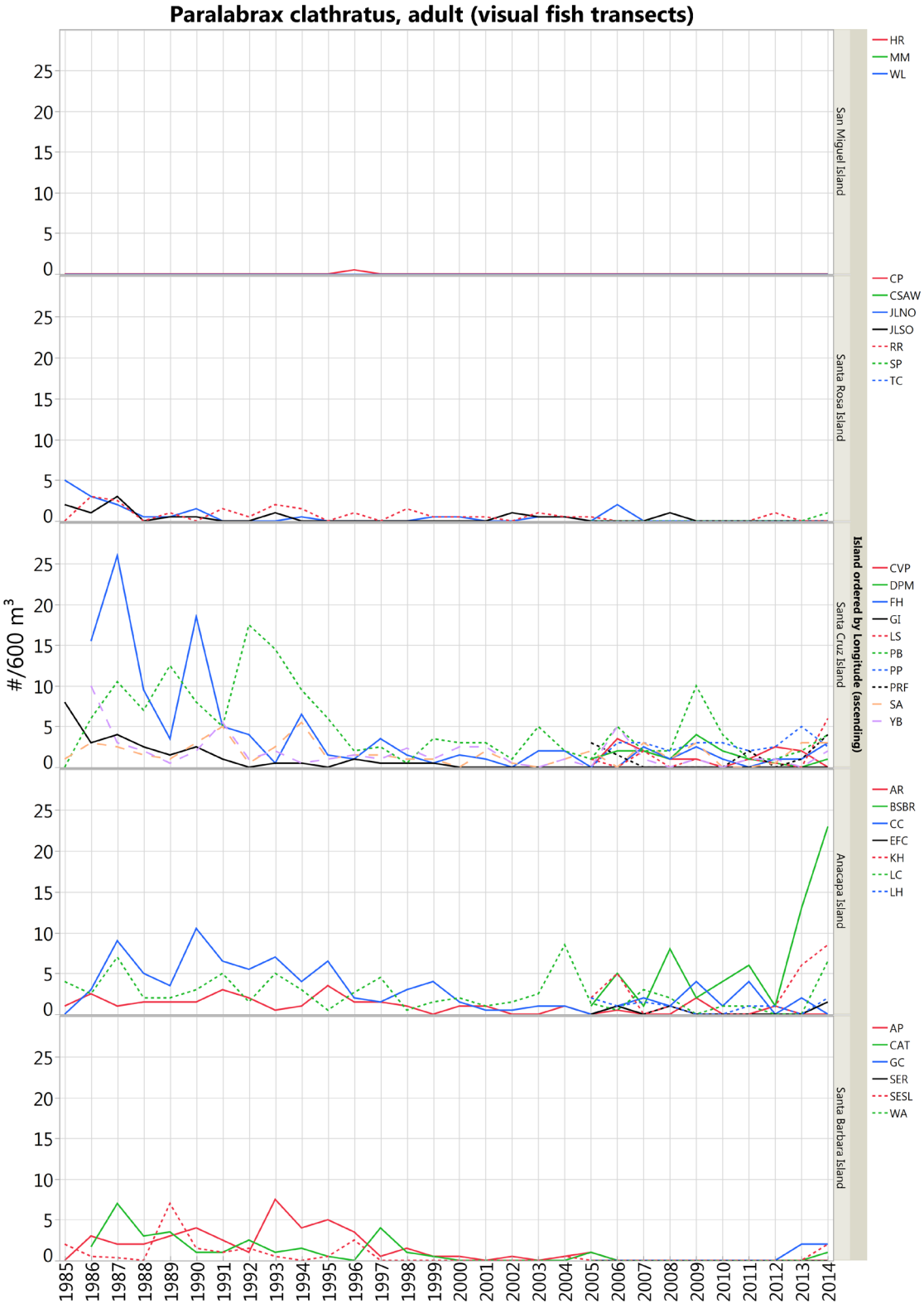


Figure I-19. Density of adult *Paralabrax clathratus* by site and island at Channel Islands National Park between 1985 and 2014.

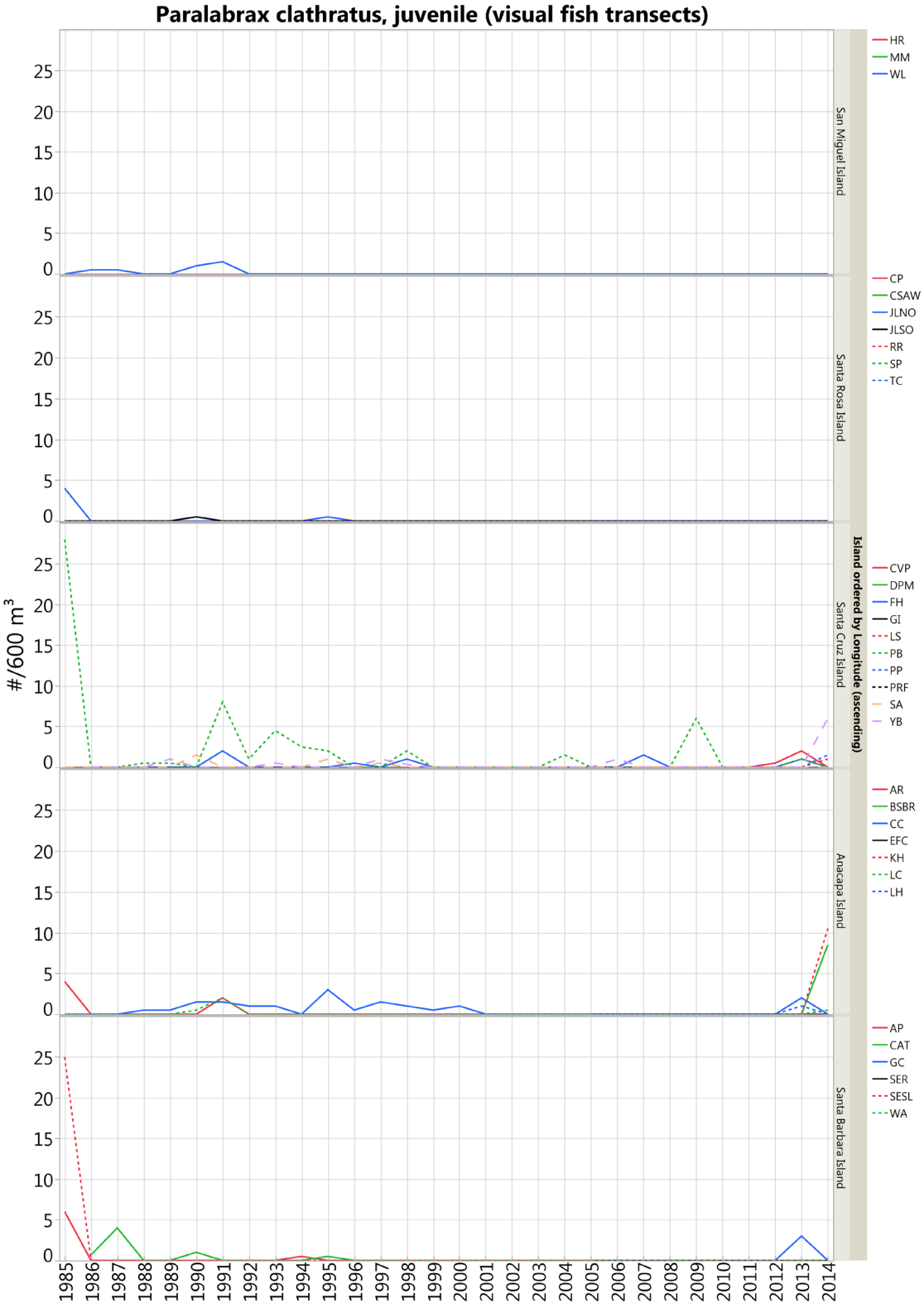


Figure I-20. Density of juvenile *Paralabrax clathratus* by site and island at Channel Islands National Park between 1985 and 2014.

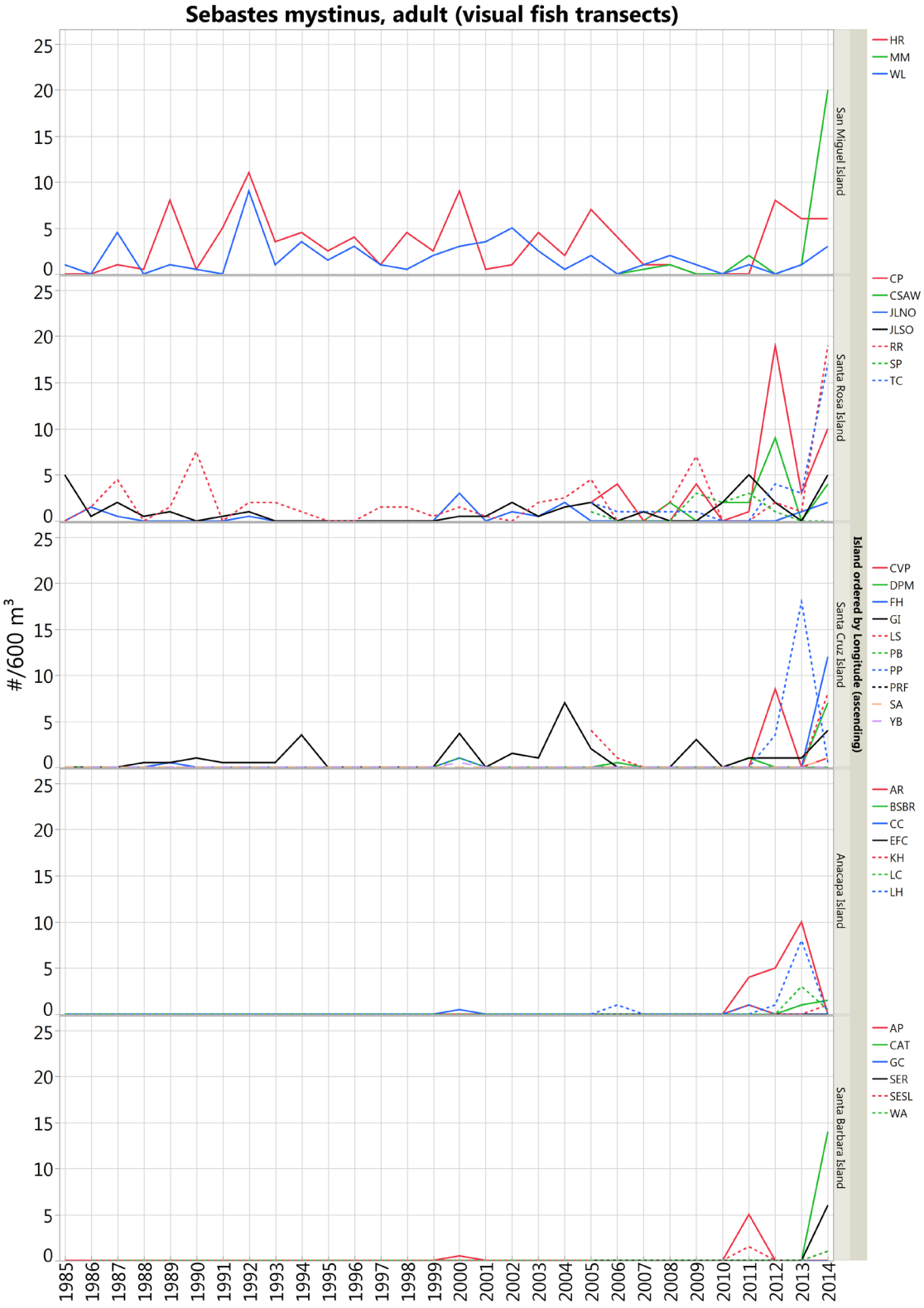


Figure I-21. Density of adult *Sebastes mystinus* by site and island at Channel Islands National Park between 1985 and 2014.

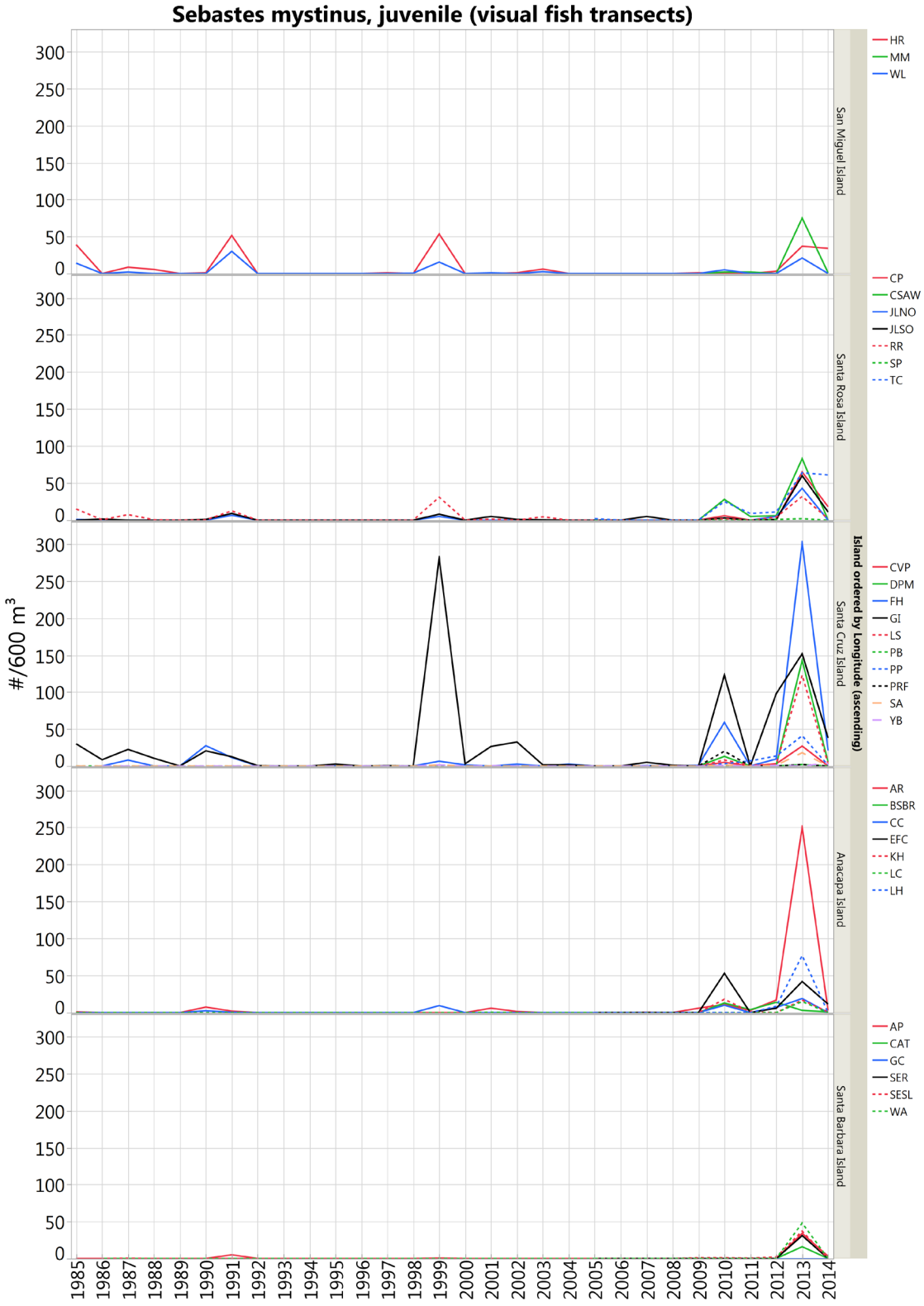


Figure I-22. Density of juvenile *Sebastes mystinus* by site and island at Channel Islands National Park between 1985 and 2014.

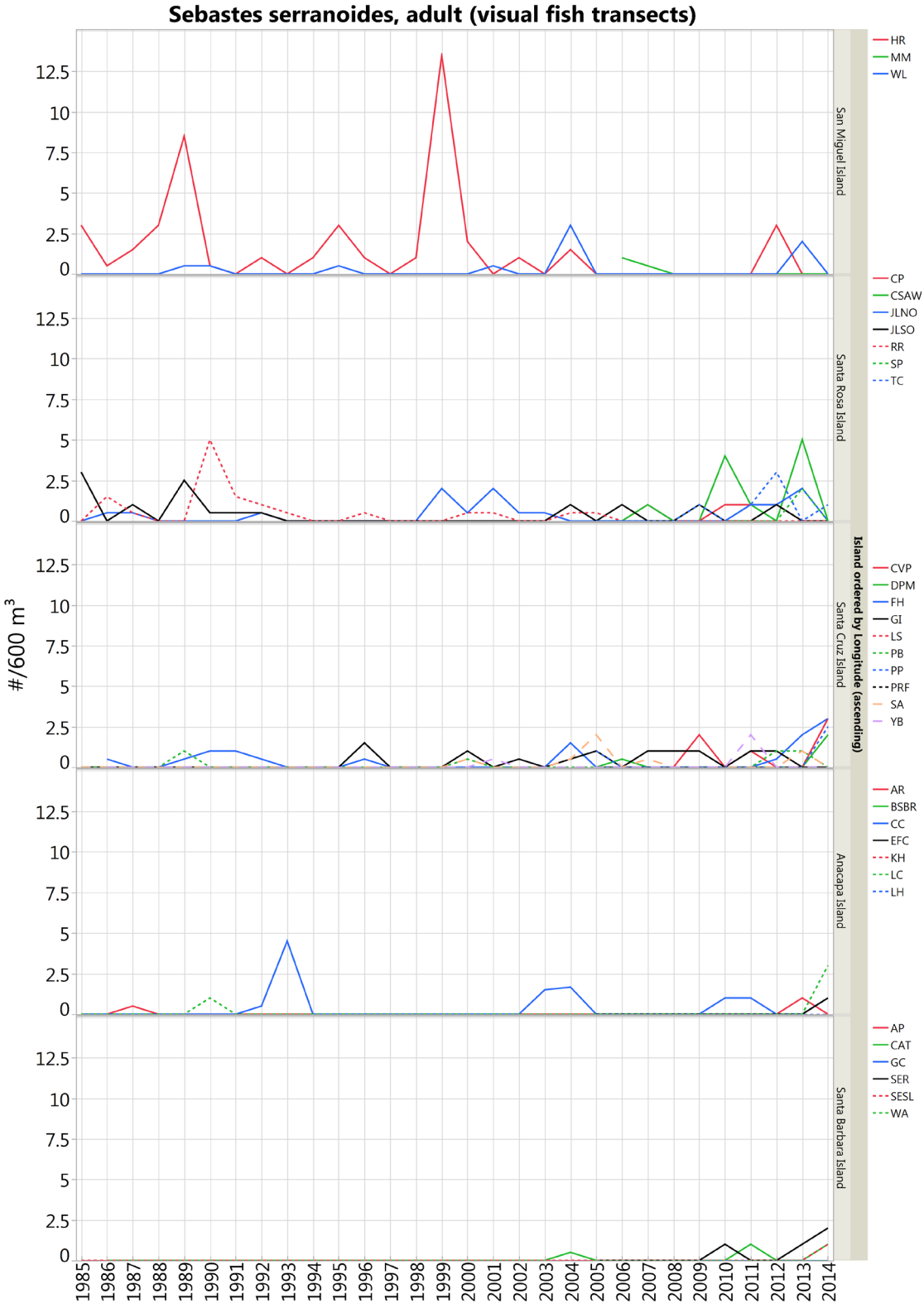


Figure I-23. Density of adult *Sebastes serranoides* by site and island at Channel Islands National Park between 1985 and 2014.

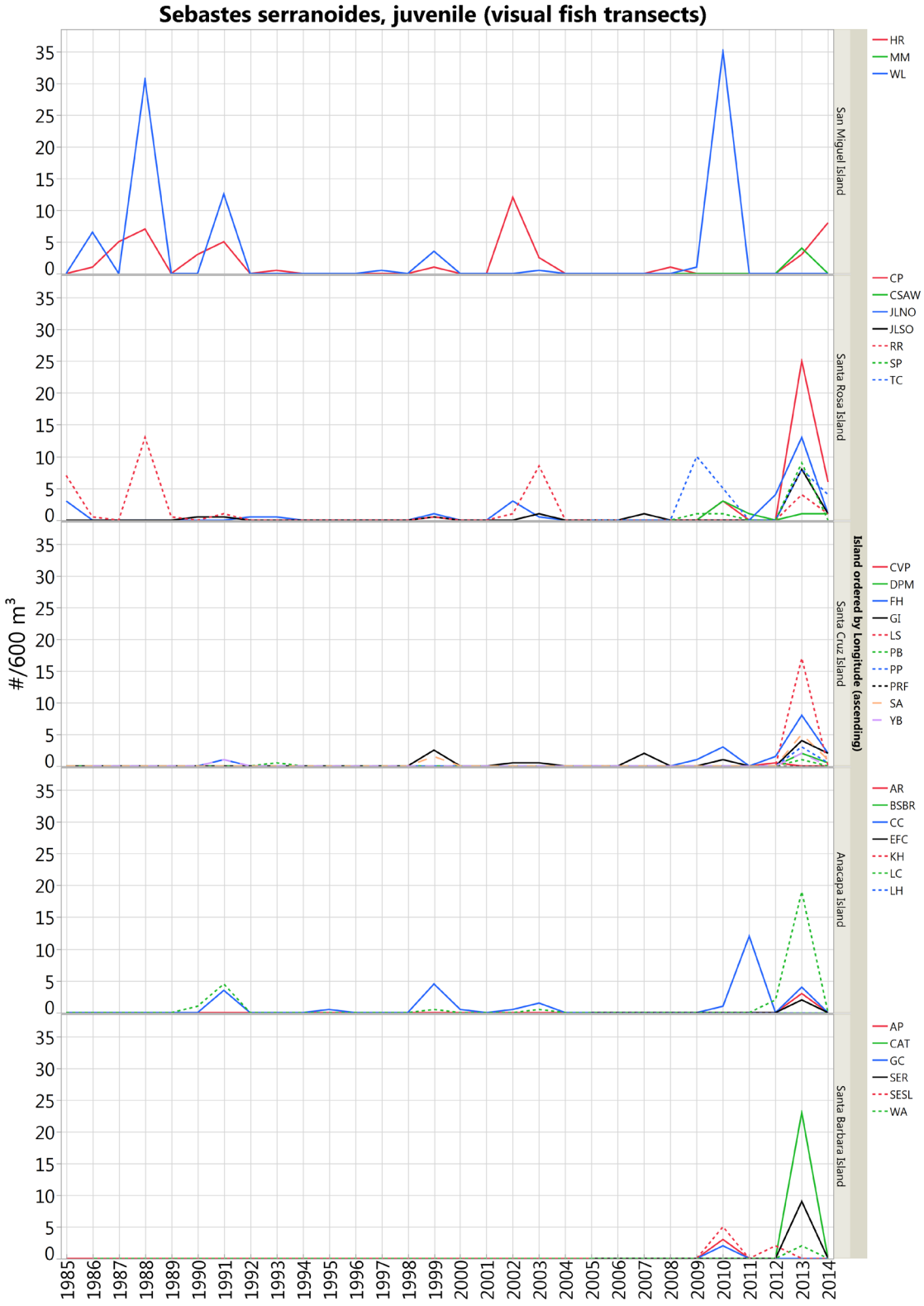


Figure I-24. Density of juvenile *Sebastes serranoides* by site and island at Channel Islands National Park between 1985 and 2014.

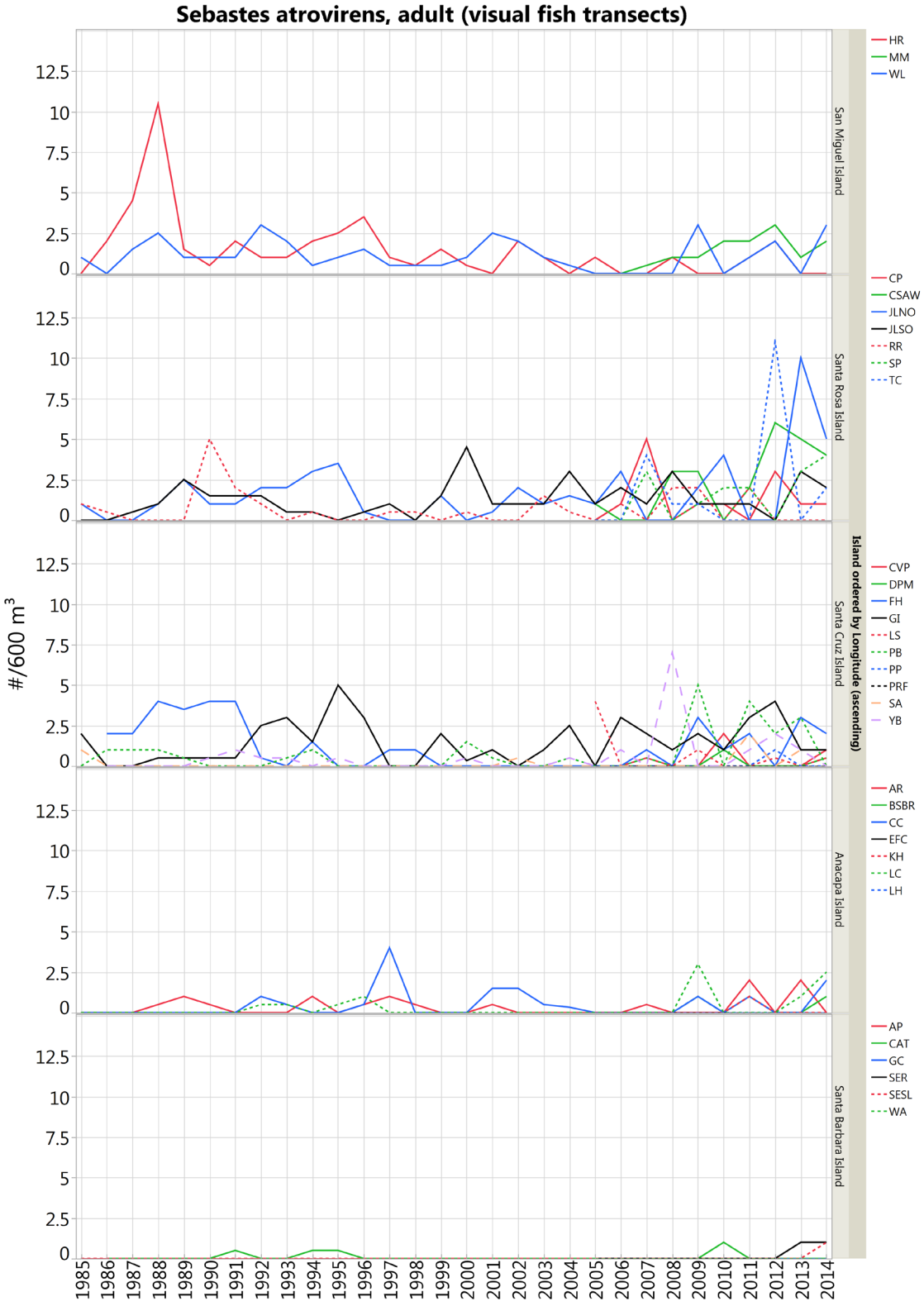


Figure I-25. Density of adult *Sebastes atrovirens* by site and island at Channel Islands National Park between 1985 and 2014.

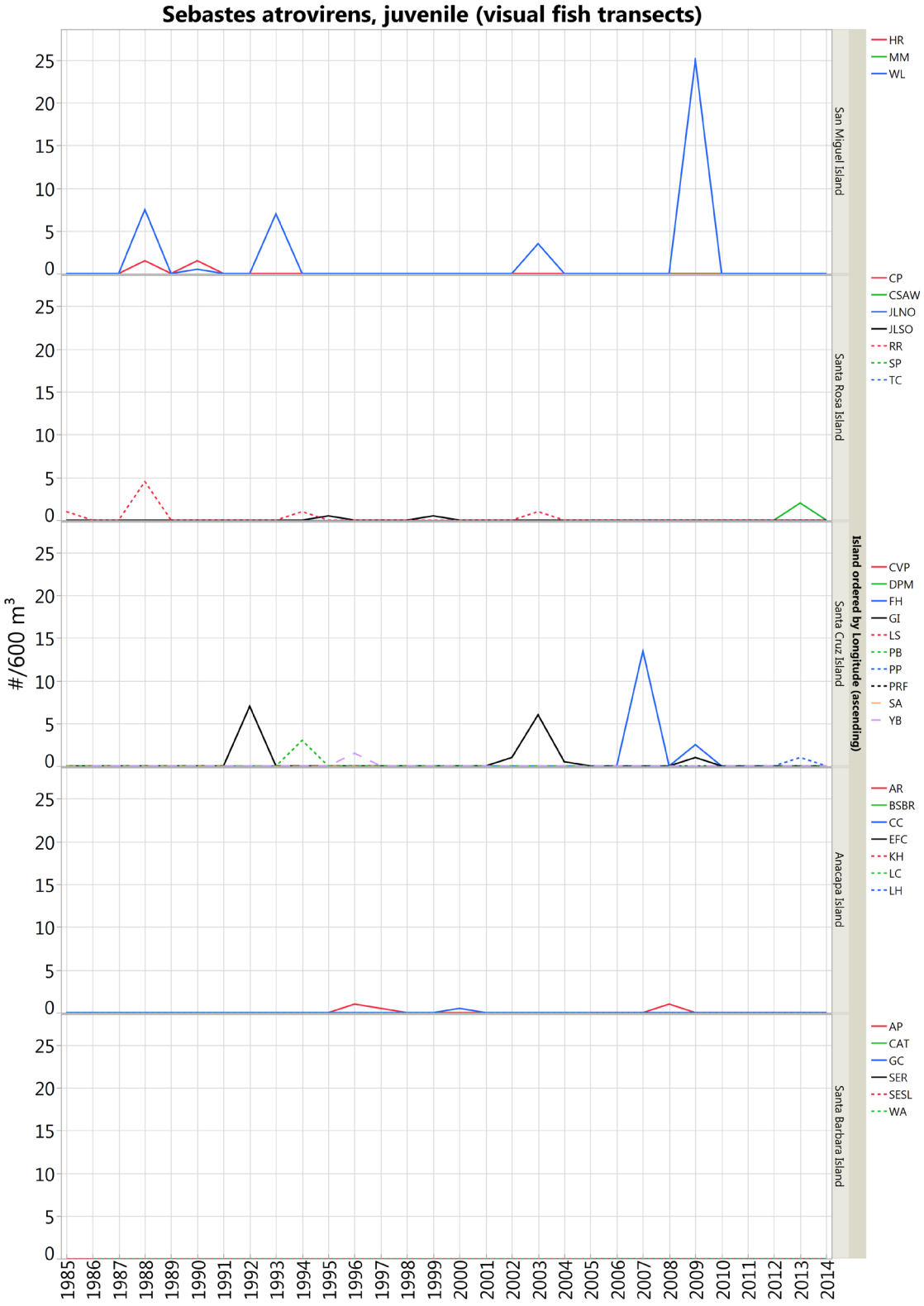


Figure I-26. Density of juvenile *Sebastes atrovirens* by site and island at Channel Islands National Park between 1985 and 2014.

Appendix J. Survey Dives

2014 Cucumber Survey Dives with CDFW

2/12/14, KFM site Johnson's Lee North, Santa Rosa Island

Participated in CDFW Parastichopus surveys. Transit to Johnson's Lee North, Santa Rosa Island where *Parastichopus parvimensis* surveys were performed along the KFM transect. No *P. parvimensis* were counted in the transects, which consisted of a 1 m x 100 m swath directly along the KFM site on the west side of the transect. We also searched for signs of sea stars wasting disease, no diseased sea stars were observed. *Patiria miniata* was abundant. Several *Dermasterias imbricata* were observed. No *Pycnopodia helianthoides* were observed at the site. The dives were brief, about 30-40 minutes long.

2/12/14, KFM site Yellowbanks, Santa Cruz Island

Participated in CDFW Parastichopus surveys. We attempted to work at Trancion Canyon, Santa Rosa Island, but the winds were unfavorable for diving off of the small vessel we were using. Instead we went to Yellowbanks on Santa Cruz Island to perform additional *P. Parvimensis* surveys and search for sea star wasting disease. Only one or two *P. parvimensis* were counted on the transects. Most were large, but one juvenile was observed. A total of four dead, disintegrating, *Pycnopodia helianthoides* were observed along with one live individual. *Patiria miniata* were abundant and were observed aggregating around the dead *P. helianthoides* and appeared to be eating the wasted remains. Several *Pisaster giganteus* were observed. Approximately half of the *P. giganteus* observed had lesions and twisted arms, indicative of sea star wasting disease. One *P. brevispinus* was observed and appeared healthy.

2014 KFM Survey Dives and Other Observations

Cruise 1

5/15/14, Landing Cove, Santa Barbara Island

Ryan Stephenson and Steve Whitaker swam inshore to check the intertidal zone at Landing Cove and found three *Pisaster ochraceus*, one *Haliotis cracherodii*, and one *Haliotis rufescens*. There were few California sea lions at the rookery on this visit and few sea lions in general for this island. Pups were common, but they appeared smaller than usual. Large aggregations of *Myliobatis californica*, bat rays, in the hundreds if not thousands were observed near Landing Cove immediately adjacent to the intertidal site in the sand flats, as well as at Southeast Reef in the sand and at the edge of the kelp bed. The water was amazingly clear and water temperatures were 62-68 degrees F. on the surface.

Cruise 3

6/10/14, Northeast side of Santa Barbara Island

This survey dive was at 75-100 ft. depth in a location that we are pretty sure was completely dominated by *Ophiothrix spiculata* 1-3 years ago. There was still a moderate amount of *O. spiculata* estimated to cover ~25% of the bottom, but there was a mature kelp forest with healthy plants reaching the surface. Understory algae consisted of *Agarum* sp. and a moderate amount of *Sargassum horneri* at 110 ft. These were scattered around, mostly small < 50 cm and reproductive. One *Haliotis assimilis* was observed and estimated at 110mm in length. One very large black seabass was

observed, but other than that there were few fish. Only a few small female Sheephead and six 8-10 cm bocaccio were observed, as well as a small copper rockfish. Several *Thetys vagina* and *Pyrosomes* were observed today. There were noticeably fewer salps than we observed during the first trip. The location of this dive was: 33° 29.6253 N, 119° 02.6364 W

6/11/14, Santa Barbara Island

From observations during our survey dive yesterday, as well as from KFM sites Southeast Sea lion, Graveyard Canyon and Cat Canyon, Sea lions were abundant as usual; we had noted on our first trip in May that there were few. Market squid (*Doryteuthis opalescens*) seemed moderately abundant around the island from in-water and depth sounder observations. We observed pyrosomes, several large *Thetys vagina* and cyclosalps this trip.

6/12/14, Offshore of KFM site Devil's Peak Member, Santa Cruz Island

Kelly Moore and David Kushner did a survey dive at the 'site', deeper to 73 ft. and in shallow. Deeper past the rocks there were large discrete *Mesochaetopterus* sp.*, Chaetopterus* sp. and dense sand dollar beds. Offshore of the transect there was an abundance of *Lophogorgia chilensis*, similar to past years. No *Sargassum horneri* were observed. They found six small fresh *Haliotis rufescens* shells.

6/13/14, Near Cat Rock, Anacapa Island

Just offshore of Cat Rock, we anchored in 42 ft. of water. The area was mostly dense *Ophiothrix spiculata* barrens. However, on the tops of the reefs there were isolated patches of *Macrocystis pyrifera* and understory algae. There were also small patches of small adult and juvenile *Sargassum horneri* and high densities of *Strongylocentrotus purpuratus*. We observed *S. purpuratus* and *S. franciscanus* actively feeding on *S. horneri.* We also saw 4-6 California yellowtail *(Seriola dorsalis).*

Cruise 5

7/9/14, Inshore of KFM site Potato Pasture, Santa Cruz Island

David Kushner swam inshore southeast to excellent black abalone, *Haliotis cracherodii*, habitat. He counted over 150, live ones ranging from about 50 mm to over 165 mm. All looked healthy. Two large fresh shells (144, 151 mm) were observed. Most were in 3-7 ft. depth range at a higher tide and were patchy.

Cruise 6

7/15/14, East of Cluster Point, Santa Rosa Island

Jack mackerel were extremely abundant around the La Jolla Vieja surf spot, Johnson's Lee and at the Cluster Point site. There were three size classes, one large, one medium (120 mm), and one small (75 mm). Similar to Kushner's observations from Santa Cruz Island, this is the most jack mackerel Kushner has ever observed. Lingcod were moderately abundant with ~15 observed covering a large area.

7/16/14, Inshore of Trancion Canyon, Santa Rosa Island

On a survey dive inshore and north of the KFM site, in 12-45 ft. of depth, one blue shark and about 15 legal-sized *Panulirus interruptus* were observed.

Cruise 7

8/1/14, Near Rat Rock, Anacapa Island
No black seabass observed. 34° 00.818 N, 119° 26.814W

8/1/14, Near Coral Reef, Anacapa Island
One very large giant black seabass (~ 6 ft.) was observed. At the base of the reef at 100 ft., juvenile vermillion rockfish were moderately abundant. On the tops of reefs juvenile *Chromis punctipinnis* were abundant in small and large schools. Four *Patiria miniata* were observed with presumably warm water wasting disease. There was kelp on top of the reef. Most of the area was *Ophiothrix spiculata* dominated. 34° 00.453 N, 119° 25.517 W

8/1/14, East of Goldfish Bowl, Anacapa Island
East of Goldfish Bowl James Grunden and Jaime McClain reported seeing several *Parastichopus parvimensis* with what appeared to be wasting like disease. 34° 01.042 N, 119° 25.517 W

8/1/14, Near Winfield Scott, Anacapa Island
Sargassum horneri, were common and the *Macrocystis pyrifera* plants were a bit tattered and unhealthy looking. There were small and large lobsters, but they were not as abundant as usual. *Parastichopus parvimensis* were abundant. Large *Strongylocentrotus franciscanus* tests recently predated upon were common. Juvenile Kelp bass and *Chromis* were moderately abundant. 34° 00.573 N, 119° 23.219 W.

On the west end of West Anacapa island, at 'the spine', several divers observed at least 3 old derelict lobster pots as well as pot line and monofilament fishing line in about 45-65ft of water in between the reef heads at location: 34° 00.8186 N, 119° 26.8140 W. We submitted the coordinates to the derelict fishing gear removal.

Cruise 8

8/14/14, Actual Wyckoff Ledge, San Miguel Island (Note this site is offshore of the KFM site.
Two *Pisaster ochraceus* as well as one *Pisaster giganteus* were observed. No *Pycnopodia helianthoides* were observed. One large red abalone was observed.

8/14/14, Offshore of Pelican Bay, Santa Cruz Island
Two large Mantis shrimp were observed offshore of the KFM site.

8/15/14, West of Potato Pasture, Santa Cruz Island
On the western side of the offshore rocks there was an abundance of *Pachythyone rubra*, but this area still had *Eisenia arborea* and kelp. Lobsters were moderately abundant and many were large. *Parastichopus parvimensis* were common but most were small to medium in size. Large scallops were common; this is as these are currently rare in shallow water. *Patiria miniata* were moderately abundant and large below 60 ft., indicating that the low abundance in shallow is due to warm water wasting disease. In shallow water, juvenile garibaldi less than 6 cm were common with at least 8 seen. Kushner observed five red abalone measuring 20-45 mm, and one green abalone under a boulder ~25mm in size. No black abalones were observed. 34° 03.175 N, 119° 35.242 W

Cruise 10

8/26/14, East of Little Scorpion

At a depth of 45 ft. there was a lot of relief with *Corynactis californica* covered rocks. In the low lying areas there are a lot of *Ophiothrix spiculata*. Most were the reefs covered with mostly female and some male *Loxorhynchus grandis*. 34° 02.525 N, 119° 31.821 W

Cruise 11

9/16/14, Anacapa and Santa Cruz Islands

Water temps hit 74^0F! Kushner says this is the highest temperature he's seen at the islands since he began working at the park in 1990. So far from our observations at East Fish Camp and Yellowbanks we have been surprised at how little of an impact the large swell event on 9/3/14 had at these sites. Just a bit of sand, cobble and small boulder movement was observed. And a small bit of ARM movement.

9/17/14, Survey dive west of Scorpion Anchorage pier

There were large to huge kelp bass and legal lobsters were common in shallow. They were not as abundant as past years. In shallow ~5ft about 15 adult black abalone were observed and were under rocks, 3 juvenile, ~20-35 mm, red abalone, *Haliotis rufescens*, and one, ~30 mm, green abalone, *H. fulgens*, were observed. Two *Parastichopus parvimensis* that appeared wasting were observed. While turning over rocks in shallow where the juvenile abalone were found (included above) there were also a moderate number (1-3 per rock) of tiny *Patiria miniata* indicating recent recruitment. 34° 02.05 N, 119° 33.332 W

Cruise 12

9/29/14, Anacapa Island

At the few sites today *Pisaster giganteus*, *Pisaster ochraceus* and *Patiria miniata* were absent or noticeably rare. Though we were not looking for them, only one *P. ochraceus* and *one Patiria miniata* were observed! Recruitment of warm water fish were abundant. Juvenile *Chromis punctipinnis* and *Oxyjulis californica* were abundant everywhere and in several juvenile size classes. Juvenile *Halichoeres semicinctus* were common to abundant with the most juveniles Kushner has ever seen anywhere at Keyhole. Juvenile *Hypsypops rubicundus* less than 7 cm were the most abundant Kushner has ever seen. These were mostly in shallow of the site in less than 20 ft. depth at Keyhole and Goldfish Bowl. Kushner could have easily counted over a 100 per dive. The juvenile *Hypsypops rubicundus* were so dense, it was easy to observe interspecific competition/ aggression towards each other and these fish were already starting to set up territories at a small age. These four species of fish were so abundant size cohorts in the future will be expected. Juvenile Kelp bass were also abundant at several of the sites. Juvenile *Semicossyphus pulcher* were common, but not particularly abundant. No sea star wasting disease was observed, but virtually no sea stars were observed.

10/3/14, Monocos/Lady Cove

Several *Pisaster ochraceus* were observed- several together. There were a few lobsters around. At Lady's cove we observed at least 10 large red abalone >140 cm, and over 40 black abalone. Water

was clear and 67^0F. Just about ½ miles off the west end of Santa Cruz Island we observed a hammerhead shark on the surface. It was estimated at about 7ft long.

David Kushner Personal Trip

10/10/14, North side of West Anacapa Island

An unidentified smaller sea turtle was observed. Also in the area near the Pelican closure, extremely high abundances of small (typically less than 25 cm) Sargassum horneri were observed. This alga covers large areas at 100% cover in some places. Many of the plants had air bladders but reproductive plants were rare. This was the most abundant we have ever observed this alga. Kushner also observed the highest abundances of juvenile garibaldi and rock wrasse he has ever observed with hundreds being observed on a dive. Juvenile senorita and *Chromis punctipinnis* were also very abundant. Juvenile sheephead were common and there seemed to be more than we have observed during earlier regular KFM sampling dates so this recruitment may have just started. Juvenile kelp bass were moderately abundant. One large finescale triggerfish was observed at a depth of about 8 meters.

Submerged Resource Center Photography Cruise

10/28/14, Black Seabass Reef, Anacapa Island

The kelp had significantly been reduced and there were fewer fish mainly kelp bass and juvenile senoritas. Juvenile garibaldi were common, more juvenile sheephead were more abundant than over last visits. Juvenile rock wrasses were abundant.

Sargassum horneri had grown to about 35 cm and had more air bladders (twice the size it was 3 weeks ago) a few plants were just beginning to become reproductive. *Ophiothrix spiculata* had declined especially where *S. horneri* were present, but most in the low lying areas. There were medium sized patches of bare sand/cobble.

10/28/14, Pelican Closure, Anacapa Island

There was an area where Kushner dove personally about two weeks ago. In this area at 30-60 feet along the offshore slope there were an abundance of large kelp bass. Sargassum horneri is abundant, the most abundant algae in shallow. Large solid patches of Sargassum muticum were also present (2-3 meter depth). One area in shallow had an abundance of black abalone (~100+ larger animals) some seemed a bit shrunken, but no fresh shells were found.

Juvenile garibaldi were extremely abundant and one could ‘likely’ count over 100 on a dive. They were aggressive to each other. Juvenile rock wrasses were also extremely abundant, like garibaldi, more than Kushner has ever observed. Juvenile senoritas and blacksmith were abundant and juvenile sheephead and kelp bass were moderately abundant.

10/28/14, Rat Rock, Anacapa Island

We made a photo dive here. Juvenile senoritas, blacksmith and garibaldi were moderately abundant.

10/29/14, Pelagophycus porra forest, Santa Cruz Island

There were no *Macrocystis pyrifera* and this was a solid *Pelagophycus porra* forest. The site was excellent white abalone habitat, but I did not get a chance to look around. One fresh *H. assimilis* shell was found.

10/29/14, East of Gull Island, Santa Cruz Island

Large lobsters were common but not as abundant as Kushner expected. Juvenile senoritas were abundant. Juvenile blacksmith were moderately abundant and several juvenile sheephead were observed. With just a few minutes searching (due to large swell) we found seven live black abalone roughly 60-160 mm in size.

10/30/14, West of Bee Rock, Santa Rosa Island

This area had a thick kelp forest with decreased understory as a result. Several small fresh red abalone shells and one large live red abalone were found. Fish were moderately abundant.

10/30/14, Johnson's Lee South, Santa Rosa Island

At least four D*ermasterias* sp. were observed with wasting disease and about eight healthy ones were observed. Well over 12 *Patiria miniata* were observed with wasting disease. Approximately 15% of all the *P. miniata* had symptoms of the disease. Many also looked unhealthy.

10/31/14, Pelagophycus porra forest, Santa Cruz Island

There was a dense *Pelagophycus porra* forest and the lower lying areas were great white abalone habitat. Two live red abalones (one 45 mm and one 200 mm) were found. One live *H. assimilis* approximately 90 mm was found with the small red abalone under a 2 m x 1 m piece of stainless steel sheet metal that Kushner turned over. Stars were common, but seem to have been affected by wasting disease. Dive location: 33° 59.643 N, 119° 31.139 W. Drop off location: 33° 59.513 N, 119° 31.271 W.

Appendix K. 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 or completely absent due to senescence since the last recruitment event.

Aplysia vaccaria were observed at Fry's Harbor, Santa Cruz Island and Arch Point, Santa Barbara Island.

Several *Laminaria setchellii* were observed at Miracle Mile, San Miguel Island, as well as Chickasaw and Cluster Point, Santa Rosa Island, this is typically a colder water alga and is relatively rare at San Miguel and Santa Rosa Islands.

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.

Skin ulcers, usually caused by the marine bacterium *Vibrio damsela*, were observed on several *Chromis punctipinnis* at Admiral's Reef, Anacapa Island. Possibly more than Kushner has ever observed. One *C. punctipinnis* was observed with skin ulcers at Keyhole, Anacapa Island. These skins ulcers are usually observed on a few *C. punctipinnis* at this particular site, especially during or after persistent warm water events.

On 6/10 at Southeast Reef, Santa Barbara Island, a new-looking 2 oz. fishing weight with monofilament line attached was found at the KFM site, indicating recent poaching activity in the MPA.

Notably few salps and jellyfish were observed. They were rare to non-existent most of the summer. Pyrosomes were present in small numbers much of the summer.

Large numbers of *Trachurus symmetricus* (Pacific jack mackerel) were observed at Anacapa, Santa Cruz, Santa Barbara, and Santa Rosa Islands. Several small size classes were observed early in the summer, then became larger towards end of summer. No sardines were observed all summer. A few small anchovies were observed. More anchovies were observed in Ventura Harbor in late summer. We observed Bonito and one Pacific halibut feeding on *T. symmetricus* from gut contents.

Appendix L. Temperature Data by Site

Figures L-1 through L-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 right graph displays temperature values for the current year compared to past years. Blue diamonds indicate the mean monthly temperatures for the current year. Violin plots indicate the distribution of all past years' monthly mean temperature values. 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.

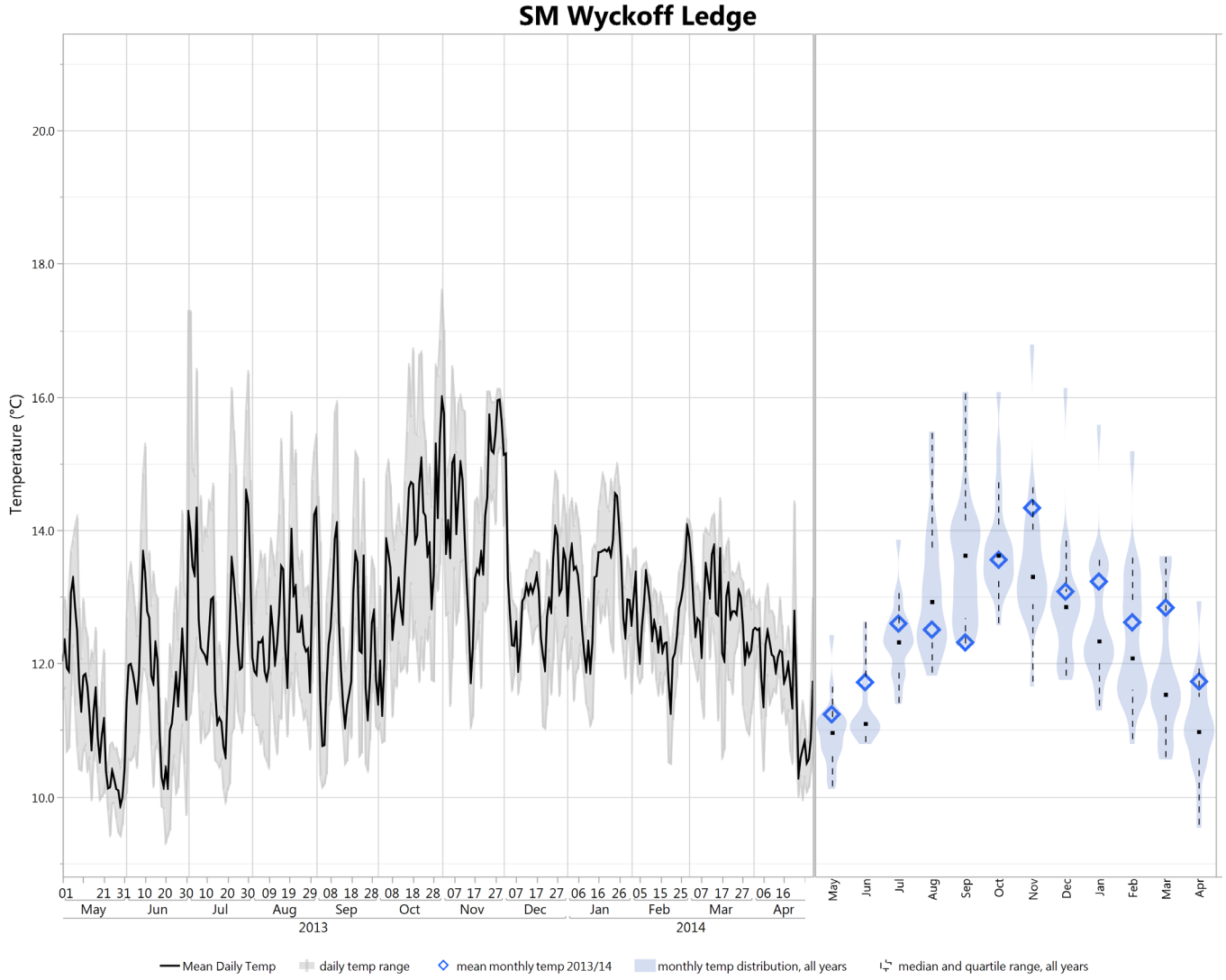


Figure L-1. Temperature at SM Wyckoff Ledge between May 2013 and April 2014 at Channel Islands National Park.

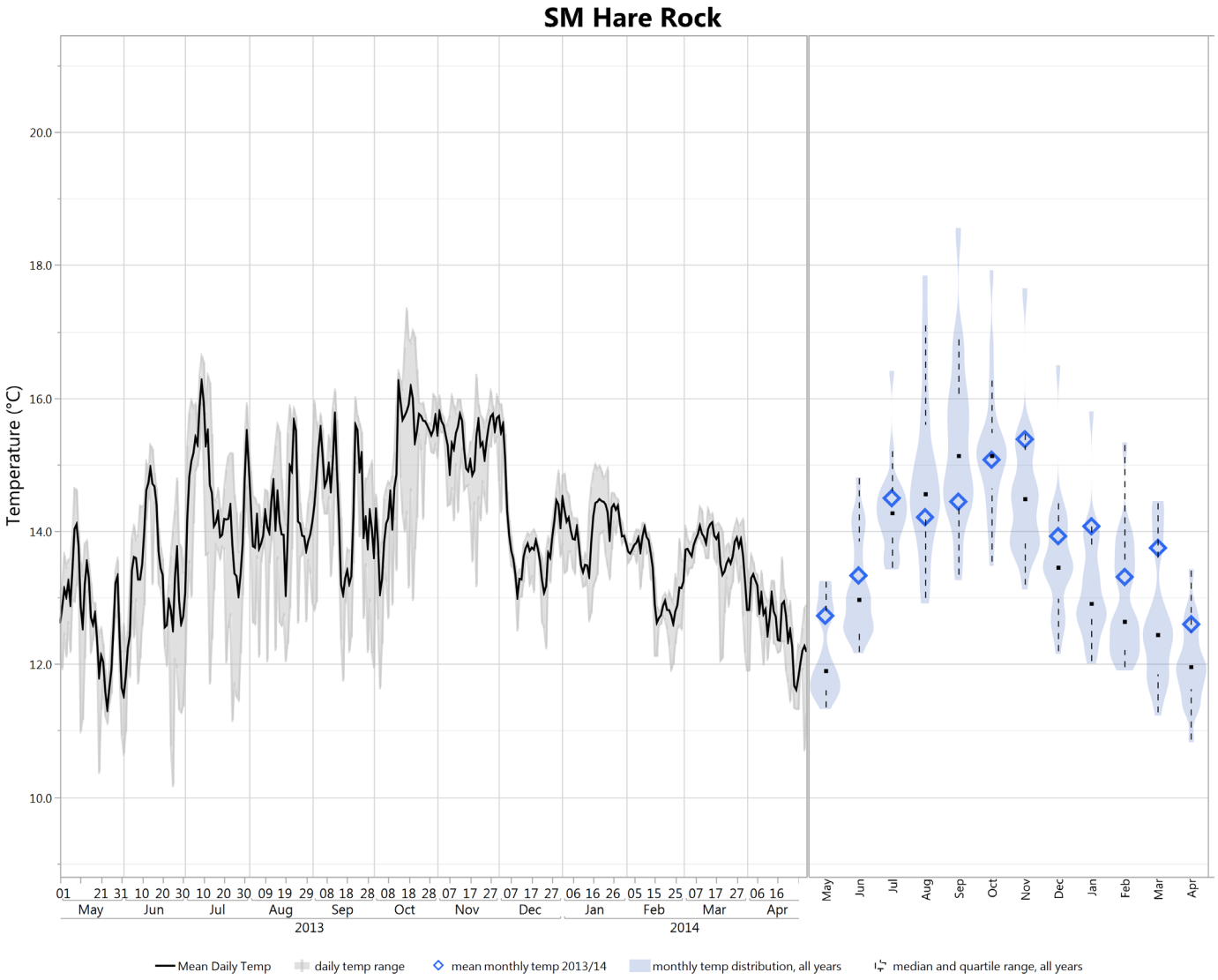


Figure L-2. Temperature at SM Hare Rock between May 2013 and April 2014 at Channel Islands National Park.

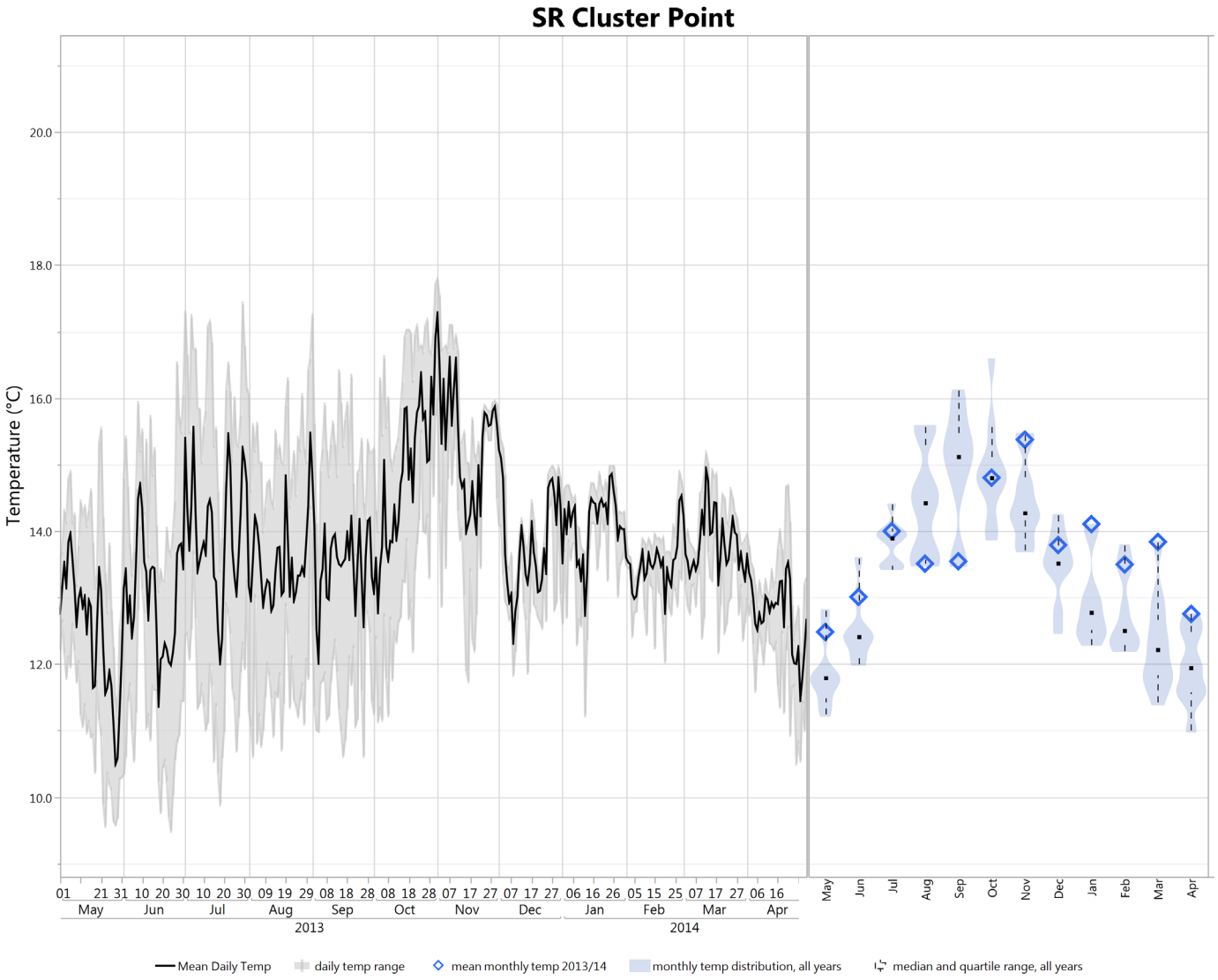


Figure L-3. Temperature at SR Cluster Point between May 2013 and April 2014 at Channel Islands National Park.

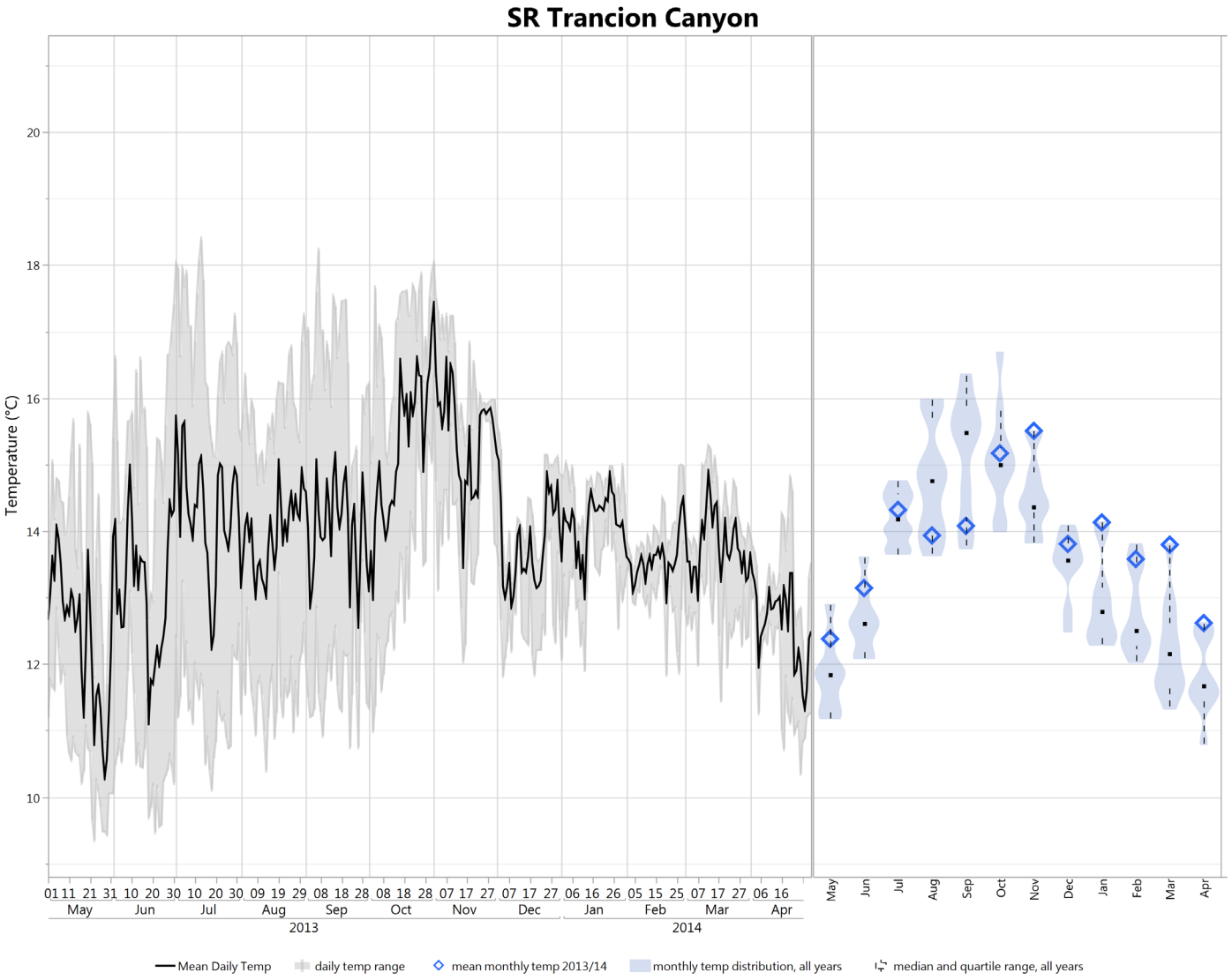


Figure L-4. Temperature at SR Trancion Canyon between May 2013 and April 2014 at Channel Islands National Park.

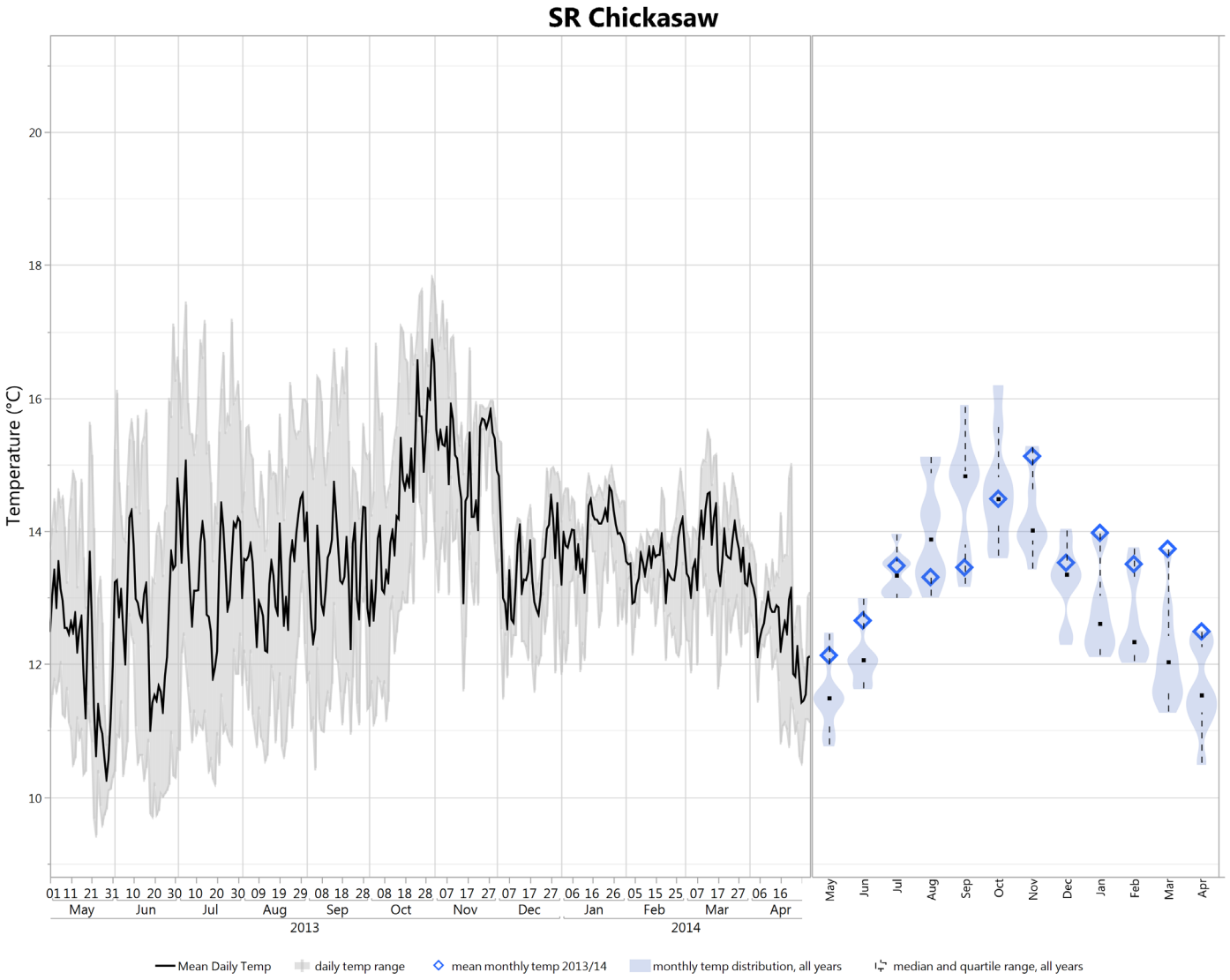


Figure L-5. Temperature at SR Chickasaw between May 2013 and April 2014 at Channel Islands National Park.

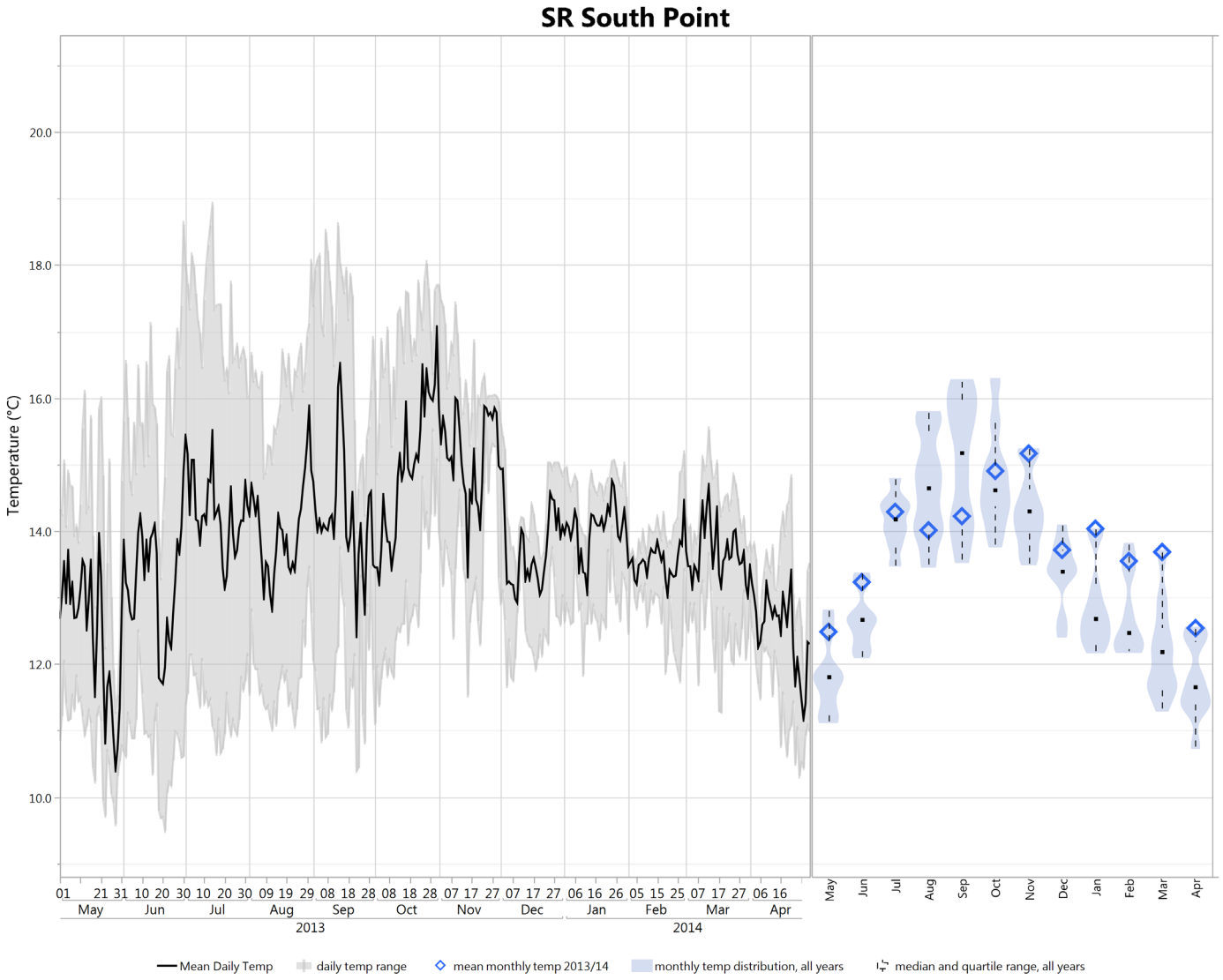


Figure L-6. Temperature at SR South Point between May 2013 and April 2014 at Channel Islands National Park.

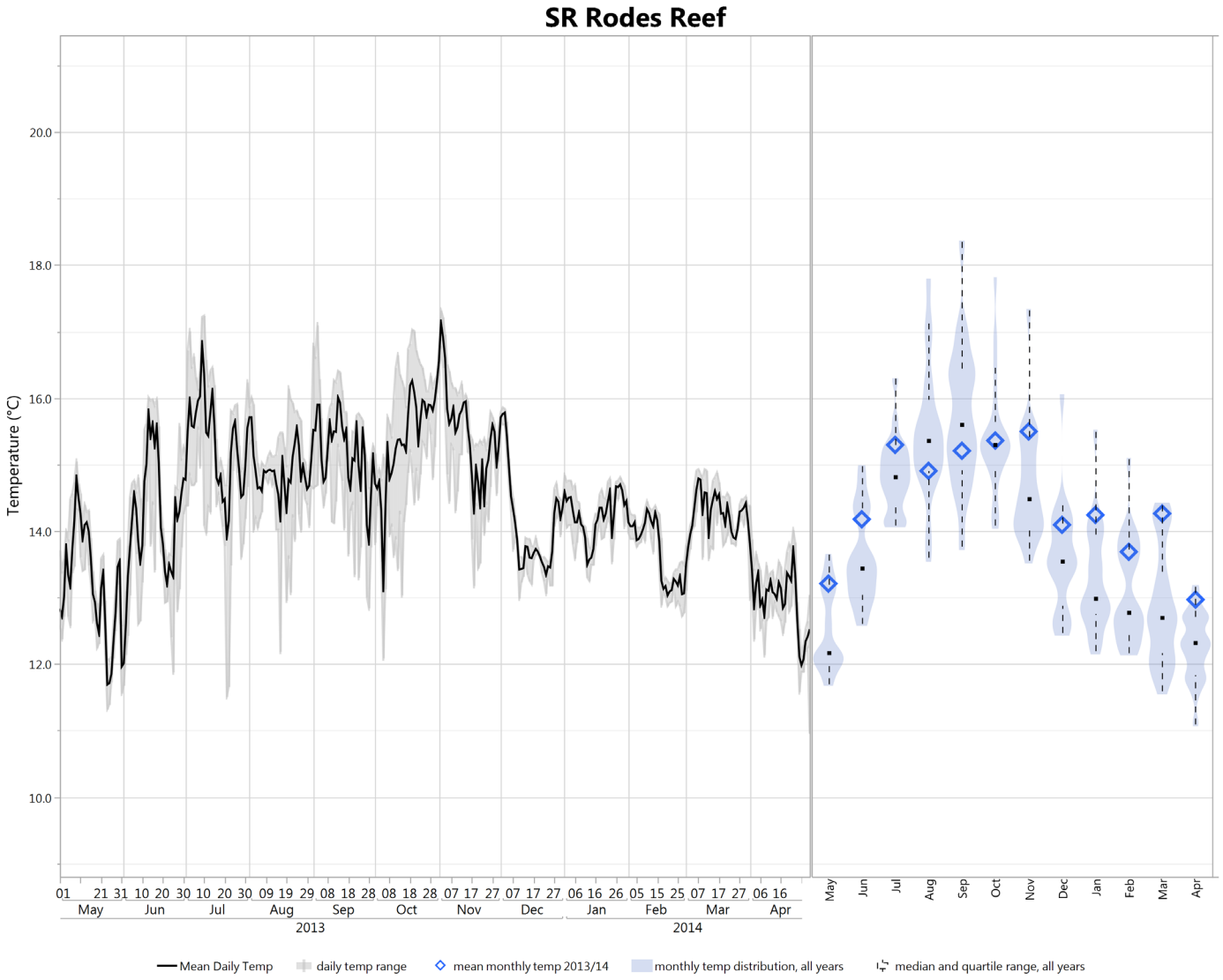


Figure L-7. Temperature at SR Rodes Reef between May 2013 and April 2014 at Channel Islands National Park.

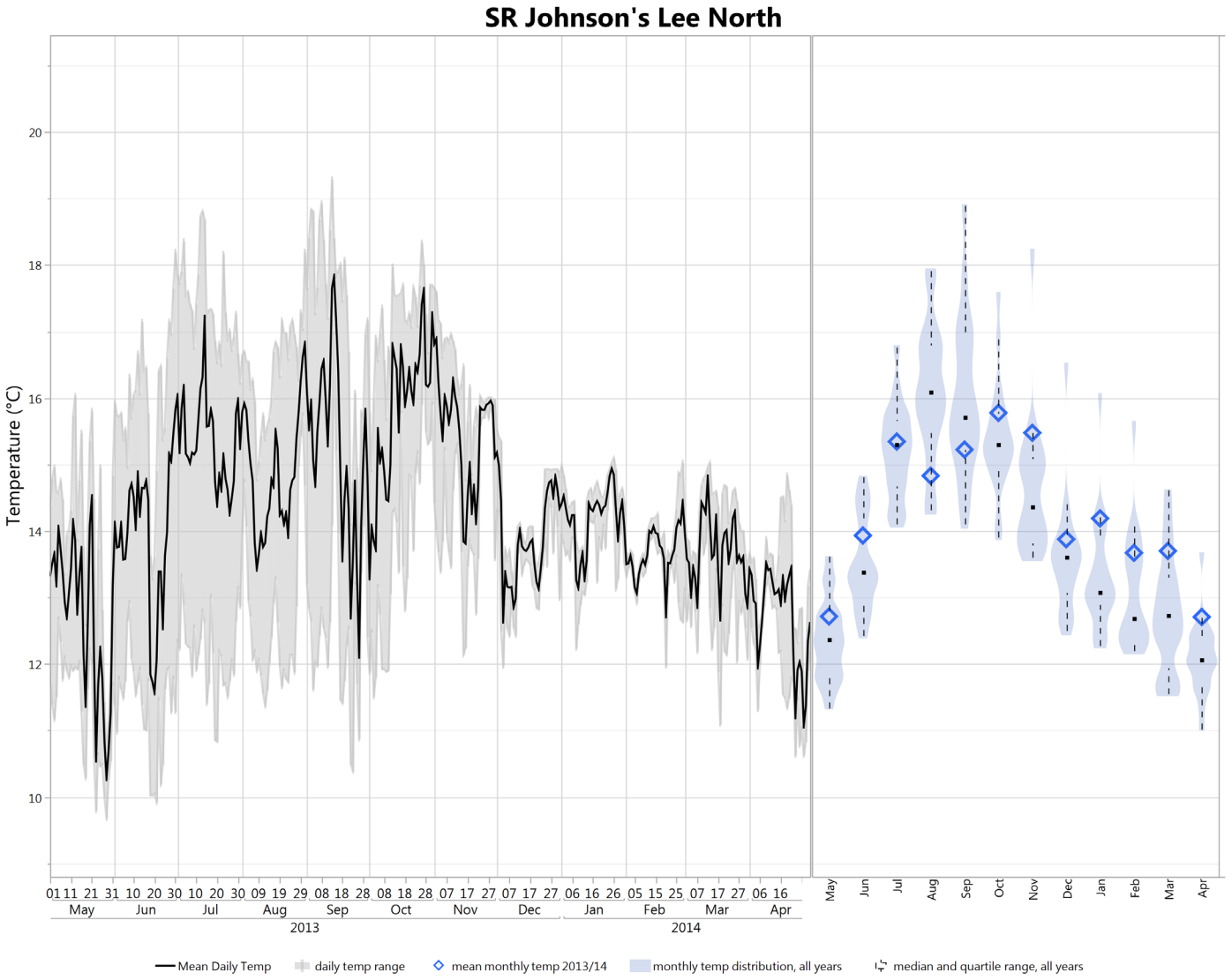


Figure L-8. Temperature at SR Johnson's Lee North between May 2013 and April 2014 at Channel Islands National Park.

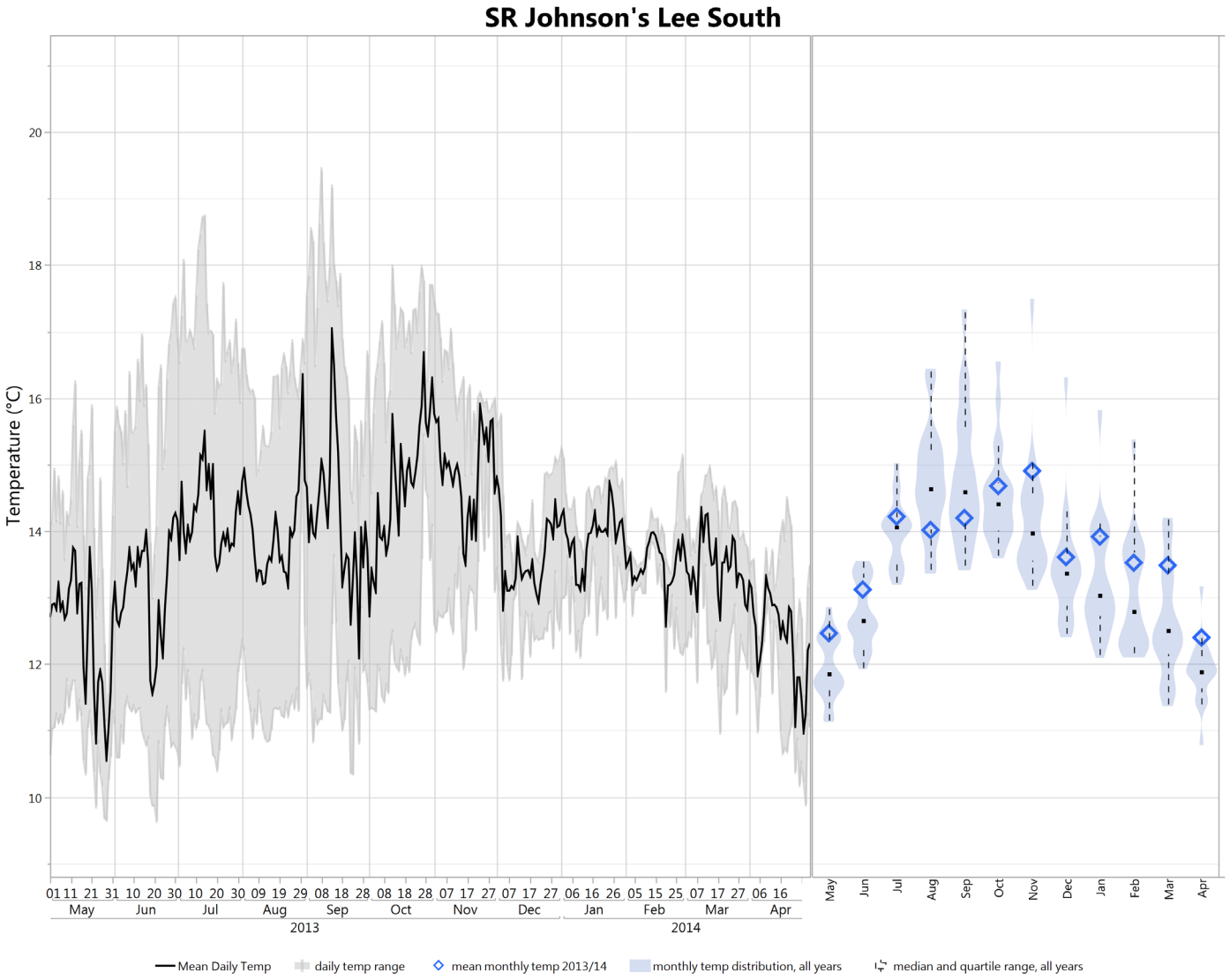


Figure L-9. Temperature at SR Johnson's Lee South between May 2013 and April 2014 at Channel Islands National Park.

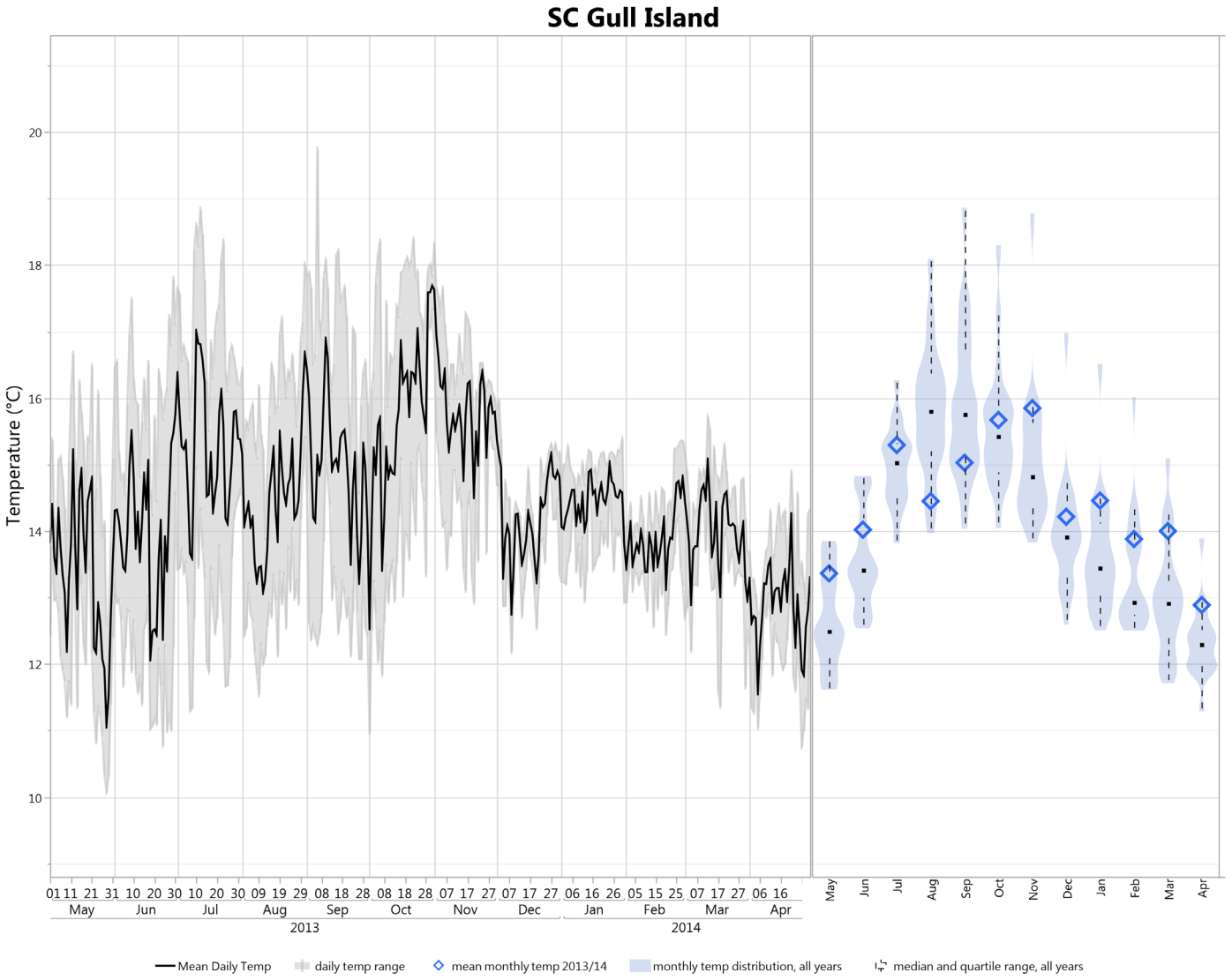


Figure L-10. Temperature at SC Gull Island between May 2013 and April 2014 at Channel Islands National Park.

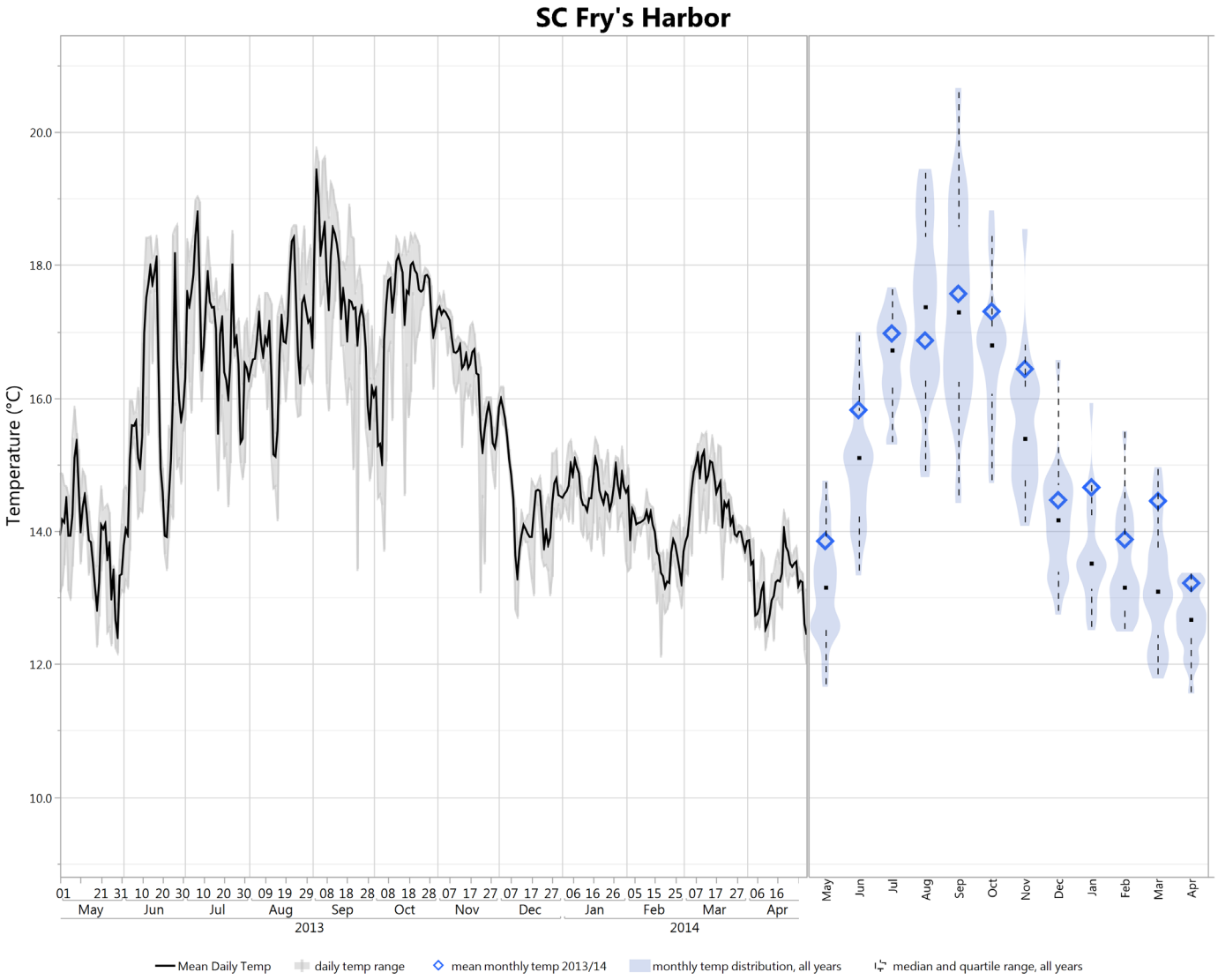


Figure L-11. Temperature at SC Fry's Harbor between May 2013 and April 2014 at Channel Islands National Park.

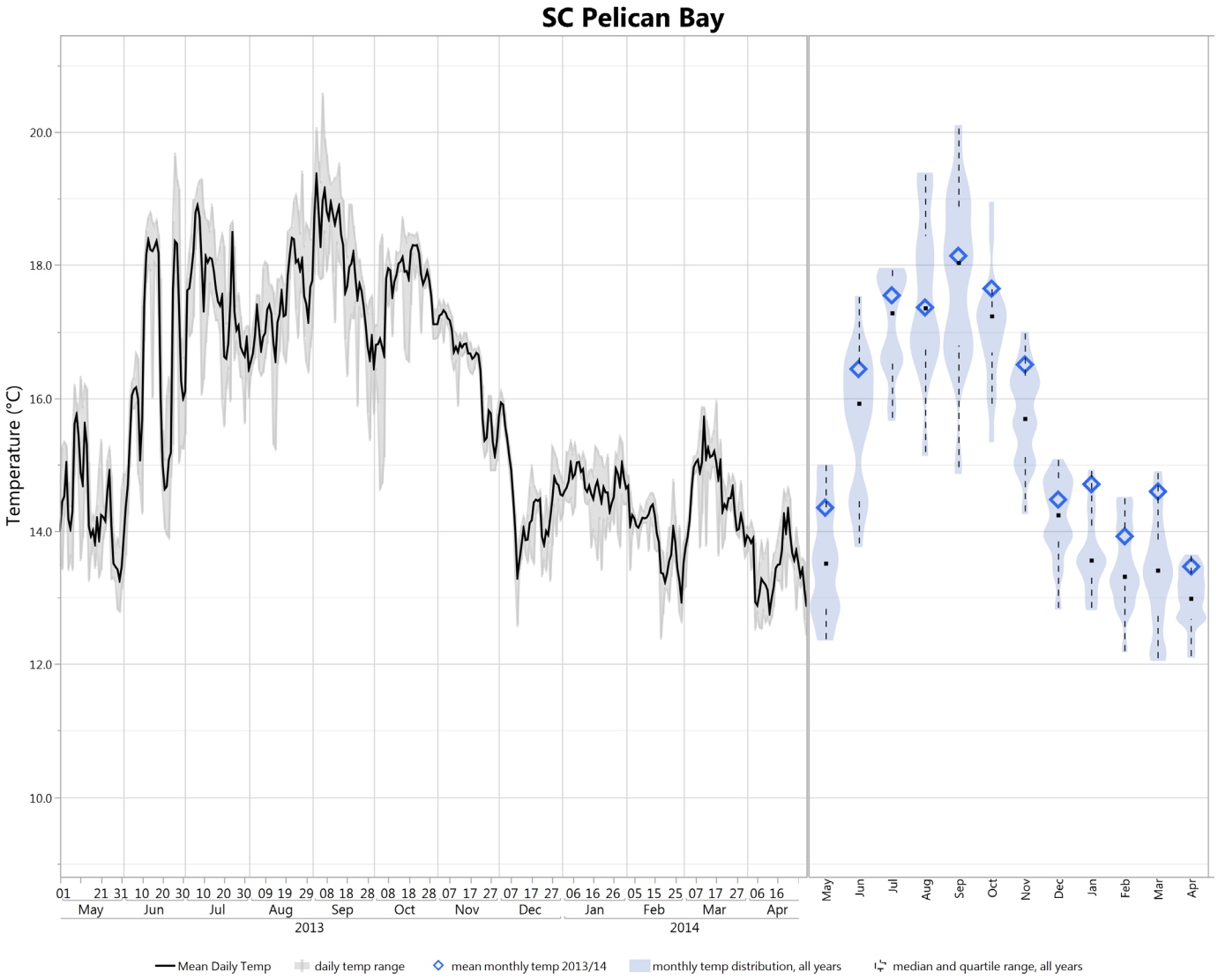


Figure L-12. Temperature at SC Pelican Bay between May 2013 and April 2014 at Channel Islands National Park.

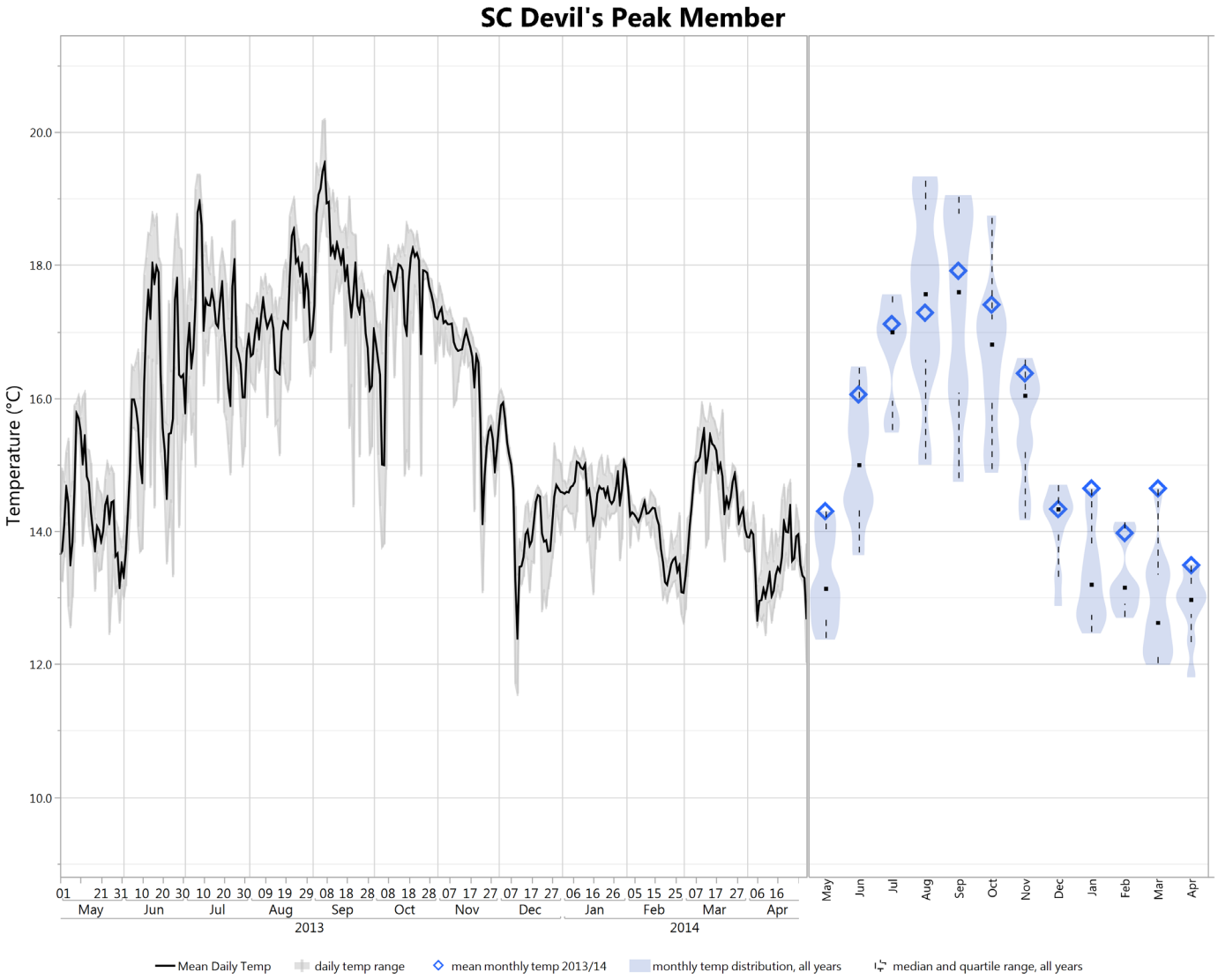


Figure L-13. Temperature at SC Devil's Peak Member between May 2013 and April 2014 at Channel Islands National Park.

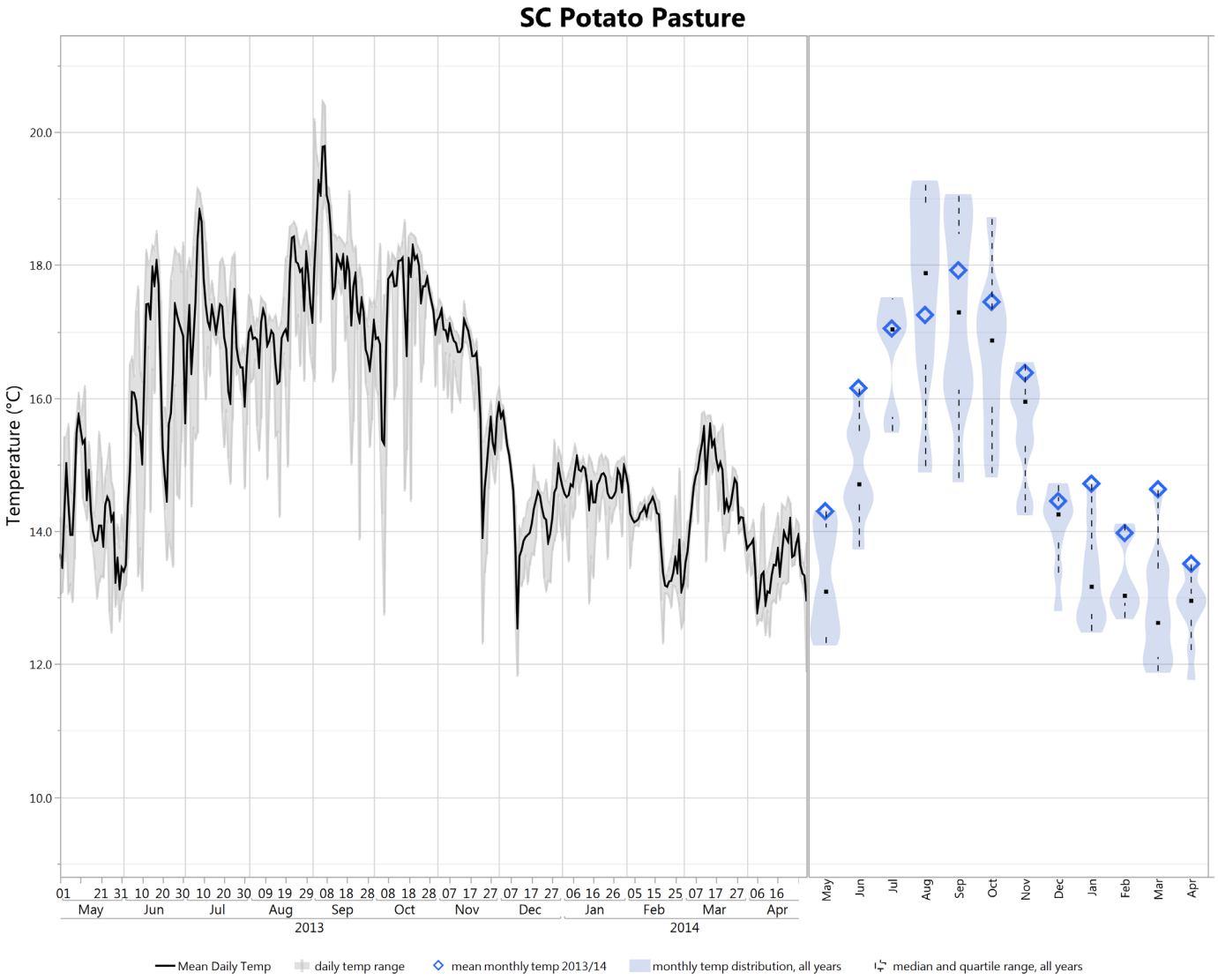


Figure L-14. Temperature at SC Potato Pasture between May 2013 and April 2014 at Channel Islands National Park.

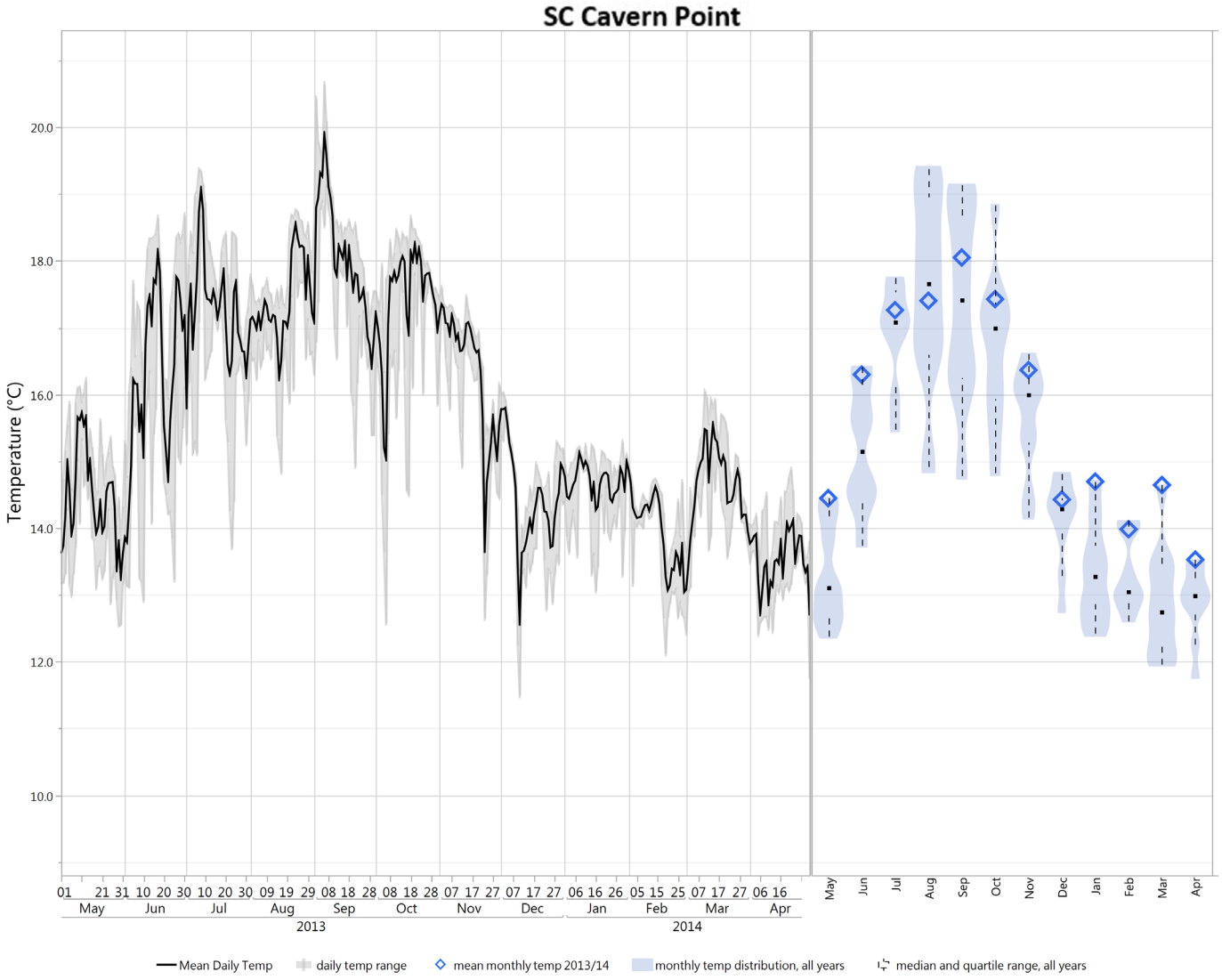


Figure L-15. Temperature at SC Cavern Point between May 2013 and April 2014 at Channel Islands National Park.

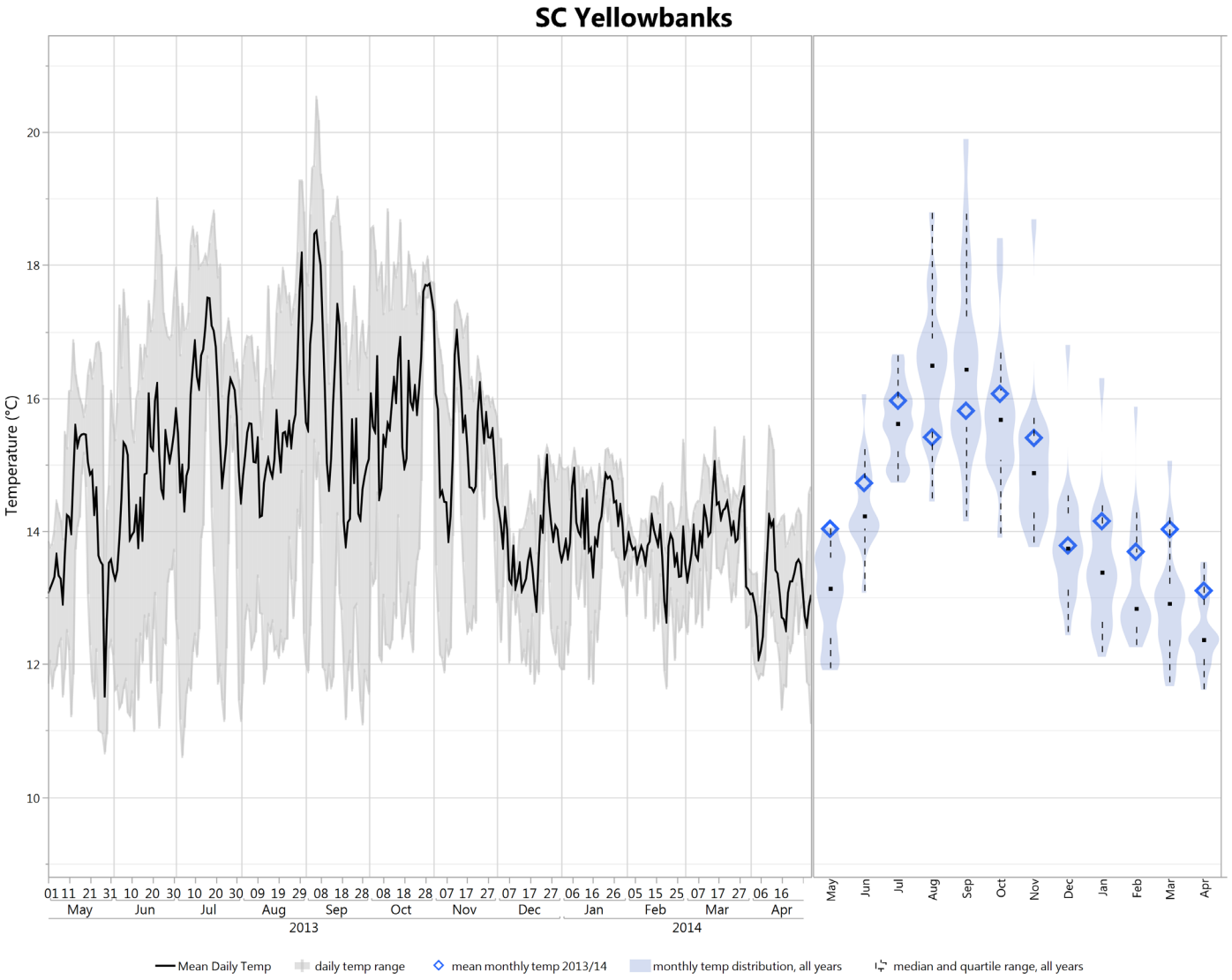


Figure L-16. Temperature at SC Yellowbanks between May 2013 and April 2014 at Channel Islands National Park.

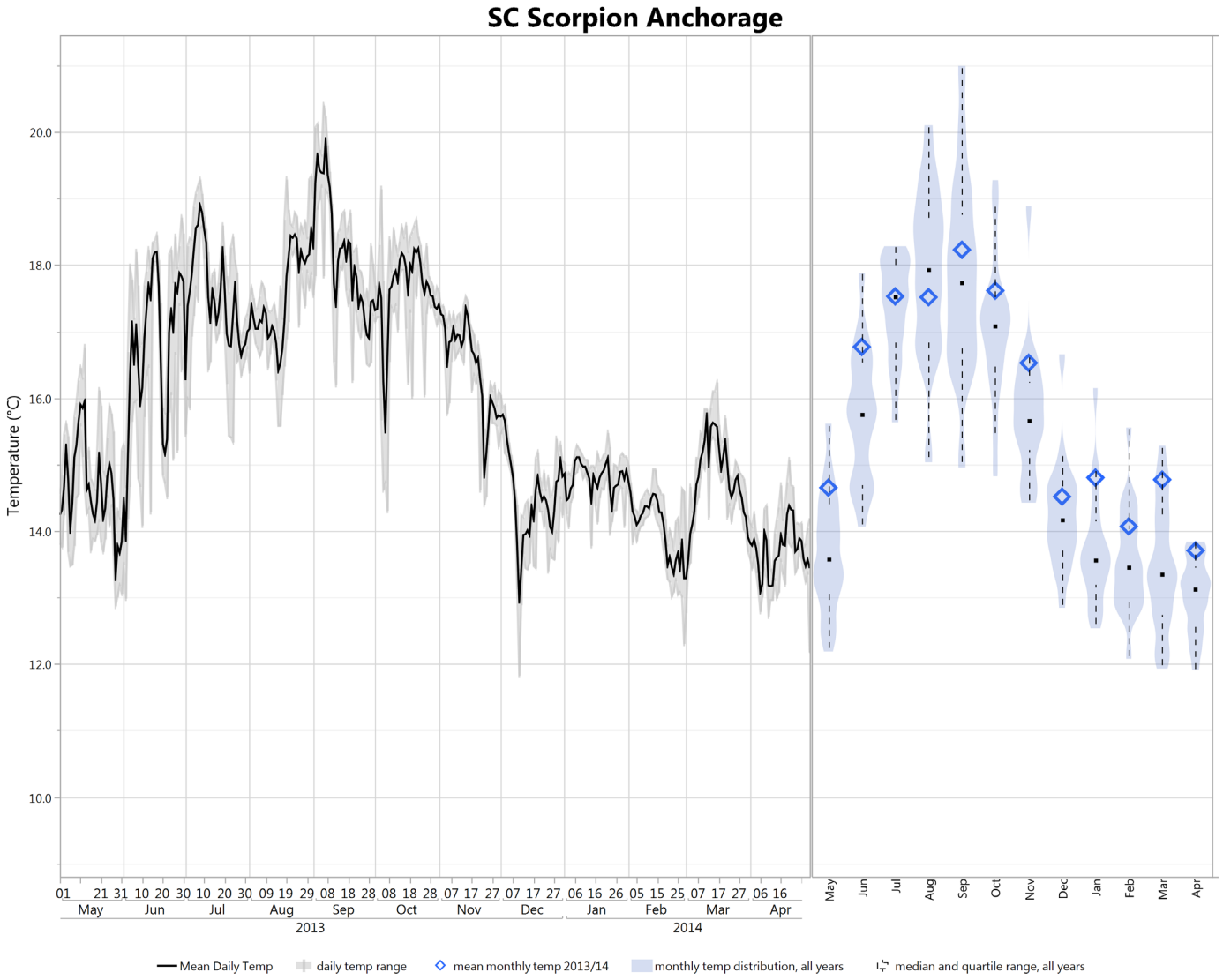


Figure L-17. Temperature at SC Scorpion Anchorage between May 2013 and April 2014 at Channel Islands National Park.

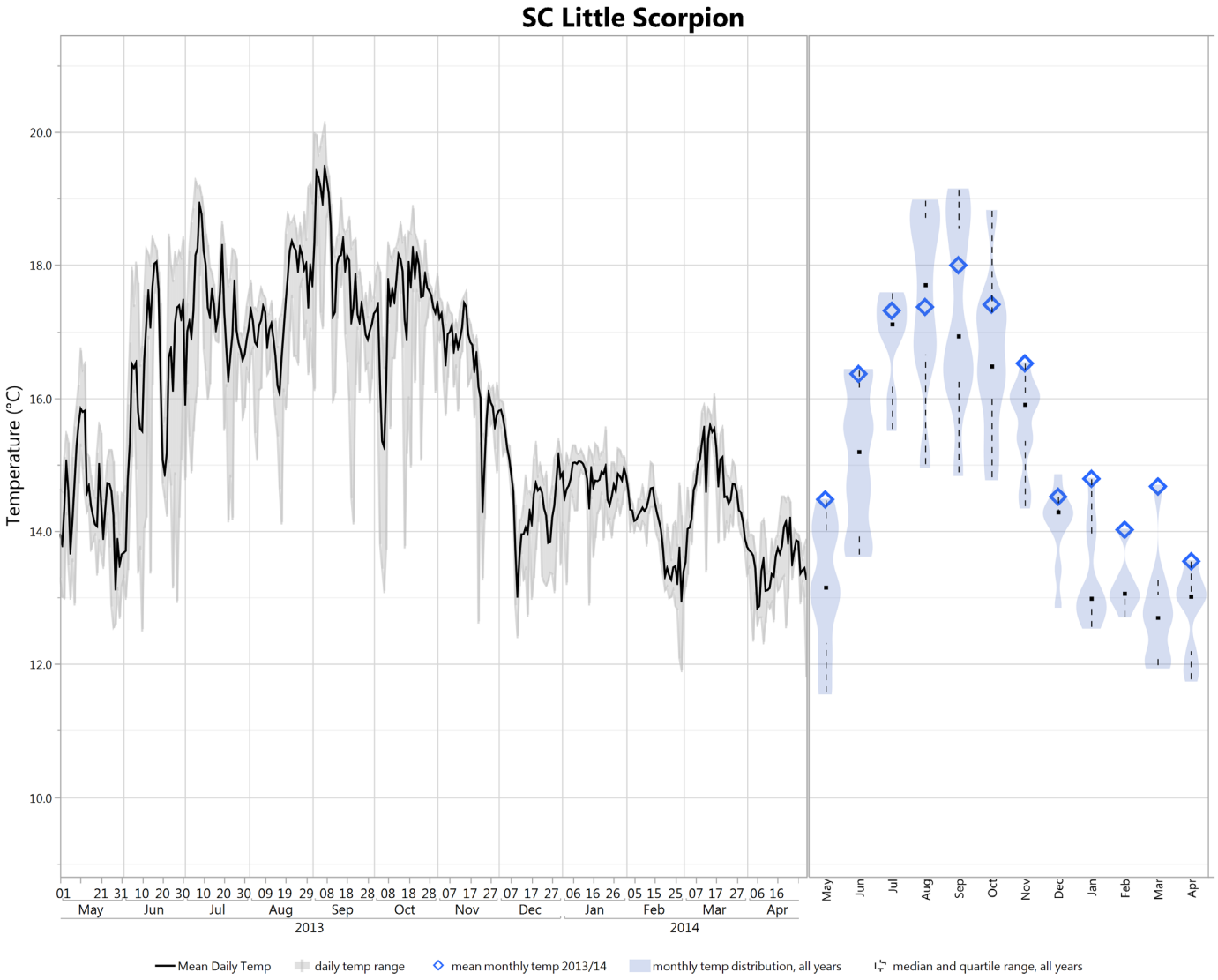


Figure L-18. Temperature at SC Little Scorpion between May 2013 and April 2014 at Channel Islands National Park.

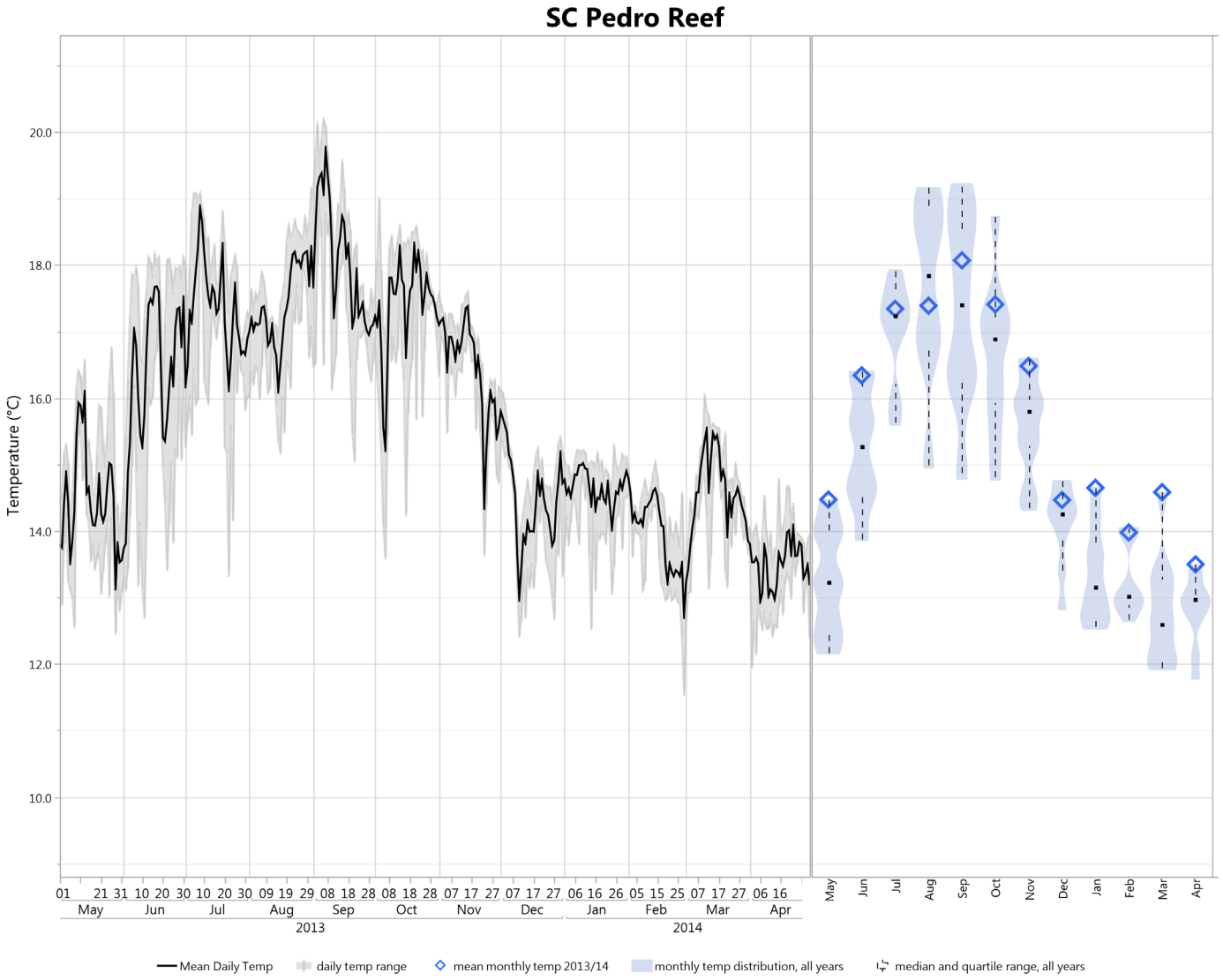


Figure L-19. Temperature at SC Pedro Reef between May 2013 and April 2014 at Channel Islands National Park.

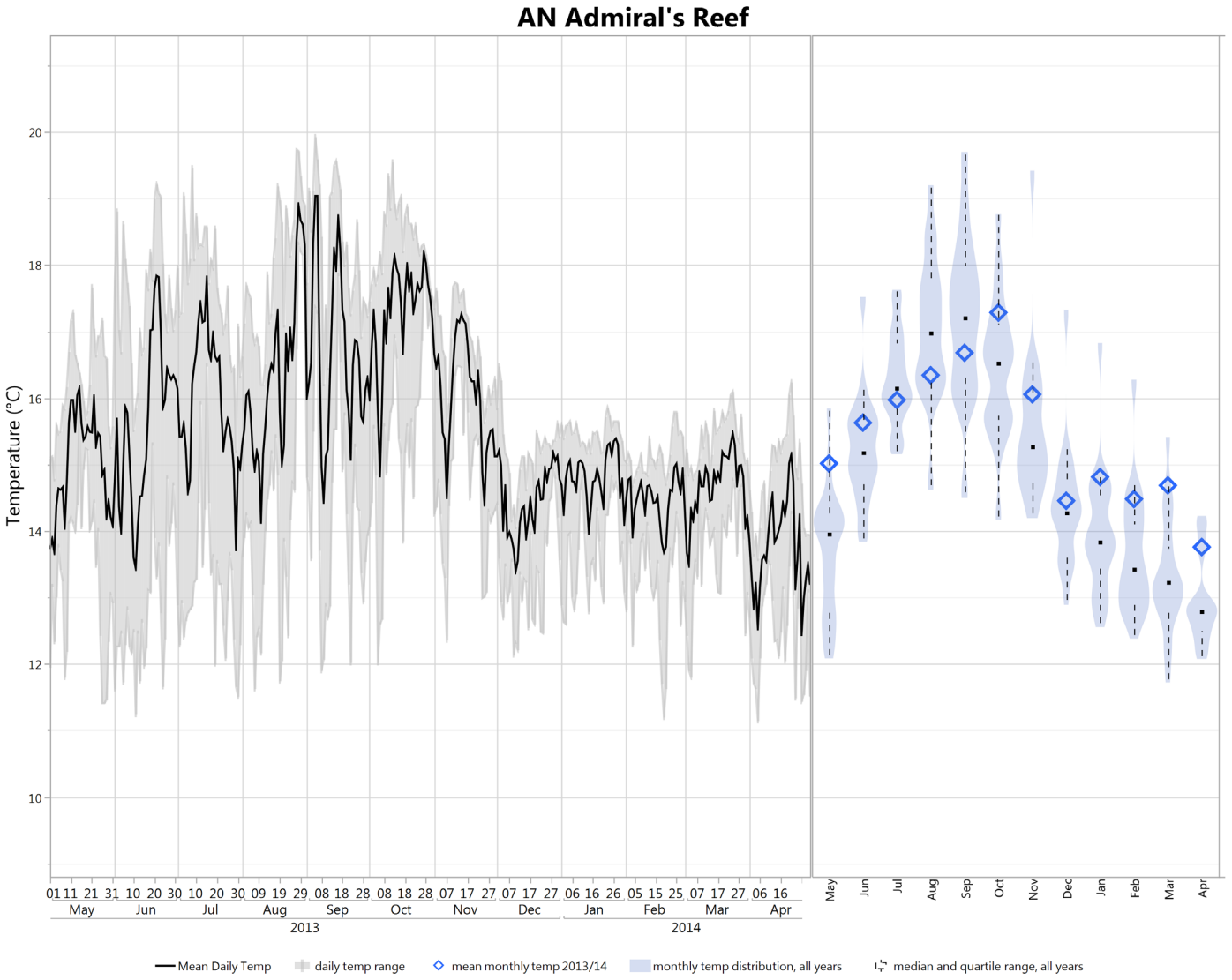


Figure L-20. Temperature at AN Admiral's Reef between May 2013 and April 2014 at Channel Islands National Park.

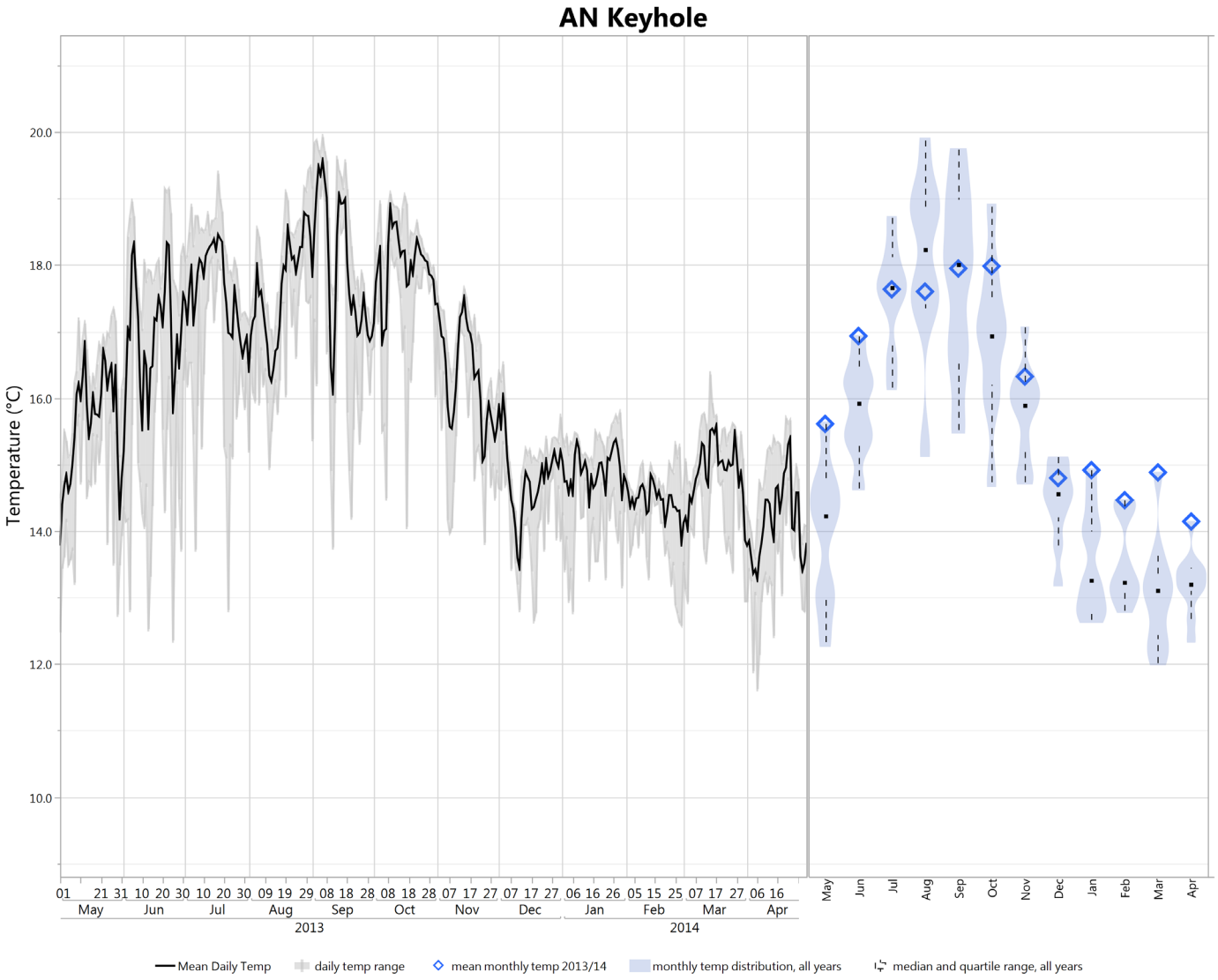


Figure L-21. Temperature at AN Keyhole between May 2013 and April 2014 at Channel Islands National Park.

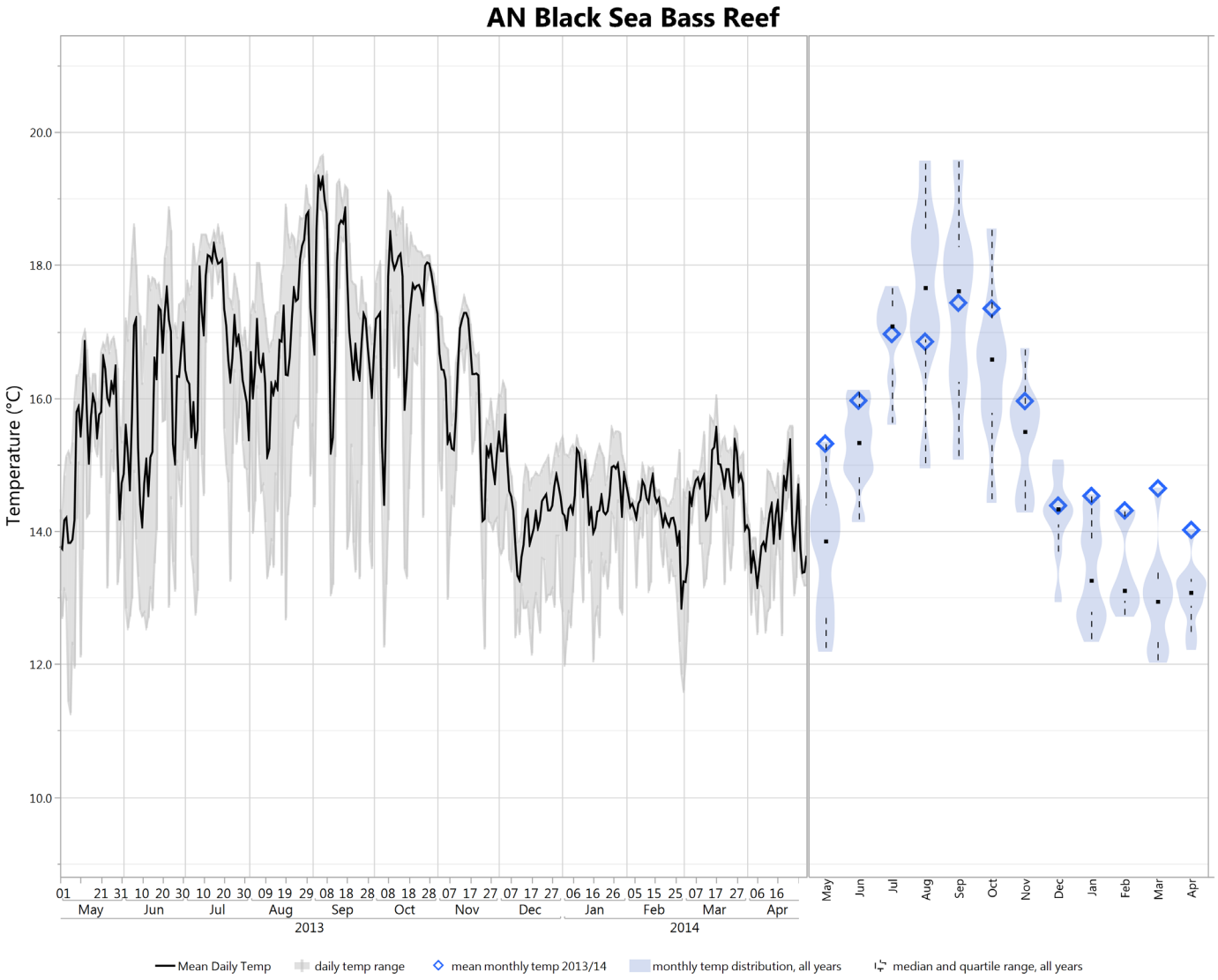


Figure L-22. Temperature at AN Black Sea Bass Reef between May 2013 and April 2014 at Channel Islands National Park.

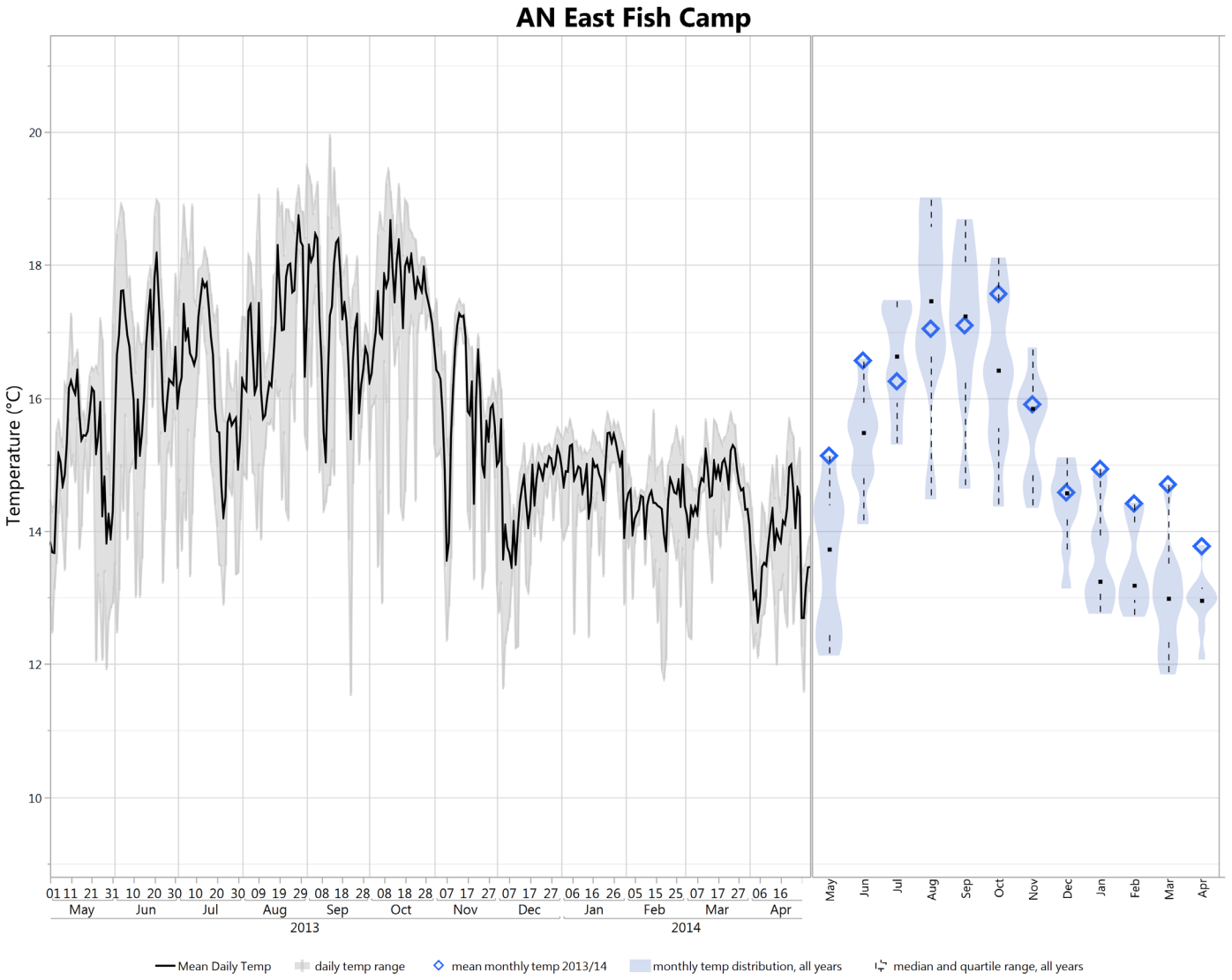


Figure L-23. Temperature at AN East Fish Camp between May 2013 and April 2014 at Channel Islands National Park.

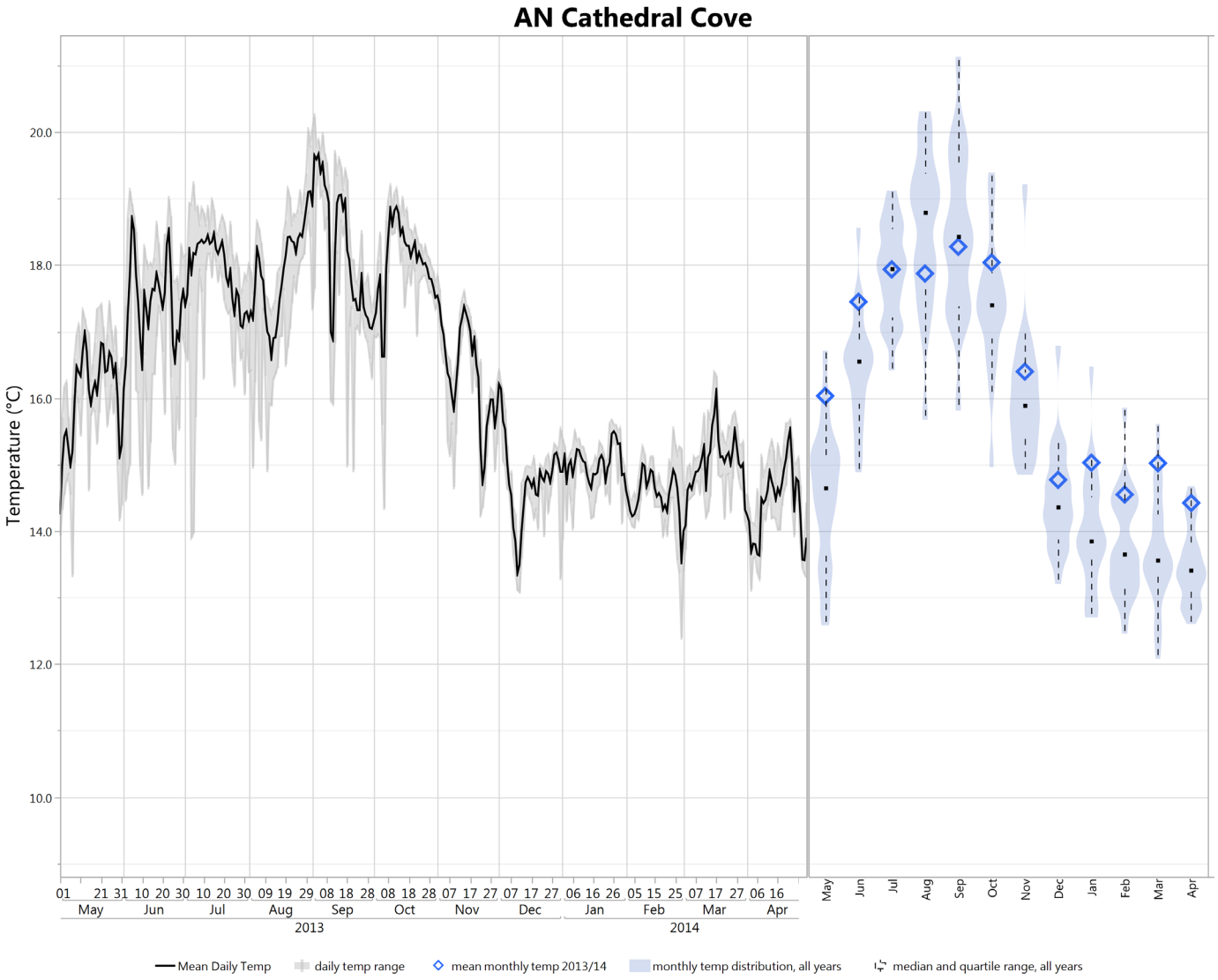


Figure L-24. Temperature at AN Cathedral Cove between May 2013 and April 2014 at Channel Islands National Park.

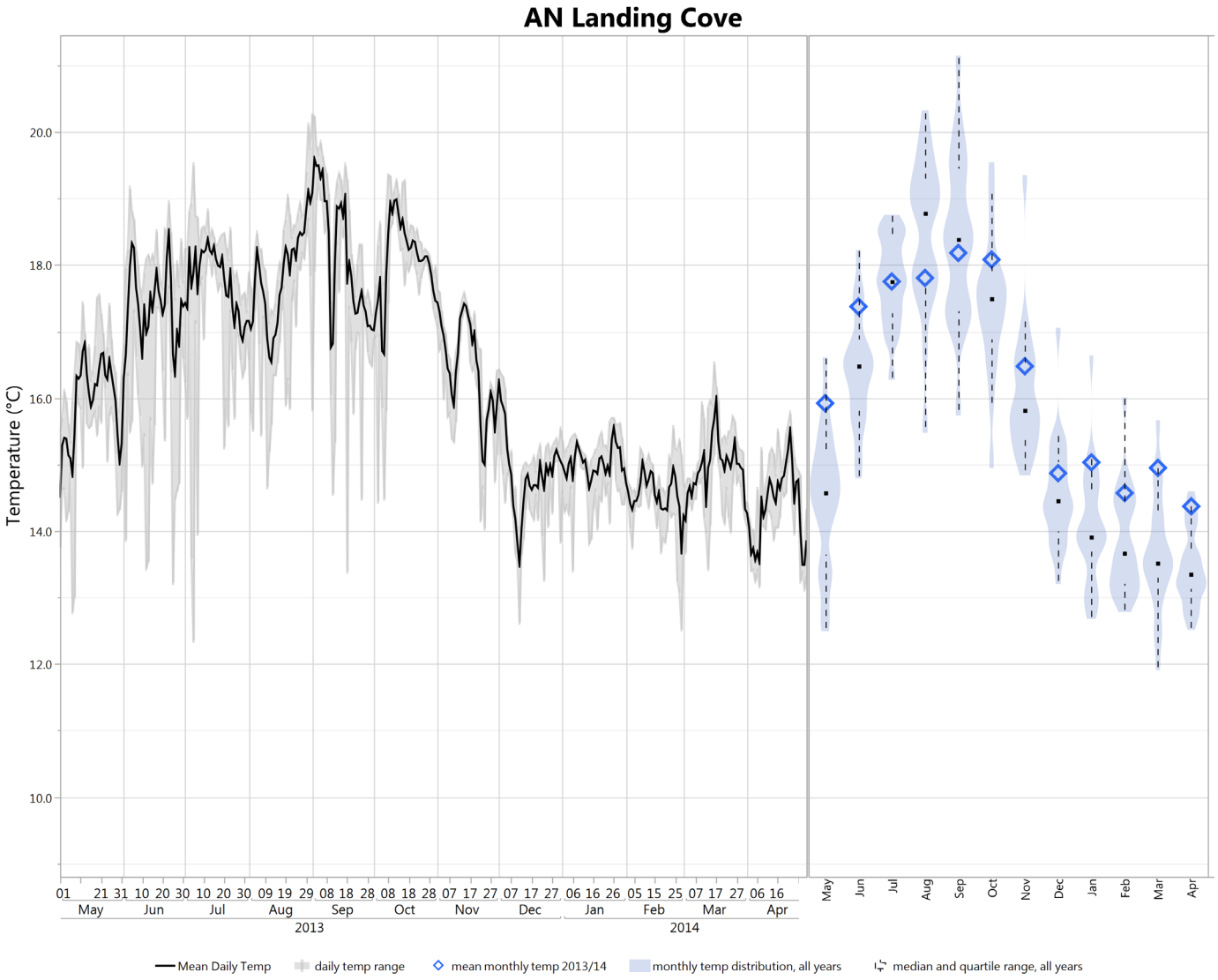


Figure L-25. Temperature at AN Landing Cove between May 2013 and April 2014 at Channel Islands National Park.

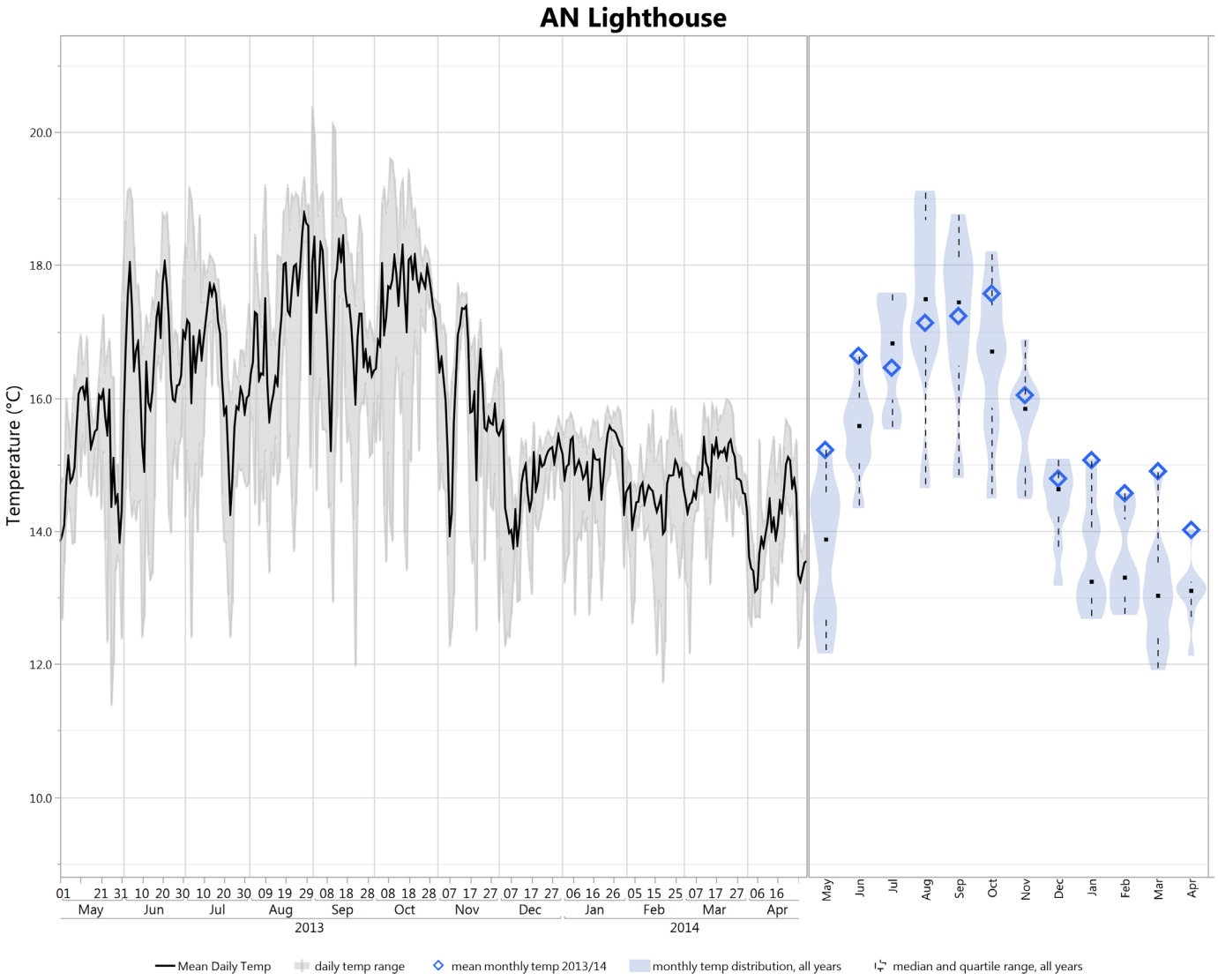


Figure L-26. Temperature at AN Lighthouse between May 2013 and April 2014 at Channel Islands National Park.

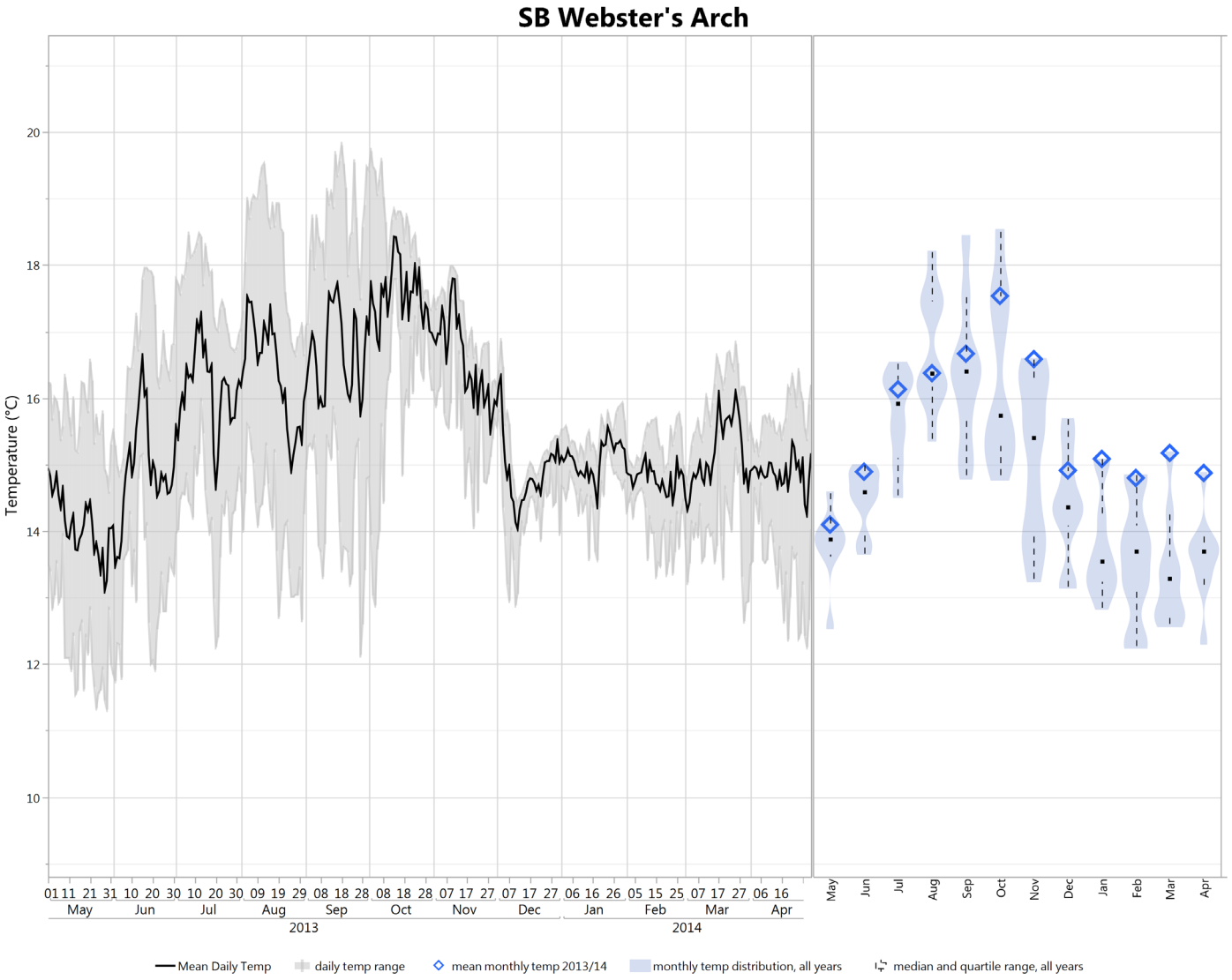


Figure L-27. Temperature at SB Webster's Arch between May 2013 and April 2014 at Channel Islands National Park.

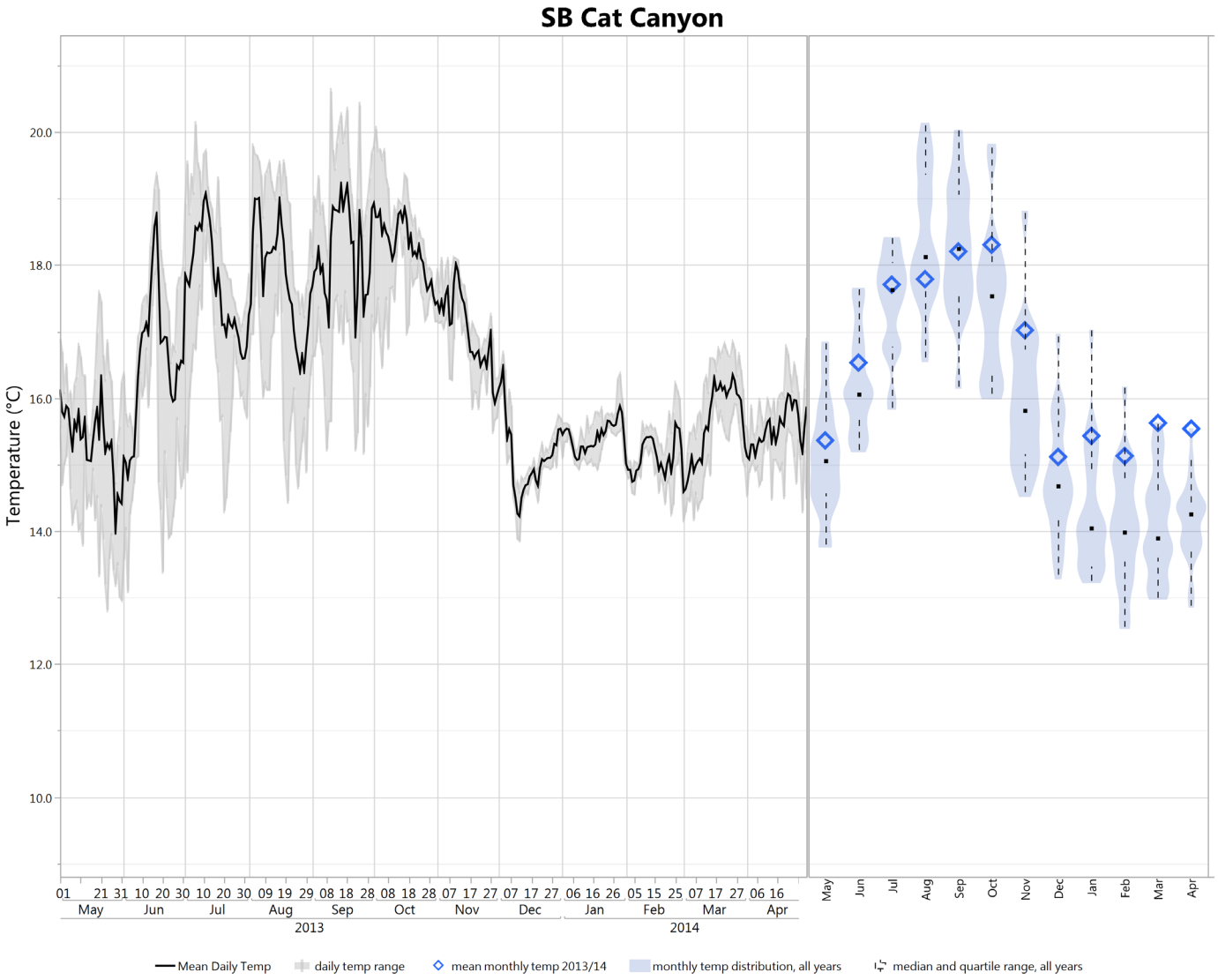


Figure L-28. Temperature at SB Cat Canyon between May 2013 and April 2014 at Channel Islands National Park.

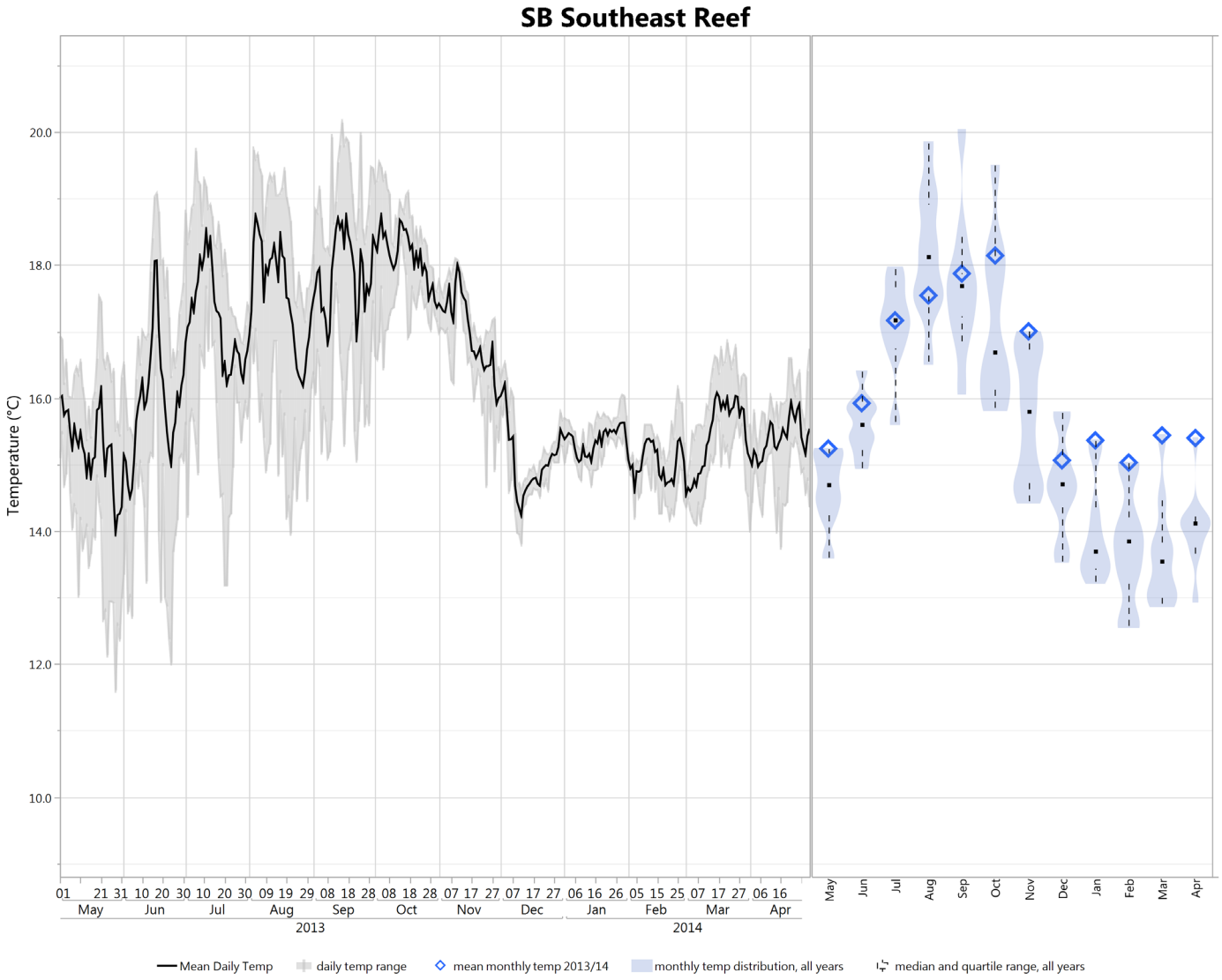


Figure L-29. Temperature at SB Southeast Reef between May 2013 and April 2014 at Channel Islands National Park.

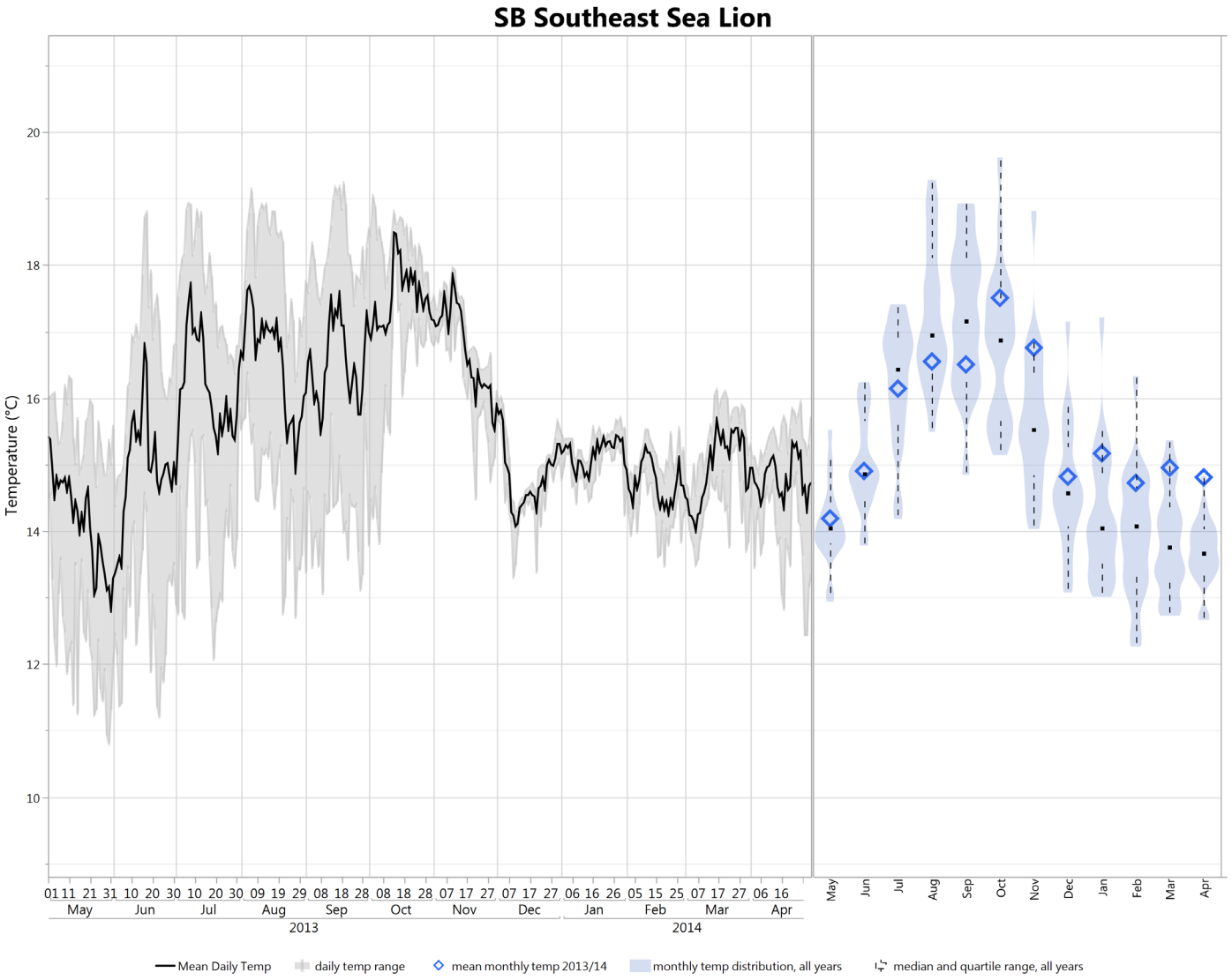


Figure L-30. Temperature at SB Southeast Sea Lion between May 2013 and April 2014 at Channel Islands National Park.

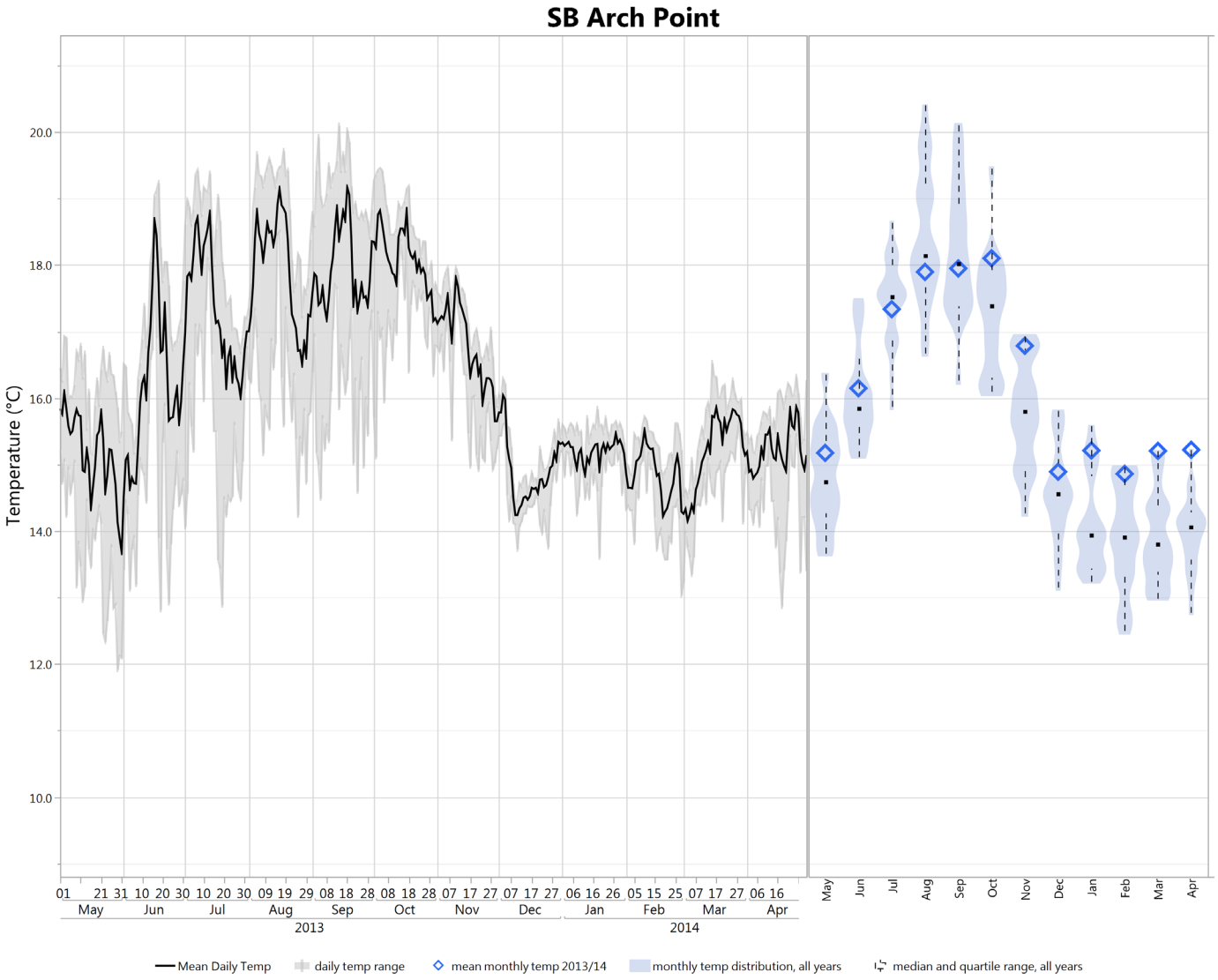


Figure L-31. Temperature at SB Arch Point between May 2013 and April 2014 at Channel Islands National Park.

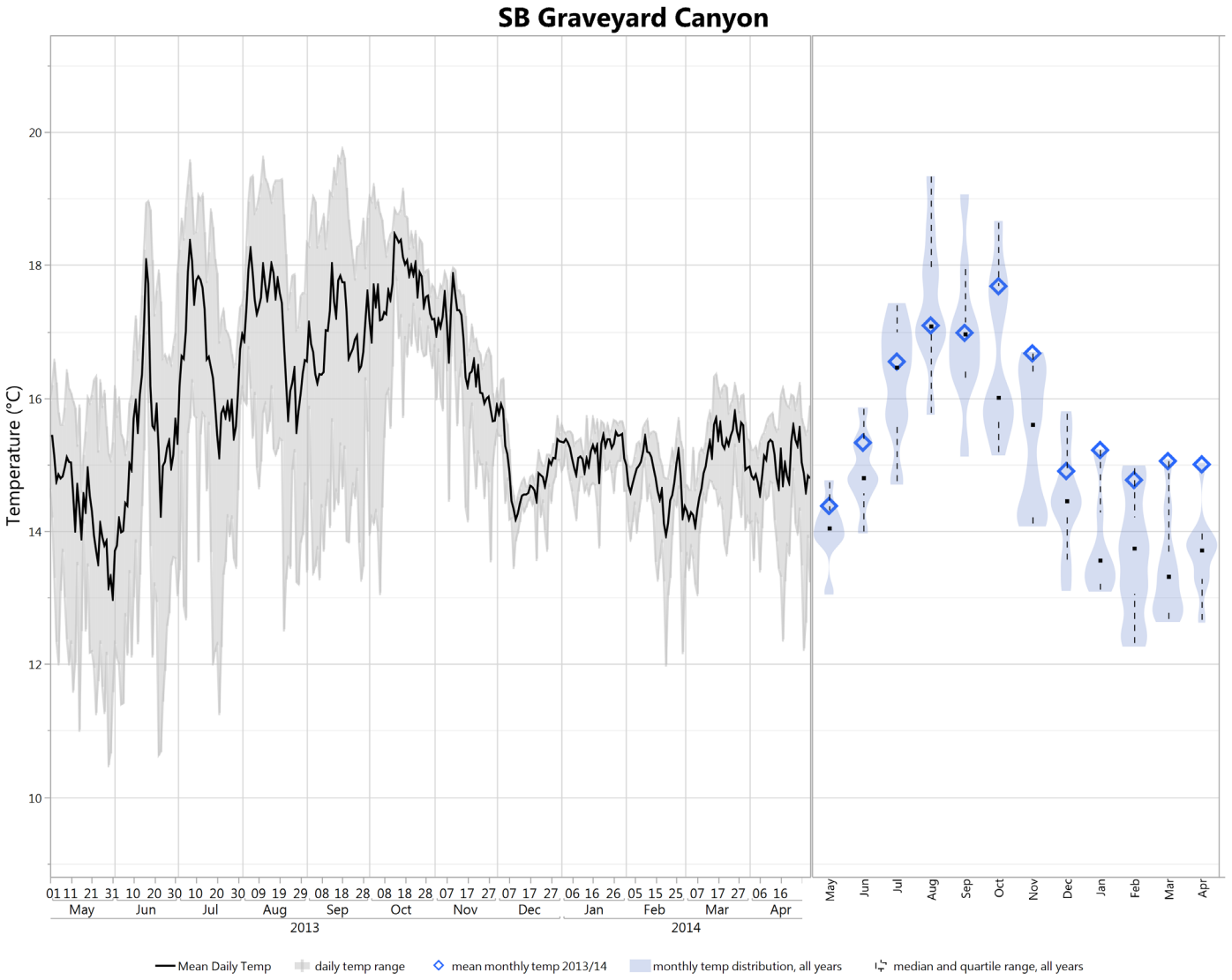


Figure L-32. Temperature at SB Graveyard Canyon between May 2013 and April 2014 at Channel Islands National Park.

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

NPS 159/182965, August 2022



Natural Resource Stewardship and Science
1201 Oakridge Drive, Suite 150
Fort Collins, CO 80525