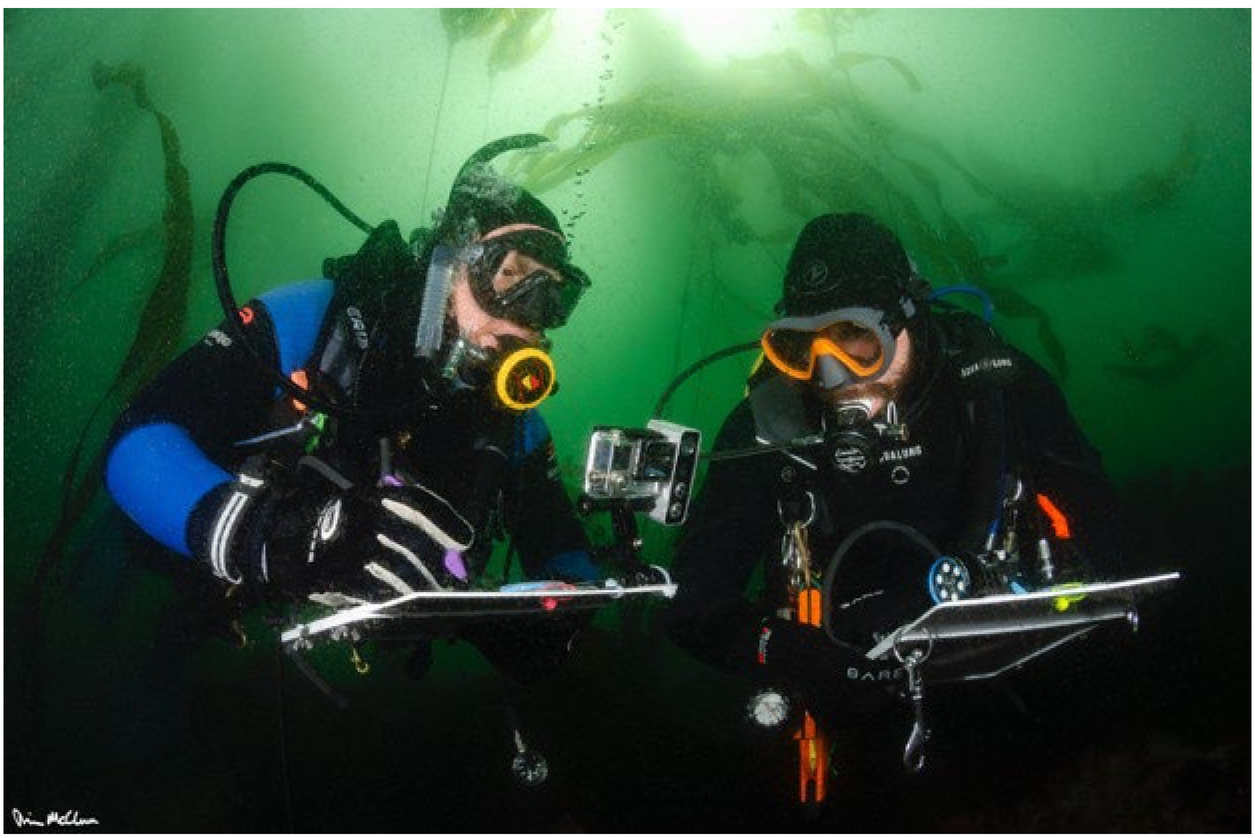
Reef Check Washington Report:

The State of Kelp Forests in Puget Sound 2023-25



Final Report
To: Department of Ecology

Community Science-Based Subtidal Kelp Forest Monitoring in the Salish Sea

Agreement No. OTGP-2023-ReChFo-00032

Jan Freiwald, Jackie Selbitschka, Dan Abbott
Reef Check Foundation
June 2025

Acknowledgments

We would like to extend a huge thank you to the Reef Check volunteers who donate their time and resources to help collect this vital data on our Puget Sound's kelp forests. We would also like to thank the funder of this work.

This grant (OTGP-2023-ReChFo-00032) was supported with funding from Washington's Climate Commitment Act. The CCA supports Washington's climate action efforts by putting cap-and-invest dollars to work reducing climate pollution, creating jobs, and improving public health. Information about the CCA is available at www.climate.wa.gov.

FUNDED BY WASHINGTON'S CLIMATE COMMITMENT ACT

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Introduction

Reef Check is a worldwide non-profit marine conservation organization that empowers local communities to monitor and manage reef health. Through rigorous, standardized training programs, Reef Check enables the collection of standardized reef health data on a global scale. To date, Reef Check has operated in over 100 countries, has 40 active chapters and a network of over 10,000 trained volunteers.

In 2005, Reef Check expanded its focus from tropical coral reefs to include temperate rocky reefs and kelp forests by launching the California monitoring program. The Reef Check kelp forest monitoring protocol (Freiwald et al., 2021) was developed by marine scientists to leverage trained volunteer divers in collecting standardized data on rocky reef and kelp forest communities. This citizen science approach provides the dual benefit of reducing research costs while increasing public awareness and engagement with ocean conservation.

Originally developed to monitor ecosystem changes in Marine Protected Areas (MPAs) in California, Reef Check's kelp forest monitoring program has since expanded due to its credibility and reputation for high-quality training and data collection (Freiwald et al., 2013, Freiwald et al., 2015, Freiwald et al., 2017). In addition, its education and outreach programs have built a dedicated constituency of skilled SCUBA divers, and its data are now widely used to support marine management and conservation efforts. The Reef Check Kelp Forest Program now includes chapters in Baja California, California, Oregon, and Washington (Figure 1), with monitoring data utilized by scientists, state agencies, and federal institutions. Notably, Reef Check data have played a vital role in informing some of the earliest kelp forest restoration projects in the wake of the marine heat wave and spread of urchin barrens over the last decade (Ward et al., 2022). For more information on how Reef Check data has been used, visit the publications page on the Reef Check website.

In addition to the expansion of monitoring projects across the West Coast, Reef Check has also started a successful education program, its Dive into Science program, in 2019. The goal of this program is to increase diversity in the sciences through training participants from underserved and tribal communities in scuba diving to be citizen scientists.

In this report, we focus on data from the Reef Check Washington program, present an update on the status of kelp beds across Puget Sound and highlight results from our 2023 and 2024 survey seasons.

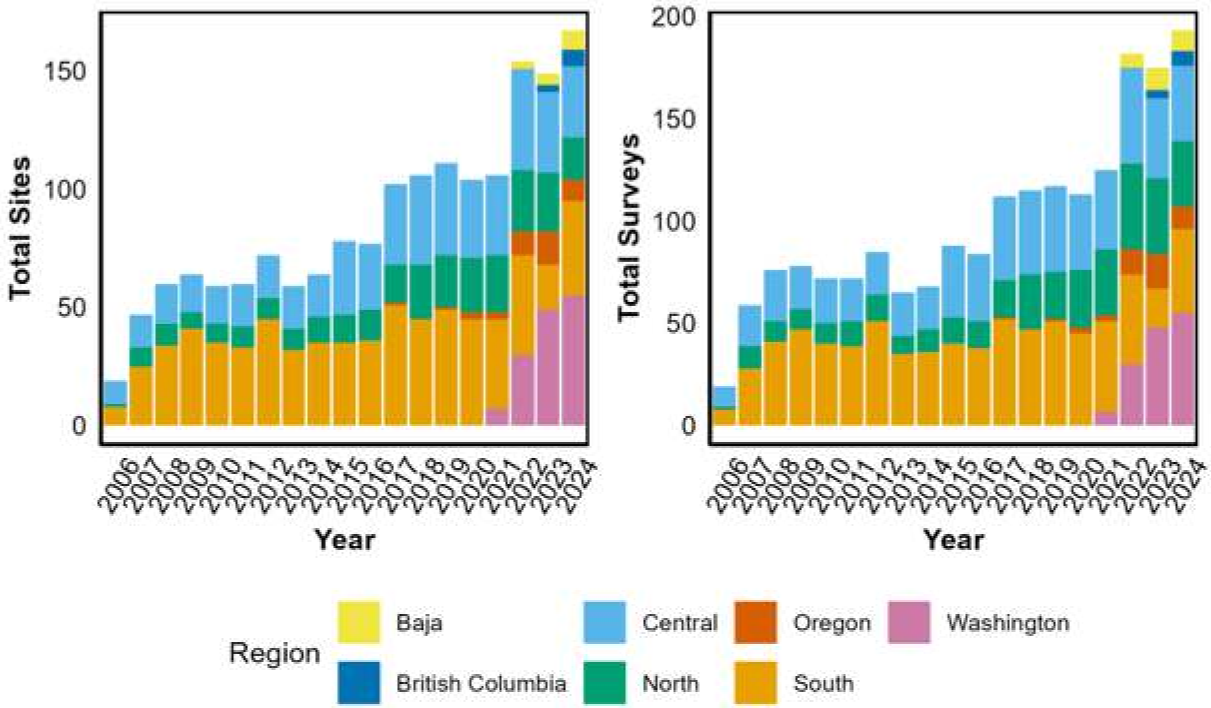


Figure 1. Number of sites (left) and surveys (right) completed each year in all seven Reef Check kelp forest monitoring regions.

Washington Program Overview

Washington Monitoring Sites

In 2021, Reef Check joined the Kelp Expedition (Garfield et al., 2021) organized to facilitate collaborative science and research on bull kelp in Puget Sound. Following that event, Reef Check partnered with Puget Sound Restoration Fund and the Paul G. Allen Family Foundation to develop the Eyes on Kelp Initiative (Peabody et al., 2022) that established the Washington chapter of Reef Check. In 2022 the first cohort of citizen science volunteer divers were trained in the Reef Check Washington (RCWA) protocols (Washington Student Guide) to monitor Washington kelp forests. In three years, the program has expanded to training 45 citizen science divers a year and is working with 8 partner agencies to complete data collection at 53 monitoring sites in the Puget Sound (Figures 2). A full list of sites and survey dates are listed in Appendix A. Additionally, the program maintains environmental sensors installed and managed by Puget Sound Restoration Fund at a subset of these Puget Sound sites and has established monitoring sites in British Columbia and the open coast of Washington (not funded by this grant).

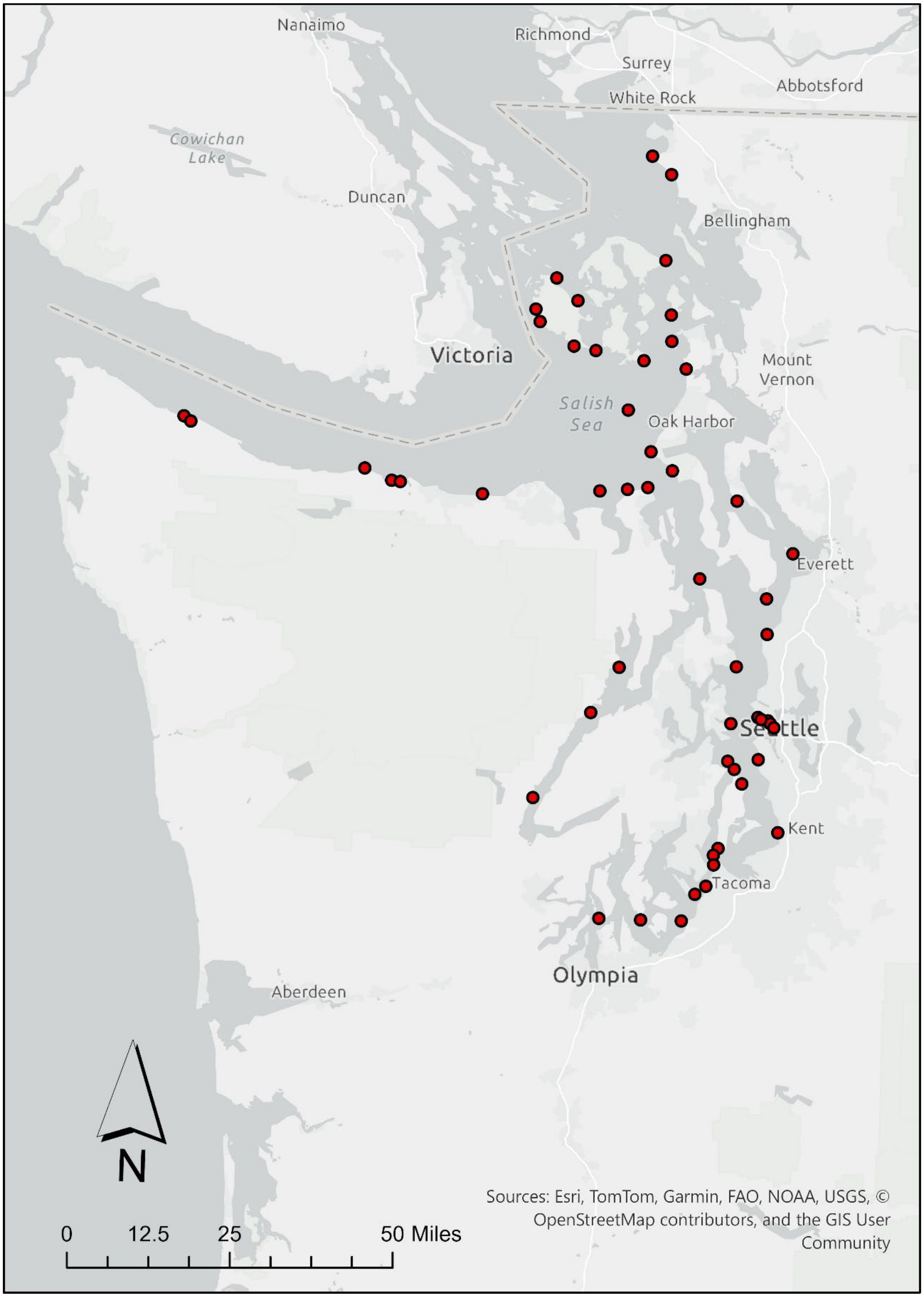
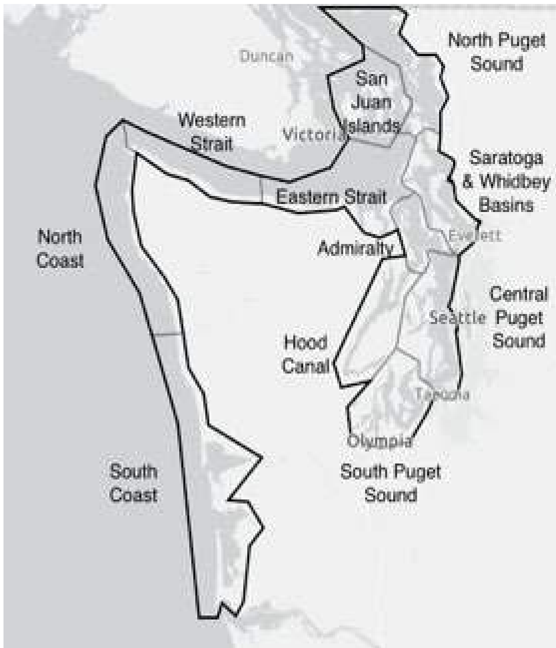


Figure 2. Reef Check monitoring sites in Puget Sound.

Table 1. Washington Department of Natural Resources (WDNR) sub-basins and number of sites per sub-basin



WDNR Sub-basins	#
Western Strait	2
Eastern Strait	11
San Juan Islands	9
North Puget Sound	3
Saratoga/Whidbey	3
Admiralty Inlet	1
Central Puget Sound	15
South Puget Sound	6
Hood Canal	3
Total Sites	53

Sites were selected based on creating a network of monitoring sites across all Puget Sound sub-basins, as defined by WDNR (Table 1). Some sub-basins, such as the Central Basin, have more sites than others due to a higher proportion of rocky reef habitat and ease of access. Site selection priority was given to sites of interest to local agencies and tribes, areas within DNR aquatic reserves, recorded or potential areas of kelp loss, and sites that had other monitoring efforts underway (i.e. kelp canopy area kayak surveys, environmental sensors deployed, ROV surveys). RCWA collaborates with dive teams from Washington Department of Natural Resources, Puget Sound Restoration Fund, Point Defiance Zoo and Aquarium, Seattle Aquarium, Samish Indian Nation, Tulalip Tribe, UW Friday Harbor Laboratories, and UW Wetland Ecosystem Team. These dive teams complete Reef Check training, provide vessel support for surveys, and/or submit survey data at sites that are near their institution or within their usual and accustomed territories. As these partnerships develop, the number of survey sites completed by partner groups has increased year over year (Figure 3).

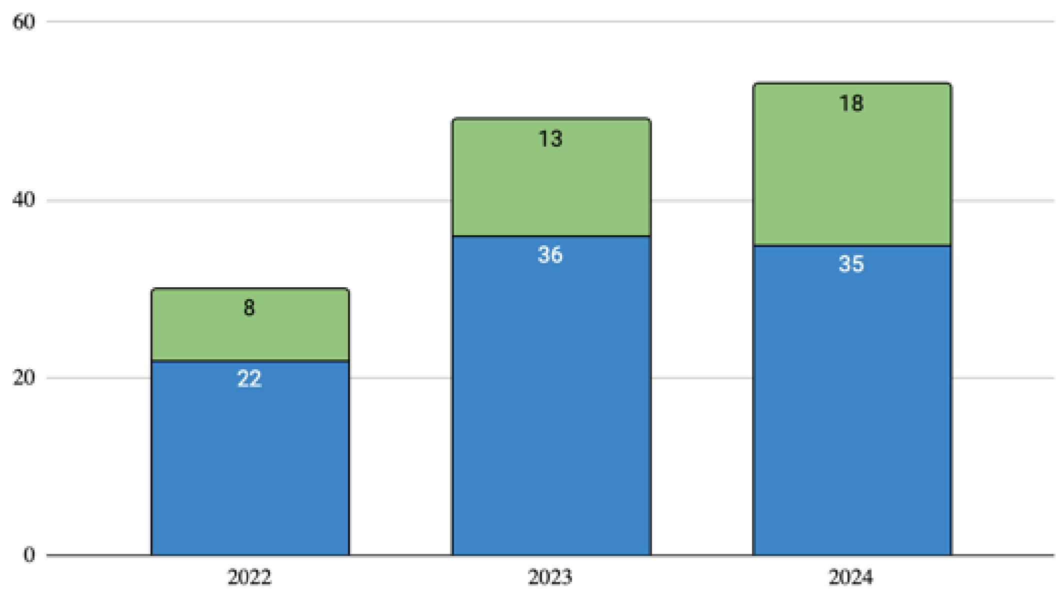


Figure 3. Monitoring site completed by volunteers (blue) and partner agencies (green).

Reef Check Methods

All Reef Check surveys are conducted by scuba divers in accordance with the Reef Check Washington Monitoring Protocol. Each survey includes six 30 m by 2 m swath transects consisting of counts of invertebrates and macroalgae, six 30-point Uniform Point Contact (UPC) transects, and a minimum of 18 fish transects (also 30 m by 2 m by 2 m). Transects are placed haphazardly at the survey site at a range of set depths. Along each transect, a set of 71 indicator species, consisting of 13 species of macroalgae, 29 taxa of invertebrates, and 29 taxa of fishes, are looked for and enumerated. All fish are sized to the nearest centimeter.

In addition to the density data, several other data types are collected during RCWA surveys. Rare species such as pinto abalone and sunflower stars are recorded if they are observed anywhere on the site. Abalone and sunflower stars are sized to the nearest centimeter when encountered on invertebrate transects, and roving urchin size frequency surveys are conducted at sites with high urchin densities. Video imagery is collected both during fish transects and after invertebrate transects and uploaded to an online archive.

Data Management

Select results from the first four years of ecological monitoring surveys are summarized in this report. The majority of the 53 long-term monitoring sites surveyed in 2024 have two to three years of data. Some sites have up to four years of data from six surveys completed during the pilot year 2021.

Accurate data entry is one of the most critical components of the monitoring process. Reef Check conducts over 180 rocky reef surveys each year, each containing hundreds of data points, over a wide geographic area with a diverse array of teams. Reef Check has developed a robust system of data management to ensure accurate, high-quality data.

The Reef Check Data Management System is comprised of the following steps (Figure 4):

Field checks: The series of checks conducted in the field immediately after data collection.
Datasheet uploading and archiving: The systematic approach to archiving data sheets and addressing ambiguous data.
Data entry: Entering data into Reef Check's database, the Global Reef Database (GRD).
QA/QC: A second pass over the entered data, where every entered value is rechecked.
Final data checks: Additional checks on the dataset to identify outliers and possible errors.
Data packaging and export: A system for requesting, tracking, and exporting data that has been packaged into formats that can easily be used by managers, scientists, and the public.

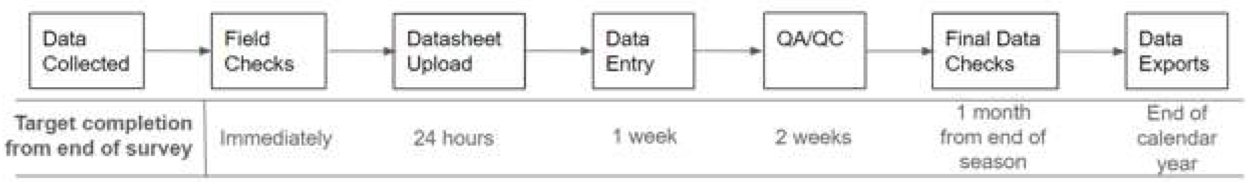


Figure 4. The Reef Check data management process with target timeline for completion

The initial Data Entry and QA/QC process is to be completed within two weeks of the survey's completion. This ensures that if any issues arise, they can be addressed in a timely fashion while the details of the survey are still fresh in people's minds. Once all the data for a season has been collected, additional checks are run within one month, and the data is packaged for export by the end of the calendar year.

Data is available through the Results page on the Reef Check website. Once requested, Reef Check staff send out data along with the Metadata for Reef Check KFM Data and the Reef Check Species Lookup Table that has taxonomic information on Reef Check species.

Reef Check Volunteers

The number of volunteers participating in RCWA monitoring surveys has stayed relatively consistent over the first three years since the program's inception, with 35-45 volunteers participating annually. The number of days that volunteers contribute over a year averaged 7.6 days in 2023 and 2024. Volunteers collectively donated over 300 volunteer days per year (Table 2). In 2023, Reef Check Washington trained 30 new Reef Check Volunteers and recertified 15 returning Reef Checkers who contributed a total of 351 volunteer days. In 2024, 17 new Reef Check volunteers were trained, and 24 returning divers were recertified. While many volunteers contribute a few days throughout the year, some have contributed over 50 days during their time with Reef Check, and a few have been volunteering since the beginning of the Washington chapter.

Additionally, each year RCWA hosts a three-day partner retreat to share program updates, initial results, and to recertify divers form partner institutions. In 2023, 28 divers participated from six partner agencies, and in 2024, 36 divers participated from eight partner agencies.

Table 2: Number of volunteers and days they participated annually.

Year	Number of Volunteers	Number of Survey Days	Average Days per volunteer
2022	35	186	5.3
2023	45	351	7.6
2024	41	312	7.6

A survey was conducted in 2024 to assess volunteer demographics across all kelp forest monitoring chapters. A total of 88 participants responded. Results of the surveys showed that participating volunteers are wide-ranging in age, from 19 to 65 years and older and fairly evenly split among male and female (4% non-binary or non-conforming). Just 26.5% of volunteers are non-white, 78% have an annual household income greater than $90,000, and 85% have four-year college degrees or higher levels of education (Figure 5). This suggests that access to the program is limited to a demographic with high levels of education and relatively high household incomes. This is in part due to high barriers to entry for scuba diving (financial, travel, and time commitment). In response to these barriers, Reef Check's Dive into Science program was created to provide access to diving and marine science (see Dive into Science under Broader Reef Check Kelp Forest Monitoring Programs).

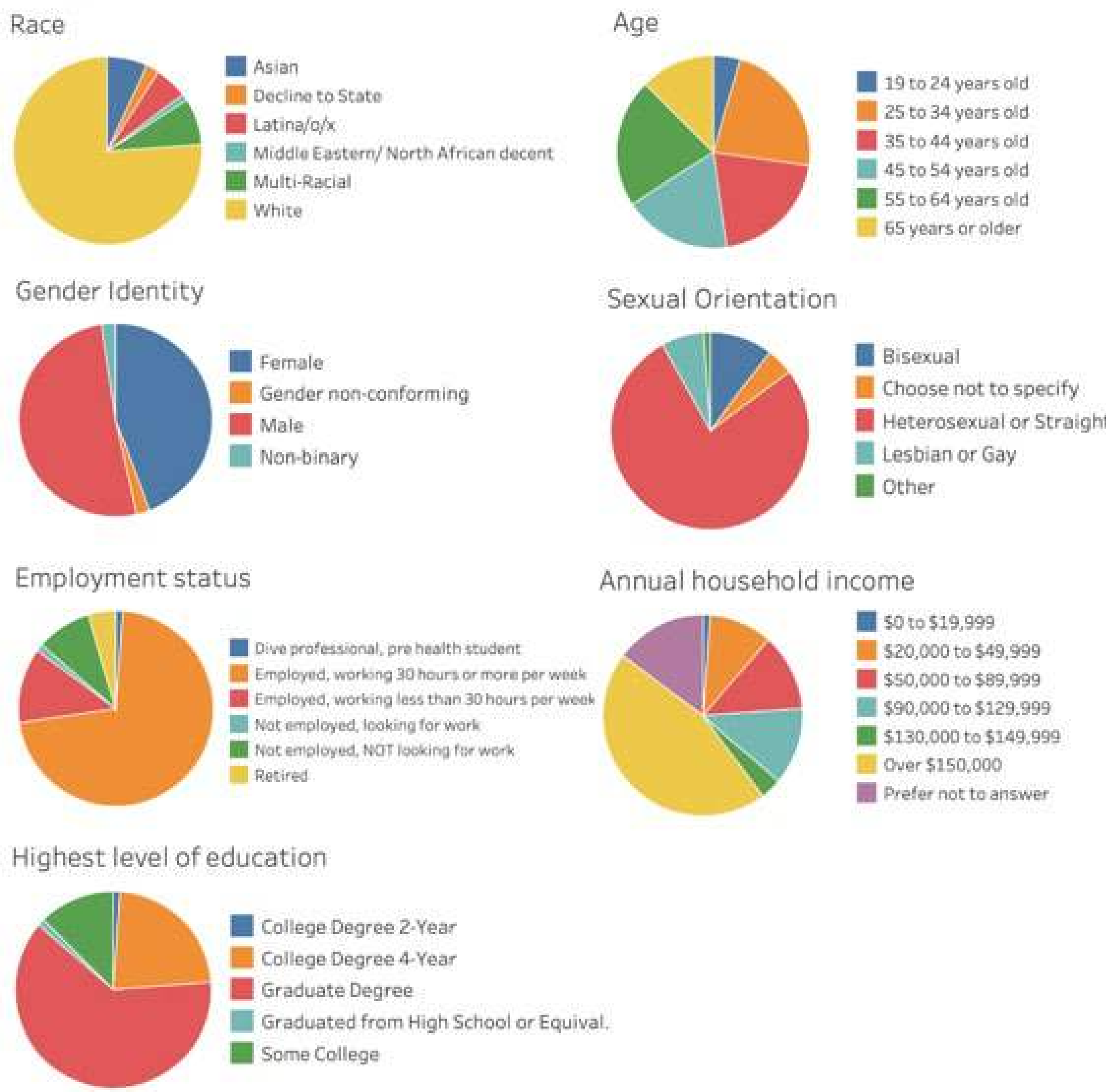


Figure 5. Demographic volunteer survey results.

Results

Ecological data from the 2023-2024 survey seasons are summarized in this report. Data is presented by sub-basin as defined by Washington Department of Natural Resources (WDNR). Sub-basins are based on large-scale oceanographic features distinguishing their environmental conditions (Berry et al., 2023).

Habitat Characterization

Substrate data was collected via Uniform Point Contact (UPC) surveys and recorded based on the size of substrate at each point (ranging from sand to bedrock reef). Substrates at Reef Check survey sites varied greatly among the different Puget Sound sub-basins (Figure 6).

Substrates in the Admiralty Inlet, Central Sound, Saratoga/Whidbey, and South Sound are dominated by aggregate substrates with over 50% under 15 cm in size (consisting of sand, pebbles (<5 cm), and cobble (< 15 cm). Sites in Hood Canal, San Juan Islands, and Western Strait of Juan de Fuca (WSJDF) have 30% or more rocky reef (rock >1 m). The substrate types at sites within the same sub-basin were relatively consistent, with a few exceptions where there was significant variability from site to site (see Appendix B for habitat percentages by site). The greatest variability between sites was in the North Basin, WSJDF, and Hood Canal.

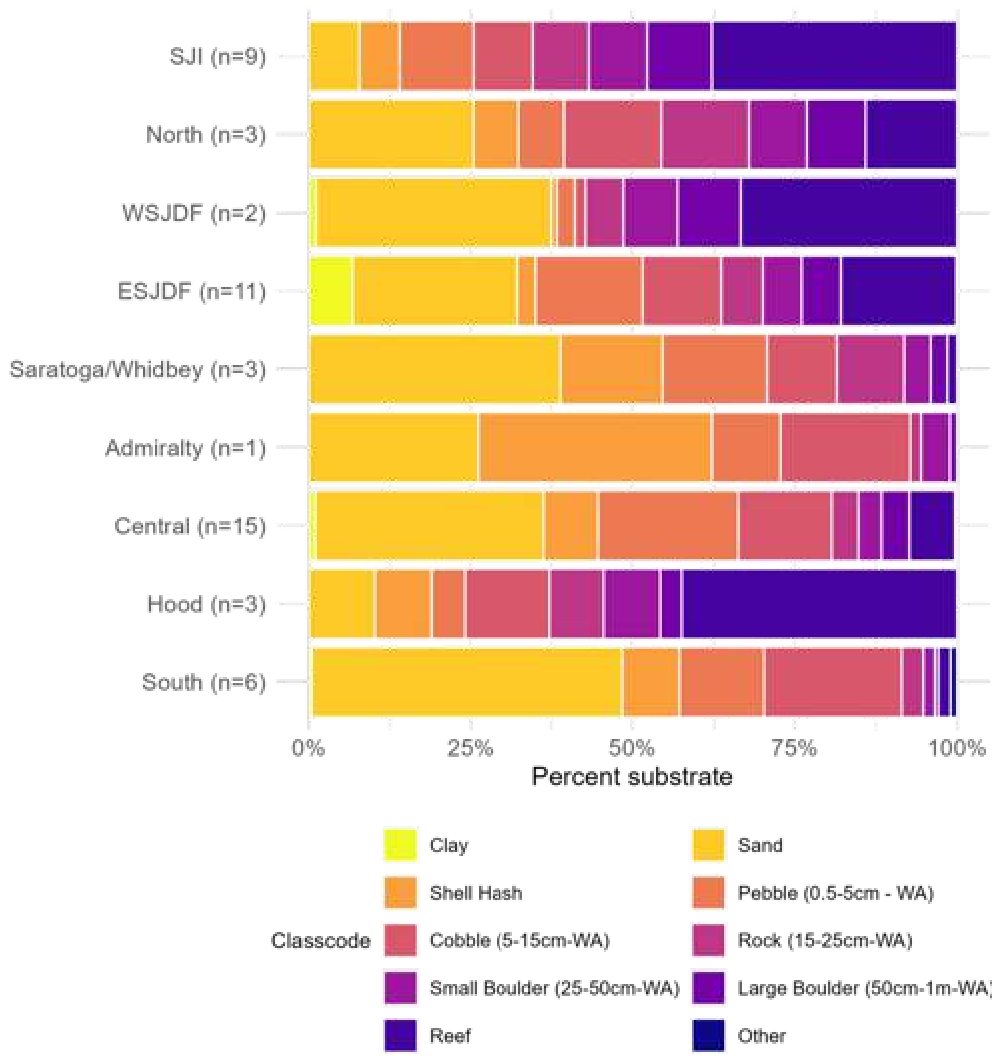


Figure 6. Mean percent of different substrates in Puget Sound sub-basins. The mean is calculated across all sites within a sub-basin based on data from 2024 surveys.

Organisms growing on the substrate are recorded during the UPC surveys at each point in 10 taxonomic categories. The mean occurrence of each taxonomic group was calculated across all sites within each sub-basin (Figure 7). Sub-basins with a higher proportion of reef substrate had a greater diversity of encrusting organisms (encrusting red and crustose coralline algae) covering the substrate. Conversely, the greater the proportion of sand and shell hash substrate within a sub-basin, the greater the proportion of bare substrate (None) as organisms cannot attach to this loose substrate. All sub-basins had a substantial amount of bare substrate, ranging from around 30 to over 60%. Sea grasses, green algae, and acid weed were the least commonly detected categories in all sub-basins.

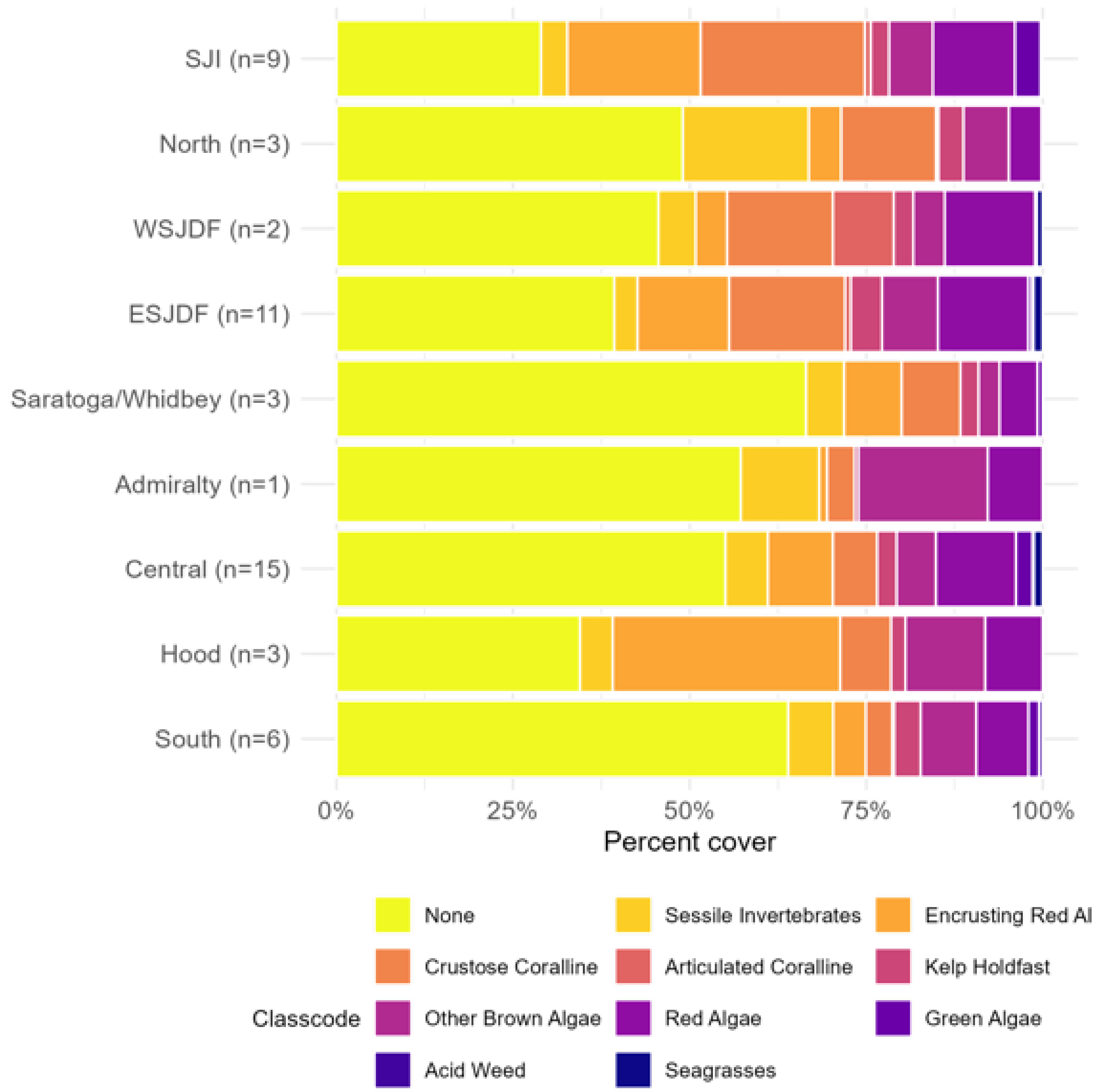


Figure 7. Mean percent of different taxonomic groups covering the substrate in Puget Sound sub-basins. The mean is calculated across all sites within a sub-basin based on data from 2024 surveys.

Kelp Communities

The species richness of kelp communities varied among sub-basins. Generally, basins north of Admiralty Inlet had higher species richness with 11-12 species than sub-basins south of the Admiralty Inlet, with less than 10 species each. The South basin is the next highest species richness with nine species. However, bull kelp, woody kelp, and acid weed were found at just two of the six sites within this sub-basin. The lowest number of kelp species was found in the Hood Canal, with only three species. Kelp density by site can be found in Appendix C.

Canopy Kelp

The primary canopy-forming kelp of Puget Sound is bull kelp (*Nereocystis luetkeana*). Historically, bull kelp was found in all Puget Sound sub-basins except for Hood Canal. The only sub-basin within Puget Sound in which giant kelp (*Macrocystis pyrifera*) occurs is the WSJDF (Raymond et al., 2022).

Over the four years that Reef Check has surveyed Puget Sound, mean bull kelp density at the San Juan Islands, Central Sound, and North Sound sites has remained relatively stable year over year. Bull kelp in the Eastern Strait of Juan de Fuca (ESJDF), Saratoga/Whidbey, and South basin showed a greater interannual variation in density (Figure 8). Bull kelp density in the Saratoga/Whidbey basin increased over the four-year period. In contrate the increases in the ESJDF and the South Basin are due to the addition of survey sites with higher kelp density than were surveyed in 2022. Bull kelp density trends by site are in Appendix D. Giant kelp was only found at two sites, both in the WSJDF. Despite these sites being only about two miles apart, Sekiu Point experienced a decline in giant kelp density while Clallam Bay West experienced an increase from 2023 to 2024 (Figure 9).

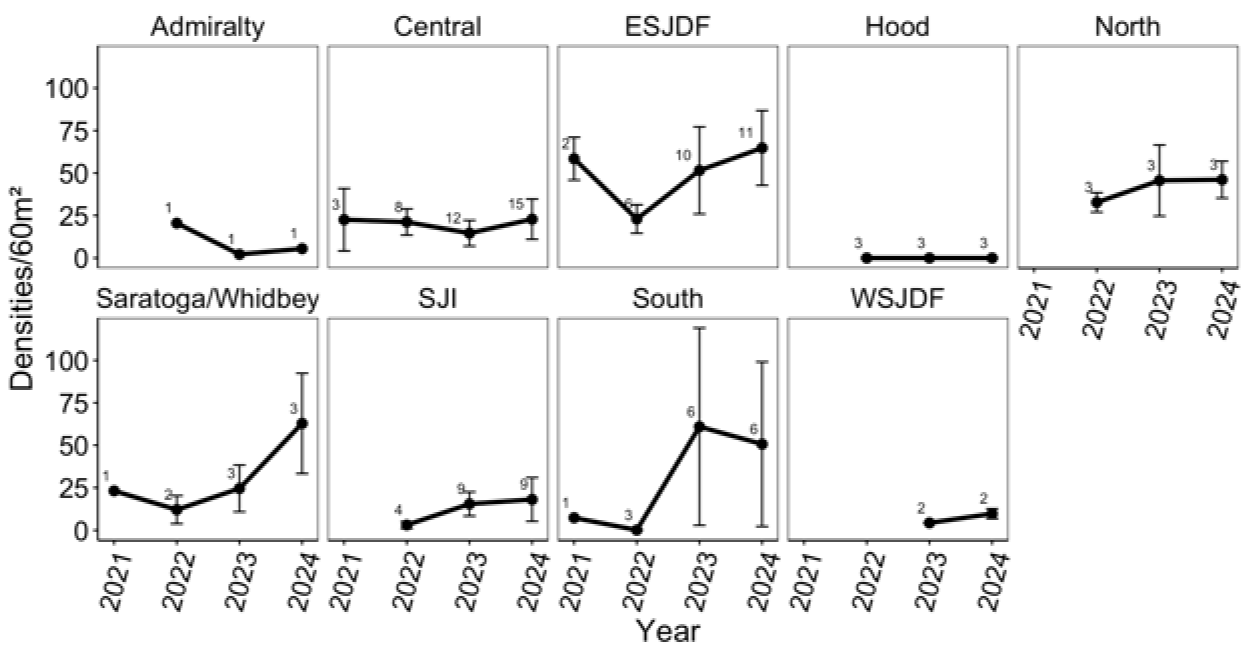


Figure 8. Mean bull kelp density trends by sub-basin. The numbers for each data point indicate the total number of sites surveyed to calculate mean densities (bars indicate standard error).

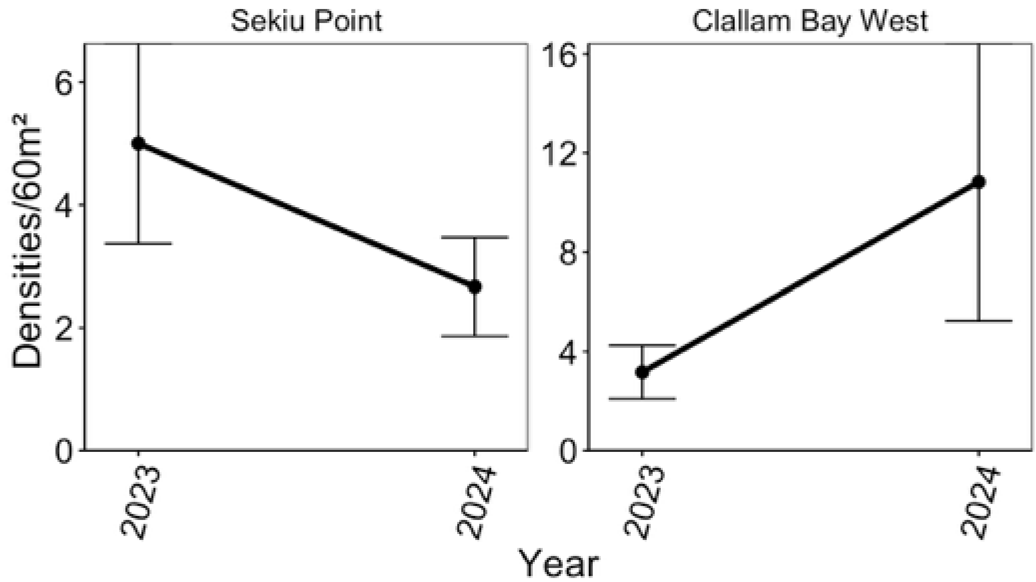


Figure 9. Mean density of giant kelp at two sites in the Western Strait of Juan de Fuca (WSJDF) (bars indicate standard error).

Understory Kelp

Reef Check kelp surveys include 11 species of understory kelps including the invasive wire weed (*Sargassum muticum*). This invasive species was detected at low densities at some sites in the following sub-basins: North, San Juan Island, ESJDF, Hood Canal, Central, Saratoga/Whidbey, and South. The highest densities of wire weed occurred in the Central basin at 3.21 plants per 60 m^2. Understory kelp species densities varied substantially across the nine sub-basins surveyed in 2024 (Figure 10). The most dominant overall was sugar kelp (*Saccharina latissima/Hedophyllum nigripes)*, which exhibited consistently high densities in several sub-basins, particularly in the San Juan Islands**,** North**,** Saratoga/Whidbey**,** and Central basins, reaching mean densities of over 100 individuals per 60 m^2 in some cases. This species was also highly abundant in the ESJDF, but, while present, less dominant in Hood Canal, WSJDF, and South basin. Woody kelp (*Pterygophora californica)* showed very high density in the WSJDF and was present in all sub-basins other than Saratoga/Whidbey and Hood Canal, but at lower densities. Acid weed (*Desmarestia ligulata)* was notably abundant in the ESJDF and the South basin, with moderate densities in the San Juan Islands. Several kelp species, including 3-ribbed kelp (*Cymathaere triplicata*), winged kelp (*Alaria marginata)*, and torn kelp (*Laminaria setchellii)*, had low densities across most sub-basins, with occasional occurrences.

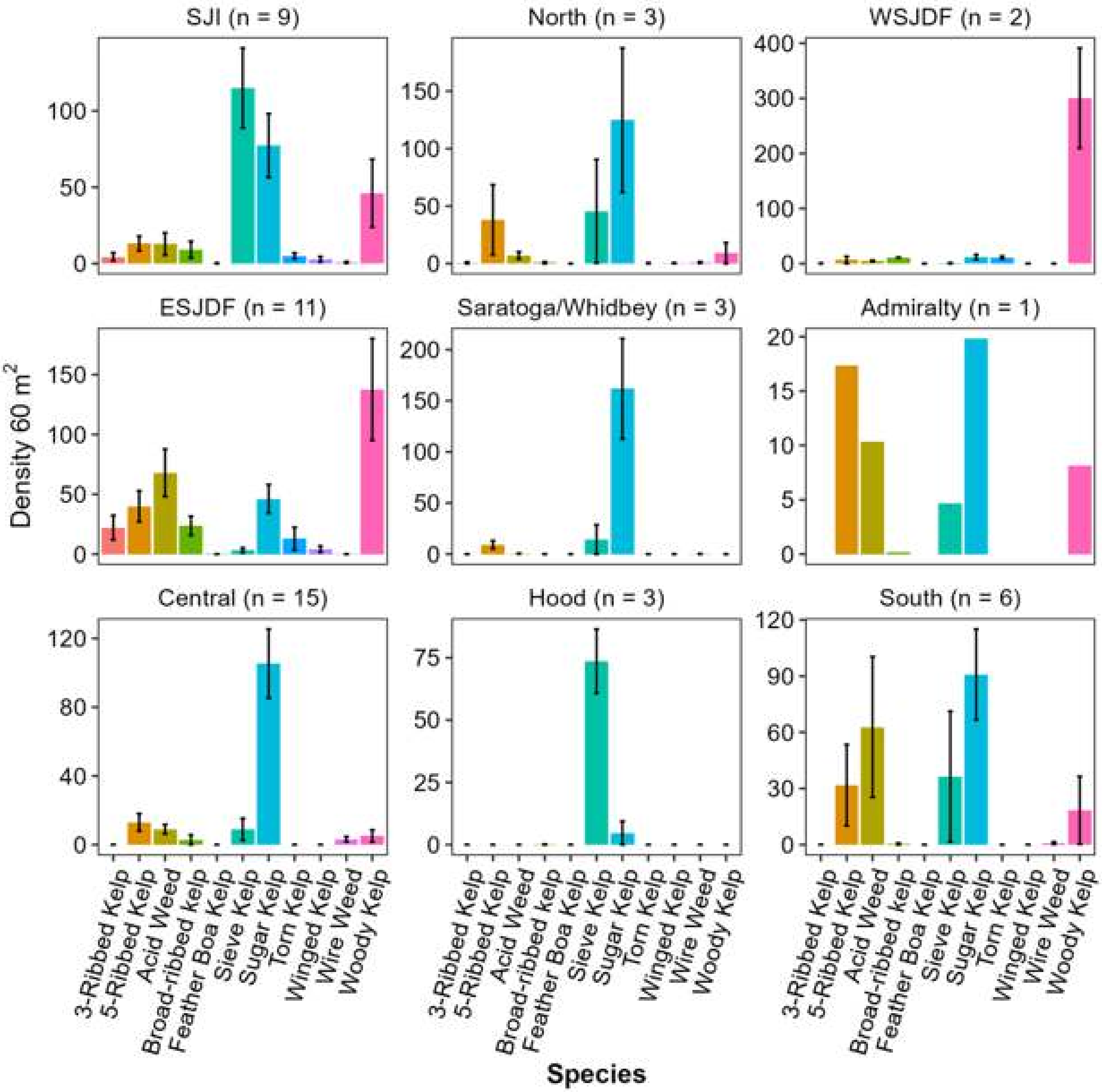


Figure 10: Mean density of understory kelp species in the Puget Sound sub-basins in 2024 (bars indicate standard error).

Invertebrate Communities

To explore patterns in invertebrate community composition across basins, we conducted a non-metric multidimensional scaling (nMDS) ordination based on Bray–Curtis dissimilarity of Hellinger transformed species abundance data using the metaMDS function from the vegan package in R (Oksanen et al., 2020, R Core Team, 2024). To visualize group-level structure, one standard deviation confidence ellipses were drawn around sites. Groups with three or fewer sites were excluded from the ellipse calculation due to insufficient data. To identify species contributing most to dissimilarity between basins, we performed a SIMPER (Similarity

Percentage) analysis using the simper() function in vegan. Species with a mean contribution greater than 1% across all pairwise comparisons were considered ecologically influential. To assess the directional influence of these species on the nMDS ordination, we applied the envfit() function to project vectors representing correlations between species abundances and nMDS axes. Arrows were plotted from the origin to indicate the direction and strength of species' relationships with the ordination space. Only species identified as both influential by SIMPER and successfully projected via envfit were included in figure.

Invertebrate community composition varied noticeably among the sub-basins of Puget Sound, as shown by the non-metric multidimensional scaling (nMDS) ordination (Stress = 0.17) (Figure 11). Sites from the Central and South basins clustered closely together, indicating similar community structure, and were primarily characterized by higher relative abundances of crab species. In contrast, sites within the San Juan Islands and adjacent straits (including ESJDF and WSJDF) formed a distinct grouping, separated from the central and southern regions by greater abundances of echinoderms such as the red urchins (*Mesocentrotus franciscanus*), purple urchins (*Strongylocentrotus purpuratus*), and green/pallid urchins (*Strongylocentrotus droebachiensis/pallidus*). The Hood Canal and Saratoga/Whidbey Basin occupied intermediate positions in the ordination space and were differentiated from both major clusters by the presence of several sea star species, anemones, and the California sea cucumber (*Parastichopus californicus)*. These patterns suggest spatial structuring of invertebrate communities across Puget Sound, with distinct species assemblages associated with different sub-basins and regions.

Sub-basins with invertebrate communities characterized by higher abundances of crabs had higher proportions of aggregate substrate of sand, pebbles, and small boulders. Whereas the sites in the San Juan Islands and sub-basins in the Strait of Juan de Fuca with a higher proportion of reef substrate (i.e., > 1 m) were characterized by diverse echinoderm communities. The sub-basins that fell within the intermediate position on the ordination plot had a greater occurrence of intermediate-sized substrate (15 cm-<1 m). This suggests a correlation between invertebrate communities and the proportion of substrate occurring within each sub-basin.

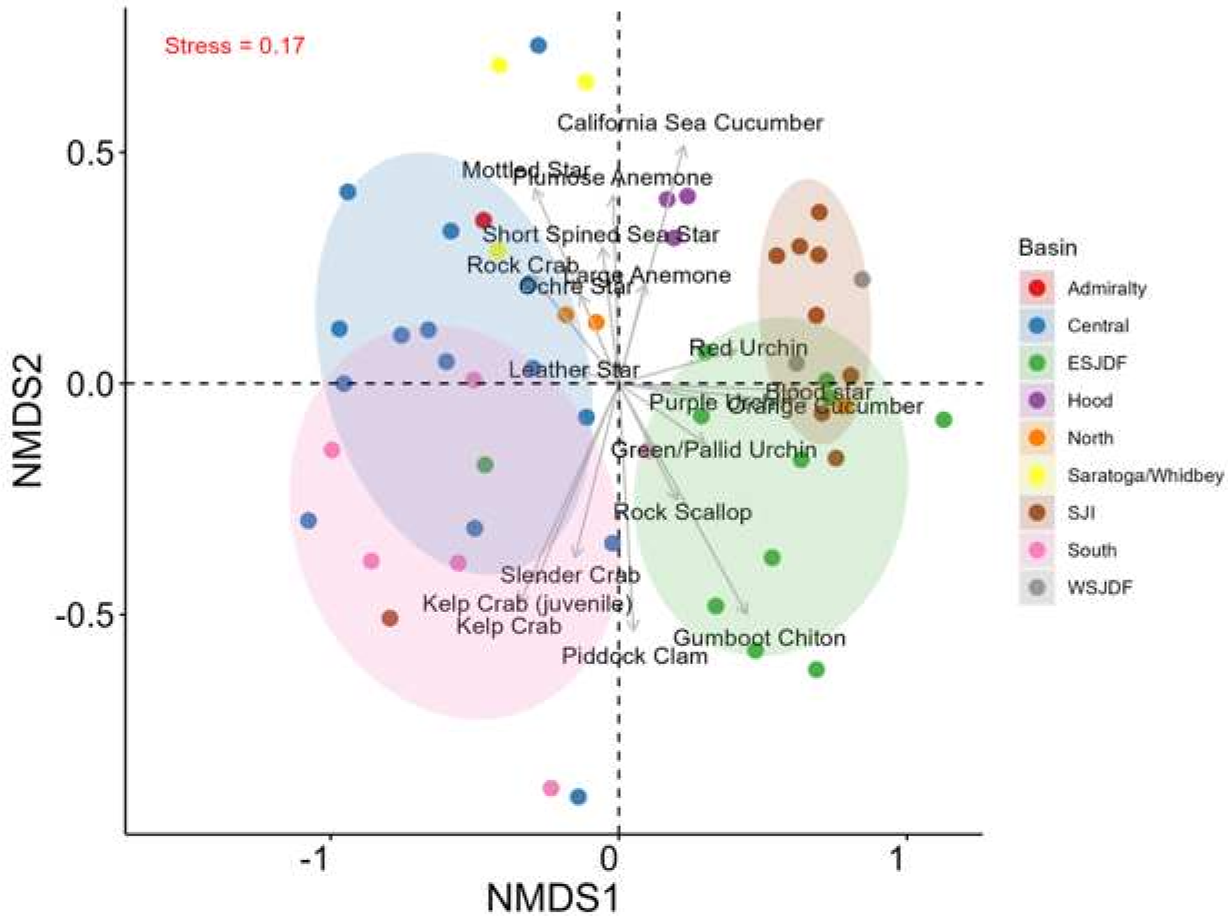
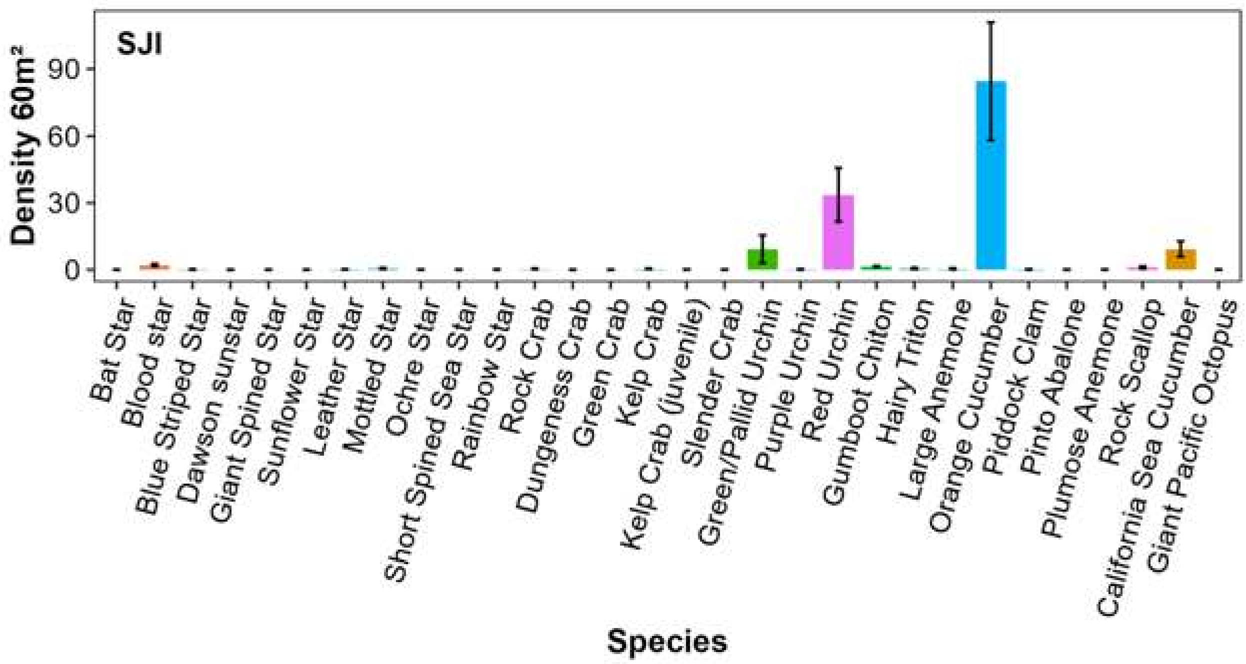


Figure 11. nMDS plot of the invertebrate community in Puget Sound in 2024. Sites are colored by their respective sub-basins. Arrows indicate the species that drive the differentiation of the sub-basin communities. Only species that contributed more than 1% of the differentiation among the sub-basins in a SIMPER analysis are indicated. Ellipses were drawn at one standard deviation around the sites within each sub-basin. If there were fewer than four sites in a sub-basin, they are plotted, but no ellipses were drawn.

The mean invertebrate species densities of the 2024 surveys in each sub-basin are shown in Figure 12 (graphs for invertebrate density by site are in Appendix E). Similarly, to kelp communities, the species richness in sub-basins north of the Admiralty was greater, with 19-25 species present. The lowest species richness of 12 was in the Admiralty basin. This may be due to only one site being surveyed within this sub-basin.



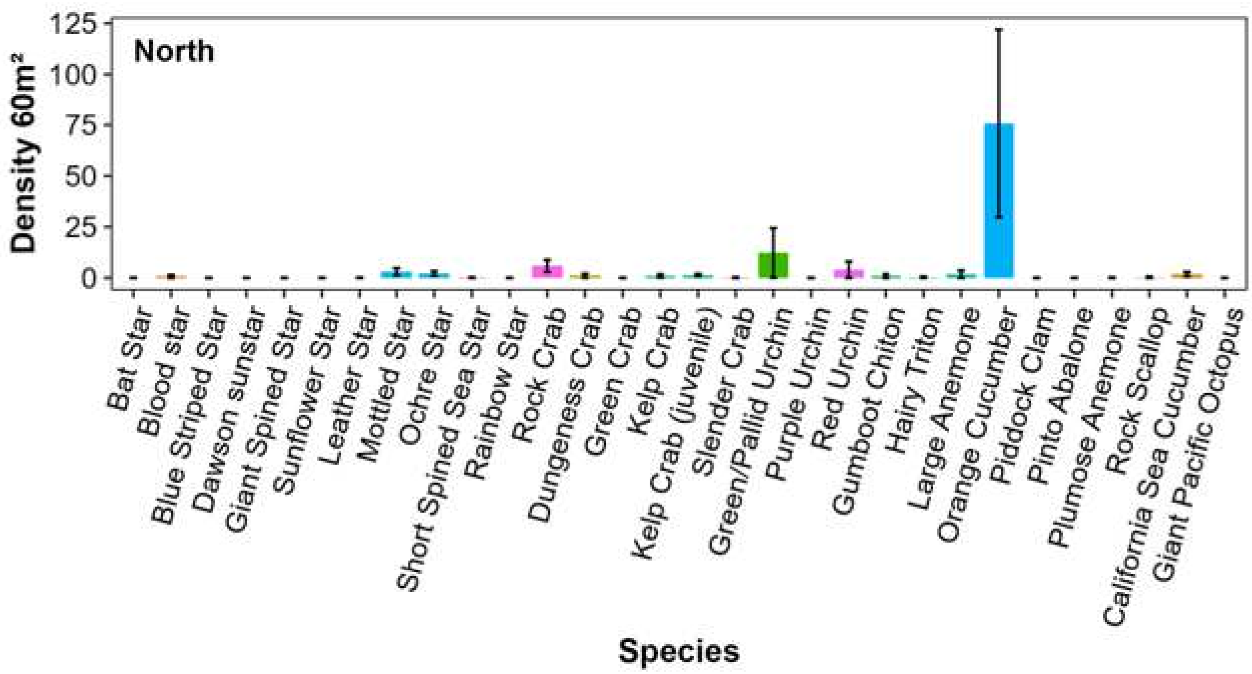


Figure 12. Mean densities of invertebrates by sub-basin in 2024 (bars indicate standard error).

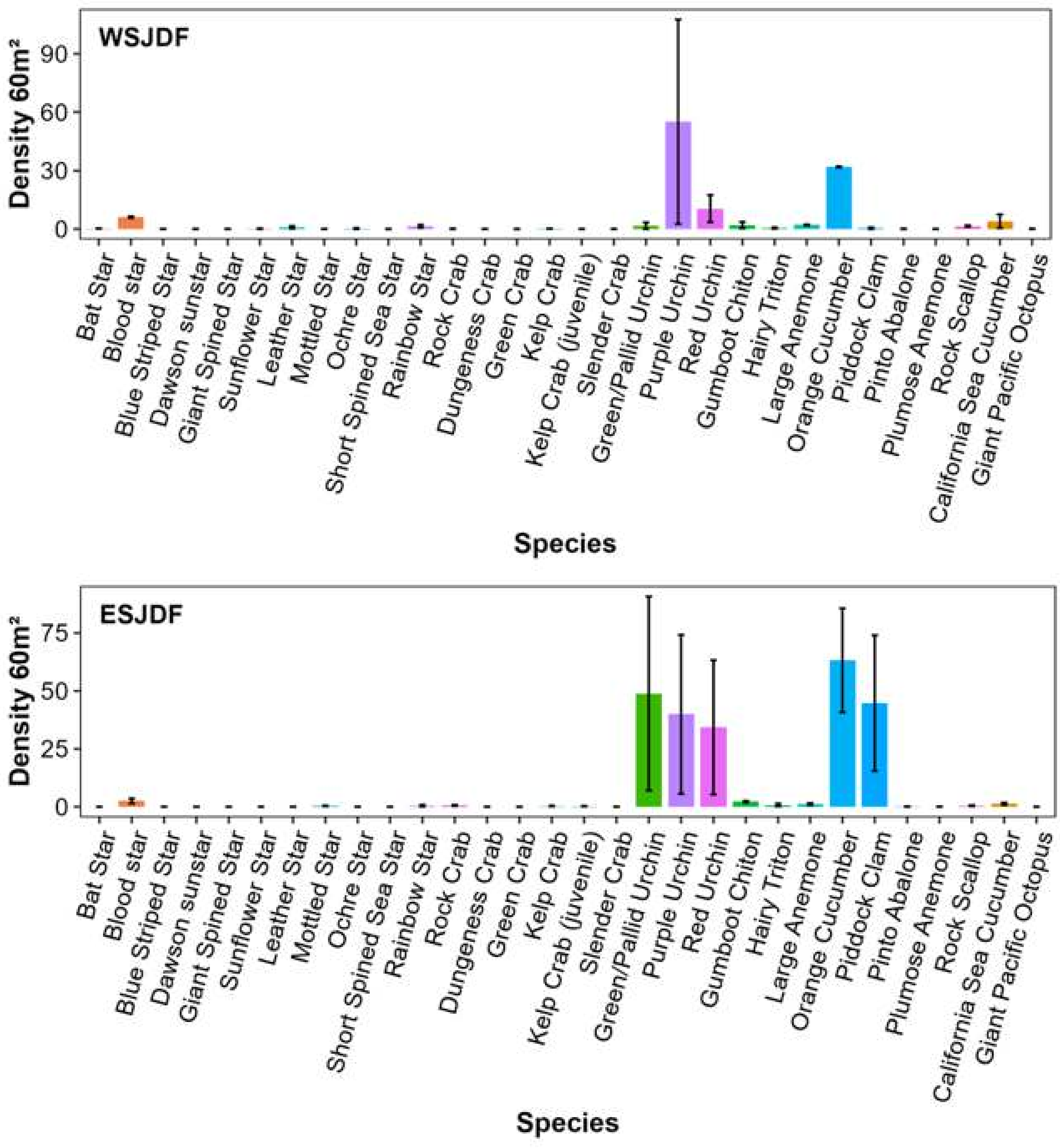
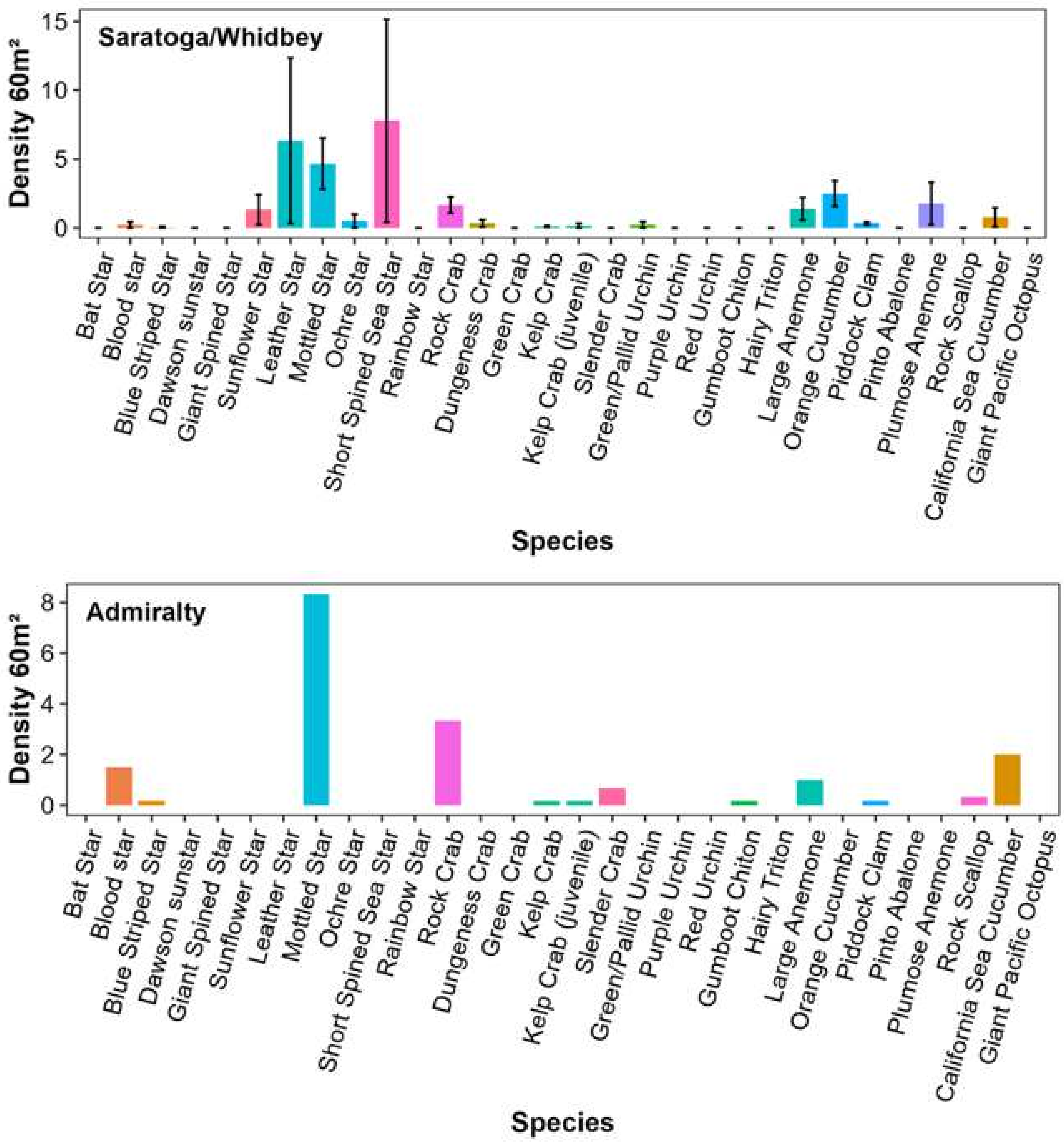


Figure 12 (continued). Mean densities of invertebrates by sub-basin in 2024 (bars indicate standard error).



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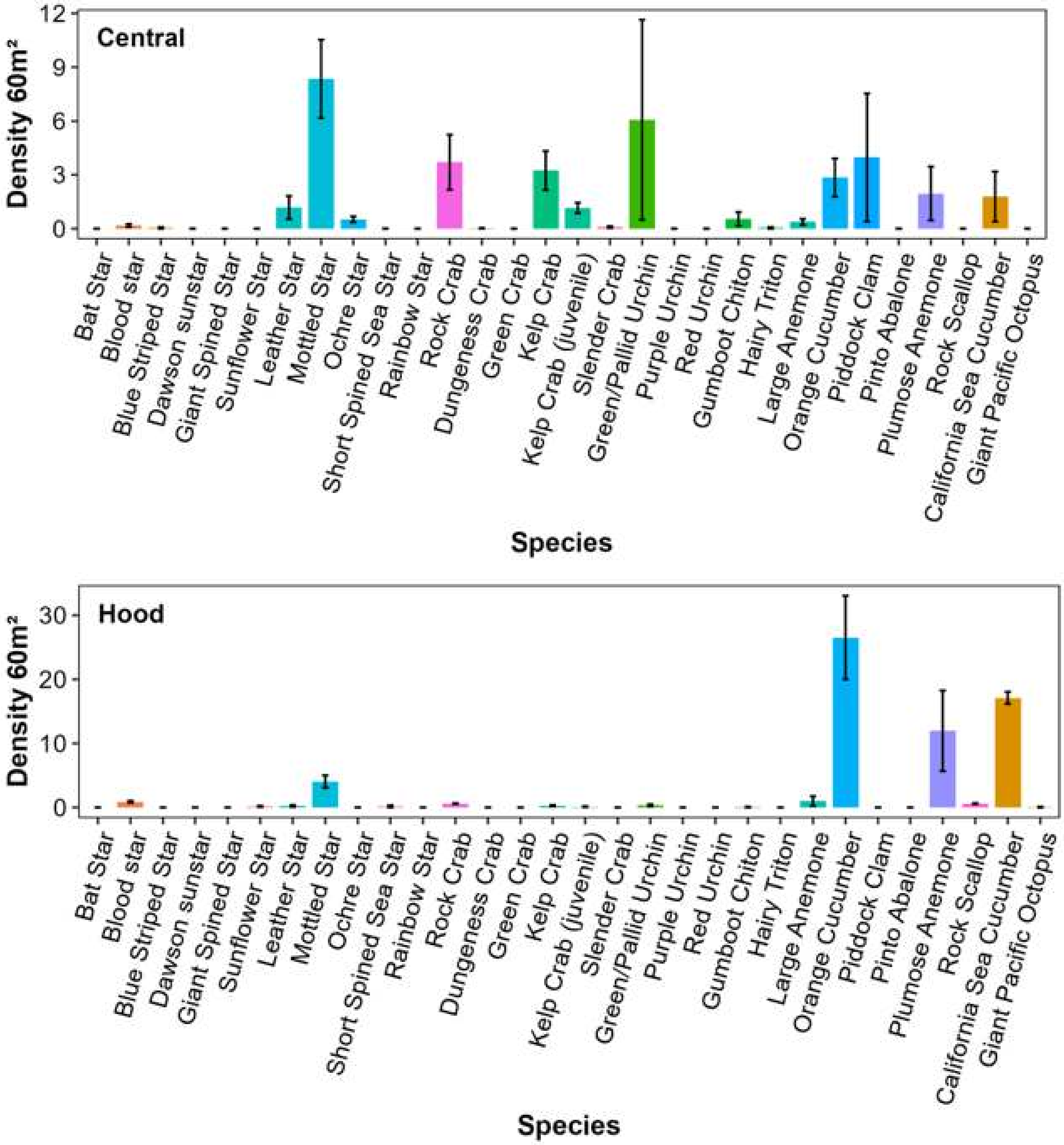

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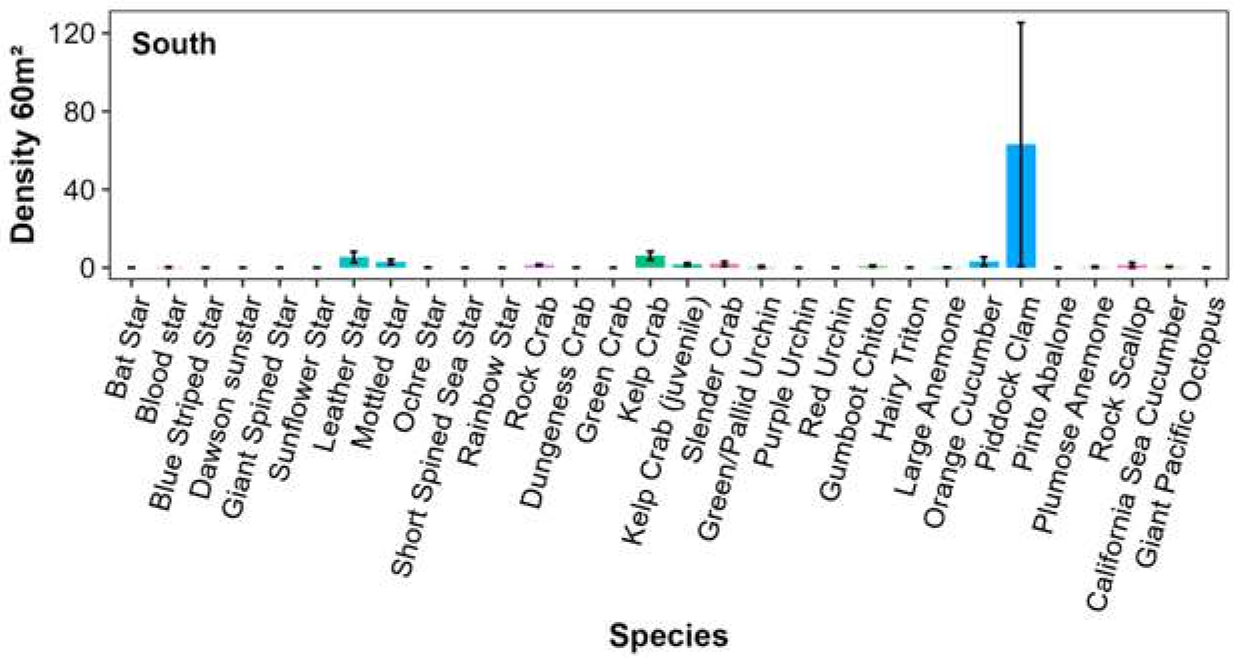


Figure 12 (continued). Mean densities of invertebrates by sub-basin in 2024 (bars indicate standard error).

Invertebrate Species of Special Concern

Crabs

The first European green crab (*Carcinus maenas*) on the West Coast of the United States was detected in San Francisco Bay in 1989. The species spread north to the Washington coast likely via planktonic larval dispersion. The first individuals found on the Washington coast in low numbers was in 1998 and later in the eastern portion of the Puget Sound and in the San Juan Islands in 2016 (Grason et al., 2018). European green crabs are of concern due to the threat they pose on native clam, mussel and shellfish populations as well as damage to important eelgrass habitat used by salmon, forage fish and many other species. European green crabs are recorded if seen on transect or anywhere during a survey, however, this species was not observed at any of the survey sites.

Kelp crabs (*Pugettia* spp.) have shown to have a metabolic rate that is greater than the expected ¾ scaling rule and may have an outsized impact on the survival of juvenile bull kelp and growth of kelp beds in Puget Sound (Dobkowski, 2017). To capture this grazing pressure on bull kelp beds, kelp crabs were recorded as adults (>5 cm) or juveniles (<5 cm). Kelp crabs were present across all sub-basins and the highest density of kelp crabs occurred in the South basin. In general, the further from the entrance to the Strait of Juan de Fuca, the higher the density of total kelp crabs (Figure 13).

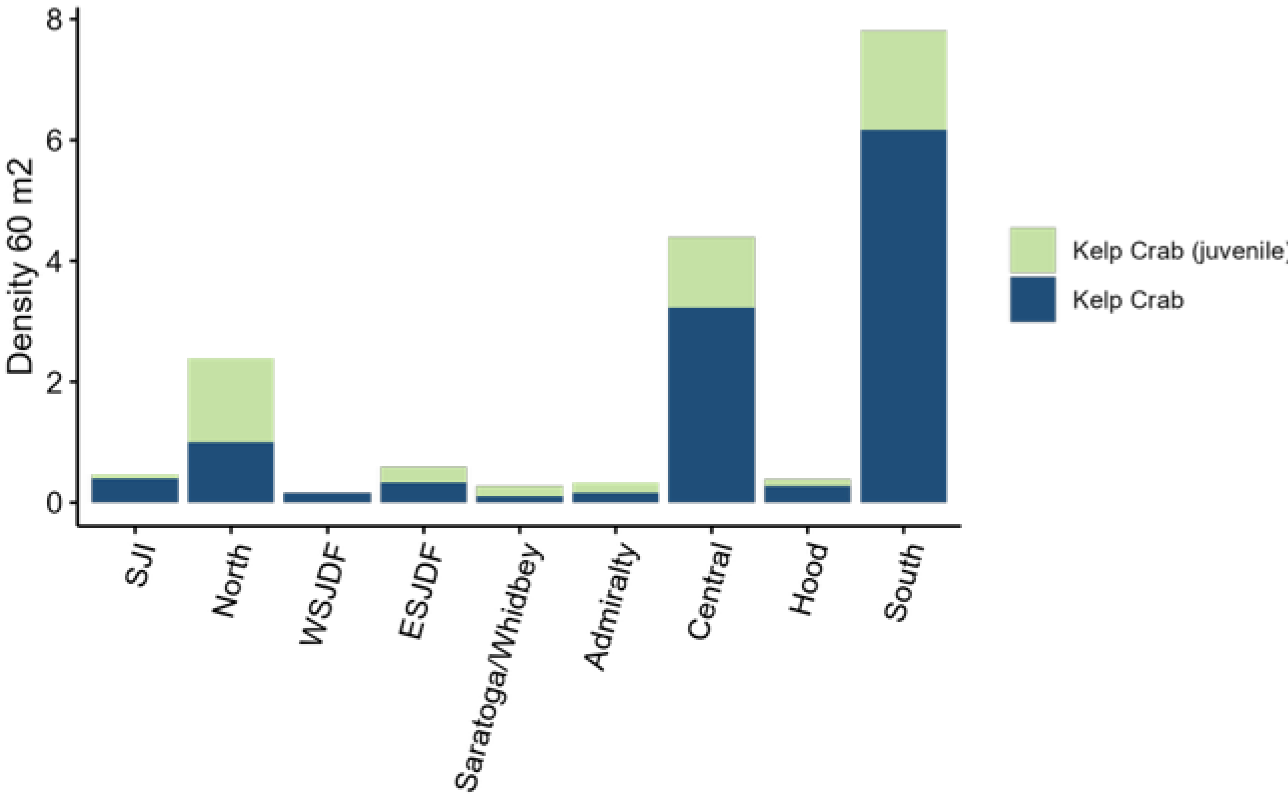


Figure 13. Mean density of adult and juvenile kelp crab by sub-basin.

Sea Urchins

Urchin barrens can have devastating effects on kelp forests and have expanded along much of the North American West Coast (e.g., McPherson et al., 2021). Urchin barrens are less common along Washington’s open coast and in Puget Sound than along the open coasts of British Columbia, Oregon, and California (Beas-Luna et al., 2020, Tolimieri et al., 2023). Nevertheless, here are some sites within Puget Sound that experience patchy urchin barrens. During the 2023 survey at Tongue Point (ESJDF), patchy urchin barrens were observed. Urchin size frequency surveys were completed at this site in 2023 and 2024 for red urchins (*Mesocentrotus franciscanus*), purple urchins (*Strongylocentrotus purpuratus*), and green/pallid urchins (*Strongylocentrotus droebachiensis/pallidus*) to track how these populations develop over time.

From 2023 to 2024 the density of all three urchin species increased at the Tongue Point site (ESJDF). Red urchin populations saw the smallest increase in density, but both green/pallid and purple urchins experienced large jumps in density. Green/pallid urchins almost doubled in density from 255 to 466 urchin per 60 m^2 and purple urchin populations nearly tripled in density from 150 to 381 per 60 m^2 (Figure 14). For each species, at least 100 individuals were measured and their test diameter was recorded in 1 cm bins. From 2023 to 2024, the median size of green/pallid urchins decreased from 6 cm to 5 cm, purple urchins increased from 6 cm to 7 cm, and red urchins showed a large decrease from 8 cm to 3 cm suggesting a recent recruitment event (Figure 15).

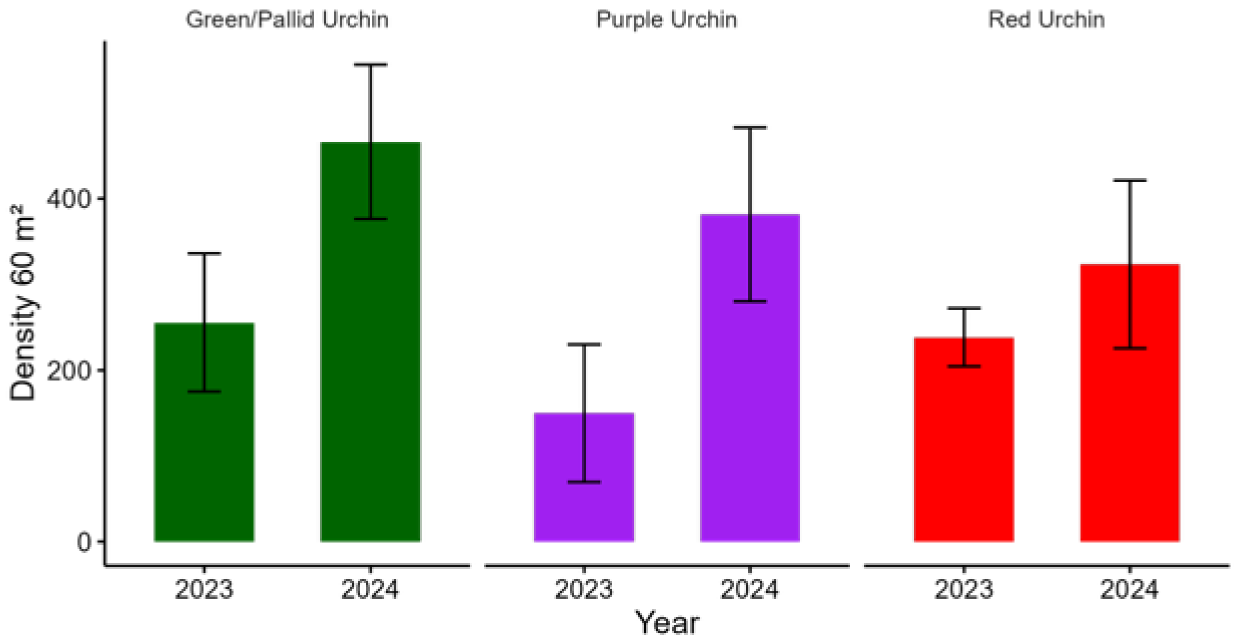


Figure 14. Urchin densities by year at Tongue Point (ESJDF).

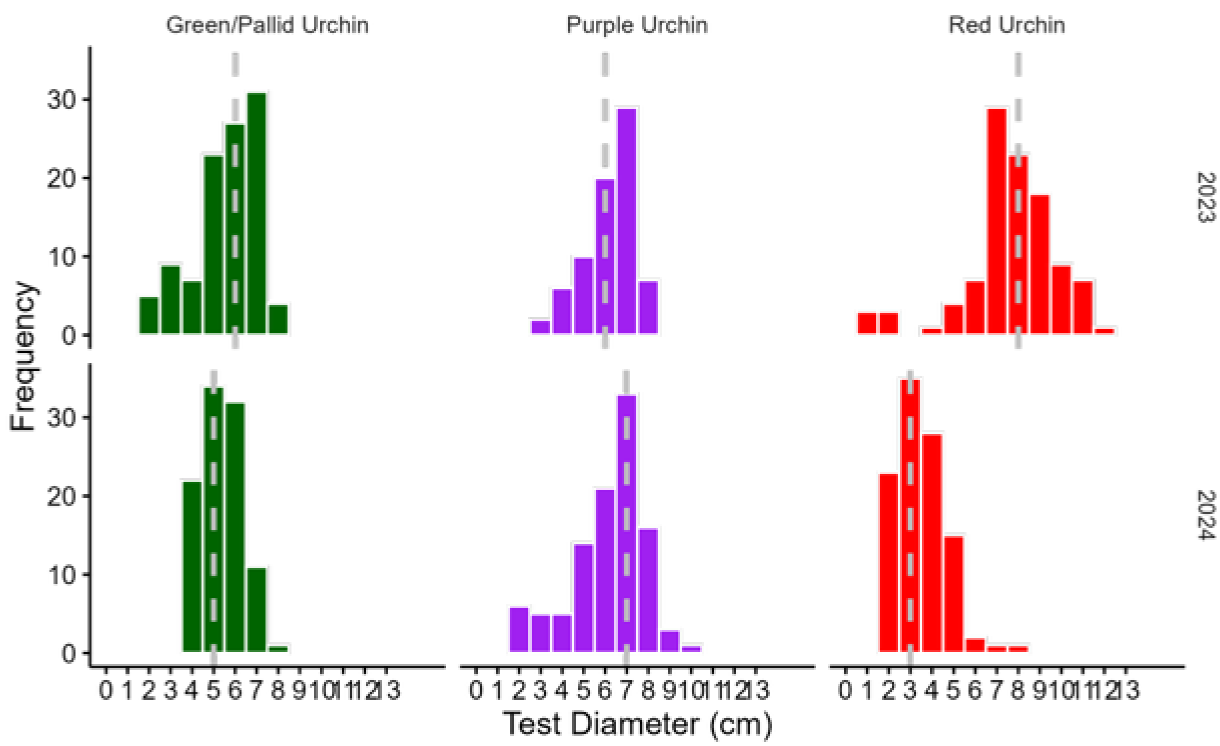


Figure 15. Urchin size frequency distribution by species and year at Tongue Point (ESJDF). The dotted vertical line indicates the median size.

Sunflower Sea Stars

Following the marine heatwave of 2014 and the spread of sea star wasting disease, sunflower sea stars *(Pycnopodia helianthoides)* experienced a sharp decline in populations along the entire West Coast, including inside Puget Sound (Hamilton et al., 2021). Due to the interest in tracking sunflower star populations, density data were recorded along with the size, in diameter, of individuals encountered. In 2023, 27 sunflower stars were recorded with a median size of 17 cm. In 2024, 34 sunflower stars were observed with a median size of 15 cm (Figure 16). More than ⅓ of these encounters occurred at the Lowell Point site in the Saratoga/Whidbey basin and none were recorded in the Central or South basin.

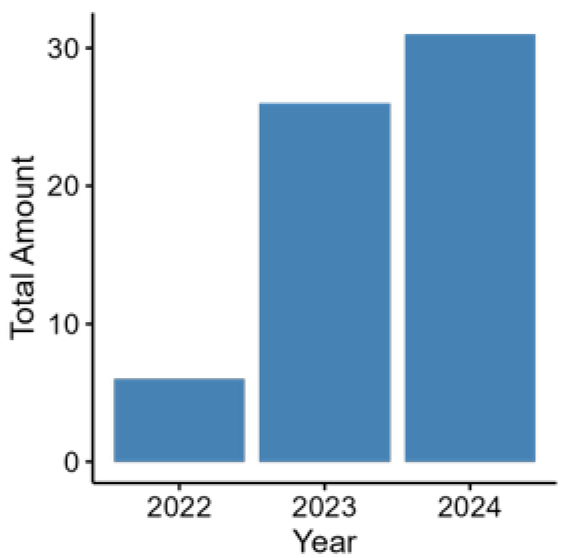


Figure 16. Total count of sunflower stars observed during Reef Check surveys in Puget Sound.

Abalone

Pinto abalone (*Haliotis kamtschatkana*) has been listed as a species of concern by the National Oceanographic and Atmospheric Administration (NOAA) since 2004 and was designated as a Washington State Endangered Species in 2019. There are many recovery efforts underway that conduct hatchery raising and out planting of pinto abalone. Some Reef Check sites are adjacent to these efforts, but due to the sensitive nature of the recovery projects, pinto abalone encounters will not be listed by location. Some of these observations are likely from out planted abalone while others are from wild populations. However, determining hatchery versus wild populations is beyond the scope of Reef Check surveys, and the distinction will not be made.

Pinto abalone were recorded and measured if found on transect. From 2022 to 2023, there was a significant increase in abalone counts long transects, from one abalone seen in 2022, to 13 encountered during all surveys in 2023 (Figure 17). This is likely due to the increase of survey sites in the San Juan Islands and the Strait of Juan de Fuca rather than a large increase in the abalone population. During the 2023 and 2024 surveys, the smallest recorded abalone was 5.5 cm and the largest 20 cm, with the median size being 13 cm. Pinto abalone were seen in the northern region of the Sound and absent from basins south of the Strait of Juan de Fuca (Figure 18).

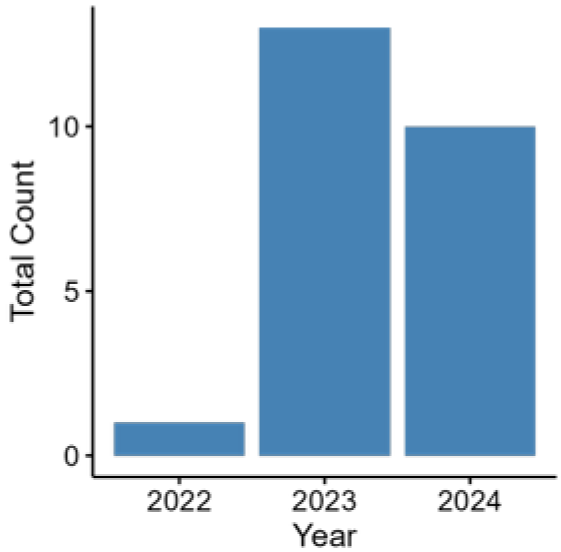


Figure 17. Total number of pinto abalone observed at all sites in Puget Sound by year.

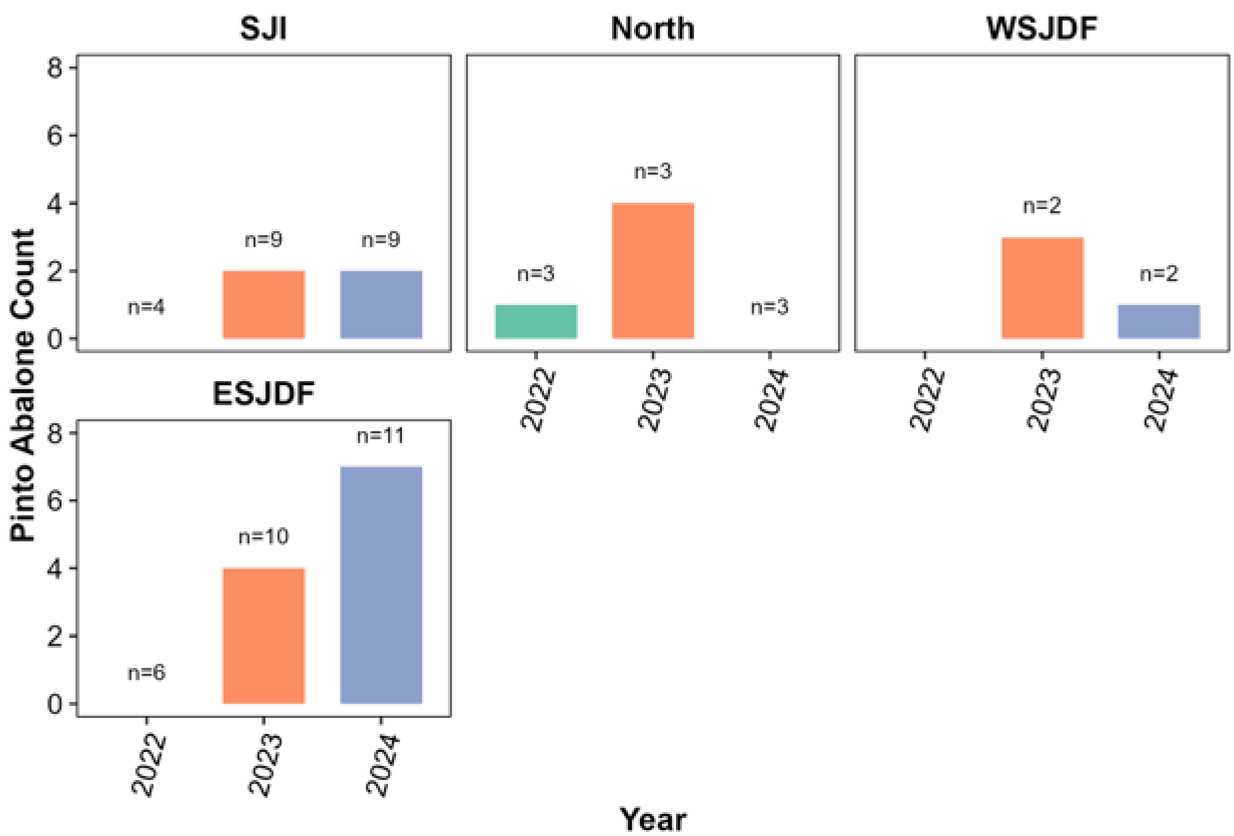


Figure 18. Total pinto abalone observed by year and sub-basin. If a basin is not shown, no pinto abalone were not found. n indicates the number of sites surveyed.

Fish Communities

To explore patterns in fish community composition across sub-basins, we conducted a similar non-metric multidimensional scaling (nMDS) ordination based on Bray–Curtis dissimilarity of Hellinger transformed species abundance data in R as for the invertebrate community- see above for details.

The fish community composition varied noticeably among the sub-basins of Puget Sound, as shown by the nMDS ordination (Stress = 0.18; Figure 19). Species vectors derived from SIMPER analysis highlight the species contributing most strongly to these differences. Sites from the Central and South basins clustered closely, indicating similar community structure, and were characterized by higher relative abundances of several perch species and sculpins. Sites from the San Juan Islands and adjacent straits (including the ESJDF and WSJDF) were grouped by communities associated with multiple rockfish species and greenlings. There was some overlap in the fish communities between the Central basin and the ESJDF, and communities in the North and Saratoga/Whidbey basins. Hood Canal showed intermediate composition but was more similar to those in the Central basin than to those in the Strait or San Juan Islands. These spatial patterns suggest that the regional structuring of fish communities across Puget Sound was associated with different species assemblages and different sub-basin groupings. The clustering of the fish communities among the sub-basins mirrored the clusters of invertebrate communities with the Central and South basins and the Straits and San Juan Islands clustered together in both taxonomic groups. The Central and South basins are dominated by sugar kelp in the kelp understory community whereas in the Straits and San Juan Islands, woody kelp was more common potentially also affecting the fish community. Mean fish species densities for each sub-basin are shown in Figure 20. Forage fish (*Clupea pallasi*, *Hypomesus pretiosus*, *Ammodytes hexapterus*, etc.) were very abundant in the Straits, around the San Juan Islands and in the North but less common in the other basins (Figure 21). Fish species richness was highest in the centrally located basins with 18 of the Reef Check indicator species detected in the Eastern straits, the Central basin and around the San Juan Islands and it decreased towards the north and south. Admiralty showed the lowest species richness but that might be an artifact of only one site being surveyed in this basin.

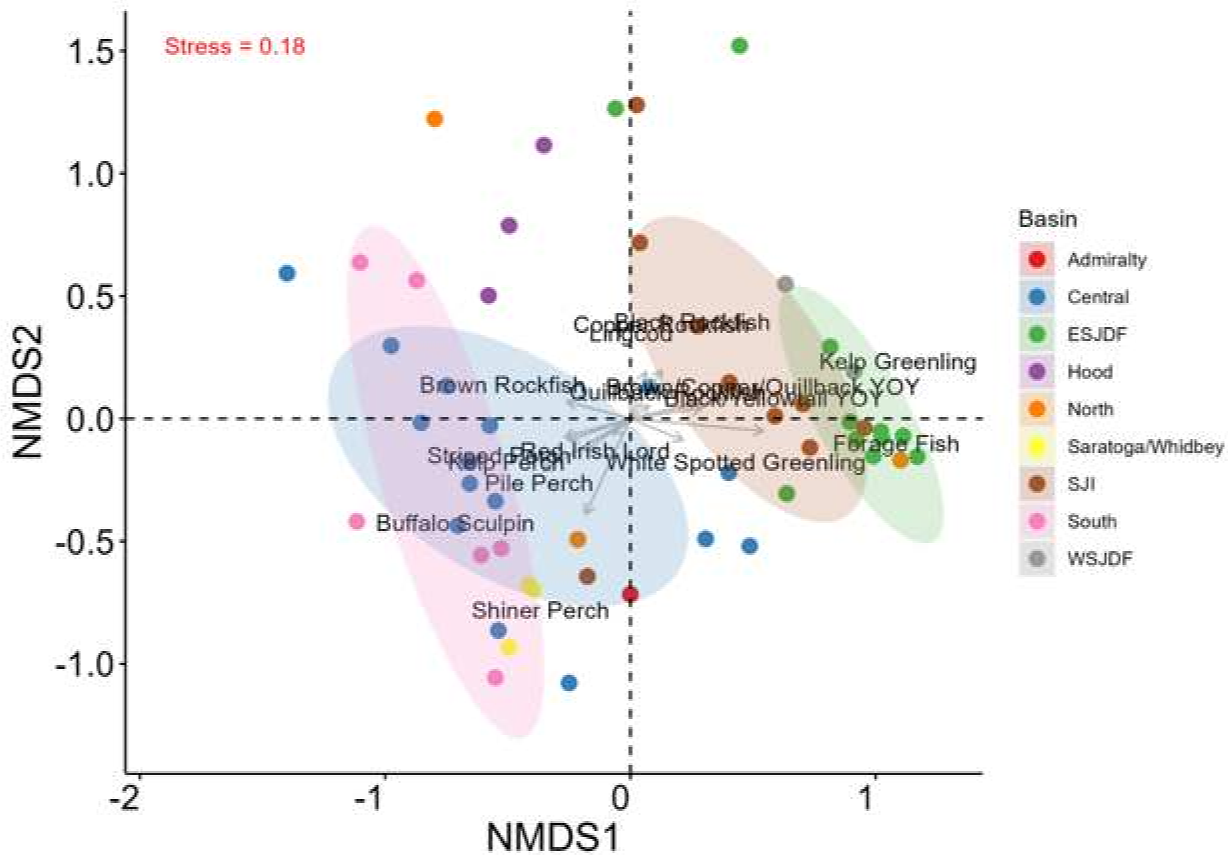


Figure 19. nMDS plot of the fish community in Puget Sound in 2024. Sites are colored by their respective sub-basins. Arrows indicate the species that drive the differentiation of the sub-basin communities. Only species that contributed more than 1% of the differentiation among the sub-basins in a SIMPER analysis are indicated. Ellipses were drawn at one Standard Deviation around the sites within each sub-basin. If there were fewer than four sites in a sub-basin, they are plotted, but no ellipses were drawn.

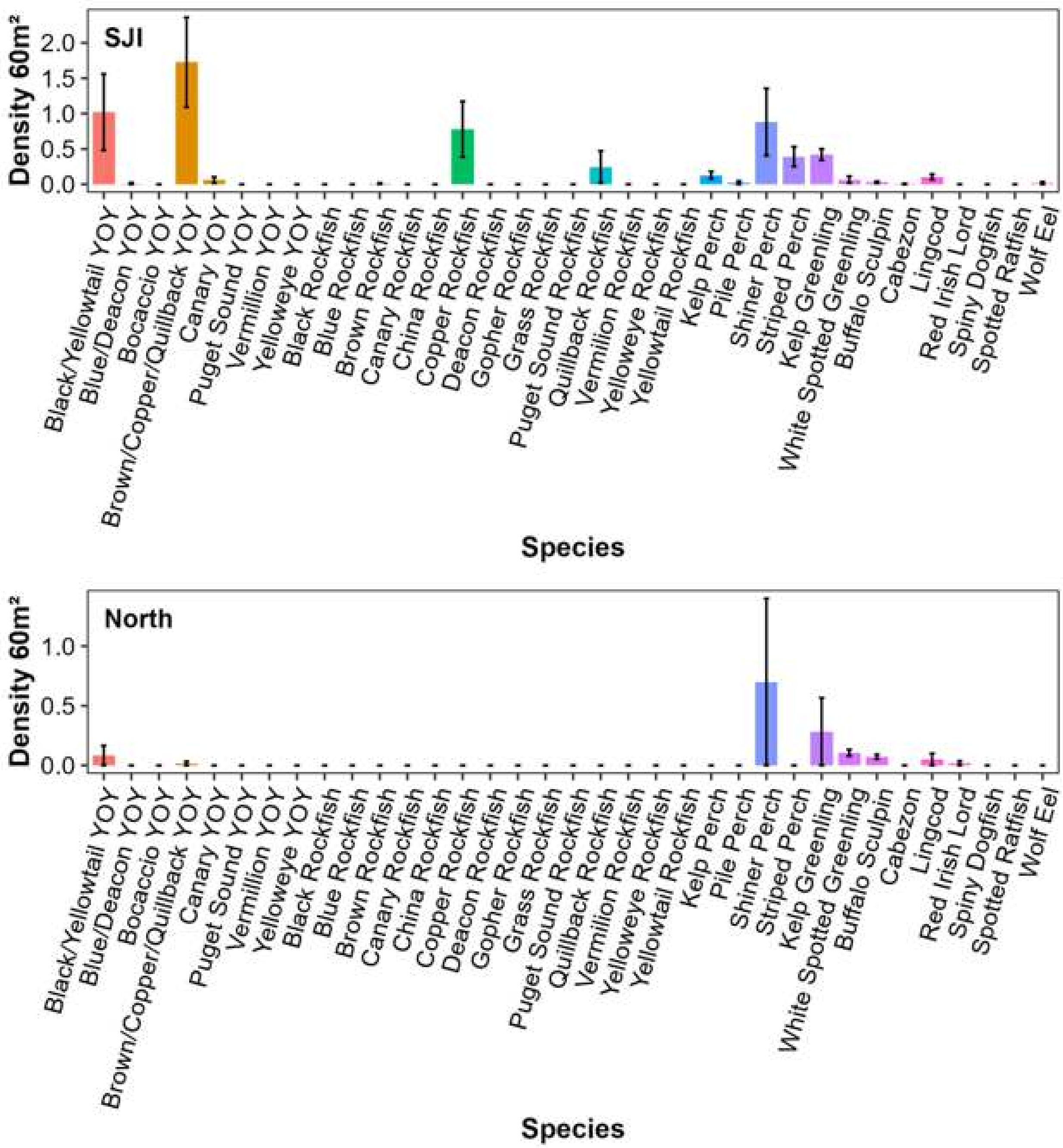
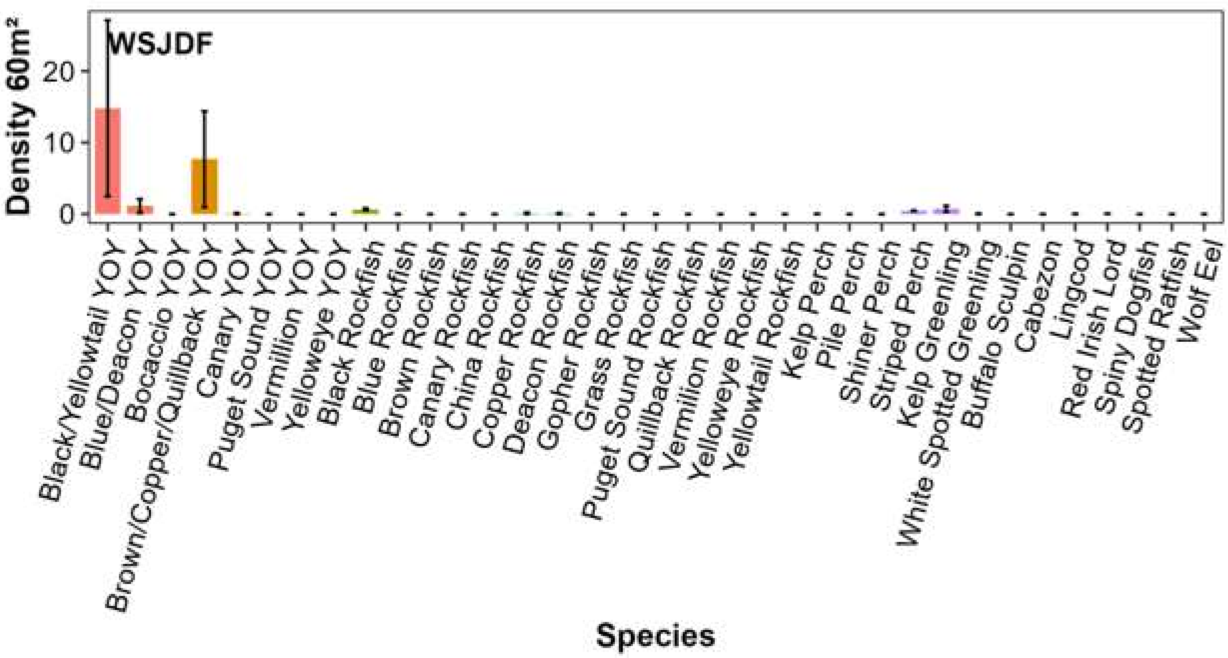


Figure 20. Mean fish density without forage fish by sub-basin in 2024 (bars are standard error).



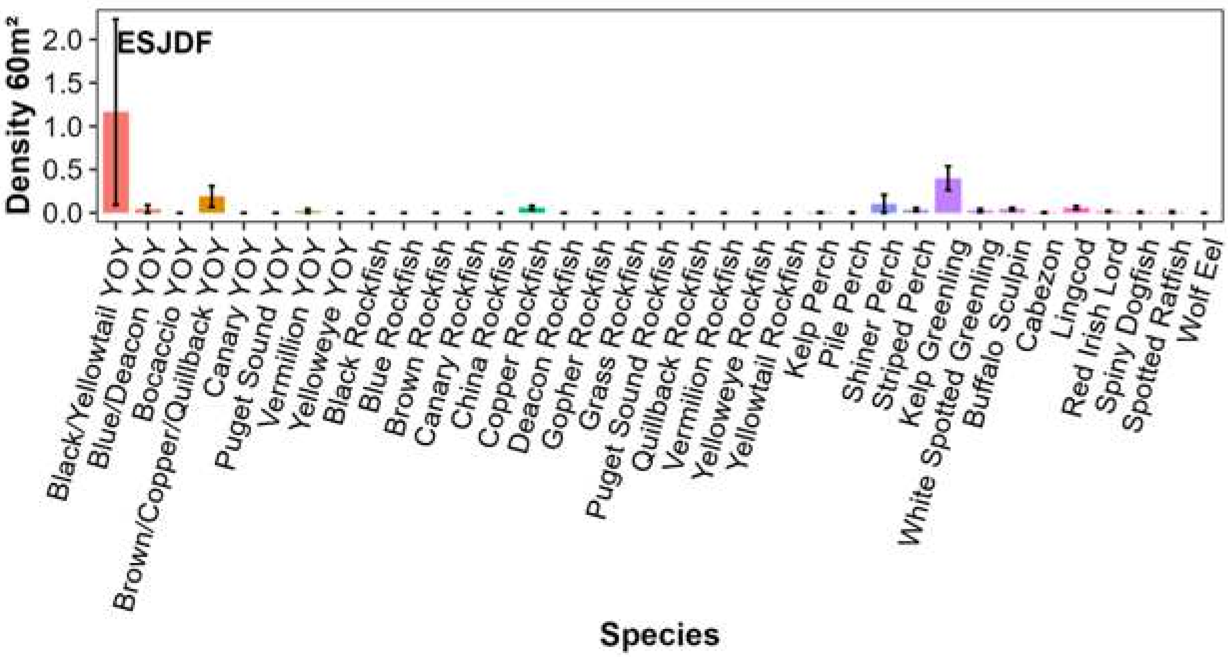


Figure 20 (continued). Mean fish density without forage fish by sub-basin in 2024 (bars are standard error).

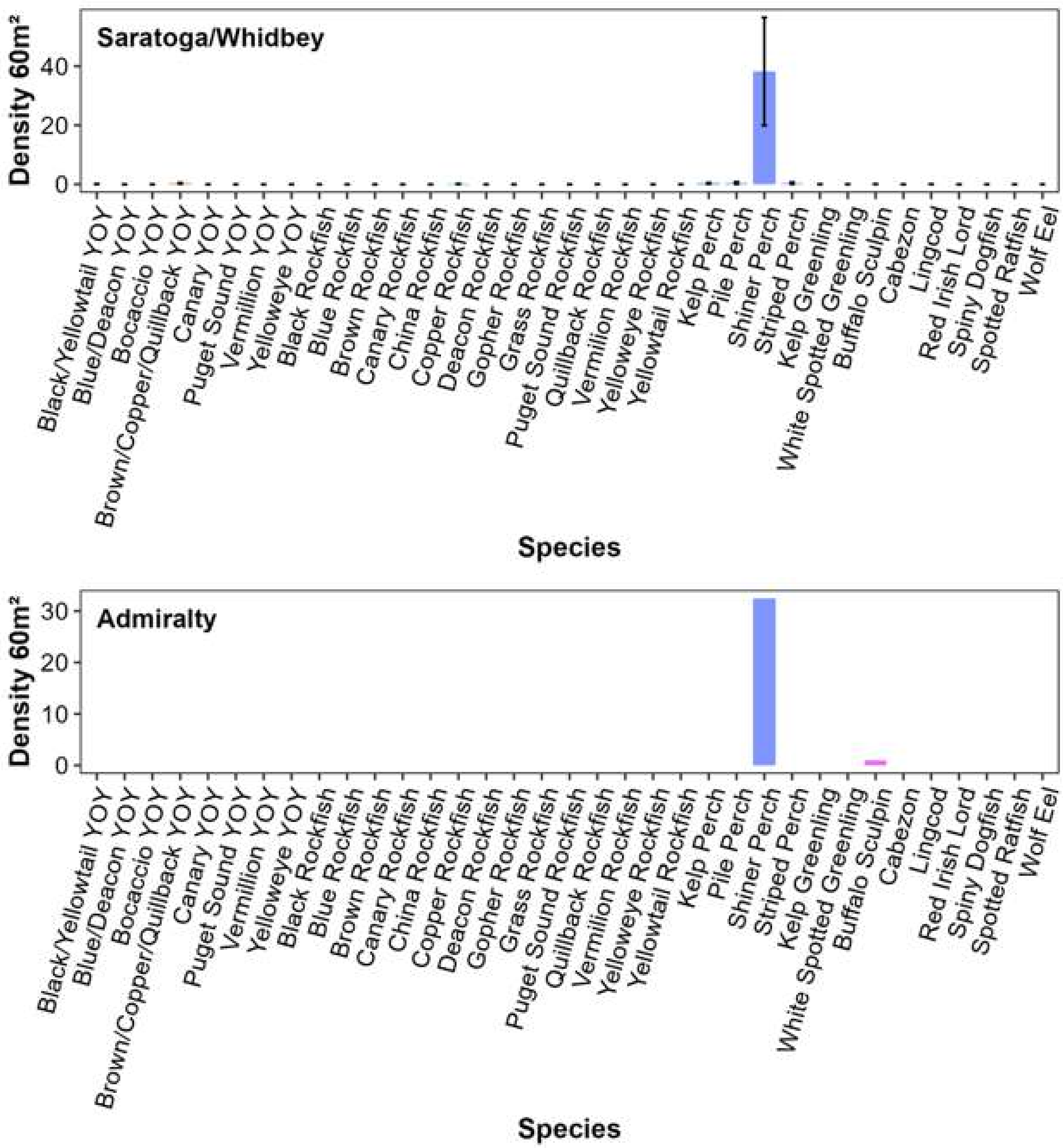


Figure 20 (continued). Mean fish density without forage fish by sub-basin in 2024 (bars are standard error).

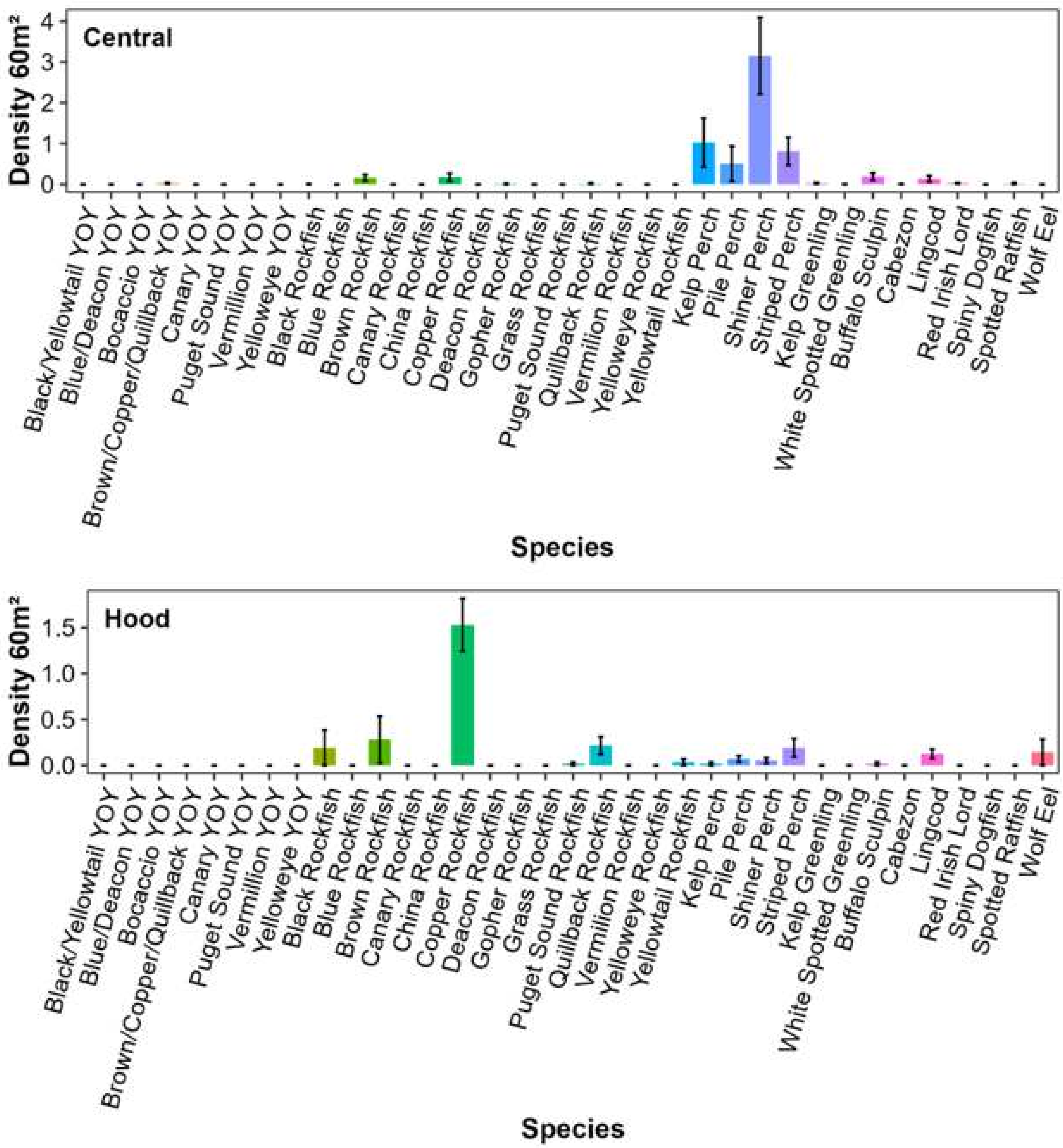


Figure 20 (continued). Mean fish density without forage fish by sub-basin in 2024 (bars are standard error).

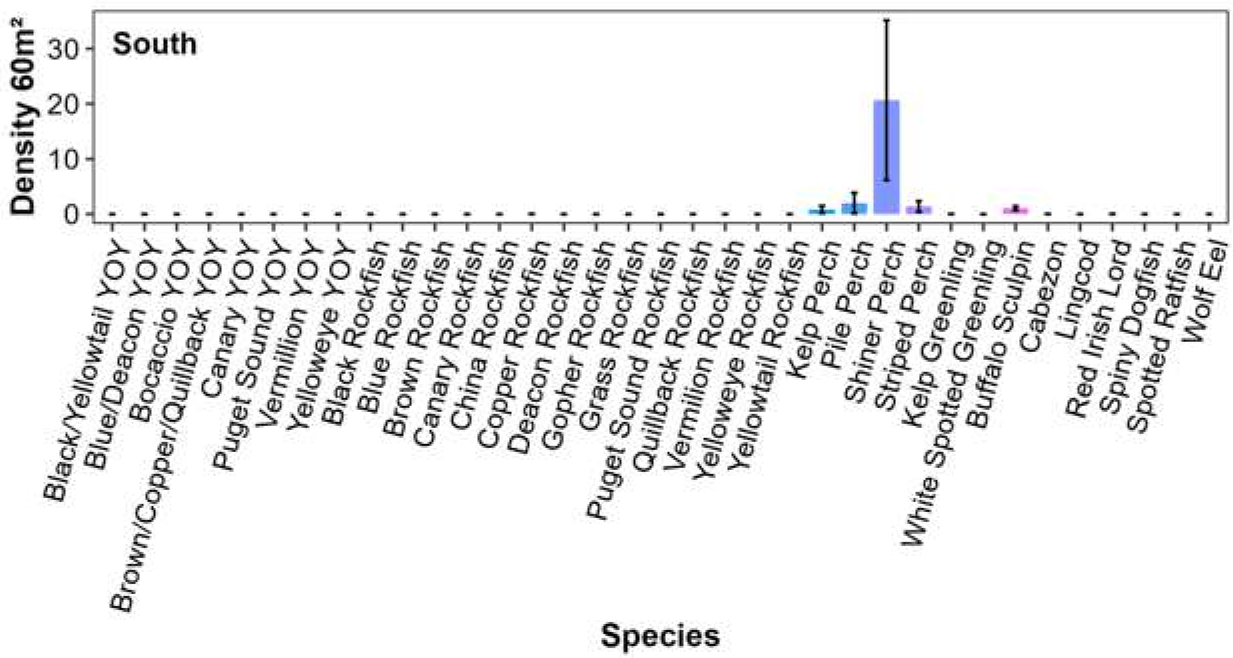


Figure 20 (continued). Mean fish density without forage fish by sub-basin in 2024 (bars are standard error).

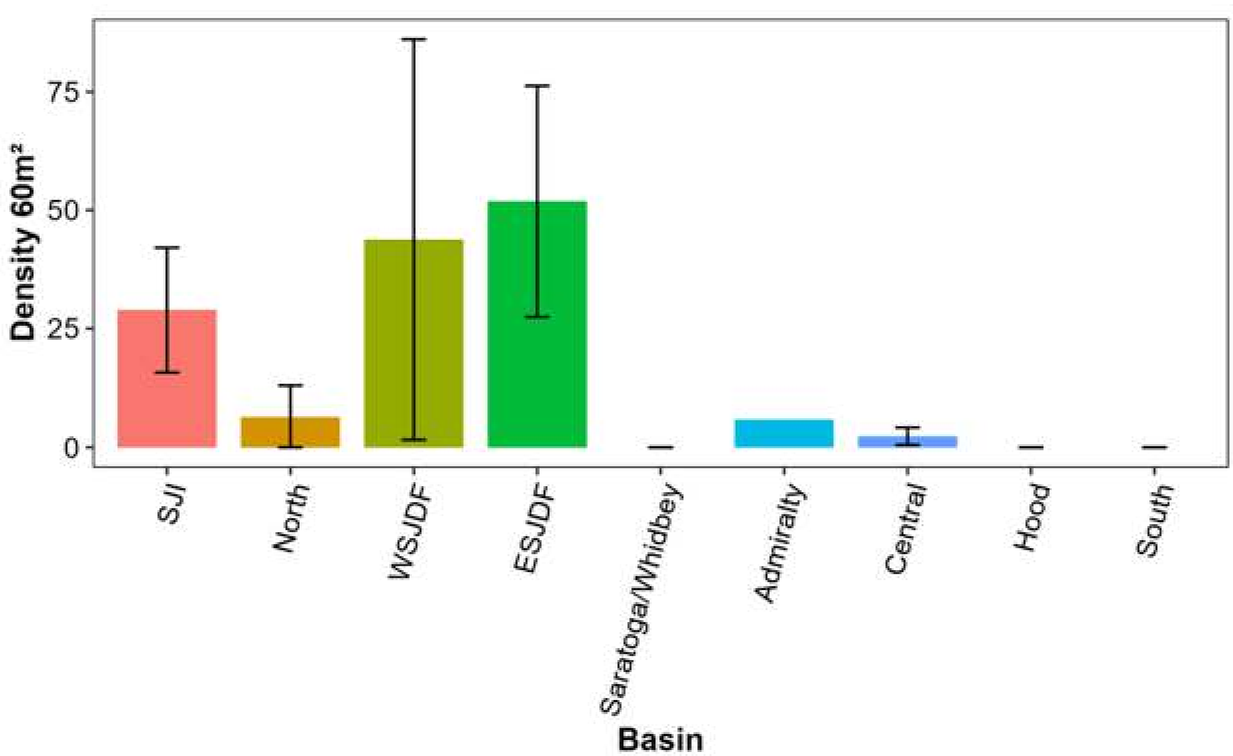


Figure 21: Mean forage fish density by sub-basin in 2024 (bars are standard error).

Environmental Monitoring

As part of the Eyes on Kelp Initiative, environmental monitoring sensors were installed at 14 index sites in the Salish Sea that are a subset of the 53 Reef Check subtidal monitoring sites. Reef Check stewards four of these monitoring buoys with scheduled quarterly downloading and servicing. Sensors are installed 1 m below the surface and 1 m above the bottom. Each sensor package includes temperature, conductivity, pH and dissolved oxygen sensors (Figure 22). Additionally, a Photosynthetic Active Radiation (PAR) logger recording light availability is installed near the base of each of the monitoring buoys.

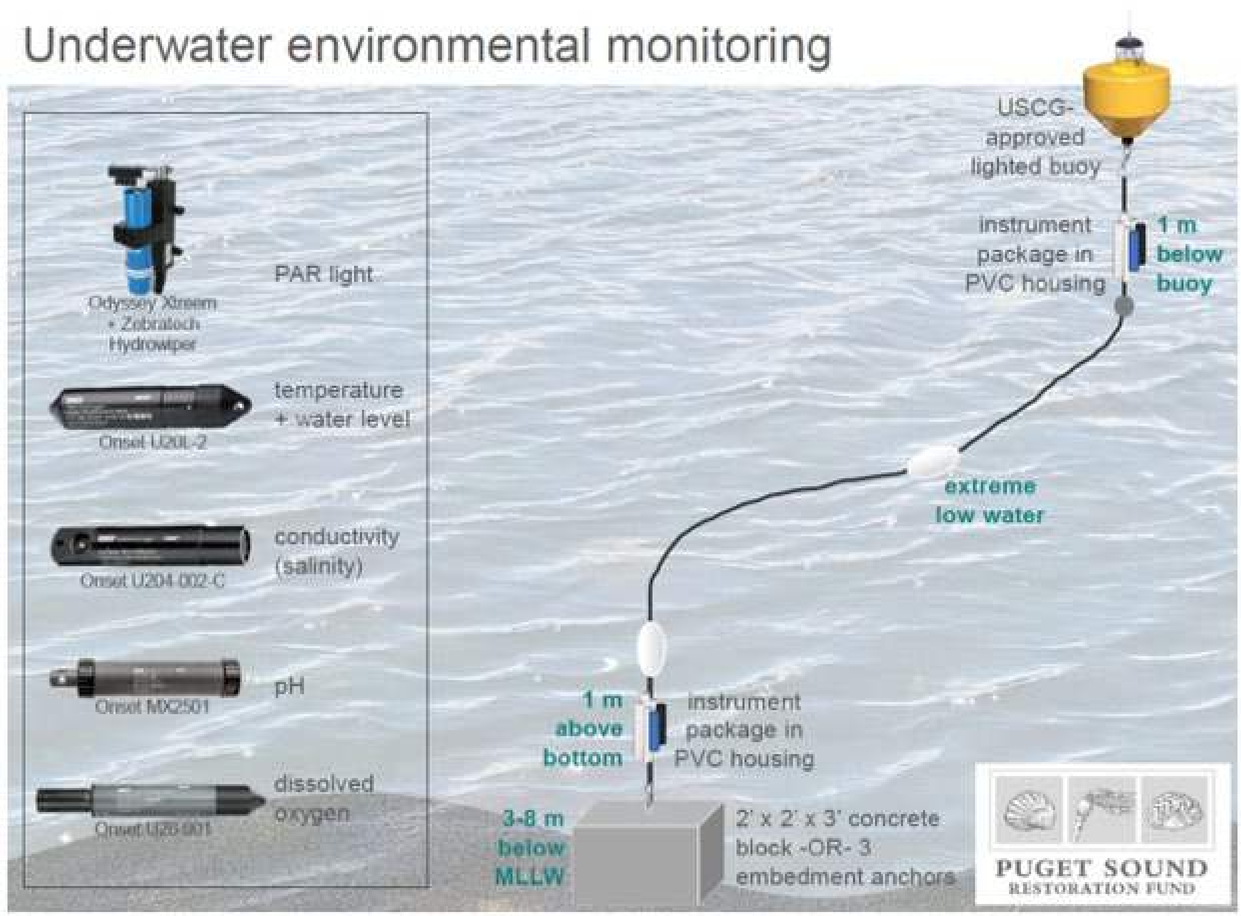


Figure 22: Index site environmental sensor buoy design

Discussion

In the last 50 years, canopy-forming bull kelp in Puget Sound has experienced dramatic declines. In some areas 80% of bull kelp beds have been lost and, around 2017, some disappeared entirely in the Central and South Sound basins (Berry et al., 2022). Less is known about the state and trajectory of the subtidal kelp forest community in Puget Sound. There is little historical data on these kelp species that are not observable from the surface. Reef Check subtidal surveys are uniquely capable of capturing these kelp communities to create a baseline and eventual long-term trends through citizen science subtidal monitoring. The data collected during these early years of the Washington program have given insight into the kelp, invertebrate and fish species composition at survey sites and, more broadly, within sub-basins. As we continue this program, this baseline will serve as an important mark against which future change can be measured. This will not only allow us to identify changes due to climate change and other anthropogenic impacts, but also to assess the impact and failure or success of future management, conservation or restoration actions.

Since 2012, Puget Sound Vital Signs have been created to measure ecosystem health and progress towards Puget Sound recovery goals (McManus et al., 2020). In 2022, under the leadership of Washington DNR-Nearshore Habitat Team, the Floating Kelp Indicator was developed to better understand the health of marine vegetation across the sound. This vital sign tracks the bull kelp bed canopy area trends across sub-basins by combining historical data and current aerial drone imagery and kayak surveys. Reef Check is working with the DNR-Nearshore Habitat team to incorporate density data into the Floating Kelp indicator. Currently, no indicator exists for the kelp forest community below the surface. Reef Check's surveys and its citizen science approach is poised to help develop an indicator for the subtidal rocky reef community. This would greatly augment the existing kelp indicator for the Puget Sound Vital Sign framework.

In the first three years of Reef Check Washington kelp forest monitoring, the number of sites surveyed has almost doubled from the initial 30 sites in 2022 to the 53 sites completed in 2024. Continued monitoring of these sites will contribute to a better understanding of annual kelp fluctuations as well as track if there are changes in abundance of key species or the community compositions regionally. These sites and the baseline data collected in 2023 and 2024 will serve as the backbone of Reef Check's long-term monitoring program in Puget Sound. In the coming years we will continue to monitor them and add additional sites in areas where we still have monitoring gaps (e.g., Admiralty Inlet). As we collect additional data we will be able to identify population trends and use this information to inform managers and conservation or restoration practitioners. We will continue to collaborate with our partners in management, conservation and restoration to make use of this information and to develop restoration strategies that address the loss of kelp forest habitat in Puget Sound.

In addition to informing management and conservation of kelp forests in Puget Sound, Reef Check's data from this region will become part of its larger West Coast-wide kelp forest monitoring program. The data are integrated with data collected from as far south as Central Baja California, Mexico. In recent years Reef Check has expanded into Baja, Oregon and most recently into British Columbia, Canada. Over this geographic range, Reef Check is collecting data at almost 200 sites and its monitoring program continue to expand geographically and by engaging with more coastal communities to increase the public participation in marine science. Over the first 20 years of its existence, participation in Reef Check's kelp forest monitoring program has, in many cases, been limited to volunteers with the resources to provide their own training, scuba gear, and transportation. To address these barriers to entry into scuba and to engage citizen science volunteers that better reflect the diversity of the communities in which we operate, Reef Check's Dive into Science program was created. The program trains participants from open water scuba certification through scientific dive training at no cost to the participants in order to encourage participation of historically underrepresented communities in marine sciences and cultivate the next generation of ocean stewards and leaders. In 2024, the Dive into Science program in California worked with foster youth and tribal communities. As we continue to expand this program, we are aiming to engage with communities in the Puget Sound region to train a diverse group of citizen scientists.

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Appendix A

List of RCWA sites monitored in 2023 and 2024. Some partner sites complete six core transects only and no additional fish transects. Sites with fewer than 18 fish transects were due to poor ocean conditions at that site during the survey.

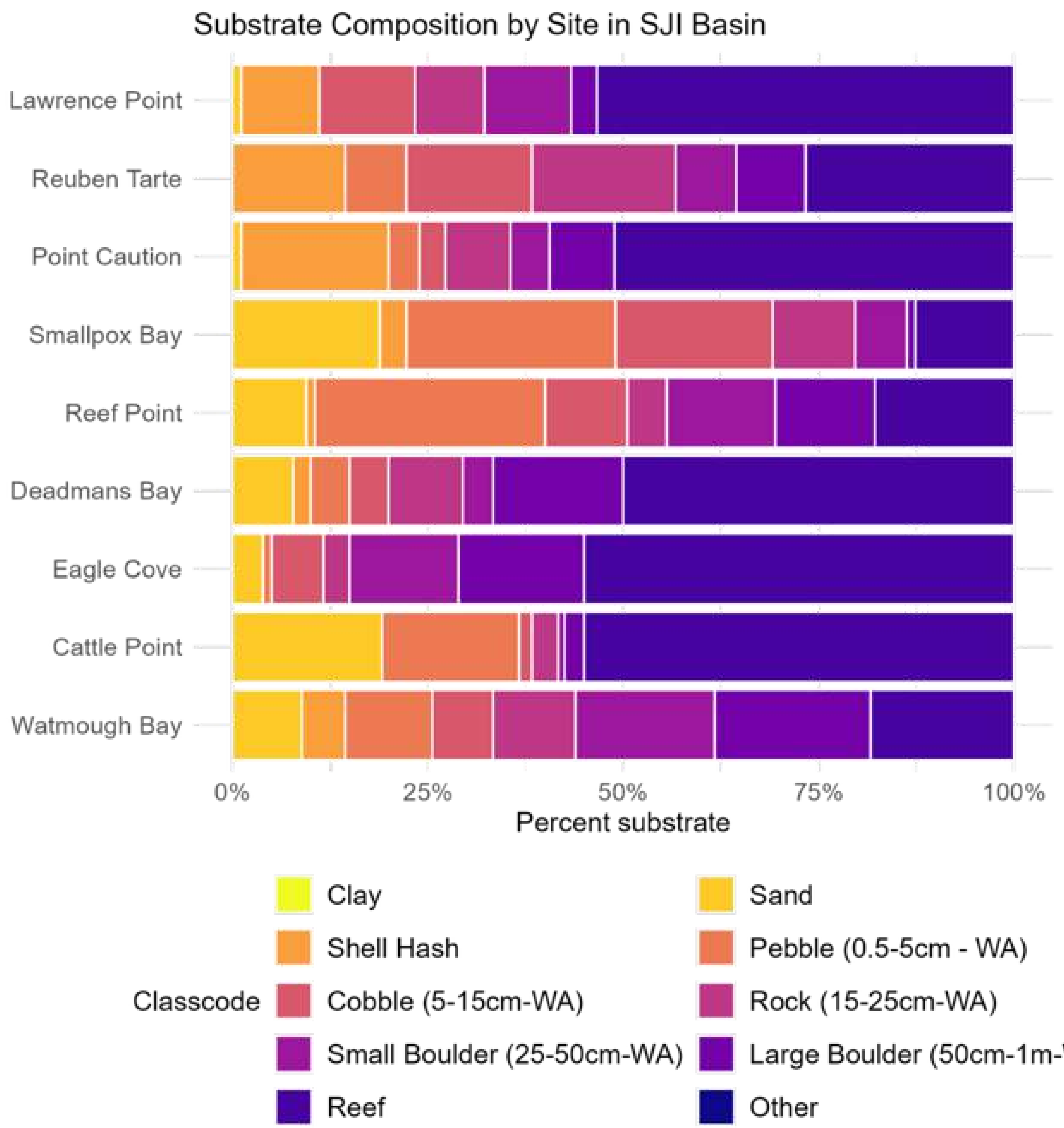
						# of Fish Transects		# of Swath Transects		Environmental Sensors
Site	**Latitude**	**Longitude**	**Total # of years surveyed**	**2023 Survey Date**	**2024 Survey Date**	**2023**	**2024**	**2023**	**2024**	
Blake Island South	47.53049	-122.49498	3	9/30/2023	7/12/2024	18	18	6	6	No
Burrows Lighthouse	48.477268	-122.714451	3	9/5/2023	9/9/2024	20	20	6	6	No
Cattle Point	48.45148	-122.961402	2	9/16/2023	9/14/2024	18	4	6	4	No
Clallam Bay West	48.256822	-124.275318	2	7/28/2023	8/3/2024	14	19	6	6	No
Dallas Banks	48.133602	-122.934924	2	7/21/2023	6/16/2024	18	22	6	6	No
Deadmans Bay	48.512846	-123.147129	3	9/15/2023	9/13/2024	18	18	6	6	No
Derelict Conveyor	48.855254	-122.730835	3	6/23/2023	6/29/2024	18	18	6	6	Yes
Devils Head	47.166934	-122.761201	3	8/25/2023	9/22/2024	22	18	6	6	No
Eagle Cove	48.459734	-123.033258	2	9/16/2023	9/14/2024	21	18	6	6	No
Ebeys Landing	48.18384	-122.7004	3	5/27/2023	7/2/2024	19	19	6	6	No
Edmonds Shell Creek	47.819549	-122.37838	4	6/17/2023	7/6/2024	18	20	6	6	Yes
Elliot Bay Marina	47.627001	-122.391019	1		10/9/2024		6		6	No

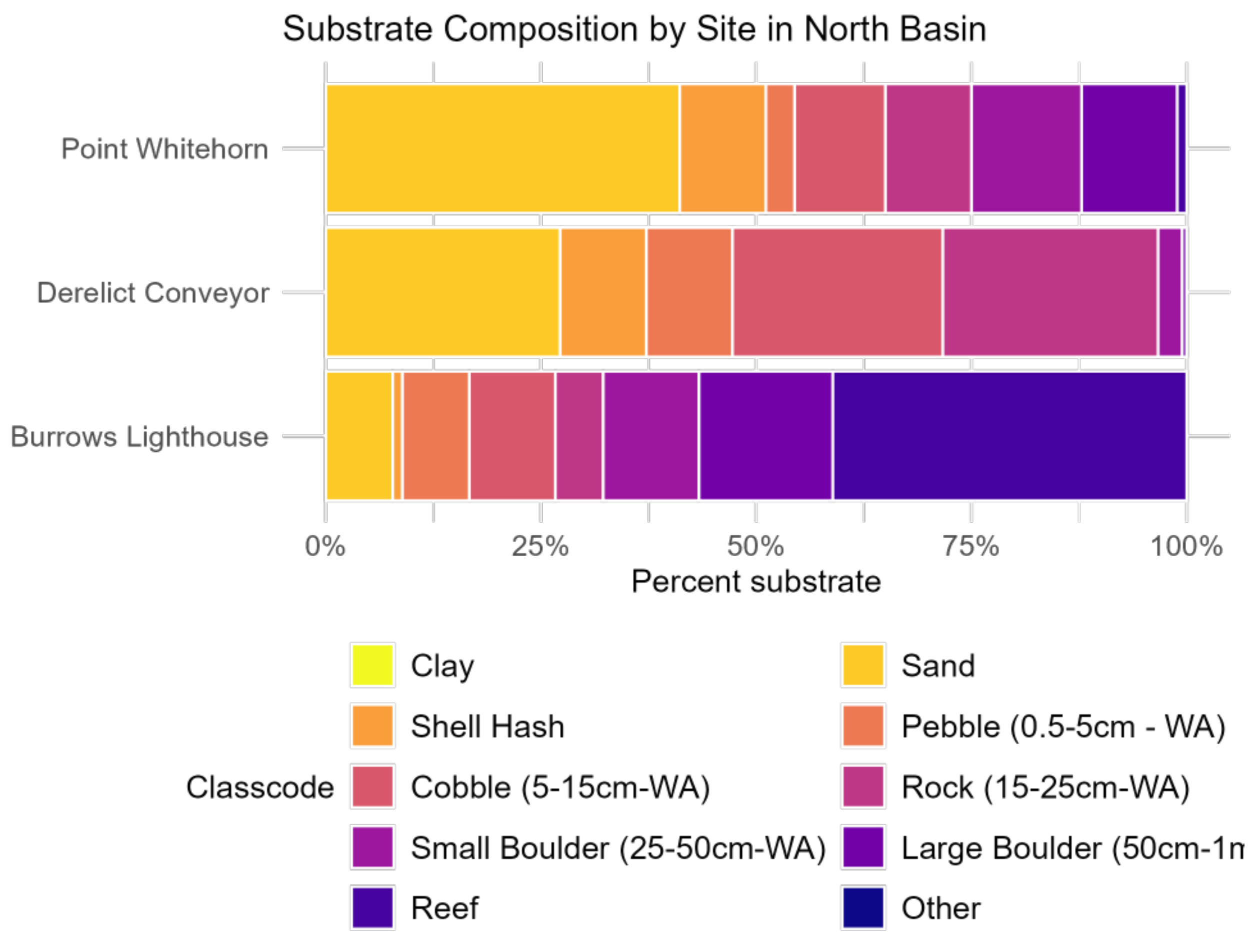
Foulweather Bluff	47.941083	-122.6012	3	8/9/2023	8/11/2024	18	13	6	6	Yes
Fox Island East Wall	47.228194	-122.589757	2	8/27/2023	8/11/2024	19	6	6	6	No
Freshwater Bay	48.141606	-123.613191	4	7/25/2023	7/17/2024	18	18	6	6	Yes
Glen Acres	47.48005	-122.448455	2	7/8/2023	7/13/2024	18	18	6	6	Yes
Goby Gardens	47.631907	-122.94162	3	6/4/2023	6/9/2024	19	19	6	6	No
Grain Terminal	47.624131	-122.369154	1		7/8/2024		18		6	Yes
Green Point	48.118525	-123.315716	2	8/4/2023	7/28/2024	6	18	6	6	No
Jefferson Head	47.744509	-122.475293	4	8/10/2023	7/1/2024	18	18	6	6	Yes
Ketron Island	47.167661	-122.63057	3	8/25/2023	8/25/2024	18	19	6	6	No
Lawrence Point	48.66048	-122.741701	2	9/18/2023	8/26/2024	18	19	6	6	No
Lincoln Park	47.536153	-122.397348	3	6/12/2023	5/25/2024	18	19	6	6	Yes
Lowell Point	48.119417	-122.487037	4	10/22/2023	10/12/2024	21	18	6	6	No
Lower Elwha	48.13964	-123.585069	1		7/27/2024		18		6	No
Magnolia	47.631423	-122.401099	4	8/23/2023	7/30/2024	6	18	6	6	Yes
McCurdy Point	48.138791	-122.844791	3	7/22/2023	6/15/2024	19	18	6	6	No
North Beach	48.144779	-122.778533	4	7/23/2023	6/14/2024	18	18	6	6	Yes
Owen Beach	47.31752	-122.53389	2	7/10/2023	6/11/2024	18	18	6	6	No
Partridge Point	48.225837	-122.771572	3	5/26/2023	6/2/2024	18	20	6	6	No
Point Caution	48.563167	-123.025641	3	6/28/2023	7/27/2024	18	18	6	6	Yes
Point Dalco	47.333519	-122.519126	2	7/9/2023	7/14/2024	18	18	6	6	No
Point Vashon	47.512553	-122.473981	3	7/10/2023	7/12/2024	19	18	6	6	Yes
Point Whitehorn	48.896331	-122.795095	3	6/23/2023	6/28/2024	18	18	6	6	No
Possession Point	47.90005	-122.383133	3	10/19/2023	10/11/2024	18	18	6	6	No
Pulali Point	47.735708	-122.85479	3	6/3/2023	6/8/2024	20	18	6	6	No
Reef Point	48.536839	-122.718458	2	9/6/2023	8/12/2024	20	18	6	6	No

Reuben Tarte	48.612837	-123.097222	3	9/15/2023	9/13/2024	18	23	6	6	No
Rock 305	47.95185	-124.6698	1		8/5/2024		19		6	No
Rosario Head	48.415477	-122.66477	3	8/12/2023	8/10/2024	18	19	6	6	No
Salmon Beach	47.296017	-122.53165	3	8/8/2023	8/14/2024	6	6	6	6	Yes
Saltwater State Park	47.372238	-122.327854	2	8/13/2023	8/17/2024	18	18	6	6	No
Seattle Waterfront	47.608873	-122.349157	3	9/19/2023	8/26/2024	6	6	6	6	No
Sekiu Point	48.267782	-124.297828	2	7/28/2023	8/3/2024	18	18	6	6	No
Sirens of Spring	47.618148	-122.360893	1		10/8/2024		6		6	No
Smallpox Bay	48.541072	-123.161846	3	9/17/2023	9/15/2024	19	19	6	6	No
Smith Island	48.318961	-122.849565	2	9/24/2023	6/16/2024	18	6	6	6	No
South Hat Island	48.003363	-122.301536	3	10/20/2023	10/10/2024	21	18	6	6	No
Squaxin Island	47.16767	-122.895667	4	7/11/2023	7/16/2024	6	6	6	6	Yes
Sund Rock	47.435996	-123.12022	3	6/2/2023	6/7/2024	18	19	6	6	No
Teahwhit Head	47.87103	-124.60768	1		8/6/2024		19		6	No
Titlow Beach	47.246982	-122.555038	2	7/23/2023	7/11/2024	18	18	6	6	No
Tongue Point	48.166808	-123.702363	2	7/29/2023	8/2/2024	20	20	6	6	No
Watmough Bay	48.431304	-122.803311	3	8/23/2023	9/10/2024	18	20	6	6	No
Wing Point	47.615814	-122.488302	4	7/20/2023	8/15/2024	6	18	6	6	Yes

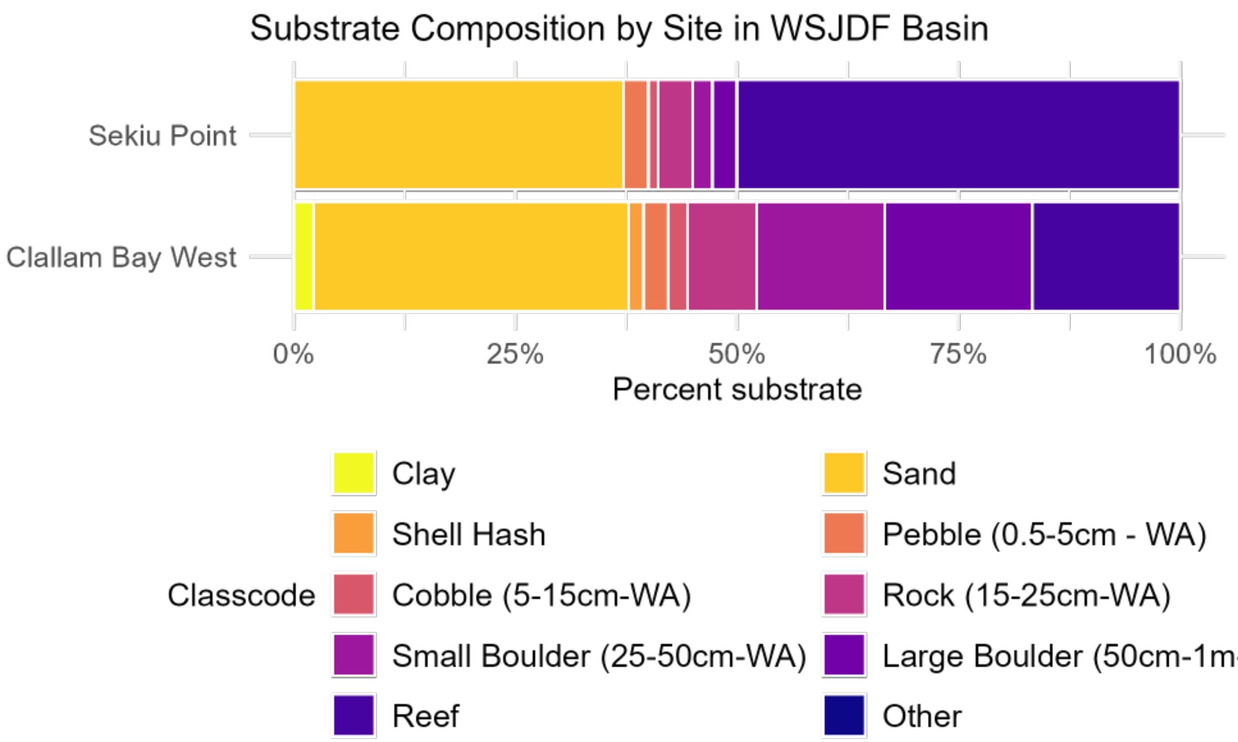
Appendix B

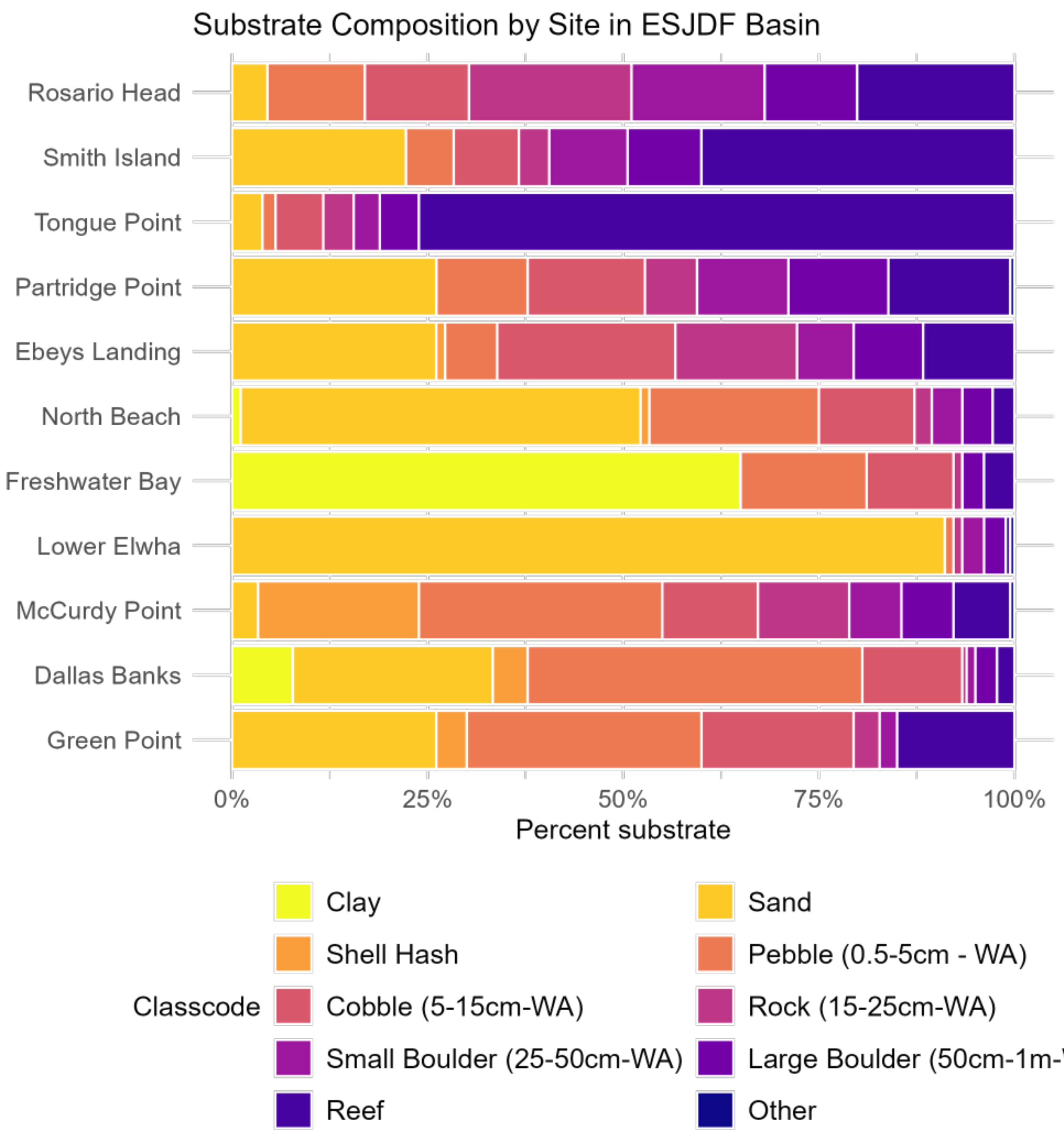
Mean substrate categories at Reef Check monitoring sites from UPC surveys in 2024.



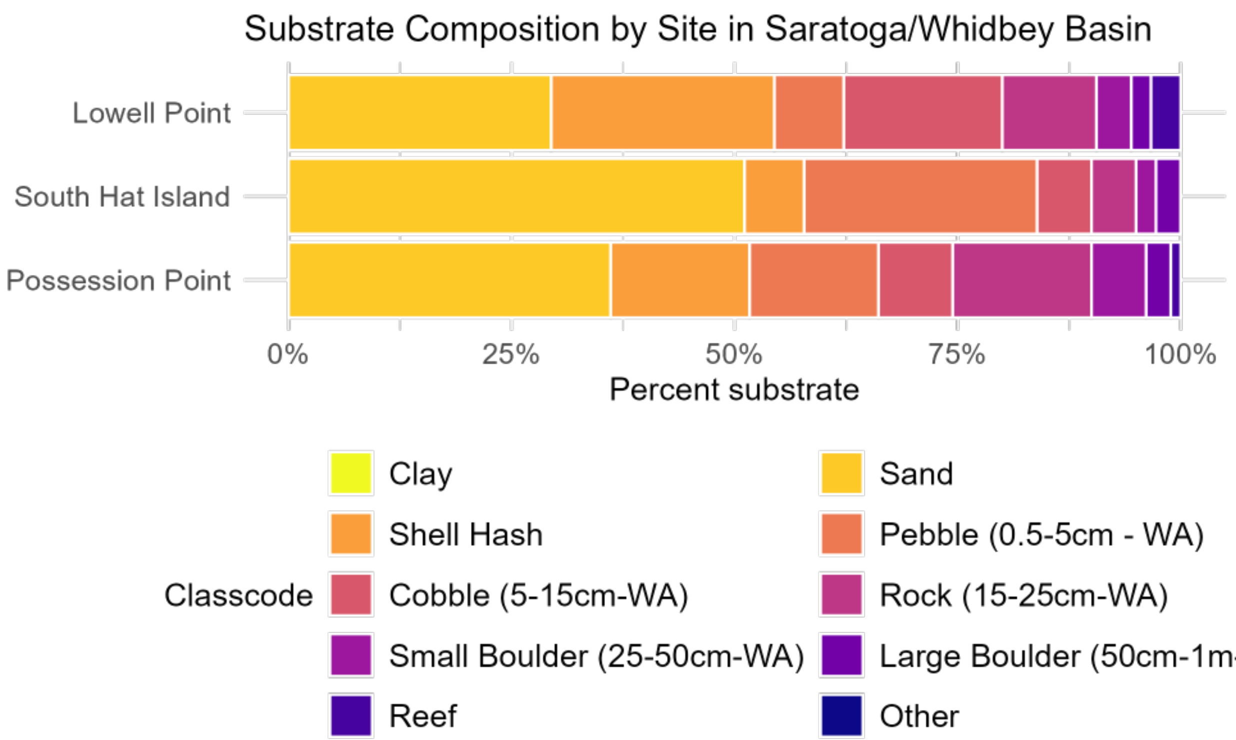


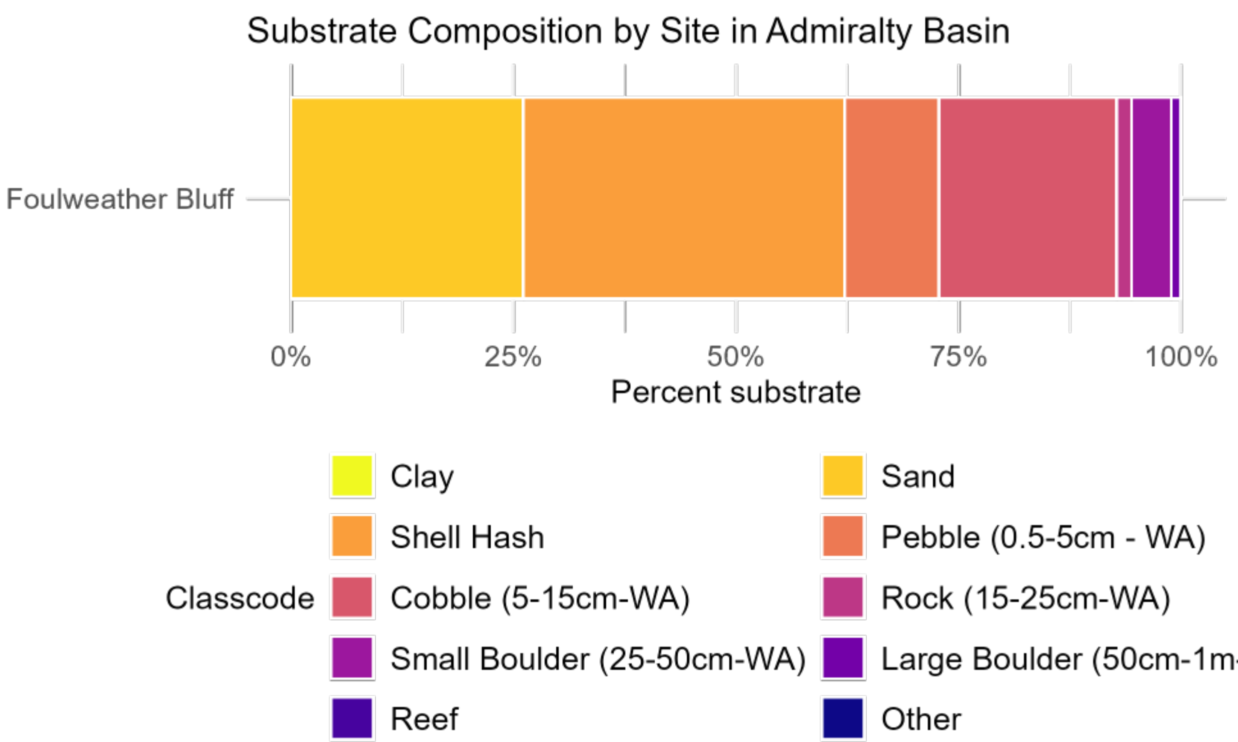
Substrate Composition by Site in North Basin
Point Whitehorn
Derelict Conveyor
Burrows Lighthouse
0%
25%
50%
75%
100%
Percent substrate
Classcode
Clay
Sand
Shell Hash
Pebble (0.5-5cm - WA)
Cobble (5-15cm-WA)
Rock (15-25cm-WA)
Small Boulder (25-50cm-WA)
Large Boulder (50cm-1m
Reef
Other

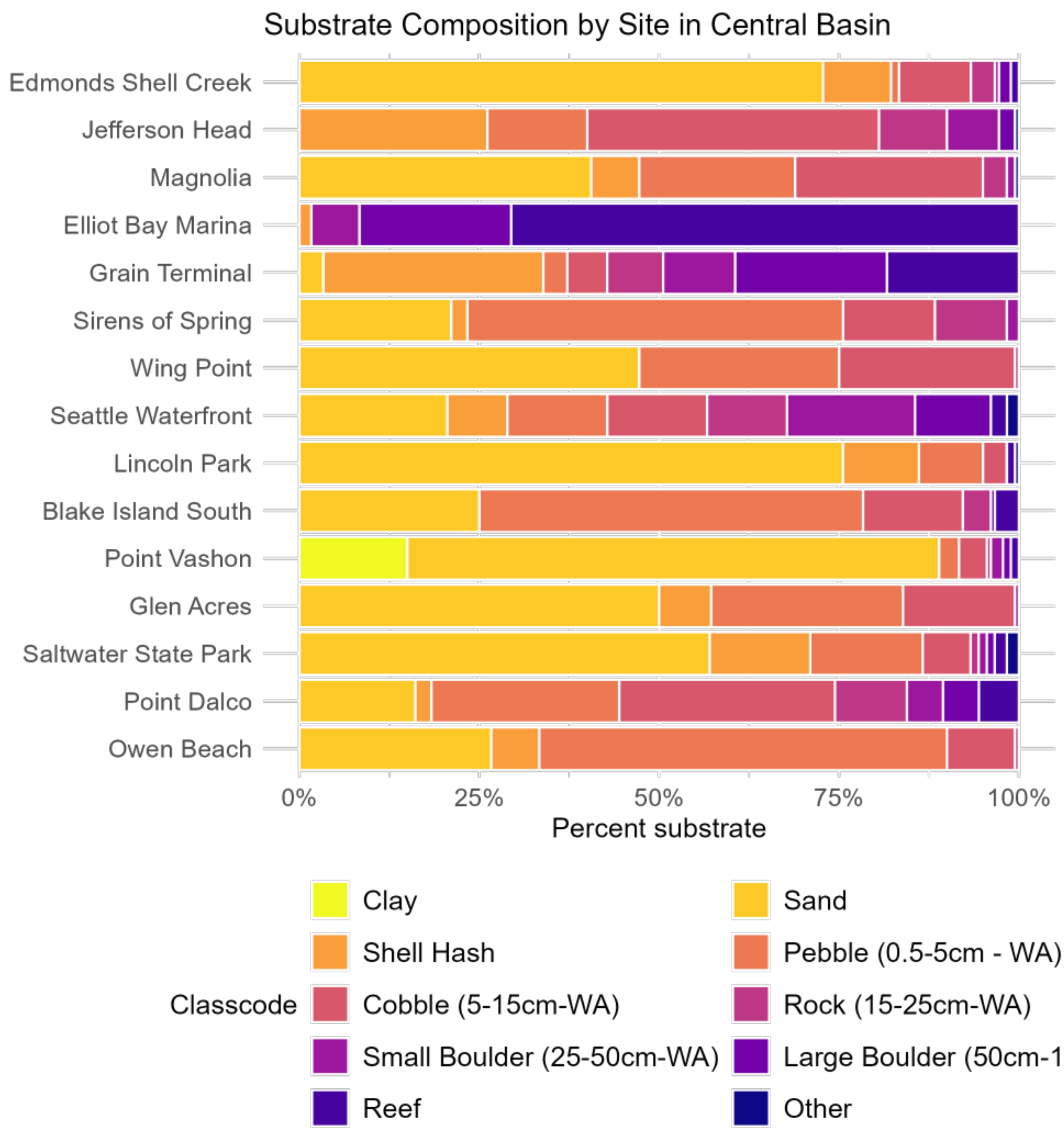

Substrate Composition by Site in WSJDF Basin
Sekiu Point
Clallam Bay West
0%
25%
50%
75%
100%
Percent substrate
Classcode
Clay
Sand
Shell Hash
Pebble (0.5-5cm - WA)
Cobble (5-15cm-WA)
Rock (15-25cm-WA)
Small Boulder (25-50cm-WA)
Large Boulder (50cm-1m
Reef
Other

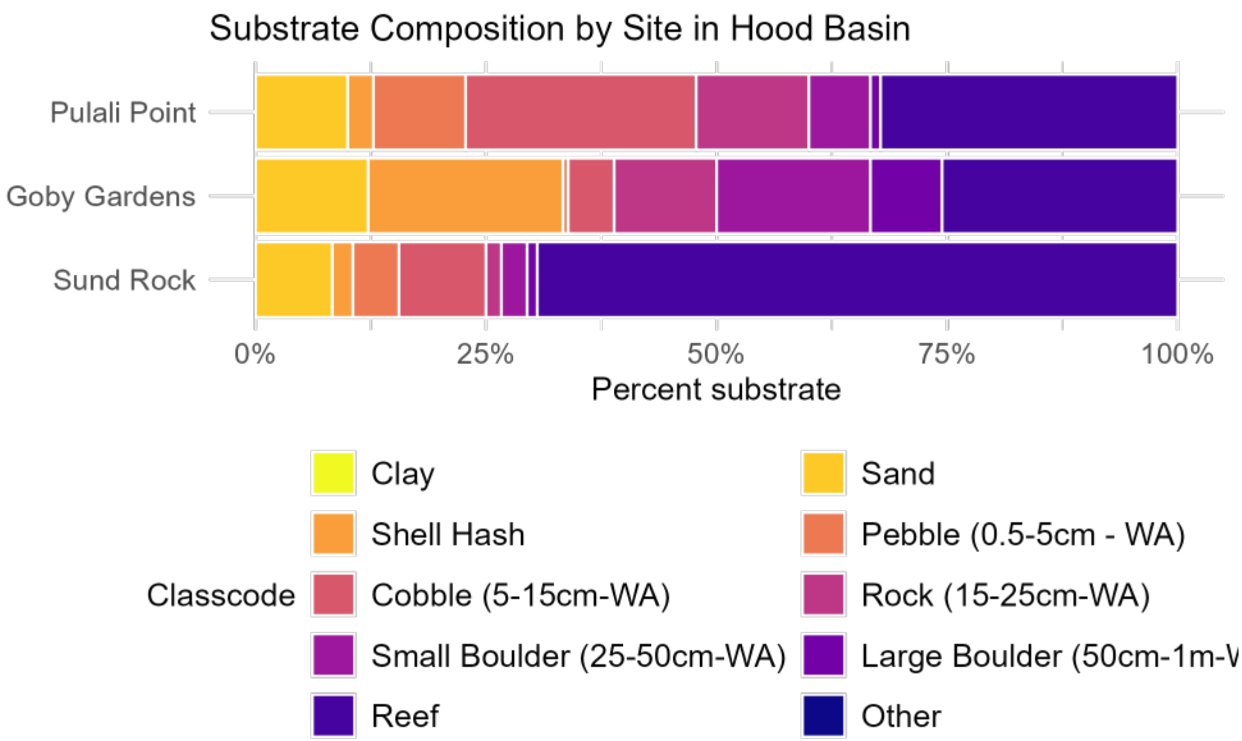


Substrate Composition by Site in ESJDF Basin
Rosario Head
Smith Island
Tongue Point
Partridge Point
Ebeys Landing
North Beach
Freshwater Bay
Lower Elwha
McCurdy Point
Dallas Banks
Green Point
0%
25%
50%
75%
100%
Percent substrate
Classcode
Clay
Sand
Shell Hash
Pebble (0.5-5cm - WA)
Cobble (5-15cm-WA)
Rock (15-25cm-WA)
Small Boulder (25-50cm-WA)
Large Boulder (50cm-1m-
Reef
Other

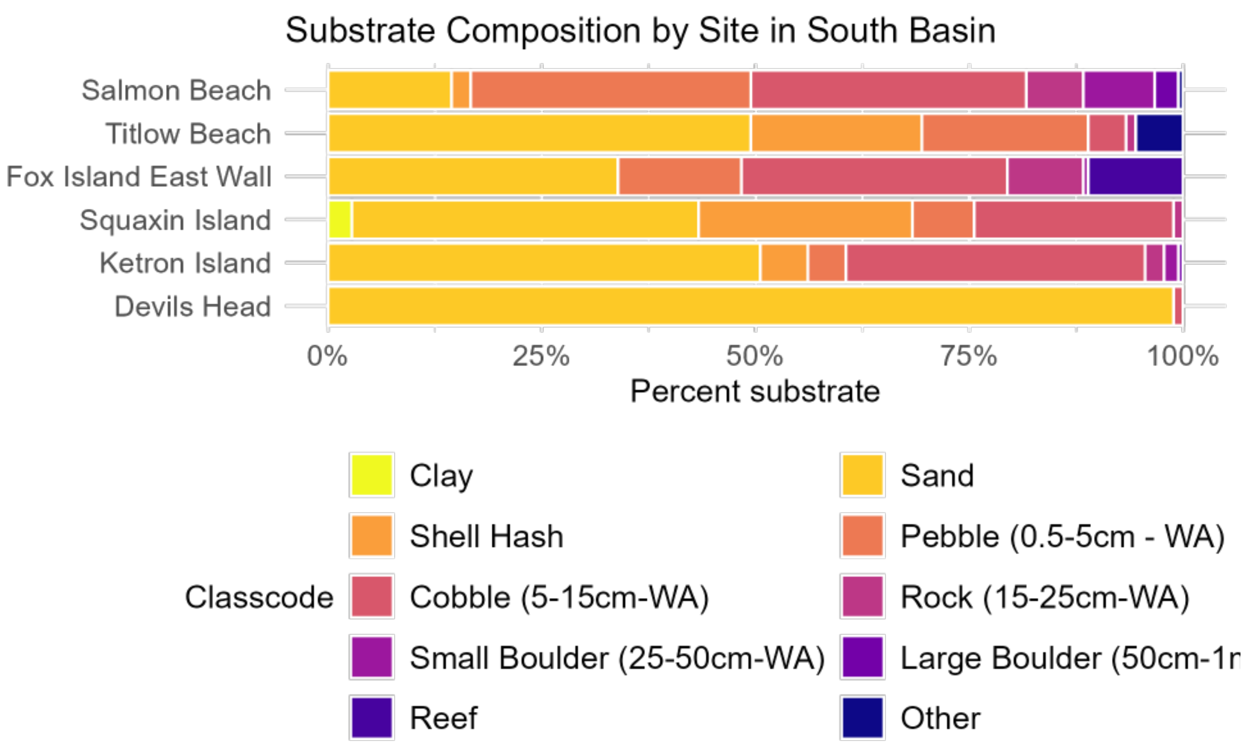

Substrate Composition by Site in Saratoga/Whidbey Basin
Lowell Point
South Hat Island
Possession Point
0%
25%
50%
75%
100%
Percent substrate
Classcode
Clay
Sand
Shell Hash
Pebble (0.5-5cm - WA)
Cobble (5-15cm-WA)
Rock (15-25cm-WA)
Small Boulder (25-50cm-WA)
Large Boulder (50cm-1m-
Reef
Other


Substrate Composition by Site in Admiralty Basin
Foulweather Bluff
0%
25%
50%
75%
100%
Percent substrate
Classcode
Clay
Sand
Shell Hash
Pebble (0.5-5cm - WA)
Cobble (5-15cm-WA)
Rock (15-25cm-WA)
Small Boulder (25-50cm-WA)
Large Boulder (50cm-1m-
Reef
Other


Substrate Composition by Site in Central Basin
Edmonds Shell Creek
Jefferson Head
Magnolia
Elliot Bay Marina
Grain Terminal
Sirens of Spring
Wing Point
Seattle Waterfront
Lincoln Park
Blake Island South
Point Vashon
Glen Acres
Saltwater State Park
Point Dalco
Owen Beach
0%
25%
50%
75%
100%
Percent substrate
Classcode
Clay
Sand
Shell Hash
Pebble (0.5-5cm - WA)
Cobble (5-15cm-WA)
Rock (15-25cm-WA)
Small Boulder (25-50cm-WA)
Large Boulder (50cm-1
Reef
Other



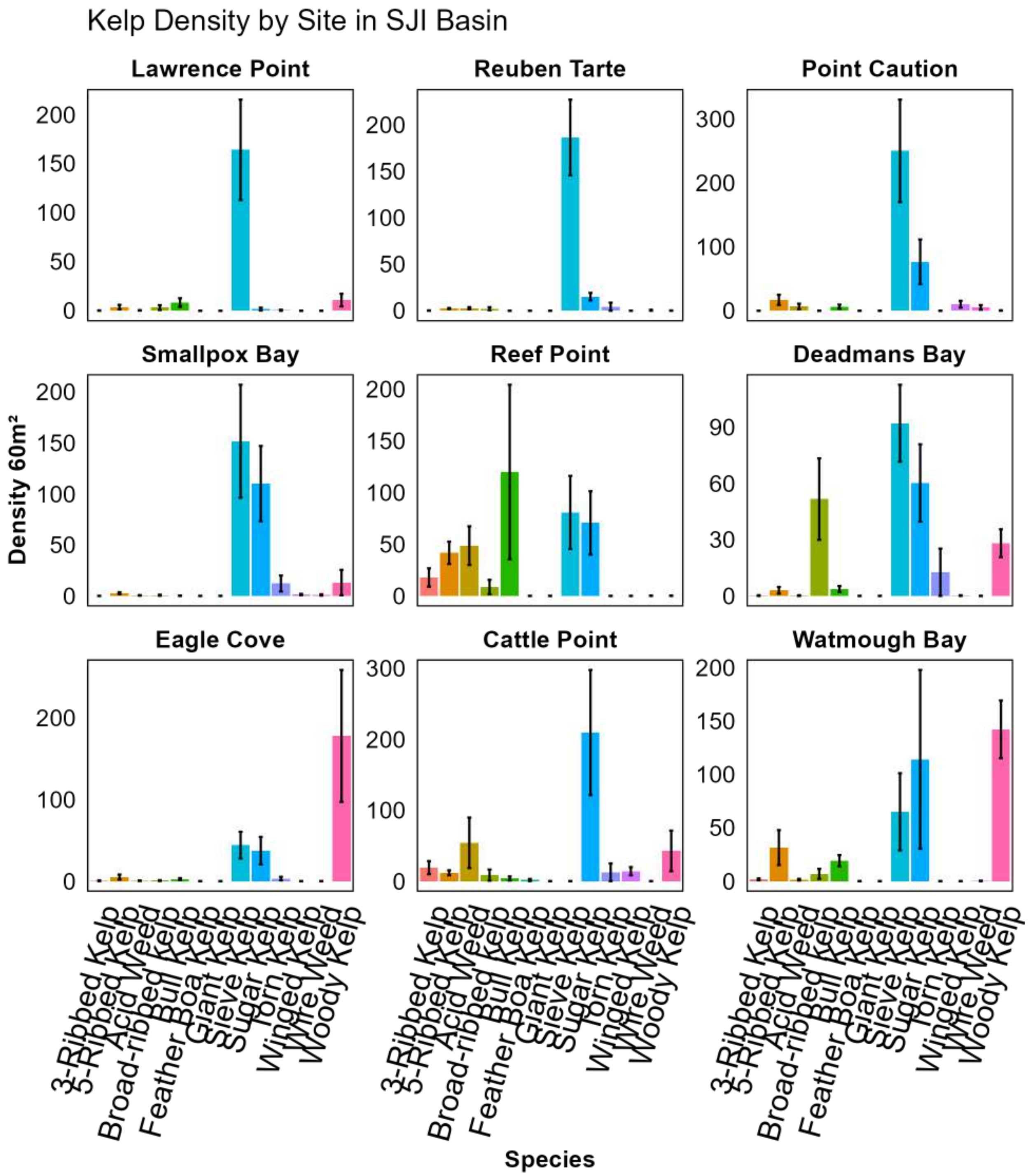
Substrate Composition by Site in Hood Basin
Pulali Point
Goby Gardens
Sund Rock
0%
25%
50%
75%
100%
Percent substrate
Classcode
Clay
Sand
Shell Hash
Pebble (0.5-5cm - WA)
Cobble (5-15cm-WA)
Rock (15-25cm-WA)
Small Boulder (25-50cm-WA)
Large Boulder (50cm-1m-W
Reef
Other

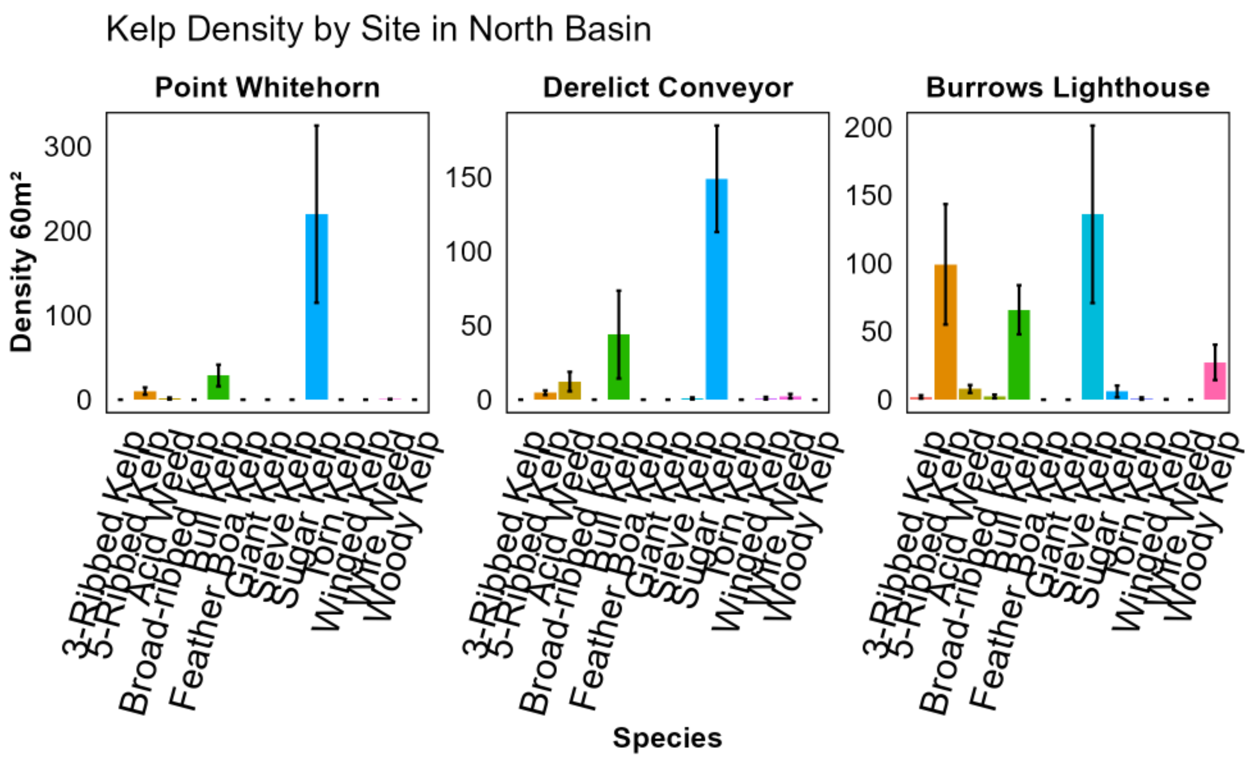


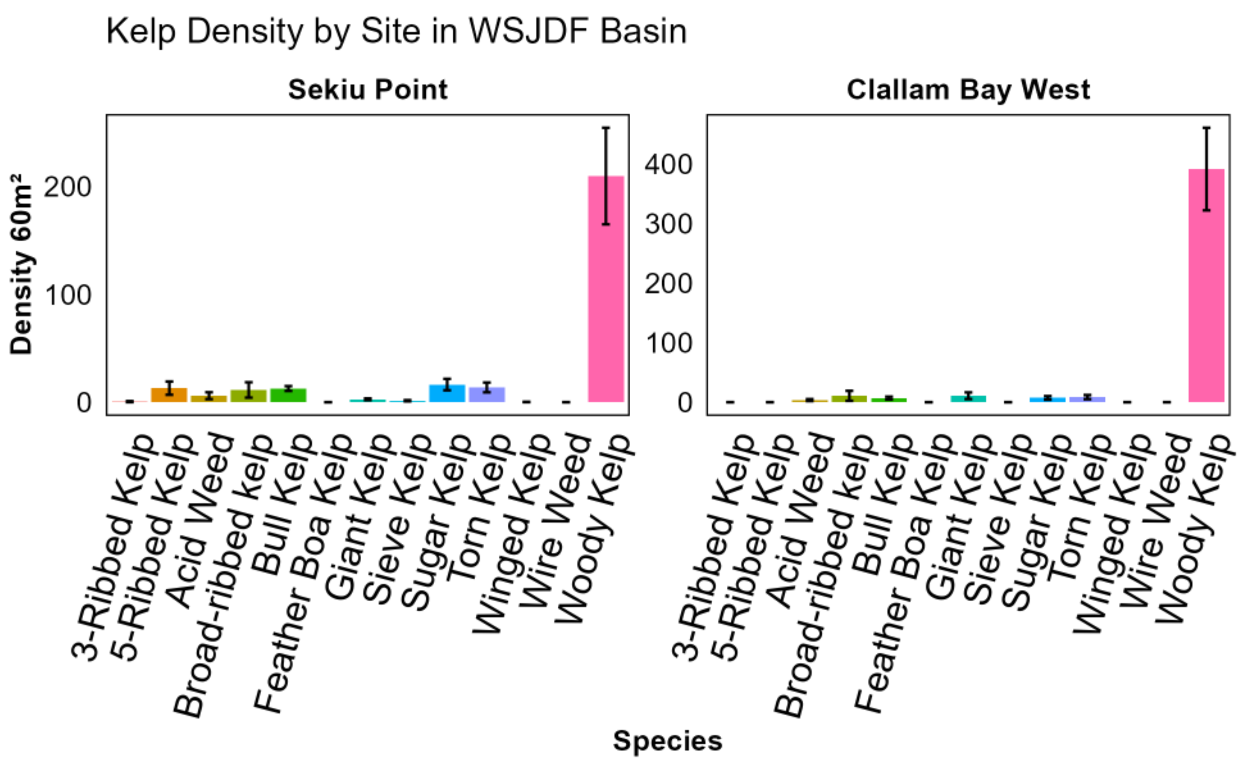
Substrate Composition by Site in South Basin
Salmon Beach
Titlow Beach
Fox Island East Wall
Squaxin Island
Ketron Island
Devils Head
0%
25%
50%
75%
100%
Percent substrate
Classcode
Clay
Sand
Shell Hash
Pebble (0.5-5cm - WA)
Cobble (5-15cm-WA)
Rock (15-25cm-WA)
Small Boulder (25-50cm-WA)
Large Boulder (50cm-1r
Reef
Other

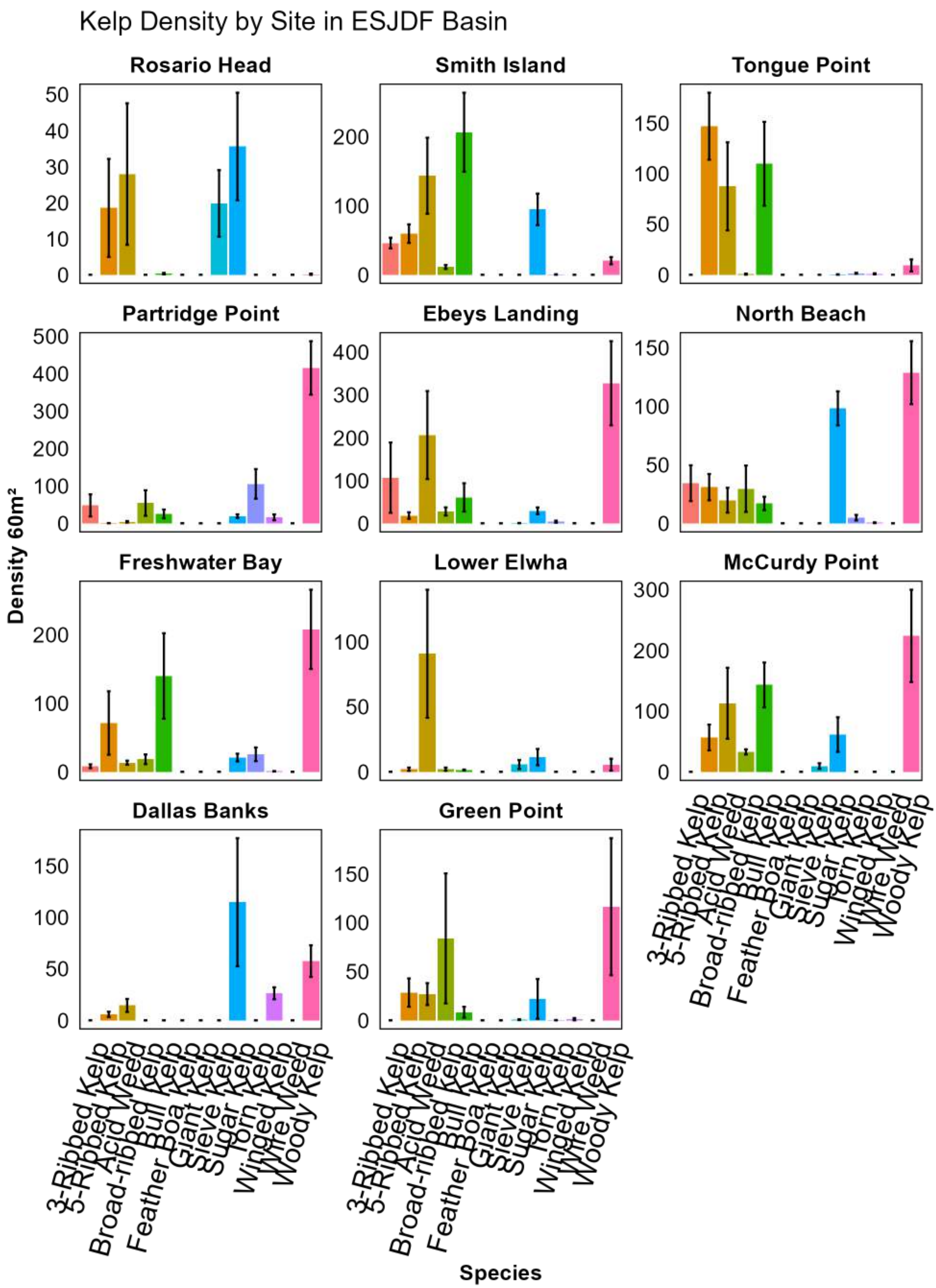
Appendix C

Mean densities of kelp species by site within each Puget Sound sub-basin from 2024 surveys (bars indicate standard error among transects).

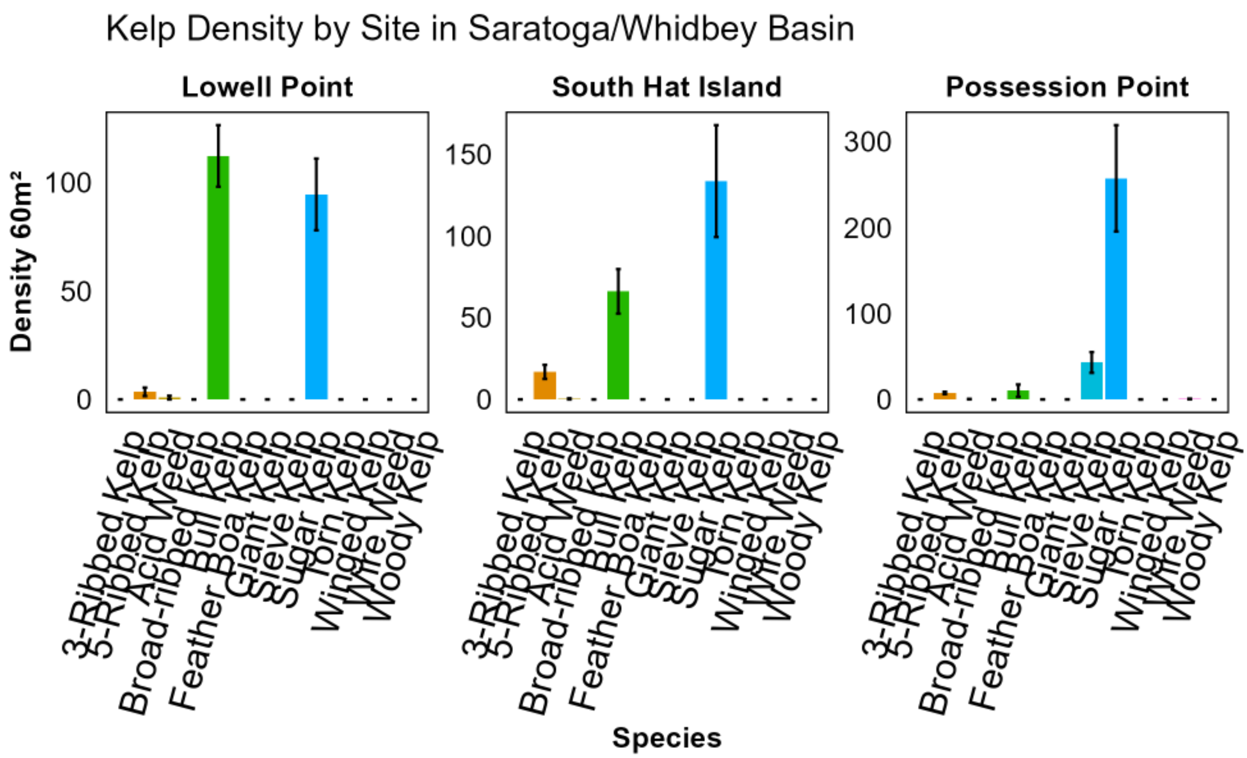


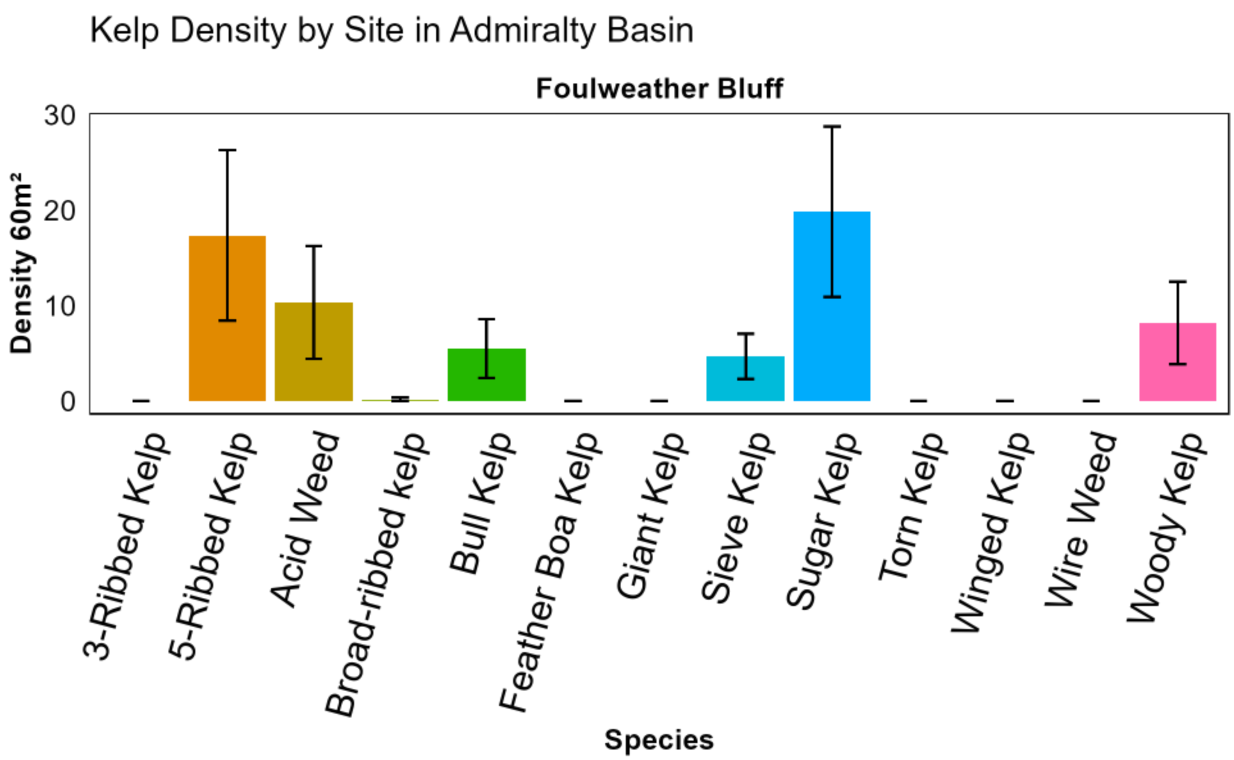

Kelp Density by Site in North Basin
Point Whitehorn
Derelict Conveyor
Burrows Lighthouse
Density 60m²
Species
3-Ribbed Kelp
5-Ribbed Kelp
Acid Weed
Broad-ribbed kelp
Bull Kelp
Feather Boa Kelp
Giant Kelp
Sieve Kelp
Sugar Kelp
Torn Kelp
Winged Kelp
Wire Weed
Woody Kelp

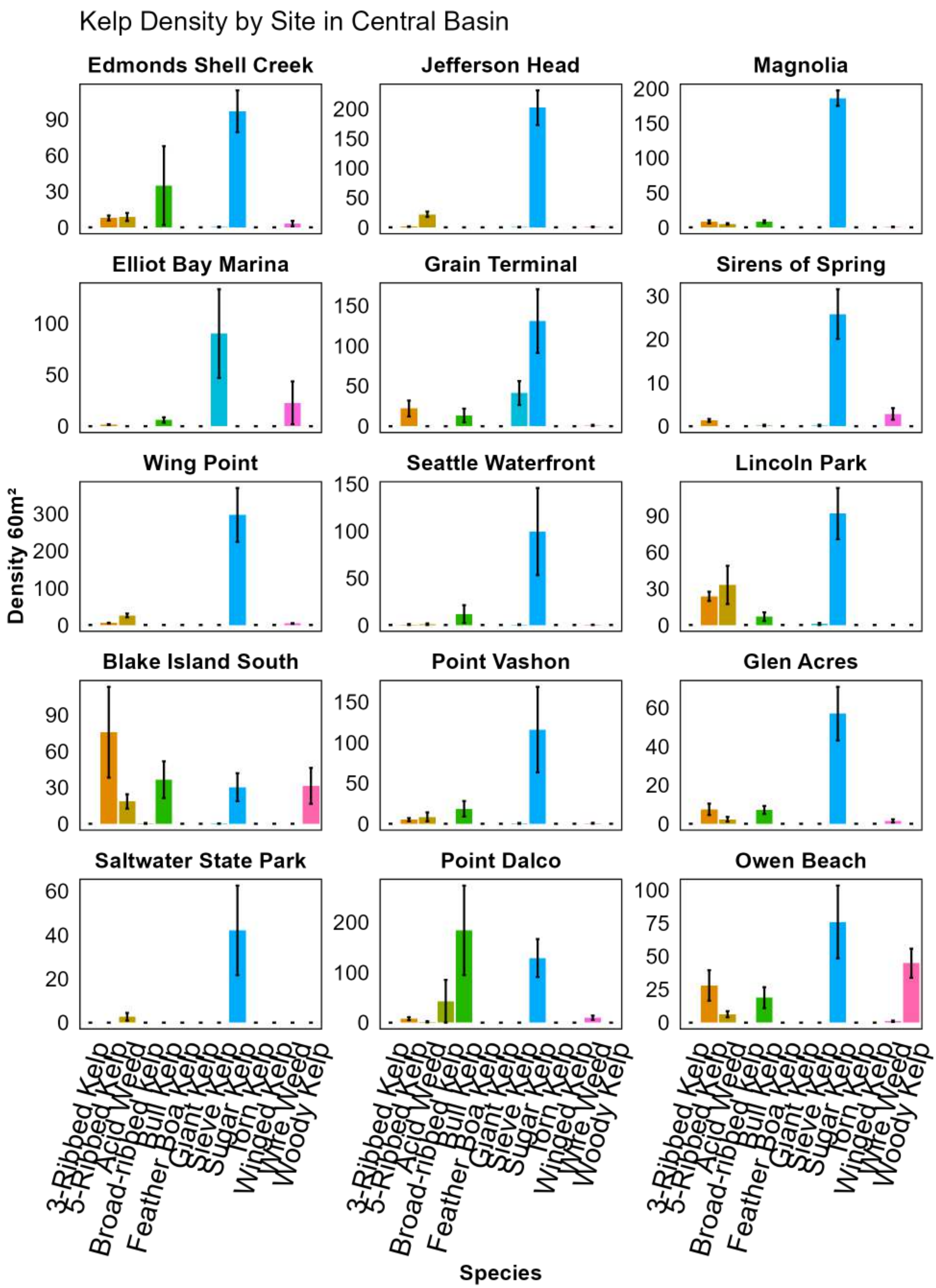

Kelp Density by Site in WSJDF Basin
Sekiu Point
Clallam Bay West
Density 60m²
Species
3-Ribbed Kelp
5-Ribbed Kelp
Acid Weed
Broad-ribbed kelp
Bull Kelp
Feather Boa Kelp
Giant Kelp
Sieve Kelp
Sugar Kelp
Torn Kelp
Winged Kelp
Wire Weed
Woody Kelp

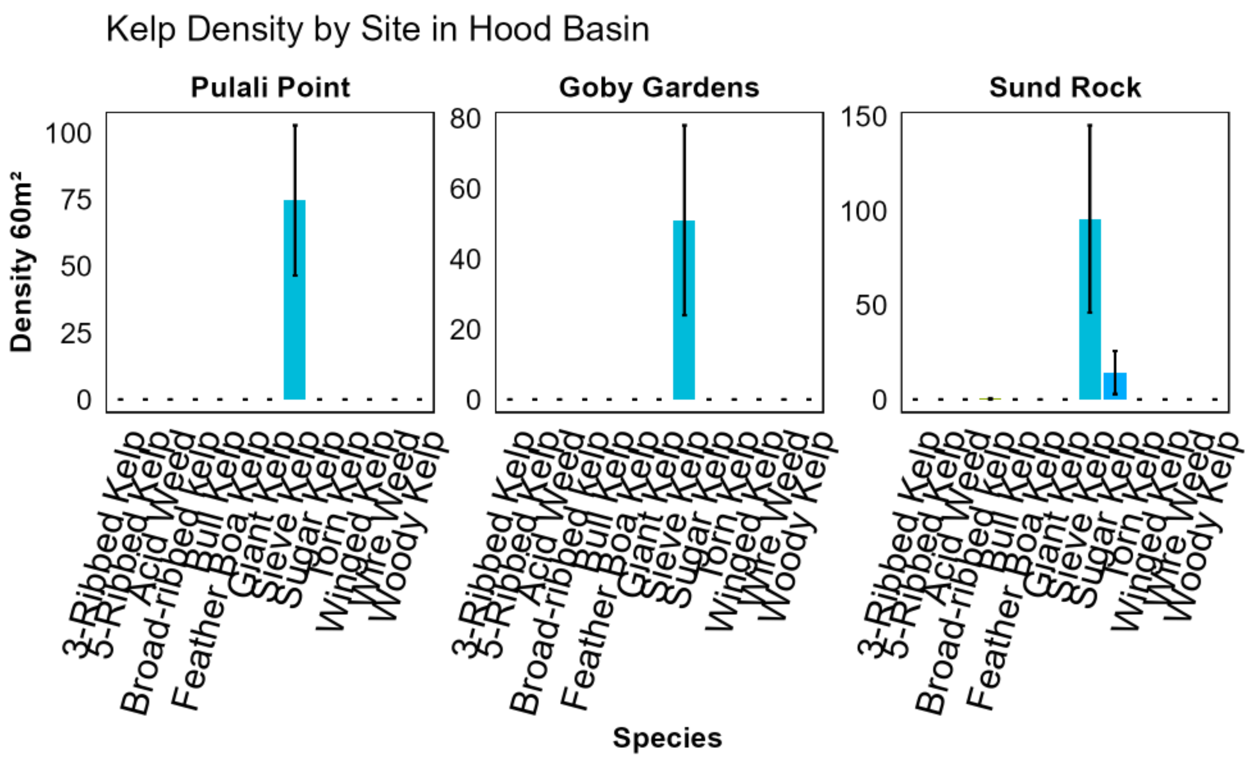


Kelp Density by Site in ESJDF Basin
Rosario Head
Smith Island
Tongue Point
Partridge Point
Ebeys Landing
North Beach
Freshwater Bay
Lower Elwha
McCurdy Point
Dallas Banks
Green Point
Density 60m²
Species
3-Ribbed Kelp
5-Ribbed Kelp
Acid Weed
Broad-ribbed Kelp
Bull Kelp
Feather Boa Kelp
Giant Kelp
Sieve Kelp
Sugar Kelp
Torn Kelp
Winged Kelp
Wire Weed
Woody Kelp

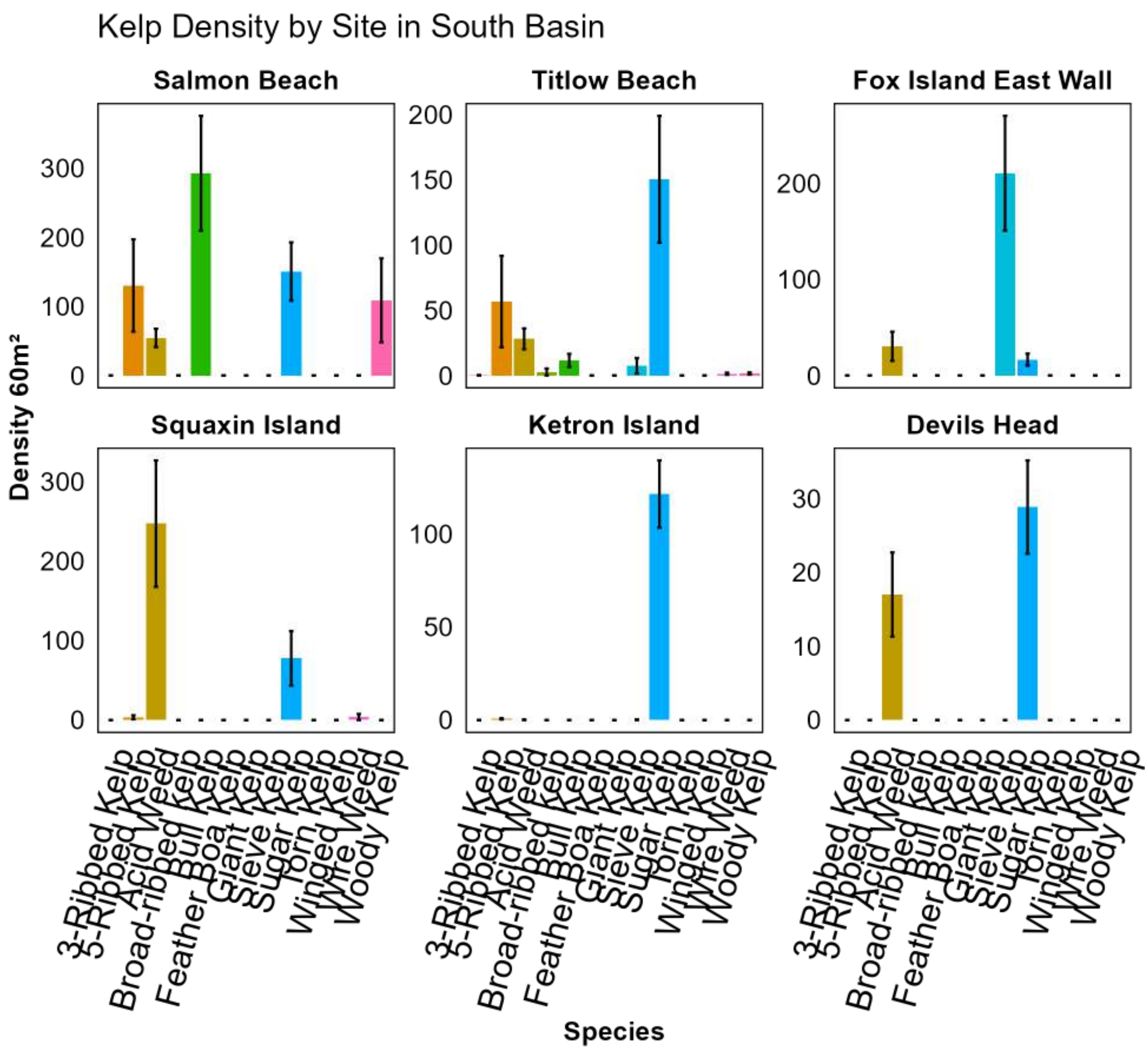

Kelp Density by Site in Saratoga/Whidbey Basin
Lowell Point
South Hat Island
Possession Point
Density 60m²
Species
3-Ribbed Kelp
5-Ribbed Kelp
Acid Weed
Broad-ribbed kelp
Bull Kelp
Feather Boa Kelp
Giant Kelp
Sieve Kelp
Sugar Kelp
Torn Kelp
Winged Kelp
Wire Weed
Woody Kelp


Kelp Density by Site in Admiralty Basin
Foulweather Bluff
Density 60m²
Species
3-Ribbed Kelp
5-Ribbed Kelp
Acid Weed
Broad-ribbed kelp
Bull Kelp
Feather Boa Kelp
Giant Kelp
Sieve Kelp
Sugar Kelp
Torn Kelp
Winged Kelp
Wire Weed
Woody Kelp

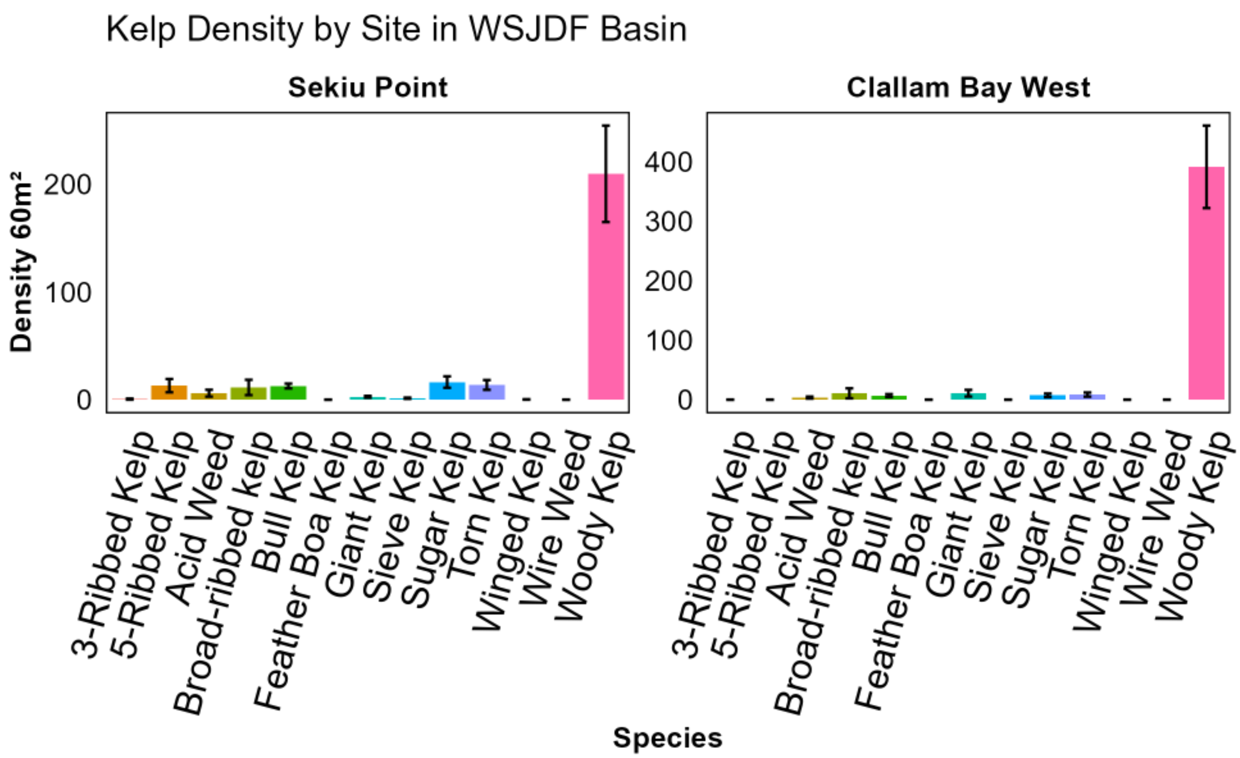

Kelp Density by Site in Central Basin
Edmonds Shell Creek
Jefferson Head
Magnolia
Elliot Bay Marina
Grain Terminal
Sirens of Spring
Wing Point
Seattle Waterfront
Lincoln Park
Blake Island South
Point Vashon
Glen Acres
Saltwater State Park
Point Dalco
Owen Beach
Density 60m²
Species
3-Ribbed Kelp
5-Ribbed Kelp
Acid Weed
Broad-ribbed Kelp
Bull Kelp
Feather Boa Kelp
Giant Kelp
Sieve Kelp
Sugar Kelp
Torn Kelp
Winged Kelp
Wire Weed
Woody Kelp



Kelp Density by Site in Hood Basin
Pulali Point
Goby Gardens
Sund Rock
Density 60m²
Species
3-Ribbed Kelp
5-Ribbed Kelp
Acid Weed
Broad-ribbed Kelp
Bull Kelp
Feather Boa Kelp
Giant Kelp
Sieve Kelp
Sugar Kelp
Torn Kelp
Winged Kelp
Wire Weed
Woody Kelp

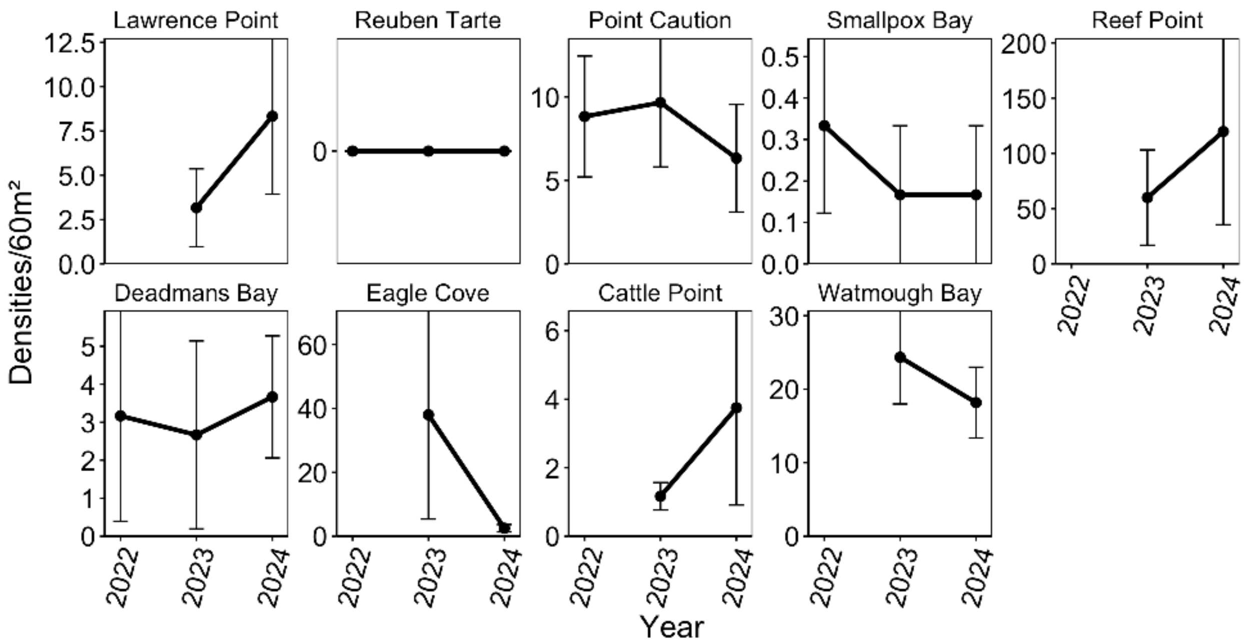


Kelp Density by Site in South Basin
Salmon Beach
Titlow Beach
Fox Island East Wall
Squaxin Island
Ketron Island
Devils Head
Density 60m²
Species
3-Ribbed Kelp
5-Ribbed Kelp
Acid Weed
Broad-ribbed Kelp
Bull Kelp
Feather Boa Kelp
Giant Kelp
Sieve Kelp
Sugar Kelp
Torn Kelp
Winged Kelp
Wire Weed
Woody Kelp

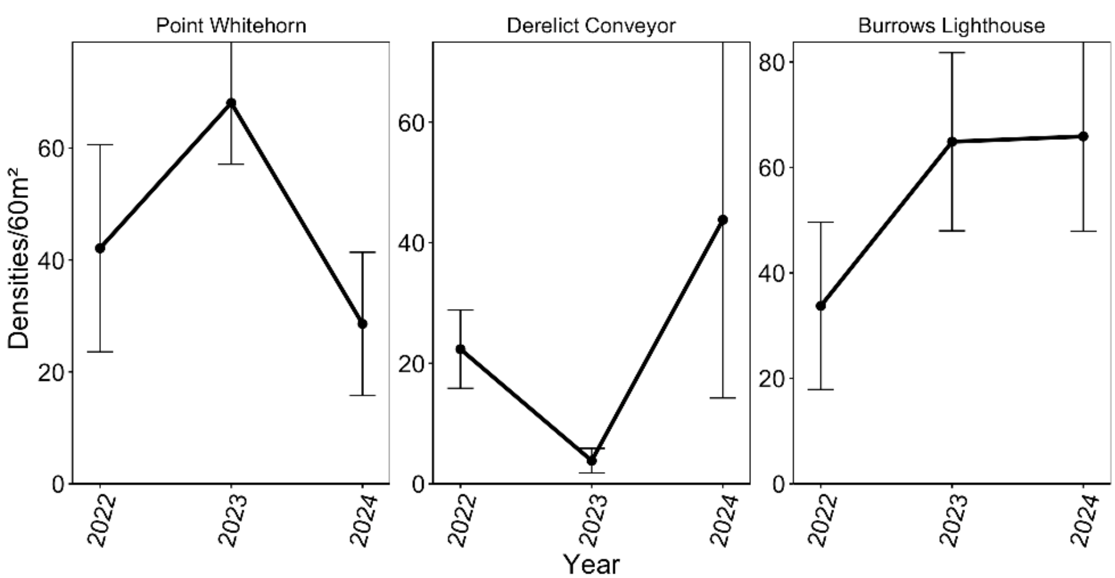

Kelp Density by Site in WSJDF Basin
Sekiu Point
Clallam Bay West
Density 60m²
0
100
200
300
400
3-Ribbed Kelp
5-Ribbed Kelp
Acid Weed
Broad-ribbed kelp
Bull Kelp
Feather Boa Kelp
Giant Kelp
Sieve Kelp
Sugar Kelp
Torn Kelp
Winged Kelp
Wire Weed
Woody Kelp
Species

Appendix D

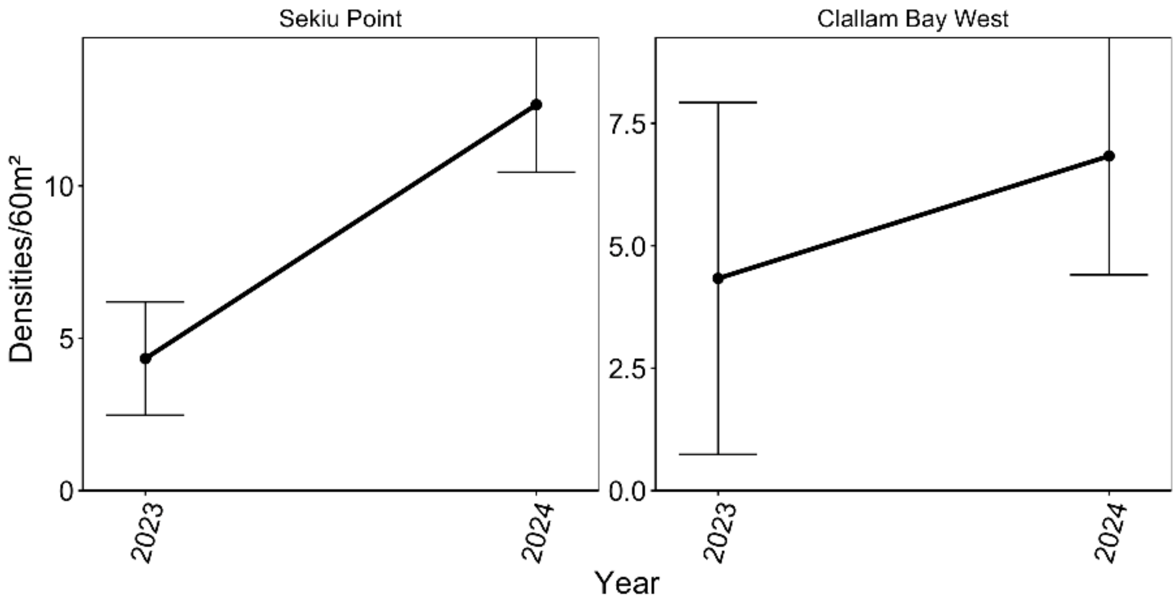
Bull kelp trends at sites within each basin.



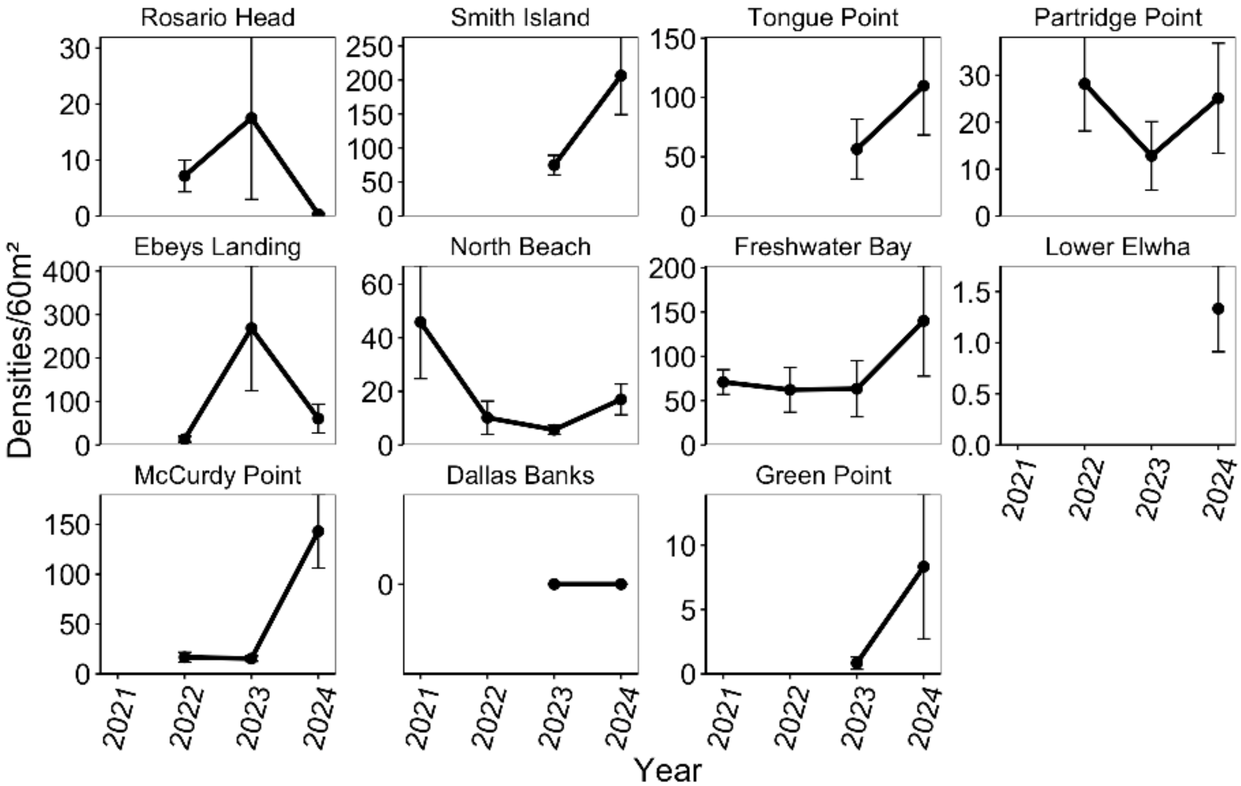
Appendix C, Figure 1. San Juan Island basin bull kelp mean density trends.



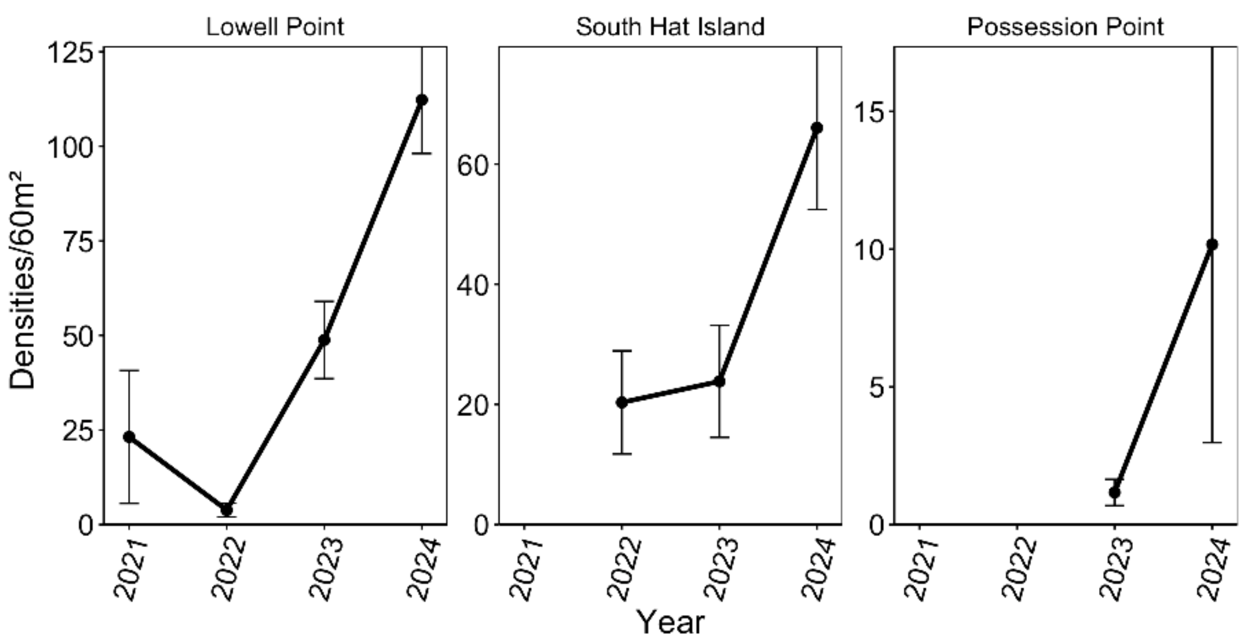
Appendix C, Figure 2. North basin bull kelp mean density trends.



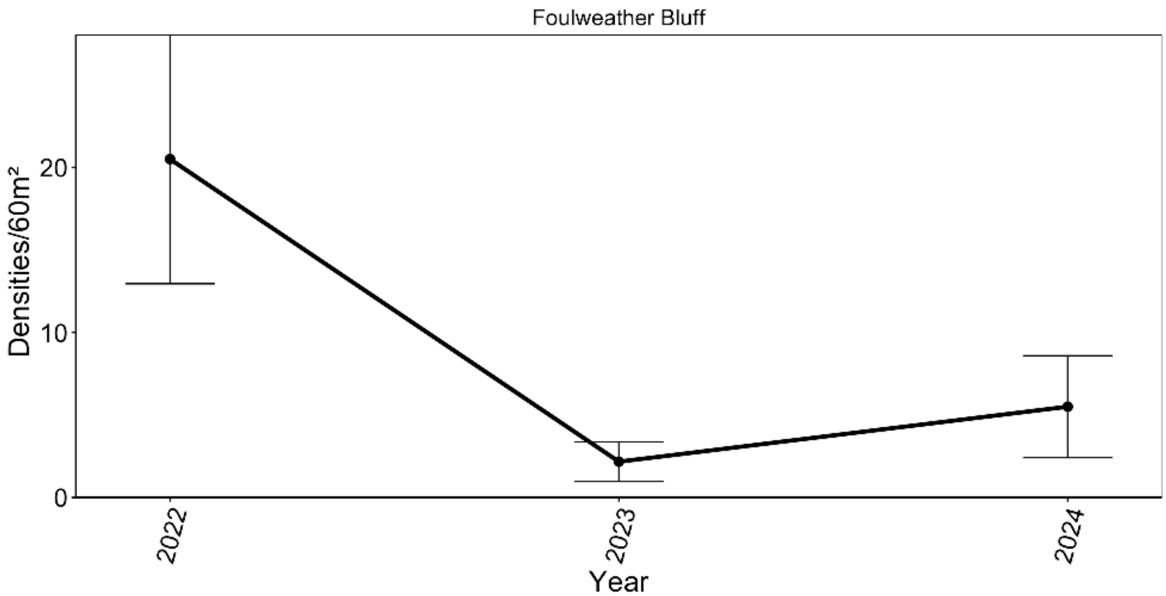
Appendix C, Figure 3. Western Strait of Juan de Fuca (WSJDF) basin bull kelp mean density trends.



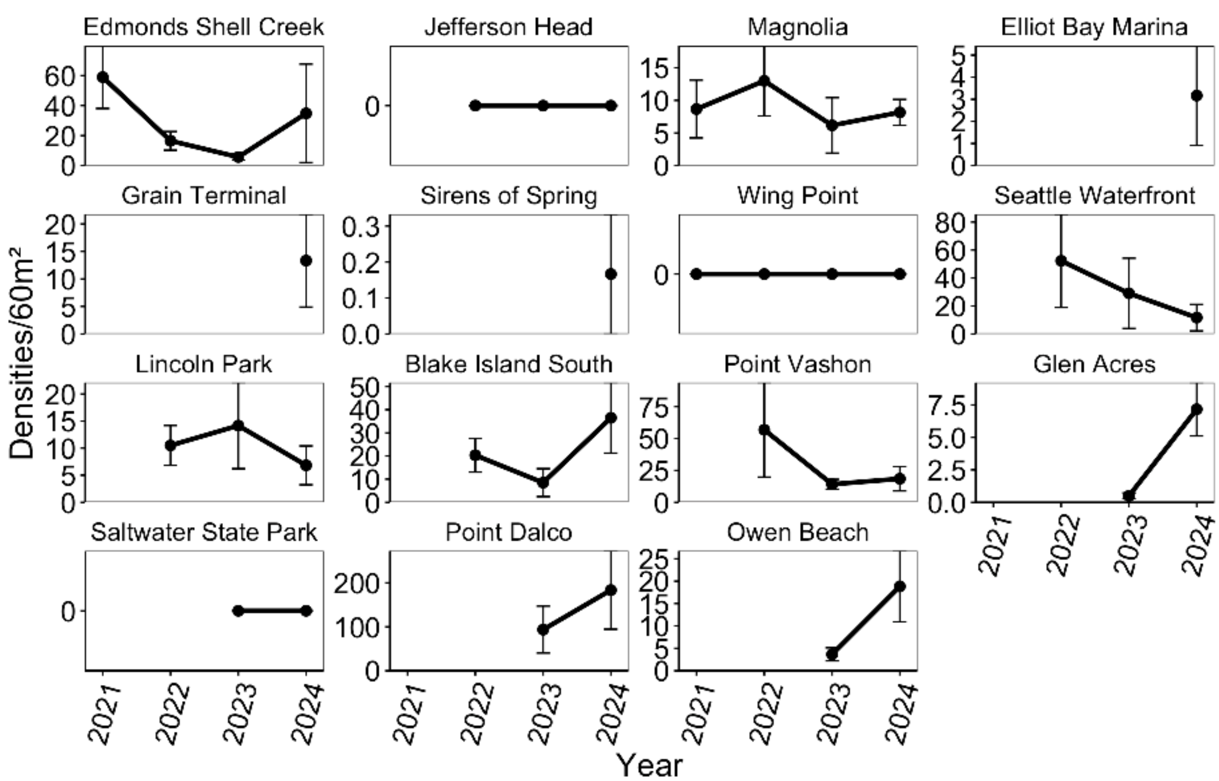
Appendix C, Figure 4. Eastern Strait of Juan de Fuca (ESJDF) basin bull kelp mean density trends.



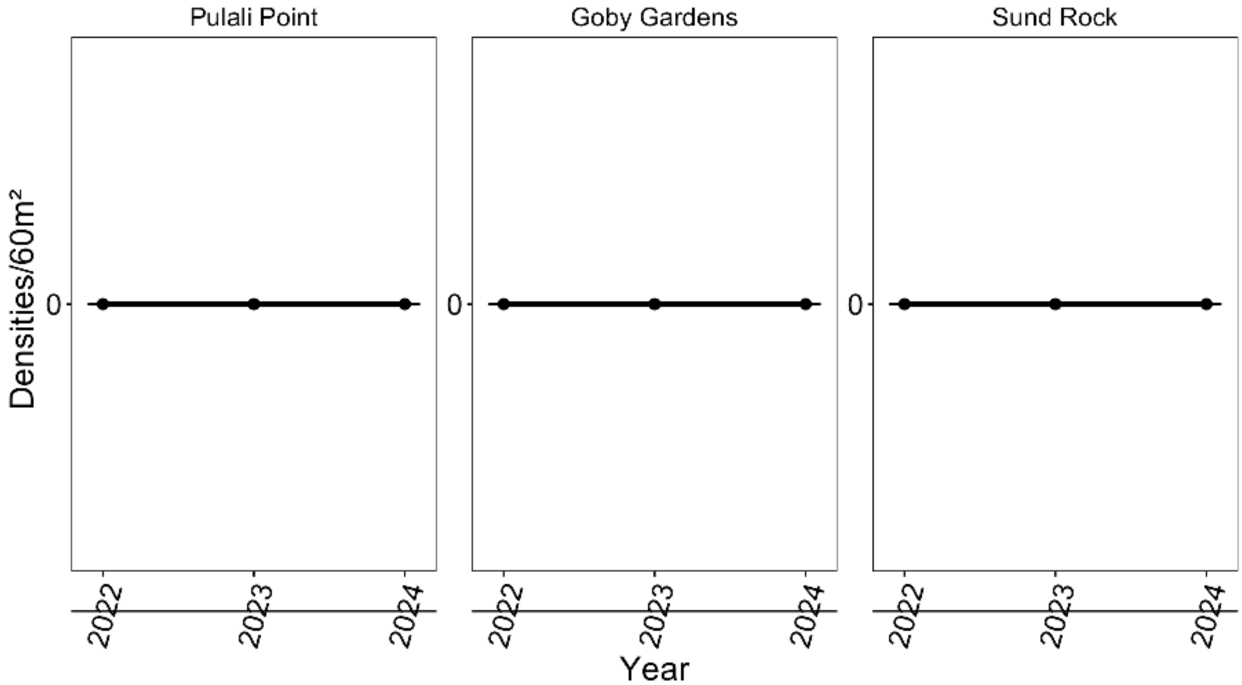
Appendix C, Figure 5. Saratoga/Whidbey basin bull kelp mean density trends.



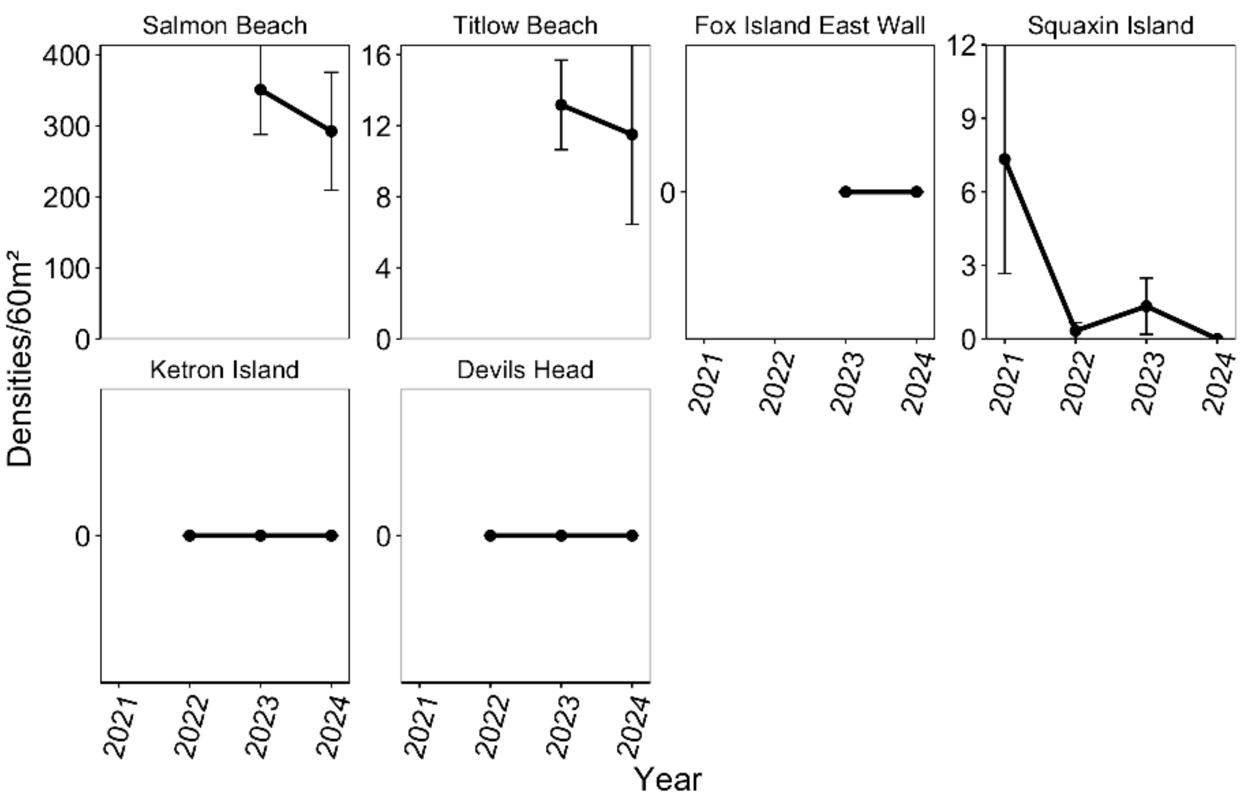
Appendix C, Figure 6. Admiralty basin bull kelp mean density trends.



Appendix C, Figure 7. Central Sound basin bull kelp mean density trends.



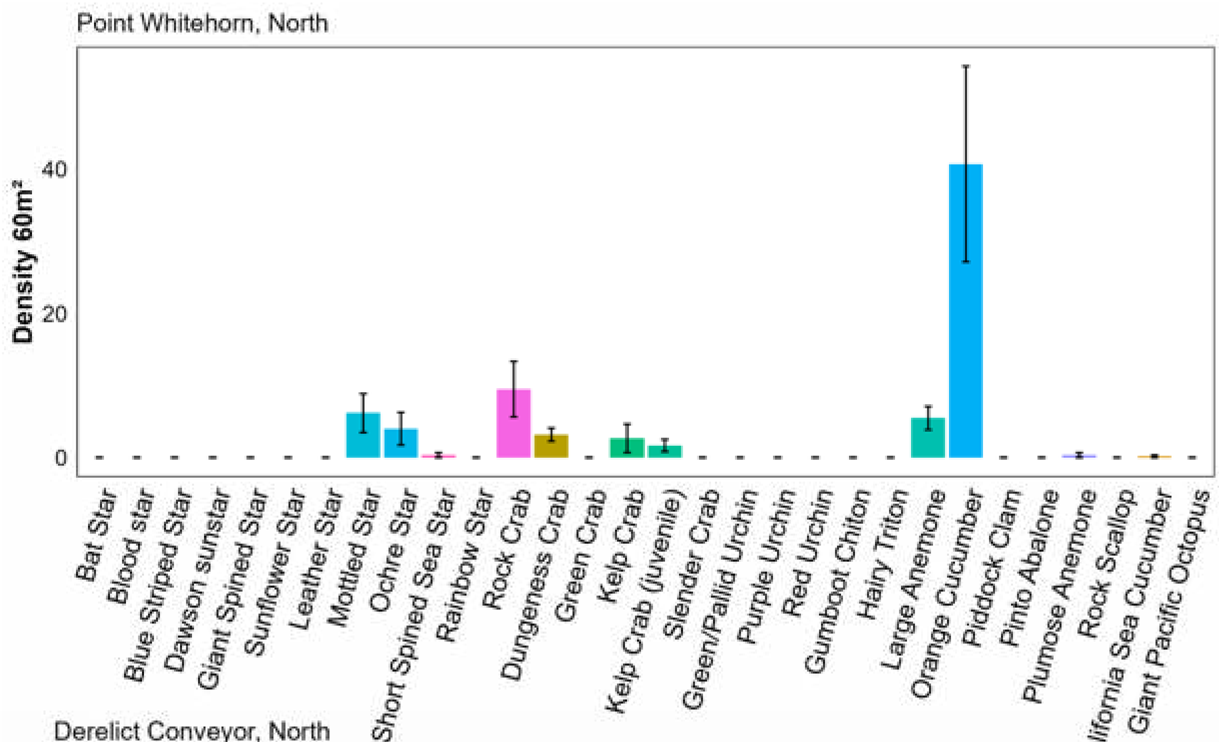
Appendix C, Figure 8. Hood Canal bull kelp mean density trends.

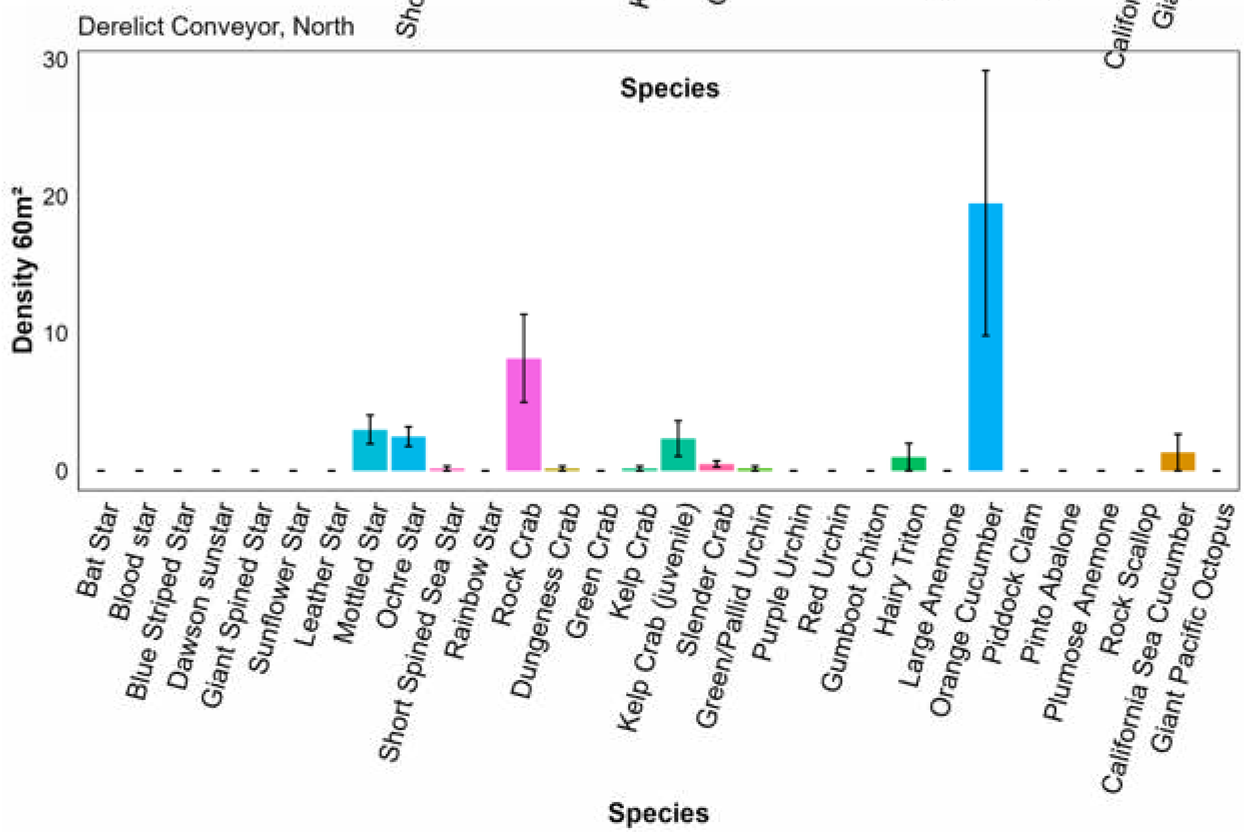


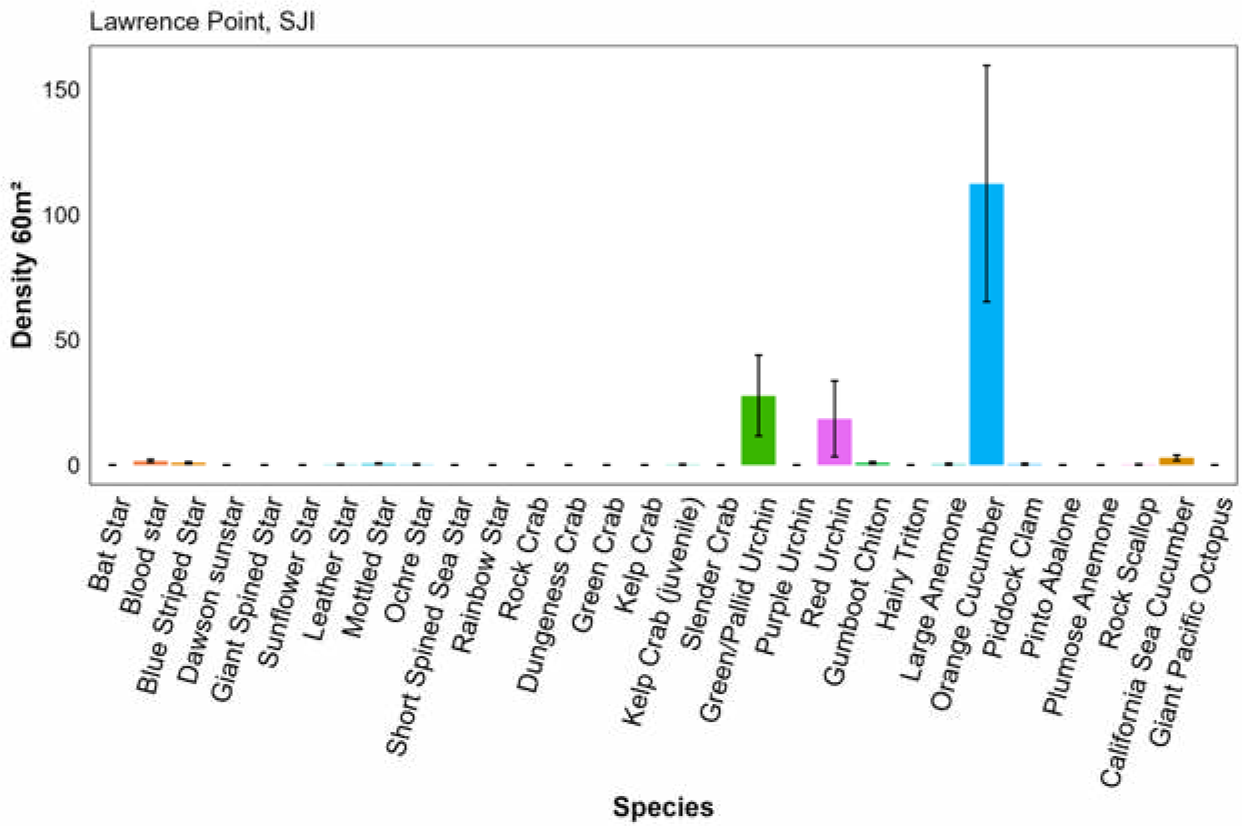
Appendix C, Figure 9. South Sound basin bull kelp mean density trend.

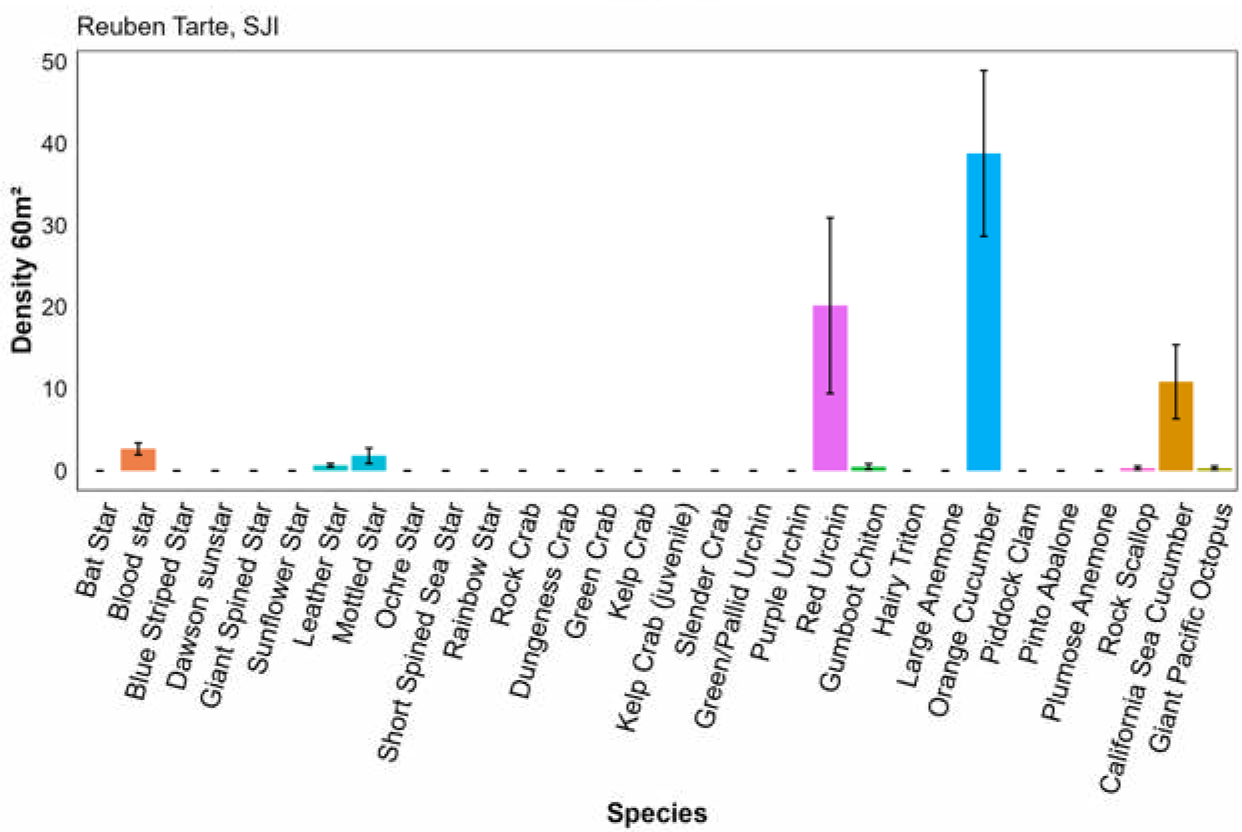
Appendix E

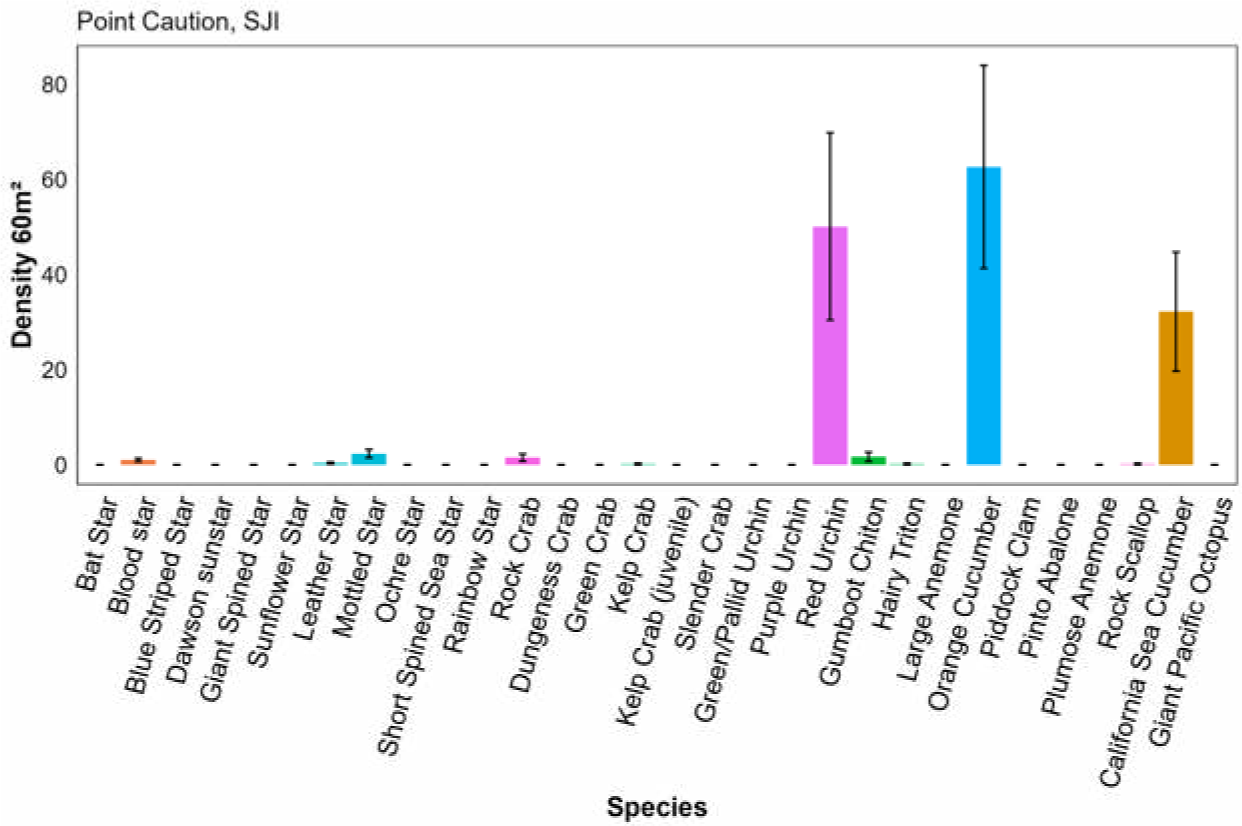
Mean densities of invertebrate species by site within each Puget Sound sub-basin from 2024 surveys (bars indicate standard error among transects).

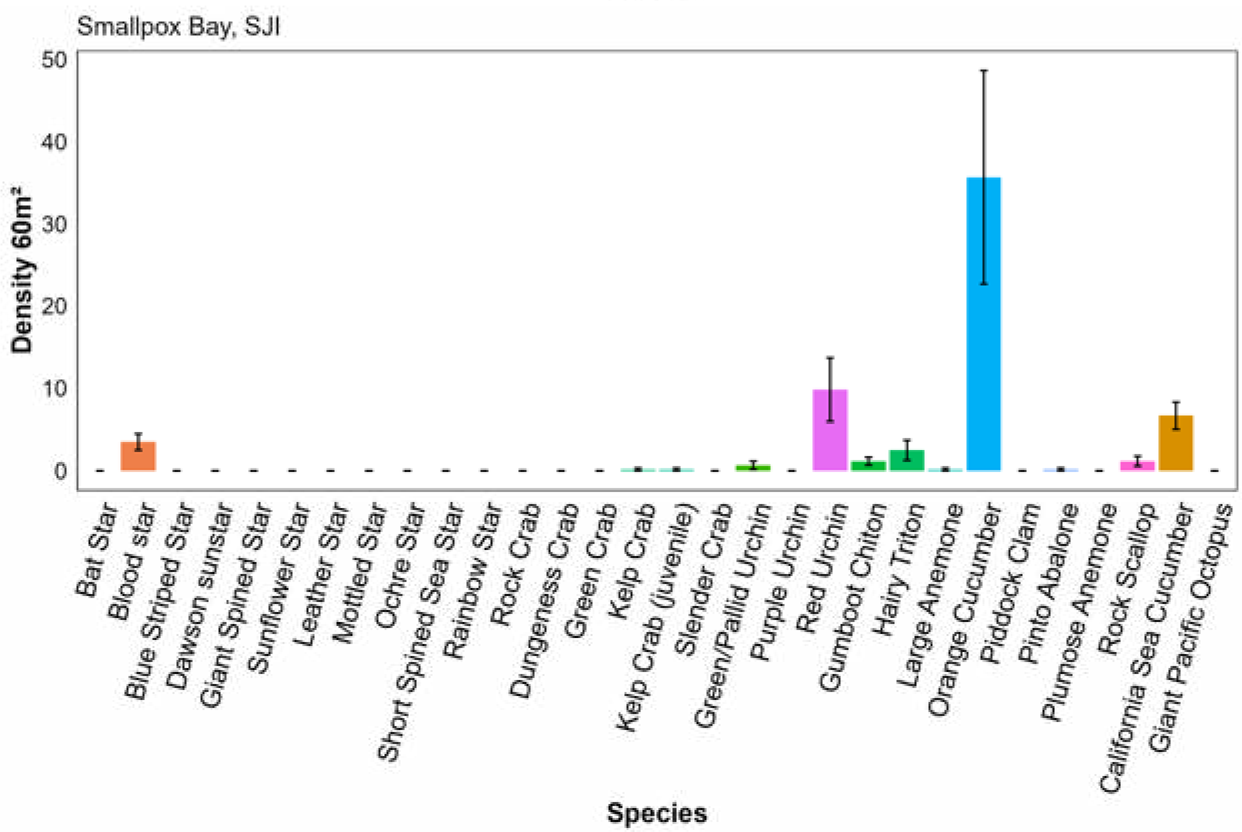


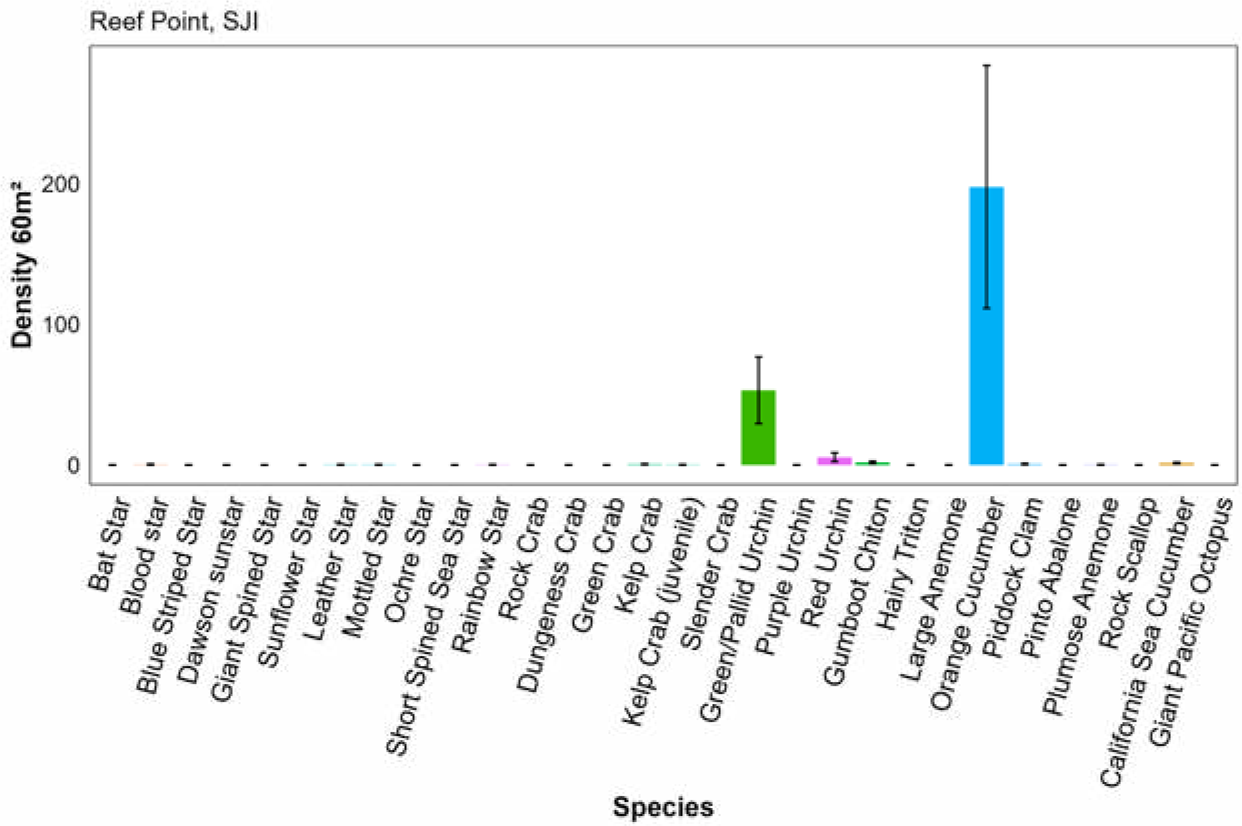


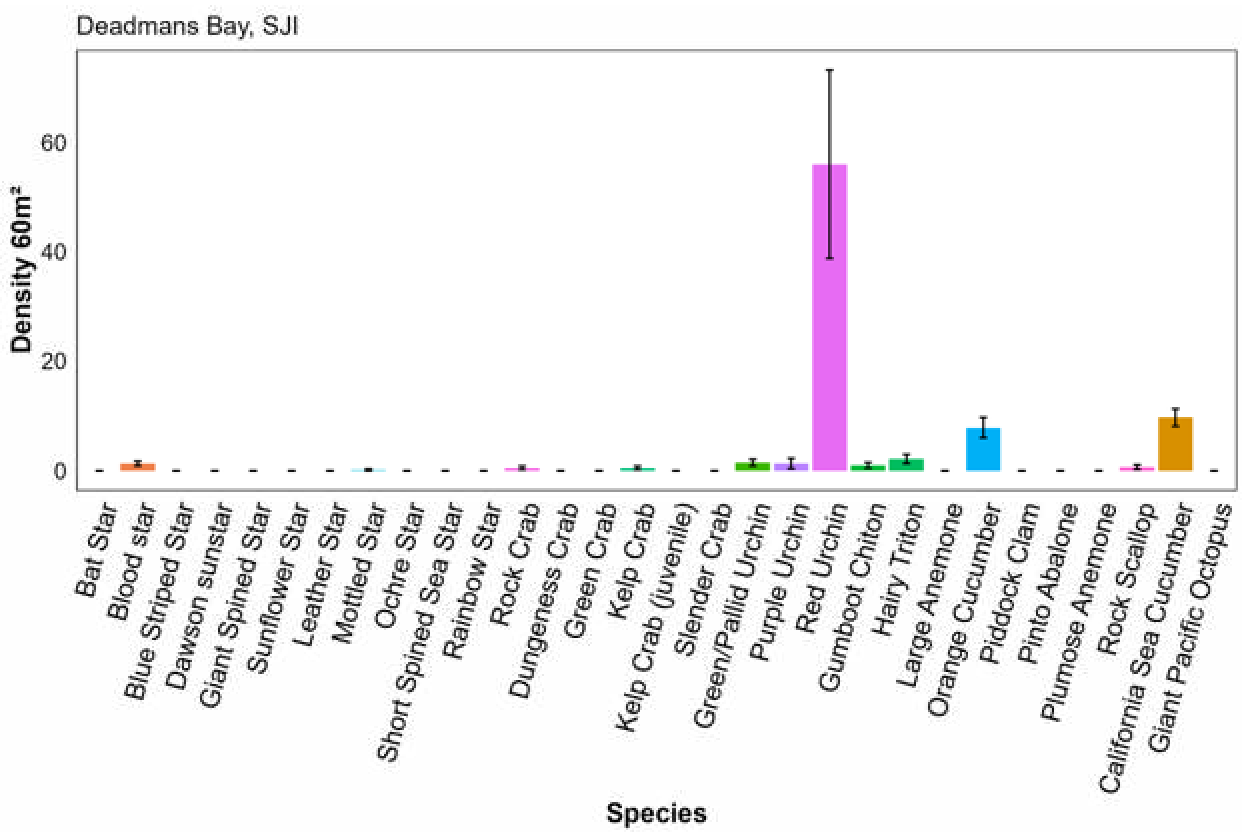

Lawrence Point, SJI
Density 60m²
150
100
50
0
Bat Star
Blood star
Blue Striped Star
Dawson sunstar
Giant Spined Star
Sunflower Star
Leather Star
Mottled Star
Ochre Star
Short Spined Sea Star
Rainbow Star
Rock Crab
Dungeness Crab
Green Crab
Kelp Crab
Kelp Crab (juvenile)
Slender Crab
Green/Pallid Urchin
Purple Urchin
Red Urchin
Gumboot Chiton
Hairy Triton
Large Anemone
Orange Cucumber
Piddock Clam
Pinto Abalone
Plumose Anemone
Rock Scallop
California Sea Cucumber
Giant Pacific Octopus
Species

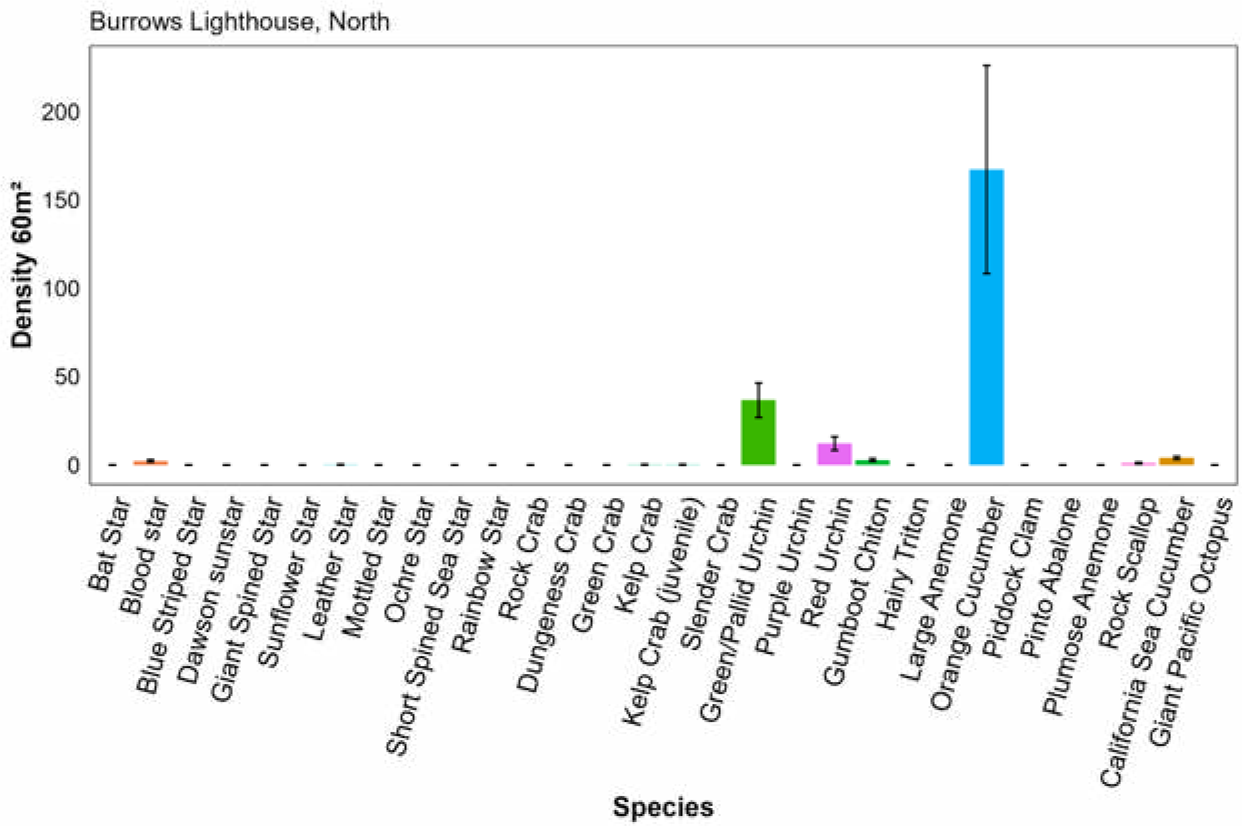

Reuben Tarte, SJI
Density 60m²
50
40
30
20
10
0
Bat Star
Blood star
Blue Striped Star
Dawson sunstar
Giant Spined Star
Sunflower Star
Leather Star
Mottled Star
Ochre Star
Short Spined Sea Star
Rainbow Star
Rock Crab
Dungeness Crab
Green Crab
Kelp Crab
Kelp Crab (juvenile)
Slender Crab
Green/Pallid Urchin
Purple Urchin
Red Urchin
Gumboot Chiton
Hairy Triton
Large Anemone
Orange Cucumber
Piddock Clam
Pinto Abalone
Plumose Anemone
Rock Scallop
California Sea Cucumber
Giant Pacific Octopus
Species

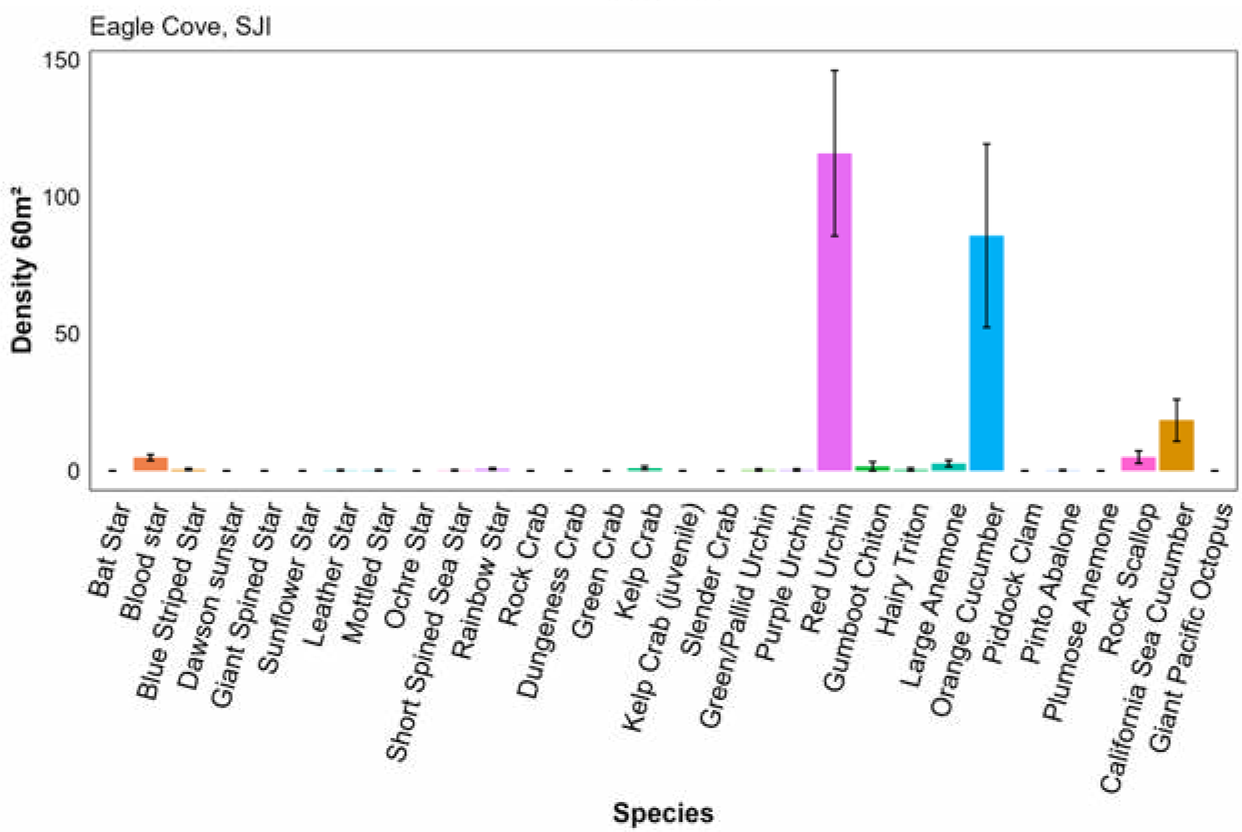

Point Caution, SJI
Density 60m²
80
60
40
20
0
Bat Star
Blood star
Blue Striped Star
Dawson sunstar
Giant Spined Star
Sunflower Star
Leather Star
Mottled Star
Ochre Star
Short Spined Sea Star
Rainbow Star
Rock Crab
Dungeness Crab
Green Crab
Kelp Crab
Kelp Crab (juvenile)
Slender Crab
Green/Pallid Urchin
Purple Urchin
Red Urchin
Gumboot Chiton
Hairy Triton
Large Anemone
Orange Cucumber
Piddock Clam
Pinto Abalone
Plumose Anemone
Rock Scallop
California Sea Cucumber
Giant Pacific Octopus
Species

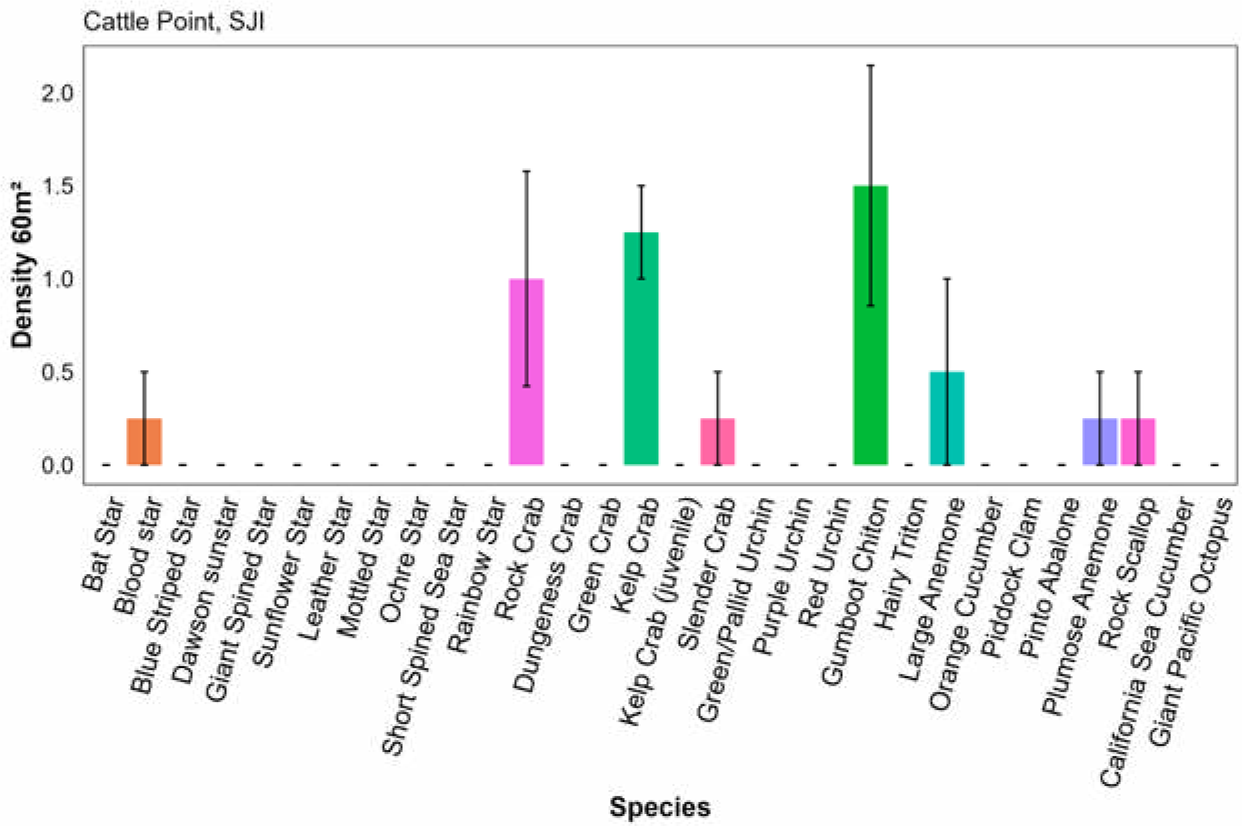

Smallpox Bay, SJI
Density 60m²
50
40
30
20
10
0
Bat Star
Blood star
Blue Striped Star
Dawson sunstar
Giant Spined Star
Sunflower Star
Leather Star
Mottled Star
Ochre Star
Short Spined Sea Star
Rainbow Star
Rock Crab
Dungeness Crab
Green Crab
Kelp Crab
Kelp Crab (juvenile)
Slender Crab
Green/Pallid Urchin
Purple Urchin
Red Urchin
Gumboot Chiton
Hairy Triton
Large Anemone
Orange Cucumber
Piddock Clam
Pinto Abalone
Plumose Anemone
Rock Scallop
California Sea Cucumber
Giant Pacific Octopus
Species

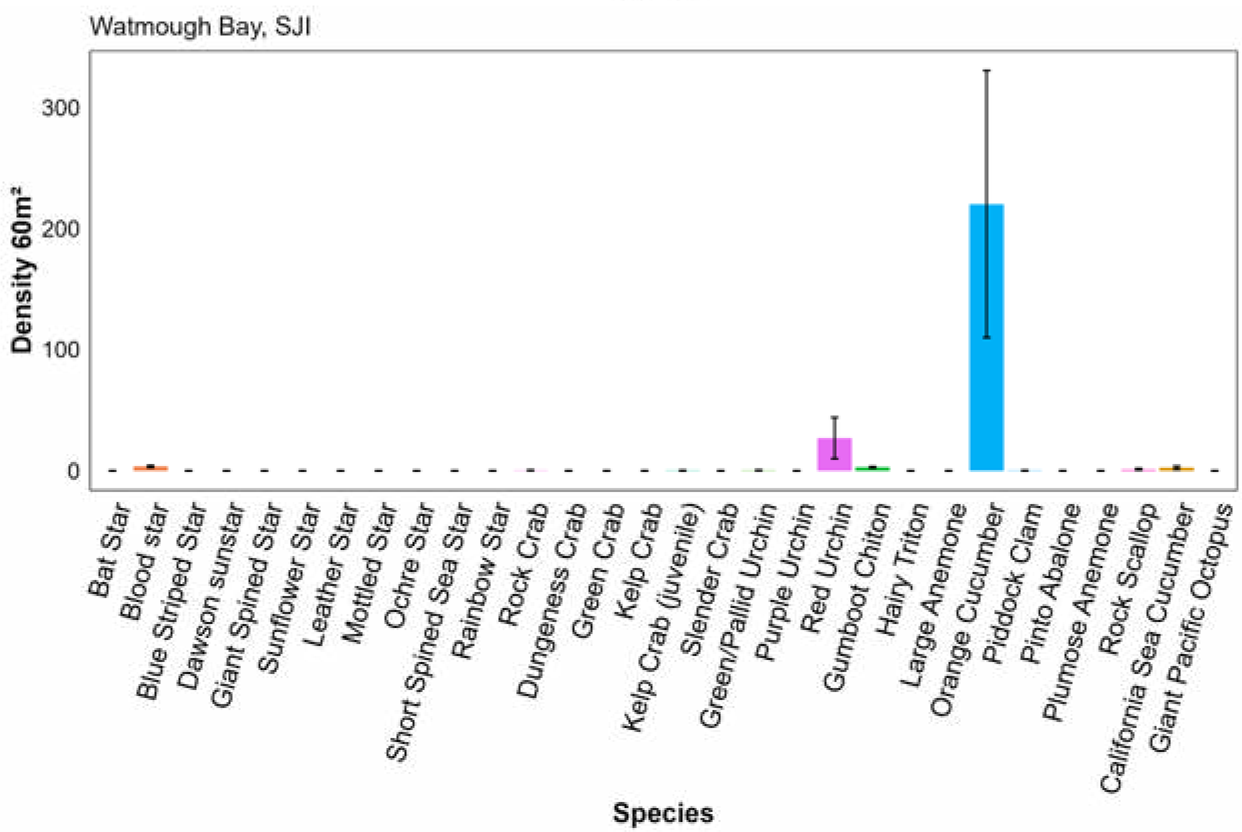

Reef Point, SJI
Density 60m²
0
100
200
Bat Star
Blood star
Blue Striped Star
Dawson sunstar
Giant Spined Star
Sunflower Star
Leather Star
Mottled Star
Ochre Star
Short Spined Sea Star
Rainbow Star
Rock Crab
Dungeness Crab
Green Crab
Kelp Crab
Kelp Crab (juvenile)
Slender Crab
Green/Pallid Urchin
Purple Urchin
Red Urchin
Gumboot Chiton
Hairy Triton
Large Anemone
Orange Cucumber
Piddock Clam
Pinto Abalone
Plumose Anemone
Rock Scallop
California Sea Cucumber
Giant Pacific Octopus
Species

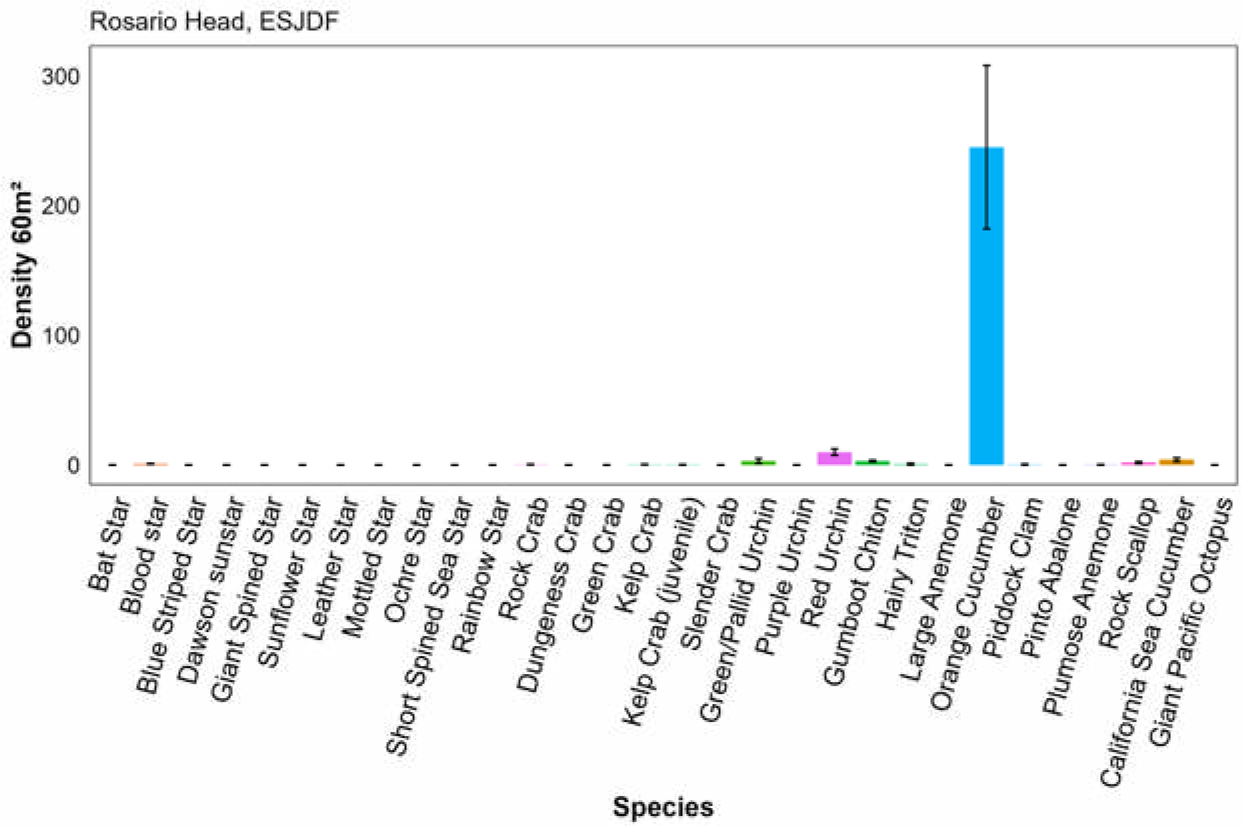

Deadmans Bay, SJI
Density 60m²
0
20
40
60
Bat Star
Blood star
Blue Striped Star
Dawson sunstar
Giant Spined Star
Sunflower Star
Leather Star
Mottled Star
Ochre Star
Short Spined Sea Star
Rainbow Star
Rock Crab
Dungeness Crab
Green Crab
Kelp Crab
Kelp Crab (juvenile)
Slender Crab
Green/Pallid Urchin
Purple Urchin
Red Urchin
Gumboot Chiton
Hairy Triton
Large Anemone
Orange Cucumber
Piddock Clam
Pinto Abalone
Plumose Anemone
Rock Scallop
California Sea Cucumber
Giant Pacific Octopus
Species

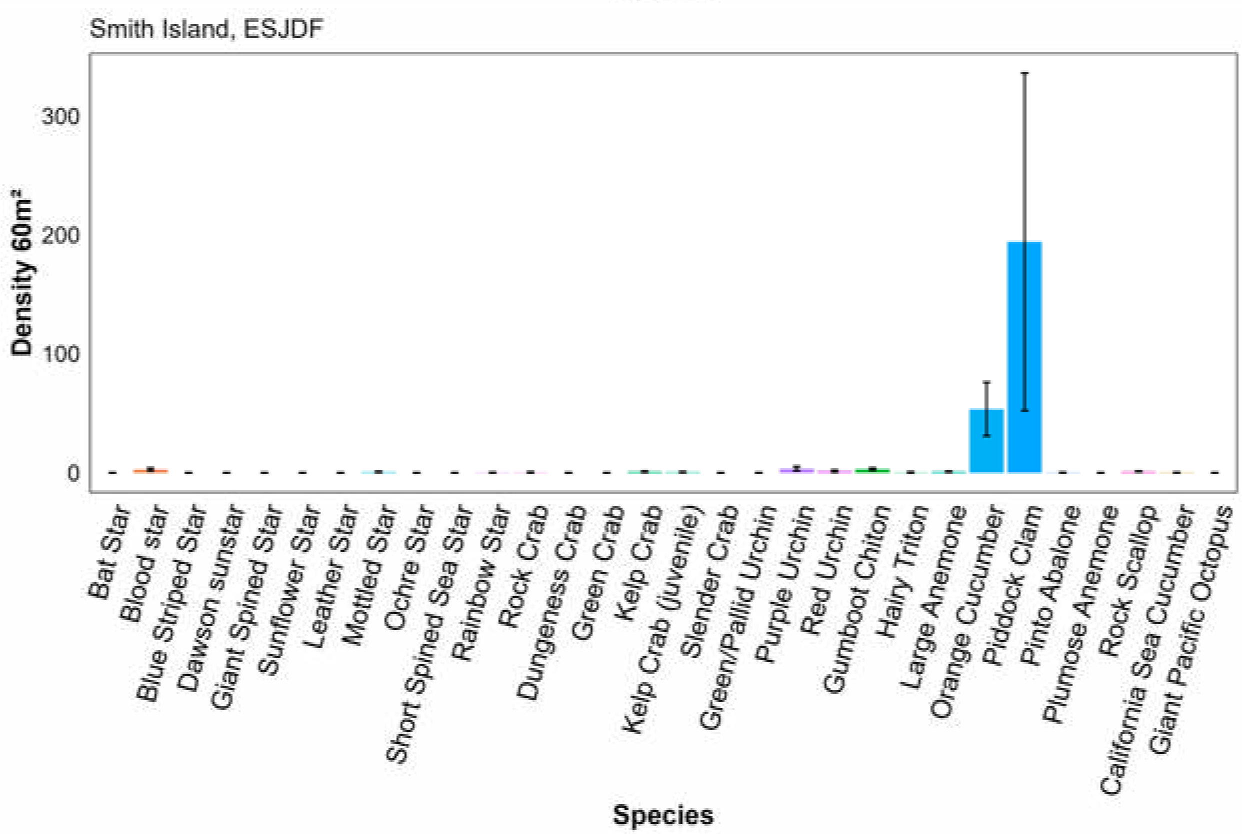

Burrows Lighthouse, North
Density 60m²
200
150
100
50
0
Bat Star
Blood star
Blue Striped Star
Dawson sunstar
Giant Spined Star
Sunflower Star
Leather Star
Mottled Star
Ochre Star
Short Spined Sea Star
Rainbow Star
Rock Crab
Dungeness Crab
Green Crab
Kelp Crab
Kelp Crab (juvenile)
Slender Crab
Green/Pallid Urchin
Purple Urchin
Red Urchin
Gumboot Chiton
Hairy Triton
Large Anemone
Orange Cucumber
Piddock Clam
Pinto Abalone
Plumose Anemone
Rock Scallop
California Sea Cucumber
Giant Pacific Octopus
Species

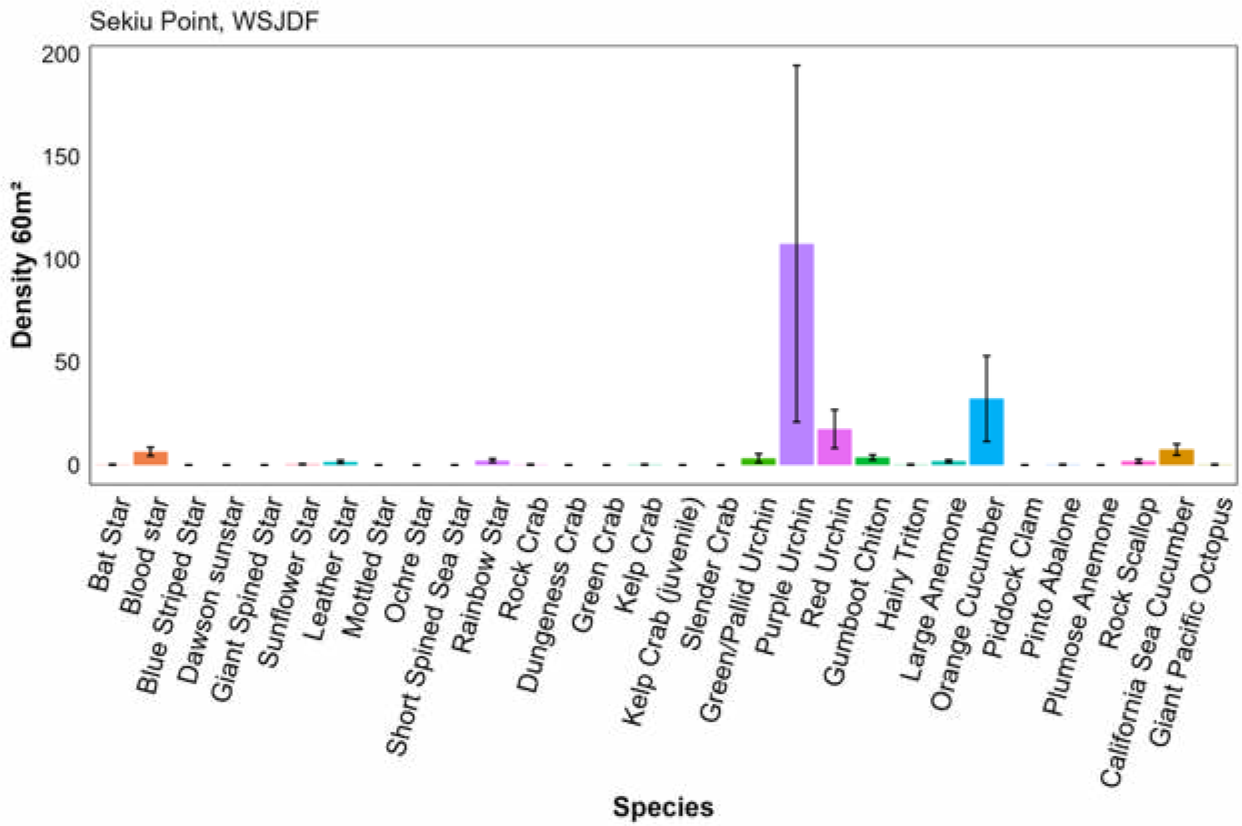

Eagle Cove, SJI
Density 60m²
150
100
50
0
Bat Star
Blood star
Blue Striped Star
Dawson sunstar
Giant Spined Star
Sunflower Star
Leather Star
Mottled Star
Ochre Star
Short Spined Sea Star
Rainbow Star
Rock Crab
Dungeness Crab
Green Crab
Kelp Crab
Kelp Crab (juvenile)
Slender Crab
Green/Pallid Urchin
Purple Urchin
Red Urchin
Gumboot Chiton
Hairy Triton
Large Anemone
Orange Cucumber
Piddock Clam
Pinto Abalone
Plumose Anemone
Rock Scallop
California Sea Cucumber
Giant Pacific Octopus
Species


Cattle Point, SJI
Density 60m²
2.0
1.5
1.0
0.5
0.0
Bat Star
Blood star
Blue Striped Star
Dawson sunstar
Giant Spined Star
Sunflower Star
Leather Star
Mottled Star
Ochre Star
Short Spined Sea Star
Rainbow Star
Rock Crab
Dungeness Crab
Green Crab
Kelp Crab
Kelp Crab (juvenile)
Slender Crab
Green/Pallid Urchin
Purple Urchin
Red Urchin
Gumboot Chiton
Hairy Triton
Large Anemone
Orange Cucumber
Piddock Clam
Pinto Abalone
Plumose Anemone
Rock Scallop
California Sea Cucumber
Giant Pacific Octopus
Species

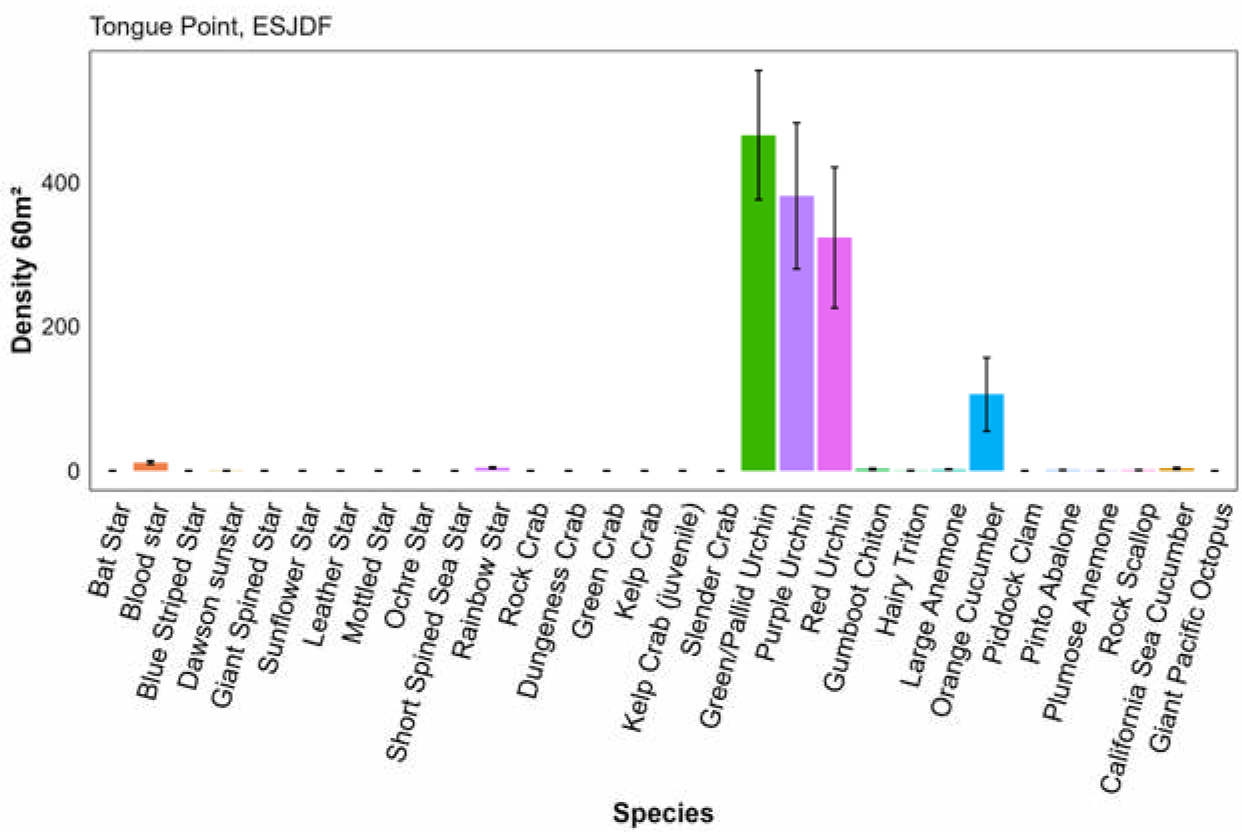

Watmough Bay, SJI
Density 60m²
300
200
100
0
Bat Star
Blood star
Blue Striped Star
Dawson sunstar
Giant Spined Star
Sunflower Star
Leather Star
Mottled Star
Ochre Star
Short Spined Sea Star
Rainbow Star
Rock Crab
Dungeness Crab
Green Crab
Kelp Crab
Kelp Crab (juvenile)
Slender Crab
Green/Pallid Urchin
Purple Urchin
Red Urchin
Gumboot Chiton
Hairy Triton
Large Anemone
Orange Cucumber
Piddock Clam
Pinto Abalone
Plumose Anemone
Rock Scallop
California Sea Cucumber
Giant Pacific Octopus
Species


Rosario Head, ESJDF
Density 60m²
300
200
100
0
Bat Star
Blood star
Blue Striped Star
Dawson sunstar
Giant Spined Star
Sunflower Star
Leather Star
Mottled Star
Ochre Star
Short Spined Sea Star
Rainbow Star
Rock Crab
Dungeness Crab
Green Crab
Kelp Crab
Kelp Crab (juvenile)
Slender Crab
Green/Pallid Urchin
Purple Urchin
Red Urchin
Gumboot Chiton
Hairy Triton
Large Anemone
Orange Cucumber
Piddock Clam
Pinto Abalone
Plumose Anemone
Rock Scallop
California Sea Cucumber
Giant Pacific Octopus
Species

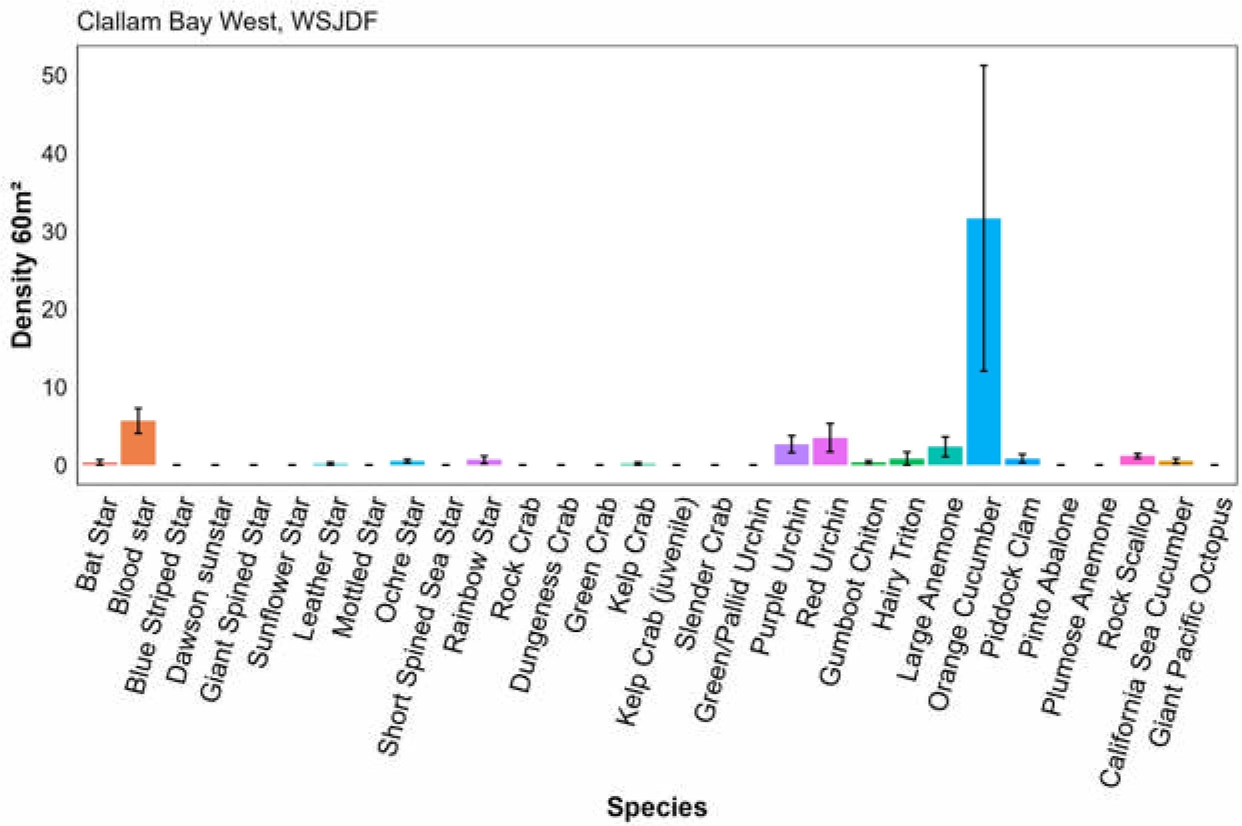

Smith Island, ESJDF
Density 60m²
300
200
100
0
Bat Star
Blood star
Blue Striped Star
Dawson sunstar
Giant Spined Star
Sunflower Star
Leather Star
Mottled Star
Ochre Star
Short Spined Sea Star
Rainbow Star
Rock Crab
Dungeness Crab
Green Crab
Kelp Crab
Kelp Crab (juvenile)
Slender Crab
Green/Pallid Urchin
Purple Urchin
Red Urchin
Gumboot Chiton
Hairy Triton
Large Anemone
Orange Cucumber
Piddock Clam
Pinto Abalone
Plumose Anemone
Rock Scallop
California Sea Cucumber
Giant Pacific Octopus
Species

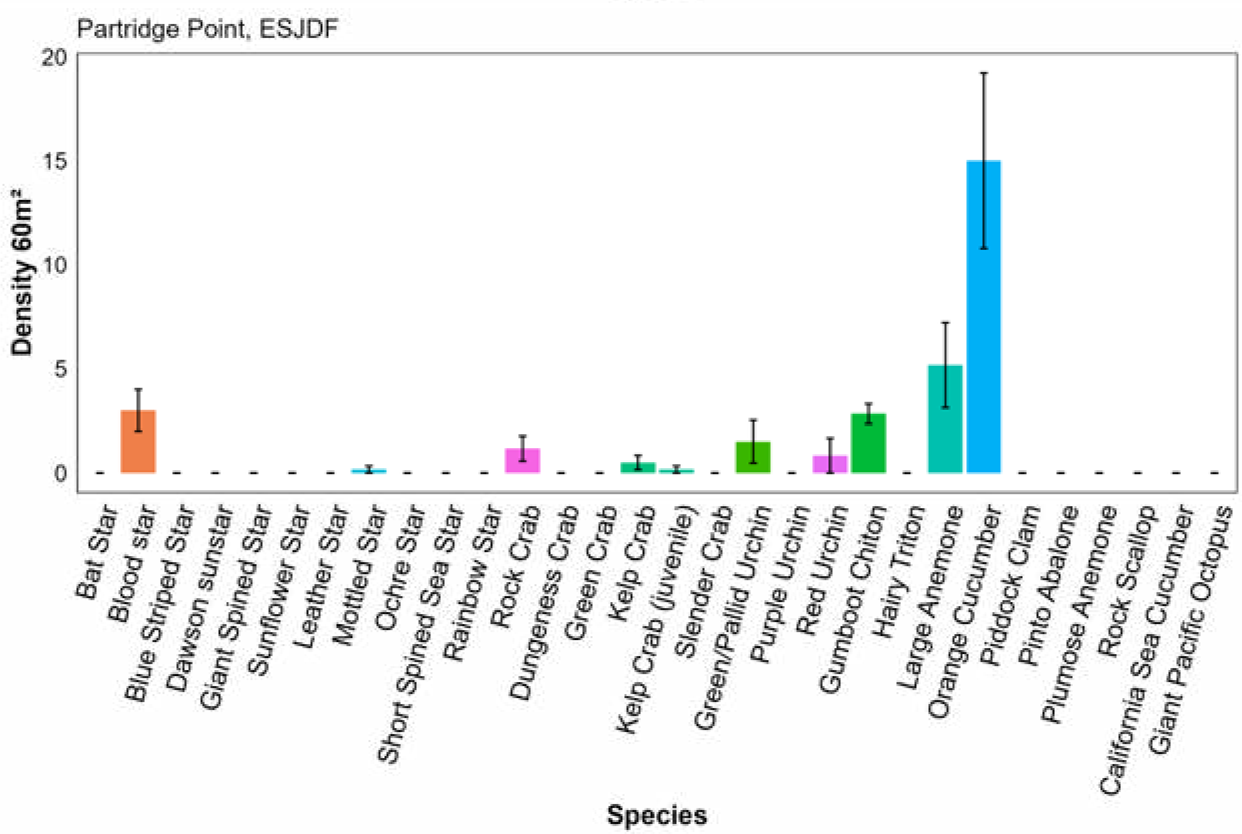


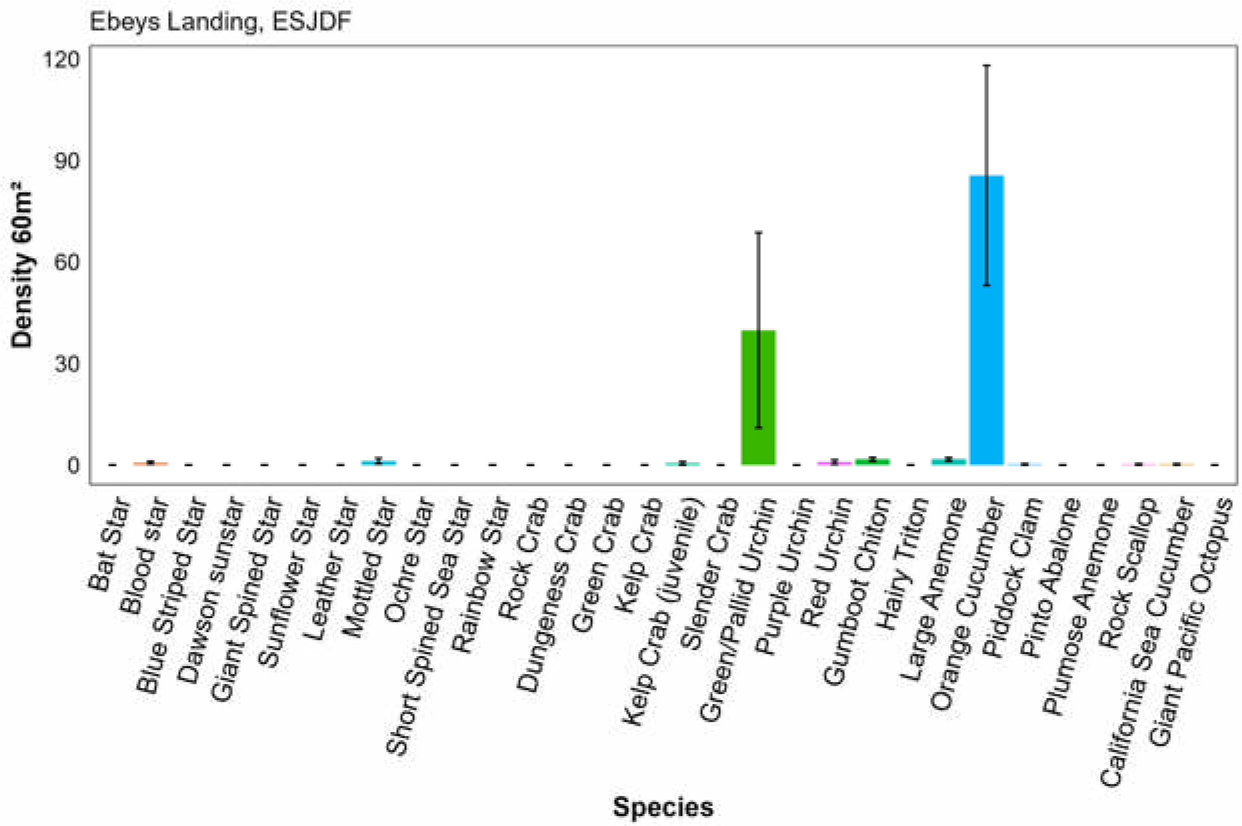
Sekiu Point, WSJDF
Density 60m²
200
150
100
50
0
Bat Star
Blood star
Blue Striped Star
Dawson sunstar
Giant Spined Star
Sunflower Star
Leather Star
Mottled Star
Ochre Star
Short Spined Sea Star
Rainbow Star
Rock Crab
Dungeness Crab
Green Crab
Kelp Crab
Kelp Crab (juvenile)
Slender Crab
Green/Pallid Urchin
Purple Urchin
Red Urchin
Gumboot Chiton
Hairy Triton
Large Anemone
Orange Cucumber
Piddock Clam
Pinto Abalone
Plumose Anemone
Rock Scallop
California Sea Cucumber
Giant Pacific Octopus
Species



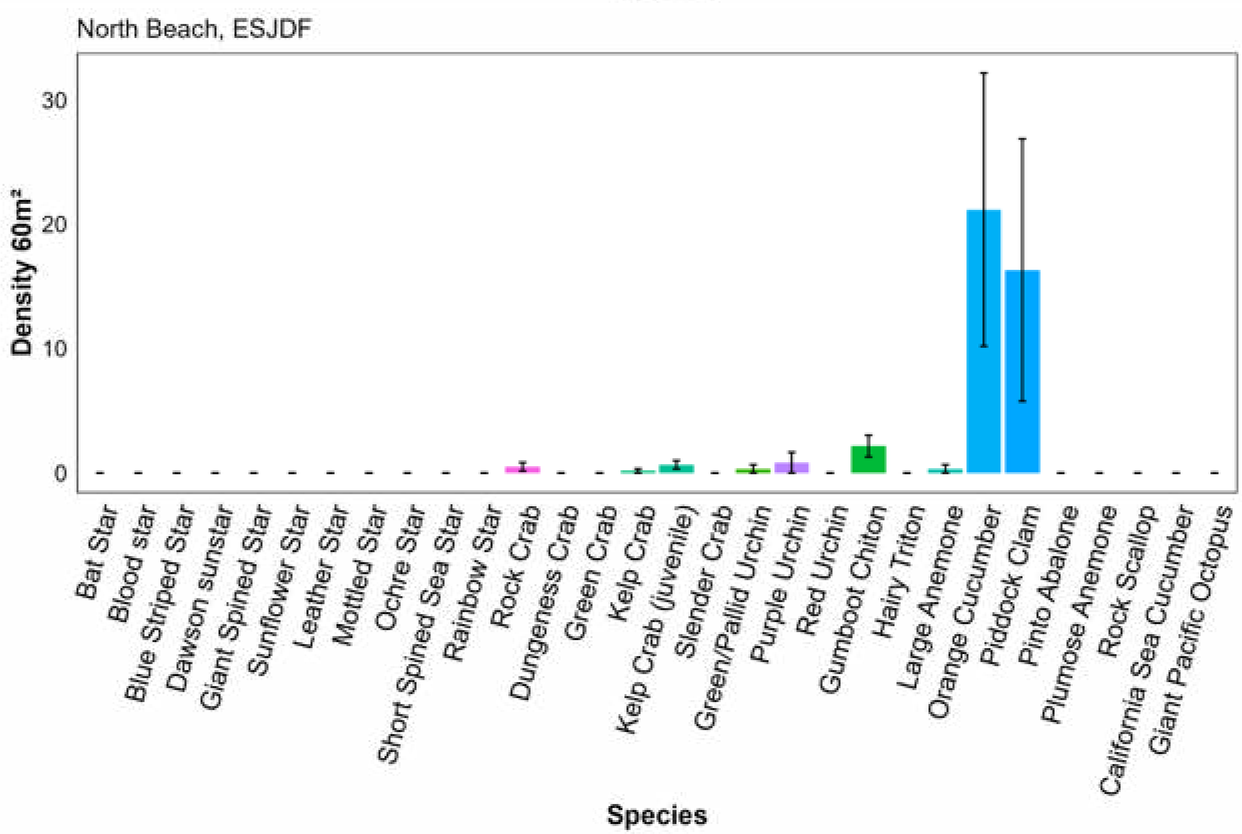
Tongue Point, ESJDF
Density 60m²
400
200
0
Bat Star
Blood star
Blue Striped Star
Dawson sunstar
Giant Spined Star
Sunflower Star
Leather Star
Mottled Star
Ochre Star
Short Spined Sea Star
Rainbow Star
Rock Crab
Dungeness Crab
Green Crab
Kelp Crab
Kelp Crab (juvenile)
Slender Crab
Green/Pallid Urchin
Purple Urchin
Red Urchin
Gumboot Chiton
Hairy Triton
Large Anemone
Orange Cucumber
Piddock Clam
Pinto Abalone
Plumose Anemone
Rock Scallop
California Sea Cucumber
Giant Pacific Octopus
Species


Clallam Bay West, WSJDF
Density 60m²
50
40
30
20
10
0
Bat Star
Blood star
Blue Striped Star
Dawson sunstar
Giant Spined Star
Sunflower Star
Leather Star
Mottled Star
Ochre Star
Short Spined Sea Star
Rainbow Star
Rock Crab
Dungeness Crab
Green Crab
Kelp Crab
Kelp Crab (juvenile)
Slender Crab
Green/Pallid Urchin
Purple Urchin
Red Urchin
Gumboot Chiton
Hairy Triton
Large Anemone
Orange Cucumber
Piddock Clam
Pinto Abalone
Plumose Anemone
Rock Scallop
California Sea Cucumber
Giant Pacific Octopus
Species

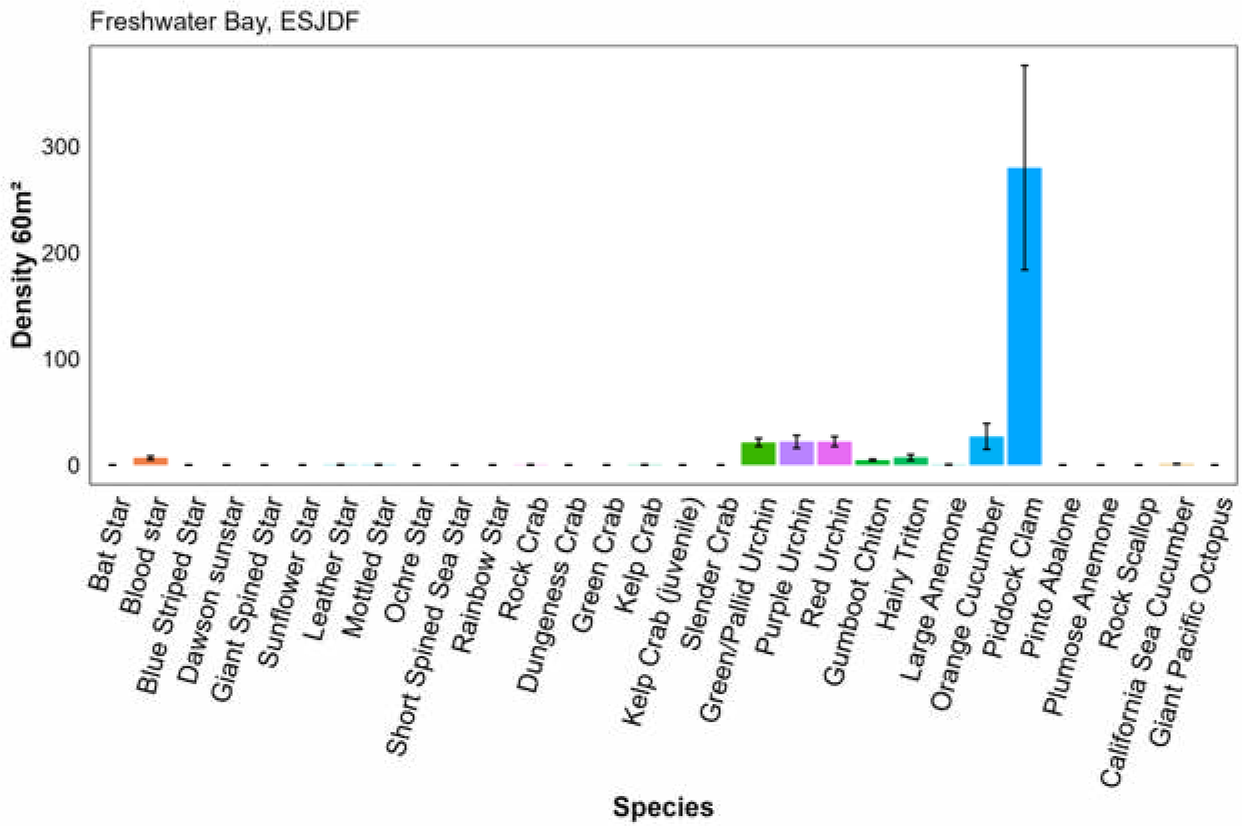

Partridge Point, ESJDF
Density 60m²
20
15
10
5
0
Bat Star
Blood star
Blue Striped Star
Dawson sunstar
Giant Spined Star
Sunflower Star
Leather Star
Mottled Star
Ochre Star
Short Spined Sea Star
Rainbow Star
Rock Crab
Dungeness Crab
Green Crab
Kelp Crab
Kelp Crab (juvenile)
Slender Crab
Green/Pallid Urchin
Purple Urchin
Red Urchin
Gumboot Chiton
Hairy Triton
Large Anemone
Orange Cucumber
Piddock Clam
Pinto Abalone
Plumose Anemone
Rock Scallop
California Sea Cucumber
Giant Pacific Octopus
Species

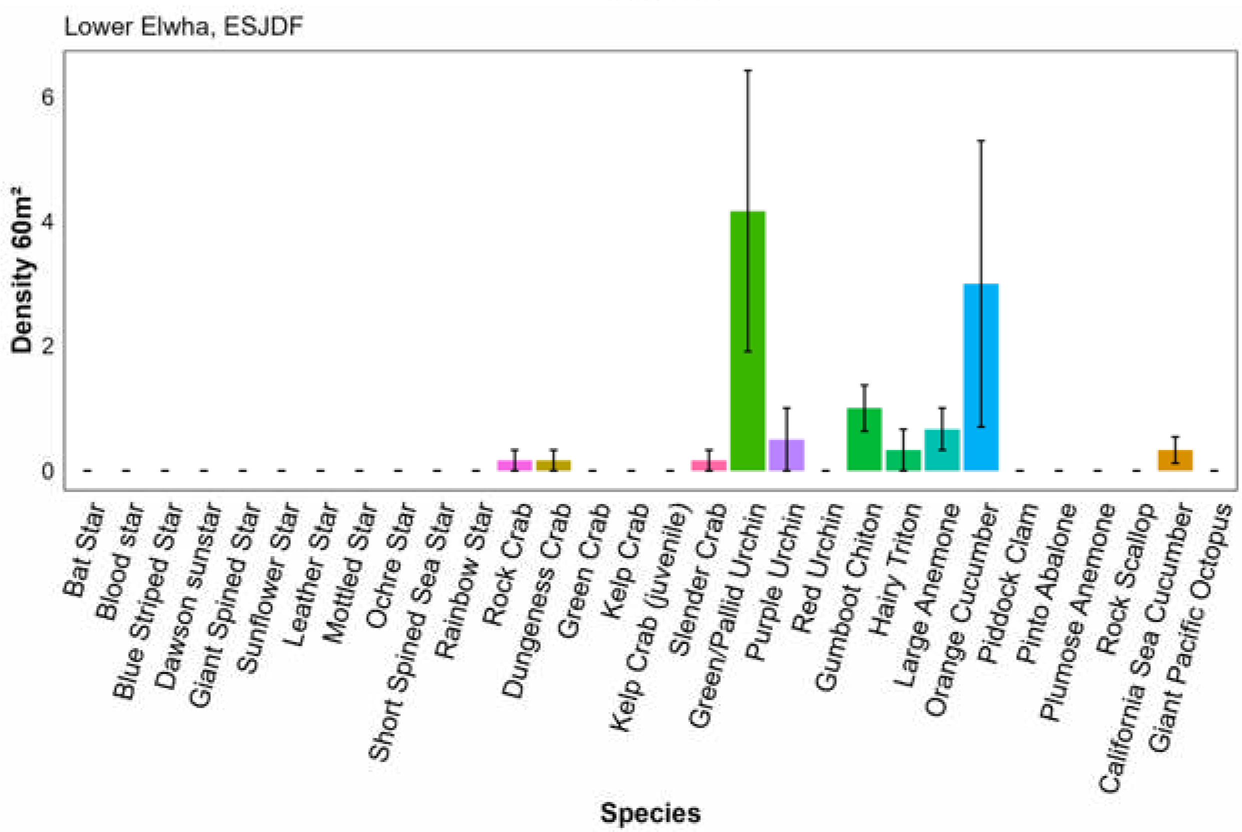


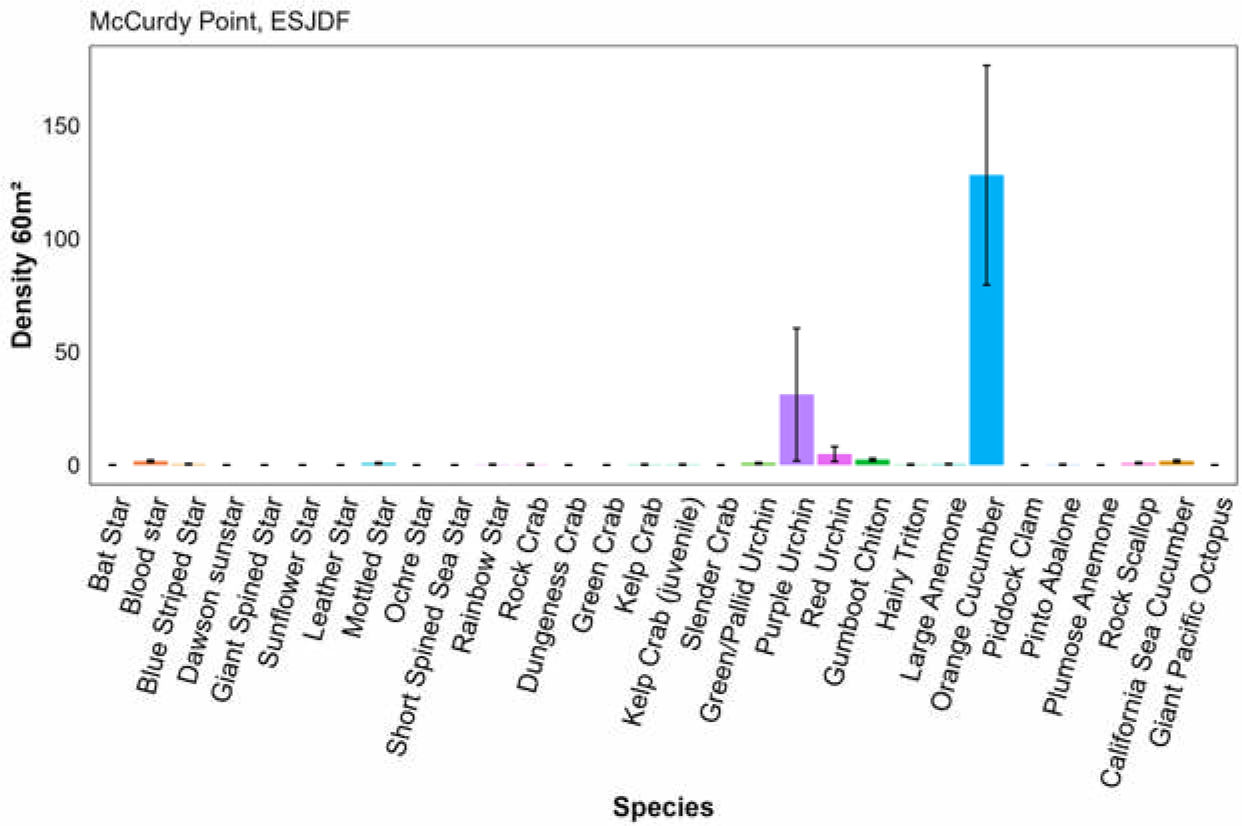
Ebeys Landing, ESJDF
Density 60m²
120
90
60
30
0
Bat Star
Blood star
Blue Striped Star
Dawson sunstar
Giant Spined Star
Sunflower Star
Leather Star
Mottled Star
Ochre Star
Short Spined Sea Star
Rainbow Star
Rock Crab
Dungeness Crab
Green Crab
Kelp Crab
Kelp Crab (juvenile)
Slender Crab
Green/Pallid Urchin
Purple Urchin
Red Urchin
Gumboot Chiton
Hairy Triton
Large Anemone
Orange Cucumber
Piddock Clam
Pinto Abalone
Plumose Anemone
Rock Scallop
California Sea Cucumber
Giant Pacific Octopus
Species

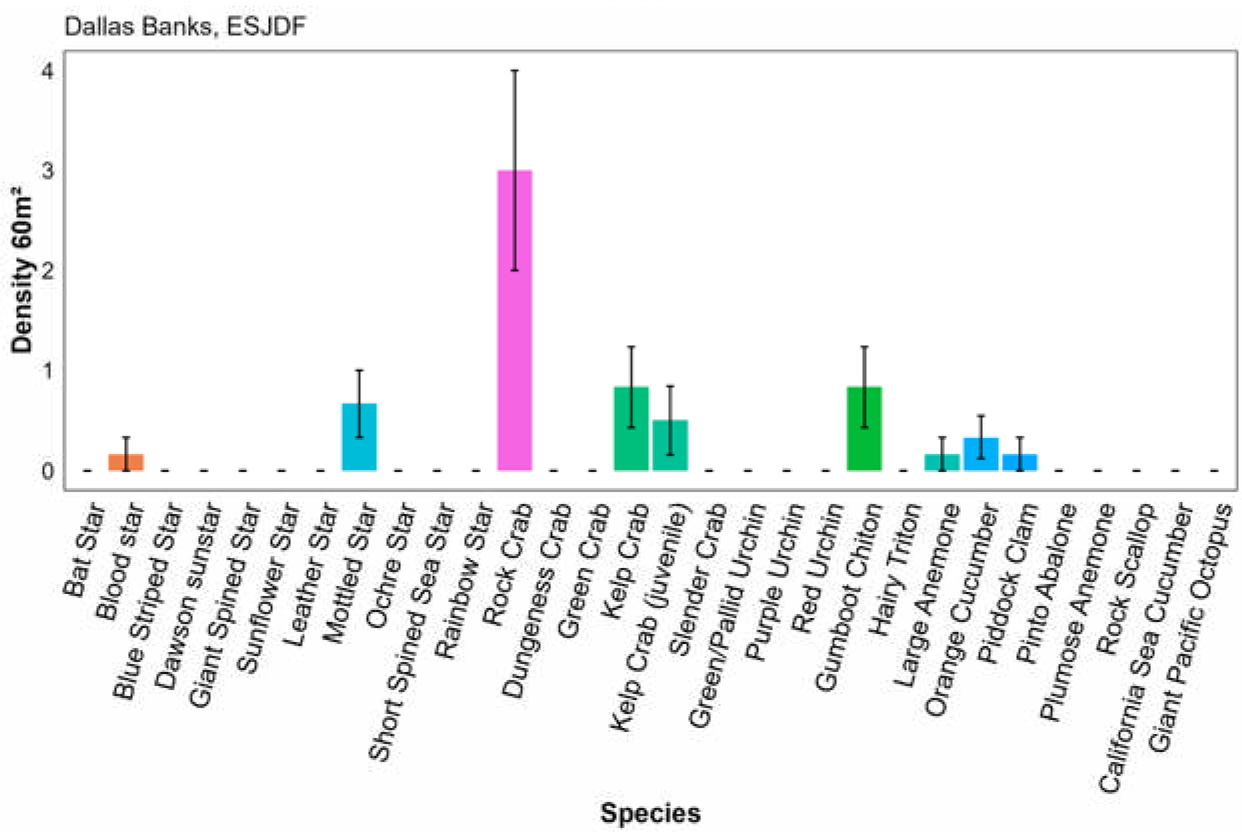


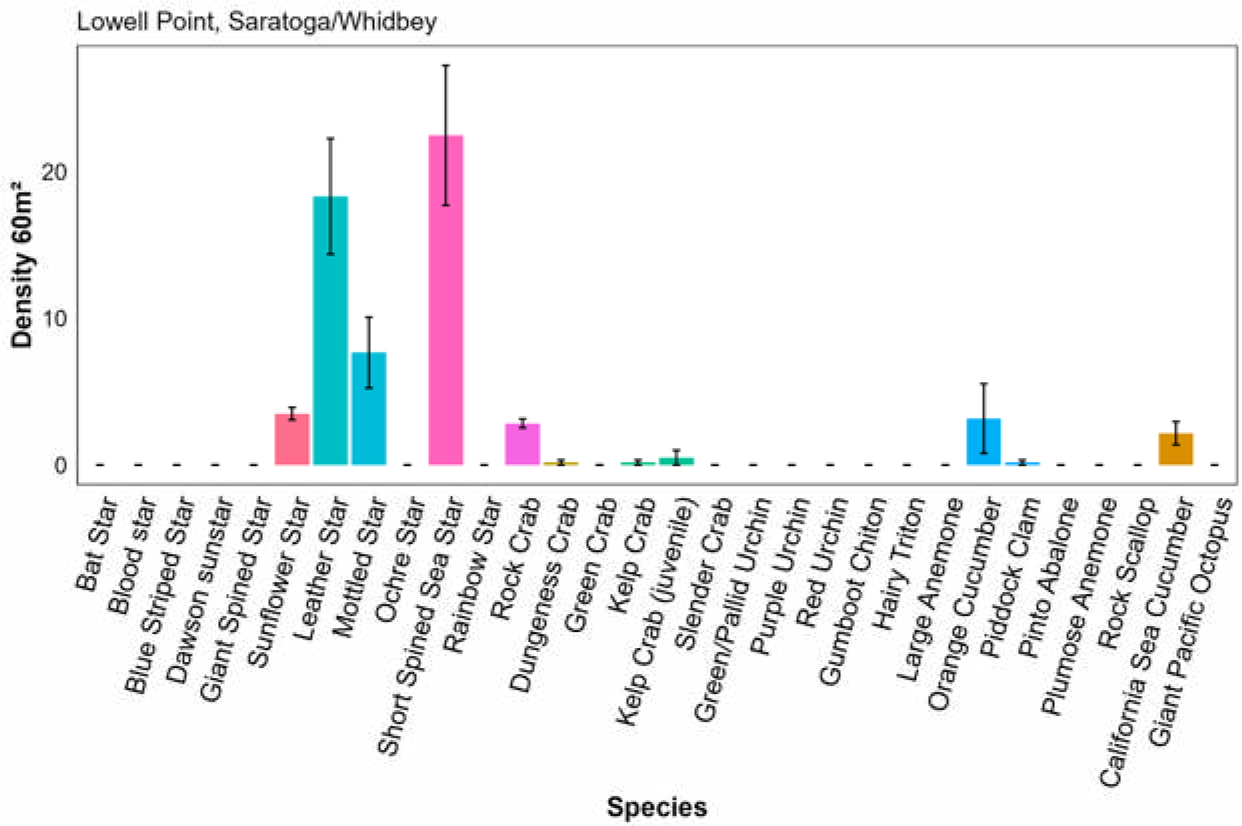
North Beach, ESJDF
Density 60m²
30
20
10
0
Bat Star
Blood star
Blue Striped Star
Dawson sunstar
Giant Spined Star
Sunflower Star
Leather Star
Mottled Star
Ochre Star
Short Spined Sea Star
Rainbow Star
Rock Crab
Dungeness Crab
Green Crab
Kelp Crab
Kelp Crab (juvenile)
Slender Crab
Green/Pallid Urchin
Purple Urchin
Red Urchin
Gumboot Chiton
Hairy Triton
Large Anemone
Orange Cucumber
Piddock Clam
Pinto Abalone
Plumose Anemone
Rock Scallop
California Sea Cucumber
Giant Pacific Octopus
Species

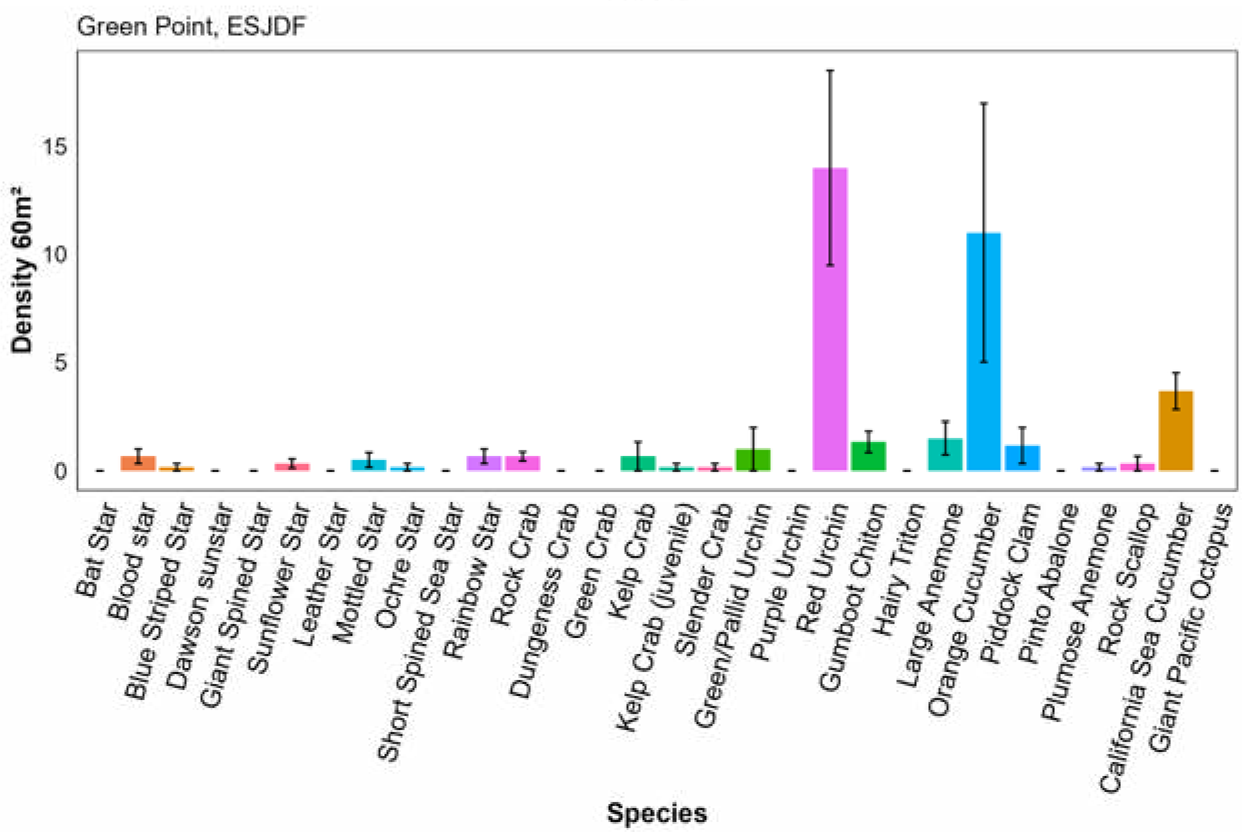

Freshwater Bay, ESJDF
Density 60m²
0
100
200
300
Bat Star
Blood star
Blue Striped Star
Dawson sunstar
Giant Spined Star
Sunflower Star
Leather Star
Mottled Star
Ochre Star
Short Spined Sea Star
Rainbow Star
Rock Crab
Dungeness Crab
Green Crab
Kelp Crab
Kelp Crab (juvenile)
Slender Crab
Green/Pallid Urchin
Purple Urchin
Red Urchin
Gumboot Chiton
Hairy Triton
Large Anemone
Orange Cucumber
Piddock Clam
Pinto Abalone
Plumose Anemone
Rock Scallop
California Sea Cucumber
Giant Pacific Octopus
Species

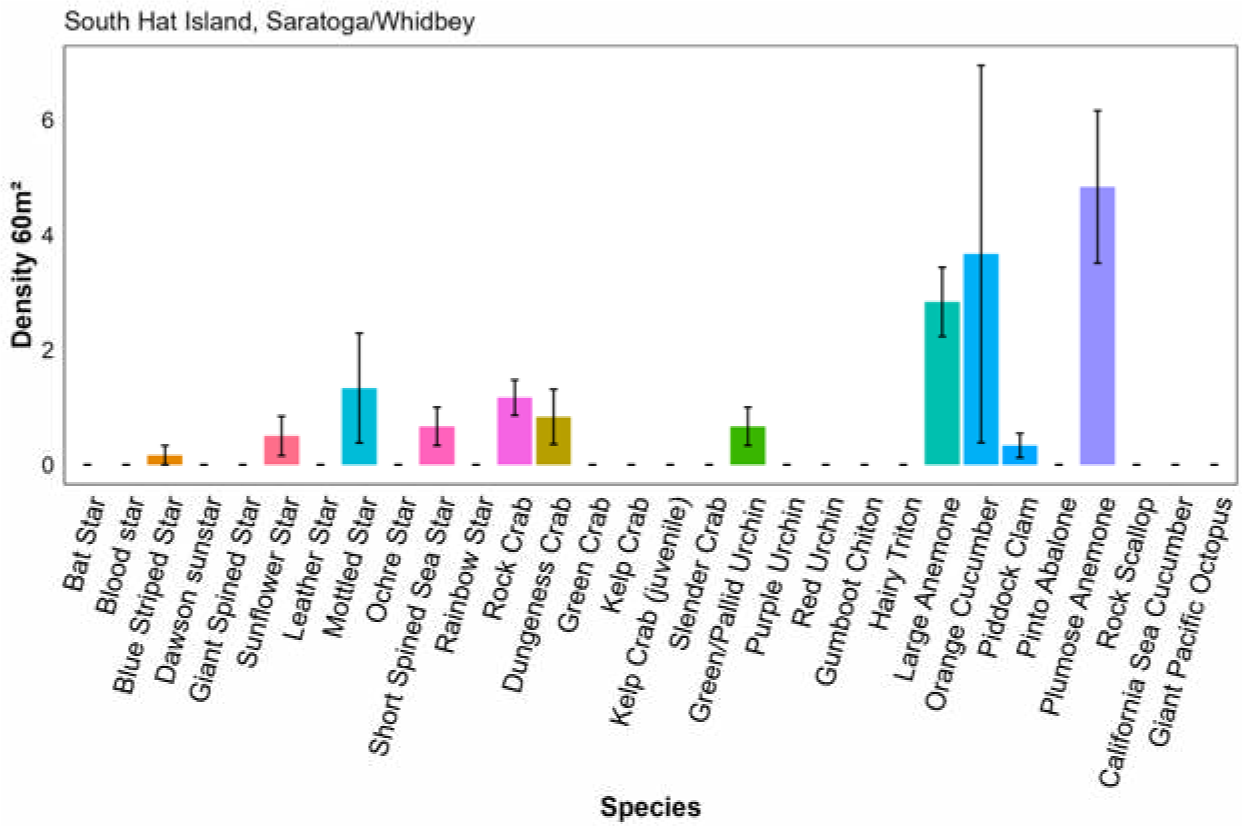

Lower Elwha, ESJDF
Density 60m²
0
2
4
6
Bat Star
Blood star
Blue Striped Star
Dawson sunstar
Giant Spined Star
Sunflower Star
Leather Star
Mottled Star
Ochre Star
Short Spined Sea Star
Rainbow Star
Rock Crab
Dungeness Crab
Green Crab
Kelp Crab
Kelp Crab (juvenile)
Slender Crab
Green/Pallid Urchin
Purple Urchin
Red Urchin
Gumboot Chiton
Hairy Triton
Large Anemone
Orange Cucumber
Piddock Clam
Pinto Abalone
Plumose Anemone
Rock Scallop
California Sea Cucumber
Giant Pacific Octopus
Species

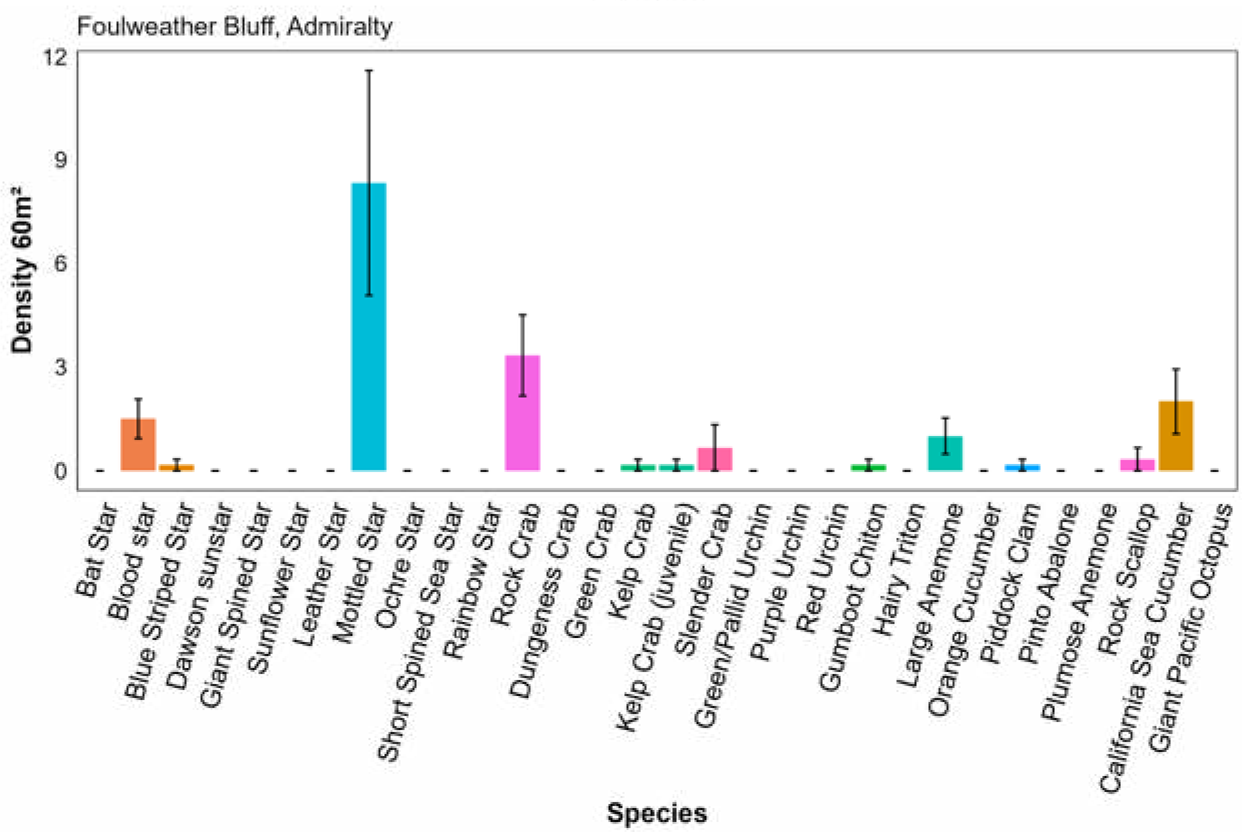

McCurdy Point, ESJDF
Density 60m²
150
100
50
0
Bat Star
Blood star
Blue Striped Star
Dawson sunstar
Giant Spined Star
Sunflower Star
Leather Star
Mottled Star
Ochre Star
Short Spined Sea Star
Rainbow Star
Rock Crab
Dungeness Crab
Green Crab
Kelp Crab
Kelp Crab (juvenile)
Slender Crab
Green/Pallid Urchin
Purple Urchin
Red Urchin
Gumboot Chiton
Hairy Triton
Large Anemone
Orange Cucumber
Piddock Clam
Pinto Abalone
Plumose Anemone
Rock Scallop
California Sea Cucumber
Giant Pacific Octopus
Species

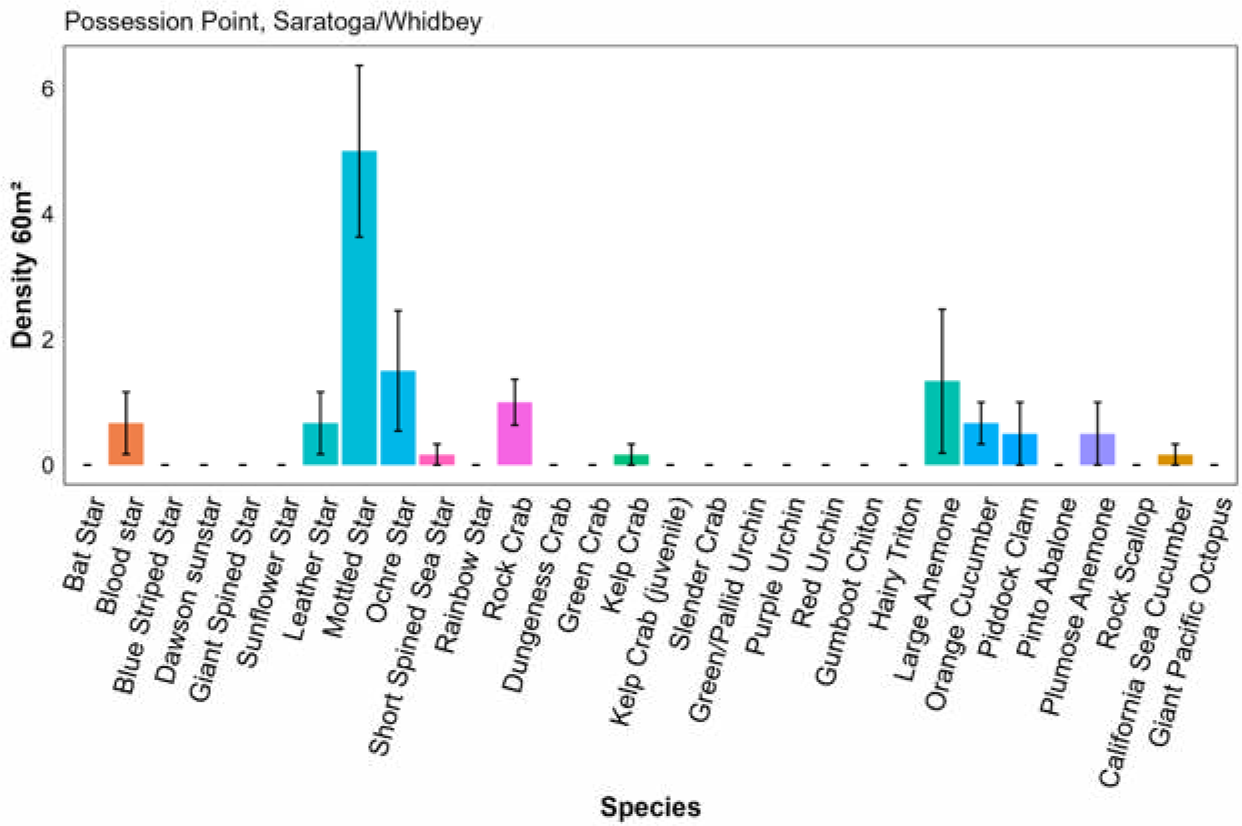

Dallas Banks, ESJDF
Density 60m²
4
3
2
1
0
Bat Star
Blood star
Blue Striped Star
Dawson sunstar
Giant Spined Star
Sunflower Star
Leather Star
Mottled Star
Ochre Star
Short Spined Sea Star
Rainbow Star
Rock Crab
Dungeness Crab
Green Crab
Kelp Crab
Kelp Crab (juvenile)
Slender Crab
Green/Pallid Urchin
Purple Urchin
Red Urchin
Gumboot Chiton
Hairy Triton
Large Anemone
Orange Cucumber
Piddock Clam
Pinto Abalone
Plumose Anemone
Rock Scallop
California Sea Cucumber
Giant Pacific Octopus
Species

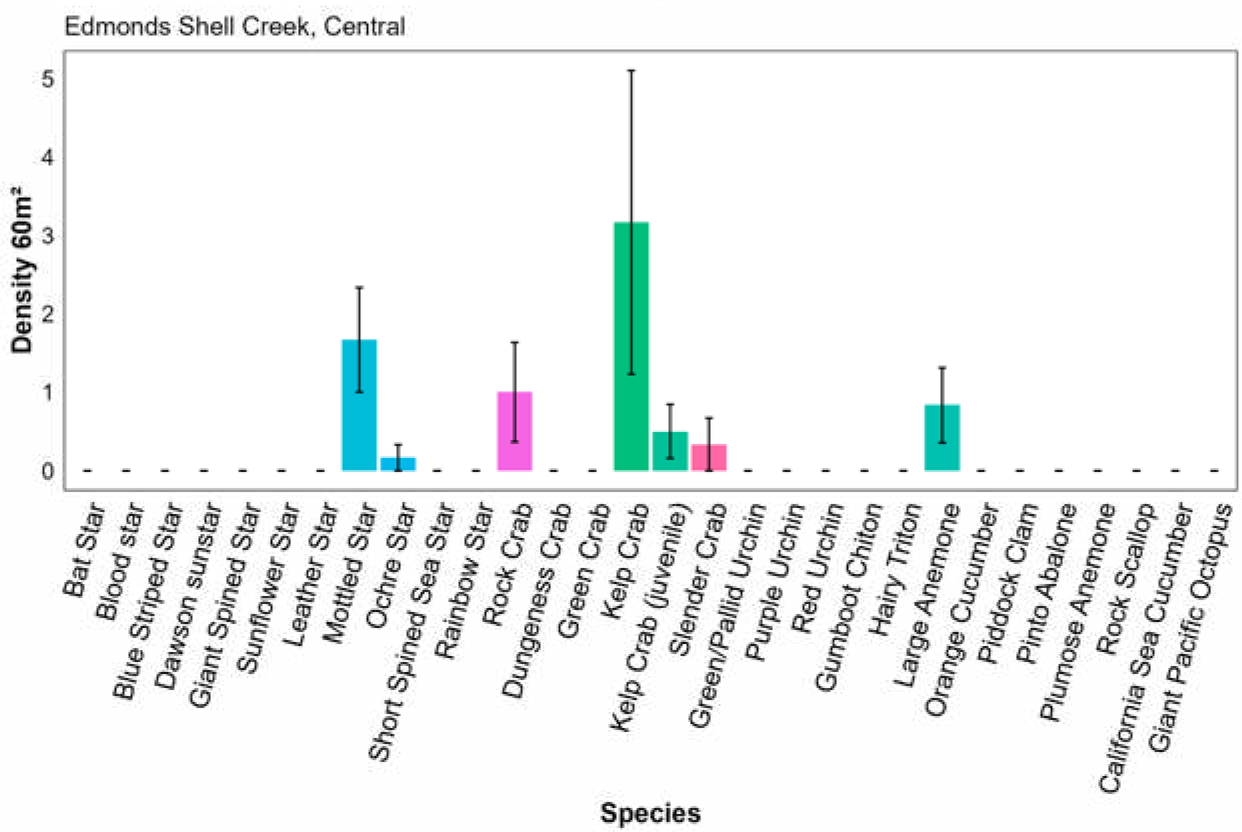

Lowell Point, Saratoga/Whidbey
Density 60m²
0
10
20
Species
Bat Star
Blood star
Blue Striped Star
Dawson sunstar
Giant Spined Star
Sunflower Star
Leather Star
Mottled Star
Ochre Star
Short Spined Sea Star
Rainbow Star
Rock Crab
Dungeness Crab
Green Crab
Kelp Crab
Kelp Crab (juvenile)
Slender Crab
Green/Pallid Urchin
Purple Urchin
Red Urchin
Gumboot Chiton
Hairy Triton
Large Anemone
Orange Cucumber
Piddock Clam
Pinto Abalone
Plumose Anemone
Rock Scallop
California Sea Cucumber
Giant Pacific Octopus

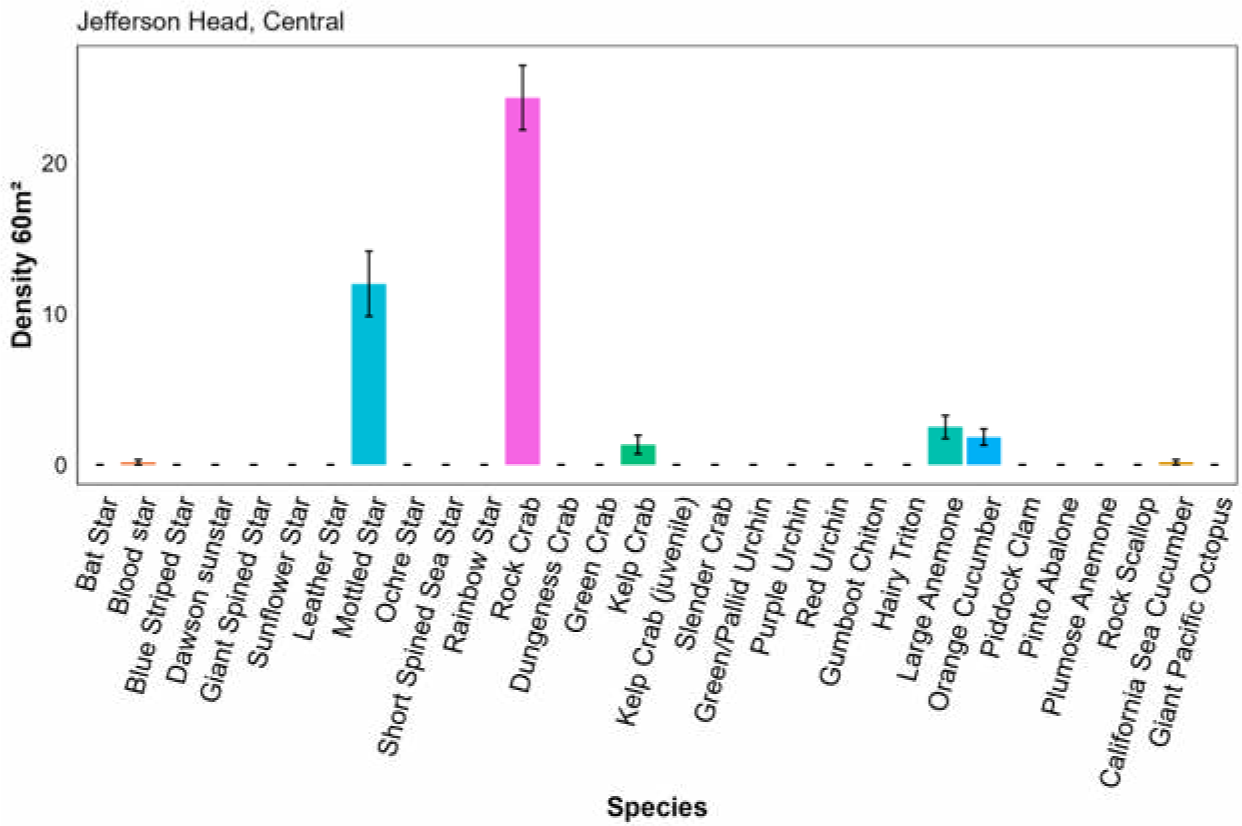

Green Point, ESJDF
Density 60m²
0
5
10
15
Species
Bat Star
Blood star
Blue Striped Star
Dawson sunstar
Giant Spined Star
Sunflower Star
Leather Star
Mottled Star
Ochre Star
Short Spined Sea Star
Rainbow Star
Rock Crab
Dungeness Crab
Green Crab
Kelp Crab
Kelp Crab (juvenile)
Slender Crab
Green/Pallid Urchin
Purple Urchin
Red Urchin
Gumboot Chiton
Hairy Triton
Large Anemone
Orange Cucumber
Piddock Clam
Pinto Abalone
Plumose Anemone
Rock Scallop
California Sea Cucumber
Giant Pacific Octopus


South Hat Island, Saratoga/Whidbey
Density 60m²
0
2
4
6
Bat Star
Blood star
Blue Striped Star
Dawson sunstar
Giant Spined Star
Sunflower Star
Leather Star
Mottled Star
Ochre Star
Short Spined Sea Star
Rainbow Star
Rock Crab
Dungeness Crab
Green Crab
Kelp Crab
Kelp Crab (juvenile)
Slender Crab
Green/Pallid Urchin
Purple Urchin
Red Urchin
Gumboot Chiton
Hairy Triton
Large Anemone
Orange Cucumber
Piddock Clam
Pinto Abalone
Plumose Anemone
Rock Scallop
California Sea Cucumber
Giant Pacific Octopus
Species

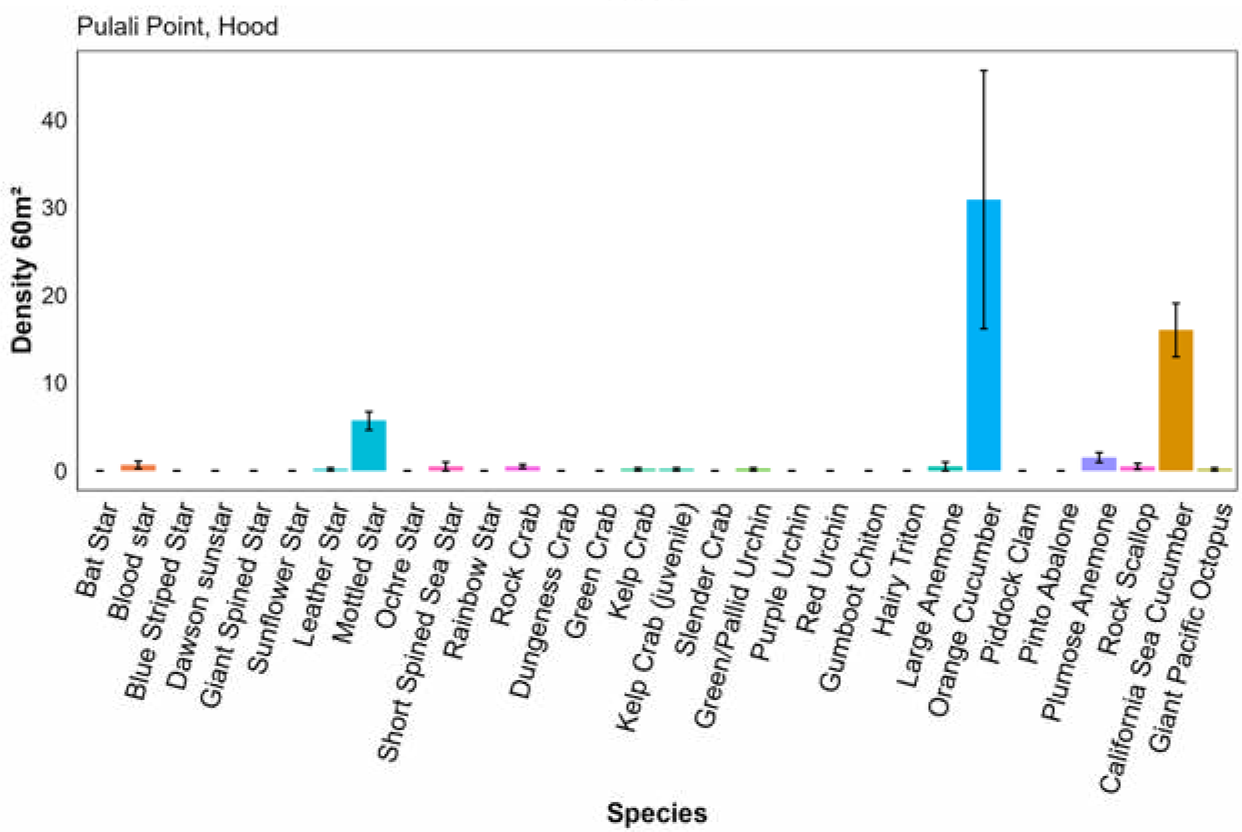

Foulweather Bluff, Admiralty
Density 60m²
0
3
6
9
12
Bat Star
Blood star
Blue Striped Star
Dawson sunstar
Giant Spined Star
Sunflower Star
Leather Star
Mottled Star
Ochre Star
Short Spined Sea Star
Rainbow Star
Rock Crab
Dungeness Crab
Green Crab
Kelp Crab
Kelp Crab (juvenile)
Slender Crab
Green/Pallid Urchin
Purple Urchin
Red Urchin
Gumboot Chiton
Hairy Triton
Large Anemone
Orange Cucumber
Piddock Clam
Pinto Abalone
Plumose Anemone
Rock Scallop
California Sea Cucumber
Giant Pacific Octopus
Species


Possession Point, Saratoga/Whidbey
Density 60m²
Species
Bat Star
Blood star
Blue Striped Star
Dawson sunstar
Giant Spined Star
Sunflower Star
Leather Star
Mottled Star
Ochre Star
Short Spined Sea Star
Rainbow Star
Rock Crab
Dungeness Crab
Green Crab
Kelp Crab
Kelp Crab (juvenile)
Slender Crab
Green/Pallid Urchin
Purple Urchin
Red Urchin
Gumboot Chiton
Hairy Triton
Large Anemone
Orange Cucumber
Piddock Clam
Pinto Abalone
Plumose Anemone
Rock Scallop
California Sea Cucumber
Giant Pacific Octopus

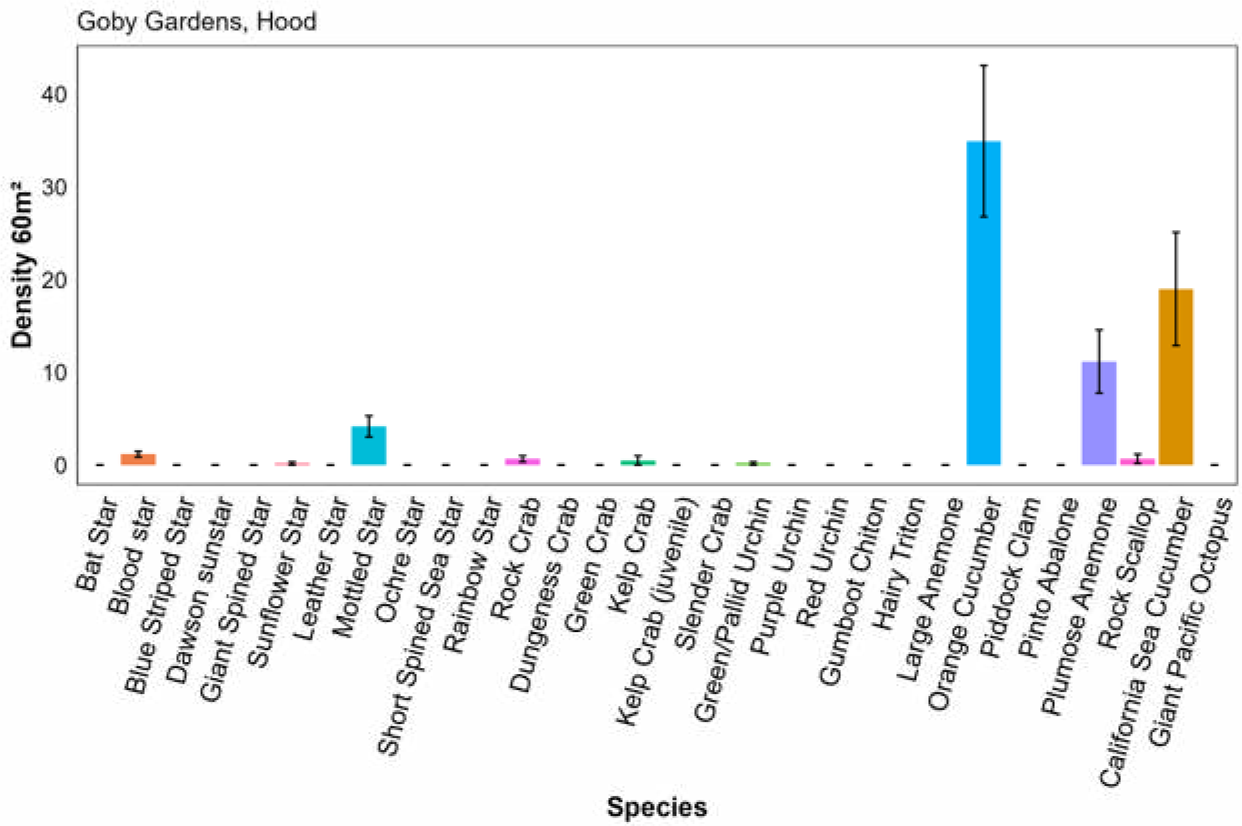

Edmonds Shell Creek, Central
Density 60m²
Species
Bat Star
Blood star
Blue Striped Star
Dawson sunstar
Giant Spined Star
Sunflower Star
Leather Star
Mottled Star
Ochre Star
Short Spined Sea Star
Rainbow Star
Rock Crab
Dungeness Crab
Green Crab
Kelp Crab
Kelp Crab (juvenile)
Slender Crab
Green/Pallid Urchin
Purple Urchin
Red Urchin
Gumboot Chiton
Hairy Triton
Large Anemone
Orange Cucumber
Piddock Clam
Pinto Abalone
Plumose Anemone
Rock Scallop
California Sea Cucumber
Giant Pacific Octopus

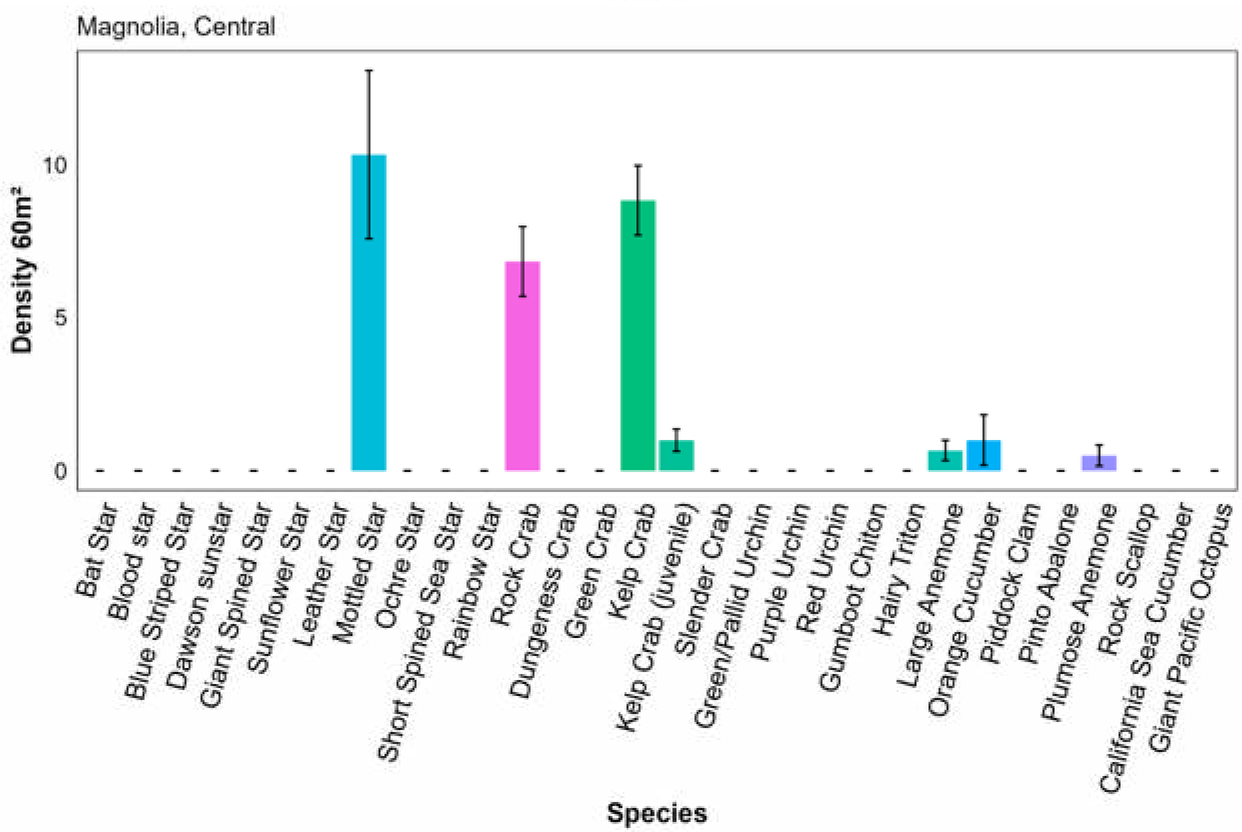


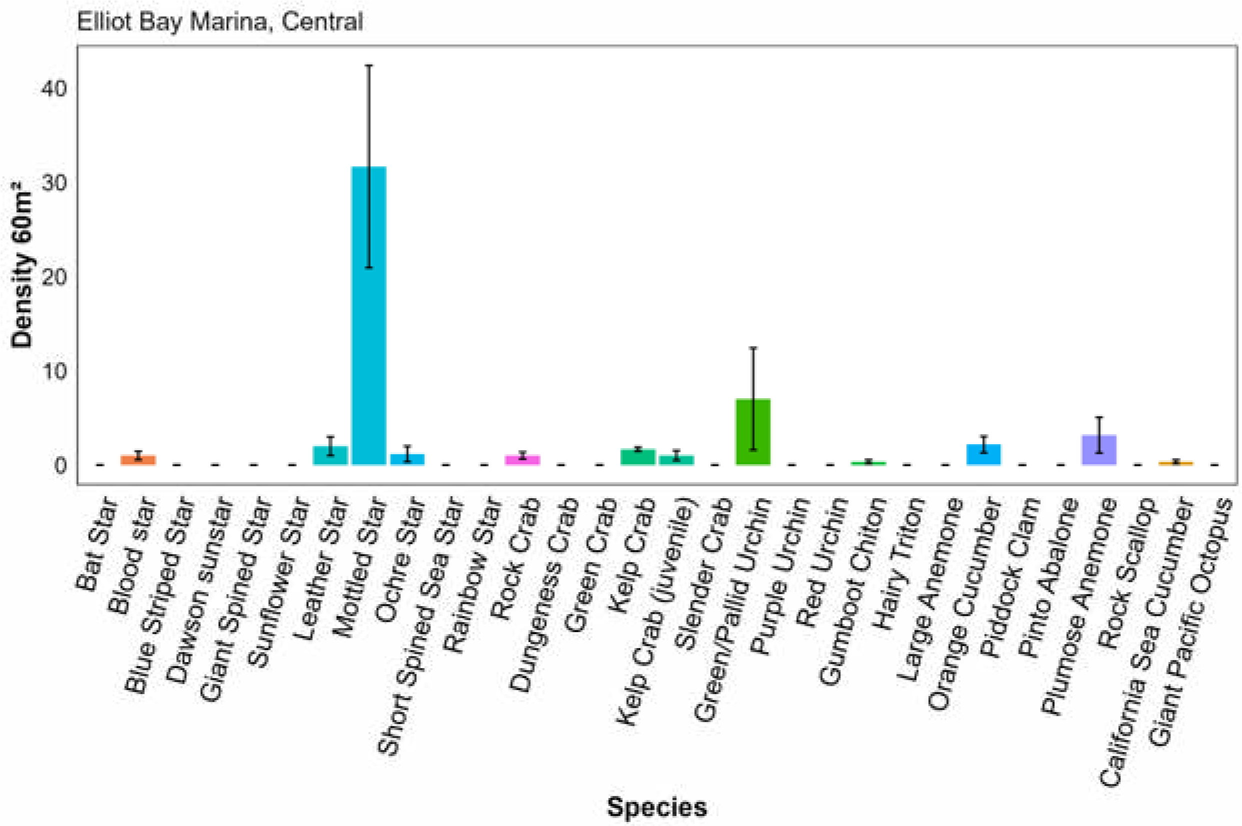
Jefferson Head, Central
Density 60m²
0
10
20
Bat Star
Blood star
Blue Striped Star
Dawson sunstar
Giant Spined Star
Sunflower Star
Leather Star
Mottled Star
Ochre Star
Short Spined Sea Star
Rainbow Star
Rock Crab
Dungeness Crab
Green Crab
Kelp Crab
Kelp Crab (juvenile)
Slender Crab
Green/Pallid Urchin
Purple Urchin
Red Urchin
Gumboot Chiton
Hairy Triton
Large Anemone
Orange Cucumber
Piddock Clam
Pinto Abalone
Plumose Anemone
Rock Scallop
California Sea Cucumber
Giant Pacific Octopus
Species



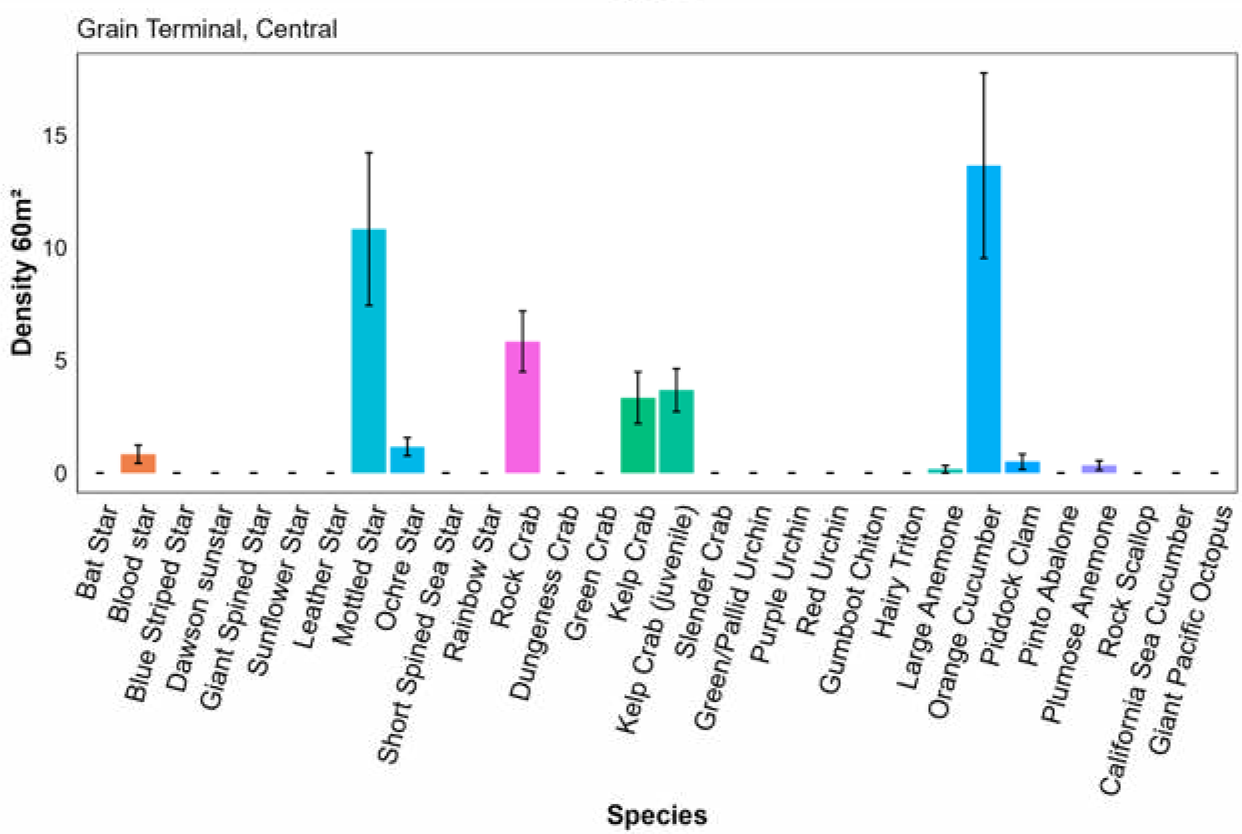
Pulali Point, Hood
Density 60m²
0
10
20
30
40
Bat Star
Blood star
Blue Striped Star
Dawson sunstar
Giant Spined Star
Sunflower Star
Leather Star
Mottled Star
Ochre Star
Short Spined Sea Star
Rainbow Star
Rock Crab
Dungeness Crab
Green Crab
Kelp Crab
Kelp Crab (juvenile)
Slender Crab
Green/Pallid Urchin
Purple Urchin
Red Urchin
Gumboot Chiton
Hairy Triton
Large Anemone
Orange Cucumber
Piddock Clam
Pinto Abalone
Plumose Anemone
Rock Scallop
California Sea Cucumber
Giant Pacific Octopus
Species


Goby Gardens, Hood
Density 60m²
0
10
20
30
40
Bat Star
Blood star
Blue Striped Star
Dawson sunstar
Giant Spined Star
Sunflower Star
Leather Star
Mottled Star
Ochre Star
Short Spined Sea Star
Rainbow Star
Rock Crab
Dungeness Crab
Green Crab
Kelp Crab
Kelp Crab (juvenile)
Slender Crab
Green/Pallid Urchin
Purple Urchin
Red Urchin
Gumboot Chiton
Hairy Triton
Large Anemone
Orange Cucumber
Piddock Clam
Pinto Abalone
Plumose Anemone
Rock Scallop
California Sea Cucumber
Giant Pacific Octopus
Species

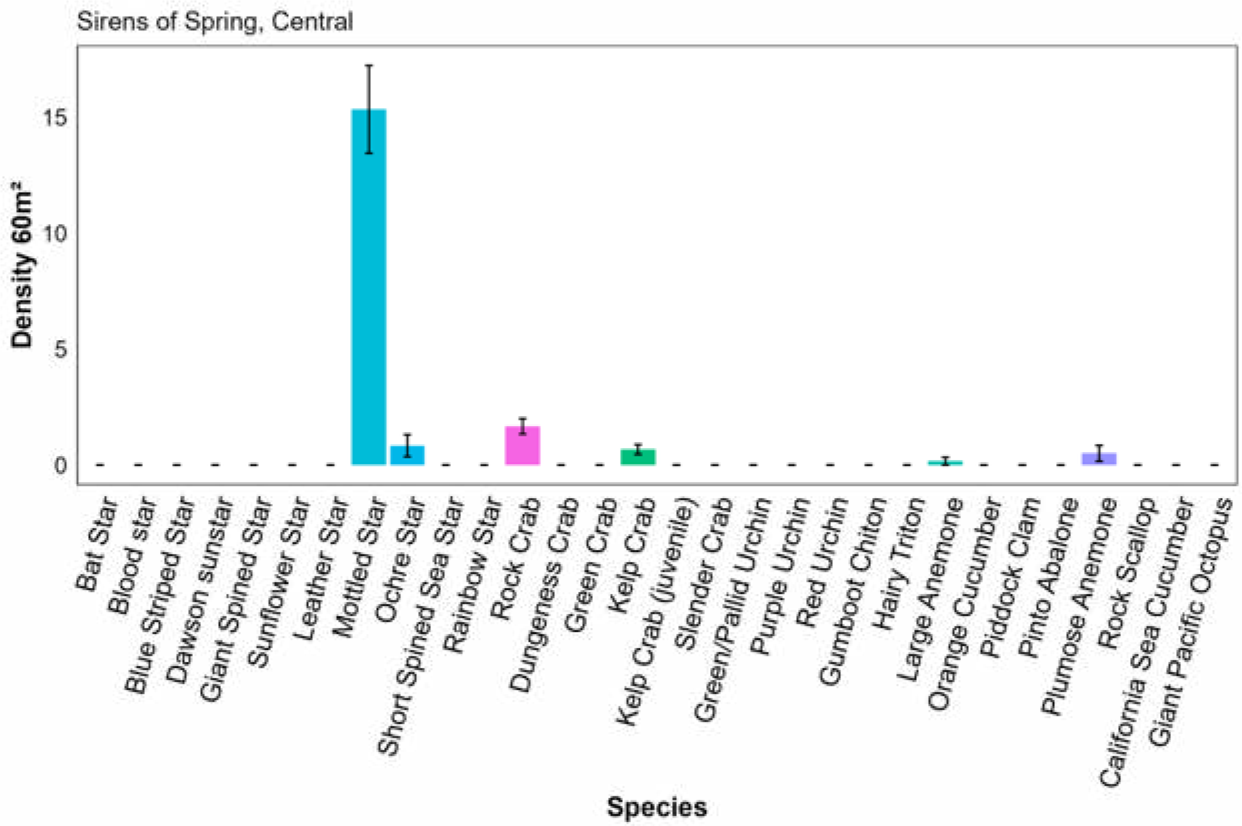

Magnolia, Central
Density 60m²
0
5
10
Bat Star
Blood star
Blue Striped Star
Dawson sunstar
Giant Spined Star
Sunflower Star
Leather Star
Mottled Star
Ochre Star
Short Spined Sea Star
Rainbow Star
Rock Crab
Dungeness Crab
Green Crab
Kelp Crab
Kelp Crab (juvenile)
Slender Crab
Green/Pallid Urchin
Purple Urchin
Red Urchin
Gumboot Chiton
Hairy Triton
Large Anemone
Orange Cucumber
Piddock Clam
Pinto Abalone
Plumose Anemone
Rock Scallop
California Sea Cucumber
Giant Pacific Octopus
Species

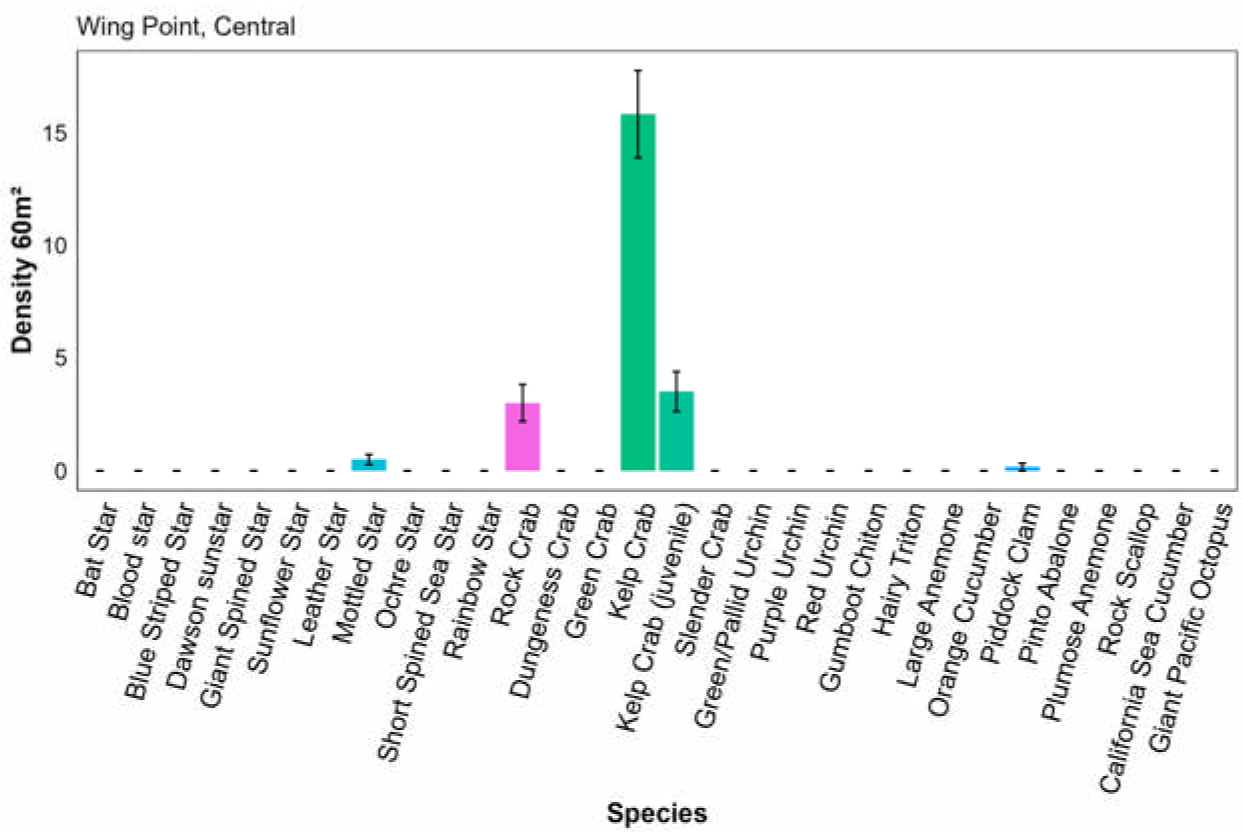


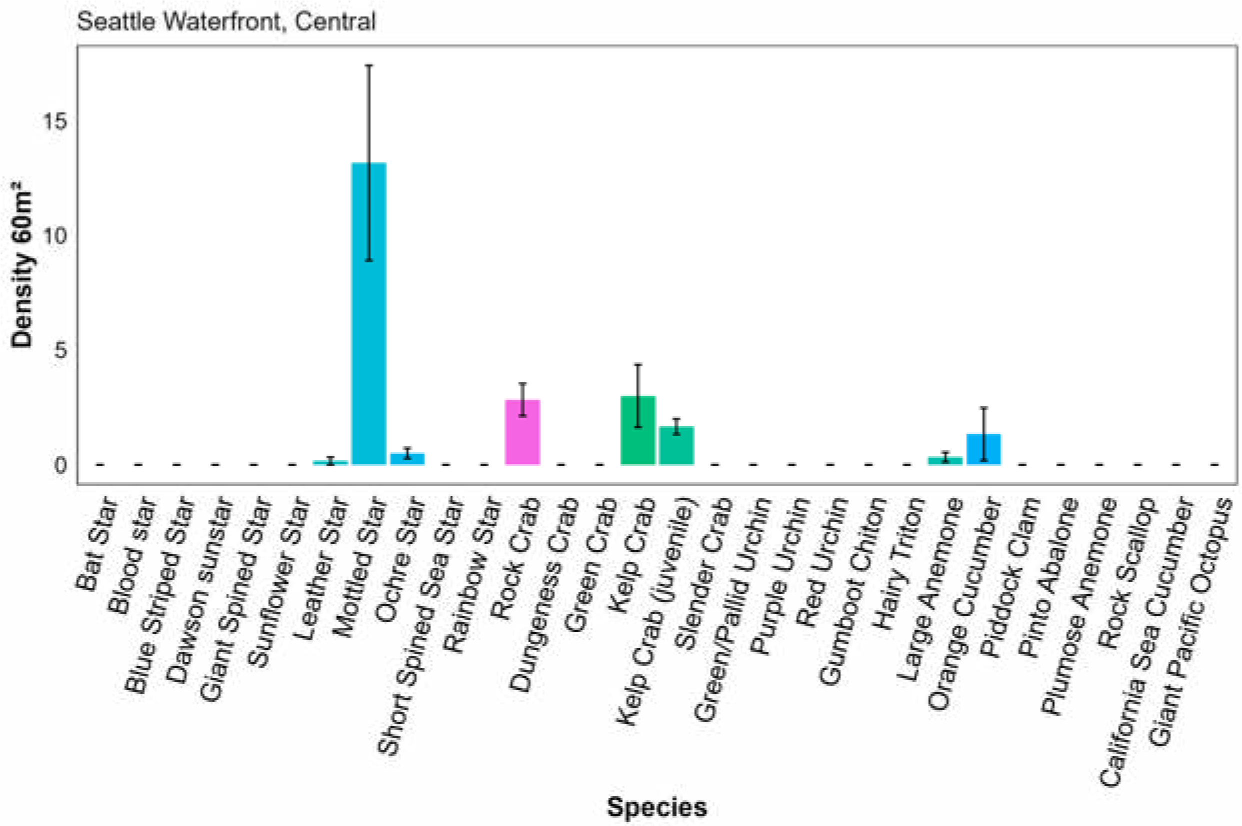
Elliot Bay Marina, Central
Density 60m²
40
30
20
10
0
Bat Star
Blood star
Blue Striped Star
Dawson sunstar
Giant Spined Star
Sunflower Star
Leather Star
Mottled Star
Ochre Star
Short Spined Sea Star
Rainbow Star
Rock Crab
Dungeness Crab
Green Crab
Kelp Crab
Kelp Crab (juvenile)
Slender Crab
Green/Pallid Urchin
Purple Urchin
Red Urchin
Gumboot Chiton
Hairy Triton
Large Anemone
Orange Cucumber
Piddock Clam
Pinto Abalone
Plumose Anemone
Rock Scallop
California Sea Cucumber
Giant Pacific Octopus
Species



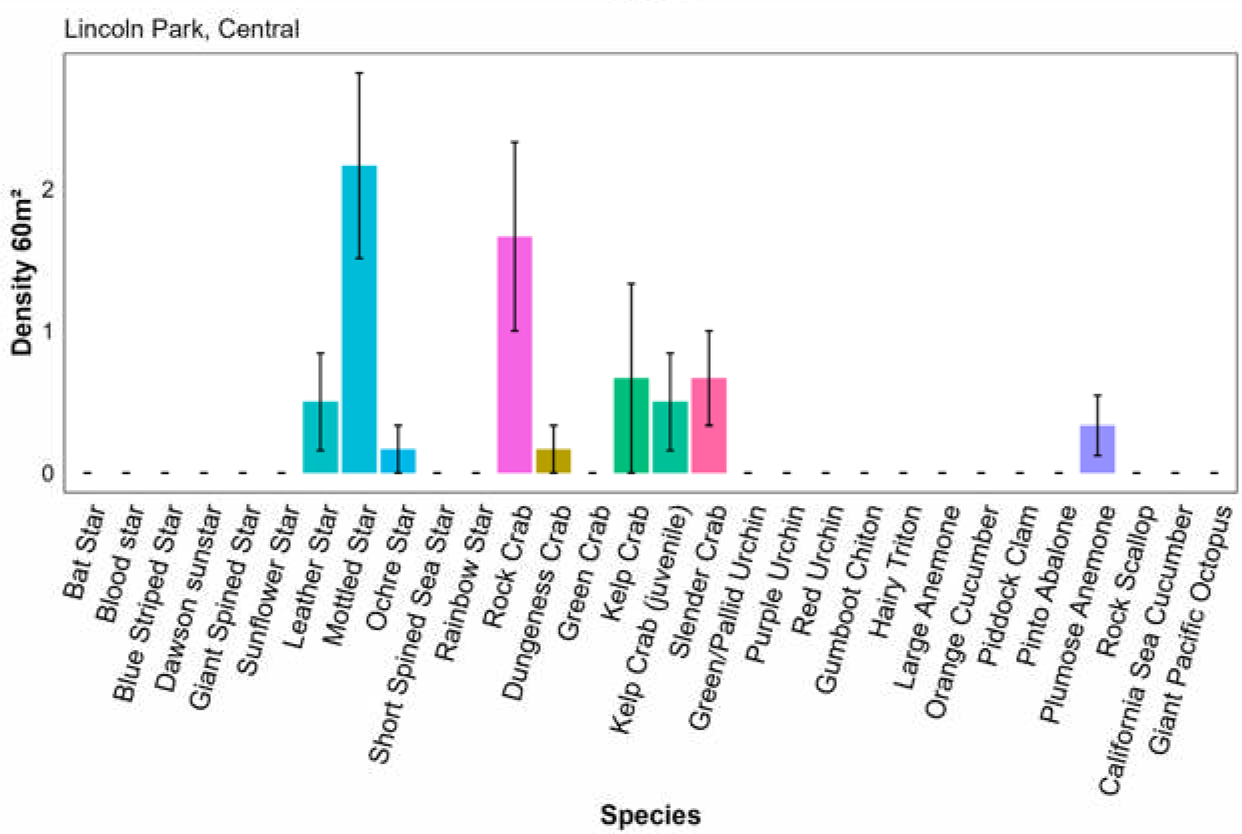
Grain Terminal, Central
Density 60m²
15
10
5
0
Bat Star
Blood star
Blue Striped Star
Dawson sunstar
Giant Spined Star
Sunflower Star
Leather Star
Mottled Star
Ochre Star
Short Spined Sea Star
Rainbow Star
Rock Crab
Dungeness Crab
Green Crab
Kelp Crab
Kelp Crab (juvenile)
Slender Crab
Green/Pallid Urchin
Purple Urchin
Red Urchin
Gumboot Chiton
Hairy Triton
Large Anemone
Orange Cucumber
Piddock Clam
Pinto Abalone
Plumose Anemone
Rock Scallop
California Sea Cucumber
Giant Pacific Octopus
Species


Sirens of Spring, Central
Density 60m²
0
5
10
15
Bat Star
Blood star
Blue Striped Star
Dawson sunstar
Giant Spined Star
Sunflower Star
Leather Star
Mottled Star
Ochre Star
Short Spined Sea Star
Rainbow Star
Rock Crab
Dungeness Crab
Green Crab
Kelp Crab
Kelp Crab (juvenile)
Slender Crab
Green/Pallid Urchin
Purple Urchin
Red Urchin
Gumboot Chiton
Hairy Triton
Large Anemone
Orange Cucumber
Piddock Clam
Pinto Abalone
Plumose Anemone
Rock Scallop
California Sea Cucumber
Giant Pacific Octopus
Species

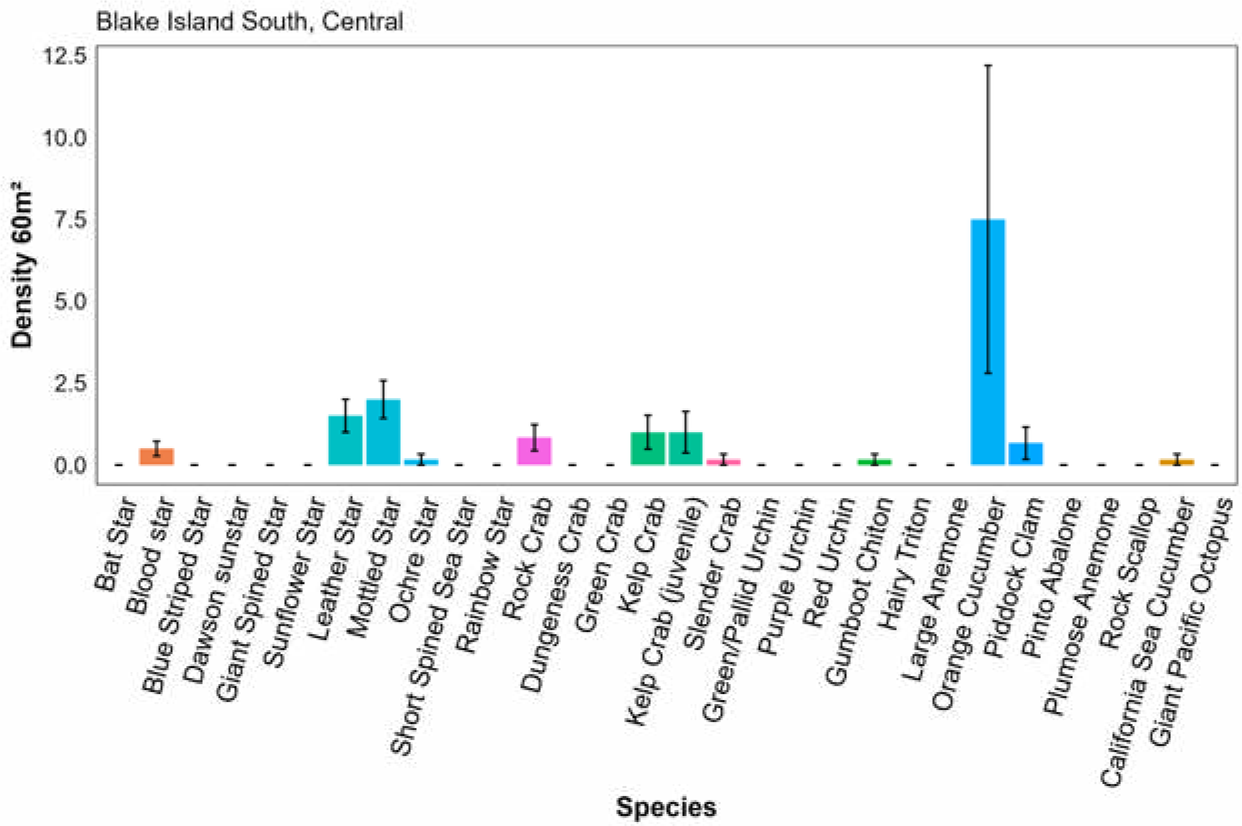

Wing Point, Central
Density 60m²
0
5
10
15
Bat Star
Blood star
Blue Striped Star
Dawson sunstar
Giant Spined Star
Sunflower Star
Leather Star
Mottled Star
Ochre Star
Short Spined Sea Star
Rainbow Star
Rock Crab
Dungeness Crab
Green Crab
Kelp Crab
Kelp Crab (juvenile)
Slender Crab
Green/Pallid Urchin
Purple Urchin
Red Urchin
Gumboot Chiton
Hairy Triton
Large Anemone
Orange Cucumber
Piddock Clam
Pinto Abalone
Plumose Anemone
Rock Scallop
California Sea Cucumber
Giant Pacific Octopus
Species

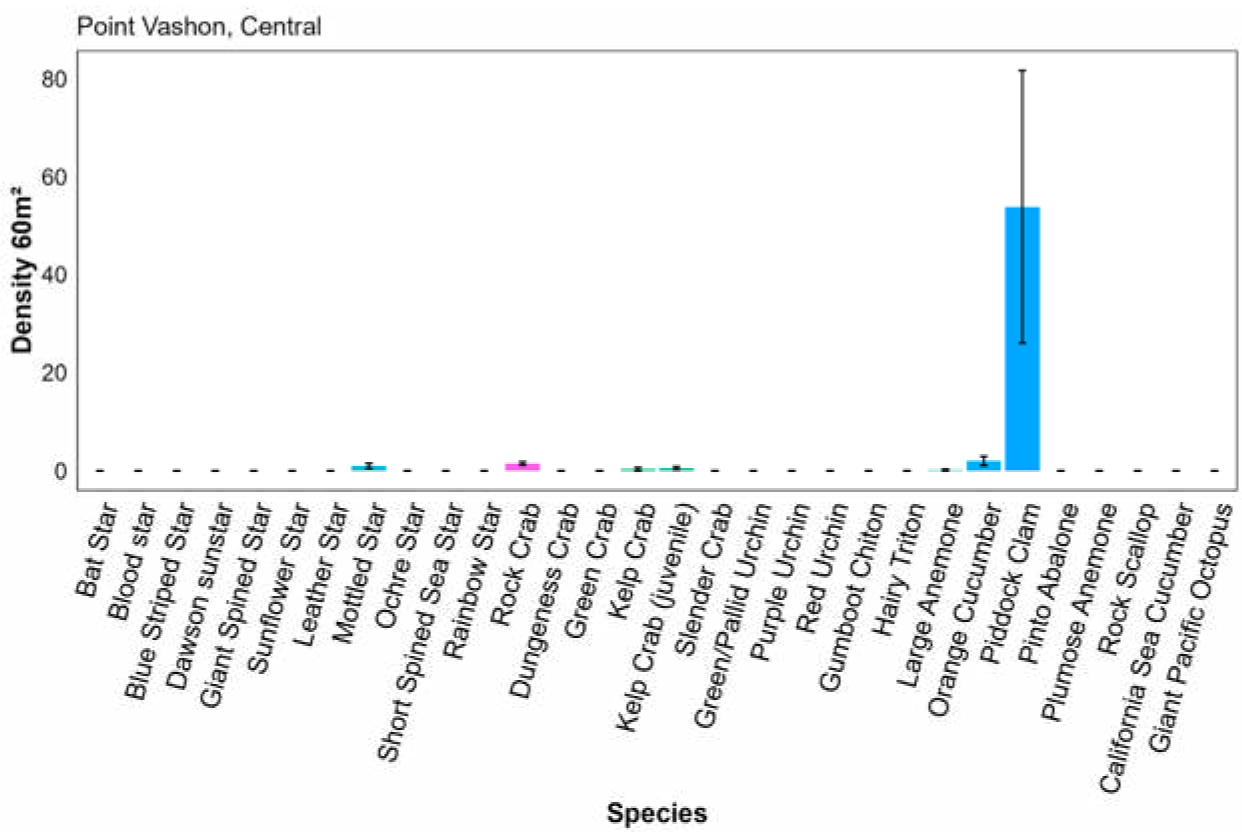


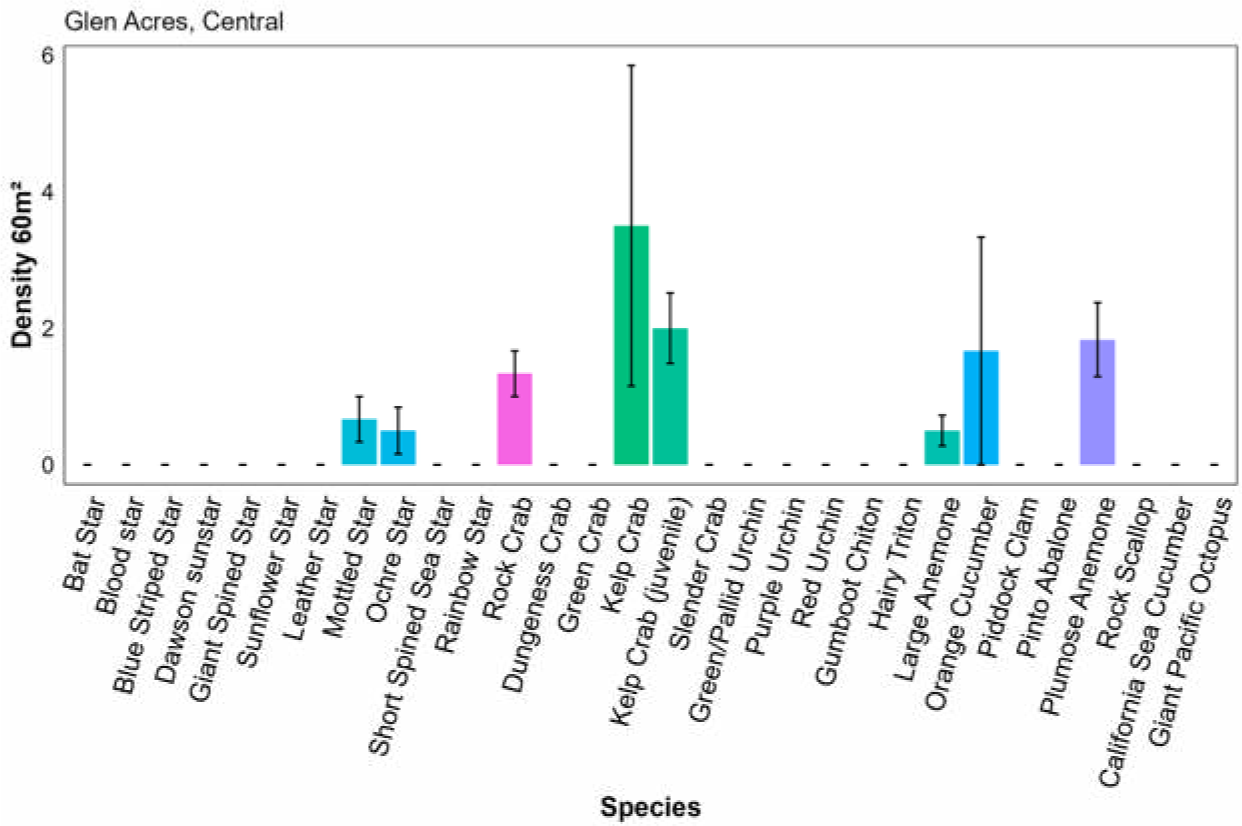
Seattle Waterfront, Central
Density 60m²
0
5
10
15
Bat Star
Blood star
Blue Striped Star
Dawson sunstar
Giant Spined Star
Sunflower Star
Leather Star
Mottled Star
Ochre Star
Short Spined Sea Star
Rainbow Star
Rock Crab
Dungeness Crab
Green Crab
Kelp Crab
Kelp Crab (juvenile)
Slender Crab
Green/Pallid Urchin
Purple Urchin
Red Urchin
Gumboot Chiton
Hairy Triton
Large Anemone
Orange Cucumber
Piddock Clam
Pinto Abalone
Plumose Anemone
Rock Scallop
California Sea Cucumber
Giant Pacific Octopus
Species

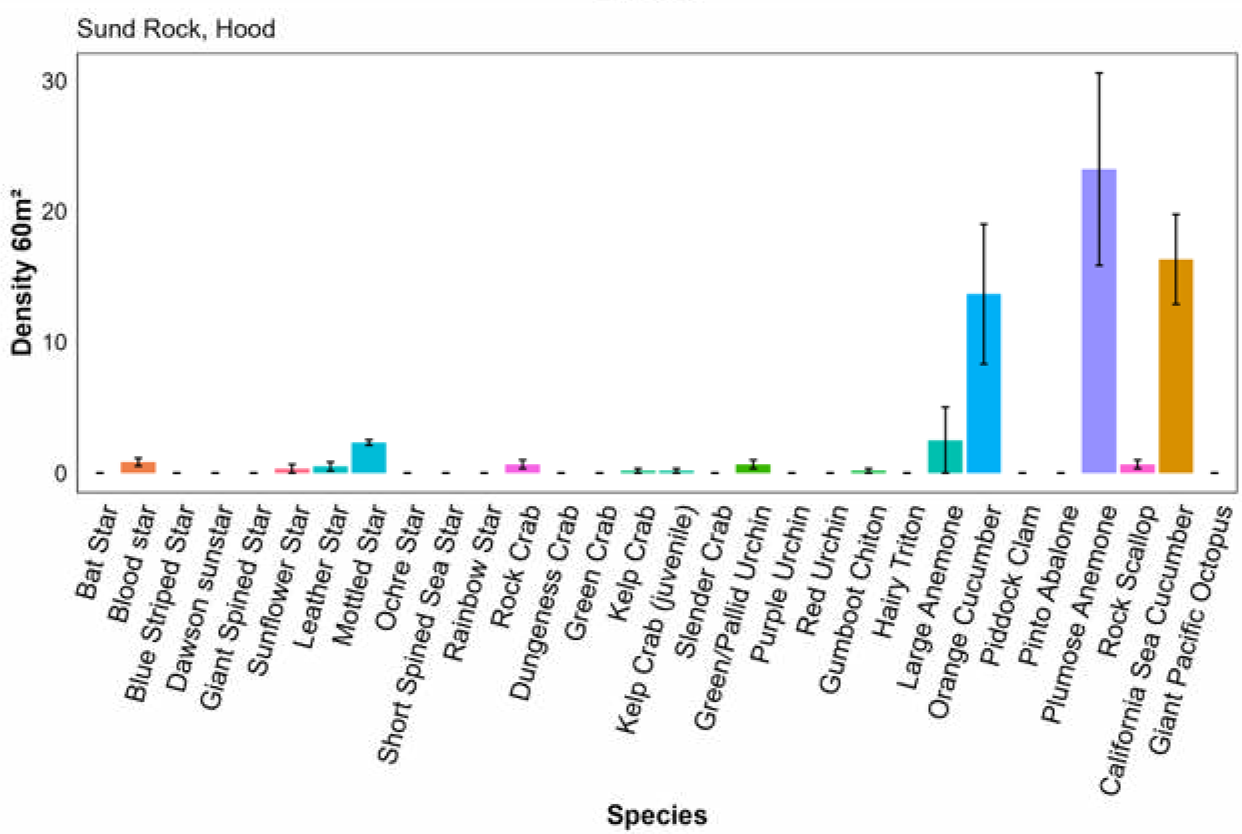


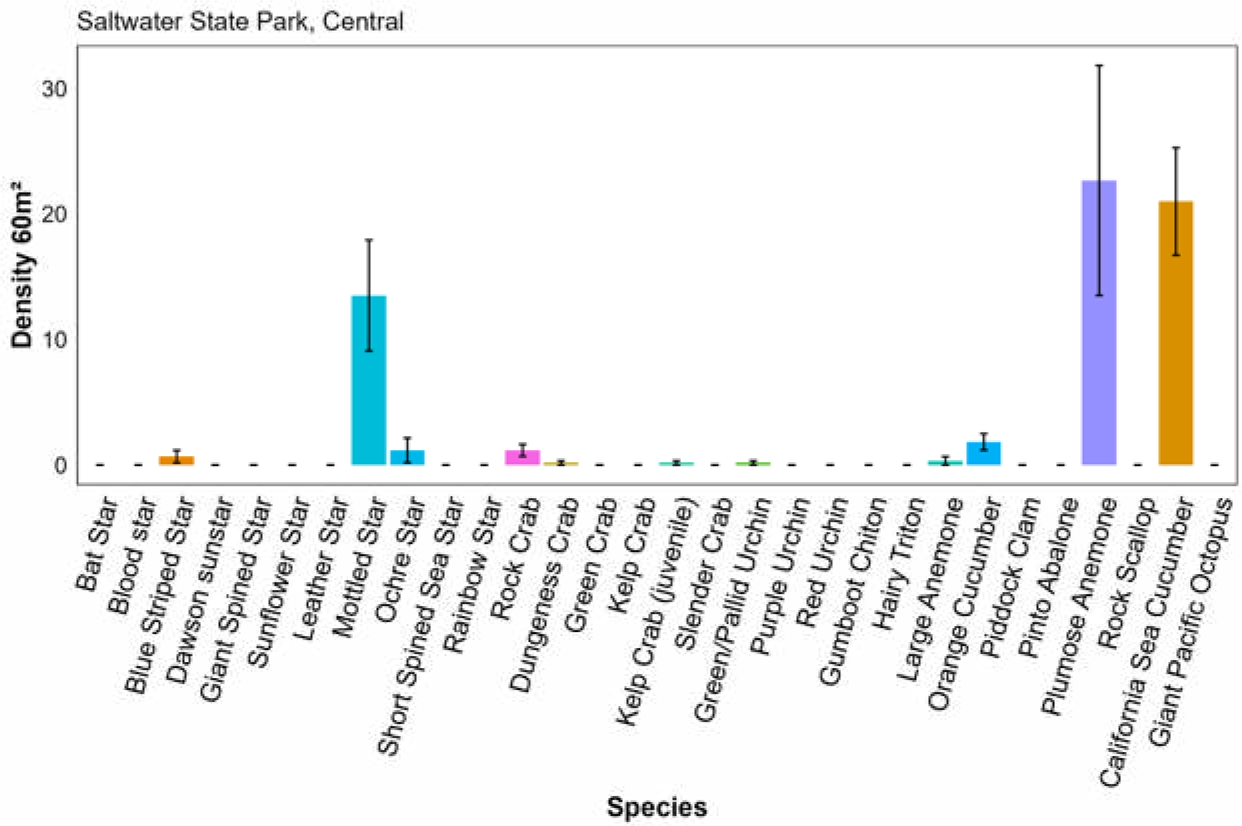
Lincoln Park, Central
Density 60m²
0
1
2
Bat Star
Blood star
Blue Striped Star
Dawson sunstar
Giant Spined Star
Sunflower Star
Leather Star
Mottled Star
Ochre Star
Short Spined Sea Star
Rainbow Star
Rock Crab
Dungeness Crab
Green Crab
Kelp Crab
Kelp Crab (juvenile)
Slender Crab
Green/Pallid Urchin
Purple Urchin
Red Urchin
Gumboot Chiton
Hairy Triton
Large Anemone
Orange Cucumber
Piddock Clam
Pinto Abalone
Plumose Anemone
Rock Scallop
California Sea Cucumber
Giant Pacific Octopus
Species


Blake Island South, Central
Density 60m²
12.5
10.0
7.5
5.0
2.5
0.0
Bat Star
Blood star
Blue Striped Star
Dawson sunstar
Giant Spined Star
Sunflower Star
Leather Star
Mottled Star
Ochre Star
Short Spined Sea Star
Rainbow Star
Rock Crab
Dungeness Crab
Green Crab
Kelp Crab
Kelp Crab (juvenile)
Slender Crab
Green/Pallid Urchin
Purple Urchin
Red Urchin
Gumboot Chiton
Hairy Triton
Large Anemone
Orange Cucumber
Piddock Clam
Pinto Abalone
Plumose Anemone
Rock Scallop
California Sea Cucumber
Giant Pacific Octopus
Species

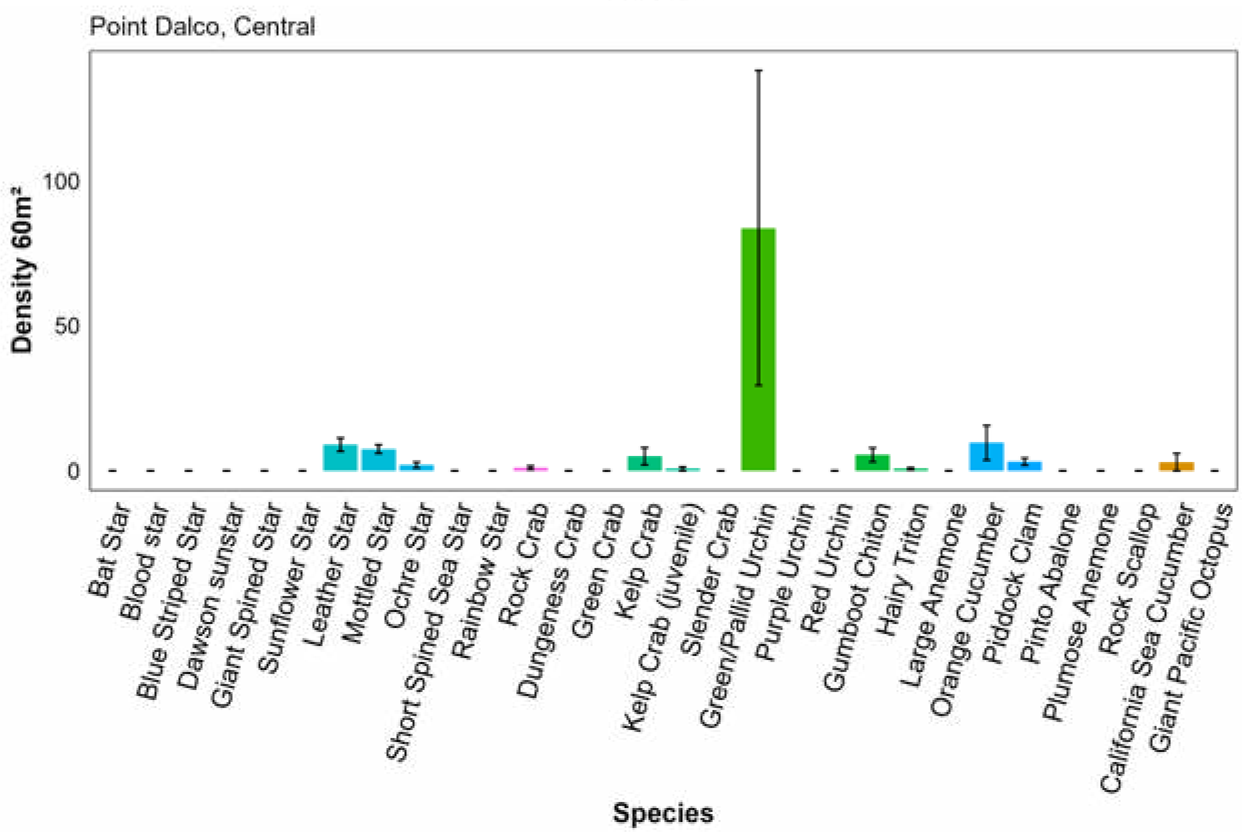

Point Vashon, Central
Density 60m²
80
60
40
20
0
Bat Star
Blood star
Blue Striped Star
Dawson sunstar
Giant Spined Star
Sunflower Star
Leather Star
Mottled Star
Ochre Star
Short Spined Sea Star
Rainbow Star
Rock Crab
Dungeness Crab
Green Crab
Kelp Crab
Kelp Crab (juvenile)
Slender Crab
Green/Pallid Urchin
Purple Urchin
Red Urchin
Gumboot Chiton
Hairy Triton
Large Anemone
Orange Cucumber
Piddock Clam
Pinto Abalone
Plumose Anemone
Rock Scallop
California Sea Cucumber
Giant Pacific Octopus
Species


Glen Acres, Central
Density 60m²
0
2
4
6
Species
Bat Star
Blood star
Blue Striped Star
Dawson sunstar
Giant Spined Star
Sunflower Star
Leather Star
Mottled Star
Ochre Star
Short Spined Sea Star
Rainbow Star
Rock Crab
Dungeness Crab
Green Crab
Kelp Crab
Kelp Crab (juvenile)
Slender Crab
Green/Pallid Urchin
Purple Urchin
Red Urchin
Gumboot Chiton
Hairy Triton
Large Anemone
Orange Cucumber
Piddock Clam
Pinto Abalone
Plumose Anemone
Rock Scallop
California Sea Cucumber
Giant Pacific Octopus

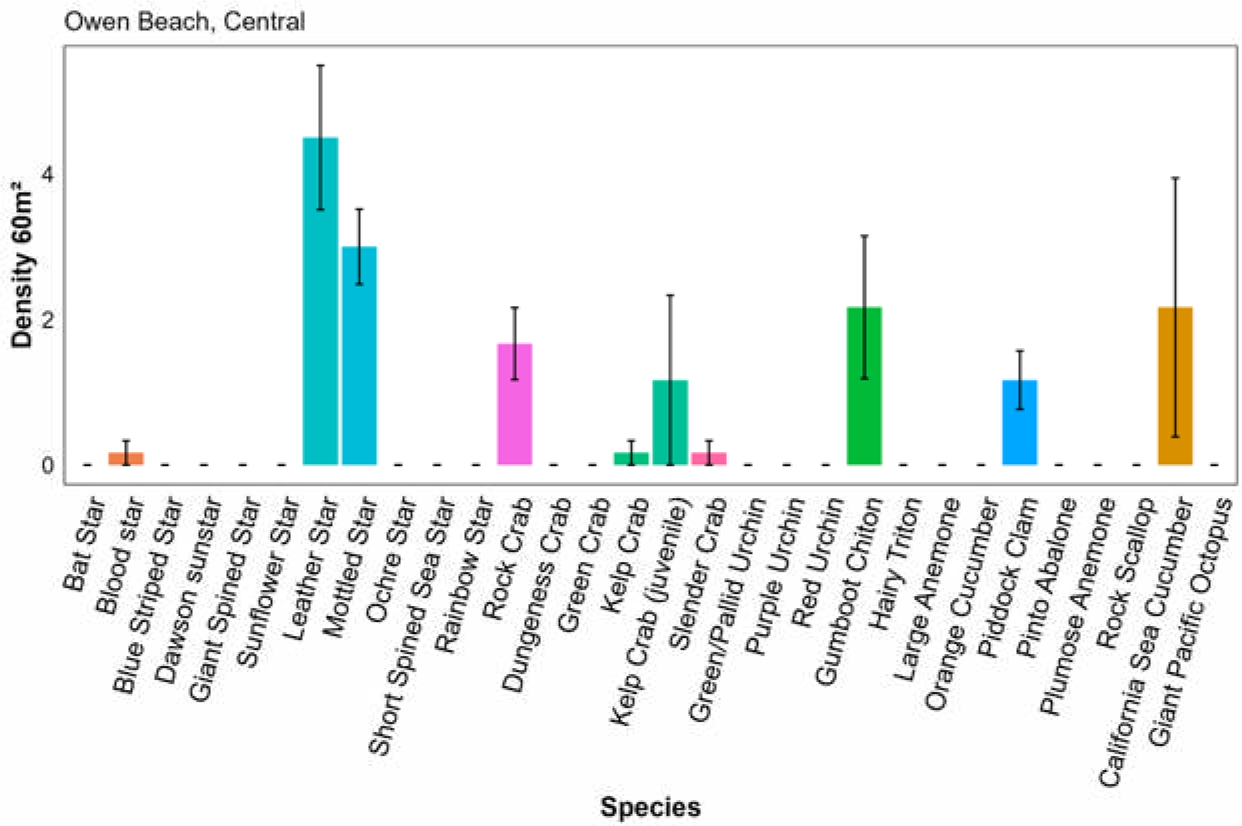

Sund Rock, Hood
Density 60m²
0
10
20
30
Species
Bat Star
Blood star
Blue Striped Star
Dawson sunstar
Giant Spined Star
Sunflower Star
Leather Star
Mottled Star
Ochre Star
Short Spined Sea Star
Rainbow Star
Rock Crab
Dungeness Crab
Green Crab
Kelp Crab
Kelp Crab (juvenile)
Slender Crab
Green/Pallid Urchin
Purple Urchin
Red Urchin
Gumboot Chiton
Hairy Triton
Large Anemone
Orange Cucumber
Piddock Clam
Pinto Abalone
Plumose Anemone
Rock Scallop
California Sea Cucumber
Giant Pacific Octopus



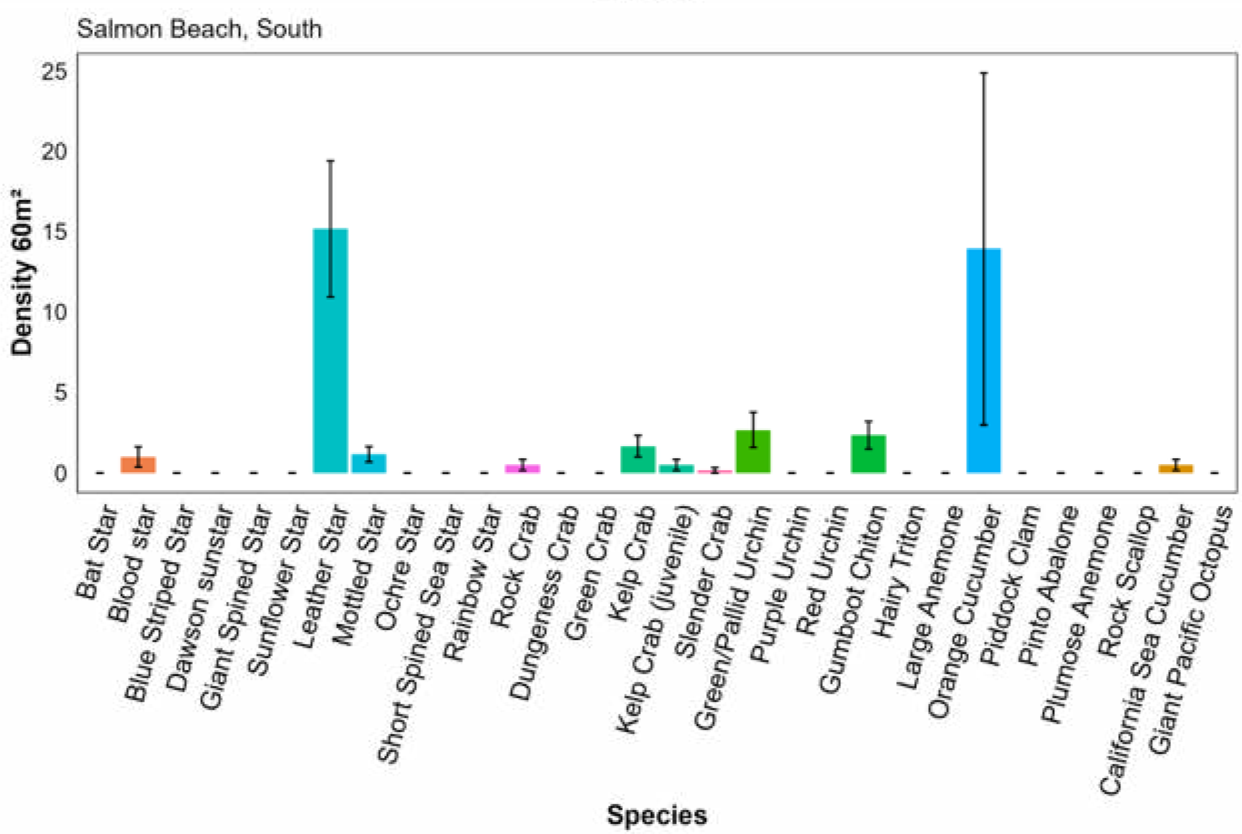
Saltwater State Park, Central
Density 60m²
30
20
10
0
Bat Star
Blood star
Blue Striped Star
Dawson sunstar
Giant Spined Star
Sunflower Star
Leather Star
Mottled Star
Ochre Star
Short Spined Sea Star
Rainbow Star
Rock Crab
Dungeness Crab
Green Crab
Kelp Crab
Kelp Crab (juvenile)
Slender Crab
Green/Pallid Urchin
Purple Urchin
Red Urchin
Gumboot Chiton
Hairy Triton
Large Anemone
Orange Cucumber
Piddock Clam
Pinto Abalone
Plumose Anemone
Rock Scallop
California Sea Cucumber
Giant Pacific Octopus
Species



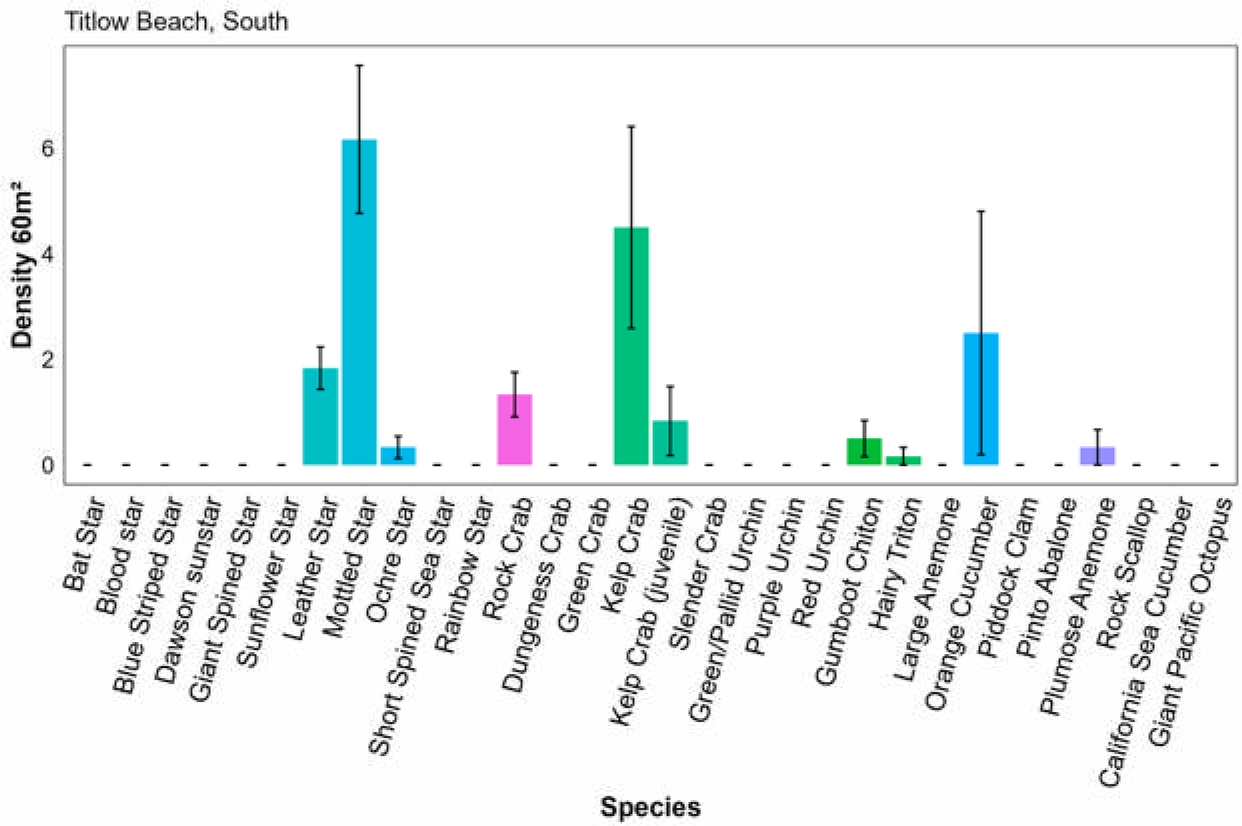
Point Dalco, Central
Density 60m²
100
50
0
Bat Star
Blood star
Blue Striped Star
Dawson sunstar
Giant Spined Star
Sunflower Star
Leather Star
Mottled Star
Ochre Star
Short Spined Sea Star
Rainbow Star
Rock Crab
Dungeness Crab
Green Crab
Kelp Crab
Kelp Crab (juvenile)
Slender Crab
Green/Pallid Urchin
Purple Urchin
Red Urchin
Gumboot Chiton
Hairy Triton
Large Anemone
Orange Cucumber
Piddock Clam
Pinto Abalone
Plumose Anemone
Rock Scallop
California Sea Cucumber
Giant Pacific Octopus
Species

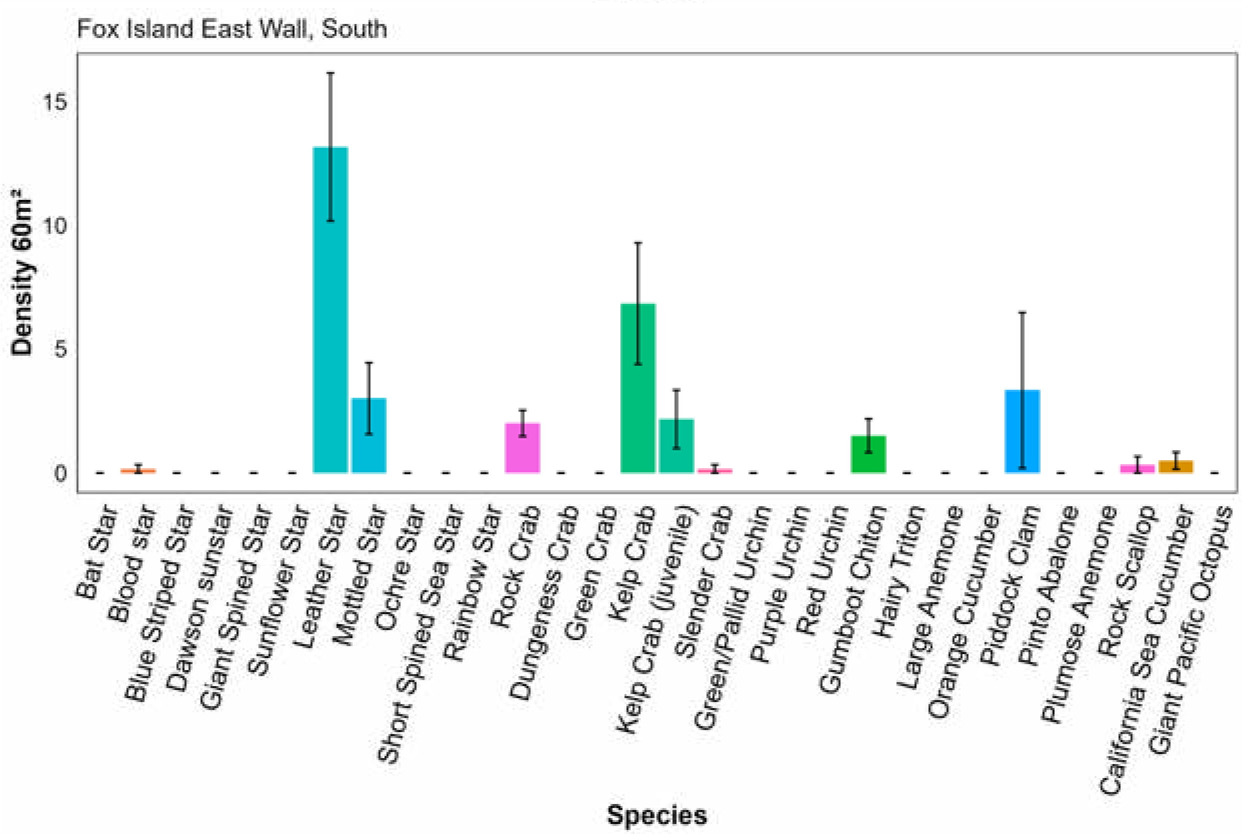


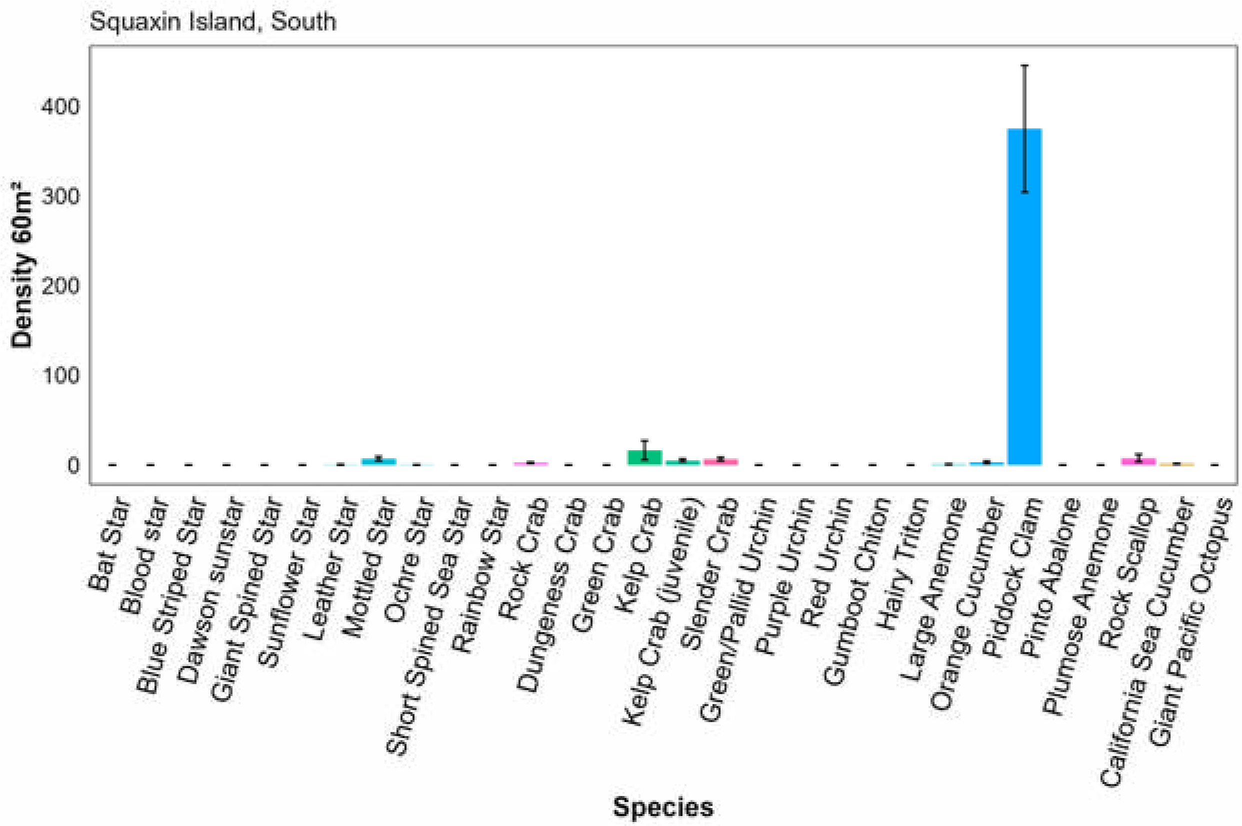
Owen Beach, Central
Density 60m²
0
2
4
Species
Bat Star
Blood star
Blue Striped Star
Dawson sunstar
Giant Spined Star
Sunflower Star
Leather Star
Mottled Star
Ochre Star
Short Spined Sea Star
Rainbow Star
Rock Crab
Dungeness Crab
Green Crab
Kelp Crab
Kelp Crab (juvenile)
Slender Crab
Green/Pallid Urchin
Purple Urchin
Red Urchin
Gumboot Chiton
Hairy Triton
Large Anemone
Orange Cucumber
Piddock Clam
Pinto Abalone
Plumose Anemone
Rock Scallop
California Sea Cucumber
Giant Pacific Octopus

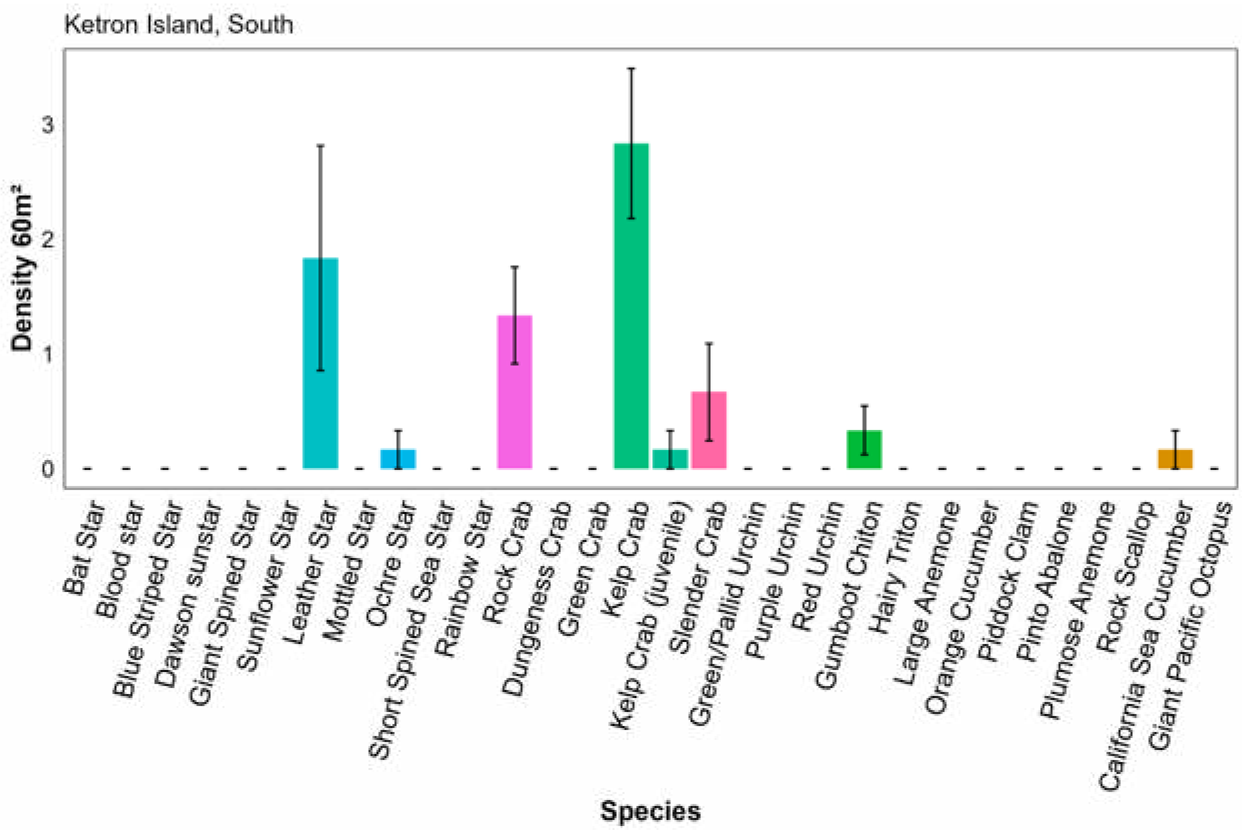


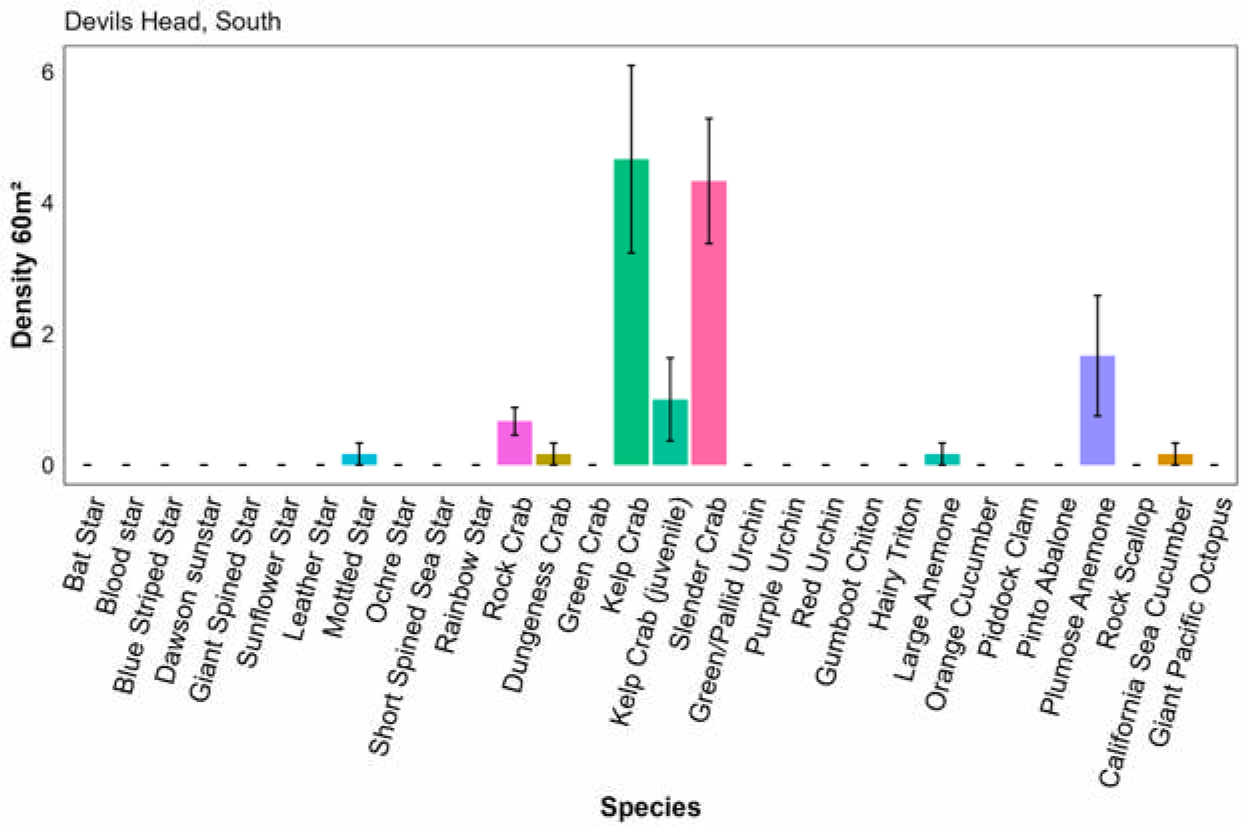
Salmon Beach, South
Density 60m²
0
5
10
15
20
25
Species
Bat Star
Blood star
Blue Striped Star
Dawson sunstar
Giant Spined Star
Sunflower Star
Leather Star
Mottled Star
Ochre Star
Short Spined Sea Star
Rainbow Star
Rock Crab
Dungeness Crab
Green Crab
Kelp Crab
Kelp Crab (juvenile)
Slender Crab
Green/Pallid Urchin
Purple Urchin
Red Urchin
Gumboot Chiton
Hairy Triton
Large Anemone
Orange Cucumber
Piddock Clam
Pinto Abalone
Plumose Anemone
Rock Scallop
California Sea Cucumber
Giant Pacific Octopus


Titlow Beach, South
Density 60m²
0
2
4
6
Bat Star
Blood star
Blue Striped Star
Dawson sunstar
Giant Spined Star
Sunflower Star
Leather Star
Mottled Star
Ochre Star
Short Spined Sea Star
Rainbow Star
Rock Crab
Dungeness Crab
Green Crab
Kelp Crab
Kelp Crab (juvenile)
Slender Crab
Green/Pallid Urchin
Purple Urchin
Red Urchin
Gumboot Chiton
Hairy Triton
Large Anemone
Orange Cucumber
Piddock Clam
Pinto Abalone
Plumose Anemone
Rock Scallop
California Sea Cucumber
Giant Pacific Octopus
Species


Fox Island East Wall, South
Density 60m²
0
5
10
15
Bat Star
Blood star
Blue Striped Star
Dawson sunstar
Giant Spined Star
Sunflower Star
Leather Star
Mottled Star
Ochre Star
Short Spined Sea Star
Rainbow Star
Rock Crab
Dungeness Crab
Green Crab
Kelp Crab
Kelp Crab (juvenile)
Slender Crab
Green/Pallid Urchin
Purple Urchin
Red Urchin
Gumboot Chiton
Hairy Triton
Large Anemone
Orange Cucumber
Piddock Clam
Pinto Abalone
Plumose Anemone
Rock Scallop
California Sea Cucumber
Giant Pacific Octopus
Species


Squaxin Island, South
Density 60m²
0
100
200
300
400
Bat Star
Blood star
Blue Striped Star
Dawson sunstar
Giant Spined Star
Sunflower Star
Leather Star
Mottled Star
Ochre Star
Short Spined Sea Star
Rainbow Star
Rock Crab
Dungeness Crab
Green Crab
Kelp Crab
Kelp Crab (juvenile)
Slender Crab
Green/Pallid Urchin
Purple Urchin
Red Urchin
Gumboot Chiton
Hairy Triton
Large Anemone
Orange Cucumber
Piddock Clam
Pinto Abalone
Plumose Anemone
Rock Scallop
California Sea Cucumber
Giant Pacific Octopus
Species


Ketron Island, South
Density 60m²
0
1
2
3
Bat Star
Blood star
Blue Striped Star
Dawson sunstar
Giant Spined Star
Sunflower Star
Leather Star
Mottled Star
Ochre Star
Short Spined Sea Star
Rainbow Star
Rock Crab
Dungeness Crab
Green Crab
Kelp Crab
Kelp Crab (juvenile)
Slender Crab
Green/Pallid Urchin
Purple Urchin
Red Urchin
Gumboot Chiton
Hairy Triton
Large Anemone
Orange Cucumber
Piddock Clam
Pinto Abalone
Plumose Anemone
Rock Scallop
California Sea Cucumber
Giant Pacific Octopus
Species


Devils Head, South
Density 60m²
6
4
2
0
Bat Star
Blood star
Blue Striped Star
Dawson sunstar
Giant Spined Star
Sunflower Star
Leather Star
Mottled Star
Ochre Star
Short Spined Sea Star
Rainbow Star
Rock Crab
Dungeness Crab
Green Crab
Kelp Crab
Kelp Crab (juvenile)
Slender Crab
Green/Pallid Urchin
Purple Urchin
Red Urchin
Gumboot Chiton
Hairy Triton
Large Anemone
Orange Cucumber
Piddock Clam
Pinto Abalone
Plumose Anemone
Rock Scallop
California Sea Cucumber
Giant Pacific Octopus
Species