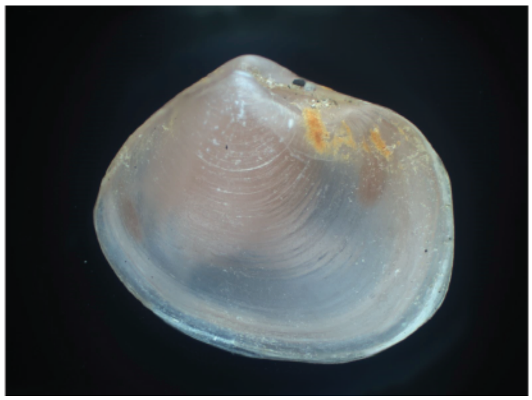
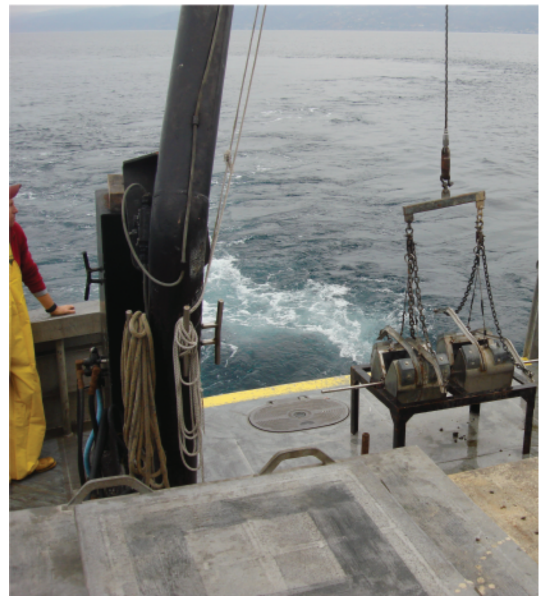
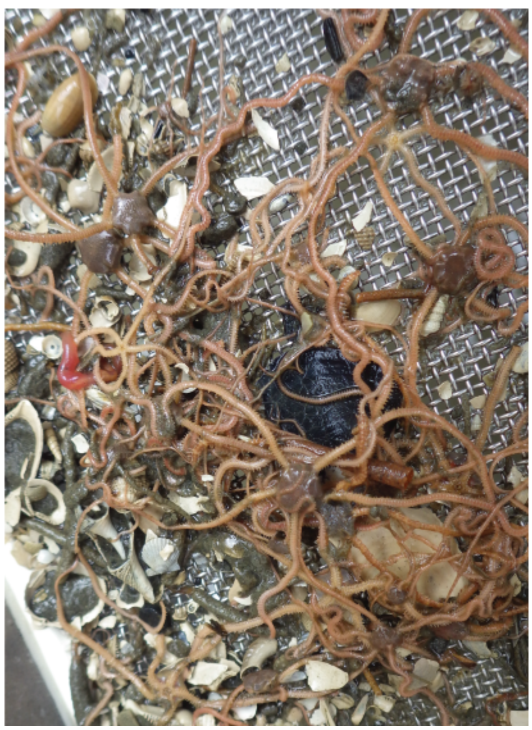
BIGHT '18

Benthic Infauna







Southern California Bight
2018 Regional Monitoring Program
Volume III

SCCWRP Technical Report 1289

Southern California Bight 2018 Regional Monitoring Program: Volume III. Benthic Infauna

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October 2022

SCCWRP Technical Report 1289

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FOREWORD

The Southern California Bight (SCB) is a 100,000-square-mile body of water and submerged continental shelf and slope that extends from Point Conception, California, in the north to Cabo Colnett, Baja California, Mexico in the south. This area is a unique and important ecological and economic resource in southern California that includes diverse habitats for a broad range of marine life including more than 3,000 species of invertebrates, 500 species of fish, and many marine mammals and birds.

The coastal region along the SCB is one of the most densely populated coastlines in the U.S. and the world. The activities of this dense human population stress the coastal marine environment by introducing pollutants from point and non-point sources, modifying natural habitats and increasing extraction of natural resources.

Millions of dollars are spent annually to monitor coastal environmental quality in the SCB. These localized monitoring programs provide important site-specific information about the impacts of individual waste discharges, but do not assess the condition of the SCB as a whole. The assessment of environmental quality on a more regional scale provides a context for localized monitoring that helps environmental regulators and resource managers understand the relative influence of local and regional factors on the coastal ecosystem.

The 2018 SCB Regional Monitoring Program (Bight ’18) is the continuation of an ongoing effort that provides an integrated assessment of the SCB through cooperative region-scale monitoring. The 2018 survey represents the joint effort of more than 100 organizations. The Bight ’18 survey is organized into five technical elements: 1. Sediment Quality Assessment; 2. Bioaccumulation of Contaminants in Sport Fish; 3. Ocean Acidification; 4. Harmful Algal Blooms; and 5. Trash Assessment. This report presents the results of the benthic macrofauna component of Bight ’18, which is a part of the Sediment Quality Assessment element. Other Sediment Quality Assessment components include sediment toxicity, sediment chemistry, as well as demersal fish and megabenthic invertebrates. Copies of this and other Bight ’18 guidance manuals, data, and reports are available for download at www.sccwrp.org/Documents/BightDocuments.aspx.

The proper citation for this report is:

Gillett, D.J., W. Enright, and J.B. Walker. 2022. Southern California Bight 2018 Regional Monitoring Program: Volume III. Benthic Infauna. Technical Report 1289. Southern California Coastal Water Research Project. Costa Mesa, CA.

ACKNOWLEDGEMENTS

This report is the product of the dedication and hard work of many individuals who share a common goal of improving our understanding of the environmental quality of the Southern California Bight. The authors thank all of those who contributed to this report. While space limitations do not allow us to acknowledge all contributors by name, we are grateful to the following people and agencies whose efforts were crucial to our success. The members of the 2018 Southern California Bight Regional Monitoring Program Steering Committee provided the impetus, vision, and resources that guided and fueled our efforts. The Bight ’18 Sediment Quality Planning Committee coordinated our efforts with other disciplines; their critical and timely reviews improved this document.

The field teams collected our samples with efficiency and care. The captains, crew and scientists on the Early Bird III, R/V Dangler, Hey Jude, La Mer, Marine Surveyor, Oceanus, R/V Ocean Sentinel, Davis, Shearwater, Waterline, M/V Nerissa, and ECOS were responsible for field collection and sample processing. They contributed to our success in no small measure. The Southern California Association of Marine Invertebrate Taxonomists (SCAMIT) provides a mechanism for standardizing the names of organisms in southern California and promotes communication among taxonomists and was an integral part of this effort.

We appreciate the efforts and expertise of the taxonomists who produced the primary data on which this report was built. Chip Barrett, Kelvin Barwick, Katie Beauchamp, Don Cadien, Craig Campbell, Andy Davenport, Dave Drumm, Wendy Enright, Ben Ferraro, Bill Furlong, Rob Gamber, Robin Gartman, Brent Haggin, Leslie Harris, Matt Hill, Maiko Kasuya, Cody Larsen, Norbert Lee, Megan Lilly, Jovairia Loan, JoAnne Linnenbrink, Greg Lyon, Chase MacDonald, Ricardo Martinez-Lara, Erin Oderlin, Dean Pasko, Terra Petry, Tony Phillips, Veronica Rodriguez-Villanueva, Ernie Ruckman, Jennifer Smolenski, Danny Tang, and Adam Webb identified and counted every one of the individuals used in this study. Special thanks are due Terra Petry and Chase McDonald for coordinating the QA/QC efforts. Additionally, Regina Wetzer from the Natural History Museum of Los Angeles County needs to be mentioned for coordinating the acquisition and archiving of the voucher collections and QA/QC samples, ensuring their preservation and availability to future generations of scientists.

We are grateful to Abel Santana for supporting the sampling design, Dana Shultz for making the maps, Paul Smith and Robert Butler for assisting with the internet data submission system, and Scott Martindale for layout and editing. The efforts of these individuals made many complicated tasks seem easy.

Don Cadien, Brent Haggin, Ami Latker, Chad Loflen, and Danny Tang all provided valuable feedback on this report. Their help greatly improved the clarity, readability, and content of this report.

EXECUTIVE SUMMARY

One of the central tenets of benthic ecology is that changes in macrobenthic (i.e., those animals that live in and on the bottom of the ocean) community structure can be used to infer the overall health and condition of the location where the organisms are collected. Macrobenthic community structure is a good indicator of ecosystem condition and health because these animals are directly associated with the sediment where most toxics accumulate, they have limited mobility to escape stressors, and they display a wide range of physiological responses and tolerances to different types of stressors. In addition to their use as ecosystem condition indicators, macrobenthic community composition also provides direct measures of Estuarine Habitat, Marine Habitat, and Shellfish Harvesting beneficial uses, as well as indirect or partial measures of a variety of other beneficial uses.

This report presents the results and interpretation of the macrobenthic infaunal component of the 2018 Southern California Bight Regional Monitoring Program's Sediment Quality Assessment element. The primary objectives of this study were to measure the extent and magnitude of macrobenthic community composition across the Southern California Bight and to characterize the trends in that condition over the last 20 years (1998-2018).

Samples of benthic macrofauna were successfully collected at 376 sites across the Southern California Bight, ranging from Point Conception in the north to the US-Mexico border in the south using a random tessellation stratified design. Samples were allocated across 11 different strata: 5 in enclosed embayments, 4 on the continental shelf, and 2 on the continental slope. Approximately a third of those sites (145) were revisits of sites that had previously been sampled in 2013, 2008, and either 2003 or 1998. Samples were collected with a 0.1-m^2 Van Veen grab, sieved on a 1-mm screen, and then preserved for identification. Specimens from each sample were sorted from the detritus and identified to the lowest possible taxonomic level, typically species.

All data passed Quality Assurance/Quality Control Data Quality Objectives set for sorting accuracy (95%), taxonomic identification accuracy (90%), and taxonomic discrimination (90%), and counting accuracy (90%). Sorting accuracy was 97.4% across all samples, with a minimum number of corrective actions needed. The taxonomy labs averaged 93.7% accuracy of identification, 97.0% precision in taxonomic discrimination, and 98.2% accuracy in counting.

Macrobenthic community composition was assessed for the continental shelf portions of the Southern California Bight (6-200 m deep) and embayments. These areas represent approximately 36% of the total area of the Southern California Bight. The Benthic Response Index (BRI) (Smith et al. 2001) was used to assess samples from the continental shelf, the California Sediment Quality Objectives Benthic Line of Evidence (SQO BLOE) (Ranasinghe et al. 2009; Bay et al. 2021) framework was used for samples from embayments with salinity greater than 27 PSU (practical salinity units), and the US version of the Multivariate AZTI Marine Biotic Index (M-AMBI) (Pelletier et al. 2018; Gillett et al. 2019) was used for brackish estuaries (salinity less than 27 PSU). Each of these indices had four condition categories, but for simpler interpretation this gradient in condition was condensed into two

categories: good condition (reference + low disturbance conditions) and poor condition (moderate disturbance + high disturbance conditions).

Benthic macrofaunal composition indicated that the majority of the Southern California Bight was doing well in 2018. More than 99% of the assessable portions of the region were in good condition (89.1% reference condition + 10.1% low disturbance condition) and less than 1% were in poor condition. However, macrobenthic community conditions were not uniform across the regions. The embayment strata were in relatively poorer condition compared to the rest of the region with over 29.7% of the embayment area in moderate (20.3%) or high disturbance (9.4%). In contrast, the continental shelf strata were in relatively better condition with no portions of the strata in the moderate or high disturbance condition.

The vast majority of the Bight macrobenthic community composition was in good condition in 2018, and the trend in habitat condition from 1998-2018 was relatively stable at both the regional (~80%) and stratum-scale (60-80%). The change in the amount of reference to low disturbance condition areas in 2013 compared to previous surveys was not apparent in 2018, where the percent area distribution in 2018 was similar to that of 1998-2008. As a whole, the assessable portions of the Southern California Bight were in proportionally better condition in 2018 than in 2013. In 2013, both the multi-survey and site-revisit approaches to characterizing temporal trends indicated that the most notable reductions were located in the Channel Islands stratum. Detailed analysis of the Channel Islands stratum data from Bight'18 and previous surveys, as well as regional water quality and water chemistry data, suggest that the change in benthic community condition observed in 2013 may have been a combination of natural biological variation and increased influence of deep basin waters (colder, less oxygenated, and more acidic) within the stratum.

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I. INTRODUCTION

Benthic macrofauna are useful indicators of the condition of marine and estuarine habitat because the community composition changes in a relatively predictable fashion when disturbed (e.g., Pearson and Rosenberg 1978; Rhodes et al. 1978; Gray et al. 2002). This predictability is because most benthic macrofaunal communities include a taxonomically diverse mixture of organisms spanning multiple phyla, with which comes a wide range of physiological responses to stress. Benthic macrofauna also serve as good integrators of their local environmental conditions, as they live directly in the sediment where many toxins accumulate, they have limited mobility, and many species live for multiple years.

Because of these traits, benthic macrofauna are one of the most commonly used elements of bioassessment programs in the coastal ocean and estuaries across the US (e.g., Dauer et al. 2012; USEPA 2012; Llansó et al. 2015; Schiff et al. 2016) and the world (e.g., Van Hoey et al. 2010). Despite their utility as indicators, changes in macrobenthic community structure in response to stress can be complex and difficult to communicate to non-specialists. One of the most common approaches to synthesize this complex information is the creation of biotic indices that distill complex community information into a relatively simple scale of condition that can easily be understood by resource managers, environmental policy makers, and the general public (e.g., Karr 1991; Diaz et al. 2004; O'Brien et al. 2016).

The use of benthic macrofauna in the regional monitoring programs of Southern California's coastal oceans has become more robust since the early regional surveys prior to 1990 (Setty et al. 2010). The present survey (Bight'18) marks the sixth monitoring survey of the Southern California Bight, beginning with a pilot study in 1994 (Bergen et al. 1998, 2000) and expanding in spatial and technical scope in each subsequent survey from 1998 (Ranasinghe et al. 2003), to 2003 (Ranasinghe et al. 2007), to 2008 (Ranasinghe et al. 2012, Schiff et al. 2016), and to 2013 (Gillett et al. 2017). The modern Southern California Bight regional surveys have been designed not only to characterize biological assemblages and to quantify regional reference condition, but also to assess the spatial extent and magnitude of impact to benthic habitats. This design provides an opportunity to evaluate cumulative effects from multiple point source and non-point source discharges, as well as basin-scale forcing factors. In addition, regional monitoring surveys have improved benthic macrofaunal condition assessments by creating taxonomic standardization across the region (Southern California Association of Marine Invertebrate Taxonomists 2018), developing assessment tools (Smith et al. 2001; Ranasinghe et al. 2009), and evaluating new habitats (Ranasinghe et al. 2007; Ranasinghe et al. 2012; Gillett et al. 2021).

The objectives of the Southern California Bight 2018 Regional Macrobenthic Community Monitoring are to:

1. Present a characterization of the macrobenthic communities found in the different soft-sediment habitats of the Southern California Bight.

2. Provide spatial estimates of habitat condition for the continental shelf and embayments of the Southern California Bight in 2018 based upon macrobenthic community composition.

3. Present the temporal trend in condition across the continental shelf and embayment of the Southern California Bight from 1998 to 2018.

The report is organized into 8 chapters and 7 appendices. Chapter 1 is the introduction and provides background to the . Chapter 2 describes the study design and the field, laboratory, and data analysis methods. Chapter 3 presents the quality assurance procedures that ensured comparability of data produced by participating organizations and the results of quality control audits measuring their success. Chapter 4 presents the results of the macrobenthic community characterization and habitat condition assessment analyses. The results are discussed in Chapter 5. Chapters 6 and 7 present the conclusions and recommendations, respectively. Chapter 8 lists the literature cited.

Appendix A contains summaries of the taxa collected in each stratum (total abundance, relative abundance, frequency of occurrence). Appendix B contains the detailed similarity percentage (SIMPER) outputs for each stratum and assemblage. Appendix C contains details of analyses looking into the applicability of the Benthic Response Index (BRI) to the Upper Slope stratum. Appendix D contains a detailed investigation of potential causes behind the decline of conditions within the Channel Islands stratum in 2013 and their subsequent recovery in 2018. Appendix E is a copy of a published manuscript on the condition of sediments surrounding four oil & gas platforms in the Santa Barbera Channel in 2018. Appendix F presents the details of % area calculations for the condition of each stratum in 2018, the condition of each stratum from each Bight Survey, and the areal extent of improving/stable/declining trends in condition at revisit sites. Appendix G contains graphs of the temporal trend in condition at each of the revisit sites.

II. METHODS

Study Design

The survey area for the 2018 Southern California Bight Regional Monitoring Program (Bight'18) spanned from Point Conception, CA in the north to the US-Mexico border in the south and from the mainland coastal embayments west to the Channel Islands (Figure 1). The soft sediment portions of this region less than 1,000 m deep were divided into eleven strata based upon known biogeographic breaks in community composition (e.g., estuaries or deep continental shelf) or area of different regulatory/management interest (e.g., ports or continental slope) (Table 1). For the 2018 survey, a new stratum – Brackish Estuaries – was established for estuarine waters less than 27 PSU salinity.

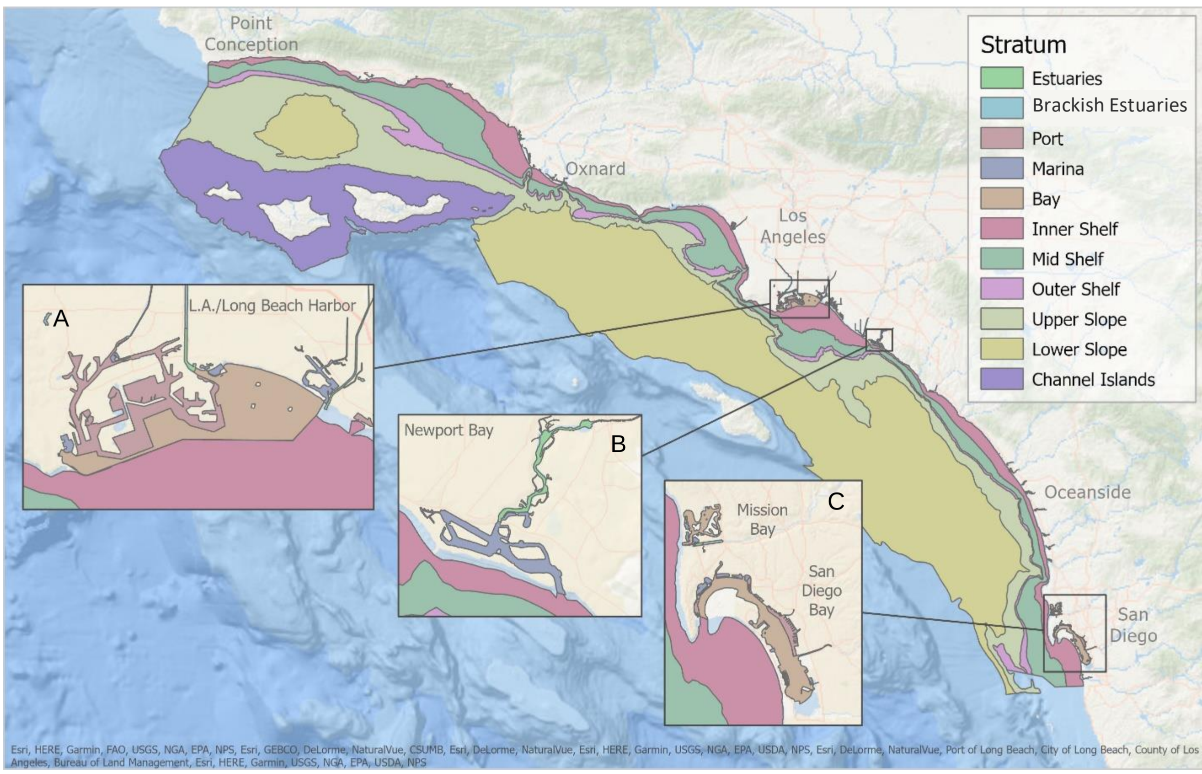

Figure 1. A map of the Southern California Bight delineating the 11 sample strata used in the survey. Insets show the details of: A) The harbors of Long Beach/Los Angeles and San Pedro Bay, B) Newport Bay, and C) San Diego Bay.

Table 1. Sample strata for the 2018 survey including total area of each stratum, the percent that stratum represents of the whole region, the number of probabilistic benthic stations assigned within each stratum, the number of revisit stations, and the range of depth at which those stations were located. § indicates strata for which no condition assessment tool was available for some or all of these stations.

Habitat	Stratum	Area (km^2)	% Area of Region	Number of Stations	Number of Revisits	Depth Range (m)
Estuaries	Estuaries	11.6	0.07	45	11	0-13
	Brackish Estuaries	4.6	0.03	12	0	0-2
Bays	Marinas	13.2	0.08	44	15	3-22
	Ports	26.8	0.16	56	15	4-28
	Bays	70.3	0.42	43	15	2-25
Continental Shelf	Inner Shelf	1,172.5	7.03	36	15	7-30
	Mid Shelf	2,019.8	12.11	36	14	30-87
	Outer Shelf	605.5	3.63	31	15	124-199
	Channel Islands	2,084.4	12.5	15	15	16-142
Continental Slope	Upper Slope§	3,130.6	18.77	31	15	211-485
	Lower Slope§	7,536.0	45.19	27	15	522-902

Across these eleven strata, 376 sites were allocated via a stratified, random tessellated design (e.g., Stevens and Olsen 2003, 2004; Olsen and Peck 2008). The random allocation process allows for an even distribution of sites among strata and the assignment of area weights for each site. The area weights can then be used for calculating unbiased areal assessments of condition in the survey area (Bergen 1996; Stevens 1997).

Among the 376 probabilistic sites assigned in the survey, 145 of those were revisit sites that had previously been sampled as part of the Southern California Bight Regional Monitoring Program in either 1998 or 2003, 2008, and 2013 (Table 1). Revisit sites provide an opportunity to assess the temporal trend in habitat condition independent of the spatial variation inherent in using data from multiple random surveys for temporal trends analysis (Urquhart and Kincaid 1999; Larsen et al. 2001).

Sample Processing

Sediment samples for benthic macrofauna analysis were collected from July 1 to September 28, 2018. Benthic samples from each site were collected and processed following the Southern California Bight Regional Monitoring Survey Field Operations Manual (B'18 Field Sampling and Logistics Committee 2018) and Macrobenthic Sample Analysis Laboratory Manual (B'18 Benthic Committee 2018). In short, sediments from all strata except Brackish Estuaries were collected with a 0.1-m^2 Van Veen grab and sieved on a 1-mm screen.

Sediments from the Brackish Estuaries stratum were collected with either two 10.1 cm interior diameter cores combined together or with a 0.1-m^2 Van Veen grab and sieved on a 1-mm screen. Material retained on the screen was placed in a chemical relaxant solution and then fixed with 10% buffered formalin. Samples were rinsed and transferred from formalin to 70% ethanol 2-5 days after collection. Samples were subsequently distributed among twelve laboratories for sorting, identification, and enumeration of the fauna. QA/QC protocols and data quality objectives for sample sorting, identification, and enumeration are detailed in the Macrobenthic Sample Analysis Laboratory Manual (B'18 Benthic Committee 2018) and in Chapter 3.

Data Analysis

Macrobenthic community composition among the different strata was evaluated using non-metric Multi-Dimensional Scaling (nMDS) ordination of Bray-Curtis similarity values calculated from square root transformed abundance of all samples. After the ordination, natural environmental factors (sediment composition, water depth, latitude, and longitude) and species abundance were correlated to the ordination plot pattern to provide insight into any distribution patterns of samples observed in the ordination (e.g., Gibson et al. 2013). Characteristic species contributing to within-group similarity and distinguishing taxa accounting for the mean Bray-Curtis dissimilarity between sample groupings illustrated in the nMDS were characterized using similarity percentage (SIMPER) analysis (Clarke et al. 2008; Warton et al. 2012). Community analyses were done with the metaMDS (similarity and ordination) and envFit (species and environmental factor correlations) programs within the R Vegan package (Oksanen et al. 2022 [R version 4.0.2]) or Primer v7 (SIMPER analysis) (Clarke et al. 2014).

Habitat condition based upon macrobenthic community composition was assessed using the Southern California Benthic Response Index (BRI) (Smith et al. 2001), the California Sediment Quality Objectives Benthic Line of Evidence tool (SQO BLOE) (Ranasinghe et al. 2009; Bay et al. 2021), or the US version of the Multivariate AZTI Marine Biotic Index (M-AMBI) (Pelletier et al. 2018; Gillett et al. 2019) depending upon the applicable habitat. The BRI is an abundance-weighted tolerance value index (Appendix J) that, within the Southern California Bight Monitoring Program, is applied to samples collected from the continental shelf of the Southern California Bight in 6 – 200 m of water (e.g., Ranasinghe et al. 2003, 2007, 2012). The index scores a sample from 0-100 (good to bad condition), which can then be separated into four condition categories (Table 2). The four condition categories are defined as: *Reference* – the condition at which natural benthic assemblages occur; *Low Disturbance* – marginal deviation, wherein there are changes in the relative abundance of taxa, but not yet species replacement; *Moderate Disturbance* – loss of biodiversity wherein 25% of the taxa in the reference condition would not be expected to occur; *High Disturbance* – loss in community function and defaunation wherein expected major taxonomic groups are absent.

Table 2. Definition of condition categories used in the assessment framework for offshore and embayment habitats used in the 2018 survey. § - Modified M-AMBI Categories from Gillett et al. (2019)

Summary Benthic Condition Level	Benthic Condition Level for Bight Program	BRI Condition Category	SQO BLOE Condition Category	M-AMBI Condition Category§
Good	Reference	Reference	Reference	Reference
	Low Disturbance	Marginal Disturbance	Low Disturbance	Low Disturbance
Poor	Moderate Disturbance	Biodiversity Loss	Moderate Disturbance	Moderate Disturbance
	High Disturbance	Community Function Loss or Defaunation	High Disturbance	High Disturbance

The SQO BLOE is a combination of four indices: two multi-metric indices (Index of Biotic Integrity [IBI] and Relative Benthic Index [RBI]), a BRI abundance weighted tolerance index, and an Observed:Expected (O:E) index. The SQO BLOE is applicable to the soft, unvegetated sediments of Southern California Embayments with overlying waters of 27 PSU or greater (Ranasinghe et al. 2009; Bay et al. 2021) (Appendix K). The four SQO BLOE are scored and integrated into four condition categories functionally equivalent to those of the Smith et al. (2001) BRI (Ranasinghe et al. 2012) (Table 2). Following Ranasinghe et al. (2009), the four condition categories can be defined as: *Reference* – a community that would occur at a reference site; *Low Disturbance* – a community that exhibits some indication of stress but might be within the measurement variability of reference condition; *Moderate Disturbance* – a community that exhibits clear evidence of physical, chemical, natural, or anthropogenic stress; *High Disturbance* – a community exhibiting a high magnitude of stress.

The M-AMBI of Pelletier et al. (2018) is an index that uses a combination of species diversity, species richness, abundance-weighted pollution tolerance score (AMBI of Gillett et al. 2015) and the relative abundance of oligochaetes. The M-AMBI is applicable in all soft sediment estuarine habitats of California from tidal freshwater to euhaline salinities. Following Gillett et al.'s (2019) modifications of M-AMBI thresholds for better integration into California's Sediment Quality Objectives framework, the four condition categories correspond to those of the SQO BLOE indices noted above.

The goal of this report, and the Bight Monitoring Program in general, was to assess condition at a regional scale. To that end, the condition results have been framed as proportions of the region's area instead of proportions of individual sites. The areal extent of habitat condition expressed as the proportional amount of each condition category within a stratum was calculated using the area weights assigned to each site. As the area weights were calculated within a stratified probabilistic sampling design, percent area estimates can be calculated without bias from the different sizes of the sample strata. Furthermore, samples can be aggregated within or across different strata. Estimates were calculated using the Horvitz-

Thompson ratio estimator (Horvitz and Thompson 1952) in lieu of a stratified mean because an unknown fraction of each stratum cannot be sampled (e.g., hard bottom). Confidence intervals (95%) for the estimates were calculated using a local neighborhood estimator that takes into account the spatial proximity of samples to each other when calculating the population variance (e.g., Diaz-Ramos et al. 1996). All calculations were made with the cat.estimate function of the R spSurvey package (Kincaid 2015 [R version 4.0.2]).

Table 3. Number of probabilistic stations sampled within each stratum during each Southern California Bight Survey from 1998-2018. § indicates strata for which no condition assessment tool was available for some or all of these stations.

Habitat	Stratum	1998	2003	2008	2013	2018
Estuaries	Estuaries	0	39	64	41	45
	Brackish Estuaries	0	0	0	0	12
Bays	Marinas	10	32	44	34	44
	Ports	39	9	46	30	56
	Bays	34	18	38	31	43
Continental Shelf	Inner Shelf	64	45	31	31	36
	Mid Shelf	85	73	32	30	36
	Outer Shelf	0	24	28	29	31
	Channel Islands	51	32	30	15	15
Continental Slope	Upper Slope§	0	8	34	41	31
	Lower Slope§	0	0	35	21	27
Survey Totals		280	280	382	303	376

Temporal trends in habitat condition of the assessable portions of the Southern California Bight were calculated with two complementary techniques: a multi-survey approach and a revisit-site approach. The multi-survey approach is a higher-level approach to temporal analysis that focused on the proportional change in each of the condition categories across the whole of the survey area through time (Table 3). This analysis entailed a visual inspection of the areal extent estimates of each condition category (+/- the local neighborhood-based confidence intervals) within each stratum from 1998 – 2018. Trends were characterized by survey-to-survey increases or decreases in the area of a given condition class. However, because a large number of these sites were randomly selected within the stratum for each survey the observed differences represented a mix of both spatial and temporal variability.

The revisit sites approach complemented the multi-survey approach by providing a more granular measure of condition change focusing solely on temporal variance. This approach measured the trend in BRI scores[1] at 114 of the 145 revisit sites, which were sampled either

[1] Smith et al. (2001) BRI for continental shelf sites or Ranasinghe et al. (2009) SQO BLOE BRI for embayment sites

three or four times: in 2018, 2013, 2008, and either 2003 or 1998. Simple linear regression was used to model the trend in BRI scores along the (typically) four data points for each site (Appendix G). All linear regressions were done with R (version 4.0.2). The slope and 95% confidence intervals (CI) of the trend line at each site was obtained from the linear regression model and used to characterize the trend at that site (e.g., Llansó et al. 2015) using the following guidelines.

1. If slope + 95% CI < 0, then the trend was characterized as **improving**
2. If slope + 95% CI ≥ 0, then the trend was characterized as **stable**
3. If slope – 95% CI ≤ 0, then the trend was characterized as **stable**
4. If slope – 95% CI > 0, then the trend was characterized as **declining**

As each site had an area weight, the percent area with improving, declining, or stable trends was estimated using the cat.estimate function in the R spSurvey package as noted above (Kincaid 2015 [R version 4.0.2]). This approach used a relatively low data density per stratum (Table 1), but because the station location was held constant, most of the change in BRI score can be attributed to temporal variance (Urquhart and Kincaid 1999; Olsen et al. 1999).

Additional Analyses

Beyond the central questions related to the extent of condition, temporal trends in condition, and community composition, three additional analyses centered on the region's macrobenthic communities were investigated: 1. An exploration of the appropriateness and performance of the BRI of Smith et al. (2001) within the Upper Slope stratum; 2. An analysis of the potential causes of lower benthic condition scores within the Channel Islands stratum in 2013 compared to previous surveys and in the context of 2018 results; and 3. An analysis of the condition of continental shelf sediments surrounding four oil and gas platforms in the Santa Barbara Channel.

BRI on the Upper Slope - Historically, the Bight Program has not assessed the condition of the Upper or Lower Slope habitats of the region due to the lack of a validated benthic index. In shallower habitats along the continental shelf, the Bight Program has used the BRI of Smith et al. (2001) to assess the condition of benthic habitat using infaunal community composition. Previous Bight Benthic Reports have highlighted the need to develop an approach for assessing the condition of the continental slope habitat of the region (Gillett et al. 2017). As part of a study characterizing the region's continental slope fauna, a historical analysis of benthic samples from these habitats suggested that the BRI could potentially be applied to samples from continental slope habitats to depths up to 400 m (Gillett et al. 2021).

Following Gillett et al. (2021), the suitability of the BRI for use with samples from the Upper Slope stratum was evaluated by determining the number of taxa and the percent of abundance that was recognized by the BRI (i.e., taxa with p-code tolerance values) compared to those of the Inner Shelf, Mid Shelf, Outer Shelf, and Channel Islands strata where the BRI is commonly used. Comparisons between strata were quantified using a Kruskal-Wallis test and Dunn post-hoc comparisons, with stratum as the predictor variable and either % of taxa with a p-code or % of abundance with a p-code as the response variable. Furthermore, the responsiveness of the BRI in different habitats was evaluated by comparing BRI scores from the Upper Slope and shelf strata to two measures of organic matter enrichment (Total Nitrogen (TN) and Total Organic Carbon (TOC)) and two measures of toxic contaminants within the sediments. Contaminants were quantified as the number of compounds in excess of their Chemical Stressor Index (CSI) Level 1 (Bay et al. 2021) or Effects Range Low (ERL) (Long et al. 1995) impact thresholds. Comparisons were made using least-squares linear regression with BRI score as the response variable and contaminant/organic matter measure as predictor variable (α=0.1). Kruskal-Wallis tests were calculated using the kruskal.test function in R (v4.2.0) and the dunnTest function within the FSA package (v0.9.3) (Ogle et al. 2022). Regressions were calculated using the glm function (gaussian error distribution) in R (v4.2.0).

Investigation of Channel Islands 2013 Condition - One of the key findings from the 2013 Bight Survey was a notable difference in the condition scores and categories of the macrobenthic community from the Channel Islands compared to previous surveys (Gillett et al. 2017). As noted below, the condition of the stratum in 2018 returned to being in 100% reference condition, as it had been in surveys prior to 2013. This pattern warranted further investigation to determine the cause of these changes in benthic communities.

BRI scores from the Channel Islands stratum in 2013 were compared to those from 2003, 2008, and 2018 using an ANOVA with BRI score as the response and year of collection as the predictor variable and post-hoc contrasts (α=0.1). BRI categories from 2013 were compared to those from 2003, 2008, and 2018 using a Fischer's Exact Chi-square test with condition category as the response and year of collection as the predictor variable and holm-adjusted post-hoc contrasts (α=0.1). The coverage of the BRI index across the Channel Islands samples from 2013 and other Bight Surveys was evaluated using a beta regression of either % taxa or % of abundance within a sample with assigned BRI tolerance values (i.e., a p-code), with coverage as the response variable and year of collection as the predictor variable (α=0.1). ANOVA and Fischer's tests were done using R (v4.1.1) and the beta regressions were done with the betareg package (v3.1-4) (Cribari-Neto and Zeileis 2010).

Differences in taxonomic composition of the 2013 Channel Islands samples were compared to those of samples from 2003, 2008, and 2018 visually using nMDS ordination of presence-absence transformed data. Taxonomic differences were quantitatively compared using a PERMANOVA with Bray-Curtis dissimilarities calculated with presence-absence transformed data as the response variable and year of collection as the predictor variable across 1,000 permutations (α=0.1). Ordinations and PERMANOVA analyses were done using the MetaMDS and adonis2 functions within the R (v4.1.1) vegan package (v2.6-2) (Oksanen et al. 2022). Presence-absence transformations were selected to emphasize potential compositional changes in communities between surveys that may be obscured in similarities calculated from abundance data.

To quantify any potential causes for shifts in benthic community condition, the distribution of sediment chemistry (metals, PAHs, PCBs, and DDTs), sediment grainsize, water quality (bottom water temperature, dissolved oxygen, and salinity), and modelled measures of ocean acidification (pH, aragonite saturation, calcite saturation, and pCO2) at the Channel Islands stratum were compared among the different Bight Surveys. Sediment chemistry and grainsize data were obtained from the 2003, 2008, and 2018 Bight Surveys. Water quality data from

2003, 2008, 2013, and 2018 were obtained from CalCOFI bottle samples collected near (within 37 km) and at the same depth (+/- 6m) as the benthic samples (following Gillett et al. in review). Acidification variables were calculated using linear regression models applied to CalCOFI water quality data (e.g., McClatchie et al. 2016). Year-to-year comparisons of all potential stressors/forcing factors (except sediment grainsize) were quantified using GLMs with either Gaussian or gamma distributions to accommodate non-normal distributions with Tukey post-hoc comparisons (α=0.1), where the different stressors or environmental factors were the response variable and year of survey was the predictor variable. Sediment grainsize was compared with a Kruskal-Wallis test with Dunn post-hoc comparisons (α=0.1), with % sand, silt, or clay as the response variable and year of collection as the predictor variable. Kruskal-Wallis tests and GLMs were quantified using R (v4.1.1). Dunn post-hoc tests were calculated using the dunnTest function within the FSA package (v0.9.3) (Ogle et al. 2022) in R.

Sediment condition around oil and gas platforms - The continental shelf of the Southern California Bight is an important location for the extraction of petroleum and natural gas. There are 15 extraction platforms within the Santa Barbara Channel, most of which have been operating for more than four decades. The older platforms are being targeted for decommissioning and an assessment of the benthic habitat around the platforms is important information for managers and regulators. During the Bight '18 Survey, the condition of sediments surrounding the A, B, C, and Hillhouse oil/gas platforms was assessed with measures of macrobenthic fauna, toxicity, and chemical composition and compared to that of Mid Shelf Strata samples from Bight '13 (due to time constraints, 2013 data were the best available for regional comparisons at the time).

Macrobenthic communities were quantified and characterized using univariate and multivariate comparisons of taxonomic composition, while habitat condition was assessed from these data using the BRI. Sediment chemistry was quantified by measurements of individual compounds (metals, PCBs, PAHs, and pesticides) and habitat condition was assessed from the chemical concentrations via potential exposure scores using the California Chemical Score Index (CSI [Bay et al. 2021]). Sediment toxicity was evaluated using a 10-day amphipod survival test (USEPA 1994; ASTM 2010) and habitat condition was interpreted from these data with the California Sediment Quality Objectives (SQOs) framework (Bay et al. 2021). Specific analytical details can be found in the published manuscript included as Appendix E.

III. QUALITY ASSURANCE AND QUALITY CONTROL

The field and laboratory analysis of benthic samples for Bight'18 involved three processes: sample washing and preservation, sample sorting, and organism identification and enumeration. Quality assurance in the form of procedures and standardized reporting requirements are provided in this document for the latter two processes. Empirical quality control measurements were implemented at stages for which Data Quality Objectives (DQOs) had been established during the design of the survey (i.e., sample sorting, taxonomic identification and enumeration). The quality control practices were designed to ensure high quality data to inform subsequent analyses (e.g., condition assessment, community characterization) and ensure comparability of data produced by different benthic laboratories and even different surveys. The following sections provided summaries of the DQO for each task, a description of the QA/QC exercise, and the results of the different labs participating in this survey. Full details of the QA/QC exercises, example forms, etc. can be found in the Bight'18 Macrobenthic Sample Analysis Laboratory Manual (Bight '18 Benthic Committee 2018).

Sample Sorting

The objective of the sorting procedure was to remove the organisms from the associated sediment and detritus of a sample. For the 2018 survey, a DQO of 95% sorting efficiency (i.e., a minimum of 95% of the total number of organisms in a sample had to be removed) was established. A minimum of 10% of all material in Bight '18 samples was re-sorted to monitor sorter performance and to determine efficiency. Sorting efficiency was assessed following the aliquot method, wherein a representative aliquot of at least 10% of the sample volume of every sample processed was re-sorted by an experienced sorter different than the original sorter.

Sorting efficiency was calculated as follows:

$$\%Efficiency = 100 * \{\#original / [\#original + (\#resort / aliquot\ fraction)]\}$$

Sorting efficiencies below 95% required continuous monitoring (i.e., 100% re-sorting) of that sorter until efficiency was improved. Organisms found in the re-sort were included in sample identification and enumeration. Average efficiency across all samples was 97.4%, meeting the DQO (Table 4).

Table 4. Summary of sorting QA/QC results. Average sorting accuracy is presented for each participating lab and across the dataset as a whole. Note that sorting QA/QC data were not provided for 63 samples.

Lab	# of Samples	Method	% Efficiency
A	73	1	99.3
B	45	1,2	96.5
C	18	1,2	90.6
D	11	2	89.6
E	83	1	98.2
F	69	1	98.6
G	14	1,2	96.8
Totals	313*	Dataset Mean = 97.4	

Sorting QC Methods:

1 - Aliquot recheck

2 - 100% recheck

Identification and Enumeration

The objective of the identification and enumeration procedures was to accurately identify and count each organism in the sample. For the 2018 survey, three QA/QC measures related to identification and enumeration – each with a DQO of 90% – were used to evaluate performance as accuracy in identification, precision in taxonomic discrimination, and accuracy in counting. A minimum of 10% of each identification laboratory's samples were re-identified by a QC laboratory to assess the quality of the identification and enumeration process. Samples for re-identification were randomly selected a priori from each lab's assigned set of samples by the Bight '18 Benthic Committee Chairperson and provided to the QC laboratories after the initial identification. The taxonomists conducting the re-identification did not have access to the original results.

Upon completion of the re-analysis, the results were submitted to SCCWRP and a match/not match comparison of primary and secondary results was produced for the reconciliation process. The original taxonomists and the re-identification taxonomists for a given sample then met to reconcile any differences between the original data and those from the QC reanalysis. Once differences in identification and enumeration were reconciled, the number and types of discrepancies/errors (Table 5) were recorded. These results were then used to calculate the % error of the original laboratory's analysis.

$$\text{Identification Accuracy} = [1 - (\#\text{ Individuals Mis-ID'd} / \#\text{ Individuals Resolved})] * 100$$

$$\text{Taxa Discriminated} = \{1 - [\,|(\#\text{ Taxa Resolved} - \#\text{ Taxa Original})| / \#\text{ Taxa Resolved}]\} * 100$$

$$\text{Count Accuracy} = \{1 - [\,|(\#\text{ Individuals Original} - \#\text{Individuals Resolved})| / \#\text{ Individuals Resolved}]\} * 100$$

Table 5. Potential taxonomic identification & enumeration errors the QA/QC process is designed to detect and the prescribed remedial actions. The True Errors are those directly measured by the three taxonomic QA/QC equations. A TRC (Taxonomic Request for Change) is an update of taxonomic information in the species look up list to match the most currently accepted naming standard.

Resolution codes:	Error type (* requires data change)	Action
1 = Primary taxonomist misidentification	True*	TRC, Training
3 = Primary taxonomist miscount	True*	TRC, Review best practices
7 = Primary naming convention discrepancy	True*	TRC, Review best practices
2 = QC taxonomist misidentification	True	Training
4 = QC taxonomist miscount	True	Review best practices
8 = QC naming convention discrepancy	True	Review best practices
5 = Primary taxonomist data entry error	Random*	Review best practices
11 = organism added from another vial	Random*	Review best practices
6 = QC taxonomist data entry error	Random	Review best practices
12 = organism lost	Random	Review best practices
13 = specimen vouchered	Non-Error	Data Tracking
14 = specimen damaged during primary ID, not identifiable by QC taxonomist	Non-Error	No Action
9 = Primary variation in level of expertise	Non-Error	Training
10 = QC variation in level of expertise	Non-Error	Training

Across all of the samples, the average accuracy in identification was 93.7%, average precision in taxonomic discrimination was 97.0%, and average accuracy of counting was 98.2% (Table 6); all of which passed the 90% DQO. Table 7 presents a summary of the number and types of taxonomic errors identified during the QA/QC process. Across the dataset, most of the errors in the initial identifications (~7 – 11% of unique taxa records) were either misidentifications (183) or miscounts (247) – both true errors – or lost individuals (180) – a random error.

Table 6. Taxonomic QA/QC results for the random 10% of samples selected from each lab participating in the 2018 survey. Each lab's mean values, as well as the mean for the entire dataset are presented for each QC measure.

Lab	Accuracy of Identification	Precision of Discrimination	Accuracy of Count
A	90.9	95.9	99.5
B	98.0	99.2	99.0
C	97.2	95.6	98.3
D	91.3	98.3	93.3
E	99.4	99.8	100.0
F	95.8	98.6	95.0
Dataset Mean	93.7	97.0	98.2

Table 7. Summary of different errors noted in the taxonomic QA/QC re-identification process.

Category	Error Type	Description	Discrepancy Code	Taxonomic Labs							Dataset Totals	
				A	B	C	D	E	F	G		
Misidentification	True	Primary taxonomist misidentification	1	29	27	12	8	0	31	75	183	7.7%
Misidentification	True	QC taxonomist misidentification	2	21	35	40	32	9	71	63	273	11.5%
Miscount	True	Primary taxonomist miscount	3	8	56	63	42	2	22	51	247	10.4%
Miscount	True	QC taxonomist miscount	4	0	10	11	16	3	7	6	57	2.4%
Data Entry	Random	Primary taxonomist data entry error	5	1	10	56	1	0	4	3	80	3.4%
Data Entry	Random	QC taxonomist data entry error	6	6	0	0	0	0	4	4	20	0.8%
Name Usage	True	Primary naming convention discrepancy	7	0	15	16	6	0	2	9	55	2.3%
Name Usage	True	QC naming convention discrepancy	8	2	11	17	2	0	1	16	57	2.4%
Level of Expertise	Non-Error	Primary variation in level of expertise	9	21	19	34	23	56	44	108	314	13.3%
Level of Expertise	Non-Error	QC variation in level of expertise	10	140	156	138	55	20	133	144	796	33.7%
Processing	Random	organism added from another vial	11	0	1	8	60	0	3	0	83	3.5%
Processing	Random	organism lost	12	14	16	38	9	8	33	50	180	7.6%
Processing	Non-Error	specimen vouchered	13	74	32	15	1	101	74	63	373	15.8%
Processing	Non-Error	specimen damaged during primary ID	14	7	4	21	5	5	15	15	86	3.6%
			Totals	323	392	469	260	204	444	607	2,804	

Taxonomic comparability – After the sample-by-sample QA/QC reconciliation among the primary and re-identification taxonomists and any true errors were fixed, all of the taxonomists convened virtually for a synoptic data review. The goal of this exercise was to ensure comparability of taxa among the different laboratories that did the identifications. When taxon names were compared across all of the different laboratories, some taxa were either synonymized under one agreed upon name or the level of identification was backed off to a higher, more inclusive level (e.g., species to genus, or genus to family).

To ensure comparability of this survey to other surveys, voucher collections from each lab were created. The voucher collections contain specimen lots of one or more individuals of each reported taxon identified to species. The voucher specimens are understood to be representative of the taxon as defined within the Bight'18 survey. After the completion of analyses and publication of reports, vouchers will be transported to the Natural History Museum of Los Angeles County (NHM). The vouchers will be placed into the NHM invertebrate collection and specimens can be borrowed for further analysis following the standard protocols of the museum. Vouchers of tentatively identified taxa that are not resolved at the time of publication of this report will also be transferred to the NHM. Further research on these taxa can be conducted through the NHM by visiting scientists.

QA/QC Discussion

The challenge of producing and verifying an accurate and internally consistent description of the species composition of benthic macrofaunal communities over a wide range of habitats and depths was considerable. The necessity of relying on a large number of taxonomists added to the complexity of the task. However, measures to coordinate and standardize taxonomic practices effectively met these challenges.

Across 376 samples, we provided species-level identifications for 80.3% of the specimens that were collected; a 1.6% decrease from the 2013 survey. A total of 1,538 taxa were reported, which was 178 less than in 2013. The primary reason for this high level of consistency among surveys was that Southern California Association of Marine Invertebrate Taxonomists (SCAMIT) has continued to use taxonomic problems discovered in the Bight surveys to focus its activities in the period between surveys. Keys and other identification aids were produced for many problem taxa from previous regional surveys, facilitating consistent treatment in the present survey. Within the Bight Program and regular year-to-year taxonomic activities, taxonomists create voucher sheets for provisional taxa they erect or to provide clarification for multi-taxa groups that can be challenging. We would encourage this continued practice and re-encourage the distribution of these sheets via the taxonomy email list-serves that are created for each new Bight Program and within SCAMIT. Distribution of these materials ensures greater consistency of identification and uniformity across the datasets produced by the survey.

While all of the DQOs were met across the dataset, a small number of samples failed to meet the objectives for sorting or identification. These failures resulted from the lack of experienced sorters and identification discrepancies made in samples with low abundance and diversity, such as those from very shallow estuarine habitats and deep slope and basin habitats. Just a few errors in samples with few individuals have a big impact on quality assurance and quality control measures. However, the ability of most labs to reach the established DQOs across the width and breadth of their samples indicated very high performance in the bulk of the data and should impart similarly high confidence in the quality of the data for all subsequent analyses.

One of the common types of changes made to the dataset during the Synoptic Data Review was the "rolling back" of an identification to a higher taxonomic level to ensure consistency of effort across the dataset. A large number of these changes were due to differences in standard practices between labs in dealing with higher-level taxonomic designations (e.g., the use of sub-family vs. family designations on polychaetes that cannot be identified to species). This aspect of taxonomic standardization is currently not considered in the creation of the pre-survey lab manual. We would recommend including group-specific guidance on the "Bight-recommended" level of taxonomic effort in future Bight Program lab manuals to help expedite the re-ID and Synoptic Data Review processes.

IV. Results

Community Composition

The nMDS ordination illustrates that all of the samples clustered into three, relatively contained groups (stress = 0.181): embayment, offshore, or deepwater assemblages (Figure 2). A visual inspection of Figure 2 shows that the embayment cluster (circles) comprised samples from the Estuaries, Brackish Estuaries, Marinas, Ports, and Bays strata. The Estuaries and Brackish Estuaries were somewhat separated from the other types of embayments but were generally still part of the larger embayment assemblage group. The offshore assemblage cluster (squares) comprised samples from the Inner Shelf, Mid Shelf, Outer Shelf, and Channel Islands strata. As indicated by the clustering and overplotting in Figure 2, the macrobenthic fauna of offshore community samples were very similar to each other and displayed a moderate gradient into the deepwater assemblage samples. The third group, a deepwater assemblage (diamonds), comprised samples from Upper Slope and Lower Slope strata. As illustrated by the broad dispersal of points across the ordination in Figure 2, these samples showed the greatest amount of taxonomic heterogeneity of the different habitats sampled in the survey; they were not particularly similar to each other, but they were quite dissimilar to all of the other samples. This pattern echoes that detailed across the continental slope of the region by Gillett et al. (2021), which suggested that these communities may be organized according to neutral (stochastic) principles instead of the niche differentiation patterns observed in shelf and embayment habitats. Note that for ease of interpreting the ordination, nine (5 from the Lower Slope and 4 from the Brackish Estuaries) outlier samples were removed from the ordination due to their low abundance or anomalous composition. See Appendix H for sample data.

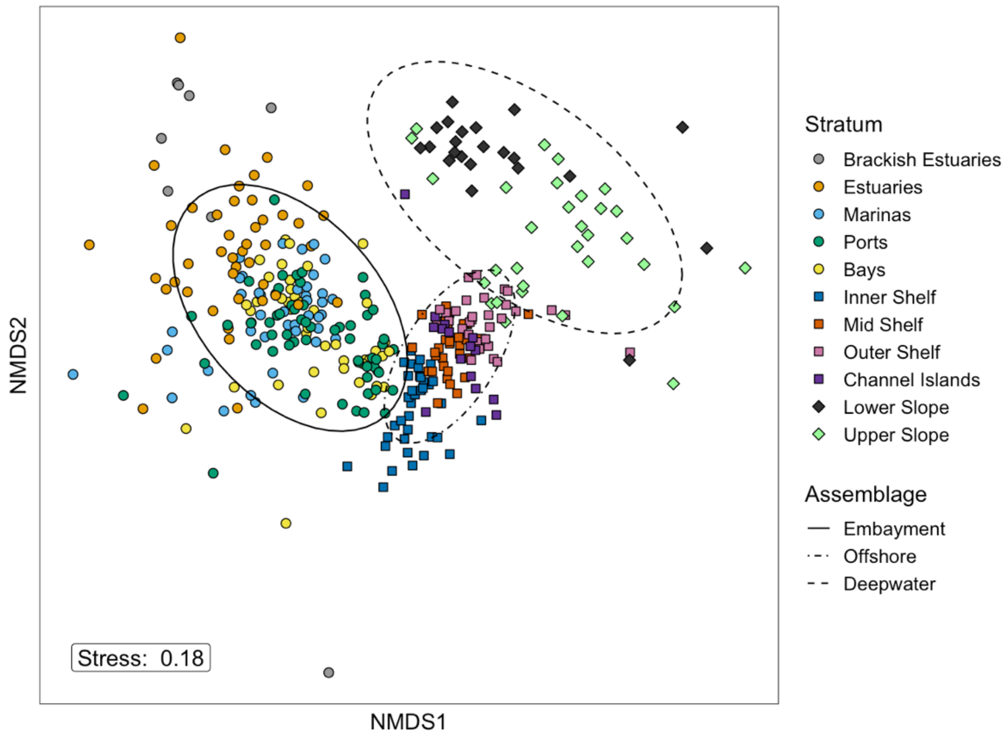

Figure 2. Two-dimensional nMDS ordination illustrating benthic infaunal community similarity of samples from the 11 different sampling strata. The three different assemblages are denoted with shapes and strata are denoted by color. The ellipses represent 90% of the data for each assemblage.

Sediment grainsize composition (% sand, r = 0.44; % silt, r = 0.46; % clay, r = 0.44) and station water depth (r = 0.81) were the two most important environmental variables contributing to the separation of samples in the nMDS ordination (Figure 3). Latitude and longitude had no meaningful (r < 0.01) relationships to the sample distribution in the nMDS ordination.

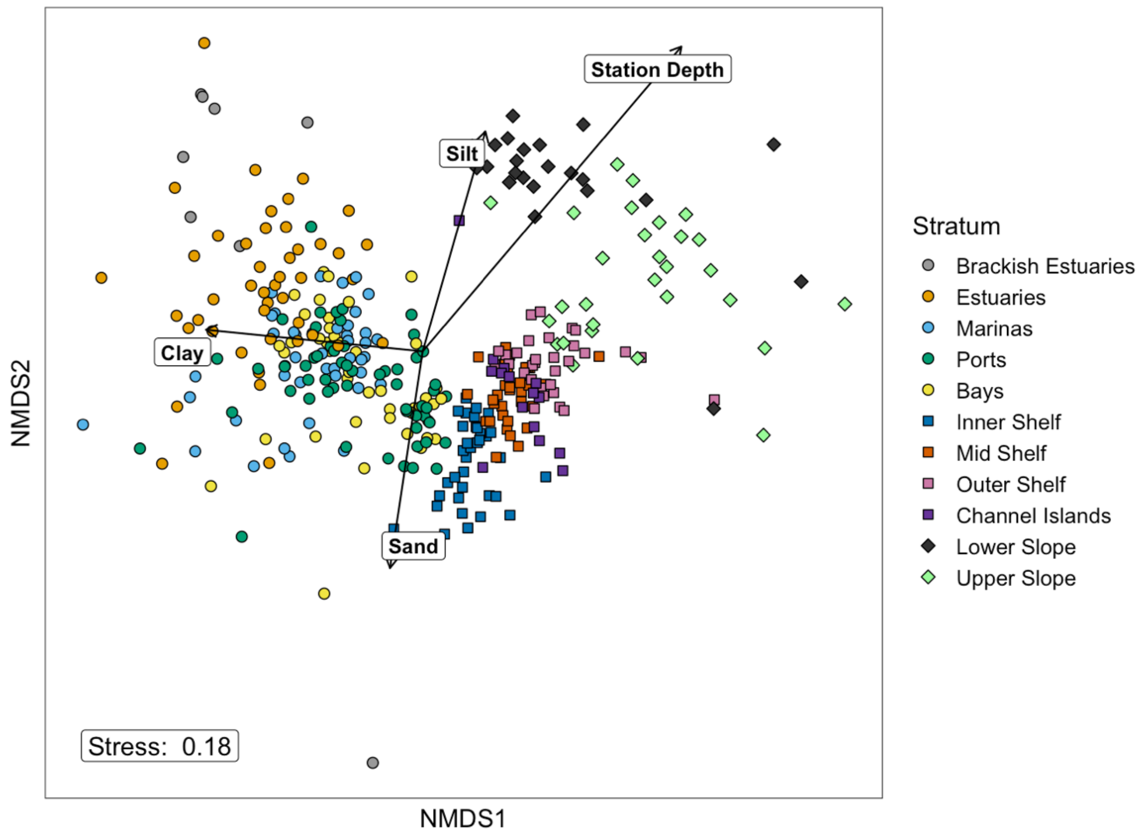

Figure 3. Two-dimensional nMDS ordination of Bight '18 macrobenthic samples from Figure 2 with environmental vectors overlaid. The length of the vectors is proportional to the strength of their correlation to the ordination pattern.

There were 11 different taxa that had comparatively strong ($r>0.3$) explanatory power for the patterns in the 2-d ordination of the samples collected in the survey (Table 8). These taxa could be grouped into those that clearly distinguished the embayment assemblage and those that identified with the offshore or deepwater assemblages (Figure 4). This clear separation was logical given the distinct differences in salinity and water depth between the embayment strata and other strata sampled in the survey. The differences between those taxa associated with the deepwater and offshore assemblages were less distinct than with the embayments. This pattern was likely reflective of the more subtle changes in depth and temperature along the continental shelf-slope continuum.

Table 8. Taxa with strongest explanatory value (r > 0.3) in the 2-dimensional nMDS ordination shown in Figures 2-4. Taxa are ranked based upon the magnitude of their correlation to the ordination. The labels of the taxa vectors in Figure 4 correspond to the Vector IDs in this table. The assemblage association indicates the direction of that taxon's vector to the assemblages defined in Figure 2.

Taxon	Vector ID	Assemblage Association
Acteocina carinata	1	Embayment
Oligochaeta	2	Embayment
Maldane californiensis	3	Deepwater
Limifossor fratula	4	Deepwater
Glycera nana	5	Offshore
Paraprionospio alata	6	Offshore
Glycinde armigera	7	Offshore
Spiophanes duplex	8	Offshore
Sigalion spinosus	9	Offshore
Carinoma mutabilis	10	Offshore
Hartmanodes hartmanae	11	Offshore

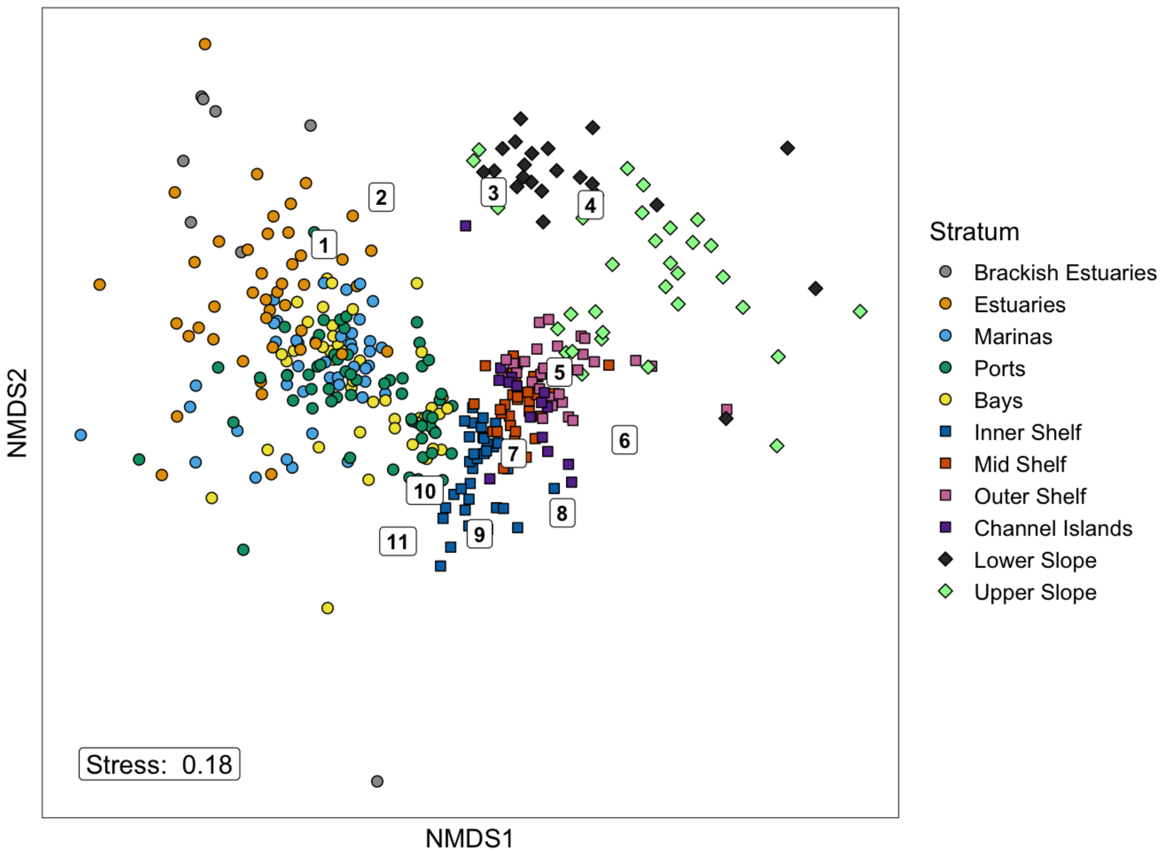

Figure 4. Two-dimensional nMDS ordination of Bight '18 macrobenthic samples from Figure 2 with taxa overlaid. Numbers correspond to taxa in Table 8.

SIMPER analysis of the samples grouped by their distribution within the three assemblages depicted in Figure 2 determined that the average community Bray-Curtis percent similarity was 13.04 among the embayment samples, 18.75 among the offshore samples, and 7.08 among the deepwater samples. Fourteen different taxa contributed just over 60% to the similarity values within the embayment assemblage (Table 9). The orbiniid polychaete *Leitoscoloplos pugettensis*, the invasive bivalve *Musculista senhousia*, and capitellid polychaetes from the genus *Mediomastus* were identified as the taxa most associated with the embayment samples, with each taxon contributing > 6% to the similarity values among the samples. In contrast, samples from the offshore group had 38 different taxa that represented 60% of the within group similarity, reflecting the greater species richness traditionally observed in the continental shelf of the region compared to the embayments or deepwater habitats (see below; Ranasinghe et al. 2012). Only the spionid polychaete *Spiophanes duplex* contributed more than 6% to the within-group similarity (Table 10). Seventeen taxa contributed to 60% of the similarity within the deepwater samples (Table 11). The polychaetes *Prionospio ehlersi*, *Maldane sarsi*, and *Bipalponephtys cornuta* each contributed > 7% to the within group similarity of the deepwater assemblages. The full output of the SIMPER analysis can be found in Appendix B.

Table 9. Similarity (%) for taxa contributing to the top 60% of within-group similarity of the samples from the embayment group. Average within-group Bray-Curtis similarity was 13.04.

Taxon	% Contribution to Similarity	% Cumulative Contribution
Leitoscoloplos pugettensis	8.3	8.3
Musculista senhousia	7.6	16.0
Mediomastus sp	6.7	22.7
Scoletoma sp C	6.0	28.6
Scoletoma sp	6.0	34.6
Theora lubrica	4.0	38.5
Pseudopolydora paucibranchiata	3.7	42.2
Phoronis sp	2.9	45.1
Amphideutopus oculatus	2.8	47.9
Exogone lourei	2.7	50.6
Oligochaeta	2.7	53.4
Grandidierella japonica	2.5	55.9
Acteocina carinata	2.4	58.3
Prionospio heterobranchia	1.9	60.2

Table 10. Similarity (%) for taxa contributing to the top 60% of within-group similarity of the samples from the offshore group. Average within-group Bray-Curtis similarity was 18.75.

Taxon	% Contribution to Similarity	% Cumulative Contribution
Spiophanes duplex	7.0	7.0
Mediomastus sp	5.8	12.8
Paraprionospio alata	4.6	17.4
Maldanidae	4.5	21.9
Prionospio jubata	2.4	24.3
Spiophanes kimballi	2.1	26.4
Amphiuridae	2.1	28.4
Euclymeninae sp A	2.0	30.5
Amphiodia urtica	1.9	32.4
Amphiodia sp	1.7	34.1
Spiophanes norrisi	1.3	35.5
Glycinde armigera	1.3	36.7
Tubulanus polymorphus	1.2	37.9
Axinopsida serricata	1.2	39.1
Spiochaetopterus costarum Cmplx	1.2	40.4
Ampelisca brevisimulata	1.1	41.5
Paradiopatra parva	1.1	42.6
Parvilucina tenuisculpta	1.1	43.8
Petaloclymene pacifica	1.0	44.8
Chondrochelia dubia Cmplx	1.0	45.8
Prionospio dubia	1.0	46.9
Aphelochaeta glandaria Cmplx	1.0	47.9
Pectinaria californiensis	0.9	48.8
Phoronis sp	0.9	49.7
Kirkegaardia siblina	0.9	50.5
Nuculana sp A	0.9	51.4
Sternaspis affinis	0.8	52.2
Scoletoma tetraura Cmplx	0.8	53.1
Scalibregma californicum	0.8	53.9

Tellina sp B	0.8	54.7
Glycera nana	0.8	55.5
Praxillella pacifica	0.8	56.2
Lineidae	0.7	57.0
Tellina carpenteri	0.7	57.7
Caecognathia crenulatifrons	0.7	58.4
Eclysippe trilobata	0.7	59.1
Nephtys ferruginea	0.7	59.7
Kirkegaardia cryptica	0.7	60.4

Table 11. Similarity (%) for taxa contributing to the top 60% of within-group similarity of the samples from the deepwater group. Average within-group Bray-Curtis similarity was 7.08.

Taxon	% Contribution to Similarity	% Cumulative Contribution
Prionospio ehlersi	12.8	12.8
Maldane sarsi	8.2	20.9
Bipalponephtys cornuta	7.7	28.7
Limifossor fratula	5.3	33.9
Paraprionospio alata	3.6	37.5
Ophiuroidea	3.2	40.7
Maldane californiensis	2.5	43.1
Glycinde armigera	1.9	45.0
Lineidae	1.8	46.8
Aphelochaeta monilaris	1.7	48.5
Stereobalanus sp	1.7	50.2
Bivalvia	1.7	51.9
Melinna heterodonta	1.6	53.5
Aricidea (Acmira) rubra	1.6	55.1
Glycera nana	1.6	56.7
Maldanidae	1.6	58.4
Mendicula ferruginosa	1.6	59.9
Brisaster townsendi	1.5	61.4

Within the embayment assemblage, Marinas, Ports, Bays, and Estuaries samples had relatively similar species diversity, richness, and evenness, while Brackish Estuaries samples had lower values for all three community metrics (Table 12). Though these univariate community metrics were relatively similar among the Marinas, Ports, Bays, and Estuaries samples, the community composition data served to highlight the differences in taxonomic composition of the different strata born out in the multivariate analyses described above. A full list of all taxa, their abundance, and frequency of occurrence within each stratum are presented in Appendix A. The most abundant and frequently observed fauna from Estuaries samples were typical, estuarine endemic taxa found in polyhaline/high mesohaline environments: the bivalve *Musculista senhousia*, oligochaetes, the syllid polychaete *Exogone lourei*, the gastropod *Acteocina carinata,* and the spionid polychaete *Pseudopolydora paucibranchiata* (Appendix A1). Marina samples were dominated by *Pseudopolydora paucibranchiata*, *M. senhousia*, the polychaetes *Leitoscoloplos pugettensis*, and *E. lourei* (Appendix A2). The Ports samples were dominated by polychaetes - *Scoletoma* sp C*, E. lourei, Mediomastus* sp, and *Scoletoma* sp. (Appendix A3). Similar to the Ports, the most frequently observed taxa in the Bays samples were polychaetes - *Scoletoma* sp*, Mediomastus* sp, *Leitoscoloplos pugettensis,* and *Glycera americana.* Unlike the other embayment strata, the three most abundant taxa in the Bays samples – the syllid polychaete *E. lourei* as well as the molluscs *M. senhousia* and *Barleeia haliotiphila* – were found in less than 40% of the samples, indicating a patchy, high-density distribution (Appendix A4).

As noted above, the Brackish Estuaries were a new stratum included in this Bight Survey. These were habitats adjacent to the other embayment strata, but with salinities less than 27 PSU. Accordingly, the taxa from the Brackish Estuaries were relatively different from those of the more saline embayment strata (e.g., Attrill 2002; Gillett and Schaffner 2009). The most abundant taxa in Brackish Estuaries were the amphipods *Grandidierella japonica* and *Monocorophium insidiosum*, which can form dense tube/burrow mats and the latter of which is common to mesohaline salinities. However, the most frequently observed taxa were Oligochaeta (Appendix A5). Given our present inability to distinguish species of oligochaetes from one another, we cannot determine if the oligochaetes observed in the Brackish Estuaries were different from those that were observed relatively frequently in the Estuaries, Ports, and Marina strata – though given the salinity differences it is likely that there were taxonomic differences within and between the strata (e.g., Giere and Pfannkuche 1982; Gillett et al. 2007).

Table 12. Mean (min - max) abundance, species richness, diversity, and evenness for all samples (probabilistic and non-probabilistic) for each stratum from the Bight '18 survey. Strata are grouped by their primary assemblage association noted in the nMDS ordination.

Assemblage	Stratum	Abundance	Shannon-Weiner Diversity (H')	Pielou's Evenness (J')	Species Richness (S)
Embayments	Brackish Estuaries	430.1	0.78	0.59	5.8
	(n=12)	(1 – 2,967)	(0 – 1.9)	(0.32 – 0.94)	(1 - 18)
	Estuaries	425	2.10	0.71	24.2
	(n=45)	(3 – 2,602)	(0.6 – 2.9)	(0.28 – 1.0)	(3 - 81)
	Marinas	407.6	2.27	0.69	31.7
	(n=44)	(22 – 2,124)	(0.7 – 3.4)	(0.31 – 0.89)	(5 - 73)
	Ports	243.1	2.85	0.79	41.4
	(n=56)	(9 - 986)	(1.3 – 3.8)	(0.57 – 0.97)	(6 - 85)
	Bays	434.7	2.81	0.75	45.3
	(n = 43)	(40 – 3,286)	(1.2 – 3.8)	(0.39 – 0.93)	(9 - 94)
Offshore	Inner Shelf	315.3	3.50	0.83	73.4
	(n=36)	(86 - 933)	(1.2 – 4.4)	(0.29 – 0.94)	(35 - 155)
	Mid Shelf	416.5	3.72	0.83	90.1
	(n=36)	(68 – 1,150)	(2.9 – 4.2)	(0.72 – 0.92)	(26 - 154)
	Outer Shelf	265	3.34	0.83	64.2
	(n=31)	(34 - 713)	(1.1 – 4.2)	(0.46 – 0.94)	(9 - 133)
	Channel Islands	539.7	3.79	0.81	110.1
	(n=15)	(171 – 1,300)	(3.0 – 4.3)	(0.66 – 0.92)	(63 - 163)
Deepwater	Upper Slope	61.9	2.5	0.83	22.9
	(n=31)	(18 - 229)	(0.8 – 3.6)	(0.37 – 0.97)	(4 - 59)
	Lower Slope	30.1	2.25	0.91	16.2
	(n=27)	(2 - 76)	(0 – 3.2)	(0.77 – 1.0)	(1 - 30)

Samples from the offshore strata had greater species richness and diversity than embayment or deepwater strata (Table 12). Species diversity and evenness were relatively similar among the samples from the offshore strata. Species richness, however, varied among the offshore strata, with the Channel Islands samples having the highest average species richness (110.1), while the Outer Shelf samples had the lowest (64.2). The Inner, Mid, and Outer Shelf samples all had relatively similar dominant taxa, characteristic of the coastal ocean: the capitellid polychaetes of the genus *Mediomastus* sp, and the spionid polychaetes *Spiophanes* *norrisi* and *S. duplex* (Appendices A6-8). As Figure 2 would suggest, the samples from the Channel Islands stratum shared many of the same dominant taxa as those from the other offshore strata. The most abundant and frequently observed additions to those taxa typical in the other offshore strata were amphipods of the genus *Photis* and the polychaete *Laphania* sp (Appendix A9).

Species diversity of the deepwater strata samples were similar to samples from the embayments, while evenness was more similar to the offshore strata (Table 12). The species richness values were lower than all the other strata, with the Lower Slope samples having the lowest richness (16.2) of any strata, except the Brackish Estuaries (5.8). Samples from the Upper Slope stratum were dominated by polychaetes - *Prionospio ehlersi, Paraprionospio alata, Maldane sarsi,* and *Bipalponephtys cornuta* (Appendix B10). The most abundant taxa in the Lower Slope stratum were the bivalve *Mendicula ferruginosa*, the enteropneust *Stereobalanus* sp, and the amphipod *Byblis barbarensis*. However, the most frequently observed taxa were Ophiuroidea and *Maldane californiensis* (Appendix A11).

Condition assessment in 2018

More than 99% of the assessable portions of the region were in good condition (89.1% reference condition + 10.1% low disturbance condition) and less than 1% were in poor condition (Figure 5). Of the four offshore strata, there were no areas in poor condition (Figure 6). Within the good condition category, the five offshore strata had varying levels of condition within the reference and low disturbance categories. One hundred percent of the Channel Islands stratum was in reference condition, while the Inner Shelf, Outer Shelf, and Mid Shelf strata had 77, 88, and 90% in reference condition, respectively. The Inner Shelf had the highest relative area in low disturbance condition (23%) compared to the Outer Shelf and Mid Shelf (11 and 10%, respectively). Full details of the condition extent estimates for all of the assessable strata can be found in Appendix F and their distribution across the region is detailed in Figure 7. Index scores are compiled in Appendix I.

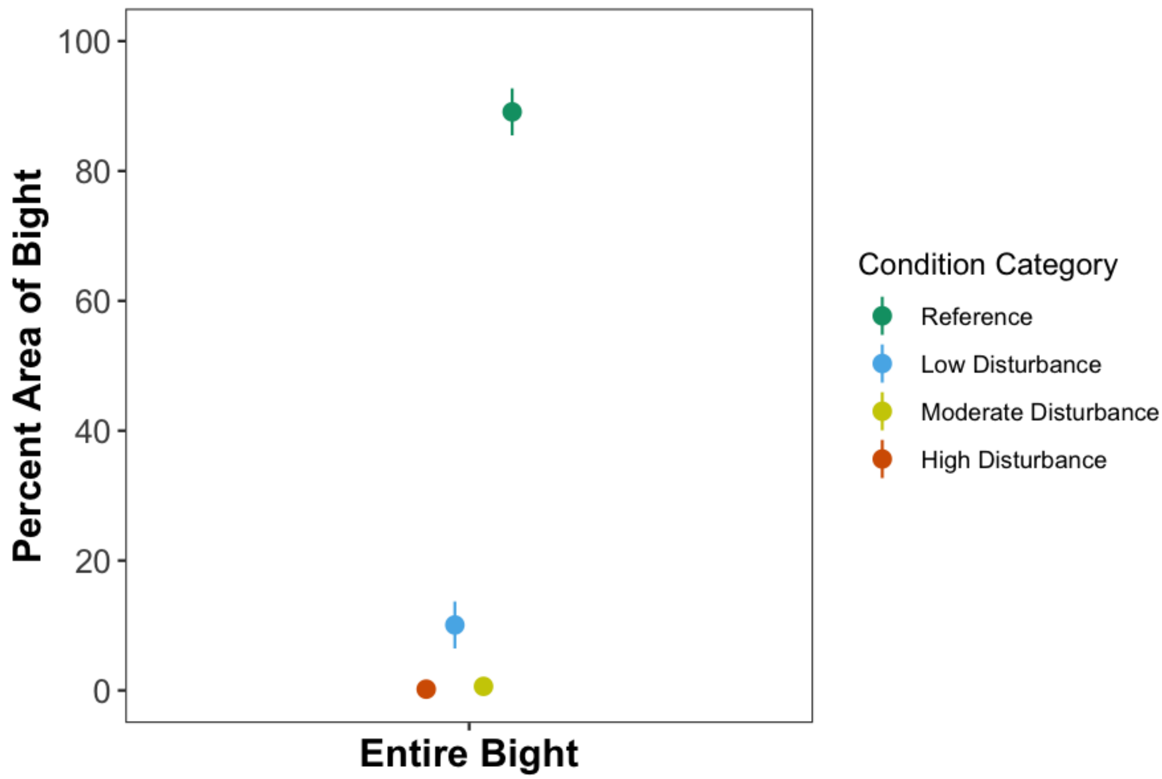

Figure 5. Percent area estimates (w/ 95% confidence intervals) of the assessable portions of the Southern California Bight in each of the four condition categories. The dots depict the estimate and the whiskers depict the local neighborhood-based confidence intervals.

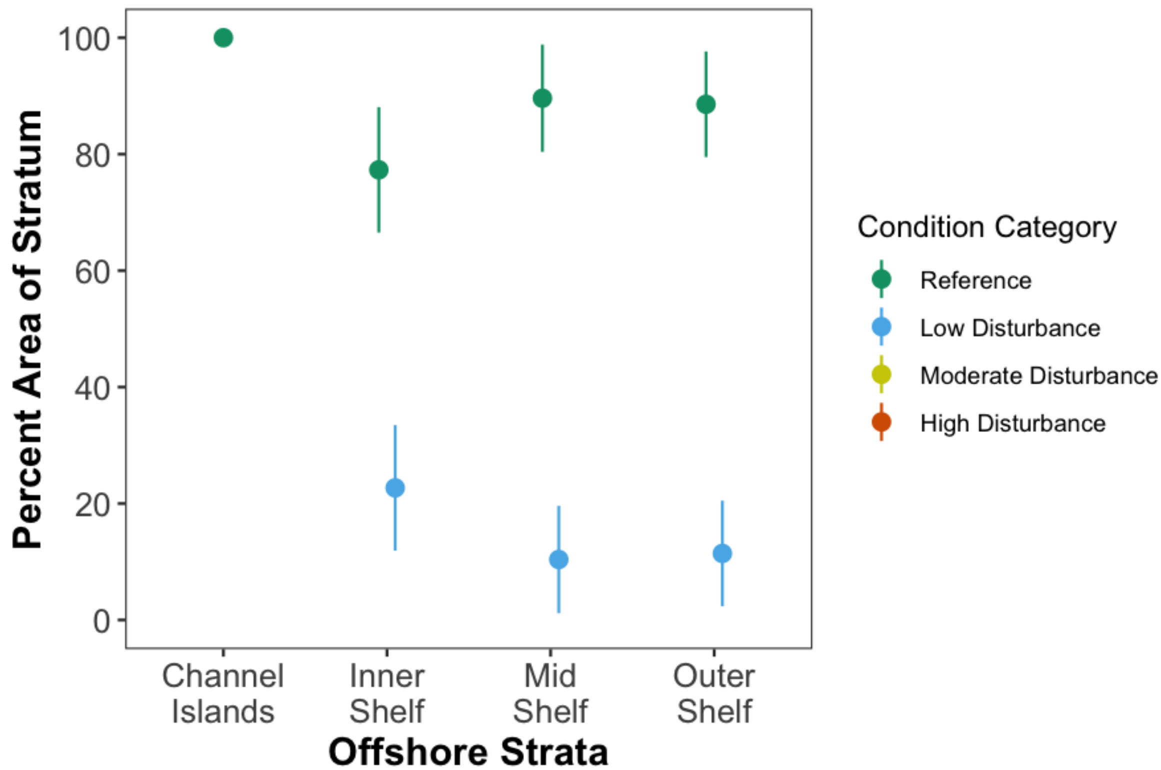

Figure 6. Percent area estimates (w/ 95% confidence intervals) of the four offshore strata in each of the four condition categories. The dots depict the estimate and the whiskers depict the local neighborhood-based confidence intervals. Note: no area was in the moderate or high disturbance category.

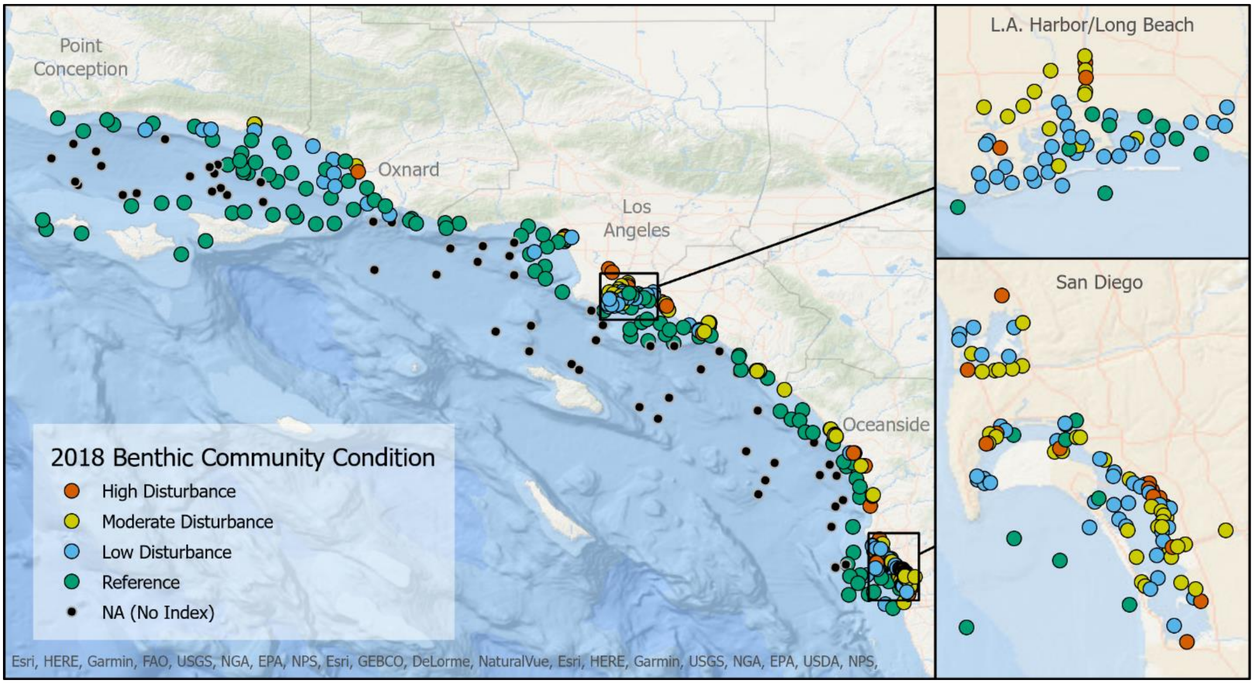

Figure 7. A map of the Southern California Bight depicting the distribution of samples and their condition collected across the eleven strata of the survey. The insets depict the distribution of samples from San Diego Bay and the ports of LA and Long Beach. The color of the dots indicate their condition and the small black dots represent samples whose condition could not be assessed (Upper Slope and Lower Slope).

The embayment strata had a greater relative extent of area in poor condition (29.7%) compared to the offshore strata (0%) (Figure 8). While a large percentage of the area in the embayment strata was in the low disturbance category (48.1%), 9.4% of the embayment area was highly disturbed. When comparing different embayment strata (Figure 9), Bays and Ports strata were in relatively better condition than the Estuaries and Marinas strata. Most of the area in Bays and Ports strata was in good condition (4-19% reference and 49-67% low disturbance condition) with less area in poor condition (22-26% moderate disturbance and 5-7% high disturbance). In contrast, the Estuaries and Marinas strata had a smaller extent of area in good condition (2-11% reference and 20-40% low disturbance condition) and a greater extent of area in poor condition (33-55% moderate disturbance and 18-22% high disturbance). Brackish Estuaries had the greatest extent of area in poor condition (54.5% moderate disturbance and 27.3% high disturbance).

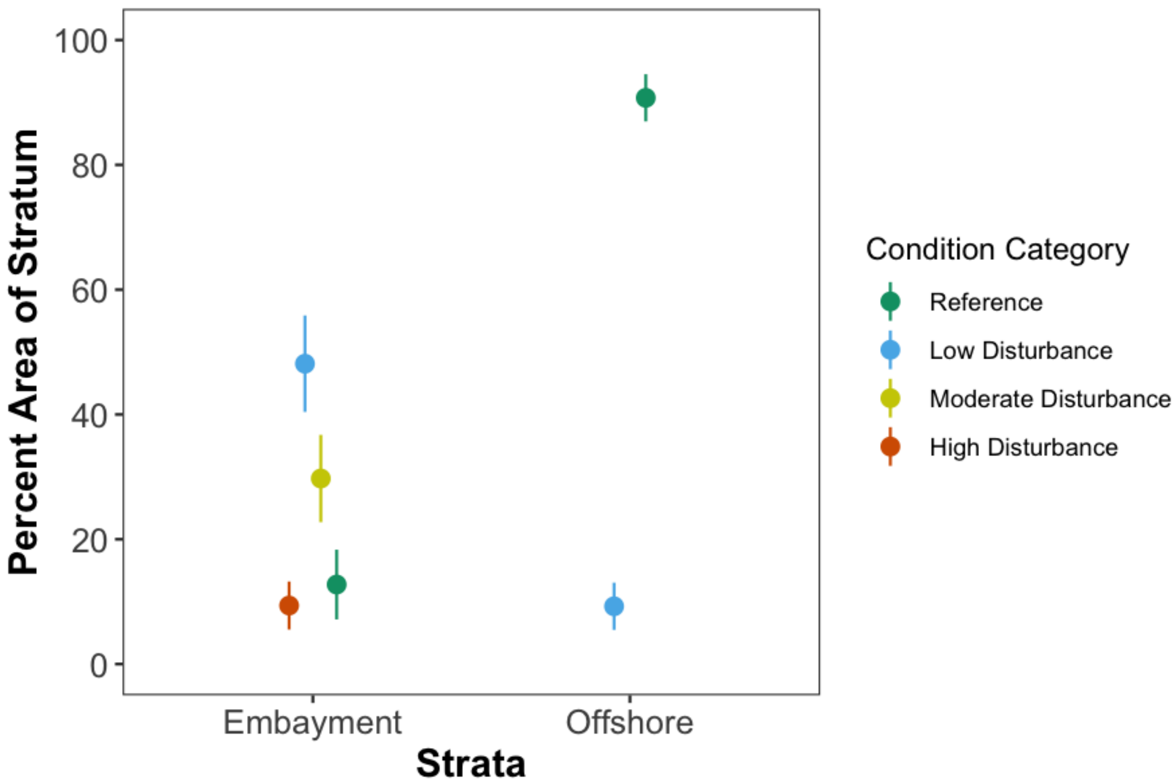

Figure 8. Percent area estimates (w/ 95% confidence intervals) of the combined embayment and offshore strata in each of the four condition categories. The dots depict the estimate and the whiskers depict the local neighborhood-based confidence intervals.

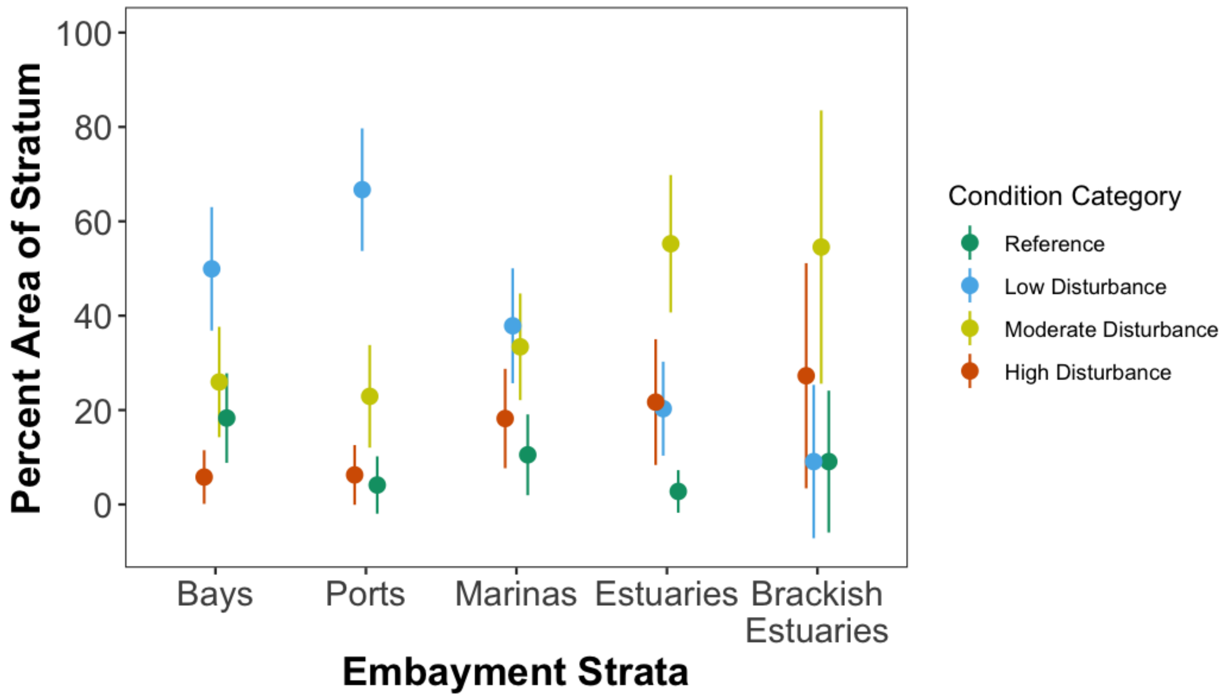

Figure 9. Percent area estimates (w/ 95% confidence intervals) of the five embayment strata in each of the four condition categories. The dots depict the estimate and the whiskers depict the local neighborhood-based confidence intervals. Note that the Brackish Estuaries data are based upon M-AMBI vs. SQO BLOE for the other strata.

Assessing condition of the Upper Slope stratum

An average of 72% of the taxa across the Upper Slope samples had tolerance values used for BRI calculation. This was significantly (α=0.1) less than Mid Shelf samples, but similar to all of the other shelf strata (Figure 10). Similarly, the % of abundance with tolerance values from the Upper Slope (77%) was less than the Mid Shelf, but similar to all of the other shelf strata (Appendix C).

The BRI scores from the Upper Slope increased (i.e., worsening condition) significantly (α=0.1) with increasing numbers of CSI-1 and ERL exceedances. However, there were no significant relationships between Upper Slope BRI scores and TN or TOC concentrations. For comparison, BRI scores from the Inner Shelf samples significantly increased with increasing measures of sediment contaminants and organic matter concentration, while those from the Mid-Shelf and Channel Islands showed no significant responses. Full details of all analyses for all strata are provided in Appendix C.

The lack of significant relationships between BRI score and TOC or TN among the Upper Slope samples despite some samples having concentrations known to negatively impact benthic fauna from other habitats (e.g., Hyland et al. 2005; Walker et al. 2022) is curious and may be related to biogeochemical or macrobenthic community composition differences associated with deepwater habitats. However, the direction of the trends in BRI scores relative to TOC and TN were indicative of the expected response to disturbance (i.e., higher scores with greater stress), suggesting that the index was performing as intended. Based upon this pattern, the significant relationships to sediment contaminants, and the large amounts of taxa from Upper Slope samples with documented tolerance values, it was deemed reasonable to use the BRI in an exploratory fashion to evaluate the relative condition of the Upper Slope in the 2018 survey as was done with the shelf strata (Figure 11). The overall pattern differed from the adjacent Outer Shelf stratum, with 60% of the Upper Slope in reference condition, 30% in low disturbance condition, and 10% in a moderate disturbance condition. However, without a proper validation of the BRI at depths below 324m the condition category thresholds should be interpreted with a note of caution when applied across the whole stratum.

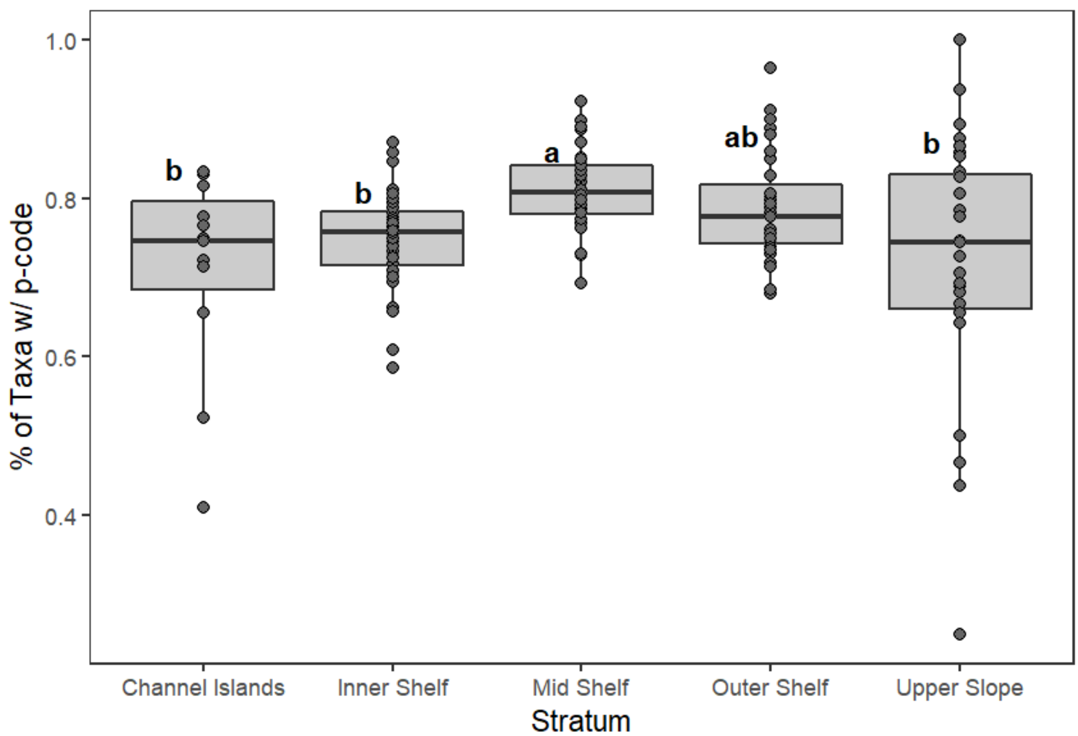

Figure 10. A schematic box and whisker plot of the percent of taxa in a given sample with a p-code tolerance value across the four shelf strata and Upper Slope stratum, with the dots representing values from individual samples. The letters indicate a similarity/difference between strata based upon a Kruskal-Wallis rank sum test with Dunn post-hoc comparisons.

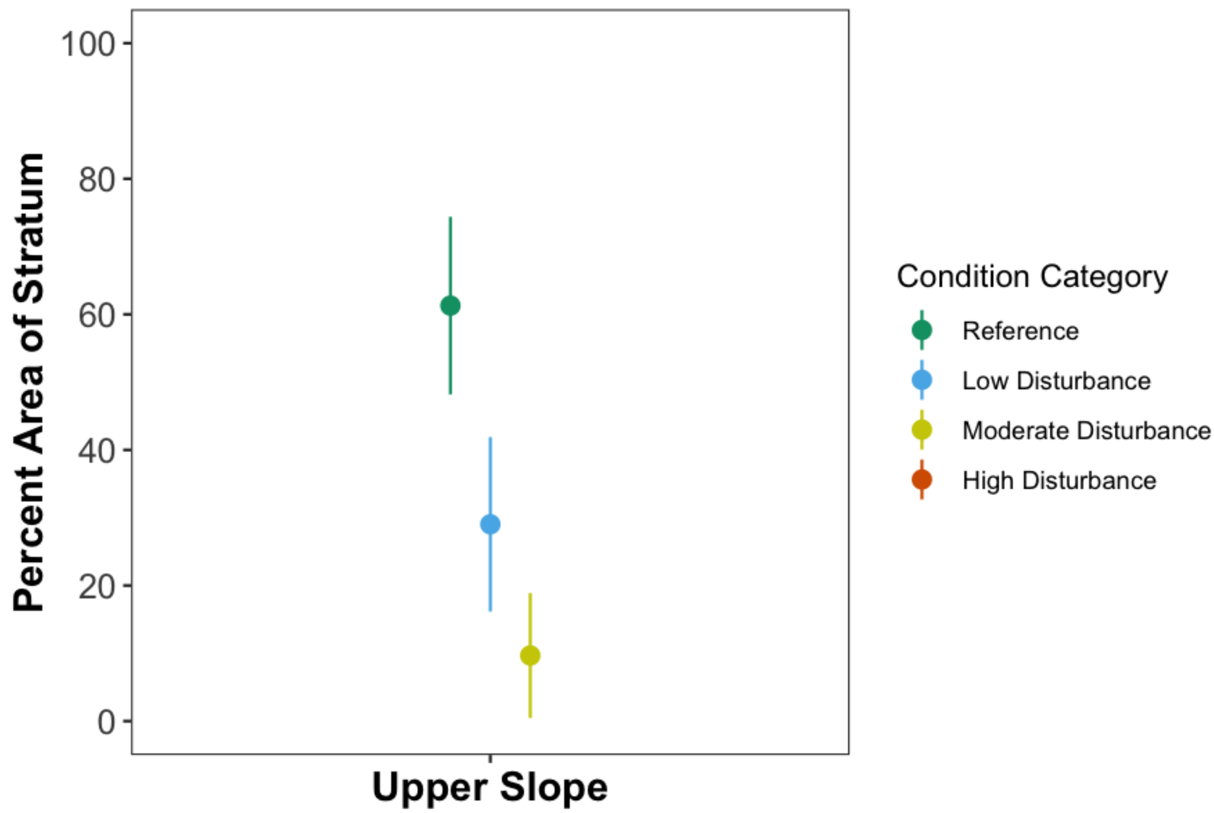

Figure 11. Percent area estimates (w/ 95% confidence intervals) of the Upper Slope stratum in each of the four condition categories. The dots depict the estimate and the whiskers depict the local neighborhood-based confidence intervals.

Condition of sediments surrounding oil/gas platforms

Full details of the oil platform study can be found in Gillett et al. (2020) published in Marine Pollution Bulletin (Open Access: https://doi.org/10.1016/j.marpolbul.2020.111662) and included in Appendix E. In brief, assessment scores indicated that the sediments surrounding the oil platforms (250 m – 2 km) were in a relatively good state, with reference-condition infauna, minimal levels of chemical exposure, and five instances (25% of samples) of low-level toxicity. Samples from around the oil platforms were in overall similar condition to Bight '13 Mid Shelf stratum samples, with slightly better condition infauna, nearly identical chemistry, and slightly worse toxicity.

Multi-survey temporal trend

A comparison of survey data from 1998-2018 shows a relatively stable trend in the proportion of the Southern California Bight in each of the four condition categories from 1998 through 2008. The change in the amount of reference to low disturbance condition areas in 2013 compared to previous surveys was not apparent in 2018, where the percent area distribution in 2018 was similar to that of 1998-2008 (Figure 12). From 1998 to 2008, nearly 90% of the assessable area was in reference condition and approximately 9% in low disturbance condition; contrasted with 78% and 21% respectively during the 2013 survey. In

2018, 89% of the assessable area was in reference and 10% was in low disturbance condition. Despite the relative change from reference to low disturbance in 2013, the areal extent of good condition habitat (i.e., reference + low disturbance) has remained stable – around 99% of the total assessable area – between 1998 and 2018. Likewise, the sum amount of moderate and high disturbance condition area bight-wide has remained stable at ≤ 2% from 1998 to 2018. Full details of the multi-survey areal extent estimates of habitat condition within each stratum can be found in Appendix F2.

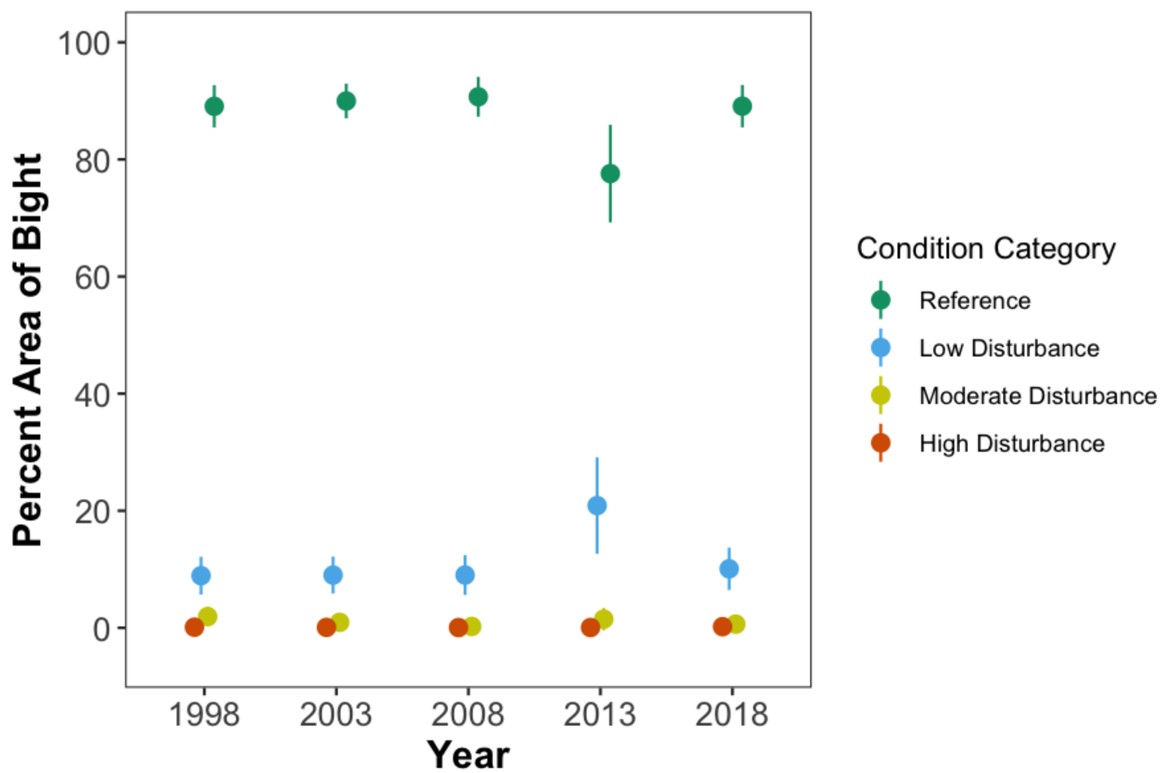

Figure 12. Percent area estimates (w/ 95% confidence intervals) for the entire Southern California Bight in each of four condition categories from the five regional surveys. The dots depict the estimate and the whiskers depict the local neighborhood-based confidence intervals.

When considering the individual offshore strata, the multi-survey trend was not uniform (Figure 13). The Mid Shelf and Outer Shelf strata displayed a small nominal change in condition (i.e., reduction in reference condition area paired with an increase in low disturbance area) from 1994 to 2018. The pattern on the Inner Shelf showed a downward trend in condition from 1994 to 2003, with decreases in the amount of Reference and increases in the amount of Low Disturbance area. However, after 2003 the trend on the Inner Shelf was an increase in the amount of Reference area, a decline in the amount of Low Disturbance, and the disappearance of the small amounts of Moderate Disturbance area. The multi-survey pattern in the Outer Shelf stratum showed a modest decline in condition compared to the Inner Shelf. From 2008 to 2013, there was a small decline in the amount of

Reference condition area and a corresponding increase in Low Disturbance area in the Outer Shelf, though the amount of area in Reference increased in 2018 relative 2013.

In the 2013 Bight Benthic Report, it was highlighted that the Channel Islands stratum showed a large change in condition in 2013 compared to previous surveys. From 1998 to 2008, nearly 100% of the area was in reference condition. In 2013, however, there was a 26.7% decrease in the amount of area in reference condition accompanied by an increase in low disturbance condition. With the inclusion of data from the 2018 survey, the trend has changed direction and returned to a state where 100% of the area was in reference condition. As is detailed below and in Appendix D, the cause(s) for this temporal fluctuation could not be definitively identified, though the data would suggest it was not related to sediment contamination.

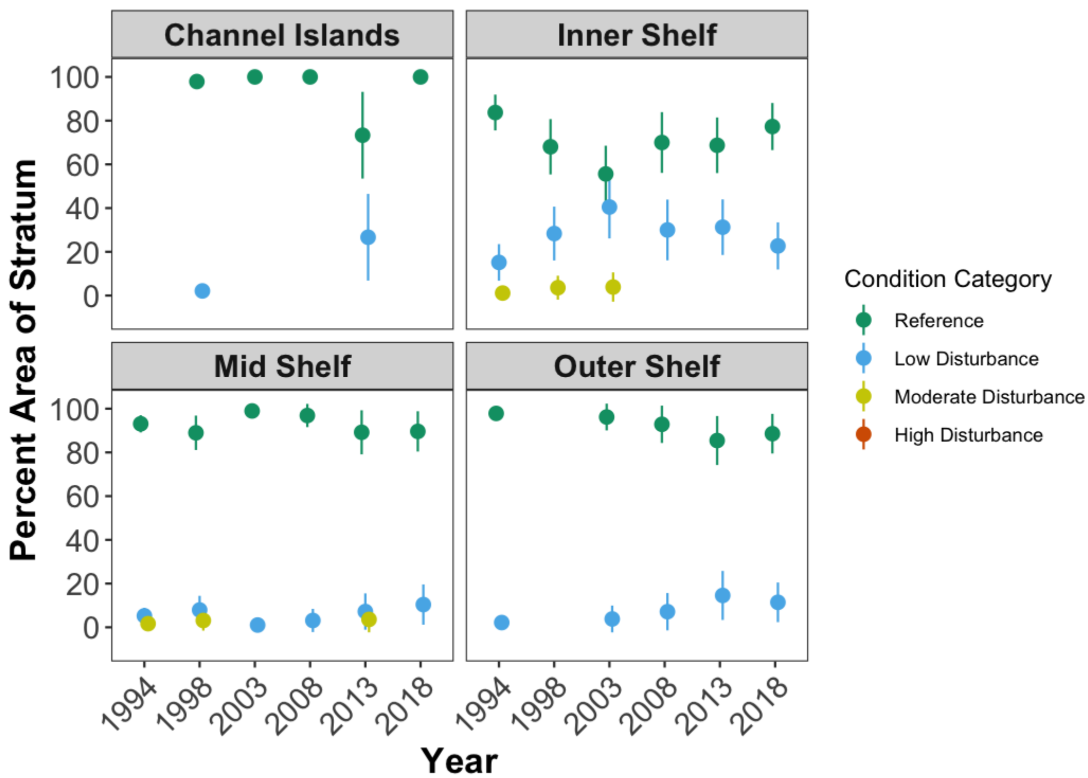

Figure 13. Percent area estimates (w/ 95% confidence intervals) in each of four condition categories for the four offshore strata sampled in the four regional surveys. The dots depict the estimate and the whiskers depict the local neighborhood-based confidence intervals. Note that no Outer Shelf samples were collected in 1998 and no Channel Islands samples were collected in 1994.

There was less consistency in the multi-survey trends in condition among the four embayment strata (Figure 14) compared to the offshore strata. In general, all four embayment strata saw increases in either moderate or high disturbance condition over time. Low disturbance condition was relatively stable in the Ports stratum, however, there was a 16% increase in moderate disturbance condition from 2013 to 2018. The ongoing trend in Estuaries and Bays of declining condition persisted in 2018. The Estuaries stratum saw a 2% increase in high disturbance condition and a 20% increase in moderate disturbance condition from 2013 to 2018. The trend in declining condition in the Bays stratum since 2003 continued, where the percent of area in reference and low disturbance condition continued to steadily decline and the area in moderate disturbance condition increased. The Marinas stratum saw the largest increase in high disturbance condition from 2013 to 2018 with a 14% increase.

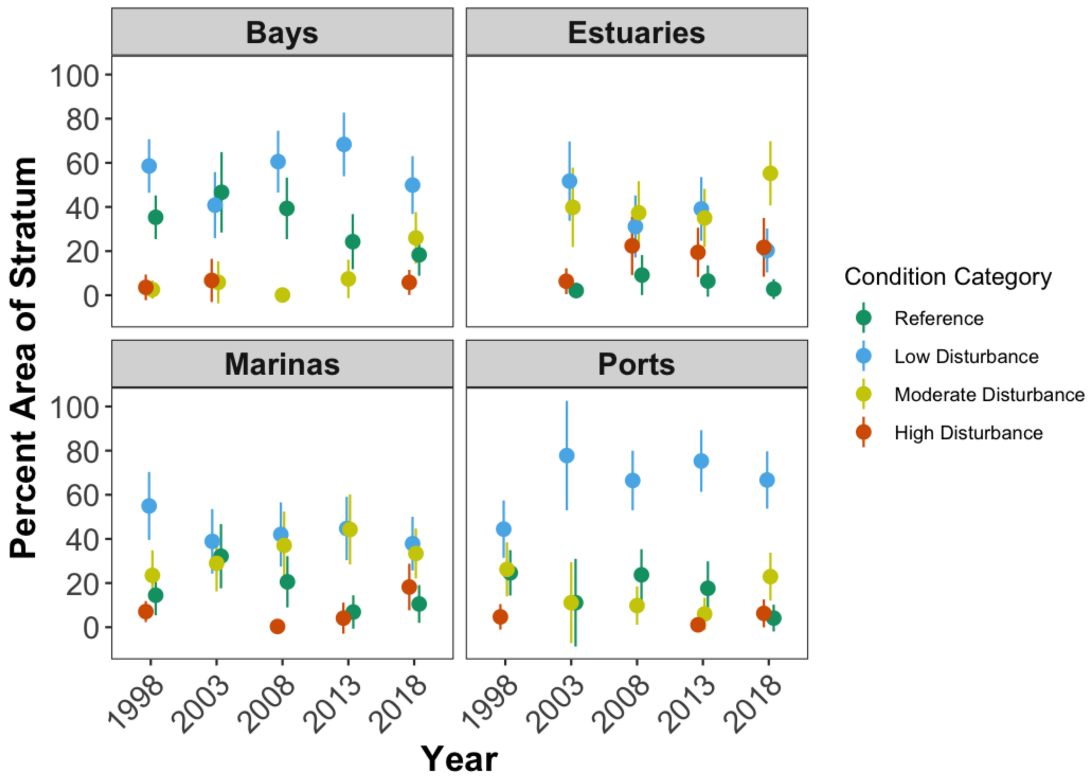

Figure 14. Percent area estimates (w/ 95% confidence intervals) in each of four condition categories for the four embayment strata sampled in the five regional surveys. The dots depict the estimate and the whiskers depict the local neighborhood-based confidence intervals. Note that no Estuaries samples were collected in 1998.

Investigating changes in the Channel Islands stratum

As noted above in Figure 13, the conditions of the Channel Islands stratum in 2018 returned to being in 100% reference condition, as it had been in surveys prior to 2013. Both condition category and BRI score were significantly worse in 2013 than the other Bight Surveys, which suggests that both the decline in 2013 and the rebound in 2018 were quantitatively "real". Furthermore, neither the percent of taxa ($p=0.123$) nor the percent of total abundance ($p=0.376$) used in calculating the BRI were different between the different surveys (e.g., Figure 15; Appendix D). More than 70% of abundance and 60% of the taxa were recognized by the BRI, which suggests the index was being performing similarly across all the surveys.

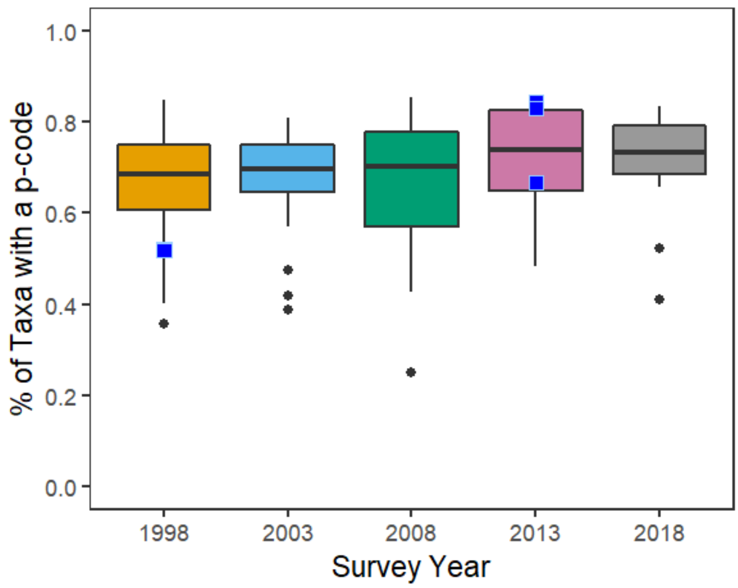

Figure 15. A schematic box and whisker plot depicting the percent of taxa in Channel Islands samples with a p-code tolerance value across different years of the Bight Program. The dark Blue squares indicate the value for samples in Low Impact condition.

The differences in condition scores from 2013 to the other surveys were not as clearly reflected in the survey-to-survey patterns of the whole community as illustrated in the nMDS ordination (Figure 16). In contrast, the pairwise PERMANOVA indicated that the benthic fauna from each survey were different than those from 2013 (Table 13). This pattern is part of a broader trend in a steady change in community composition that has been observed at a variety of habitats across the Southern California Bight over the 25+ years of sampling (Gillett et al. in review; Walker et al. unpublished).

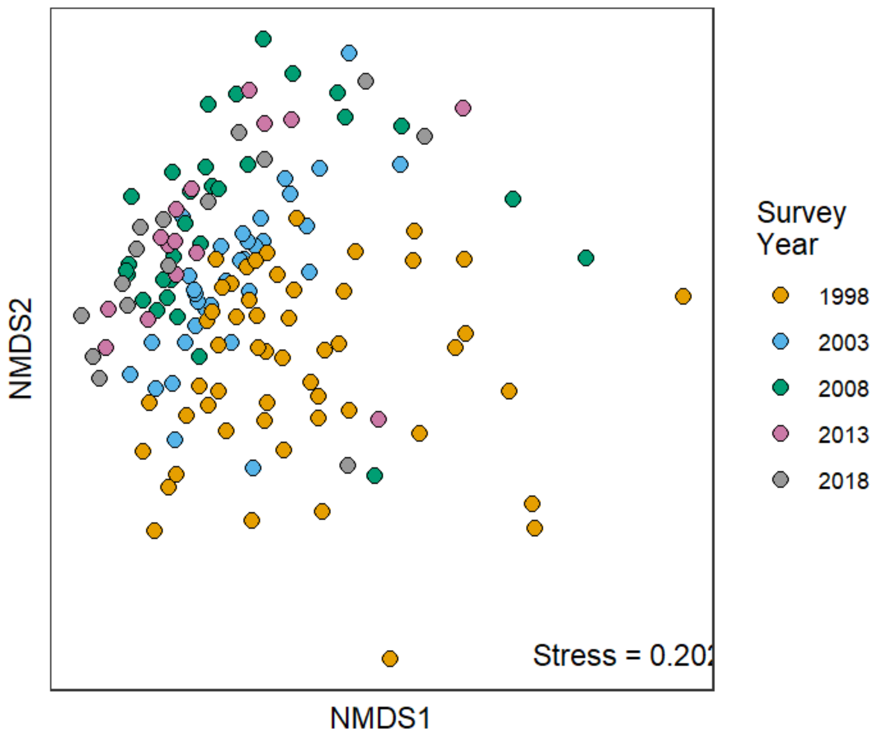

Figure 16. A two-dimensional nMDS ordination of Bray-Curtis dissimilarities of presence/absence transformed macrobenthic abundance from the Channel Islands stratum collected in different Bight Surveys between 1998-2018. Points are color-coded by the year of collection.

Table 13. Main effect and pairwise comparison outputs from a PERMANOVA of Channel Islands stratum benthic fauna from 1998-2018. PERMANOVA calculated from Bray-Curtis dissimilarities of presence/absence abundance over 10,000 permutations.

Test Type	Term	dfs	Pseudo R^2	F-statistic	p-value
Main Effect	Year of Survey	4	0.13	5.1	<0.001
	Residuals	141			
	Total	145			

Test Type	Contrast	dfs	Pseudo R^2	F-statistic	p-value
Pairwise Comparisons	2013 vs 1998	1, 66	0.08	5.6	<0.001
	2013 vs 2003	1, 46	0.10	4.9	<0.001
	2013 vs 2008	1, 43	0.05	2.5	0.006
	2013 vs 2018	1, 28	0.10	3.0	<0.001

There were no clear, obvious relationships between BRI scores and the stressors or environmental factors considered in the analyses (see Appendix D for full details). However, there were differences in water quality/chemistry between survey years. On average, the bottom waters in 2013 tended to be colder and more acidic, with lower dissolved oxygen than in 2018 or previous surveys. The survey-to-survey patterns were complex, but generally 2013 values were significantly different from 1998 and some of the prior surveys (depending on the parameter), but never significantly different from 2018 values (Figures 17 and 18). Sediment contaminants and organic matter content were not significantly greater in 2018 than they were in the 2008 survey (e.g., Figures 19 and 20).

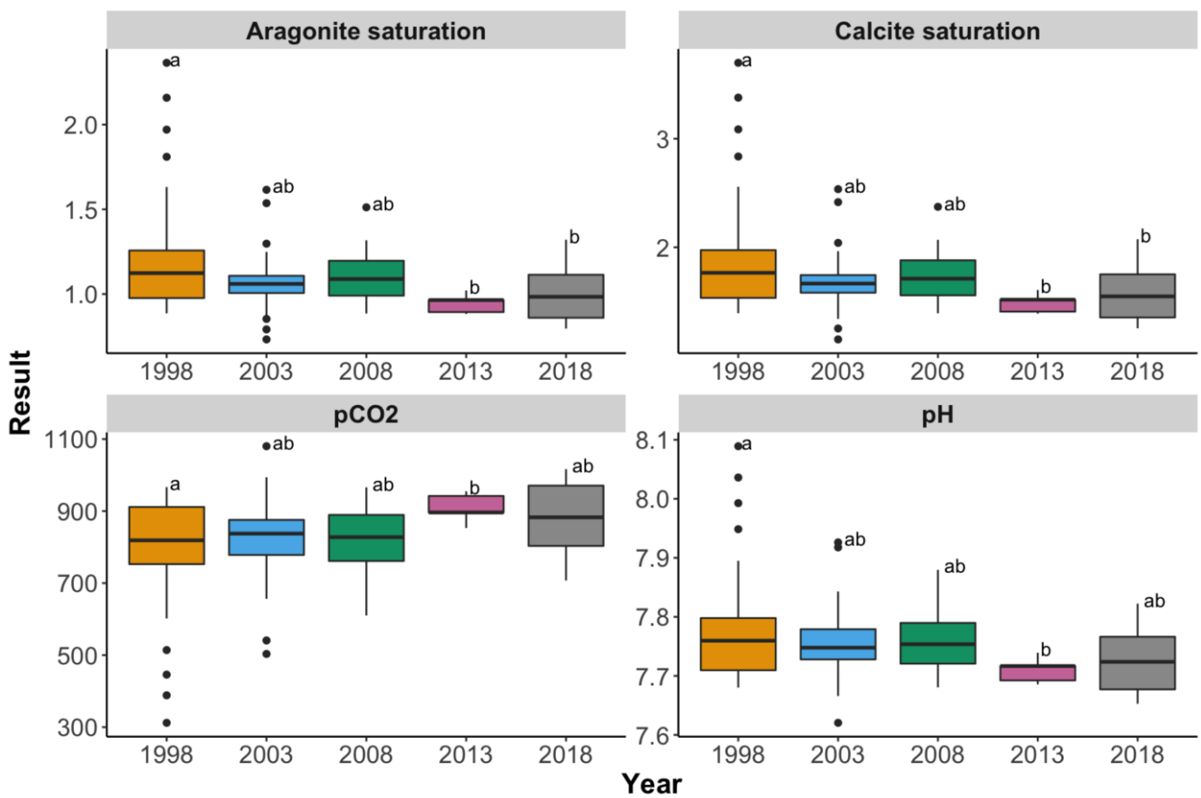

Figure 17. Aragonite saturation, calcite saturation, partial pressure of CO_2, and pH values in the Channel Islands for each Bight Survey (1998, 2003, 2008, 2013, and 2018). Lines inside each box depict the median value, box limits are Q1 and Q3, and whiskers represent non-outlier ranges. Letters represent significant differences between treatments (Tukey HSD test; α=0.1).

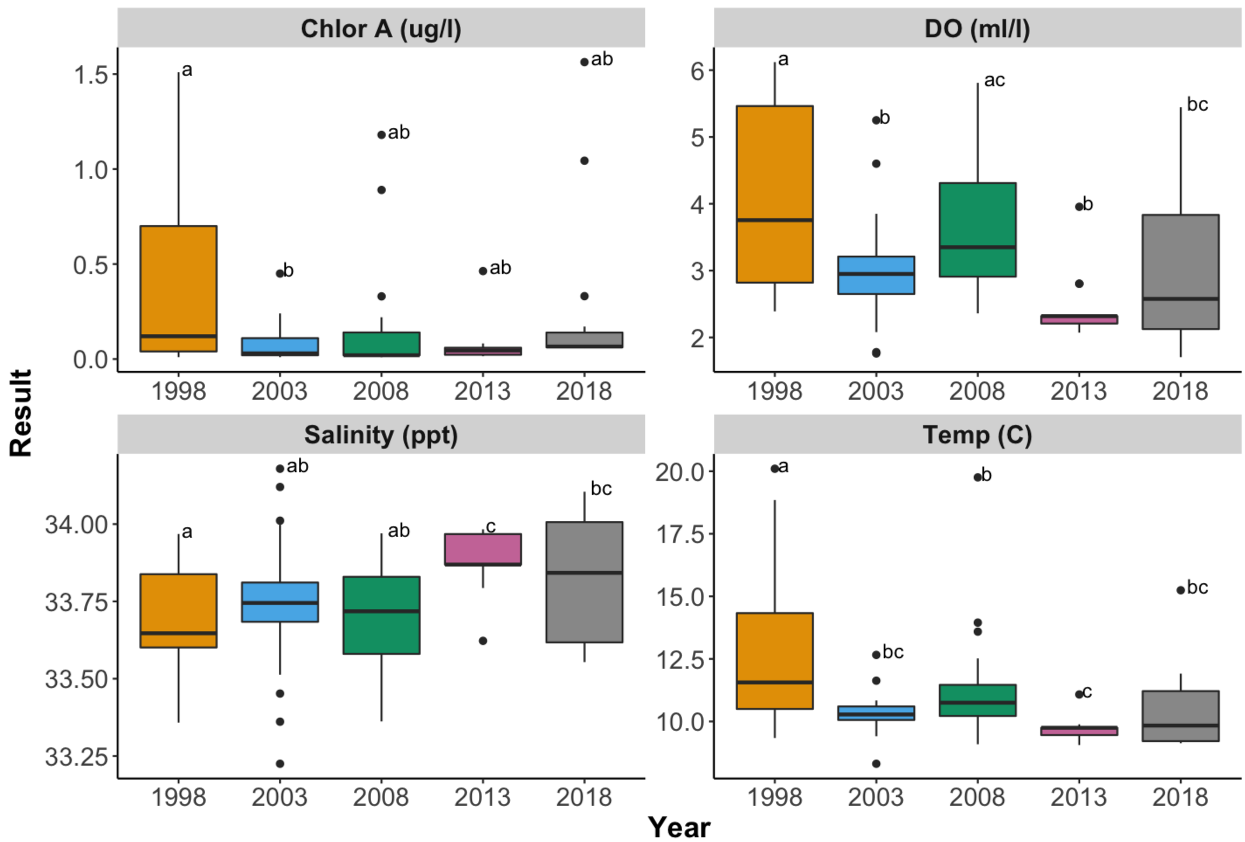

Figure 18. Chlorophyll A, dissolved oxygen (DO), salinity, and temperature values in the Channel Islands for each Bight Survey (1998, 2003, 2008, 2013, and 2018). Lines inside each box depict the median value, box limits are Q1 and Q3, and whiskers represent non-outlier ranges. Letters represent significant differences between treatments (Tukey HSD test; α=0.1).

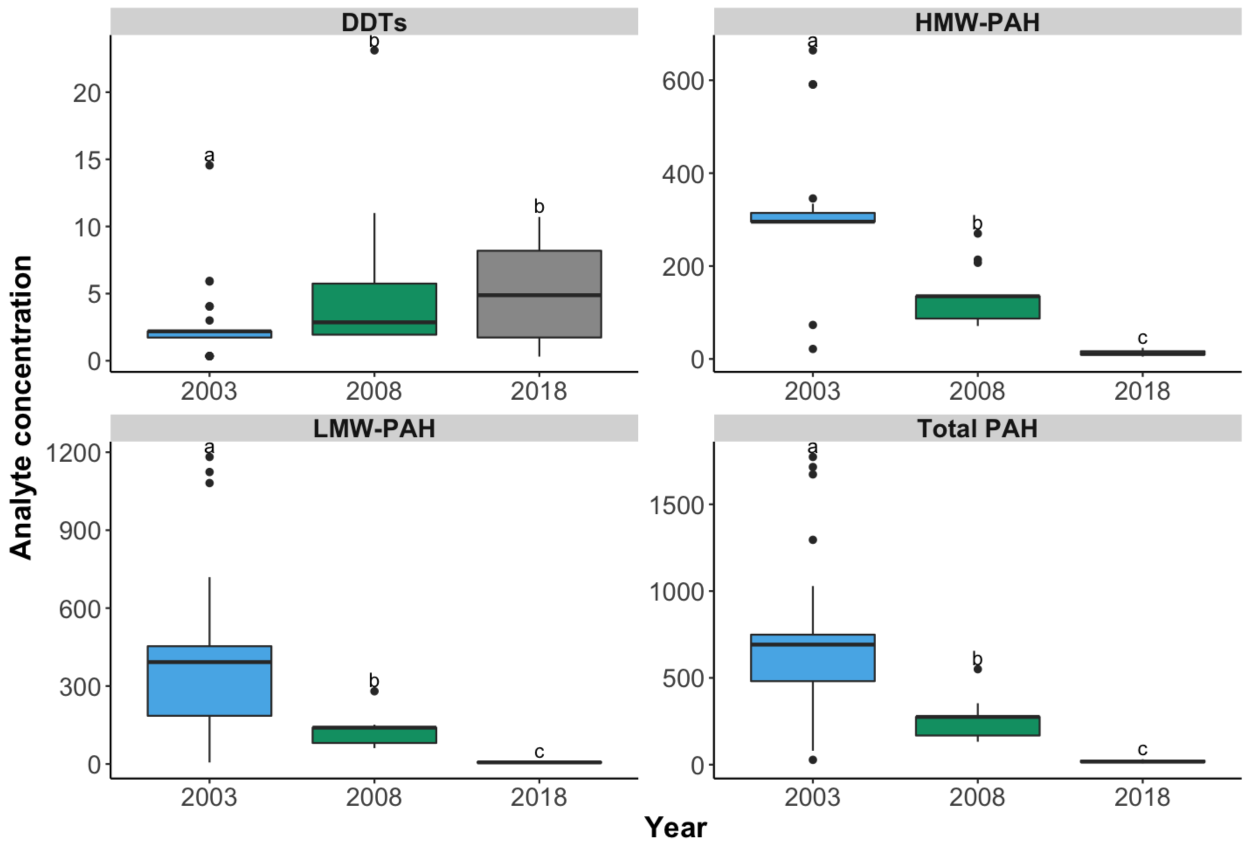

Figure 19. Schematic boxplots of organic contaminant (DDTs, HMW-PAH, LMW-PAH, and Total PAH) concentration (ng g^{-1}) at the Channel Islands from the Bight 2003, 2008, and 2018 surveys. Lines inside each box depict the median value, box limits are Q1 and Q3, and whiskers represent non-outlier ranges. Letters represent significant differences/similarities between treatments (Tukey HSD test; α=0.1).

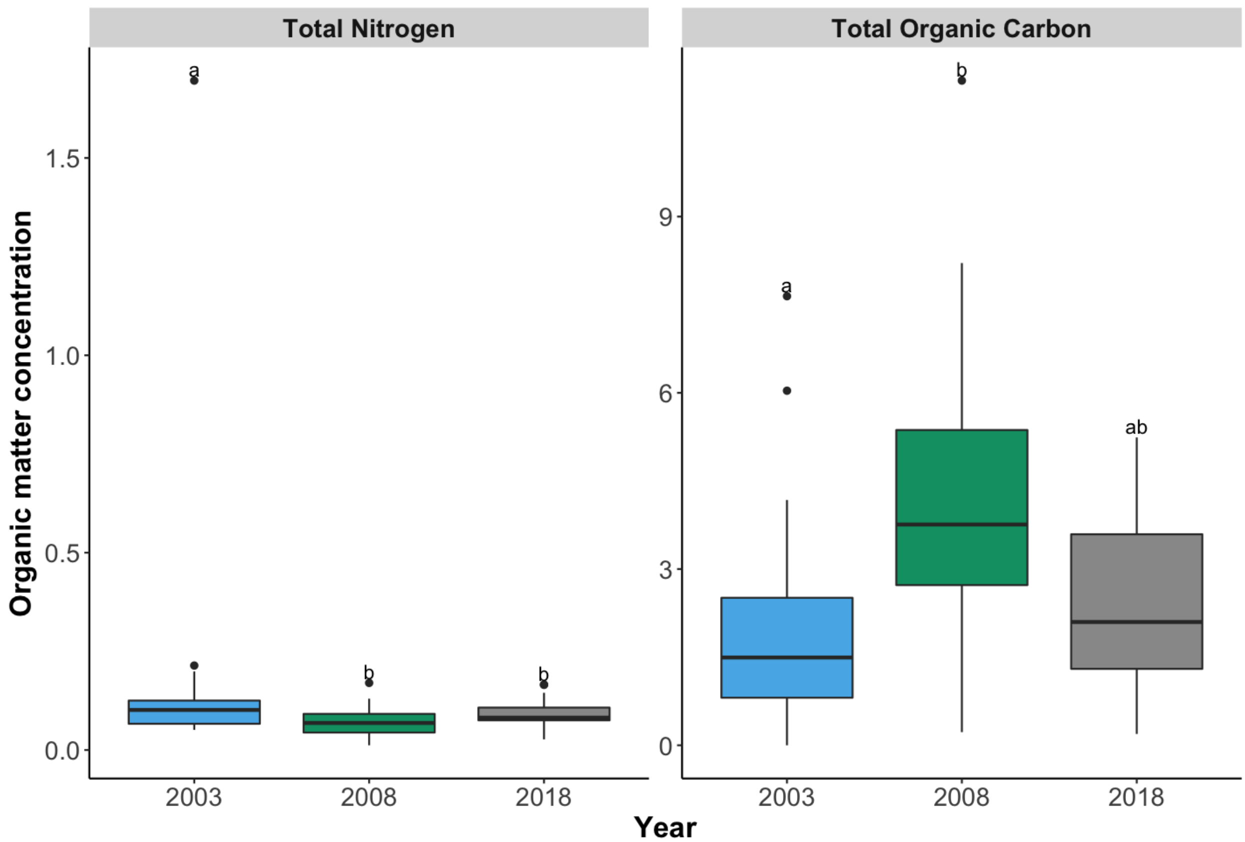

Figure 20. Schematic box plots of organic matter concentrations (% total nitrogen and % total organic carbon) in the Channel Islands from the Bight 2003, 2008, and 2018 surveys. Lines inside each box depict the median value, box limits are Q1 and Q3, and whiskers represent non-outlier ranges. Letters represent significant differences between treatments (Dunn test; α=0.1).

Site revisit temporal trends

Based upon sites revisited from 1998 through 2018, 4.5% of the assessable portions of the Southern California Bight showed a trend towards improving condition (i.e., better BRI scores), 77.9% had a stable trend, and 17.6% had a trend of declining condition (Figure 21; Appendix F). Compared to the other offshore strata, the Outer Shelf had the greatest amount of area (40%) in a declining trend with 6% in improving condition (Figure 23). Most of the area in the Inner Shelf, Mid Shelf, and Channel Islands strata had a stable (80 - 82%) or declining (7 - 20%) trend in condition. The Mid Shelf and Inner Shelf had only 9 and 14% in improving condition, while the Channel Islands had no area in improving condition (Figure 23). None of the changes in condition scores within the offshore strata crossed the condition threshold from good to poor or poor to good (Appendix G), though some did change with the good/poor summary categories.

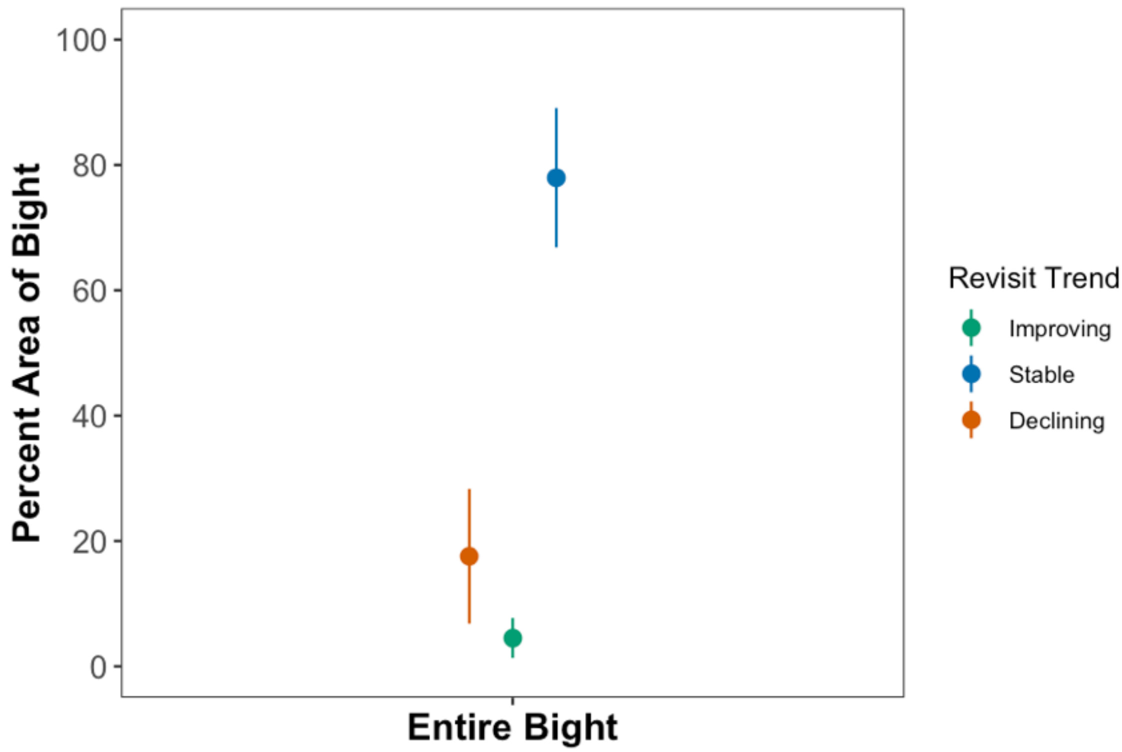

Figure 21. Percent area estimates (w/ 95% confidence intervals) of the assessable portions of the Southern California Bight with an improving, stable, or declining trend in condition score derived from revisited sites sampled from 1998 to 2018. The dots depict the estimate and the whiskers depict the local neighborhood-based confidence intervals.

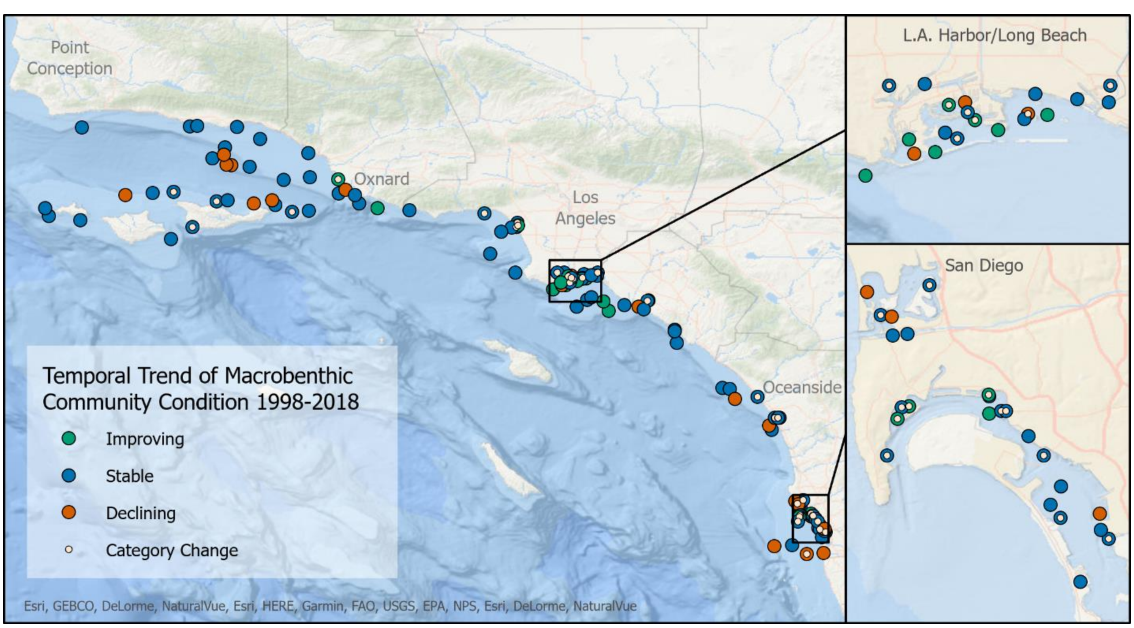

Figure 22. A map of the Southern California Bight depicting the distribution of revisit samples and their trend in condition between 1998/2003 and 2018. The insets depict the distribution of samples from San Diego Bay and the harbors of LA and Long Beach. The color of the dots

indicate the nature of the trend and the small white dots represent samples whose condition category changed from 2013 to 2018.

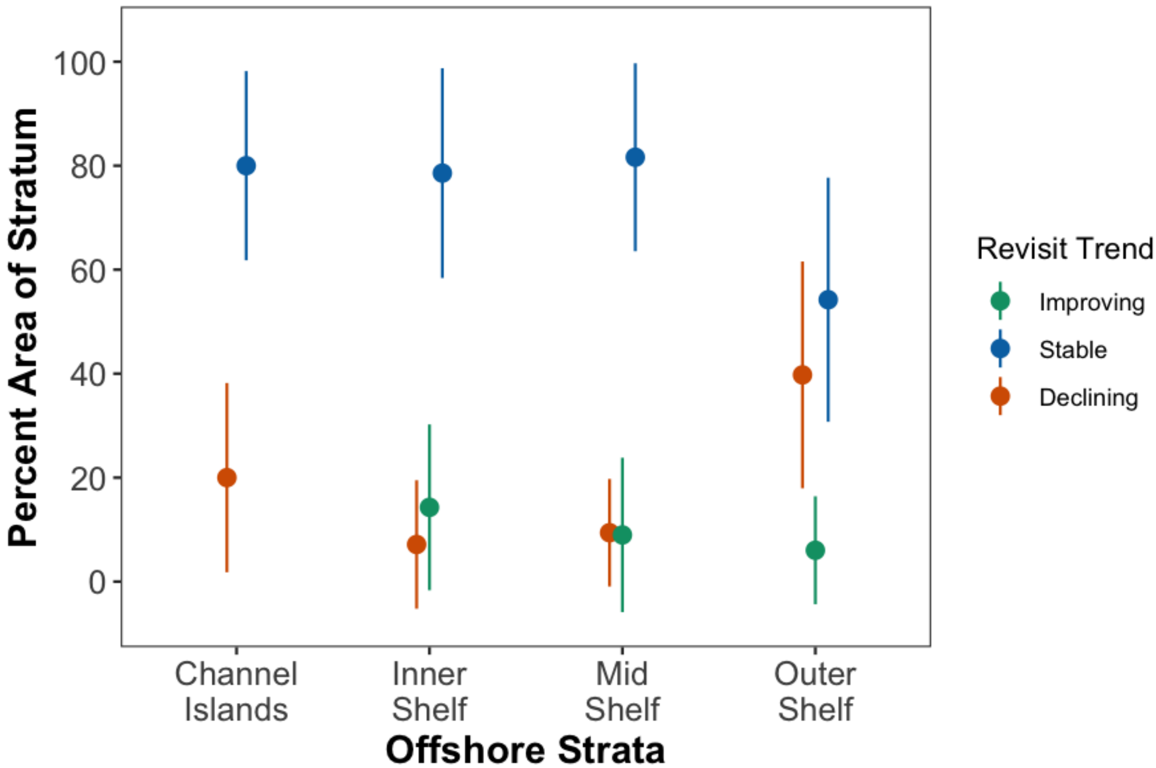

Figure 23. Percent area estimates (w/ 95% confidence intervals) of the four offshore strata with an improving, stable, or declining trend in condition score derived from revisited sites sampled from 1998 to 2018. The dots depict the estimate and the whiskers depict the local neighborhood-based confidence intervals.

Among the embayment strata, the Estuaries stratum was the only strata that had no area that showed an improving trend in condition scores (0%), with the majority of the area showing a stable trend (90.2%) and a relatively small area showing a declining trend (9.8%) in condition scores (Figure 24). The Bays, Marinas, and Ports strata had relatively similar trends in condition, showing similar amounts of stable (44-61%), improving (22-42%), and declining (12-20%) condition scores. A number of the increasing trends in condition score within the embayment strata represented a change from poor to good condition (Appendix G). Similarly, some of the declining trends represented a change from good to poor condition. Full details of the temporal trend areal extent estimates using the revisit sites can be found in Appendix F3.

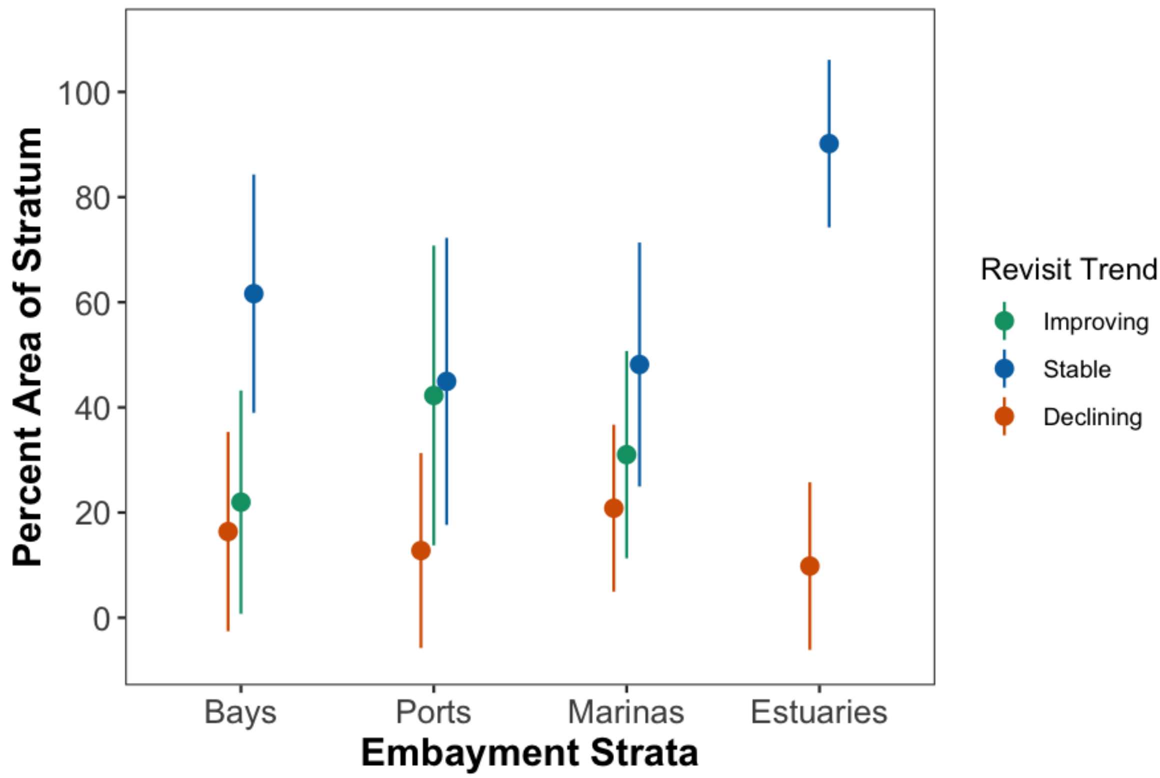

Figure 24. Percent area estimates (w/ 95% confidence intervals) of the four embayment strata with an improving, stable, or declining trend in condition score derived from revisited sites sampled from 1998 to 2018. The dots depict the estimate and the whiskers depict the local neighborhood-based confidence intervals.

Among the revisit stations within the four shelf strata, the condition category of 5 stations improved from Low Disturbance in 2013 to Reference in 2018 (Table 14). Conversely, the condition category of one Mid Shelf site declined from Reference to Low Disturbance. In the Bays stratum, 1 site improved from Moderate Disturbance to Low Disturbance between 2013 and 2018, while 5 sites declined from Low to Moderate disturbance. Three sites from the Ports stratum declined from Reference to Low Disturbance, while further 5 sites that were in Reference or Low Disturbance declined into Moderate Disturbance condition. In the Marinas stratum, 2 sites that were in Low or Moderate disturbance condition in 2013 improved to Reference condition in 2018. Conversely, 2 Reference condition Marina sites declined into Low Disturbance condition, while 3 sites declined into High Disturbance condition from Moderate and Low Disturbance conditions in 2013. The Estuaries stratum had 2 sites improve from Moderate Disturbance in 2013 to Low Disturbance in 2018 and 2 sites from High Disturbance to Moderate Disturbance. One Estuaries site declined from Moderate Disturbance to High disturbance conditions in 2018.

Table 14. A comparison of condition categories among revisit sites in each stratum between Bight 2018 and Bight 2013. A cell highlighted in green indicates an improvement in condition category between 2013 and 2018. A cell highlighted in red indicates a decline in condition category between 2013 and 2018.

		2013 Condition Category			
Stratum	**2018 Condition Category**	Reference	Low Disturbance	Moderate Disturbance	High Disturbance
Inner Shelf	Reference	10	1	0	0
	Low Disturbance	0	4	0	0
	Moderate Disturbance	0	0	0	0
	High Disturbance	0	0	0	0
Mid Shelf	Reference	12	0	0	0
	Low Disturbance	1	1	0	0
	Moderate Disturbance	0	0	0	0
	High Disturbance	0	0	0	0
Outer Shelf	Reference	13	0	0	0
	Low Disturbance	0	2	0	0
	Moderate Disturbance	0	0	0	0
	High Disturbance	0	0	0	0
Channel Islands	Reference	11	4	0	0
	Low Disturbance	0	0	0	0
	Moderate Disturbance	0	0	0	0
	High Disturbance	0	0	0	0
Bays	Reference	3	0	0	0
	Low Disturbance	0	6	1	0
	Moderate Disturbance	0	5	0	0
	High Disturbance	0	0	0	0
Ports	Reference	0	0	0	0
	Low Disturbance	3	6	0	0
	Moderate Disturbance	1	4	1	0
	High Disturbance	0	0	0	0
Marinas	Reference	0	1	1	0
	Low Disturbance	2	4	0	0

	Moderate Disturbance	0	1	3	0
	High Disturbance	0	1	2	0
Estuaries	Reference	0	0	0	0
	Low Disturbance	0	1	2	0
	Moderate Disturbance	0	0	5	2
	High Disturbance	0	0	1	0

V. Discussion

Bight '18 represents the fifth full regional survey of the area's macrobenthic infauna. With this iteration of the Bight Program, we have been able to finally include condition assessments across the full extent of the region's coastal embayments by applying a newly modified and adopted benthic index that did not have the habitat restrictions of previous indices to a new lower salinity estuarine stratum. The probabilistic sampling design, with a subset of fixed-position revisit sites woven among new randomly selected sites, provided us with a powerful analytical framework to measure spatial extent and temporal changes in condition of the region and its different habitats. Multi-survey comparisons provided a stratum-level assessment that was easier to quickly communicate temporal patterns in habitat condition. Analysis of the revisit sites allowed for an assessment of habitat condition that minimizes spatial variability to focus on temporal trends in the region's waterbodies (Urquhart and Kincaid 1999). Furthermore, the high-quality taxonomic data generated by the survey, as well as abiotic data generated by the other components of the Bight Program, allowed for investigation of the underlying ecology of the region's benthic communities from 2018 and across the 20 years of the Bight Program. The patterns in these data are only touched upon in this report, but will be invaluable to scientists across the region beyond the scope of the 2018 survey and this report.

From the perspective of macrobenthic community composition, the assessable portions of the Southern California Bight continued to be doing well in 2018. More than 99% of the assessable portions of the region were in good condition (89.1 % reference condition + 10.1 % low disturbance condition) and less than 1% were in poor condition. However, conditions were not uniform across the region. As was observed in previous Bight surveys (Ranasinghe et al. 2007, Ranasinghe et al. 2012; Gillett et al. 2017), the benthic habitat of the offshore strata (Inner Shelf, Mid Shelf, Outer Shelf, and Channel Islands) was in better condition than that in the embayment strata (Estuaries, Marinas, Ports, and Bays). The offshore strata were largely all in reference condition, with a relatively small area in low disturbance condition. The exception to this general pattern was the Inner Shelf stratum, which had proportionally smaller amounts of reference condition habitat and more than 22% of area in low disturbance condition. In contrast to the offshore strata, the embayment strata were largely comprised of areas with low to moderate levels of disturbance and relatively small areas with reference conditions. Among the embayment strata, the Bays and Ports strata were in relatively better condition than the Marinas, Estuaries and Brackish Estuaries strata.

As a whole, the assessable portions of the Southern California Bight were in proportionally better condition in 2018 than in 2013. In 2013, there was a noticeable increase in the amount of area in Low Disturbance condition compared to previous surveys. As detailed in the Bight'13 Benthic Report, this pattern was reflective of changes in the condition of sites within the Channel Islands stratum (Gillett et al. 2017). However, conditions Bight-wide and within the Channel Islands stratum in 2018 more closely resemble those from Bight Surveys prior to 2013.

Detailed analysis of the Channel Islands stratum data from Bight '18 and previous surveys, as well as regional water quality and water chemistry data, suggest that the change in benthic community condition observed in 2013 may have been a combination of natural biological variation and increased influence of deep basin waters (colder, less oxygenated, and more acidic) within the stratum. It should be noted that sediment chemistry samples were not collected within the Channel Islands stratum in 2013 (Doddard et al. 2016). However, comparisons of 2018 measures to those of 2008 and 2003 indicated that there were no appreciable changes in the exposure of the benthic community to toxic chemicals. This would suggest that sediment toxics were not a likely cause of the changes in benthic community condition observed between surveys. Our initial forays into assessing the impact of non-toxin-based factors would support the idea that a more directed investigation of regional oceanographic and climate change variables in future Bight surveys could provide better insight into changes in macrobenthic community composition and condition in the offshore strata of the region.

One of the recommendations coming out of the Bight '13 Benthic Report was for the adoption of a condition assessment framework for low salinity estuarine habitats. Consequently, the 2018 survey represented the Bight Regional Monitoring Program's first attempts to assess the condition of these habitats and therefore the entirety of the region's estuaries and embayments across the salinity gradient. The Multivariate AZTI Benthic Index (M-AMBI) of Pelletier et al. (2018) modified for use in California's Sediment Quality Objectives (SQO) program (Gillett et al. 2019) allowed the macrobenthic communities from any embayment less than 27 PSU salinity to be assessed in a context compatible with other habitats in the Southern California Bight. The resultant data illustrated that these previously unsampled portions of the coast were, along with their saline estuary counterparts, the most degraded parts of the Southern California Bight. It is worth noting that the locations that comprised the Brackish Estuaries stratum were not discrete waterbodies, but instead a continuation of higher salinity estuaries. As such it is a reasonable expectation that, across the region, they would be in similar condition to the Estuaries stratum. Unsurprisingly (e.g., Attril 2002; Hampel et al. 2009; Bleich et al. 2011), the taxa that live in these lower salinity habitats were different than those from further along the estuarine gradient despite the similarity in condition (i.e., mostly degraded) between high and low salinity estuarine waters.

These habitats were populated by taxa more tolerant of lower salinities and fluctuations in salinity, including insect larvae and oligochaetes. It should be noted that many of these taxa are rather difficult to identify to species and therefore were poorly differentiated in the dataset (i.e., specimens often left at family or class designations). The condition assessment tools used in these environments are robust enough to handle this coarser taxonomy (see Gillett et al. 2019), but the lack of precision may prevent us from better understanding the underlying processes of these systems.

For the most part, the spatial pattern of condition that was observed in Bight '18 – poorer condition in the marinas, brackish, and saline estuaries moving towards better conditions in the offshore strata – was similar to observations from previous surveys (Ranasinghe et al. 2007; Ranasinghe et al. 2012, Gillett et al. 2017). The general pattern that emerges is that more enclosed waterbodies, which are also more intimately associated with anthropogenic activities, are in poorer condition than more open waterbodies further removed from anthropogenic activities, such as bays and the continental shelf. This pattern is not unique to Southern California and has been similarly observed in other systems (Holland et al. 2004; Llansó et al. 2015). Unfortunately, beyond the broad catch-all of "proximity to anthropogenic activities", we cannot confidently identify the reasons for any instances of disturbed benthic communities observed across the region. In embayments, the CA SQO framework was designed to assess the impact of toxic compounds in the sediment on the benthic fauna, but it was not intended to assess the impacts from eutrophication, poor water quality (e.g., low dissolved oxygen, salinity fluctuation), physical disturbance, or climate change. Much of the data produced by the Southern California Bight Monitoring Program could be used to begin identifying the pressures on the benthic fauna in different parts of the region. However, we lack a fully realized causal assessment framework (e.g., Norton et al. 2015) that can be applied in marine and estuarine settings (Newman et al. 2007; Davis and Kidd 2012). More detailed, site-specific studies are needed to identify the specific causes of impacted macrobenthic communities observed in Bight '18 and previous surveys.

The regional pattern in the extent of the four condition categories from 2018 rebounding back to levels from surveys prior to 2013 was mirrored in the trends among the revisited sites. Almost 78% of the region was in stable condition and 4.5% in improving condition. This region-wide pattern was echoed in most of the offshore strata, which have generally been in stable condition from 1998-2018. The Outer Shelf stratum was the one exception to the offshore pattern of stability; it had less area in stable condition (~54%) than the other offshore strata and had the largest area in declining condition (~40%). This is a pattern reminiscent of that at the Channel Islands stratum from Bight'13. As such, the trend may reflect some shift in oceanographic conditions at the shelf/slope boundary, similar to what may have happened at the Channel Islands. A consistent trend over four surveys would suggest that it was not biological noise or oscillation. However, as these trends were all within the reference or low disturbance categories, drastic action is not warranted. Given the pattern seen in the Channel Islands stratum in 2013, it is advisable to revisit these 2018 patterns with those from the Bight 2023 survey to validate or refute the declining trend observed in a sizeable portion of the Outer Shelf during this survey.

Within the embayments, the relative proportion of area with stable, increasing, or declining trends in condition from 1998-2018 was consistent among the strata. Most of the area of these strata were in stable condition, with relatively small and equivalent amounts of increasing or declining areas. However, given that nearly 78% of these strata were in moderate or high disturbance categories in 2018, a stable trend in condition indicates that disturbed areas have remained impacted over time. Furthermore, it would suggest that the types of disturbances impacting these waterbodies are either persistent legacy factors (e.g., sediment heavy metals or shoreline hardening) or frequently and consistently occurring factors (e.g., watershed eutrophication or physical disturbance). Development of a causal assessment program for diagnosing the nature of the disturbance(s) affecting sites within the region's embayments would help to inform management strategies to potentially intercede and change the condition at certain sites through time.

As has been noted in previous Bight Regional Monitoring reports, we can only assess the condition of approximately 36% of the 16,676 km^2 surveyed by the program. The macrobenthic-based assessment tools that have been validated for use in this region (BRI and SQO benthic indices) are limited by design or standard practice to waters 6 – 200m deep in continental shelf habitats and embayment waters with salinity greater than 27 PSU. These traditional limitations excluded continental slope habitats (too deep) and lower salinity embayments. Since the last Bight Survey, a new US version of the M-AMBI assessment tool has been calibrated and validated for use in all of California's estuaries and embayments. This assessment index was therefore used in assessing the condition of the new Brackish Estuaries stratum in the 2018 survey. However, we would suggest that in following the best practices associated with applying a bioassessment index to any new location (e.g., Gillett et al. 2019), it be validated in the embayments and estuaries of Southern California – possibly as part of the 2023 Bight Survey – to ensure consistent evaluation across the different strata of the Bight Program.

The continental slope provides a more challenging problem. Gillett et al. (2021) suggested that the BRI scores could be derived within habitats equivalent to the Upper Slope stratum, but that the thresholds used to categorize those scores into the different condition classes should be done carefully. Caution is needed as water depth is an important structuring element of benthic communities (Bergen et al. 2001; Gillett et al. 2021) and the effects of depth on BRI category threshold have not been calibrated nor validated at depths below 300m. Following Gillett et al. (2021), we demonstrated the applicability of the BRI to the Upper Slope stratum. We could conditionally illustrate that the stratum was mostly in Reference condition (~60%), but that it had greater amounts of Low and Moderate disturbance than the adjacent Outer Shelf stratum. Moreover, the pattern in index scores was significantly related to the amount of toxic chemicals in the sediment, which further indicates the index was performing as intended. Though imperfect in this specific application, the patterns on the Upper Slope and our inability to provide any insight into condition of the

Lower slope reinforce the notion that an assessment tool, calibrated and validated for application on the continental slope habitats of the region, is a pressing need if we are to fully understand the condition of the Southern California Bight.

As has been observed in previous Bight Surveys (e.g., Gillett et al. 2017), the benthic communities of the region fell into three relatively distinct assemblages we have termed embayment, offshore, and deepwater. Within those assemblages the fauna from the different sampling strata were separated from each other along environmental gradients of depth, sediment composition, and salinity. As noted above, the fauna from the new Brackish Estuaries stratum fell within the embayments assemblage but were relatively distinct from the other embayment strata. Other studies separate from the Bight Program (Gillett et al. in review; Walker et al. in prep), have identified that the composition of the macrobenthic communities of the Southern California Bight has been slowly changing across the breadth of the Bight Surveys since 1998. As an illustration, the most frequently observed, and often most abundant, species in most of the embayment strata (excluding Brackish Estuaries) in 2018 was the invasive mussel *M. senhousia*. This bivalve has been observed in the embayments of the region in previous surveys but not to the degree it was in 2018. The mussel is known to form dense mats on soft sediments and has been observed to have boom-bust pulses of recruitment (Crooks 1996; Creese et al. 1997) potentially due to fluctuations in favorable environmental conditions. Less dramatic, though still indicative of slow, unidirectional changes in community composition, the macrobenthic communities of the continental shelf strata have been increasing in taxonomic and autecological diversity. Communities are still dominated by deposit/interface-feeding amphiurid ophiuroids and spionid polychaetes, but the relative abundance of other species of polychaetes (e.g., cirratulids, lumbrinerids, maldanids) that occupy different ecological niches is detectable across surveys (Walker in prep). Though not directly related to understanding the health of the region's waters, the benthic ecology data produced by the Bight Program is key to understanding the progression of the region's biological resources (e.g., Tomašových and Kidwell 2017; Leonard-Pingel et al. 2019; Gillett et al. 2021; Simons et al. in press).

VI. CONCLUSIONS

1. **Macrobenthic community composition indicates the Southern California Bight was largely in good condition during 2018**

   Approximately 99% of the assessable portions of the region (i.e., continental shelf and embayment soft bottom habitat) were in good condition (89% reference and 10% low disturbance) and less than 1% in poor condition (moderate or high disturbance).

2. **Not all habitats were in equally good condition**

   The offshore strata were predominantly in reference condition, with some low disturbance areas. The embayment strata, in contrast, were composed of predominantly low and moderate disturbance areas with small amounts of reference and highly disturbed areas. Of the embayment strata, Estuaries and Brackish Estuaries – the more enclosed strata associated with human activity – were in notably poor condition, with more than 75% of their area in moderate-to-highly disturbed condition.

3. **Most of the region was in stable condition**

   The trend in habitat condition from 1998-2018 was relatively stable at both the regional (~80%) and stratum-scale (60-80%). Among the offshore strata, that stability represents habitat that has been consistently in Reference condition. However, in much of the embayment strata the stability represents habitat that has consistently been in non-reference condition and predominantly in the Moderate or High disturbance categories.

4. **Conditions within the Channel Islands stratum have improved since 2013**

   A notable finding of the 2013 Bight Survey was a decline in the condition of four sites from Reference to Low Disturbance condition. The assessment of 2018 data indicate that all of the sites within the stratum were in Reference condition, similar to what had been observed in Bight Surveys prior to 2013. Analysis of the biotic and abiotic data indicate that the declines of 2013 were real, both quantitatively and ecologically. The data suggest that the changes observed in 2013 were likely a reflection of biological variation combined with localized changes in oceanographic factors (e.g., dissolved oxygen and ocean acidification), but not with any increased exposure to toxins measured before or after 2013.

VII. RECOMMENDATIONS

1. Develop condition assessment framework for deepwater habitats

The Bight Monitoring Program collects and characterizes macrobenthic infauna across the region, from nearly 1000m deep to the shallow coastal lagoons. However, the area for which there are calibrated and validated macrobenthic-based assessment tools only comprises 37% of the total area that is sampled. The largest areas where condition cannot be assessed are the deepwater (i.e., > 200 m deep) habitats of the continental slope. Within this report, we experimentally applied the BRI tool to the Upper Slope stratum (200-500 m). The index has not been calibrated for these depths – so discretion should be used in interpreting the results – but the results suggest that the Upper Slope had a greater amount of non-reference condition area than adjacent continental shelf strata. Given this result and the large area the slope habitats represent, it is apparent that an assessment framework purpose built for the deeper waters of the continental slope needs to be developed. Bight'18 marks the fourth survey where macrobenthic and environmental data have been intensively collected from the deepwater habitats. These are the ideal data to be used in developing an assessment framework for these areas that would finally allow us to truly provide estimates of the condition of the region's coastal ocean versus the caveated results we presently produce.

2. Continue sampling low salinity estuaries in future surveys

The creation of the Brackish Estuaries stratum was the Bight Program's first targeted effort to sample and assess the low salinity habitats of coastal embayments. Our ability to assess these benthic communities was facilitated by the adoption of the M-AMBI assessment tool for California's estuaries and embayments (as recommend in Bight '13). The fauna from these communities were generally different from those of higher salinity embayments, with an increase in the importance of oligochaetes, insect larvae, and other meso- and oligohaline taxa. Condition assessment scores calculated from these fauna indicated that these habitats were in relatively poor condition, with most of the area in moderate or highly disturbed condition. Given the pervasiveness and degree of disturbance in these systems, we recommend a continued focus on sampling low salinity habitats in future Bight surveys. Furthermore, given the taxonomic challenges presented by the fauna from these habitats, it would be recommended to modify the taxonomic standards (e.g., working with freshwater and estuarine taxonomists) and methods (application of DNA methods) to allow for more precise identification of the benthos in the future.

3. Develop a causal assessment framework for different Southern California Bight habitats

We have statistically rigorous bioassessment frameworks for evaluating the condition of embayment and continental shelf habitats. However, when severely impacted conditions are detected (e.g., embayment strata), or departures from reference conditions over time are observed, the Bight Regional Monitoring Program is not designed to determine the cause(s) of the alterations to community composition. However, Bight data combined with that from other more localized and frequent monitoring programs (e.g., POTWs, WQIPs, estuarine MPA), could provide a reasonable platform upon which a causal assessment framework could be built. Developing a causal assessment framework will assist ecosystem managers in understanding why sites are in poor condition so they can take appropriate action. At a minimum, the causal assessment framework should be able to distinguish between oceanic-scale (e.g., ENSO-PDO, climate change, ocean acidification) and local-scale (e.g., eutrophication, contaminants, physical disturbance) impacts.

4. More fully incorporate climate and oceanographic change measures into the sediment quality components of future Bight surveys

The Bight Program has traditionally been centered around assessing the condition of the region's soft sediment habitats, with an emphasis on the effects of toxic chemicals and, to a lesser degree, eutrophication. Historically this made sense, as chemicals and excess nutrients have been important drivers of the health of the region's benthic and demersal biotic resources. However, with improvements in managing local anthropogenic discharges and land use, these types of drivers have become less important to the biota – especially in the offshore environment. Instead, changes in oceanographic circulation, water temperature, acidification, and dissolved oxygen appear to be impacting the biota, as illustrated by the decline in benthic community condition at the Channel Islands observed in Bight'13. Characterizing these aspects of regional water quality and composition have been included in recent Bight Programs, but they have tended to be collected spatially and temporally asynchronous to the benthic and demersal biological measurements. This disconnect makes it difficult to accurately interpret patterns of benthic community change and condition. We would recommend that a priori considerations are made in the design of future Bight surveys to better incorporate water quality and oceanographic elements of the program with the sediment quality elements to provide a more wholistic interpretation of patterns in condition of the region.

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APPENDIX A – ENCOUNTERED TAXA LIST

Appendix A1. Macrobenthic community summary for the Estuaries stratum in the Bight'18 survey. Total abundance from all samples, relative abundance across the stratum, and the frequency of occurrence within a stratum are presented. Taxa are ranked by total abundance.

Taxon	Phylum	Class	Family	Total Abundance	Relative Abundance (%)	Frequency of Occurrence (%)
Musculista senhousia	Mollusca	Bivalvia	Mytilidae	1,417	7.41	80.00
Oligochaeta	Annelida	Oligochaeta		1,396	7.30	60.00
Exogone lourei	Annelida	Polychaeta	Syllidae	1,052	5.50	31.11
Acteocina carinata	Mollusca	Gastropoda	Cylichnidae	871	4.55	55.56
Pseudopolydora paucibranchiata	Annelida	Polychaeta	Spionidae	809	4.23	40.00
Crucibulum spinosum	Mollusca	Gastropoda	Calyptraeidae	808	4.22	11.11
Grandidierella japonica	Arthropoda	Malacostraca	Aoridae	736	3.85	57.78
Nereididae	Annelida	Polychaeta	Nereididae	721	3.77	4.44
Streblospio benedicti	Annelida	Polychaeta	Spionidae	529	2.77	28.89
Fabricinuda limnicola	Annelida	Polychaeta	Fabriciidae	422	2.21	17.78
Tryonia imitator	Mollusca	Gastropoda	Hydrobiidae	404	2.11	8.89
Mediomastus sp	Annelida	Polychaeta	Capitellidae	403	2.11	33.33
Phoronis sp	Phoronida		Phoronidae	392	2.05	42.22
Zeuxo normani Cmplx	Arthropoda	Malacostraca	Tanaididae	343	1.79	24.44
Actiniaria	Cnidaria	Anthozoa		319	1.67	33.33
Theora lubrica	Mollusca	Bivalvia	Semelidae	313	1.64	28.89
Neanthes acuminata Cmplx	Annelida	Polychaeta	Nereididae	310	1.62	57.78
Exogone sp A	Annelida	Polychaeta	Syllidae	295	1.54	17.78
Paracerceis sculpta	Arthropoda	Malacostraca	Sphaeromatidae	289	1.51	26.67
Monocorophium insidiosum	Arthropoda	Malacostraca	Corophiidae	287	1.50	20.00

Calyptraeidae	Mollusca	Gastropoda	Calyptraeidae	272	1.42	13.33
Phoronidae	Phoronida		Phoronidae	267	1.40	17.78
Monocorophium acherusicum	Arthropoda	Malacostraca	Corophiidae	259	1.35	17.78
Polydora cornuta	Annelida	Polychaeta	Spionidae	245	1.28	15.56
Capitella capitata Cmplx	Annelida	Polychaeta	Capitellidae	212	1.11	33.33
Tagelus affinis	Mollusca	Bivalvia	Solecurtidae	210	1.10	42.22
Actiniaria sp 1	Cnidaria	Anthozoa		209	1.09	8.89
Laevicardium substriatum	Mollusca	Bivalvia	Cardiidae	199	1.04	44.44
Cerithidea californica	Mollusca	Gastropoda	Potamididae	199	1.04	11.11
Scoletoma sp C	Annelida	Polychaeta	Lumbrineridae	194	1.01	22.22
Chondrochelia dubia Cmplx	Arthropoda	Malacostraca	Leptocheliidae	192	1.00	22.22
Tellina cadieni	Mollusca	Bivalvia	Tellinidae	181	0.95	28.89
Scoloplos acmeceps	Annelida	Polychaeta	Orbiniidae	178	0.93	22.22
Euchone limnicola	Annelida	Polychaeta	Sabellidae	174	0.91	11.11
Armandia brevis	Annelida	Polychaeta	Opheliidae	173	0.90	24.44
Leitoscoloplos pugettensis	Annelida	Polychaeta	Orbiniidae	161	0.84	35.56
Barleeia subtenuis	Mollusca	Gastropoda	Barleeiidae	145	0.76	8.89
Scyphoproctus oculatus	Annelida	Polychaeta	Capitellidae	142	0.74	8.89
Amphipholis squamata	Echinodermata	Ophiuroidea	Amphiuridae	141	0.74	17.78
Cirriformia sp	Annelida	Polychaeta	Cirratulidae	114	0.60	17.78
Monocorophium sp	Arthropoda	Malacostraca	Corophiidae	112	0.59	15.56
Dorvillea (*Schistomeringos*) *annulata*	Annelida	Polychaeta	Dorvilleidae	107	0.56	8.89
Mayerella acanthopoda	Arthropoda	Malacostraca	Caprellidae	100	0.52	15.56
Megasyllis nipponica	Annelida	Polychaeta	Syllidae	99	0.52	6.67
Nassarius tiarula	Mollusca	Gastropoda	Nassariidae	92	0.48	22.22
Acteocina inculta	Mollusca	Gastropoda	Cylichnidae	82	0.43	15.56
Caecum californicum	Mollusca	Gastropoda	Caecidae	79	0.41	13.33
Polydora nuchalis	Annelida	Polychaeta	Spionidae	79	0.41	4.44

Barleeia haliotiphila	Mollusca	Gastropoda	Barleeiidae	78	0.41	17.78
Podocerus fulanus	Arthropoda	Malacostraca	Podoceridae	76	0.40	31.11
Paracerceis sp A	Arthropoda	Malacostraca	Sphaeromatidae	72	0.38	6.67
Elasmopus bampo	Arthropoda	Malacostraca	Maeridae	70	0.37	11.11
Acromegalomma pigmentum	Annelida	Polychaeta	Sabellidae	67	0.35	24.44
Scoletoma sp	Annelida	Polychaeta	Lumbrineridae	67	0.35	15.56
Pista brevibranchiata	Annelida	Polychaeta	Terebellidae	64	0.33	15.56
Prionospio heterobranchia	Annelida	Polychaeta	Spionidae	62	0.32	24.44
Lyonsia californica	Mollusca	Bivalvia	Lyonsiidae	60	0.31	22.22
Protohyale frequens	Arthropoda	Malacostraca	Hyalidae	60	0.31	6.67
Venerupis philippinarum	Mollusca	Bivalvia	Veneridae	55	0.29	15.56
Naineris sp	Annelida	Polychaeta	Orbiniidae	54	0.28	8.89
Spionidae	Annelida	Polychaeta	Spionidae	51	0.27	4.44
Euphilomedes carcharodonta	Arthropoda	Ostracoda	Philomedidae	49	0.26	17.78
Bulla gouldiana	Mollusca	Gastropoda	Bullidae	46	0.24	20.00
Tellina meropsis	Mollusca	Bivalvia	Tellinidae	37	0.19	13.33
Scolelepis (Parascolelepis) texana	Annelida	Polychaeta	Spionidae	36	0.19	13.33
Maldanidae	Annelida	Polychaeta	Maldanidae	36	0.19	6.67
Astyris sp	Mollusca	Gastropoda	Columbellidae	35	0.18	4.44
Syllis gracilis Cmplx	Annelida	Polychaeta	Syllidae	35	0.18	4.44
Piromis capulata	Annelida	Polychaeta	Flabelligeridae	34	0.18	13.33
Oxyurostylis pacifica	Arthropoda	Malacostraca	Diastylidae	31	0.16	17.78
Paranthura japonica	Arthropoda	Malacostraca	Paranthuridae	30	0.16	15.56
Crepidula onyx	Mollusca	Gastropoda	Calyptraeidae	27	0.14	6.67
Amphiuridae	Echinodermata	Ophiuroidea	Amphiuridae	27	0.14	4.44
Astyris aurantiaca	Mollusca	Gastropoda	Columbellidae	27	0.14	4.44
Tagelus subteres	Mollusca	Bivalvia	Solecurtidae	26	0.14	6.67
Lineidae	Nemertea	Anopla	Lineidae	25	0.13	20.00

Paradexamine sp SD1	Arthropoda	Malacostraca	Dexaminidae	23	0.12	4.44
Marphysa sp	Annelida	Polychaeta	Eunicidae	22	0.12	11.11
Ampithoe valida	Arthropoda	Malacostraca	Ampithoidae	22	0.12	8.89
Eochelidium sp A	Arthropoda	Malacostraca	Oedicerotidae	22	0.12	4.44
Pseudatherospio fauchaldi	Annelida	Polychaeta	Spionidae	22	0.12	2.22
Leptosynapta sp	Echinodermata	Holothuroidea	Synaptidae	21	0.11	15.56
Cossura sp	Annelida	Polychaeta	Cossuridae	20	0.10	11.11
Dorvillea (Schistomeringos) longicornis	Annelida	Polychaeta	Dorvilleidae	20	0.10	6.67
Caprella simia	Arthropoda	Malacostraca	Caprellidae	20	0.10	2.22
Octopus bimaculoides	Mollusca	Cephalopoda	Octopodidae	19	0.10	2.22
Scoletoma tetraura Cmplx	Annelida	Polychaeta	Lumbrineridae	18	0.09	8.89
Leucothoe alata	Arthropoda	Malacostraca	Leucothoidae	18	0.09	6.67
Diopatra ornata	Annelida	Polychaeta	Onuphidae	18	0.09	2.22
Haminoea vesicula	Mollusca	Gastropoda	Haminoeidae	16	0.08	13.33
Bemlos macromanus	Arthropoda	Malacostraca	Aoridae	16	0.08	4.44
Mactrotoma californica	Mollusca	Bivalvia	Mactridae	15	0.08	8.89
Leukoma laciniata	Mollusca	Bivalvia	Veneridae	15	0.08	6.67
Pseudopolydora sp	Annelida	Polychaeta	Spionidae	15	0.08	2.22
Paranemertes californica	Nemertea	Enopla	Emplectonematidae	14	0.07	22.22
Diplocirrus sp SD1	Annelida	Polychaeta	Flabelligeridae	14	0.07	8.89
Lumbrineridae	Annelida	Polychaeta	Lumbrineridae	14	0.07	2.22
Naineris quadricuspida	Annelida	Polychaeta	Orbiniidae	14	0.07	2.22
Sphenia fragilis	Mollusca	Bivalvia	Myidae	14	0.07	2.22
Spiophanes duplex	Annelida	Polychaeta	Spionidae	13	0.07	6.67
Tagelus sp	Mollusca	Bivalvia	Solecurtidae	13	0.07	2.22
Rudilemboides stenopropodus	Arthropoda	Malacostraca	Unciolidae	12	0.06	17.78
Ophiactis simplex	Echinodermata	Ophiuroidea	Ophiactidae	12	0.06	4.44
Aphelochaeta sp	Annelida	Polychaeta	Cirratulidae	12	0.06	2.22

Maculaura alaskensis Cmplx	Nemertea	Anopla	Lineidae	12	0.06	2.22
Ampithoe sp	Arthropoda	Malacostraca	Ampithoidae	11	0.06	6.67
Ericthonius brasiliensis	Arthropoda	Malacostraca	Ischyroceridae	11	0.06	6.67
Prionospio lighti	Annelida	Polychaeta	Spionidae	11	0.06	4.44
Cossura sp A	Annelida	Polychaeta	Cossuridae	10	0.05	8.89
Tubulanus polymorphus	Nemertea	Anopla	Tubulanidae	10	0.05	8.89
Marphysa sp B	Annelida	Polychaeta	Eunicidae	10	0.05	6.67
Eunicidae	Annelida	Polychaeta	Eunicidae	10	0.05	4.44
Styela truncata	Chordata	Ascidiacea	Styelidae	10	0.05	4.44
Chione californiensis	Mollusca	Bivalvia	Veneridae	9	0.05	8.89
Cirratulidae	Annelida	Polychaeta	Cirratulidae	9	0.05	8.89
Lamispina schmidtii	Annelida	Polychaeta	Flabelligeridae	9	0.05	8.89
Boccardiella hamata	Annelida	Polychaeta	Spionidae	9	0.05	6.67
Asthenothaerus diegensis	Mollusca	Bivalvia	Thraciidae	8	0.04	11.11
Anemonactis sp A	Cnidaria	Anthozoa	Haloclavidae	8	0.04	6.67
Polycirrus sp	Annelida	Polychaeta	Terebellidae	8	0.04	4.44
Sabellidae	Annelida	Polychaeta	Sabellidae	8	0.04	4.44
Ampithoe longimana	Arthropoda	Malacostraca	Ampithoidae	8	0.04	2.22
Parasabella sp	Annelida	Polychaeta	Sabellidae	8	0.04	2.22
Scleroplax granulata	Arthropoda	Malacostraca	Pinnotheridae	8	0.04	2.22
Sphaerosyllis californiensis	Annelida	Polychaeta	Syllidae	8	0.04	2.22
Glycera americana	Annelida	Polychaeta	Glyceridae	7	0.04	11.11
Mytilidae	Mollusca	Bivalvia	Mytilidae	7	0.04	11.11
Nephtys caecoides	Annelida	Polychaeta	Nephtyidae	7	0.04	11.11
Veneridae	Mollusca	Bivalvia	Veneridae	7	0.04	8.89
Leukoma sp	Mollusca	Bivalvia	Veneridae	7	0.04	4.44
Paracerceis sp	Arthropoda	Malacostraca	Sphaeromatidae	7	0.04	4.44
Protohyale canalina	Arthropoda	Malacostraca	Hyalidae	7	0.04	4.44

Notomastus sp	Annelida	Polychaeta	Capitellidae	6	0.03	6.67
Amphideutopus oculatus	Arthropoda	Malacostraca	Kamakidae	6	0.03	4.44
Caprella sp	Arthropoda	Malacostraca	Caprellidae	6	0.03	4.44
Hartmanodes hartmanae	Arthropoda	Malacostraca	Oedicerotidae	6	0.03	4.44
Marphysa angelensis	Annelida	Polychaeta	Eunicidae	6	0.03	4.44
Salvatoria sp	Annelida	Polychaeta	Syllidae	6	0.03	4.44
Prionospio sp	Annelida	Polychaeta	Spionidae	6	0.03	2.22
Odontosyllis phosphorea	Annelida		Syllidae	5	0.03	8.89
Diopatra sp	Annelida	Polychaeta	Onuphidae	5	0.03	6.67
Heteronemertea	Nemertea	Anopla		5	0.03	6.67
Farfantepenaeus californiensis	Arthropoda	Malacostraca	Penaeidae	5	0.03	4.44
Phtisica marina	Arthropoda	Malacostraca	Caprellidae	5	0.03	4.44
Donax californicus	Mollusca	Bivalvia	Donacidae	5	0.03	2.22
Molgula ficus	Chordata	Ascidiacea	Molgulidae	5	0.03	2.22
Streblosoma uncinatus	Annelida	Polychaeta	Terebellidae	5	0.03	2.22
Tellina modesta	Mollusca	Bivalvia	Tellinidae	5	0.03	2.22
Anoplodactylus erectus	Arthropoda	Pycnogonida	Phoxichilidiidae	4	0.02	8.89
Edwardsiidae	Cnidaria	Anthozoa	Edwardsiidae	4	0.02	6.67
Ambidexter panamensis	Arthropoda	Malacostraca	Processidae	4	0.02	4.44
Amphipoda	Arthropoda	Malacostraca		4	0.02	4.44
Caulleriella pacifica	Annelida	Polychaeta	Cirratulidae	4	0.02	4.44
Hippolyte californiensis	Arthropoda	Malacostraca	Hippolytidae	4	0.02	4.44
Mysidopsis californica	Arthropoda	Malacostraca	Mysidae	4	0.02	4.44
Philine ornatissima	Mollusca	Gastropoda	Philinidae	4	0.02	4.44
Pyramidellidae	Mollusca	Gastropoda	Pyramidellidae	4	0.02	4.44
Branchiosyllis exilis Cmplx	Annelida	Polychaeta	Syllidae	4	0.02	2.22
Oxydromus pugettensis	Annelida	Polychaeta	Hesionidae	4	0.02	2.22
Paraprionospio alata	Annelida	Polychaeta	Spionidae	4	0.02	2.22

Tethygeneia opata	Arthropoda	Malacostraca	Eusiridae	4	0.02	2.22
Macoma yoldiformis	Mollusca	Bivalvia	Tellinidae	3	0.02	6.67
Tubulanidae	Nemertea	Anopla	Tubulanidae	3	0.02	6.67
Alpheus californiensis	Arthropoda	Malacostraca	Alpheidae	3	0.02	4.44
Alpheus sp	Arthropoda	Malacostraca	Alpheidae	3	0.02	4.44
Bemlos sp	Arthropoda	Malacostraca	Aoridae	3	0.02	4.44
Bivalvia	Mollusca	Bivalvia		3	0.02	4.44
Capitellidae	Annelida	Polychaeta	Capitellidae	3	0.02	4.44
Eteone brigitteae	Annelida	Polychaeta	Phyllodocidae	3	0.02	4.44
Pitar newcombianus	Mollusca	Bivalvia	Veneridae	3	0.02	4.44
Schmittius politus	Arthropoda	Malacostraca	Squillidae	3	0.02	4.44
Zygonemertes virescens	Nemertea	Enopla	Amphiporidae	3	0.02	4.44
Amphiodia urtica	Echinodermata	Ophiuroidea	Amphiuridae	3	0.02	2.22
Kirkegaardia siblina	Annelida	Polychaeta	Cirratulidae	3	0.02	2.22
Mediomastus sp 6	Annelida	Polychaeta	Capitellidae	3	0.02	2.22
Monocorophium uenoi	Arthropoda	Malacostraca	Corophiidae	3	0.02	2.22
Neotrypaea sp	Arthropoda	Malacostraca	Callianassidae	3	0.02	2.22
Polydora cirrosa	Annelida	Polychaeta	Spionidae	3	0.02	2.22
Pontogeneia rostrata	Arthropoda	Malacostraca	Eusiridae	3	0.02	2.22
Sinocorophium heteroceratum	Arthropoda	Malacostraca	Corophiidae	3	0.02	2.22
Spio maculata	Annelida	Polychaeta	Spionidae	3	0.02	2.22
Amphilochidae	Arthropoda	Malacostraca	Amphilochidae	2	0.01	4.44
Euclymeninae sp A	Annelida	Polychaeta	Maldanidae	2	0.01	4.44
Gastropoda	Mollusca	Gastropoda		2	0.01	4.44
Majoidea	Arthropoda	Malacostraca		2	0.01	4.44
Panopeidae	Arthropoda	Malacostraca	Panopeidae	2	0.01	4.44
Photis brevipes	Arthropoda	Malacostraca	Photidae	2	0.01	4.44
Platynereis bicanaliculata	Annelida	Polychaeta	Nereididae	2	0.01	4.44

Psammotreta obesa	Mollusca	Bivalvia	Tellinidae	2	0.01	4.44
Acromegalomma sp	Annelida	Polychaeta	Sabellidae	2	0.01	2.22
Cerebratulus marginatus	Nemertea	Anopla	Lineidae	2	0.01	2.22
Cerebratulus sp	Nemertea	Anopla	Lineidae	2	0.01	2.22
Colomastix sp A	Arthropoda	Malacostraca	Colomastigidae	2	0.01	2.22
Cryptomya californica	Mollusca	Bivalvia	Myidae	2	0.01	2.22
Dipolydora socialis	Annelida	Polychaeta	Spionidae	2	0.01	2.22
Dorvilleidae	Annelida	Polychaeta	Dorvilleidae	2	0.01	2.22
Harpacticoida	Arthropoda	Maxillopoda		2	0.01	2.22
Malacoplax californiensis	Arthropoda	Malacostraca	Panopeidae	2	0.01	2.22
Malmgreniella macginitiei	Annelida	Polychaeta	Polynoidae	2	0.01	2.22
Microspio microcera	Annelida	Polychaeta	Spionidae	2	0.01	2.22
Nemertea	Nemertea			2	0.01	2.22
Paradialychone ecaudata	Annelida	Polychaeta	Sabellidae	2	0.01	2.22
Petricola californiensis	Mollusca	Bivalvia	Petricolidae	2	0.01	2.22
Petricola sp	Mollusca	Bivalvia	Petricolidae	2	0.01	2.22
Philine bakeri	Mollusca	Gastropoda	Philinidae	2	0.01	2.22
Polyophthalmus pictus	Annelida	Polychaeta	Opheliidae	2	0.01	2.22
Serpulidae	Annelida	Polychaeta	Serpulidae	2	0.01	2.22
Sphaerosyllis sp	Annelida	Polychaeta	Syllidae	2	0.01	2.22
Spio filicornis	Annelida	Polychaeta	Spionidae	2	0.01	2.22
Syllis heterochaeta	Annelida	Polychaeta	Syllidae	2	0.01	2.22
Acteocina harpa	Mollusca	Gastropoda	Cylichnidae	1	0.01	2.22
Alia sp	Mollusca	Gastropoda	Columbellidae	1	0.01	2.22
Amphicteis scaphobranchiata	Annelida	Polychaeta	Ampharetidae	1	0.01	2.22
Anopla	Nemertea	Anopla		1	0.01	2.22
Anthuridae	Arthropoda	Malacostraca	Anthuridae	1	0.01	2.22
Arabella iricolor Cmplx	Annelida	Polychaeta	Oenonidae	1	0.01	2.22

Argopecten ventricosus	Mollusca	Bivalvia	Pectinidae	1	0.01	2.22
Baseodiscus delineatus	Nemertea	Anopla	Valenciniidae	1	0.01	2.22
Caecum occidentale	Mollusca	Gastropoda	Caecidae	1	0.01	2.22
Californiconus californicus	Mollusca	Gastropoda	Conidae	1	0.01	2.22
Calyptraea fastigiata	Mollusca	Gastropoda	Calyptraeidae	1	0.01	2.22
Caprellidae	Arthropoda	Malacostraca	Caprellidae	1	0.01	2.22
Cerithiopsis carpenteri	Mollusca	Gastropoda	Cerithiopsidae	1	0.01	2.22
Chaetozone corona	Annelida	Polychaeta	Cirratulidae	1	0.01	2.22
Chironomini	Arthropoda	Insecta	Chironomidae	1	0.01	2.22
Cirratulus sp	Annelida	Polychaeta	Cirratulidae	1	0.01	2.22
Cooperella subdiaphana	Mollusca	Bivalvia	Petricolidae	1	0.01	2.22
Corymorpha sp	Cnidaria	Hydrozoa	Corymorphidae	1	0.01	2.22
Cossura candida	Annelida	Polychaeta	Cossuridae	1	0.01	2.22
Crepipatella lingulata	Mollusca	Gastropoda	Calyptraeidae	1	0.01	2.22
Cylindroleberididae	Arthropoda	Ostracoda	Cylindroleberididae	1	0.01	2.22
Diopatra splendidissima	Annelida	Polychaeta	Onuphidae	1	0.01	2.22
Diplandros singularis	Platyhelminthes	Turbellaria	Notocirridae	1	0.01	2.22
Dipolydora sp	Annelida	Polychaeta	Spionidae	1	0.01	2.22
Diptera	Arthropoda			1	0.01	2.22
Dorvillea sp	Annelida	Polychaeta	Dorvilleidae	1	0.01	2.22
Edotia sublittoralis	Arthropoda	Malacostraca	Idoteidae	1	0.01	2.22
Eteone dilatae	Annelida	Polychaeta	Phyllodocidae	1	0.01	2.22
Exogone sp	Annelida	Polychaeta	Syllidae	1	0.01	2.22
Goniada littorea	Annelida	Polychaeta	Goniadidae	1	0.01	2.22
Halosydna johnsoni	Annelida	Polychaeta	Polynoidae	1	0.01	2.22
Halosydna sp	Annelida	Polychaeta	Polynoidae	1	0.01	2.22
Haminoea virescens	Mollusca	Gastropoda	Haminoeidae	1	0.01	2.22
Harmothoe fragilis	Annelida	Polychaeta	Polynoidae	1	0.01	2.22

Hemiproto sp A	Arthropoda	Malacostraca	Caprellidae	1	0.01	2.22
Heteromastus sp	Annelida	Polychaeta	Capitellidae	1	0.01	2.22
Ianiropsis analoga	Arthropoda	Malacostraca	Janiridae	1	0.01	2.22
Laomedea calceolifera	Cnidaria	Hydrozoa	Campanulariidae	1	0.01	2.22
Lasaea adansoni	Mollusca	Bivalvia	Lasaeidae	1	0.01	2.22
Leitoscoloplos sp	Annelida	Polychaeta	Orbiniidae	1	0.01	2.22
Leptoplanoidea	Platyhelminthes	Turbellaria		1	0.01	2.22
Lumbrineris sp E	Annelida	Polychaeta	Lumbrineridae	1	0.01	2.22
Macoma nasuta	Mollusca	Bivalvia	Tellinidae	1	0.01	2.22
Melanoides tuberculata	Mollusca	Gastropoda	Thiaridae	1	0.01	2.22
Murchisonella occidentalis	Mollusca	Gastropoda	Murchisonellidae	1	0.01	2.22
Mytilus galloprovincialis	Mollusca	Bivalvia	Mytilidae	1	0.01	2.22
Neotrypaea gigas	Arthropoda	Malacostraca	Callianassidae	1	0.01	2.22
Notomastus tenuis	Annelida	Polychaeta	Capitellidae	1	0.01	2.22
Notoplanidae	Platyhelminthes	Turbellaria	Notoplanidae	1	0.01	2.22
Nuculana taphria	Mollusca	Bivalvia	Nuculanidae	1	0.01	2.22
Ocinebrina circumtexta	Mollusca	Gastropoda	Muricidae	1	0.01	2.22
Oerstedia dorsalis Cmplx	Nemertea	Enopla	Prosorhochmidae	1	0.01	2.22
Ophryotrocha sp	Annelida	Polychaeta	Dorvilleidae	1	0.01	2.22
Owenia collaris	Annelida	Polychaeta	Oweniidae	1	0.01	2.22
Pectinaria californiensis	Annelida	Polychaeta	Pectinariidae	1	0.01	2.22
Penaeoidea	Arthropoda	Malacostraca		1	0.01	2.22
Petaloclymene pacifica	Annelida	Polychaeta	Maldanidae	1	0.01	2.22
Pholoe glabra	Annelida	Polychaeta	Pholoidae	1	0.01	2.22
Pinnixa franciscana	Arthropoda	Malacostraca	Pinnotheridae	1	0.01	2.22
Pista moorei	Annelida	Polychaeta	Terebellidae	1	0.01	2.22
Pista sp	Annelida	Polychaeta	Terebellidae	1	0.01	2.22
Pista wui	Annelida	Polychaeta	Terebellidae	1	0.01	2.22

Podocopa	Arthropoda	Ostracoda		1	0.01	2.22
Praxillella pacifica	Annelida	Polychaeta	Maldanidae	1	0.01	2.22
Protocirrineris sp	Annelida	Polychaeta	Cirratulidae	1	0.01	2.22
Pyramidella adamsi	Mollusca	Gastropoda	Pyramidellidae	1	0.01	2.22
Rhynchospio arenincola	Annelida	Polychaeta	Spionidae	1	0.01	2.22
Salvatoria californiensis	Annelida	Polychaeta	Syllidae	1	0.01	2.22
Salvatoria heterocirra	Annelida	Polychaeta	Syllidae	1	0.01	2.22
Saxidomus nuttalli	Mollusca	Bivalvia	Veneridae	1	0.01	2.22
Scoletoma erecta	Annelida	Polychaeta	Lumbrineridae	1	0.01	2.22
Siriella pacifica	Arthropoda	Malacostraca	Mysidae	1	0.01	2.22
Spiochaetopterus costarum Cmplx	Annelida	Polychaeta	Chaetopteridae	1	0.01	2.22
Spiophanes berkeleyorum	Annelida	Polychaeta	Spionidae	1	0.01	2.22
Streblosoma sp	Annelida	Polychaeta	Terebellidae	1	0.01	2.22
Syllis sp	Annelida	Polychaeta	Syllidae	1	0.01	2.22
Tanaidacea	Arthropoda	Malacostraca		1	0.01	2.22
Thelepus hamatus	Annelida	Polychaeta	Terebellidae	1	0.01	2.22
Tubulanidae sp B	Nemertea	Anopla	Tubulanidae	1	0.01	2.22
Turbonilla laminata	Mollusca	Gastropoda	Pyramidellidae	1	0.01	2.22
Uromunna ubiquita	Arthropoda	Malacostraca	Munnidae	1	0.01	2.22
Zygeupolia rubens	Nemertea	Anopla	Valenciniidae	1	0.01	2.22

Appendix A2. Macrobenthic community summary for the Marinas stratum in the Bight'18 survey. Total abundance from all samples, relative abundance across the stratum, and the frequency of occurrence within a stratum are presented. Taxa are ranked by total abundance.

Taxon	Phylum	Class	Family	Total Abundance	Relative Abundance (%)	Frequency of Occurrence (%)
Pseudopolydora paucibranchiata	Annelida	Polychaeta	Spionidae	3,708	20.67	68.18
Musculista senhousia	Mollusca	Bivalvia	Mytilidae	1,361	7.59	52.27
Leitoscoloplos pugettensis	Annelida	Polychaeta	Orbiniidae	1,283	7.15	90.91
Exogone lourei	Annelida	Polychaeta	Syllidae	1,165	6.50	56.82
Zeuxo normani Cmplx	Arthropoda	Malacostraca	Tanaididae	657	3.66	29.55
Oligochaeta	Annelida	Oligochaeta		655	3.65	38.64
Scoletoma sp C	Annelida	Polychaeta	Lumbrineridae	540	3.01	68.18
Grandidierella japonica	Arthropoda	Malacostraca	Aoridae	479	2.67	43.18
Cossura sp A	Annelida	Polychaeta	Cossuridae	446	2.49	47.73
Fabricinuda limnicola	Annelida	Polychaeta	Fabriciidae	401	2.24	20.45
Neotrypaea sp	Arthropoda	Malacostraca	Callianassidae	385	2.15	4.55
Mediomastus sp	Annelida	Polychaeta	Capitellidae	340	1.90	72.73
Scoletoma sp	Annelida	Polychaeta	Lumbrineridae	339	1.89	50.00
Heterophoxus cf *ellisi*	Arthropoda	Malacostraca	Phoxocephalidae	265	1.48	27.27
Amphideutopus oculatus	Arthropoda	Malacostraca	Kamakidae	260	1.45	40.91
Dorvillea (Schistomeringos) longicornis	Annelida	Polychaeta	Dorvilleidae	226	1.26	22.73
Mayerella acanthopoda	Arthropoda	Malacostraca	Caprellidae	225	1.25	45.45
Rudilemboides stenopropodus	Arthropoda	Malacostraca	Unciolidae	210	1.17	29.55
Acteocina carinata	Mollusca	Gastropoda	Cylichnidae	183	1.02	34.09
Phoronis sp	Phoronida		Phoronidae	173	0.96	38.64
Euclymeninae sp A	Annelida	Polychaeta	Maldanidae	165	0.92	25.00
Theora lubrica	Mollusca	Bivalvia	Semelidae	160	0.89	52.27

Diplocirrus sp SD1	Annelida	Polychaeta	Flabelligeridae	147	0.82	22.73
Phoronidae	Phoronida		Phoronidae	141	0.79	22.73
Prionospio heterobranchia	Annelida	Polychaeta	Spionidae	134	0.75	47.73
Amphipholis squamata	Echinodermata	Ophiuroidea	Amphiuridae	122	0.68	36.36
Euchone limnicola	Annelida	Polychaeta	Sabellidae	116	0.65	50.00
Eochelidium sp A	Arthropoda	Malacostraca	Oedicerotidae	113	0.63	34.09
Megasyllis nipponica	Annelida	Polychaeta	Syllidae	111	0.62	27.27
Caecum californicum	Mollusca	Gastropoda	Caecidae	111	0.62	6.82
Euphilomedes carcharodonta	Arthropoda	Ostracoda	Philomedidae	107	0.60	27.27
Capitella capitata Cmplx	Annelida	Polychaeta	Capitellidae	105	0.59	11.36
Sinocorophium alienense	Arthropoda	Malacostraca	Corophiidae	104	0.58	2.27
Lyonsia californica	Mollusca	Bivalvia	Lyonsiidae	103	0.57	43.18
Tagelus affinis	Mollusca	Bivalvia	Solecurtidae	92	0.51	47.73
Pista brevibranchiata	Annelida	Polychaeta	Terebellidae	90	0.50	18.18
Laevicardium substriatum	Mollusca	Bivalvia	Cardiidae	86	0.48	47.73
Caprella sp	Arthropoda	Malacostraca	Caprellidae	84	0.47	18.18
Phtisica marina	Arthropoda	Malacostraca	Caprellidae	78	0.43	18.18
Caprella simia	Arthropoda	Malacostraca	Caprellidae	74	0.41	9.09
Praxillella pacifica	Annelida	Polychaeta	Maldanidae	68	0.38	13.64
Chondrochelia dubia Cmplx	Arthropoda	Malacostraca	Leptocheliidae	66	0.37	22.73
Leptosynapta sp	Echinodermata	Holothuroidea	Synaptidae	63	0.35	20.45
Petaloclymene pacifica	Annelida	Polychaeta	Maldanidae	62	0.35	9.09
Aoridae	Arthropoda	Malacostraca	Aoridae	58	0.32	2.27
Neanthes acuminata Cmplx	Annelida	Polychaeta	Nereididae	51	0.28	20.45
Armandia brevis	Annelida	Polychaeta	Opheliidae	51	0.28	11.36
Monocorophium acherusicum	Arthropoda	Malacostraca	Corophiidae	49	0.27	22.73
Postasterope barnesi	Arthropoda	Ostracoda	Cylindroleberididae	44	0.25	11.36
Acromegalomma pigmentum	Annelida	Polychaeta	Sabellidae	43	0.24	15.91

Bipalponephtys cornuta	Annelida	Polychaeta	Nephtyidae	43	0.24	4.55
Haminoea vesicula	Mollusca	Gastropoda	Haminoeidae	42	0.23	34.09
Actiniaria sp 1	Cnidaria	Anthozoa		42	0.23	6.82
Spiophanes duplex	Annelida	Polychaeta	Spionidae	41	0.23	34.09
Tubulanus polymorphus	Nemertea	Anopla	Tubulanidae	41	0.23	27.27
Oxyurostylis pacifica	Arthropoda	Malacostraca	Diastylidae	38	0.21	13.64
Cirratulus dillonensis	Annelida	Polychaeta	Cirratulidae	35	0.20	2.27
Barleeia haliotiphila	Mollusca	Gastropoda	Barleeiidae	34	0.19	9.09
Scoletoma sp B	Annelida	Polychaeta	Lumbrineridae	32	0.18	20.45
Ericthonius brasiliensis	Arthropoda	Malacostraca	Ischyroceridae	32	0.18	2.27
Anoplodactylus erectus	Arthropoda	Pycnogonida	Phoxichilidiidae	31	0.17	25.00
Maldanidae	Annelida	Polychaeta	Maldanidae	31	0.17	25.00
Exogone sp	Annelida	Polychaeta	Syllidae	31	0.17	2.27
Harmothoe imbricata Cmplx	Annelida	Polychaeta	Polynoidae	29	0.16	13.64
Scolelepis (Parascolelepis) texana	Annelida	Polychaeta	Spionidae	29	0.16	11.36
Murchisonella occidentalis	Mollusca	Gastropoda	Murchisonellidae	29	0.16	6.82
Metasychis disparidentatus	Annelida	Polychaeta	Maldanidae	28	0.16	15.91
Spio maculata	Annelida	Polychaeta	Spionidae	28	0.16	2.27
Heteronemertea	Nemertea	Anopla		26	0.14	27.27
Acuminodeutopus heteruropus	Arthropoda	Malacostraca	Unciolidae	25	0.14	4.55
Asthenothaerus diegensis	Mollusca	Bivalvia	Thraciidae	23	0.13	25.00
Paranthura japonica	Arthropoda	Malacostraca	Paranthuridae	22	0.12	18.18
Cossura candida	Annelida	Polychaeta	Cossuridae	22	0.12	2.27
Prionospio lighti	Annelida	Polychaeta	Spionidae	21	0.12	22.73
Caprellidae	Arthropoda	Malacostraca	Caprellidae	21	0.12	2.27
Edwardsia californica	Cnidaria	Anthozoa	Edwardsiidae	20	0.11	15.91
Streblospio benedicti	Annelida	Polychaeta	Spionidae	20	0.11	4.55
Podocerus fulanus	Arthropoda	Malacostraca	Podoceridae	19	0.11	18.18

Tellina sp B	Mollusca	Bivalvia	Tellinidae	19	0.11	15.91
Solen rostriformis	Mollusca	Bivalvia	Solenidae	17	0.09	18.18
Lineidae	Nemertea	Anopla	Lineidae	17	0.09	15.91
Paranemertes californica	Nemertea	Enopla	Emplectonematidae	17	0.09	15.91
Cossura sp	Annelida	Polychaeta	Cossuridae	17	0.09	13.64
Kirkegaardia serratiseta	Annelida	Polychaeta	Cirratulidae	17	0.09	6.82
Glycera americana	Annelida	Polychaeta	Glyceridae	16	0.09	25.00
Neotrypaea gigas	Arthropoda	Malacostraca	Callianassidae	16	0.09	11.36
Hartmanodes hartmanae	Arthropoda	Malacostraca	Oedicerotidae	14	0.08	13.64
Bulla gouldiana	Mollusca	Gastropoda	Bullidae	14	0.08	11.36
Kurtiella coani	Mollusca	Bivalvia	Lasaeidae	14	0.08	4.55
Actiniaria	Cnidaria	Anthozoa		13	0.07	18.18
Mysidopsis californica	Arthropoda	Malacostraca	Mysidae	13	0.07	15.91
Mactrotoma californica	Mollusca	Bivalvia	Mactridae	13	0.07	13.64
Ampithoe lacertosa	Arthropoda	Malacostraca	Ampithoidae	13	0.07	2.27
Goniada littorea	Annelida	Polychaeta	Goniadidae	12	0.07	15.91
Nereididae	Annelida	Polychaeta	Nereididae	12	0.07	2.27
Notomastus sp	Annelida	Polychaeta	Capitellidae	12	0.07	2.27
Paracerceis sculpta	Arthropoda	Malacostraca	Sphaeromatidae	11	0.06	11.36
Scoletoma sp A	Annelida	Polychaeta	Lumbrineridae	11	0.06	11.36
Monocorophium sp	Arthropoda	Malacostraca	Corophiidae	11	0.06	9.09
Paramicrodeutopus schmitti	Arthropoda	Malacostraca	Aoridae	11	0.06	9.09
Tellina cadieni	Mollusca	Bivalvia	Tellinidae	11	0.06	6.82
Alpheus californiensis	Arthropoda	Malacostraca	Alpheidae	10	0.06	15.91
Nephtys caecoides	Annelida	Polychaeta	Nephtyidae	10	0.06	13.64
Philine auriformis	Mollusca	Gastropoda	Philinidae	10	0.06	13.64
Prionospio pygmaeus	Annelida	Polychaeta	Spionidae	10	0.06	6.82
Siriella pacifica	Arthropoda	Malacostraca	Mysidae	10	0.06	4.55

Crucibulum spinosum	Mollusca	Gastropoda	Calyptraeidae	10	0.06	2.27
Lottia depicta	Mollusca	Gastropoda	Lottiidae	10	0.06	2.27
Kirkegaardia cryptica	Annelida	Polychaeta	Cirratulidae	9	0.05	15.91
Paradexamine sp SD1	Arthropoda	Malacostraca	Dexaminidae	9	0.05	11.36
Caprella californica Cmplx	Arthropoda	Malacostraca	Caprellidae	9	0.05	6.82
Cirriformia sp	Annelida	Polychaeta	Cirratulidae	9	0.05	2.27
Paraprionospio alata	Annelida	Polychaeta	Spionidae	8	0.04	13.64
Eteone brigitteae	Annelida	Polychaeta	Phyllodocidae	8	0.04	11.36
Alpheus sp	Arthropoda	Malacostraca	Alpheidae	8	0.04	9.09
Cooperella subdiaphana	Mollusca	Bivalvia	Petricolidae	8	0.04	9.09
Cryptomya californica	Mollusca	Bivalvia	Myidae	8	0.04	9.09
Lamispina schmidtii	Annelida	Polychaeta	Flabelligeridae	8	0.04	6.82
Aphelochaeta glandaria Cmplx	Annelida	Polychaeta	Cirratulidae	8	0.04	2.27
Malacoplax californiensis	Arthropoda	Malacostraca	Panopeidae	7	0.04	11.36
Psammotreta obesa	Mollusca	Bivalvia	Tellinidae	7	0.04	11.36
Sphaeromatidae	Arthropoda	Malacostraca	Sphaeromatidae	7	0.04	11.36
Amphiuridae	Echinodermata	Ophiuroidea	Amphiuridae	7	0.04	9.09
Edwardsiidae	Cnidaria	Anthozoa	Edwardsiidae	7	0.04	6.82
Bemlos macromanus	Arthropoda	Malacostraca	Aoridae	7	0.04	4.55
Crepipatella lingulata	Mollusca	Gastropoda	Calyptraeidae	7	0.04	4.55
Mediomastus sp 6	Annelida	Polychaeta	Capitellidae	7	0.04	4.55
Pseudotanais makrothrix	Arthropoda	Malacostraca	Pseudotanaidae	7	0.04	4.55
Serpulidae	Annelida	Polychaeta	Serpulidae	7	0.04	4.55
Cirratulus sp	Annelida	Polychaeta	Cirratulidae	7	0.04	2.27
Piromis capulata	Annelida	Polychaeta	Flabelligeridae	7	0.04	2.27
Tubulanus sp A	Nemertea	Anopla	Tubulanidae	6	0.03	11.36
Tellina modesta	Mollusca	Bivalvia	Tellinidae	6	0.03	9.09
Leukoma laciniata	Mollusca	Bivalvia	Veneridae	6	0.03	6.82

Tanaididae	Arthropoda	Malacostraca	Tanaididae	6	0.03	6.82
Chaetozone corona	Annelida	Polychaeta	Cirratulidae	6	0.03	4.55
Lumbrineris sp E	Annelida	Polychaeta	Lumbrineridae	6	0.03	4.55
Protohyale frequens	Arthropoda	Malacostraca	Hyalidae	6	0.03	4.55
Laomedea calceolifera	Cnidaria	Hydrozoa	Campanulariidae	6	0.03	2.27
Molgula manhattensis	Chordata	Ascidiacea	Molgulidae	6	0.03	2.27
Sabellidae	Annelida	Polychaeta	Sabellidae	6	0.03	2.27
Philine ornatissima	Mollusca	Gastropoda	Philinidae	5	0.03	11.36
Tellina meropsis	Mollusca	Bivalvia	Tellinidae	5	0.03	11.36
Malmgreniella macginitiei	Annelida	Polychaeta	Polynoidae	5	0.03	9.09
Owenia collaris	Annelida	Polychaeta	Oweniidae	5	0.03	9.09
Nassarius tiarula	Mollusca	Gastropoda	Nassariidae	5	0.03	6.82
Aphelochaeta sp	Annelida	Polychaeta	Cirratulidae	5	0.03	4.55
Dorvillea (Dorvillea) sp	Annelida	Polychaeta	Dorvilleidae	5	0.03	4.55
Heteromysis odontops	Arthropoda	Malacostraca	Mysidae	5	0.03	4.55
Polydora heterochaeta	Annelida	Polychaeta	Spionidae	5	0.03	2.27
Tagelus sp	Mollusca	Bivalvia	Solecurtidae	5	0.03	2.27
Tagelus subteres	Mollusca	Bivalvia	Solecurtidae	5	0.03	2.27
Palaeonemertea	Nemertea	Anopla		4	0.02	9.09
Scoletoma erecta	Annelida	Polychaeta	Lumbrineridae	4	0.02	9.09
Anemonactis sp A	Cnidaria	Anthozoa	Haloclavidae	4	0.02	6.82
Spiochaetopterus costarum Cmplx	Annelida	Polychaeta	Chaetopteridae	4	0.02	6.82
Upogebia lepta	Arthropoda	Malacostraca	Upogebiidae	4	0.02	6.82
Americhelidium sp SD4	Arthropoda	Malacostraca	Oedicerotidae	4	0.02	4.55
Cirratulidae	Annelida	Polychaeta	Cirratulidae	4	0.02	4.55
Corymorpha sp	Cnidaria	Hydrozoa	Corymorphidae	4	0.02	4.55
Glycera tenuis	Annelida	Polychaeta	Glyceridae	4	0.02	4.55
Kirkegaardia sp 1	Annelida	Polychaeta	Cirratulidae	4	0.02	4.55

Pitar newcombianus	Mollusca	Bivalvia	Veneridae	4	0.02	4.55
Rhynchospio arenincola	Annelida	Polychaeta	Spionidae	4	0.02	4.55
Scleroplax granulata	Arthropoda	Malacostraca	Pinnotheridae	4	0.02	4.55
Scoloplos acmeceps	Annelida	Polychaeta	Orbiniidae	4	0.02	4.55
Amphiodia urtica	Echinodermata	Ophiuroidea	Amphiuridae	4	0.02	2.27
Limaria hemphilli	Mollusca	Bivalvia	Limidae	4	0.02	2.27
Paradialychone ecaudata	Annelida	Polychaeta	Sabellidae	4	0.02	2.27
Protocirrineris sp	Annelida	Polychaeta	Cirratulidae	4	0.02	2.27
Quasitetrastemma nigrifrons	Nemertea	Enopla	Tetrastemmatidae	4	0.02	2.27
Rhepoxynius menziesi	Arthropoda	Malacostraca	Phoxocephalidae	4	0.02	2.27
Scyphoproctus oculatus	Annelida	Polychaeta	Capitellidae	4	0.02	2.27
Apionsoma misakianum	Sipuncula	Phascolosomatidea	Phascolosomatidae	3	0.02	6.82
Bivalvia	Mollusca	Bivalvia		3	0.02	6.82
Leukoma staminea	Mollusca	Bivalvia	Veneridae	3	0.02	6.82
Melinna oculata	Annelida	Polychaeta	Ampharetidae	3	0.02	6.82
Schmittius politus	Arthropoda	Malacostraca	Squillidae	3	0.02	6.82
Amaeana occidentalis	Annelida	Polychaeta	Terebellidae	3	0.02	4.55
Anotomastus gordiodes	Annelida	Polychaeta	Capitellidae	3	0.02	4.55
Baseodiscus delineatus	Nemertea	Anopla	Valenciniidae	3	0.02	4.55
Carinomella lactea	Nemertea	Anopla	Tubulanidae	3	0.02	4.55
Listriella melanica	Arthropoda	Malacostraca	Liljeborgiidae	3	0.02	4.55
Microspio sp	Annelida	Polychaeta	Spionidae	3	0.02	4.55
Nebalia pugettensis Cmplx	Arthropoda	Malacostraca	Nebaliidae	3	0.02	4.55
Prionospio jubata	Annelida	Polychaeta	Spionidae	3	0.02	4.55
Capitellidae	Annelida	Polychaeta	Capitellidae	3	0.02	2.27
Corymorphidae sp SD1	Cnidaria	Hydrozoa	Corymorphidae	3	0.02	2.27
Diopatra sp	Annelida	Polychaeta	Onuphidae	3	0.02	2.27
Kirkegaardia sp	Annelida	Polychaeta	Cirratulidae	3	0.02	2.27

Listriella eriopisa	Arthropoda	Malacostraca	Liljeborgiidae	3	0.02	2.27
Polydora sp	Annelida	Polychaeta	Spionidae	3	0.02	2.27
Amphicteis scaphobranchiata	Annelida	Polychaeta	Ampharetidae	2	0.01	4.55
Amphiodia digitata	Echinodermata	Ophiuroidea	Amphiuridae	2	0.01	4.55
Campylaspis rubromaculata	Arthropoda	Malacostraca	Nannastacidae	2	0.01	4.55
Corymorpha bigelowi	Cnidaria	Hydrozoa	Corymorphidae	2	0.01	4.55
Crepidula onyx	Mollusca	Gastropoda	Calyptraeidae	2	0.01	4.55
Deltamysis holmquistae	Arthropoda	Malacostraca	Mysidae	2	0.01	4.55
Halcampa decemtentaculata	Cnidaria	Anthozoa	Halcampidae	2	0.01	4.55
Hartmanodes sp SD1	Arthropoda	Malacostraca	Oedicerotidae	2	0.01	4.55
Lumbrineris sp	Annelida	Polychaeta	Lumbrineridae	2	0.01	4.55
Macoma yoldiformis	Mollusca	Bivalvia	Tellinidae	2	0.01	4.55
Molgula ficus	Chordata	Ascidiacea	Molgulidae	2	0.01	4.55
Monocorophium insidiosum	Arthropoda	Malacostraca	Corophiidae	2	0.01	4.55
Mysidae	Arthropoda	Malacostraca	Mysidae	2	0.01	4.55
Naushonia macginitiei	Arthropoda	Malacostraca	Laomediidae	2	0.01	4.55
Oxydromus pugettensis	Annelida	Polychaeta	Hesionidae	2	0.01	4.55
Zygonemertes virescens	Nemertea	Enopla	Amphiporidae	2	0.01	4.55
Amphiodia psara	Echinodermata	Ophiuroidea	Amphiuridae	2	0.01	2.27
Argopecten ventricosus	Mollusca	Bivalvia	Pectinidae	2	0.01	2.27
Aricidea sp	Annelida	Polychaeta	Paraonidae	2	0.01	2.27
Astyris aurantiaca	Mollusca	Gastropoda	Columbellidae	2	0.01	2.27
Brada pilosa	Annelida	Polychaeta	Flabelligeridae	2	0.01	2.27
Harmothoe fragilis	Annelida	Polychaeta	Polynoidae	2	0.01	2.27
Harmothoe sp LA1	Annelida	Polychaeta	Polynoidae	2	0.01	2.27
Kurtiella pedroana	Mollusca	Bivalvia	Lasaeidae	2	0.01	2.27
Maculaura alaskensis Cmplx	Nemertea	Anopla	Lineidae	2	0.01	2.27
Marphysa sp	Annelida	Polychaeta	Eunicidae	2	0.01	2.27

Notomastus magnus	Annelida	Polychaeta	Capitellidae	2	0.01	2.27
Nuculana taphria	Mollusca	Bivalvia	Nuculanidae	2	0.01	2.27
Panopeidae	Arthropoda	Malacostraca	Panopeidae	2	0.01	2.27
Paracerceis sp	Arthropoda	Malacostraca	Sphaeromatidae	2	0.01	2.27
Polygireulima rutila	Mollusca	Gastropoda	Eulimidae	2	0.01	2.27
Saccoglossus sp	Chordata	Enteropneusta	Harrimaniidae	2	0.01	2.27
Saxidomus nuttalli	Mollusca	Bivalvia	Veneridae	2	0.01	2.27
Sicyoniidae	Arthropoda	Malacostraca	Sicyoniidae	2	0.01	2.27
Sphaerosyllis californiensis	Annelida	Polychaeta	Syllidae	2	0.01	2.27
Acteocina culcitella	Mollusca	Gastropoda	Cylichnidae	1	0.01	2.27
Actiniaria sp DC2	Cnidaria	Anthozoa		1	0.01	2.27
Adula diegensis	Mollusca	Bivalvia	Mytilidae	1	0.01	2.27
Alia carinata	Mollusca	Gastropoda	Columbellidae	1	0.01	2.27
Alia tuberosa	Mollusca	Gastropoda	Columbellidae	1	0.01	2.27
Amathimysis trigibba	Arthropoda	Malacostraca	Mysidae	1	0.01	2.27
Ambidexter panamensis	Arthropoda	Malacostraca	Processidae	1	0.01	2.27
Americhelidium sp	Arthropoda	Malacostraca	Oedicerotidae	1	0.01	2.27
Ampharete labrops	Annelida	Polychaeta	Ampharetidae	1	0.01	2.27
Amphiodia sp	Echinodermata	Ophiuroidea	Amphiuridae	1	0.01	2.27
Aoroides sp	Arthropoda	Malacostraca	Aoridae	1	0.01	2.27
Arachnida	Arthropoda	Arachnida		1	0.01	2.27
Ascidia ceratodes	Chordata	Ascidiacea	Ascidiidae	1	0.01	2.27
Bemlos concavus	Arthropoda	Malacostraca	Aoridae	1	0.01	2.27
Betaeus sp	Arthropoda	Malacostraca	Alpheidae	1	0.01	2.27
Brachyura	Arthropoda	Malacostraca		1	0.01	2.27
Caesia perpinguis	Mollusca	Gastropoda	Nassariidae	1	0.01	2.27
Callianax baetica	Mollusca	Gastropoda	Olivellidae	1	0.01	2.27
Callipallene pacifica	Arthropoda	Pycnogonida	Callipallenidae	1	0.01	2.27

Caprella verrucosa	Arthropoda	Malacostraca	Caprellidae	1	0.01	2.27
Caulleriella pacifica	Annelida	Polychaeta	Cirratulidae	1	0.01	2.27
Ceriantharia	Cnidaria	Anthozoa		1	0.01	2.27
Chione californiensis	Mollusca	Bivalvia	Veneridae	1	0.01	2.27
Compsomyax subdiaphana	Mollusca	Bivalvia	Veneridae	1	0.01	2.27
Corophioidea	Arthropoda	Malacostraca		1	0.01	2.27
Corymorpha palma	Cnidaria	Hydrozoa	Corymorphidae	1	0.01	2.27
Crepidula sp	Mollusca	Gastropoda	Calyptraeidae	1	0.01	2.27
Cumacea	Arthropoda	Malacostraca		1	0.01	2.27
Cumella californica	Arthropoda	Malacostraca	Nannastacidae	1	0.01	2.27
Dipolydora socialis	Annelida	Polychaeta	Spionidae	1	0.01	2.27
Edotia sublittoralis	Arthropoda	Malacostraca	Idoteidae	1	0.01	2.27
Elasmopus sp	Arthropoda	Malacostraca	Maeridae	1	0.01	2.27
Epitonium sp	Mollusca	Gastropoda	Epitoniidae	1	0.01	2.27
Ericerodes hemphillii	Arthropoda	Malacostraca	Inachidae	1	0.01	2.27
Erileptus spinosus	Arthropoda	Malacostraca	Inachidae	1	0.01	2.27
Euchone incolor	Annelida	Polychaeta	Sabellidae	1	0.01	2.27
Euphysa sp	Cnidaria	Hydrozoa	Corymorphidae	1	0.01	2.27
Eusarsiella thominx	Arthropoda	Ostracoda	Sarsiellidae	1	0.01	2.27
Foxiphalus golfensis	Arthropoda	Malacostraca	Phoxocephalidae	1	0.01	2.27
Glycera macrobranchia	Annelida	Polychaeta	Glyceridae	1	0.01	2.27
Glycera nana	Annelida	Polychaeta	Glyceridae	1	0.01	2.27
Goniada maculata	Annelida	Polychaeta	Goniadidae	1	0.01	2.27
Haminoea sp	Mollusca	Gastropoda	Haminoeidae	1	0.01	2.27
Harmothoe sp	Annelida	Polychaeta	Polynoidae	1	0.01	2.27
Harpacticoida	Arthropoda	Maxillopoda		1	0.01	2.27
Hermundura fauveli	Annelida	Polychaeta	Pilargidae	1	0.01	2.27
Heteronemertea sp SD2	Nemertea	Anopla	uncertain	1	0.01	2.27

Hiatella arctica	Mollusca	Bivalvia	Hiatellidae	1	0.01	2.27
Hippolyte californiensis	Arthropoda	Malacostraca	Hippolytidae	1	0.01	2.27
Hippomedon zetesimus	Arthropoda	Malacostraca	Lysianassidae	1	0.01	2.27
Hydroides elegans	Annelida	Polychaeta	Serpulidae	1	0.01	2.27
Kirkegaardia siblina	Annelida	Polychaeta	Cirratulidae	1	0.01	2.27
Kurtiella tumida	Mollusca	Bivalvia	Lasaeidae	1	0.01	2.27
Leptopecten latiauratus	Mollusca	Bivalvia	Pectinidae	1	0.01	2.27
Lumbrineris limicola	Annelida	Polychaeta	Lumbrineridae	1	0.01	2.27
Macoma nasuta	Mollusca	Bivalvia	Tellinidae	1	0.01	2.27
Microspio pigmentata	Annelida	Polychaeta	Spionidae	1	0.01	2.27
Modiolatus neglectus	Mollusca	Bivalvia	Mytilidae	1	0.01	2.27
Molgulidae	Chordata	Ascidiacea	Molgulidae	1	0.01	2.27
Nassarius mendicus	Mollusca	Gastropoda	Nassariidae	1	0.01	2.27
Neolepton subtrigonum	Mollusca	Bivalvia	Neoleptonidae	1	0.01	2.27
Neotrypaea californiensis	Arthropoda	Malacostraca	Callianassidae	1	0.01	2.27
Nephtys sp	Annelida	Polychaeta	Nephtyidae	1	0.01	2.27
Nereis sp A	Annelida	Polychaeta	Nereididae	1	0.01	2.27
Notomastus lineatus	Annelida	Polychaeta	Capitellidae	1	0.01	2.27
Notomastus tenuis	Annelida	Polychaeta	Capitellidae	1	0.01	2.27
Nutricola cymata	Mollusca	Bivalvia	Veneridae	1	0.01	2.27
Nutricola sp	Mollusca	Bivalvia	Veneridae	1	0.01	2.27
Nutricola tantilla	Mollusca	Bivalvia	Veneridae	1	0.01	2.27
Nymphon pixellae	Arthropoda	Pycnogonida	Nymphonidae	1	0.01	2.27
Odontosyllis phosphorea	Annelida		Syllidae	1	0.01	2.27
Onuphidae	Annelida	Polychaeta	Onuphidae	1	0.01	2.27
Ophiactis simplex	Echinodermata	Ophiuroidea	Ophiactidae	1	0.01	2.27
Owenia johnsoni	Annelida	Polychaeta	Oweniidae	1	0.01	2.27
Periploma discus	Mollusca	Bivalvia	Periplomatidae	1	0.01	2.27

Photis californica	Arthropoda	Malacostraca	Photidae	1	0.01	2.27
Phyllochaetopterus prolifica	Annelida	Polychaeta	Chaetopteridae	1	0.01	2.27
Phyllodoce hartmanae	Annelida	Polychaeta	Phyllodocidae	1	0.01	2.27
Phyllodoce longipes	Annelida	Polychaeta	Phyllodocidae	1	0.01	2.27
Platynereis bicanaliculata	Annelida	Polychaeta	Nereididae	1	0.01	2.27
Podarkeopsis glabrus	Annelida	Polychaeta	Hesionidae	1	0.01	2.27
Podocopa	Arthropoda	Ostracoda		1	0.01	2.27
Polycirrus sp	Annelida	Polychaeta	Terebellidae	1	0.01	2.27
Polydora cornuta	Annelida	Polychaeta	Spionidae	1	0.01	2.27
Prosthiostomum latocelis	Platyhelminthes	Turbellaria	Prostiostomidae	1	0.01	2.27
Protocirrineris sp B	Annelida	Polychaeta	Cirratulidae	1	0.01	2.27
Salvatoria sp	Annelida	Polychaeta	Syllidae	1	0.01	2.27
Serpula columbiana	Annelida	Polychaeta	Serpulidae	1	0.01	2.27
Sigambra sp	Annelida	Polychaeta	Pilargidae	1	0.01	2.27
Solen sp	Mollusca	Bivalvia	Solenidae	1	0.01	2.27
Sphaerosyllis sp	Annelida	Polychaeta	Syllidae	1	0.01	2.27
Sphenia fragilis	Mollusca	Bivalvia	Myidae	1	0.01	2.27
Spionidae	Annelida	Polychaeta	Spionidae	1	0.01	2.27
Spiophanes sp	Annelida	Polychaeta	Spionidae	1	0.01	2.27
Spirorbidae	Annelida	Polychaeta	Spirorbidae	1	0.01	2.27
Stomatopoda	Arthropoda	Malacostraca		1	0.01	2.27
Strongylocentrotus sp	Echinodermata	Echinoidea	Strongylocentrotidae	1	0.01	2.27
Sulcoretusa xystrum	Mollusca	Gastropoda	Retusidae	1	0.01	2.27
Syllis gracilis Cmplx	Annelida	Polychaeta	Syllidae	1	0.01	2.27
Syllis sp	Annelida	Polychaeta	Syllidae	1	0.01	2.27
Teinostoma sp	Mollusca	Gastropoda	Tornidae	1	0.01	2.27
Tenonia priops	Annelida	Polychaeta	Polynoidae	1	0.01	2.27
Thysanocardia nigra	Sipuncula	Sipunculidea	Golfingiidae	1	0.01	2.27

Trophoniella harrisae	Annelida	Polychaeta	Flabelligeridae	1	0.01	2.27
Tryphosinae incertae sedis entalladurus	Arthropoda	Malacostraca	Tryphosidae	1	0.01	2.27
Tubulanus sp SD1	Nemertea	Anopla	Tubulanidae	1	0.01	2.27
Turbonilla almo	Mollusca	Gastropoda	Pyramidellidae	1	0.01	2.27
Veneridae	Mollusca	Bivalvia	Veneridae	1	0.01	2.27
Zygeupolia rubens	Nemertea	Anopla	Valenciniidae	1	0.01	2.27

Appendix A3. Macrobenthic community summary for the Ports stratum in the Bight'18 survey. Total abundance from all samples, relative abundance across the stratum, and the frequency of occurrence within a stratum are presented. Taxa are ranked by total abundance.

Taxon	Phylum	Class	Family	Total Abundance	Relative Abundance (%)	Frequency of Occurrence (%)
Scoletoma sp C	Annelida	Polychaeta	Lumbrineridae	1,056	7.76	55.36
Exogone lourei	Annelida	Polychaeta	Syllidae	630	4.63	42.86
Mediomastus sp	Annelida	Polychaeta	Capitellidae	580	4.26	80.36
Scoletoma sp	Annelida	Polychaeta	Lumbrineridae	570	4.19	67.86
Musculista senhousia	Mollusca	Bivalvia	Mytilidae	565	4.15	41.07
Edwardsia californica	Cnidaria	Anthozoa	Edwardsiidae	480	3.53	25.00
Pseudopolydora paucibranchiata	Annelida	Polychaeta	Spionidae	476	3.50	39.29
Amphideutopus oculatus	Arthropoda	Malacostraca	Kamakidae	450	3.31	66.07
Leitoscoloplos pugettensis	Annelida	Polychaeta	Orbiniidae	402	2.95	50.00
Theora lubrica	Mollusca	Bivalvia	Semelidae	391	2.87	69.64
Cossura sp A	Annelida	Polychaeta	Cossuridae	378	2.78	42.86
Kirkegaardia siblina	Annelida	Polychaeta	Cirratulidae	351	2.58	35.71
Paracerceis sculpta	Arthropoda	Malacostraca	Sphaeromatidae	261	1.92	7.14
Monocorophium acherusicum	Arthropoda	Malacostraca	Corophiidae	260	1.91	14.29
Fabricinuda limnicola	Annelida	Polychaeta	Fabriciidae	243	1.79	33.93
Prionospio heterobranchia	Annelida	Polychaeta	Spionidae	238	1.75	44.64
Leitoscoloplos sp A	Annelida	Polychaeta	Orbiniidae	230	1.69	16.07
Scoletoma sp A	Annelida	Polychaeta	Lumbrineridae	199	1.46	30.36
Petaloclymene pacifica	Annelida	Polychaeta	Maldanidae	167	1.23	53.57
Phoronis sp	Phoronida		Phoronidae	146	1.07	53.57
Amphipholis squamata	Echinodermata	Ophiuroidea	Amphiuridae	141	1.04	28.57

Scleroplax granulata	Arthropoda	Malacostraca	Pinnotheridae	111	0.82	28.57
Diplocirrus sp SD1	Annelida	Polychaeta	Flabelligeridae	105	0.77	48.21
Rudilemboides stenopropodus	Arthropoda	Malacostraca	Unciolidae	105	0.77	32.14
Chondrochelia dubia Cmplx	Arthropoda	Malacostraca	Leptocheliidae	105	0.77	17.86
Poecilochaetus martini	Annelida	Polychaeta	Poecilochaetidae	103	0.76	23.21
Leptosynapta sp	Echinodermata	Holothuroidea	Synaptidae	98	0.72	21.43
Heterophoxus cf *ellisi*	Arthropoda	Malacostraca	Phoxocephalidae	93	0.68	30.36
Maldanidae	Annelida	Polychaeta	Maldanidae	92	0.68	28.57
Amage scutata	Annelida	Polychaeta	Ampharetidae	91	0.67	30.36
Tubulanus polymorphus	Nemertea	Anopla	Tubulanidae	89	0.65	50.00
Eochelidium sp A	Arthropoda	Malacostraca	Oedicerotidae	87	0.64	14.29
Laonice cirrata	Annelida	Polychaeta	Spionidae	78	0.57	30.36
Photis brevipes	Arthropoda	Malacostraca	Photidae	78	0.57	7.14
Tagelus affinis	Mollusca	Bivalvia	Solecurtidae	76	0.56	30.36
Spiophanes duplex	Annelida	Polychaeta	Spionidae	74	0.54	30.36
Glycera americana	Annelida	Polychaeta	Glyceridae	72	0.53	58.93
Ampharete labrops	Annelida	Polychaeta	Ampharetidae	72	0.53	16.07
Listriella goleta	Arthropoda	Malacostraca	Liljeborgiidae	71	0.52	30.36
Philine auriformis	Mollusca	Gastropoda	Philinidae	64	0.47	30.36
Marphysa disjuncta	Annelida	Polychaeta	Eunicidae	61	0.45	23.21
Melinna oculata	Annelida	Polychaeta	Ampharetidae	60	0.44	21.43
Laevicardium substriatum	Mollusca	Bivalvia	Cardiidae	58	0.43	28.57
Oligochaeta	Annelida	Oligochaeta		58	0.43	21.43
Chaetozone corona	Annelida	Polychaeta	Cirratulidae	57	0.42	33.93
Acanthoptilum sp	Cnidaria	Anthozoa	Virgulariidae	55	0.40	7.14
Anoplodactylus erectus	Arthropoda	Pycnogonida	Phoxichilidiidae	54	0.40	19.64
Tagelus subteres	Mollusca	Bivalvia	Solecurtidae	53	0.39	16.07
Phtisica marina	Arthropoda	Malacostraca	Caprellidae	49	0.36	19.64

Cossura candida	Annelida	Polychaeta	Cossuridae	49	0.36	17.86
Edwardsiidae	Cnidaria	Anthozoa	Edwardsiidae	49	0.36	10.71
Podocerus fulanus	Arthropoda	Malacostraca	Podoceridae	49	0.36	7.14
Ampelisca cristata microdentata	Arthropoda	Malacostraca	Ampeliscidae	47	0.35	25.00
Pista brevibranchiata	Annelida	Polychaeta	Terebellidae	46	0.34	30.36
Lumbrineris sp E	Annelida	Polychaeta	Lumbrineridae	46	0.34	12.50
Amphipholis pugetana	Echinodermata	Ophiuroidea	Amphiuridae	46	0.34	7.14
Phoronidae	Phoronida		Phoronidae	45	0.33	39.29
Aphelochaeta petersenae	Annelida	Polychaeta	Cirratulidae	43	0.32	7.14
Euchone limnicola	Annelida	Polychaeta	Sabellidae	41	0.30	23.21
Amphiodia sp	Echinodermata	Ophiuroidea	Amphiuridae	41	0.30	16.07
Nuculana taphria	Mollusca	Bivalvia	Nuculanidae	40	0.29	26.79
Lumbrineridae	Annelida	Polychaeta	Lumbrineridae	39	0.29	16.07
Nassarius tiarula	Mollusca	Gastropoda	Nassariidae	38	0.28	26.79
Pista wui	Annelida	Polychaeta	Terebellidae	38	0.28	25.00
Asthenothaerus diegensis	Mollusca	Bivalvia	Thraciidae	38	0.28	19.64
Solen rostriformis	Mollusca	Bivalvia	Solenidae	38	0.28	19.64
Philine ornatissima	Mollusca	Gastropoda	Philinidae	37	0.27	26.79
Prionospio lighti	Annelida	Polychaeta	Spionidae	37	0.27	23.21
Kurtiella coani	Mollusca	Bivalvia	Lasaeidae	37	0.27	7.14
Paraprionospio alata	Annelida	Polychaeta	Spionidae	35	0.26	30.36
Majoidea	Arthropoda	Malacostraca		35	0.26	19.64
Scoletoma sp B	Annelida	Polychaeta	Lumbrineridae	35	0.26	10.71
Ampharetidae	Annelida	Polychaeta	Ampharetidae	33	0.24	16.07
Aruga holmesi	Arthropoda	Malacostraca	Lysianassidae	33	0.24	16.07
Amphicteis scaphobranchiata	Annelida	Polychaeta	Ampharetidae	31	0.23	21.43
Actiniaria	Cnidaria	Anthozoa		31	0.23	17.86
Amphiodia urtica	Echinodermata	Ophiuroidea	Amphiuridae	29	0.21	16.07

Dorvillea (Schistomeringos) annulata	Annelida	Polychaeta	Dorvilleidae	29	0.21	12.50
Grandidierella japonica	Arthropoda	Malacostraca	Aoridae	28	0.21	23.21
Baseodiscus delineatus	Nemertea	Anopla	Valenciniidae	28	0.21	8.93
Metasychis disparidentatus	Annelida	Polychaeta	Maldanidae	26	0.19	25.00
Sigambra sp	Annelida	Polychaeta	Pilargidae	26	0.19	23.21
Thyasira flexuosa	Mollusca	Bivalvia	Thyasiridae	26	0.19	19.64
Neotrypaea sp	Arthropoda	Malacostraca	Callianassidae	26	0.19	17.86
Tellina sp B	Mollusca	Bivalvia	Tellinidae	25	0.18	19.64
Ericerodes hemphillii	Arthropoda	Malacostraca	Inachidae	24	0.18	16.07
Sabellides manriquei	Annelida	Polychaeta	Ampharetidae	24	0.18	12.50
Ampelisca brachycladus	Arthropoda	Malacostraca	Ampeliscidae	24	0.18	10.71
Diopatra ornata	Annelida	Polychaeta	Onuphidae	23	0.17	17.86
Lumbrineris japonica	Annelida	Polychaeta	Lumbrineridae	23	0.17	17.86
Pyromaia tuberculata	Arthropoda	Malacostraca	Inachoididae	23	0.17	17.86
Panopeidae	Arthropoda	Malacostraca	Panopeidae	23	0.17	12.50
Aphelochaeta glandaria Cmplx	Annelida	Polychaeta	Cirratulidae	23	0.17	5.36
Scolanthus scamiti	Cnidaria	Anthozoa	Edwardsiidae	22	0.16	19.64
Hartmanodes hartmanae	Arthropoda	Malacostraca	Oedicerotidae	22	0.16	12.50
Kirkegaardia cryptica	Annelida	Polychaeta	Cirratulidae	21	0.15	21.43
Periploma discus	Mollusca	Bivalvia	Periplomatidae	21	0.15	19.64
Hartmanodes sp SD1	Arthropoda	Malacostraca	Oedicerotidae	21	0.15	14.29
Neotrypaea gigas	Arthropoda	Malacostraca	Callianassidae	21	0.15	12.50
Lyonsia californica	Mollusca	Bivalvia	Lyonsiidae	20	0.15	21.43
Nereis sp A	Annelida	Polychaeta	Nereididae	20	0.15	12.50
Pinnixa franciscana	Arthropoda	Malacostraca	Pinnotheridae	20	0.15	12.50
Alpheus californiensis	Arthropoda	Malacostraca	Alpheidae	19	0.14	19.64
Paranemertes californica	Nemertea	Enopla	Emplectonematidae	19	0.14	19.64
Macoma yoldiformis	Mollusca	Bivalvia	Tellinidae	19	0.14	17.86

Amaeana occidentalis	Annelida	Polychaeta	Terebellidae	19	0.14	10.71
Lineidae	Nemertea	Anopla	Lineidae	18	0.13	17.86
Amage anops	Annelida	Polychaeta	Ampharetidae	18	0.13	5.36
Ampelisca cristata	Arthropoda	Malacostraca	Ampeliscidae	18	0.13	5.36
Compsomyax subdiaphana	Mollusca	Bivalvia	Veneridae	17	0.12	16.07
Poecilochaetus sp	Annelida	Polychaeta	Poecilochaetidae	17	0.12	14.29
Zeuxo normani Cmplx	Arthropoda	Malacostraca	Tanaididae	17	0.12	10.71
Ericthonius brasiliensis	Arthropoda	Malacostraca	Ischyroceridae	17	0.12	7.14
Scoletoma erecta	Annelida	Polychaeta	Lumbrineridae	17	0.12	5.36
Vitrinella oldroydi	Mollusca	Gastropoda	Tornidae	17	0.12	1.79
Sinocorophium alienense	Arthropoda	Malacostraca	Corophiidae	16	0.12	14.29
Crepidula onyx	Mollusca	Gastropoda	Calyptraeidae	16	0.12	12.50
Lumbrineris sp	Annelida	Polychaeta	Lumbrineridae	16	0.12	8.93
Streblosoma sp B	Annelida	Polychaeta	Terebellidae	16	0.12	8.93
Crucibulum spinosum	Mollusca	Gastropoda	Calyptraeidae	16	0.12	5.36
Exogone dwisula	Annelida	Polychaeta	Syllidae	16	0.12	3.57
Bivalvia	Mollusca	Bivalvia		15	0.11	12.50
Monocorophium sp	Arthropoda	Malacostraca	Corophiidae	15	0.11	5.36
Tubulanus cingulatus	Nemertea	Anopla	Tubulanidae	14	0.10	19.64
Volvulella panamica	Mollusca	Gastropoda	Retusidae	14	0.10	12.50
Cirriformia sp	Annelida	Polychaeta	Cirratulidae	14	0.10	10.71
Cryptomya californica	Mollusca	Bivalvia	Myidae	14	0.10	8.93
Aphelochaeta monilaris	Annelida	Polychaeta	Cirratulidae	13	0.10	8.93
Diopatra sp	Annelida	Polychaeta	Onuphidae	13	0.10	8.93
Pista sp	Annelida	Polychaeta	Terebellidae	13	0.10	7.14
Oxyurostylis pacifica	Arthropoda	Malacostraca	Diastylidae	13	0.10	5.36
Spiochaetopterus costarum Cmplx	Annelida	Polychaeta	Chaetopteridae	12	0.09	17.86
Tubulanus sp SD1	Nemertea	Anopla	Tubulanidae	12	0.09	14.29

Cirratulidae	Annelida	Polychaeta	Cirratulidae	12	0.09	12.50
Leptopecten latiauratus	Mollusca	Bivalvia	Pectinidae	12	0.09	10.71
Ampelisca brevisimulata	Arthropoda	Malacostraca	Ampeliscidae	12	0.09	8.93
Laomedea calceolifera	Cnidaria	Hydrozoa	Campanulariidae	12	0.09	3.57
Notomastus hemipodus	Annelida	Polychaeta	Capitellidae	11	0.08	14.29
Lysippe sp A	Annelida	Polychaeta	Ampharetidae	11	0.08	10.71
Dorvillea (Schistomeringos) longicornis	Annelida	Polychaeta	Dorvilleidae	11	0.08	7.14
Streblosoma crassibranchia	Annelida	Polychaeta	Terebellidae	11	0.08	5.36
Amphisamytha bioculata	Annelida	Polychaeta	Ampharetidae	10	0.07	7.14
Lumbrineris latreilli	Annelida	Polychaeta	Lumbrineridae	10	0.07	7.14
Tellina cadieni	Mollusca	Bivalvia	Tellinidae	10	0.07	7.14
Anoplodactylus viridintestinalis	Arthropoda	Pycnogonida	Phoxichilidiidae	10	0.07	5.36
Actiniaria sp 1	Cnidaria	Anthozoa		10	0.07	3.57
Crepipatella lingulata	Mollusca	Gastropoda	Calyptraeidae	9	0.07	14.29
Ambidexter panamensis	Arthropoda	Malacostraca	Processidae	9	0.07	12.50
Malmgreniella sp	Annelida	Polychaeta	Polynoidae	9	0.07	10.71
Odontosyllis phosphorea	Annelida		Syllidae	9	0.07	10.71
Erileptus spinosus	Arthropoda	Malacostraca	Inachidae	9	0.07	8.93
Pinnotheridae	Arthropoda	Malacostraca	Pinnotheridae	9	0.07	8.93
Microspio pigmentata	Annelida	Polychaeta	Spionidae	9	0.07	5.36
Myxicola sp	Annelida	Polychaeta	Sabellidae	9	0.07	5.36
Acteocina inculta	Mollusca	Gastropoda	Cylichnidae	9	0.07	3.57
Scolelepis (Scolelepis) squamata	Annelida	Polychaeta	Spionidae	9	0.07	3.57
Scalibregma californicum	Annelida	Polychaeta	Scalibregmatidae	8	0.06	12.50
Gadila aberrans	Mollusca	Scaphopoda	Gadilidae	8	0.06	8.93
Dialychone albocincta	Annelida	Polychaeta	Sabellidae	8	0.06	5.36
Chaetozone hartmanae	Annelida	Polychaeta	Cirratulidae	8	0.06	3.57
Leukoma staminea	Mollusca	Bivalvia	Veneridae	8	0.06	3.57

Carinomella lactea	Nemertea	Anopla	Tubulanidae	7	0.05	10.71
Heteronemertea	Nemertea	Anopla		7	0.05	10.71
Harmothoe imbricata Cmplx	Annelida	Polychaeta	Polynoidae	7	0.05	8.93
Mactrotoma californica	Mollusca	Bivalvia	Mactridae	7	0.05	8.93
Microcosmus squamiger	Chordata	Ascidiacea	Pyuridae	7	0.05	8.93
Gammaropsis thompsoni	Arthropoda	Malacostraca	Photidae	7	0.05	7.14
Microspio sp	Annelida	Polychaeta	Spionidae	7	0.05	7.14
Acteocina harpa	Mollusca	Gastropoda	Cylichnidae	7	0.05	5.36
Americhelidium sp SD4	Arthropoda	Malacostraca	Oedicerotidae	7	0.05	5.36
Gymnonereis crosslandi	Annelida	Polychaeta	Nereididae	7	0.05	5.36
Tellina modesta	Mollusca	Bivalvia	Tellinidae	7	0.05	3.57
Alvania compacta	Mollusca	Gastropoda	Rissoidae	7	0.05	1.79
Spio maculata	Annelida	Polychaeta	Spionidae	7	0.05	1.79
Schmittius politus	Arthropoda	Malacostraca	Squillidae	6	0.04	10.71
Ampelisca sp	Arthropoda	Malacostraca	Ampeliscidae	6	0.04	8.93
Bipalponephtys cornuta	Annelida	Polychaeta	Nephtyidae	6	0.04	8.93
Capitella capitata Cmplx	Annelida	Polychaeta	Capitellidae	6	0.04	7.14
Ceriantharia	Cnidaria	Anthozoa		6	0.04	7.14
Euphilomedes carcharodonta	Arthropoda	Ostracoda	Philomedidae	6	0.04	7.14
Goniada maculata	Annelida	Polychaeta	Goniadidae	6	0.04	7.14
Ninoe tridentata	Annelida	Polychaeta	Lumbrineridae	6	0.04	7.14
Postasterope barnesi	Arthropoda	Ostracoda	Cylindroleberididae	6	0.04	7.14
Praxillella pacifica	Annelida	Polychaeta	Maldanidae	6	0.04	7.14
Sthenelanella uniformis	Annelida	Polychaeta	Sigalionidae	6	0.04	7.14
Virgularia californica	Cnidaria	Anthozoa	Virgulariidae	6	0.04	7.14
Caecognathia crenulatifrons	Arthropoda	Malacostraca	Gnathiidae	6	0.04	5.36
Caprella californica Cmplx	Arthropoda	Malacostraca	Caprellidae	6	0.04	5.36
Levinsenia gracilis	Annelida	Polychaeta	Paraonidae	6	0.04	5.36

Listriella melanica	Arthropoda	Malacostraca	Liljeborgiidae	6	0.04	5.36
Neastacilla californica	Arthropoda	Malacostraca	Arcturidae	6	0.04	5.36
Protocirrineris sp B	Annelida	Polychaeta	Cirratulidae	6	0.04	5.36
Virgulariidae	Cnidaria	Anthozoa	Virgulariidae	6	0.04	5.36
Ampelisca agassizi	Arthropoda	Malacostraca	Ampeliscidae	6	0.04	1.79
Caulleriella pacifica	Annelida	Polychaeta	Cirratulidae	6	0.04	1.79
Notoproctus pacificus	Annelida	Polychaeta	Maldanidae	6	0.04	1.79
Megasyllis nipponica	Annelida	Polychaeta	Syllidae	5	0.04	8.93
Pectinaria californiensis	Annelida	Polychaeta	Pectinariidae	5	0.04	8.93
Spiophanes berkeleyorum	Annelida	Polychaeta	Spionidae	5	0.04	8.93
Tenonia priops	Annelida	Polychaeta	Polynoidae	5	0.04	8.93
Amphiuridae	Echinodermata	Ophiuroidea	Amphiuridae	5	0.04	7.14
Calyptraeidae	Mollusca	Gastropoda	Calyptraeidae	5	0.04	7.14
Cylichna diegensis	Mollusca	Gastropoda	Cylichnidae	5	0.04	7.14
Eteone brigitteae	Annelida	Polychaeta	Phyllodocidae	5	0.04	7.14
Glottidia albida	Brachiopoda	Inarticulata	Lingulidae	5	0.04	7.14
Mayerella acanthopoda	Arthropoda	Malacostraca	Caprellidae	5	0.04	5.36
Pista estevanica	Annelida	Polychaeta	Terebellidae	5	0.04	5.36
Sinocorophium heteroceratum	Arthropoda	Malacostraca	Corophiidae	5	0.04	5.36
Crepidula fornicata	Mollusca	Gastropoda	Calyptraeidae	5	0.04	3.57
Hiatella arctica	Mollusca	Bivalvia	Hiatellidae	5	0.04	3.57
Nephtys simoni	Annelida	Polychaeta	Nephtyidae	5	0.04	3.57
Bemlos macromanus	Arthropoda	Malacostraca	Aoridae	5	0.04	1.79
Gammaropsis shoemakeri	Arthropoda	Malacostraca	Photidae	5	0.04	1.79
Maculaura alaskensis Cmplx	Nemertea	Anopla	Lineidae	5	0.04	1.79
Neanthes acuminata Cmplx	Annelida	Polychaeta	Nereididae	5	0.04	1.79
Semele venusta	Mollusca	Bivalvia	Semelidae	5	0.04	1.79
Drilonereis mexicana	Annelida	Polychaeta	Oenonidae	4	0.03	7.14

Kurtiella tumida	Mollusca	Bivalvia	Lasaeidae	4	0.03	7.14
Palaeonemertea	Nemertea	Anopla		4	0.03	7.14
Alia carinata	Mollusca	Gastropoda	Columbellidae	4	0.03	5.36
Bemlos sp	Arthropoda	Malacostraca	Aoridae	4	0.03	5.36
Nephtys sp	Annelida	Polychaeta	Nephtyidae	4	0.03	5.36
Parvilucina tenuisculpta	Mollusca	Bivalvia	Lucinidae	4	0.03	5.36
Sabellidae	Annelida	Polychaeta	Sabellidae	4	0.03	5.36
Terebellidae	Annelida	Polychaeta	Terebellidae	4	0.03	5.36
Edwardsia juliae	Cnidaria	Anthozoa	Edwardsiidae	4	0.03	3.57
Paracaprella sp SD1	Arthropoda	Malacostraca	Caprellidae	4	0.03	3.57
Pinnixa sp	Arthropoda	Malacostraca	Pinnotheridae	4	0.03	3.57
Psammotreta obesa	Mollusca	Bivalvia	Tellinidae	4	0.03	3.57
Rhamphidonta retifera	Mollusca	Bivalvia	Lasaeidae	4	0.03	3.57
Syllis hyperioni	Annelida	Polychaeta	Syllidae	4	0.03	3.57
Thysanocardia nigra	Sipuncula	Sipunculidea	Golfingiidae	4	0.03	3.57
Zaolutus actius	Cnidaria	Anthozoa	Isanthidae	4	0.03	3.57
Hesperonoe adventor	Annelida	Polychaeta	Polynoidae	4	0.03	1.79
Thraciidae	Mollusca	Bivalvia	Thraciidae	4	0.03	1.79
Acromegalomma sp	Annelida	Polychaeta	Sabellidae	3	0.02	5.36
Drilonereis sp	Annelida	Polychaeta	Oenonidae	3	0.02	5.36
Malmgreniella macginitiei	Annelida	Polychaeta	Polynoidae	3	0.02	5.36
Mysidae	Arthropoda	Malacostraca	Mysidae	3	0.02	5.36
Oxydromus pugettensis	Annelida	Polychaeta	Hesionidae	3	0.02	5.36
Pherusa neopapillata	Annelida	Polychaeta	Flabelligeridae	3	0.02	5.36
Prionospio jubata	Annelida	Polychaeta	Spionidae	3	0.02	5.36
Tubulanus sp A	Nemertea	Anopla	Tubulanidae	3	0.02	5.36
Alpheus sp	Arthropoda	Malacostraca	Alpheidae	3	0.02	3.57
Amphiodia digitata	Echinodermata	Ophiuroidea	Amphiuridae	3	0.02	3.57

Apionsoma misakianum	Sipuncula	Phascolosomatidea	Phascolosomatidae	3	0.02	3.57
Armandia brevis	Annelida	Polychaeta	Opheliidae	3	0.02	3.57
Caprella verrucosa	Arthropoda	Malacostraca	Caprellidae	3	0.02	3.57
Columbellidae	Mollusca	Gastropoda	Columbellidae	3	0.02	3.57
Crepidula sp	Mollusca	Gastropoda	Calyptraeidae	3	0.02	3.57
Haminoea vesicula	Mollusca	Gastropoda	Haminoeidae	3	0.02	3.57
Lamispina schmidtii	Annelida	Polychaeta	Flabelligeridae	3	0.02	3.57
Magelona berkeleyi	Annelida	Polychaeta	Magelonidae	3	0.02	3.57
Mysidopsis californica	Arthropoda	Malacostraca	Mysidae	3	0.02	3.57
Paradialychone paramollis	Annelida	Polychaeta	Sabellidae	3	0.02	3.57
Paradoneis spinifera	Annelida	Polychaeta	Paraonidae	3	0.02	3.57
Platynereis bicanaliculata	Annelida	Polychaeta	Nereididae	3	0.02	3.57
Polycirrus sp	Annelida	Polychaeta	Terebellidae	3	0.02	3.57
Prionospio pygmaeus	Annelida	Polychaeta	Spionidae	3	0.02	3.57
Schizocardium sp	Chordata	Enteropneusta	Spengeliidae	3	0.02	3.57
Solen sicarius	Mollusca	Bivalvia	Solenidae	3	0.02	3.57
Solen sp	Mollusca	Bivalvia	Solenidae	3	0.02	3.57
Zygonemertes virescens	Nemertea	Enopla	Amphiporidae	3	0.02	3.57
Epitonium hindsii	Mollusca	Gastropoda	Epitoniidae	3	0.02	1.79
Semelidae	Mollusca	Bivalvia	Semelidae	3	0.02	1.79
Stylatula sp A	Cnidaria	Anthozoa	Virgulariidae	3	0.02	1.79
Ampelisca milleri	Arthropoda	Malacostraca	Ampeliscidae	2	0.01	3.57
Anemonactis sp A	Cnidaria	Anthozoa	Haloclavidae	2	0.01	3.57
Aonides sp SD1	Annelida	Polychaeta	Spionidae	2	0.01	3.57
Argua sp				2	0.01	3.57
Barleeia haliotiphila	Mollusca	Gastropoda	Barleeiidae	2	0.01	3.57
Caprella simia	Arthropoda	Malacostraca	Caprellidae	2	0.01	3.57
Caridea	Arthropoda	Malacostraca		2	0.01	3.57

Cerebratulus californiensis	Nemertea	Anopla	Lineidae	2	0.01	3.57
Cerebratulus marginatus	Nemertea	Anopla	Lineidae	2	0.01	3.57
Chaetopterus variopedatus Cmplx	Annelida	Polychaeta	Chaetopteridae	2	0.01	3.57
Ciona savignyi	Chordata	Ascidiacea	Cionidae	2	0.01	3.57
Cooperella subdiaphana	Mollusca	Bivalvia	Petricolidae	2	0.01	3.57
Cyathodonta pedroana	Mollusca	Bivalvia	Thraciidae	2	0.01	3.57
Deflexilodes sp	Arthropoda	Malacostraca	Oedicerotidae	2	0.01	3.57
Diopatra tridentata	Annelida	Polychaeta	Onuphidae	2	0.01	3.57
Drilonereis falcata	Annelida	Polychaeta	Oenonidae	2	0.01	3.57
Elasmopus sp	Arthropoda	Malacostraca	Maeridae	2	0.01	3.57
Enteropneusta	Chordata	Enteropneusta		2	0.01	3.57
Euclymeninae sp A	Annelida	Polychaeta	Maldanidae	2	0.01	3.57
Goniada littorea	Annelida	Polychaeta	Goniadidae	2	0.01	3.57
Heterophoxus sp	Arthropoda	Malacostraca	Phoxocephalidae	2	0.01	3.57
Hippolyte californiensis	Arthropoda	Malacostraca	Hippolytidae	2	0.01	3.57
Kurtiella mortoni	Mollusca	Bivalvia	Lasaeidae	2	0.01	3.57
Kurtzina beta	Mollusca	Gastropoda	Mangeliidae	2	0.01	3.57
Mesocrangon munitella	Arthropoda	Malacostraca	Crangonidae	2	0.01	3.57
Modiolatus neglectus	Mollusca	Bivalvia	Mytilidae	2	0.01	3.57
Molgula ficus	Chordata	Ascidiacea	Molgulidae	2	0.01	3.57
Molgulidae	Chordata	Ascidiacea	Molgulidae	2	0.01	3.57
Neogyptis sp	Annelida	Polychaeta	Hesionidae	2	0.01	3.57
Nereididae	Annelida	Polychaeta	Nereididae	2	0.01	3.57
Notomastus lineatus	Annelida	Polychaeta	Capitellidae	2	0.01	3.57
Nymphon pixellae	Arthropoda	Pycnogonida	Nymphonidae	2	0.01	3.57
Odostomia sp	Mollusca	Gastropoda	Pyramidellidae	2	0.01	3.57
Ophiothrix spiculata	Echinodermata	Ophiuroidea	Ophiotricidae	2	0.01	3.57
Owenia collaris	Annelida	Polychaeta	Oweniidae	2	0.01	3.57

Paradoneis sp SD1	Annelida	Polychaeta	Paraonidae	2	0.01	3.57
Podocopa	Arthropoda	Ostracoda		2	0.01	3.57
Raeta undulata	Mollusca	Bivalvia	Mactridae	2	0.01	3.57
Romaleon branneri	Arthropoda	Malacostraca	Cancridae	2	0.01	3.57
Salvatoria californiensis	Annelida	Polychaeta	Syllidae	2	0.01	3.57
Scoloplos acmeceps	Annelida	Polychaeta	Orbiniidae	2	0.01	3.57
Sphaerosyllis sp	Annelida	Polychaeta	Syllidae	2	0.01	3.57
Sthenelais tertiaglabra	Annelida	Polychaeta	Sigalionidae	2	0.01	3.57
Tellina meropsis	Mollusca	Bivalvia	Tellinidae	2	0.01	3.57
Tetrastemma candidum	Nemertea	Enopla	Tetrastemmatidae	2	0.01	3.57
Tubulanidae	Nemertea	Anopla	Tubulanidae	2	0.01	3.57
Acromegalomma pigmentum	Annelida	Polychaeta	Sabellidae	2	0.01	1.79
Amage sp	Annelida	Polychaeta	Ampharetidae	2	0.01	1.79
Aoroides sp	Arthropoda	Malacostraca	Aoridae	2	0.01	1.79
Apolochus picadurus	Arthropoda	Malacostraca	Amphilochidae	2	0.01	1.79
Betaeus ensenadensis	Arthropoda	Malacostraca	Alpheidae	2	0.01	1.79
Branchiosyllis exilis Cmplx	Annelida	Polychaeta	Syllidae	2	0.01	1.79
Calocarides spinulicauda	Arthropoda	Malacostraca	Axiidae	2	0.01	1.79
Caprella equilibra	Arthropoda	Malacostraca	Caprellidae	2	0.01	1.79
Cirratulus spectabilis	Annelida	Polychaeta	Cirratulidae	2	0.01	1.79
Harmothoe sp	Annelida	Polychaeta	Polynoidae	2	0.01	1.79
Here excavata	Mollusca	Bivalvia	Lucinidae	2	0.01	1.79
Hippomedon zetesimus	Arthropoda	Malacostraca	Lysianassidae	2	0.01	1.79
Kirkegaardia serratiseta	Annelida	Polychaeta	Cirratulidae	2	0.01	1.79
Leopecten diegensis	Mollusca	Bivalvia	Pectinidae	2	0.01	1.79
Paleanotus bellis	Annelida	Polychaeta	Chrysopetalidae	2	0.01	1.79
Paramicrodeutopus schmitti	Arthropoda	Malacostraca	Aoridae	2	0.01	1.79
Pettiboneia sanmatiensis	Annelida	Polychaeta	Dorvilleidae	2	0.01	1.79

Pholoides asperus	Annelida	Polychaeta	Sigalionidae	2	0.01	1.79
Protocirrineris sp	Annelida	Polychaeta	Cirratulidae	2	0.01	1.79
Streblosoma uncinatus	Annelida	Polychaeta	Terebellidae	2	0.01	1.79
Sunamphitoe sp	Arthropoda	Malacostraca	Ampithoidae	2	0.01	1.79
Syllis alternata	Annelida	Polychaeta	Syllidae	2	0.01	1.79
Syllis hyalina	Annelida	Polychaeta	Syllidae	2	0.01	1.79
Venerupis philippinarum	Mollusca	Bivalvia	Veneridae	2	0.01	1.79
Acteocina carinata	Mollusca	Gastropoda	Cylichnidae	1	0.01	1.79
Acteocina culcitella	Mollusca	Gastropoda	Cylichnidae	1	0.01	1.79
Aegires albopunctatus	Mollusca	Gastropoda	Aegiretidae	1	0.01	1.79
Aglaja ocelligera	Mollusca	Gastropoda	Aglajidae	1	0.01	1.79
Aglaophamus verrilli	Annelida	Polychaeta	Nephtyidae	1	0.01	1.79
Alienacanthomysis macropsis	Arthropoda	Malacostraca	Mysidae	1	0.01	1.79
Americhelidium sp	Arthropoda	Malacostraca	Oedicerotidae	1	0.01	1.79
Ammothella spinifera	Arthropoda	Pycnogonida	Ammotheidae	1	0.01	1.79
Ampelisca lobata	Arthropoda	Malacostraca	Ampeliscidae	1	0.01	1.79
Ampelisca pugetica	Arthropoda	Malacostraca	Ampeliscidae	1	0.01	1.79
Ampelisciphotis podophthalma	Arthropoda	Malacostraca	Photidae	1	0.01	1.79
Ancistrosyllis sp	Annelida	Polychaeta	Pilargidae	1	0.01	1.79
Anopla	Nemertea	Anopla		1	0.01	1.79
Anthozoa	Cnidaria	Anthozoa		1	0.01	1.79
Aphelochaeta sp	Annelida	Polychaeta	Cirratulidae	1	0.01	1.79
Arcteobia cf anticostiensis	Annelida	Polychaeta	Polynoidae	1	0.01	1.79
Armina californica	Mollusca	Gastropoda	Arminidae	1	0.01	1.79
Ascidia ceratodes	Chordata	Ascidiacea	Ascidiidae	1	0.01	1.79
Betaeus sp	Arthropoda	Malacostraca	Alpheidae	1	0.01	1.79
Boccardia basilaria	Annelida	Polychaeta	Spionidae	1	0.01	1.79
Byblis sp	Arthropoda	Malacostraca	Ampeliscidae	1	0.01	1.79

Caesia fossatus	Mollusca	Gastropoda	Nassariidae	1	0.01	1.79
Calliostoma annulatum	Mollusca	Gastropoda	Calliostomatidae	1	0.01	1.79
Calyptraea fastigiata	Mollusca	Gastropoda	Calyptraeidae	1	0.01	1.79
Caprella penantis	Arthropoda	Malacostraca	Caprellidae	1	0.01	1.79
Caprellidae	Arthropoda	Malacostraca	Caprellidae	1	0.01	1.79
Carinoma mutabilis	Nemertea	Anopla	Carinomidae	1	0.01	1.79
Caryocorbula luteola	Mollusca	Bivalvia	Corbulidae	1	0.01	1.79
Cerebratulus sp	Nemertea	Anopla	Lineidae	1	0.01	1.79
Cirratulus sp	Annelida	Polychaeta	Cirratulidae	1	0.01	1.79
Cirrophorus furcatus	Annelida	Polychaeta	Paraonidae	1	0.01	1.79
Corophioidea	Arthropoda	Malacostraca		1	0.01	1.79
Corymorpha palma	Cnidaria	Hydrozoa	Corymorphidae	1	0.01	1.79
Crangonidae	Arthropoda	Malacostraca	Crangonidae	1	0.01	1.79
Cranopsis multistriata	Mollusca	Gastropoda	Fissurellidae	1	0.01	1.79
Cylindroleberididae	Arthropoda	Ostracoda	Cylindroleberididae	1	0.01	1.79
Cymatioa electilis	Mollusca	Bivalvia	Galeommatidae	1	0.01	1.79
Diplodonta sericata	Mollusca	Bivalvia	Ungulinidae	1	0.01	1.79
Dipolydora socialis	Annelida	Polychaeta	Spionidae	1	0.01	1.79
Enopla	Nemertea	Enopla		1	0.01	1.79
Ericthonius sp	Arthropoda	Malacostraca	Ischyroceridae	1	0.01	1.79
Euchone hancocki	Annelida	Polychaeta	Sabellidae	1	0.01	1.79
Eugyra glutinans	Chordata	Ascidiacea	Molgulidae	1	0.01	1.79
Flosmaris grandis	Cnidaria	Anthozoa	Isopheliidae	1	0.01	1.79
Gastropoda	Mollusca	Gastropoda		1	0.01	1.79
Gastropteron pacificum	Mollusca	Gastropoda	Gastropteridae	1	0.01	1.79
Glycera oxycephala	Annelida	Polychaeta	Glyceridae	1	0.01	1.79
Glycinde armigera	Annelida	Polychaeta	Goniadidae	1	0.01	1.79
Gyptis brunnea	Annelida	Polychaeta	Hesionidae	1	0.01	1.79

Halianthella sp A	Cnidaria	Anthozoa	Halcampidae	1	0.01	1.79
Halosydna latior	Annelida	Polychaeta	Polynoidae	1	0.01	1.79
Harpacticoida	Arthropoda	Maxillopoda		1	0.01	1.79
Hermundura fauveli	Annelida	Polychaeta	Pilargidae	1	0.01	1.79
Heteromastus filobranchus	Annelida	Polychaeta	Capitellidae	1	0.01	1.79
Heteromysis odontops	Arthropoda	Malacostraca	Mysidae	1	0.01	1.79
Heteronemertea sp HYP1	Nemertea	Anopla	uncertain	1	0.01	1.79
Hippolytidae	Arthropoda	Malacostraca	Hippolytidae	1	0.01	1.79
Hoplonemertea	Nemertea	Enopla		1	0.01	1.79
Hydroides dirampha	Annelida	Polychaeta	Serpulidae	1	0.01	1.79
Iselica ovoidea	Mollusca	Gastropoda	Amathinidae	1	0.01	1.79
Jassa slatteryi	Arthropoda	Malacostraca	Ischyroceridae	1	0.01	1.79
Kurtiella grippi	Mollusca	Bivalvia	Lasaeidae	1	0.01	1.79
Kurtiella sp D	Mollusca	Bivalvia	Lasaeidae	1	0.01	1.79
Kurtziella plumbea	Mollusca	Gastropoda	Mangeliidae	1	0.01	1.79
Latulambrus occidentalis	Arthropoda	Malacostraca	Parthenopidae	1	0.01	1.79
Leitoscoloplos sp	Annelida	Polychaeta	Orbiniidae	1	0.01	1.79
Leodice americana	Annelida	Polychaeta	Eunicidae	1	0.01	1.79
Lepidonotus sp	Annelida	Polychaeta	Polynoidae	1	0.01	1.79
Leucothoe sp	Arthropoda	Malacostraca	Leucothoidae	1	0.01	1.79
Leukoma laciniata	Mollusca	Bivalvia	Veneridae	1	0.01	1.79
Leuroleberis sharpei	Arthropoda	Ostracoda	Cylindroleberididae	1	0.01	1.79
Limnactiniidae sp A	Cnidaria	Anthozoa	Limnactiniidae	1	0.01	1.79
Lineus flavescens	Nemertea	Anopla	Lineidae	1	0.01	1.79
Listriella eriopisa	Arthropoda	Malacostraca	Liljeborgiidae	1	0.01	1.79
Listriella sp	Arthropoda	Malacostraca	Liljeborgiidae	1	0.01	1.79
Lumbrineris cruzensis	Annelida	Polychaeta	Lumbrineridae	1	0.01	1.79
Macoma nasuta	Mollusca	Bivalvia	Tellinidae	1	0.01	1.79

Mactromeris catilliformis	Mollusca	Bivalvia	Mactridae	1	0.01	1.79
Maera jerrica	Arthropoda	Malacostraca	Melitidae	1	0.01	1.79
Magelona sp B	Annelida	Polychaeta	Magelonidae	1	0.01	1.79
Malacoplax californiensis	Arthropoda	Malacostraca	Panopeidae	1	0.01	1.79
Malmgreniella sp A	Annelida	Polychaeta	Polynoidae	1	0.01	1.79
Melanochlamys diomedea	Mollusca	Gastropoda	Aglajidae	1	0.01	1.79
Murchisonella occidentalis	Mollusca	Gastropoda	Murchisonellidae	1	0.01	1.79
Naineris sp	Annelida	Polychaeta	Orbiniidae	1	0.01	1.79
Naticidae	Mollusca	Gastropoda	Naticidae	1	0.01	1.79
Naushonia macginitiei	Arthropoda	Malacostraca	Laomediidae	1	0.01	1.79
Nephtys caecoides	Annelida	Polychaeta	Nephtyidae	1	0.01	1.79
Onuphis sp	Annelida	Polychaeta	Onuphidae	1	0.01	1.79
Ophiactis simplex	Echinodermata	Ophiuroidea	Ophiactidae	1	0.01	1.79
Pachycerianthus fimbriatus	Cnidaria	Anthozoa	Cerianthidae	1	0.01	1.79
Palola paloloides	Annelida	Polychaeta	Eunicidae	1	0.01	1.79
Paradialychone ecaudata	Annelida	Polychaeta	Sabellidae	1	0.01	1.79
Paradialychone harrisae	Annelida	Polychaeta	Sabellidae	1	0.01	1.79
Paradoneis lyra	Annelida	Polychaeta	Paraonidae	1	0.01	1.79
Phascolion sp A	Sipuncula	Sipunculidea	Phascolionidae	1	0.01	1.79
Phisidia sanctaemariae	Annelida	Polychaeta	Terebellidae	1	0.01	1.79
Pholoe glabra	Annelida	Polychaeta	Pholoidae	1	0.01	1.79
Phoronis sp SD1	Phoronida		Phoronidae	1	0.01	1.79
Phoronopsis sp	Phoronida		Phoronidae	1	0.01	1.79
Phtisicinae	Arthropoda	Malacostraca	Caprellidae	1	0.01	1.79
Phyllodoce hartmanae	Annelida	Polychaeta	Phyllodocidae	1	0.01	1.79
Phyllodoce longipes	Annelida	Polychaeta	Phyllodocidae	1	0.01	1.79
Phyllophoridae	Echinodermata	Holothuroidea	Phyllophoridae	1	0.01	1.79
Pilargis sp A	Annelida	Polychaeta	Pilargidae	1	0.01	1.79

Podarkeopsis glabrus	Annelida	Polychaeta	Hesionidae	1	0.01	1.79
Poecilochaetus johnsoni	Annelida	Polychaeta	Poecilochaetidae	1	0.01	1.79
Polycirrus sp A	Annelida	Polychaeta	Terebellidae	1	0.01	1.79
Polydora cirrosa	Annelida	Polychaeta	Spionidae	1	0.01	1.79
Polyodontes sp	Annelida	Polychaeta	Acoetidae	1	0.01	1.79
Pseudotanais makrothrix	Arthropoda	Malacostraca	Pseudotanaidae	1	0.01	1.79
Rictaxis punctocaelatus	Mollusca	Gastropoda	Acteonidae	1	0.01	1.79
Salmoneus sp A	Arthropoda	Malacostraca	Alpheidae	1	0.01	1.79
Salvatoria brevipharyngea	Annelida	Polychaeta	Syllidae	1	0.01	1.79
Scolanthus triangulus	Cnidaria	Anthozoa	Edwardsiidae	1	0.01	1.79
Scolelepis (Parascolelepis) texana	Annelida	Polychaeta	Spionidae	1	0.01	1.79
Scolelepis sp	Annelida	Polychaeta	Spionidae	1	0.01	1.79
Scoletoma tetraura Cmplx	Annelida	Polychaeta	Lumbrineridae	1	0.01	1.79
Semiodera inflata	Annelida	Polychaeta	Flabelligeridae	1	0.01	1.79
Sipunculidea	Sipuncula	Sipunculidea		1	0.01	1.79
Spiophanes sp	Annelida	Polychaeta	Spionidae	1	0.01	1.79
Stereobalanus sp	Chordata	Enteropneusta	Harrimaniidae	1	0.01	1.79
Streblosoma sp C	Annelida	Polychaeta	Terebellidae	1	0.01	1.79
Stylatula elongata	Cnidaria	Anthozoa	Virgulariidae	1	0.01	1.79
Stylochus exiguus	Platyhelminthes	Turbellaria	Stylochidae	1	0.01	1.79
Tagelus sp	Mollusca	Bivalvia	Solecurtidae	1	0.01	1.79
Tanystylum intermedium	Arthropoda	Pycnogonida	Ammotheidae	1	0.01	1.79
Tellina idae	Mollusca	Bivalvia	Tellinidae	1	0.01	1.79
Trachycardium quadragenarium	Mollusca	Bivalvia	Cardiidae	1	0.01	1.79
Tubulanidae sp B	Nemertea	Anopla	Tubulanidae	1	0.01	1.79
Turbonilla santarosana	Mollusca	Gastropoda	Pyramidellidae	1	0.01	1.79
Turbonilla sp A	Mollusca	Gastropoda	Pyramidellidae	1	0.01	1.79
Urechis caupo	Echiura	Echiuridea	Urechidae	1	0.01	1.79

Vargula tsujii	Arthropoda	Ostracoda	Cypridinidae	1	0.01	1.79
Veneridae	Mollusca	Bivalvia	Veneridae	1	0.01	1.79
Vermiliopsis infundibulum	Annelida	Polychaeta	Serpulidae	1	0.01	1.79
Vitrinella berryi	Mollusca	Gastropoda	Tornidae	1	0.01	1.79
Volvarina taeniolata	Mollusca	Gastropoda	Marginellidae	1	0.01	1.79
Zygeupolia rubens	Nemertea	Anopla	Valenciniidae	1	0.01	1.79

Appendix A4. Macrobenthic community summary for the Bays stratum in the Bight'18 survey. Total abundance from all samples, relative abundance across the stratum, and the frequency of occurrence within a stratum are presented. Taxa are ranked by total abundance.

Taxon	Phylum	Class	Family	Total Abundance	Relative Abundance (%)	Frequency of Occurrence (%)
Exogone lourei	Annelida	Polychaeta	Syllidae	1,285	6.87	37.21
Musculista senhousia	Mollusca	Bivalvia	Mytilidae	1,186	6.34	39.53
Barleeia haliotiphila	Mollusca	Gastropoda	Barleeiidae	1,145	6.12	23.26
Fabricinuda limnicola	Annelida	Polychaeta	Fabriciidae	975	5.22	30.23
Leitoscoloplos pugettensis	Annelida	Polychaeta	Orbiniidae	855	4.57	74.42
Amphideutopus oculatus	Arthropoda	Malacostraca	Kamakidae	755	4.04	53.49
Scoletoma sp C	Annelida	Polychaeta	Lumbrineridae	743	3.97	58.14
Scoletoma sp	Annelida	Polychaeta	Lumbrineridae	616	3.30	76.74
Acteocina carinata	Mollusca	Gastropoda	Cylichnidae	520	2.78	32.56
Mediomastus sp	Annelida	Polychaeta	Capitellidae	518	2.77	76.74
Pseudopolydora paucibranchiata	Annelida	Polychaeta	Spionidae	478	2.56	37.21
Dorvillea (Schistomeringos) longicornis	Annelida	Polychaeta	Dorvilleidae	360	1.93	13.95
Petaloclymene pacifica	Annelida	Polychaeta	Maldanidae	335	1.79	48.84
Chondrochelia dubia Cmplx	Arthropoda	Malacostraca	Leptocheliidae	313	1.67	34.88
Actiniaria	Cnidaria	Anthozoa		263	1.41	30.23
Phoronis sp	Phoronida		Phoronidae	253	1.35	60.47
Exogone dwisula	Annelida	Polychaeta	Syllidae	241	1.29	4.65
Paracerceis sculpta	Arthropoda	Malacostraca	Sphaeromatidae	234	1.25	13.95
Scoletoma sp A	Annelida	Polychaeta	Lumbrineridae	215	1.15	39.53
Cossura sp A	Annelida	Polychaeta	Cossuridae	186	0.99	34.88
Armandia brevis	Annelida	Polychaeta	Opheliidae	168	0.90	23.26
Podocerus fulanus	Arthropoda	Malacostraca	Podoceridae	168	0.90	27.91

Phoronidae	Phoronida		Phoronidae	166	0.89	27.91
Prionospio heterobranchia	Annelida	Polychaeta	Spionidae	159	0.85	39.53
Kirkegaardia siblina	Annelida	Polychaeta	Cirratulidae	155	0.83	27.91
Spirorbidae	Annelida	Polychaeta	Spirorbidae	147	0.79	4.65
Neanthes acuminata Cmplx	Annelida	Polychaeta	Nereididae	137	0.73	16.28
Theora lubrica	Mollusca	Bivalvia	Semelidae	136	0.73	48.84
Metridium sp	Cnidaria	Anthozoa	Metridiidae	125	0.67	4.65
Leitoscoloplos sp A	Annelida	Polychaeta	Orbiniidae	122	0.65	6.98
Maldanidae	Annelida	Polychaeta	Maldanidae	121	0.65	39.53
Lamispina schmidtii	Annelida	Polychaeta	Flabelligeridae	114	0.61	11.63
Amphipholis squamata	Echinodermata	Ophiuroidea	Amphiuridae	112	0.60	32.56
Sphaeromatidae	Arthropoda	Malacostraca	Sphaeromatidae	104	0.56	6.98
Leptosynapta sp	Echinodermata	Holothuroidea	Synaptidae	100	0.53	20.93
Tagelus affinis	Mollusca	Bivalvia	Solecurtidae	94	0.50	25.58
Glycera americana	Annelida	Polychaeta	Glyceridae	92	0.49	67.44
Diplocirrus sp SD1	Annelida	Polychaeta	Flabelligeridae	90	0.48	46.51
Exogone sp A	Annelida	Polychaeta	Syllidae	87	0.47	20.93
Poecilochaetus martini	Annelida	Polychaeta	Poecilochaetidae	87	0.47	27.91
Protohyale sp	Arthropoda	Malacostraca	Hyalidae	86	0.46	6.98
Pista brevibranchiata	Annelida	Polychaeta	Terebellidae	85	0.45	37.21
Elasmopus bampo	Arthropoda	Malacostraca	Maeridae	84	0.45	13.95
Caprella californica Cmplx	Arthropoda	Malacostraca	Caprellidae	81	0.43	16.28
Acromegalomma pigmentum	Annelida	Polychaeta	Sabellidae	75	0.40	16.28
Monocorophium acherusicum	Arthropoda	Malacostraca	Corophiidae	70	0.37	11.63
Nuculana taphria	Mollusca	Bivalvia	Nuculanidae	67	0.36	25.58
Chaetozone corona	Annelida	Polychaeta	Cirratulidae	66	0.35	23.26
Ampithoidae	Arthropoda	Malacostraca	Ampithoidae	65	0.35	2.33
Ampithoe plumulosa	Arthropoda	Malacostraca	Ampithoidae	64	0.34	2.33

Spiophanes duplex	Annelida	Polychaeta	Spionidae	63	0.34	37.21
Acteocina inculta	Mollusca	Gastropoda	Cylichnidae	62	0.33	2.33
Rudilemboides stenopropodus	Arthropoda	Malacostraca	Unciolidae	62	0.33	39.53
Astyris aurantiaca	Mollusca	Gastropoda	Columbellidae	59	0.32	9.30
Mayerella acanthopoda	Arthropoda	Malacostraca	Caprellidae	57	0.30	18.60
Marphysa disjuncta	Annelida	Polychaeta	Eunicidae	56	0.30	18.60
Listriella goleta	Arthropoda	Malacostraca	Liljeborgiidae	55	0.29	27.91
Bemlos macromanus	Arthropoda	Malacostraca	Aoridae	53	0.28	6.98
Amphiodia urtica	Echinodermata	Ophiuroidea	Amphiuridae	52	0.28	27.91
Euphilomedes carcharodonta	Arthropoda	Ostracoda	Philomedidae	52	0.28	32.56
Lumbrineris latreilli	Annelida	Polychaeta	Lumbrineridae	50	0.27	4.65
Scoletoma sp B	Annelida	Polychaeta	Lumbrineridae	49	0.26	30.23
Amphiodia sp	Echinodermata	Ophiuroidea	Amphiuridae	46	0.25	18.60
Aphelochaeta glandaria Cmplx	Annelida	Polychaeta	Cirratulidae	45	0.24	4.65
Laevicardium substriatum	Mollusca	Bivalvia	Cardiidae	45	0.24	27.91
Tellina meropsis	Mollusca	Bivalvia	Tellinidae	45	0.24	32.56
Hornellia occidentalis	Arthropoda	Malacostraca	Cheirocratidae	44	0.24	4.65
Dendraster terminalis	Echinodermata	Echinoidea	Dendrasteridae	43	0.23	2.33
Oligochaeta	Annelida	Oligochaeta		43	0.23	23.26
Oxyurostylis pacifica	Arthropoda	Malacostraca	Diastylidae	43	0.23	32.56
Paraprionospio alata	Annelida	Polychaeta	Spionidae	43	0.23	44.19
Heterophoxus cf ellisi	Arthropoda	Malacostraca	Phoxocephalidae	41	0.22	11.63
Praxillella pacifica	Annelida	Polychaeta	Maldanidae	41	0.22	16.28
Odontosyllis phosphorea	Annelida		Syllidae	40	0.21	11.63
Megasyllis nipponica	Annelida	Polychaeta	Syllidae	37	0.20	11.63
Scleroplax granulata	Arthropoda	Malacostraca	Pinnotheridae	37	0.20	25.58
Eochelidium sp A	Arthropoda	Malacostraca	Oedicerotidae	36	0.19	4.65
Ampelisca cristata microdentata	Arthropoda	Malacostraca	Ampeliscidae	35	0.19	20.93

Philine auriformis	Mollusca	Gastropoda	Philinidae	34	0.18	32.56
Edwardsia californica	Cnidaria	Anthozoa	Edwardsiidae	33	0.18	16.28
Laonice cirrata	Annelida	Polychaeta	Spionidae	33	0.18	30.23
Leucothoe alata	Arthropoda	Malacostraca	Leucothoidae	33	0.18	9.30
Pseudopolydora sp	Annelida	Polychaeta	Spionidae	33	0.18	2.33
Volvulella panamica	Mollusca	Gastropoda	Retusidae	33	0.18	18.60
Hartmanodes hartmanae	Arthropoda	Malacostraca	Oedicerotidae	32	0.17	25.58
Lumbrineris sp	Annelida	Polychaeta	Lumbrineridae	32	0.17	13.95
Lumbrineris sp E	Annelida	Polychaeta	Lumbrineridae	30	0.16	11.63
Tubulanus polymorphus	Nemertea	Anopla	Tubulanidae	30	0.16	34.88
Kirkegaardia cryptica	Annelida	Polychaeta	Cirratulidae	29	0.16	20.93
Actiniaria sp DC2	Cnidaria	Anthozoa		28	0.15	2.33
Ampelisca brachycladus	Arthropoda	Malacostraca	Ampeliscidae	28	0.15	16.28
Ampharete labrops	Annelida	Polychaeta	Ampharetidae	28	0.15	13.95
Cossura candida	Annelida	Polychaeta	Cossuridae	27	0.14	23.26
Crepidula onyx	Mollusca	Gastropoda	Calyptraeidae	27	0.14	11.63
Grandidierella japonica	Arthropoda	Malacostraca	Aoridae	27	0.14	18.60
Lyonsia californica	Mollusca	Bivalvia	Lyonsiidae	26	0.14	25.58
Zeuxo normani Cmplx	Arthropoda	Malacostraca	Tanaididae	26	0.14	13.95
Asthenothaerus diegensis	Mollusca	Bivalvia	Thraciidae	25	0.13	20.93
Ericthonius brasiliensis	Arthropoda	Malacostraca	Ischyroceridae	25	0.13	13.95
Paradialychone paramollis	Annelida	Polychaeta	Sabellidae	25	0.13	11.63
Pareurythoe californica	Annelida	Polychaeta	Amphinomidae	25	0.13	2.33
Caecum californicum	Mollusca	Gastropoda	Caecidae	24	0.13	4.65
Harmothoe imbricata Cmplx	Annelida	Polychaeta	Polynoidae	24	0.13	13.95
Amphicteis scaphobranchiata	Annelida	Polychaeta	Ampharetidae	22	0.12	23.26
Caprella sp	Arthropoda	Malacostraca	Caprellidae	22	0.12	16.28
Euchone limnicola	Annelida	Polychaeta	Sabellidae	22	0.12	25.58

Goniada littorea	Annelida	Polychaeta	Goniadidae	22	0.12	18.60
Exogone sp	Annelida	Polychaeta	Syllidae	21	0.11	2.33
Gadila aberrans	Mollusca	Scaphopoda	Gadilidae	21	0.11	23.26
Mactrotoma californica	Mollusca	Bivalvia	Mactridae	21	0.11	9.30
Paramicrodeutopus schmitti	Arthropoda	Malacostraca	Aoridae	21	0.11	4.65
Paranemertes californica	Nemertea	Enopla	Emplectonematidae	21	0.11	27.91
Philine ornatissima	Mollusca	Gastropoda	Philinidae	21	0.11	20.93
Prionospio pygmaeus	Annelida	Polychaeta	Spionidae	21	0.11	11.63
Protohyale frequens	Arthropoda	Malacostraca	Hyalidae	21	0.11	6.98
Amaeana occidentalis	Annelida	Polychaeta	Terebellidae	20	0.11	11.63
Caprella simia	Arthropoda	Malacostraca	Caprellidae	20	0.11	2.33
Levinsenia gracilis	Annelida	Polychaeta	Paraonidae	20	0.11	9.30
Macoma yoldiformis	Mollusca	Bivalvia	Tellinidae	20	0.11	27.91
Monocorophium sp	Arthropoda	Malacostraca	Corophiidae	20	0.11	2.33
Tagelus subteres	Mollusca	Bivalvia	Solecurtidae	20	0.11	11.63
Heterophoxus oculatus	Arthropoda	Malacostraca	Phoxocephalidae	19	0.10	2.33
Nassarius tiarula	Mollusca	Gastropoda	Nassariidae	19	0.10	20.93
Neotrypaea gigas	Arthropoda	Malacostraca	Callianassidae	19	0.10	11.63
Alpheus californiensis	Arthropoda	Malacostraca	Alpheidae	18	0.10	23.26
Eteone brigitteae	Annelida	Polychaeta	Phyllodocidae	18	0.10	16.28
Lottia depicta	Mollusca	Gastropoda	Lottiidae	18	0.10	2.33
Metasychis disparidentatus	Annelida	Polychaeta	Maldanidae	18	0.10	20.93
Paradexamine sp SD1	Arthropoda	Malacostraca	Dexaminidae	18	0.10	6.98
Virgularia californica	Cnidaria	Anthozoa	Virgulariidae	18	0.10	16.28
Ampelisca brevisimulata	Arthropoda	Malacostraca	Ampeliscidae	17	0.09	23.26
Edwardsiidae	Cnidaria	Anthozoa	Edwardsiidae	17	0.09	25.58
Neotrypaea sp	Arthropoda	Malacostraca	Callianassidae	17	0.09	11.63
Pista wui	Annelida	Polychaeta	Terebellidae	17	0.09	9.30

Stylatula elongata	Cnidaria	Anthozoa	Virgulariidae	17	0.09	18.60
Cirriformia sp	Annelida	Polychaeta	Cirratulidae	16	0.09	4.65
Cossura sp	Annelida	Polychaeta	Cossuridae	16	0.09	13.95
Panopeidae	Arthropoda	Malacostraca	Panopeidae	16	0.09	18.60
Prionospio lighti	Annelida	Polychaeta	Spionidae	16	0.09	13.95
Sinocorophium heteroceratum	Arthropoda	Malacostraca	Corophiidae	16	0.09	13.95
Tellina cadieni	Mollusca	Bivalvia	Tellinidae	16	0.09	16.28
Compsomyax subdiaphana	Mollusca	Bivalvia	Veneridae	15	0.08	9.30
Lineidae	Nemertea	Anopla	Lineidae	15	0.08	25.58
Lumbrineris japonica	Annelida	Polychaeta	Lumbrineridae	15	0.08	23.26
Salvatoria sp	Annelida	Polychaeta	Syllidae	15	0.08	4.65
Baseodiscus delineatus	Nemertea	Anopla	Valenciniidae	14	0.07	13.95
Stylatula sp A	Cnidaria	Anthozoa	Virgulariidae	14	0.07	18.60
Acanthoptilum sp	Cnidaria	Anthozoa	Virgulariidae	13	0.07	6.98
Capitella capitata Cmplx	Annelida	Polychaeta	Capitellidae	13	0.07	13.95
Carinoma mutabilis	Nemertea	Anopla	Carinomidae	13	0.07	11.63
Hemipodia borealis	Annelida	Polychaeta	Glyceridae	13	0.07	2.33
Postasterope barnesi	Arthropoda	Ostracoda	Cylindroleberididae	13	0.07	13.95
Syllis gracilis Cmplx	Annelida	Polychaeta	Syllidae	13	0.07	4.65
Cirratulidae	Annelida	Polychaeta	Cirratulidae	12	0.06	4.65
Hippolyte californiensis	Arthropoda	Malacostraca	Hippolytidae	12	0.06	9.30
Kurtiella coani	Mollusca	Bivalvia	Lasaeidae	12	0.06	9.30
Microspio pigmentata	Annelida	Polychaeta	Spionidae	12	0.06	6.98
Neotrypaea biffari	Arthropoda	Malacostraca	Callianassidae	12	0.06	2.33
Nereis sp A	Annelida	Polychaeta	Nereididae	12	0.06	11.63
Amage scutata	Annelida	Polychaeta	Ampharetidae	11	0.06	9.30
Anoplodactylus erectus	Arthropoda	Pycnogonida	Phoxichilidiidae	11	0.06	11.63
Anotomastus gordiodes	Annelida	Polychaeta	Capitellidae	11	0.06	6.98

Bemlos sp	Arthropoda	Malacostraca	Aoridae	11	0.06	6.98
Cyathura munda	Arthropoda	Malacostraca	Anthuridae	11	0.06	2.33
Scolanthus scamiti	Cnidaria	Anthozoa	Edwardsiidae	11	0.06	13.95
Caecognathia crenulatifrons	Arthropoda	Malacostraca	Gnathiidae	10	0.05	9.30
Notomastus hemipodus	Annelida	Polychaeta	Capitellidae	10	0.05	13.95
Plesiocystiscus politulus	Mollusca	Gastropoda	Cysticidae	10	0.05	2.33
Polydora cirrosa	Annelida	Polychaeta	Spionidae	10	0.05	2.33
Prionospio sp	Annelida	Polychaeta	Spionidae	10	0.05	4.65
Rutiderma rotundum	Arthropoda	Ostracoda	Rutidermatidae	10	0.05	2.33
Solen rostriformis	Mollusca	Bivalvia	Solenidae	10	0.05	9.30
Tenonia priops	Annelida	Polychaeta	Polynoidae	10	0.05	18.60
Vitrinella oldroydi	Mollusca	Gastropoda	Tornidae	10	0.05	6.98
Ampharetidae	Annelida	Polychaeta	Ampharetidae	9	0.05	11.63
Bivalvia	Mollusca	Bivalvia		9	0.05	13.95
Diopatra ornata	Annelida	Polychaeta	Onuphidae	9	0.05	6.98
Kurtiella grippi	Mollusca	Bivalvia	Lasaeidae	9	0.05	4.65
Palaeonemertea	Nemertea	Anopla		9	0.05	13.95
Pinnixa franciscana	Arthropoda	Malacostraca	Pinnotheridae	9	0.05	11.63
Spiochaetopterus costarum Cmplx	Annelida	Polychaeta	Chaetopteridae	9	0.05	13.95
Tubulanus sp A	Nemertea	Anopla	Tubulanidae	9	0.05	13.95
Virgulariidae	Cnidaria	Anthozoa	Virgulariidae	9	0.05	13.95
Acuminodeutopus heteruropus	Arthropoda	Malacostraca	Unciolidae	8	0.04	13.95
Crucibulum spinosum	Mollusca	Gastropoda	Calyptraeidae	8	0.04	6.98
Foxiphalus golfensis	Arthropoda	Malacostraca	Phoxocephalidae	8	0.04	2.33
Paranthura japonica	Arthropoda	Malacostraca	Paranthuridae	8	0.04	6.98
Pinnixa sp	Arthropoda	Malacostraca	Pinnotheridae	8	0.04	6.98
Protodorvillea gracilis	Annelida	Polychaeta	Dorvilleidae	8	0.04	2.33
Sigambra sp	Annelida	Polychaeta	Pilargidae	8	0.04	6.98

Tellina sp B	Mollusca	Bivalvia	Tellinidae	8	0.04	6.98
Amphiuridae	Echinodermata	Ophiuroidea	Amphiuridae	7	0.04	11.63
Aphelochaeta monilaris	Annelida	Polychaeta	Cirratulidae	7	0.04	6.98
Aphelochaeta petersenae	Annelida	Polychaeta	Cirratulidae	7	0.04	6.98
Epigamia-Myrianida Cmplx	Annelida	Polychaeta	Syllidae	7	0.04	6.98
Glycera sp	Annelida	Polychaeta	Glyceridae	7	0.04	6.98
Heteronemertea	Nemertea	Anopla		7	0.04	11.63
Listriella melanica	Arthropoda	Malacostraca	Liljeborgiidae	7	0.04	4.65
Malmgreniella macginitiei	Annelida	Polychaeta	Polynoidae	7	0.04	13.95
Microspio sp	Annelida	Polychaeta	Spionidae	7	0.04	9.30
Neastacilla californica	Arthropoda	Malacostraca	Arcturidae	7	0.04	4.65
Pinnotheridae	Arthropoda	Malacostraca	Pinnotheridae	7	0.04	9.30
Pisione sp	Annelida	Polychaeta	Pisionidae	7	0.04	2.33
Polydora sp	Annelida	Polychaeta	Spionidae	7	0.04	2.33
Tetrastemma candidum	Nemertea	Enopla	Tetrastemmatidae	7	0.04	4.65
Aplysiopsis enteromorphae	Mollusca	Gastropoda	Hermaeidae	6	0.03	2.33
Carinomella lactea	Nemertea	Anopla	Tubulanidae	6	0.03	11.63
Eobrolgus chumashi	Arthropoda	Malacostraca	Phoxocephalidae	6	0.03	2.33
Haminoea vesicula	Mollusca	Gastropoda	Haminoeidae	6	0.03	9.30
Harmothoe fragilis	Annelida	Polychaeta	Polynoidae	6	0.03	6.98
Hartmanodes sp SD1	Arthropoda	Malacostraca	Oedicerotidae	6	0.03	9.30
Leitoscoloplos sp	Annelida	Polychaeta	Orbiniidae	6	0.03	4.65
Majoidea	Arthropoda	Malacostraca		6	0.03	11.63
Nasageneia quinsana	Arthropoda	Malacostraca	Eusiridae	6	0.03	6.98
Phtisica marina	Arthropoda	Malacostraca	Caprellidae	6	0.03	4.65
Pista sp	Annelida	Polychaeta	Terebellidae	6	0.03	6.98
Schizocardium sp	Chordata	Enteropneusta	Spengeliidae	6	0.03	11.63
Tellina modesta	Mollusca	Bivalvia	Tellinidae	6	0.03	13.95

Terebellidae	Annelida	Polychaeta	Terebellidae	6	0.03	6.98
Actiniaria sp 1	Cnidaria	Anthozoa		5	0.03	4.65
Ambidexter panamensis	Arthropoda	Malacostraca	Processidae	5	0.03	6.98
Bipalponephtys cornuta	Annelida	Polychaeta	Nephtyidae	5	0.03	11.63
Brachyura	Arthropoda	Malacostraca		5	0.03	6.98
Chiridota	Echinodermata	Holothuroidea	Chiridotidae	5	0.03	2.33
Diopatra tridentata	Annelida	Polychaeta	Onuphidae	5	0.03	6.98
Heteromysis odontops	Arthropoda	Malacostraca	Mysidae	5	0.03	9.30
Heterophoxus sp	Arthropoda	Malacostraca	Phoxocephalidae	5	0.03	2.33
Hoplonemertea	Nemertea	Enopla		5	0.03	11.63
Lucinisca nuttalli	Mollusca	Bivalvia	Lucinidae	5	0.03	9.30
Melinna oculata	Annelida	Polychaeta	Ampharetidae	5	0.03	6.98
Micropodarke dubia	Annelida	Polychaeta	Hesionidae	5	0.03	4.65
Molgula ficus	Chordata	Ascidiacea	Molgulidae	5	0.03	4.65
Periploma discus	Mollusca	Bivalvia	Periplomatidae	5	0.03	9.30
Photis bifurcata	Arthropoda	Malacostraca	Photidae	5	0.03	6.98
Polygireulima rutila	Mollusca	Gastropoda	Eulimidae	5	0.03	2.33
Pyromaia tuberculata	Arthropoda	Malacostraca	Inachoididae	5	0.03	6.98
Schmittius politus	Arthropoda	Malacostraca	Squillidae	5	0.03	11.63
Syllidae	Annelida	Polychaeta	Syllidae	5	0.03	4.65
Thyasira flexuosa	Mollusca	Bivalvia	Thyasiridae	5	0.03	11.63
Trophoniella harrisae	Annelida	Polychaeta	Flabelligeridae	5	0.03	4.65
Aglaja ocelligera	Mollusca	Gastropoda	Aglajidae	4	0.02	2.33
Anemonactis sp A	Cnidaria	Anthozoa	Haloclavidae	4	0.02	2.33
Aphelochaeta sp	Annelida	Polychaeta	Cirratulidae	4	0.02	9.30
Caesia fossatus	Mollusca	Gastropoda	Nassariidae	4	0.02	4.65
Cooperella subdiaphana	Mollusca	Bivalvia	Petricolidae	4	0.02	9.30
Cylichna diegensis	Mollusca	Gastropoda	Cylichnidae	4	0.02	6.98

Diplodonta sericata	Mollusca	Bivalvia	Ungulinidae	4	0.02	2.33
Ericthonius sp SD1	Arthropoda	Malacostraca	Ischyroceridae	4	0.02	2.33
Erileptus spinosus	Arthropoda	Malacostraca	Inachidae	4	0.02	4.65
Euclymeninae sp A	Annelida	Polychaeta	Maldanidae	4	0.02	6.98
Gibberosus myersi	Arthropoda	Malacostraca	Megaluropidae	4	0.02	2.33
Hoploplana californica	Platyhelminthes	Turbellaria	Leptoplanidae	4	0.02	2.33
Magelona berkeleyi	Annelida	Polychaeta	Magelonidae	4	0.02	6.98
Metamysidopsis elongata	Arthropoda	Malacostraca	Mysidae	4	0.02	6.98
Mysidopsis intii	Arthropoda	Malacostraca	Mysidae	4	0.02	4.65
Ninoe tridentata	Annelida	Polychaeta	Lumbrineridae	4	0.02	6.98
Notomastus sp	Annelida	Polychaeta	Capitellidae	4	0.02	4.65
Onuphidae	Annelida	Polychaeta	Onuphidae	4	0.02	9.30
Piromis capulata	Annelida	Polychaeta	Flabelligeridae	4	0.02	4.65
Poecilochaetus sp	Annelida	Polychaeta	Poecilochaetidae	4	0.02	4.65
Polynoidae	Annelida	Polychaeta	Polynoidae	4	0.02	4.65
Prionospio jubata	Annelida	Polychaeta	Spionidae	4	0.02	9.30
Scolelepis (Parascolelepis) texana	Annelida	Polychaeta	Spionidae	4	0.02	9.30
Amage anops	Annelida	Polychaeta	Ampharetidae	3	0.02	2.33
Amphiodia digitata	Echinodermata	Ophiuroidea	Amphiuridae	3	0.02	6.98
Bispira sp	Annelida	Polychaeta	Sabellidae	3	0.02	4.65
Callianax biplicata	Mollusca	Gastropoda	Olivellidae	3	0.02	2.33
Caryocorbula porcella	Mollusca	Bivalvia	Corbulidae	3	0.02	4.65
Ceriantharia	Cnidaria	Anthozoa		3	0.02	6.98
Cryptomya californica	Mollusca	Bivalvia	Myidae	3	0.02	6.98
Decamastus gracilis	Annelida	Polychaeta	Capitellidae	3	0.02	2.33
Ericerodes hemphillii	Arthropoda	Malacostraca	Inachidae	3	0.02	6.98
Glycera nana	Annelida	Polychaeta	Glyceridae	3	0.02	4.65
Gymnonereis crosslandi	Annelida	Polychaeta	Nereididae	3	0.02	4.65

Kurtiella tumida	Mollusca	Bivalvia	Lasaeidae	3	0.02	4.65
Nephtys californiensis	Annelida	Polychaeta	Nephtyidae	3	0.02	2.33
Nereididae	Annelida	Polychaeta	Nereididae	3	0.02	6.98
Neverita recluziana	Mollusca	Gastropoda	Naticidae	3	0.02	4.65
Notopoma sp A	Arthropoda	Malacostraca	Ischyroceridae	3	0.02	2.33
Rhepoxynius heterocuspidatus	Arthropoda	Malacostraca	Phoxocephalidae	3	0.02	2.33
Rhepoxynius lucubrans	Arthropoda	Malacostraca	Phoxocephalidae	3	0.02	2.33
Rictaxis punctocaelatus	Mollusca	Gastropoda	Acteonidae	3	0.02	2.33
Streblosoma sp B	Annelida	Polychaeta	Terebellidae	3	0.02	2.33
Tubulanus sp SD1	Nemertea	Anopla	Tubulanidae	3	0.02	4.65
Acanthomysis californica	Arthropoda	Malacostraca	Mysidae	2	0.01	2.33
Acteocina sp	Mollusca	Gastropoda	Cylichnidae	2	0.01	4.65
Aglaophamus verrilli	Annelida	Polychaeta	Nephtyidae	2	0.01	4.65
Americhelidium sp	Arthropoda	Malacostraca	Oedicerotidae	2	0.01	2.33
Ampelisca cristata	Arthropoda	Malacostraca	Ampeliscidae	2	0.01	2.33
Amphioplus sp A	Echinodermata	Ophiuroidea	Amphiuridae	2	0.01	2.33
Ampithoe longimana	Arthropoda	Malacostraca	Ampithoidae	2	0.01	2.33
Aonides sp SD1	Annelida	Polychaeta	Spionidae	2	0.01	2.33
Aoridae	Arthropoda	Malacostraca	Aoridae	2	0.01	2.33
Apionsoma misakianum	Sipuncula	Phascolosomatidea	Phascolosomatidae	2	0.01	2.33
Apolochus barnardi	Arthropoda	Malacostraca	Amphilochidae	2	0.01	2.33
Armina californica	Mollusca	Gastropoda	Arminidae	2	0.01	2.33
Aruga holmesi	Arthropoda	Malacostraca	Lysianassidae	2	0.01	4.65
Betaeus ensenadensis	Arthropoda	Malacostraca	Alpheidae	2	0.01	2.33
Betaeus sp	Arthropoda	Malacostraca	Alpheidae	2	0.01	4.65
Campylaspis rubromaculata	Arthropoda	Malacostraca	Nannastacidae	2	0.01	4.65
Capitellidae	Annelida	Polychaeta	Capitellidae	2	0.01	2.33
Caryocorbula luteola	Mollusca	Bivalvia	Corbulidae	2	0.01	4.65

Caulleriella sp	Annelida	Polychaeta	Cirratulidae	2	0.01	2.33
Cerebratulus marginatus	Nemertea	Anopla	Lineidae	2	0.01	4.65
Crepidula sp	Mollusca	Gastropoda	Calyptraeidae	2	0.01	2.33
Diopatra sp	Annelida	Polychaeta	Onuphidae	2	0.01	2.33
Dipolydora sp	Annelida	Polychaeta	Spionidae	2	0.01	2.33
Drilonereis sp	Annelida	Polychaeta	Oenonidae	2	0.01	2.33
Drilonereis sp LA1	Annelida	Polychaeta	Oenonidae	2	0.01	2.33
Enopla	Nemertea	Enopla		2	0.01	2.33
Eugyra glutinans	Chordata	Ascidiacea	Molgulidae	2	0.01	4.65
Eunicidae	Annelida	Polychaeta	Eunicidae	2	0.01	4.65
Glycinde armigera	Annelida	Polychaeta	Goniadidae	2	0.01	4.65
Goniada maculata	Annelida	Polychaeta	Goniadidae	2	0.01	4.65
Leptopecten latiauratus	Mollusca	Bivalvia	Pectinidae	2	0.01	4.65
Lumbrineridae	Annelida	Polychaeta	Lumbrineridae	2	0.01	4.65
Lumbrineris cruzensis	Annelida	Polychaeta	Lumbrineridae	2	0.01	2.33
Macoma sp	Mollusca	Bivalvia	Tellinidae	2	0.01	4.65
Nephtys caecoides	Annelida	Polychaeta	Nephtyidae	2	0.01	4.65
Paracaprella sp	Arthropoda	Malacostraca	Caprellidae	2	0.01	2.33
Paracerceis sp A	Arthropoda	Malacostraca	Sphaeromatidae	2	0.01	2.33
Parvilucina tenuisculpta	Mollusca	Bivalvia	Lucinidae	2	0.01	4.65
Phoronis sp SD1	Phoronida		Phoronidae	2	0.01	4.65
Photis sp C	Arthropoda	Malacostraca	Photidae	2	0.01	2.33
Pilargis sp A	Annelida	Polychaeta	Pilargidae	2	0.01	4.65
Pinnixa longipes	Arthropoda	Malacostraca	Pinnotheridae	2	0.01	4.65
Podarkeopsis glabrus	Annelida	Polychaeta	Hesionidae	2	0.01	4.65
Polycladida	Platyhelminthes	Turbellaria		2	0.01	2.33
Pseudotanais makrothrix	Arthropoda	Malacostraca	Pseudotanaidae	2	0.01	4.65
Rhepoxynius menziesi	Arthropoda	Malacostraca	Phoxocephalidae	2	0.01	2.33

Scolanthus triangulus	Cnidaria	Anthozoa	Edwardsiidae	2	0.01	2.33
Scolelepis (Scolelepis) squamata	Annelida	Polychaeta	Spionidae	2	0.01	2.33
Scoloplos armiger Cmplx	Annelida	Polychaeta	Orbiniidae	2	0.01	2.33
Solen sp	Mollusca	Bivalvia	Solenidae	2	0.01	4.65
Spiophanes berkeleyorum	Annelida	Polychaeta	Spionidae	2	0.01	4.65
Spiophanes sp	Annelida	Polychaeta	Spionidae	2	0.01	4.65
Styela plicata	Chordata	Ascidiacea	Styelidae	2	0.01	2.33
Talitridae	Arthropoda	Malacostraca	Talitridae	2	0.01	2.33
Xanthidae	Arthropoda	Malacostraca	Xanthidae	2	0.01	2.33
Xanthoidea	Arthropoda	Malacostraca		2	0.01	2.33
Acteocina culcitella	Mollusca	Gastropoda	Cylichnidae	1	0.01	2.33
Alienacanthomysis macropsis	Arthropoda	Malacostraca	Mysidae	1	0.01	2.33
Americhelidium sp SD4	Arthropoda	Malacostraca	Oedicerotidae	1	0.01	2.33
Amphiodia psara	Echinodermata	Ophiuroidea	Amphiuridae	1	0.01	2.33
Amphipoda	Arthropoda	Malacostraca		1	0.01	2.33
Amphisamytha bioculata	Annelida	Polychaeta	Ampharetidae	1	0.01	2.33
Ampithoe valida	Arthropoda	Malacostraca	Ampithoidae	1	0.01	2.33
Ancistrosyllis hamata	Annelida	Polychaeta	Pilargidae	1	0.01	2.33
Aricidea (Acmira) catherinae	Annelida	Polychaeta	Paraonidae	1	0.01	2.33
Aricidea (Acmira) horikoshii	Annelida	Polychaeta	Paraonidae	1	0.01	2.33
Aricidea sp	Annelida	Polychaeta	Paraonidae	1	0.01	2.33
Asteropella slatteryi	Arthropoda	Ostracoda	Cylindroleberididae	1	0.01	2.33
Branchiostoma californiense	Chordata		Branchiostomatidae	1	0.01	2.33
Bulla gouldiana	Mollusca	Gastropoda	Bullidae	1	0.01	2.33
Callianax baetica	Mollusca	Gastropoda	Olivellidae	1	0.01	2.33
Calyptraeidae	Mollusca	Gastropoda	Calyptraeidae	1	0.01	2.33
Cephalaspidea	Mollusca	Gastropoda		1	0.01	2.33
Cerebratulus sp	Nemertea	Anopla	Lineidae	1	0.01	2.33

Chaetozone columbiana	Annelida	Polychaeta	Cirratulidae	1	0.01	2.33
Ciona robusta	Chordata	Ascidiacea	Cionidae	1	0.01	2.33
Cirratulus sp	Annelida	Polychaeta	Cirratulidae	1	0.01	2.33
Cirrophorus furcatus	Annelida	Polychaeta	Paraonidae	1	0.01	2.33
Columbellidae	Mollusca	Gastropoda	Columbellidae	1	0.01	2.33
Crangon alaskensis	Arthropoda	Malacostraca	Crangonidae	1	0.01	2.33
Crepipatella lingulata	Mollusca	Gastropoda	Calyptraeidae	1	0.01	2.33
Cryptonemertes actinophila	Nemertea	Enopla	Emplectonematidae	1	0.01	2.33
Cumacea	Arthropoda	Malacostraca		1	0.01	2.33
Cymatioa electilis	Mollusca	Bivalvia	Galeommatidae	1	0.01	2.33
Deflexilodes sp	Arthropoda	Malacostraca	Oedicerotidae	1	0.01	2.33
Dialychone albocincta	Annelida	Polychaeta	Sabellidae	1	0.01	2.33
Dialychone veleronis	Annelida	Polychaeta	Sabellidae	1	0.01	2.33
Dipolydora socialis	Annelida	Polychaeta	Spionidae	1	0.01	2.33
Ensis myrae	Mollusca	Bivalvia	Pharidae	1	0.01	2.33
Eohaustorius barnardi	Arthropoda	Malacostraca	Haustoriidae	1	0.01	2.33
Erichsonella crenulata	Arthropoda	Malacostraca	Idoteidae	1	0.01	2.33
Eupolymnia heterobranchia	Annelida	Polychaeta	Terebellidae	1	0.01	2.33
Flabelligeridae	Annelida	Polychaeta	Flabelligeridae	1	0.01	2.33
Garnotia naticarum	Mollusca	Gastropoda	Calyptraeidae	1	0.01	2.33
Halosydna sp	Annelida	Polychaeta	Polynoidae	1	0.01	2.33
Haplosyllis spongicola Cmplx	Annelida	Polychaeta	Syllidae	1	0.01	2.33
Harpacticoida	Arthropoda	Maxillopoda		1	0.01	2.33
Hesionella mccullochae	Annelida	Polychaeta	Hesionidae	1	0.01	2.33
Hesionidae	Annelida	Polychaeta	Hesionidae	1	0.01	2.33
Hippolyte clarki	Arthropoda	Malacostraca	Hippolytidae	1	0.01	2.33
Hippomedon zetesimus	Arthropoda	Malacostraca	Lysianassidae	1	0.01	2.33
Hourstonius vilordes	Arthropoda	Malacostraca	Amphilochidae	1	0.01	2.33

Hyalidae	Arthropoda	Malacostraca	Hyalidae	1	0.01	2.33
Kirkegaardia sp	Annelida	Polychaeta	Cirratulidae	1	0.01	2.33
Kurtiella mortoni	Mollusca	Bivalvia	Lasaeidae	1	0.01	2.33
Lepidonotus spiculus	Annelida	Polychaeta	Polynoidae	1	0.01	2.33
Leptoplanoidea	Platyhelminthes	Turbellaria		1	0.01	2.33
Leucothoe sp	Arthropoda	Malacostraca	Leucothoidae	1	0.01	2.33
Leukoma laciniata	Mollusca	Bivalvia	Veneridae	1	0.01	2.33
Limaria hemphilli	Mollusca	Bivalvia	Limidae	1	0.01	2.33
Listriella sp SD1	Arthropoda	Malacostraca	Liljeborgiidae	1	0.01	2.33
Lophopanopeus frontalis	Arthropoda	Malacostraca	Panopeidae	1	0.01	2.33
Lysippe sp A	Annelida	Polychaeta	Ampharetidae	1	0.01	2.33
Macoma nasuta	Mollusca	Bivalvia	Tellinidae	1	0.01	2.33
Mactridae	Mollusca	Bivalvia	Mactridae	1	0.01	2.33
Maculaura alaskensis Cmplx	Nemertea	Anopla	Lineidae	1	0.01	2.33
Malmgreniella sp	Annelida	Polychaeta	Polynoidae	1	0.01	2.33
Marphysa sp B	Annelida	Polychaeta	Eunicidae	1	0.01	2.33
Mesokalliapseudes crassus	Arthropoda	Malacostraca	Kalliapseudidae	1	0.01	2.33
Molgulidae	Chordata	Ascidiacea	Molgulidae	1	0.01	2.33
Molpadia arenicola	Echinodermata	Holothuroidea	Molpadiidae	1	0.01	2.33
Monocorophium insidiosum	Arthropoda	Malacostraca	Corophiidae	1	0.01	2.33
Mysida	Arthropoda	Malacostraca		1	0.01	2.33
Mysidae	Arthropoda	Malacostraca	Mysidae	1	0.01	2.33
Mytilus galloprovincialis	Mollusca	Bivalvia	Mytilidae	1	0.01	2.33
Naineris dendritica	Annelida	Polychaeta	Orbiniidae	1	0.01	2.33
Naineris sp	Annelida	Polychaeta	Orbiniidae	1	0.01	2.33
Nassarius mendicus	Mollusca	Gastropoda	Nassariidae	1	0.01	2.33
Naushonia macginitiei	Arthropoda	Malacostraca	Laomediidae	1	0.01	2.33
Nephtys simoni	Annelida	Polychaeta	Nephtyidae	1	0.01	2.33

Nephtys sp	Annelida	Polychaeta	Nephtyidae	1	0.01	2.33
Netastoma rostratum	Mollusca	Bivalvia	Pholadidae	1	0.01	2.33
Notomastus lineatus	Annelida	Polychaeta	Capitellidae	1	0.01	2.33
Notomastus magnus	Annelida	Polychaeta	Capitellidae	1	0.01	2.33
Notomastus tenuis	Annelida	Polychaeta	Capitellidae	1	0.01	2.33
Nudibranchia	Mollusca	Gastropoda		1	0.01	2.33
Odostomia sp	Mollusca	Gastropoda	Pyramidellidae	1	0.01	2.33
Ophelia limacina	Annelida	Polychaeta	Opheliidae	1	0.01	2.33
Ophiactis simplex	Echinodermata	Ophiuroidea	Ophiactidae	1	0.01	2.33
Ophiuroidea	Echinodermata	Ophiuroidea		1	0.01	2.33
Ophryotrocha sp	Annelida	Polychaeta	Dorvilleidae	1	0.01	2.33
Ostrea lurida	Mollusca	Bivalvia	Ostreidae	1	0.01	2.33
Oxydromus pugettensis	Annelida	Polychaeta	Hesionidae	1	0.01	2.33
Paradialychone harrisae	Annelida	Polychaeta	Sabellidae	1	0.01	2.33
Paraprionospio sp	Annelida	Polychaeta	Spionidae	1	0.01	2.33
Parexogone molesta	Annelida	Polychaeta	Syllidae	1	0.01	2.33
Pectinaria californiensis	Annelida	Polychaeta	Pectinariidae	1	0.01	2.33
Phascolion sp A	Sipuncula	Sipunculidea	Phascolionidae	1	0.01	2.33
Pherusa neopapillata	Annelida	Polychaeta	Flabelligeridae	1	0.01	2.33
Philine bakeri	Mollusca	Gastropoda	Philinidae	1	0.01	2.33
Photis brevipes	Arthropoda	Malacostraca	Photidae	1	0.01	2.33
Phyllodoce medipapillata	Annelida	Polychaeta	Phyllodocidae	1	0.01	2.33
Platymera gaudichaudii	Arthropoda	Malacostraca	Calappidae	1	0.01	2.33
Podarkeopsis sp A	Annelida	Polychaeta	Hesionidae	1	0.01	2.33
Poecilochaetus johnsoni	Annelida	Polychaeta	Poecilochaetidae	1	0.01	2.33
Prosthiostomum latocelis	Platyhelminthes	Turbellaria	Prostiostomidae	1	0.01	2.33
Psammotreta obesa	Mollusca	Bivalvia	Tellinidae	1	0.01	2.33
Romaleon branneri	Arthropoda	Malacostraca	Cancridae	1	0.01	2.33

Rutiderma judayi	Arthropoda	Ostracoda	Rutidermatidae	1	0.01	2.33
Rutidermatidae	Arthropoda	Ostracoda	Rutidermatidae	1	0.01	2.33
Salmacina tribranchiata	Annelida	Polychaeta	Serpulidae	1	0.01	2.33
Salvatoria californiensis	Annelida	Polychaeta	Syllidae	1	0.01	2.33
Sige sp A	Annelida	Polychaeta	Phyllodocidae	1	0.01	2.33
Sipunculidea	Sipuncula	Sipunculidea		1	0.01	2.33
Siriella pacifica	Arthropoda	Malacostraca	Mysidae	1	0.01	2.33
Solen sicarius	Mollusca	Bivalvia	Solenidae	1	0.01	2.33
Sphaerosyllis sp	Annelida	Polychaeta	Syllidae	1	0.01	2.33
Spio maculata	Annelida	Polychaeta	Spionidae	1	0.01	2.33
Spiophanes norrisi	Annelida	Polychaeta	Spionidae	1	0.01	2.33
Sternaspis affinis	Annelida	Polychaeta	Sternaspidae	1	0.01	2.33
Sthenelais tertiaglabra	Annelida	Polychaeta	Sigalionidae	1	0.01	2.33
Sthenelanella uniformis	Annelida	Polychaeta	Sigalionidae	1	0.01	2.33
Syllis sp	Annelida	Polychaeta	Syllidae	1	0.01	2.33
Thysanocardia nigra	Sipuncula	Sipunculidea	Golfingiidae	1	0.01	2.33
Trachycardium quadragenarium	Mollusca	Bivalvia	Cardiidae	1	0.01	2.33
Tryphosinae incertae sedis entalladurus	Arthropoda	Malacostraca	Tryphosidae	1	0.01	2.33
Tubulanidae	Nemertea	Anopla	Tubulanidae	1	0.01	2.33
Tubulanidae sp B	Nemertea	Anopla	Tubulanidae	1	0.01	2.33
Tubulanus cingulatus	Nemertea	Anopla	Tubulanidae	1	0.01	2.33
Zygeupolia rubens	Nemertea	Anopla	Valenciniidae	1	0.01	2.33
Zygonemertes virescens	Nemertea	Enopla	Amphiporidae	1	0.01	2.33

Appendix A5. Macrobenthic community summary for the Brackish Estuaries stratum in the Bight'18 survey. Total abundance from all samples, relative abundance across the stratum, and the frequency of occurrence within a stratum are presented. Taxa are ranked by total abundance.

Taxon	Phylum	Class	Family	Total Abundance	Relative Abundance (%)	Frequency of Occurrence (%)
Monocorophium insidiosum	Arthropoda	Malacostraca	Corophiidae	1,879	36.41	16.67
Grandidierella japonica	Arthropoda	Malacostraca	Aoridae	1,096	21.24	33.33
Oligochaeta	Annelida	Oligochaeta		970	18.79	58.33
Podocopa	Arthropoda	Ostracoda		192	3.72	33.33
Ampithoe valida	Arthropoda	Malacostraca	Ampithoidae	152	2.95	8.33
Acteocina carinata	Mollusca	Gastropoda	Cylichnidae	149	2.89	16.67
Diptera	Arthropoda			123	2.38	41.67
Streblospio benedicti	Annelida	Polychaeta	Spionidae	115	2.23	25.00
Dipolydora socialis	Annelida	Polychaeta	Spionidae	105	2.03	8.33
Polydora cornuta	Annelida	Polychaeta	Spionidae	55	1.07	25.00
Monocorophium uenoi	Arthropoda	Malacostraca	Corophiidae	48	0.93	16.67
Neanthes acuminata Cmplx	Annelida	Polychaeta	Nereididae	46	0.89	16.67
Tethygeneia opata	Arthropoda	Malacostraca	Eusiridae	41	0.79	8.33
Rhabdocoela	Platyhelminthes	Turbellaria		38	0.74	8.33
Monocorophium sp	Arthropoda	Malacostraca	Corophiidae	23	0.45	8.33
Leptoconops sp	Arthropoda	Insecta	Ceratopogonidae	21	0.41	8.33
Monocorophium acherusicum	Arthropoda	Malacostraca	Corophiidae	20	0.39	8.33
Nippoleucon hinumensis	Arthropoda	Malacostraca	Leuconidae	15	0.29	16.67
Tagelus affinis	Mollusca	Bivalvia	Solecurtidae	12	0.23	8.33
Capitella capitata Cmplx	Annelida	Polychaeta	Capitellidae	10	0.19	16.67
Chironomini	Arthropoda	Insecta	Chironomidae	8	0.16	8.33
Chondrochelia dubia Cmplx	Arthropoda	Malacostraca	Leptocheliidae	6	0.12	8.33

Actiniaria	Cnidaria	Anthozoa		5	0.10	8.33
Hemiptera	Arthropoda	Insecta		4	0.08	25.00
Musculista senhousia	Mollusca	Bivalvia	Mytilidae	4	0.08	16.67
Cerithidea californica	Mollusca	Gastropoda	Potamididae	4	0.08	8.33
Psocidae	Arthropoda	Insecta	Psocidae	3	0.06	8.33
Alderia willowi	Mollusca	Gastropoda	Hermaeidae	2	0.04	8.33
Amphipoda	Arthropoda	Malacostraca		2	0.04	8.33
Barleeia haliotiphila	Mollusca	Gastropoda	Barleeiidae	2	0.04	8.33
Exogone lourei	Annelida	Polychaeta	Syllidae	2	0.04	8.33
Armandia brevis	Annelida	Polychaeta	Opheliidae	1	0.02	8.33
Chionista fluctifraga	Mollusca	Bivalvia	Veneridae	1	0.02	8.33
Coleoptera	Arthropoda	Insecta		1	0.02	8.33
Eteone brigitteae	Annelida	Polychaeta	Phyllodocidae	1	0.02	8.33
Hartmanodes hartmanae	Arthropoda	Malacostraca	Oedicerotidae	1	0.02	8.33
Marphysa sp	Annelida	Polychaeta	Eunicidae	1	0.02	8.33
Physa sp	Mollusca	Gastropoda	Physidae	1	0.02	8.33
Staphylinidae	Arthropoda	Insecta	Staphylinidae	1	0.02	8.33
Tanaididae	Arthropoda	Malacostraca	Tanaididae	1	0.02	8.33

Appendix A6. Macrobenthic community summary for the Inner Shelf stratum in the Bight'18 survey. Total abundance from all samples, relative abundance across the stratum, and the frequency of occurrence within a stratum are presented. Taxa are ranked by total abundance.

Taxon	Phylum	Class	Family	Total Abundance	Relative Abundance (%)	Frequency of Occurrence (%)
Spiophanes norrisi	Annelida	Polychaeta	Spionidae	1,164	10.25	83.33
Mediomastus sp	Annelida	Polychaeta	Capitellidae	336	2.96	72.22
Kirkegaardia siblina	Annelida	Polychaeta	Cirratulidae	331	2.92	66.67
Amphideutopus oculatus	Arthropoda	Malacostraca	Kamakidae	294	2.59	50.00
Spiophanes duplex	Annelida	Polychaeta	Spionidae	261	2.30	83.33
Ampelisca brevisimulata	Arthropoda	Malacostraca	Ampeliscidae	238	2.10	63.89
Ampelisca cristata microdentata	Arthropoda	Malacostraca	Ampeliscidae	218	1.92	58.33
Euphilomedes carcharodonta	Arthropoda	Ostracoda	Philomedidae	216	1.90	58.33
Tellina modesta	Mollusca	Bivalvia	Tellinidae	161	1.42	75.00
Maldanidae	Annelida	Polychaeta	Maldanidae	156	1.37	69.44
Prionospio pygmaeus	Annelida	Polychaeta	Spionidae	156	1.37	55.56
Chondrochelia dubia Cmplx	Arthropoda	Malacostraca	Leptocheliidae	149	1.31	38.89
Diastylopsis tenuis	Arthropoda	Malacostraca	Diastylidae	148	1.30	22.22
Ampharete labrops	Annelida	Polychaeta	Ampharetidae	141	1.24	38.89
Gadila aberrans	Mollusca	Scaphopoda	Gadilidae	140	1.23	69.44
Foxiphalus obtusidens	Arthropoda	Malacostraca	Phoxocephalidae	121	1.07	38.89
Rhepoxynius menziesi	Arthropoda	Malacostraca	Phoxocephalidae	115	1.01	63.89
Chaetozone corona	Annelida	Polychaeta	Cirratulidae	115	1.01	52.78
Carinoma mutabilis	Nemertea	Anopla	Carinomidae	108	0.95	69.44
Photis brevipes	Arthropoda	Malacostraca	Photidae	107	0.94	33.33
Exogone dwisula	Annelida	Polychaeta	Syllidae	104	0.92	5.56
Goniada littorea	Annelida	Polychaeta	Goniadidae	103	0.91	50.00

Photis sp	Arthropoda	Malacostraca	Photidae	99	0.87	33.33
Petaloclymene pacifica	Annelida	Polychaeta	Maldanidae	99	0.87	30.56
Cooperella subdiaphana	Mollusca	Bivalvia	Petricolidae	97	0.85	55.56
Dialychone veleronis	Annelida	Polychaeta	Sabellidae	96	0.85	38.89
Tubulanus polymorphus	Nemertea	Anopla	Tubulanidae	95	0.84	58.33
Prionospio jubata	Annelida	Polychaeta	Spionidae	91	0.80	47.22
Polydora sp	Annelida	Polychaeta	Spionidae	88	0.78	11.11
Glycinde armigera	Annelida	Polychaeta	Goniadidae	87	0.77	69.44
Paraprionospio alata	Annelida	Polychaeta	Spionidae	85	0.75	52.78
Owenia collaris	Annelida	Polychaeta	Oweniidae	83	0.73	19.44
Polydora cirrosa	Annelida	Polychaeta	Spionidae	80	0.70	11.11
Sigalion spinosus	Annelida	Polychaeta	Sigalionidae	79	0.70	69.44
Metasychis disparidentatus	Annelida	Polychaeta	Maldanidae	77	0.68	47.22
Macoma yoldiformis	Mollusca	Bivalvia	Tellinidae	66	0.58	47.22
Spiophanes berkeleyorum	Annelida	Polychaeta	Spionidae	65	0.57	41.67
Caprella sp	Arthropoda	Malacostraca	Caprellidae	65	0.57	8.33
Lineidae	Nemertea	Anopla	Lineidae	62	0.55	50.00
Nereis sp A	Annelida	Polychaeta	Nereididae	59	0.52	47.22
Ericthonius brasiliensis	Arthropoda	Malacostraca	Ischyroceridae	59	0.52	13.89
Marphysa disjuncta	Annelida	Polychaeta	Eunicidae	58	0.51	8.33
Phoronis sp	Phoronida		Phoronidae	57	0.50	47.22
Nuculana taphria	Mollusca	Bivalvia	Nuculanidae	57	0.50	38.89
Dipolydora socialis	Annelida	Polychaeta	Spionidae	55	0.48	16.67
Salvatoria californiensis	Annelida	Polychaeta	Syllidae	55	0.48	16.67
Laonice cirrata	Annelida	Polychaeta	Spionidae	53	0.47	52.78
Ampelisca brachycladus	Arthropoda	Malacostraca	Ampeliscidae	52	0.46	38.89
Kirkegaardia cryptica	Annelida	Polychaeta	Cirratulidae	52	0.46	33.33
Leptopecten latiauratus	Mollusca	Bivalvia	Pectinidae	52	0.46	30.56

Ampelisca cristata	Arthropoda	Malacostraca	Ampeliscidae	49	0.43	27.78
Glottidia albida	Brachiopoda	Inarticulata	Lingulidae	47	0.41	33.33
Ampelisciphotis podophthalma	Arthropoda	Malacostraca	Photidae	47	0.41	16.67
Odontosyllis phosphorea	Annelida		Syllidae	45	0.40	27.78
Sabellides manriquei	Annelida	Polychaeta	Ampharetidae	45	0.40	19.44
Amphicteis scaphobranchiata	Annelida	Polychaeta	Ampharetidae	43	0.38	38.89
Diopatra sp	Annelida	Polychaeta	Onuphidae	43	0.38	38.89
Euclymeninae sp A	Annelida	Polychaeta	Maldanidae	42	0.37	47.22
Ampelisca agassizi	Arthropoda	Malacostraca	Ampeliscidae	41	0.36	27.78
Sthenelanella uniformis	Annelida	Polychaeta	Sigalionidae	41	0.36	27.78
Kurtiella tumida	Mollusca	Bivalvia	Lasaeidae	40	0.35	44.44
Rhepoxynius variatus	Arthropoda	Malacostraca	Phoxocephalidae	40	0.35	30.56
Scoletoma tetraura Cmplx	Annelida	Polychaeta	Lumbrineridae	40	0.35	25.00
Gammaropsis thompsoni	Arthropoda	Malacostraca	Photidae	40	0.35	13.89
Ophiuroconis bispinosa	Echinodermata	Ophiuroidea	Ophiodermatidae	40	0.35	13.89
Amaeana occidentalis	Annelida	Polychaeta	Terebellidae	39	0.34	19.44
Dialychone albocincta	Annelida	Polychaeta	Sabellidae	38	0.33	27.78
Ampelisca cf *brevisimulata*	Arthropoda	Malacostraca	Ampeliscidae	38	0.33	8.33
Rhepoxynius stenodes	Arthropoda	Malacostraca	Phoxocephalidae	37	0.33	38.89
Praxillella pacifica	Annelida	Polychaeta	Maldanidae	36	0.32	47.22
Hartmanodes hartmanae	Arthropoda	Malacostraca	Oedicerotidae	36	0.32	44.44
Diopatra ornata	Annelida	Polychaeta	Onuphidae	36	0.32	22.22
Polycirrus sp	Annelida	Polychaeta	Terebellidae	35	0.31	36.11
Onuphis sp A	Annelida	Polychaeta	Onuphidae	35	0.31	30.56
Pectinaria californiensis	Annelida	Polychaeta	Pectinariidae	35	0.31	27.78
Chaetozone columbiana	Annelida	Polychaeta	Cirratulidae	35	0.31	25.00
Spiochaetopterus costarum Cmplx	Annelida	Polychaeta	Chaetopteridae	33	0.29	44.44
Goniada maculata	Annelida	Polychaeta	Goniadidae	33	0.29	38.89

Callianax baetica	Mollusca	Gastropoda	Olivellidae	33	0.29	27.78
Platynereis bicanaliculata	Annelida	Polychaeta	Nereididae	33	0.29	13.89
Onuphidae	Annelida	Polychaeta	Onuphidae	32	0.28	36.11
Leitoscoloplos pugettensis	Annelida	Polychaeta	Orbiniidae	32	0.28	33.33
Hemilamprops californicus	Arthropoda	Malacostraca	Lampropidae	31	0.27	27.78
Chaetozone sp	Annelida	Polychaeta	Cirratulidae	31	0.27	22.22
Notopoma sp A	Arthropoda	Malacostraca	Ischyroceridae	30	0.26	16.67
Scalibregma californicum	Annelida	Polychaeta	Scalibregmatidae	29	0.26	30.56
Philine auriformis	Mollusca	Gastropoda	Philinidae	28	0.25	41.67
Photis sp OC1	Arthropoda	Malacostraca	Photidae	28	0.25	25.00
Ampelisca pugetica	Arthropoda	Malacostraca	Ampeliscidae	28	0.25	19.44
Scoloplos acmeceps	Annelida	Polychaeta	Orbiniidae	28	0.25	19.44
Lumbrineridae	Annelida	Polychaeta	Lumbrineridae	28	0.25	16.67
Polycirrus sp A	Annelida	Polychaeta	Terebellidae	28	0.25	16.67
Hoplonemertea	Nemertea	Enopla		27	0.24	41.67
Pista wui	Annelida	Polychaeta	Terebellidae	27	0.24	30.56
Glycera oxycephala	Annelida	Polychaeta	Glyceridae	27	0.24	27.78
Phyllodoce hartmanae	Annelida	Polychaeta	Phyllodocidae	27	0.24	25.00
Cossura sp A	Annelida	Polychaeta	Cossuridae	27	0.24	16.67
Paradoneis sp SD1	Annelida	Polychaeta	Paraonidae	27	0.24	5.56
Magelona sacculata	Annelida	Polychaeta	Magelonidae	26	0.23	11.11
Ampelisca sp	Arthropoda	Malacostraca	Ampeliscidae	25	0.22	25.00
Syllis heterochaeta	Annelida	Polychaeta	Syllidae	25	0.22	16.67
Nephtys caecoides	Annelida	Polychaeta	Nephtyidae	24	0.21	44.44
Melinna oculata	Annelida	Polychaeta	Ampharetidae	24	0.21	36.11
Phyllodoce longipes	Annelida	Polychaeta	Phyllodocidae	24	0.21	33.33
Listriella goleta	Arthropoda	Malacostraca	Liljeborgiidae	24	0.21	27.78
Americhelidium shoemakeri	Arthropoda	Malacostraca	Oedicerotidae	23	0.20	33.33

Agnezia septentrionalis	Chordata	Ascidiacea	Agneziidae	23	0.20	5.56
Westwoodilla tone	Arthropoda	Malacostraca	Oedicerotidae	22	0.19	16.67
Amphiura arcystata	Echinodermata	Ophiuroidea	Amphiuridae	22	0.19	5.56
Hesionura coineaui difficilis	Annelida	Polychaeta	Phyllodocidae	22	0.19	2.78
Solen sicarius	Mollusca	Bivalvia	Solenidae	21	0.19	30.56
Photis californica	Arthropoda	Malacostraca	Photidae	21	0.19	13.89
Amphioplus sp A	Echinodermata	Ophiuroidea	Amphiuridae	21	0.19	8.33
Lumbrineris latreilli	Annelida	Polychaeta	Lumbrineridae	21	0.19	2.78
Onuphis sp	Annelida	Polychaeta	Onuphidae	20	0.18	30.56
Paranemertes californica	Nemertea	Enopla	Emplectonematidae	20	0.18	30.56
Caecognathia crenulatifrons	Arthropoda	Malacostraca	Gnathiidae	20	0.18	22.22
Heteronemertea sp SD2	Nemertea	Anopla	uncertain	20	0.18	22.22
Kurtiella grippi	Mollusca	Bivalvia	Lasaeidae	20	0.18	16.67
Paradialychone paramollis	Annelida	Polychaeta	Sabellidae	20	0.18	16.67
Ampharetidae	Annelida	Polychaeta	Ampharetidae	19	0.17	19.44
Eumida longicornuta	Annelida	Polychaeta	Phyllodocidae	19	0.17	19.44
Prionospio lighti	Annelida	Polychaeta	Spionidae	19	0.17	19.44
Caprella californica Cmplx	Arthropoda	Malacostraca	Caprellidae	19	0.17	5.56
Tenonia priops	Annelida	Polychaeta	Polynoidae	18	0.16	33.33
Palaeonemertea	Nemertea	Anopla		18	0.16	25.00
Scoletoma sp	Annelida	Polychaeta	Lumbrineridae	18	0.16	25.00
Tellina sp B	Mollusca	Bivalvia	Tellinidae	18	0.16	16.67
Bivalvia	Mollusca	Bivalvia		18	0.16	13.89
Streblosoma crassibranchia	Annelida	Polychaeta	Terebellidae	18	0.16	8.33
Dispio sp	Annelida	Polychaeta	Spionidae	18	0.16	2.78
Nebalia daytoni	Arthropoda	Malacostraca	Nebaliidae	17	0.15	30.56
Parvilucina tenuisculpta	Mollusca	Bivalvia	Lucinidae	17	0.15	22.22
Aricidea (Acmira) catherinae	Annelida	Polychaeta	Paraonidae	17	0.15	19.44

Rudilemboides stenopropodus	Arthropoda	Malacostraca	Unciolidae	17	0.15	19.44
Caprella mendax	Arthropoda	Malacostraca	Caprellidae	17	0.15	13.89
Mooreonuphis nebulosa	Annelida	Polychaeta	Onuphidae	16	0.14	25.00
Exogone lourei	Annelida	Polychaeta	Syllidae	16	0.14	22.22
Notomastus hemipodus	Annelida	Polychaeta	Capitellidae	16	0.14	22.22
Edwardsia juliae	Cnidaria	Anthozoa	Edwardsiidae	16	0.14	11.11
Praxillella gracilis	Annelida	Polychaeta	Maldanidae	16	0.14	5.56
Scoloplos armiger Cmplx	Annelida	Polychaeta	Orbiniidae	15	0.13	27.78
Edwardsiidae	Cnidaria	Anthozoa	Edwardsiidae	15	0.13	22.22
Rictaxis punctocaelatus	Mollusca	Gastropoda	Acteonidae	15	0.13	22.22
Parexogone breviseta	Annelida	Polychaeta	Syllidae	15	0.13	16.67
Spionidae	Annelida	Polychaeta	Spionidae	15	0.13	16.67
Amphiodia urtica	Echinodermata	Ophiuroidea	Amphiuridae	15	0.13	13.89
Kirkegaardia tesselata	Annelida	Polychaeta	Cirratulidae	15	0.13	11.11
Streblosoma sp	Annelida	Polychaeta	Terebellidae	15	0.13	8.33
Amphiodia sp	Echinodermata	Ophiuroidea	Amphiuridae	14	0.12	22.22
Odostomia sp	Mollusca	Gastropoda	Pyramidellidae	14	0.12	16.67
Actiniaria	Cnidaria	Anthozoa		14	0.12	13.89
Diopatra tridentata	Annelida	Polychaeta	Onuphidae	14	0.12	11.11
Eupolymnia heterobranchia	Annelida	Polychaeta	Terebellidae	14	0.12	8.33
Tubulanidae	Nemertea	Anopla	Tubulanidae	13	0.11	22.22
Anotomastus gordiodes	Annelida	Polychaeta	Capitellidae	13	0.11	19.44
Oxyurostylis pacifica	Arthropoda	Malacostraca	Diastylidae	13	0.11	19.44
Tubulanus cingulatus	Nemertea	Anopla	Tubulanidae	13	0.11	19.44
Metamysidopsis elongata	Arthropoda	Malacostraca	Mysidae	13	0.11	13.89
Phoronis sp SD1	Phoronida		Phoronidae	13	0.11	13.89
Rhepoxynius abronius	Arthropoda	Malacostraca	Phoxocephalidae	13	0.11	8.33
Pacifoculodes barnardi	Arthropoda	Malacostraca	Oedicerotidae	13	0.11	2.78

Balanoglossus sp	Chordata	Enteropneusta	Ptychoderidae	12	0.11	19.44
Edotia sublittoralis	Arthropoda	Malacostraca	Idoteidae	12	0.11	19.44
Phyllodoce sp	Annelida	Polychaeta	Phyllodocidae	12	0.11	19.44
Syllis farallonensis	Annelida	Polychaeta	Syllidae	12	0.11	16.67
Acromegalomma pigmentum	Annelida	Polychaeta	Sabellidae	12	0.11	13.89
Sabellidae	Annelida	Polychaeta	Sabellidae	12	0.11	13.89
Carazziella sp A	Annelida	Polychaeta	Spionidae	12	0.11	8.33
Sphaerosyllis californiensis	Annelida	Polychaeta	Syllidae	12	0.11	8.33
Syllis hyperioni	Annelida	Polychaeta	Syllidae	12	0.11	8.33
Syllis sp	Annelida	Polychaeta	Syllidae	12	0.11	5.56
Amphiuridae	Echinodermata	Ophiuroidea	Amphiuridae	11	0.10	25.00
Ensis myrae	Mollusca	Bivalvia	Pharidae	11	0.10	25.00
Glycera macrobranchia	Annelida	Polychaeta	Glyceridae	11	0.10	22.22
Cylichna diegensis	Mollusca	Gastropoda	Cylichnidae	11	0.10	19.44
Malmgreniella macginitiei	Annelida	Polychaeta	Polynoidae	11	0.10	16.67
Ampelisca careyi	Arthropoda	Malacostraca	Ampeliscidae	11	0.10	13.89
Lumbrineris ligulata	Annelida	Polychaeta	Lumbrineridae	11	0.10	13.89
Spiophanes sp	Annelida	Polychaeta	Spionidae	11	0.10	13.89
Aoroides exilis	Arthropoda	Malacostraca	Aoridae	11	0.10	11.11
Leodice americana	Annelida	Polychaeta	Eunicidae	11	0.10	11.11
Pinnixa franciscana	Arthropoda	Malacostraca	Pinnotheridae	11	0.10	11.11
Chaetozone lunula	Annelida	Polychaeta	Cirratulidae	11	0.10	8.33
Enteropneusta	Chordata	Enteropneusta		11	0.10	5.56
Tellina carpenteri	Mollusca	Bivalvia	Tellinidae	11	0.10	5.56
Chauliopleona dentata	Arthropoda	Malacostraca	Akanthophoreidae	11	0.10	2.78
Pinnixa sp	Arthropoda	Malacostraca	Pinnotheridae	10	0.09	22.22
Poecilochaetus johnsoni	Annelida	Polychaeta	Poecilochaetidae	10	0.09	22.22
Modiolinae	Mollusca	Bivalvia	Mytilidae	10	0.09	19.44

Siliqua lucida	Mollusca	Bivalvia	Pharidae	10	0.09	16.67
Streblosoma sp B	Annelida	Polychaeta	Terebellidae	10	0.09	16.67
Levinsenia gracilis	Annelida	Polychaeta	Paraonidae	10	0.09	13.89
Axiothella rubrocincta	Annelida	Polychaeta	Maldanidae	10	0.09	11.11
Photis bifurcata	Arthropoda	Malacostraca	Photidae	10	0.09	11.11
Lysippe sp A	Annelida	Polychaeta	Ampharetidae	10	0.09	8.33
Streblosoma sp SF1	Annelida	Polychaeta	Terebellidae	10	0.09	8.33
Eupolymnia sp	Annelida	Polychaeta	Terebellidae	10	0.09	5.56
Syllidae	Annelida	Polychaeta	Syllidae	10	0.09	5.56
Urticina sp A	Cnidaria	Anthozoa	Actiniidae	10	0.09	5.56
Protodorvillea gracilis	Annelida	Polychaeta	Dorvilleidae	10	0.09	2.78
Semiodera inflata	Annelida	Polychaeta	Flabelligeridae	10	0.09	2.78
Aricidea (Aricidea) wassi	Annelida	Polychaeta	Paraonidae	9	0.08	22.22
Cerebratulus californiensis	Nemertea	Anopla	Lineidae	9	0.08	22.22
Glycera americana	Annelida	Polychaeta	Glyceridae	9	0.08	22.22
Lumbrineris japonica	Annelida	Polychaeta	Lumbrineridae	9	0.08	13.89
Pherusa neopapillata	Annelida	Polychaeta	Flabelligeridae	9	0.08	11.11
Pinnixa longipes	Arthropoda	Malacostraca	Pinnotheridae	9	0.08	11.11
Ampharete finmarchica	Annelida	Polychaeta	Ampharetidae	9	0.08	8.33
Aphelochaeta glandaria Cmplx	Annelida	Polychaeta	Cirratulidae	9	0.08	8.33
Schistocomus sp A	Annelida	Polychaeta	Ampharetidae	9	0.08	8.33
Tetrastemma candidum	Nemertea	Enopla	Tetrastemmatidae	9	0.08	8.33
Dipolydora sp	Annelida	Polychaeta	Spionidae	9	0.08	5.56
Aphelochaeta sp LA1	Annelida	Polychaeta	Cirratulidae	9	0.08	2.78
Aricidea (Acmira) horikoshii	Annelida	Polychaeta	Paraonidae	8	0.07	19.44
Acteocina culcitella	Mollusca	Gastropoda	Cylichnidae	8	0.07	13.89
Paradialychone harrisae	Annelida	Polychaeta	Sabellidae	8	0.07	13.89
Prionospio sp	Annelida	Polychaeta	Spionidae	8	0.07	13.89

Terebellidae	Annelida	Polychaeta	Terebellidae	8	0.07	13.89
Amphiporus californicus	Nemertea	Enopla	Amphiporidae	8	0.07	11.11
Lumbrineris cruzensis	Annelida	Polychaeta	Lumbrineridae	8	0.07	11.11
Malmgreniella sp	Annelida	Polychaeta	Polynoidae	8	0.07	11.11
Microspio pigmentata	Annelida	Polychaeta	Spionidae	8	0.07	11.11
Turbonilla santarosana	Mollusca	Gastropoda	Pyramidellidae	8	0.07	8.33
Exosphaeroma amplicauda	Arthropoda	Malacostraca	Sphaeromatidae	8	0.07	5.56
Ogyrides sp A	Arthropoda	Malacostraca	Ogyrididae	8	0.07	5.56
Sige sp A	Annelida	Polychaeta	Phyllodocidae	8	0.07	5.56
Oligochaeta	Annelida	Oligochaeta		8	0.07	2.78
Ampharete sp	Annelida	Polychaeta	Ampharetidae	7	0.06	13.89
Compsomyax subdiaphana	Mollusca	Bivalvia	Veneridae	7	0.06	13.89
Cryptonemertes actinophila	Nemertea	Enopla	Emplectonematidae	7	0.06	13.89
Kurtziella plumbea	Mollusca	Gastropoda	Mangeliidae	7	0.06	13.89
Phyllodoce pettiboneae	Annelida	Polychaeta	Phyllodocidae	7	0.06	13.89
Saccoglossus sp	Chordata	Enteropneusta	Harrimaniidae	7	0.06	13.89
Heteronemertea	Nemertea	Anopla		7	0.06	11.11
Lyonsia californica	Mollusca	Bivalvia	Lyonsiidae	7	0.06	11.11
Sternaspis affinis	Annelida	Polychaeta	Sternaspidae	7	0.06	11.11
Amage scutata	Annelida	Polychaeta	Ampharetidae	7	0.06	8.33
Diopatra splendidissima	Annelida	Polychaeta	Onuphidae	7	0.06	8.33
Ischyrocerus pelagops	Arthropoda	Malacostraca	Ischyroceridae	7	0.06	8.33
Quasitetrastemma nigrifrons	Nemertea	Enopla	Tetrastemmatidae	7	0.06	8.33
Anchicolurus occidentalis	Arthropoda	Malacostraca	Diastylidae	7	0.06	5.56
Caesia perpinguis	Mollusca	Gastropoda	Nassariidae	7	0.06	5.56
Pholoe glabra	Annelida	Polychaeta	Pholoidae	7	0.06	5.56
Poecilochaetus martini	Annelida	Polychaeta	Poecilochaetidae	7	0.06	5.56
Onuphis iridescens	Annelida	Polychaeta	Onuphidae	7	0.06	2.78

SIPUNCULA	Sipuncula			7	0.06	2.78
Campylaspis rubromaculata	Arthropoda	Malacostraca	Nannastacidae	6	0.05	13.89
Drilonereis sp	Annelida	Polychaeta	Oenonidae	6	0.05	13.89
Haliophasma geminata	Arthropoda	Malacostraca	Anthuridae	6	0.05	11.11
Lumbrineris sp	Annelida	Polychaeta	Lumbrineridae	6	0.05	11.11
Ampelisca milleri	Arthropoda	Malacostraca	Ampeliscidae	6	0.05	8.33
Eunicidae	Annelida	Polychaeta	Eunicidae	6	0.05	8.33
Hippomedon zetesimus	Arthropoda	Malacostraca	Lysianassidae	6	0.05	8.33
Mayerella banksia	Arthropoda	Malacostraca	Caprellidae	6	0.05	8.33
Scaphopoda	Mollusca	Scaphopoda		6	0.05	8.33
Scoloplos sp	Annelida	Polychaeta	Orbiniidae	6	0.05	8.33
Pista sp	Annelida	Polychaeta	Terebellidae	6	0.05	5.56
Aoroides inermis	Arthropoda	Malacostraca	Aoridae	6	0.05	2.78
Aphelochaeta monilaris	Annelida	Polychaeta	Cirratulidae	6	0.05	2.78
Idarcturus allelomorphus	Arthropoda	Malacostraca	Arcturidae	6	0.05	2.78
Leukoma staminea	Mollusca	Bivalvia	Veneridae	6	0.05	2.78
Armandia brevis	Annelida	Polychaeta	Opheliidae	5	0.04	13.89
Astropecten californicus	Echinodermata	Asteroidea	Astropectinidae	5	0.04	13.89
Diastylis californica	Arthropoda	Malacostraca	Diastylidae	5	0.04	13.89
Bipalponephtys cornuta	Annelida	Polychaeta	Nephtyidae	5	0.04	11.11
Glycera nana	Annelida	Polychaeta	Glyceridae	5	0.04	11.11
Orchomene anaquelus	Arthropoda	Malacostraca	Lysianassidae	5	0.04	11.11
Phoronidae	Phoronida		Phoronidae	5	0.04	11.11
Rutiderma rostratum	Arthropoda	Ostracoda	Rutidermatidae	5	0.04	11.11
Aphelochaeta sp	Annelida	Polychaeta	Cirratulidae	5	0.04	8.33
Apionsoma misakianum	Sipuncula	Phascolosomatidea	Phascolosomatidae	5	0.04	8.33
Leitoscoloplos sp A	Annelida	Polychaeta	Orbiniidae	5	0.04	8.33
Pinnotheridae	Arthropoda	Malacostraca	Pinnotheridae	5	0.04	8.33

Alamprops quadriplicatus	Arthropoda	Malacostraca	Lampropidae	5	0.04	5.56
Eulima raymondi	Mollusca	Gastropoda	Eulimidae	5	0.04	5.56
Hoplonemertea sp B	Nemertea	Enopla		5	0.04	5.56
Incisocalliope newportensis	Arthropoda	Malacostraca	Pleustidae	5	0.04	5.56
Micropodarke dubia	Annelida	Polychaeta	Hesionidae	5	0.04	5.56
Phyllochaetopterus prolifica	Annelida	Polychaeta	Chaetopteridae	5	0.04	5.56
Scoletoma sp A	Annelida	Polychaeta	Lumbrineridae	5	0.04	5.56
Solen sp	Mollusca	Bivalvia	Solenidae	5	0.04	5.56
Stylatula sp A	Cnidaria	Anthozoa	Virgulariidae	5	0.04	5.56
Eohaustorius barnardi	Arthropoda	Malacostraca	Haustoriidae	5	0.04	2.78
Gammaropsis sp	Arthropoda	Malacostraca	Photidae	5	0.04	2.78
Kurtiella coani	Mollusca	Bivalvia	Lasaeidae	5	0.04	2.78
Corymorpha bigelowi	Cnidaria	Hydrozoa	Corymorphidae	4	0.04	11.11
Sthenelais tertiaglabra	Annelida	Polychaeta	Sigalionidae	4	0.04	11.11
Sthenelais verruculosa	Annelida	Polychaeta	Sigalionidae	4	0.04	11.11
Aglaja ocelligera	Mollusca	Gastropoda	Aglajidae	4	0.04	8.33
Amphioplus sp	Echinodermata	Ophiuroidea	Amphiuridae	4	0.04	8.33
Arachnanthus sp A	Cnidaria	Anthozoa	Cerianthidae	4	0.04	8.33
Boccardia basilaria	Annelida	Polychaeta	Spionidae	4	0.04	8.33
Carinomella lactea	Nemertea	Anopla	Tubulanidae	4	0.04	8.33
Cirratulidae	Annelida	Polychaeta	Cirratulidae	4	0.04	8.33
Epigamia-Myrianida Cmplx	Annelida	Polychaeta	Syllidae	4	0.04	8.33
Euchone hancocki	Annelida	Polychaeta	Sabellidae	4	0.04	8.33
Notocirrus californiensis	Annelida	Polychaeta	Oenonidae	4	0.04	8.33
Phascolion sp A	Sipuncula	Sipunculidea	Phascolionidae	4	0.04	8.33
Photis sp C	Arthropoda	Malacostraca	Photidae	4	0.04	8.33
Podarkeopsis glabrus	Annelida	Polychaeta	Hesionidae	4	0.04	8.33
Simomactra falcata	Mollusca	Bivalvia	Mactridae	4	0.04	8.33

Trichobranchus hancocki	Annelida	Polychaeta	Trichobranchidae	4	0.04	8.33
Veneridae	Mollusca	Bivalvia	Veneridae	4	0.04	8.33
Virgulariidae	Cnidaria	Anthozoa	Virgulariidae	4	0.04	8.33
Aphelochaeta petersenae	Annelida	Polychaeta	Cirratulidae	4	0.04	5.56
Leptosynapta sp	Echinodermata	Holothuroidea	Synaptidae	4	0.04	5.56
Nephtys ferruginea	Annelida	Polychaeta	Nephtyidae	4	0.04	5.56
Ophiuroidea	Echinodermata	Ophiuroidea		4	0.04	5.56
Owenia sp	Annelida	Polychaeta	Oweniidae	4	0.04	5.56
Polydora cornuta	Annelida	Polychaeta	Spionidae	4	0.04	5.56
Praxillella sp	Annelida	Polychaeta	Maldanidae	4	0.04	5.56
Rhepoxynius sp	Arthropoda	Malacostraca	Phoxocephalidae	4	0.04	5.56
Tiron biocellata	Arthropoda	Malacostraca	Synopiidae	4	0.04	5.56
Caecum crebricinctum	Mollusca	Gastropoda	Caecidae	4	0.04	2.78
Galathowenia pygidialis	Annelida	Polychaeta	Oweniidae	4	0.04	2.78
Halistylus pupoideus	Mollusca	Gastropoda	Trochidae	4	0.04	2.78
Scoletoma sp B	Annelida	Polychaeta	Lumbrineridae	4	0.04	2.78
Terebra hemphilli	Mollusca	Gastropoda	Terebridae	4	0.04	2.78
Volvulella panamica	Mollusca	Gastropoda	Retusidae	4	0.04	2.78
Cancridae	Arthropoda	Malacostraca	Cancridae	3	0.03	8.33
Crepidula sp	Mollusca	Gastropoda	Calyptraeidae	3	0.03	8.33
Drilonereis falcata	Annelida	Polychaeta	Oenonidae	3	0.03	8.33
Gibberosus myersi	Arthropoda	Malacostraca	Megaluropidae	3	0.03	8.33
Lineus bilineatus	Nemertea	Anopla	Lineidae	3	0.03	8.33
Magelona hartmanae	Annelida	Polychaeta	Magelonidae	3	0.03	8.33
Pista estevanica	Annelida	Polychaeta	Terebellidae	3	0.03	8.33
Scolanthus triangulus	Cnidaria	Anthozoa	Edwardsiidae	3	0.03	8.33
Terebellides californica	Annelida	Polychaeta	Trichobranchidae	3	0.03	8.33
Terebra pedroana	Mollusca	Gastropoda	Terebridae	3	0.03	8.33

Zaolutus actius	Cnidaria	Anthozoa	Isanthidae	3	0.03	8.33
Alienacanthomysis macropsis	Arthropoda	Malacostraca	Mysidae	3	0.03	5.56
Americhelidium sp SD4	Arthropoda	Malacostraca	Oedicerotidae	3	0.03	5.56
Ancistrosyllis groenlandica	Annelida	Polychaeta	Pilargidae	3	0.03	5.56
Anopla	Nemertea	Anopla		3	0.03	5.56
Cerebratulus sp	Nemertea	Anopla	Lineidae	3	0.03	5.56
Cossura candida	Annelida	Polychaeta	Cossuridae	3	0.03	5.56
Diastylis pellucida	Arthropoda	Malacostraca	Diastylidae	3	0.03	5.56
Eulalia californiensis	Annelida	Polychaeta	Phyllodocidae	3	0.03	5.56
Maculaura alaskensis Cmplx	Nemertea	Anopla	Lineidae	3	0.03	5.56
Modiolatus neglectus	Mollusca	Bivalvia	Mytilidae	3	0.03	5.56
Neastacilla californica	Arthropoda	Malacostraca	Arcturidae	3	0.03	5.56
Nereis latescens	Annelida	Polychaeta	Nereididae	3	0.03	5.56
Neverita recluziana	Mollusca	Gastropoda	Naticidae	3	0.03	5.56
Pentamera populifera	Echinodermata	Holothuroidea	Phyllophoridae	3	0.03	5.56
Periploma discus	Mollusca	Bivalvia	Periplomatidae	3	0.03	5.56
Philine ornatissima	Mollusca	Gastropoda	Philinidae	3	0.03	5.56
Phisidia sanctaemariae	Annelida	Polychaeta	Terebellidae	3	0.03	5.56
Poecilochaetus sp	Annelida	Polychaeta	Poecilochaetidae	3	0.03	5.56
Prionospio dubia	Annelida	Polychaeta	Spionidae	3	0.03	5.56
Rhepoxynius heterocuspidatus	Arthropoda	Malacostraca	Phoxocephalidae	3	0.03	5.56
Schizocardium sp	Chordata	Enteropneusta	Spengeliidae	3	0.03	5.56
Solamen columbianum	Mollusca	Bivalvia	Mytilidae	3	0.03	5.56
Tellina sp	Mollusca	Bivalvia	Tellinidae	3	0.03	5.56
Tubulanus sp A	Nemertea	Anopla	Tubulanidae	3	0.03	5.56
Xenoleberis californica	Arthropoda	Ostracoda	Cylindroleberididae	3	0.03	5.56
Acromegalomma splendidum	Annelida	Polychaeta	Sabellidae	3	0.03	2.78
Alia carinata	Mollusca	Gastropoda	Columbellidae	3	0.03	2.78

Bemlos audbettius	Arthropoda	Malacostraca	Aoridae	3	0.03	2.78
Euchone sp	Annelida	Polychaeta	Sabellidae	3	0.03	2.78
Garnotia naticarum	Mollusca	Gastropoda	Calyptraeidae	3	0.03	2.78
Kurtzina beta	Mollusca	Gastropoda	Mangeliidae	3	0.03	2.78
Malmgreniella sp A	Annelida	Polychaeta	Polynoidae	3	0.03	2.78
Nebalia pugettensis Cmplx	Arthropoda	Malacostraca	Nebaliidae	3	0.03	2.78
Owenia johnsoni	Annelida	Polychaeta	Oweniidae	3	0.03	2.78
Photis macrotica	Arthropoda	Malacostraca	Photidae	3	0.03	2.78
Pseudopotamilla sp	Annelida	Polychaeta	Sabellidae	3	0.03	2.78
Rhynchospio arenincola	Annelida	Polychaeta	Spionidae	3	0.03	2.78
Solen rostriformis	Mollusca	Bivalvia	Solenidae	3	0.03	2.78
Stenothoides bicoma	Arthropoda	Malacostraca	Stenothoidae	3	0.03	2.78
Sthenelais sp	Annelida	Polychaeta	Sigalionidae	3	0.03	2.78
Amphicteis sp	Annelida	Polychaeta	Ampharetidae	2	0.02	5.56
Amphiodia psara	Echinodermata	Ophiuroidea	Amphiuridae	2	0.02	5.56
Anobothrus gracilis	Annelida	Polychaeta	Ampharetidae	2	0.02	5.56
Anoplodactylus erectus	Arthropoda	Pycnogonida	Phoxichilidiidae	2	0.02	5.56
Aphrodita sp	Annelida	Polychaeta	Aphroditidae	2	0.02	5.56
Argissa hamatipes	Arthropoda	Malacostraca	Argissidae	2	0.02	5.56
Aricidea (Acmira) simplex	Annelida	Polychaeta	Paraonidae	2	0.02	5.56
Ascidiacea	Chordata	Ascidiacea		2	0.02	5.56
Axiothella sp	Annelida	Polychaeta	Maldanidae	2	0.02	5.56
Brachyura	Arthropoda	Malacostraca		2	0.02	5.56
Ceriantharia	Cnidaria	Anthozoa		2	0.02	5.56
Echinoidea	Echinodermata	Echinoidea		2	0.02	5.56
Eclysippe trilobata	Annelida	Polychaeta	Ampharetidae	2	0.02	5.56
Euchone incolor	Annelida	Polychaeta	Sabellidae	2	0.02	5.56
Eulalia sp	Annelida	Polychaeta	Phyllodocidae	2	0.02	5.56

Goniadidae	Annelida	Polychaeta	Goniadidae	2	0.02	5.56
Halcampa decemtentaculata	Cnidaria	Anthozoa	Halcampidae	2	0.02	5.56
Halosydna johnsoni	Annelida	Polychaeta	Polynoidae	2	0.02	5.56
Laonice sp	Annelida	Polychaeta	Spionidae	2	0.02	5.56
Leptoplanoidea	Platyhelminthes	Turbellaria		2	0.02	5.56
Limnactiniidae sp A	Cnidaria	Anthozoa	Limnactiniidae	2	0.02	5.56
Listriolobus pelodes	Echiura	Echiuridea	Thalassematidae	2	0.02	5.56
Lucinisca nuttalli	Mollusca	Bivalvia	Lucinidae	2	0.02	5.56
Mesolamprops bispinosus	Arthropoda	Malacostraca	Lampropidae	2	0.02	5.56
Mysidopsis intii	Arthropoda	Malacostraca	Mysidae	2	0.02	5.56
NEMERTEA	Nemertea			2	0.02	5.56
Nephtys sp SD2	Annelida	Polychaeta	Nephtyidae	2	0.02	5.56
Nereididae	Annelida	Polychaeta	Nereididae	2	0.02	5.56
Nereis sp	Annelida	Polychaeta	Nereididae	2	0.02	5.56
Notomastus sp	Annelida	Polychaeta	Capitellidae	2	0.02	5.56
Paradialychone ecaudata	Annelida	Polychaeta	Sabellidae	2	0.02	5.56
Paradiopatra parva	Annelida	Polychaeta	Onuphidae	2	0.02	5.56
Parougia caeca	Annelida	Polychaeta	Dorvilleidae	2	0.02	5.56
Pennatulacea	Cnidaria	Anthozoa		2	0.02	5.56
Phyllodocidae	Annelida	Polychaeta	Phyllodocidae	2	0.02	5.56
Pinnixa forficulimanus	Arthropoda	Malacostraca	Pinnotheridae	2	0.02	5.56
Pinnixa occidentalis Cmplx	Arthropoda	Malacostraca	Pinnotheridae	2	0.02	5.56
Pleustidae	Arthropoda	Malacostraca	Pleustidae	2	0.02	5.56
Polycirrus californicus	Annelida	Polychaeta	Terebellidae	2	0.02	5.56
Randallia ornata	Arthropoda	Malacostraca	Leucosiidae	2	0.02	5.56
Spio filicornis	Annelida	Polychaeta	Spionidae	2	0.02	5.56
Stylatula sp	Cnidaria	Anthozoa	Virgulariidae	2	0.02	5.56
Tellina idae	Mollusca	Bivalvia	Tellinidae	2	0.02	5.56

Thysanocardia nigra	Sipuncula	Sipunculidea	Golfingiidae	2	0.02	5.56
Tubulanidae sp B	Nemertea	Anopla	Tubulanidae	2	0.02	5.56
Tubulanidae sp E	Nemertea	Anopla	Tubulanidae	2	0.02	5.56
Turbonilla chocolata	Mollusca	Gastropoda	Pyramidellidae	2	0.02	5.56
Zygeupolia rubens	Nemertea	Anopla	Valenciniidae	2	0.02	5.56
Acromegalomma sp	Annelida	Polychaeta	Sabellidae	2	0.02	2.78
Amphipholis squamata	Echinodermata	Ophiuroidea	Amphiuridae	2	0.02	2.78
Amphiporus flavescens	Nemertea	Enopla	Amphiporidae	2	0.02	2.78
Asteropella slatteryi	Arthropoda	Ostracoda	Cylindroleberididae	2	0.02	2.78
Campylaspis canaliculata	Arthropoda	Malacostraca	Nannastacidae	2	0.02	2.78
Crangonidae	Arthropoda	Malacostraca	Crangonidae	2	0.02	2.78
Cryptomya californica	Mollusca	Bivalvia	Myidae	2	0.02	2.78
Dialychone trilineata	Annelida	Polychaeta	Sabellidae	2	0.02	2.78
Dipolydora barbilla	Annelida	Polychaeta	Spionidae	2	0.02	2.78
Dorvilleidae	Annelida	Polychaeta	Dorvilleidae	2	0.02	2.78
Doto sp	Mollusca	Gastropoda	Dotoidae	2	0.02	2.78
Ephesiella brevicapitis	Annelida	Polychaeta	Sphaerodoridae	2	0.02	2.78
Eulalia levicornuta Cmplx	Annelida	Polychaeta	Phyllodocidae	2	0.02	2.78
Eulithidium pulloides	Mollusca	Gastropoda	Phasianellidae	2	0.02	2.78
Eusyllis sp	Annelida	Polychaeta	Syllidae	2	0.02	2.78
Halosydna brevisetosa	Annelida	Polychaeta	Polynoidae	2	0.02	2.78
Heterophoxus oculatus	Arthropoda	Malacostraca	Phoxocephalidae	2	0.02	2.78
Kirkegaardia serratiseta	Annelida	Polychaeta	Cirratulidae	2	0.02	2.78
Leitoscoloplos sp	Annelida	Polychaeta	Orbiniidae	2	0.02	2.78
Malmgreniella bansei	Annelida	Polychaeta	Polynoidae	2	0.02	2.78
Molgulidae	Chordata	Ascidiacea	Molgulidae	2	0.02	2.78
Mytilidae	Mollusca	Bivalvia	Mytilidae	2	0.02	2.78
Nassariidae	Mollusca	Gastropoda	Nassariidae	2	0.02	2.78

Neotrypaea gigas	Arthropoda	Malacostraca	Callianassidae	2	0.02	2.78
Pachynus barnardi	Arthropoda	Malacostraca	Pachynidae	2	0.02	2.78
Periploma planiusculum	Mollusca	Bivalvia	Periplomatidae	2	0.02	2.78
Pholoe sp B	Annelida	Polychaeta	Pholoidae	2	0.02	2.78
Photis lacia	Arthropoda	Malacostraca	Photidae	2	0.02	2.78
Phoxocephalidae	Arthropoda	Malacostraca	Phoxocephalidae	2	0.02	2.78
Phyllochaetopterus limicolus	Annelida	Polychaeta	Chaetopteridae	2	0.02	2.78
Rhepoxynius daboius	Arthropoda	Malacostraca	Phoxocephalidae	2	0.02	2.78
Rhepoxynius lucubrans	Arthropoda	Malacostraca	Phoxocephalidae	2	0.02	2.78
Sabellaria gracilis	Annelida	Polychaeta	Sabellariidae	2	0.02	2.78
Tritella pilimana	Arthropoda	Malacostraca	Caprellidae	2	0.02	2.78
Zygonemertes virescens	Nemertea	Enopla	Amphiporidae	2	0.02	2.78
Acari	Arthropoda	Arachnida		1	0.01	2.78
Acteocina cerealis	Mollusca	Gastropoda	Cylichnidae	1	0.01	2.78
Acuminodeutopus heteruropus	Arthropoda	Malacostraca	Unciolidae	1	0.01	2.78
Aglaophamus verrilli	Annelida	Polychaeta	Nephtyidae	1	0.01	2.78
Amage anops	Annelida	Polychaeta	Ampharetidae	1	0.01	2.78
Americhelidium sp SD1	Arthropoda	Malacostraca	Oedicerotidae	1	0.01	2.78
Ampelisca lobata	Arthropoda	Malacostraca	Ampeliscidae	1	0.01	2.78
Amphicteis mucronata	Annelida	Polychaeta	Ampharetidae	1	0.01	2.78
Amphiporidae sp HYP2	Nemertea	Enopla	Amphiporidae	1	0.01	2.78
Amphisamytha bioculata	Annelida	Polychaeta	Ampharetidae	1	0.01	2.78
Ancistrosyllis hamata	Annelida	Polychaeta	Pilargidae	1	0.01	2.78
Aonides sp	Annelida	Polychaeta	Spionidae	1	0.01	2.78
Aoroides sp	Arthropoda	Malacostraca	Aoridae	1	0.01	2.78
Aphelochaeta sp SD5	Annelida	Polychaeta	Cirratulidae	1	0.01	2.78
Apistobranchus ornatus	Annelida	Polychaeta	Apistobranchidae	1	0.01	2.78
Arcteobia cf anticostiensis	Annelida	Polychaeta	Polynoidae	1	0.01	2.78

Aricidea (Acmira) cerrutii	Annelida	Polychaeta	Paraonidae	1	0.01	2.78
Aricidea (Aedicira) pacifica	Annelida	Polychaeta	Paraonidae	1	0.01	2.78
Aricidea (Aricidea) sp SD1	Annelida	Polychaeta	Paraonidae	1	0.01	2.78
Aricidea (Strelzovia) antennata	Annelida	Polychaeta	Paraonidae	1	0.01	2.78
Aricidea (Strelzovia) hartleyi	Annelida	Polychaeta	Paraonidae	1	0.01	2.78
Armina californica	Mollusca	Gastropoda	Arminidae	1	0.01	2.78
Aruga holmesi	Arthropoda	Malacostraca	Lysianassidae	1	0.01	2.78
Aruga oculata	Arthropoda	Malacostraca	Lysianassidae	1	0.01	2.78
Asteroidea	Echinodermata	Asteroidea		1	0.01	2.78
Astyris aurantiaca	Mollusca	Gastropoda	Columbellidae	1	0.01	2.78
Balcis micans	Mollusca	Gastropoda	Eulimidae	1	0.01	2.78
Bispira sp	Annelida	Polychaeta	Sabellidae	1	0.01	2.78
Brada pilosa	Annelida	Polychaeta	Flabelligeridae	1	0.01	2.78
Branchiostoma californiense	Chordata		Branchiostomatidae	1	0.01	2.78
Byblis millsi	Arthropoda	Malacostraca	Ampeliscidae	1	0.01	2.78
Callianax pycna	Mollusca	Gastropoda	Olivellidae	1	0.01	2.78
Calyptraeidae	Mollusca	Gastropoda	Calyptraeidae	1	0.01	2.78
Campylaspis hartae	Arthropoda	Malacostraca	Nannastacidae	1	0.01	2.78
Capitella capitata Cmplx	Annelida	Polychaeta	Capitellidae	1	0.01	2.78
Cephalothrix sp	Nemertea	Anopla	Cephalotrichidae	1	0.01	2.78
Cerberilla mosslandica	Mollusca	Gastropoda	Aeolidiidae	1	0.01	2.78
Chaetopteridae	Annelida	Polychaeta	Chaetopteridae	1	0.01	2.78
Chaetozone bansei	Annelida	Polychaeta	Cirratulidae	1	0.01	2.78
Chaetozone hedgpethi	Annelida	Polychaeta	Cirratulidae	1	0.01	2.78
Chone sp	Annelida	Polychaeta	Sabellidae	1	0.01	2.78
Chrysopetalidae	Annelida	Polychaeta	Chrysopetalidae	1	0.01	2.78
Clymenella complanata	Annelida	Polychaeta	Maldanidae	1	0.01	2.78
Corophiidae	Arthropoda	Malacostraca	Corophiidae	1	0.01	2.78

Crangon alaskensis	Arthropoda	Malacostraca	Crangonidae	1	0.01	2.78
Cryptocelis occidentalis	Platyhelminthes	Turbellaria	Cryptocelididae	1	0.01	2.78
Cumacea	Arthropoda	Malacostraca		1	0.01	2.78
Cyclaspis nubila	Arthropoda	Malacostraca	Bodotriidae	1	0.01	2.78
Cylindroleberididae	Arthropoda	Ostracoda	Cylindroleberididae	1	0.01	2.78
Dendraster sp	Echinodermata	Echinoidea	Dendrasteridae	1	0.01	2.78
Diplocirrus sp SD1	Annelida	Polychaeta	Flabelligeridae	1	0.01	2.78
Dipolydora bidentata	Annelida	Polychaeta	Spionidae	1	0.01	2.78
Drilonereis mexicana	Annelida	Polychaeta	Oenonidae	1	0.01	2.78
Drilonereis sp A	Annelida	Polychaeta	Oenonidae	1	0.01	2.78
Drilonereis sp LA1	Annelida	Polychaeta	Oenonidae	1	0.01	2.78
Enopla	Nemertea	Enopla		1	0.01	2.78
Euphysa sp A	Cnidaria	Hydrozoa	Corymorphidae	1	0.01	2.78
Eurydice caudata	Arthropoda	Malacostraca	Cirolanidae	1	0.01	2.78
Eurylepta leoparda	Platyhelminthes	Turbellaria	Euryleptidae	1	0.01	2.78
Euryleptodes insularis	Platyhelminthes	Turbellaria	Euryleptidae	1	0.01	2.78
Eusarsiella thominx	Arthropoda	Ostracoda	Sarsiellidae	1	0.01	2.78
Eusyllis transecta	Annelida	Polychaeta	Syllidae	1	0.01	2.78
Exogone sp	Annelida	Polychaeta	Syllidae	1	0.01	2.78
Gastropoda	Mollusca	Gastropoda		1	0.01	2.78
Glycera sp	Annelida	Polychaeta	Glyceridae	1	0.01	2.78
Gymnonereis crosslandi	Annelida	Polychaeta	Nereididae	1	0.01	2.78
Halianthella sp A	Cnidaria	Anthozoa	Halcampidae	1	0.01	2.78
Halicoides synopiae	Arthropoda	Malacostraca	Pardaliscidae	1	0.01	2.78
Halosydna latior	Annelida	Polychaeta	Polynoidae	1	0.01	2.78
Harpacticoida	Arthropoda	Maxillopoda		1	0.01	2.78
Hemiproto sp A	Arthropoda	Malacostraca	Caprellidae	1	0.01	2.78
Hesionidae	Annelida	Polychaeta	Hesionidae	1	0.01	2.78

Hesperonoe complanata	Annelida	Polychaeta	Polynoidae	1	0.01	2.78
Heterophoxus sp	Arthropoda	Malacostraca	Phoxocephalidae	1	0.01	2.78
Heterospio catalinensis	Annelida	Polychaeta	Longosomatidae	1	0.01	2.78
Hiatella arctica	Mollusca	Bivalvia	Hiatellidae	1	0.01	2.78
Hippolyte californiensis	Arthropoda	Malacostraca	Hippolytidae	1	0.01	2.78
Isanthidae sp A	Cnidaria	Anthozoa	Isanthidae	1	0.01	2.78
Isopoda	Arthropoda	Malacostraca		1	0.01	2.78
Jasmineira sp B	Annelida	Polychaeta	Sabellidae	1	0.01	2.78
Latulambrus occidentalis	Arthropoda	Malacostraca	Parthenopidae	1	0.01	2.78
Leopecten diegensis	Mollusca	Bivalvia	Pectinidae	1	0.01	2.78
Leukoma laciniata	Mollusca	Bivalvia	Veneridae	1	0.01	2.78
Leukoma sp	Mollusca	Bivalvia	Veneridae	1	0.01	2.78
Leuroleberis sharpei	Arthropoda	Ostracoda	Cylindroleberididae	1	0.01	2.78
Listriella eriopisa	Arthropoda	Malacostraca	Liljeborgiidae	1	0.01	2.78
Lumbrinerides platypygos	Annelida	Polychaeta	Lumbrineridae	1	0.01	2.78
Macoma sp	Mollusca	Bivalvia	Tellinidae	1	0.01	2.78
Majoidea	Arthropoda	Malacostraca		1	0.01	2.78
Malacoceros indicus	Annelida	Polychaeta	Spionidae	1	0.01	2.78
Maldane sarsi	Annelida	Polychaeta	Maldanidae	1	0.01	2.78
Malmgreniella nigralba	Annelida	Polychaeta	Polynoidae	1	0.01	2.78
Mesochaetopterus sp	Annelida	Polychaeta	Chaetopteridae	1	0.01	2.78
Myriochele olgae	Annelida	Polychaeta	Oweniidae	1	0.01	2.78
Myriochele striolata	Annelida	Polychaeta	Oweniidae	1	0.01	2.78
Mysida	Arthropoda	Malacostraca		1	0.01	2.78
Nephtys simoni	Annelida	Polychaeta	Nephtyidae	1	0.01	2.78
Nephtys sp	Annelida	Polychaeta	Nephtyidae	1	0.01	2.78
Nereiphylla ferruginea Cmplx	Annelida	Polychaeta	Phyllodocidae	1	0.01	2.78
Nuculana sp	Mollusca	Bivalvia	Nuculanidae	1	0.01	2.78

Oerstedia dorsalis Cmplx	Nemertea	Enopla	Prosorhochmidae	1	0.01	2.78
Ophelia pulchella	Annelida	Polychaeta	Opheliidae	1	0.01	2.78
Ophiodermella inermis	Mollusca	Gastropoda	Borsoniidae	1	0.01	2.78
Orbiniidae	Annelida	Polychaeta	Orbiniidae	1	0.01	2.78
Pacifacanthomysis nephrophthalma	Arthropoda	Malacostraca	Mysidae	1	0.01	2.78
Paguristes bakeri	Arthropoda	Malacostraca	Diogenidae	1	0.01	2.78
Paguristes ulreyi	Arthropoda	Malacostraca	Diogenidae	1	0.01	2.78
Paradialychone bimaculata	Annelida	Polychaeta	Sabellidae	1	0.01	2.78
Parexogone acutipalpa	Annelida	Polychaeta	Syllidae	1	0.01	2.78
Parexogone molesta	Annelida	Polychaeta	Syllidae	1	0.01	2.78
Parexogone sp	Annelida	Polychaeta	Syllidae	1	0.01	2.78
Pectinidae	Mollusca	Bivalvia	Pectinidae	1	0.01	2.78
Pentactinia californica	Cnidaria	Anthozoa	Halcampoididae	1	0.01	2.78
Pentamera pseudopopulifera	Echinodermata	Holothuroidea	Phyllophoridae	1	0.01	2.78
Periploma sp	Mollusca	Bivalvia	Periplomatidae	1	0.01	2.78
Philine bakeri	Mollusca	Gastropoda	Philinidae	1	0.01	2.78
Philine sp	Mollusca	Gastropoda	Philinidae	1	0.01	2.78
Pholoides asperus	Annelida	Polychaeta	Sigalionidae	1	0.01	2.78
Phoronopsis sp	Phoronida		Phoronidae	1	0.01	2.78
Phyllochaetopterus sp	Annelida	Polychaeta	Chaetopteridae	1	0.01	2.78
Phyllodoce groenlandica	Annelida	Polychaeta	Phyllodocidae	1	0.01	2.78
Phyllophoridae	Echinodermata	Holothuroidea	Phyllophoridae	1	0.01	2.78
Pilargis berkeleyae	Annelida	Polychaeta	Pilargidae	1	0.01	2.78
Pilargis sp	Annelida	Polychaeta	Pilargidae	1	0.01	2.78
Pilargis sp B	Annelida	Polychaeta	Pilargidae	1	0.01	2.78
Pisione sp	Annelida	Polychaeta	Pisionidae	1	0.01	2.78
Pista moorei	Annelida	Polychaeta	Terebellidae	1	0.01	2.78
Pleusymtes subglaber	Arthropoda	Malacostraca	Pleustidae	1	0.01	2.78

Podarkeopsis sp A	Annelida	Polychaeta	Hesionidae	1	0.01	2.78
Polycladida	Platyhelminthes	Turbellaria		1	0.01	2.78
Polydora narica	Annelida	Polychaeta	Spionidae	1	0.01	2.78
Polydora nuchalis	Annelida	Polychaeta	Spionidae	1	0.01	2.78
Proceraea sp	Annelida	Polychaeta	Syllidae	1	0.01	2.78
Pugettia dalli	Arthropoda	Malacostraca	Epialtidae	1	0.01	2.78
Romaleon jordani	Arthropoda	Malacostraca	Cancridae	1	0.01	2.78
Schistocomus hiltoni	Annelida	Polychaeta	Ampharetidae	1	0.01	2.78
Sicyoniidae	Arthropoda	Malacostraca	Sicyoniidae	1	0.01	2.78
Sigambra sp	Annelida	Polychaeta	Pilargidae	1	0.01	2.78
Stereobalanus sp	Chordata	Enteropneusta	Harrimaniidae	1	0.01	2.78
Sthenelais berkeleyi	Annelida	Polychaeta	Sigalionidae	1	0.01	2.78
Sthenelais fusca	Annelida	Polychaeta	Sigalionidae	1	0.01	2.78
Stylatula elongata	Cnidaria	Anthozoa	Virgulariidae	1	0.01	2.78
Stylochus exiguus	Platyhelminthes	Turbellaria	Stylochidae	1	0.01	2.78
Tagelus subteres	Mollusca	Bivalvia	Solecurtidae	1	0.01	2.78
Tetrastemma bilineatum	Nemertea	Enopla	Tetrastemmatidae	1	0.01	2.78
Thracioidea	Mollusca	Bivalvia		1	0.01	2.78
Trachycardium quadragenarium	Mollusca	Bivalvia	Cardiidae	1	0.01	2.78
Travisia gigas	Annelida	Polychaeta	Travisiidae	1	0.01	2.78
Tritella laevis	Arthropoda	Malacostraca	Caprellidae	1	0.01	2.78
Tryphosinae incertae sedis entalladurus	Arthropoda	Malacostraca	Tryphosidae	1	0.01	2.78
Turbonilla sp	Mollusca	Gastropoda	Pyramidellidae	1	0.01	2.78
Virgularia californica	Cnidaria	Anthozoa	Virgulariidae	1	0.01	2.78
Volvulella cylindrica	Mollusca	Gastropoda	Retusidae	1	0.01	2.78
Yoldia cooperii	Mollusca	Bivalvia	Yoldiidae	1	0.01	2.78

Appendix A7. Macrobenthic community summary for the Mid Shelf stratum in the Bight'18 survey. Total abundance from all samples, relative abundance across the stratum, and the frequency of occurrence within a stratum are presented. Taxa are ranked by total abundance.

Taxon	Phylum	Class	Family	Total Abundance	Relative Abundance (%)	Frequency of Occurrence (%)
Spiophanes duplex	Annelida	Polychaeta	Spionidae	1,117	7.45	100.00
Mediomastus sp	Annelida	Polychaeta	Capitellidae	771	5.14	91.67
Amphiodia urtica	Echinodermata	Ophiuroidea	Amphiuridae	743	4.96	75.00
Eclysippe trilobata	Annelida	Polychaeta	Ampharetidae	363	2.42	61.11
Spiophanes norrisi	Annelida	Polychaeta	Spionidae	329	2.19	38.89
Maldanidae	Annelida	Polychaeta	Maldanidae	323	2.15	80.56
Prionospio dubia	Annelida	Polychaeta	Spionidae	304	2.03	80.56
Prionospio jubata	Annelida	Polychaeta	Spionidae	290	1.93	86.11
Amphiodia sp	Echinodermata	Ophiuroidea	Amphiuridae	290	1.93	77.78
Chondrochelia dubia Cmplx	Arthropoda	Malacostraca	Leptocheliidae	281	1.87	58.33
Aphelochaeta sp LA1	Annelida	Polychaeta	Cirratulidae	252	1.68	16.67
Amphiuridae	Echinodermata	Ophiuroidea	Amphiuridae	246	1.64	86.11
Paradiopatra parva	Annelida	Polychaeta	Onuphidae	235	1.57	72.22
Sabellides manriquei	Annelida	Polychaeta	Ampharetidae	221	1.47	16.67
Spiophanes kimballi	Annelida	Polychaeta	Spionidae	199	1.33	52.78
Phisidia sanctaemariae	Annelida	Polychaeta	Terebellidae	191	1.27	58.33
Ampelisca brevisimulata	Arthropoda	Malacostraca	Ampeliscidae	182	1.21	61.11
Poecilochaetus martini	Annelida	Polychaeta	Poecilochaetidae	177	1.18	16.67
Sthenelanella uniformis	Annelida	Polychaeta	Sigalionidae	159	1.06	55.56
Photis californica	Arthropoda	Malacostraca	Photidae	152	1.01	27.78
Tellina sp B	Mollusca	Bivalvia	Tellinidae	151	1.01	63.89
Travisia brevis	Annelida	Polychaeta	Travisiidae	146	0.97	44.44

Kirkegaardia cryptica	Annelida	Polychaeta	Cirratulidae	145	0.97	52.78
Euclymeninae sp A	Annelida	Polychaeta	Maldanidae	135	0.90	72.22
Sternaspis affinis	Annelida	Polychaeta	Sternaspidae	131	0.87	77.78
Paraprionospio alata	Annelida	Polychaeta	Spionidae	115	0.77	86.11
Petaloclymene pacifica	Annelida	Polychaeta	Maldanidae	105	0.70	41.67
Exogone dwisula	Annelida	Polychaeta	Syllidae	105	0.70	19.44
Axinopsida serricata	Mollusca	Bivalvia	Thyasiridae	103	0.69	63.89
Amphideutopus oculatus	Arthropoda	Malacostraca	Kamakidae	97	0.65	38.89
Cossura sp A	Annelida	Polychaeta	Cossuridae	97	0.65	25.00
Rhepoxynius bicuspidatus	Arthropoda	Malacostraca	Phoxocephalidae	93	0.62	52.78
Lysippe sp B	Annelida	Polychaeta	Ampharetidae	92	0.61	52.78
Ampelisca pugetica	Arthropoda	Malacostraca	Ampeliscidae	91	0.61	80.56
Chaetozone hartmanae	Annelida	Polychaeta	Cirratulidae	91	0.61	38.89
Syllis heterochaeta	Annelida	Polychaeta	Syllidae	91	0.61	25.00
Kirkegaardia siblina	Annelida	Polychaeta	Cirratulidae	87	0.58	38.89
Euchone incolor	Annelida	Polychaeta	Sabellidae	86	0.57	33.33
Scalibregma californicum	Annelida	Polychaeta	Scalibregmatidae	84	0.56	69.44
Phoronis sp	Phoronida		Phoronidae	84	0.56	61.11
Gymnonereis crosslandi	Annelida	Polychaeta	Nereididae	84	0.56	11.11
Tubulanus polymorphus	Nemertea	Anopla	Tubulanidae	82	0.55	63.89
Nuculana sp A	Mollusca	Bivalvia	Nuculanidae	81	0.54	55.56
Heteronemertea sp SD2	Nemertea	Anopla	uncertain	79	0.53	50.00
Praxillella pacifica	Annelida	Polychaeta	Maldanidae	76	0.51	50.00
Pista estevanica	Annelida	Polychaeta	Terebellidae	73	0.49	33.33
Nuculana taphria	Mollusca	Bivalvia	Nuculanidae	72	0.48	30.56
Foxiphalus obtusidens	Arthropoda	Malacostraca	Phoxocephalidae	72	0.48	16.67
Euphilomedes carcharodonta	Arthropoda	Ostracoda	Philomedidae	71	0.47	27.78
Spiochaetopterus costarum Cmplx	Annelida	Polychaeta	Chaetopteridae	70	0.47	61.11

Paradoneis sp SD1	Annelida	Polychaeta	Paraonidae	70	0.47	16.67
Scolanthus triangulus	Cnidaria	Anthozoa	Edwardsiidae	69	0.46	50.00
Pholoe glabra	Annelida	Polychaeta	Pholoidae	67	0.45	50.00
Aphelochaeta glandaria Cmplx	Annelida	Polychaeta	Cirratulidae	63	0.42	47.22
Glottidia albida	Brachiopoda	Inarticulata	Lingulidae	63	0.42	36.11
Stereobalanus sp	Chordata	Enteropneusta	Harrimaniidae	62	0.41	47.22
Ampelisca cristata microdentata	Arthropoda	Malacostraca	Ampeliscidae	62	0.41	13.89
Lumbrineris cruzensis	Annelida	Polychaeta	Lumbrineridae	60	0.40	38.89
Scoletoma tetraura Cmplx	Annelida	Polychaeta	Lumbrineridae	60	0.40	33.33
Scoloplos armiger Cmplx	Annelida	Polychaeta	Orbiniidae	59	0.39	44.44
Aglaophamus verrilli	Annelida	Polychaeta	Nephtyidae	59	0.39	41.67
Prionospio lighti	Annelida	Polychaeta	Spionidae	56	0.37	38.89
Goniada maculata	Annelida	Polychaeta	Goniadidae	55	0.37	47.22
Diopatra sp	Annelida	Polychaeta	Onuphidae	54	0.36	36.11
Caecognathia crenulatifrons	Arthropoda	Malacostraca	Gnathiidae	52	0.35	41.67
Dialychone trilineata	Annelida	Polychaeta	Sabellidae	49	0.33	36.11
Aphelochaeta monilaris	Annelida	Polychaeta	Cirratulidae	48	0.32	50.00
Heterophoxus oculatus	Arthropoda	Malacostraca	Phoxocephalidae	48	0.32	41.67
Cossura candida	Annelida	Polychaeta	Cossuridae	46	0.31	30.56
Ampelisciphotis podophthalma	Arthropoda	Malacostraca	Photidae	45	0.30	25.00
Polycirrus sp OC1	Annelida	Polychaeta	Terebellidae	45	0.30	19.44
Parvilucina tenuisculpta	Mollusca	Bivalvia	Lucinidae	44	0.29	58.33
Lineidae	Nemertea	Anopla	Lineidae	44	0.29	55.56
Pectinaria californiensis	Annelida	Polychaeta	Pectinariidae	44	0.29	55.56
Chloeia pinnata	Annelida	Polychaeta	Amphinomidae	44	0.29	25.00
Edwardsiidae	Cnidaria	Anthozoa	Edwardsiidae	44	0.29	25.00
Ampelisca agassizi	Arthropoda	Malacostraca	Ampeliscidae	44	0.29	22.22
Compsomyax subdiaphana	Mollusca	Bivalvia	Veneridae	42	0.28	33.33

Glycera nana	Annelida	Polychaeta	Glyceridae	41	0.27	55.56
Caprella mendax	Arthropoda	Malacostraca	Caprellidae	41	0.27	11.11
Spiophanes berkeleyorum	Annelida	Polychaeta	Spionidae	40	0.27	33.33
Rhodine bitorquata	Annelida	Polychaeta	Maldanidae	38	0.25	30.56
Marphysa disjuncta	Annelida	Polychaeta	Eunicidae	36	0.24	33.33
Scoletoma sp	Annelida	Polychaeta	Lumbrineridae	36	0.24	11.11
Rhepoxynius menziesi	Arthropoda	Malacostraca	Phoxocephalidae	35	0.23	30.56
Ampelisca careyi	Arthropoda	Malacostraca	Ampeliscidae	34	0.23	52.78
Ennucula tenuis	Mollusca	Bivalvia	Nuculidae	34	0.23	52.78
Pinnixa sp	Arthropoda	Malacostraca	Pinnotheridae	34	0.23	30.56
Parexogone breviseta	Annelida	Polychaeta	Syllidae	34	0.23	13.89
Phyllodoce pettiboneae	Annelida	Polychaeta	Phyllodocidae	33	0.22	44.44
Microspio pigmentata	Annelida	Polychaeta	Spionidae	33	0.22	38.89
Phascolion sp A	Sipuncula	Sipunculidea	Phascolionidae	33	0.22	38.89
Lysippe sp A	Annelida	Polychaeta	Ampharetidae	33	0.22	30.56
Gadila aberrans	Mollusca	Scaphopoda	Gadilidae	33	0.22	25.00
Aricidea (Acmira) simplex	Annelida	Polychaeta	Paraonidae	32	0.21	38.89
Pinnixa occidentalis Cmplx	Arthropoda	Malacostraca	Pinnotheridae	32	0.21	36.11
Ampharete sp	Annelida	Polychaeta	Ampharetidae	32	0.21	19.44
Nereis sp A	Annelida	Polychaeta	Nereididae	31	0.21	22.22
Polycirrus sp	Annelida	Polychaeta	Terebellidae	30	0.20	36.11
Listriella goleta	Arthropoda	Malacostraca	Liljeborgiidae	30	0.20	19.44
Chiridota sp	Echinodermata	Holothuroidea	Chiridotidae	29	0.19	47.22
Aphelochaeta sp	Annelida	Polychaeta	Cirratulidae	29	0.19	27.78
Rhepoxynius stenodes	Arthropoda	Malacostraca	Phoxocephalidae	29	0.19	13.89
Maldane sarsi	Annelida	Polychaeta	Maldanidae	28	0.19	33.33
Polyschides quadrifissatus	Mollusca	Scaphopoda	Gadilidae	28	0.19	27.78
Anobothrus gracilis	Annelida	Polychaeta	Ampharetidae	27	0.18	33.33

Paradialychone harrisae	Annelida	Polychaeta	Sabellidae	27	0.18	19.44
Amphipholis sp	Echinodermata	Ophiuroidea	Amphiuridae	27	0.18	11.11
Ampharetidae	Annelida	Polychaeta	Ampharetidae	26	0.17	41.67
Kurtiella tumida	Mollusca	Bivalvia	Lasaeidae	26	0.17	38.89
Nephtys ferruginea	Annelida	Polychaeta	Nephtyidae	26	0.17	30.56
Protomedeia articulata Cmplx	Arthropoda	Malacostraca	Corophiidae	26	0.17	22.22
Ophiuroconis bispinosa	Echinodermata	Ophiuroidea	Ophiodermatidae	26	0.17	11.11
Cooperella subdiaphana	Mollusca	Bivalvia	Petricolidae	25	0.17	25.00
Photis sp	Arthropoda	Malacostraca	Photidae	25	0.17	22.22
Cirratulidae	Annelida	Polychaeta	Cirratulidae	25	0.17	11.11
Lumbrineris sp	Annelida	Polychaeta	Lumbrineridae	24	0.16	36.11
Byblis millsi	Arthropoda	Malacostraca	Ampeliscidae	24	0.16	30.56
Lanassa venusta	Annelida	Polychaeta	Terebellidae	24	0.16	13.89
Notomastus hemipodus	Annelida	Polychaeta	Capitellidae	23	0.15	36.11
Levinsenia gracilis	Annelida	Polychaeta	Paraonidae	23	0.15	33.33
Westwoodilla tone	Arthropoda	Malacostraca	Oedicerotidae	23	0.15	30.56
Amage scutata	Annelida	Polychaeta	Ampharetidae	23	0.15	27.78
Dipolydora socialis	Annelida	Polychaeta	Spionidae	23	0.15	27.78
Nephtys caecoides	Annelida	Polychaeta	Nephtyidae	22	0.15	38.89
Streblosoma crassibranchia	Annelida	Polychaeta	Terebellidae	22	0.15	25.00
Exogone lourei	Annelida	Polychaeta	Syllidae	22	0.15	13.89
Ampelisca pacifica	Arthropoda	Malacostraca	Ampeliscidae	21	0.14	33.33
Dialychone veleronis	Annelida	Polychaeta	Sabellidae	21	0.14	22.22
Macoma yoldiformis	Mollusca	Bivalvia	Tellinidae	21	0.14	19.44
Myriochele olgae	Annelida	Polychaeta	Oweniidae	21	0.14	13.89
Glycinde armigera	Annelida	Polychaeta	Goniadidae	20	0.13	41.67
Aricidea (Strelzovia) sp A	Annelida	Polychaeta	Paraonidae	20	0.13	27.78
Keenaea centifilosum	Mollusca	Bivalvia	Cardiidae	20	0.13	27.78

Kirkegaardia tesselata	Annelida	Polychaeta	Cirratulidae	20	0.13	25.00
Mesolamprops bispinosus	Arthropoda	Malacostraca	Lampropidae	20	0.13	22.22
Phoronidae	Phoronida		Phoronidae	20	0.13	16.67
Polycirrus sp A	Annelida	Polychaeta	Terebellidae	19	0.13	22.22
Ophiura luetkenii	Echinodermata	Ophiuroidea	Ophiuridae	19	0.13	13.89
Ophiuroidea	Echinodermata	Ophiuroidea		18	0.12	33.33
Terebellides californica	Annelida	Polychaeta	Trichobranchidae	18	0.12	27.78
Onuphidae	Annelida	Polychaeta	Onuphidae	18	0.12	25.00
Onuphis sp A	Annelida	Polychaeta	Onuphidae	18	0.12	22.22
Photis brevipes	Arthropoda	Malacostraca	Photidae	18	0.12	19.44
Ampharete labrops	Annelida	Polychaeta	Ampharetidae	18	0.12	11.11
Volvulella panamica	Mollusca	Gastropoda	Retusidae	17	0.11	30.56
Phoronis sp SD1	Phoronida		Phoronidae	17	0.11	22.22
Poecilochaetus johnsoni	Annelida	Polychaeta	Poecilochaetidae	17	0.11	13.89
Laonice cirrata	Annelida	Polychaeta	Spionidae	16	0.11	25.00
Edwardsia olguini	Cnidaria	Anthozoa	Edwardsiidae	16	0.11	19.44
Diastylis crenellata	Arthropoda	Malacostraca	Diastylidae	16	0.11	16.67
Prionospio pygmaeus	Annelida	Polychaeta	Spionidae	16	0.11	16.67
Eulalia californiensis	Annelida	Polychaeta	Phyllodocidae	16	0.11	11.11
Tellina modesta	Mollusca	Bivalvia	Tellinidae	16	0.11	8.33
Trichobranchus hancocki	Annelida	Polychaeta	Trichobranchidae	15	0.10	30.56
Kurtzina beta	Mollusca	Gastropoda	Mangeliidae	15	0.10	27.78
Araphura breviaria	Arthropoda	Malacostraca	Tanaellidae	15	0.10	25.00
Hartmanodes hartmanae	Arthropoda	Malacostraca	Oedicerotidae	15	0.10	25.00
Leptosynapta sp	Echinodermata	Holothuroidea	Synaptidae	15	0.10	22.22
Lyonsiidae	Mollusca	Bivalvia	Lyonsiidae	15	0.10	19.44
Ampelisca sp	Arthropoda	Malacostraca	Ampeliscidae	15	0.10	16.67
Metasychis disparidentatus	Annelida	Polychaeta	Maldanidae	15	0.10	16.67

Sthenelais tertiaglabra	Annelida	Polychaeta	Sigalionidae	14	0.09	27.78
Malmgreniella sp A	Annelida	Polychaeta	Polynoidae	14	0.09	25.00
Thyasira flexuosa	Mollusca	Bivalvia	Thyasiridae	14	0.09	25.00
Bivalvia	Mollusca	Bivalvia		14	0.09	19.44
Jasmineira sp B	Annelida	Polychaeta	Sabellidae	14	0.09	11.11
Molgulidae	Chordata	Ascidiacea	Molgulidae	14	0.09	5.56
Aricidea (Strelzovia) antennata	Annelida	Polychaeta	Paraonidae	13	0.09	27.78
Ampelisca cf brevisimulata	Arthropoda	Malacostraca	Ampeliscidae	13	0.09	25.00
Aricidea (Acmira) catherinae	Annelida	Polychaeta	Paraonidae	13	0.09	22.22
Enteropneusta	Chordata	Enteropneusta		13	0.09	22.22
Aricidea (Acmira) lopezi	Annelida	Polychaeta	Paraonidae	13	0.09	19.44
Eudorella pacifica	Arthropoda	Malacostraca	Leuconidae	13	0.09	16.67
Ampharete finmarchica	Annelida	Polychaeta	Ampharetidae	13	0.09	13.89
Photis bifurcata	Arthropoda	Malacostraca	Photidae	13	0.09	13.89
Amphipholis squamata	Echinodermata	Ophiuroidea	Amphiuridae	13	0.09	11.11
Photis lacia	Arthropoda	Malacostraca	Photidae	13	0.09	11.11
Notomastus latericeus	Annelida	Polychaeta	Capitellidae	13	0.09	5.56
Lineus bilineatus	Nemertea	Anopla	Lineidae	12	0.08	27.78
Scoloplos acmeceps	Annelida	Polychaeta	Orbiniidae	12	0.08	25.00
Haliophasma geminata	Arthropoda	Malacostraca	Anthuridae	12	0.08	22.22
Spiophanes sp	Annelida	Polychaeta	Spionidae	12	0.08	22.22
Clymenura gracilis	Annelida	Polychaeta	Maldanidae	12	0.08	19.44
Glycera oxycephala	Annelida	Polychaeta	Glyceridae	12	0.08	16.67
Amphichondrius granulatus	Echinodermata	Ophiuroidea	Amphiuridae	12	0.08	13.89
Sigalion spinosus	Annelida	Polychaeta	Sigalionidae	12	0.08	13.89
Tanaopsis cadieni	Arthropoda	Malacostraca	Tanaopsidae	12	0.08	11.11
Euphysa sp A	Cnidaria	Hydrozoa	Corymorphidae	12	0.08	8.33
Melinna oculata	Annelida	Polychaeta	Ampharetidae	11	0.07	25.00

Palaeonemertea	Nemertea	Anopla		11	0.07	25.00
Phyllodoce hartmanae	Annelida	Polychaeta	Phyllodocidae	11	0.07	25.00
Cylichna diegensis	Mollusca	Gastropoda	Cylichnidae	11	0.07	22.22
Tellina carpenteri	Mollusca	Bivalvia	Tellinidae	11	0.07	22.22
Amphiura arcystata	Echinodermata	Ophiuroidea	Amphiuridae	11	0.07	16.67
Mooreonuphis nebulosa	Annelida	Polychaeta	Onuphidae	11	0.07	16.67
Aphelochaeta sp SD5	Annelida	Polychaeta	Cirratulidae	11	0.07	13.89
Dialychone albocincta	Annelida	Polychaeta	Sabellidae	11	0.07	13.89
Eulalia levicornuta Cmplx	Annelida	Polychaeta	Phyllodocidae	10	0.07	25.00
Chaetozone sp	Annelida	Polychaeta	Cirratulidae	10	0.07	13.89
Crepidula sp	Mollusca	Gastropoda	Calyptraeidae	10	0.07	8.33
Saxicavella pacifica	Mollusca	Bivalvia	Hiatellidae	10	0.07	8.33
Periploma sp	Mollusca	Bivalvia	Periplomatidae	10	0.07	5.56
Syllides mikeli	Annelida	Polychaeta	Syllidae	10	0.07	5.56
Ampelisca hancocki	Arthropoda	Malacostraca	Ampeliscidae	9	0.06	22.22
Amaeana occidentalis	Annelida	Polychaeta	Terebellidae	9	0.06	19.44
Tubulanus cingulatus	Nemertea	Anopla	Tubulanidae	9	0.06	19.44
Aphelochaeta tigrina	Annelida	Polychaeta	Cirratulidae	9	0.06	16.67
Aricidea (Strelzovia) hartleyi	Annelida	Polychaeta	Paraonidae	9	0.06	16.67
Podarkeopsis glabrus	Annelida	Polychaeta	Hesionidae	9	0.06	16.67
Tubulanus sp A	Nemertea	Anopla	Tubulanidae	9	0.06	16.67
Actiniaria	Cnidaria	Anthozoa		9	0.06	13.89
Amphisamytha bioculata	Annelida	Polychaeta	Ampharetidae	9	0.06	13.89
Diastylis californica	Arthropoda	Malacostraca	Diastylidae	9	0.06	13.89
Nicippe tumida	Arthropoda	Malacostraca	Pardaliscidae	9	0.06	13.89
Zygeupolia rubens	Nemertea	Anopla	Valenciniidae	9	0.06	13.89
Aphelochaeta sp HYP2	Annelida	Polychaeta	Cirratulidae	9	0.06	11.11
Epigamia-Myrianida Cmplx	Annelida	Polychaeta	Syllidae	9	0.06	11.11

Streblosoma sp C	Annelida	Polychaeta	Terebellidae	9	0.06	8.33
Phyllodocidae	Annelida	Polychaeta	Phyllodocidae	9	0.06	5.56
Amphicteis scaphobranchiata	Annelida	Polychaeta	Ampharetidae	8	0.05	19.44
Carinoma mutabilis	Nemertea	Anopla	Carinomidae	8	0.05	16.67
Ninoe tridentata	Annelida	Polychaeta	Lumbrineridae	8	0.05	16.67
Paradoneis sp	Annelida	Polychaeta	Paraonidae	8	0.05	16.67
Hoplonemertea	Nemertea	Enopla		8	0.05	13.89
Kirkegaardia sp	Annelida	Polychaeta	Cirratulidae	8	0.05	13.89
Malmgreniella baschi	Annelida	Polychaeta	Polynoidae	8	0.05	13.89
Modiolinae	Mollusca	Bivalvia	Mytilidae	8	0.05	13.89
Ampelisca indentata	Arthropoda	Malacostraca	Ampeliscidae	8	0.05	11.11
Euchone sp A	Annelida	Polychaeta	Sabellidae	8	0.05	11.11
Leodice americana	Annelida	Polychaeta	Eunicidae	8	0.05	11.11
Philine ornatissima	Mollusca	Gastropoda	Philinidae	8	0.05	11.11
Poecilochaetus sp	Annelida	Polychaeta	Poecilochaetidae	8	0.05	11.11
Drilonereis falcata	Annelida	Polychaeta	Oenonidae	8	0.05	8.33
Pista wui	Annelida	Polychaeta	Terebellidae	8	0.05	8.33
Phyllodoce longipes	Annelida	Polychaeta	Phyllodocidae	7	0.05	19.44
Thysanocardia nigra	Sipuncula	Sipunculidea	Golfingiidae	7	0.05	19.44
Deflexilodes norvegicus	Arthropoda	Malacostraca	Oedicerotidae	7	0.05	16.67
Procampylaspis caenosa	Arthropoda	Malacostraca	Nannastacidae	7	0.05	16.67
Sabellidae	Annelida	Polychaeta	Sabellidae	7	0.05	16.67
Tubulanidae	Nemertea	Anopla	Tubulanidae	7	0.05	16.67
Balanoglossus sp	Chordata	Enteropneusta	Ptychoderidae	7	0.05	13.89
Capitella capitata Cmplx	Annelida	Polychaeta	Capitellidae	7	0.05	13.89
Paranemertes californica	Nemertea	Enopla	Emplectonematidae	7	0.05	13.89
Philine auriformis	Mollusca	Gastropoda	Philinidae	7	0.05	13.89
Acteocina cerealis	Mollusca	Gastropoda	Cylichnidae	7	0.05	11.11

Ceriantharia	Cnidaria	Anthozoa		7	0.05	11.11
Diopatra tridentata	Annelida	Polychaeta	Onuphidae	7	0.05	11.11
Lumbrineris ligulata	Annelida	Polychaeta	Lumbrineridae	7	0.05	11.11
Tellina sp	Mollusca	Bivalvia	Tellinidae	7	0.05	11.11
Turbonilla santarosana	Mollusca	Gastropoda	Pyramidellidae	7	0.05	11.11
Byblis sp	Arthropoda	Malacostraca	Ampeliscidae	7	0.05	8.33
Malmgreniella scriptoria	Annelida	Polychaeta	Polynoidae	7	0.05	8.33
Paradialychone ecaudata	Annelida	Polychaeta	Sabellidae	7	0.05	8.33
Prionospio sp	Annelida	Polychaeta	Spionidae	7	0.05	8.33
Xenoleberis californica	Arthropoda	Ostracoda	Cylindroleberididae	7	0.05	8.33
Americhelidium sp SD4	Arthropoda	Malacostraca	Oedicerotidae	7	0.05	5.56
Lumbrineris japonica	Annelida	Polychaeta	Lumbrineridae	7	0.05	5.56
Magelona hartmanae	Annelida	Polychaeta	Magelonidae	7	0.05	5.56
Ophiura sp	Echinodermata	Ophiuroidea	Ophiuridae	7	0.05	5.56
Asteroidea	Echinodermata	Asteroidea		6	0.04	16.67
Heteronemertea	Nemertea	Anopla		6	0.04	16.67
Leitoscoloplos pugettensis	Annelida	Polychaeta	Orbiniidae	6	0.04	16.67
Amphissa undata	Mollusca	Gastropoda	Columbellidae	6	0.04	13.89
Pista brevibranchiata	Annelida	Polychaeta	Terebellidae	6	0.04	11.11
Acromegalomma pigmentum	Annelida	Polychaeta	Sabellidae	6	0.04	8.33
Arachnanthus sp A	Cnidaria	Anthozoa	Cerianthidae	6	0.04	8.33
Dendrochirotida	Echinodermata	Holothuroidea		6	0.04	8.33
Nebalia daytoni	Arthropoda	Malacostraca	Nebaliidae	6	0.04	8.33
Oligochaeta	Annelida	Oligochaeta		6	0.04	8.33
Stenothoides bicoma	Arthropoda	Malacostraca	Stenothoidae	6	0.04	8.33
Diopatra ornata	Annelida	Polychaeta	Onuphidae	6	0.04	5.56
Edwardsia juliae	Cnidaria	Anthozoa	Edwardsiidae	6	0.04	5.56
Cyclocardia sp	Mollusca	Bivalvia	Carditidae	6	0.04	2.78

Levinsenia kirbyae	Annelida	Polychaeta	Paraonidae	5	0.03	13.89
Onuphis sp	Annelida	Polychaeta	Onuphidae	5	0.03	13.89
Sige sp A	Annelida	Polychaeta	Phyllodocidae	5	0.03	13.89
Apionsoma misakianum	Sipuncula	Phascolosomatidea	Phascolosomatidae	5	0.03	11.11
Cerebratulus californiensis	Nemertea	Anopla	Lineidae	5	0.03	11.11
Halianthella sp A	Cnidaria	Anthozoa	Halcampidae	5	0.03	11.11
Listriolobus pelodes	Echiura	Echiuridea	Thalassematidae	5	0.03	11.11
Odostomia sp	Mollusca	Gastropoda	Pyramidellidae	5	0.03	11.11
Phyllodoce cuspidata	Annelida	Polychaeta	Phyllodocidae	5	0.03	11.11
Polycirrus californicus	Annelida	Polychaeta	Terebellidae	5	0.03	11.11
Streblosoma sp B	Annelida	Polychaeta	Terebellidae	5	0.03	11.11
Aphelochaeta williamsae	Annelida	Polychaeta	Cirratulidae	5	0.03	8.33
Astropecten californicus	Echinodermata	Asteroidea	Astropectinidae	5	0.03	8.33
Eulima raymondi	Mollusca	Gastropoda	Eulimidae	5	0.03	8.33
Notomastus magnus	Annelida	Polychaeta	Capitellidae	5	0.03	8.33
Pectinidae	Mollusca	Bivalvia	Pectinidae	5	0.03	8.33
Bemlos audbettius	Arthropoda	Malacostraca	Aoridae	5	0.03	5.56
Euchone arenae	Annelida	Polychaeta	Sabellidae	5	0.03	5.56
Euphilomedes producta	Arthropoda	Ostracoda	Philomedidae	5	0.03	5.56
Marphysa sp	Annelida	Polychaeta	Eunicidae	5	0.03	5.56
Neomysis kadiakensis	Arthropoda	Malacostraca	Mysidae	5	0.03	5.56
Sthenelais verruculosa	Annelida	Polychaeta	Sigalionidae	5	0.03	5.56
Tanaella propinquus	Arthropoda	Malacostraca	Tanaellidae	5	0.03	5.56
Myriochele sp	Annelida	Polychaeta	Oweniidae	5	0.03	2.78
Parexogone molesta	Annelida	Polychaeta	Syllidae	5	0.03	2.78
Aglaja ocelligera	Mollusca	Gastropoda	Aglajidae	4	0.03	11.11
Americhelidium shoemakeri	Arthropoda	Malacostraca	Oedicerotidae	4	0.03	11.11
Anoplodactylus erectus	Arthropoda	Pycnogonida	Phoxichilidiidae	4	0.03	11.11

Campylaspis canaliculata	Arthropoda	Malacostraca	Nannastacidae	4	0.03	11.11
Lucinoma annulatum	Mollusca	Bivalvia	Lucinidae	4	0.03	11.11
Neotrypaea gigas	Arthropoda	Malacostraca	Callianassidae	4	0.03	11.11
Spiophanes wigleyi	Annelida	Polychaeta	Spionidae	4	0.03	11.11
Adontorhina cyclia	Mollusca	Bivalvia	Thyasiridae	4	0.03	8.33
Amygdalum pallidulum	Mollusca	Bivalvia	Mytilidae	4	0.03	8.33
Anopla	Nemertea	Anopla		4	0.03	8.33
Capitellidae	Annelida	Polychaeta	Capitellidae	4	0.03	8.33
Glycera americana	Annelida	Polychaeta	Glyceridae	4	0.03	8.33
Hoplonemertea sp A SCAMIT 2007	Nemertea	Enopla		4	0.03	8.33
Malmgreniella macginitiei	Annelida	Polychaeta	Polynoidae	4	0.03	8.33
Neaeromya compressa	Mollusca	Bivalvia	Lasaeidae	4	0.03	8.33
Turbonilla sp	Mollusca	Gastropoda	Pyramidellidae	4	0.03	8.33
Chaetozone corona	Annelida	Polychaeta	Cirratulidae	4	0.03	5.56
Chaetozone sp SD3	Annelida	Polychaeta	Cirratulidae	4	0.03	5.56
Hemilamprops californicus	Arthropoda	Malacostraca	Lampropidae	4	0.03	5.56
Heterophoxus sp	Arthropoda	Malacostraca	Phoxocephalidae	4	0.03	5.56
Hippomedon zetesimus	Arthropoda	Malacostraca	Lysianassidae	4	0.03	5.56
Laomedea calceolifera	Cnidaria	Hydrozoa	Campanulariidae	4	0.03	5.56
Lumbrineris latreilli	Annelida	Polychaeta	Lumbrineridae	4	0.03	5.56
Odontosyllis phosphorea	Annelida		Syllidae	4	0.03	5.56
Paradoneis lyra	Annelida	Polychaeta	Paraonidae	4	0.03	5.56
Samytha californiensis	Annelida	Polychaeta	Ampharetidae	4	0.03	5.56
Spionidae	Annelida	Polychaeta	Spionidae	4	0.03	5.56
Terebellidae	Annelida	Polychaeta	Terebellidae	4	0.03	5.56
Volvulella cylindrica	Mollusca	Gastropoda	Retusidae	4	0.03	5.56
Rhepoxynius lucubrans	Arthropoda	Malacostraca	Phoxocephalidae	4	0.03	2.78
Argissa hamatipes	Arthropoda	Malacostraca	Argissidae	3	0.02	8.33

Aruga oculata	Arthropoda	Malacostraca	Lysianassidae	3	0.02	8.33
Ascidiacea	Chordata	Ascidiacea		3	0.02	8.33
Chaetoderma pacificum	Mollusca	Caudofoveata	Chaetodermidae	3	0.02	8.33
Chaetozone hedgpethi	Annelida	Polychaeta	Cirratulidae	3	0.02	8.33
Crenella decussata	Mollusca	Bivalvia	Mytilidae	3	0.02	8.33
Drilonereis sp	Annelida	Polychaeta	Oenonidae	3	0.02	8.33
Echinoidea	Echinodermata	Echinoidea		3	0.02	8.33
Hermundura fauveli	Annelida	Polychaeta	Pilargidae	3	0.02	8.33
Kurtzia arteaga	Mollusca	Gastropoda	Mangeliidae	3	0.02	8.33
Levinsenia oculata	Annelida	Polychaeta	Paraonidae	3	0.02	8.33
Nereiphylla ferruginea Cmplx	Annelida	Polychaeta	Phyllodocidae	3	0.02	8.33
Notomastus sp	Annelida	Polychaeta	Capitellidae	3	0.02	8.33
Solamen columbianum	Mollusca	Bivalvia	Mytilidae	3	0.02	8.33
Solen sicarius	Mollusca	Bivalvia	Solenidae	3	0.02	8.33
Sthenelais fusca	Annelida	Polychaeta	Sigalionidae	3	0.02	8.33
Tenonia priops	Annelida	Polychaeta	Polynoidae	3	0.02	8.33
Tetrastemma candidum	Nemertea	Enopla	Tetrastemmatidae	3	0.02	8.33
Decamastus gracilis	Annelida	Polychaeta	Capitellidae	3	0.02	5.56
Dipolydora sp	Annelida	Polychaeta	Spionidae	3	0.02	5.56
Euchone sp	Annelida	Polychaeta	Sabellidae	3	0.02	5.56
Foxiphalus golfensis	Arthropoda	Malacostraca	Phoxocephalidae	3	0.02	5.56
Laonice nuchala	Annelida	Polychaeta	Spionidae	3	0.02	5.56
Leptopecten latiauratus	Mollusca	Bivalvia	Pectinidae	3	0.02	5.56
Lytechinus pictus	Echinodermata	Echinoidea	Toxopneustidae	3	0.02	5.56
Pherusa neopapillata	Annelida	Polychaeta	Flabelligeridae	3	0.02	5.56
SIPUNCULA	Sipuncula			3	0.02	5.56
Solemya pervernicosa	Mollusca	Bivalvia	Solemyidae	3	0.02	5.56
Syllidae	Annelida	Polychaeta	Syllidae	3	0.02	5.56

Terebellides sp	Annelida	Polychaeta	Trichobranchidae	3	0.02	5.56
Acromegalomma sp	Annelida	Polychaeta	Sabellidae	3	0.02	2.78
Acromegalomma splendidum	Annelida	Polychaeta	Sabellidae	3	0.02	2.78
Amphiodia digitata	Echinodermata	Ophiuroidea	Amphiuridae	3	0.02	2.78
Amphiporus californicus	Nemertea	Enopla	Amphiporidae	3	0.02	2.78
Bipalponephtys cornuta	Annelida	Polychaeta	Nephtyidae	3	0.02	2.78
Delectopecten vancouverensis	Mollusca	Bivalvia	Pectinidae	3	0.02	2.78
Dipolydora bidentata	Annelida	Polychaeta	Spionidae	3	0.02	2.78
Ericerodes hemphillii	Arthropoda	Malacostraca	Inachidae	3	0.02	2.78
Ericthonius brasiliensis	Arthropoda	Malacostraca	Ischyroceridae	3	0.02	2.78
Fauveliopsis sp SD1	Annelida	Polychaeta	Fauveliopsidae	3	0.02	2.78
Levinsenia multibranchiata	Annelida	Polychaeta	Paraonidae	3	0.02	2.78
Owenia collaris	Annelida	Polychaeta	Oweniidae	3	0.02	2.78
Paramicrodeutopus schmitti	Arthropoda	Malacostraca	Aoridae	3	0.02	2.78
Phyllochaetopterus prolifica	Annelida	Polychaeta	Chaetopteridae	3	0.02	2.78
Pseudofabriciola californica	Annelida	Polychaeta	Fabriciidae	3	0.02	2.78
Rutiderma lomae	Arthropoda	Ostracoda	Rutidermatidae	3	0.02	2.78
Streblosoma sp	Annelida	Polychaeta	Terebellidae	3	0.02	2.78
Synidotea magnifica	Arthropoda	Malacostraca	Idoteidae	3	0.02	2.78
Ampelisca romigi	Arthropoda	Malacostraca	Ampeliscidae	2	0.01	5.56
Ampharetidae sp SD1	Annelida	Polychaeta	Ampharetidae	2	0.01	5.56
Aphelochaeta elongata	Annelida	Polychaeta	Cirratulidae	2	0.01	5.56
Aricidea (Acmira) rubra	Annelida	Polychaeta	Paraonidae	2	0.01	5.56
Aricidea (Aricidea) wassi	Annelida	Polychaeta	Paraonidae	2	0.01	5.56
Calyptraea fastigiata	Mollusca	Gastropoda	Calyptraeidae	2	0.01	5.56
Caprellidae	Arthropoda	Malacostraca	Caprellidae	2	0.01	5.56
Cardiomya pectinata	Mollusca	Bivalvia	Cuspidariidae	2	0.01	5.56
Chaetoderma marinelli	Mollusca	Caudofoveata	Chaetodermidae	2	0.01	5.56

Chaetozone lunula	Annelida	Polychaeta	Cirratulidae	2	0.01	5.56
Cossura sp	Annelida	Polychaeta	Cossuridae	2	0.01	5.56
Cuspidaria parapodema	Mollusca	Bivalvia	Cuspidariidae	2	0.01	5.56
Diplehnia caeca	Platyhelminthes	Turbellaria	Plehniidae	2	0.01	5.56
Eyakia robusta	Arthropoda	Malacostraca	Phoxocephalidae	2	0.01	5.56
Fauveliopsis glabra	Annelida	Polychaeta	Fauveliopsidae	2	0.01	5.56
Glycera robusta	Annelida	Polychaeta	Glyceridae	2	0.01	5.56
Hesperonoe laevis	Annelida	Polychaeta	Polynoidae	2	0.01	5.56
Heterophoxus ellisi	Arthropoda	Malacostraca	Phoxocephalidae	2	0.01	5.56
Lanice conchilega	Annelida	Polychaeta	Terebellidae	2	0.01	5.56
Malmgreniella sp	Annelida	Polychaeta	Polynoidae	2	0.01	5.56
Myriowenia californiensis	Annelida	Polychaeta	Oweniidae	2	0.01	5.56
Notocirrus californiensis	Annelida	Polychaeta	Oenonidae	2	0.01	5.56
Ophelina acuminata	Annelida	Polychaeta	Opheliidae	2	0.01	5.56
Paradoneis spinifera	Annelida	Polychaeta	Paraonidae	2	0.01	5.56
Parougia caeca	Annelida	Polychaeta	Dorvilleidae	2	0.01	5.56
Pherusa sp	Annelida	Polychaeta	Flabelligeridae	2	0.01	5.56
Pholoe sp B	Annelida	Polychaeta	Pholoidae	2	0.01	5.56
Phyllochaetopterus limicolus	Annelida	Polychaeta	Chaetopteridae	2	0.01	5.56
Pinnixa franciscana	Arthropoda	Malacostraca	Pinnotheridae	2	0.01	5.56
Piromis sp	Annelida	Polychaeta	Flabelligeridae	2	0.01	5.56
Platynereis bicanaliculata	Annelida	Polychaeta	Nereididae	2	0.01	5.56
Proclea sp A	Annelida	Polychaeta	Terebellidae	2	0.01	5.56
Rhamphobrachium longisetosum	Annelida	Polychaeta	Onuphidae	2	0.01	5.56
Scaphopoda	Mollusca	Scaphopoda		2	0.01	5.56
Scoloplos sp	Annelida	Polychaeta	Orbiniidae	2	0.01	5.56
Sosane occidentalis	Annelida	Polychaeta	Ampharetidae	2	0.01	5.56
Syllis hyperioni	Annelida	Polychaeta	Syllidae	2	0.01	5.56

Terebellides sp Type C	Annelida	Polychaeta	Trichobranchidae	2	0.01	5.56
Thracia trapezoides	Mollusca	Bivalvia	Thraciidae	2	0.01	5.56
Thraciidae	Mollusca	Bivalvia	Thraciidae	2	0.01	5.56
Tiron biocellata	Arthropoda	Malacostraca	Synopiidae	2	0.01	5.56
Trophoniella harrisae	Annelida	Polychaeta	Flabelligeridae	2	0.01	5.56
Turbonilla sp A	Mollusca	Gastropoda	Pyramidellidae	2	0.01	5.56
Typhlotanais williamsae	Arthropoda	Malacostraca	Typhlotanaidae	2	0.01	5.56
Virgularia agassizii	Cnidaria	Anthozoa	Virgulariidae	2	0.01	5.56
Virgulariidae	Cnidaria	Anthozoa	Virgulariidae	2	0.01	5.56
Volvulella californica	Mollusca	Gastropoda	Retusidae	2	0.01	5.56
Amphioplus sp A	Echinodermata	Ophiuroidea	Amphiuridae	2	0.01	2.78
Aricidea (Aricidea) pseudoarticulata	Annelida	Polychaeta	Paraonidae	2	0.01	2.78
Asabellides lineata	Annelida	Polychaeta	Ampharetidae	2	0.01	2.78
Bathymedon pumilus	Arthropoda	Malacostraca	Oedicerotidae	2	0.01	2.78
Chaetopteridae	Annelida	Polychaeta	Chaetopteridae	2	0.01	2.78
Corymorpha bigelowi	Cnidaria	Hydrozoa	Corymorphidae	2	0.01	2.78
Cossura bansei	Annelida	Polychaeta	Cossuridae	2	0.01	2.78
Decapoda	Arthropoda	Malacostraca		2	0.01	2.78
Ephesiella brevicapitis	Annelida	Polychaeta	Sphaerodoridae	2	0.01	2.78
Limnactiniidae sp A	Cnidaria	Anthozoa	Limnactiniidae	2	0.01	2.78
Lirobittium sp	Mollusca	Gastropoda	Cerithiidae	2	0.01	2.78
Maera jerrica	Arthropoda	Malacostraca	Melitidae	2	0.01	2.78
Magelona sp	Annelida	Polychaeta	Magelonidae	2	0.01	2.78
NEMERTEA	Nemertea			2	0.01	2.78
Nuculana hamata	Mollusca	Bivalvia	Nuculanidae	2	0.01	2.78
Orchomene anaquelus	Arthropoda	Malacostraca	Lysianassidae	2	0.01	2.78
Pentamera pseudopopulifera	Echinodermata	Holothuroidea	Phyllophoridae	2	0.01	2.78
Photis sp C	Arthropoda	Malacostraca	Photidae	2	0.01	2.78

Pinnixa longipes	Arthropoda	Malacostraca	Pinnotheridae	2	0.01	2.78
Pleusymtes subglaber	Arthropoda	Malacostraca	Pleustidae	2	0.01	2.78
Rhepoxynius variatus	Arthropoda	Malacostraca	Phoxocephalidae	2	0.01	2.78
Rictaxis punctocaelatus	Mollusca	Gastropoda	Acteonidae	2	0.01	2.78
Rutiderma rostratum	Arthropoda	Ostracoda	Rutidermatidae	2	0.01	2.78
Saccoglossus sp	Chordata	Enteropneusta	Harrimaniidae	2	0.01	2.78
Schizocardium sp	Chordata	Enteropneusta	Spengeliidae	2	0.01	2.78
Streblosoma sp *SF1*	Annelida	Polychaeta	Terebellidae	2	0.01	2.78
Tanaididae	Arthropoda	Malacostraca	Tanaididae	2	0.01	2.78
Travisia pupa	Annelida	Polychaeta	Travisiidae	2	0.01	2.78
Tubulanidae sp B	Nemertea	Anopla	Tubulanidae	2	0.01	2.78
Acidostoma hancocki	Arthropoda	Malacostraca	Acidostomatidae	1	0.01	2.78
Acteocina culcitella	Mollusca	Gastropoda	Cylichnidae	1	0.01	2.78
Agnezia septentrionalis	Chordata	Ascidiacea	Agneziidae	1	0.01	2.78
Alienacanthomysis macropsis	Arthropoda	Malacostraca	Mysidae	1	0.01	2.78
Alvania rosana	Mollusca	Gastropoda	Rissoidae	1	0.01	2.78
Amage anops	Annelida	Polychaeta	Ampharetidae	1	0.01	2.78
Amphipoda	Arthropoda	Malacostraca		1	0.01	2.78
Amphiporus flavescens	Nemertea	Enopla	Amphiporidae	1	0.01	2.78
Amphisamytha sp	Annelida	Polychaeta	Ampharetidae	1	0.01	2.78
Anarthruridae sp *3*	Arthropoda	Malacostraca	Anarthruridae	1	0.01	2.78
Anemonactis sp A	Cnidaria	Anthozoa	Haloclavidae	1	0.01	2.78
Aphelochaeta petersenae	Annelida	Polychaeta	Cirratulidae	1	0.01	2.78
Aphelochaeta phillipsi	Annelida	Polychaeta	Cirratulidae	1	0.01	2.78
Aphrodita sp	Annelida	Polychaeta	Aphroditidae	1	0.01	2.78
Araphura sp	Arthropoda	Malacostraca	Tanaellidae	1	0.01	2.78
Araphura sp SD1	Arthropoda	Malacostraca	Tanaellidae	1	0.01	2.78
Aricidea (Acmira) sp	Annelida	Polychaeta	Paraonidae	1	0.01	2.78

Aricidea (Strelzovia) sp SD1	Annelida	Polychaeta	Paraonidae	1	0.01	2.78
Astropecten sp	Echinodermata	Asteroidea	Astropectinidae	1	0.01	2.78
Axiothella sp	Annelida	Polychaeta	Maldanidae	1	0.01	2.78
Balcis oldroydae	Mollusca	Gastropoda	Eulimidae	1	0.01	2.78
Brachyura	Arthropoda	Malacostraca		1	0.01	2.78
Campylaspis hartae	Arthropoda	Malacostraca	Nannastacidae	1	0.01	2.78
Caprella californica Cmplx	Arthropoda	Malacostraca	Caprellidae	1	0.01	2.78
Caprella sp	Arthropoda	Malacostraca	Caprellidae	1	0.01	2.78
Carazziella sp A	Annelida	Polychaeta	Spionidae	1	0.01	2.78
Carinomella lactea	Nemertea	Anopla	Tubulanidae	1	0.01	2.78
Chaetoderma elegans	Mollusca	Caudofoveata	Chaetodermidae	1	0.01	2.78
Chaetopterus variopedatus Cmplx	Annelida	Polychaeta	Chaetopteridae	1	0.01	2.78
Chaetozone columbiana	Annelida	Polychaeta	Cirratulidae	1	0.01	2.78
Cirriformia sp	Annelida	Polychaeta	Cirratulidae	1	0.01	2.78
Cirrophorus furcatus	Annelida	Polychaeta	Paraonidae	1	0.01	2.78
Clymenella sp A	Annelida	Polychaeta	Maldanidae	1	0.01	2.78
Columbellidae	Mollusca	Gastropoda	Columbellidae	1	0.01	2.78
Corophiidae	Arthropoda	Malacostraca	Corophiidae	1	0.01	2.78
Crepidula glottidiarum	Mollusca	Gastropoda	Calyptraeidae	1	0.01	2.78
Cryptonemertes actinophila	Nemertea	Enopla	Emplectonematidae	1	0.01	2.78
Cyclocardia ventricosa	Mollusca	Bivalvia	Carditidae	1	0.01	2.78
Desdimelita desdichada	Arthropoda	Malacostraca	Melitidae	1	0.01	2.78
Dialychone sp	Annelida	Polychaeta	Sabellidae	1	0.01	2.78
Drilonereis mexicana	Annelida	Polychaeta	Oenonidae	1	0.01	2.78
Drilonereis sp LA1	Annelida	Polychaeta	Oenonidae	1	0.01	2.78
Elaeocyma empyrosia	Mollusca	Gastropoda	Drillidae	1	0.01	2.78
Enopla	Nemertea	Enopla		1	0.01	2.78
Epitonium bellastriatum	Mollusca	Gastropoda	Epitoniidae	1	0.01	2.78

Epitonium sawinae	Mollusca	Gastropoda	Epitoniidae	1	0.01	2.78
Eteone pigmentata	Annelida	Polychaeta	Phyllodocidae	1	0.01	2.78
Euchone hancocki	Annelida	Polychaeta	Sabellidae	1	0.01	2.78
Eugyra arenosa californica	Chordata	Ascidiacea	Molgulidae	1	0.01	2.78
Eumida longicornuta	Annelida	Polychaeta	Phyllodocidae	1	0.01	2.78
Eunicidae	Annelida	Polychaeta	Eunicidae	1	0.01	2.78
Euphysa sp	Cnidaria	Hydrozoa	Corymorphidae	1	0.01	2.78
Eusyllis habei	Annelida	Polychaeta	Syllidae	1	0.01	2.78
Falcidens longus	Mollusca	Caudofoveata	Falcidentidae	1	0.01	2.78
Galathowenia pygidialis	Annelida	Polychaeta	Oweniidae	1	0.01	2.78
Gastropoda	Mollusca	Gastropoda		1	0.01	2.78
Gastropteron pacificum	Mollusca	Gastropoda	Gastropteridae	1	0.01	2.78
Glycera sp	Annelida	Polychaeta	Glyceridae	1	0.01	2.78
Goniada brunnea	Annelida	Polychaeta	Goniadidae	1	0.01	2.78
Halcampa decemtentaculata	Cnidaria	Anthozoa	Halcampidae	1	0.01	2.78
Hyalidae	Arthropoda	Malacostraca	Hyalidae	1	0.01	2.78
Hyalinoecia juvenalis	Annelida	Polychaeta	Onuphidae	1	0.01	2.78
Isocirrus longiceps	Annelida	Polychaeta	Maldanidae	1	0.01	2.78
Jassa staudei	Arthropoda	Malacostraca	Ischyroceridae	1	0.01	2.78
Kirkegaardia serratiseta	Annelida	Polychaeta	Cirratulidae	1	0.01	2.78
Kurtiella sp D	Mollusca	Bivalvia	Lasaeidae	1	0.01	2.78
Latulambrus occidentalis	Arthropoda	Malacostraca	Parthenopidae	1	0.01	2.78
Leitoscoloplos sp	Annelida	Polychaeta	Orbiniidae	1	0.01	2.78
Lepidasthenia berkeleyae	Annelida	Polychaeta	Polynoidae	1	0.01	2.78
Leptostylis abditis	Arthropoda	Malacostraca	Diastylidae	1	0.01	2.78
Leptostylis calva	Arthropoda	Malacostraca	Diastylidae	1	0.01	2.78
Leuroleberis sharpei	Arthropoda	Ostracoda	Cylindroleberididae	1	0.01	2.78
Levinsenia sp	Annelida	Polychaeta	Paraonidae	1	0.01	2.78

Levinsenia sp SD1	Annelida	Polychaeta	Paraonidae	1	0.01	2.78
Limifossor fratula	Mollusca	Caudofoveata	Limifossoridae	1	0.01	2.78
Listriella albina	Arthropoda	Malacostraca	Liljeborgiidae	1	0.01	2.78
Listriella eriopisa	Arthropoda	Malacostraca	Liljeborgiidae	1	0.01	2.78
Lovenia cordiformis	Echinodermata	Echinoidea	Loveniidae	1	0.01	2.78
Luidia sp	Echinodermata	Asteroidea	Luidiidae	1	0.01	2.78
Lumbrineridae	Annelida	Polychaeta	Lumbrineridae	1	0.01	2.78
Lyonsia californica	Mollusca	Bivalvia	Lyonsiidae	1	0.01	2.78
Magelona hobsonae	Annelida	Polychaeta	Magelonidae	1	0.01	2.78
Magelona sp B	Annelida	Polychaeta	Magelonidae	1	0.01	2.78
Malmgreniella liei	Annelida	Polychaeta	Polynoidae	1	0.01	2.78
Malmgreniella sanpedroensis	Annelida	Polychaeta	Polynoidae	1	0.01	2.78
Mayerella banksia	Arthropoda	Malacostraca	Caprellidae	1	0.01	2.78
Megaluropidae sp A	Arthropoda	Malacostraca	Megaluropidae	1	0.01	2.78
Megasurcula carpenteriana	Mollusca	Gastropoda	Pseudomelatomidae	1	0.01	2.78
Mesochaetopterus sp	Annelida	Polychaeta	Chaetopteridae	1	0.01	2.78
Micrura wilsoni	Nemertea	Anopla	Lineidae	1	0.01	2.78
Modiolatus neglectus	Mollusca	Bivalvia	Mytilidae	1	0.01	2.78
Molpadia intermedia	Echinodermata	Holothuroidea	Molpadiidae	1	0.01	2.78
Monoculodes emarginatus	Arthropoda	Malacostraca	Oedicerotidae	1	0.01	2.78
Myriochele gracilis	Annelida	Polychaeta	Oweniidae	1	0.01	2.78
Myxicola sp	Annelida	Polychaeta	Sabellidae	1	0.01	2.78
Nannastacidae	Arthropoda	Malacostraca	Nannastacidae	1	0.01	2.78
Neastacilla californica	Arthropoda	Malacostraca	Arcturidae	1	0.01	2.78
Neogyptis sp	Annelida	Polychaeta	Hesionidae	1	0.01	2.78
Nephtyidae	Annelida	Polychaeta	Nephtyidae	1	0.01	2.78
Ninoe sp	Annelida	Polychaeta	Lumbrineridae	1	0.01	2.78
Nuculana sp	Mollusca	Bivalvia	Nuculanidae	1	0.01	2.78

Oedicerotidae	Arthropoda	Malacostraca	Oedicerotidae	1	0.01	2.78
Oerstedia dorsalis Cmplx	Nemertea	Enopla	Prosorhochmidae	1	0.01	2.78
Ophiodermella sp	Mollusca	Gastropoda	Borsoniidae	1	0.01	2.78
Opisa tridentata	Arthropoda	Malacostraca	Opisidae	1	0.01	2.78
Oxydromus pugettensis	Annelida	Polychaeta	Hesionidae	1	0.01	2.78
Pachynus barnardi	Arthropoda	Malacostraca	Pachynidae	1	0.01	2.78
Paguristes sp	Arthropoda	Malacostraca	Diogenidae	1	0.01	2.78
Paguroidea	Arthropoda	Malacostraca		1	0.01	2.78
Paradialychone paramollis	Annelida	Polychaeta	Sabellidae	1	0.01	2.78
Paradoneis eliasoni	Annelida	Polychaeta	Paraonidae	1	0.01	2.78
Paraonidae	Annelida	Polychaeta	Paraonidae	1	0.01	2.78
Pentamera lissoplaca	Echinodermata	Holothuroidea	Phyllophoridae	1	0.01	2.78
Pettiboneia sanmatiensis	Annelida	Polychaeta	Dorvilleidae	1	0.01	2.78
Pholoe sp	Annelida	Polychaeta	Pholoidae	1	0.01	2.78
Pholoides asperus	Annelida	Polychaeta	Sigalionidae	1	0.01	2.78
Phoronopsis sp	Phoronida		Phoronidae	1	0.01	2.78
Photis parvidons	Arthropoda	Malacostraca	Photidae	1	0.01	2.78
Phoxocephalidae	Arthropoda	Malacostraca	Phoxocephalidae	1	0.01	2.78
Phyllodoce groenlandica	Annelida	Polychaeta	Phyllodocidae	1	0.01	2.78
Phyllodoce sp	Annelida	Polychaeta	Phyllodocidae	1	0.01	2.78
Phyllophoridae	Echinodermata	Holothuroidea	Phyllophoridae	1	0.01	2.78
Pilargis sp A	Annelida	Polychaeta	Pilargidae	1	0.01	2.78
Pista moorei	Annelida	Polychaeta	Terebellidae	1	0.01	2.78
Plexauridae	Cnidaria	Anthozoa	Plexauridae	1	0.01	2.78
Polycirrus sp I	Annelida	Polychaeta	Terebellidae	1	0.01	2.78
Polygireulima rutila	Mollusca	Gastropoda	Eulimidae	1	0.01	2.78
Potamethus sp A	Annelida	Polychaeta	Sabellidae	1	0.01	2.78
Praxillella gracilis	Annelida	Polychaeta	Maldanidae	1	0.01	2.78

Prosorhochmus albidus	Nemertea	Enopla	Prosorhochmidae	1	0.01	2.78
Pseudotanais californiensis	Arthropoda	Malacostraca	Pseudotanaidae	1	0.01	2.78
Rhachotropis sp A	Arthropoda	Malacostraca	Eusiridae	1	0.01	2.78
Rhepoxynius abronius	Arthropoda	Malacostraca	Phoxocephalidae	1	0.01	2.78
Rhepoxynius sp	Arthropoda	Malacostraca	Phoxocephalidae	1	0.01	2.78
Rudilemboides sp A	Arthropoda	Malacostraca	Unciolidae	1	0.01	2.78
Rudilemboides stenopropodus	Arthropoda	Malacostraca	Unciolidae	1	0.01	2.78
Schistocomus sp	Annelida	Polychaeta	Ampharetidae	1	0.01	2.78
Scolelepis (Parascolelepis) texana	Annelida	Polychaeta	Spionidae	1	0.01	2.78
Scolelepis (Scolelepis) occidentalis	Annelida	Polychaeta	Spionidae	1	0.01	2.78
Sigambra setosa	Annelida	Polychaeta	Pilargidae	1	0.01	2.78
Sigambra sp	Annelida	Polychaeta	Pilargidae	1	0.01	2.78
Siphonolabrum californiensis	Arthropoda	Malacostraca	Anarthruridae	1	0.01	2.78
Sipunculidae	Sipuncula	Sipunculidea	Sipunculidae	1	0.01	2.78
Solen sp	Mollusca	Bivalvia	Solenidae	1	0.01	2.78
Stylatula elongata	Cnidaria	Anthozoa	Virgulariidae	1	0.01	2.78
Stylatula sp	Cnidaria	Anthozoa	Virgulariidae	1	0.01	2.78
Stylatula sp A	Cnidaria	Anthozoa	Virgulariidae	1	0.01	2.78
Syllis farallonensis	Annelida	Polychaeta	Syllidae	1	0.01	2.78
Tellina idae	Mollusca	Bivalvia	Tellinidae	1	0.01	2.78
Terebellides reishi	Annelida	Polychaeta	Trichobranchidae	1	0.01	2.78
Terebra hemphilli	Mollusca	Gastropoda	Terebridae	1	0.01	2.78
Terebra pedroana	Mollusca	Gastropoda	Terebridae	1	0.01	2.78
Thracioidea	Mollusca	Bivalvia		1	0.01	2.78
Travisia gigas	Annelida	Polychaeta	Travisiidae	1	0.01	2.78
Trigonulina novemcostatus	Mollusca	Bivalvia	Verticordiidae	1	0.01	2.78
Tritia insculpta	Mollusca	Gastropoda	Nassariidae	1	0.01	2.78
Tubulanidae sp E	Nemertea	Anopla	Tubulanidae	1	0.01	2.78

Zaolutus actius	Cnidaria	Anthozoa	Isanthidae	1	0.01	2.78

Appendix A8. Macrobenthic community summary for the Outer Shelf stratum in the Bight'18 survey. Total abundance from all samples, relative abundance across the stratum, and the frequency of occurrence within a stratum are presented. Taxa are ranked by total abundance.

Taxon	Phylum	Class	Family	Total Abundance	Relative Abundance (%)	Frequency of Occurrence (%)
Mediomastus sp	Annelida	Polychaeta	Capitellidae	534	6.50	80.65
Spiophanes kimballi	Annelida	Polychaeta	Spionidae	433	5.27	83.87
Paraprionospio alata	Annelida	Polychaeta	Spionidae	398	4.84	93.55
Spiophanes duplex	Annelida	Polychaeta	Spionidae	280	3.41	67.74
Phyllochaetopterus limicolus	Annelida	Polychaeta	Chaetopteridae	248	3.02	25.81
Axinopsida serricata	Mollusca	Bivalvia	Thyasiridae	224	2.73	74.19
Maldanidae	Annelida	Polychaeta	Maldanidae	196	2.39	74.19
Photis lacia	Arthropoda	Malacostraca	Photidae	192	2.34	19.35
Photis sp	Arthropoda	Malacostraca	Photidae	173	2.11	25.81
Tellina carpenteri	Mollusca	Bivalvia	Tellinidae	153	1.86	67.74
Phisidia sanctaemariae	Annelida	Polychaeta	Terebellidae	128	1.56	25.81
Euphilomedes producta	Arthropoda	Ostracoda	Philomedidae	127	1.55	22.58
Spiochaetopterus costarum Cmplx	Annelida	Polychaeta	Chaetopteridae	124	1.51	38.71
Podoceropsis ociosa	Arthropoda	Malacostraca	Photidae	116	1.41	12.90
Eclysippe trilobata	Annelida	Polychaeta	Ampharetidae	109	1.33	41.94
Aphelochaeta glandaria Cmplx	Annelida	Polychaeta	Cirratulidae	108	1.31	70.97
Amphiuridae	Echinodermata	Ophiuroidea	Amphiuridae	103	1.25	61.29
Nuculana sp A	Mollusca	Bivalvia	Nuculanidae	102	1.24	61.29
Amphiodia sp	Echinodermata	Ophiuroidea	Amphiuridae	94	1.14	48.39
Amphiodia urtica	Echinodermata	Ophiuroidea	Amphiuridae	90	1.10	51.61
Petaloclymene pacifica	Annelida	Polychaeta	Maldanidae	87	1.06	58.06
Scoletoma tetraura Cmplx	Annelida	Polychaeta	Lumbrineridae	84	1.02	64.52

Prionospio jubata	Annelida	Polychaeta	Spionidae	81	0.99	58.06
Amphiodia digitata	Echinodermata	Ophiuroidea	Amphiuridae	76	0.93	22.58
Euclymeninae sp A	Annelida	Polychaeta	Maldanidae	73	0.89	64.52
Decamastus gracilis	Annelida	Polychaeta	Capitellidae	69	0.84	48.39
Euphilomedes carcharodonta	Arthropoda	Ostracoda	Philomedidae	69	0.84	6.45
Nephtys ferruginea	Annelida	Polychaeta	Nephtyidae	68	0.83	70.97
Parvilucina tenuisculpta	Mollusca	Bivalvia	Lucinidae	68	0.83	61.29
Photis brevipes	Arthropoda	Malacostraca	Photidae	68	0.83	12.90
Paradiopatra parva	Annelida	Polychaeta	Onuphidae	66	0.80	48.39
Pista wui	Annelida	Polychaeta	Terebellidae	66	0.80	48.39
Caecognathia crenulatifrons	Arthropoda	Malacostraca	Gnathiidae	65	0.79	41.94
Thyasira flexuosa	Mollusca	Bivalvia	Thyasiridae	64	0.78	22.58
Aphelochaeta sp	Annelida	Polychaeta	Cirratulidae	62	0.75	41.94
Cirratulidae	Annelida	Polychaeta	Cirratulidae	62	0.75	35.48
Chondrochelia dubia Cmplx	Arthropoda	Malacostraca	Leptocheliidae	60	0.73	22.58
Phyllochaetopterus sp	Annelida	Polychaeta	Chaetopteridae	60	0.73	12.90
Tellina sp B	Mollusca	Bivalvia	Tellinidae	59	0.72	38.71
Pectinaria californiensis	Annelida	Polychaeta	Pectinariidae	54	0.66	54.84
Prionospio dubia	Annelida	Polychaeta	Spionidae	44	0.54	48.39
Chloeia pinnata	Annelida	Polychaeta	Amphinomidae	44	0.54	38.71
Aphelochaeta monilaris	Annelida	Polychaeta	Cirratulidae	43	0.52	61.29
Kirkegaardia cryptica	Annelida	Polychaeta	Cirratulidae	43	0.52	38.71
Pholoe glabra	Annelida	Polychaeta	Pholoidae	41	0.50	45.16
Rhepoxynius bicuspidatus	Arthropoda	Malacostraca	Phoxocephalidae	39	0.47	32.26
Terebellidae	Annelida	Polychaeta	Terebellidae	38	0.46	32.26
Praxillella pacifica	Annelida	Polychaeta	Maldanidae	37	0.45	32.26
Glycera nana	Annelida	Polychaeta	Glyceridae	36	0.44	51.61
Spiophanes berkeleyorum	Annelida	Polychaeta	Spionidae	36	0.44	22.58

Notomastus hemipodus	Annelida	Polychaeta	Capitellidae	35	0.43	41.94
Spiophanes sp	Annelida	Polychaeta	Spionidae	35	0.43	29.03
Amphichondrius granulatus	Echinodermata	Ophiuroidea	Amphiuridae	34	0.41	48.39
Kirkegaardia siblina	Annelida	Polychaeta	Cirratulidae	34	0.41	19.35
Levinsenia gracilis	Annelida	Polychaeta	Paraonidae	33	0.40	41.94
Malmgreniella scriptoria	Annelida	Polychaeta	Polynoidae	32	0.39	41.94
Phascolion sp A	Sipuncula	Sipunculidea	Phascolionidae	32	0.39	41.94
Ophiuroidea	Echinodermata	Ophiuroidea		31	0.38	48.39
Polycirrus sp A	Annelida	Polychaeta	Terebellidae	30	0.37	29.03
Laonice nuchala	Annelida	Polychaeta	Spionidae	29	0.35	38.71
Cossura candida	Annelida	Polychaeta	Cossuridae	27	0.33	38.71
Scoletoma sp	Annelida	Polychaeta	Lumbrineridae	27	0.33	22.58
Glycinde armigera	Annelida	Polychaeta	Goniadidae	26	0.32	45.16
Sternaspis affinis	Annelida	Polychaeta	Sternaspidae	26	0.32	35.48
Scalibregma californicum	Annelida	Polychaeta	Scalibregmatidae	25	0.30	16.13
Photis californica	Arthropoda	Malacostraca	Photidae	25	0.30	6.45
Prionospio lighti	Annelida	Polychaeta	Spionidae	23	0.28	22.58
Aoroides sp A	Arthropoda	Malacostraca	Aoridae	23	0.28	12.90
Rhabdus rectius	Mollusca	Scaphopoda	Rhabdidae	22	0.27	35.48
Westwoodilla tone	Arthropoda	Malacostraca	Oedicerotidae	22	0.27	35.48
Eudorella pacifica	Arthropoda	Malacostraca	Leuconidae	22	0.27	22.58
Tanaopsis cadieni	Arthropoda	Malacostraca	Tanaopsidae	22	0.27	19.35
Photis bifurcata	Arthropoda	Malacostraca	Photidae	22	0.27	16.13
Scoloplos armiger Cmplx	Annelida	Polychaeta	Orbiniidae	22	0.27	12.90
Diastylis crenellata	Arthropoda	Malacostraca	Diastylidae	20	0.24	25.81
Cossura sp	Annelida	Polychaeta	Cossuridae	20	0.24	16.13
Onuphis iridescens	Annelida	Polychaeta	Onuphidae	20	0.24	16.13
Cuspidaria parapodema	Mollusca	Bivalvia	Cuspidariidae	19	0.23	45.16

Dougaloplus amphacanthus	Echinodermata	Ophiuroidea	Amphiuridae	19	0.23	38.71
Maldane sarsi	Annelida	Polychaeta	Maldanidae	19	0.23	32.26
Ampelisca romigi	Arthropoda	Malacostraca	Ampeliscidae	19	0.23	19.35
Myriochele olgae	Annelida	Polychaeta	Oweniidae	19	0.23	12.90
Pinnixa occidentalis Cmplx	Arthropoda	Malacostraca	Pinnotheridae	18	0.22	38.71
Aricidea (Acmira) catherinae	Annelida	Polychaeta	Paraonidae	18	0.22	25.81
Polycirrus sp	Annelida	Polychaeta	Terebellidae	18	0.22	16.13
Tellina sp	Mollusca	Bivalvia	Tellinidae	18	0.22	12.90
Chaetopteridae	Annelida	Polychaeta	Chaetopteridae	18	0.22	9.68
Kirkegaardia tesselata	Annelida	Polychaeta	Cirratulidae	17	0.21	25.81
Araphura breviaria	Arthropoda	Malacostraca	Tanaellidae	17	0.21	12.90
Aglaophamus verrilli	Annelida	Polychaeta	Nephtyidae	15	0.18	35.48
Nereis sp A	Annelida	Polychaeta	Nereididae	15	0.18	35.48
Onuphis sp	Annelida	Polychaeta	Onuphidae	15	0.18	32.26
Nephtys caecoides	Annelida	Polychaeta	Nephtyidae	15	0.18	22.58
Terebellides californica	Annelida	Polychaeta	Trichobranchidae	15	0.18	22.58
Chaetoderma pacificum	Mollusca	Caudofoveata	Chaetodermidae	14	0.17	32.26
Haliophasma geminata	Arthropoda	Malacostraca	Anthuridae	14	0.17	32.26
Tubulanus polymorphus	Nemertea	Anopla	Tubulanidae	14	0.17	32.26
Brisaster sp	Echinodermata	Echinoidea	Schizasteridae	14	0.17	22.58
Ophiura luetkenii	Echinodermata	Ophiuroidea	Ophiuridae	14	0.17	19.35
Eudorellopsis longirostris	Arthropoda	Malacostraca	Leuconidae	14	0.17	16.13
Lanassa venusta	Annelida	Polychaeta	Terebellidae	14	0.17	16.13
Dipolydora socialis	Annelida	Polychaeta	Spionidae	14	0.17	12.90
Amphipoda	Arthropoda	Malacostraca		14	0.17	3.23
Oweniidae	Annelida	Polychaeta	Oweniidae	14	0.17	3.23
Ennucula tenuis	Mollusca	Bivalvia	Nuculidae	13	0.16	32.26
Pista estevanica	Annelida	Polychaeta	Terebellidae	13	0.16	32.26

Ampharetidae	Annelida	Polychaeta	Ampharetidae	13	0.16	22.58
Lumbrineris cruzensis	Annelida	Polychaeta	Lumbrineridae	13	0.16	22.58
Aoroides sp	Arthropoda	Malacostraca	Aoridae	13	0.16	9.68
Photis parvidons	Arthropoda	Malacostraca	Photidae	13	0.16	9.68
Metatiron tropakis	Arthropoda	Malacostraca	Synopiidae	13	0.16	6.45
Aphelochaeta tigrina	Annelida	Polychaeta	Cirratulidae	12	0.15	25.81
Brisaster latifrons	Echinodermata	Echinoidea	Schizasteridae	12	0.15	22.58
Drilonereis sp	Annelida	Polychaeta	Oenonidae	12	0.15	19.35
Magelona sp B	Annelida	Polychaeta	Magelonidae	12	0.15	16.13
Onuphidae	Annelida	Polychaeta	Onuphidae	12	0.15	12.90
Photis sp HYP2	Arthropoda	Malacostraca	Photidae	12	0.15	6.45
Rhodine bitorquata	Annelida	Polychaeta	Maldanidae	11	0.13	29.03
Lineidae	Nemertea	Anopla	Lineidae	11	0.13	25.81
Thysanocardia nigra	Sipuncula	Sipunculidea	Golfingiidae	11	0.13	25.81
Metasychis disparidentatus	Annelida	Polychaeta	Maldanidae	11	0.13	22.58
Polyschides quadrifissatus	Mollusca	Scaphopoda	Gadilidae	11	0.13	19.35
Brisaster townsendi	Echinodermata	Echinoidea	Schizasteridae	11	0.13	16.13
Cossura sp A	Annelida	Polychaeta	Cossuridae	11	0.13	16.13
Kurtiella sp D	Mollusca	Bivalvia	Lasaeidae	11	0.13	16.13
Byblis millsi	Arthropoda	Malacostraca	Ampeliscidae	11	0.13	9.68
Ampelisca pugetica	Arthropoda	Malacostraca	Ampeliscidae	11	0.13	6.45
Aoroides inermis	Arthropoda	Malacostraca	Aoridae	11	0.13	6.45
Kirkegaardia sp	Annelida	Polychaeta	Cirratulidae	10	0.12	19.35
Spiophanes fimbriata	Annelida	Polychaeta	Spionidae	10	0.12	19.35
Aphelochaeta petersenae	Annelida	Polychaeta	Cirratulidae	10	0.12	16.13
Syllis heterochaeta	Annelida	Polychaeta	Syllidae	10	0.12	16.13
Chaetozone hartmanae	Annelida	Polychaeta	Cirratulidae	10	0.12	12.90
Echinoidea	Echinodermata	Echinoidea		10	0.12	12.90

Marphysa disjuncta	Annelida	Polychaeta	Eunicidae	10	0.12	12.90
Ampelisca sp	Arthropoda	Malacostraca	Ampeliscidae	10	0.12	9.68
Melinna heterodonta	Annelida	Polychaeta	Ampharetidae	10	0.12	6.45
Podoceropsis sp	Arthropoda	Malacostraca	Photidae	10	0.12	3.23
Goniada brunnea	Annelida	Polychaeta	Goniadidae	9	0.11	25.81
Akanthophoreus phillipsi	Arthropoda	Malacostraca	Akanthophoreidae	9	0.11	22.58
Compressidens stearnsii	Mollusca	Scaphopoda		9	0.11	22.58
Kirkegaardia serratiseta	Annelida	Polychaeta	Cirratulidae	9	0.11	22.58
Monoculodes emarginatus	Arthropoda	Malacostraca	Oedicerotidae	9	0.11	22.58
Ampelisca careyi	Arthropoda	Malacostraca	Ampeliscidae	9	0.11	19.35
Ampelisca hancocki	Arthropoda	Malacostraca	Ampeliscidae	9	0.11	19.35
Lucinoma annulatum	Mollusca	Bivalvia	Lucinidae	9	0.11	19.35
Lumbrineris sp	Annelida	Polychaeta	Lumbrineridae	9	0.11	19.35
Aphelochaeta phillipsi	Annelida	Polychaeta	Cirratulidae	9	0.11	12.90
Leptochiton rugatus	Mollusca	Polyplacophora	Leptochitonidae	9	0.11	9.68
Listriolobus pelodes	Echiura	Echiuridea	Thalassematidae	9	0.11	6.45
Sige sp A	Annelida	Polychaeta	Phyllodocidae	8	0.10	19.35
Heteronemertea sp SD2	Nemertea	Anopla	uncertain	8	0.10	16.13
Hippomedon sp A	Arthropoda	Malacostraca	Lysianassidae	8	0.10	16.13
Leodice americana	Annelida	Polychaeta	Eunicidae	8	0.10	16.13
Mayerella banksia	Arthropoda	Malacostraca	Caprellidae	8	0.10	16.13
Phoronis sp	Phoronida		Phoronidae	8	0.10	16.13
Travisia brevis	Annelida	Polychaeta	Travisiidae	8	0.10	16.13
Waldo arthuri	Mollusca	Bivalvia	Galeommatidae	8	0.10	16.13
Chiridota sp	Echinodermata	Holothuroidea	Chiridotidae	8	0.10	12.90
Aricidea (Strelzovia) sp A	Annelida	Polychaeta	Paraonidae	8	0.10	9.68
Bivalvia	Mollusca	Bivalvia		8	0.10	9.68
Caprella mendax	Arthropoda	Malacostraca	Caprellidae	8	0.10	9.68

Protomedeia articulata Cmplx	Arthropoda	Malacostraca	Corophiidae	8	0.10	9.68
Tanaella propinquus	Arthropoda	Malacostraca	Tanaellidae	8	0.10	9.68
Edwardsiidae	Cnidaria	Anthozoa	Edwardsiidae	8	0.10	6.45
Hesperonoe laevis	Annelida	Polychaeta	Polynoidae	8	0.10	6.45
Lineus bilineatus	Nemertea	Anopla	Lineidae	7	0.09	16.13
Malmgreniella sp	Annelida	Polychaeta	Polynoidae	7	0.09	16.13
Odostomia sp	Mollusca	Gastropoda	Pyramidellidae	7	0.09	16.13
Limifossor fratula	Mollusca	Caudofoveata	Limifossoridae	7	0.09	12.90
Chaetozone commonalis	Annelida	Polychaeta	Cirratulidae	7	0.09	9.68
Kurtzina beta	Mollusca	Gastropoda	Mangeliidae	7	0.09	9.68
Aphelochaeta sp HYP5	Annelida	Polychaeta	Cirratulidae	7	0.09	6.45
Photis macrotica	Arthropoda	Malacostraca	Photidae	7	0.09	6.45
Prionospio sp	Annelida	Polychaeta	Spionidae	7	0.09	6.45
Heteromastus filiformis Cmplx	Annelida	Polychaeta	Capitellidae	7	0.09	3.23
Amphicteis scaphobranchiata	Annelida	Polychaeta	Ampharetidae	6	0.07	19.35
Scaphopoda	Mollusca	Scaphopoda		6	0.07	19.35
Aglaja ocelligera	Mollusca	Gastropoda	Aglajidae	6	0.07	16.13
Amaeana occidentalis	Annelida	Polychaeta	Terebellidae	6	0.07	16.13
Amphiura arcystata	Echinodermata	Ophiuroidea	Amphiuridae	6	0.07	16.13
Malmgreniella baschi	Annelida	Polychaeta	Polynoidae	6	0.07	16.13
Goniada maculata	Annelida	Polychaeta	Goniadidae	6	0.07	12.90
Scolanthus triangulus	Cnidaria	Anthozoa	Edwardsiidae	6	0.07	12.90
Heterophoxus ellisi	Arthropoda	Malacostraca	Phoxocephalidae	6	0.07	9.68
Lirobittium sp	Mollusca	Gastropoda	Cerithiidae	6	0.07	9.68
Sipuncula	Sipuncula			6	0.07	6.45
Caecognathia sp SD1	Arthropoda	Malacostraca	Gnathiidae	6	0.07	3.23
Eranno lagunae	Annelida	Polychaeta	Lumbrineridae	5	0.06	16.13
Ampelisca brevisimulata	Arthropoda	Malacostraca	Ampeliscidae	5	0.06	12.90

Asteroidea	Echinodermata	Asteroidea		5	0.06	12.90
Philine auriformis	Mollusca	Gastropoda	Philinidae	5	0.06	12.90
Chaetozone sp	Annelida	Polychaeta	Cirratulidae	5	0.06	9.68
Malmgreniella sp A	Annelida	Polychaeta	Polynoidae	5	0.06	9.68
Munnogonium tillerae	Arthropoda	Malacostraca	Paramunnidae	5	0.06	9.68
Polygireulima rutila	Mollusca	Gastropoda	Eulimidae	5	0.06	9.68
Amphissa undata	Mollusca	Gastropoda	Columbellidae	5	0.06	6.45
Magelona berkeleyi	Annelida	Polychaeta	Magelonidae	5	0.06	6.45
Malmgreniella nigralba	Annelida	Polychaeta	Polynoidae	5	0.06	6.45
Phoronidae	Phoronida		Phoronidae	5	0.06	6.45
Rutiderma lomae	Arthropoda	Ostracoda	Rutidermatidae	5	0.06	6.45
Bipalponephtys cornuta	Annelida	Polychaeta	Nephtyidae	4	0.05	12.90
Glycera americana	Annelida	Polychaeta	Glyceridae	4	0.05	12.90
Palaeonemertea	Nemertea	Anopla		4	0.05	12.90
Pleurogonium californiense	Arthropoda	Malacostraca	Paramunnidae	4	0.05	12.90
Americhelidium sp	Arthropoda	Malacostraca	Oedicerotidae	4	0.05	9.68
Ampelisca pacifica	Arthropoda	Malacostraca	Ampeliscidae	4	0.05	9.68
Anobothrus gracilis	Annelida	Polychaeta	Ampharetidae	4	0.05	9.68
Brissopsis pacifica	Echinodermata	Echinoidea	Brissidae	4	0.05	9.68
Dialychone trilineata	Annelida	Polychaeta	Sabellidae	4	0.05	9.68
Glycera oxycephala	Annelida	Polychaeta	Glyceridae	4	0.05	9.68
Microspio pigmentata	Annelida	Polychaeta	Spionidae	4	0.05	9.68
Myriochele gracilis	Annelida	Polychaeta	Oweniidae	4	0.05	9.68
Orchomenella decipiens	Arthropoda	Malacostraca	Lysianassidae	4	0.05	9.68
Sthenelais tertiaglabra	Annelida	Polychaeta	Sigalionidae	4	0.05	9.68
Tubulanidae	Nemertea	Anopla	Tubulanidae	4	0.05	9.68
Heterophoxus oculatus	Arthropoda	Malacostraca	Phoxocephalidae	4	0.05	6.45
Hippomedon columbianus	Arthropoda	Malacostraca	Lysianassidae	4	0.05	6.45

Ilyarachna acarina	Arthropoda	Malacostraca	Munnopsidae	4	0.05	6.45
Lysippe sp B	Annelida	Polychaeta	Ampharetidae	4	0.05	6.45
Macoma carlottensis	Mollusca	Bivalvia	Tellinidae	4	0.05	6.45
Notomastus magnus	Annelida	Polychaeta	Capitellidae	4	0.05	6.45
Photis linearmanus	Arthropoda	Malacostraca	Photidae	4	0.05	6.45
Saxicavella pacifica	Mollusca	Bivalvia	Hiatellidae	4	0.05	6.45
Terebellides sp	Annelida	Polychaeta	Trichobranchidae	4	0.05	6.45
Bathyleberis sp	Arthropoda	Ostracoda	Cylindroleberididae	4	0.05	3.23
Bemlos audbettius	Arthropoda	Malacostraca	Aoridae	4	0.05	3.23
Hartmanodes sp SD1	Arthropoda	Malacostraca	Oedicerotidae	4	0.05	3.23
Magelona sacculata	Annelida	Polychaeta	Magelonidae	4	0.05	3.23
Maldane sp	Annelida	Polychaeta	Maldanidae	4	0.05	3.23
Notoproctus pacificus	Annelida	Polychaeta	Maldanidae	4	0.05	3.23
Thyone benti	Echinodermata	Holothuroidea	Phyllophoridae	4	0.05	3.23
Typhlotanais williamsae	Arthropoda	Malacostraca	Typhlotanaidae	4	0.05	3.23
Aricidea (Strelzovia) antennata	Annelida	Polychaeta	Paraonidae	3	0.04	9.68
Campylaspis rubromaculata	Arthropoda	Malacostraca	Nannastacidae	3	0.04	9.68
Deflexilodes similis	Arthropoda	Malacostraca	Oedicerotidae	3	0.04	9.68
Heterophoxus affinis	Arthropoda	Malacostraca	Phoxocephalidae	3	0.04	9.68
Jasmineira sp B	Annelida	Polychaeta	Sabellidae	3	0.04	9.68
Keenaea centifilosum	Mollusca	Bivalvia	Cardiidae	3	0.04	9.68
Laonice cirrata	Annelida	Polychaeta	Spionidae	3	0.04	9.68
Mesochaetopterus sp	Annelida	Polychaeta	Chaetopteridae	3	0.04	9.68
Oligochaeta	Annelida	Oligochaeta		3	0.04	9.68
Phyllodoce hartmanae	Annelida	Polychaeta	Phyllodocidae	3	0.04	9.68
Phyllodocidae	Annelida	Polychaeta	Phyllodocidae	3	0.04	9.68
Pista sp	Annelida	Polychaeta	Terebellidae	3	0.04	9.68
Turbonilla sp	Mollusca	Gastropoda	Pyramidellidae	3	0.04	9.68

Adontorhina cyclia	Mollusca	Bivalvia	Thyasiridae	3	0.04	6.45
Amygdalum pallidulum	Mollusca	Bivalvia	Mytilidae	3	0.04	6.45
Aphelochaeta sp LA1	Annelida	Polychaeta	Cirratulidae	3	0.04	6.45
Cirrophorus branchiatus	Annelida	Polychaeta	Paraonidae	3	0.04	6.45
Diastylis sentosa	Arthropoda	Malacostraca	Diastylidae	3	0.04	6.45
Dipolydora sp	Annelida	Polychaeta	Spionidae	3	0.04	6.45
Eulalia sp	Annelida	Polychaeta	Phyllodocidae	3	0.04	6.45
Gymnonereis crosslandi	Annelida	Polychaeta	Nereididae	3	0.04	6.45
Harpiniopsis fulgens	Arthropoda	Malacostraca	Phoxocephalidae	3	0.04	6.45
Hoplonemertea	Nemertea	Enopla		3	0.04	6.45
Lysippe sp A	Annelida	Polychaeta	Ampharetidae	3	0.04	6.45
Microspio sp	Annelida	Polychaeta	Spionidae	3	0.04	6.45
Nicippe tumida	Arthropoda	Malacostraca	Pardaliscidae	3	0.04	6.45
Orchomenella pacifica	Arthropoda	Malacostraca	Lysianassidae	3	0.04	6.45
Pentamera populifera	Echinodermata	Holothuroidea	Phyllophoridae	3	0.04	6.45
Zygeupolia rubens	Nemertea	Anopla	Valenciniidae	3	0.04	6.45
Ampelisca cf brevisimulata	Arthropoda	Malacostraca	Ampeliscidae	3	0.04	3.23
Amphipholis sp	Echinodermata	Ophiuroidea	Amphiuridae	3	0.04	3.23
Desdimelita desdichada	Arthropoda	Malacostraca	Melitidae	3	0.04	3.23
Ericthonius rubricornis	Arthropoda	Malacostraca	Ischyroceridae	3	0.04	3.23
Gnathiidae	Arthropoda	Malacostraca	Gnathiidae	3	0.04	3.23
Halicoides synopiae	Arthropoda	Malacostraca	Pardaliscidae	3	0.04	3.23
Heterophoxus sp	Arthropoda	Malacostraca	Phoxocephalidae	3	0.04	3.23
Paradoneis sp SD1	Annelida	Polychaeta	Paraonidae	3	0.04	3.23
Phoronis sp SD1	Phoronida		Phoronidae	3	0.04	3.23
Pleurogonium sp A	Arthropoda	Malacostraca	Paramunnidae	3	0.04	3.23
Polycirrus sp OC1	Annelida	Polychaeta	Terebellidae	3	0.04	3.23
Polydora sp	Annelida	Polychaeta	Spionidae	3	0.04	3.23

Turbonilla santarosana	Mollusca	Gastropoda	Pyramidellidae	3	0.04	3.23
Acromegalomma splendidum	Annelida	Polychaeta	Sabellidae	2	0.02	6.45
Amage anops	Annelida	Polychaeta	Ampharetidae	2	0.02	6.45
Amage scutata	Annelida	Polychaeta	Ampharetidae	2	0.02	6.45
Americhelidium shoemakeri	Arthropoda	Malacostraca	Oedicerotidae	2	0.02	6.45
Bullomorpha sp A	Mollusca	Gastropoda		2	0.02	6.45
Campylaspis hartae	Arthropoda	Malacostraca	Nannastacidae	2	0.02	6.45
Capitella capitata Cmplx	Annelida	Polychaeta	Capitellidae	2	0.02	6.45
Cephalophoxoides homilis	Arthropoda	Malacostraca	Phoxocephalidae	2	0.02	6.45
Chaetozone columbiana	Annelida	Polychaeta	Cirratulidae	2	0.02	6.45
Cyclocardia ventricosa	Mollusca	Bivalvia	Carditidae	2	0.02	6.45
Cylichna diegensis	Mollusca	Gastropoda	Cylichnidae	2	0.02	6.45
Diastylis pellucida	Arthropoda	Malacostraca	Diastylidae	2	0.02	6.45
Drilonereis falcata	Annelida	Polychaeta	Oenonidae	2	0.02	6.45
Epigamia-Myrianida Cmplx	Annelida	Polychaeta	Syllidae	2	0.02	6.45
Eulalia levicornuta Cmplx	Annelida	Polychaeta	Phyllodocidae	2	0.02	6.45
Eunicidae	Annelida	Polychaeta	Eunicidae	2	0.02	6.45
Leitoscoloplos sp A	Annelida	Polychaeta	Orbiniidae	2	0.02	6.45
Leucon subnasica	Arthropoda	Malacostraca	Leuconidae	2	0.02	6.45
Levinsenia sp	Annelida	Polychaeta	Paraonidae	2	0.02	6.45
Lumbrineridae	Annelida	Polychaeta	Lumbrineridae	2	0.02	6.45
Nephtys punctata	Annelida	Polychaeta	Nephtyidae	2	0.02	6.45
Pachynus barnardi	Arthropoda	Malacostraca	Pachynidae	2	0.02	6.45
Pardaliscella symmetrica	Arthropoda	Malacostraca	Pardaliscidae	2	0.02	6.45
Philine sp	Mollusca	Gastropoda	Philinidae	2	0.02	6.45
Phyllodoce cuspidata	Annelida	Polychaeta	Phyllodocidae	2	0.02	6.45
Phyllodoce pettiboneae	Annelida	Polychaeta	Phyllodocidae	2	0.02	6.45
Phyllodoce sp	Annelida	Polychaeta	Phyllodocidae	2	0.02	6.45

Phyllodoce williamsi	Annelida	Polychaeta	Phyllodocidae	2	0.02	6.45
Pinnixa sp	Arthropoda	Malacostraca	Pinnotheridae	2	0.02	6.45
Procampylaspis caenosa	Arthropoda	Malacostraca	Nannastacidae	2	0.02	6.45
Rictaxis punctocaelatus	Mollusca	Gastropoda	Acteonidae	2	0.02	6.45
Sabellidae	Annelida	Polychaeta	Sabellidae	2	0.02	6.45
Scoletoma sp C	Annelida	Polychaeta	Lumbrineridae	2	0.02	6.45
Spiophanes wigleyi	Annelida	Polychaeta	Spionidae	2	0.02	6.45
Sthenelais fusca	Annelida	Polychaeta	Sigalionidae	2	0.02	6.45
Subadyte mexicana	Annelida	Polychaeta	Polynoidae	2	0.02	6.45
Tanaidacea	Arthropoda	Malacostraca		2	0.02	6.45
Tritella pilimana	Arthropoda	Malacostraca	Caprellidae	2	0.02	6.45
Virgularia agassizii	Cnidaria	Anthozoa	Virgulariidae	2	0.02	6.45
Volvulella cylindrica	Mollusca	Gastropoda	Retusidae	2	0.02	6.45
Volvulella panamica	Mollusca	Gastropoda	Retusidae	2	0.02	6.45
Volvulella sp	Mollusca	Gastropoda	Retusidae	2	0.02	6.45
Acila castrensis	Mollusca	Bivalvia	Nuculidae	2	0.02	3.23
Amphioplus sp A	Echinodermata	Ophiuroidea	Amphiuridae	2	0.02	3.23
Apionsoma misakianum	Sipuncula	Phascolosomatidea	Phascolosomatidae	2	0.02	3.23
Araphura cuspirostris	Arthropoda	Malacostraca	Tanaellidae	2	0.02	3.23
Caprellidae	Arthropoda	Malacostraca	Caprellidae	2	0.02	3.23
Chaetoderma elegans	Mollusca	Caudofoveata	Chaetodermidae	2	0.02	3.23
Chaetozone lunula	Annelida	Polychaeta	Cirratulidae	2	0.02	3.23
Chauliopleona dentata	Arthropoda	Malacostraca	Akanthophoreidae	2	0.02	3.23
Drilonereis filum	Annelida	Polychaeta	Oenonidae	2	0.02	3.23
Eusarsiella thominx	Arthropoda	Ostracoda	Sarsiellidae	2	0.02	3.23
Eyakia robusta	Arthropoda	Malacostraca	Phoxocephalidae	2	0.02	3.23
Hemiproto sp A	Arthropoda	Malacostraca	Caprellidae	2	0.02	3.23
Heterophoxus conlanae	Arthropoda	Malacostraca	Phoxocephalidae	2	0.02	3.23

Jassa slatteryi	Arthropoda	Malacostraca	Ischyroceridae	2	0.02	3.23
Joeropsis concava	Arthropoda	Malacostraca	Joeropsididae	2	0.02	3.23
Kinbergonuphis vermillionesis	Annelida	Polychaeta	Onuphidae	2	0.02	3.23
Lampropidae	Arthropoda	Malacostraca	Lampropidae	2	0.02	3.23
Leptostylis sp	Arthropoda	Malacostraca	Diastylidae	2	0.02	3.23
Lysidice sp	Annelida	Polychaeta	Eunicidae	2	0.02	3.23
Maera bousfieldi	Arthropoda	Malacostraca	Melitidae	2	0.02	3.23
Melinna oculata	Annelida	Polychaeta	Ampharetidae	2	0.02	3.23
Mooreonuphis exigua	Annelida	Polychaeta	Onuphidae	2	0.02	3.23
Ninoe tridentata	Annelida	Polychaeta	Lumbrineridae	2	0.02	3.23
Ophelina acuminata	Annelida	Polychaeta	Opheliidae	2	0.02	3.23
Paranemertes californica	Nemertea	Enopla	Emplectonematidae	2	0.02	3.23
Pentamera rigida	Echinodermata	Holothuroidea	Phyllophoridae	2	0.02	3.23
Platymera gaudichaudii	Arthropoda	Malacostraca	Calappidae	2	0.02	3.23
Protocirrineris sp B	Annelida	Polychaeta	Cirratulidae	2	0.02	3.23
Stereobalanus sp	Chordata	Enteropneusta	Harrimaniidae	2	0.02	3.23
Zoantharia	Cnidaria	Anthozoa		2	0.02	3.23
Acidostoma hancocki	Arthropoda	Malacostraca	Acidostomatidae	1	0.01	3.23
Acteocina cerealis	Mollusca	Gastropoda	Cylichnidae	1	0.01	3.23
Acteocina culcitella	Mollusca	Gastropoda	Cylichnidae	1	0.01	3.23
Aglaophamus sp	Annelida	Polychaeta	Nephtyidae	1	0.01	3.23
Americhelidium sp SD4	Arthropoda	Malacostraca	Oedicerotidae	1	0.01	3.23
Ampelisca indentata	Arthropoda	Malacostraca	Ampeliscidae	1	0.01	3.23
Ampharete finmarchica	Annelida	Polychaeta	Ampharetidae	1	0.01	3.23
Amphicteis sp	Annelida	Polychaeta	Ampharetidae	1	0.01	3.23
Amphideutopus oculatus	Arthropoda	Malacostraca	Kamakidae	1	0.01	3.23
Antalis pretiosa	Mollusca	Scaphopoda	Dentaliidae	1	0.01	3.23
Anthozoa	Cnidaria	Anthozoa		1	0.01	3.23

Antiplanes catalinae	Mollusca	Gastropoda	Pseudomelatomidae	1	0.01	3.23
Antiplanes thalea	Mollusca	Gastropoda	Pseudomelatomidae	1	0.01	3.23
Aphelochaeta williamsae	Annelida	Polychaeta	Cirratulidae	1	0.01	3.23
Aphrodita sp	Annelida	Polychaeta	Aphroditidae	1	0.01	3.23
Arcteobia sp LA1	Annelida	Polychaeta	Polynoidae	1	0.01	3.23
Aricidea (Acmira) lopezi	Annelida	Polychaeta	Paraonidae	1	0.01	3.23
Aricidea (Acmira) simplex	Annelida	Polychaeta	Paraonidae	1	0.01	3.23
Aricidea (Acmira) sp	Annelida	Polychaeta	Paraonidae	1	0.01	3.23
Aruga holmesi	Arthropoda	Malacostraca	Lysianassidae	1	0.01	3.23
Asabellides lineata	Annelida	Polychaeta	Ampharetidae	1	0.01	3.23
Asabellides sp	Annelida	Polychaeta	Ampharetidae	1	0.01	3.23
Balcis oldroydae	Mollusca	Gastropoda	Eulimidae	1	0.01	3.23
Bathymedon pumilus	Arthropoda	Malacostraca	Oedicerotidae	1	0.01	3.23
Brada pilosa	Annelida	Polychaeta	Flabelligeridae	1	0.01	3.23
Bruzelia tuberculata	Arthropoda	Malacostraca	Synopiidae	1	0.01	3.23
Calocarides spinulicauda	Arthropoda	Malacostraca	Axiidae	1	0.01	3.23
Campylaspis blakei	Arthropoda	Malacostraca	Nannastacidae	1	0.01	3.23
Cardiomya planetica	Mollusca	Bivalvia	Cuspidariidae	1	0.01	3.23
Carinoma mutabilis	Nemertea	Anopla	Carinomidae	1	0.01	3.23
Cerebratulus sp	Nemertea	Anopla	Lineidae	1	0.01	3.23
Chaetoderma marinelli	Mollusca	Caudofoveata	Chaetodermidae	1	0.01	3.23
Chaetodermatida	Mollusca	Caudofoveata		1	0.01	3.23
Chaetozone setosa Cmplx	Annelida	Polychaeta	Cirratulidae	1	0.01	3.23
Chaetozone sp SD3	Annelida	Polychaeta	Cirratulidae	1	0.01	3.23
Compsomyax subdiaphana	Mollusca	Bivalvia	Veneridae	1	0.01	3.23
Crenella decussata	Mollusca	Bivalvia	Mytilidae	1	0.01	3.23
Dentalium vallicolens	Mollusca	Scaphopoda	Dentaliidae	1	0.01	3.23
Diastylidae	Arthropoda	Malacostraca	Diastylidae	1	0.01	3.23

Dougaloplus sp	Echinodermata	Ophiuroidea	Amphiuridae	1	0.01	3.23
Echiura	Echiura			1	0.01	3.23
Enopla	Nemertea	Enopla		1	0.01	3.23
Eulalia californiensis	Annelida	Polychaeta	Phyllodocidae	1	0.01	3.23
Exogone lourei	Annelida	Polychaeta	Syllidae	1	0.01	3.23
Foxiphalus similis	Arthropoda	Malacostraca	Phoxocephalidae	1	0.01	3.23
Glycera robusta	Annelida	Polychaeta	Glyceridae	1	0.01	3.23
Guernea reduncans	Arthropoda	Malacostraca	Dexaminidae	1	0.01	3.23
Halcampa decemtentaculata	Cnidaria	Anthozoa	Halcampidae	1	0.01	3.23
Hartmanodes hartmanae	Arthropoda	Malacostraca	Oedicerotidae	1	0.01	3.23
Heteronemertea	Nemertea	Anopla		1	0.01	3.23
Heteronemertea sp HYP3	Nemertea	Anopla	uncertain	1	0.01	3.23
Hexactinellida	Silicea	Hexactinellida		1	0.01	3.23
Hippomedon sp	Arthropoda	Malacostraca	Lysianassidae	1	0.01	3.23
Hippomedon zetesimus	Arthropoda	Malacostraca	Lysianassidae	1	0.01	3.23
Ischyrocerus sp	Arthropoda	Malacostraca	Ischyroceridae	1	0.01	3.23
Joeropsis dubia	Arthropoda	Malacostraca	Joeropsididae	1	0.01	3.23
Kurtiella tumida	Mollusca	Bivalvia	Lasaeidae	1	0.01	3.23
Laonice sp	Annelida	Polychaeta	Spionidae	1	0.01	3.23
Lepidozona retiporosa	Mollusca	Polyplacophora	Ischnochitonidae	1	0.01	3.23
Leptostylis abditis	Arthropoda	Malacostraca	Diastylidae	1	0.01	3.23
Leucon falcicosta	Arthropoda	Malacostraca	Leuconidae	1	0.01	3.23
Leucon sp	Arthropoda	Malacostraca	Leuconidae	1	0.01	3.23
Levinsenia kirbyae	Annelida	Polychaeta	Paraonidae	1	0.01	3.23
Listriella eriopisa	Arthropoda	Malacostraca	Liljeborgiidae	1	0.01	3.23
Listriella goleta	Arthropoda	Malacostraca	Liljeborgiidae	1	0.01	3.23
Listriella sp SD1	Arthropoda	Malacostraca	Liljeborgiidae	1	0.01	3.23
Lumbrineris japonica	Annelida	Polychaeta	Lumbrineridae	1	0.01	3.23

Lumbrineris latreilli	Annelida	Polychaeta	Lumbrineridae	1	0.01	3.23
Lumbrineris ligulata	Annelida	Polychaeta	Lumbrineridae	1	0.01	3.23
Lysianassoidea	Arthropoda	Malacostraca		1	0.01	3.23
Macoma sp	Mollusca	Bivalvia	Tellinidae	1	0.01	3.23
Magelona sp	Annelida	Polychaeta	Magelonidae	1	0.01	3.23
Magelona sp A	Annelida	Polychaeta	Magelonidae	1	0.01	3.23
Malmgreniella bansei	Annelida	Polychaeta	Polynoidae	1	0.01	3.23
Malmgreniella liei	Annelida	Polychaeta	Polynoidae	1	0.01	3.23
Malmgreniella macginitiei	Annelida	Polychaeta	Polynoidae	1	0.01	3.23
Malmgreniella sanpedroensis	Annelida	Polychaeta	Polynoidae	1	0.01	3.23
Metaphoxus frequens	Arthropoda	Malacostraca	Phoxocephalidae	1	0.01	3.23
Metopa cistella	Arthropoda	Malacostraca	Stenothoidae	1	0.01	3.23
Microjassa bousfieldi	Arthropoda	Malacostraca	Ischyroceridae	1	0.01	3.23
Mooreonuphis segmentispadix	Annelida	Polychaeta	Onuphidae	1	0.01	3.23
Myodocopa	Arthropoda	Ostracoda		1	0.01	3.23
Myriochele striolata	Annelida	Polychaeta	Oweniidae	1	0.01	3.23
Nellobia eusoma	Echiura	Echiuridea	Bonelliidae	1	0.01	3.23
Nephtyidae	Annelida	Polychaeta	Nephtyidae	1	0.01	3.23
Nereididae	Annelida	Polychaeta	Nereididae	1	0.01	3.23
Notomastus sp	Annelida	Polychaeta	Capitellidae	1	0.01	3.23
Onuphis geophiliformis	Annelida	Polychaeta	Onuphidae	1	0.01	3.23
Ophiuridae	Echinodermata	Ophiuroidea	Ophiuridae	1	0.01	3.23
Opisa tridentata	Arthropoda	Malacostraca	Opisidae	1	0.01	3.23
Paguristes parvus	Arthropoda	Malacostraca	Diogenidae	1	0.01	3.23
Paguroidea	Arthropoda	Malacostraca		1	0.01	3.23
Pandora bilirata	Mollusca	Bivalvia	Pandoridae	1	0.01	3.23
Paradialychone harrisae	Annelida	Polychaeta	Sabellidae	1	0.01	3.23
Paranaitis polynoides	Annelida	Polychaeta	Phyllodocidae	1	0.01	3.23

Pherusa neopapillata	Annelida	Polychaeta	Flabelligeridae	1	0.01	3.23
Phoxocephalidae	Arthropoda	Malacostraca	Phoxocephalidae	1	0.01	3.23
Phyllodoce groenlandica	Annelida	Polychaeta	Phyllodocidae	1	0.01	3.23
Piromis sp	Annelida	Polychaeta	Flabelligeridae	1	0.01	3.23
Pleusymtes subglaber	Arthropoda	Malacostraca	Pleustidae	1	0.01	3.23
Polycirrus sp I	Annelida	Polychaeta	Terebellidae	1	0.01	3.23
Polynoidae	Annelida	Polychaeta	Polynoidae	1	0.01	3.23
Potamethus sp A	Annelida	Polychaeta	Sabellidae	1	0.01	3.23
Praxillella gracilis	Annelida	Polychaeta	Maldanidae	1	0.01	3.23
Prionospio ehlersi	Annelida	Polychaeta	Spionidae	1	0.01	3.23
Prionospio pygmaeus	Annelida	Polychaeta	Spionidae	1	0.01	3.23
Proclea sp A	Annelida	Polychaeta	Terebellidae	1	0.01	3.23
Propebela sp	Mollusca	Gastropoda	Mangeliidae	1	0.01	3.23
Rhachotropis sp SD1	Arthropoda	Malacostraca	Eusiridae	1	0.01	3.23
Rhepoxynius menziesi	Arthropoda	Malacostraca	Phoxocephalidae	1	0.01	3.23
Rhepoxynius variatus	Arthropoda	Malacostraca	Phoxocephalidae	1	0.01	3.23
Rocinela angustata	Arthropoda	Malacostraca	Aegidae	1	0.01	3.23
Rutiderma rostratum	Arthropoda	Ostracoda	Rutidermatidae	1	0.01	3.23
Saxicavella nybakkeni	Mollusca	Bivalvia	Hiatellidae	1	0.01	3.23
Schistocomus sp A	Annelida	Polychaeta	Ampharetidae	1	0.01	3.23
Scionella japonica	Annelida	Polychaeta	Terebellidae	1	0.01	3.23
Scleroconcha trituberculata	Arthropoda	Ostracoda	Philomedidae	1	0.01	3.23
Scoloplos acmeceps	Annelida	Polychaeta	Orbiniidae	1	0.01	3.23
Sigalion spinosus	Annelida	Polychaeta	Sigalionidae	1	0.01	3.23
Sigambra sp	Annelida	Polychaeta	Pilargidae	1	0.01	3.23
Siphonosoma ingens	Sipuncula	Sipunculidea	Sipunculidae	1	0.01	3.23
Sipunculus nudus	Sipuncula	Sipunculidea	Sipunculidae	1	0.01	3.23
Solamen columbianum	Mollusca	Bivalvia	Mytilidae	1	0.01	3.23

Solariella peramabilis	Mollusca	Gastropoda	Solariellidae	1	0.01	3.23
Sosane occidentalis	Annelida	Polychaeta	Ampharetidae	1	0.01	3.23
Spatangoida	Echinodermata	Echinoidea		1	0.01	3.23
Spio filicornis	Annelida	Polychaeta	Spionidae	1	0.01	3.23
Spionidae	Annelida	Polychaeta	Spionidae	1	0.01	3.23
Sthenelanella uniformis	Annelida	Polychaeta	Sigalionidae	1	0.01	3.23
Streblosoma sp	Annelida	Polychaeta	Terebellidae	1	0.01	3.23
Strongylocentrotus fragilis	Echinodermata	Echinoidea	Strongylocentrotidae	1	0.01	3.23
Syllis hyperioni	Annelida	Polychaeta	Syllidae	1	0.01	3.23
Syllis sp	Annelida	Polychaeta	Syllidae	1	0.01	3.23
Terebellides reishi	Annelida	Polychaeta	Trichobranchidae	1	0.01	3.23
Travisia pupa	Annelida	Polychaeta	Travisiidae	1	0.01	3.23
Travisia sp	Annelida	Polychaeta	Travisiidae	1	0.01	3.23
Trichobranchidae	Annelida	Polychaeta	Trichobranchidae	1	0.01	3.23
Tritia insculpta	Mollusca	Gastropoda	Nassariidae	1	0.01	3.23
Tubulanus cingulatus	Nemertea	Anopla	Tubulanidae	1	0.01	3.23
Tubulanus sp A	Nemertea	Anopla	Tubulanidae	1	0.01	3.23
Turbonilla sp 7	Mollusca	Gastropoda	Pyramidellidae	1	0.01	3.23
Urothoe elegans Cmplx	Arthropoda	Malacostraca	Urothoidae	1	0.01	3.23
Volvulella catharia	Mollusca	Gastropoda	Retusidae	1	0.01	3.23

Appendix A9. Macrobenthic community summary for the Channel Islands stratum in the Bight'18 survey. Total abundance from all samples, relative abundance across the stratum, and the frequency of occurrence within a stratum are presented. Taxa are ranked by total abundance.

Taxon	Phylum	Class	Family	Total Abundance	Relative Abundance (%)	Frequency of Occurrence (%)
Laphania sp	Annelida	Polychaeta	Terebellidae	356	4.40	6.67
Photis californica	Arthropoda	Malacostraca	Photidae	261	3.22	33.33
Ophiuroidea	Echinodermata	Ophiuroidea		250	3.09	66.67
Ampelisca romigi	Arthropoda	Malacostraca	Ampeliscidae	239	2.95	13.33
Spiophanes duplex	Annelida	Polychaeta	Spionidae	234	2.89	86.67
Mediomastus sp	Annelida	Polychaeta	Capitellidae	196	2.42	80.00
Tellina carpenteri	Mollusca	Bivalvia	Tellinidae	171	2.11	73.33
Axinopsida serricata	Mollusca	Bivalvia	Thyasiridae	166	2.05	46.67
Photis sp	Arthropoda	Malacostraca	Photidae	162	2.00	40.00
Parvilucina tenuisculpta	Mollusca	Bivalvia	Lucinidae	156	1.93	66.67
Maldanidae	Annelida	Polychaeta	Maldanidae	133	1.64	100.00
Spiophanes kimballi	Annelida	Polychaeta	Spionidae	113	1.40	66.67
Photis lacia	Arthropoda	Malacostraca	Photidae	110	1.36	46.67
Sphaerosyllis sp OC1	Annelida	Polychaeta	Syllidae	106	1.31	6.67
Amphiodia sp	Echinodermata	Ophiuroidea	Amphiuridae	105	1.30	73.33
Oligochaeta	Annelida	Oligochaeta		95	1.17	20.00
Amphiuridae	Echinodermata	Ophiuroidea	Amphiuridae	93	1.15	80.00
Paraprionospio alata	Annelida	Polychaeta	Spionidae	89	1.10	80.00
Amphiodia urtica	Echinodermata	Ophiuroidea	Amphiuridae	85	1.05	60.00
Spiophanes norrisi	Annelida	Polychaeta	Spionidae	80	0.99	46.67
Exogone lourei	Annelida	Polychaeta	Syllidae	77	0.95	60.00
Chondrochelia dubia Cmplx	Arthropoda	Malacostraca	Leptocheliidae	73	0.90	66.67

Euclymeninae sp A	Annelida	Polychaeta	Maldanidae	69	0.85	66.67
Aphelochaeta glandaria Cmplx	Annelida	Polychaeta	Cirratulidae	69	0.85	46.67
Kurtiella tumida	Mollusca	Bivalvia	Lasaeidae	68	0.84	46.67
Ampelisca sp	Arthropoda	Malacostraca	Ampeliscidae	67	0.83	53.33
Cirratulidae	Annelida	Polychaeta	Cirratulidae	64	0.79	53.33
Sthenelanella uniformis	Annelida	Polychaeta	Sigalionidae	61	0.75	46.67
Amphiura arcystata	Echinodermata	Ophiuroidea	Amphiuridae	58	0.72	46.67
Rhepoxynius menziesi	Arthropoda	Malacostraca	Phoxocephalidae	57	0.70	6.67
Amphipholis sp	Echinodermata	Ophiuroidea	Amphiuridae	54	0.67	26.67
Phascolion sp A	Sipuncula	Sipunculidea	Phascolionidae	53	0.65	53.33
Euphilomedes carcharodonta	Arthropoda	Ostracoda	Philomedidae	52	0.64	33.33
Mooreonuphis sp	Annelida	Polychaeta	Onuphidae	52	0.64	13.33
Sphaerosyllis sp SD2	Annelida	Polychaeta	Syllidae	51	0.63	6.67
Prionospio jubata	Annelida	Polychaeta	Spionidae	47	0.58	80.00
Caecognathia crenulatifrons	Arthropoda	Malacostraca	Gnathiidae	47	0.58	60.00
Byblis millsi	Arthropoda	Malacostraca	Ampeliscidae	47	0.58	46.67
Amphicteis scaphobranchiata	Annelida	Polychaeta	Ampharetidae	46	0.57	33.33
Phisidia sanctaemariae	Annelida	Polychaeta	Terebellidae	45	0.56	53.33
Cossura sp A	Annelida	Polychaeta	Cossuridae	45	0.56	46.67
Nuculana sp A	Mollusca	Bivalvia	Nuculanidae	45	0.56	46.67
Spiochaetopterus costarum Cmplx	Annelida	Polychaeta	Chaetopteridae	43	0.53	73.33
Polycirrus sp	Annelida	Polychaeta	Terebellidae	43	0.53	53.33
Amphissa undata	Mollusca	Gastropoda	Columbellidae	42	0.52	46.67
Paradiopatra parva	Annelida	Polychaeta	Onuphidae	41	0.51	53.33
Pisione sp	Annelida	Polychaeta	Pisionidae	40	0.49	13.33
Lanassa venusta	Annelida	Polychaeta	Terebellidae	39	0.48	33.33
Scoletoma sp	Annelida	Polychaeta	Lumbrineridae	37	0.46	46.67
Scalibregma californicum	Annelida	Polychaeta	Scalibregmatidae	36	0.44	73.33

Onuphidae	Annelida	Polychaeta	Onuphidae	36	0.44	26.67
Eusyllis habei	Annelida	Polychaeta	Syllidae	35	0.43	46.67
Caecum crebricinctum	Mollusca	Gastropoda	Caecidae	35	0.43	26.67
Sphaerosyllis sp	Annelida	Polychaeta	Syllidae	35	0.43	26.67
Nephtys ferruginea	Annelida	Polychaeta	Nephtyidae	34	0.42	60.00
Hesionura coineaui difficilis	Annelida	Polychaeta	Phyllodocidae	34	0.42	13.33
Paguridae	Arthropoda	Malacostraca	Paguridae	33	0.41	20.00
Pholoe glabra	Annelida	Polychaeta	Pholoidae	32	0.40	66.67
Chaetozone hartmanae	Annelida	Polychaeta	Cirratulidae	32	0.40	53.33
Euphilomedes producta	Arthropoda	Ostracoda	Philomedidae	31	0.38	33.33
Aphelochaeta sp LA1	Annelida	Polychaeta	Cirratulidae	31	0.38	20.00
Glycera nana	Annelida	Polychaeta	Glyceridae	29	0.36	73.33
Pista brevibranchiata	Annelida	Polychaeta	Terebellidae	29	0.36	53.33
Petaloclymene pacifica	Annelida	Polychaeta	Maldanidae	29	0.36	40.00
Ampharetidae	Annelida	Polychaeta	Ampharetidae	28	0.35	66.67
Pista estevanica	Annelida	Polychaeta	Terebellidae	28	0.35	53.33
Ampharete labrops	Annelida	Polychaeta	Ampharetidae	28	0.35	6.67
Compressidens stearnsii	Mollusca	Scaphopoda		27	0.33	33.33
Rhepoxynius bicuspidatus	Arthropoda	Malacostraca	Phoxocephalidae	27	0.33	26.67
Aonides sp	Annelida	Polychaeta	Spionidae	26	0.32	13.33
Kinbergonuphis paradiopatra	Annelida	Polychaeta	Onuphidae	26	0.32	13.33
Polycirrus sp A	Annelida	Polychaeta	Terebellidae	25	0.31	40.00
Gammaropsis thompsoni	Arthropoda	Malacostraca	Photidae	25	0.31	13.33
Notoproctus pacificus	Annelida	Polychaeta	Maldanidae	25	0.31	6.67
Haliophasma geminata	Arthropoda	Malacostraca	Anthuridae	24	0.30	66.67
Terebellidae	Annelida	Polychaeta	Terebellidae	24	0.30	33.33
Paradialychone harrisae	Annelida	Polychaeta	Sabellidae	24	0.30	26.67
Tiron biocellata	Arthropoda	Malacostraca	Synopiidae	24	0.30	26.67

Lumbrineris sp	Annelida	Polychaeta	Lumbrineridae	23	0.28	66.67
Levinsenia gracilis	Annelida	Polychaeta	Paraonidae	23	0.28	46.67
Aoroides sp A	Arthropoda	Malacostraca	Aoridae	23	0.28	33.33
Amphiodia digitata	Echinodermata	Ophiuroidea	Amphiuridae	23	0.28	26.67
Glycera sp LA1	Annelida	Polychaeta	Glyceridae	23	0.28	13.33
Edwardsiidae	Cnidaria	Anthozoa	Edwardsiidae	22	0.27	60.00
Notomastus hemipodus	Annelida	Polychaeta	Capitellidae	22	0.27	53.33
Dialychone trilineata	Annelida	Polychaeta	Sabellidae	22	0.27	33.33
Rutiderma lomae	Arthropoda	Ostracoda	Rutidermatidae	22	0.27	33.33
Urothoe elegans Cmplx	Arthropoda	Malacostraca	Urothoidae	22	0.27	33.33
Paradialychone bimaculata	Annelida	Polychaeta	Sabellidae	22	0.27	13.33
Aglaophamus verrilli	Annelida	Polychaeta	Nephtyidae	21	0.26	46.67
Halicoides synopiae	Arthropoda	Malacostraca	Pardaliscidae	21	0.26	40.00
Lirobittium sp	Mollusca	Gastropoda	Cerithiidae	21	0.26	40.00
Balanoglossus sp	Chordata	Enteropneusta	Ptychoderidae	21	0.26	13.33
Podoceropsis ociosa	Arthropoda	Malacostraca	Photidae	21	0.26	13.33
Synaptotanais notabilis	Arthropoda	Malacostraca	Tanaididae	21	0.26	6.67
Ampelisca pugetica	Arthropoda	Malacostraca	Ampeliscidae	20	0.25	46.67
Kirkegaardia siblina	Annelida	Polychaeta	Cirratulidae	20	0.25	46.67
Pectinaria californiensis	Annelida	Polychaeta	Pectinariidae	20	0.25	40.00
Microspio sp	Annelida	Polychaeta	Spionidae	20	0.25	6.67
Lanassa gracilis	Annelida	Polychaeta	Terebellidae	19	0.23	20.00
Caecianiropsis sp LA2	Arthropoda	Malacostraca	Janiridae	19	0.23	13.33
Hesionidae	Annelida	Polychaeta	Hesionidae	19	0.23	13.33
Phoronis sp	Phoronida		Phoronidae	18	0.22	53.33
Photis brevipes	Arthropoda	Malacostraca	Photidae	18	0.22	26.67
Jasmineira sp B	Annelida	Polychaeta	Sabellidae	17	0.21	53.33
Ceriantharia	Cnidaria	Anthozoa		17	0.21	33.33

Tanaella propinquus	Arthropoda	Malacostraca	Tanaellidae	17	0.21	20.00
Pseudexogone sp	Annelida	Polychaeta	Pilargidae	17	0.21	13.33
Bivalvia	Mollusca	Bivalvia		16	0.20	13.33
Lysippe sp A	Annelida	Polychaeta	Ampharetidae	15	0.19	53.33
Chloeia pinnata	Annelida	Polychaeta	Amphinomidae	15	0.19	46.67
Spiophanes berkeleyorum	Annelida	Polychaeta	Spionidae	15	0.19	40.00
Praxillella pacifica	Annelida	Polychaeta	Maldanidae	15	0.19	26.67
Guernea reduncans	Arthropoda	Malacostraca	Dexaminidae	15	0.19	13.33
Dorvillea (Schistomeringos) longicornis	Annelida	Polychaeta	Dorvilleidae	15	0.19	6.67
Polyschides quadrifissatus	Mollusca	Scaphopoda	Gadilidae	14	0.17	46.67
Sternaspis affinis	Annelida	Polychaeta	Sternaspidae	14	0.17	46.67
Decamastus gracilis	Annelida	Polychaeta	Capitellidae	14	0.17	26.67
Eudorella pacifica	Arthropoda	Malacostraca	Leuconidae	14	0.17	26.67
Kurtiella sp D	Mollusca	Bivalvia	Lasaeidae	14	0.17	26.67
Deilocerus decorus	Arthropoda	Malacostraca	Cyclodorippidae	14	0.17	20.00
Sosane occidentalis	Annelida	Polychaeta	Ampharetidae	14	0.17	20.00
Westwoodilla tone	Arthropoda	Malacostraca	Oedicerotidae	13	0.16	53.33
Glycinde armigera	Annelida	Polychaeta	Goniadidae	13	0.16	40.00
Thyasira flexuosa	Mollusca	Bivalvia	Thyasiridae	13	0.16	33.33
Photis bifurcata	Arthropoda	Malacostraca	Photidae	13	0.16	20.00
Prionospio lighti	Annelida	Polychaeta	Spionidae	13	0.16	20.00
Tellina sp B	Mollusca	Bivalvia	Tellinidae	13	0.16	20.00
Pholoe sp B	Annelida	Polychaeta	Pholoidae	13	0.16	13.33
Corophiidae	Arthropoda	Malacostraca	Corophiidae	13	0.16	6.67
Chiridota sp	Echinodermata	Holothuroidea	Chiridotidae	12	0.15	53.33
Kirkegaardia tesselata	Annelida	Polychaeta	Cirratulidae	12	0.15	40.00
Aricidea (Acmira) simplex	Annelida	Polychaeta	Paraonidae	12	0.15	33.33
Ephesiella brevicapitis	Annelida	Polychaeta	Sphaerodoridae	12	0.15	26.67

Syllidae	Annelida	Polychaeta	Syllidae	12	0.15	20.00
Cyclocardia sp	Mollusca	Bivalvia	Carditidae	12	0.15	6.67
Glyceridae	Annelida	Polychaeta	Glyceridae	12	0.15	6.67
Platynereis bicanaliculata	Annelida	Polychaeta	Nereididae	12	0.15	6.67
Ampelisca brevisimulata	Arthropoda	Malacostraca	Ampeliscidae	11	0.14	46.67
Anobothrus gracilis	Annelida	Polychaeta	Ampharetidae	11	0.14	40.00
Levinsenia kirbyae	Annelida	Polychaeta	Paraonidae	11	0.14	40.00
Eulalia levicornuta Cmplx	Annelida	Polychaeta	Phyllodocidae	11	0.14	33.33
Ennucula tenuis	Mollusca	Bivalvia	Nuculidae	11	0.14	26.67
Phyllophoridae	Echinodermata	Holothuroidea	Phyllophoridae	11	0.14	26.67
Erileptus spinosus	Arthropoda	Malacostraca	Inachidae	11	0.14	20.00
Euchone incolor	Annelida	Polychaeta	Sabellidae	11	0.14	13.33
Eusyllis sp	Annelida	Polychaeta	Syllidae	11	0.14	13.33
Saccoglossus sp	Chordata	Enteropneusta	Harrimaniidae	11	0.14	13.33
Scolelepis (Parascolelepis) texana	Annelida	Polychaeta	Spionidae	11	0.14	6.67
Chaetoderma pacificum	Mollusca	Caudofoveata	Chaetodermidae	10	0.12	46.67
Paradialychone ecaudata	Annelida	Polychaeta	Sabellidae	10	0.12	26.67
Euchone arenae	Annelida	Polychaeta	Sabellidae	10	0.12	20.00
Spiophanes sp	Annelida	Polychaeta	Spionidae	10	0.12	20.00
Aricidea (Acmira) cerrutii	Annelida	Polychaeta	Paraonidae	10	0.12	13.33
Phyllodocidae	Annelida	Polychaeta	Phyllodocidae	10	0.12	13.33
Nuculana hamata	Mollusca	Bivalvia	Nuculanidae	9	0.11	40.00
Syllis hyperioni	Annelida	Polychaeta	Syllidae	9	0.11	40.00
Apionsoma misakianum	Sipuncula	Phascolosomatidea	Phascolosomatidae	9	0.11	33.33
Microspio pigmentata	Annelida	Polychaeta	Spionidae	9	0.11	33.33
Glycera sp	Annelida	Polychaeta	Glyceridae	9	0.11	20.00
Hoplonemertea	Nemertea	Enopla		9	0.11	20.00
Procampylaspis caenosa	Arthropoda	Malacostraca	Nannastacidae	9	0.11	20.00

Maldane sarsi	Annelida	Polychaeta	Maldanidae	8	0.10	40.00
Arachnanthus sp A	Cnidaria	Anthozoa	Cerianthidae	8	0.10	33.33
Keenaea centifilosum	Mollusca	Bivalvia	Cardiidae	8	0.10	33.33
Amphichondrius granulatus	Echinodermata	Ophiuroidea	Amphiuridae	8	0.10	26.67
Aphelochaeta monilaris	Annelida	Polychaeta	Cirratulidae	8	0.10	26.67
Diastylis crenellata	Arthropoda	Malacostraca	Diastylidae	8	0.10	26.67
Echinoidea	Echinodermata	Echinoidea		8	0.10	26.67
Goniada maculata	Annelida	Polychaeta	Goniadidae	8	0.10	26.67
Heteronemertea	Nemertea	Anopla		8	0.10	26.67
Lineidae	Nemertea	Anopla	Lineidae	8	0.10	26.67
Malmgreniella sp A	Annelida	Polychaeta	Polynoidae	8	0.10	26.67
Neastacilla californica	Arthropoda	Malacostraca	Arcturidae	8	0.10	26.67
Paranemertes californica	Nemertea	Enopla	Emplectonematidae	8	0.10	26.67
Phyllodoce hartmanae	Annelida	Polychaeta	Phyllodocidae	8	0.10	26.67
Prionospio dubia	Annelida	Polychaeta	Spionidae	8	0.10	26.67
Eulalia californiensis	Annelida	Polychaeta	Phyllodocidae	8	0.10	20.00
Laonice cirrata	Annelida	Polychaeta	Spionidae	8	0.10	20.00
Pholoides asperus	Annelida	Polychaeta	Sigalionidae	8	0.10	20.00
Phyllodoce longipes	Annelida	Polychaeta	Phyllodocidae	8	0.10	20.00
Spio maculata	Annelida	Polychaeta	Spionidae	8	0.10	20.00
Spionidae	Annelida	Polychaeta	Spionidae	8	0.10	20.00
Gastropoda	Mollusca	Gastropoda		8	0.10	13.33
Joeropsis dubia	Arthropoda	Malacostraca	Joeropsididae	8	0.10	13.33
Streblosoma sp C	Annelida	Polychaeta	Terebellidae	8	0.10	13.33
Amphissa bicolor	Mollusca	Gastropoda	Columbellidae	8	0.10	6.67
Mooreonuphis segmentispadix	Annelida	Polychaeta	Onuphidae	8	0.10	6.67
Phyllodoce groenlandica	Annelida	Polychaeta	Phyllodocidae	7	0.09	40.00
Syllis heterochaeta	Annelida	Polychaeta	Syllidae	7	0.09	33.33

Actiniaria	Cnidaria	Anthozoa		7	0.09	26.67
Gastropteron pacificum	Mollusca	Gastropoda	Gastropteridae	7	0.09	26.67
Lucinoma annulatum	Mollusca	Bivalvia	Lucinidae	7	0.09	26.67
Tanaopsis cadieni	Arthropoda	Malacostraca	Tanaopsidae	7	0.09	26.67
Tubulanus polymorphus	Nemertea	Anopla	Tubulanidae	7	0.09	26.67
Foxiphalus obtusidens	Arthropoda	Malacostraca	Phoxocephalidae	7	0.09	20.00
Trichobranchus hancocki	Annelida	Polychaeta	Trichobranchidae	7	0.09	20.00
Ampelisca cristata microdentata	Arthropoda	Malacostraca	Ampeliscidae	7	0.09	13.33
Eusarsiella thominx	Arthropoda	Ostracoda	Sarsiellidae	7	0.09	13.33
Ampelisca indentata	Arthropoda	Malacostraca	Ampeliscidae	7	0.09	6.67
Metatiron tropakis	Arthropoda	Malacostraca	Synopiidae	7	0.09	6.67
Tritia insculpta	Mollusca	Gastropoda	Nassariidae	7	0.09	6.67
Acteocina cerealis	Mollusca	Gastropoda	Cylichnidae	6	0.07	26.67
Drilonereis falcata	Annelida	Polychaeta	Oenonidae	6	0.07	26.67
Drilonereis sp	Annelida	Polychaeta	Oenonidae	6	0.07	26.67
Limatula saturna	Mollusca	Bivalvia	Limidae	6	0.07	26.67
Nereis sp A	Annelida	Polychaeta	Nereididae	6	0.07	26.67
Philine auriformis	Mollusca	Gastropoda	Philinidae	6	0.07	26.67
Rhodine bitorquata	Annelida	Polychaeta	Maldanidae	6	0.07	26.67
Chaetozone armata	Annelida	Polychaeta	Cirratulidae	6	0.07	20.00
Kirkegaardia sp	Annelida	Polychaeta	Cirratulidae	6	0.07	20.00
Ophiuroconis bispinosa	Echinodermata	Ophiuroidea	Ophiodermatidae	6	0.07	20.00
Paguroidea	Arthropoda	Malacostraca		6	0.07	20.00
Podarkeopsis glabrus	Annelida	Polychaeta	Hesionidae	6	0.07	20.00
Terebellides reishi	Annelida	Polychaeta	Trichobranchidae	6	0.07	20.00
Turbonilla santarosana	Mollusca	Gastropoda	Pyramidellidae	6	0.07	20.00
Turbonilla sp A	Mollusca	Gastropoda	Pyramidellidae	6	0.07	20.00
Glottidia albida	Brachiopoda	Inarticulata	Lingulidae	6	0.07	13.33

Parexogone breviseta	Annelida	Polychaeta	Syllidae	6	0.07	13.33
Macrochaeta sp OC1	Annelida	Polychaeta	Acrocirridae	6	0.07	6.67
Dougaloplus amphacanthus	Echinodermata	Ophiuroidea	Amphiuridae	5	0.06	33.33
Pista wui	Annelida	Polychaeta	Terebellidae	5	0.06	33.33
Caryocorbula porcella	Mollusca	Bivalvia	Corbulidae	5	0.06	26.67
Foxiphalus similis	Arthropoda	Malacostraca	Phoxocephalidae	5	0.06	26.67
Malmgreniella sp	Annelida	Polychaeta	Polynoidae	5	0.06	26.67
Ninoe tridentata	Annelida	Polychaeta	Lumbrineridae	5	0.06	26.67
Prionospio sp	Annelida	Polychaeta	Spionidae	5	0.06	26.67
Dipolydora socialis	Annelida	Polychaeta	Spionidae	5	0.06	20.00
Eclysippe trilobata	Annelida	Polychaeta	Ampharetidae	5	0.06	20.00
Epigamia-Myrianida Cmplx	Annelida	Polychaeta	Syllidae	5	0.06	20.00
Eunicidae	Annelida	Polychaeta	Eunicidae	5	0.06	20.00
Heteronemertea sp SD2	Nemertea	Anopla	uncertain	5	0.06	20.00
Heteropodarke heteromorpha	Annelida	Polychaeta	Hesionidae	5	0.06	20.00
Lepidasthenia longicirrata	Annelida	Polychaeta	Polynoidae	5	0.06	20.00
Phyllodoce pettiboneae	Annelida	Polychaeta	Phyllodocidae	5	0.06	20.00
Rictaxis punctocaelatus	Mollusca	Gastropoda	Acteonidae	5	0.06	20.00
Thysanocardia nigra	Sipuncula	Sipunculidea	Golfingiidae	5	0.06	20.00
Ampelisca agassizi	Arthropoda	Malacostraca	Ampeliscidae	5	0.06	13.33
Aricidea (Acmira) catherinae	Annelida	Polychaeta	Paraonidae	5	0.06	13.33
Cancridae	Arthropoda	Malacostraca	Cancridae	5	0.06	13.33
Crenella decussata	Mollusca	Bivalvia	Mytilidae	5	0.06	13.33
Deilocerus planus	Arthropoda	Malacostraca	Cyclodorippidae	5	0.06	13.33
Leptochiton rugatus	Mollusca	Polyplacophora	Leptochitonidae	5	0.06	13.33
Malmgreniella macginitiei	Annelida	Polychaeta	Polynoidae	5	0.06	13.33
Odontosyllis phosphorea	Annelida		Syllidae	5	0.06	13.33
Pleurogonium californiense	Arthropoda	Malacostraca	Paramunnidae	5	0.06	13.33

Tetrastemma candidum	Nemertea	Enopla	Tetrastemmatidae	5	0.06	13.33
Ampelisca cristata	Arthropoda	Malacostraca	Ampeliscidae	5	0.06	6.67
Cyclocardia ventricosa	Mollusca	Bivalvia	Carditidae	5	0.06	6.67
Saccocirrus sp	Annelida	Polychaeta	Saccocirridae	5	0.06	6.67
Aricidea (Strelzovia) antennata	Annelida	Polychaeta	Paraonidae	4	0.05	26.67
Lumbrineridae	Annelida	Polychaeta	Lumbrineridae	4	0.05	26.67
Lysippe sp B	Annelida	Polychaeta	Ampharetidae	4	0.05	26.67
Mayerella banksia	Arthropoda	Malacostraca	Caprellidae	4	0.05	26.67
Nephtys sp	Annelida	Polychaeta	Nephtyidae	4	0.05	26.67
Travisia brevis	Annelida	Polychaeta	Travisiidae	4	0.05	26.67
Volvulella cylindrica	Mollusca	Gastropoda	Retusidae	4	0.05	26.67
Amygdalum pallidulum	Mollusca	Bivalvia	Mytilidae	4	0.05	20.00
Balcis oldroydae	Mollusca	Gastropoda	Eulimidae	4	0.05	20.00
Dougaloplus sp A	Echinodermata	Ophiuroidea	Amphiuridae	4	0.05	20.00
Glycera americana	Annelida	Polychaeta	Glyceridae	4	0.05	20.00
Gymnonereis crosslandi	Annelida	Polychaeta	Nereididae	4	0.05	20.00
Heterophoxus oculatus	Arthropoda	Malacostraca	Phoxocephalidae	4	0.05	20.00
Leitoscoloplos sp	Annelida	Polychaeta	Orbiniidae	4	0.05	20.00
Naineris sp	Annelida	Polychaeta	Orbiniidae	4	0.05	20.00
Poecilochaetus sp	Annelida	Polychaeta	Poecilochaetidae	4	0.05	20.00
Scoloplos armiger Cmplx	Annelida	Polychaeta	Orbiniidae	4	0.05	20.00
Scoloplos sp	Annelida	Polychaeta	Orbiniidae	4	0.05	20.00
Amage scutata	Annelida	Polychaeta	Ampharetidae	4	0.05	13.33
Americhelidium shoemakeri	Arthropoda	Malacostraca	Oedicerotidae	4	0.05	13.33
Ampharete acutifrons	Annelida	Polychaeta	Ampharetidae	4	0.05	13.33
Ampharetidae sp SD1	Annelida	Polychaeta	Ampharetidae	4	0.05	13.33
Chaetozone sp	Annelida	Polychaeta	Cirratulidae	4	0.05	13.33
Dendrochirotida	Echinodermata	Holothuroidea		4	0.05	13.33

Heterophoxus ellisi	Arthropoda	Malacostraca	Phoxocephalidae	4	0.05	13.33
Hiatella arctica	Mollusca	Bivalvia	Hiatellidae	4	0.05	13.33
Kurtiella mortoni	Mollusca	Bivalvia	Lasaeidae	4	0.05	13.33
Nacospatangus laevis	Echinodermata	Echinoidea	Spatangidae	4	0.05	13.33
Ophiura luetkenii	Echinodermata	Ophiuroidea	Ophiuridae	4	0.05	13.33
Opisthodonta tridentata	Annelida	Polychaeta	Syllidae	4	0.05	13.33
Owenia collaris	Annelida	Polychaeta	Oweniidae	4	0.05	13.33
Paradoneis sp SD1	Annelida	Polychaeta	Paraonidae	4	0.05	13.33
Phyllodoce sp	Annelida	Polychaeta	Phyllodocidae	4	0.05	13.33
Questa caudicirra	Annelida	Polychaeta	Orbiniidae	4	0.05	13.33
Terebellides sp	Annelida	Polychaeta	Trichobranchidae	4	0.05	13.33
Xenoleberis californica	Arthropoda	Ostracoda	Cylindroleberididae	4	0.05	13.33
Aphelochaeta williamsae	Annelida	Polychaeta	Cirratulidae	4	0.05	6.67
Euchone hancocki	Annelida	Polychaeta	Sabellidae	4	0.05	6.67
Lacydonia sp	Annelida	Polychaeta	Lacydoniidae	4	0.05	6.67
Maera jerrica	Arthropoda	Malacostraca	Melitidae	4	0.05	6.67
Myriochele olgae	Annelida	Polychaeta	Oweniidae	4	0.05	6.67
Nebalia daytoni	Arthropoda	Malacostraca	Nebaliidae	4	0.05	6.67
Notopoma sp A	Arthropoda	Malacostraca	Ischyroceridae	4	0.05	6.67
Oxydromus sp	Annelida	Polychaeta	Hesionidae	4	0.05	6.67
Photis macrotica	Arthropoda	Malacostraca	Photidae	4	0.05	6.67
Plakosyllis sp OC1	Annelida	Polychaeta	Syllidae	4	0.05	6.67
Prosphaerosyllis bilineata	Annelida	Polychaeta	Syllidae	4	0.05	6.67
Protomedeia articulata Cmplx	Arthropoda	Malacostraca	Corophiidae	4	0.05	6.67
Salvatoria californiensis	Annelida	Polychaeta	Syllidae	4	0.05	6.67
Ampelisca cf *brevisimulata*	Arthropoda	Malacostraca	Ampeliscidae	3	0.04	20.00
Ampelisca pacifica	Arthropoda	Malacostraca	Ampeliscidae	3	0.04	20.00
Balcis micans	Mollusca	Gastropoda	Eulimidae	3	0.04	20.00

Clymenura gracilis	Annelida	Polychaeta	Maldanidae	3	0.04	20.00
Dialychone albocincta	Annelida	Polychaeta	Sabellidae	3	0.04	20.00
Goniada brunnea	Annelida	Polychaeta	Goniadidae	3	0.04	20.00
Halianthella sp A	Cnidaria	Anthozoa	Halcampidae	3	0.04	20.00
Kurtzia arteaga	Mollusca	Gastropoda	Mangeliidae	3	0.04	20.00
Munnogonium tillerae	Arthropoda	Malacostraca	Paramunnidae	3	0.04	20.00
Odostomia sp	Mollusca	Gastropoda	Pyramidellidae	3	0.04	20.00
Polycirrus sp OC1	Annelida	Polychaeta	Terebellidae	3	0.04	20.00
Sige sp A	Annelida	Polychaeta	Phyllodocidae	3	0.04	20.00
Terebellides californica	Annelida	Polychaeta	Trichobranchidae	3	0.04	20.00
Tubulanus cingulatus	Nemertea	Anopla	Tubulanidae	3	0.04	20.00
Amphideutopus oculatus	Arthropoda	Malacostraca	Kamakidae	3	0.04	13.33
Aoridae	Arthropoda	Malacostraca	Aoridae	3	0.04	13.33
Aphelochaeta sp	Annelida	Polychaeta	Cirratulidae	3	0.04	13.33
Bipalponephtys cornuta	Annelida	Polychaeta	Nephtyidae	3	0.04	13.33
Eteone pigmentata	Annelida	Polychaeta	Phyllodocidae	3	0.04	13.33
Garosyrrhoe bigarra	Arthropoda	Malacostraca	Synopiidae	3	0.04	13.33
Joeropsis concava	Arthropoda	Malacostraca	Joeropsididae	3	0.04	13.33
Kirkegaardia serratiseta	Annelida	Polychaeta	Cirratulidae	3	0.04	13.33
Lepidepecreum gurjanovae	Arthropoda	Malacostraca	Lysianassidae	3	0.04	13.33
Listriella goleta	Arthropoda	Malacostraca	Liljeborgiidae	3	0.04	13.33
Lytechinus pictus	Echinodermata	Echinoidea	Toxopneustidae	3	0.04	13.33
Malmgreniella sanpedroensis	Annelida	Polychaeta	Polynoidae	3	0.04	13.33
Nephtys caecoides	Annelida	Polychaeta	Nephtyidae	3	0.04	13.33
Pinnixa sp	Arthropoda	Malacostraca	Pinnotheridae	3	0.04	13.33
Sabellidae	Annelida	Polychaeta	Sabellidae	3	0.04	13.33
Solamen columbianum	Mollusca	Bivalvia	Mytilidae	3	0.04	13.33
Solariella peramabilis	Mollusca	Gastropoda	Solariellidae	3	0.04	13.33

Sthenelais tertiaglabra	Annelida	Polychaeta	Sigalionidae	3	0.04	13.33
Trophoniella sp	Annelida	Polychaeta	Flabelligeridae	3	0.04	13.33
Amphissa sp	Mollusca	Gastropoda	Columbellidae	3	0.04	6.67
Anoplodactylus erectus	Arthropoda	Pycnogonida	Phoxichilidiidae	3	0.04	6.67
Dorvilleidae	Annelida	Polychaeta	Dorvilleidae	3	0.04	6.67
Laticorophium baconi	Arthropoda	Malacostraca	Corophiidae	3	0.04	6.67
Limnactiniidae sp A	Cnidaria	Anthozoa	Limnactiniidae	3	0.04	6.67
Magelona berkeleyi	Annelida	Polychaeta	Magelonidae	3	0.04	6.67
Malmgreniella baschi	Annelida	Polychaeta	Polynoidae	3	0.04	6.67
Neosabellaria cementarium	Annelida	Polychaeta	Sabellariidae	3	0.04	6.67
Opisthodonta sp	Annelida	Polychaeta	Syllidae	3	0.04	6.67
Pagurus hartae	Arthropoda	Malacostraca	Paguridae	3	0.04	6.67
Pareurythoe californica	Annelida	Polychaeta	Amphinomidae	3	0.04	6.67
Pholoe sp	Annelida	Polychaeta	Pholoidae	3	0.04	6.67
Pinnixa forficulimanus	Arthropoda	Malacostraca	Pinnotheridae	3	0.04	6.67
Aglaja ocelligera	Mollusca	Gastropoda	Aglajidae	2	0.02	13.33
Americhelidium sp SD4	Arthropoda	Malacostraca	Oedicerotidae	2	0.02	13.33
Ampelisca hancocki	Arthropoda	Malacostraca	Ampeliscidae	2	0.02	13.33
Araphura sp SD1	Arthropoda	Malacostraca	Tanaellidae	2	0.02	13.33
Argissa hamatipes	Arthropoda	Malacostraca	Argissidae	2	0.02	13.33
Aricidea (Acmira) rubra	Annelida	Polychaeta	Paraonidae	2	0.02	13.33
Caprella mendax	Arthropoda	Malacostraca	Caprellidae	2	0.02	13.33
Cumacea	Arthropoda	Malacostraca		2	0.02	13.33
Epitonium sawinae	Mollusca	Gastropoda	Epitoniidae	2	0.02	13.33
Exogone dwisula	Annelida	Polychaeta	Syllidae	2	0.02	13.33
Heterophoxus affinis	Arthropoda	Malacostraca	Phoxocephalidae	2	0.02	13.33
Heterophoxus sp	Arthropoda	Malacostraca	Phoxocephalidae	2	0.02	13.33
Kirkegaardia cryptica	Annelida	Polychaeta	Cirratulidae	2	0.02	13.33

Kurtzina beta	Mollusca	Gastropoda	Mangeliidae	2	0.02	13.33
Laonice nuchala	Annelida	Polychaeta	Spionidae	2	0.02	13.33
Leucon subnasica	Arthropoda	Malacostraca	Leuconidae	2	0.02	13.33
Lumbrineris latreilli	Annelida	Polychaeta	Lumbrineridae	2	0.02	13.33
Lumbrineris ligulata	Annelida	Polychaeta	Lumbrineridae	2	0.02	13.33
Maculaura alaskensis Cmplx	Nemertea	Anopla	Lineidae	2	0.02	13.33
Malmgreniella scriptoria	Annelida	Polychaeta	Polynoidae	2	0.02	13.33
Monoculodes emarginatus	Arthropoda	Malacostraca	Oedicerotidae	2	0.02	13.33
Mooreonuphis nebulosa	Annelida	Polychaeta	Onuphidae	2	0.02	13.33
Nereididae	Annelida	Polychaeta	Nereididae	2	0.02	13.33
Oedicerotidae	Arthropoda	Malacostraca	Oedicerotidae	2	0.02	13.33
Onuphis geophiliformis	Annelida	Polychaeta	Onuphidae	2	0.02	13.33
Onuphis sp A	Annelida	Polychaeta	Onuphidae	2	0.02	13.33
Ophelina sp	Annelida	Polychaeta	Opheliidae	2	0.02	13.33
Orthopagurus minimus	Arthropoda	Malacostraca	Paguridae	2	0.02	13.33
Pandora bilirata	Mollusca	Bivalvia	Pandoridae	2	0.02	13.33
Parexogone molesta	Annelida	Polychaeta	Syllidae	2	0.02	13.33
Pentactinia californica	Cnidaria	Anthozoa	Halcampoididae	2	0.02	13.33
Pentamera rigida	Echinodermata	Holothuroidea	Phyllophoridae	2	0.02	13.33
Pherusa neopapillata	Annelida	Polychaeta	Flabelligeridae	2	0.02	13.33
Pleusymtes subglaber	Arthropoda	Malacostraca	Pleustidae	2	0.02	13.33
Propebela sp	Mollusca	Gastropoda	Mangeliidae	2	0.02	13.33
Rhamphobrachium longisetosum	Annelida	Polychaeta	Onuphidae	2	0.02	13.33
Samytha californiensis	Annelida	Polychaeta	Ampharetidae	2	0.02	13.33
Scolanthus triangulus	Cnidaria	Anthozoa	Edwardsiidae	2	0.02	13.33
Subadyte mexicana	Annelida	Polychaeta	Polynoidae	2	0.02	13.33
Thyone benti	Echinodermata	Holothuroidea	Phyllophoridae	2	0.02	13.33
Virgularia agassizii	Cnidaria	Anthozoa	Virgulariidae	2	0.02	13.33

Zygeupolia rubens	Nemertea	Anopla	Valenciniidae	2	0.02	13.33
Acrocirridae	Annelida	Polychaeta	Acrocirridae	2	0.02	6.67
Acromegalomma splendidum	Annelida	Polychaeta	Sabellidae	2	0.02	6.67
Alvania rosana	Mollusca	Gastropoda	Rissoidae	2	0.02	6.67
Amphicteis sp	Annelida	Polychaeta	Ampharetidae	2	0.02	6.67
Amphipholis pugetana	Echinodermata	Ophiuroidea	Amphiuridae	2	0.02	6.67
Amphipoda	Arthropoda	Malacostraca		2	0.02	6.67
Anthozoa #49	Cnidaria	Anthozoa		2	0.02	6.67
Aoroides exilis	Arthropoda	Malacostraca	Aoridae	2	0.02	6.67
Aphelochaeta phillipsi	Annelida	Polychaeta	Cirratulidae	2	0.02	6.67
Araphura breviaria	Arthropoda	Malacostraca	Tanaellidae	2	0.02	6.67
Aricidea (Acmira) lopezi	Annelida	Polychaeta	Paraonidae	2	0.02	6.67
Aricidea (Strelzovia) sp	Annelida	Polychaeta	Paraonidae	2	0.02	6.67
Asabellides lineata	Annelida	Polychaeta	Ampharetidae	2	0.02	6.67
Brissopsis pacifica	Echinodermata	Echinoidea	Brissidae	2	0.02	6.67
Campylaspis canaliculata	Arthropoda	Malacostraca	Nannastacidae	2	0.02	6.67
Campylaspis hartae	Arthropoda	Malacostraca	Nannastacidae	2	0.02	6.67
Chaetozone hedgpethi	Annelida	Polychaeta	Cirratulidae	2	0.02	6.67
Chaetozone sp SD3	Annelida	Polychaeta	Cirratulidae	2	0.02	6.67
Cuspidaria parapodema	Mollusca	Bivalvia	Cuspidariidae	2	0.02	6.67
Cyclaspis sp A	Arthropoda	Malacostraca	Bodotriidae	2	0.02	6.67
Dialychone veleronis	Annelida	Polychaeta	Sabellidae	2	0.02	6.67
Diastylopsis tenuis	Arthropoda	Malacostraca	Diastylidae	2	0.02	6.67
Diplehnia caeca	Platyhelminthes	Turbellaria	Plehniidae	2	0.02	6.67
Dorvillea sp	Annelida	Polychaeta	Dorvilleidae	2	0.02	6.67
Eurydice caudata	Arthropoda	Malacostraca	Cirolanidae	2	0.02	6.67
Eusyllis blomstrandi Cmplx	Annelida	Polychaeta	Syllidae	2	0.02	6.67
Flabelligeridae	Annelida	Polychaeta	Flabelligeridae	2	0.02	6.67

Glycera oxycephala	Annelida	Polychaeta	Glyceridae	2	0.02	6.67
Halosydna johnsoni	Annelida	Polychaeta	Polynoidae	2	0.02	6.67
Hemilamprops californicus	Arthropoda	Malacostraca	Lampropidae	2	0.02	6.67
Hemipodia borealis	Annelida	Polychaeta	Glyceridae	2	0.02	6.67
Idarcturus allelomorphus	Arthropoda	Malacostraca	Arcturidae	2	0.02	6.67
Isocirrus longiceps	Annelida	Polychaeta	Maldanidae	2	0.02	6.67
Lineus bilineatus	Nemertea	Anopla	Lineidae	2	0.02	6.67
Macoma carlottensis	Mollusca	Bivalvia	Tellinidae	2	0.02	6.67
Macrochaeta sp	Annelida	Polychaeta	Acrocirridae	2	0.02	6.67
Magelona sp B	Annelida	Polychaeta	Magelonidae	2	0.02	6.67
Majoidea	Arthropoda	Malacostraca		2	0.02	6.67
Marphysa sp	Annelida	Polychaeta	Eunicidae	2	0.02	6.67
Metaphoxus frequens	Arthropoda	Malacostraca	Phoxocephalidae	2	0.02	6.67
Molgula regularis	Chordata	Ascidiacea	Molgulidae	2	0.02	6.67
Molpadia intermedia	Echinodermata	Holothuroidea	Molpadiidae	2	0.02	6.67
Notomastus latericeus	Annelida	Polychaeta	Capitellidae	2	0.02	6.67
Onuphis sp	Annelida	Polychaeta	Onuphidae	2	0.02	6.67
Paradialychone paramollis	Annelida	Polychaeta	Sabellidae	2	0.02	6.67
Pennatulacea	Cnidaria	Anthozoa		2	0.02	6.67
Photis sp C	Arthropoda	Malacostraca	Photidae	2	0.02	6.67
Photis sp HYP2	Arthropoda	Malacostraca	Photidae	2	0.02	6.67
Polygireulima rutila	Mollusca	Gastropoda	Eulimidae	2	0.02	6.67
Protomystides sp	Annelida	Polychaeta	Phyllodocidae	2	0.02	6.67
Pylopagurus holmesi	Arthropoda	Malacostraca	Paguridae	2	0.02	6.67
Scolelepis (Parascolelepis) tridentata	Annelida	Polychaeta	Spionidae	2	0.02	6.67
Sigalion spinosus	Annelida	Polychaeta	Sigalionidae	2	0.02	6.67
Sphaerodoropsis biserialis	Annelida	Polychaeta	Sphaerodoridae	2	0.02	6.67
Tanaidacea	Arthropoda	Malacostraca		2	0.02	6.67

Terebra pedroana	Mollusca	Gastropoda	Terebridae	2	0.02	6.67
Tubulanus sp A	Nemertea	Anopla	Tubulanidae	2	0.02	6.67
Acanthoptilum sp	Cnidaria	Anthozoa	Virgulariidae	1	0.01	6.67
Acidostoma hancocki	Arthropoda	Malacostraca	Acidostomatidae	1	0.01	6.67
Acteocina culcitella	Mollusca	Gastropoda	Cylichnidae	1	0.01	6.67
Adontorhina cyclia	Mollusca	Bivalvia	Thyasiridae	1	0.01	6.67
Amaeana occidentalis	Annelida	Polychaeta	Terebellidae	1	0.01	6.67
Americhelidium rectipalmum	Arthropoda	Malacostraca	Oedicerotidae	1	0.01	6.67
Ampelisca careyi	Arthropoda	Malacostraca	Ampeliscidae	1	0.01	6.67
Ampelisca lobata	Arthropoda	Malacostraca	Ampeliscidae	1	0.01	6.67
Amphicteis glabra	Annelida	Polychaeta	Ampharetidae	1	0.01	6.67
Amphioplus sp	Echinodermata	Ophiuroidea	Amphiuridae	1	0.01	6.67
Amphipholis squamata	Echinodermata	Ophiuroidea	Amphiuridae	1	0.01	6.67
Amphisamytha bioculata	Annelida	Polychaeta	Ampharetidae	1	0.01	6.67
Anemonactis sp A	Cnidaria	Anthozoa	Haloclavidae	1	0.01	6.67
Antalis pretiosa	Mollusca	Scaphopoda	Dentaliidae	1	0.01	6.67
Aonides sp SD1	Annelida	Polychaeta	Spionidae	1	0.01	6.67
Aphelochaeta elongata	Annelida	Polychaeta	Cirratulidae	1	0.01	6.67
Aphelochaeta sp SD5	Annelida	Polychaeta	Cirratulidae	1	0.01	6.67
Aphrodita sp	Annelida	Polychaeta	Aphroditidae	1	0.01	6.67
Aricidea (Aedicira) pacifica	Annelida	Polychaeta	Paraonidae	1	0.01	6.67
Aricidea (Aricidea) wassi	Annelida	Polychaeta	Paraonidae	1	0.01	6.67
Aricidea (Strelzovia) hartleyi	Annelida	Polychaeta	Paraonidae	1	0.01	6.67
Aruga holmesi	Arthropoda	Malacostraca	Lysianassidae	1	0.01	6.67
Aruga oculata	Arthropoda	Malacostraca	Lysianassidae	1	0.01	6.67
Asclerocheilus sp	Annelida	Polychaeta	Scalibregmatidae	1	0.01	6.67
Asteroidea	Echinodermata	Asteroidea		1	0.01	6.67
Bemlos audbettius	Arthropoda	Malacostraca	Aoridae	1	0.01	6.67

Brachyura	Arthropoda	Malacostraca		1	0.01	6.67
Brada pluribranchiata	Annelida	Polychaeta	Flabelligeridae	1	0.01	6.67
Byblis sp	Arthropoda	Malacostraca	Ampeliscidae	1	0.01	6.67
Callianax sp	Mollusca	Gastropoda	Olivellidae	1	0.01	6.67
Calyptraea fastigiata	Mollusca	Gastropoda	Calyptraeidae	1	0.01	6.67
Campylaspis blakei	Arthropoda	Malacostraca	Nannastacidae	1	0.01	6.67
Campylaspis rubromaculata	Arthropoda	Malacostraca	Nannastacidae	1	0.01	6.67
Capitellidae	Annelida	Polychaeta	Capitellidae	1	0.01	6.67
Carinoma mutabilis	Nemertea	Anopla	Carinomidae	1	0.01	6.67
Cerebratulus sp	Nemertea	Anopla	Lineidae	1	0.01	6.67
Chaetodermatida	Mollusca	Caudofoveata		1	0.01	6.67
Chauliopleona dentata	Arthropoda	Malacostraca	Akanthophoreidae	1	0.01	6.67
Cirrophorus branchiatus	Annelida	Polychaeta	Paraonidae	1	0.01	6.67
Columbellidae	Mollusca	Gastropoda	Columbellidae	1	0.01	6.67
Compsomyax subdiaphana	Mollusca	Bivalvia	Veneridae	1	0.01	6.67
Cooperella subdiaphana	Mollusca	Bivalvia	Petricolidae	1	0.01	6.67
Crepipatella lingulata	Mollusca	Gastropoda	Calyptraeidae	1	0.01	6.67
Crockerella evadne	Mollusca	Gastropoda	Clathurellidae	1	0.01	6.67
Cyclaspis nubila	Arthropoda	Malacostraca	Bodotriidae	1	0.01	6.67
Dacrydium pacificum	Mollusca	Bivalvia	Mytilidae	1	0.01	6.67
Deflexilodes sp	Arthropoda	Malacostraca	Oedicerotidae	1	0.01	6.67
Dentaliidae	Mollusca	Scaphopoda	Dentaliidae	1	0.01	6.67
Diastylidae	Arthropoda	Malacostraca	Diastylidae	1	0.01	6.67
Diastylis californica	Arthropoda	Malacostraca	Diastylidae	1	0.01	6.67
Diopatra splendidissima	Annelida	Polychaeta	Onuphidae	1	0.01	6.67
Dipolydora barbilla	Annelida	Polychaeta	Spionidae	1	0.01	6.67
Dipolydora caulleryi	Annelida	Polychaeta	Spionidae	1	0.01	6.67
Edwardsia juliae	Cnidaria	Anthozoa	Edwardsiidae	1	0.01	6.67

Ensis myrae	Mollusca	Bivalvia	Pharidae	1	0.01	6.67
Enteropneusta	Chordata	Enteropneusta		1	0.01	6.67
Epitonium sp	Mollusca	Gastropoda	Epitoniidae	1	0.01	6.67
Eranno lagunae	Annelida	Polychaeta	Lumbrineridae	1	0.01	6.67
Ericthonius sp	Arthropoda	Malacostraca	Ischyroceridae	1	0.01	6.67
Eteone sp	Annelida	Polychaeta	Phyllodocidae	1	0.01	6.67
Euchone sp	Annelida	Polychaeta	Sabellidae	1	0.01	6.67
Eudorellopsis longirostris	Arthropoda	Malacostraca	Leuconidae	1	0.01	6.67
Eunoe sp	Annelida	Polychaeta	Polynoidae	1	0.01	6.67
Eusyllis transecta	Annelida	Polychaeta	Syllidae	1	0.01	6.67
Glycera macrobranchia	Annelida	Polychaeta	Glyceridae	1	0.01	6.67
Glycymeris septentrionalis	Mollusca	Bivalvia	Glycymerididae	1	0.01	6.67
Halcampa decemtentaculata	Cnidaria	Anthozoa	Halcampidae	1	0.01	6.67
Harenactis attenuata	Cnidaria	Anthozoa	Haloclavidae	1	0.01	6.67
Hartmanodes hartmanae	Arthropoda	Malacostraca	Oedicerotidae	1	0.01	6.67
Huxleyia munita	Mollusca	Bivalvia	Nucinellidae	1	0.01	6.67
Lampropidae	Arthropoda	Malacostraca	Lampropidae	1	0.01	6.67
Leptochiton nexus	Mollusca	Polyplacophora	Leptochitonidae	1	0.01	6.67
Leptopecten latiauratus	Mollusca	Bivalvia	Pectinidae	1	0.01	6.67
Leptoplanidae sp A	Platyhelminthes	Rhabditophora	Leptoplanidae	1	0.01	6.67
Leptoplanoidea	Platyhelminthes	Turbellaria		1	0.01	6.67
Lumbrinerides platypygos	Annelida	Polychaeta	Lumbrineridae	1	0.01	6.67
Lumbrinerides sp OC1	Annelida	Polychaeta	Lumbrineridae	1	0.01	6.67
Lumbrineriopsis sp SD1	Annelida	Polychaeta	Lumbrineridae	1	0.01	6.67
Lumbrineris cruzensis	Annelida	Polychaeta	Lumbrineridae	1	0.01	6.67
Lyonsiidae	Mollusca	Bivalvia	Lyonsiidae	1	0.01	6.67
Magelona hobsonae	Annelida	Polychaeta	Magelonidae	1	0.01	6.67
Malacoceros indicus	Annelida	Polychaeta	Spionidae	1	0.01	6.67

Mangelia hexagona	Mollusca	Gastropoda	Mangeliidae	1	0.01	6.67
Melanochlamys diomedea	Mollusca	Gastropoda	Aglajidae	1	0.01	6.67
Melinna oculata	Annelida	Polychaeta	Ampharetidae	1	0.01	6.67
Metasychis disparidentatus	Annelida	Polychaeta	Maldanidae	1	0.01	6.67
Micropodarke dubia	Annelida	Polychaeta	Hesionidae	1	0.01	6.67
Myriochele sp	Annelida	Polychaeta	Oweniidae	1	0.01	6.67
Nassariidae	Mollusca	Gastropoda	Nassariidae	1	0.01	6.67
Nemertea	Nemertea			1	0.01	6.67
Nereis latescens	Annelida	Polychaeta	Nereididae	1	0.01	6.67
Nothria occidentalis	Annelida	Polychaeta	Onuphidae	1	0.01	6.67
Notocirrus californiensis	Annelida	Polychaeta	Oenonidae	1	0.01	6.67
Odontosyllis sp	Annelida	Polychaeta	Syllidae	1	0.01	6.67
Onuphis iridescens	Annelida	Polychaeta	Onuphidae	1	0.01	6.67
Ophelina sp SD1	Annelida	Polychaeta	Opheliidae	1	0.01	6.67
Orchomenella decipiens	Arthropoda	Malacostraca	Lysianassidae	1	0.01	6.67
Oxydromus pugettensis	Annelida	Polychaeta	Hesionidae	1	0.01	6.67
Palaeonemertea	Nemertea	Anopla		1	0.01	6.67
Paradoneis sp	Annelida	Polychaeta	Paraonidae	1	0.01	6.67
Paraonidae	Annelida	Polychaeta	Paraonidae	1	0.01	6.67
Parexogone acutipalpa	Annelida	Polychaeta	Syllidae	1	0.01	6.67
Pentamera sp	Echinodermata	Holothuroidea	Phyllophoridae	1	0.01	6.67
Pherusa sp	Annelida	Polychaeta	Flabelligeridae	1	0.01	6.67
Philomedidae	Arthropoda	Ostracoda	Philomedidae	1	0.01	6.67
Phoronis sp SD1	Phoronida		Phoronidae	1	0.01	6.67
Phoronopsis sp	Phoronida		Phoronidae	1	0.01	6.67
Photis sp A	Arthropoda	Malacostraca	Photidae	1	0.01	6.67
Phyllodoce cuspidata	Annelida	Polychaeta	Phyllodocidae	1	0.01	6.67
Pinnixa occidentalis Cmplx	Arthropoda	Malacostraca	Pinnotheridae	1	0.01	6.67

Plakosyllis sp	Annelida	Polychaeta	Syllidae	1	0.01	6.67
Pleurobranchaea californica	Mollusca	Gastropoda	Pleurobranchidae	1	0.01	6.67
Pleurogonium sp A	Arthropoda	Malacostraca	Paramunnidae	1	0.01	6.67
Polychaeta	Annelida	Polychaeta		1	0.01	6.67
Polycirrus californicus	Annelida	Polychaeta	Terebellidae	1	0.01	6.67
Polycladida	Platyhelminthes	Turbellaria		1	0.01	6.67
Potamethus sp A	Annelida	Polychaeta	Sabellidae	1	0.01	6.67
Prachynella lodo	Arthropoda	Malacostraca	Pakynidae	1	0.01	6.67
Praxillura maculata	Annelida	Polychaeta	Maldanidae	1	0.01	6.67
Prionospio pygmaeus	Annelida	Polychaeta	Spionidae	1	0.01	6.67
Protocirrineris sp B	Annelida	Polychaeta	Cirratulidae	1	0.01	6.67
Pseudopotamilla sp	Annelida	Polychaeta	Sabellidae	1	0.01	6.67
Rudilemboides sp A	Arthropoda	Malacostraca	Unciolidae	1	0.01	6.67
Rudilemboides stenopropodus	Arthropoda	Malacostraca	Unciolidae	1	0.01	6.67
Sabellides manriquei	Annelida	Polychaeta	Ampharetidae	1	0.01	6.67
Scalibregmatidae	Annelida	Polychaeta	Scalibregmatidae	1	0.01	6.67
Scaphopoda	Mollusca	Scaphopoda		1	0.01	6.67
Schistocomus hiltoni	Annelida	Polychaeta	Ampharetidae	1	0.01	6.67
Scionella japonica	Annelida	Polychaeta	Terebellidae	1	0.01	6.67
Scleroconcha trituberculata	Arthropoda	Ostracoda	Philomedidae	1	0.01	6.67
Scoletoma tetraura Cmplx	Annelida	Polychaeta	Lumbrineridae	1	0.01	6.67
Scoloplos acmeceps	Annelida	Polychaeta	Orbiniidae	1	0.01	6.67
Sigambra sp	Annelida	Polychaeta	Pilargidae	1	0.01	6.67
Siphonolabrum californiensis	Arthropoda	Malacostraca	Anarthruridae	1	0.01	6.67
Siphonosoma ingens	Sipuncula	Sipunculidea	Sipunculidae	1	0.01	6.67
Sipuncula	Sipuncula			1	0.01	6.67
Spatangus californicus	Echinodermata	Echinoidea	Spatangidae	1	0.01	6.67
Sphaerodoridium sp	Annelida	Polychaeta	Sphaerodoridae	1	0.01	6.67

Sphaerosyllis californiensis	Annelida	Polychaeta	Syllidae	1	0.01	6.67
Stenothoe frecanda	Arthropoda	Malacostraca	Stenothoidae	1	0.01	6.67
Sthenelais fusca	Annelida	Polychaeta	Sigalionidae	1	0.01	6.67
Streblosoma sp B	Annelida	Polychaeta	Terebellidae	1	0.01	6.67
Stylatula sp A	Cnidaria	Anthozoa	Virgulariidae	1	0.01	6.67
Syllis farallonensis	Annelida	Polychaeta	Syllidae	1	0.01	6.67
Thelepus setosus	Annelida	Polychaeta	Terebellidae	1	0.01	6.67
Thracia trapezoides	Mollusca	Bivalvia	Thraciidae	1	0.01	6.67
Trichobranchidae	Annelida	Polychaeta	Trichobranchidae	1	0.01	6.67
Tubulanidae	Nemertea	Anopla	Tubulanidae	1	0.01	6.67
Turbonilla sp	Mollusca	Gastropoda	Pyramidellidae	1	0.01	6.67
Turbonilla sp 2	Mollusca	Gastropoda	Pyramidellidae	1	0.01	6.67
Turbonilla tenuicula	Mollusca	Gastropoda	Pyramidellidae	1	0.01	6.67
Turritella cooperi	Mollusca	Gastropoda	Turritellidae	1	0.01	6.67
Virgularia californica	Cnidaria	Anthozoa	Virgulariidae	1	0.01	6.67
Virgulariidae	Cnidaria	Anthozoa	Virgulariidae	1	0.01	6.67

Appendix A10. Macrobenthic community summary for the Upper Slope stratum in the Bight'18 survey. Total abundance from all samples, relative abundance across the stratum, and the frequency of occurrence within a stratum are presented. Taxa are ranked by total abundance.

Taxon	Phylum	Class	Family	Total Abundance	Relative Abundance (%)	Frequency of Occurrence (%)
Prionospio ehlersi	Annelida	Polychaeta	Spionidae	185	9.64	58.06
Paraprionospio alata	Annelida	Polychaeta	Spionidae	151	7.86	41.94
Maldane sarsi	Annelida	Polychaeta	Maldanidae	114	5.94	64.52
Bipalponephtys cornuta	Annelida	Polychaeta	Nephtyidae	64	3.33	58.06
Byblis barbarensis	Arthropoda	Malacostraca	Ampeliscidae	50	2.60	3.23
Aphelochaeta monilaris	Annelida	Polychaeta	Cirratulidae	41	2.14	32.26
Tellina carpenteri	Mollusca	Bivalvia	Tellinidae	39	2.03	19.35
Cyclocardia ventricosa	Mollusca	Bivalvia	Carditidae	37	1.93	16.13
Spiophanes kimballi	Annelida	Polychaeta	Spionidae	33	1.72	22.58
Macoma carlottensis	Mollusca	Bivalvia	Tellinidae	30	1.56	12.90
Pectinaria californiensis	Annelida	Polychaeta	Pectinariidae	30	1.56	32.26
Saxicavella pacifica	Mollusca	Bivalvia	Hiatellidae	29	1.51	16.13
Pista wui	Annelida	Polychaeta	Terebellidae	25	1.30	22.58
Phyllochaetopterus limicolus	Annelida	Polychaeta	Chaetopteridae	24	1.25	16.13
Melinna heterodonta	Annelida	Polychaeta	Ampharetidae	23	1.20	32.26
Rhabdus rectius	Mollusca	Scaphopoda	Rhabdidae	23	1.20	29.03
Cyclocardia gouldii	Mollusca	Bivalvia	Carditidae	22	1.15	6.45
Glycinde armigera	Annelida	Polychaeta	Goniadidae	22	1.15	32.26
Axinopsida serricata	Mollusca	Bivalvia	Thyasiridae	21	1.09	19.35
Caecognathia crenulatifrons	Arthropoda	Malacostraca	Gnathiidae	19	0.99	16.13
Paguridae	Arthropoda	Malacostraca	Paguridae	19	0.99	3.23

Onuphis iridescens	Annelida	Polychaeta	Onuphidae	18	0.94	19.35
Brisaster townsendi	Echinodermata	Echinoidea	Schizasteridae	16	0.83	32.26
Maldanidae	Annelida	Polychaeta	Maldanidae	16	0.83	16.13
Scaphopoda	Mollusca	Scaphopoda		16	0.83	19.35
Glycera nana	Annelida	Polychaeta	Glyceridae	15	0.78	32.26
Lineidae	Nemertea	Anopla	Lineidae	15	0.78	22.58
Mediomastus sp	Annelida	Polychaeta	Capitellidae	15	0.78	16.13
Leitoscoloplos sp A	Annelida	Polychaeta	Orbiniidae	14	0.73	25.81
Limifossor fratula	Mollusca	Caudofoveata	Limifossoridae	14	0.73	35.48
Paraphoxus sp 1	Arthropoda	Malacostraca	Phoxocephalidae	14	0.73	3.23
Phyllochaetopterus sp	Annelida	Polychaeta	Chaetopteridae	14	0.73	3.23
Prionospio lighti	Annelida	Polychaeta	Spionidae	14	0.73	32.26
Spiochaetopterus costarum Cmplx	Annelida	Polychaeta	Chaetopteridae	13	0.68	9.68
Amphissa bicolor	Mollusca	Gastropoda	Columbellidae	12	0.63	6.45
Amphiuridae	Echinodermata	Ophiuroidea	Amphiuridae	12	0.63	12.90
Chaetoderma pacificum	Mollusca	Caudofoveata	Chaetodermidae	12	0.63	12.90
Nephtys ferruginea	Annelida	Polychaeta	Nephtyidae	12	0.63	22.58
Scoletoma tetraura Cmplx	Annelida	Polychaeta	Lumbrineridae	12	0.63	16.13
Spiophanes fimbriata	Annelida	Polychaeta	Spionidae	12	0.63	12.90
Amphiodia sp	Echinodermata	Ophiuroidea	Amphiuridae	11	0.57	6.45
Astyris sp	Mollusca	Gastropoda	Columbellidae	11	0.57	6.45
Ancistrosyllis groenlandica	Annelida	Polychaeta	Pilargidae	10	0.52	22.58
Compressidens stearnsii	Mollusca	Scaphopoda		10	0.52	12.90
Eclysippe trilobata	Annelida	Polychaeta	Ampharetidae	10	0.52	12.90
Ericthonius rubricornis	Arthropoda	Malacostraca	Ischyroceridae	10	0.52	3.23
Odostomia sp	Mollusca	Gastropoda	Pyramidellidae	10	0.52	19.35
Cerebratulus californiensis	Nemertea	Anopla	Lineidae	9	0.47	9.68
Chaetoderma nanulum	Mollusca	Caudofoveata	Chaetodermatidae	9	0.47	16.13

Ophiuroidea	Echinodermata	Ophiuroidea		9	0.47	9.68
Aphelochaeta glandaria Cmplx	Annelida	Polychaeta	Cirratulidae	8	0.42	12.90
Brissopsis pacifica	Echinodermata	Echinoidea	Brissidae	8	0.42	16.13
Harpiniopsis fulgens	Arthropoda	Malacostraca	Phoxocephalidae	8	0.42	16.13
Lirobittium calenum	Mollusca	Gastropoda	Cerithiidae	8	0.42	6.45
Ampelisca brevisimulata	Arthropoda	Malacostraca	Ampeliscidae	7	0.36	3.23
Euclymeninae sp A	Annelida	Polychaeta	Maldanidae	7	0.36	3.23
Heteromastus filobranchus	Annelida	Polychaeta	Capitellidae	7	0.36	12.90
Leitoscoloplos pugettensis	Annelida	Polychaeta	Orbiniidae	7	0.36	9.68
Lumbrineris cruzensis	Annelida	Polychaeta	Lumbrineridae	7	0.36	19.35
Malmgreniella scriptoria	Annelida	Polychaeta	Polynoidae	7	0.36	19.35
Nephtys caecoides	Annelida	Polychaeta	Nephtyidae	7	0.36	3.23
Notomastus hemipodus	Annelida	Polychaeta	Capitellidae	7	0.36	16.13
Arhynchite californicus	Echiura	Echiuridea	Thalassematidae	6	0.31	16.13
Dougaloplus amphacanthus	Echinodermata	Ophiuroidea	Amphiuridae	6	0.31	12.90
Eunicidae	Annelida	Polychaeta	Eunicidae	6	0.31	6.45
Onuphis sp	Annelida	Polychaeta	Onuphidae	6	0.31	9.68
Phoronis sp	Phoronida		Phoronidae	6	0.31	12.90
Polynoidae	Annelida	Polychaeta	Polynoidae	6	0.31	16.13
Praxillella pacifica	Annelida	Polychaeta	Maldanidae	6	0.31	9.68
Scleroconcha trituberculata	Arthropoda	Ostracoda	Philomedidae	6	0.31	6.45
Spiophanes sp	Annelida	Polychaeta	Spionidae	6	0.31	9.68
Aglaophamus erectans	Annelida	Polychaeta	Nephtyidae	5	0.26	9.68
Brisaster latifrons	Echinodermata	Echinoidea	Schizasteridae	5	0.26	12.90
Brisaster sp	Echinodermata	Echinoidea	Schizasteridae	5	0.26	12.90
Calocarides quinqueseriatus	Arthropoda	Malacostraca	Axiidae	5	0.26	6.45
Euphilomedes producta	Arthropoda	Ostracoda	Philomedidae	5	0.26	12.90
Kurtiella sp D	Mollusca	Bivalvia	Lasaeidae	5	0.26	12.90

Pentamera pseudocalcigera	Echinodermata	Holothuroidea	Phyllophoridae	5	0.26	6.45
Pinnixa occidentalis Cmplx	Arthropoda	Malacostraca	Pinnotheridae	5	0.26	9.68
Spiophanes duplex	Annelida	Polychaeta	Spionidae	5	0.26	9.68
Tellina sp B	Mollusca	Bivalvia	Tellinidae	5	0.26	6.45
Yoldia seminuda	Mollusca	Bivalvia	Yoldiidae	5	0.26	12.90
Americhelidium shoemakeri	Arthropoda	Malacostraca	Oedicerotidae	4	0.21	3.23
Ampharete finmarchica	Annelida	Polychaeta	Ampharetidae	4	0.21	6.45
Amphiodia digitata	Echinodermata	Ophiuroidea	Amphiuridae	4	0.21	6.45
Chloeia pinnata	Annelida	Polychaeta	Amphinomidae	4	0.21	12.90
Columbellidae	Mollusca	Gastropoda	Columbellidae	4	0.21	3.23
Ennucula tenuis	Mollusca	Bivalvia	Nuculidae	4	0.21	9.68
Fauveliopsis glabra	Annelida	Polychaeta	Fauveliopsidae	4	0.21	6.45
Heteronemertea sp SD2	Nemertea	Anopla	uncertain	4	0.21	9.68
Leodice americana	Annelida	Polychaeta	Eunicidae	4	0.21	12.90
Maldane sp	Annelida	Polychaeta	Maldanidae	4	0.21	6.45
Malmgreniella baschi	Annelida	Polychaeta	Polynoidae	4	0.21	6.45
Myxoderma platyacanthum	Echinodermata	Asteroidea	Zoroasteridae	4	0.21	6.45
Neomediomastus glabrus	Annelida	Polychaeta	Capitellidae	4	0.21	3.23
Nicippe tumida	Arthropoda	Malacostraca	Pardaliscidae	4	0.21	9.68
Oligochaeta	Annelida	Oligochaeta		4	0.21	3.23
Parvilucina tenuisculpta	Mollusca	Bivalvia	Lucinidae	4	0.21	9.68
Rhodine bitorquata	Annelida	Polychaeta	Maldanidae	4	0.21	3.23
Streblosoma pacifica	Annelida	Polychaeta	Terebellidae	4	0.21	6.45
Thyasira flexuosa	Mollusca	Bivalvia	Thyasiridae	4	0.21	12.90
Volvulella cylindrica	Mollusca	Gastropoda	Retusidae	4	0.21	9.68
Amage scutata	Annelida	Polychaeta	Ampharetidae	3	0.16	3.23
Ampelisca careyi	Arthropoda	Malacostraca	Ampeliscidae	3	0.16	3.23
Ampelisca unsocalae	Arthropoda	Malacostraca	Ampeliscidae	3	0.16	3.23

Anobothrus gracilis	Annelida	Polychaeta	Ampharetidae	3	0.16	3.23
Aricidea (Strelzovia) antennata	Annelida	Polychaeta	Paraonidae	3	0.16	9.68
Bivalvia	Mollusca	Bivalvia		3	0.16	6.45
Cadulus californicus	Mollusca	Scaphopoda	Gadilidae	3	0.16	3.23
Dendrochirotida	Echinodermata	Holothuroidea		3	0.16	3.23
Listriolobus hexamyotus	Echiura	Echiuridea	Thalassematidae	3	0.16	6.45
Lumbrineris sp	Annelida	Polychaeta	Lumbrineridae	3	0.16	6.45
Malmgreniella nigralba	Annelida	Polychaeta	Polynoidae	3	0.16	3.23
Philine auriformis	Mollusca	Gastropoda	Philinidae	3	0.16	3.23
Prionospio jubata	Annelida	Polychaeta	Spionidae	3	0.16	3.23
Protomedeia articulata Cmplx	Arthropoda	Malacostraca	Corophiidae	3	0.16	9.68
Tubulanus polymorphus	Nemertea	Anopla	Tubulanidae	3	0.16	9.68
Aphelochaeta williamsae	Annelida	Polychaeta	Cirratulidae	2	0.10	3.23
Araphura breviaria	Arthropoda	Malacostraca	Tanaellidae	2	0.10	3.23
Araphura cuspirostris	Arthropoda	Malacostraca	Tanaellidae	2	0.10	3.23
Bathymedon kassites	Arthropoda	Malacostraca	Oedicerotidae	2	0.10	6.45
Ceriantharia	Cnidaria	Anthozoa		2	0.10	6.45
Chaetodermatida	Mollusca	Caudofoveata		2	0.10	6.45
Chaetopteridae	Annelida	Polychaeta	Chaetopteridae	2	0.10	6.45
Cirrophorus branchiatus	Annelida	Polychaeta	Paraonidae	2	0.10	6.45
Decamastus gracilis	Annelida	Polychaeta	Capitellidae	2	0.10	3.23
Diastylis pellucida	Arthropoda	Malacostraca	Diastylidae	2	0.10	6.45
Drilonereis sp	Annelida	Polychaeta	Oenonidae	2	0.10	6.45
Echiura	Echiura			2	0.10	6.45
Eudorella pacifica	Arthropoda	Malacostraca	Leuconidae	2	0.10	6.45
Falcidens longus	Mollusca	Caudofoveata	Falcidentidae	2	0.10	3.23
Glycera americana	Annelida	Polychaeta	Glyceridae	2	0.10	3.23
Goniada brunnea	Annelida	Polychaeta	Goniadidae	2	0.10	6.45

Haliophasma geminata	Arthropoda	Malacostraca	Anthuridae	2	0.10	6.45
Harpiniopsis epistomata	Arthropoda	Malacostraca	Phoxocephalidae	2	0.10	3.23
Hesperonoe laevis	Annelida	Polychaeta	Polynoidae	2	0.10	6.45
Heteromastus sp	Annelida	Polychaeta	Capitellidae	2	0.10	3.23
Heterophoxus ellisi	Arthropoda	Malacostraca	Phoxocephalidae	2	0.10	6.45
Kirkegaardia tesselata	Annelida	Polychaeta	Cirratulidae	2	0.10	6.45
Laonice cirrata	Annelida	Polychaeta	Spionidae	2	0.10	6.45
Levinsenia kirbyae	Annelida	Polychaeta	Paraonidae	2	0.10	3.23
Levinsenia oculata	Annelida	Polychaeta	Paraonidae	2	0.10	6.45
Lirobittium paganicum	Mollusca	Gastropoda	Cerithiidae	2	0.10	3.23
Listriella albina	Arthropoda	Malacostraca	Liljeborgiidae	2	0.10	6.45
Lucinoma aequizonatum	Mollusca	Bivalvia	Lucinidae	2	0.10	3.23
Malmgreniella sanpedroensis	Annelida	Polychaeta	Polynoidae	2	0.10	6.45
Myriochele olgae	Annelida	Polychaeta	Oweniidae	2	0.10	6.45
Nereididae	Annelida	Polychaeta	Nereididae	2	0.10	3.23
Notomastus magnus	Annelida	Polychaeta	Capitellidae	2	0.10	3.23
Ophelina pallida	Annelida	Polychaeta	Opheliidae	2	0.10	3.23
Paradialychone ecaudata	Annelida	Polychaeta	Sabellidae	2	0.10	6.45
Petaloclymene pacifica	Annelida	Polychaeta	Maldanidae	2	0.10	3.23
Pherusa neopapillata	Annelida	Polychaeta	Flabelligeridae	2	0.10	3.23
Photis sp	Arthropoda	Malacostraca	Photidae	2	0.10	6.45
Pista sp	Annelida	Polychaeta	Terebellidae	2	0.10	3.23
Prachynella lodo	Arthropoda	Malacostraca	Pakynidae	2	0.10	6.45
Rhachotropis distincta	Arthropoda	Malacostraca	Eusiridae	2	0.10	6.45
Rhepoxynius bicuspidatus	Arthropoda	Malacostraca	Phoxocephalidae	2	0.10	3.23
Samytha californiensis	Annelida	Polychaeta	Ampharetidae	2	0.10	6.45
Spatangoida	Echinodermata	Echinoidea		2	0.10	6.45
Strongylocentrotus fragilis	Echinodermata	Echinoidea	Strongylocentrotidae	2	0.10	6.45

Subadyte mexicana	Annelida	Polychaeta	Polynoidae	2	0.10	6.45
Terebellides sp	Annelida	Polychaeta	Trichobranchidae	2	0.10	6.45
Thysanocardia nigra	Sipuncula	Sipunculidea	Golfingiidae	2	0.10	6.45
Travisia brevis	Annelida	Polychaeta	Travisiidae	2	0.10	3.23
Travisia pupa	Annelida	Polychaeta	Travisiidae	2	0.10	6.45
Tritia insculpta	Mollusca	Gastropoda	Nassariidae	2	0.10	6.45
Westwoodilla tone	Arthropoda	Malacostraca	Oedicerotidae	2	0.10	6.45
Actiniaria	Cnidaria	Anthozoa		1	0.05	3.23
Acuminodeutopus heteruropus	Arthropoda	Malacostraca	Unciolidae	1	0.05	3.23
Adontorhina cyclia	Mollusca	Bivalvia	Thyasiridae	1	0.05	3.23
Amblyops abbreviatus	Arthropoda	Malacostraca	Mysidae	1	0.05	3.23
Ampelisca agassizi	Arthropoda	Malacostraca	Ampeliscidae	1	0.05	3.23
Ampelisca pacifica	Arthropoda	Malacostraca	Ampeliscidae	1	0.05	3.23
Ampelisca pugetica	Arthropoda	Malacostraca	Ampeliscidae	1	0.05	3.23
Ampharetidae	Annelida	Polychaeta	Ampharetidae	1	0.05	3.23
Amphicteis glabra	Annelida	Polychaeta	Ampharetidae	1	0.05	3.23
Amphiodia urtica	Echinodermata	Ophiuroidea	Amphiuridae	1	0.05	3.23
Amphioplus strongyloplax	Echinodermata	Ophiuroidea	Amphiuridae	1	0.05	3.23
Amphisamytha bioculata	Annelida	Polychaeta	Ampharetidae	1	0.05	3.23
Amphitrite robusta	Annelida	Polychaeta	Terebellidae	1	0.05	3.23
Amphiura sp	Echinodermata	Ophiuroidea	Amphiuridae	1	0.05	3.23
Antiplanes catalinae	Mollusca	Gastropoda	Pseudomelatomidae	1	0.05	3.23
Aoroides sp A	Arthropoda	Malacostraca	Aoridae	1	0.05	3.23
Aphelochaeta petersenae	Annelida	Polychaeta	Cirratulidae	1	0.05	3.23
Aphelochaeta sp	Annelida	Polychaeta	Cirratulidae	1	0.05	3.23
Aricidea (Strelzovia) sp A	Annelida	Polychaeta	Paraonidae	1	0.05	3.23
Asteroidea	Echinodermata	Asteroidea		1	0.05	3.23
Balcis micans	Mollusca	Gastropoda	Eulimidae	1	0.05	3.23

Campylaspis rubromaculata	Arthropoda	Malacostraca	Nannastacidae	1	0.05	3.23
Caprella mendax	Arthropoda	Malacostraca	Caprellidae	1	0.05	3.23
Cerebratulus marginatus	Nemertea	Anopla	Lineidae	1	0.05	3.23
Chaetoderma elegans	Mollusca	Caudofoveata	Chaetodermidae	1	0.05	3.23
Chaetozone sp	Annelida	Polychaeta	Cirratulidae	1	0.05	3.23
Chiridota sp	Echinodermata	Holothuroidea	Chiridotidae	1	0.05	3.23
Cirratulidae	Annelida	Polychaeta	Cirratulidae	1	0.05	3.23
Cirratulus multioculatus	Annelida	Polychaeta	Cirratulidae	1	0.05	3.23
Corophiida	Arthropoda	Malacostraca		1	0.05	3.23
Cossura sp A	Annelida	Polychaeta	Cossuridae	1	0.05	3.23
Crockerella evadne	Mollusca	Gastropoda	Clathurellidae	1	0.05	3.23
Cylichna diegensis	Mollusca	Gastropoda	Cylichnidae	1	0.05	3.23
Dentalium vallicolens	Mollusca	Scaphopoda	Dentaliidae	1	0.05	3.23
Dermatomya sp	Mollusca	Bivalvia	Poromyidae	1	0.05	3.23
Dipolydora sp	Annelida	Polychaeta	Spionidae	1	0.05	3.23
Distichoptilum gracile	Cnidaria	Anthozoa	Protoptilidae	1	0.05	3.23
Dorvillea (Dorvillea) sp	Annelida	Polychaeta	Dorvilleidae	1	0.05	3.23
Dorvilleidae	Annelida	Polychaeta	Dorvilleidae	1	0.05	3.23
Eucranta anoculata	Annelida	Polychaeta	Polynoidae	1	0.05	3.23
Eudorella sp	Arthropoda	Malacostraca	Leuconidae	1	0.05	3.23
Eurycope californiensis	Arthropoda	Malacostraca	Munnopsidae	1	0.05	3.23
Falcidens hartmanae	Mollusca	Caudofoveata	Falcidentidae	1	0.05	3.23
Fauveliopsis sp	Annelida	Polychaeta	Fauveliopsidae	1	0.05	3.23
Fauveliopsis sp SD1	Annelida	Polychaeta	Fauveliopsidae	1	0.05	3.23
Galathowenia pygidialis	Annelida	Polychaeta	Oweniidae	1	0.05	3.23
Gastropteron pacificum	Mollusca	Gastropoda	Gastropteridae	1	0.05	3.23
Glycera branchiopoda	Annelida	Polychaeta	Glyceridae	1	0.05	3.23
Glycera oxycephala	Annelida	Polychaeta	Glyceridae	1	0.05	3.23

Gnathiidae	Arthropoda	Malacostraca	Gnathiidae	1	0.05	3.23
Gymnonereis crosslandi	Annelida	Polychaeta	Nereididae	1	0.05	3.23
Halcampa decemtentaculata	Cnidaria	Anthozoa	Halcampidae	1	0.05	3.23
Halcampa sp	Cnidaria	Anthozoa	Halcampidae	1	0.05	3.23
Heterophoxus affinis	Arthropoda	Malacostraca	Phoxocephalidae	1	0.05	3.23
Hippomedon sp A	Arthropoda	Malacostraca	Lysianassidae	1	0.05	3.23
Hippomedon zetesimus	Arthropoda	Malacostraca	Lysianassidae	1	0.05	3.23
Hyboscolex sp	Annelida	Polychaeta	Scalibregmatidae	1	0.05	3.23
Ilyarachna acarina	Arthropoda	Malacostraca	Munnopsidae	1	0.05	3.23
Jassa slatteryi	Arthropoda	Malacostraca	Ischyroceridae	1	0.05	3.23
Kirkegaardia cryptica	Annelida	Polychaeta	Cirratulidae	1	0.05	3.23
Kurtiella sp	Mollusca	Bivalvia	Lasaeidae	1	0.05	3.23
Lanassa venusta	Annelida	Polychaeta	Terebellidae	1	0.05	3.23
Laonice nuchala	Annelida	Polychaeta	Spionidae	1	0.05	3.23
Leitoscoloplos sp	Annelida	Polychaeta	Orbiniidae	1	0.05	3.23
Leucon declivis	Arthropoda	Malacostraca	Leuconidae	1	0.05	3.23
Leucon magnadentata	Arthropoda	Malacostraca	Leuconidae	1	0.05	3.23
Levinsenia multibranchiata	Annelida	Polychaeta	Paraonidae	1	0.05	3.23
Lineus bilineatus	Nemertea	Anopla	Lineidae	1	0.05	3.23
Listriella goleta	Arthropoda	Malacostraca	Liljeborgiidae	1	0.05	3.23
Lucinoma annulatum	Mollusca	Bivalvia	Lucinidae	1	0.05	3.23
Lumbrineris japonica	Annelida	Polychaeta	Lumbrineridae	1	0.05	3.23
Macoma sp	Mollusca	Bivalvia	Tellinidae	1	0.05	3.23
Magelona sp	Annelida	Polychaeta	Magelonidae	1	0.05	3.23
Malmgreniella sp	Annelida	Polychaeta	Polynoidae	1	0.05	3.23
Malmgreniella sp A	Annelida	Polychaeta	Polynoidae	1	0.05	3.23
Mesochaetopterus sp	Annelida	Polychaeta	Chaetopteridae	1	0.05	3.23
Metasychis disparidentatus	Annelida	Polychaeta	Maldanidae	1	0.05	3.23

Mysidae	Arthropoda	Malacostraca	Mysidae	1	0.05	3.23
Nellobia eusoma	Echiura	Echiuridea	Bonelliidae	1	0.05	3.23
Nereis sp A	Annelida	Polychaeta	Nereididae	1	0.05	3.23
Nereis sp SD1	Annelida	Polychaeta	Nereididae	1	0.05	3.23
Ninoe sp	Annelida	Polychaeta	Lumbrineridae	1	0.05	3.23
Nuculana conceptionis	Mollusca	Bivalvia	Nuculanidae	1	0.05	3.23
Nuculana sp A	Mollusca	Bivalvia	Nuculanidae	1	0.05	3.23
Nuculana sp B	Mollusca	Bivalvia	Nuculanidae	1	0.05	3.23
Onuphis sp A	Annelida	Polychaeta	Onuphidae	1	0.05	3.23
Ophelina acuminata	Annelida	Polychaeta	Opheliidae	1	0.05	3.23
Ophiura luetkenii	Echinodermata	Ophiuroidea	Ophiuridae	1	0.05	3.23
Pandora bilirata	Mollusca	Bivalvia	Pandoridae	1	0.05	3.23
Paradiopatra parva	Annelida	Polychaeta	Onuphidae	1	0.05	3.23
Paranemertes californica	Nemertea	Enopla	Emplectonematidae	1	0.05	3.23
Pentamera populifera	Echinodermata	Holothuroidea	Phyllophoridae	1	0.05	3.23
Phascolion sp A	Sipuncula	Sipunculidea	Phascolionidae	1	0.05	3.23
Philine polystrigma	Mollusca	Gastropoda	Philinidae	1	0.05	3.23
Phoronidae	Phoronida		Phoronidae	1	0.05	3.23
Photis bifurcata	Arthropoda	Malacostraca	Photidae	1	0.05	3.23
Photis parvidons	Arthropoda	Malacostraca	Photidae	1	0.05	3.23
Phyllodoce groenlandica	Annelida	Polychaeta	Phyllodocidae	1	0.05	3.23
Phyllodoce hartmanae	Annelida	Polychaeta	Phyllodocidae	1	0.05	3.23
Phyllodoce sp	Annelida	Polychaeta	Phyllodocidae	1	0.05	3.23
Pinnotheridae	Arthropoda	Malacostraca	Pinnotheridae	1	0.05	3.23
Pista disjuncta	Annelida	Polychaeta	Terebellidae	1	0.05	3.23
Pliocardia stearnsii	Mollusca	Bivalvia	Vesicomyidae	1	0.05	3.23
Podarkeopsis glabrus	Annelida	Polychaeta	Hesionidae	1	0.05	3.23
Podarkeopsis perkinsi	Annelida	Polychaeta	Hesionidae	1	0.05	3.23

Polycirrus californicus	Annelida	Polychaeta	Terebellidae	1	0.05	3.23
Polycirrus sp	Annelida	Polychaeta	Terebellidae	1	0.05	3.23
Polycladida	Platyhelminthes	Turbellaria		1	0.05	3.23
Prionospio sp	Annelida	Polychaeta	Spionidae	1	0.05	3.23
Rhachotropis barnardi	Arthropoda	Malacostraca	Eusiridae	1	0.05	3.23
Rhepoxynius abronius	Arthropoda	Malacostraca	Phoxocephalidae	1	0.05	3.23
Saxicavella sp	Mollusca	Bivalvia	Hiatellidae	1	0.05	3.23
Schisturella sp	Arthropoda	Malacostraca	Uristidae	1	0.05	3.23
Sige sp A	Annelida	Polychaeta	Phyllodocidae	1	0.05	3.23
Spionidae	Annelida	Polychaeta	Spionidae	1	0.05	3.23
Spirontocaris sp	Arthropoda	Malacostraca	Hippolytidae	1	0.05	3.23
Syllidae	Annelida	Polychaeta	Syllidae	1	0.05	3.23
Tanaidacea	Arthropoda	Malacostraca		1	0.05	3.23
Tanaopsis cadieni	Arthropoda	Malacostraca	Tanaopsidae	1	0.05	3.23
Tellina sp	Mollusca	Bivalvia	Tellinidae	1	0.05	3.23
Tellinidae	Mollusca	Bivalvia	Tellinidae	1	0.05	3.23
Terebellidae	Annelida	Polychaeta	Terebellidae	1	0.05	3.23
Terebellides californica	Annelida	Polychaeta	Trichobranchidae	1	0.05	3.23
Thyasiridae	Mollusca	Bivalvia	Thyasiridae	1	0.05	3.23
Tubulanidae	Nemertea	Anopla	Tubulanidae	1	0.05	3.23
Virgulariidae	Cnidaria	Anthozoa	Virgulariidae	1	0.05	3.23
Volvulella californica	Mollusca	Gastropoda	Retusidae	1	0.05	3.23
Volvulella sp	Mollusca	Gastropoda	Retusidae	1	0.05	3.23
Waldo arthuri	Mollusca	Bivalvia	Galeommatidae	1	0.05	3.23
Yoldiella nana	Mollusca	Bivalvia	Yoldiidae	1	0.05	3.23

Appendix A11. Macrobenthic community summary for the Lower Slope stratum in the Bight'18 survey. Total abundance from all samples, relative abundance across the stratum, and the frequency of occurrence within a stratum are presented. Taxa are ranked by total abundance.

Taxon	Phylum	Class	Family	Total Abundance	Relative Abundance (%)	Frequency of Occurrence (%)
Mendicula ferruginosa	Mollusca	Bivalvia	Thyasiridae	36	4.43	33.33
Stereobalanus sp	Chordata	Enteropneusta	Harrimaniidae	36	4.43	33.33
Byblis barbarensis	Arthropoda	Malacostraca	Ampeliscidae	26	3.20	18.52
Maldane californiensis	Annelida	Polychaeta	Maldanidae	23	2.83	40.74
Ophiuroidea	Echinodermata	Ophiuroidea		22	2.71	44.44
Kirkegaardia cryptica	Annelida	Polychaeta	Cirratulidae	22	2.71	22.22
Ampharetidae	Annelida	Polychaeta	Ampharetidae	21	2.59	18.52
Aricidea (Acmira) rubra	Annelida	Polychaeta	Paraonidae	17	2.09	37.04
Kirkegaardia sp LA1	Annelida	Polychaeta	Cirratulidae	16	1.97	18.52
Eclysippe trilobata	Annelida	Polychaeta	Ampharetidae	15	1.85	11.11
Harpiniopsis epistomata	Arthropoda	Malacostraca	Phoxocephalidae	14	1.72	29.63
Enteropneusta	Chordata	Enteropneusta		14	1.72	18.52
Bivalvia	Mollusca	Bivalvia		13	1.60	33.33
Maldanidae	Annelida	Polychaeta	Maldanidae	12	1.48	22.22
Euclymeninae sp A	Annelida	Polychaeta	Maldanidae	12	1.48	14.81
Aricidea (Acmira) sp LA1	Annelida	Polychaeta	Paraonidae	12	1.48	7.41
Yoldiella nana	Mollusca	Bivalvia	Yoldiidae	10	1.23	25.93
Cerebratulus sp	Nemertea	Anopla	Lineidae	10	1.23	22.22
Amphiuridae	Echinodermata	Ophiuroidea	Amphiuridae	10	1.23	18.52
Phyllochaetopterus sp	Annelida	Polychaeta	Chaetopteridae	10	1.23	11.11
Protis pacifica	Annelida	Polychaeta	Serpulidae	10	1.23	11.11

Leiochrides hemipodus	Annelida	Polychaeta	Capitellidae	9	1.11	22.22
Levinsenia oculata	Annelida	Polychaeta	Paraonidae	9	1.11	18.52
Bathyleberis sp	Arthropoda	Ostracoda	Cylindroleberididae	9	1.11	14.81
Maldane sarsi	Annelida	Polychaeta	Maldanidae	9	1.11	11.11
Aphelochaeta phillipsi	Annelida	Polychaeta	Cirratulidae	9	1.11	7.41
Lysippe annectens	Annelida	Polychaeta	Ampharetidae	9	1.11	7.41
Kurtiella sp D	Mollusca	Bivalvia	Lasaeidae	9	1.11	3.70
Leucon bishopi	Arthropoda	Malacostraca	Leuconidae	8	0.99	18.52
Aphelochaeta monilaris	Annelida	Polychaeta	Cirratulidae	8	0.99	7.41
Limifossor fratula	Mollusca	Caudofoveata	Limifossoridae	7	0.86	22.22
Aricidea (Strelzovia) monicae	Annelida	Polychaeta	Paraonidae	7	0.86	14.81
Myriochele gracilis	Annelida	Polychaeta	Oweniidae	7	0.86	11.11
Oligochaeta	Annelida	Oligochaeta		7	0.86	7.41
Terebellides sp	Annelida	Polychaeta	Trichobranchidae	7	0.86	7.41
Edwardsia profunda	Cnidaria	Anthozoa	Edwardsiidae	6	0.74	18.52
Prionospio ehlersi	Annelida	Polychaeta	Spionidae	6	0.74	18.52
Astyris permodesta	Mollusca	Gastropoda	Columbellidae	6	0.74	14.81
Cephalophoxoides homilis	Arthropoda	Malacostraca	Phoxocephalidae	6	0.74	7.41
Glycinde armigera	Annelida	Polychaeta	Goniadidae	6	0.74	7.41
Ophiopholis sp	Echinodermata	Ophiuroidea	Ophiactidae	6	0.74	3.70
Phoronis sp	Phoronida		Phoronidae	6	0.74	3.70
Tubulanus polymorphus	Nemertea	Anopla	Tubulanidae	5	0.62	18.52
Lineidae	Nemertea	Anopla	Lineidae	5	0.62	14.81
Myriochele olgae	Annelida	Polychaeta	Oweniidae	5	0.62	14.81
Aphelochaeta sp LA3	Annelida	Polychaeta	Cirratulidae	5	0.62	11.11
Cirratulidae	Annelida	Polychaeta	Cirratulidae	5	0.62	7.41
Sonatsa carinata	Annelida	Polychaeta	Maldanidae	5	0.62	7.41
Actiniaria	Cnidaria	Anthozoa		4	0.49	14.81

Falcidens hartmanae	Mollusca	Caudofoveata	Falcidentidae	4	0.49	14.81
Leucon declivis	Arthropoda	Malacostraca	Leuconidae	4	0.49	14.81
Adontorhina cyclia	Mollusca	Bivalvia	Thyasiridae	4	0.49	11.11
Ampelisca unsocalae	Arthropoda	Malacostraca	Ampeliscidae	4	0.49	11.11
Aphelochaeta sp	Annelida	Polychaeta	Cirratulidae	4	0.49	11.11
Axinodon redondoensis	Mollusca	Bivalvia	Thyasiridae	4	0.49	11.11
Califia calida	Annelida	Polychaeta	Orbiniidae	4	0.49	11.11
Dodecamastus mariaensis	Annelida	Polychaeta	Capitellidae	4	0.49	7.41
Pista wui	Annelida	Polychaeta	Terebellidae	4	0.49	7.41
Aricidea sp	Annelida	Polychaeta	Paraonidae	4	0.49	3.70
Trichobranchidae sp LA1	Annelida	Polychaeta	Trichobranchidae	4	0.49	3.70
Pennatula phosphorea	Cnidaria	Anthozoa	Pennatulidae	3	0.37	11.11
Spathoderma californicum	Mollusca	Caudofoveata	Prochaetodermatidae	3	0.37	11.11
Ampelisca hancocki	Arthropoda	Malacostraca	Ampeliscidae	3	0.37	7.41
Cadulus californicus	Mollusca	Scaphopoda	Gadilidae	3	0.37	7.41
Cerebratulus californiensis	Nemertea	Anopla	Lineidae	3	0.37	7.41
Jasmineira sp LA1	Annelida	Polychaeta	Sabellidae	3	0.37	7.41
Leitoscoloplos sp A	Annelida	Polychaeta	Orbiniidae	3	0.37	7.41
Mayerella banksia	Arthropoda	Malacostraca	Caprellidae	3	0.37	7.41
Spionidae	Annelida	Polychaeta	Spionidae	3	0.37	7.41
Spiophanes fimbriata	Annelida	Polychaeta	Spionidae	3	0.37	7.41
Tritella tenuissima	Arthropoda	Malacostraca	Caprellidae	3	0.37	7.41
Amphipholis squamata	Echinodermata	Ophiuroidea	Amphiuridae	3	0.37	3.70
Brada pilosa	Annelida	Polychaeta	Flabelligeridae	3	0.37	3.70
Cossura sp	Annelida	Polychaeta	Cossuridae	3	0.37	3.70
Eurycope californiensis	Arthropoda	Malacostraca	Munnopsidae	3	0.37	3.70
Hemilamprops sp	Arthropoda	Malacostraca	Lampropidae	3	0.37	3.70
Kirkegaardia serratiseta	Annelida	Polychaeta	Cirratulidae	3	0.37	3.70

Ophiopholis longispina	Echinodermata	Ophiuroidea	Ophiactidae	3	0.37	3.70
Abyssorchomene abyssorum	Arthropoda	Malacostraca	Uristidae	2	0.25	7.41
Amage longibranchiata	Annelida	Polychaeta	Ampharetidae	2	0.25	7.41
Amphiura arcystata	Echinodermata	Ophiuroidea	Amphiuridae	2	0.25	7.41
Aphelochaeta williamsae	Annelida	Polychaeta	Cirratulidae	2	0.25	7.41
Caprella californica Cmplx	Arthropoda	Malacostraca	Caprellidae	2	0.25	7.41
Cirrophorus branchiatus	Annelida	Polychaeta	Paraonidae	2	0.25	7.41
Cumacea	Arthropoda	Malacostraca		2	0.25	7.41
Decamastus gracilis	Annelida	Polychaeta	Capitellidae	2	0.25	7.41
Fauveliopsis glabra	Annelida	Polychaeta	Fauveliopsidae	2	0.25	7.41
Flabelligeridae	Annelida	Polychaeta	Flabelligeridae	2	0.25	7.41
Glycera nana	Annelida	Polychaeta	Glyceridae	2	0.25	7.41
Harpiniopsis naiadis	Arthropoda	Malacostraca	Phoxocephalidae	2	0.25	7.41
Leptosynapta sp	Echinodermata	Holothuroidea	Synaptidae	2	0.25	7.41
Megayoldia sp	Mollusca	Bivalvia	Yoldiidae	2	0.25	7.41
Ophelina pallida	Annelida	Polychaeta	Opheliidae	2	0.25	7.41
Paraphoxus sp 1	Arthropoda	Malacostraca	Phoxocephalidae	2	0.25	7.41
Polynoidae	Annelida	Polychaeta	Polynoidae	2	0.25	7.41
Scaphopoda	Mollusca	Scaphopoda		2	0.25	7.41
Syllidae	Annelida	Polychaeta	Syllidae	2	0.25	7.41
Terebellides sp Type C	Annelida	Polychaeta	Trichobranchidae	2	0.25	7.41
Thyasiridae	Mollusca	Bivalvia	Thyasiridae	2	0.25	7.41
Ypsilothuria bitentaculata	Echinodermata	Holothuroidea	Ypsilothuriidae	2	0.25	7.41
Adontorhina lynnae	Mollusca	Bivalvia	Thyasiridae	2	0.25	3.70
Aglaophamus erectans	Annelida	Polychaeta	Nephtyidae	2	0.25	3.70
Amphiura diomedeae	Echinodermata	Ophiuroidea	Amphiuridae	2	0.25	3.70
Aricidea (Strelzovia) sp A	Annelida	Polychaeta	Paraonidae	2	0.25	3.70
Aristias sp	Arthropoda	Malacostraca	Aristiidae	2	0.25	3.70

Cerebratulus marginatus	Nemertea	Anopla	Lineidae	2	0.25	3.70
Galathowenia pygidialis	Annelida	Polychaeta	Oweniidae	2	0.25	3.70
Leucon sp	Arthropoda	Malacostraca	Leuconidae	2	0.25	3.70
Myxoderma platyacanthum	Echinodermata	Asteroidea	Zoroasteridae	2	0.25	3.70
Neomediomastus glabrus	Annelida	Polychaeta	Capitellidae	2	0.25	3.70
Acharax johnsoni	Mollusca	Bivalvia	Solemyidae	1	0.12	3.70
Actiniaria sp DC2	Cnidaria	Anthozoa		1	0.12	3.70
Aglaophamus paucilamellata	Annelida	Polychaeta	Nephtyidae	1	0.12	3.70
Amage sp	Annelida	Polychaeta	Ampharetidae	1	0.12	3.70
Ampharete sp	Annelida	Polychaeta	Ampharetidae	1	0.12	3.70
Amphipoda	Arthropoda	Malacostraca		1	0.12	3.70
Amphissa bicolor	Mollusca	Gastropoda	Columbellidae	1	0.12	3.70
Anthozoa	Cnidaria	Anthozoa		1	0.12	3.70
Aphelochaeta sp LA4	Annelida	Polychaeta	Cirratulidae	1	0.12	3.70
Aphelochaeta sp LA5	Annelida	Polychaeta	Cirratulidae	1	0.12	3.70
Aricidea (Acmira) catherinae	Annelida	Polychaeta	Paraonidae	1	0.12	3.70
Aricidea (Acmira) lopezi	Annelida	Polychaeta	Paraonidae	1	0.12	3.70
Aricidea (Acmira) sp	Annelida	Polychaeta	Paraonidae	1	0.12	3.70
Aricidea (Strelzovia) sp	Annelida	Polychaeta	Paraonidae	1	0.12	3.70
Asabellides cornuta	Annelida	Polychaeta	Ampharetidae	1	0.12	3.70
Asteronyx longifissus	Echinodermata	Ophiuroidea	Asteronychidae	1	0.12	3.70
Bathymedon covilhani	Arthropoda	Malacostraca	Oedicerotidae	1	0.12	3.70
Bathymedon pumilus	Arthropoda	Malacostraca	Oedicerotidae	1	0.12	3.70
Bipalponephtys cornuta	Annelida	Polychaeta	Nephtyidae	1	0.12	3.70
Brisaster sp	Echinodermata	Echinoidea	Schizasteridae	1	0.12	3.70
Brissopsis pacifica	Echinodermata	Echinoidea	Brissidae	1	0.12	3.70
Brissopsis sp LA1	Echinodermata	Echinoidea	Brissidae	1	0.12	3.70
Campylaspis sp B	Arthropoda	Malacostraca	Nannastacidae	1	0.12	3.70

Cardiomya planetica	Mollusca	Bivalvia	Cuspidariidae	1	0.12	3.70
Chaetozone sp	Annelida	Polychaeta	Cirratulidae	1	0.12	3.70
Columbellidae	Mollusca	Gastropoda	Columbellidae	1	0.12	3.70
Compressidens stearnsii	Mollusca	Scaphopoda		1	0.12	3.70
Cossura candida	Annelida	Polychaeta	Cossuridae	1	0.12	3.70
Dacrydium pacificum	Mollusca	Bivalvia	Mytilidae	1	0.12	3.70
Delectopecten vancouverensis	Mollusca	Bivalvia	Pectinidae	1	0.12	3.70
Echinoidea	Echinodermata	Echinoidea		1	0.12	3.70
Ennucula tenuis	Mollusca	Bivalvia	Nuculidae	1	0.12	3.70
Euchone sp A	Annelida	Polychaeta	Sabellidae	1	0.12	3.70
Eucranta anoculata	Annelida	Polychaeta	Polynoidae	1	0.12	3.70
Eucranta sp	Annelida	Polychaeta	Polynoidae	1	0.12	3.70
Eudorella pacifica	Arthropoda	Malacostraca	Leuconidae	1	0.12	3.70
Eudorella truncatula	Arthropoda	Malacostraca	Leuconidae	1	0.12	3.70
Euphilomedes longiseta	Arthropoda	Ostracoda	Philomedidae	1	0.12	3.70
Fauveliopsis sp SD1	Annelida	Polychaeta	Fauveliopsidae	1	0.12	3.70
Foxiphalus sp	Arthropoda	Malacostraca	Phoxocephalidae	1	0.12	3.70
Gastropoda	Mollusca	Gastropoda		1	0.12	3.70
Glycera branchiopoda	Annelida	Polychaeta	Glyceridae	1	0.12	3.70
Glyphanostomum pallescens	Annelida	Polychaeta	Ampharetidae	1	0.12	3.70
Harmothoe sp LA1	Annelida	Polychaeta	Polynoidae	1	0.12	3.70
Harpiniopsis emeryi	Arthropoda	Malacostraca	Phoxocephalidae	1	0.12	3.70
Harpiniopsis fulgens	Arthropoda	Malacostraca	Phoxocephalidae	1	0.12	3.70
Hesionidae	Annelida	Polychaeta	Hesionidae	1	0.12	3.70
Heteronemertea	Nemertea	Anopla		1	0.12	3.70
Heteronemertea sp SD2	Nemertea	Anopla	uncertain	1	0.12	3.70
Heterophoxus affinis	Arthropoda	Malacostraca	Phoxocephalidae	1	0.12	3.70
Heterophoxus sp	Arthropoda	Malacostraca	Phoxocephalidae	1	0.12	3.70

Hexactinellida	Silicea	Hexactinellida		1	0.12	3.70
Ilyarachna profunda	Arthropoda	Malacostraca	Munnopsidae	1	0.12	3.70
Kirkegaardia siblina	Annelida	Polychaeta	Cirratulidae	1	0.12	3.70
Lepidonotus sp	Annelida	Polychaeta	Polynoidae	1	0.12	3.70
Levinsenia sp	Annelida	Polychaeta	Paraonidae	1	0.12	3.70
Listriella albina	Arthropoda	Malacostraca	Liljeborgiidae	1	0.12	3.70
Lucinoma annulatum	Mollusca	Bivalvia	Lucinidae	1	0.12	3.70
Lysippe sp	Annelida	Polychaeta	Ampharetidae	1	0.12	3.70
Lysippe sp B	Annelida	Polychaeta	Ampharetidae	1	0.12	3.70
Melinna heterodonta	Annelida	Polychaeta	Ampharetidae	1	0.12	3.70
Microglyphis brevicula	Mollusca	Gastropoda	Ringiculidae	1	0.12	3.70
Mysida	Arthropoda	Malacostraca		1	0.12	3.70
Neilonella mexicana	Mollusca	Bivalvia	Neilonellidae	1	0.12	3.70
Nicomache lumbricalis	Annelida	Polychaeta	Maldanidae	1	0.12	3.70
Ninoe sp	Annelida	Polychaeta	Lumbrineridae	1	0.12	3.70
Nuculanida	Mollusca	Bivalvia		1	0.12	3.70
Odostomia sp	Mollusca	Gastropoda	Pyramidellidae	1	0.12	3.70
Oediceropsis elsula	Arthropoda	Malacostraca	Oedicerotidae	1	0.12	3.70
Oedicerotidae	Arthropoda	Malacostraca	Oedicerotidae	1	0.12	3.70
Onuphidae	Annelida	Polychaeta	Onuphidae	1	0.12	3.70
Ophiacantha phragma	Echinodermata	Ophiuroidea	Ophiacanthidae	1	0.12	3.70
Ophiosphalma jolliense	Echinodermata	Ophiuroidea	Ophiuridae	1	0.12	3.70
Oweniidae	Annelida	Polychaeta	Oweniidae	1	0.12	3.70
Paraprionospio alata	Annelida	Polychaeta	Spionidae	1	0.12	3.70
Pennatulacea	Cnidaria	Anthozoa		1	0.12	3.70
Pentactinia californica	Cnidaria	Anthozoa	Halcampoididae	1	0.12	3.70
Petaloproctus neoborealis	Annelida	Polychaeta	Maldanidae	1	0.12	3.70
Pliocardia stearnsii	Mollusca	Bivalvia	Vesicomyidae	1	0.12	3.70

Praxillella gracilis	Annelida	Polychaeta	Maldanidae	1	0.12	3.70
Prionospio sp	Annelida	Polychaeta	Spionidae	1	0.12	3.70
Rhabdus rectius	Mollusca	Scaphopoda	Rhabdidae	1	0.12	3.70
Rhachotropis distincta	Arthropoda	Malacostraca	Eusiridae	1	0.12	3.70
Rhodine bitorquata	Annelida	Polychaeta	Maldanidae	1	0.12	3.70
Sabellidae	Annelida	Polychaeta	Sabellidae	1	0.12	3.70
Sergestidae	Arthropoda	Malacostraca	Sergestidae	1	0.12	3.70
Sigambra setosa	Annelida	Polychaeta	Pilargidae	1	0.12	3.70
Sigambra sp	Annelida	Polychaeta	Pilargidae	1	0.12	3.70
Solemya pervernicosa	Mollusca	Bivalvia	Solemyidae	1	0.12	3.70
Spiophanes wigleyi	Annelida	Polychaeta	Spionidae	1	0.12	3.70
Stachyptilum superbum	Cnidaria	Anthozoa	Stachyptilidae	1	0.12	3.70
Sternaspis williamsae	Annelida	Polychaeta	Sternaspidae	1	0.12	3.70
Streblosoma pacifica	Annelida	Polychaeta	Terebellidae	1	0.12	3.70
Stylatula sp A	Cnidaria	Anthozoa	Virgulariidae	1	0.12	3.70
Subadyte mexicana	Annelida	Polychaeta	Polynoidae	1	0.12	3.70
Syllis sp LA4	Annelida	Polychaeta	Syllidae	1	0.12	3.70
Trichobranchus hancocki	Annelida	Polychaeta	Trichobranchidae	1	0.12	3.70
Volvulella sp	Mollusca	Gastropoda	Retusidae	1	0.12	3.70
Yoldiella sp	Mollusca	Bivalvia	Yoldiidae	1	0.12	3.70

APPENDIX B – DETAILED SIMPER OUTPUT

Appendix B1. Detailed SIMPER output of the top 60% of taxa contributing to the disimilarity of Embayment assemblage samples to Deepwater assemblage samples, with the mean Bray-Curtis dissimilarity for each taxon, the amount each taxon contributes to the dissimilarity between assemblages, and the cumulative dissimilarity.

Taxon	Embayment Square Root Abundance	Deepwater Square Root Abundance	Mean Dissimilarity	% Contribution to Dissimilarity	% Cumulative Contribution
Musculista senhousia	2.74	0.00	2.59	2.62	2.62
Leitoscoloplos pugettensis	2.35	0.08	2.26	2.29	4.9
Scoletoma sp C	2.10	0.00	1.98	2.01	6.91
Pseudopolydora paucibranchiata	2.16	0.00	1.79	1.82	8.73
Scoletoma sp	1.77	0.00	1.76	1.78	10.5
Oligochaeta	1.64	0.10	1.73	1.75	12.26
Mediomastus sp	1.95	0.10	1.69	1.71	13.96
Theora lubrica	1.22	0.00	1.41	1.43	15.39
Exogone lourei	1.91	0.00	1.4	1.41	16.8
Acteocina carinata	1.31	0.00	1.39	1.4	18.2
Grandidierella japonica	1.26	0.00	1.35	1.36	19.57
Amphideutopus oculatus	1.36	0.00	1.24	1.25	20.82
Prionospio ehlersi	0.00	0.97	1.16	1.18	22
Phoronis sp	1.12	0.13	1.09	1.11	23.11
Cossura sp A	1.03	0.02	0.97	0.99	24.09
Fabricinuda limnicola	1.25	0.00	0.97	0.98	25.07
Maldane sarsi	0.00	0.76	0.84	0.85	25.93
Paraprionospio alata	0.29	0.65	0.79	0.8	26.72
Prionospio heterobranchia	0.92	0.00	0.78	0.79	27.51
Tagelus affinis	0.79	0.00	0.75	0.76	28.27

Laevicardium substriatum	0.70	0.00	0.74	0.75	29.02
Bipalponephtys cornuta	0.09	0.58	0.74	0.75	29.77
Chondrochelia dubia Cmplx	0.71	0.00	0.59	0.6	30.37
Maldanidae	0.48	0.29	0.59	0.6	30.97
Petaloclymene pacifica	0.70	0.02	0.58	0.59	31.56
Phoronidae	0.63	0.02	0.58	0.58	32.14
Neanthes acuminata Cmplx	0.66	0.00	0.57	0.58	32.72
Amphipholis squamata	0.70	0.03	0.57	0.58	33.3
Mayerella acanthopoda	0.50	0.00	0.56	0.57	33.87
Diplocirrus sp SD1	0.60	0.00	0.56	0.56	34.43
Glycera americana	0.56	0.02	0.54	0.54	34.98
Zeuxo normani Cmplx	0.74	0.00	0.54	0.54	35.52
Heterophoxus cf *ellisi*	0.49	0.00	0.53	0.54	36.05
Kirkegaardia siblina	0.55	0.02	0.53	0.53	36.59
Euchone limnicola	0.51	0.00	0.52	0.53	37.11
Tubulanus polymorphus	0.47	0.14	0.51	0.51	37.63
Actiniaria	0.65	0.09	0.5	0.51	38.14
Leitoscoloplos sp A	0.29	0.22	0.5	0.51	38.64
Rudilemboides stenopropodus	0.57	0.00	0.48	0.48	39.13
Monocorophium acherusicum	0.55	0.00	0.47	0.48	39.61
Lineidae	0.24	0.25	0.46	0.47	40.07
Monocorophium insidiosum	0.46	0.00	0.46	0.47	40.54
Lyonsia californica	0.47	0.00	0.43	0.43	40.97
Limifossor fratula	0.00	0.33	0.42	0.43	41.4
Scoletoma sp A	0.48	0.00	0.41	0.42	41.82
Streblospio benedicti	0.41	0.00	0.41	0.41	42.23
Kirkegaardia cryptica	0.19	0.21	0.4	0.41	42.64
Spiophanes duplex	0.43	0.04	0.4	0.41	43.05

Ophiuroidea	0.00	0.36	0.4	0.4	43.45
Leptosynapta sp	0.42	0.04	0.39	0.4	43.85
Aphelochaeta monilaris	0.06	0.34	0.39	0.4	44.25
Prionospio lighti	0.23	0.20	0.39	0.39	44.64
Byblis barbarensis	0.00	0.28	0.38	0.39	45.03
Paracerceis sculpta	0.57	0.00	0.38	0.39	45.41
Pista brevibranchiata	0.49	0.00	0.38	0.38	45.8
Tellina cadieni	0.31	0.00	0.37	0.38	46.18
Nassarius tiarula	0.32	0.00	0.37	0.38	46.55
Stereobalanus sp	0.00	0.29	0.37	0.38	46.93
Polydora cornuta	0.22	0.00	0.36	0.37	47.3
Eochelidium sp A	0.35	0.00	0.36	0.36	47.66
Bivalvia	0.11	0.21	0.35	0.36	48.01
Capitella capitata Cmplx	0.40	0.00	0.35	0.35	48.37
Mendicula ferruginosa	0.00	0.29	0.35	0.35	48.72
Maldane californiensis	0.00	0.27	0.35	0.35	49.07
Pista wui	0.15	0.23	0.34	0.34	49.42
Euclymeninae sp A	0.19	0.16	0.32	0.33	49.74
Diptera	0.11	0.00	0.31	0.32	50.06
Edwardsia californica	0.38	0.00	0.31	0.32	50.38
Glycinde armigera	0.01	0.28	0.3	0.31	50.69
Scleroplax granulata	0.31	0.00	0.3	0.31	51
Melinna heterodonta	0.00	0.27	0.3	0.31	51.3
Podocopa	0.15	0.00	0.3	0.3	51.61
Amphiuridae	0.11	0.23	0.3	0.3	51.91
Philine auriformis	0.29	0.03	0.29	0.3	52.21
Euphilomedes carcharodonta	0.38	0.00	0.29	0.3	52.51
Poecilochaetus martini	0.29	0.00	0.29	0.29	52.8

Laonice cirrata	0.27	0.04	0.28	0.28	53.09
Exogone sp A	0.34	0.00	0.28	0.28	53.37
Listriella goleta	0.29	0.02	0.28	0.28	53.65
Podocerus fulanus	0.44	0.00	0.28	0.28	53.93
Hartmanodes hartmanae	0.21	0.00	0.28	0.28	54.22
Cyclocardia ventricosa	0.00	0.21	0.28	0.28	54.49
Aricidea (Acmira) rubra	0.00	0.22	0.27	0.28	54.77
Eclysippe trilobata	0.00	0.22	0.27	0.28	55.05
Armandia brevis	0.43	0.00	0.27	0.28	55.33
Neotrypaea sp	0.22	0.00	0.27	0.27	55.6
Barleeia haliotiphila	0.48	0.00	0.27	0.27	55.87
Glycera nana	0.02	0.25	0.27	0.27	56.14
Ampharetidae	0.11	0.17	0.26	0.27	56.41
Oxyurostylis pacifica	0.28	0.00	0.26	0.27	56.67
Chaetozone corona	0.29	0.00	0.26	0.26	56.94
Harpiniopsis epistomata	0.00	0.20	0.26	0.26	57.2
Pectinaria californiensis	0.03	0.25	0.26	0.26	57.46
Brisaster townsendi	0.00	0.22	0.26	0.26	57.72
Acromegalomma pigmentum	0.31	0.00	0.25	0.25	57.97
Kirkegaardia sp LA1	0.00	0.15	0.25	0.25	58.22
Asthenothaerus diegensis	0.27	0.00	0.24	0.25	58.47
Anoplodactylus erectus	0.24	0.00	0.23	0.23	58.7
Philine ornatissima	0.21	0.00	0.23	0.23	58.93
Nereididae	0.22	0.02	0.23	0.23	59.16
Scoletoma sp B	0.25	0.00	0.22	0.23	59.39
Haminoea vesicula	0.20	0.00	0.22	0.23	59.61
Nuculana taphria	0.24	0.00	0.22	0.23	59.84
Saxicavella pacifica	0.00	0.20	0.22	0.23	60.07

Appendix B2. Detailed SIMPER output of the top 60% of taxa contributing to the disimilarity of Embayment assemblage samples to Offshore assemblage samples, with the mean Bray-Curtis dissimilarity for each taxon, the amount each taxon contributes to the dissimilarity between assemblages, and the cumulative dissimilarity.

Taxon	Embayment Square Root Abundance	Offshore Square Root Abundance	Mean Dissimilarity	% Contribution to Dissimilarity	% Cumulative Contribution
Spiophanes duplex	0.43	3.23	1.41	1.49	1.49
Mediomastus sp	1.95	2.99	1.33	1.40	2.90
Musculista senhousia	2.74	0.00	1.28	1.35	4.25
Leitoscoloplos pugettensis	2.35	0.20	1.12	1.18	5.44
Paraprionospio alata	0.29	1.91	1.03	1.09	6.52
Scoletoma sp C	2.10	0.02	0.99	1.05	7.57
Pseudopolydora paucibranchiata	2.16	0.00	0.95	1.00	8.57
Maldanidae	0.48	2.08	0.94	1.00	9.57
Scoletoma sp	1.77	0.44	0.90	0.95	10.52
Exogone lourei	1.91	0.33	0.84	0.89	11.42
Oligochaeta	1.64	0.22	0.82	0.87	12.29
Amphiodia urtica	0.21	1.63	0.81	0.86	13.15
Spiophanes kimballi	0.00	1.53	0.81	0.86	14.00
Amphideutopus oculatus	1.36	0.77	0.80	0.84	14.85
Spiophanes norrisi	0.00	1.62	0.77	0.81	15.66
Prionospio jubata	0.05	1.49	0.67	0.71	16.37
Chondrochelia dubia Cmplx	0.71	1.18	0.66	0.70	17.07
Amphiodia sp	0.18	1.29	0.64	0.68	17.75
Acteocina carinata	1.31	0.00	0.64	0.68	18.43
Theora lubrica	1.22	0.00	0.63	0.67	19.10
Phoronis sp	1.12	0.71	0.63	0.67	19.76

Grandidierella japonica	1.26	0.00	0.63	0.66	20.43
Amphiuridae	0.11	1.34	0.62	0.65	21.08
Cossura sp A	1.03	0.48	0.60	0.64	21.72
Petaloclymene pacifica	0.70	0.96	0.60	0.63	22.35
Kirkegaardia siblina	0.55	0.97	0.59	0.62	22.97
Euclymeninae sp A	0.19	1.17	0.58	0.61	23.58
Axinopsida serricata	0.00	1.09	0.54	0.58	24.15
Fabricinuda limnicola	1.25	0.00	0.53	0.56	24.72
Ampelisca brevisimulata	0.10	1.09	0.51	0.54	25.26
Euphilomedes carcharodonta	0.38	0.88	0.50	0.53	25.79
Paradiopatra parva	0.00	0.99	0.48	0.50	26.30
Aphelochaeta glandaria Cmplx	0.09	0.85	0.45	0.48	26.78
Tubulanus polymorphus	0.47	0.83	0.45	0.48	27.25
Prionospio dubia	0.00	0.99	0.45	0.47	27.73
Spiochaetopterus costarum Cmplx	0.11	0.94	0.44	0.47	28.20
Eclysippe trilobata	0.00	0.96	0.43	0.46	28.65
Tellina sp B	0.15	0.81	0.42	0.44	29.09
Parvilucina tenuisculpta	0.03	0.90	0.41	0.44	29.53
Tellina carpenteri	0.00	0.87	0.41	0.43	29.96
Prionospio heterobranchia	0.92	0.00	0.41	0.43	30.40
Scoletoma tetraura Cmplx	0.04	0.68	0.40	0.43	30.82
Glycinde armigera	0.01	0.75	0.40	0.43	31.25
Nuculana sp A	0.00	0.77	0.39	0.41	31.66
Tagelus affinis	0.79	0.00	0.37	0.40	32.05
Ampelisca cristata microdentata	0.19	0.67	0.37	0.39	32.45
Kirkegaardia cryptica	0.19	0.72	0.37	0.39	32.84
Praxillella pacifica	0.19	0.68	0.36	0.39	33.23
Phisidia sanctaemariae	0.00	0.82	0.36	0.38	33.60

Laevicardium substriatum	0.70	0.00	0.35	0.37	33.97
Pectinaria californiensis	0.03	0.70	0.34	0.36	34.34
Sternaspis affinis	0.00	0.73	0.34	0.36	34.69
Caecognathia crenulatifrons	0.05	0.71	0.34	0.36	35.05
Tellina modesta	0.08	0.55	0.33	0.35	35.40
Phoronidae	0.63	0.15	0.33	0.35	35.75
Lineidae	0.24	0.60	0.33	0.35	36.10
Scalibregma californicum	0.04	0.73	0.33	0.34	36.44
Rhepoxynius menziesi	0.02	0.60	0.32	0.34	36.78
Pista wui	0.15	0.45	0.32	0.34	37.12
Amphipholis squamata	0.70	0.08	0.32	0.33	37.45
Aphelochaeta monilaris	0.06	0.54	0.31	0.33	37.78
Zeuxo normani Cmplx	0.74	0.00	0.30	0.32	38.10
Spiophanes berkeleyorum	0.04	0.59	0.30	0.32	38.42
Nephtys ferruginea	0.00	0.61	0.30	0.32	38.74
Prionospio pygmaeus	0.08	0.52	0.30	0.32	39.06
Actiniaria	0.65	0.16	0.30	0.31	39.37
Gadila aberrans	0.10	0.57	0.30	0.31	39.69
Photis sp	0.00	0.77	0.30	0.31	40.00
Sthenelanella uniformis	0.03	0.72	0.29	0.31	40.31
Neanthes acuminata Cmplx	0.66	0.00	0.29	0.31	40.62
Carinoma mutabilis	0.04	0.47	0.29	0.31	40.93
Glycera americana	0.56	0.16	0.29	0.31	41.24
Chaetozone corona	0.29	0.36	0.29	0.31	41.54
Glycera nana	0.02	0.61	0.29	0.31	41.85
Pholoe glabra	0.01	0.63	0.29	0.31	42.16
Laonice cirrata	0.27	0.42	0.28	0.30	42.46
Ophiuroidea	0.00	0.62	0.28	0.30	42.76

Diplocirrus sp SD1	0.60	0.01	0.28	0.30	43.06
Ampharete labrops	0.17	0.43	0.28	0.30	43.36
Prionospio lighti	0.23	0.45	0.28	0.29	43.65
Rudilemboides stenopropodus	0.57	0.10	0.27	0.29	43.94
Rhepoxynius bicuspidatus	0.00	0.57	0.27	0.29	44.23
Nuculana taphria	0.24	0.42	0.27	0.28	44.51
Nereis sp A	0.10	0.52	0.27	0.28	44.79
Ampelisca pugetica	0.00	0.64	0.26	0.28	45.08
Metasychis disparidentatus	0.21	0.42	0.26	0.27	45.35
Kurtiella tumida	0.04	0.50	0.26	0.27	45.62
Mayerella acanthopoda	0.50	0.00	0.26	0.27	45.89
Cossura candida	0.21	0.33	0.25	0.27	46.16
Monocorophium acherusicum	0.55	0.00	0.25	0.27	46.42
Euchone limnicola	0.51	0.00	0.25	0.27	46.69
Goniada littorea	0.12	0.32	0.25	0.26	46.95
Aglaophamus verrilli	0.01	0.44	0.25	0.26	47.21
Pista brevibranchiata	0.49	0.16	0.25	0.26	47.47
Philine auriformis	0.29	0.29	0.25	0.26	47.73
Phascolion sp A	0.01	0.53	0.24	0.26	47.99
Cooperella subdiaphana	0.06	0.43	0.24	0.26	48.25
Photis brevipes	0.09	0.52	0.24	0.26	48.51
Notomastus hemipodus	0.08	0.51	0.24	0.26	48.76
Polycirrus sp	0.04	0.53	0.24	0.25	49.02
Levinsenia gracilis	0.06	0.46	0.24	0.25	49.27
Heterophoxus cf *ellisi*	0.49	0.00	0.24	0.25	49.52
Poecilochaetus martini	0.29	0.27	0.24	0.25	49.77
Goniada maculata	0.04	0.49	0.24	0.25	50.02
Lyonsia californica	0.47	0.05	0.24	0.25	50.27

Sigalion spinosus	0.00	0.43	0.24	0.25	50.52
Amphicteis scaphobranchiata	0.17	0.43	0.23	0.25	50.77
Listriella goleta	0.29	0.27	0.23	0.25	51.02
Cirratulidae	0.11	0.46	0.23	0.24	51.26
Hartmanodes hartmanae	0.21	0.30	0.23	0.24	51.50
Scoletoma sp A	0.48	0.03	0.23	0.24	51.74
Monocorophium insidiosum	0.46	0.00	0.22	0.24	51.98
Nephtys caecoides	0.08	0.41	0.22	0.24	52.21
Ampharetidae	0.11	0.46	0.22	0.24	52.45
Macoma yoldiformis	0.17	0.36	0.22	0.24	52.68
Edwardsiidae	0.18	0.38	0.22	0.23	52.92
Marphysa disjuncta	0.22	0.30	0.22	0.23	53.15
Leptosynapta sp	0.42	0.11	0.22	0.23	53.38
Paracerceis sculpta	0.57	0.00	0.22	0.23	53.61
Foxiphalus obtusidens	0.00	0.50	0.21	0.22	53.83
Lumbrineris sp	0.11	0.37	0.21	0.22	54.06
Photis californica	0.00	0.60	0.20	0.21	54.27
Heteronemertea sp SD2	0.00	0.48	0.20	0.21	54.48
Glottidia albida	0.02	0.43	0.20	0.21	54.70
Capitella capitata Cmplx	0.40	0.07	0.20	0.21	54.91
Scoloplos armiger Cmplx	0.01	0.44	0.20	0.21	55.12
Travisia brevis	0.00	0.43	0.20	0.21	55.33
Streblospio benedicti	0.41	0.00	0.20	0.21	55.54
Aphelochaeta sp	0.06	0.39	0.20	0.21	55.75
Pinnixa occidentalis Cmplx	0.00	0.31	0.20	0.21	55.95
Chaetozone hartmanae	0.02	0.43	0.19	0.20	56.16
Chloeia pinnata	0.00	0.41	0.19	0.20	56.36
Polycirrus sp A	0.00	0.40	0.19	0.20	56.55

Westwoodilla tone	0.00	0.43	0.18	0.20	56.75
Scoloplos acmeceps	0.20	0.20	0.18	0.19	56.94
Phyllochaetopterus limicolus	0.00	0.27	0.18	0.19	57.13
Onuphidae	0.02	0.40	0.18	0.19	57.32
Paranemertes californica	0.25	0.22	0.18	0.19	57.51
Pista estevanica	0.02	0.43	0.18	0.19	57.70
Diopatra sp	0.07	0.39	0.18	0.19	57.89
Exogone dwisula	0.12	0.33	0.18	0.19	58.08
Photis lacia	0.00	0.50	0.18	0.19	58.26
Lysippe sp B	0.00	0.38	0.18	0.19	58.45
Lumbrineris cruzensis	0.01	0.37	0.17	0.18	58.63
Armandia brevis	0.43	0.04	0.17	0.18	58.82
Amage scutata	0.20	0.20	0.17	0.18	59.00
Eochelidium sp A	0.35	0.00	0.17	0.18	59.18
Ennucula tenuis	0.00	0.36	0.17	0.18	59.36
Nassarius tiarula	0.32	0.00	0.17	0.18	59.54
Dipolydora socialis	0.07	0.33	0.17	0.18	59.72
Ampelisca sp	0.03	0.37	0.17	0.18	59.90
Dialychone veleronis	0.00	0.36	0.17	0.18	60.07

Appendix B3. Detailed SIMPER output of the top 60% of taxa contributing to the disimilarity of Deepwater assemblage samples to Offshore assemblage samples, with the mean Bray-Curtis dissimilarity for each taxon, the amount each taxon contributes to the dissimilarity between assemblages, and the cumulative dissimilarity.

Taxon	Deepwater Square Root Abundance	Offshore Square Root Abundance	Mean Dissimilarity	% Contribution to Dissimilarity	% Cumulative Contribution
Spiophanes duplex	3.23	0.04	1.89	1.97	1.97
Mediomastus sp	2.99	0.10	1.76	1.83	3.81
Paraprionospio alata	1.91	0.65	1.48	1.54	5.35
Maldanidae	2.08	0.29	1.19	1.24	6.59
Spiophanes kimballi	1.53	0.19	1.09	1.13	7.72
Amphiodia urtica	1.63	0.02	1.02	1.06	8.78
Spiophanes norrisi	1.62	0.00	0.98	1.02	9.80
Prionospio jubata	1.49	0.03	0.85	0.88	10.68
Amphiodia sp	1.29	0.08	0.81	0.84	11.52
Amphiuridae	1.34	0.23	0.79	0.82	12.35
Axinopsida serricata	1.09	0.15	0.74	0.77	13.11
Euclymeninae sp A	1.17	0.16	0.73	0.76	13.87
Prionospio ehlersi	0.02	0.97	0.69	0.71	14.59
Ampelisca brevisimulata	1.09	0.05	0.64	0.66	15.25
Eclysippe trilobata	0.96	0.22	0.63	0.65	15.91
Paradiopatra parva	0.99	0.02	0.62	0.64	16.55
Chondrochelia dubia Cmplx	1.18	0.00	0.59	0.62	17.16
Aphelochaeta glandaria Cmplx	0.85	0.06	0.58	0.60	17.77
Maldane sarsi	0.33	0.76	0.58	0.60	18.37
Spiochaetopterus costarum Cmplx	0.94	0.09	0.57	0.60	18.97
Petaloclymene pacifica	0.96	0.02	0.56	0.59	19.55

Glycinde armigera	0.75	0.28	0.56	0.59	20.14
Prionospio dubia	0.99	0.00	0.56	0.59	20.73
Tellina carpenteri	0.87	0.16	0.56	0.59	21.31
Scoletoma tetraura Cmplx	0.68	0.11	0.55	0.57	21.88
Euphilomedes carcharodonta	0.88	0.00	0.54	0.56	22.45
Kirkegaardia siblina	0.97	0.02	0.53	0.55	23.00
Parvilucina tenuisculpta	0.90	0.06	0.53	0.55	23.55
Tubulanus polymorphus	0.83	0.14	0.52	0.54	24.09
Kirkegaardia cryptica	0.72	0.21	0.51	0.53	24.62
Nuculana sp A	0.77	0.02	0.51	0.53	25.15
Aphelochaeta monilaris	0.54	0.34	0.50	0.52	25.68
Tellina sp B	0.81	0.02	0.50	0.52	26.20
Pectinaria californiensis	0.70	0.25	0.49	0.52	26.71
Ophiuroidea	0.62	0.36	0.48	0.50	27.21
Phoronis sp	0.71	0.13	0.48	0.50	27.71
Pista wui	0.45	0.23	0.48	0.50	28.21
Caecognathia crenulatifrons	0.71	0.14	0.47	0.49	28.70
Phisidia sanctaemariae	0.82	0.00	0.44	0.46	29.15
Bipalponephtys cornuta	0.11	0.58	0.43	0.45	29.61
Lineidae	0.60	0.25	0.43	0.45	30.06
Sternaspis affinis	0.73	0.00	0.43	0.45	30.50
Praxillella pacifica	0.68	0.07	0.43	0.44	30.95
Nephtys ferruginea	0.61	0.14	0.42	0.44	31.39
Glycera nana	0.61	0.25	0.42	0.44	31.83
Amphideutopus oculatus	0.77	0.00	0.42	0.44	32.26
Tellina modesta	0.55	0.00	0.42	0.43	32.70
Rhepoxynius menziesi	0.60	0.00	0.41	0.43	33.12
Scalibregma californicum	0.73	0.00	0.40	0.42	33.54

Ampelisca cristata microdentata	0.67	0.00	0.40	0.42	33.96
Spiophanes berkeleyorum	0.59	0.00	0.39	0.40	34.36
Carinoma mutabilis	0.47	0.00	0.38	0.40	34.75
Photis sp	0.77	0.04	0.37	0.39	35.14
Prionospio pygmaeus	0.52	0.00	0.37	0.38	35.53
Pholoe glabra	0.63	0.00	0.37	0.38	35.91
Sthenelanella uniformis	0.72	0.00	0.35	0.37	36.28
Gadila aberrans	0.57	0.00	0.35	0.36	36.64
Rhepoxynius bicuspidatus	0.57	0.00	0.35	0.36	37.00
Phyllochaetopterus limicolus	0.27	0.18	0.35	0.36	37.36
Prionospio lighti	0.45	0.20	0.35	0.36	37.72
Stereobalanus sp	0.27	0.29	0.33	0.35	38.07
Nereis sp A	0.52	0.02	0.33	0.35	38.41
Ampelisca pugetica	0.64	0.02	0.33	0.34	38.76
Aglaophamus verrilli	0.44	0.00	0.33	0.34	39.10
Kurtiella tumida	0.50	0.00	0.32	0.33	39.43
Ampharetidae	0.46	0.17	0.31	0.33	39.76
Sigalion spinosus	0.43	0.00	0.31	0.32	40.08
Phascolion sp A	0.53	0.00	0.31	0.32	40.40
Notomastus hemipodus	0.51	0.08	0.30	0.31	40.72
Cooperella subdiaphana	0.43	0.00	0.30	0.31	41.03
Pinnixa occidentalis Cmplx	0.31	0.07	0.30	0.31	41.34
Ampharete labrops	0.43	0.00	0.30	0.31	41.65
Polycirrus sp	0.53	0.00	0.29	0.30	41.96
Goniada maculata	0.49	0.00	0.29	0.30	42.26
Nephtys caecoides	0.41	0.05	0.29	0.30	42.56
Levinsenia gracilis	0.46	0.00	0.29	0.30	42.86
Goniada littorea	0.32	0.00	0.28	0.30	43.16

Heteronemertea sp SD2	0.48	0.08	0.28	0.29	43.45
Cirratulidae	0.46	0.07	0.28	0.29	43.74
Scoletoma sp	0.44	0.00	0.27	0.29	44.03
Chloeia pinnata	0.41	0.07	0.27	0.28	44.31
Laonice cirrata	0.42	0.04	0.27	0.28	44.59
Bivalvia	0.24	0.21	0.27	0.28	44.87
Cossura sp A	0.48	0.02	0.27	0.28	45.15
Aphelochaeta sp	0.39	0.08	0.26	0.27	45.42
Foxiphalus obtusidens	0.50	0.00	0.26	0.27	45.70
Photis brevipes	0.52	0.00	0.26	0.27	45.97
Limifossor fratula	0.05	0.33	0.26	0.27	46.24
Travisia brevis	0.43	0.02	0.26	0.27	46.51
Rhabdus rectius	0.14	0.23	0.26	0.27	46.77
Lumbrineris cruzensis	0.37	0.09	0.25	0.26	47.04
Metasychis disparidentatus	0.42	0.02	0.25	0.26	47.30
Ennucula tenuis	0.36	0.08	0.25	0.26	47.56
Scoloplos armiger Cmplx	0.44	0.00	0.25	0.26	47.82
Chaetozone corona	0.36	0.00	0.25	0.26	48.08
Cossura candida	0.33	0.02	0.25	0.26	48.34
Glottidia albida	0.43	0.00	0.24	0.25	48.59
Malmgreniella scriptoria	0.22	0.11	0.24	0.25	48.84
Lumbrineris sp	0.37	0.04	0.24	0.25	49.09
Photis californica	0.60	0.00	0.24	0.25	49.34
Westwoodilla tone	0.43	0.02	0.24	0.25	49.59
Amphicteis scaphobranchiata	0.43	0.00	0.23	0.24	49.84
Polycirrus sp A	0.40	0.00	0.23	0.24	50.08
Nuculana taphria	0.42	0.00	0.23	0.24	50.32
Chaetozone hartmanae	0.43	0.00	0.23	0.24	50.56

Lysippe sp B	0.38	0.02	0.23	0.24	50.80
Onuphidae	0.40	0.02	0.22	0.23	51.03
Philine auriformis	0.29	0.03	0.22	0.23	51.26
Decamastus gracilis	0.33	0.06	0.22	0.23	51.49
Macoma yoldiformis	0.36	0.00	0.22	0.23	51.72
Onuphis iridescens	0.13	0.12	0.22	0.23	51.95
Brisaster townsendi	0.06	0.22	0.22	0.23	52.17
Pista estevanica	0.43	0.00	0.21	0.22	52.40
Dialychone veleronis	0.36	0.00	0.21	0.22	52.62
Kirkegaardia tesselata	0.33	0.04	0.21	0.22	52.84
Byblis barbarensis	0.00	0.28	0.21	0.22	53.06
Photis lacia	0.50	0.00	0.21	0.22	53.28
Onuphis sp	0.28	0.05	0.21	0.22	53.49
Ampelisca agassizi	0.32	0.00	0.21	0.22	53.71
Mendicula ferruginosa	0.00	0.29	0.21	0.21	53.92
Amphiura arcystata	0.30	0.04	0.21	0.21	54.14
Spiophanes sp	0.33	0.05	0.21	0.21	54.35
Edwardsiidae	0.38	0.00	0.20	0.21	54.57
Scolanthus triangulus	0.36	0.00	0.20	0.21	54.78
Euphilomedes producta	0.34	0.05	0.20	0.21	54.99
Chaetoderma pacificum	0.19	0.12	0.20	0.21	55.20
Ampelisca sp	0.37	0.00	0.20	0.21	55.41
Melinna heterodonta	0.04	0.27	0.20	0.21	55.62
Maldane californiensis	0.00	0.27	0.20	0.20	55.82
Exogone lourei	0.33	0.00	0.20	0.20	56.02
Haliophasma geminata	0.35	0.02	0.20	0.20	56.23
Ampelisca careyi	0.35	0.00	0.20	0.20	56.43
Diopatra sp	0.39	0.00	0.19	0.20	56.63

Saxicavella pacifica	0.07	0.20	0.19	0.20	56.83
Phyllochaetopterus sp	0.12	0.16	0.19	0.20	57.03
Cyclocardia ventricosa	0.04	0.21	0.19	0.20	57.23
Amphichondrius granulatus	0.29	0.00	0.19	0.20	57.43
Scaphopoda	0.11	0.20	0.19	0.20	57.63
Hartmanodes hartmanae	0.30	0.00	0.19	0.20	57.82
Polyschides quadrifissatus	0.28	0.00	0.18	0.19	58.02
Odostomia sp	0.18	0.15	0.18	0.19	58.21
Owenia collaris	0.22	0.00	0.18	0.19	58.40
Thyasira flexuosa	0.29	0.07	0.18	0.19	58.59
Chiridota sp	0.30	0.02	0.18	0.19	58.78
Syllis heterochaeta	0.39	0.00	0.18	0.19	58.97
Diastylopsis tenuis	0.23	0.00	0.18	0.19	59.15
Dougaloplus amphacanthus	0.18	0.06	0.18	0.19	59.34
Leitoscoloplos sp A	0.05	0.22	0.18	0.19	59.53
Dipolydora socialis	0.33	0.00	0.18	0.19	59.71
Rhodine bitorquata	0.30	0.02	0.18	0.19	59.90
Terebellidae	0.32	0.00	0.18	0.18	60.08

APPENDIX C – APPLYING THE BRI TO THE UPPER SLOPE

Background

One of the key tenets of the Bight Regional Monitoring Program has been the use of benthic infauna community composition to infer the health and condition of sediment habitats. Benthic community composition data are translated into evaluations of habitat condition using bioassessment tools and interpretive frameworks – typically referred to as benthic indices. These tools have been developed and calibrated to transform complex ecological information into ecologically and managerially meaningful categories. Moreover, when they are correctly applied, they have been validated for the fauna in the habitats/biogeographies where they are used. In the soft sediment habitats of the continental shelf of Southern California that range from 6 to 200 m deep, the Bight Program uses the Benthic Response Index (BRI) of Smith et al. (2001) for conducting condition assessments. Historically, the Bight Program has not assessed the condition of the continental slope habitats of the region due to the lack of a validated benthic index. Previous Bight Benthic Reports have highlighted the need to develop an approach for assessing the condition of the continental slope habitat of the region (Gillett et al. 2017).

Gillett et al. (2021) have characterized three distinct continental slope habitats in the region, separated by latitude, longitude, and depth. The Northwest Slope habitat was comprised of locations deeper than 200 m and west of -120.4562°W (near Santa Barbara, CA) to Point Conception, CA. The Upper Slope was comprised of locations between 200 m and 400 m extending north-west from near Tijuana, Mexico to -119.76911°W. The Lower Slope was comprised of locations between 400 m and 1,000 m deep extending north-west from near Tijuana, Mexico to -119.76911°W. As part of this study, it was suggested that the BRI could potentially be applied to samples to all continental slope habitats to depths of ~400 m (Gillett et al. 2021). This suggestion is reasonable, as the original work describing the BRI (Smith et al. 2001) included calibration and validation data from up to 324 m deep and the fauna of the shallower parts of the continental slope have similar composition to the deeper parts of the continental shelf. As such, the BRI may represent a reasonable "first-step" option in assessing the condition of the shallower parts of the Bight Program's Upper Slope stratum.

Approach

Before applying the BRI to Bight '18 data, the general applicability of the index to the fauna of the habitat needed to be evaluated. Our approach was two-fold: 1. Determine if the taxa observed in the Upper Slope were recognized by the BRI. The BRI is an abundance-weighted tolerance index. It is comprised a 700+ taxa that have been assigned p-codes associated with a pollution tolerance value ranging from very sensitive to very tolerant (referred to as a p-value). If the amount of taxa observed in the Upper Slope that have BRI tolerance values is similar to the amount from the continental shelf habitats, then the index could be applicable. 2. Determine if the index responds to stress in a similar fashion in slope-depth waters as it does in shelf-depth waters. Depth is an important factor influencing changes in community composition of benthic infauna in Southern California (Bergen et al. 2001; Gillett et al.

2021). If the index is performing as expected and applicable to the Upper Slope stratum, it will be sensitive to disturbance independent of the depth of the samples it is applied to.

Methods

Following Gillett et al. (2021), the suitability of the BRI for use with samples from the Upper Slope stratum was evaluated by determining the number of taxa and the percent of abundance that had p-code tolerance values compared to those of the Inner Shelf, Mid Shelf, Outer Shelf, and Channel Islands strata. Comparisons between strata were quantified using a Kruskal-Wallis test and Dunn post-hoc comparisons (α=0.1), with stratum as the predictor variable and either % of taxa with a p-code or % of abundance with a p-code as the response variable. Kruskal-Wallis tests were calculated using the kruskal.test function in R (v4.2.0) and the Dunn-post-hoc tests were calculated using the dunnTest function within the FSA package (v0.9.3) (Ogle et al. 2022) in R.

Responsiveness of the BRI in different habitats was evaluated by comparing BRI scores from the Upper Slope and shelf strata to two measures of organic matter enrichment (Total Nitrogen (TN) and Total Organic Carbon (TOC)) and two measures of sediment contaminants. Contaminants were quantified as the number of compounds in excess of their Chemical Stressor Index (CSI) Level 1 (Bay et al. 2021) or Effects Range Low (ERL) (Long et al. 1995) impact thresholds. Comparisons were made using least-squares linear regression with BRI score as the response variable and contaminant/organic matter measure as predictor variable (α=0.1). Regressions were calculated using the glm function (gaussian error distribution) in R (v4.2.0).

Results

An average of 72% of the taxa across the Upper Slope samples had tolerance values used for BRI calculation (Table 15). This was significantly (α=0.1) less than Mid Shelf samples, but similar to all of the other shelf strata (Figure 25). Similarly, the % of abundance with tolerance values from the Upper Slope (77%) was less than the Mid Shelf, but similar to the other shelf strata (Figure 26). There were two samples from the Northwest Slope with relatively low p-code coverage – both from a richness and abundance perspective – but the majority of the Northwest Slope samples were similar to those from the Upper Slope and the continental shelf habitats.

Table 15. Percent of species richness or abundance with BRI p-code tolerance values for each stratum from Bight '18 sampling. SE = Standard error of the mean.

Stratum	n	% of Species Richness with p-code	SE Species Richness	% of Abundance with p-code	SE Abundance
Channel Islands	15	71.7	3.1	74.0	5.2
Inner Shelf	36	74.9	1.0	83.0	1.4
Mid Shelf	36	81.1	0.8	87.2	0.9
Outer Shelf	31	78.9	1.2	84.4	1.4
Upper Slope	31	71.8	2.9	76.8	3.5

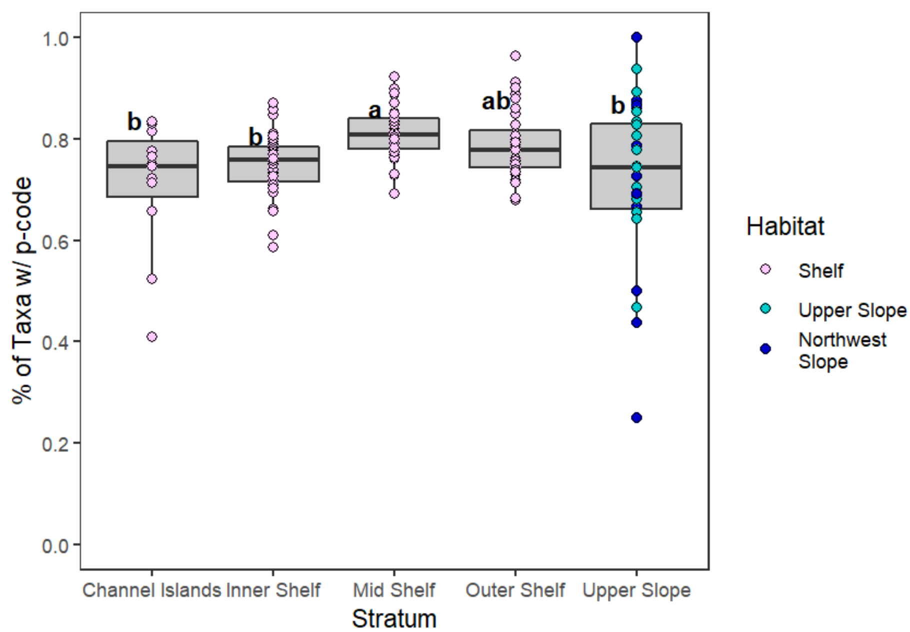

Figure 25. Schematic boxplot illustrating the percent of taxa from a given sample with a recognized BRI p-code tolerance value within each stratum of Bight '18 sampling. The letters indicate significant (α=0.1) differences/similarities between strata, based upon Dunn post-hoc tests of Kruskal-Wallis rank tests. The dots indicate the values from each individual samples and are color coded by their habitat, as designated by Gillett et al. (2021).

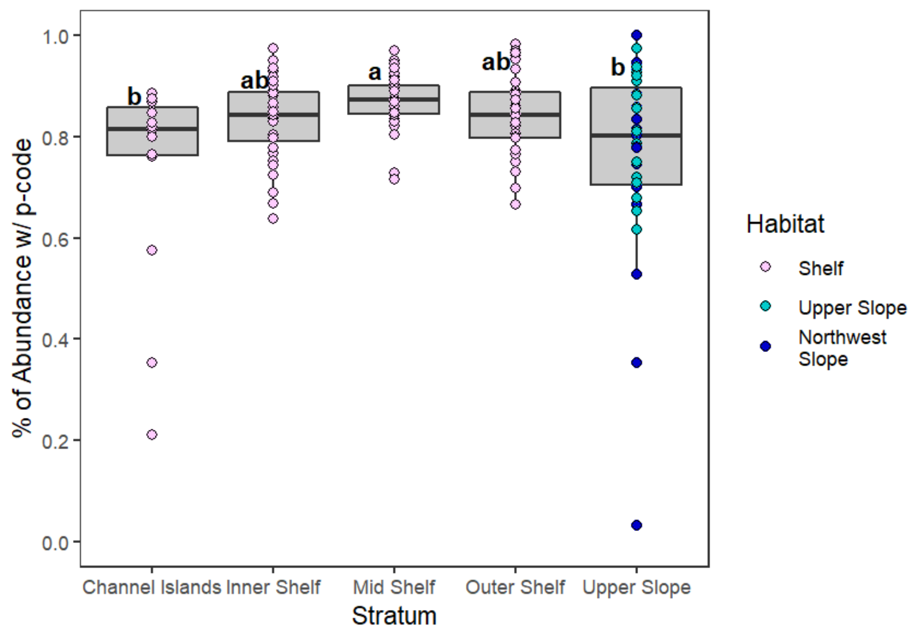

Figure 26. Schematic boxplot illustrating the percent of total abundance from a given sample with a recognized BRI p-code tolerance value within each stratum of Bight '18 sampling. The letters indicate significant (α=0.1) differences/similarities between strata, based upon Dunn post-hoc tests of Kruskal-Wallis rank tests. The dots indicate the values from each individual samples and are color coded by their habitat, as designated by Gillett et al. (2021).

The BRI scores from the Upper Slope increased (i.e., worsening condition) significantly (α=0.1) with increasing numbers of CSI-1 and ERL exceedances (Figure 27). However, there were no significant relationships between Upper Slope BRI scores and TN or TOC concentrations (Table 16). For comparison, BRI scores from the Inner Shelf samples significantly increased with increasing measures of sediment contaminants and organic matter concentration, while those from the Mid-Shelf and Channel Islands showed no significant responses to either. The BRI scores from the Outer Shelf samples showed no relationship to the sediment contaminant measures but were significantly related to increasing TOC and TN concentrations (Table 16).

Table 16. Outputs from linear least-squares regression of BRI scores with measures of exposure to toxic sediment chemicals (CSI-1 and ERL exceedances) and sediment organic matter (TOC and TN) at each of the shelf and Upper Slope strata from Bight ‘18. The expectation is that the slope (Beta) of the regressions would be positive, indicating worsening condition with increasing amounts of stress.

Stressor	Stratum	Y-Intercept	Beta	SE	F-value	p-value
CSI Level 1 Exceedances	Channel Islands	14.5	0.72	2.06	0.35	0.734
	Inner Shelf	19.5	3.38	1.35	2.50	0.017
	Mid Shelf	15.8	0.58	0.84	0.69	0.492
	Outer Shelf	15.6	1.09	0.79	1.37	0.182
	Upper Slope	19.3	1.53	0.67	2.29	0.030
ERL Exceedances	Channel Islands	14.1	1.44	1.28	1.13	0.281
	Inner Shelf	20.4	3.09	1.54	2.01	0.053
	Mid Shelf	16.1	0.40	0.78	0.51	0.614
	Outer Shelf	16.2	1.02	0.81	1.26	0.218
	Upper Slope	19.7	1.37	0.60	2.28	0.030
Total Nitrogen (%)	Channel Islands	15.9	-9.19	30.08	-0.31	0.765
	Inner Shelf	16.1	155.13	65.92	2.35	0.025
	Mid Shelf	18.0	-25.53	35.44	-0.72	0.476
	Outer Shelf	5.4	153.90	34.97	4.40	<0.001
	Upper Slope	19.4	17.45	15.95	1.09	0.283
TOC (%)	Channel Islands	17.6	-1.17	0.64	-1.82	0.092
	Inner Shelf	16.5	13.07	3.51	3.72	0.001
	Mid Shelf	18.2	-2.44	2.65	-0.92	0.363
	Outer Shelf	8.2	10.20	2.57	3.96	<0.001
	Upper Slope	21.6	0.87	1.75	0.49	0.626

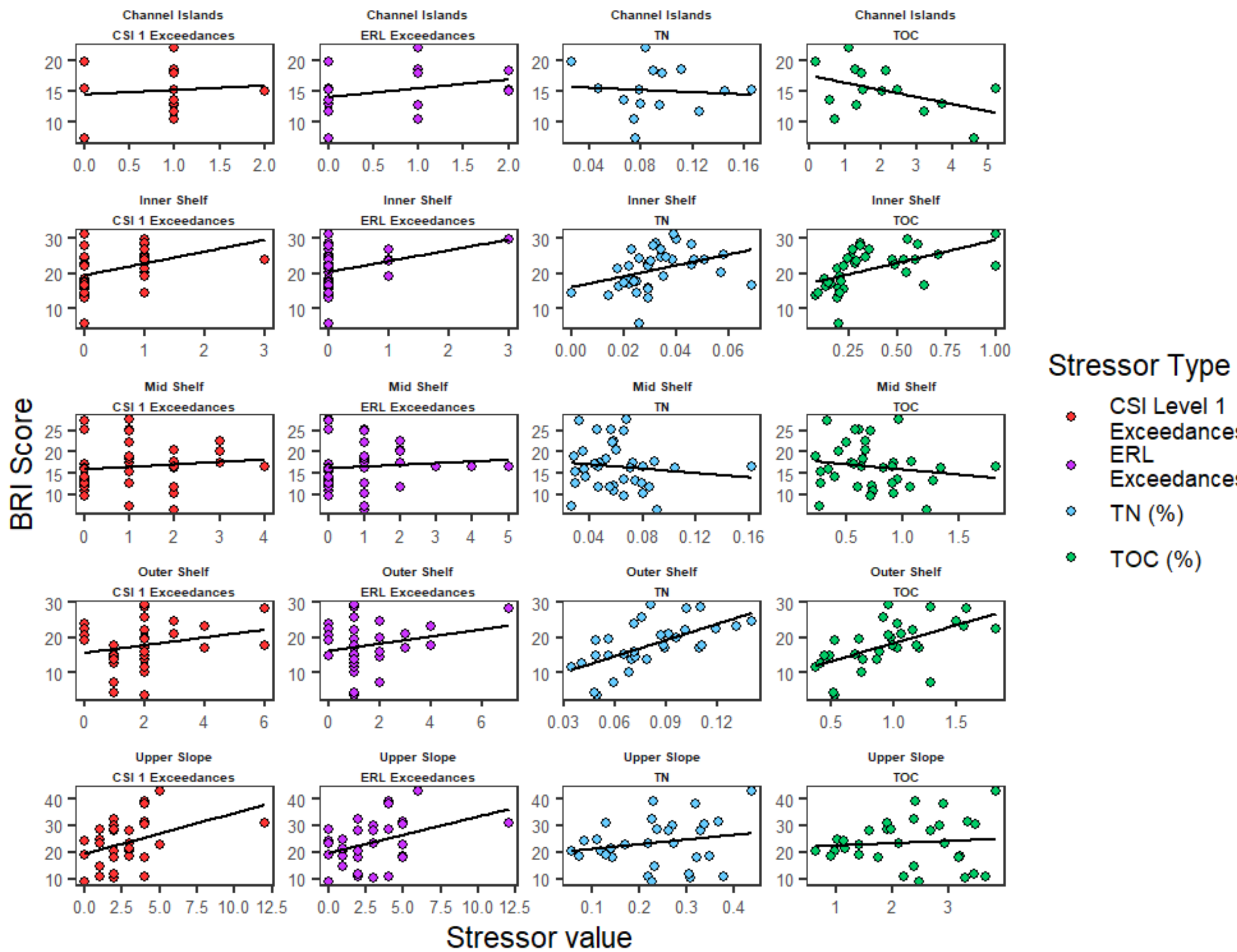

Figure 27. Scatter plots of BRI scores and measures of exposure to toxic sediment chemicals (CSI-1 and ERL exceedances) and measures of sediment organic matter (TOC an TN) at each of the shelf and Upper Slope strata from Bight '18. The solid black line represents the least-squares linear regression modelled fit.

Discussion

Based upon taxonomic coverage of the index and performance along gradients in stressor exposure, it would seem reasonable to use BRI scores as a relative measure of habitat condition within the Upper Slope stratum. Properly validating the condition thresholds used to translate scores into condition categories was beyond the scope of this investigation, so the thresholds were applied with a degree of caution to scores from the Upper Slope as an illustration of their potential (Figure 11 (main body) / Figure 28 (Appendix C)). The (exploratory) overall pattern in % area of the Upper Slope was somewhat worse than the adjacent Outer Shelf stratum, with 60% of the stratum in reference condition, 30% in low disturbance condition, and 10% in a moderate disturbance condition compared to 89% reference and 11% low disturbance estimates for the Outer Shelf.

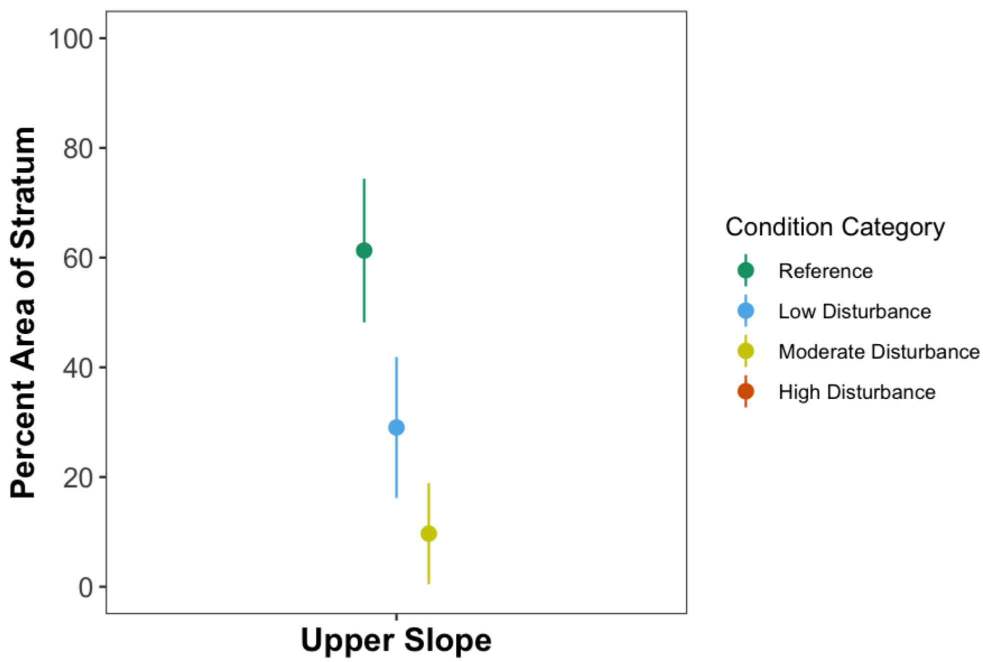

Figure 28. Percent area estimates (w/ 95% confidence intervals) of the Upper Slope strata in each of the four condition categories. The dots depict the estimate and the whiskers depict the local neighborhood-based confidence intervals. Note that this the same as Figure 11 in the main body of this report.

The lack of significant relationships between the BRI score and TOC or TN among the Upper Slope samples, despite some samples having concentrations known to negatively impact benthic fauna from other habitats (e.g., Hyland et al. 2005; Walker et al. 2022), is curious and may be related to biogeochemical or macrobenthic community composition differences associated with deepwater habitats. Excessive amounts of TOC and TN in the sediment negatively impact macrobenthic fauna in an indirect fashion. Bacterial consumption of labile organic matter leads to a decrease in redox potential discontinuity coupled with accumulation of ammonia and sulfides in the porewater of anoxic sediments, which are toxic to many macrobenthic species (Karakassis et al. 1999; Kalantzi and Karakassis 2006; Shin et al. 2006; Cranford et al. 2020). The rates of bacterial respiration are influenced by water temperature (e.g., Moodley et al. 2005; Sawicka et al. 2012) and bottom water temperatures at depths equivalent to the Upper Slope samples were ~2°C cooler than those of the Outer Shelf (https://calcofi.org/data/oceanographic-data/bottle-database/). From the macrobenthic perspective, the dominant fauna of the Upper Slope were largely deposit feeders and scavengers that might not be as sensitive to higher concentrations of TOC and TN as fauna from shallower depths (e.g., Walker et al. 2022).

The biogeochemical setting and the autecology of the macrobenthic fauna, among other factors, may combine to make the deepwater benthic communities less sensitive to organic matter stress than their shallower counterparts. However, the trends in BRI scores relative to TOC and TN suggest some degree of community composition change along TOC and TN gradients. Furthermore, the direction of the trends were indicative of the expected response to disturbance (i.e., higher scores with greater stress), suggesting that the index was performing as intended.

Overall, the results of these analyses echo those of Gillett et al. (2021) and suggest that applying the BRI to Upper Slope stratum fauna is a reasonable thing to do. However, it is not a perfect fit without a robust validation of the condition category thresholds. As such, we believe that the development of a purpose-built index for all continental slope habitats in the region should remain a priority for those interested in the assessment of the region's coastal waters. This is especially important, as the Lower Slope stratum represents nearly 40% of the entire Southern California Bight region and it has an ecologically different community structure that negates the application of the continental shelf BRI (Gillett et al. 2021).

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APPENDIX D – INVESTIGATING THE 2013 CHANNEL ISLANDS PATTERNS

Background

One of the key findings from the 2013 Bight Survey was a decrease in the condition of the macrobenthic community from the Channel Islands compared to previous surveys (Gillett et al. 2017). As noted in the multi-survey section of the main body of this report, the condition of the stratum in 2018 returned to being in 100% reference condition as it had been in surveys prior to 2013. The abrupt decline and rebound in habitat condition was anomalous compared to patterns previously seen among the different Bight Program strata. Consequently, it was important to identify the potential causes for these apparent fluctuations in macrobenthic community condition.

The Sediment Quality Assessment element of the Bight Regional Monitoring Program (and its predecessors) was focused on understanding the impacts of toxic chemicals and (to a lesser degree) excessive sediment organic matter on the condition of the region's benthic and demersal biological resources. As such, the majority of the data available within the Bight Program are benthic in nature. There is much less data available to quantify the relationships between water quality/chemistry and benthic fauna. This presents a challenging problem of spatial and temporal scale when developing stressor-response relationships. Water column stressors can be ephemeral in nature, changing with seasonal or year-to-year changes in currents, upwelling, or other movements of water masses (e.g., Bograd et al. 2019). Furthermore, the water is always moving, so the specific parcel of water the fauna are exposed to is always changing. Conversely, sediments do not move as much as the overlying water and tend to integrate stressors over time. As such, the stressor an organism is exposed to in the sediment may predate the settlement/migration of the organism. The macrofauna themselves occupy a spatial/temporal position in the middle, where they live and interact with the sediment and overlying water for months to years and many of the taxa do not move large distances once they reach adulthood.

Our goals were to determine if the decline in condition of the macrobenthos in the Channel Islands stratum in 2013 could be related to changes in a variety of potential stressors or environmental forcing factors. We also wanted to determine if the changes in the BRI scores and categories corresponded to potentially anomalous changes in the community composition in 2013 that may have affected index performance.

Approach

We began by verifying that the BRI scores in 2013 were quantitatively lower than in all of the other survey years and if the relative proportion of reference to low impact samples were different in 2013. Any potential change in the composition of the whole community between survey years was evaluated with multivariate ordination and PERMANOVA. Sediment chemistry was not measured in the stratum as part of Bight '13, so comparisons were made between 2018 measurements and those from 2003 and 2008. If concentrations of a given contaminant were higher in 2018 than previous years, then it could be presumed that the contaminant may have also been elevated in 2013 and therefore potentially responsible for the dip in BRI scores. Sediment grainsize composition was measured as % sand using data obtained from previous Bight surveys. Due to errors in the measurement of silt and clay in Bight 2013, these data could not be compared to other surveys and therefore silt and clay were omitted from the sediment composition comparison. However, as there is a general inverse relationship between % sand and % silt and clay in sediments, this was thought to not be a critical analytical gap.

Water quality data are not measured concurrently with benthic sample collection, so data were obtained from CalCOFI bottle surveys collected during the same summer as the benthic samples. Water quality data were matched to a given benthic sample based upon water depth and proximity to the coordinates of the benthic sample (following Gillett et al. in review). Measures of ocean acidification/carbonate chemistry were estimated from the water quality data using linear regression models created for the Southern California Bight (e.g., McClatchie et al. 2016; Gillett et al. in review).

Methods

BRI scores from the Channel Islands stratum in 2013 were compared to those from 2003, 2008, and 2018 using an ANOVA with BRI score as the response and year of collection as the predictor variable and post-hoc contrasts (α=0.1). BRI categories from 2013 were compared to those from 2003, 2008, and 2018 using a Fischer's Exact Chi-square test with condition category as the response and year of collection as the predictor variable and holm-adjusted post-hoc contrasts (α=0.1). The coverage of the BRI index across the channels Channel Islands samples from 2013 and other Bight Surveys was evaluated using a beta regression of either % taxa or % of abundance within a sample with assigned BRI tolerance values (i.e., a p-code), with coverage as the response variable and year of collection as the predictor variable (α=0.1). ANOVA and Fischer's tests were done using R (v4.1.1) and the beta regressions were done with the betareg package (v3.1-4) (Cribari-Neto and Zeileis 2010).

Differences in taxonomic composition of the 2013 Channel Islands samples were compared to those of samples from 2003, 2008, and 2018 visually using nMDS ordination of presence-absence transformed data. Taxonomic differences were quantitatively compared using a PERMANOVA with Bray-Curtis dissimilarities calculated from presence-absence transformed data as the response variable and year of collection as the predictor variable across 10,000 permutations (α=0.1). Ordinations and PERMANOVA analyses were done using the MetaMDS and adonis2 functions within the R (v4.1.1) vegan package (v2.6-2) (Oksanen et al. 2022)

To quantify any potential causes for shifts in benthic community condition, the distribution of sediment chemistry (metals, PAHs, PCBs, and DDTs), % sand, water quality (bottom water temperature, dissolved oxygen, and salinity), and modelled measures of ocean acidification (pH, aragonite saturation, calcite saturation, and pCO2) at the Channel Islands stratum were compared among the different Bight Surveys. Sediment chemistry data were obtained from the 2003, 2008, and 2018 Bight Surveys. Grainsize data were obtained from the 2003, 2008, 2013, and 2018 Bight Surveys. Water quality data from 2003, 2008, 2013, and 2018 were obtained from CalCOFI (https://calcofi.org/data/oceanographic-data/bottle-database/) bottle samples collected within 37 km and at the same depth (+/- 6m) as the benthic sample stations (following Gillett et al. in review). Acidification variables were calculated using linear regression models applied to CalCOFI water quality data (e.g., McClatchie et al. 2016). Survey-to-survey comparisons of all potential stressors/forcing factors (except sediment grainsize) were quantified using GLMs with either Gaussian or gamma distributions to accommodate non-normal distributions with Tukey post-hoc comparisons (α=0.1), where the different stressors or environmental factors were the response variable and year of survey was the predictor variable. Sediment grainsize was compared with a Kruskal-Wallis test with Dunn post-hoc comparisons (α=0.1), with % sand, silt, or clay as the response variable and year of collection as the predictor variable. Kruskal-Wallis tests and GLMs were quantified using R (v4.1.1). Dunn-post-hoc tests were calculated using the dunnTest function within the FSA package (v0.9.3) (Ogle et al. 2022) in R.

Results

Benthic community condition was significantly different in the 2013 survey than other previous or subsequent Bight surveys. This pattern was evident in the condition categories (Fisher's exact Chi-square p=0.002) and the condition scores (Figure 29). There were more incidences of low disturbance samples in 2013 than in 1998, 2003, 2008, or 2018 (Table 17 and Table 18). Similarly, 2013 BRI scores were higher (worse condition) than previous surveys and Bight 2018. Interestingly, mean Bight 2018 scores were significantly higher than all previous surveys other than 2013 (Figure 29).

Table 17. Counts of BRI categories in the Channel Islands stratum during all Bight surveys. Note that Bight '98 data include Catalina Islands stratum samples.

Survey	Reference	Low Disturbance	Moderate Disturbance	High Disturbance
Bight 98	51	2	0	0
Bight 03	33	0	0	0
Bight 08	30	0	0	0
Bight 13	11	4	0	0
Bight 18	15	0	0	0

Table 18. Pairwise outputs of Fisher's exact comparison of BRI categories between Bight '13 and other survey years. The overall test had p-value of 0.0022. Holm correction for multiple comparisons used for pairwise tests.

Comparison	Method	Adjusted p-value
B13 v B98	Fisher's Exact Test for Count Data	0.0374
B13 v B03	Fisher's Exact Test for Count Data	0.0281
B13 v B08	Fisher's Exact Test for Count Data	0.0281
B13 v B18	Fisher's Exact Test for Count Data	0.0996

The differences in condition scores from 2013 to the other surveys were not as clearly reflected in the survey-to-survey patterns of the whole community as illustrated in the nMDS ordination (Figure 30). In contrast, the pairwise PERMANOVA indicated that the benthic fauna from each survey were different than those from 2013 (Table 19). This pattern is part of a broader trend in a steady change in community composition that has been observed at a variety of habitats across the region over the past 25+ years (Gillett et al. in review; Walker et al. unpublished).

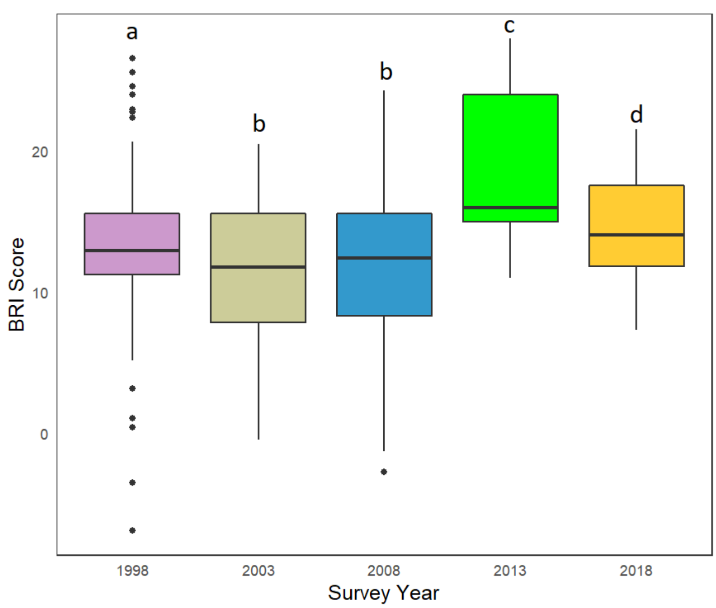

Figure 29. Schematic box plot of BRI scores in each of the Bight surveys. The letters indicate significant (α=0.1) differences between surveys based on Tukey's multiple comparison adjusted values. This figure is the same as Figure 15 in the main body of the report.

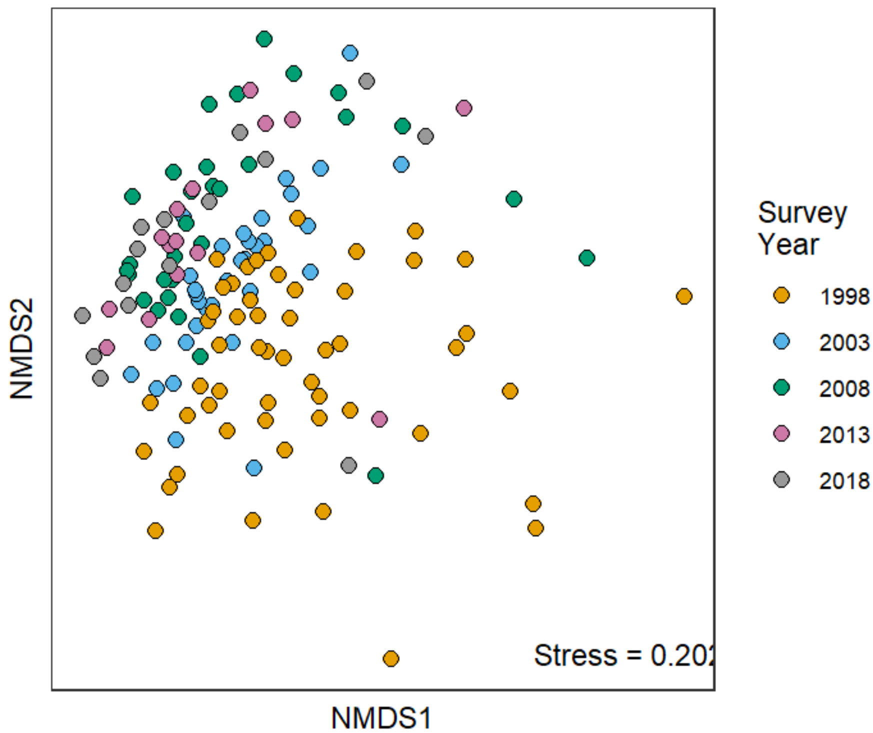

Figure 30. A two-dimensional nMDS ordination of Bray-Curtis dissimilarities of presence/absence transformed macrobenthic abundance from the Channel Islands stratum collected in different Bight Surveys between 1998-2018. Points are color-coded by the year of collection. This figure is the same as Figure 16 in the main body of the report.

Table 19. Main effect and pairwise comparison outputs from a PERMANOVA of Channel Islands stratum benthic fauna from 1998-2018. PERMANOVA calculated from Bray-Curtis dissimilarities of presence/absence abundance over 10,000 permutations. This table is the same as Table 13 in the main body of the report.

Test Type	Term	dfs	Pseudo R^2	F-statistic	p-value
Main Effect	Year of Survey	4	0.13	5.1	<0.001
	Residuals	141			
	Total	145			

Test Type	Contrast	dfs	Pseudo R^2	F-statistic	p-value
Pairwise Comparisons	2013 vs 1998	1, 66	0.08	5.6	<0.001
	2013 vs 2003	1, 46	0.10	4.9	<0.001
	2013 vs 2008	1, 43	0.05	2.5	0.006
	2013 vs 2018	1, 28	0.10	3.0	<0.001

Most of the sediment contaminant measures were not higher in 2018 than they were in previous surveys (Figure 31 and Figure 32). The one exception was mercury, which was higher in 2018 than in either 2003 or 2008. However, that difference was most likely driven by a single high concentration sample, which was in the 2nd (low potential exposure) category of the California-based CSI index (Ritter et al. 2012) and above the national ERL threshold (Long et al. 1995). High molecular weight, low molecular weight, and total PAHs were lower in 2018 than 2008 or 2003. All other contaminants were equivalent in 2018 to previous survey years. The sediment grainsize was similar between 2013 and the 2003, 2008, and 2018 surveys (Figure 33). Sediment TOC and TN content in 2018 were not significantly higher than in 2008 or 2003 (Figure 34).

Bottom water temperature and dissolved oxygen in 2013 were significantly lower than in 1998 and 2008 but were equivalent (albeit lower on average) than measures from 2003 and 2018 (Figure 35). Chlorophyll a in 2013 was equivalent to that from 1998, 2003, 2008, and 2018. Bottom water salinity was significantly higher in 2013 than in 1998, 2003, and 2008, but was equivalent to 2018. It should be noted that the differences in salinity were all less than 1 PSU. Aragonite saturation, calcite saturation, and pH were equivalent, but lower on average in 2013 compared to 2003, 2008, and 2018 (Figure 36). Similarly, pCO2 was equivalent across years but higher in 2013 compared to 2003, 2008, and 2018.

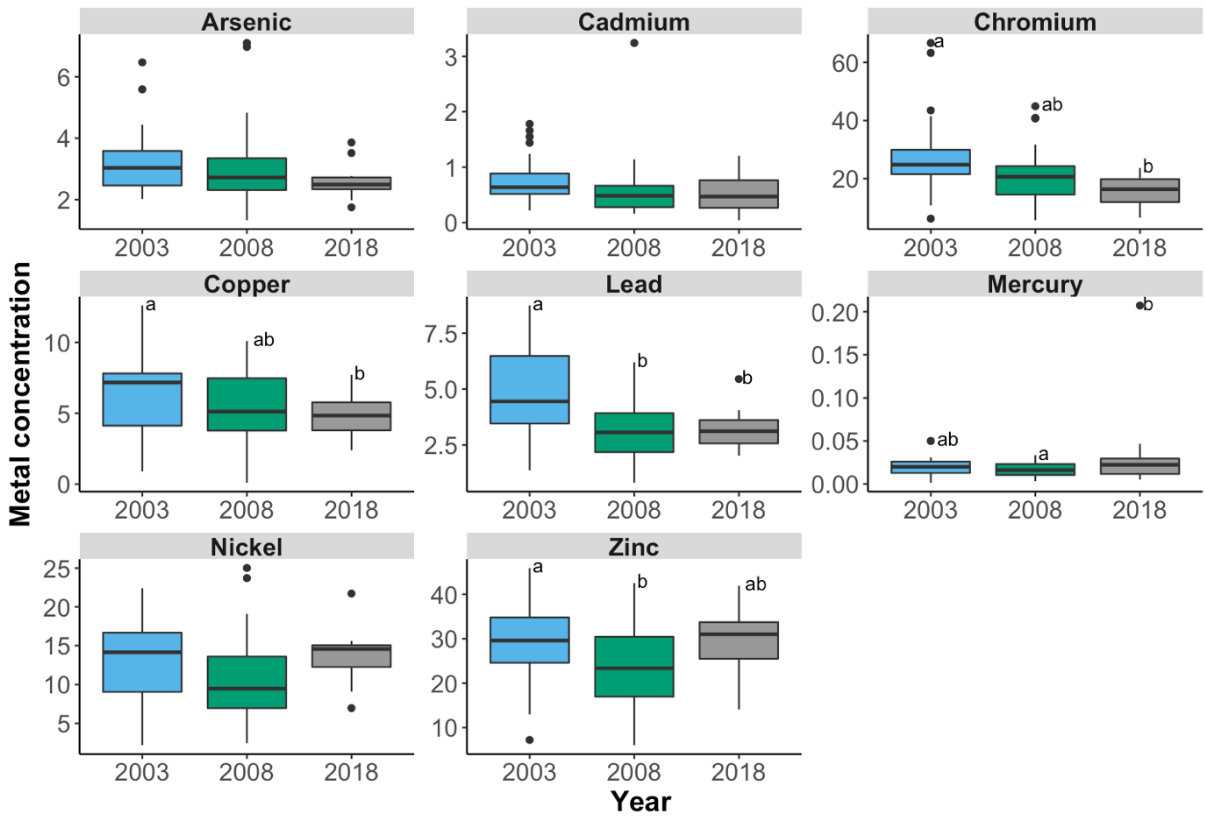

Figure 31. Schematic boxplots of heavy metals measured during the Bight'03, '08, and '18 surveys. Letters indicate significantly (α=0.1) similar/different concentrations between surveys based upon Tukey's multiple comparisons of an ANOVA. No letters indicate no differences. Chemistry was not sampled at the stations in 2013 or 1998.

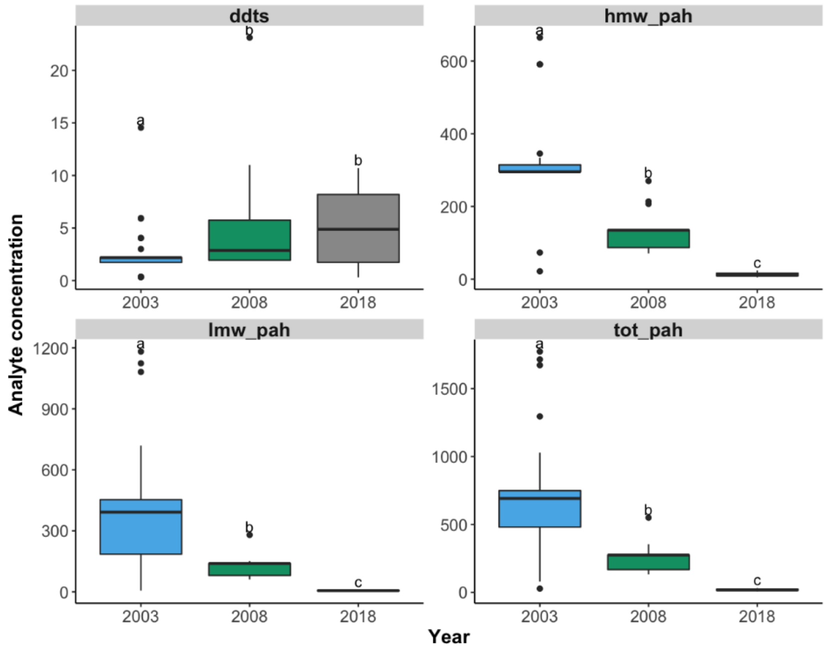

Figure 32. Schematic boxplots of DDTs and PAHs measured during the Bight'03, '08, and '18 surveys. Letters indicate significantly (α=0.1) similar/different concentrations between surveys based upon Tukey's multiple comparisons of an ANOVA. HMW = high molecular weight, LMW = low molecular weight. Chemistry was not sampled at the stations in 2013 or 1998 This figure is the same as Figure 19 in the main body of the report.

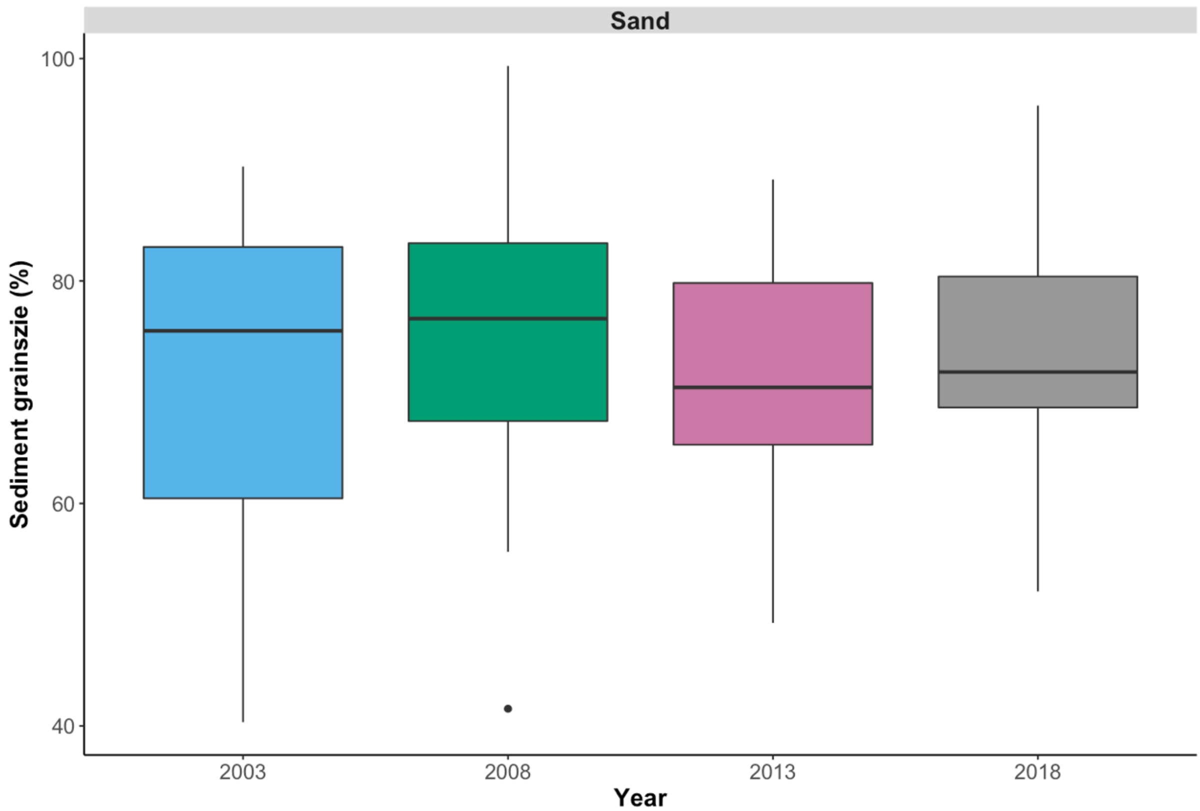

Figure 33. Schematic boxplot of sediment composition during the Bight'03, '08, '13, and '18 surveys. There were no significant (α=0.1) differences between years based upon a Kruskal-Wallis test. Clays and silts were not compared due to errors with clay and silt content measures in the 2013 survey.

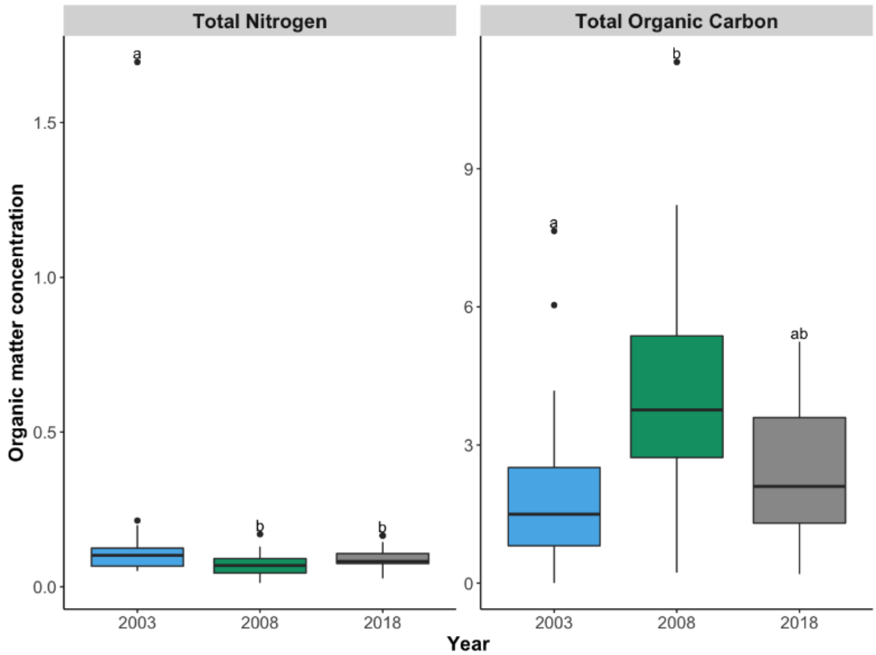

Figure 34. Schematic boxplots of sediment organic matter measured during the 2003, '08, and '18 surveys. Letters indicate significantly (α=0.1) similar/different concentrations between surveys based upon Tukey's multiple comparisons of an ANOVA. No letters indicate no differences. Chemistry was not sampled at the stations in 2013 or 1998. This figure is the same as Figure 20 from the main body of the report.

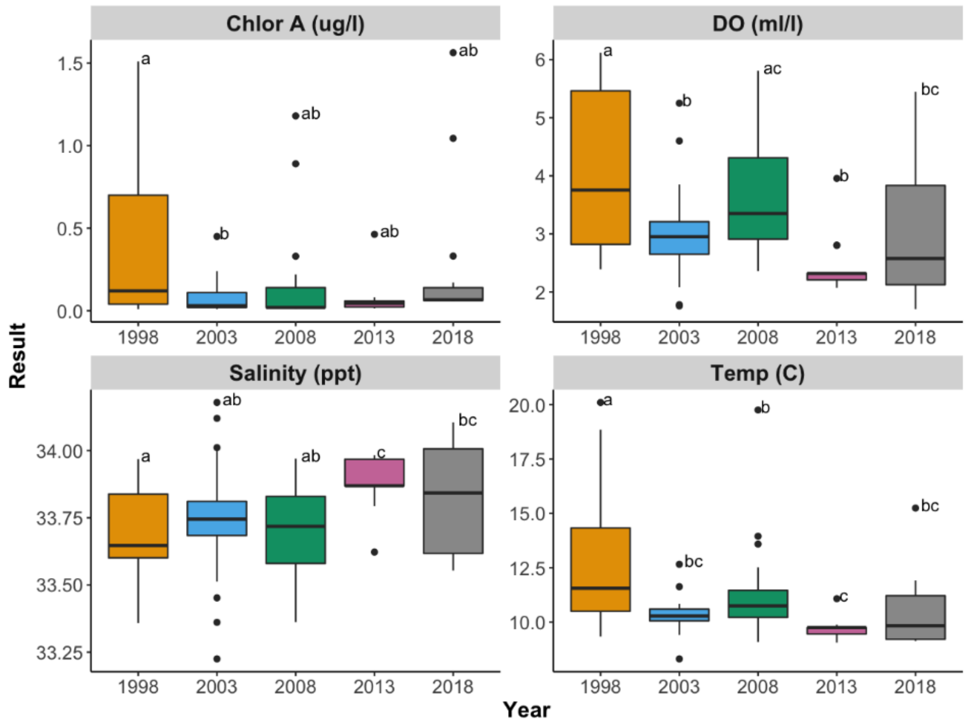

Figure 35. Schematic boxplots of water quality metrics from CalCOFI water quality data during the Bight'98, '03, '08, '13, and '18 surveys. Letters indicate significantly (α=0.1) similar/different values between years based upon Tukey's multiple comparisons of an ANOVA. All measures are bottom water measurements. This figure is the same as Figure 18 in the main body of the report.

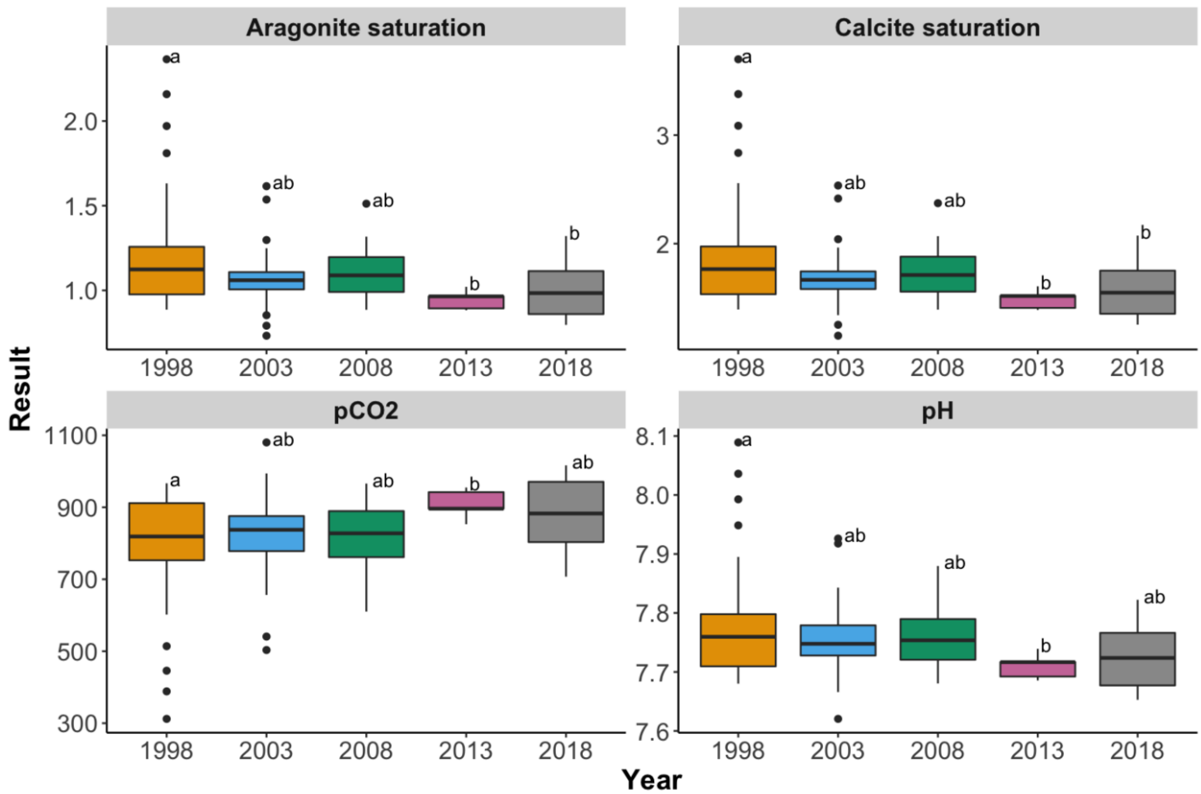

Figure 36. Schematic boxplots of ocean acidification metrics modeled from CalCOFI water quality data during the Bight'98, '03, '08, '13, and '18 surveys. Letters indicate significantly (α=0.1) similar/different values between years based upon Tukey's multiple comparisons of an ANOVA. Values were modeled from CalCOFI bottle data closest to the location and depth of the benthic samples. Higher values of aragonite saturation, calcite saturation, and pH are, in general, less stressful to marine organisms. Higher pCO2 values are, in general, more stressful. This figure is the same as Figure 17 in the main body of the report.

Discussion

The in-depth analysis of biotic and abiotic data from the Channel Islands stratum indicated that the differences in condition observed in 2013 were "real" and represented a quantitative shift in continuous and categorical measures of the BRI from Bight surveys in all of the other surveys before and after. The departure of 2013 BRI scores from the "norm" of the other survey years was not as clearly reflected in the overall community composition. The 2013 community composition was different than the surveys preceding and following it. However, instead of a rebound or return to the composition of previous surveys, the survey-to-survey pattern in community composition is indicative of gradual, decade-long changes in the macrobenthic communities of the region.

The year-to-year patterns in potential stressors and environmental forcing factors indicated that the lower scores were not reflective of changes in the sedimentary environment – not toxic chemicals, sediment organic matter, nor composition of the sediment. However, the waters within the Channel Islands stratum in 2013 appeared to have been colder, with less oxygen and more corrosive. These types of oceanographic changes can alter community structure (e.g., Gillet et al. in review) but it is unclear if they are reflected in BRI scores or categories (Gillett unpublished). The observed water characteristics are suggestive of a temporary intrusion of deeper continental slope and deep basin waters up into continental shelf depths in 2013.

These analyses and those in the main body of the report indicate that there was a rebound in condition of the Channel Islands stratum by the time of the 2018 survey. It is worth noting that, although all samples were in the reference condition category, the BRI scores from the 2018 samples were elevated (more disturbed) than any of the pre-2013 surveys. This pattern may be an echo of the disturbance from 2013, where there was some degree of lag in the recovery of the community from whatever led to the altered BRI scores initially. It may also be a product of elevated sea surface temperatures that have persisted over the last number of years (e.g., Hobday et al. 2015, 2018).

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APPENDIX E – SEDIMENT CONDITION SURROUNDING OIL PLATFORMS IN THE SANTA BARBARA CHANNEL

The following paper details the results of a study done in collaboration between SCCWRP and the Bureau of Ocean Energy Management (BOEM) as part of BOEM's participation in Bight'18. The paper was published as open access in Marine Pollution Bulletin. It can be cited as:

Gillett, D.J., L. Gilbane, and K.C. Schiff. 2020. Benthic habitat condition of the continental shelf surrounding oil and gas platforms in the Santa Barbara Channel, Southern California. Marine Pollution Bulletin 160:111662.

Marine Pollution Bulletin 160 (2020) 111662

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Benthic habitat condition of the continental shelf surrounding oil and gas platforms in the Santa Barbara Channel, Southern California

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ARTICLE INFO

Keywords:
Macrobenthos
Sediment toxicity
Sediment chemistry
Sediment triad
Oil platform decommissioning

ABSTRACT

The continental shelf of southern California is an important location for the extraction of petroleum and natural gas. Many platforms in the region have been operating for more than four decades and are being targeted for decommissioning. Information on the condition of surrounding habitats to the platforms will be important for regulators. The condition of sediments near (250 m–2 km) four active oil/gas platforms was evaluated with measures of macrobenthic infauna, toxicity, and chemical composition using standardized assessment indices and compared to that of equivalent locations across the region without platforms. Assessment scores indicated that the sediments surrounding the oil platforms were in a relatively good state, with reference-condition infauna, minimal levels of chemical exposure, and five instances (25% of samples) of low-level toxicity. Samples from around the oil platforms were in overall similar condition to the region, with slightly better condition infauna, nearly identical chemistry, and slightly worse toxicity.

1. Introduction

The continental shelf of southern California is an important location for the extraction of petroleum and natural gas within the coastal waters of the United States. There are 23 platforms of varying ages within Federal waters offshore of California (McCrary et al., 2003; BSEE, 2018), with the oldest installed in 1967 (Love et al., 2003; BSEE, 2018). Fifteen of these platforms are within the Santa Barbara Channel portion of the Southern California Bight. The Santa Barbara Channel is an ecologically unique and complex region of the US Pacific Coast, as it is a transition between biogeographic regions (Oregonian to the north and Californian to the south), contains a number of marine protected areas, and borders the second largest metroplex in the United States (Schiff et al., 2016).

A variety of operational platform-related activities (e.g., drilling, maintenance, waste water production), as well as the physical presence of the platform itself, have the potential to influence the condition of the seafloor habitat near the platform (Bishop et al., 2017; Heery et al., 2017; Henry et al., 2017). The cables, pipes, and support structures provide protection from predation and represent more hard substrate for epifauna to grow on than the low-profile soft sediments that comprise much of the continental margin seafloor. In many cases, demersal fishes and megainvertebrates may actually benefit from the structural complexity created by the platform (Love and York, 2005; Page et al., 2008; Claisse et al., 2014).

In contrast to demersal and pelagic fauna, sessile infauna abundance and species compositions are often negatively impacted by platform operations (Denoyelle et al., 2010; Manoukian et al., 2010; Ellis et al., 2012). When wells are drilled for oil and gas exploration or production, fluids and sediments from the drilling process can be released into the water and settle onto the sea floor. Deposits from drilling can bury organisms and increase sediment toxicity over time due to additives introduced to improve the performance of the drilling fluid (Neff, 1987). The amount of materials released from drilling can be substantial – nearly 2000 metric tons of material may be discharged during drilling of an exploration well (Neff, 1987). The size of the area affected from drilling deposits depends on the volume of released materials, the age of the platform, depth of water, sediment characteristics, and ocean conditions. As such, the area of deposition can range from distances of 10 to 20 m from the discharging platform (Neff, 2005) to over 2000 m (Davies et al., 1984).

The investigation of benthic impacts was an important area of study for Federal platforms in southern California early in their development and installation. A large survey in 1975–76 examined metals, chemicals, sediments, and infauna communities associated potential areas for development throughout the Southern California Bight (Callahan and Shokes, 1977). Later, the California Outer Continental Shelf Monitoring Program evaluated the effect of drilling 39 wells from three offshore

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https://doi.org/10.1016/j.marpolbul.2020.111662
Received 18 June 2020; Received in revised form 2 September 2020; Accepted 6 September 2020
Available online 10 September 2020

platforms off Point Arguello, California from 1986 to 1995 (Hyland et al., 1991a; Lissner, 1993).

Most of the platforms in the Santa Barbara Channel ecosystem have been in operation for four to five decades and a number of them are approaching the end of their productive lifespans (Schroeder and Love, 2004; Henrion et al., 2014; Bull and Love, 2019). Many of these older platforms are being targeted for decommissioning, which in California currently means the complete removal of oil and gas facilities. Data on the present-day conditions of the benthic habitats around the platforms are important for managers and regulators seeking to predict potential disturbances stemming from changes in platform operation and activities. It would be best if that information would be observational in nature– as opposed to generalized conceptual models – and have as close spatial and temporal proximity to any planned activities as is possible.

Unfortunately, at the present moment nearly all the information available in the scientific literature detailing the relationships between sediment habitat condition and oil and gas platform operation are not from southern California (e.g., North Sea – Olsgard and Gray, 1995; Gulf of Mexico –Montagna and Harper Jr., 1996; Hernández Arana et al., 2005; Mediterranean Sea – Manoukian et al., 2010; Terlizzi et al., 2008). Hyland et al. (1990, 1991a, 1991b, 1994) represents that most recent analysis of sediment chemistry and infauna from soft-sediment habitats near southern California oil platforms, which were based upon sampling conducted more than 30 years ago. As such, there is a lack of current information on the condition of benthic habitat surrounding platforms from southern California, leaving local managers at a disadvantage as decommissioning assessments begin.

The goal of this study was to assess the benthic habitat condition of continental shelf sediments surrounding four active oil/gas platforms in the Santa Barbara Channel in southern California. Condition was evaluated with macrobenthic infaunal community composition, sediment toxicity, and sediment chemical composition. To provide a regional context for our observations of condition, results were compared to those from the most recently completed Southern California Bight Regional Monitoring Program Survey, conducted in 2013 (Schiff et al., 2016).

2. Methods

2.1. Study area and sampling design

Sampling was focused around four active offshore oil and gas producing platforms (A, B, C, and Hillhouse) in the eastern part of the Santa Barbara Channel (Fig. 1). This area of the Southern California Bight is on the continental shelf with water depths of ~60 m (i.e., mid-shelf depths). This is an area oceanographically influenced by the cold-water California Current flowing to the south mixing with the warm-water Davidson Countercurrent flowing to the north (Bray et al., 1999), as well as seasonal upwelling of nutrient-rich bottom waters (Chhak and Di Lorenzo, 2007). Additionally, these waters are adjacent to a densely populated United States metro-center (http://california.us.censusviewer.com/client) and receive point-source and non-point source discharges from more than 23 million people (County Sanitation Districts of Los Angeles County, 2016; Orange County Sanitation District, 2017).

Two sampling strata were created around the platforms, representing polygons with 0–1 km and 1–2 km distances from any of the platforms. Within these strata, 250 m exclusion buffers were created around the platform structures, underwater pipes and cables, as well the shell mounds associated with each platform. These buffers ensured sampling crew safety, prevented damage to the platform infrastructure, and maximized the likelihood of finding sediments suitable for sampling via a grab (i.e., not on shell debris or consolidated sediments). Ten sample sites were allocated within each stratum via a stratified, random tessellated design (Stevens and Olsen, 2003, 2004; Olsen and Peck, 2008). The random allocation process allows for an even distribution of sites among strata. An additional 20 overdraw sites were selected for each stratum in case samples could not be collected at any of the initially identified sampling sites.

2.2. Analytical approach

Habitat condition was assessed at each site with three types of measurements: benthic infaunal community composition, sediment chemistry, and sediment toxicity. Sediment for the three assessment components was collected from each of the 20 sampling sites using a double 0.1 m^2 Van Veen grab following the sampling protocols detailed in the Southern California Bight 2018 Regional Marine Monitoring Survey Sediment Quality Assessment Field Operations Manual (Bight "18 Field Sampling and Logistics Committee, 2018). All measurements from the platform strata were compared to measurements from across the region at the same mid-shelf depth range (30–93 m) that were collected as part of a prior regional survey (2013 Southern California Bight Regional Monitoring Program Survey [Bay et al., 2015; Dodder et al., 2016; Gillett et al., 2017]).

Macrobenthic communities were quantified and characterized using univariate and multivariate comparisons of taxonomic composition, while habitat condition was assessed from these data using the Southern California Benthic Response Index (BRI [Smith et al., 2001]). Sediment chemistry was quantified by measurements of individual compounds (metals, PCBs, PAHs, and pesticides) and habitat condition was assessed from the chemical concentrations via potential exposure scores using the California Chemical Score Index (CSI [Bay et al., 2014]). Sediment toxicity was evaluated using a 10-day amphipod survival test (US Environmental Protection Agency (USEPA), 1994; American Society for Testing and Materials (ASTM), 2010) and habitat condition was interpreted from these data with the California Sediment Quality Objectives (SQOs) framework (Bay et al., 2014). Individual condition assessment categories based upon macrobenthic community, sediment chemical content, and toxicity test results (see Table 1) are combined to give an overall condition assessment (e.g., minimal chemistry exposure + low disturbance macrobenthos + moderate toxicity = Likely Unimpacted) for each sample following Bay et al. (2014).

2.3. Benthic infauna

Methods for processing and identification of benthic infauna followed the guidelines of the Southern California Bight 2018 Macrobenthic Sample Analysis Laboratory Manual (Bight '18 Benthic Committee, 2018). In short, sediments were sieved on a 1-mm screen, the material retained on the screen was placed in a chemical relaxant solution, and then fixed with 10% buffered formalin. Samples were rinsed and transferred from formalin to 70% ethanol 2–5 days after collection. Organisms were sorted from the retained material, counted, and identified to the lowest possible taxonomic level following the Southern California Association of Marine Invertebrate Taxonomists (SCAMIT) Edition 12 species list (Southern California Association of Marine Invertebrate Taxonomists (SCAMIT), 2018). Quality assurance and control protocols and data quality objectives for sample sorting, identification, and enumeration are detailed in the Southern California Bight 2018 Benthic Committee Lab Manual (Bight '18 Benthic Committee, 2018).

Taxonomic composition among the platform samples was visually compared by ordination of untransformed abundance Bray-Curtis dissimilarity values in a 2-D non-Metric Multi-Dimensional Scaling (nMDS) plot. Similarly, the composition of the platform samples was compared to all mid-shelf depth samples from the 2013 regional survey (2018 data were not available at time of publication). Differences in taxonomic composition between the platform samples and the regional mid-shelf samples were quantified with a 1-way permANOVA ($\alpha = 0.1$,

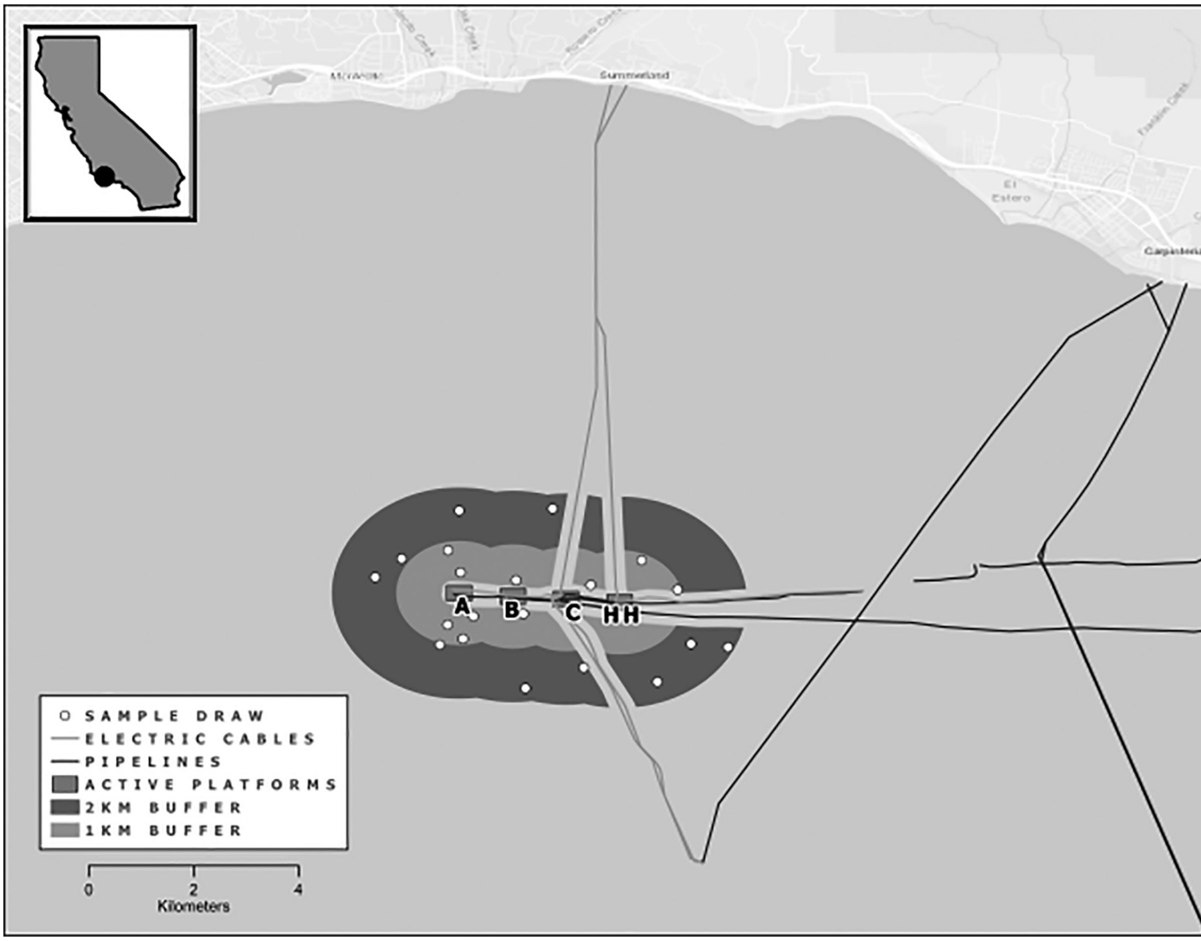

Fig. 1. A map depicting the approximate location of the twenty sampling sites within the1-km (medium grey) and 2-km (dark grey) strata around the A, B, C and Hillhouse (HH) oil platforms. The inset shows the location of the area with respect to the Pacific Coast of the US.

Table 1
Condition category thresholds for condition assessment tools used to interpret macrobenthic infauna (BRI [after Gillett et al., 2017]), sediment chemistry (CSI [after Bay et al., 2014]), and sediment toxicity (after Bay et al., 2014).

Assessment tool	Category	Response range
BRI score	Reference	0– < 34
	Low disturbance	34– < 44
	Moderate disturbance	44– < 72
	High disturbance	≥72
CSI score	Minimal exposure	< 1.69
	Low exposure	1.69–2.33
	Moderate exposure	> 2.33–2.99
	High exposure	> 2.99
Toxicity % survival (control adjusted)	Non-toxic	100–90
	Low toxicity	89 - 82[a]
	Moderate toxicity	59 - 81[b]
	High toxicity	< 59

[a] If the response is not significantly different than the negative control, then the category become Non-Toxic.
[b] If the response is not significantly different than the negative control, then the category becomes Low Toxicity.

1000 permutations, Bray-Curtis dissimilarities), with data source as the treatment variable. Differences in univariate measures of community composition (e.g., abundance, diversity, etc.) between oil platform samples and those from similar depths across the region were quantified using a 1-way ANOVA, with data source as the treatment variable ($\alpha = 0.1$). All nMDS ordinations and permANOVA analyses were conducted with the Vegan package (v 2.5–4) in R (v3.5.3). ANOVA analyses were conducted with the aov function in R (v3.5.3).

Habitat condition of the sediments at each site was assessed using the Benthic Response Index (BRI) (Smith et al., 2001). BRI scores and condition categories were calculated using the Southern California Coastal Water Research Project's online BRI calculator (http://data.sccwrp.org/upload/bri_map.v6.php). BRI scores were compared to those of other mid-shelf sites within the region using a 1-way ANOVA, with data source as the treatment variable ($\alpha = 0.1$).

2.4. Sediment chemistry

Methods for processing and measuring sediment contaminants, grainsize composition, and organic matter content followed Dodder et al. (2016). Individual target analytes included a suite of compounds typically measured in regional surveys: metals, polychlorinated biphenyls (PCBs), polynuclear aromatic hydrocarbons (PAHs), pesticides, measures of sediment grainsize, total organic carbon (TOC) and total nitrogen (TN) (Supplemental Material A). Briefly, grainsize samples were sieved on 2-mm and 1-mm screens to capture the gravel fraction and the remaining smaller particles were analyzed using a SM2560D laser refractometer. Sediments for TOC and TN analysis were acidified with hydrochloric acid vapors and combusted in a high temperature elemental analyzer with gas chromatography. Samples for all metals except for mercury were digested in a strong acid, with the digestate analyzed by inductively coupled plasma mass spectrometry. Mercury was analyzed using cold vapor atomic adsorption spectroscopy. The trace organics (PAHs, PCBs, and pesticides) were solvent extracted and analyzed with gas chromatography mass spectrometry. All analytes

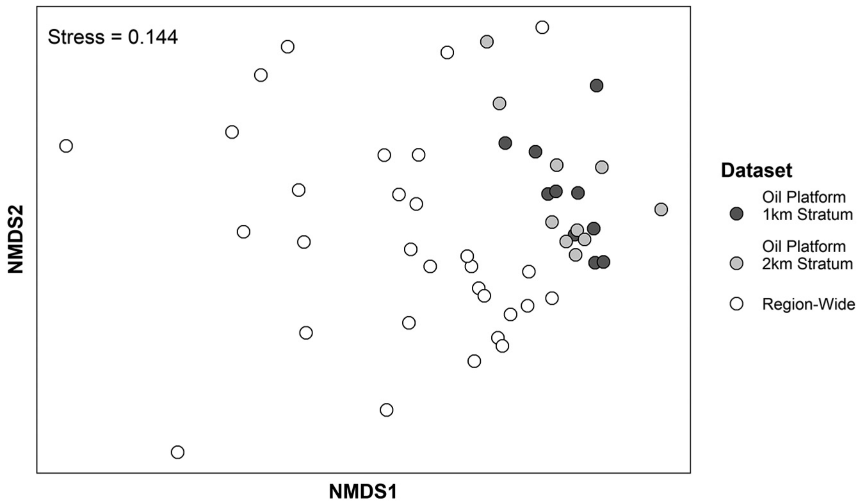

Fig. 2. A 2-D nMDS plot summarizing the similarity of benthic infauna in samples from the 1-km and 2-km strata of the oil platforms, as well as those from mid shelf depths across the Southern California Bight collected in 2013. The ordination was based upon Bray-Curtis dissimilarities calculated from untransformed species abundance.

were measured and summed with the same methods in both the present study and the regional survey.

Comparisons of key compounds of interest including Total PAHs, Low (< 4 aromatic rings) and High (> 3 aromatic rings) molecular weight PAHs, copper, barium, and total DDE, as well as TOC, TN, and grainsize were compared between the platform samples and those from mid-shelf depths across the region collected in 2013. Comparisons of individual compounds between oil platform and regional samples were quantified in a 1-way ANOVA, with the data source as the treatment variable ($\alpha = 0.1$). ANOVA calculations were conducted with the aov function in R (v3.5.3). Habitat condition based upon potential chemical exposure was assessed using the CSI framework (Bay et al., 2014). Comparisons of CSI scores and the distribution of habitat condition categories was made between the platform and regional samples.

2.5. Sediment toxicity

Laboratory methods, as well as quality assurance and control for whole sediment toxicity testing followed the guidelines of Bay et al. (2015). The toxicity of sediments collected from each of the platform stations was evaluated with a 10-day survival test using the amphipod *Eohaustorius estuarius* (US Environmental Protection Agency (USEPA), 1994; American Society for Testing and Materials (ASTM), 2010). Twenty amphipods were used in each replicate test at 15 ± 2 °C under constant illumination. Sediment toxicity was quantified as control adjusted survival after the 10-day exposure. Control adjusted survival rates for the platform samples was compared to that of similar mid-shelf depth samples from across the region collected in2013. Habitat condition based upon the toxicity of the sediment was evaluated using California's SQO assessment framework (Bay et al., 2014). The distribution of condition categories was compared that of similar mid-shelf depth samples from across the region.

Any platform samples that demonstrated toxicity were further investigated for potential causality by comparing the chemical concentrations and sediment conditions between non-toxic and toxic samples. Differences in the concentrations of major constituents (barium, copper, mercury, zinc, total high molecular weight PAHs, total low molecular weight PAHs, total PAHs, total DDEs, total nitrogen, total organic carbon, and clay composition) between samples were quantified with a one-way ANOVA, with toxicity test status as the treatment variable ($\alpha = 0.1$). ANOVA tests were conducted using the aov function in R (v 3.5.3).

The potential impacts of toxicity on benthic community were investigated by comparing differences in benthic community composition and condition between non-toxic and toxic samples. Differences in community composition were estimated visually with an nMDS ordination and quantified with one-way permANOVA between the groups of samples, with toxicity test status as the treatment variable ($\alpha = 0.1$) across 1000 permutations using untransformed abundance Bray-Curtis dissimilarities. Similarly, the difference in BRI score between the two groups of samples was quantified with a one-way ANOVA, with toxicity test status as the treatment variable ($\alpha = 0.1$). ANOVA tests were conducted using the aov function in R (v 3.5.3) and the permANOVA was conducted using the adonis2 function in the Vegan package (2.5–4) in R (v 3.5.3).

3. Results

3.1. Benthic infauna

Across the 20 samples, 338 different taxa were identified. A comparison of the benthic infauna collected from the 1-km and 2-km strata indicated that the strata were relatively similar to each other. Within both strata, the macrobenthic community was dominated by the ophiuroid *Amphiodia urtica*, and the polychaetes *Spiophanes duplex*, *Aglaophamus verrilli*, and *Mediomastus* sp., which were among the top ten most abundant taxa across all the samples. A permANOVA of Bray-Curtis dissimilarities (untransformed abundances) indicated that there were no differences between the infauna from the 1-km and 2-km strata ($p = 0.45$, df = 1,18). Multivariate comparisons between the platform samples and those from across the region suggest that there were differences in community composition and abundance between the two data sets (permANOVA $p = 0.001$, df = 1,48). A visual inspection of the ordination (Fig. 2) confirms the permANOVA results, in that platform samples clustered to themselves (i.e., more similar) than to the regional samples, albeit without complete separation from them.

From a univariate perspective, the samples from around the oil platforms were somewhat different than similar regional mid-shelf samples. The oil platform samples had significantly lower total abundance ($p = 0.012$, df = 1,48, f = 6.8), taxa richness ($p < 0.001$, df = 1,48, f = 24.4), and Shannon-Weiner taxa diversity ($p = 0.006$, df = 1,48, f = 8.2) than the regional samples based upon the results of the 1-way ANOVA tests (Fig. 3).

3.2. Sediment chemistry

Measurements were made for 87 different chemical contaminants, as well as measurements of sediment grainsize, TOC, and TN content, at each of the 20 sampling sites. Of the priority toxic compounds with published biological effects thresholds (Table 2), no compounds were observed at concentrations above their ERM or CSI High Impact values and most of the compounds were below any biologically meaningful

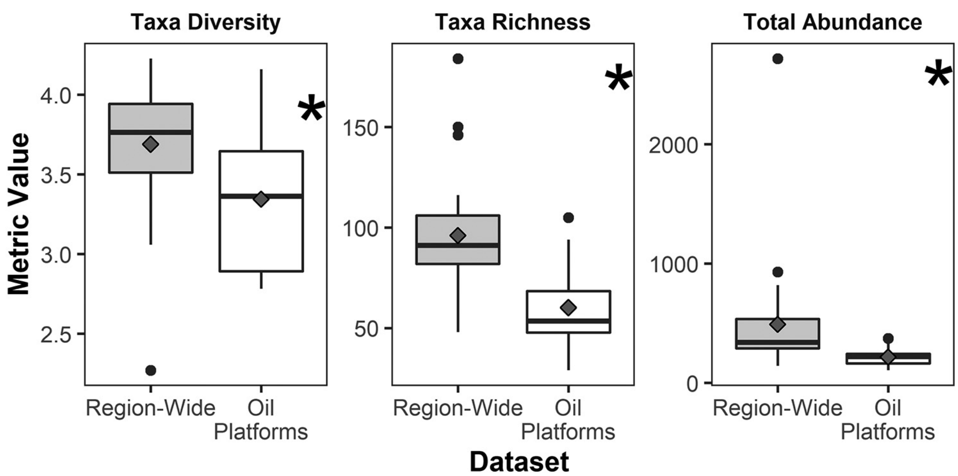

Fig. 3. Schematic box-plots comparing taxa richness (S), taxa diversity (H′), and total abundance (# grab^{-1}) between oil platform samples and those from mid shelf depths across the Southern California Bight collected in 2013. An asterisk indicates a significant difference (α = 0.1) in a 1-way ANOVA test between the Regional and Oil Platform datasets. The grey diamonds indicate the mean value for each metric.

Table 2
The counts of oil platform samples where concentrations of chemicals were measured in exceedance of their respective ERL/ERM (Long et al., 1995) or CSI Condition (Bay et al., 2014) thresholds. A blank cell indicates that the assessment framework did not have a threshold for that particular chemical compound.

Chemical	Greater than ERL	Greater than ERM	CSI condition thresholds		
			Low impact	Moderate impact	High impact
Arsenic	11	0			
Cadmium	0	0			
Chromium	0	0			
Copper	0	0	0	0	0
Lead	0	0	0	0	0
Mercury	0	0	0	0	0
Nickel	7	0			
Silver	0	0			
Zinc	0	0	0	0	0
2-methyl naphthalene	0	0			
Acenaphthene	0	0			
Acenaphthylene	0	0			
Anthracene	0	0			
Benzo(*a*)anthracene	0	0			
Benzo(*a*)pyrene	0	0			
Chrysene	0	0			
Fluoranthene	0	0			
Fluorene	0	0			
Naphthalene	0	0			
Phenanthrene	0	0			
Pyrene	0	0			
Summed high molecular weight PAHs			1	0	0
Summed low molecular weight PAHs			0	0	0
Sum of all PAHs	0	0			
Summed DDDs			2	0	0
Summed DDEs	16	0	19	2	0
Summed DDTs	0	0	5	0	0
Cis-chlordane			0	0	0
Trans-chlordane			0	0	0
Summed PCBs	0	0	0	0	0

concentration at all. Total DDEs (i.e., 2,4 DDE + 4,4 DDE) was the compound measured most frequently in exceedance of its thresholds: Nineteen samples had total DDEs above the CSI Low Impact threshold, with two of those samples above the Moderate Impact threshold; 16 samples had total DDEs above the ERL threshold. The contaminant with the second most exceedances was arsenic, with 11 samples above the ERL value.

Compared to samples collected from mid-shelf depths across the region, samples from the oil platforms had significantly higher concentrations of barium ($p < 0.001$, df = 1,48, f = 14.5), high molecular weight PAHs ($p = 0.035$, df = 1,48, f = 4.7), and total PAHs ($p = 0.069$, df = 1,48, f = 3.5) (Fig. 4). In contrast, oil platform samples had similar amounts of copper ($p = 0.203$, df = 1,48, f = 1.7) and low molecular weight PAHs ($p = 0.474$, df = 1,49, f = 0.52) as the regional samples. The concentration of total DDE was higher in regional samples than those from the oil platforms ($p = 0.087$, df = 1,42, f = 3.1). Sediments from the oil platform samples were sandier ($p = 0.073$, df = 1,46, f = 3.4) than those from across the region. Sediment TOC content ($p = 0.252$, df = 1,46, f = 1.3), and TN content ($p = 0.987$, df = 1,39, f = 0.0003) were similar between the oil platform and regional samples (Fig. 5).

3.3. Sediment toxicity

Successful 10-day survival toxicity tests were conducted with sediments from each of the 20 oil platform sampling sites. Fifteen of the samples showed no toxicity. Five of the samples showed low toxicity, three of which were located in the 1-km stratum. Control adjusted survival was slightly lower among the oil platform samples compared to that of samples from mid-shelf depth sites from across the region (Fig. 6).

The low toxicity platform samples had significantly higher concentrations of copper ($p = 0.044$, df = 1,18, f = 4.7), mercury ($p = 0.007$, df = 1,18, f = 9.2), zinc ($p = 0.067$, df = 1,18, f = 3.8), and total DDEs ($p = 0.018$, df = 1,18, f = 6.8) (Fig. 7) than did the platform samples with non-toxic values. Additionally, sediments from the low toxicity samples contained significantly more clay ($p = 0.016$, df = 1,18, f = 7.0), nitrogen ($p = 0.015$, df = 1,18, f = 7.2), and organic carbon ($p = 0.022$, df = 1,18, f = 6.3) (Fig. 7). There were no differences in the amounts of barium or the different PAH mixes measured between the two types of samples. There were no differences in benthic community composition between the low toxicity and no toxicity platform samples (permANOVA $p = 0.405$, df = 1,18), which confirms the pattern apparent in the nMDS ordination of the data (Fig. 8).

3.4. Habitat condition

Based upon the BRI benthic infauna-based condition assessment tool, 100% of the sampling sites around the oil platforms were in reference condition. In comparison to the mid-shelf depth samples from across the region assessed during the Bight '13 survey, the oil platform samples had lower (i.e., healthier) BRI scores (Fig. 6) and a greater

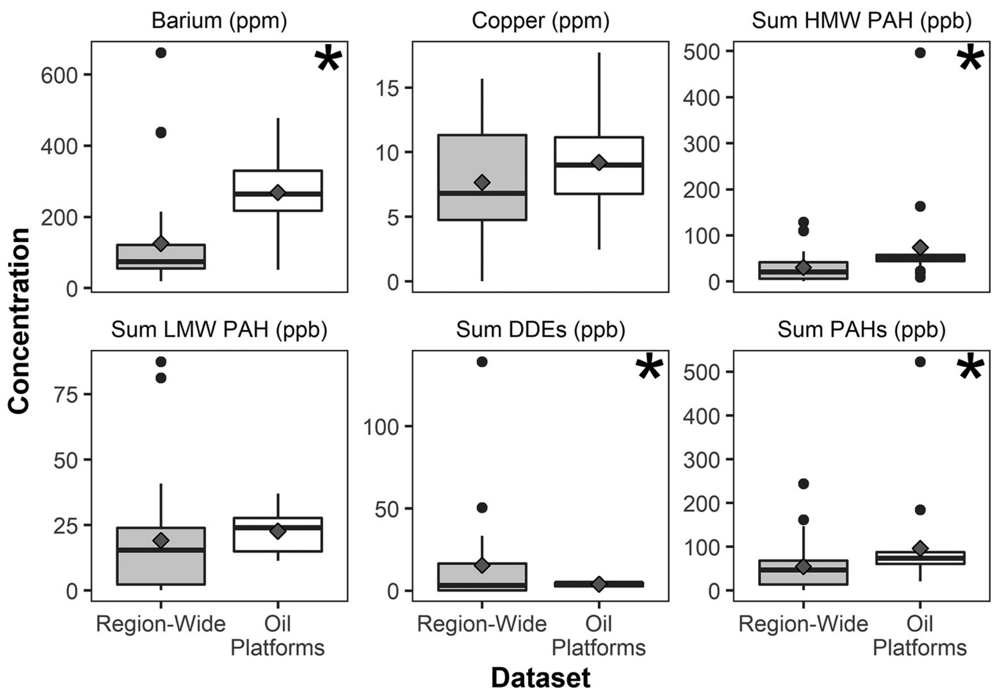

Fig. 4. Schematic box plots comparing select chemical compounds between oil platform samples and those from mid shelf depths across the Southern California Bight collected in 2013. An asterisk indicates a significant difference (α = 0.1) in a 1-way ANOVA test between the Regional and Oil Platform datasets. The grey diamonds indicate the mean value for each compound.

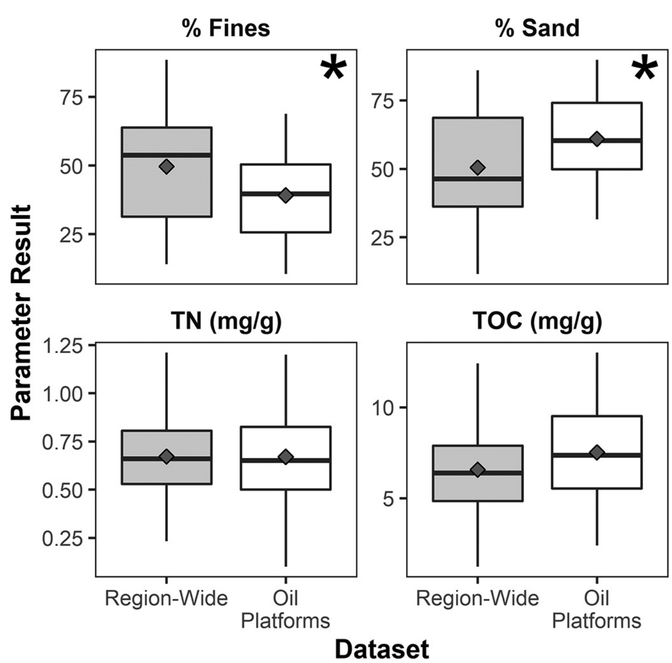

Fig. 5. Schematic box plots comparing measures of sediment grainsize composition (% Fines = %Mud + % Clay), total organic carbon (TOC), total nitrogen (TN) between oil platform samples and those from mid shelf depths across the Southern California Bight collected in 2013. An asterisk indicates a significant difference (α = 0.1) in a 1-way ANOVA test between the Regional and Oil Platform datasets. The grey diamonds indicate the mean value for each sediment parameter.

percent of the samples were categorized in reference condition than those from the regional dataset (90% reference, 6.7% low impact, 3.3% moderate impact). Based upon the CSI chemistry-based condition assessment tool, 100% of the sampling sites around the oil platforms had minimal potential chemical exposure. CSI scores of the oil platform samples were similar to that of the mid-shelf samples from across the region (Fig. 6). All of the oil platform samples were evaluated as having minimum chemical exposure to benthic infauna, as were 100% of regional mid-shelf samples. The toxicity -based condition tools indicated that of 75% of the oil platform samples were evaluated as non-toxic and 25% as low toxicity. Regional mid shelf samples were100% non-toxic. Overall, the oil platform samples had lower control adjusted survival than samples from mid-shelf depths across the region (Fig. 6).

There was no clear expression of the patterns the sediment toxicity among the macrofauna observed at the 20 sites that were sampled around the platforms. The low toxicity result – within the interpretation framework we used – represents only a subtle potential impact to the environment (Bay and Weisberg, 2012). This is bore out in the profiles of taxa composition and abundance among all the samples, which – while not identical (Fig. 8) – did not follow a detectable pattern related to the toxicity status.

When the three measurements of habitat condition – macrobenthic community composition, sediment chemistry, and sediment toxicity – were combined together following the guidelines of the California SQO framework (Bay et al., 2014), all of the samples from around the oil platforms were evaluated to be in unimpacted condition.

4. Discussion

This work is the first comprehensive condition assessment of benthic habitats adjacent to oil and gas platforms in southern California in over 20 years. Using regionally calibrated assessment tools that measure habitat condition using benthic infauna, sediment chemistry and sediment toxicity, we demonstrated that the soft sediment seafloor surrounding the A, B, C, and Hillhouse oil platforms were in a relatively good state. Based upon this assessment framework, all of the sample area had reference-condition benthic infauna and sediments with minimal levels of potential chemical exposure, which was proportionally better than the region as a whole. When compared to regional data, however, statistical differences in benthic community composition and lower total infaunal abundances were observed in the sediments near the platforms. Similarly, sediments around the platforms had statistically higher concentrations of barium and total PAHs than the regional average. Taken together, these results would suggest that present day oil platform operations at these locations could be detected in the environment but were not substantially degrading the continental shelf habitat around them. This overall result illustrates the value of targeted

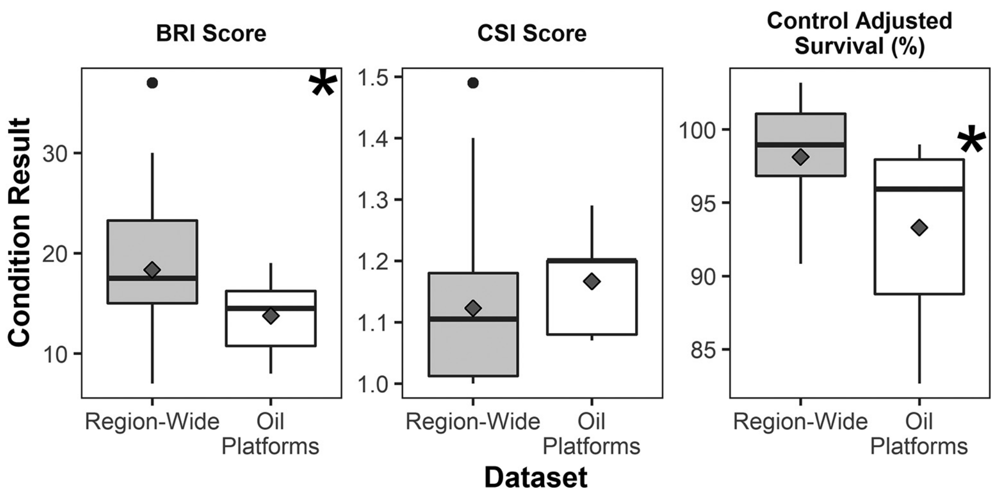

Fig. 6. Schematic box plots comparing benthic habitat condition scores between oil platform samples and those from mid shelf depths across the Southern California Bight collected in 2013 based upon benthic infauna (BRI Score), sediment chemical content (CSI Score), and sediment toxicity tests (Control Adjusted Survival. An asterisk indicates a significant difference (α = 0.1) in a 1-way ANOVA test between the Regional and Oil Platform datasets. The grey diamonds indicate the mean value for each metric. Note that lower BRI scores indicate better condition infauna and lower CSI scores indicater less contaminated sediment.

assessment studies conducted within the larger framework of regional, probabilistic assessments. The combination of sampling schemes provides insight into the impacts of different human activities – oil and gas extraction in this case – on the coastal ocean. It allows for the answering of directed questions at spatial- or mechanistic-scales that would be more challenging to address with only regional monitoring program data, but it also produces results can still be placed within the milieu of the region as a whole.

The benthic infauna that were living around the oil platforms were typical of mid-shelf infauna found across the Southern California Bight (Ranasinghe et al., 2012; Gillett et al., 2017). The total abundance of organisms found in the oil platform samples was somewhat lower than what was typical for the region, but the samples were far from depauperate. Density of fauna in a location can be influenced by a mix of natural (e.g., predation or recruitment) (Wilson, 1990; Cowen and Sponaugle, 2009) or anthropogenic processes (Pearson and Rosenberg, 1978; Warwick, 1986). The habitat condition index we applied (Smith et al., 2001) indicated that all of the samples were in reference condition, which would suggest that the somewhat low abundance may have been biologically-based phenomena or related to oceanographic

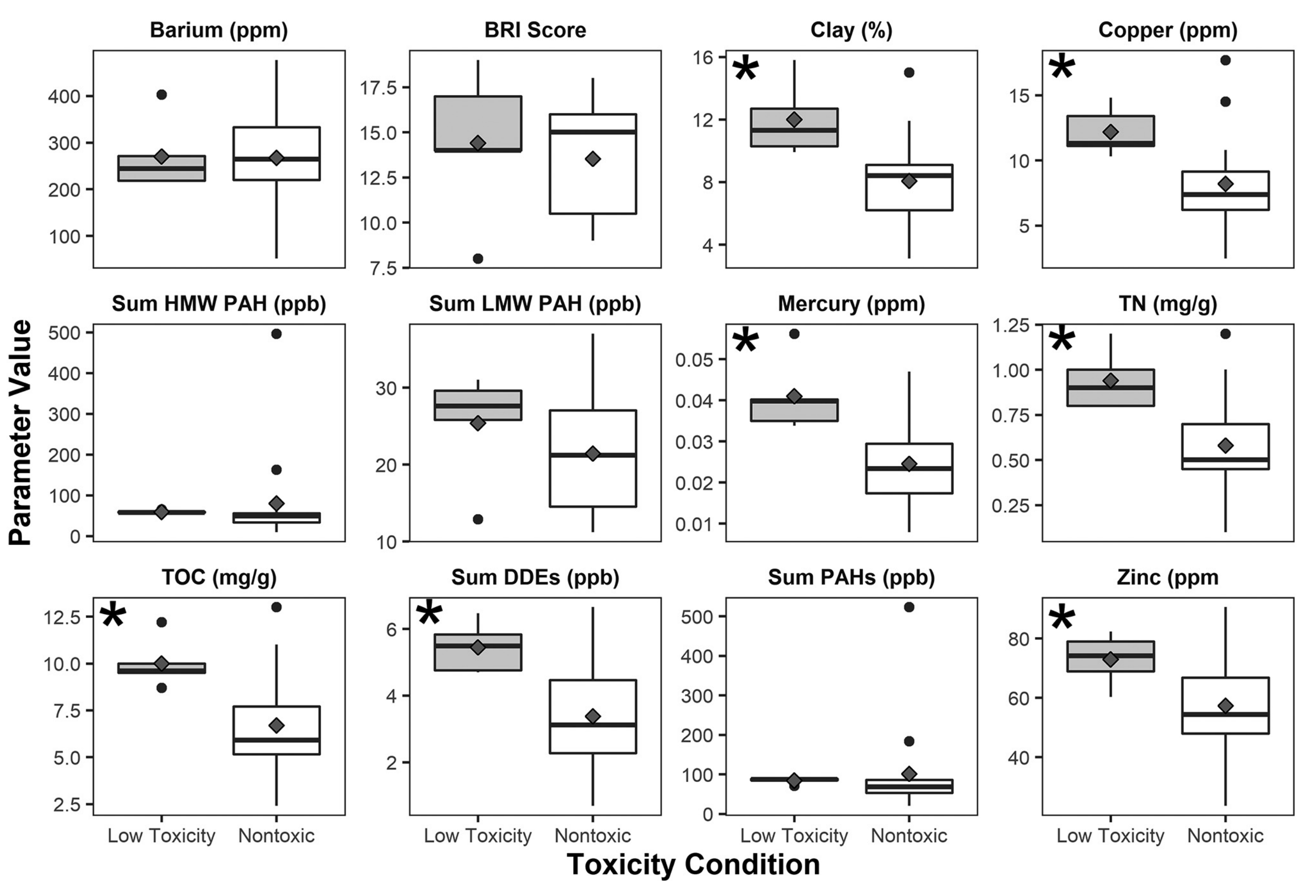

Fig. 7. Schematic box plots of important chemical compounds, sediment characteristics, and BRI scores between samples collected from around the four oil platforms that exhibited either low toxicity or no toxicity. An asterisk indicates compounds for which the low toxicity samples had significantly higher concentrations based upon the results of a one-way ANOVA (α = 0.1). The grey diamonds indicate the mean value for each parameter. Note that lower BRI scores indicater better condition infuana.

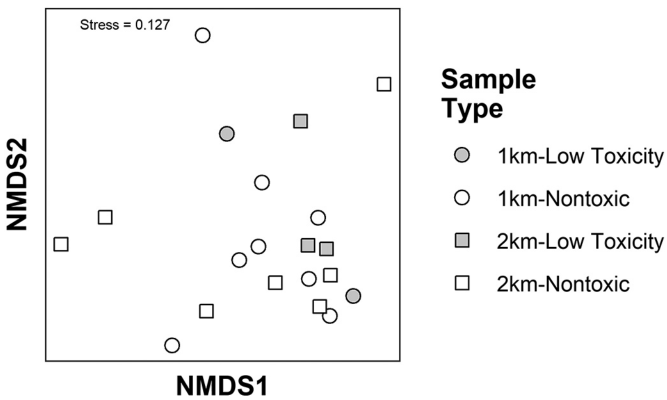

Fig. 8. A 2-D nMDS plot summarizing the similarity of low- and no-toxicity samples collected from the 1 km and 2 km zones around the four platforms. The ordination was based upon Bray-Curtis dissimilarities calculated from untransformed species abundance.

conditions in this northern portion of the region. Eventual comparison of the infauna from the oil platform samples to more recently collected benthic community information from the 2018 Southern California Bight Regional Monitoring Program, may provide further insight into the lower overall abundances and taxa richness observed in the samples.

Benthic infauna are one of the most important indicators of overall habitat condition in marine systems. Because of their relatively sessile lifestyle, intimate association with the sediment, and varied autecological traits, infauna accurately reflect potential impacts to the biological resources of a given location (e.g., McIntyre, 1984; Warwick, 1988; Gray and Elliott, 2009). Focusing on the health and condition of resident biota directly speaks to the motivations of nearly all regulatory monitoring programs (e.g., United States Clean Water Act [33 U.S.C. 1251], European Union Water Framework Directive [WFD 2000/60/EC]) and provides ecologically meaningful insight into any potential disturbances of an ecosystem. Specific to California, biologically-based assessment of habitat condition directly informs a number of the designated Beneficial Uses defined by the California State Water Resources Control Board (2012) and assigned to each water body within the state.

Sediment chemistry and toxicity measures of habitat condition provide contextual information that can help in interpreting the causality of any observed biotic degradation. While a variety of different chemical compounds were detected in the sediments surrounding these four platforms, very few of them were at concentrations likely to cause significant impacts the fauna of the system. This is good confirmatory evidence to support the results of the infauna-based assessment, which indicated the whole of the area sampled around the platforms was in reference condition. There were moderately high levels of the DDT breakdown product DDE, but that is a characteristic of much of the continental shelf sediments in the northern parts of the Southern California Bight (Niedoroda et al., 1996; Zeng and Venkatesan, 1999; Dodder et al., 2016) and most likely not related to the platforms. In contrast, barium and high molecular weight PAH concentrations were elevated in sediments from around the oil platforms compared to the regional average, which was not surprising given the association of both types of chemicals with drill cuttings (Olsen et al., 2007; Schaanning et al., 2008). Other chemicals one might associate with oil platform operation (e.g., low molecular weight PAHs from the petroleum or copper from anti-fouling paint) were not particularly elevated in the samples relative to regional background concentrations, nor were they at concentrations believed to impact the fauna living in the habitat.

All of the samples were evaluated as being in reference/minimal chemical exposure condition (i.e., non-disturbed) from the biology/chemistry- perspective, but 25% of those samples exhibited low levels of toxicity. This level of disagreement among multiple measures of habitat condition are not uncommon and illustrates the benefits of looking at multiple facets of benthic habitat condition (Chapman et al., 1997; Bay and Weisberg, 2012; Schiff et al., 2016). Conducting toxicity tests with ambient material provides a biological relevant test of any potentially harmful compound that is in the sediment – not just the ones that were measured in chemical analyses. As such, in its most direct interpretation, low toxicity results would suggest that some unmeasured compounds were present in the environment that may have had potentially negative consequences for some of the resident fauna, but these impacts not reflected in the measurement of the entire community. However, these types of toxicity tests typically use only a single species that is selected for consistency of results and sensitivity to toxic chemicals, not whether it was a component of the local faunal assemblages (Chapman et al., 2002). While this approach provides a reliable assessment of toxicity, the link between single-species toxicity tests and observable impacts in the community composition of resident biota is not always tightly coupled (Buchwalter et al., 2007; Poteat and Buchwalter, 2014).

The disconnect between toxicity tests and in situ benthic infauna was born out in our results, where there were no observable differences in community composition or benthic index score between the samples with low toxicity and nontoxic results. In contrast, there were interesting patterns between the sediment chemistry measures and the toxicity test results. The five samples that showed low-levels of toxicity had greater concentrations of copper, mercury, zinc, total DDEs, total nitrogen, and total organic carbon. However, those concentrations were below the most commonly used thresholds that imply potential toxicity or problems to resident infauna. The exception would be DDE, which was observed at concentrations above ERL (2.2 ppb) and CSI low impact (1.19 ppb) thresholds, though below the corresponding higher thresholds that have more likely biological effects. The amount of DDE may partially explain the observed toxicity, but it should be noted that nearly all of the no-toxicity samples also had DDE concentrations in excess of the ERL/CSI low impact thresholds.

Overall, we cannot rule out that the combination of multiple low-levels of these compounds or the presence of some unmeasured toxic chemicals in the sediments from around the platforms could have caused the observed toxicity. However, in addition to the elevated chemicals, the sediments of five samples also had elevated clay content compared to the 15 non-toxic samples. Sediments with a high clay content have been observed to cause mortality to the *E. estuarius* test organisms; especially if they are large specimens (Anderson et al., 2017). It is therefore possible that the low toxicity evaluation may not have been related to any toxic chemicals in the sediments, but instead to the granulometric composition of the sediments themselves. Given the lack of any clear response in the benthic community and the magnitude of the chemical concentration that were measured, it seems reasonable that the elevated clay content of the sediments was the most parsimonious factor behind the observed toxicity.

An important caveat with the patterns we observed, is that we actively chose to not sample within the shell debris/muds and cutting deposit fields of the platforms due the incompatibility of the sampling gear with consolidated, shell hash sediments. These sediments have been shown to be toxic to resident fauna and a potential source of chemicals to the surrounding environment (Neff, 1987; Schaanning et al., 2008; Ellis et al., 2012). These drill cuttings may have also been a source for the elevated amounts of clay observed in the low toxicity samples and possibly contributing to the observed toxicity. A targeted study of sediments and chemicals in the debris fields immediately surrounding the platforms, in conjunction with a soft sediment study would provide a more complete evaluation of the potential impacts of platforms on their adjacent sediment.

In situations where sediments could be sampled directly underneath or immediately adjacent to oil platform structures, other studies have observed habitat degradation in the form of altered benthic communities, elevated sediment contaminants (typically hydrocarbons, copper, and barium), and toxic responses to sediment (Chapman et al., 1991; Hernández Arana et al., 2005; Terlizzi et al., 2008; Spagnolo et al., 2014). A study of platform discharges near Point Arguello, California (~100 km WNW of the present study), detected minor biological changes in hard bottom assemblages approximately 1000 m from the discharge source, as well as elevated barium and a peak in sedimentation from drilling solids out to 1500 m from the platform (Hyland et al., 1994). The degree of habitat degradation observed in most studies from the Gulf of Mexico and the Mediterranean Sea declined when moving away from the platform and few effects could be detected beyond 1500 to 2000 m. Similar studies from the North Sea also report the effects of sediment contamination declining with distance from platforms, but with impacts persisting out to 6 km from the platform (Olsgard and Gray, 1995; Schaanning et al., 2008; Bakke et al., 2013). The differences in the spatial-scale of oil platform influence on the adjacent habitat is thought to be a function of the size of platforms and the nature of their operations (Spagnolo et al., 2014). The patterns in our study more closely resembled those of the Gulf of Mexico and Mediterranean platforms. Even then, the degree of impact we observed was much more constrained, with no meaningful departures from unimpacted conditions at distances from as little as 250 m up to 2 km from a platform.

In addition to their comparatively small size of operation, the muted impact of the four oil platforms in the present study to their surroundings could also be due to their use of water- and synthetic-based drilling fluids instead of oil-based ones. Much of the toxicity observed in platform adjacent sediment in other location has been associated with the discharge of oil-based drilling fluids, which contain toxic aromatic and poly cyclic aromatic hydrocarbons (Boehm et al., 2001). Discharge of these fluids to the adjacent ocean is no longer allowed within the waters of United States. In contrast, synthetic-based fluids contain manufactured hydrocarbons that are not petroleum based and therefore do not contain the aromatic hydrocarbons that contribute to the toxicity of sediments (Bernier et al., 2003). Water-based drilling fluids have mineral oil as the principal additive and are permitted for discharge to surrounding waters in most parts of the United States (MMS, 2007). Strong currents in the Santa Barbara Channel may also dampen the signal of the platforms in the surrounding seafloor by dispersing and thereby diluting the drill cuttings from the platforms (e.g., Coats, 1994) compared to platforms in in other regions.

Much of the oil and gas extraction infrastructure offshore of southern California is nearing the end of the practical lifespan and will most likely be decommissioned in the foreseeable future (McCrary et al., 2003; Schroeder and Love, 2004; Henrion et al., 2014). Any type of removal activity will invariably have the potential to disturb the surrounding sea floor habitat, the impacts of which will most likely need to be quantified. These results from our study could be used to represent the baseline environmental conditions of the sediment habitat surrounding the A, B, C, and Hillhouse oil platforms prior to any decommissioning activities that were to take place. Our characterization of the benthic infauna, the chemical content, and toxicity of the sediments around the platforms should be used as a point of reference for any future changes in operations and evaluating their potential impacts on the local environment. Furthermore, given the similarity of the benthic infauna observed in the present study to those of other parts of the Santa Barbara Channel and the region as a whole, infaunal data collected from the northern portions of the Southern California Bight during routine monitoring should also be used as a benchmark to interpret temporal patterns in benthic community change at the four platforms in our study, as well as other platforms in the region.

CRediT authorship contribution statement

David Gillett: Conceptualization, methodology, formal analysis, writing, editing, and visualization. Lisa Gilbane: Conceptualization, facilitation of sample collection, writing, review, editing, and funding acquisition. Ken Schiff: Conceptualization, methodology, review, editing, supervision, project administration.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgments

The authors thank DCOR LLC, and in particular Bob Garcia and Keith Moschetto, for facilitating and coordinating sampling around the offshore platform operations. Aquatic Bioassay & Consulting Laboratories collected and processed samples with additional field support from Dario Diehl aboard the *Hey Jude*. The authors thank Darrin Greenstein, Ashley Parks, and Abel Santana for help with data organization and help with some of the analyses. The authors also thank the Southern California Bight Regional Monitoring Program for providing the infaunal, chemistry, and toxicity data used for the regional comparisons. The content of this report was improved by comments provided by Jonathan Blythe, SCCWRP's Commission Technical Advisory Group, and one anonymous reviewer.

Study collaboration and funding were provided by the US Department of the Interior, Bureau of Ocean Energy Management (BOEM), Environmental Studies Program, Washington, DC, under Agreement Number M16AC00013. This work has been technically reviewed by BOEM, and it has been approved for publication. The views and conclusions contained in this document are those of the authors and should not be interpreted as representing the opinions or policies of the US Government, nor does mention of trade names or commercial products constitute endorsement or recommendation for use.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.marpolbul.2020.111662.

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Appendix F – Condition Category and Revisit Site Condition Trend Extent Details

Appendix F1. Areal estimates of habitat condition for each assessable stratum across the Southern California Bight in 2018, with the number of samples and the local neighborhood 95% confidence intervals.

Analysis Type	Stratum	Trend Category	Number of Samples	% Area Estimate	Lower Confidence Interval	Upper Confidence Interval
Bight-Wide	Entire Bight	Reference	117	89.10	85.48	92.71
	Entire Bight	Low Disturbance	96	10.08	6.46	13.69
	Entire Bight	Moderate Disturbance	74	0.63	0.46	0.79
	Entire Bight	High Disturbance	30	0.20	0.11	0.28
Embayment & Offshore Aggregated	Embayment	Reference	15	12.75	7.16	18.33
	Embayment	Low Disturbance	80	48.13	40.41	55.86
	Embayment	Moderate Disturbance	74	29.74	22.75	36.73
	Embayment	High Disturbance	30	9.38	5.54	13.23
	Offshore	Reference	102	90.74	86.96	94.52
	Offshore	Low Disturbance	16	9.26	5.48	13.04
	Offshore	Moderate Disturbance	0	0.00	0.00	0.00
	Offshore	High Disturbance	0	0.00	0.00	0.00
Offshore Strata	Channel Islands	Reference	15	100.00	100.00	100.00
	Channel Islands	Low Disturbance	0	0.00	0.00	0.00
	Channel Islands	Moderate Disturbance	0	0.00	0.00	0.00
	Channel Islands	High Disturbance	0	0.00	0.00	0.00
	Inner Shelf	Reference	28	77.31	66.54	88.08
	Inner Shelf	Low Disturbance	8	22.69	11.92	33.46
	Inner Shelf	Moderate Disturbance	0	0.00	0.00	0.00
	Inner Shelf	High Disturbance	0	0.00	0.00	0.00
	Mid Shelf	Reference	32	89.61	80.40	98.82

	Mid Shelf	Low Disturbance	4	10.39	1.18	19.60
	Mid Shelf	Moderate Disturbance	0	0.00	0.00	0.00
	Mid Shelf	High Disturbance	0	0.00	0.00	0.00
	Outer Shelf	Reference	27	88.57	79.50	97.64
	Outer Shelf	Low Disturbance	4	11.43	2.36	20.50
	Outer Shelf	Moderate Disturbance	0	0.00	0.00	0.00
	Outer Shelf	High Disturbance	0	0.00	0.00	0.00
Embayment Strata	Bays	Reference	7	18.31	8.82	27.80
	Bays	Low Disturbance	21	49.92	36.83	63.01
	Bays	Moderate Disturbance	12	25.95	14.26	37.65
	Bays	High Disturbance	3	5.81	0.13	11.49
	Brackish Estuaries	Reference	1	9.09	0.00	24.12
	Brackish Estuaries	Low Disturbance	1	9.09	0.00	25.34
	Brackish Estuaries	Moderate Disturbance	6	54.55	25.59	83.50
	Brackish Estuaries	High Disturbance	3	27.27	3.42	51.13
	Estuaries	Reference	1	2.76	0.00	7.27
	Estuaries	Low Disturbance	9	20.30	10.34	30.25
	Estuaries	Moderate Disturbance	23	55.25	40.69	69.81
	Estuaries	High Disturbance	12	21.69	8.37	35.01
	Marinas	Reference	4	10.52	1.96	19.08
	Marinas	Low Disturbance	16	37.86	25.68	50.03
	Marinas	Moderate Disturbance	17	33.41	22.11	44.71
	Marinas	High Disturbance	7	18.21	7.68	28.74
	Ports	Reference	2	4.12	0.00	10.19
	Ports	Low Disturbance	33	66.70	53.71	79.69
	Ports	Moderate Disturbance	16	22.91	12.04	33.78
	Ports	High Disturbance	5	6.26	0.00	12.58

Appendix F2. Areal estimates of habitat condition for each assessable stratum across the Southern California Bight from 1998 - 2018, with the number of samples and the local neighborhood 95% confidence intervals.

Analysis Type	Year	Stratum	Trend Category	Number of Samples	% Area Estimate	Lower Confidence Interval	Upper Confidence Interval
Bight-Wide	1998	Entire Bight	Reference	190	89.07	85.46	92.68
	1998	Entire Bight	Low Disturbance	84	8.90	5.69	12.12
	1998	Entire Bight	Moderate Disturbance	27	1.91	0.26	3.57
	1998	Entire Bight	High Disturbance	8	0.11	0.03	0.19
	2003	Entire Bight	Reference	171	89.98	87.01	92.94
	2003	Entire Bight	Low Disturbance	65	9.01	5.85	12.16
	2003	Entire Bight	Moderate Disturbance	29	0.94	0.00	2.07
	2003	Entire Bight	High Disturbance	6	0.08	0.00	0.18
	2008	Entire Bight	Reference	145	90.70	87.31	94.10
	2008	Entire Bight	Low Disturbance	90	9.02	5.62	12.41
	2008	Entire Bight	Moderate Disturbance	59	0.23	0.17	0.30
	2008	Entire Bight	High Disturbance	18	0.05	0.02	0.07
	2013	Entire Bight	Reference	102	77.58	69.25	85.92
	2013	Entire Bight	Low Disturbance	92	20.88	12.65	29.11
	2013	Entire Bight	Moderate Disturbance	35	1.48	0.00	3.39
	2013	Entire Bight	High Disturbance	12	0.05	0.02	0.08
	2018	Entire Bight	Reference	117	89.10	85.48	92.71
	2018	Entire Bight	Low Disturbance	96	10.08	6.46	13.69
	2018	Entire Bight	Moderate Disturbance	74	0.63	0.46	0.79
	2018	Entire Bight	High Disturbance	30	0.20	0.11	0.28
Offshore Strata	1998	Channel Islands	Reference	51	97.89	95.10	100.00
	1998	Channel Islands	Low Disturbance	2	2.11	0.00	4.90
	1998	Channel Islands	Moderate Disturbance	0	0.00	0.00	0.00

1998	Channel Islands	High Disturbance	0	0.00	0.00	0.00
2003	Channel Islands	Reference	32	100.00	100.00	100.00
2003	Channel Islands	Low Disturbance	0	0.00	0.00	0.00
2003	Channel Islands	Moderate Disturbance	0	0.00	0.00	0.00
2003	Channel Islands	High Disturbance	0	0.00	0.00	0.00
2008	Channel Islands	Reference	30	100.00	100.00	100.00
2008	Channel Islands	Low Disturbance	0	0.00	0.00	0.00
2008	Channel Islands	Moderate Disturbance	0	0.00	0.00	0.00
2008	Channel Islands	High Disturbance	0	0.00	0.00	0.00
2013	Channel Islands	Reference	11	73.33	53.50	93.16
2013	Channel Islands	Low Disturbance	4	26.67	6.84	46.50
2013	Channel Islands	Moderate Disturbance	0	0.00	0.00	0.00
2013	Channel Islands	High Disturbance	0	0.00	0.00	0.00
2018	Channel Islands	Reference	15	100.00	100.00	100.00
2018	Channel Islands	Low Disturbance	0	0.00	0.00	0.00
2018	Channel Islands	Moderate Disturbance	0	0.00	0.00	0.00
2018	Channel Islands	High Disturbance	0	0.00	0.00	0.00
1994	Inner Shelf	Reference	52	83.72	75.54	91.90
1994	Inner Shelf	Low Disturbance	13	15.15	6.79	23.51
1994	Inner Shelf	Moderate Disturbance	4	1.13	0.36	1.89
1994	Inner Shelf	High Disturbance	0	0.00	0.00	0.00
1998	Inner Shelf	Reference	41	68.05	55.39	80.71
1998	Inner Shelf	Low Disturbance	15	28.36	16.05	40.67
1998	Inner Shelf	Moderate Disturbance	2	3.59	0.00	9.06
1998	Inner Shelf	High Disturbance	0	0.00	0.00	0.00
2003	Inner Shelf	Reference	27	55.63	42.72	68.53
2003	Inner Shelf	Low Disturbance	15	40.49	26.13	54.84
2003	Inner Shelf	Moderate Disturbance	1	3.89	0.00	10.58

2003	Inner Shelf	High Disturbance	0	0.00	0.00	0.00
2008	Inner Shelf	Reference	21	70.00	56.11	83.89
2008	Inner Shelf	Low Disturbance	9	30.00	16.11	43.89
2008	Inner Shelf	Moderate Disturbance	0	0.00	0.00	0.00
2008	Inner Shelf	High Disturbance	0	0.00	0.00	0.00
2013	Inner Shelf	Reference	21	68.74	56.03	81.44
2013	Inner Shelf	Low Disturbance	10	31.26	18.56	43.97
2013	Inner Shelf	Moderate Disturbance	0	0.00	0.00	0.00
2013	Inner Shelf	High Disturbance	0	0.00	0.00	0.00
2018	Inner Shelf	Reference	28	77.31	66.54	88.08
2018	Inner Shelf	Low Disturbance	8	22.69	11.92	33.46
2018	Inner Shelf	Moderate Disturbance	0	0.00	0.00	0.00
2018	Inner Shelf	High Disturbance	0	0.00	0.00	0.00
1994	Mid Shelf	Reference	125	93.08	89.14	97.02
1994	Mid Shelf	Low Disturbance	8	5.25	1.58	8.91
1994	Mid Shelf	Moderate Disturbance	2	1.67	0.00	3.72
1994	Mid Shelf	High Disturbance	0	0.00	0.00	0.00
1998	Mid Shelf	Reference	69	88.97	81.11	96.83
1998	Mid Shelf	Low Disturbance	13	7.91	1.43	14.39
1998	Mid Shelf	Moderate Disturbance	3	3.12	0.00	7.74
1998	Mid Shelf	High Disturbance	0	0.00	0.00	0.00
2003	Mid Shelf	Reference	69	98.96	98.33	99.60
2003	Mid Shelf	Low Disturbance	4	1.04	0.40	1.67
2003	Mid Shelf	Moderate Disturbance	0	0.00	0.00	0.00
2003	Mid Shelf	High Disturbance	0	0.00	0.00	0.00
2008	Mid Shelf	Reference	31	96.88	91.57	100.00
2008	Mid Shelf	Low Disturbance	1	3.13	0.00	8.43
2008	Mid Shelf	Moderate Disturbance	0	0.00	0.00	0.00

2008	Mid Shelf	High Disturbance	0	0.00	0.00	0.00
2013	Mid Shelf	Reference	27	89.19	79.11	99.26
2013	Mid Shelf	Low Disturbance	2	7.21	0.00	15.51
2013	Mid Shelf	Moderate Disturbance	1	3.60	0.00	9.50
2013	Mid Shelf	High Disturbance	0	0.00	0.00	0.00
2018	Mid Shelf	Reference	32	89.61	80.40	98.82
2018	Mid Shelf	Low Disturbance	4	10.39	1.18	19.60
2018	Mid Shelf	Moderate Disturbance	0	0.00	0.00	0.00
2018	Mid Shelf	High Disturbance	0	0.00	0.00	0.00
1994	Outer Shelf	Reference	38	97.83	95.05	100.00
1994	Outer Shelf	Low Disturbance	2	2.17	0.00	4.95
1994	Outer Shelf	Moderate Disturbance	0	0.00	0.00	0.00
1994	Outer Shelf	High Disturbance	0	0.00	0.00	0.00
2003	Outer Shelf	Reference	23	96.19	90.07	100.00
2003	Outer Shelf	Low Disturbance	1	3.81	0.00	9.93
2003	Outer Shelf	Moderate Disturbance	0	0.00	0.00	0.00
2003	Outer Shelf	High Disturbance	0	0.00	0.00	0.00
2008	Outer Shelf	Reference	26	92.86	84.32	100.00
2008	Outer Shelf	Low Disturbance	2	7.14	0.00	15.68
2008	Outer Shelf	Moderate Disturbance	0	0.00	0.00	0.00
2008	Outer Shelf	High Disturbance	0	0.00	0.00	0.00
2013	Outer Shelf	Reference	25	85.43	74.23	96.64
2013	Outer Shelf	Low Disturbance	4	14.57	3.36	25.77
2013	Outer Shelf	Moderate Disturbance	0	0.00	0.00	0.00
2013	Outer Shelf	High Disturbance	0	0.00	0.00	0.00
2018	Outer Shelf	Reference	27	88.57	79.50	97.64
2018	Outer Shelf	Low Disturbance	4	11.43	2.36	20.50
2018	Outer Shelf	Moderate Disturbance	0	0.00	0.00	0.00

	2018	Outer Shelf	High Disturbance	0	0.00	0.00	0.00
Embayment Strata	1998	Bays	Reference	13	35.32	25.42	45.22
	1998	Bays	Low Disturbance	19	58.57	46.44	70.69
	1998	Bays	Moderate Disturbance	1	2.55	0.00	6.68
	1998	Bays	High Disturbance	1	3.56	0.00	9.35
	2003	Bays	Reference	8	46.65	28.44	64.86
	2003	Bays	Low Disturbance	7	40.82	25.83	55.80
	2003	Bays	Moderate Disturbance	1	5.83	0.00	15.35
	2003	Bays	High Disturbance	2	6.71	0.00	16.49
	2008	Bays	Reference	15	39.34	25.39	53.30
	2008	Bays	Low Disturbance	21	60.54	46.55	74.52
	2008	Bays	Moderate Disturbance	2	0.12	0.00	0.24
	2008	Bays	High Disturbance	0	0.00	0.00	0.00
	2013	Bays	Reference	8	24.27	11.79	36.74
	2013	Bays	Low Disturbance	21	68.35	53.94	82.76
	2013	Bays	Moderate Disturbance	2	7.38	0.00	16.07
	2013	Bays	High Disturbance	0	0.00	0.00	0.00
	2018	Bays	Reference	7	18.31	8.82	27.80
	2018	Bays	Low Disturbance	21	49.92	36.83	63.01
	2018	Bays	Moderate Disturbance	12	25.95	14.26	37.65
	2018	Bays	High Disturbance	3	5.81	0.13	11.49
	2003	Estuaries	Reference	1	2.13	0.00	5.62
	2003	Estuaries	Low Disturbance	18	51.70	33.72	69.67
	2003	Estuaries	Moderate Disturbance	17	39.84	21.87	57.80
	2003	Estuaries	High Disturbance	4	6.34	0.46	12.21
	2008	Estuaries	Reference	4	9.13	0.07	18.19
	2008	Estuaries	Low Disturbance	14	31.13	17.06	45.20

2008	Estuaries	Moderate Disturbance	29	37.34	23.00	51.68
2008	Estuaries	High Disturbance	17	22.40	9.16	35.64
2013	Estuaries	Reference	2	6.42	0.00	13.52
2013	Estuaries	Low Disturbance	14	39.11	24.67	53.56
2013	Estuaries	Moderate Disturbance	15	35.03	21.87	48.19
2013	Estuaries	High Disturbance	10	19.43	8.27	30.59
2018	Estuaries	Reference	1	2.76	0.00	7.27
2018	Estuaries	Low Disturbance	9	20.30	10.34	30.25
2018	Estuaries	Moderate Disturbance	23	55.25	40.69	69.81
2018	Estuaries	High Disturbance	12	21.69	8.37	35.01
1998	Marinas	Reference	7	14.48	5.38	23.59
1998	Marinas	Low Disturbance	17	54.94	39.55	70.32
1998	Marinas	Moderate Disturbance	11	23.50	12.18	34.82
1998	Marinas	High Disturbance	5	7.08	2.33	11.83
2003	Marinas	Reference	10	32.16	17.62	46.71
2003	Marinas	Low Disturbance	13	38.89	24.28	53.50
2003	Marinas	Moderate Disturbance	9	28.95	16.21	41.68
2003	Marinas	High Disturbance	0	0.00	0.00	0.00
2008	Marinas	Reference	9	20.57	8.96	32.18
2008	Marinas	Low Disturbance	16	42.03	27.49	56.57
2008	Marinas	Moderate Disturbance	18	37.07	21.78	52.37
2008	Marinas	High Disturbance	1	0.33	0.00	0.87
2013	Marinas	Reference	3	6.89	0.00	14.47
2013	Marinas	Low Disturbance	15	44.73	30.38	59.09
2013	Marinas	Moderate Disturbance	15	44.28	28.45	60.11
2013	Marinas	High Disturbance	1	4.10	0.00	11.15
2018	Marinas	Reference	4	10.52	1.96	19.08

2018	Marinas	Low Disturbance	16	37.86	25.68	50.03
2018	Marinas	Moderate Disturbance	17	33.41	22.11	44.71
2018	Marinas	High Disturbance	7	18.21	7.68	28.74
1998	Ports	Reference	9	24.65	14.37	34.92
1998	Ports	Low Disturbance	18	44.45	31.44	57.46
1998	Ports	Moderate Disturbance	10	26.21	13.93	38.48
1998	Ports	High Disturbance	2	4.69	0.00	10.46
2003	Ports	Reference	1	11.11	0.00	30.98
2003	Ports	Low Disturbance	7	77.78	52.99	100.00
2003	Ports	Moderate Disturbance	1	11.11	0.00	29.46
2003	Ports	High Disturbance	0	0.00	0.00	0.00
2008	Ports	Reference	9	23.73	12.11	35.34
2008	Ports	Low Disturbance	27	66.48	53.01	79.95
2008	Ports	Moderate Disturbance	10	9.79	1.10	18.48
2008	Ports	High Disturbance	0	0.00	0.00	0.00
2013	Ports	Reference	5	17.62	5.41	29.84
2013	Ports	Low Disturbance	22	75.30	61.35	89.26
2013	Ports	Moderate Disturbance	2	6.00	0.00	13.28
2013	Ports	High Disturbance	1	1.08	0.00	2.91
2018	Ports	Reference	2	4.12	0.00	10.19
2018	Ports	Low Disturbance	33	66.70	53.71	79.69
2018	Ports	Moderate Disturbance	16	22.91	12.04	33.78
2018	Ports	High Disturbance	5	6.26	0.00	12.58

Appendix F3. Areal estimates of revisit site-based condition trends from 1998-2018 in the assessable strata of the Southern California Bight, with the number of samples and the local neighborhood 95% confidence intervals.

Analysis Type	Stratum	Trend Category	Number of Samples	% Area Estimate	Lower Confidence Interval	Upper Confidence Interval
Bight-wide	Entire Bight	Declining	19	17.56	6.80	28.33
	Entire Bight	Improving	16	4.50	1.32	7.68
	Entire Bight	Stable	79	77.93	66.82	89.04
Offshore Strata	Channel Islands	Declining	3	20.00	1.80	38.20
	Channel Islands	Improving	0	0.00	0.00	0.00
	Channel Islands	Stable	12	80.00	61.80	98.20
	Inner Shelf	Declining	1	7.14	0.00	19.50
	Inner Shelf	Improving	2	14.29	0.00	30.23
	Inner Shelf	Stable	11	78.57	58.40	98.75
	Mid Shelf	Declining	2	9.40	0.00	19.74
	Mid Shelf	Improving	1	8.97	0.00	23.82
	Mid Shelf	Stable	11	81.62	63.55	99.70
	Outer Shelf	Declining	5	39.76	17.95	61.57
	Outer Shelf	Improving	1	6.02	0.00	16.41
	Outer Shelf	Stable	9	54.22	30.74	77.69
Embayment Strata	Bays	Declining	2	16.38	0.00	35.33
	Bays	Improving	3	21.98	0.74	43.22
	Bays	Stable	10	61.64	38.97	84.30
	Estuaries	Declining	1	9.83	0.00	25.76
	Estuaries	Improving	0	0.00	0.00	0.00
	Estuaries	Stable	10	90.17	74.24	100.00
	Marinas	Declining	3	20.83	4.96	36.71
	Marinas	Improving	5	31.01	11.29	50.73

Marinas	Stable	7	48.16	24.95	71.36
Ports	Declining	2	12.78	0.00	31.31
Ports	Improving	4	42.27	13.76	70.78
Ports	Stable	9	44.95	17.65	72.25

APPENDIX G – REVISIT SITE TREND REGRESSIONS

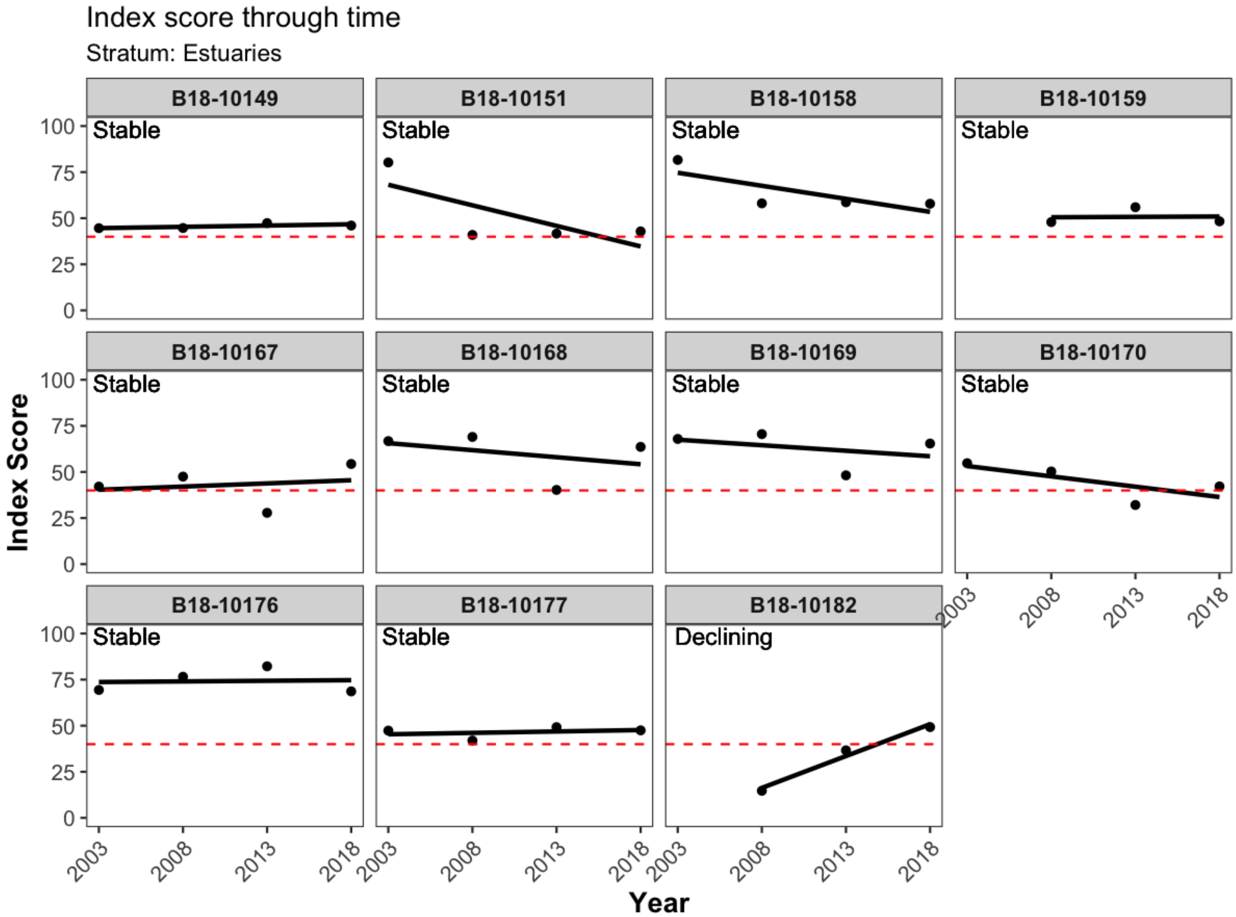

Figure 37. Temporal trends in BRI scores among Estuaries stratum revisit sites. Each trend is categorized as being indicative of Improving condition, Stable condition, or Declining condition. The black line represents a least-squares regression of the 3 or 4 samples from each site. The red-dashed line represents the threshold between the Reference and Low Impact condition categories. Note that lower BRI scores represent less disturbed conditions.

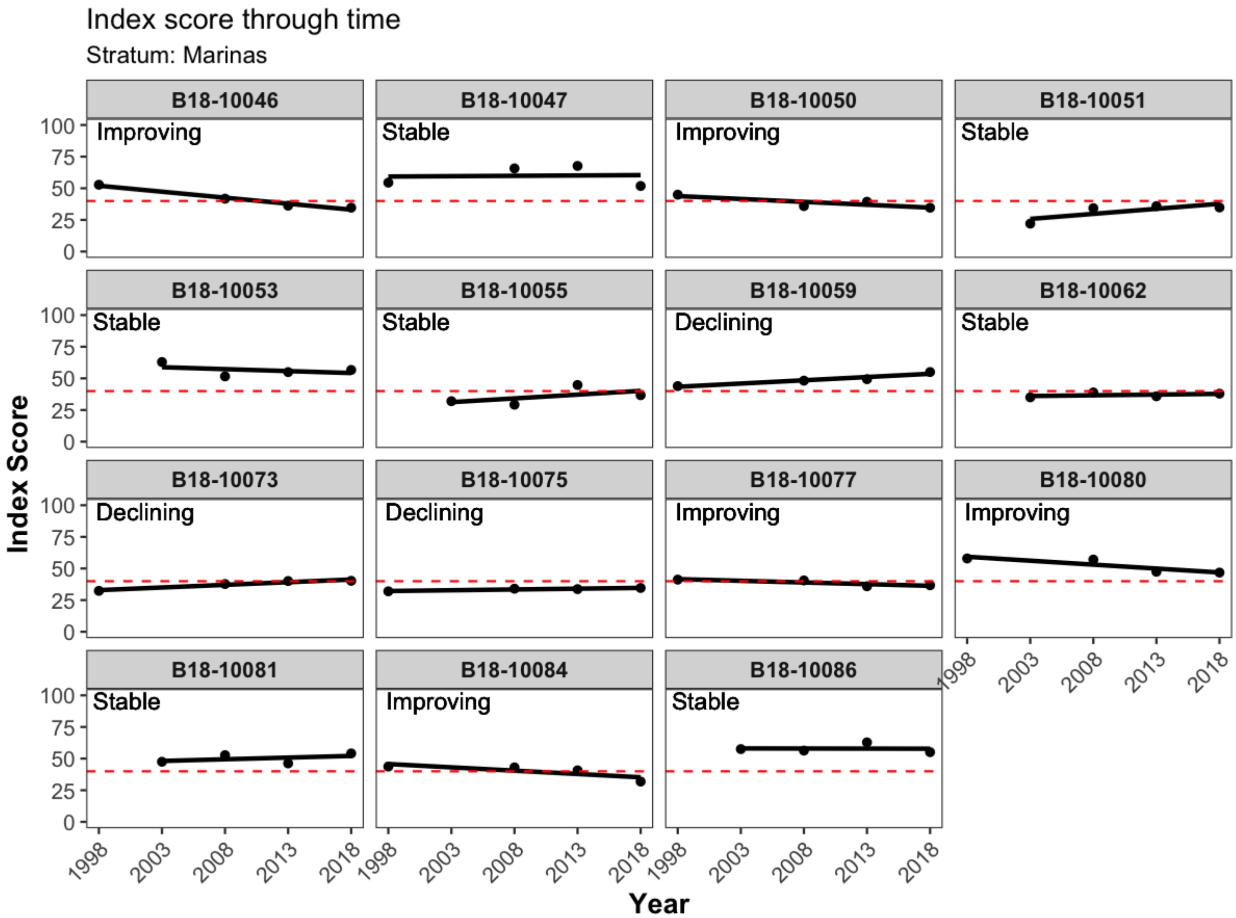

Figure 38. Temporal trends in BRI scores among the Marinas stratum revisit sites. Each trend is categorized as being indicative of Improving condition, Stable condition, or Declining condition. The black line represents a least-squares regression of the 3 or 4 samples from each site. The red-dashed line represents the threshold between the Reference and Low Impact condition categories. Note that lower BRI scores represent less disturbed conditions.

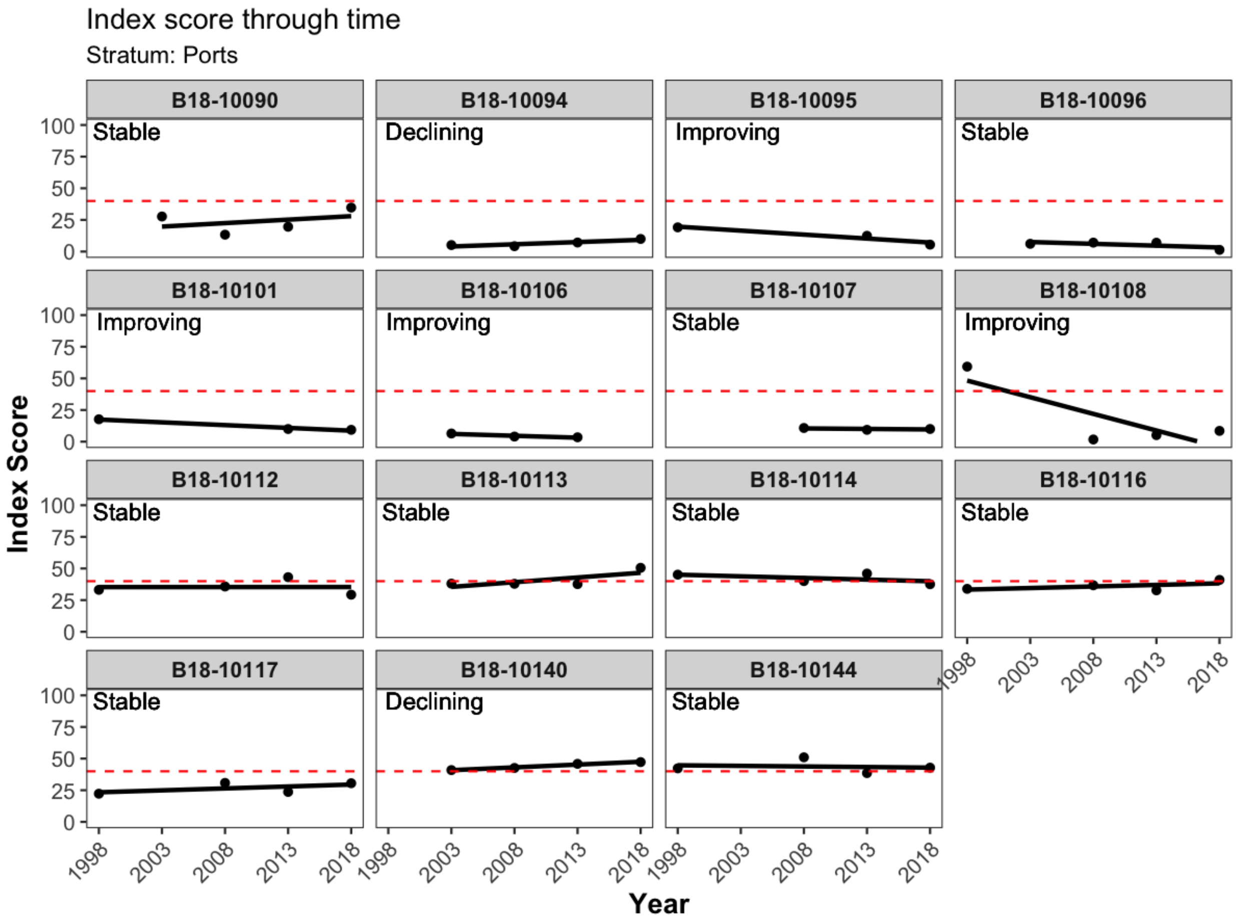

Figure 39. Temporal trends in BRI scores among Ports stratum revisit sites. Each trend is categorized as being indicative of Improving condition, Stable condition, or Declining condition. The black line represents a least-squares regression of the 3 or 4 samples from each site. The red-dashed line represents the threshold between the Reference and Low Impact condition categories. Note that lower BRI scores represent less disturbed conditions.

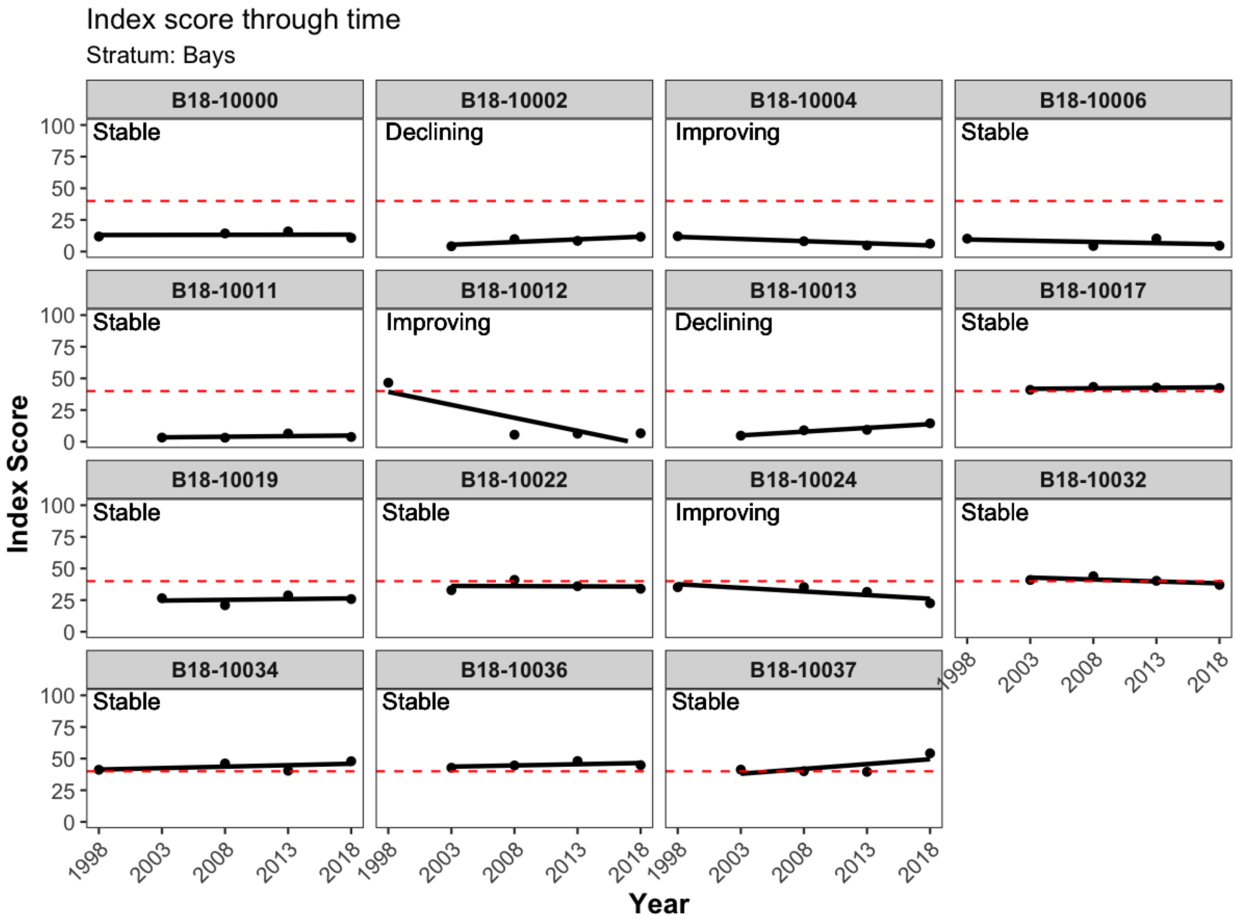

Figure 40. Temporal trends in BRI scores among Bays stratum revisit sites. Each trend is categorized as being indicative of Improving condition, Stable condition, or Declining condition. The black line represents a least-squares regression of the 3 or 4 samples from each site. The red-dashed line represents the threshold between the Reference and Low Impact condition categories. Note that lower BRI scores represent less disturbed conditions.

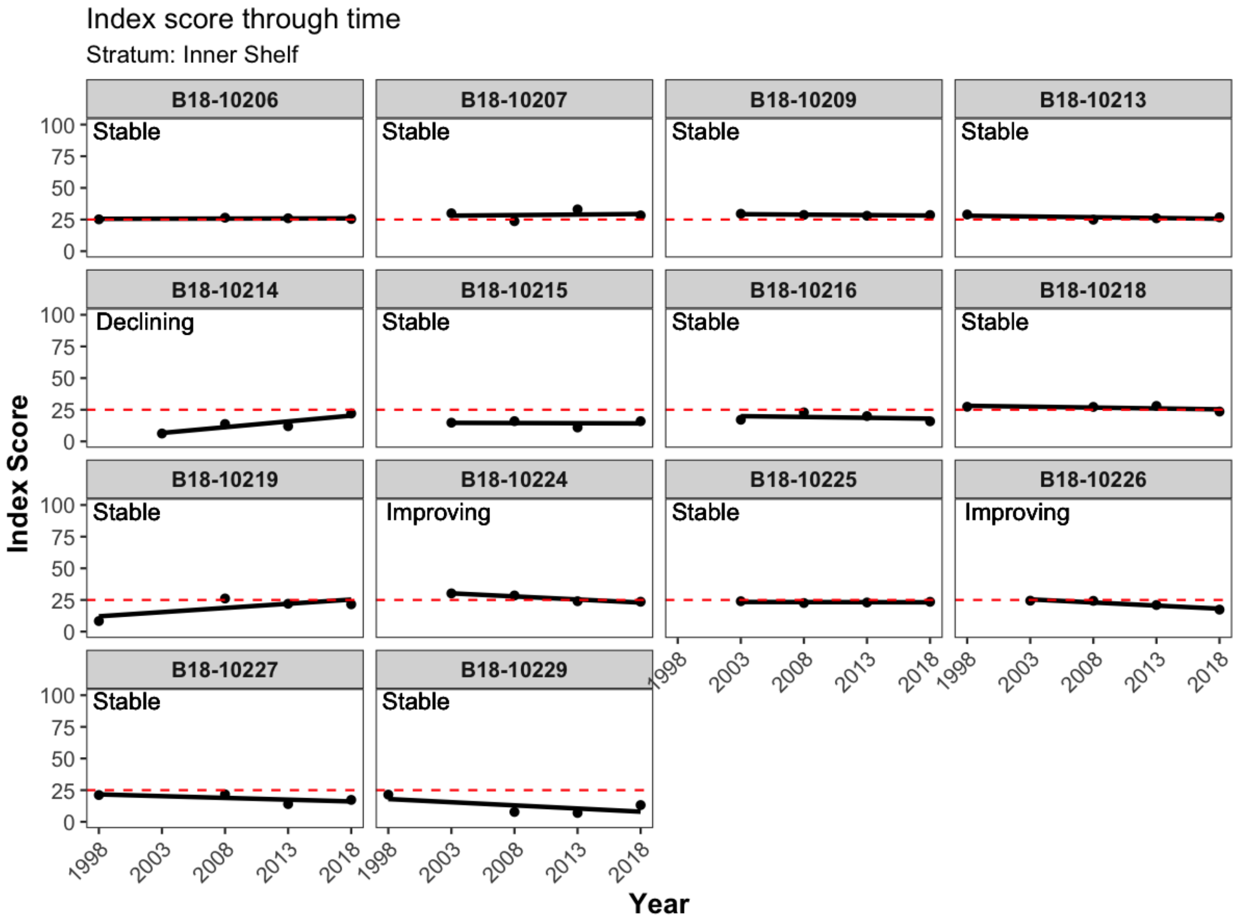

Figure 41. Temporal trends in BRI scores among Inner Shelf stratum revisit sites. Each trend is categorized as being indicative of Improving condition, Stable condition, or Declining condition. The black line represents a least-squares regression of the 3 or 4 samples from each site. The red-dashed line represents the threshold between the Reference and Low Impact condition categories. Note that lower BRI scores represent less disturbed conditions.

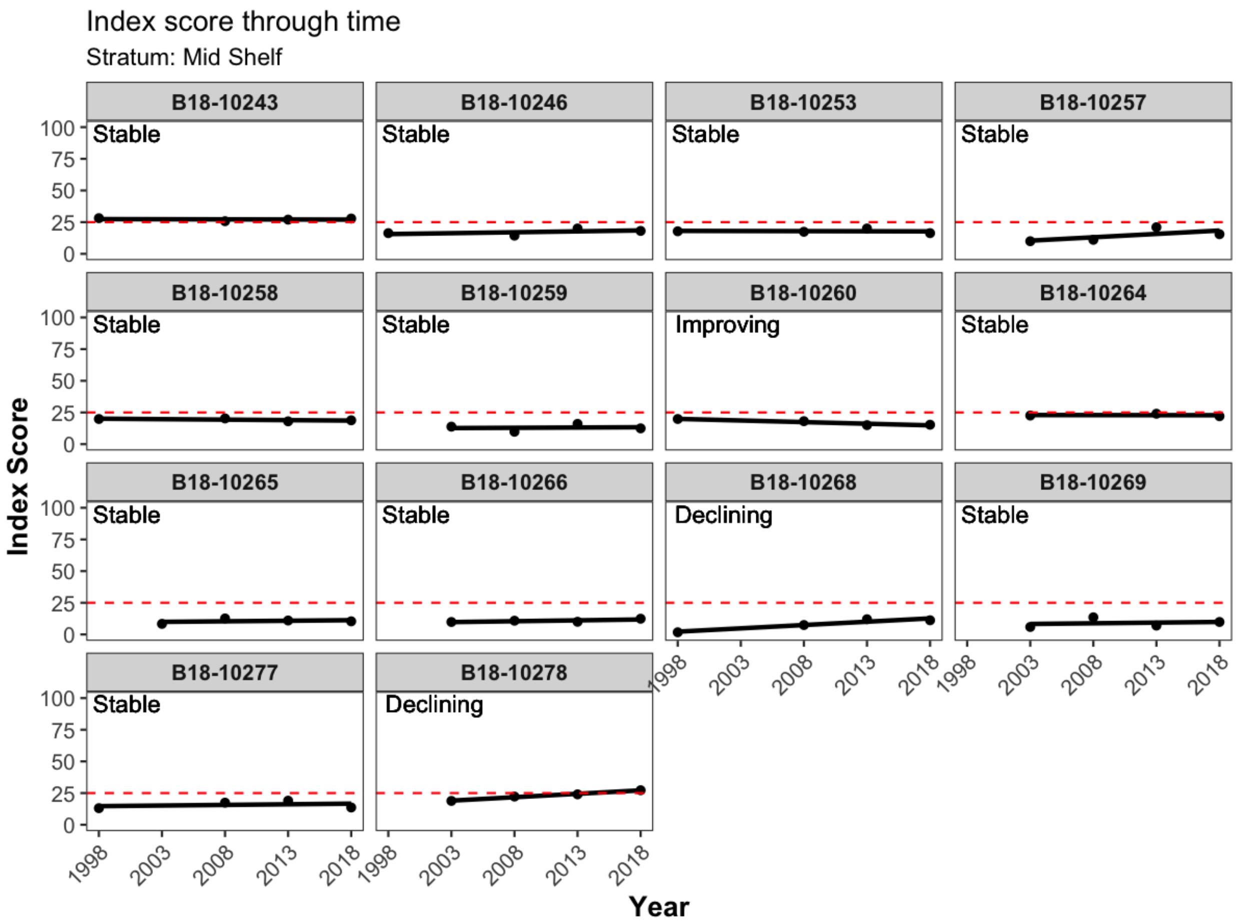

Figure 42. Temporal trends in BRI scores among Mid Shelf stratum revisit sites. Each trend is categorized as being indicative of Improving condition, Stable condition, or Declining condition. The black line represents a least-squares regression of the 3 or 4 samples from each site. The red-dashed line represents the threshold between the Reference and Low Impact condition categories. Note that lower BRI scores represent less disturbed conditions.

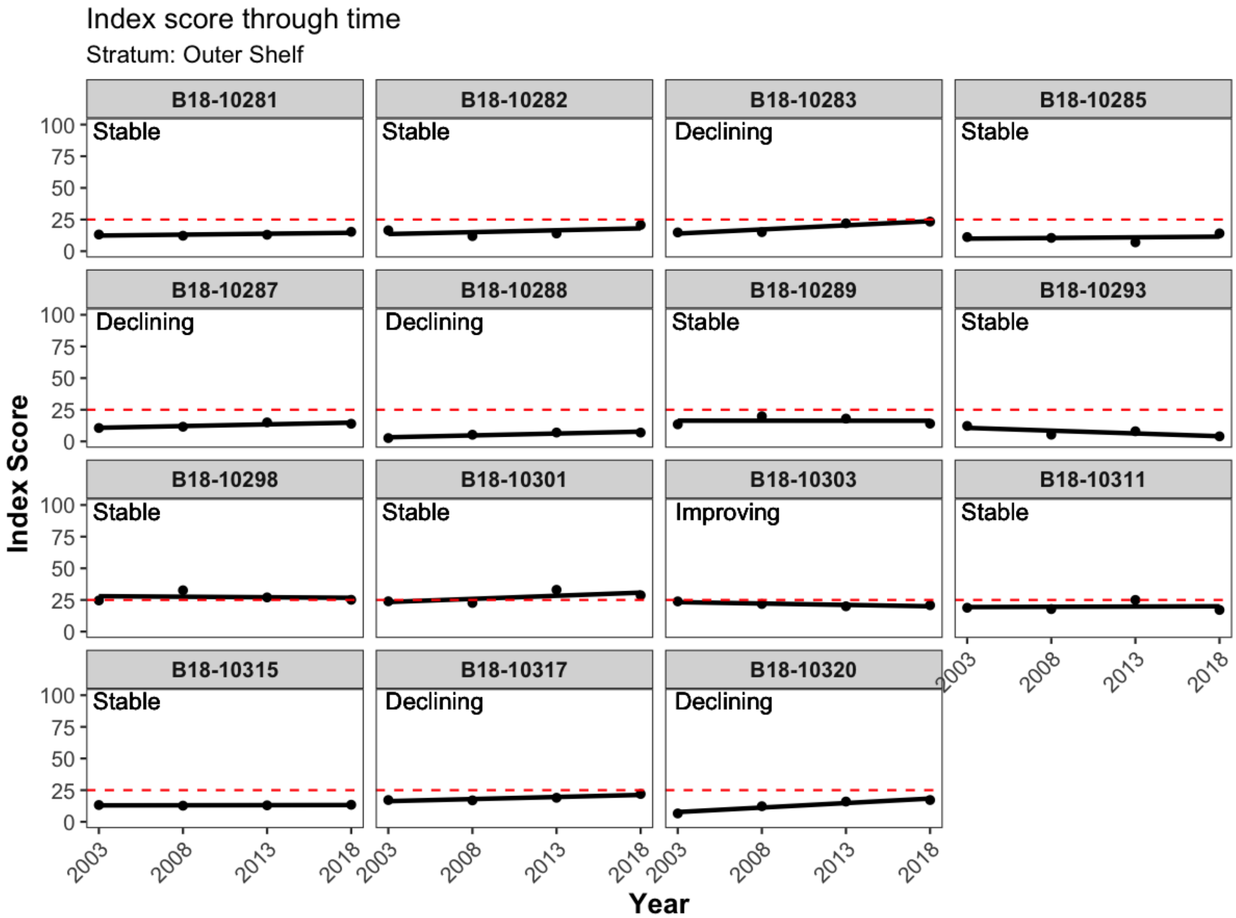

Figure 43. Temporal trends in BRI scores among Outer Shelf stratum revisit sites. Each trend is categorized as being indicative of Improving condition, Stable condition, or Declining condition. The black line represents a least-squares regression of the 3 or 4 samples from each site. The red-dashed line represents the threshold between the Reference and Low Impact condition categories. Note that lower BRI scores represent less disturbed conditions.

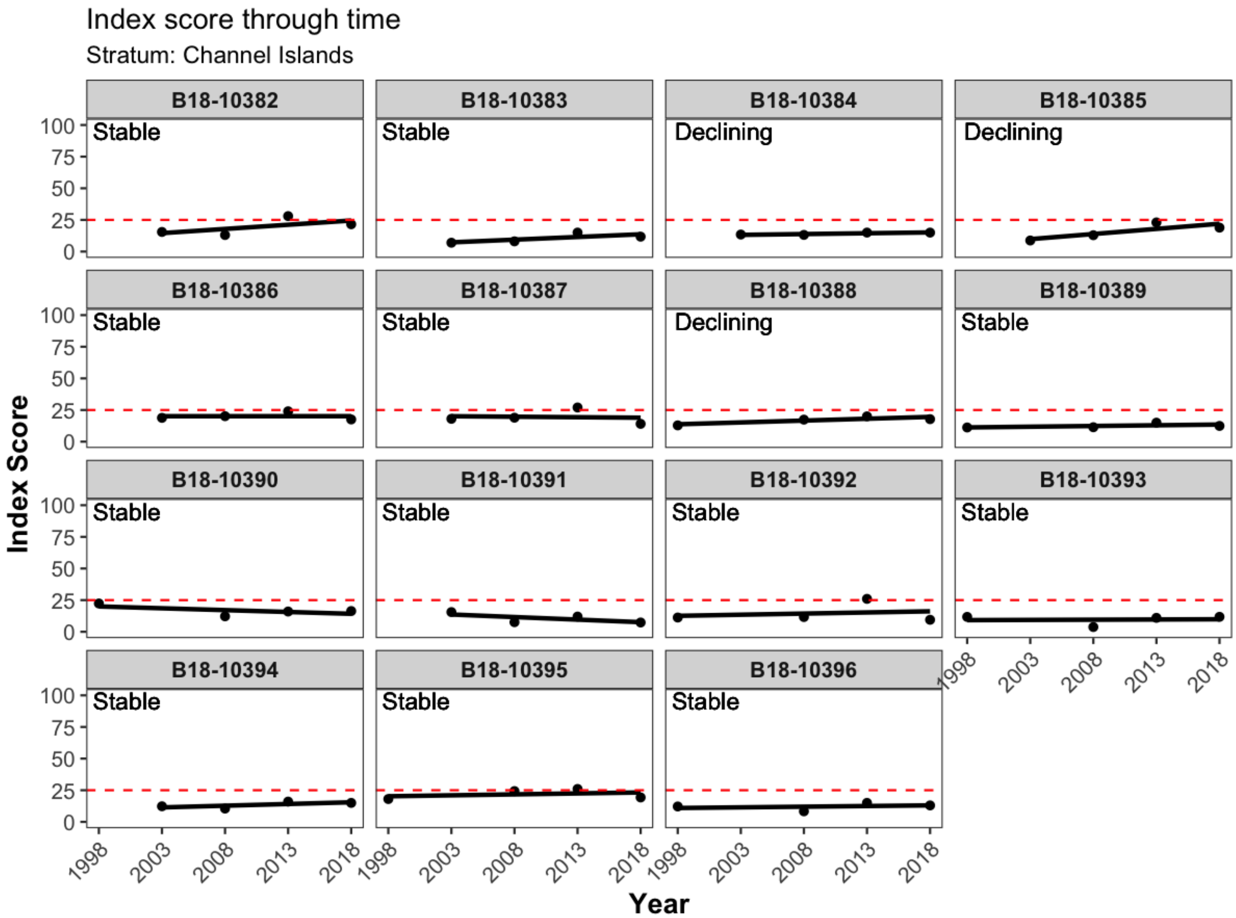

Figure 44. Temporal trends in BRI scores among Channel Islands stratum revisit sites. Each trend is categorized as being indicative of Improving condition, Stable condition, or Declining condition. The black line represents a least-squares regression of the 3 or 4 samples from each site. The red-dashed line represents the threshold between the Reference and Low Impact condition categories. Note that lower BRI scores represent less disturbed conditions.

APPENDIX H – BENTHIC SAMPLE DATA

Identity and abundance of each macrobenthic infauna sample collected as part of the Bight'18 Survey. Samples are organized by stratum and nominal depth of the sample is presented for context.

Appendix I – Benthic Index Data

Benthic index information associated with each sample collected as part of the Bight'18 Survey. Samples are organized by stratum. The benthic index (or indices) used to evaluate the sample is listed, along with the numerical score produced by the index, the corresponding condition level that score is classified as, and the condition category the condition level represents. The Bight summary condition level is also provided for each sample. Note that for samples where the California Sediment Quality Benthic Line of Evidence (BLOE) framework was appropriate, the component indices used in calculating the BLOE are presented. Details on benthic index application and calculation are presented in the methods section of the main body of the report.

APPENDIX J – BRI TOLERANCE VALUES

Depth zone-specific tolerance values and the associated p-codes used to associate tolerance values with different taxa. Taxa names are based upon SCAMIT ed 12 and tolerance values are based upon the original values in Smith et al. 2001.

APPENDIX K – SOUTHERN CALIFORNIA EMBAYMENTS SQO SPECIES LIST

List of all taxa used in calculating the four California Sediment Quality Objectives (SQO) benthic indices, with taxa names based upon SCAMIT ed12. Application and calculation of the different SQO indices are detailed in the methods section of the main body of this report and in Bay et al. 2021.