Data Documentation Warty Sea Cucumber

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Metadata

There are both fishery-dependent and fishery-independent data available for the southern California Red Sea Urchin fishery. Landings and fishing effort (numbers of trips) are available from landings receipts. Self-reported catch and effort data are also available via logbooks, but this information requires a further analysis in order to be informative, and was not used in this study. Fishery-independent data is available from the Channel Islands Kelp Forest Monitoring Program (KFMP). Since 1985 size frequency and density information has been collected for Warty Sea Urchin using quadrant transect surveys at 37 sites around the Channel Islands National Park. Many of these sites are located within no-take Marine Protected Areas.

Table 1: Table 1. Summary of metadata

Name	Example of Warty Sea Cucumber Data
Common Name	Warty Sea Cucumber
Species	Apostichopus parvimensis
Region	Southern California
Last Historical Year	2019
Last TAC	NA
Units	lbs
Last TAE	1
Number of areas	2

Biology

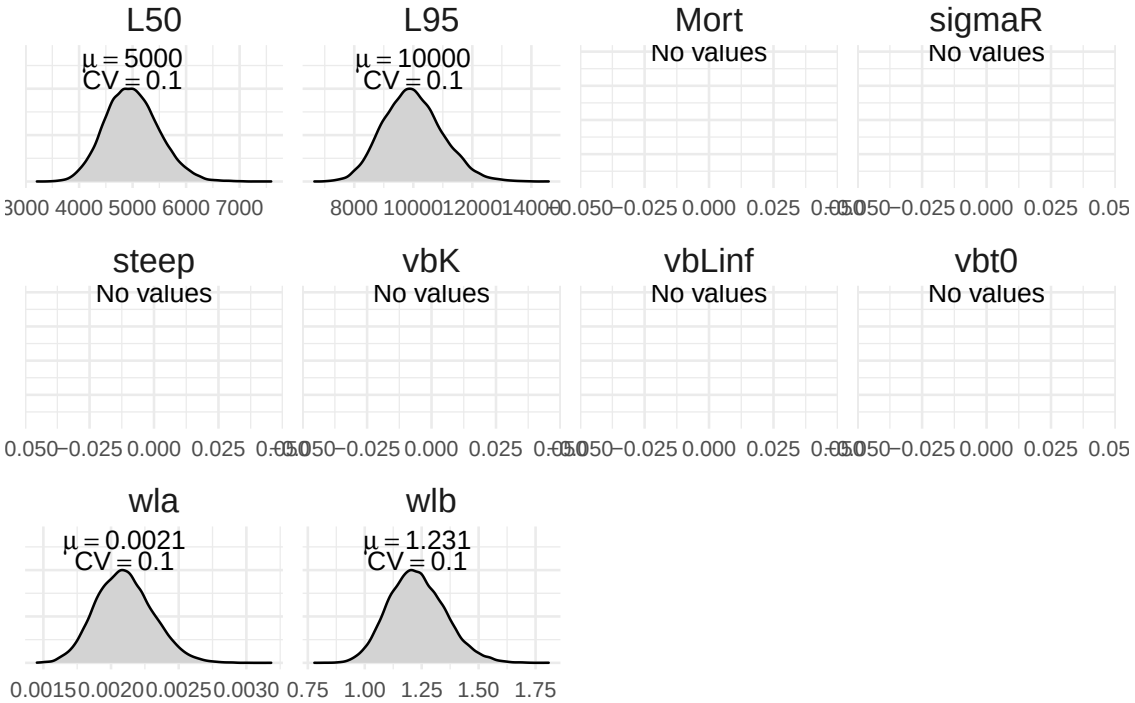
Limited biological data for Warty Sea Cucumber exists. The Warty Sea Cucumber data object has estimates of the length weight relationship and size at sexual maturity. These were estimated from data collected by CDFW staff.

When individual Warty Sea Cucumber are encountered on the seafloor in their original “in situ” position, individuals can reach a maximum length of 20 in (51 cm) Total Length (TL)); however, this form of measurement is inconsistent due to the fact that Warty Sea Cucumber can bend, extend, and contract their bodies. Yingst (1974) developed a standardized method for measuring Warty Sea Cucumber based on their

Contracted Length (CL) and Contracted Width (CW). This measurement is taken underwater at depth of capture after an individual has been handled and agitated, which results in the individual contracting its body into a tight cylindrical shape. At this point, CL, CW, and Contracted Height (CH) measurements can be taken. CDFW research suggests that this method of measuring size produces the most consistent results.

Sea cucumber can stretch and contract, making it difficult to record a consistent size measurement. For this reason, the size of maturity for Warty Sea Cucumber is best estimated using the cut weight (CWT) of individuals after all viscera and water has been removed from the body cavity. The minimum observed weight at sexual maturity for Warty Sea Cucumber was found to be 40 g (0.09 lb) CWT for individuals collected off Santa Catalina Island (Muscat 1983) and 37 g (0.08 lb) CWT for individuals collected at Anacapa Island(CDFW unpublished data). The estimated weight at 25%, 50%, 75%, 90% and 100% are 43 g (0.09 lb), 73 g (0.16 lb), 102 g (0.22 lb), 132 g (0.29 g), and 215 g (0.47 lb) CWT, respectively. It should be noted that estimating the percentage of sexually mature individuals for each size class is challenging since individuals that have already spawned may be difficult to distinguish from individuals that are sexually immature or are in the process of developing gonads. To account for this, only individuals that were collected during the gonad development months of March and April from Anacapa and Santa Cruz Islands were used in this analysis: however, there is a possibility that spawning may have occurred prior to individuals being collected. In southern Baja California, Mexico, the weight at 50% sexual maturity was estimated to be 120 g (0.26 lb) CWT at Bah?a Tortuga and 140 g (0.31 lb) CWT at Isla Natividad (Fajardo-Le?n et al. 2008). Because there is no information on age at size or growth rates available for Warty Sea Cucumber, it is unknown how many years it takes an individual to reach the size at sexual maturity.

Figure 1. Density plots of biological parameters

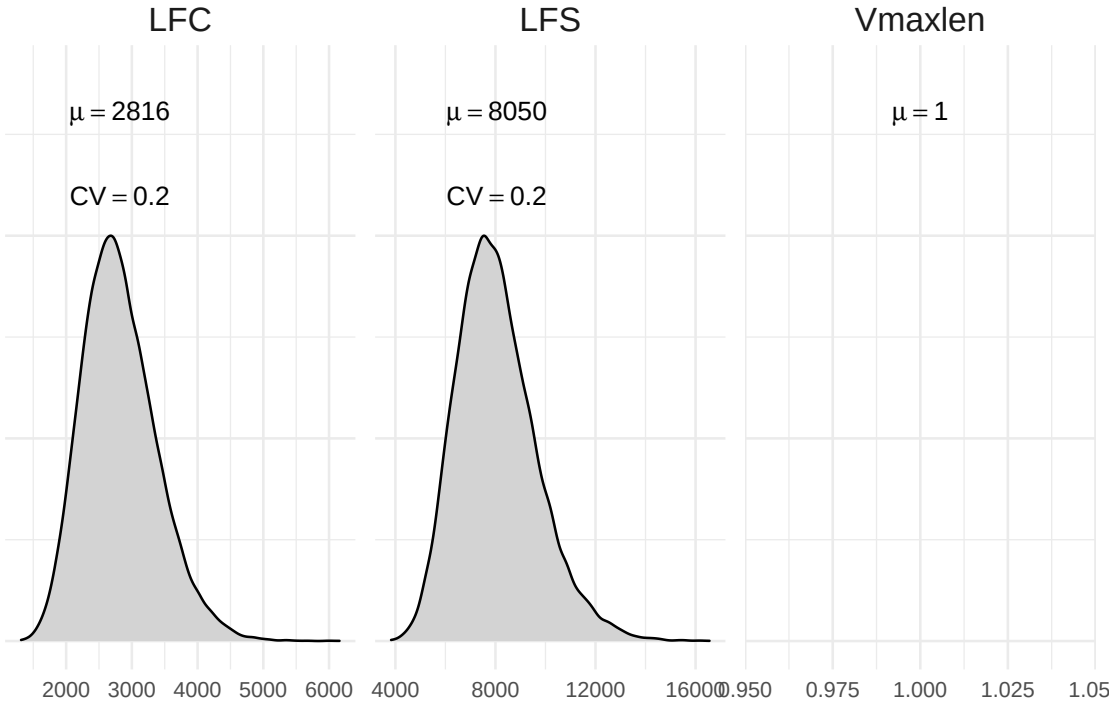


Selectivity

Hand-take is the primary method of take for the dive fishery. Warty Sea Cucumber are “picked” off the bottom, placed into game bags, and brought to the surface at the conclusion of each dive.The initial demand for Warty Sea Cucumber in California was to supply a market that specialized in a boiled and dried product. For processors to make a profitable yield off a boiled and dried product, they requested that commercial fishermen only harvest individuals that were greater than approximately 1/3 lb (151 g) after all water and

viscera were removed. This resulted in a de-facto size limit over the history of the fishery until roughly 2009, when new buyers began to request small "baby" sea cucumber for a domestic live market. Based on these evolving fishery dynamics and considering the extremly low densities currently observed at fished sites by both CDFW and the National Park Service's Kelp Forest Monitoring Program, it can be assumed that all sizes of emmergent or observable Warty Sea Cucumber are harvested by the fishery. To model this selectivity, the size distributions recorded within and outside MPAs by CDFW and other monitoring groups(PISCO, NPS KFMP) from 2013 to 2019 were used.

Figure 2. Density plots of selectivity parameters



Time-Series

Landings data comes from landing receipts, and is available from when the fishery began in 1980 through 2019. Landings are reported in pounds. During the 1980s, the fishery exhibited extremely low landings until the early 1990s, after which time commercial landings continued to increase until reaching a record high of 660,000 lb (299,371 kilogram (kg)) in 2002. By 2004, the fishery experienced a 50% decline, reaching 298,000 lb (135,170 kg), which may be partially explained by the practice of commercial divers cutting sea cucumber prior to landing to better preserve the product and to reduce the amount of water weight (approximately 50%) in each load. This change in the processing and recording of landings occurred gradually over time as more and more permit holders adopted the practice of cutting. This makes it very difficult to compare more recent landings with historical landings.

Effort

The effort data for the Warty Sea Cucumber fishery is available from dive logs books of the fishing fleet. However, this data needs to be QAQCed in order to produce a reliable effort time series. The number of landing receipts was used as proxy for the number of fishing trips each year.

Abundance

Since 1982 the KFMP has conducted surveys of counts of Warty Sea Cucumbers at each site along a 100 m (328 ft) permanently fixed transect line and produced density estimates (count per unit area). We created an

index of abundance by weighting the average density at sites inside and outside of MPAs by the amount of suitable habitat that is current inside and outside MPAs. As addiional inidices of abundance we include the density from only the fished sites (Index 1) and only the MPA sites (Index 2).

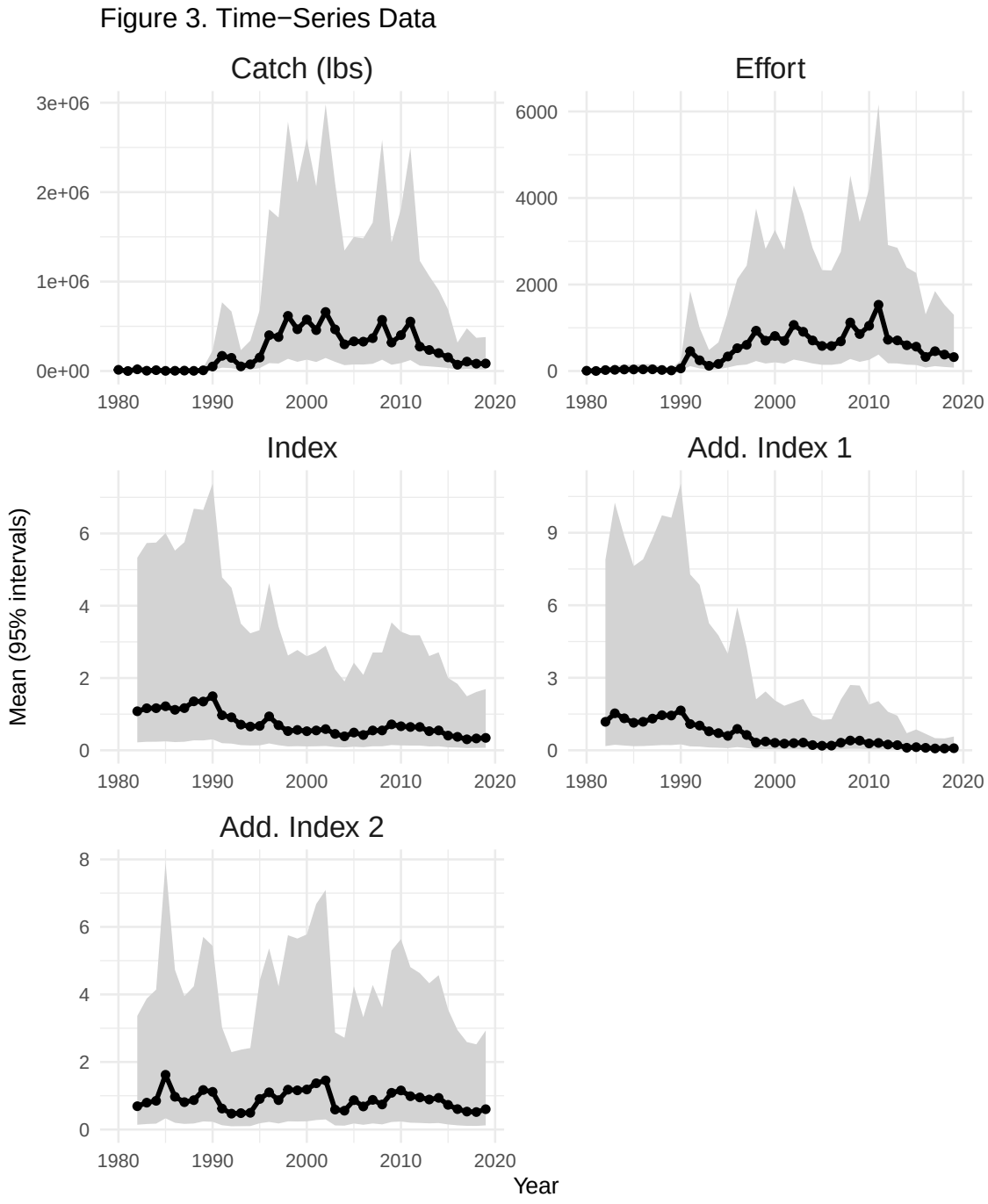
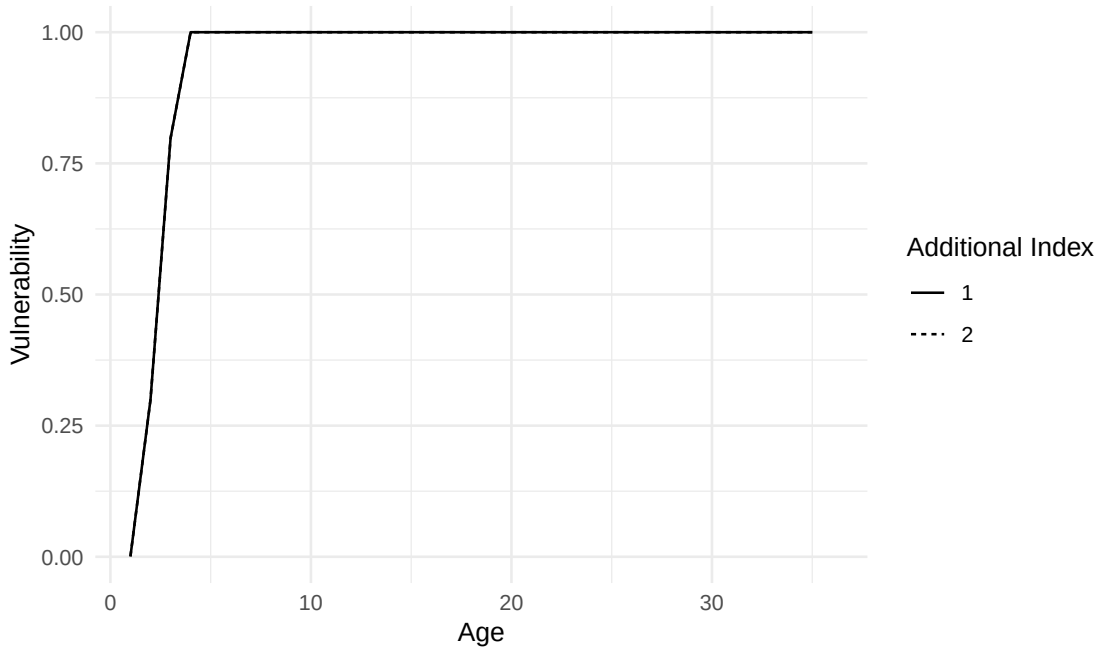


Figure 5. Vulnerability−at−age schedules for Additional Indices

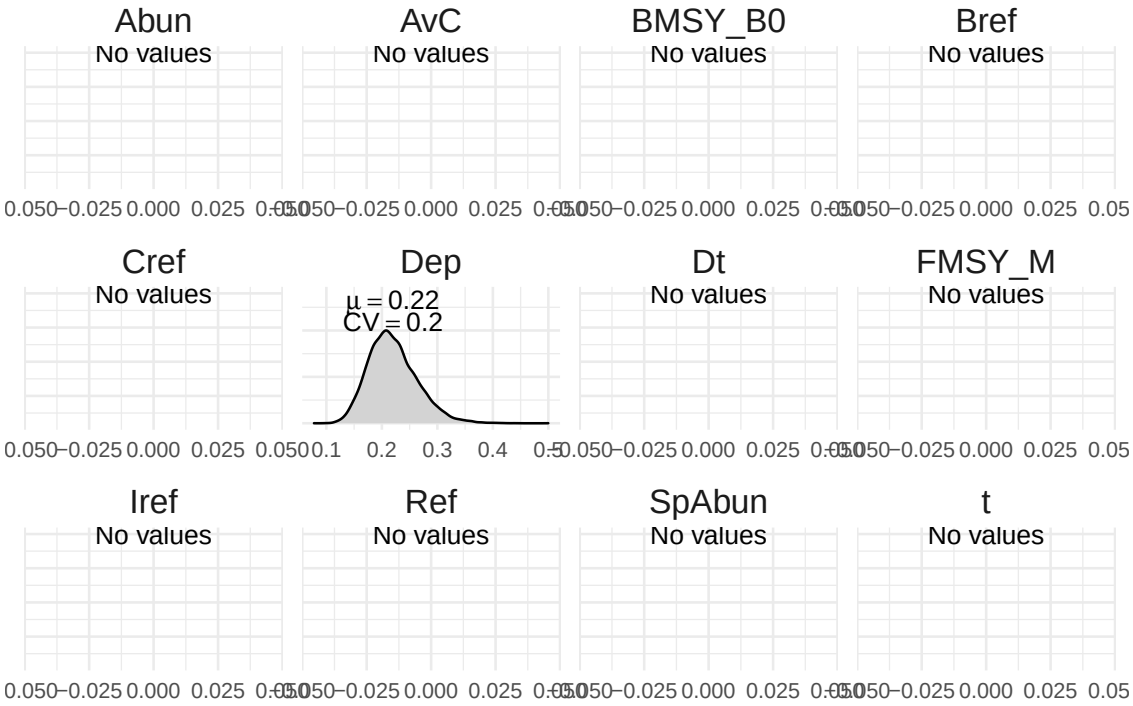


Catch-at-Age

Catch-at-Length

Reference

Figure 6. Density plots of Reference parameters



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Muscat AM. 1983. Population dynamics and the effect on the infauna of the deposit feeding Holothurian Parastichopus parvimensis. [Ph.D.Thesis] University of Southern: California, Los Angeles. 328 p.

Yingst JY. 1974. The utilization of organic detritus and associated microorganisms by Parastichopus parvimensis a benthic deposit-feeding holothurian. Ph.D. Thesis, University of Southern California, Los Angeles. 154 p.