Intertidal community diversity surveys at 23 sites in California, USA and Baja California, Mexico across tidal elevations from 2022-2023

Website: https://www.bco-dmo.org/dataset/935622
Data Type: Other Field Results
Version: 1
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Project
» Predicting impacts of coastal species redistribution in a changing climate (CoastalRedistImpacts)

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Abstract
This dataset includes information on over 100 species found in the intertidal zone on a rocky shoreline during community surveys conducted at 23 sites along the coast of California and Baja California, Mexico in 2022 and 2023. Community survey data includes visual estimates of percent area covered by various species with corresponding season and tide height.

Table of Contents

Coverage

Location: California, USA and Baja California, Mexico
Spatial Extent: **N**:40.4 **E**:-116 **S**:30.474 **W**:-124.4
Temporal Extent: 2022-04-13 - 2023-10-30

Dataset Description

The taxonomy of the species observed in the intertidal community survey dataset can be found in the supplemental file taxonomy_of_intertidal_community.csv.

This file contains an Organism_parameter column which lists the species name parameters used in the intertidal community survey files of

935622_suppl_intertidal_comm_survey_ca_and_baja_ca_mexico_2022_2023.csv and 935622_v1_unpivoted_intertidal_comm_survey_ca_and_baja_ca_mexico_2022_2023.csv.

Each row lists the species name parameter, the observed species, a note clarifying the observed species, since there may be an adjective describing the species or two species observed at once, and the matching taxonomy of the observed species using taxonomy information attained from WoRMS (World Register of Marine Species). Since some of the species name parameters represent two species, such as Balanus_and_Chthamalus_spp, there are two rows in the taxonomy file where the taxonomy is listed for each of the separate species.

Methods & Sampling

We conducted field surveys at 23 sites across California, USA and Baja California, Mexico between April 2022 and October 2023. Sites in northern California and Mexico were surveyed once per year in the spring (total n = 2 surveys per site), and sites in southern California were surveyed in the spring and fall each year (total n = 4 surveys per site). At each site, we laid a 25 m horizontal transect at the top of the intertidal zone (i.e., parallel to the water at the top of the barnacle zone) and 5 vertical transects (perpendicular and extending toward the waterline) at random locations along the horizontal transect. Along each vertical transect, we placed 0.25 m × 0.25 m (0.0625 m^2) quadrats every 0.25 m drop in vertical elevation. Within each quadrat, we conducted community diversity surveys where we assessed the relative abundance of all species, both mobile and sessile, as percent cover. Tidal elevation was determined using an Apache Tools Mesa SL101 laser level with reference to tidal predictions from the National Oceanic and Atmospheric Administration.

BCO-DMO Processing Description

The submitter's file Community_survey_data_for_BCODMO_RangeShiftNSF_2024_0816.xlsx was an Excel spreadsheet with metadata columns and over 100 columns with species names as headers.

This file was processed with Excel first to alphabetize the species name columns, and then the sorted table was saved to a file named sorted_Community_survey_data_for_BCODMO_RangeShiftNSF_2024_0816.xlsx.

Overview

This file was then processed with BCO-DMO's Laminar tool to create a primary dataset file in a long format (fewer columns) and a supplemental dataset file in a wide format (fewer rows).

Step 1

Renamed two species column headers to clarify two species were observed for coverage data.

Renamed the parameter Nucella_emarginata/ostrina to Nucella_emarginata_and_ostrina.

Renamed the parameter Dead_Balanus_Chthamalus to Dead_Balanus_and_Chthamalus.

Renamed Errant_Polychaete renamed Errant_Polychaetes by adding an 's' to fix the spelling of the plural form.

The units "_m" were removed from the parameter names "Vert_Transect_Dist_m", "Quad_Dist_m", and "Quad_TH_m" to conform with the BCO-DMO parameter naming convention. The units will be noted in the parameters section on the dataset page.

The format of the dates in the column "Survey_Date" were reformatted from %m-%d-%y into the ISO 8601 date format of %Y-%m-%d.

This reformatted dataset table was saved as 'survey_data' in Laminar and was duplicated to create two files at the end of processing. One in long format and the other in wide format.

Step 2

One of the duplicated 'survey_data' tables was saved as the supplemental dataset file named 935622_supl_intertidal_comm_survey_ca_and_baja_ca_mexico_2022_2023.csv. This file is in a 'wide' format with many columns and fewer rows than an unpivoted version.

Definitions for the parameters in 935622_supl_intertidal_comm_survey_ca_and_baja_ca_mexico_2022_2023.csv are in the supplemental file parameter_definitions_for_supplemental_community_survey_data.csv.

Step 3

The other 'survey_data' table was unpivoted into a long format with fewer columns and more rows. This was achieved by unpivoting all the column parameters with species names. There are now two columns named "Organism_parameter" and "Coverage" where each "Organism_parameter" cell contains a species parameter name (maintaining the column name from before) and each "Coverage" cell contains a coverage percentage for each species name, location, and date. There are now many more rows than the submitted file, but fewer columns.

The "Organism_parameter" column was duplicated as "Organism_name" and the underscores in "Organism_name" were replaced with spaces and any suffix of 'spp' was replaced with 'spp.' to result in the parameter "Organism_name" containing the species name spelling.

This table was saved as the primary dataset file named 935622_v1_unpivoted_intertidal_comm_survey_ca_and_baja_ca_mexico_2022_2023.csv.

Step 4

Taxonomic names in the dataset were checked using the World Register of Marine Species (WoRMS) taxon match tool at https://www.marinespecies.org/aphia.php?p=match. The species name of each organism in the intertidal community surveys dataset was uploaded to the WoRMS taxon match tool and the output saved as taxonomy_of_intertidal_community.csv. This file includes the column Organism_parameter which contains species names parameters used in the supplemental file 935622_supl_intertidal_comm_survey_ca_and_baja_ca_mexico_2022_2023.csv and in the primary file 935622_v1_unpivoted_intertidal_comm_survey_ca_and_baja_ca_mexico_2022_2023.csv.

For values in Organism_parameter that represented two observed species, e.g. Balanus_and_Chthamalus_spp, the parameter value was copied into a second row to separate out the taxonomy for each species on separate rows. The notes column provides clarifying information for the Organism_parameter when needed.

A corresponding column named Organism_species contains the species name of the Organism_parameter. This species name was created from the Organism_parameter entry by replacing underscores with spaces and replacing 'spp' with 'spp.'. Clarifying information like 'articulated' in the Organism_parameter was removed in the Organism_species column. For cases where the Organism_parameter represented two observed species, one species name in the Organism_species column is used per duplicated Organism_parameter with the description in the 'Notes' column clarifying the species name used.

The Organism_species names are clarified as taxon accepted or unaccepted in WoRMS and their corresponding taxon, including AphiaID and LSID, are listed as of December 2024. The Organism_species Biofilm is a general term and had no match in WoRMS.

See the supplemental file parameter_definitions_for_taxonomy_of_intertidal_community_file.csv for the column definitions in the taxonomy file taxonomy_of_intertidal_community.csv.

Problem Description

Gaps in sampling are most likely due to:
(1) tidal and weather conditions, or that allowed us to survey plots to a lower elevation during some sampling events and not others, and/or
(2) inundation of areas by sand, that allowed us to survey plots during some sampling events and not others.

[table of contents | back to top]

Data Files

File
Unpivoted long format intertidal community survey from 2022 to 2023 filename: 935622_v1_unpivoted_intertidal_comm_survey_ca_and_baja_ca_mexico_2022_2023.csv (Comma Separated Values (.csv), 20.28 MB) MD5:18045d4f6fb4ad8d1c96c4f80b712273 Primary data file for dataset ID 935622, version 1 Unpivoted long format primary file (one column listing species names) using data from the wide format supplemental file 935622_suppl_intertidal_comm_survey_ca_and_baja_ca_mexico_2022_2023.csv

[table of contents | back to top]

Supplemental Files

File
Parameter definitions for supplemental wide format community survey data file filename: parameter_definitions_for_supplemental_community_survey_data.csv (Comma Separated Values (.csv), 30.27 KB) MD5:5a29c2447e363c4966cab342645ae5e2 Parameter definitions for the supplemental file 935622_suppl_intertidal_comm_survey_ca_and_baja_ca_mexico_2022_2023.csv
Parameter definitions for taxonomy of intertidal community file filename: parameter_definitions_for_taxonomy_of_intertidal_community_file.csv (Comma Separated Values (.csv), 1.07 KB) MD5:cdfa79224cbc92bc80ea2209906764ac Parameter definitions for the file taxonomy_of_intertidal_community.csv
Taxonomy of intertidal community filename: taxonomy_of_intertidal_community.csv (Comma Separated Values (.csv), 27.75 KB) MD5:8b006f70afc71ae33219252b3013d7e2 Taxonomy of observed intertidal community species incorporating taxonomy information from WoRMS (The World Register of Marine Species). Definitions of parameters are in the file parameter_definitions_for_taxonomy_of_intertidal_community_file.csv
Wide format version of the primary file of intertidal community survey from 2022 to 2023 filename: 935622_suppl_intertidal_comm_survey_ca_and_baja_ca_mexico_2022_2023.csv (Comma Separated Values (.csv), 515.49 KB) MD5:6b4a78823b3d6e49a21897f6ed8d71b2 Wide format version of the primary file (multiple parameter columns representing species names and fewer rows than the primary file). Definitions of parameters in this supplemental file can be found in the supplemental file named parameter_definitions_for_supplemental_community_survey_data.csv.

[table of contents | back to top]

Parameters

Parameter	Description	Units
Region	The overall geographical region in which a specific site exists; NorCal (Northern CA), SoCal (Southern CA), Baja (Baja California, Mexico)	unitless
Site	Name of the sites surveyed	unitless
Lat	Latitude of site (South is negative)	decimal degrees
Long	Longitude of site (West is negative)	decimal degrees
Survey_Date	Date on which community diversity data was collected	unitless
Season	Season in which the survey was conducted; Spring (all regions), Fall (SoCal only)	unitless
Vert_Transect_Dist	Distance along the 25 m horizontal transect that the vertical transect was placed, based on random numbers at whole integer locations	meters (m)
Quad_Dist	Distance along the vertical transect that the quadrat was placed for commiunity diversity surveys	meters (m)
TH_Transect_Top	Tide height (in meters above mean lower low water) at the top of a given vertical transect.	meters (m)
Quad_TH	Tide height of the quadrat surveyed (in meters above mean lower low water). Calculated in 0.25 m steps down from the top of the vertical transect.	meters (m)
Pct_Pool	Percentage of the plot that falls within a tidepool.	percent (%)
Bare_Space	Bare space observed in quadrat. Values indicate visual estimates of % area.	percent (%)
Organism_parameter	Parameter name of the observed organism species as it appears in the wide format supplemental file 935622_suppl_intertidal_comm_survey_ca_and_baja_ca_mexico_2022_2023.csv	unitless
Organism	Observed organism species	unitless
Coverage	Coverage of species that may have been observed in quadrat. Values indicate visual estimates of % area covered by this species. Total cover of a quadrat across multiple species may exceed 100% due to layering.	percent (%)

[table of contents | back to top]

Project Information

Predicting impacts of coastal species redistribution in a changing climate (CoastalRedistImpacts)

NSF Award Abstract:
This project will improve our ability to anticipate the impacts of shifts in the geographic range of coastal species in a changing climate. Although range shifts may be necessary for some species to avoid extinction as the climate warms, the arrival of new ones to an ecosystem can also lead to population declines and loss of biodiversity. The investigator is developing approaches to predict the impacts of range shifts along Pacific shorelines using techniques that have been previously validated for risk assessments for invasive species. The research objectives of this study are integrated with educational activities: engagement of undergraduate and graduate students in data collection and analysis and implementation of a hierarchical mentoring program to serve English Language Learners within the investigator's Minority Serving Institution. The investigator is also partnering with outreach organizations in the U.S. and Mexico to educate K-12 students and multiple stakeholder groups about climate-driven range shifts and tools for predicting outcomes of redistribution, which can assist practitioners in creating management plans and policies.

This study is developing a framework for understanding the impacts of marine species redistribution with a focus on poleward-moving carnivorous whelk species in rocky shorelines from Northern California to Baja, Mexico. Project goals are to 1) quantify the impacts of shifting species on populations and communities in the expanded range; 2) assess whether impacts of shifting species differ between their native and expanded ranges; and 3) predict future impacts under climate warming. The investigator is addressing fundamental questions in community ecology about the degree to which species interactions are density- and context-dependent. She is combining observational and experimental approaches with a broader data synthesis effort to test whether the impacts of species redistribution can be predicted by key indicators of invasion impacts: abundance, trophic level, and impacts in the native range. Empirical data combined with paired demographic and distribution modeling will be used to project future impacts across the expanded ranges of these coastal marine species.

[table of contents | back to top]

Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-2124438

[table of contents | back to top]