Sunflower star tissue collection metadata from specimens collected in British Columbia, Washington, and California between Mar 2022 and Apr 2025

Website: https://www.bco-dmo.org/dataset/986632
Data Type: Other Field Results
Version: 1
Version Date: 2025-11-12

Project
» RAPID: Recolonization dynamics following mass mortality in the ecologically important sunflower star (Pycnopodia helianthoides) (Phel recol dynamics)

Contributors	Affiliation	Role
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Abstract
Following extirpation of the sunflower star (Pycnopodia helianthoides (urn:lsid:marinespecies.org:taxname:240764)) from the southern half of its range by sea star wasting (SSW) in the mid-twenty-teens, this project aims to document the population and genetic recovery of the species in Oregon, California, and possibly beyond. We aim also to identify potential sources from remnant populations in Alaska, British Columbia, and Washington. For this, we collaborated with teams across these states and provinces who were conducting intertidal and subtidal research. Tissues were collected if individuals were encountered, along with information on location, habitat, SSW status. This dataset lists the currently available dataset: tissues from 43 specimens from reference sites in British Columbia and Washington, and a recruit from Northern California, collected between March 2022 and April 2025 including associated metadata (Number, FieldNumber, Country, State_Province, Location_name, Latitude, Longitude, DateCollected, Collector, General notes, Depth, Size, Photo, PhotoFileName, Tissue, RNAlater, DNA, Habitat, Substrate, Phylum, Class, Order, Family, Genus, Species).

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Coverage

Location: Northeastern Pacific Ocean
Spatial Extent: **N**:51.8105451 **E**:-122.522588 **S**:41.04897 **W**:-128.05288
Temporal Extent: 2022-03-26 - 2022-04-30

Methods & Sampling

Tissues from 43 specimens of *Pycnopodia helianthoides* (urn:lsid:marinespecies.org:taxname:240764) were collected using SCUBA (Self-Contained Underwater Breathing Apparatus) from reference sites in British Columbia and Washington, and a recruit from Northern California. Specimens were collected between March

2022 and April 2025.

Specimens were located visually during recreational and/or scientific dives and during intertidal research or surveys conducted for other purposes. Tissues (tube feet or arm tips) were collected as incidental products of those dives and research. Tissues were sampled 1) subtidally by clipping tissue using clamps or scissors into a plastic bag while underwater, and then preserved in RNAlater or 100% EtOH when at the surface, or 2) intertidally by clipping tissue using scissors directly into a 2 ml vial of RNAlater or 100% EtOH. RNAlater samples were refrigerated overnight then placed in a -20C freezer. EtOH samples were placed in a -20C freezer.

Data Processing Description

Data were usually recorded in the field on water proof paper or dive slates and transferred to an excel spreadsheet by field collectors.

BCO-DMO Processing Description

- Imported "SampleList4Upload.xlsx" into the BCO-DMO system
- Converted "DateCollected (DD/Mmm/YYYY)" to ISO date format in "DateCollected_ISO"
- Replaced spaces with underscores and removed special characters from the parameter names in keeping with BCO-DMO guidelines
- Replaced non-standard characters in "Baker’s Beach, Trinidad" with "Baker's Beach, Trinidad"
- Exported file as "986632_v1_sunflower_star_sample_list.csv"

All scientific names referenced were checked in the World Register of Marine Species (WoRMS) Taxon Match. All scientific names referenced are valid and accepted names as of 2025-11-12.

Pycnopodia helianthoides (urn:lsid:marinespecies.org:taxname:240764)

Problem Description

Collecting was the result of a team of over 50 researchers and community scientists looking for Pycnopodia while conducting dives or intertidal work for other purposes. It is therefore spatially and temporally ad hoc.

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Parameters

Parameter	Description	Units
Species	Latin binomial	unitless
Number	Unique M0D# assigned to specimen on receipt at UCM lab	unitless
FieldNumber	Unique identifier assigned to specimen at time of collection in the field	unitless
Country	Country of origin	unitless
State_Province	State/Province of origin	unitless

Location_name	Full name of location	unitless
Latitude	Field-based GPS waypoint latitude	decimal degrees
Longitude	Field-based GPS waypoint longitude	decimal degrees
DateCollected	Date collected, (DD/Mmm/YYYY)	unitless
DateCollected_ISO	Date collected (ISO 8601 format)	unitless
Collector	Name(s) of collector(s)	unitless
General_notes	Any additional notes of interest	unitless
Depth	Depth at which the specimen was collected; should include a numerical depth and either 'ft' or 'm' unit as appropriate	feet or meters
Size	Size of specimen; includes a numerical size, the units (cm, mm), and the kind of measurement made (i.e. 'radius' [oral disc center to an ~average-sized arm tip] or 'diameter' [~average-sized arm tip to arm tip traversing across center of disc]); Value of "See photo for size" indicates that size is indicated in the photo	mm
Photo	TRUE if there is a photograph of the specimen	unitless
PhotoFileName	Filename(s) of photograph	unitless
Tissue	Tissue sampled for molecular analyses, e.g. tube foot, dermis, pyloric cecum, gonad, gut, coelomic fluid	unitless
RNAlater	TRUE if there is a tissue sample preserved in RNAlater	unitless
DNA	TRUE if extracted DNA sample exists	unitless
Habitat	Habitat or subhabitat type in which specimen was found, e.g. kelp forest, eelgrass, rocky intertidal, subtidal, etc, or a combination thereof; Eelgrass Bed (BED), Eelgrass Edge (EDG), Saccharina Bed (SAC), Sand Slope (SLP), Kelp Forest (KF), Urchin Barren (UB)	unitless
Substrate	Substrate on which specimen was found, e.g. kelp holdfast, rock (& rock type if known), etc	unitless

Phylum	Phylum name	unitless
Class	Class name	unitless
Order	Order name	unitless
Family	Family name	unitless
Genus	Genus name	unitless

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Instruments

Dataset-specific Instrument Name	GPS units
Generic Instrument Name	Global Positioning System Receiver
Dataset-specific Description	GPS units (various)
Generic Instrument Description	The Global Positioning System (GPS) is a U.S. space-based radionavigation system that provides reliable positioning, navigation, and timing services to civilian users on a continuous worldwide basis. The U.S. Air Force develops, maintains, and operates the space and control segments of the NAVSTAR GPS transmitter system. Ships use a variety of receivers (e.g. Trimble and Ashtech) to interpret the GPS signal and determine accurate latitude and longitude.

Dataset-specific Instrument Name	
Generic Instrument Name	Manual Biota Sampler
Dataset-specific Description	Specimens were located visually during recreational and/or scientific dives and during intertidal research or surveys conducted for other purposes.
Generic Instrument Description	"Manual Biota Sampler" indicates that a sample was collected in situ by a person, possibly using a hand-held collection device such as a jar, a net, or their hands. This term could also refer to a simple tool like a hammer, saw, or other hand-held tool.

Dataset-specific Instrument Name	SCUBA
Generic Instrument Name	Self-Contained Underwater Breathing Apparatus
Dataset-specific Description	Specimens were located visually during recreational and/or scientific dives and during intertidal research or surveys conducted for other purposes.
Generic Instrument Description	The self-contained underwater breathing apparatus or scuba diving system is the result of technological developments and innovations that began almost 300 years ago. Scuba diving is the most extensively used system for breathing underwater by recreational divers throughout the world and in various forms is also widely used to perform underwater work for military, scientific, and commercial purposes. Reference: https://oceanexplorer.noaa.gov/technology/technical/technical.html

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Project Information

RAPID: Recolonization dynamics following mass mortality in the ecologically important sunflower star (Pycnopodia helianthoides) (Phel recol dynamics)

Coverage: coastal British Columbia, Canada; California, Oregon, and Washington, USA. (~33–52 ºN)

NSF Award Abstract:
Many marine species are known for their large population sizes and high dispersal potential due to the time their larval offspring spend in the open ocean before settling into the adult habitat. Despite these characteristics, that often buffer against decimation, the sunflower sea star (Pycnopodia helianthoides) suffered major declines between 2013 and 2020 due to a disease outbreak and warming events, which led to listing by the IUCN as Critically Endangered. The sunflower star helps maintain ecological balance in kelp forest ecosystems; its absence across large swaths of its range has led to concerns for the future of the ecosystem. This loss has highlighted the need to better understand dispersal and recovery dynamics in this ecologically important species in a time when global change stressors are intensifying. The widespread loss of Pycnopodia — combined with recent sightings of new juveniles in the range where it's been lost — created an opportunity to answer questions about the genetic relatedness among new colonists, source populations of colonists, patterns of gene expression, and associations with environmental factors, and their implications for the future of the species. The investigators are collaborating with a diverse team of partners already surveying the coast, to collect genetic information from new colonists. The research proposed here has direct and consequential impacts on conservation actions for Pycnopodia through ongoing collaborations with the Nature Conservancy and fills an important gap for future conservation decisions aimed at restoring this important member of the kelp forest ecosystem to its historical range. As more species come under threat from rapidly intensifying global change, understanding recovery dynamics is an important and necessary step in instigating conservation actions. The investigator is developing a teaching lesson for a nearby community college and an undergraduate student will be trained.

Massive demographic declines associated with anthropogenically-induced stressors have increased in recent years, raising questions about species' ability to recover. The ecologically important sunflower sea star (Pycnopodia helianthoides) has suffered a precipitous (88–100%) decline since 2013 due to sea star wasting (SSW) disease and warming. The widespread loss of Pycnopodia provides a backdrop against which recent sightings of new juveniles in the extirpated range offer an opportunity to examine the contributions of four processes — (1) sweepstakes reproductive success, (2) cohesive dispersal, (3) larval cloning, and (4) allele surfing — to the evolutionary trajectory of populations following mass mortality. Additionally, identifying propagules' source populations, evaluating gene expression profiles, and analyzing genotype–environment associations of colonists can help elucidate potential colonization pathways that favor recovery or signal ongoing threats. The investigators are soliciting new opportunistic collections of Pycnopodia from many

partners and are responding to any observation in California and Oregon to acquire the samples and generate the whole genome resequencing data needed to test hypotheses segregating the aforementioned processes. As more species come under threat from rapidly intensifying global change, understanding recovery dynamics is critical to understanding population dynamics in the marine benthic environment.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-2224698

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