

Zooplankton abundance and size data from Bongo plankton net tows conducted in the subtropical Southern California Bight during February and April 2021

Website: <https://www.bco-dmo.org/dataset/915900>

Data Type: Cruise Results

Version: 1

Version Date: 2023-11-30

Project

» [RAPID: Understanding the unprecedented anchovy response to warm-water conditions in the California Current](#) (RAPID Anchovy Response)

Contributors	Affiliation	Role
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Abstract

This dataset includes zooplankton abundance and size from Bongo plankton net tows conducted in the subtropical Southern California Bight during February and April 2021. Net tows were carried out on several cruises aboard R/V Bob and Betty Beyster and R/V Shearwater.

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Coverage

Spatial Extent: N:34.1796 E:-117.390867 S:32.847217 W:-119.5062

Temporal Extent: 2021-02-01 - 2021-04-15

Methods & Sampling

This study was carried out within the temperate to subtropical Southern California Bight and surrounding coastal areas between 32° and 35° N, and 117° and 120° W. Specific locations sampled fall within the CalCOFI and CCE-LTER programs' quarterly survey grid from lines 76.7 to 93.4 and stations 26 to 55.

Sampling took place during February 2021 and April 2021 on R/V Bob and Betty Beyster cruises BBB2102 and BBB2104 and on R/V Shearwater cruise SW2104. Each cruise was composed of one or more day trips using one of the two research vessels. The two-three letters in the cruise ID number indicate the research vessel and the four digits indicate YYYY.

Zooplankton were collected using a 71-centimeter (cm) diameter dual Bongo plankton net system equipped

with a small CTD to record depth and physical variables during horizontal net tows at a ship speed of 1.5-2.5 knots down to 30-33 meters (m) depth. The Bongo was equipped with two nets, one with a 53-micrometer (μm) and the other with a 202 μm mesh size, and a flowmeter mounted in the center of each of the two nets.

Once the nets were retrieved, they were gently rinsed with saltwater. The content of the cod-ends was then concentrated onto a sieve of 50 μm mesh size, transferred into glass jars, and preserved in buffered 3.7% formaldehyde. The 53 μm samples were split using a 10-milliliter (mL) Hensen Stempel Pipette and sorted under a dissecting microscope. Zooplankton were identified based on morphological characteristics and measured using an eyepiece micrometer. The 202 μm samples were size fractioned into two replicate small (202 - 999 μm), one large (1000 - 4999 μm), and one extra large (> 5000 μm) size fractions, split into appropriately sized subsamples using a Folsom splitter, and analyzed by ZooScan. The organism's images were then identified manually and sized using ImageJ. In most identified taxonomic groups, up to 30 individuals were size-measured and a target of 50 individuals were counted per sample. Length measurements represent the total body length for all organisms except copepodites where prosome length was measured instead. Width measurements were taken at the widest part of the body.

Known problems or issues: Unicellular organisms such as dinoflagellates, diatoms, and tintinnids are underrepresented in the samples due to their small size and fragile structure.

Data Processing Description

The flowmeter was calibrated between cruises to accurately calculate the volume of water strained by the 53 and 202 μm nets and the abundance of zooplankton.

BCO-DMO Processing Description

- Imported original file "Zooplankton abundance data from Bongo plankton net tows.xlsx" into the BCO-DMO system.
- Marked 'nd' as a missing data value (missing data are blank/empty in the final CSV file).
- Created local and UTC date/time fields in ISO 8601 format; removed original separate date and time columns.
- Rounded numeric fields.
- Saved the final file as "915900_v1_zooplankton_abund_and_size.csv".

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Data Files

File
915900_v1_zooplankton_abund_and_size.csv (Comma Separated Values (.csv), 43.11 KB) MD5:d0505d59d76ad6ac8b2bcf0415fd3cf9
Primary data file for dataset ID 915900, version 1

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Parameters

Parameter	Description	Units
Cruise	Cruise identifier	unitless
ISO_DateTime_UTC	Date and time (UTC) in ISO 8601 format	unitless
ISO_DateTime_PDT	Date and time (PDT) is ISO 8601 format	unitless
Line	CalCOFI line	unitless
St	CalCOFI station	unitless
Lat	Latitude; positive values = North	decimal degrees
Long	Longitude; negative values = West	decimal degrees
Tow_depth	Maximum depth of net	meters (m)
Mesh_size	Bongo net mesh size	micrometers (um)
Taxa	Zooplankton latin name (the taxonomic resolution varies between groups)	unitless
Development_stage	Zooplankton development stage	unitless
ind_per_cubic_m	Zooplankton abundance	individuals per cubic meter
Avg_length	Average zooplankton length	micrometers (um)
SD_length	Length standard deviation	micrometers (um)
Avg_width	Average zooplankton width	micrometers (um)
SD_width	Width standard deviation	micrometers (um)
Num_Measured	Number of organisms that were size measured	unitless

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Instruments

Dataset-specific Instrument Name	71 cm diameter dual Bongo plankton net system
Generic Instrument Name	Bongo Net
Dataset-specific Description	Zooplankton were collected using a 71 cm diameter dual Bongo plankton net system equipped with a small CTD to record depth and physical variables during horizontal net tows at a ship speed of 1.5-2.5 knots down to 30-33 m depth. The Bongo was equipped with two nets, one with a 53 µm and the other with a 202 µm mesh sized, and a flowmeter mounted in the center of each of the two nets.
Generic Instrument Description	A Bongo Net consists of paired plankton nets, typically with a 60 cm diameter mouth opening and varying mesh sizes, 10 to 1000 micron. The Bongo Frame was designed by the National Marine Fisheries Service for use in the MARMAP program. It consists of two cylindrical collars connected with a yoke so that replicate samples are collected at the same time. Variations in models are designed for either vertical hauls (OI-2500 = NMFS Pairovet-Style, MARMAP Bongo, CalVET) or both oblique and vertical hauls (Aquatic Research). The OI-1200 has an opening and closing mechanism that allows discrete "known-depth" sampling. This model is large enough to filter water at the rate of 47.5 m3/minute when towing at a speed of two knots. More information: Ocean Instruments, Aquatic Research, Sea-Gear

Dataset-specific Instrument Name	Folsom splitter
Generic Instrument Name	Folsom Plankton Splitter
Dataset-specific Description	The 202 μm samples were size fractionated into two replicate small (202 - 999 μm), one large (1000 - 4999 μm) and one extra large (> 5000 μm) size fractions, split into appropriately sized subsamples using a Folsom splitter, and analyzed by ZooScan
Generic Instrument Description	A Folsom Plankton Splitter is used for sub-sampling of plankton and ichthyoplankton samples.

Dataset-specific Instrument Name	Zeiss Stemi 2000-C dissecting microscope
Generic Instrument Name	Microscope - Optical
Dataset-specific Description	The 53 μm samples were split using a 10 ml Hensen Stempel Pipette, sorted under a dissecting microscope and zooplankton identified based on morphological characteristics and measured using an eyepiece micrometer
Generic Instrument Description	Instruments that generate enlarged images of samples using the phenomena of reflection and absorption of visible light. Includes conventional and inverted instruments. Also called a "light microscope".

Dataset-specific Instrument Name	Hensen Stempel Pipette
Generic Instrument Name	Plankton sub-sampler
Dataset-specific Description	The 53 μm samples were split using a 10 ml Hensen Stempel Pipette, sorted under a dissecting microscope and zooplankton identified based on morphological characteristics and measured using an eyepiece micrometer.
Generic Instrument Description	Various devices for sub-sampling plankton samples Folsom splitter: http://www.aquaticresearch.com/folsom_plankton_splitter.htm Motoda box splitter: http://www.aquaticresearch.com/motodo_plankton_splitter.htm Hensen Stempel Pipette: http://www.envcoglobal.com/catalog/product/plankton-counting/hensen-stem... Sedgewick-Rafter Plankton Counting Chamber: http://www.benmeadows.com/wildco-sedgewick-rafter-counting-chambers_3681...

Dataset-specific Instrument Name	ZooScan
Generic Instrument Name	ZooSCAN
Dataset-specific Description	The 202 μm samples were size fractionated into two replicate small (202 - 999 μm), one large (1000 - 4999 μm) and one extra large (> 5000 μm) size fractions, split into appropriately sized subsamples using a Folsom splitter, and analyzed by ZooScan.
Generic Instrument Description	Description excerpt from Hydroptic website http://www.hydroptic.com/index.php/public/Page/product_item/ZOOSCAN The ZooSCAN (CNRS patent) system makes use of scanner technology with custom lighting and a watertight scanning chamber into which liquid zooplankton samples can be placed. The scanner recovers a high-resolution, digital image and the sample can be recovered without damage. These digital images can then be investigated by computer processing. While the resolution of the digitized zooplankton images is lower than the image obtained using a binocular microscope this technique has proved to be more than adequate for large sample sets. Identification of species is done by automatic comparison of the image (vignette) of each individual animal in the scanned image with a library data set which may be built by the investigator for each individual survey or imported from a previous survey. The latest machine learning algorithm allows high recognition levels even if we recommend complementary manual sorting to achieve a high number of taxonomic groups.

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Deployments

BBB2102

Website	https://www.bco-dmo.org/deployment/871650
Platform	R/V Bob and Betty Beyster
Start Date	2021-02-01
End Date	2021-02-01

BBB2104

Website	https://www.bco-dmo.org/deployment/871651
Platform	R/V Bob and Betty Beyster
Start Date	2021-04-06
End Date	2021-04-07

SW2104

Website	https://www.bco-dmo.org/deployment/871652
Platform	R/V Shearwater
Start Date	2021-04-13
End Date	2021-04-15

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Project Information

RAPID: Understanding the unprecedented anchovy response to warm-water conditions in the California Current (RAPID Anchovy Response)

Coverage: Southern California Bight and surrounding coastal areas between 32° and 35° N, and 117° and 120° W

NSF Award Abstract:

Like many species of small pelagic marine fish, recruitment and productivity of Northern Anchovy fluctuate by orders of magnitude among years. When abundant, the anchovy support a wide range of marine species, including marine mammals, seabirds and a diverse group of marine fishes. Anchovy, which previously thrived during periods of cool-water temperatures and strong coastal upwelling, are currently booming with abundances far in excess of any historical record, even though the California Current Ecosystem is experiencing an unprecedented marine heat wave. This unexpected occurrence challenges the most basic understanding of the mechanisms driving population dynamics in the species. This project is investigating the effects of trophic relationships on population productivity by capitalizing on the immediate research opportunity afforded by the novel, yet ephemeral, state of a local marine heat wave. Findings from the work are being used to develop a mechanistic model of coastal pelagic fish population dynamics generally, and anchovy dynamics in particular. Funded field and lab work are supporting opportunities for undergraduate training and research, and are generating open-access data that serve the research and teaching/training communities into the future.

This RAPID project augments the scheduled Fall research cruises jointly run by the California Cooperative Oceanic Fisheries Investigation and the California Current Ecosystem Long-Term Ecological Research programs. Together, these programs conduct regional oceanographic surveys that include anchovy spawning grounds and larval nursery areas. The RAPID-augmented sampling is designed to test the emerging hypothesis that anchovy populations are trophodynamically mediated at the larval stage, whereby high recruitment results from increased trophic transfer efficiency from the base of the food web. Larval diets and prey selection analyses are being paired with amino acid compound-specific isotope analysis ($\delta^{15}\text{N}$) of the larvae and prey field to generate detailed information on larval trophic ecology. Larval diets and plankton community structure are being related to available data on upwelling and productivity to assess environmental and biological drivers to trophic transfer efficiency. Collectively, these analyses are revealing how food chain length is regulated at the larval level through prey selection, at the prey level through community composition, and at the base of the food chain via coastal upwelling and primary production. Furthermore, this project is establishing whether the current trophic level of anchovy larvae is equal to that of historic population booms and if this is the result of favorable feeding conditions throughout their habitat. Findings from the study are generating a mechanistic understanding of the trophic underpinnings of small pelagic fish population productivity in coastal upwelling systems.

This award reflects NSF's statutory mission and has been deemed worthy of support through evaluation using the Foundation's intellectual merit and broader impacts review criteria.

Location Description:

This study is carried out within the temperate to subtropical Southern California Bight and surrounding coastal areas between 32° and 35° N, and 117° and 120° W. Specific locations sampled fall within the CalCOFI and CCE-LTER programs quarterly survey grid from lines 76.7 to 93.4 and stations 26 to 55.

Project Affiliations:

[California Current Ecosystem Long-term Ecological Research Program \(CCE-LTER\)](#)
[California Cooperative Oceanic Fisheries Investigations \(CalCOFI\)](#)

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-2053719

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