Amino acid compound-specific isotope analysis (AA-CSIA) from tissue samples from pelagic fish from R/V Kilo Moana cruise KM1123 in the north and west of the island of O'ahu in 2011

Website: https://www.bco-dmo.org/dataset/559181
Version: 19 May 2015
Version Date: 2015-05-19

Project
» CAMEO 2009 - A novel tool for validating trophic position estimates in ecosystem-based fisheries models (CAMEO_Trophic_Position)

Program
» Comparative Analysis of Marine Ecosystem Organization (CAMEO)

Contributors	Affiliation	Role
Popp, Brian N.	University of Hawaii at Manoa (SOEST)	Principal Investigator
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Dataset Description

Amino acid compound-specific isotope analysis (AA-CSIA) from tissue samples from pelagic fish collected at two sites in offshore waters to the north and west of the island of O'ahu, Hawaii.

Related Publications:
Choy C. A., Popp B. N., Hannides C. C. S. and Drazen J. C. (2015) Trophic structure and food resources of epipelagic and mesopelagic fishes in the North Pacific Subtropical Gyre ecosystem inferred from nitrogen isotopic compositions. Limnology and Oceanography doi:10.1002/lno.10085. (PDF)

Methods & Sampling

The majority of micronekton fish samples were collected in August 2011 using R/V Kilo Moana (KM1123) at two sites in offshore waters to the north and west of the island of O'ahu in the NPSG. Station ALOHA is the Hawaii Ocean Time-series site located north of O'ahu (22.45 N, 158 W) and Station KAHE is an offshore site located west of O'ahu at (~21.3 N, 158.3 W).

Large pelagic fish tissue samples were collected at sea by trained longline fishery observers of the National Oceanic and Atmospheric Administration's (NOAA) Pacific Islands Regional Observer Program during the years 2009-2011. Approximate catch locations were reported in accordance with NOAA's Fisheries Operations Data

Confidentiality Policy (see Figure 1 of Choy et al. 2015).

Methods are described in Choy et al. (2015). Briefly:
Outer layers of large pelagic fish tissue samples were removed with clean tools to avoid any potential sampling contamination. Only dorsal white muscle tissue of micronekton fish specimens was used for analysis. Bulk sample nitrogen (N) and carbon (C) isotope compositions of all fishes were determined using an isotope ratio mass spectrometer (IRMS; Delta PlusXP) coupled to an elemental analyzer (Conflo IV/Costech ECS 4010). Isotope values are reported in conventional delta-notation relative to the international standards atmospheric N2 and V-PDB, for N and C, respectively. A subset of large pelagic and micronekton fishes (60 of 222) was selected for amino acid (AA) compound-specific isotope analysis (AA-CSIA). The d15N values of individual AAs were measured using an IRMS (Delta PlusXP, Delta V Plus or MAT 253) interfaced with a gas chromatograph (Trace GC) through a GC-C III combustion furnace (980 degrees C), reduction furnace (650 degrees C), and liquid-N cold trap. All samples were analyzed in triplicate and the measured AA-d15N values were normalized to known d15N values of two coinjected internal reference compounds (norleucine [Nor] and aminoadipic acid [AAA] with d15N reference values of 19.06 o/oo and -5.8 o/oo, respectively).

Related Publications:
Choy C. A., Popp B. N., Hannides C. C. S. and Drazen J. C. (2015) Trophic structure and food resources of epipelagic and mesopelagic fishes in the North Pacific Subtropical Gyre ecosystem inferred from nitrogen isotopic compositions. Limnology and Oceanography doi:10.1002/lno.10085. (PDF)

Data Processing Description

BCO-DMO Processing:
- Modified parameter names to conform with BCO-DMO naming conventions.
- Replaced blanks (missing data), 'U' (unknown), and 'NA' with 'nd' to indicate 'no data'.
- Transposed columns to rows for amino acid and standard deviation columns.

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Data Files

File
isotopes_all_AA.csv (Comma Separated Values (.csv), 59.34 KB) MD5:efc0f0aea58a6836b888313c249257c3 Primary data file for dataset ID 559181

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Parameters

Parameter	Description	Units
species	Name of the species.	text
sample	Sample identification numer.	alphanumeric
length	Length of fish in millimeters.	millimeters (mm)
year	4-digit year when the fish samples were collected.	YYYY
month	2-digit month of year when the fish samples were collected.	mm (01 to 12)
day	2-digit day of month when the fish samples were collected.	dd (01 to 31)
amino_acid	Name of the amino acid.	text
d15N_AA	d15N value of individual the amino acid.	parts per thousand (per mil, ‰)
stdev	Standard deviation of the d15N value.	parts per thousand (per mil, ‰)

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Instruments

Dataset-specific Instrument Name	gas chromatograph
Generic Instrument Name	Gas Analyzer
Dataset-specific Description	Individual amino acids were measured using an IRMS (Delta PlusXP, Delta V Plus or MAT 253) interfaced with a gas chromatograph (Trace GC).
Generic Instrument Description	Gas Analyzers - Instruments for determining the qualitative and quantitative composition of gas mixtures.

Dataset-specific Instrument Name	isotope ratio mass spectrometer
Generic Instrument Name	Isotope-ratio Mass Spectrometer
Dataset-specific Description	Individual amino acids were measured using an IRMS (Delta PlusXP, Delta V Plus or MAT 253) interfaced with a gas chromatograph (Trace GC).
Generic Instrument Description	The Isotope-ratio Mass Spectrometer is a particular type of mass spectrometer used to measure the relative abundance of isotopes in a given sample (e.g. VG Prism II Isotope Ratio Mass-Spectrometer).

Dataset-specific Instrument Name	Longline Fishing Gear
Generic Instrument Name	Longline Fishing Gear
Dataset-specific Description	Large pelagic fish tissue samples were collected at sea by trained longline fishery observers of the National Oceanic and Atmospheric Administration’s (NOAA) Pacific Islands Regional Observer Program during the years 2009-2011.
Generic Instrument Description	Longlining employs a central fishing line that can range from one to 50 miles long; this line is strung with smaller lines of baited hooks, dangling at evenly spaced intervals. Longlines can be set near the surface to catch pelagic fish like tuna and swordfish, or laid on the sea floor to catch deepdwelling fish like cod and halibut. (www.montereybayaquarium.org/cr/cr_seafoodwatch/sfw_gear.aspx)

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Deployments

KM1123

Website	https://www.bco-dmo.org/deployment/559102
Platform	R/V Kilo Moana
Start Date	2011-08-19
End Date	2011-08-25
Description	Additional cruise information and original data are available from the NSF R2R Data Catalog.

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Project Information

CAMEO 2009 - A novel tool for validating trophic position estimates in ecosystem-based fisheries models (CAMEO_Trophic_Position)

Website: http://cameo.noaa.gov/pres_bpopp.html

Coverage: Subtropical North Pacific Ocean

(*From NSF Award Abstract*)

Evidence increasingly demonstrates that selective removal of marine life can induce restructuring of marine food webs. Trophic structure is the central component of mass balance models, widely used tools to evaluate fisheries in an ecosystem context. Food web structure is commonly determined by stomach contents or by bulk tissue stable isotope analyses, both of which are limited in terms of resolution and versatility. The investigators will refine a tool, Amino Acid Compound-Specific Isotopic Analyses (AA-CSIA), which can be broadly applicable for quantifying the time-integrated trophic position (TP) of consumers. Differences in source and trophic nitrogen isotopic composition for specific amino acids will provide an unambiguous and integrated measure of fractional trophic TP across multiple phyla, regardless of an animal's physiological condition or of the biogeochemical cycling at the base of the food web. AA-CSIA will allow testing of the efficacy of trophic position estimates derived from ecosystem-based models and promote the evolution of these models into decision-support tools.

This project has three goals: 1. To validate the application of AA-CSIA across multiple marine phyla under differing physiological conditions. 2. To compare the application of AA-CSIA across systems with contrasting biogeochemical cycling regimes. 3. To develop the use of AA-CSIA TP estimates for validating trophic models of exploited ecosystems. The investigators will test and refine the approach using a combination of laboratory feeding experiments and field studies across regions with differing biogeochemical cycling regimes. They will determine the applicability of the AA-CSIA approach in a variety of marine organisms assessed in controlled studies. Subsequently, ecosystem components will be sampled from the eastern tropical Pacific, coastal California and the subtropical Pacific gyre. They will also test the effects of sample preservation on the isotopic composition of individual AA to determine whether the approach can be used on archived samples. This tool will allow testing of the efficacy of ecosystem-based models currently used to gain insight into the ecological effects of fisheries removals and improve the reliability of future models required to manage marine resources. In addition to the goal of developing AA-CSIA for use as a TP indicator, the information obtained through this project will provide important species-specific biological data on the feeding behavior of marine organisms that could have implications for their resilience to anthropogenic pressures and climate change.

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Program Information

Comparative Analysis of Marine Ecosystem Organization (CAMEO)

Website: http://www.nsf.gov/geo/oce/programs/CAMEO_Webpage.jsp

CAMEO Science Plan (2012).

The Comparative Analysis of Marine Ecosystem Organization (CAMEO) program was implemented as a partnership between the NOAA National Marine Fisheries Service and National Science Foundation Division of Ocean Sciences. The purpose of CAMEO was to strengthen the scientific basis for an ecosystem approach to the stewardship of our ocean and coastal living marine resources. The program supported fundamental research to understand complex dynamics controlling ecosystem structure, productivity, behavior, resilience, and population connectivity, as well as effects of climate variability and anthropogenic pressures on living marine resources and critical habitats. CAMEO encouraged the development of multiple approaches, such as ecosystem models and comparative analyses of managed and unmanaged areas (e.g., marine protected areas) that can ultimately form a basis for forecasting and decision support. Central to the program was the emphasis on collaborations between academic and private researchers and federal agency scientists with mission responsibilities to inform ecosystem management activities. (adapted from CAMEO website)

This funding opportunity implemented CAMEO research by supporting the development of research tools and strategic approaches through the following types of proposals:

1. Development of strategies and methodologies for comparative analyses that can be applied consistently across spatial and temporal scales and ecosystems, and that facilitate the design of decision support tools for marine populations, ecosystems and habitats.

2. Development of models that address key scientific questions by comparing ecosystems and ecosystem processes. Models that are geographically and temporally portable, and that incorporate assessment of modeling skill, are particularly encouraged.

3. Retrospective studies that analyze, re-analyze or synthesize existing information (historic, time-series, ongoing program, etc.) using a comparative approach.

4. Studies that integrate the human dimension within ecosystem dynamics. The CAMEO program seeks to promote interdisciplinary research using comparative approaches to link marine ecosystem research with the social and behavioral sciences in new and vital ways.

To guide program priorities, a Science Steering Committee was formed through Dr. Linda Deegan and the initial Scientific Planning Office at the Marine Biological Laboratory in Woods Hole, MA. This Committee was designed to provide scientific advice and broad direction to NOAA and NSF regarding the CAMEO program.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1041329
Pelagic Fisheries Research Program (PFRP)	NA09OAR4320075

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