C and N isotope data of archaeological fish bones from Penobscot Bay (Isotopes and Fish Diets GoM project)

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Project
» Changes in Baseline Conditions in Gulf of Maine Coastal Ecosystems Over the Last 4000 Years (Isotopes and Fish Diets GoM)

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Dataset Description

Note: Preliminary data have been submitted to BCO-DMO, but are not yet available online. Final data are expected to be submitted and made available during the summer of 2014.

This dataset includes carbon and nitrogen isotope data of archaeological fish bones from Penobscot Bay, Gulf of Maine (44.18 ˚N, 68.92 ˚W).

Methods & Sampling

Between 0.4 and 0.8 mg of collagen were analyzed for stable carbon and nitrogen isotope values using a ThermoFinnigan Delta Plus Advantage stable isotope ratio mass spectrometer (IRMS) coupled to a Costech elemental analyzer via a Conflo III combustion interface in the Environmental Geochemistry Laboratory, Department of Geology, Bates College. Stable isotope values are expressed in δ (‰) notation according to the following definition:

δ X(‰) = [(Rsample/Rstandard)-1]*1000

where X is 13C or 15N and R is 13C:12C or 15N:14N, and the standards were Pee Dee Belemnite (PDB) for carbon and AIR for nitrogen. The accuracy and precision of the IRMS, as determined by multiple analyses of a working standard (acetanilide: C8H9NO) run every sixth sample, was ± 0.2‰ for both δ13C and δ15N.

Data Processing Description

Approximately 1/3 of the samples run are working standards of different and known isotopic compositions. In a batch of 49 samples, for example, approximately 16 of these are working standards. (The δ13C values of the standards range between -18.6 and -30.9‰. The δ15N of the standards range from -11.0 to 14.5‰.) A linear regression is used to establish the relationship between the 13/12C and 15/14N ratios of the standards and the δ13C and δ15N values of the standards. This equation is then used to determine the δ13C and δ15N values of the unknowns. The limits of detection for N are 1 umole.

BCO-DMO Processing Notes:
- Modified parameter names;
- Sorted data alphabetically by common_name;
- Corrected typos in taxonomic names (e.g. 'Gatus' changed to 'Gadus').

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Parameters

Parameter	Description	Units
common_name	Common name of the species.	text
genus	Genus.	text
species	Species.	text
BC_ID	Bates College identification number.	alphanumeric
sample_type	Description of type of sample (bone, shell, etc.)	text
tissue_type	Description of type of tissue (collagen).	text
mass	Sample mass analyzed via Elemental Analysis - Isotope Ratio Mass Spectrometry (EA-IRMS).	milligrams (mg)
pcnt_N	Percent nitrogen.	percent (%)
N_umoles	Nitrogen concentration; amount of gas measured via EA-IRMS.	micromoles (umoles)
d15N	delta 15N (air). Stable isotope values are expressed in δ (‰) notation according to the following definition: δ X(‰) = [(Rsample/Rstandard)-1]*1000 where X is 15N and R is 15N:14N, and the standard was air.	per mil (‰)
pcnt_C	Percent carbon.	percent (%)
C_umoles	Carbon concentration; amount of gas measured via EA-IRMS.	micromoles (umoles)
d13C	delta 13C (PDB). Stable isotope values are expressed in δ (‰) notation according to the following definition: δ X(‰) = [(Rsample/Rstandard)-1]*1000 where X is 13C and R is 13C:12C, and the standard was Pee Dee Belemnite (PDB).	per mil (‰)
C_to_N_molar	Ratio of carbon to nitrogen (molar).	dimensionless
date_run	Date the sample was run via EA-IRMS.	mm/dd/yyyy
sample_prep	Description of how the sample was prepared.	text
depth	Archaeologist's depth of excavation.	inches or centimeters
location1	General location.	text
location2	Site.	text
quadrat	Archaeologist's quadrat ID.	alphanumeric
sample_id	Archaeologist's sample ID.	alphanumeric
color	Archaeologist's stratigraphy (coded to notebook).	text
descriptor	Archaeologist's descriptor of stratigraphy.	text
archaeologist	Name of the archaeologist.	text
prep_person	Name of the person who did sample preparation.	text
comments	Free-text comments.	text

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Instruments

Dataset-specific Instrument Name	Stable Isotope Ratio Mass Spectrometer
Generic Instrument Name	Isotope-ratio Mass Spectrometer
Dataset-specific Description	Between 0.4 and 0.8 mg of collagen were analyzed for stable carbon and nitrogen isotope values using a ThermoFinnigan Delta Plus Advantage stable isotope ratio mass spectrometer (IRMS) coupled to a Costech elemental analyzer via a Conflo III combustion interface in the Environmental Geochemistry Laboratory, Department of Geology, Bates College.
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).

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Project Information

Changes in Baseline Conditions in Gulf of Maine Coastal Ecosystems Over the Last 4000 Years (Isotopes and Fish Diets GoM)

Website: http://thegulfofmaine.com/

Coverage: Coastal Gulf of Maine (44N,70W)

Description from NSF award abstract:
Predicting the responses of marine ecosystems to natural and anthropogenic perturbation remains one of the greatest challenges to oceanography. In order to assess the significance of current changes in these systems and to predict possible future changes, oceanographers need to understand the ecological history of the ecosystem. The aim of this study is to create long-term records for the Gulf of Maine (GoM), a marginal shelf basin in the northwest Atlantic. Current knowledge of the resilience of the GoM ecosystem is based largely on studies focused on the last 70+ years. In this project, investigators will develop an understanding of ecosystem processes in the GoM extending back 4000 years by analyzing stable carbon (C), nitrogen (N) and sulfur (S) isotopes preserved in tissues of modern and ancient marine organisms to assess long-term trends in nearshore primary production, trophic connectivity, and food web dynamics.

The investigators will employ a combination of field, analytical, and modeling techniques to:
(1) determine the spatial scale over which organic matter derived from seagrasses, microalgae, and macroalgae is currently transferred into coastal food webs, and
(2) determine the timing, magnitude, and spatial extent of changes in nearshore primary production and trophic connectivity among organisms living in the GoM through the last 4000 years.

Tissue samples will be obtained from different coastal settings, museum collections, and three coastal archaeological sites in the GoM. The bulk organic fractions of primary producers and consumers will be analyzed for C, N, and S isotopes. The C isotope composition of essential amino acids (e.g., phenylalanine) will be measured, allowing for determination of the carbon source at the base of the food web. Nearshore food web interactions will be modeled by using the C, N and S isotope data and non-steady state equations that include competition-dependant changes in the consumers prey choice.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-0929900

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