Bulk Carbon and Nitrogen isotopes from sperm whale dentin from the UC-Santa Cruz labs of P. Koch and M. McCarthy (Sperm Whale SI Ratios project)

Website: https://www.bco-dmo.org/dataset/652931
Data Type: Other Field Results
Version:
Version Date: 2016-08-01

Project
» A novel approach for evaluating temporal and spatial changes in trophic structure of the mesopelagic eastern Pacific (Sperm Whale SI Ratios)

Contributors	Affiliation	Role
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Table of Contents

Dataset Description

Bulk Carbon and Nitrogen isotope values of raw and decalcified dentin from a sperm whale tooth were measured to determine the effects of decalcification and the accuracy of untreated dentin results.The sperm whale tooth came from the California Current System.

Related Reference:
All sampling and analytical information are supplied in: Brault EK, Koch PK, Gier E, Ruiz-Cooley RI, Zupcic J, Gilbert KN, McCarthy MD (2014) Effects of decalcification on bulk and compound-specific nitrogen and carbon isotope analyses of dentin. Rapid Communications in Mass Spectrometry 28: 2744-2752.

Related Datasets:
Brault 2014: Compound-specific Carbon in sperm whale dentin
Brault 2014: Compound-specific Nitrogen in sperm whale dentin

Methods & Sampling

Materials and methods for analysis are described in detail in the Brault et al (2014). Briefly, a homogenized sample of sperm whale dentin was split into 20 sub-samples. Ten received "Conventional" extractraction (decalcification with 0.5N HCl, rinsing with water to neutrality, freeze-drying) and ten were not treated ("Raw") before stable isotope and elemental analysis by with an elemental analyzer coupled to a gas source, isotope ratio monitoring mass spectrometer. Carbon isotope values are reference to V-PDB; nitrogen isotope values are referenced to AIR. Mass and drift corrections were performed by analysis of gelatin standard replicates

during each instrument session. Standard deviations for replicate analyses of gelatin were <0.1‰ for both δ13C and δ15N values. The standard deviations for molar C:N ratio was <0.01%. n.d., not determined.

Data Processing Description

BCO-DMO Processing:

- added conventional header with dataset name, PI name, version date, reference information
- renamed parameters to BCO-DMO standard

[table of contents | back to top]

Data Files

File
bulk_CN.csv (Comma Separated Values (.csv), 610 bytes) MD5:77de9d38a1b0d7fd41db200ff71217d3 Primary data file for dataset ID 652931

[table of contents | back to top]

Parameters

Parameter	Description	Units
sample	Sample identification numer	alphanumeric
method	Conventional extraction: decalcification with 0.5N HCl; rinsing with water to neutrality; freeze-drying; "Raw": not treated	unitless
d13C	delta 13 C. Isotope values are reported in conventional d-notation relative to the international standard V-PDB.	parts per thousand
d15N	delta 15 N. Isotope values are reported in conventional d-notation relative to the international standard atmospheric N2.	parts per thousand
molar_C_to_N	Molar Carbon to Nitrogen ratio	dimensionless (ratio)

[table of contents | back to top]

Instruments

Dataset-specific Instrument Name	
Generic Instrument Name	Elemental Analyzer
Dataset-specific Description	These samples were analyzed for bulk delta-13C and delta-15N values in the Stable Isotope Lab at University of California at Santa Cruz on a EA 1108 elemental analyzer (Carlo Erba, Milan, Italy) coupled to a Thermo Finnigan DeltaPlus XP isotope ratio mass spectrometer (Thermo Scientific, Bremen, Germany).
Generic Instrument Description	Instruments that quantify carbon, nitrogen and sometimes other elements by combusting the sample at very high temperature and assaying the resulting gaseous oxides. Usually used for samples including organic material.

Dataset-specific Instrument Name	
Generic Instrument Name	Isotope-ratio Mass Spectrometer
Dataset-specific Description	Thermo Finnigan DeltaPlus XP isotope ratio mass spectrometer (Thermo Scientific, Bremen, Germany)
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).

[table of contents | back to top]

Deployments

lab_UCSC_Koch

Website	https://www.bco-dmo.org/deployment/652950
Platform	UCSC
Start Date	2012-03-01
End Date	2016-03-01
Description	whale isoptope studies

[table of contents | back to top]

Project Information

A novel approach for evaluating temporal and spatial changes in trophic structure of the mesopelagic eastern Pacific (Sperm Whale SI Ratios)

Coverage: California Current, Eastern Tropical Pacific, and the Peru-Humboldt Current

Description from NSF award abstract:
Anthropogenic and natural climatic perturbations drive changes in population dynamics of species, the

structure and function of food webs, and biogeochemical processes. The PIs propose a comparative analysis of three major ecosystems to investigate temporal change in the structure of mesopelagic food webs.

The PIs will investigate temporal changes in the structure of mesopelagic food webs in three major ecosystems: the California Current, Eastern Tropical Pacific, and the Peru-Humboldt Current over the past 50 years using a globally distributed apex predator as an indicator species. The predator is the sperm whale, *Physeter macrocephalus*, and the PIs will use stable isotope ratios of carbon and nitrogen as indicators of habitat and diet. Isotope values from bulk tissues of teeth and skin (C and N) as well as specific amino acids (N) will be used to address two primary objectives: (a) examine temporal patterns in the trophic position of sperm whales (as an indicator of changes in mesopelagic trophic structure) and baseline isotopic values (as indicators of nutrient cycling); and (b) use isotopic values, which vary among systems, to define the population structure of sperm whales from past and present times, and connectivity among populations.

This project will be conducted by researchers from academia and NOAA/NMFS with expertise in stable isotope analysis, trophic ecology, and ecosystem-based management of protected species. As such, it represents an opportunity for collaboration between scientists with complementary skills and from diverse institutions to compare structure and function of ecosystems across the eastern Pacific. Moreover, it represents a collaboration between academia and a federal agency with research and management responsibilities. The project will support a postdoctoral scholar (Iliana Ruiz-Cooley), a Ph.D. student, and undergraduate students to enhance their career and collaborative opportunities. The PIs anticipate that the results of their study will provide unique data to evaluate the effects of perturbations within and among mesopelagic ecosystems. This information may allow the scientific community to relate trends in climate to changes in trophic position of top predators and nutrient cycling, allowing more robust understanding of possible responses to future warming. Finally, as the first systematic applications of compound-specific stable isotope analysis to marine mammals, the project should be highly instructive for future evaluations of the feeding ecology, population structure and dynamics of endangered marine mammals. As such, this novel approach and unique historic perspective will be directly applicable for stock assessment and management.

[table of contents | back to top]

Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1155728

[table of contents | back to top]