Isotope ratios of carbon and nitrogen from harbor seals and prey species analyzed at the Stable Isotope Core Laboratory in Pullman, WA in 2009 (Seal_response_to_prey project)

Website: https://www.bco-dmo.org/dataset/3708
Version: 04 December 2012
Version Date: 2012-12-04

Project
» Responses of Seals and Sea Lions to Increased Rockfish Density (Seal_response_to_prey)

Contributors	Affiliation	Role
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Dataset Description

In April and June 2009, tissues from harbor seals and their prey (fish species) were analyzed at the Stable Isotope Core Laboratory at Washington State University. Reported results include: %C, %N, delta 13C relative to VPDB, and delta 15N relative to air.

Methods & Sampling

Further methodology is available in thein the lab report (PDF).

Samples for isotopic analysis were converted to N2 and CO2 with an elemental analyzer (Costech Analytical ECS 4010). The two gases were separated with a 3m GC column and analyzed with a continuous flow isotope ratio mass spectrometer (Thermo Finnigan Delta PlusXP).

The 2-sigma uncertainty of both carbon and nitrogen isotopic results is 0.5 per mill, unless otherwise indicated.

Instrument stability checks and necessary calibrations were performed prior to all analyses. A linearity check prior to analysis of these samples indicated 13C linearity of 0.045 per mil/V and 15N linearity of 0.04 per mil per volt. These are within the 0.06 per mil/V spec defined by the manufacturer. Blind reference materials (in this

case, two replicates of protein standard B-2155) were also analyzed with the samples as a check of normalization.

Delta 13C and 15N values were calculated using a two point normalization by fitting a regression line through two running standards. %C and %N were calculated with a multi-point normalization using acetanilide. See the following:
Normalization information for April 2009 samples (PDF)
Normalization information for June 2009 samples (PDF)

Data Processing Description

Parameter names were modified to conform with BCO-DMO conventions. Data from 2 Excel files (1 for each processing date) were merged into 1 dataset.

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Data Files

File
seal_and_prey_stable_isotopes.csv (Comma Separated Values (.csv), 23.34 KB) MD5:cfb98bca838d8fbe12aa5d3727a7880e Primary data file for dataset ID 3708

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Parameters

Parameter	Description	Units
common_name	Common name of the species from which the sample was taken.	text
lab_id	Sample ID number assigned by the lab.	unitless
sample_id	Sample ID number.	unitless
d13C_VPDB	delta 13C relative to VPDB x 1000; the stable isotope ratio of 13C.	per mil
pcnt_C	Percent Carbon.	%
d15N_air	delta 15N relative to air x 1000; the stable isotope ratio of 15N.	per mil
pcnt_N	Percent Nitrogen.	%
date_lab	Date of results reported by the lab.	mm/dd/YYYY

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Instruments

Dataset-specific Instrument Name	CHN Elemental Analyzer
Generic Instrument Name	CHN Elemental Analyzer
Dataset-specific Description	Samples were converted to N2 and CO2 with a Costech Analytical ECS 4010 elemental analyzer.
Generic Instrument Description	A CHN Elemental Analyzer is used for the determination of carbon, hydrogen, and nitrogen content in organic and other types of materials, including solids, liquids, volatile, and viscous samples.

Dataset-specific Instrument Name	Isotope-ratio Mass Spectrometer
Generic Instrument Name	Isotope-ratio Mass Spectrometer
Dataset-specific Description	Samples were analyzed with a Thermo Finnigan Delta PlusXP continuous flow isotope ratio mass spectrometer.
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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Deployments

Stable_Isotope_Core_seals

Website	https://www.bco-dmo.org/deployment/58899
Platform	Stable Isotope Core Laboratory
Start Date	2009-04-01
End Date	2009-06-01
Description	In April and May 2009, tissues from harbor seals and their prey (fish species) were analyzed at the Stable Isotope Core Laboratory at Washington State University. Part of the project titled "Responses of Seals and Sea Lions to Increased Rockfish Density" (NSF OCE-0550443); Lead PI: Alejandro Acevedo-Gutierrez. Address: Washington State University Stable Isotope Core Laboratory G-81 Eastlick Hall Pullman, WA 99164-4236

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Project Information

Responses of Seals and Sea Lions to Increased Rockfish Density (Seal_response_to_prey)

Website: http://biol.wwu.edu/mbel/?page=research

Coverage: Salish Sea, USA and Canada

From NSF proposal:
This project is a collaborative study of the responses of harbor seals and other mammalian predators to changes in prey density in Puget Sound. The general study approach will involve multi-year field estimates to observe the responses of predators to rockfish density in protected areas, candidate marine reserves, and unprotected sites.

The collaborating investigators will estimate 1) rockfish density using visual and mark and recapture techniques; 2) predator abundance using aerials surveys and dedicated land observations; and 3) predator food consumption using scat to describe diet, tagging of harbor seals to describe individual foraging sites, and population-based and individual bioenergetics models to describe consumption of rockfish. The investigators will also take into account confounding factors that might explain predator behavior, such as environmental variables and alternative prey, by creating a GIS database from available information from the area. The different field observations and database estimates are explicitly linked through a common hypothesis and coordinated methodologies, and their results will be integrated into a model describing the impact of predation on rockfish populations. The responses of top predators to changes in prey density and their impact on fish populations of interest are unknown. This study will evaluate the effectiveness of MPAs as fish refugia, offer a framework for the management and conservation of marine resources, and provide an exciting opportunity for students to participate in ecological and conservation research.

Hypotheses:
1) Harbor seals and other pinniped species show aggregative responses to changes in prey density. Hence, their abundance will increase with fish density.
2) Harbor seals and other pinniped species show Type 2 or 3 functional responses to changes in prey density. Thus, their consumption rate of a particular prey type follows an asymptotic or sigmoidal curve relative to the prey's density, respectively.
3) Predation by harbor seals and other pinniped species is sufficiently intense that it impedes recovery of depleted fish populations.

Objectives:
1) Quantify the number of harbor seals and other pinniped species in relation to rockfish density and other environmental (confounding) factors.
2) Estimate the consumption rate of harbor seals and other pinniped species in relation to rockfish density and other prey species.
3) Correlatively estimate the influence of predation by harbor seals and other pinniped species on survivorship and population size of rockfish.

Publications resulting from this NSF award:
Bjorland, R. H., Pearson, S. F, Jeffries, S. J, Lance, M. M., Acevedo- Gutiérrez, A. & Ward, E. J. 2015. Stable isotope mixing models elucidate sex and size effects on the diet of a generalist marine predator. Marine Ecology Progress Series 526: 213-225. DOI: 10.3354/meps11230
Bromaghin, J. F., Lance, M. M., Elliott, E. W., Jeffries, S. J., Acevedo-Gutierrez, A. & Kennish, J. M. 2013. New insights into the diets of harbor seals in the Salish Sea of western North America revealed by quantitative fatty acid signature analysis. Fishery Bulletin 111: 13-26. DOI: 10.7755/FB.111.1.2
Buzzell, B.1, Lance, M. & Acevedo-Gutiérrez, A. 2014. Spatial and temporal variation in river otter (Lontra canadensis) diet and predation on rockfish (Genus Sebastes) in the San Juan Islands, Washington. Aquatic Mammals 40: 150- 161. DOI: 10.1578/AM.40.2.2014.150
Howard, S., Lance, M., Jeffries, S. & Acevedo-Gutierrez, A. 2013. Fish consumption by harbor seals (Phoca vitulina) in the San Juan Islands, WA. Fishery Bulletin 111: 27-41. DOI: 10.7755/FB.111.1.3
Lance, M. M., Chang, W.-Y., Jeffries, S. J., Pearson, S. F. & Acevedo-Gutierrez, A. 2012. Harbor seal diet in northern Puget Sound: implications for the recovery of depressed fish stocks. Marine Ecology Progress Series 464:257-271. DOI:10.3354/meps09880
Luxa, K. & Acevedo-Gutierrez, A. 2013. Food habits of harbor seals (*Phoca vitulina*) in two estuaries in the central Salish Sea. Aquatic Mammals 39: 10- 22. DOI: 10.1578/AM.39.1.2013.10
Peterson, S., Lance, M. M., Jeffries, S. J. & Acevedo-Gutierrez, A. 2012. Long distance movements and disjunct spatial use of harbor seals (*Phoca vitulina*) in the inland waters of the Pacific Northwest. PLoS ONE 7: e39046. DOI: 10.1371/journal.pone.0039046
Thomas, AC; Lance, MM; Jeffries, SJ; Miner, BG; Acevedo-Gutierrez, A. 2011. Harbor seal foraging response to a seasonal resource pulse, spawning Pacific herring. Marine Ecology-Progress Series, v.441. p. 225. DOI: 10.3354/meps09370
Ward, EJ; Levin, PS; Lance, MM; Jeffries, SJ; Acevedo-Gutierrez, A. 2012. Integrating diet and movement data

to identify hot spots of predation risk and areas of conservation concern for endangered species. Conservation Letters, v.5, p. 37. DOI: 10.1111/j.1755-263X.2011.00210.x
Wilson, K.2, Lance, M., Jeffries, S. & Acevedo-Gutiérrez, A. 2014. Fine-scale variability in harbor seal foraging behavior. PLoS ONE 9: e92838. DOI: 10.1371/journal.pone.0092838.

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