

Visual estimates of seal abundance from aerial surveys conducted by a Cessna-185 in the San Juan Islands, Salish Sea in 2008 (Seal_response_to_prey project)

Website: <https://www.bco-dmo.org/dataset/3707>

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Project

» [Responses of Seals and Sea Lions to Increased Rockfish Density](#) (Seal_response_to_prey)

Contributors	Affiliation	Role
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Dataset Description

Number of seals counted during several aerial surveys of the Salish Sea during July and August of 2008. Data are also available from [2007 surveys](#).

Related publications: (Both available from [Alejandro Acevedo's lab website](#).)

Howard, S. 2009. Seasonal energy budgets to model energy use and prey consumption in harbor seals (*Phoca vitulina*) in the San Juan Islands, WA. MSc thesis, Department of Biology, Western Washington University, Bellingham, WA.

Hardee, S. 2008. Movements and home ranges of harbor seals (*Phoca vitulina*) in the Georgia Basin: implications for marine reservinland waters of the Pacific Northwest. MSc thesis, Department of Biology, Western Washington University, Bellingham, WA.

Methods & Sampling

Following protocol from Jeffries et al. (2003), with collaboration from the Washington Department of Fish and Wildlife, surveys were flown in a Cessna 185 at 200 to 300 m, moving at 90 kt, on two or three consecutive days during moderately low tides. Flights were made over the region moving with the tide, to cover the entire

area within +/- 2 h from low tide. Visual counts were taken on sites with < 25 seals and digital photographs and visual counts were taken concurrently at sites with > 25 animals, using a Nikon D100 with a 200 mm lens. The time was documented on the survey log for all haul-out counts, haul-out estimates and photographs. Surveys were conducted under permit 782-1702 awarded to the Washington Department of Fish and Wildlife by the Office of Protected Resources.

Selection of flight times was not only dependent on tidal conditions but also on time of day. If one chooses tidal heights that are extremely low, there is a risk that the survey underestimates the number of seals in the region because normal haul-out sites may be inaccessible (Jeffries, pers. comm.). Additionally, fog may become problematic for flying if the tide window, especially in August, is too early in the morning. These factors were taken into account when selecting the survey dates.

Tide times on dates of aerial surveys are as follows:

Date	Tide Station	Tide Time	Tide Height (ft)
07/17/08	Port Townsend	10:12	-1.7
07/18/08	Port Townsend	10:49	-1.8
07/18/08	Seattle	11:48	-1.6
07/31/08	Port Townsend	09:44	-2.6
07/31/08	Seattle	10:39	-2.9
08/01/08	Port Townsend	10:32	-2.4
08/14/08	Port Townsend	09:14	-0.9
08/15/08	Port Townsend	09:52	-1.0

References:

Jeffries SJ, Huber HR, Calambokidis J, Laake J (2003) Trends and status of harbor seals in Washington State: 1978-1999. Journal of Wildlife Management 67:208-219. Available online from [Washington Department of Fish and Wildlife](#).

Huber HR, Jeffries SJ, Brown RF, DeLong RL, Van Blaricom G (2001) Correcting aerial survey counts of harbor seals (*Phoca vitulina richardsi*) in Washington and Oregon. Marine Mammal Science 17:276-293.

DOI: [10.1111/j.1748-7692.2001.tb01271.x](https://doi.org/10.1111/j.1748-7692.2001.tb01271.x)

Data Processing Description

The estimation of seal population size based on haul-out counts requires a correction factor to account for seals in the water at the time of the survey (Huber et al. 2001, Jeffries et al. 2003), however, correction factors have NOT been applied to these data.

BCO-DMO made the following edits to the dataset:

- Blanks and 'NA' were replaced with 'nd' to indicate 'no data';
- Parameter names were modified to conform with BCO-DMO conventions;
- day, month, and year were separated from original date column;
- Abbreviated species names were replaced with the full species names;
- Corrected typos in the year column from '2009' to '2008';
- lat and lon were added based on the site_code (2007 site_codes are the same locations as 2008).

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Data Files

File
seal_counts_2008.csv (Comma Separated Values (.csv), 53.87 KB) MD5:72535028c0ca4c0387d01ae142a587f0
Primary data file for dataset ID 3707

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Parameters

Parameter	Description	Units
date	Month, day, and year in mmddyy format (local time).	mmddyy
month	2-digit month of year, local time.	mm (01 to 12)
day	2-digit day of month, local time.	dd (01 to 31)
year	4-digit year (local time).	YYYY
site_code	Numeric identifier for the sampling site.	unitless
lat	Latitude; North = positive. (Added by BCO-DMO; assumes site_codes used in 2008 are the same locations as 2007.)	decimal degrees
lon	Longitude; West = negative. (Added by BCO-DMO; assumes site_codes used in 2008 are the same locations as 2007.)	decimal degrees
time_local	Local time when the survey occurred, in hours and minutes, 24-hour clock.	HH:MM
species	Name of the species: Phoca vitulina = Harbor seal Mirounga angustirostris = Northern elephant seal Eumetopias jubatus = Steller sea lion	text
est_total	Estimated total number of seals.	unitless
est_pups	Estimated number of pups.	unitless
count_total	Total number seals, corrected using photos if available.	unitless
count_pups	Number of pups, corrected using photos if available.	unitless
photo	TRUE = photo was taken; FALSE = no photo was taken.	unitless
photo_no	The photograph identification number, if a photo was taken.	unitless
count_type	1 = hauled out; 2 = in the water.	unitless

count_q_flag	Count quality flag: 1 = slides countable; 2 = slides blurry or similar problem but countable; 3 = seals disturbed after photo or count; 4 = major disturbance (by plane) before plane or count; 5 = major disturbance (other than plane); 6 = slides not countable or estimate >50 and no slides; 7 = miscellaneous reason for concern about count or estimate.	unitless
comment	Remarks/comments about the observation.	text

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Instruments

Dataset-specific Instrument Name	Camera
Generic Instrument Name	Camera
Dataset-specific Description	Photos were taken using a Nikon D100 with a 200 mm lens.
Generic Instrument Description	All types of photographic equipment including stills, video, film and digital systems.

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Deployments

Aerial Survey 2008_SRtP

Website	https://www.bco-dmo.org/deployment/58887
Platform	Cessna-185
Start Date	2008-07-17
End Date	2008-08-15
Description	With collaboration from the Washington Department of Fish and Wildlife, aerial surveys of harbor seals were flown in a Cessna 185 at 200 to 300 m. Six flights were made between 07/17/2008 and 08/15/2008 in support of the project "Responses of Seals and Sea Lions to Increased Rockfish Density".

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Project Information

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

Website: <http://biol.wvu.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 aerial 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](https://doi.org/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](https://doi.org/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](https://doi.org/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](https://doi.org/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](https://doi.org/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](https://doi.org/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](https://doi.org/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](https://doi.org/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](https://doi.org/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](https://doi.org/10.1371/journal.pone.0092838).

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-0550443

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