

## AFSC/ABL: Karluk sockeye salmon scale time series

**Theme keywords:** Biota, 002, growth, scale, Sockeye salmon, Oncorhynchus nerka

**Abstract:** To better understand how density-dependent growth of ocean-dwelling Pacific salmon varied with climate and population dynamics, we examined the marine growth of sockeye salmon in relation to an index of sockeye salmon abundances among climate regimes, population abundances, and body sizes under varied life history stages, from 1925 to 1998 using ordinary least squares and multivariate adaptive regression spline threshold models. The annual marine growth and body size during the juvenile, immature, and maturing life stages were estimated from increments on the scales of adult age 2.2 sockeye salmon that returned to spawn at Karluk River and Lake on Kodiak Island, Alaska. Intra-specific density-dependent growth was inferred from inverse relationships between growth and sockeye salmon abundance based on commercial harvest. Density-dependent growth occurred in all marine life stages, during the cool regime, at lower abundance levels, and at smaller body sizes at the start of the juvenile life stage. The finding that density-dependence occurred during the cool regime and at low population abundances suggests that a shift to a cool regime or extreme warm regime at higher population abundances could further reduce the marine growth of salmon and increase competition for resources. Alaska salmon production fluctuates with climate and ocean conditions in the North Pacific Ocean. In this study, we evaluated the hypothesis that faster marine growth was related to higher survival as a consequence of more favorable ocean conditions for growth during the 1927-46 and 1977-2000 warm regimes, and slower growth was related to lower survival as a consequence of less favorable climatic and oceanic conditions for growth during the 1947-76 cool regime. We measured and compared the annual growth on scales collected from age 2.2 sockeye salmon that returned to Karluk Lake on Kodiak Island, Alaska from 1927 to 2000 to regime periods, climatic and oceanic indices, and survival. First and second marine-year scale growth fluctuated with the cool regime and recent warm regime. Survival estimated as the ratio of offspring to parental escapement was lower during the 1925-46 warm regime and 1947-76 cool regime. Survival was positively related to first and second marine year scale growth, eastern North Pacific atmospheric circulation, and reduced winter and spring coastal downwelling in the Gulf of Alaska. Winter and spring climatic and oceanic conditions influences on first and second year marine growth of Karluk Lake sockeye are a possible mechanisms linking Karluk Lake sockeye salmon survival to climate over the past half century.

### FGDC, ESRI, and Biological Profile Metadata:

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- [Metadata Reference Information](#)

Metadata elements shown with **blue** text are defined in the Federal Geographic Data Committee's (FGDC) [Content Standard for Digital Geospatial Metadata \(CSDGM\)](#). Elements shown with **green** text are defined in the [ESRI Profile of the CSDGM](#). Elements shown with **brown** text are defined in the [NBII Biological Profile of the CSDGM](#). Elements shown with a green asterisk (\*) will be automatically updated by ArcCatalog. ArcCatalog adds hints indicating which FGDC

elements are mandatory; these are shown with gray text.

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## Identification Information:

### Citation:

#### Citation information:

**Originators:** Ellen Martinson, AFSC

#### Title:

AFSC/ABL: Karluk sockeye salmon scale time series

**Publication date:** Unknown

**Geospatial data presentation form:** maps and data

#### Other citation details:

Ellen Martinson, John Helle, Dennis Scarnecchia, Houston Stokes (2008) Density-dependent growth of Alaska sockeye salmon in relation to climate-oceanic regimes, population abundance, and body size, 1925-1998. Marine Ecology Progress Series, Feature Article October issue (in press) Ellen Martinson, John Helle, Dennis Scarnecchia (2008) Growth and survival of sockeye salmon (*Oncorhynchus nerka*) from Karluk Lake, Alaska in relation to climatic and oceanic regimes and indices, 1927-2000. Fishery Bulletin (in review)

### Description:

#### Abstract:

To better understand how density-dependent growth of ocean-dwelling Pacific salmon varied with climate and population dynamics, we examined the marine growth of sockeye salmon in relation to an index of sockeye salmon abundances among climate regimes, population abundances, and body sizes under varied life history stages, from 1925 to 1998 using ordinary least squares and multivariate adaptive regression spline threshold models. The annual marine growth and body size during the juvenile, immature, and maturing life stages were estimated from increments on the scales of adult age 2.2 sockeye salmon that returned to spawn at Karluk River and Lake on Kodiak Island, Alaska. Intra-specific density-dependent growth was inferred from inverse relationships between growth and sockeye salmon abundance based on commercial harvest. Density-dependent growth occurred in all marine life stages, during the cool regime, at lower abundance levels, and at smaller body sizes at the start of the juvenile life stage. The finding that density-dependence occurred during the cool regime and at low population abundances suggests that a shift to a cool regime or extreme warm regime at higher population abundances could further reduce the marine growth of salmon and increase competition for resources.

Alaska salmon production fluctuates with climate and ocean conditions in the North Pacific Ocean. In this study, we evaluated the hypothesis that faster marine growth was related to higher survival as a consequence of more favorable ocean conditions for growth during the 1927-46 and 1977-2000 warm regimes, and slower growth was related to lower survival as a consequence of less favorable climatic and oceanic conditions for growth during the

1947-76 cool regime. We measured and compared the annual growth on scales collected from age 2.2 sockeye salmon that returned to Karluk Lake on Kodiak Island, Alaska from 1927 to 2000 to regime periods, climatic and oceanic indices, and survival. First and second marine-year scale growth fluctuated with the cool regime and recent warm regime. Survival estimated as the ratio of offspring to parental escapement was lower during the 1925-46 warm regime and 1947-76 cool regime. Survival was positively related to first and second marine year scale growth, eastern North Pacific atmospheric circulation, and reduced winter and spring coastal downwelling in the Gulf of Alaska. Winter and spring climatic and oceanic conditions influences on first and second year marine growth of Karluk Lake sockeye are a possible mechanisms linking Karluk Lake sockeye salmon survival to climate over the past half century.

**Purpose:**

This database contains the mean annual marine and total freshwater scale measurements for the age 2.2 sockeye.

**Time period of content:****Time period information:****Range of dates/times:**

**Beginning date:** 1925

**Ending date:** 2000

**Currentness reference:**

ground condition

**Status:**

**Progress:** In work

**Maintenance and update frequency:** As needed

**Spatial domain:****Description of geographic extent:**

Karluk Lake and River system on Kodiak Island, Alaska

**Bounding coordinates:**

**West bounding coordinate:** -154.04083

**East bounding coordinate:** -154.46222

**North bounding coordinate:** 57.57167

**South bounding coordinate:** 57.3655

**Keywords:****Theme:**

**Theme keywords:** Biota, 002

**Theme keyword thesaurus:** ISO 19115 Topic Categories

**Theme:**

**Theme keywords:** growth, scale  
**Theme keyword thesaurus:** None

**Theme:**

**Theme keywords:** Sockeye salmon, Oncorhynchus nerka  
**Theme keyword thesaurus:** ITIS

**Place:**

**Place keywords:** Alaska, Kodiak Island, Karluk Lake  
**Place keyword thesaurus:** GNIS - Geographic Names Information System

**Place:**

**Place keywords:** AK  
**Place keyword thesaurus:** None

**Taxonomy:****Keywords/taxon:**

**Taxonomic keywords:** single species, vertebrates  
**Taxonomic keyword thesaurus:** None

**Taxonomic classification:**

**Taxon rank name:** Empire  
**Taxon rank value:** Biovitae  
**Applicable common names:** Carbon-based lifeforms

**Taxonomic classification:**

**Taxon rank name:** Kingdom  
**Taxon rank value:** Animalia

**Taxonomic classification:**

**Taxon rank name:** Phylum  
**Taxon rank value:** Chordata

**Taxonomic classification:**

**Taxon rank name:** Subphylum  
**Taxon rank value:** Vertebrata

**Taxonomic classification:**

**Taxon rank name:** Superclass  
**Taxon rank value:** Osteichthyes

**Taxonomic classification:**

Taxon rank name: Class

Taxon rank value: Actinopterygii

**Taxonomic classification:**

Taxon rank name: Subclass

Taxon rank value: Neopterygii

**Taxonomic classification:**

Taxon rank name: Infraclass

Taxon rank value: Teleostei

**Taxonomic classification:**

Taxon rank name: Superorder

Taxon rank value: Protacanthopterygii

**Taxonomic classification:**

Taxon rank name: Order

Taxon rank value: Salmoniformes

**Taxonomic classification:**

Taxon rank name: Family

Taxon rank value: Salmonidae

**Taxonomic classification:**

Taxon rank name: Subfamily

Taxon rank value: Salmoninae

**Taxonomic classification:**

Taxon rank name: Genus

Taxon rank value: Oncorhynchus

**Taxonomic classification:**

Taxon rank name: Species

Taxon rank value: nerka

Applicable common names: Sockeye  
salmon

**Access constraints:** Contact the Point of Contact for data request form. The Data set is still being analyzed and will not be

available for distribution until it has been finalized and all QA/QC practices have been performed. Contact the Data Point of Contact for estimated time of release.

**Use constraints:**

User must read and fully comprehend the metadata prior to use. Data should not be used beyond the limits of the source scale. Acknowledgement of NOAA, as the source from which these data were obtained, in any publications and/or other representations of these data is suggested.

**Point of contact:**

**Contact information:**

**Contact person primary:**

**Contact person:** Ellen Martinson

**Contact organization:** National Oceanic and Atmospheric Administration (NOAA) Alaska Fisheries Science Center (AFSC) Auke Bay Laboratories (ABL)

**Contact address:**

**Address type:** mailing and physical

**Address:**

17109 Point Lena Loop Road

**City:** Juneau

**State or province:** AK

**Postal code:** 99801

**Country:** USA

**Contact voice telephone:** 907-789-6000

**Contact facsimile telephone:** 907-789-6094

**Contact electronic mail address:** ellen.martinson@noaa.gov

**Contact instructions:**

The e-mail address directs you to the person most knowledgeable about this data. If an alternative contact person becomes necessary, use the voice phone number for referral.

**Data set credit:**

NOAA collection 1925-1984

ADFG-collection 1985-2000

NOAA-analysis

**Native data set environment:**

Microsoft Excel 2003 Spreadsheets

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## Data Quality Information:

### Logical consistency report:

No logical consistency test were run.

### Completeness report:

Data were visually examined for outliers after measurement.

### Lineage:

#### Methodology:

##### Methodology type:

Field

##### Methodology description:

Scale samples from the age 2.2 sockeye were systematically selected from the archived collection through out the early run from all scales collected each year. The scales were mounted on gum cards in the field. In the laboratory, impressions of the scales were made on plastic acetate cards (Arnold 1951).

#### Methodology:

##### Methodology type:

Lab

##### Methodology description:

Scale impressions were viewed using an Indus microfiche reader Model 4601-11 (West Salem, WI) with a 24X objective lens. Scale images were copied from the reader screen with the Screenscan Microfiche PC Model high-resolution scanner hardware and saved as tiff files using the ScreenScan Application software, version 1.00.0.8. Images were then imported into the Optimate image analysis program for measurement.

#### Methodology:

##### Methodology type:

Lab

##### Methodology description:

One scale was measured per fish, and 30-50 scales were measured per year ( $n = 70$  years) for a total of 3,167 scales. Measurements were taken along a reference line drawn from the focus to the edge of the scale along the longest anterior radial axis (Narver 1968). Marks were made along the reference line at the center of the scale focus, between the last freshwater circulus and the first marine circulus, at the outer edge of the first marine annulus, at the outer edge of the second marine annulus, and the outer edge of the scale. Scales were measured to the ten-thousandth of a millimeter.

### Process step:

#### Process description:

No process steps have been described for this data set

**Process date:** Unknown

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## Entity and Attribute Information:

### Overview description:

#### Entity and attribute overview:

After the database is available for distribution, the database will be described in the Entity and Attribute section.

#### Entity and attribute detail citation:

None

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## Distribution Information:

### Distributor:

#### Contact information:

##### Contact person primary:

**Contact person:** Ellen Martinson

**Contact organization:** National Oceanic and Atmospheric Administration (NOAA) Alaska Fisheries Science Center (AFSC) Auke Bay Laboratories (ABL)

##### Contact address:

**Address type:** mailing and physical

##### Address:

17109 Point Lena Loop Road

**City:** Juneau

**State or province:** AK

**Postal code:** 99801

**Country:** USA

**Contact voice telephone:** 907-789-6000

**Contact facsimile telephone:** 907-789-6094



**Contact electronic mail address:** ellen.martinson@noaa.gov

**Contact instructions:**

The e-mail address directs you to the person most knowledgeable about this data. If an alternative contact person becomes necessary, use the voice phone number for referral.

**Resource description:** offline data

**Distribution liability:**

The user is responsible for the results of any application of this data for other than its intended purpose.

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**Metadata Reference Information:**

**Metadata date:** 20081107

**Metadata review date:** 20100129

**Metadata contact:**

**Contact information:**

**Contact person primary:**

**Contact person:** Emily Fergusson

**Contact organization:** National Oceanic and Atmospheric Administration (NOAA) Alaska Fisheries Science Center (AFSC) Auke Bay Laboratories (ABL)

**Contact position:** Metadata coordinator

**Contact address:**

**Address type:** mailing and physical

**Address:**

17109 Point Lena Loop Road

**City:** Juneau

**State or province:** AK

**Postal code:** 99801

**Country:** USA

**Contact voice telephone:** Use e-mail to contact the metadata coordinator.

**Contact facsimile telephone:** 907-789-6094

**Contact electronic mail address:** AFSC.metadata@noaa.gov

**Metadata standard name:** FGDC Biological Data Profile of the Content Standard for Digital Geospatial Metadata  
**Metadata standard version:** FGDC-STD-001.1-1999

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