Northwest **Power** and **Conservation** Council

January 6, 2015

MEMORANDUM

TO: **Council members**

FROM: **Jim Ruff – Manager, Mainstem Passage and River Operations**

SUBJECT: **Briefing on the current status of marine mammal populations in the lower Columbia and Willamette Rivers**

BACKGROUND:

Presenters: This briefing by will be presented by Robin Brown of the Oregon Department of Fish and Wildlife (ODFW), Steve Jeffries of the Washington Department of Fish and Wildlife (WDFW), Bob DeLong of NOAA Fisheries and Doug Hatch of the Columbia River Inter-tribal Fish Commission (CRITFC).

Summary: Pinniped (seal and sea lion) abundance in the Pacific Northwest increased significantly over the latter part of the 20th century. Marine mammal experts from NOAA Fisheries, WDFW and ODFW will present information on the distribution, abundance, and population trends of the three most common pinnipeds found in Oregon and Washington. The general life history of these animals will be covered, followed by a focus on the harbor seals, California sea lions, and Steller sea lions that occupy the lower Columbia River. Seasonal trends in the presence and numbers of the three pinnipeds will be presented along with information on their movements, foraging behavior, and food habits in the river. A review of the relatively recent occurrence, feeding activities, and management of the two sea lion species in the area immediately below Bonneville Dam will be provided, along with a brief description of the growing problem of California sea lion predation on threatened salmonids in the lower Willamette River at Willamette Falls.

CRITFC biologists have conducted surveys in the lower Columbia River to estimate sea lion abundance over the last 3 years. Surveys were conducted

during 2013 and 2014 for 10 weeks from early March through mid-May. CRITFC surveyed from Bonneville Dam to the mouth of the Cowlitz River weekly and made 3 trips from Bonneville Dam to the East Mooring Basin in Astoria each year. Each survey trip used two boats to observe, locate, identify, and count sea lions. Bayesian statistics were used to generate abundance estimates from the counts.

Doug Hatch of CRITFC will present sea lion abundance estimates for the lower Columbia River in March, April, and May of 2013 and 2014. During both years sea lion abundance was highest in March and dropped to minimal numbers in May.

Additionally, the distribution of sea lions during each of the surveys from Bonneville Dam to Astoria will be shown. Although a greater abundance of sea lions was observed in the lower reaches of the Columbia River, during peak abundances sea lions were distributed throughout the lower Columbia. Sea lions also appear to associate with particular areas of the river.

Relevance: Improving the survival of salmon, steelhead and other native focal fish species in the by managing and controlling marine mammal predation rates in the Columbia River is a key measure identified in the predator management sub-strategy in the Council's amended 2014 Fish and Wildlife Program. In particular, the Program states "the federal action agencies should fund federal, tribal and state agencies to evaluate the extent of seal and sea lion predation on salmonids, sturgeon and lamprey in the lower Columbia River from below Bonneville Dam to the mouth of the river."

Work plan: Expanded management and control of predators of salmonids and other native fish species is identified as a high priority in the Fish and Wildlife Division's work plan. It will also help preserve program effectiveness, as well as help protect Fish and Wildlife Program investments.

Background: This briefing is a follow-up to the presentation to the Fish Committee on November 4, 2014, by Michelle Wargo Rub. Dr. Rub presented preliminary information from her ongoing study of the survival estimates and run timing of adult spring/summer Chinook salmon in the lower Columbia River. Council members may wish to ask the panel presenters what opportunities or actions could be implemented to help reduce salmon, steelhead, sturgeon and lamprey losses by seals and sea lions in the lower Columbia River, e.g., what are the next steps to reduce or manage pinniped predation?

More Info: For additional information on this subject, the presenters have provided the following links to their agency web sites, information on marine mammals, or technical papers that may be of interest to Council members and staff.

NOAA Fisheries West Coast Region website on pinnipeds (species information, policy and management, stewardship):
http://www.westcoast.fisheries.noaa.gov/protected_species/marine_mammals/pinnipeds/

NOAA Fisheries' Marine Mammal Protection Act website:
http://www.nmfs.noaa.gov/pr/laws/mmpa/

ODFW marine mammal website:
http://www.dfw.state.or.us/MRP/mammals/

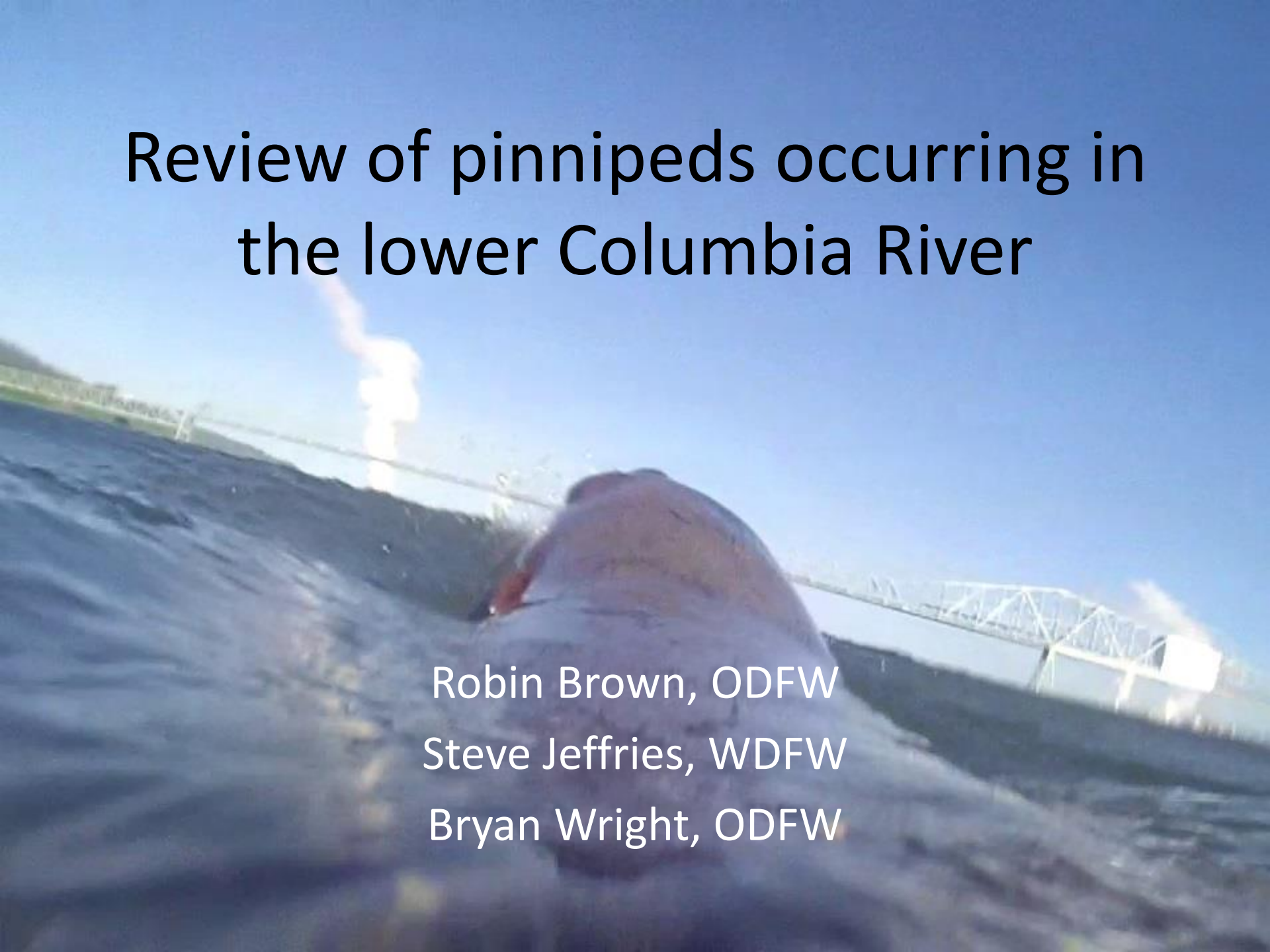
PSMFC summary report on west coast pinniped research:
http://www.psmfc.org/wp-content/uploads/2012/01/expand_pinniped_report_2010.pdf

WDFW marine mammal website with additional links to provide more background:
http://wdfw.wa.gov/conservation/sealions/
http://wdfw.wa.gov/conservation/sealions/links.html

Abstract to a recent ODFW paper on "Movements of Male California sea lions captured in the Columbia River" (If interested, I also have a PDF of the entire paper):
http://www.bioone.org/doi/abs/10.3955/046.084.0107?journalCode=nwsc

California sea lions on a pier in Astoria, OR

Review of pinnipeds occurring in the lower Columbia River



Robin Brown, ODFW
Steve Jeffries, WDFW
Bryan Wright, ODFW

Acknowlegments

- NOAA Fisheries
- National Marine Mammal Laboratory
- U.S. Army Corps of Engineers
- NPCC and BPA
- Pacific States Marine Fisheries Commission
- Columbia River Inter-Tribal Fish Commission
- Washington Department of Fish and Wildlife
- Oregon Department of Fish and Wildlife

South Jetty, Columbia River
(8/10/2004)

Historic/prehistoric occurrence of pinnipeds in the lower Columbia River

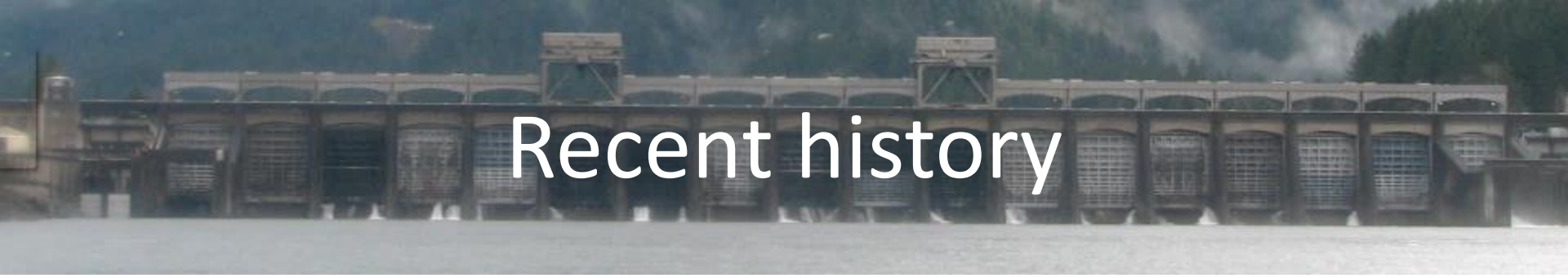
- Archaeological evidence shows harbor seals present in lower Columbia River up to 10,000 years ago; no similar evidence for other pinnipeds.
- Harbor seals observed to Celilo Falls during 19th (e.g., Lewis & Clark) and early 20th centuries.
- Steller sea lion observations at river-km 70 in 1814 & river-km 150 in 1930s.
- *No history of CSLs in river*.

Source: Lyman et al. 2002, Northwestern Naturalist

Recent history

- 1970s
  - Marine Mammal Protection Act (MMPA) of 1972
- 1980s
  - CSLs begin occurring regularly in the lower Columbia River
- 1990s
  - CSLs start occurring regularly at Willamette Falls
  - CSL branding program starts in Astoria 1997
  - ESA listings of Columbia River salmonids

Sources: ODFW, WDFW



Recent history

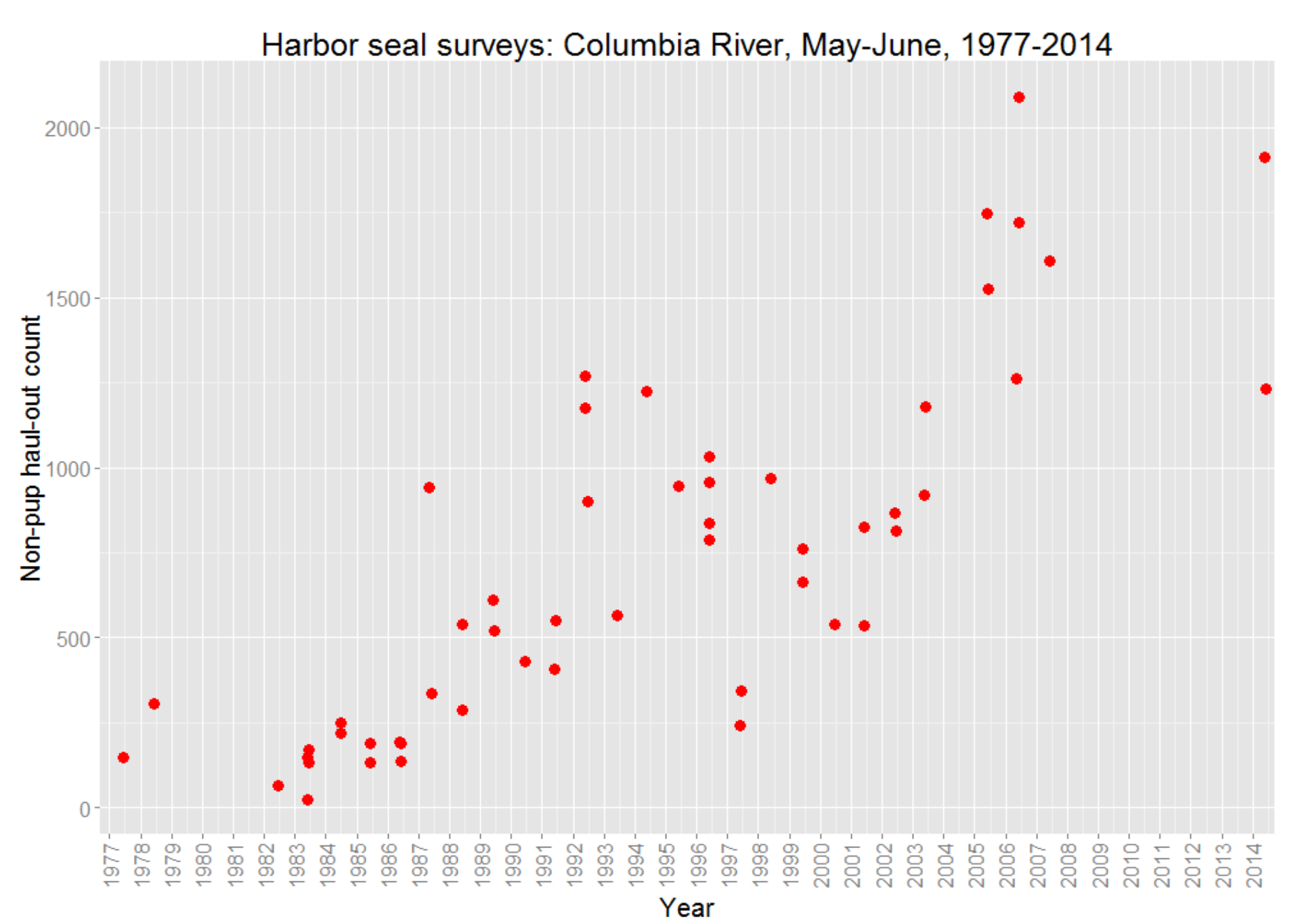
- 2000s
  - CSLs occurring regularly at Bonneville Dam 2001
  - Monitoring at dam starts 2002
  - SSLs occurring regularly at Bonneville Dam 2006
  - MMPA Section 120 authority granted 2008 (73 CSLs removed through 2014)
  - CSL & SSL increase at Willamette Falls

Sources: USACE, ODFW, WDFW

Harbor seals

- Widely distributed North Atlantic and North Pacific.
- West coast U.S. stocks (5): California stock; OR/WA coast stock; WA inland stocks (3)
- OR/WA coast stock:
  - 1999 estimate: ~25,000 seals (~10,000 in Oregon)
  - 2014 estimate pending
- Columbia River
  - Year-around "resident", breeds May-June

Sources: U.S. Pacific Marine Mammal Stock Assessments, 2013 (NOAA-TM-NMFS-SWFSC-532); ODFW; WDFW



Sources: ODFW, WDFW

Steller sea lions

- U.S. stocks (2): Western, Eastern
- Eastern stock: ~63,000-78,000 sea lions
  - Growth rate: 3%-5% per year
  - Delisted as "threatened" under ESA in 2013
  - Potential Biological Removal: 1,500 sea lions/year
- OR/WA May-June breeding season
  - ~7,900 total (~1,500 pups)

Sources: Alaska Marine Mammal Stock Assessments, 2013 (NOAA-TM-NMFS-AFSC-277); ODFW

Steller sea lions

- Columbia River – typical/recent single-day spring counts
  - South Jetty: ~100
  - Phoca Rock/Bonneville Dam: ~40
  - Willamette Falls: ~2
- Observed predation Bonneville Dam, 2005-2014
  - Salmonids: ~8,000
  - White sturgeon: >12,000

Sources: ODFW; WDFW; USACE

California sea lions

- Stocks (5): Pacific Temperate (U.S.), Pacific Subtropical (Western Baja California), Gulf of California (3)
- U.S. stock
  - ~300,000 sea lions
  - Growth rate: 5% per year (non-El Nino years only)
  - Potential Biological Removal: 9,200 sea lions per year
- Pacific Northwest
  - Seasonal migrants (fall, winter, spring)
  - Nearly all sub-adult and adult males

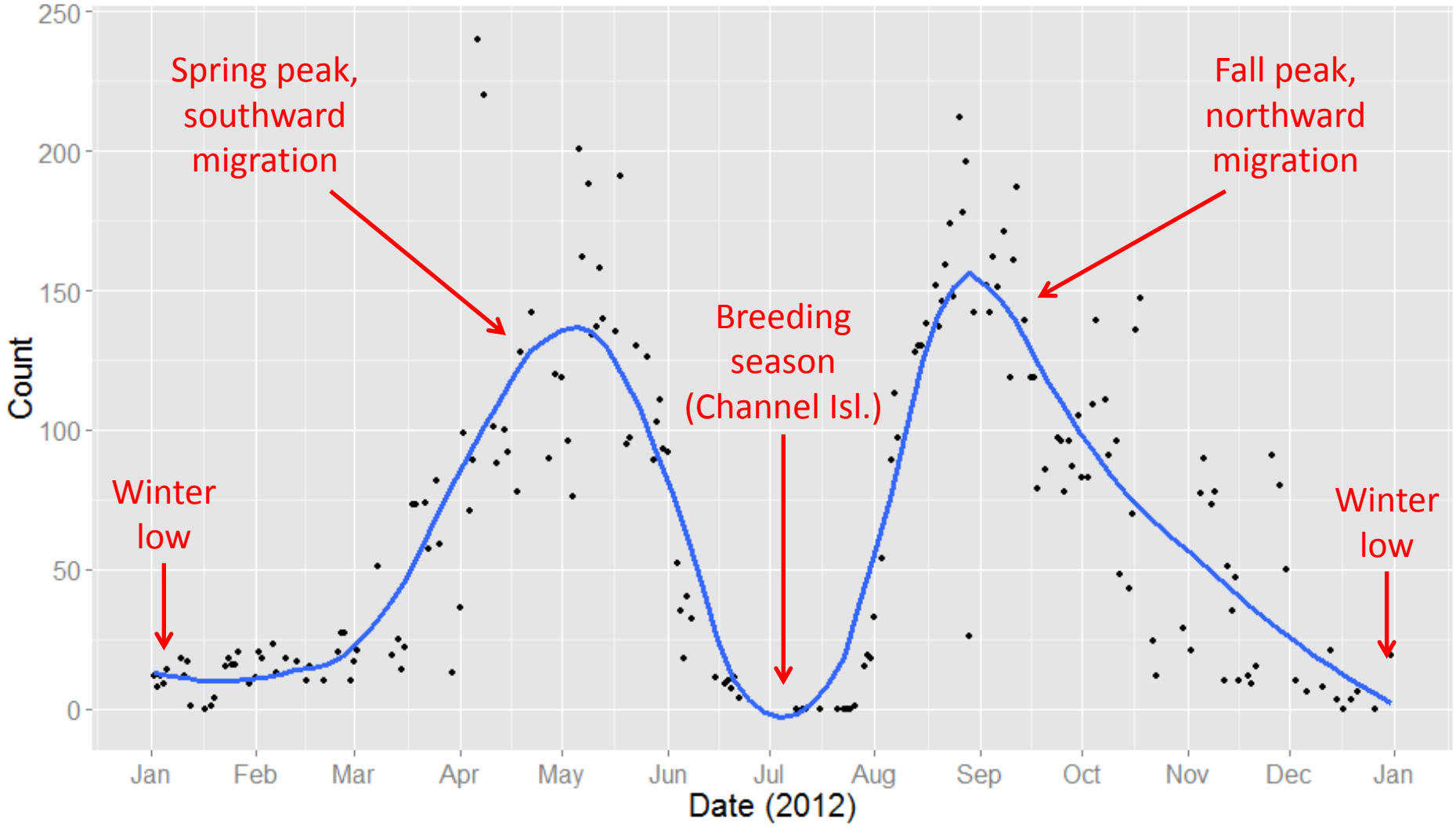
Source: U.S. Pacific Marine Mammal Stock Assessments, 2013 (NOAA-TM-NMFS-SWFSC-532)

California sea lions

- Columbia River – typical/recent single-day spring counts
  - South Jetty: ~50
  - East Mooring Basin: ~250
  - Bonneville Dam: ~25
  - The Dalles: ~3
  - Willamette Falls: ~20

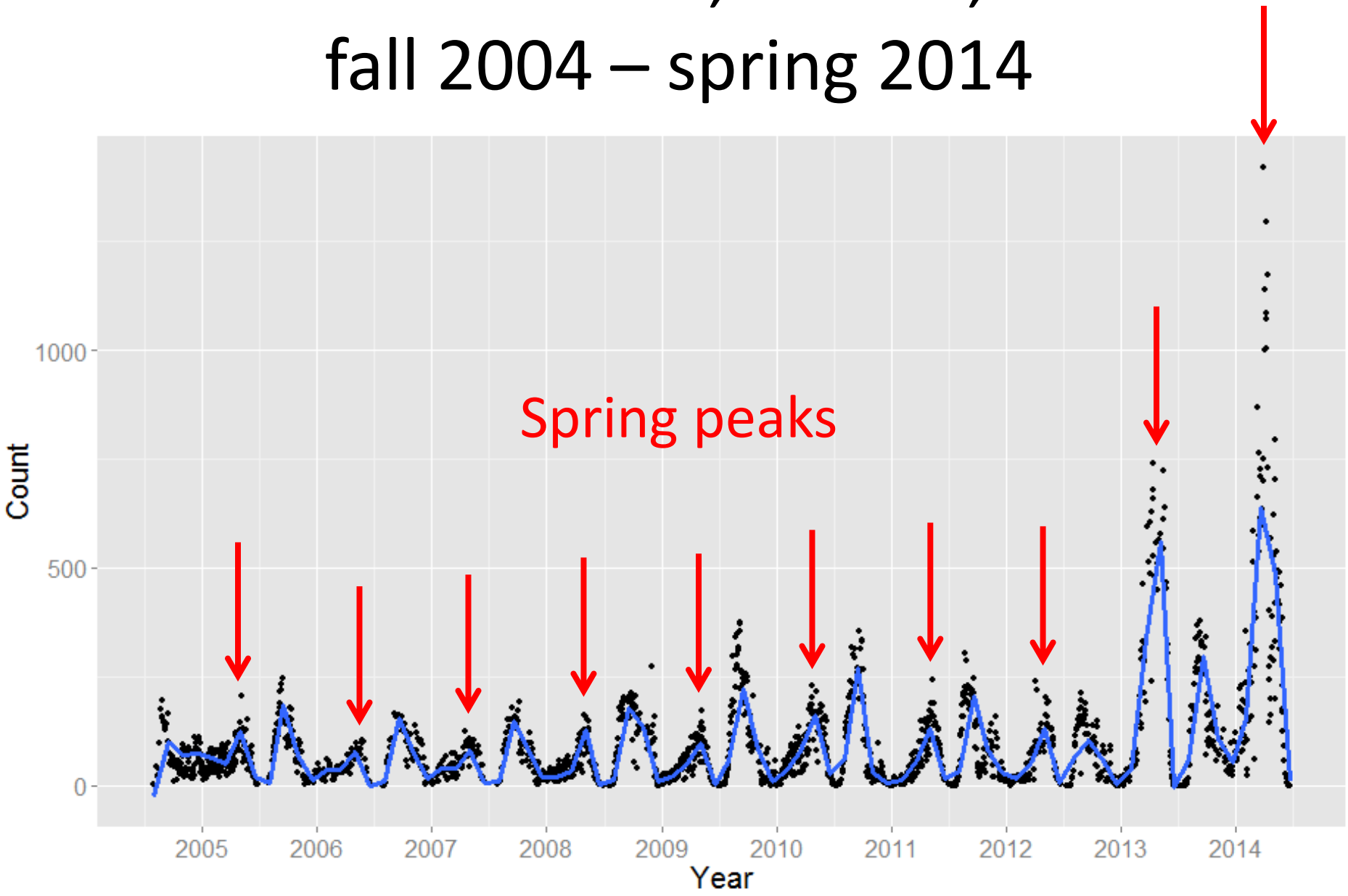
Sources: ODFW; WDFW; USACE

Seasonal pattern of CSL occurrence, East Mooring Basin, Astoria



Source: ODFW, unpublished data

CSL counts, Astoria, fall 2004 – spring 2014



Source: ODFW, unpublished data

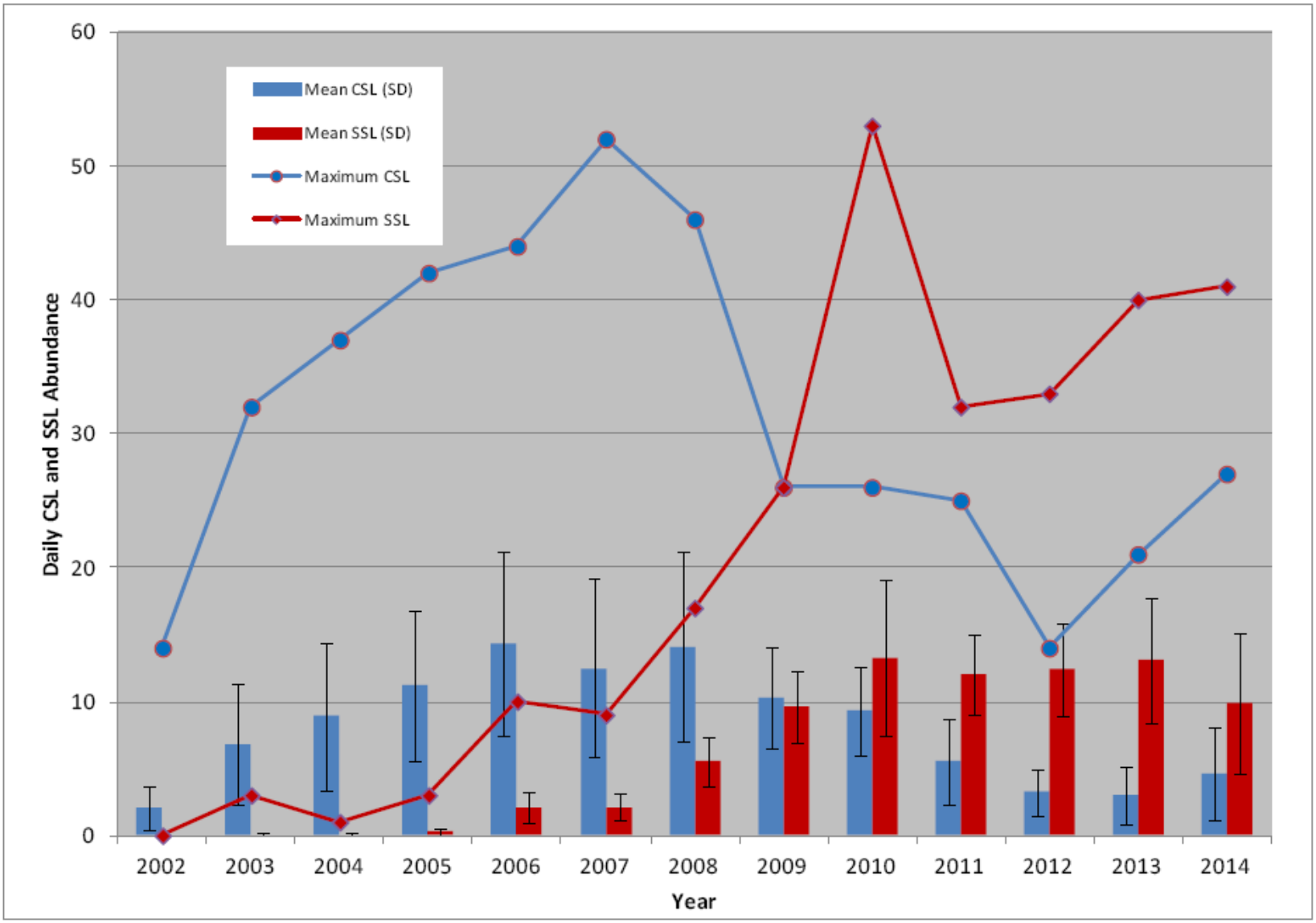


Figure 13. Mean, standard deviation, and maximum daily estimated number of CSL and SSL present at Bonneville Dam between January 1 and May 31, 2002 to 2014.

Source: USACE, Pinniped 2014 Final Report

California sea lion feeding rates

- Maximum USACE-observed consumption:
  - 12 salmon/day
  - 198 salmon/season
- Prey requirements at dam based on model:
  - 15 kg/day (95% CI: 8-25 kg/day)
  - ~3 salmon/day (2-6 salmon/day)
  - ~57 salmon/season (6-216 salmon/season)
- Observed predation at Bonneville Dam 2002-2014: >40,000 salmonids

Sources: USACE, ODFW

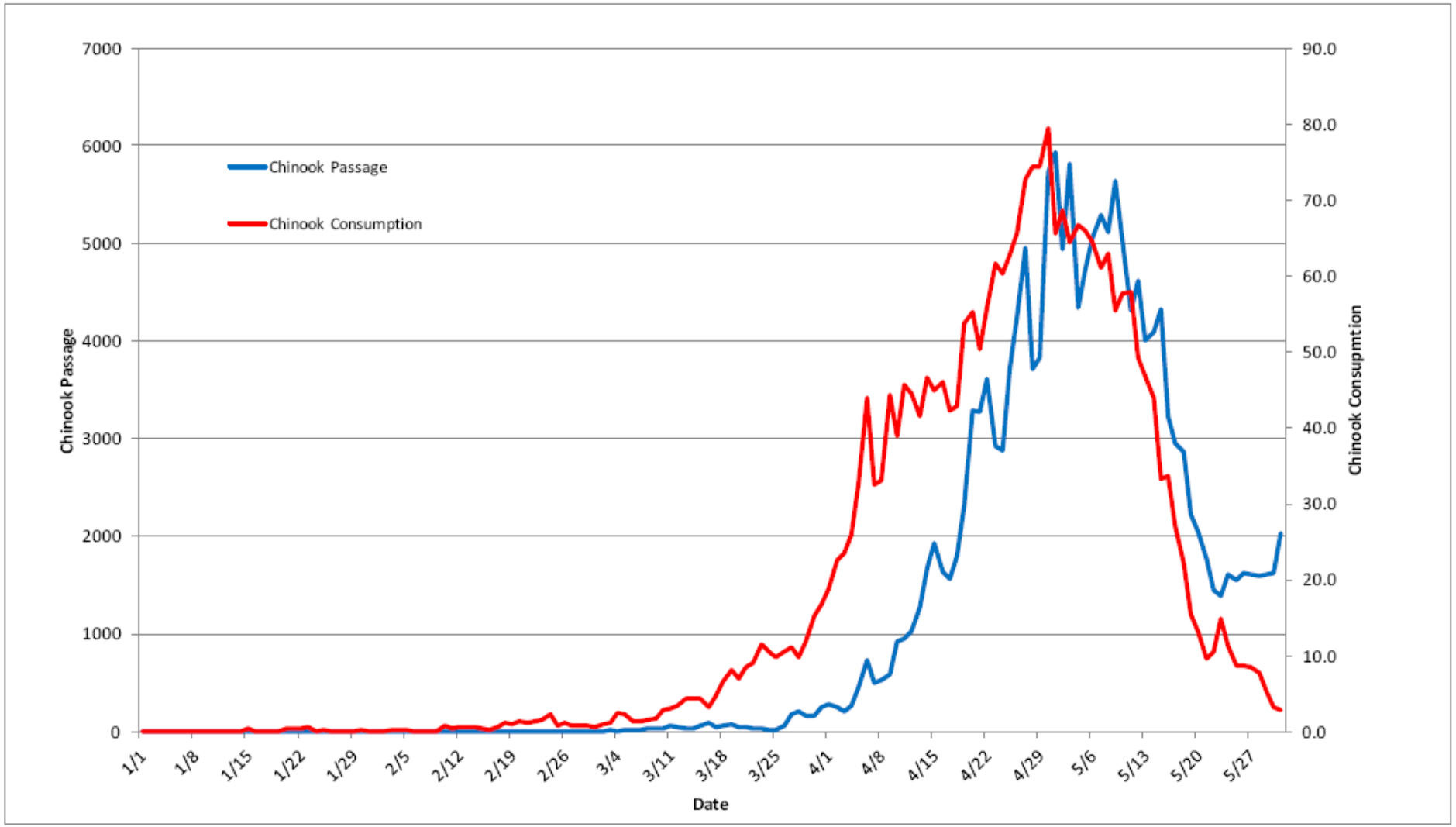
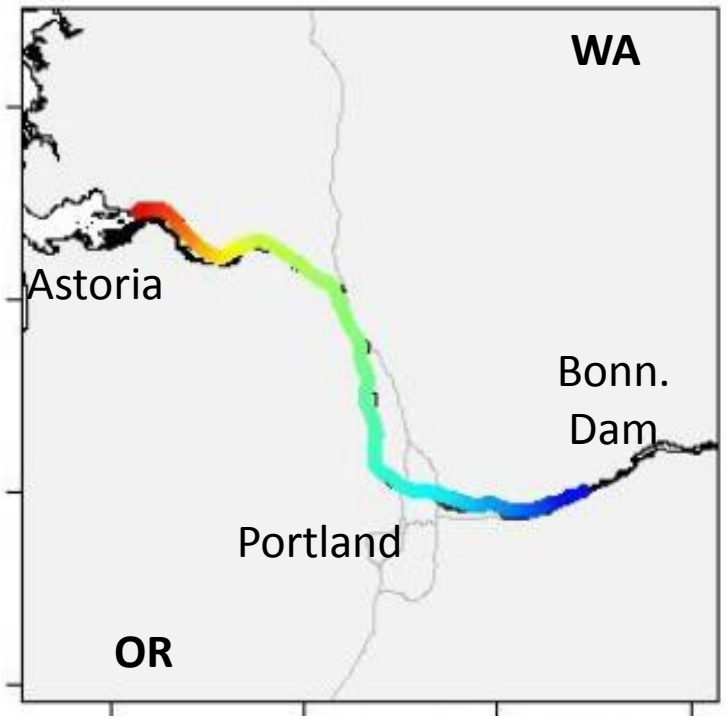
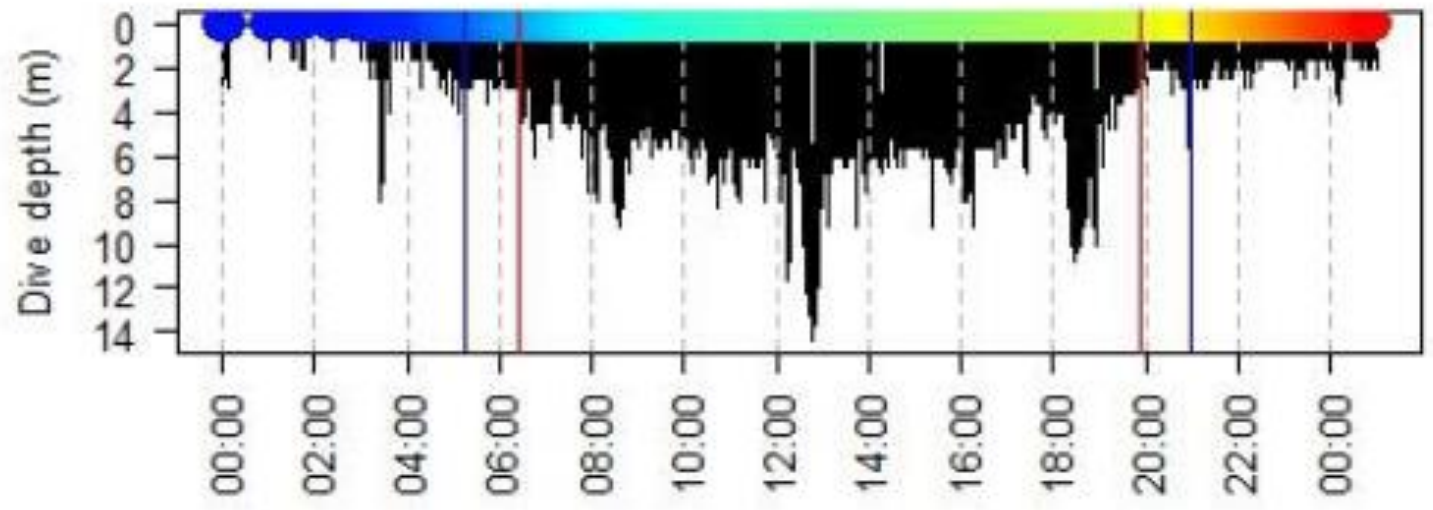


Figure 4. Mean daily Chinook consumption by CSL and mean daily Chinook passage at Bonneville Dam by date, 2002-2014.

Source: USACE, Pinniped 2014 Final Report

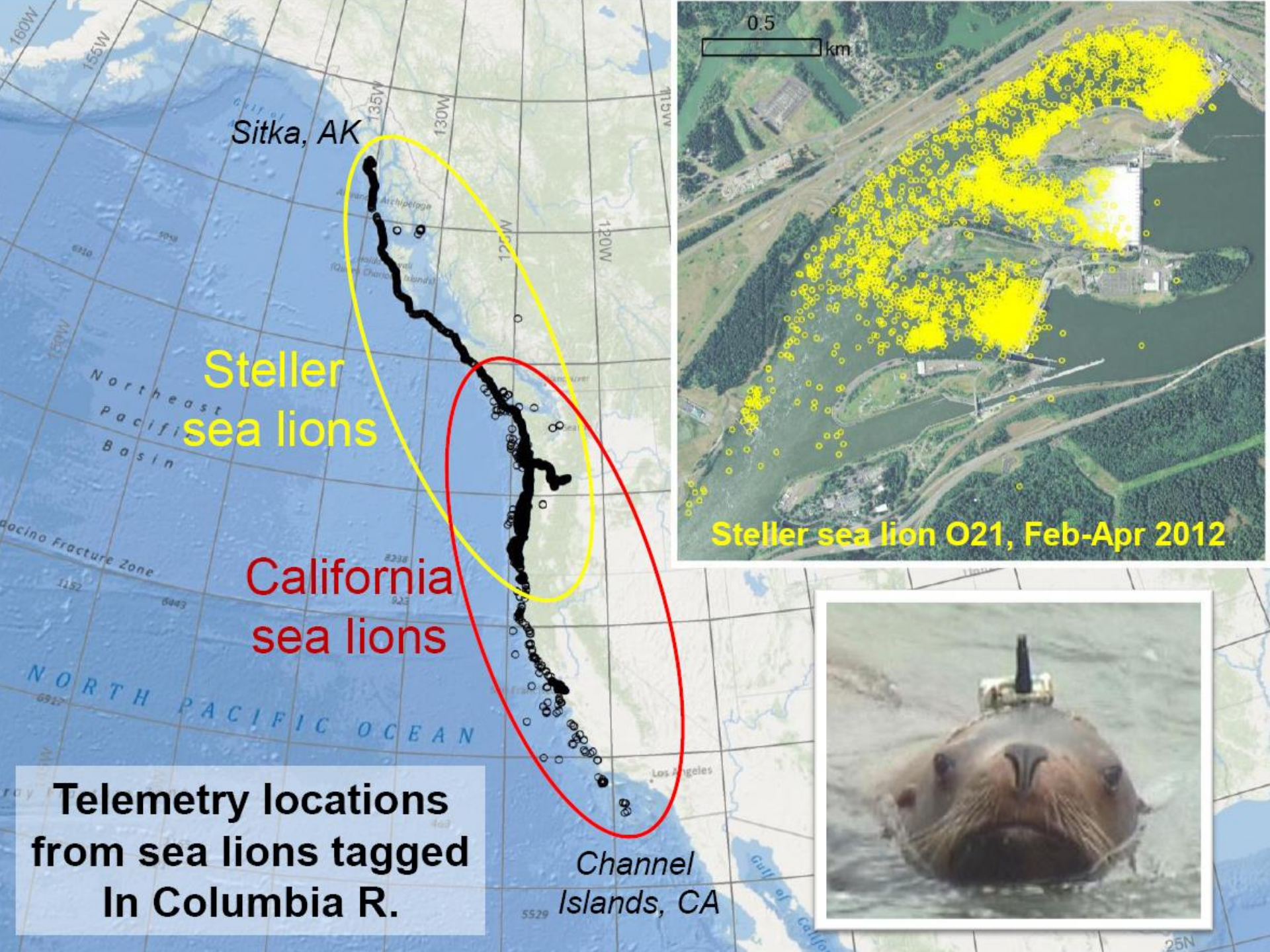
24-hr dive track of CSL U159 on April 13, 2012





741 dives

Source: Bonneville 2012 Field Report


Sitka, AK
Steller sea lions
California sea lions
Channel Islands, CA
Telemetry locations from sea lions tagged In Columbia R.
0.5
km
Steller sea lion O21, Feb-Apr 2012


Willamette Falls

Willamette Falls

- Monitoring: 1995-2003, 2009-2013, 2014-
- Hazing by ODFW: 2010, 2012-2013
- 2014 results (March-May)
  - At least 27 CSLs, 2 SSLs, 1 HS
  - 14 CSLs seen previous years at WF or Bonneville
  - 5 CSLs on removal list
  - 3,700 (+/- 400) salmonids killed
  - 13% (+/- 3%) of listed winter steelhead
  - 8% (+/- 2%) of listed spring Chinook
- 2015: increased monitoring; trap preparations

Source: Willamette Falls 2014 Field Report

Questions?

Extra slides

"Zoogeography of Oregon Coast Marine Mammals: the Last 3,000 Years" Lyman 1988, Marine Mammal Science

- California sea lions were not very abundant, making up only 2.5% of the total pinniped remains.
- Northern fur seals and California sea lions bred and pupped on the Oregon coast, although not as abundant as harbor seals or Steller sea lions.
- Oregon coastal waters appear to have been a zoogeographic border zone for California sea lions in recent prehistoric times as well as historically.
- 18th and 19th century commercial exploitation affected populations and altered ranges

"Abundance and Distribution of Harbor Seals and Northern Sea Lions in Oregon" Pearson and Verts 1970, The Murrelet

- Northern (Steller) sea lions
  - Statewide bounty 1925-1933; 1,387 killed in 1925
  - Reports of them in the Columbia River were relatively common
  - ~1,000 statewide estimated from 1967-1968 surveys
- Harbor seals
  - Statewide bounty 1924-1933; killed in all major estuaries but Columbia River consistently highest
  - Columbia River bounty program: 1935-1967; >300 killed annually from 1938-1942, only 14 in 1967.
  - <500 harbor seals statewide estimated from 1967-1968 surveys
- California sea lions
  - Noted as winter migrants but not surveyed

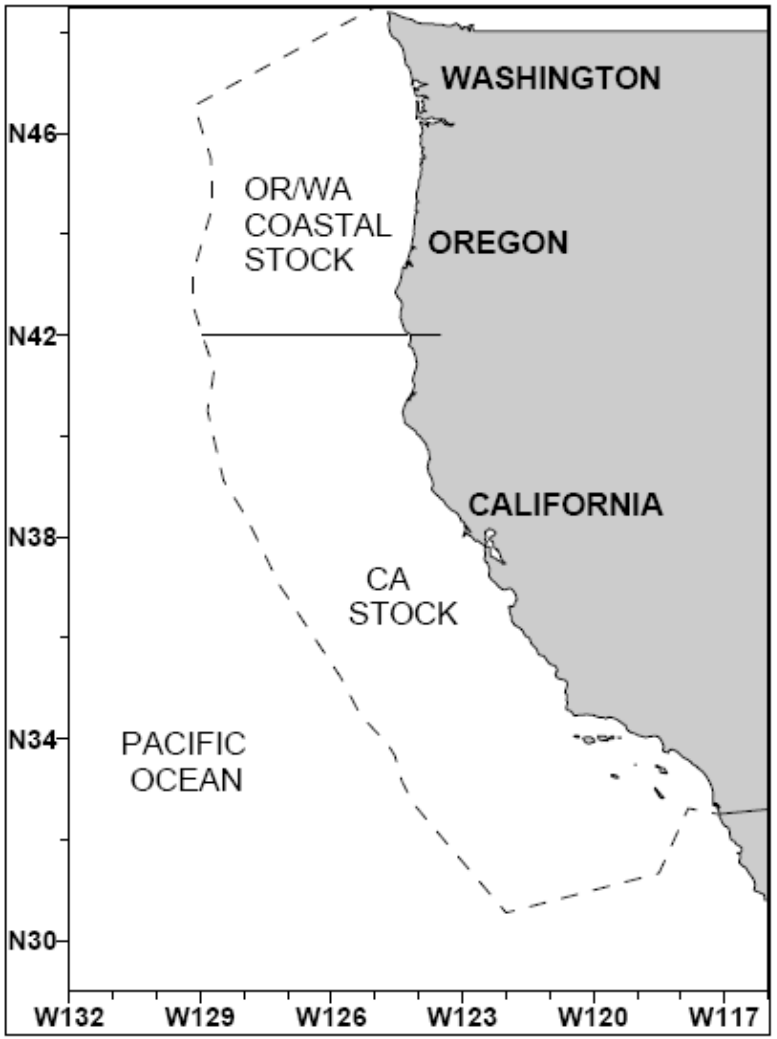


Figure 1. Stock boundaries for the California and Oregon/Washington coastal stocks of harbor seals. Dashed line represents the U.S. EEZ.

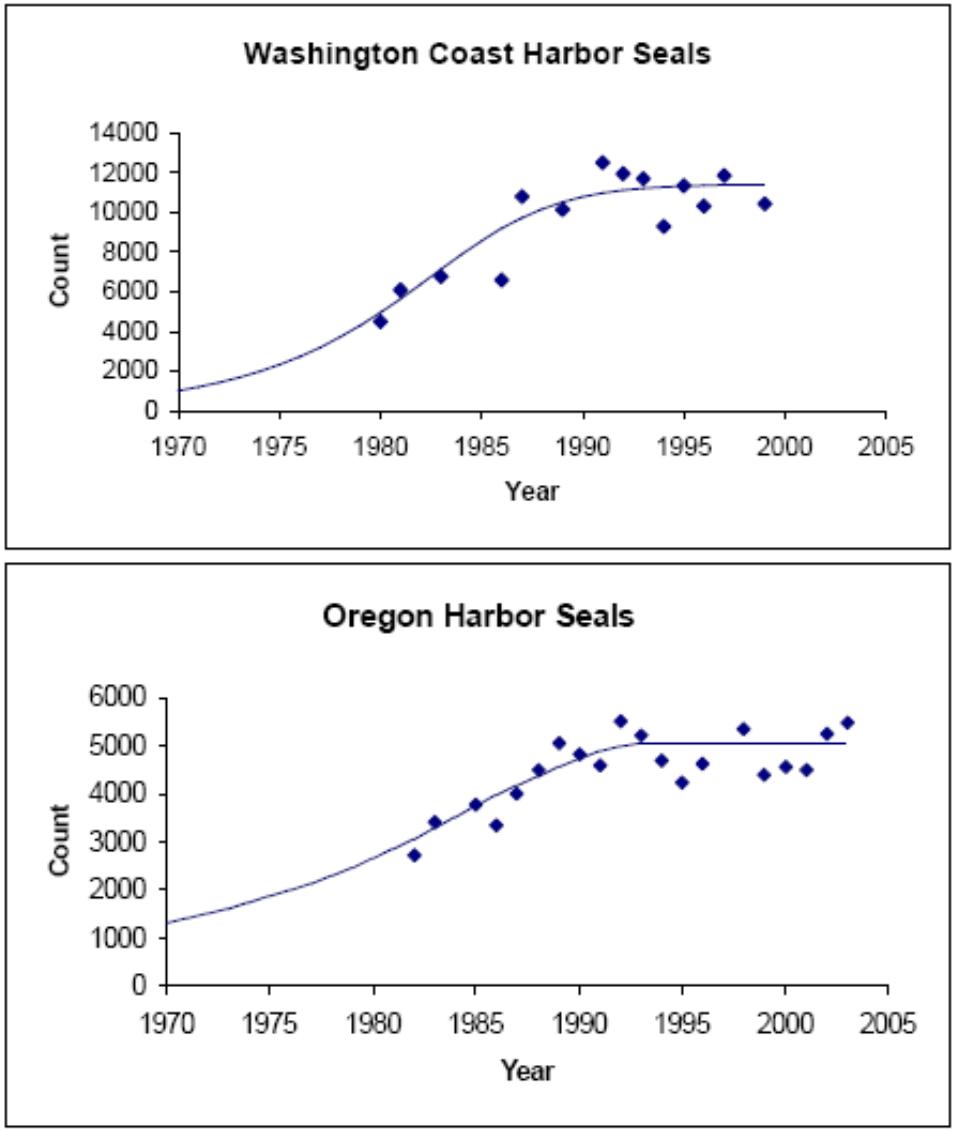


Figure 2. Generalized logistic growth curves of Washington Coast (Jeffries et al. 2003) and Oregon (Brown et al. 2005) harbor seals.

Source: U.S. Pacific Marine Mammal Stock Assessments, 2013 (NOAA-TM-NMFS-SWFSC-532)

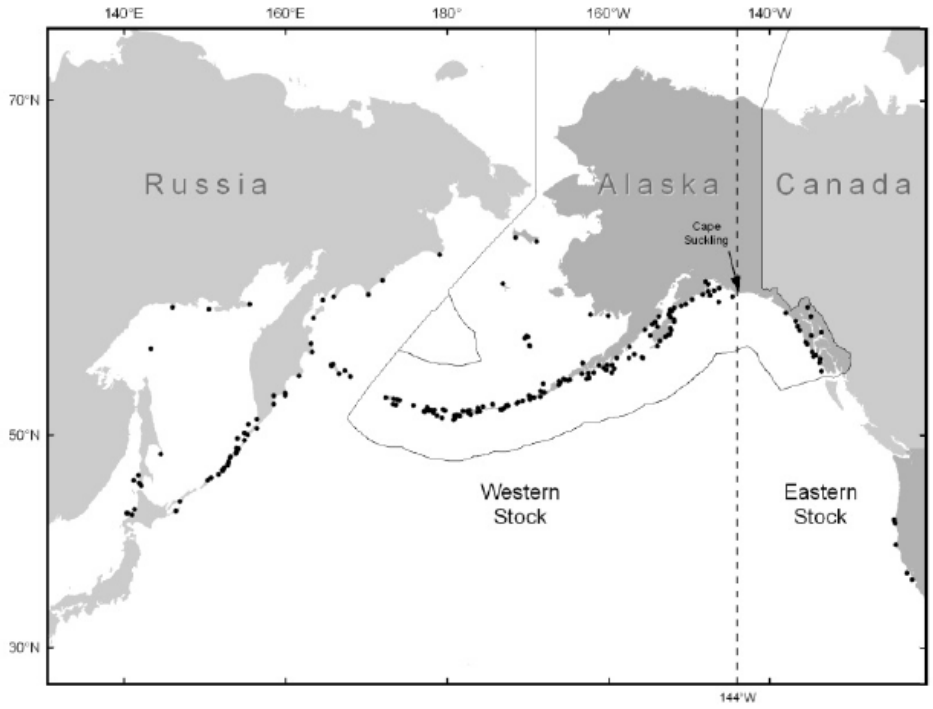


Figure 3. Approximate distribution of Steller sea lions in the North Pacific. Major U.S. haulouts and rookeries (50 CFR 226.202, 27 August 1993) and active Asian haulouts and rookeries (Burkanov and Loughlin, 2005) are depicted (points). Black dashed line (144° W) indicates stock boundary (Loughlin 1997). Note: Haulouts and rookeries in British Columbia are not shown.

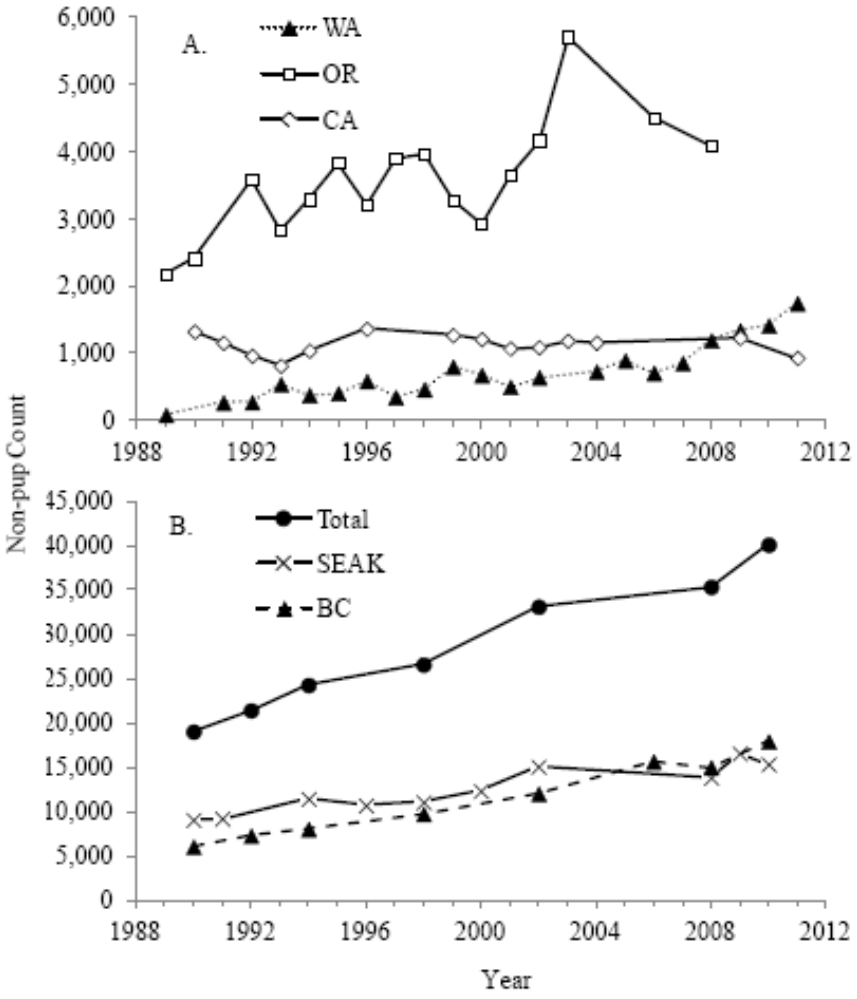


Figure 4. Counts of adult and juvenile Steller sea lions at rookery and haulout trend sites by region throughout the range of the eastern U.S. stock, 1990-2011. Data from Oregon and British Columbia include all sites. Region abbreviations and data are in Table 4. A. CA, OR, and WA. B. BC, SEAK, and Total Eastern stock.

Source: Alaska Marine Mammal Stock Assessments, 2013 (NOAA-TM-NMFS-AFSC-277)

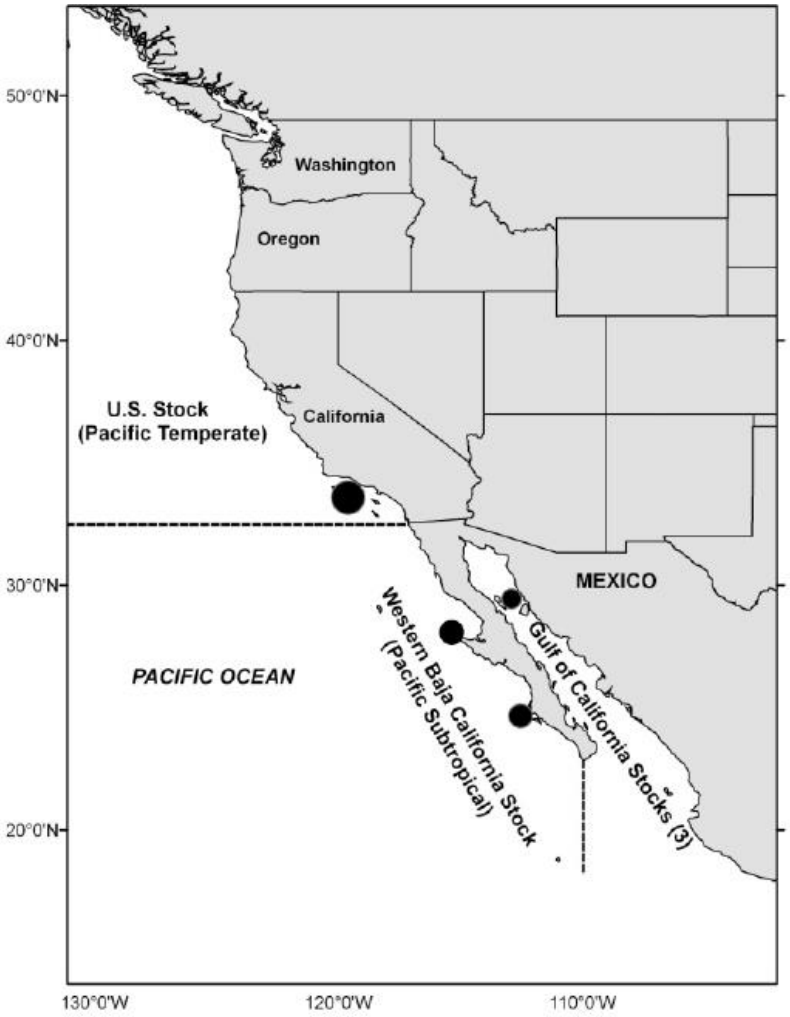


Figure 1. Geographic range of California sea lions showing stock boundaries and locations of major rookeries. The U.S. stock also ranges north into Canadian waters.

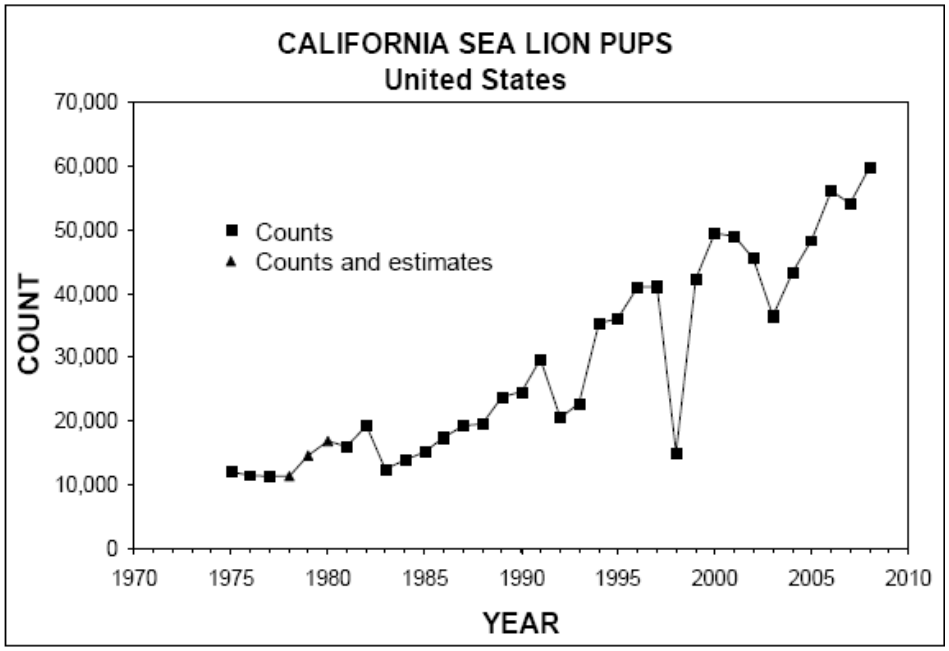


Figure 2. U.S. pup count index for California sea lions (1975-2005 2008). Trends in pup counts from 1975 through 2008 are shown for four rookeries in southern California and for haulouts in central and northern California. Records of pup counts from 1975 to 2008 were compiled from Lowry and Maravilla (2005) and unpublished NMFS data.

Source: U.S. Pacific Marine Mammal Stock Assessments, 2013 (NOAA-TM-NMFS-SWFSC-532)

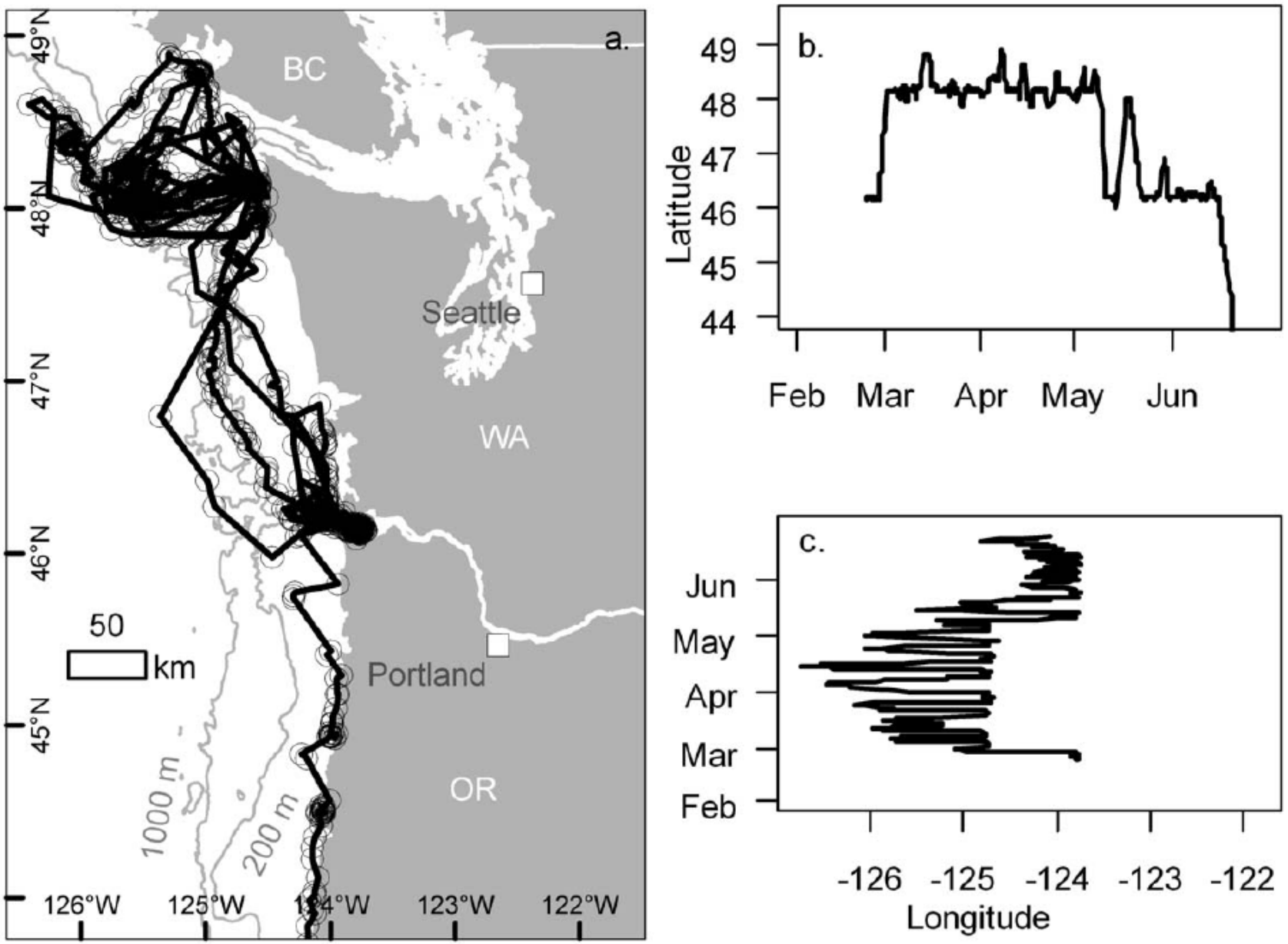


Figure 5. (a) Movement path, and (b) latitudinal and (c) longitudinal movement profiles for C634, an "unknown"-type California sea lion tracked 22 February 2007 to 20 June 2007.

Source: Wright et al. 2010, Northwest Science, 84

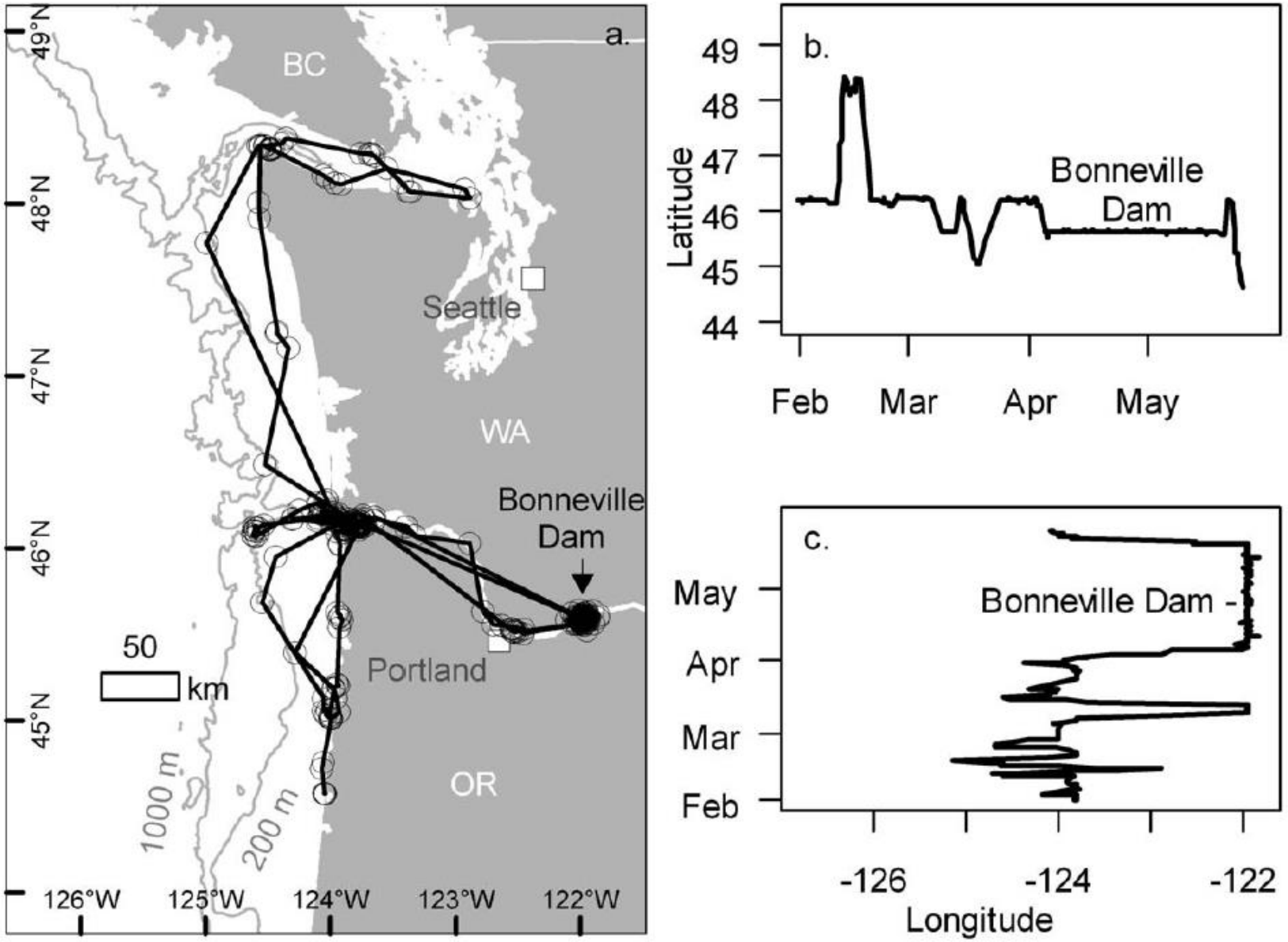


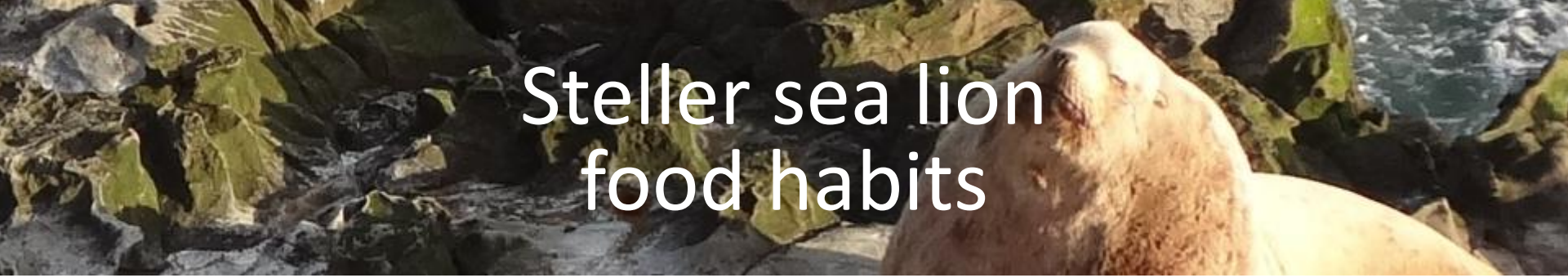
Figure 4. (a) Movement path, and (b) latitudinal and (c) longitudinal movement profiles for C265, a "river"-type California sea lion tracked from 1 February 2007 to 25 May 2007.

Source: Wright et al. 2010, Northwest Science, 84

Harbor seal food habits

- 3,800 fecal samples; 77 prey types identified
- Coast-wide primary prey (% of scat samples)
  - English sole 25%
  - Rex sole 25%
  - Tomcod 17%
  - Sand lance 14%
  - Herring 13%
  - Others (e.g., hake, smelt)
  - Salmonids 5%

Source: ODFW



Steller sea lion food habits

- 1,300 fecal samples; 70 prey types identified
- Coast-wide primary prey (% of scat samples)
  - Pacific Hake 78%
  - Salmon 26%
  - Skates 24%
  - Others…

Sources: USACE, ODFW

California sea lion food habits

- 572 fecal samples; 43 prey types identified
- Coast-wide primary prey (% of scat samples)
  - Sardine 66%
  - Pacific Hake 24%
  - Salmon 19%
  - Anchovy 7%
  - Herring 6%
  - Others…

Sources: USACE, ODFW

California sea lion removals

Year	Captivity	Accidental mortality	Euthanized	Total
2008	6	5		11
2009	4		11	15
2010			14	14
2011			1	1
2012	1		12	13
2013	2		2	4
2014			15	15
Total	13	5	55	73

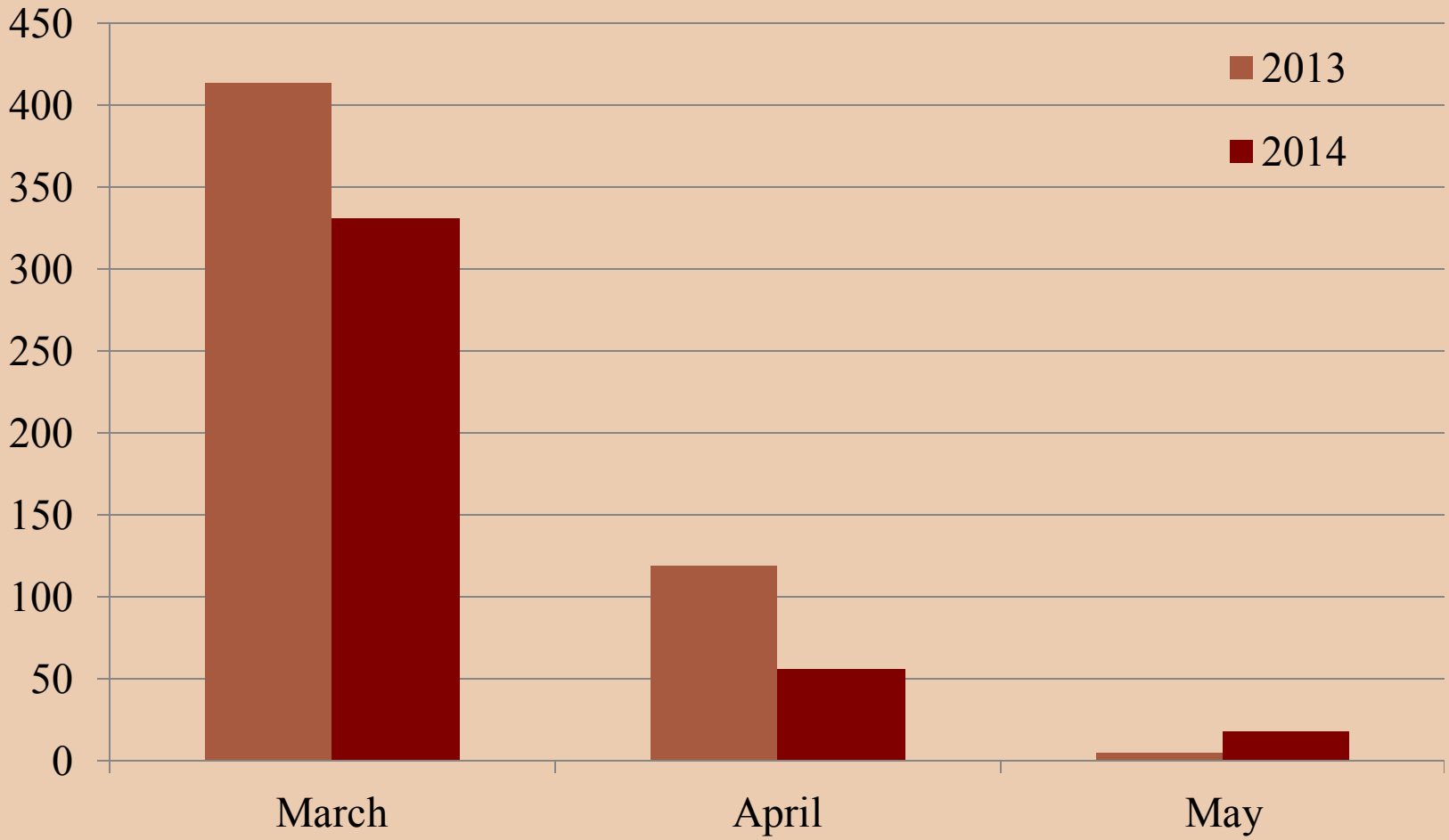
Sources: ODFW, WDFW


N
WASHINGTON
Pacific Ocean
Astoria
Columbia R.
Bonneville Dam
Portland
"Celilo Falls"
Willamette Falls
OREGON
100
km

Sea Lion Abundance and Distribution in the Lower Columbia River

Columbia River Inter-Tribal Fish Commission

Sea Lion Abundance Estimates



Distribution of Sightings
March 19, 2013

Distribution of Sightings
March 18, 2014

Distribution of Sightings: Estuary March 19, 2013

Distribution of Sightings: Estuary March 18, 2014

Distribution of Sightings
April 9, 2013

Distribution of Sightings
April 17, 2014

Abundance Estimate

55.53

Columbia River Inter-Tribal Fish Commission

Distribution of Sightings
May 7, 2013

Abundance Estimate

4.92

Distribution of Sightings
May 6, 2014

Abundance Estimate

17.26

All 2013


CSL
HS CSL HS SSL CSL
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Columbia River Inter-Tribal Fish Commission
Imagery Date: 4/9/2013 lat 45.926270° lon -122.739864° elev 538 ft eye alt 119.90 mi

All 2014


CSL
SSL
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image Landsat
Google Earth
Columbia River Inter-Tribal Fish Commission
Imagery Date: 4/9/2013 lat 45.926270° lon -122.739864° elev 538 ft eye alt 119.90 mi

Findings

- Peak sea lion abundance is mid-March through early April.
- During peak sea lion abundance, highest density is in the lower Columbia R. and estuary.
- Sea lions can be found in all areas below Bonneville Dam during all survey dates.
- Typical “hot spots” are in the upper estuary and tributary river mouths although not exclusively.
- About 3.5% of the observations include fish predation on salmon and sturgeon.

Unknowns/Future

- What is the predation impact on adult salmon, sturgeon, and eulachon?
- What is the predation impact on juvenile salmon and sturgeon?
- What is the pinniped abundance, distribution and predation throughout the year?
- Do fisheries (sport and commercial) create predation advantage for pinnipeds?
- Do sea lions habitually return to specific “hot spots” year after year?