March 9, 2022

MEMORANDUM

TO: Council Members
FROM: Mark Fritsch
SUBJECT: Briefing on Ocean Observations and Outlooks for Salmon Returns

BACKGROUND:

Presenter: Brian Burke (Supervisory Research Fish Biologist, National Oceanic and Atmospheric Administration, Northwest Fisheries Science Center)

Summary: Brian will present research findings and outlooks associated with Chinook and Coho returns to the Columbia River based on indicators of ocean conditions. These monitoring efforts have been consistently supported by the Council and were also highlighted as critical in both the 2014 Fish and Wildlife Program and the 2020 addendum. The monitoring efforts are support through Project #1998-014-00, Ocean Survival Of Salmonids.

Relevance: This information is relevant to our high-level indicators and strategy performance indicators by providing a preview for what is expected for adult returns in the current year. This work also addresses several measures in the Fish and Wildlife Program.

Workplan: Fish and Wildlife Division work plan 2022; Program planning & policy, and Program Implementation.

Background: The Council’s research and monitoring efforts related to the marine environment for anadromous fish began in 1998 in response to the 1996 amendment to the Northwest Power Act, which calls on the Council to consider ocean conditions when making project funding
recommendations. The Council’s Fish and Wildlife Program recognizes the ocean environment as an integral component of the Columbia River ecosystem. Measures in the Program support monitoring the ocean conditions and in-river restoration actions to determine those actions of greatest benefit, to separate the effects of ocean-related mortality from that caused in the freshwater part of the life cycle, and to assess salmonid survival and evaluate restoration potential given variable ocean conditions. To date, full support for this baseline information has not been provided by Bonneville.

More Info:

- Ocean and Plume Science and Management Forum website

- Mainstem and Program Support Project review, *Final Decision Document August 14, 2019, Project-Specific Recommendations (page 13)*
Salmon in the Ocean: A temporary respite

Northwest Power and Conservation Council Meeting
March 15th, 2022

Presenter: Brian Burke
NOAA Fisheries, NWFSC

Team: Brian Beckman, Cindy Bucher, Brandon Chasco, Elizabeth Daly, Susan Hinton, David Huff, Mary Hunsicker, Kym Jacobson, Meredith Journey, Jessica Miller, Cheryl Morgan, Krista Nichols, Craig Norrie, Joe Smith, Don Van Doornik, Laurie Weitkamp, Brian Wells, Jen Zamon

Also supported by:
Take home message:

• We are experiencing a temporary respite from a continuous and dramatic decline in ocean conditions
  • In the short term, this means slightly higher returns of adult salmon than we’ve seen in the last few years
  • In the long term, we are failing to do the minimum ocean science required for adequate management recommendations to mitigate or offset the decline in ocean conditions
1. Salmon Research and Monitoring Ocean Conditions
2. Modeling Survival and Climate Impacts
Pacific Decadal Oscillation (PDO)
Marine Heat Wave

* High pressure reduces winter storms, resulting in less mixing with deep, cold water

https://psl.noaa.gov/map/clim/sst.shtml
NE Pacific marine heatwaves are increasing

2020-21 California Current Ecosystem Status Report
NOAA California Current IEA Team
NE Pacific marine heatwaves are increasing

(i) Global mean sea surface temperature change
relative to 1986-2005

(j) Probability of marine heatwaves
surface ocean global mean (relative to 1850-1900)

(k) Surface ocean pH
(global mean)

IPCC 2019. The Ocean and Cryosphere in a Changing Climate, Fig SPM.1
Newport Hydrographic Line and Northern California Current Survey

**Newport Line:** Sampled biweekly for 27 years

**Pre-recruit:** May-June (2011, 2013-2019)

**NCC Survey:** Seasonal (2-4 times per year)
Juvenile Salmon and Ocean Ecosystem Survey (JSOES)

- June (1998 – present)
- September (1998 – 2012)
SOBaD Advanced Technologies and Emerging Tools

REXUS 1000

1000 Meter Rated
22.25 feet Long
High Endurance
Food Resources are Critical
Chinook and Coho ~ average CPUE in 2021

Juvenile Salmon and Ocean Ecosystem Surveys June, 1998-2021
New ‘Stoplight’ Website


Stoplight Table

Ocean Conditions Summary

Newportal Blog
1. Salmon Research and Monitoring Ocean Conditions
2. Modeling Survival and Climate Impacts
Stock-specific Stoplight Charts (the ink is still drying)
One-Step Ahead Predictions and 2020 Estimated SAR

Snake River
- Spring/Summer Chinook
- Fall Chinook
- Steelhead

Columbia River
- Spring Chinook
- Summer/Fall Chinook
- Steelhead

PIT tag data from Columbia Basin Research: http://www.cbr.washington.edu/dart
## Estimates of SAR (Bonn to Bonn)

<table>
<thead>
<tr>
<th>Outmigration Year</th>
<th>Spring Chinook</th>
<th>Fall Chinook</th>
<th>Steelhead</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean Estimate</td>
<td>Proportion of 10-yr mean</td>
<td>Mean Estimate</td>
</tr>
<tr>
<td>Snake R</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2020</td>
<td>0.8</td>
<td>1.04</td>
<td>1.3</td>
</tr>
<tr>
<td>2021</td>
<td>1.0</td>
<td>1.31</td>
<td>2.2</td>
</tr>
<tr>
<td>Up Col. R</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2020</td>
<td>1.1</td>
<td>1.10</td>
<td>1.8</td>
</tr>
<tr>
<td>2021</td>
<td>1.4</td>
<td>1.35</td>
<td>2.9</td>
</tr>
</tbody>
</table>

- Estimates are means of 7 models – details available upon request
- 2020 Chinook estimates include jack counts as a covariate
- Snake R. summer run included with spring run, Up Col. R summer run included with fall run
Life Cycle Models and Climate Effects

Crozier et al. 2021. Communications Biology
https://doi.org/10.1038/s42003-021-01734-w
Rapid Declines in a Changing Climate

Crozier et al. 2021. Communications Biology https://doi.org/10.1038/s42003-021-01734-w
What if climate only impacted a single life stage?

Percent of spawning adults left by the 2060s

Crozier et al. 2021. Communications Biology https://doi.org/10.1038/s42003-021-01734-w
Carryover Effects on Ocean Survival

We Have Management Options

- Riparian and floodplain restoration
- Estuary Restoration Act

Fishery Management Plans:
- Coastal Pelagic Species
  - Hake
  - Salmon
- Colony management

Marine Mammal Protection Act
Pinniped Removal Program

- Smolt body size and timing
- Carryover effects
- Zooplankton, invertebrates, fish larvae
- Prey
- Anchovy
- Competitors
- Prey
- Hake
- Competitors
- Other Fisheries
- Indirect effects
- Seabirds
- Predators
- Marine mammals
• We saw widespread and significant improvement in recent ocean conditions

• This is not the beginning of a general upward trend, but a temporary respite in a long-term decline

• Carry-over effects from the river and estuary represent important existing management levers

• But it is not enough - now is the time to ramp up marine science efforts to identify and inform additional management actions