Spatial and Temporal Patterns in the Returns of Hatchery- and Natural-origin Pink and Chum Salmon in Prince William Sound during 2013-2015

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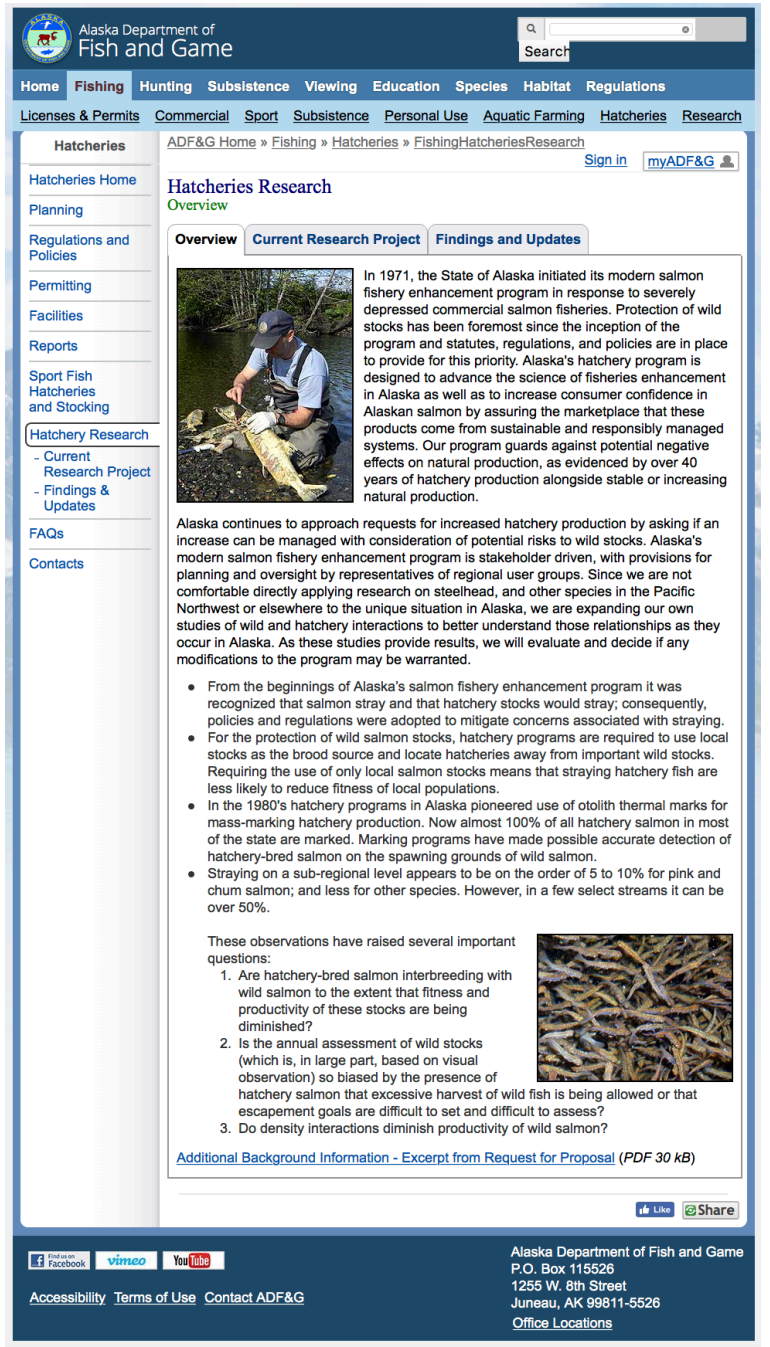
PRINCE WILLIAM SOUND SCIENCE CENTER

Alaska Hatchery Research Project

"Because of the value of hatchery production to Alaska's salmon harvest and its place in the international market, and the state's mandate that hatchery production be compatible with sustainable productivity of wild stocks, Alaska Department of Fish and Game (ADF&G) and Private Nonprofit (PNP) salmon hatchery corporations have recognized the need for a research program ***addressing the concerns about escapement assessment and genetic and ecological interactions between hatchery and wild salmon stocks****. In July, 2011, ADF&G convened a Science Panel composed of current and retired scientists from ADF&G, University of Alaska, PNP corporations, and the National Marine Fisheries Service. The Panel members have broad experience in enhancement, fisheries management, pathology, genetics, and biometrics pertaining to wild and hatchery salmon interactions; they designed and guided this research."*

Alaska Hatchery Research Project

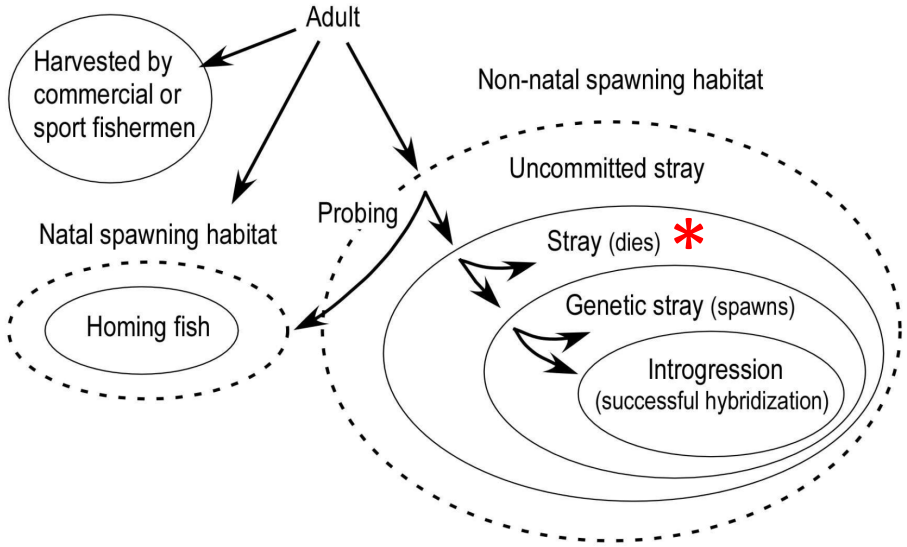


Objectives

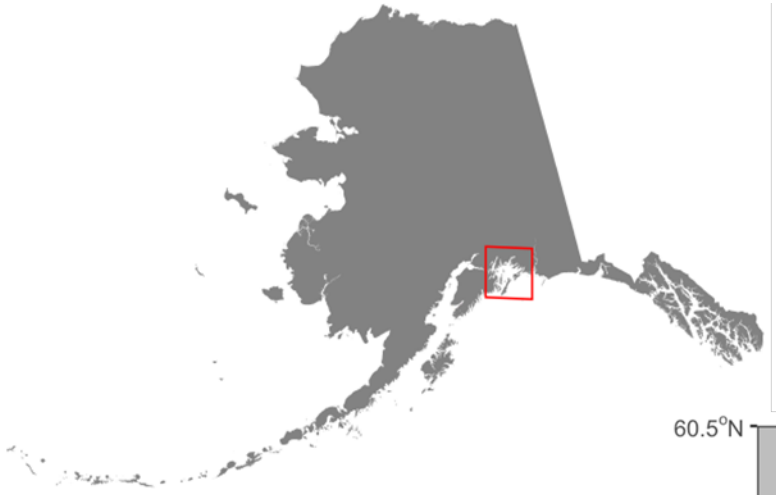
- Focus was on estimating total run size for natural- and hatchery-origin pink and chum salmon during 2013-2015 based on *unbiased estimates of hatchery fractions* (ocean test fishing and stream surveys).
- Explore spatial and temporal patterns in the data to describe differences in spatial distribution and timing between natural- and hatchery-origin salmon.
- Working toward first, peer-reviewed product generated from the Alaska Hatchery Research Project.

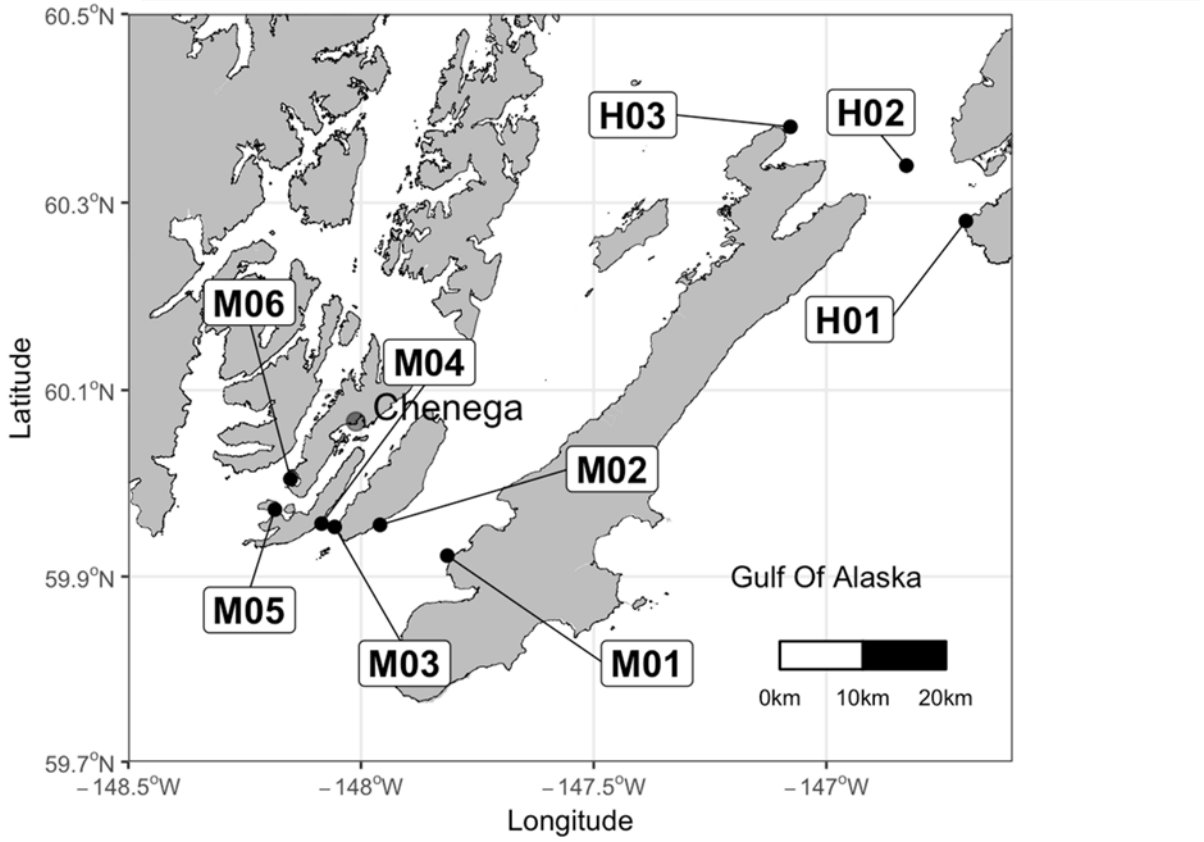
Key definitions

- *Natural-origin:* Fish originating from natural spawning parents.
- *Hatchery fraction*: Percentage of the natural spawning population that originated in a hatchery.
- *Hatchery stray rate*: Percentage of the total hatchery-origin salmon run that enter spawning streams.



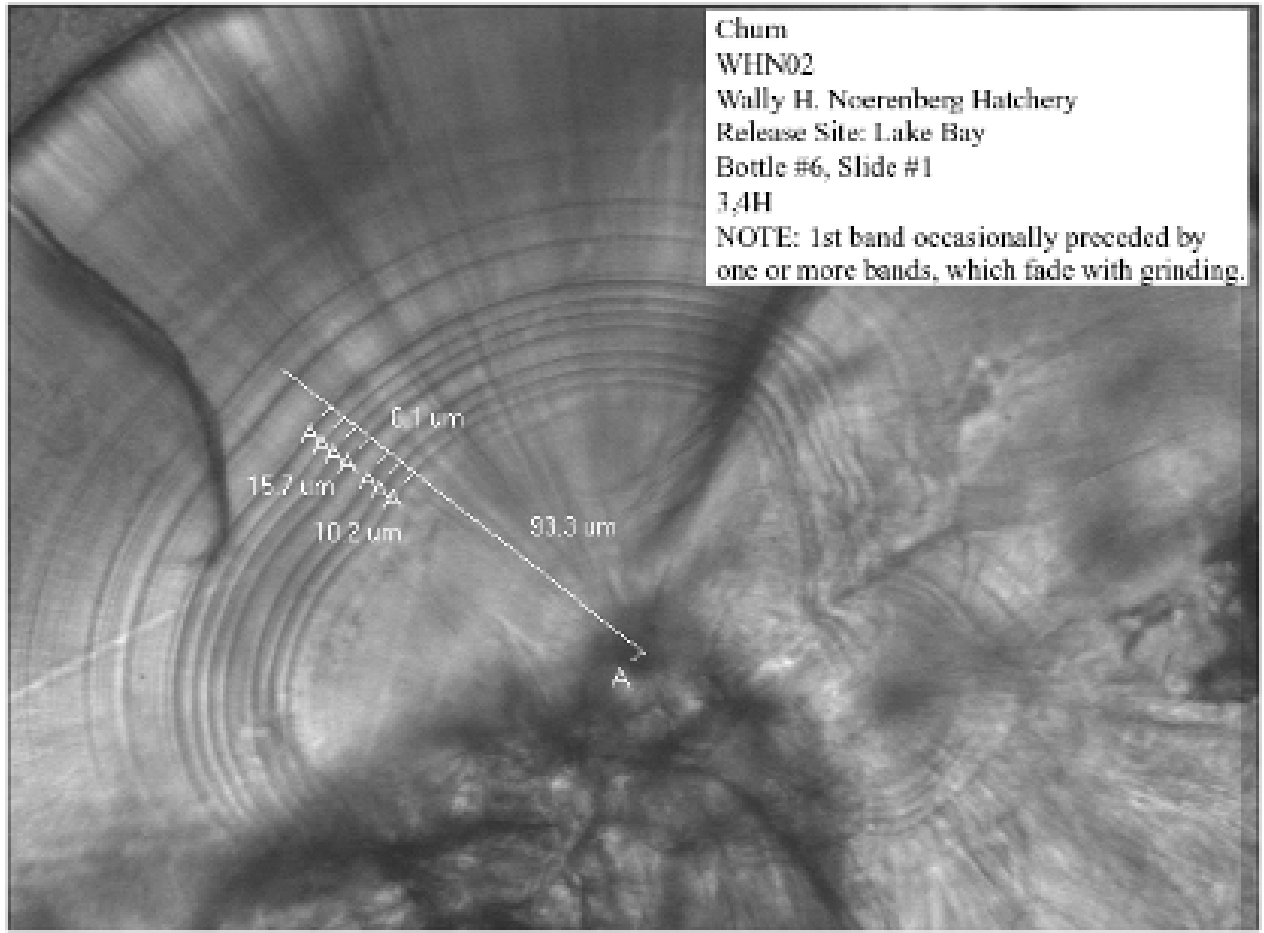
Ocean sampling



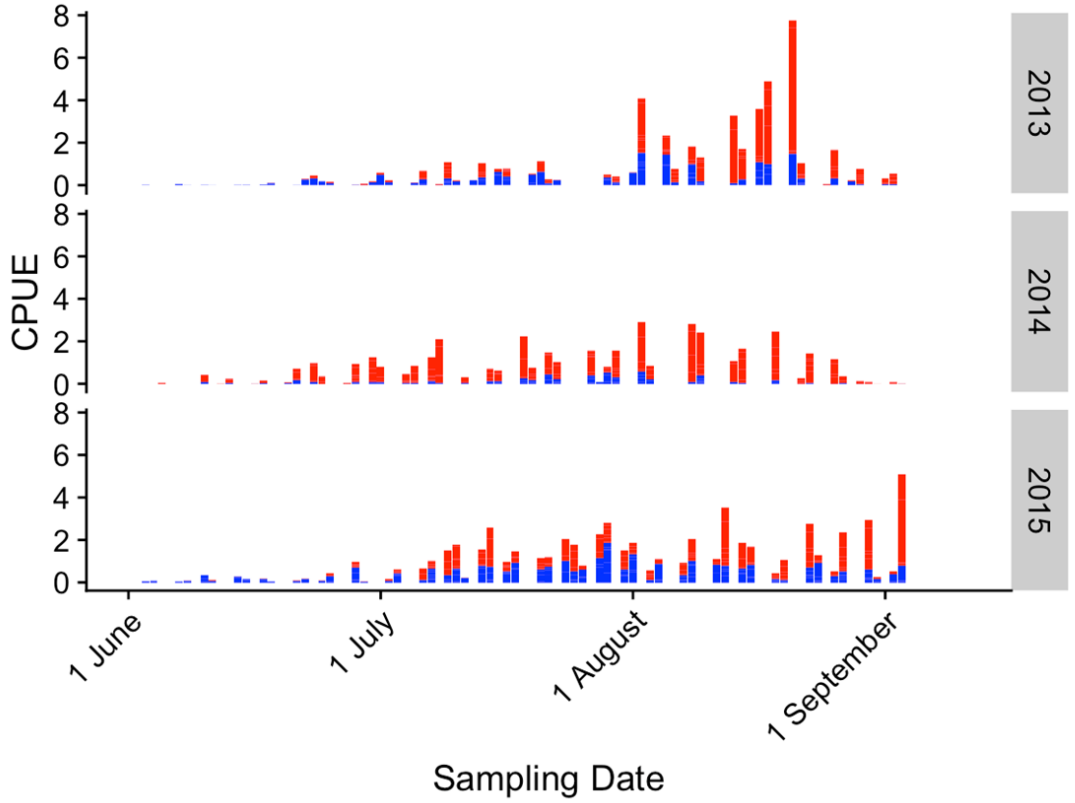


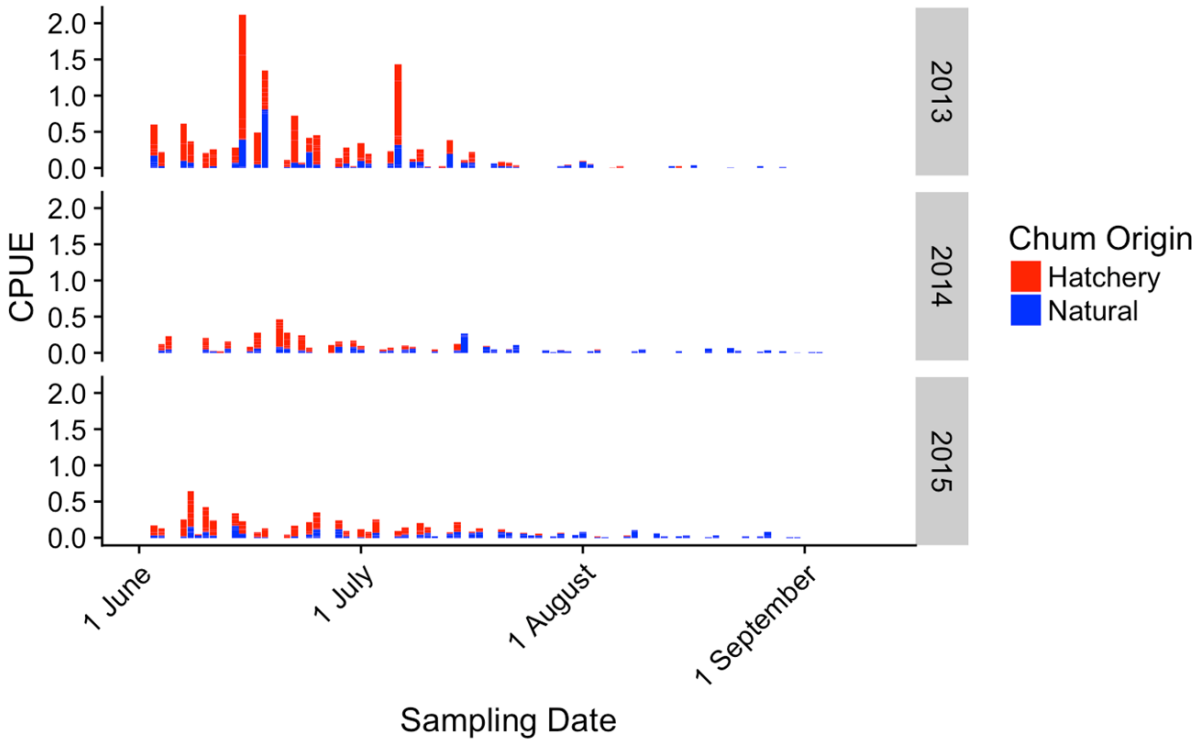
Ocean test fishing

Cordova Otolith Lab, ADF&G

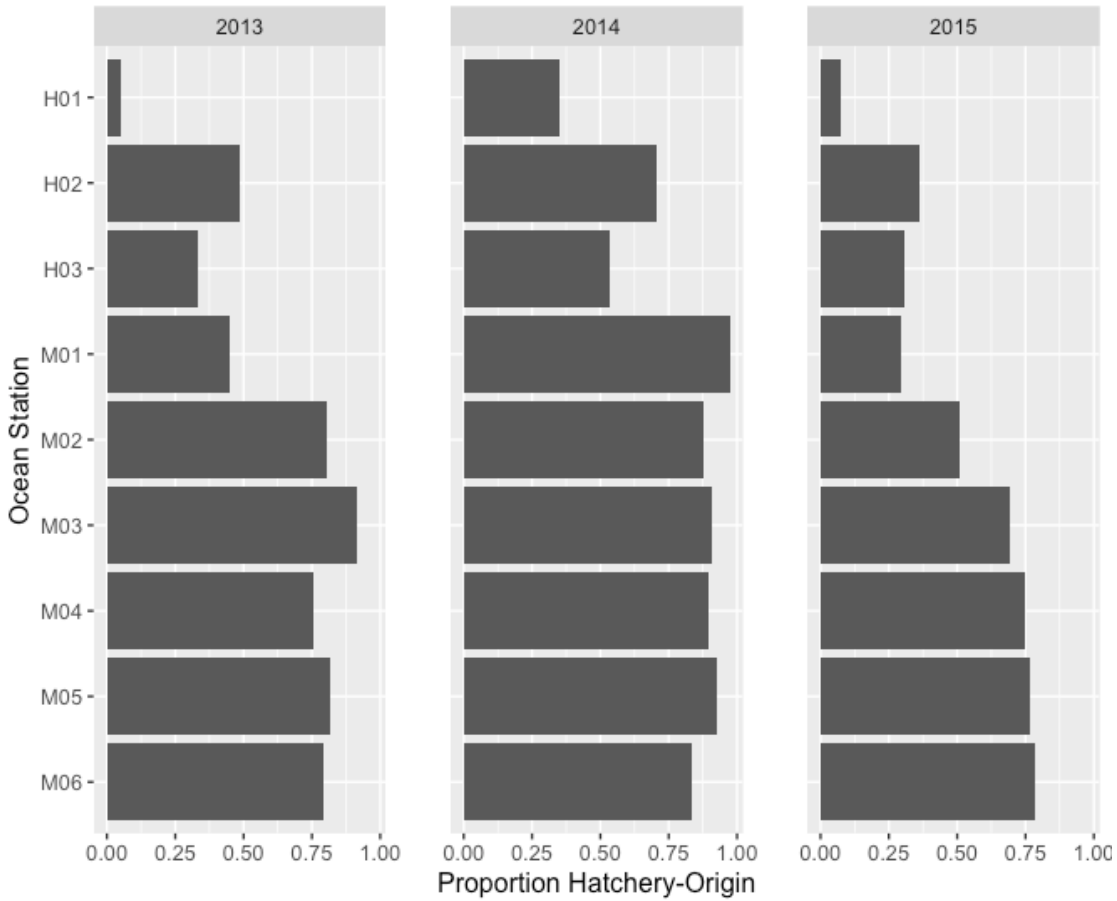


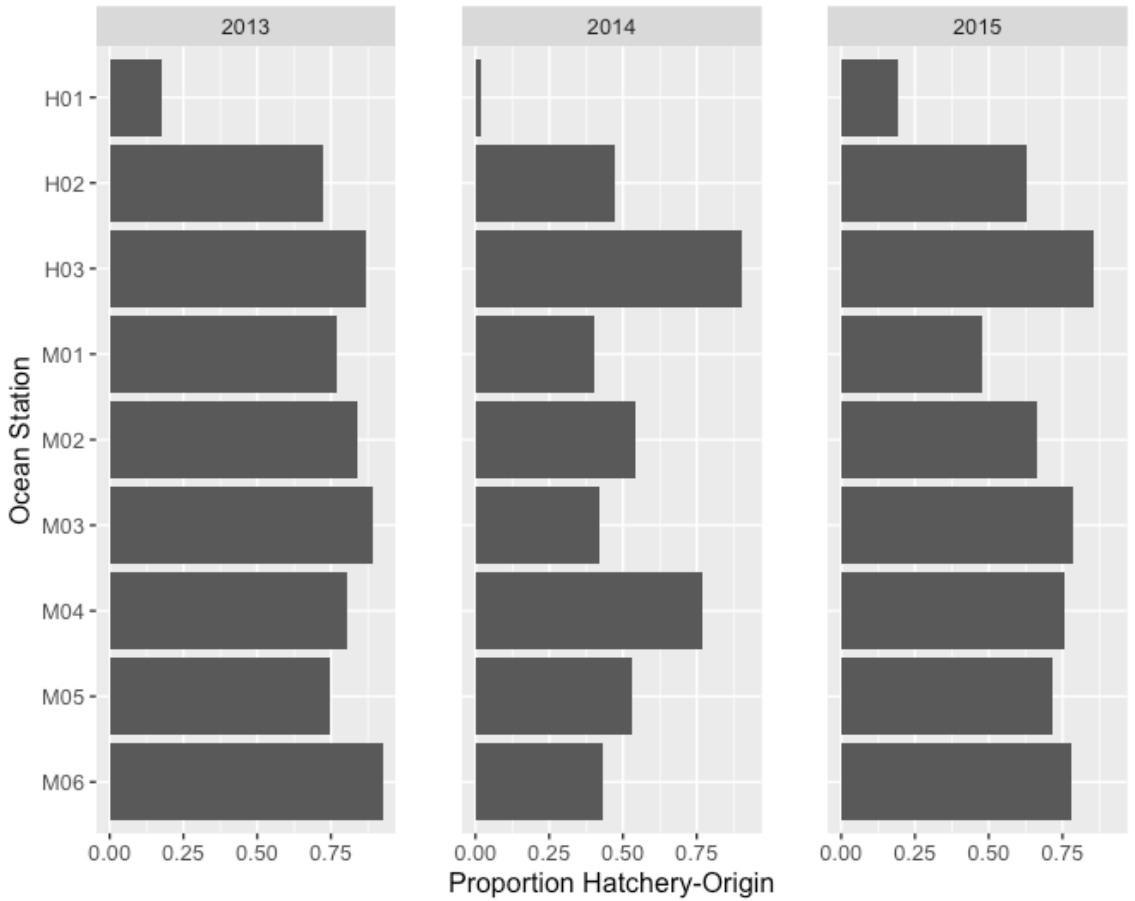
CPUE, over time at ocean stations



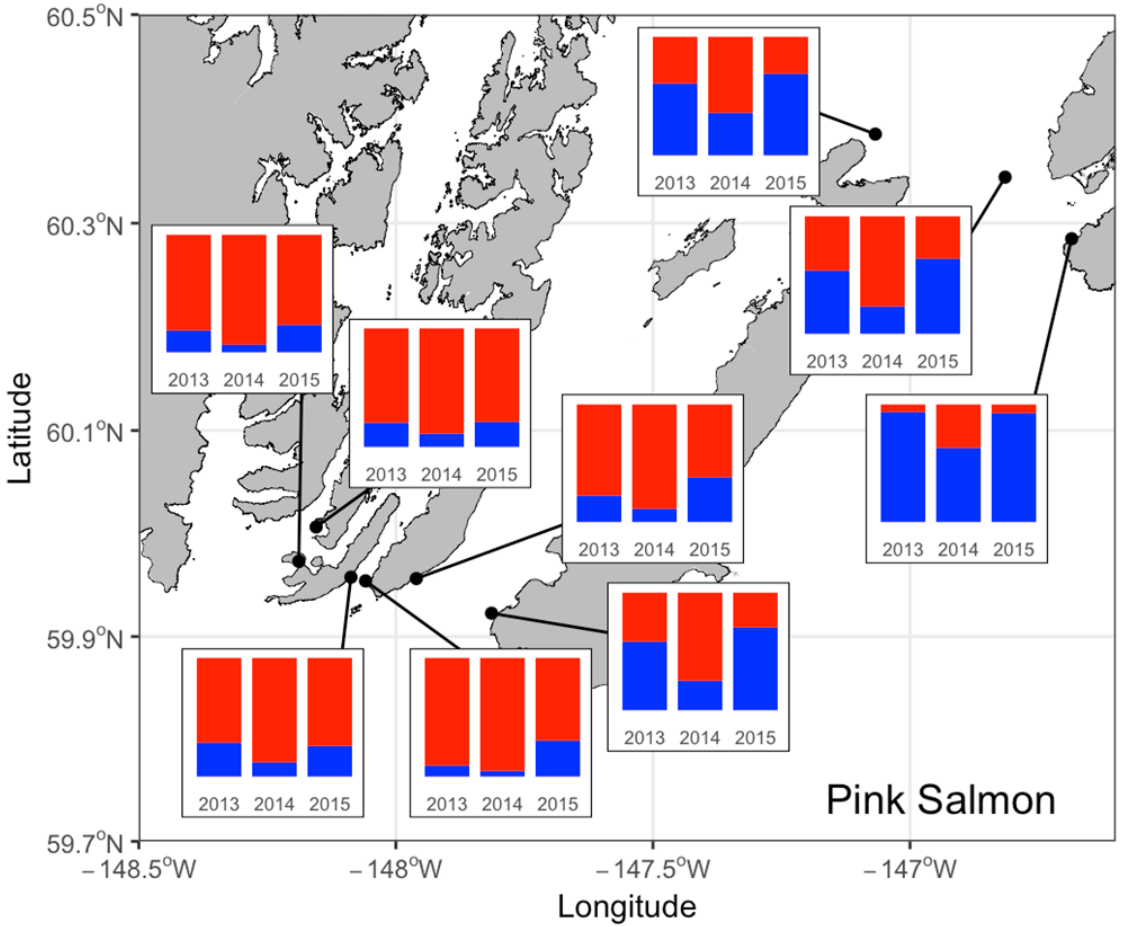


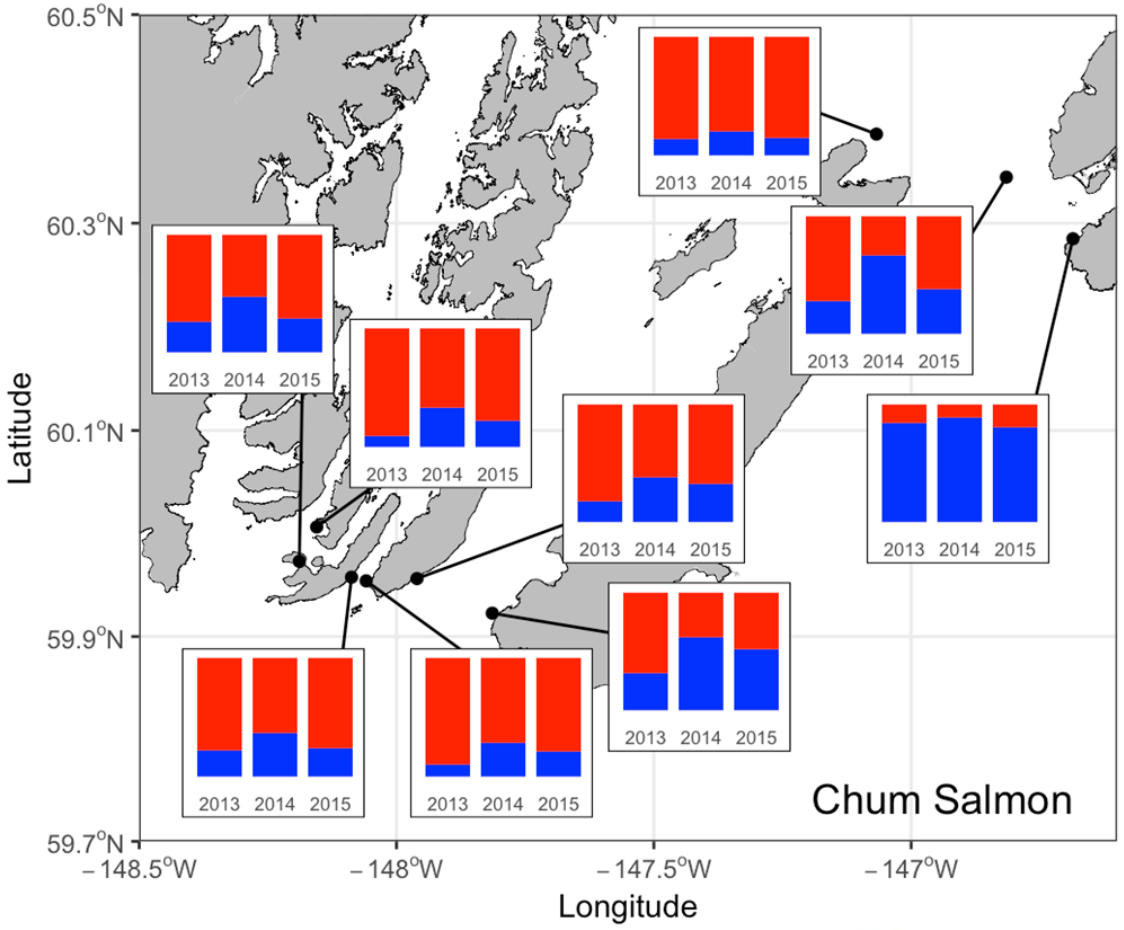
Hatchery fraction by ocean station



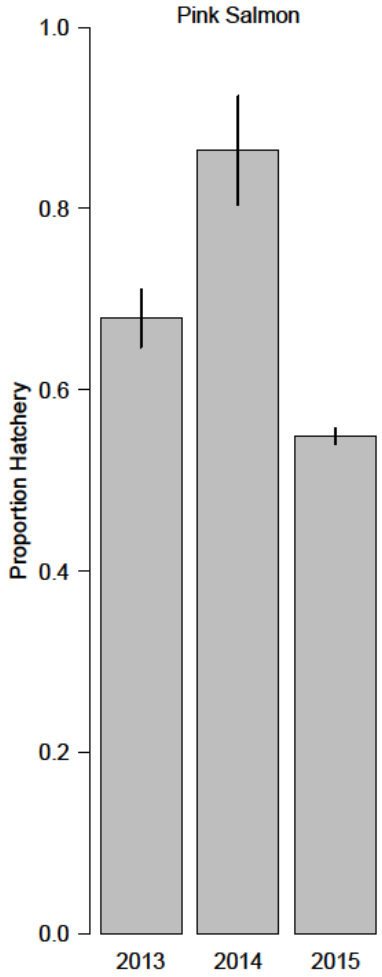


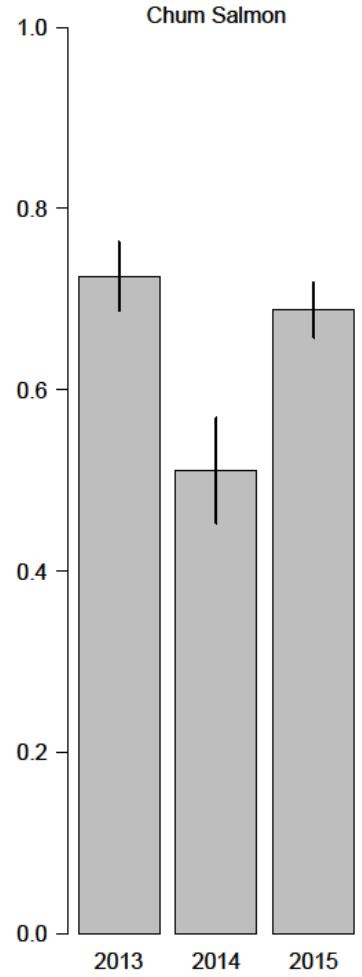
Annual summary of hatchery fractions



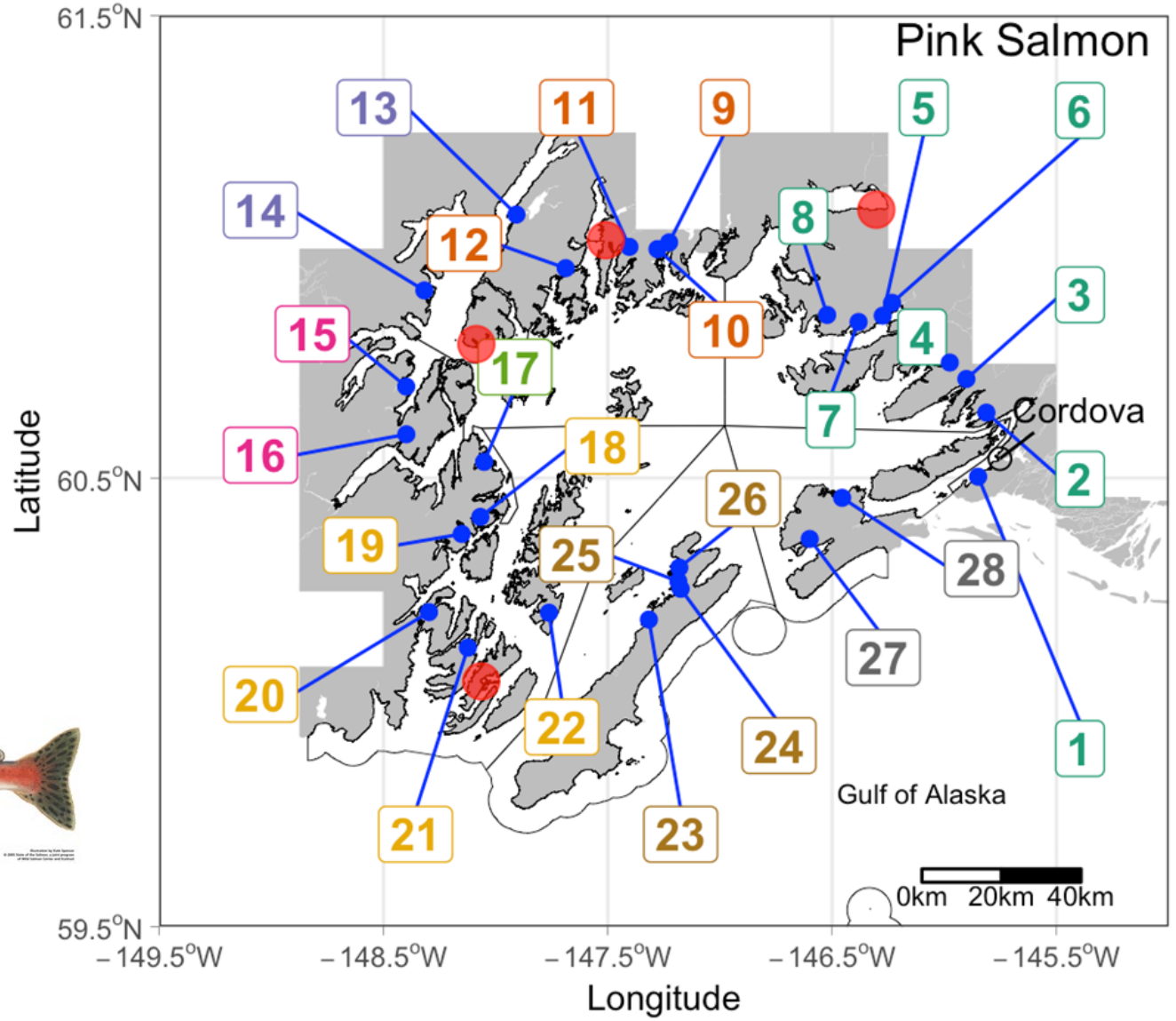


Hatchery fraction in PWS run

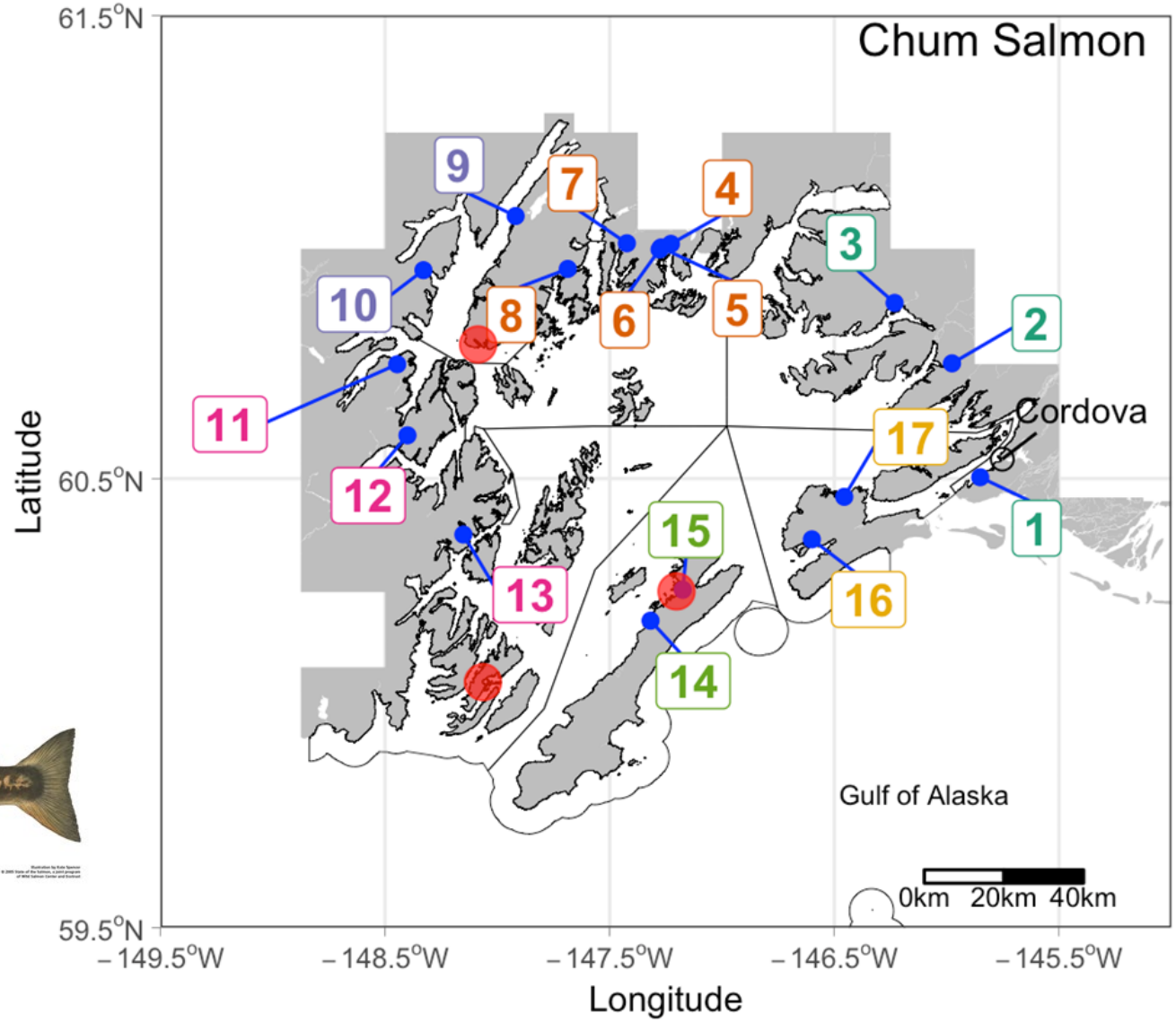




Stream sampling



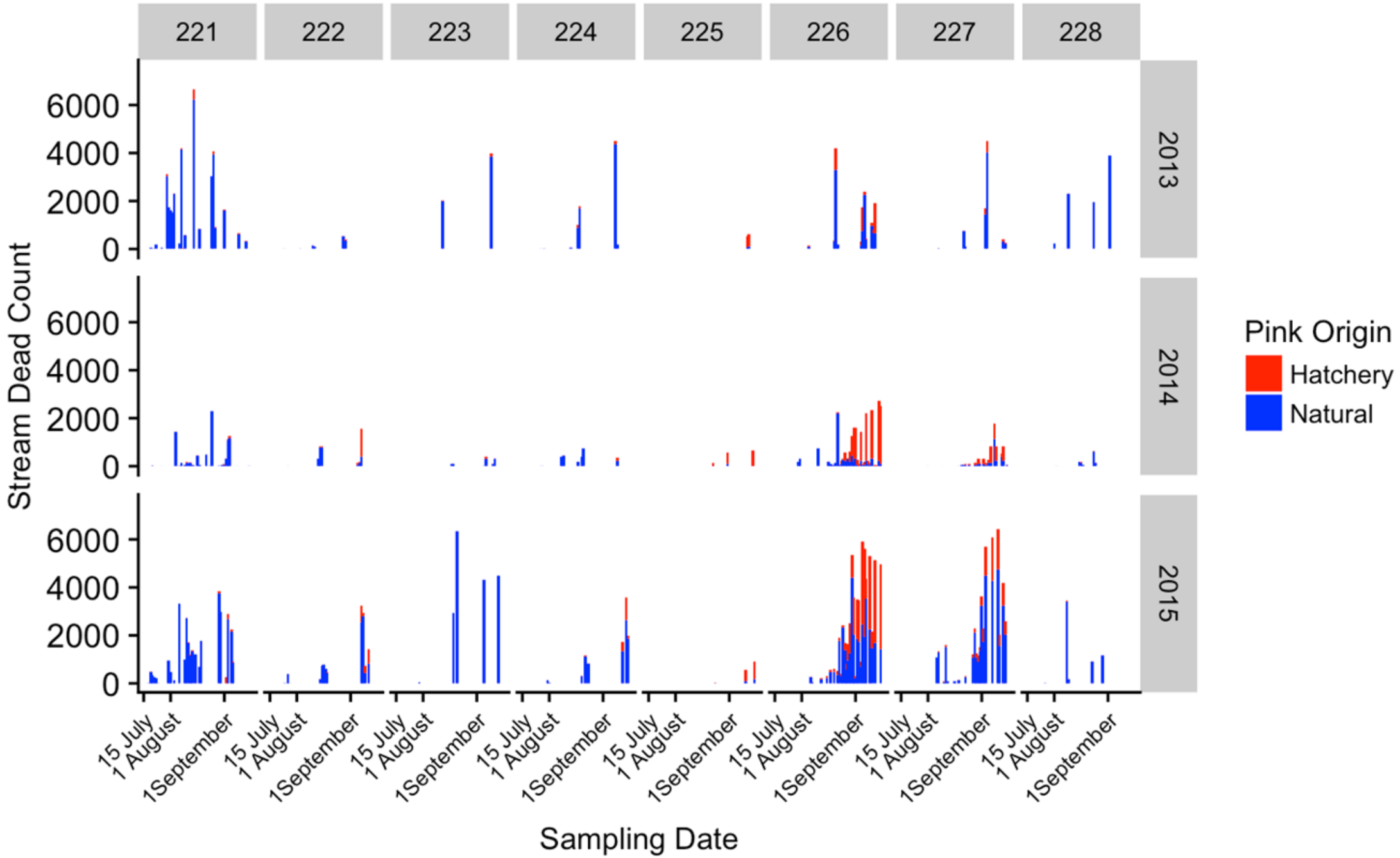
Stream sampling

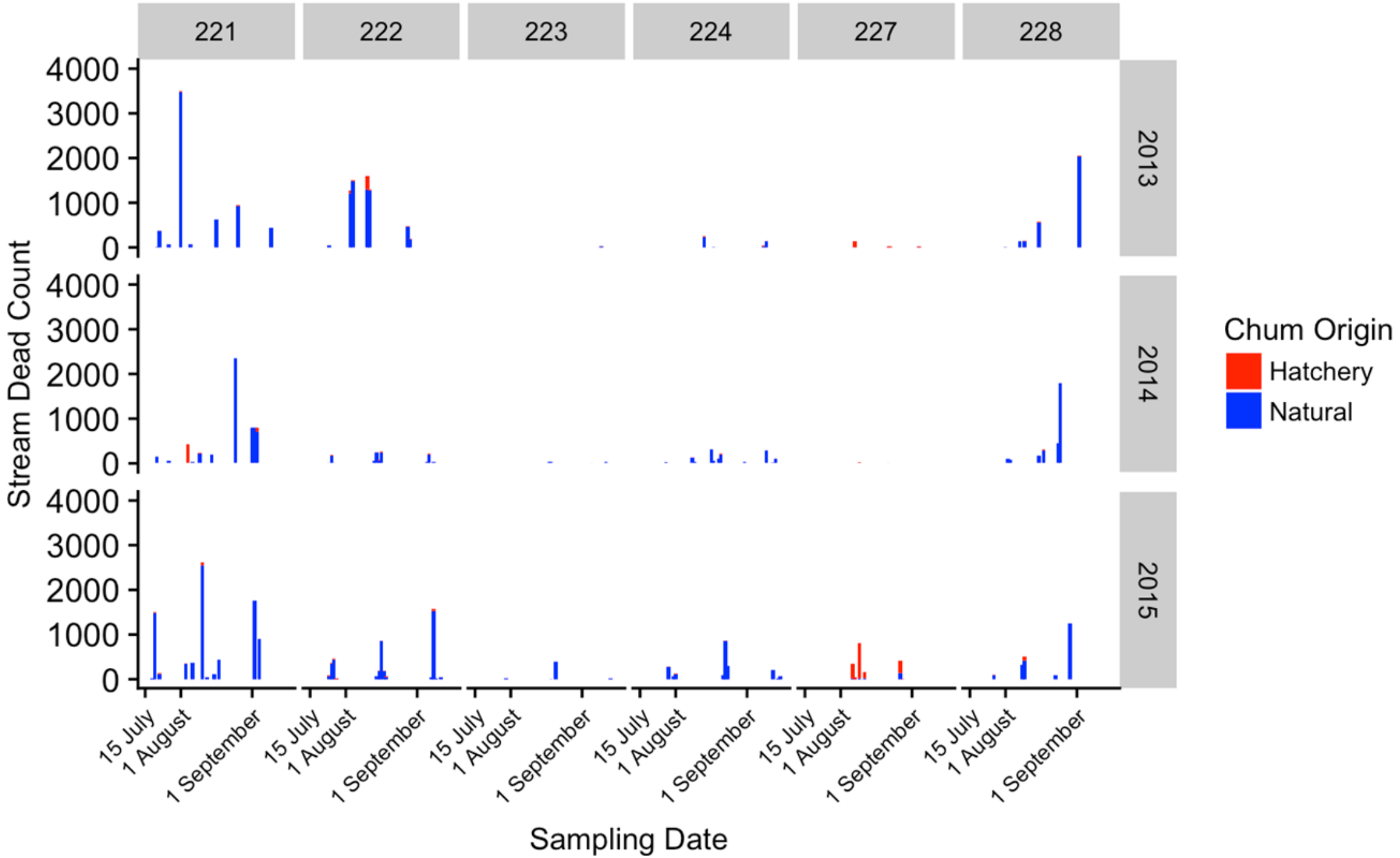


Stream sampling

Stream sampling

Sampling protocols


221
222
223
224
225
226
227
228
2013
2014
2015
Stream Dead Count
6000
4000
2000
0
15 July
1 August
1September
Sampling Date
Pink Origin
Hatchery
Natural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2013
2014
2015
Stream Dead Count
4000
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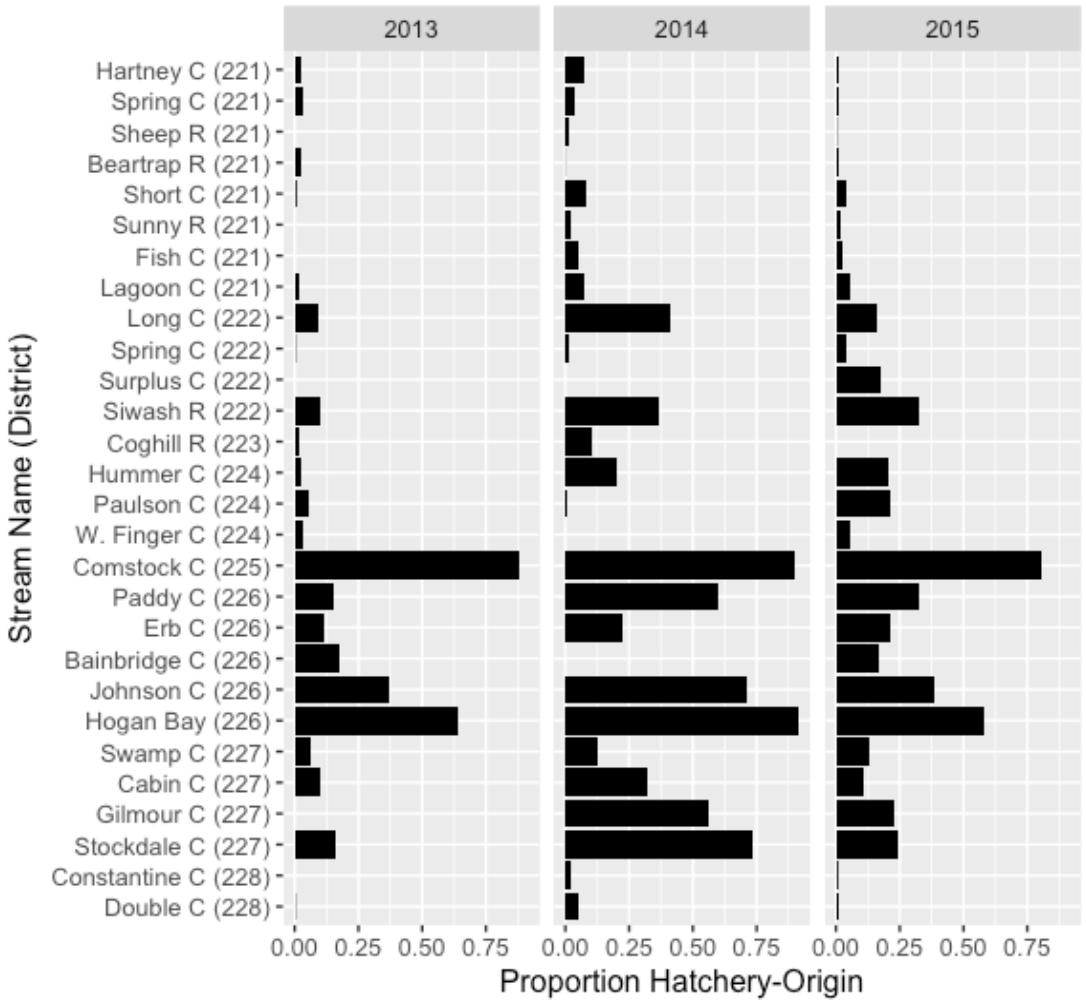
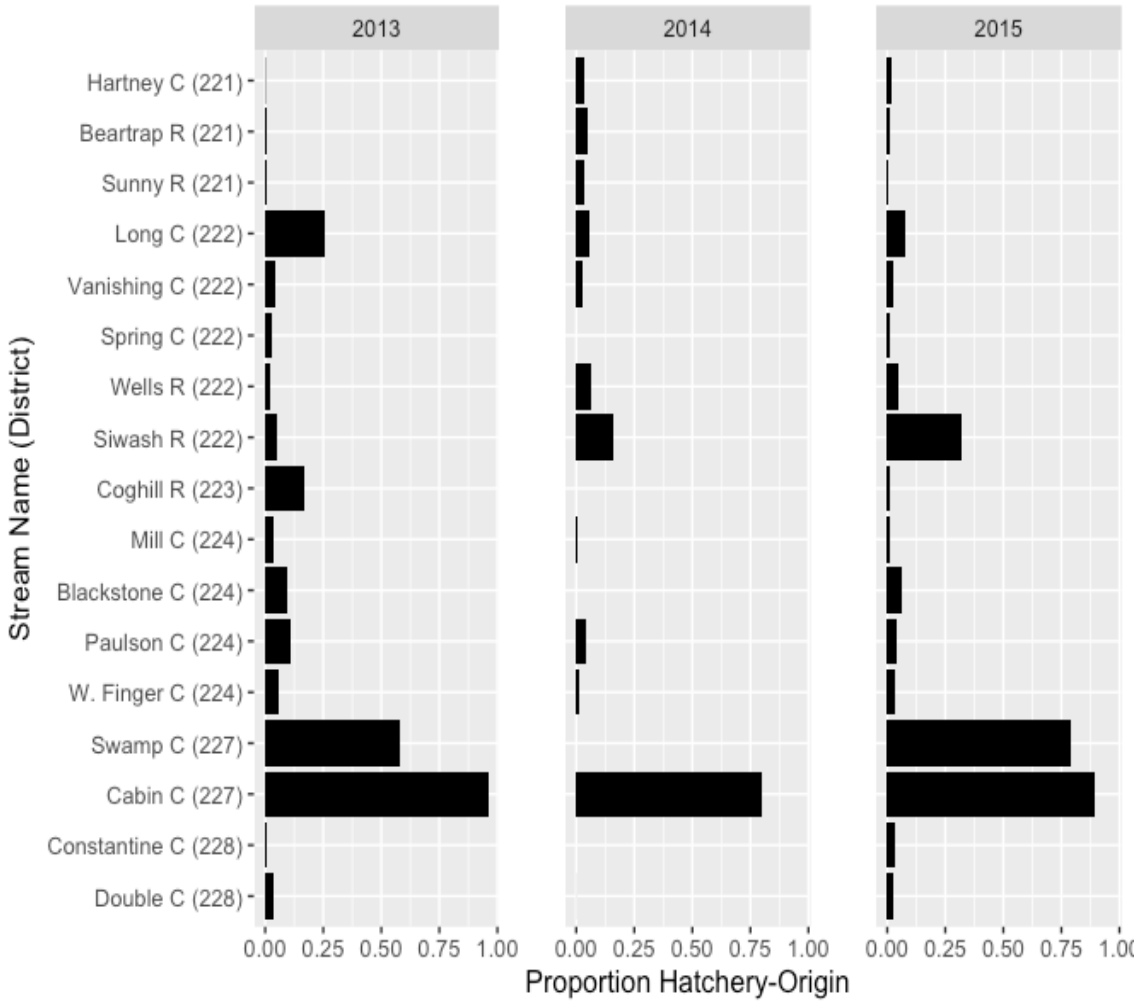
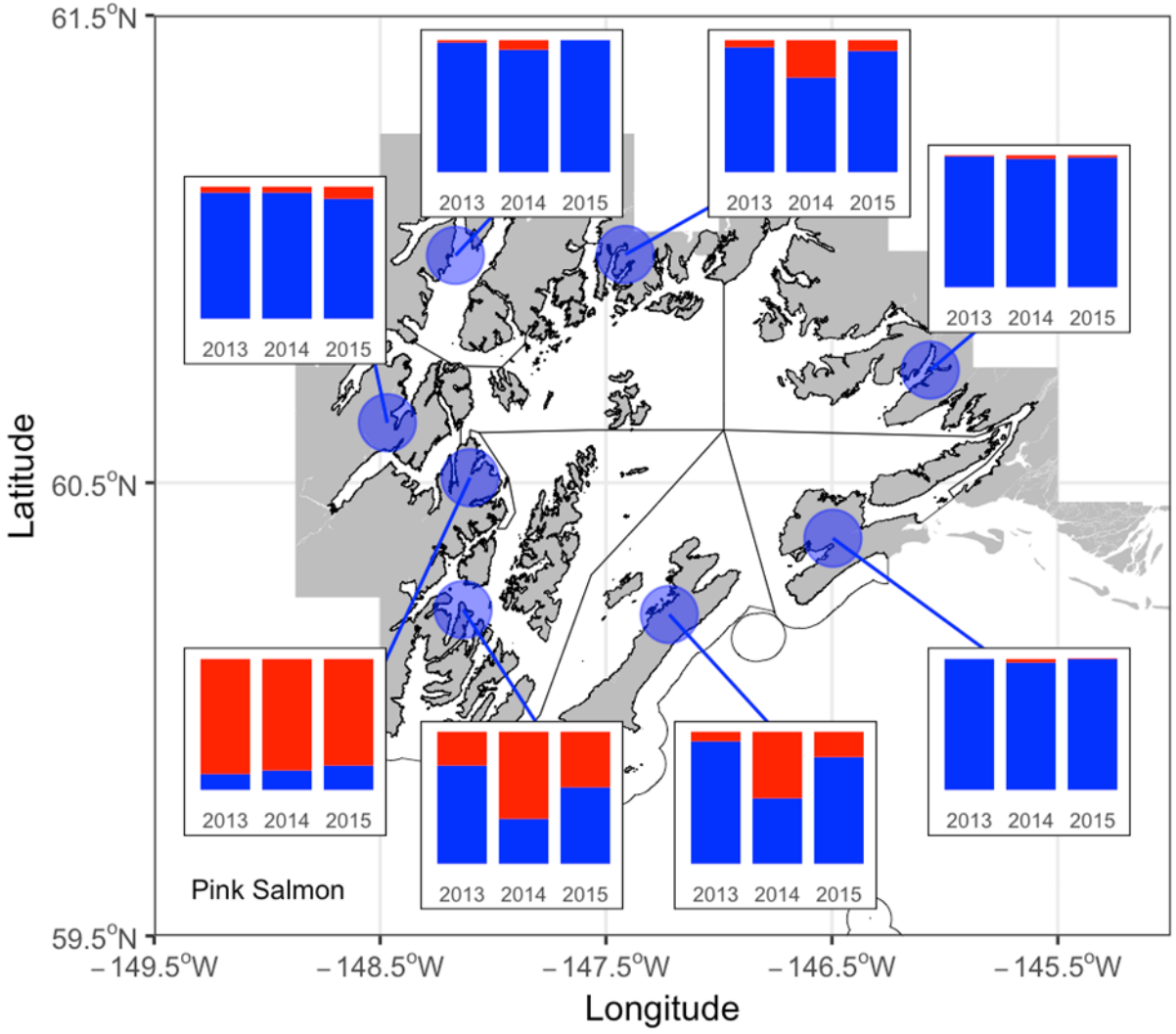
2000
1000
0
15 July
1 August
1 September
Sampling Date
Chum Origin
Hatchery
Natural

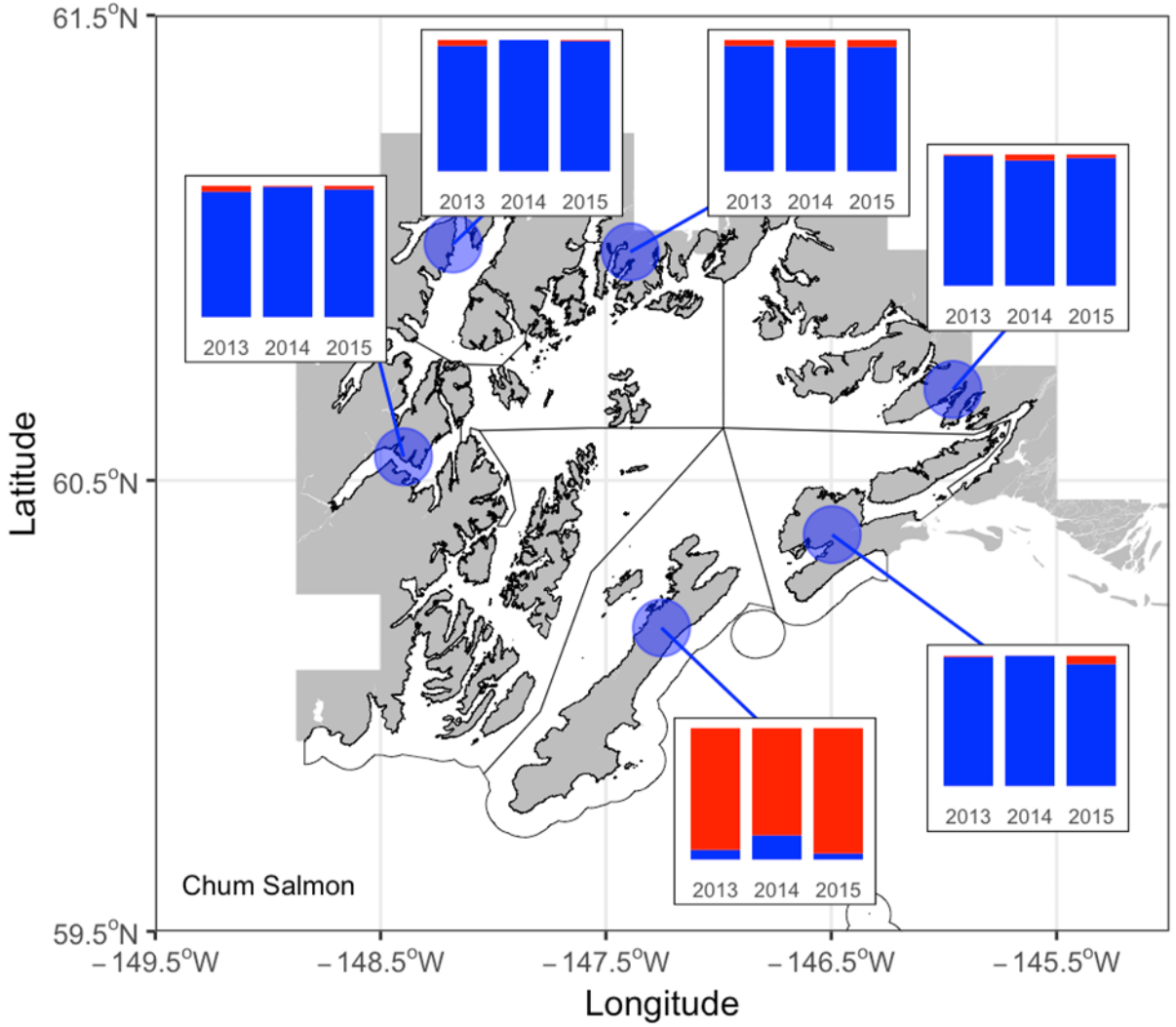
Hatchery fraction by stream





Stream results, district averages





Overall PWS hatchery fractions in spawning streams

Species	2013	2014	2015
Pink	4.4%	14.8%	9.5%
Chum	2.8%	3.2%	3.1%

Key results

- Spatial patterns:
  - Pink
    - Natural-origin fish tend to enter PWS through eastern corridors
    - Eastern district streams tended to have lower hatchery fractions
  - Chum
    - Higher hatchery fraction observed at H3 (west Hinchinbrook Entrance)
    - High hatchery fractions on Montague Island (District 227).
- Temporal patterns:
  - Natural-origin pink salmon tend to return earlier than hatchery-origin individuals
  - Natural-origin chum salmon tend to return later than hatchery-origin individuals
- Context is important!
  - Overall, hatchery fraction in streams is relatively low, but in some streams it is high.
  - Underscores need to look at the ecological implications of N and H crosses.

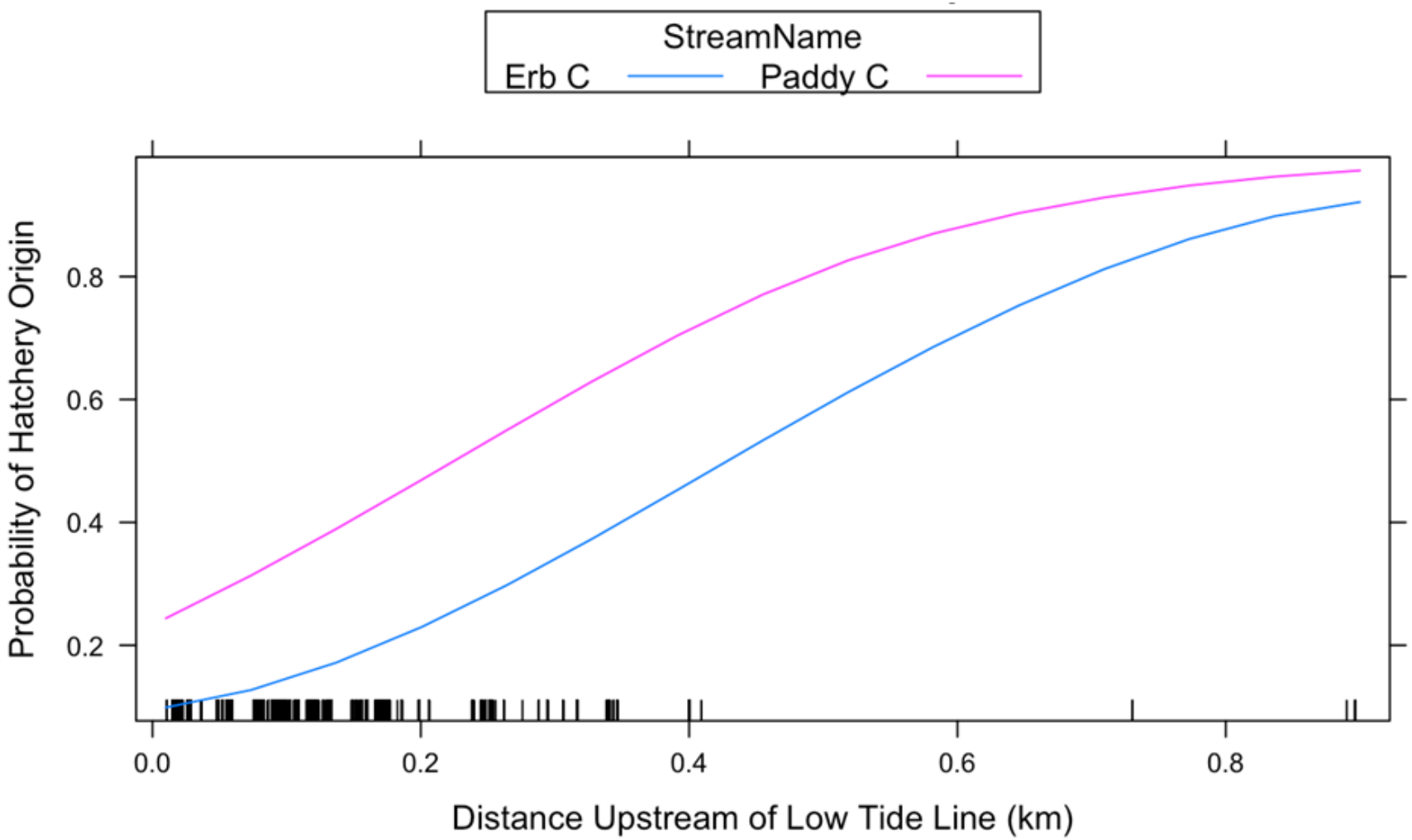
Acknowledgements

- Gratitude toward the PWSSC field crews for dutifully carrying out the field work with great attention to detail. A few in particular stand out: Julia McMahon, Megan Roberts, Neil Durco, and Garrett Dunne.
- Amazing contribution by Brad Reynolds for carrying out all three years of test fishing for this project.
- Special thanks to staff of the ADF&G Cordova Otolith Lab for otolith reading and Rick Busch at Resource Data, Inc. for managing our field data.

Future

- Despite significant investment in research on this topic, we still lack an understanding of basic ecological processes related to straying and interactions.
- Important themes include:
  - Examination of fitness-related traits (secondary sexual characteristics, stream life, egg retention)
  - Closer examination of freshwater and intertidal spawning, habitat selection
  - Factors affecting homing and straying
- We realize the greatest benefits by industry, management and scientists working together rather than in silos.
- Need to investigate potential changes to management to minimize risk.

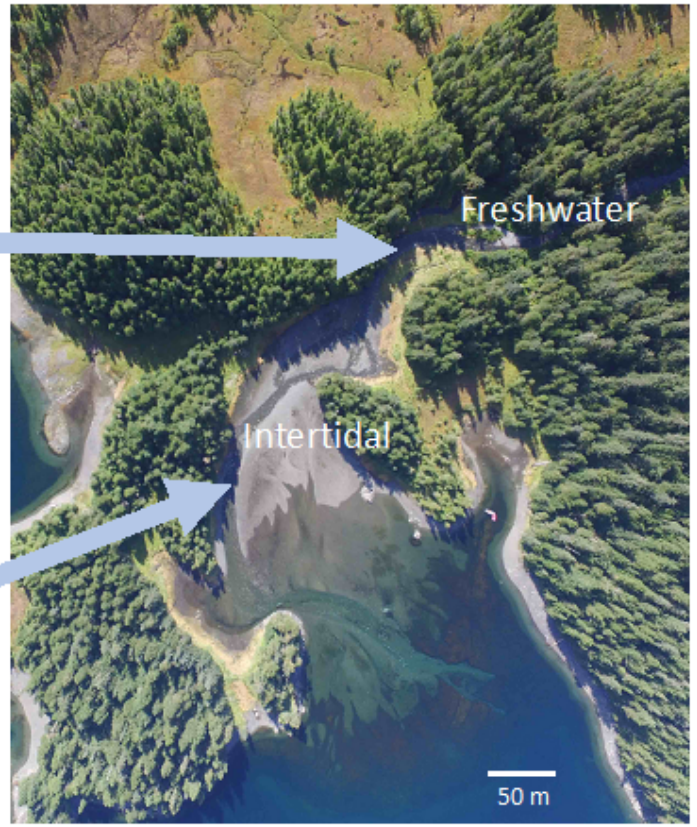
Habitat Use Within Stream



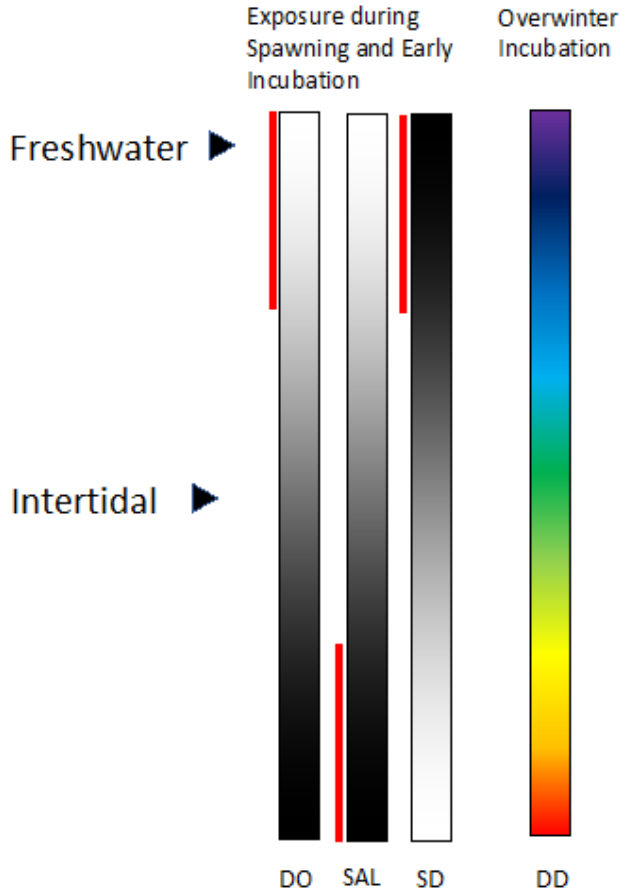
Proposed ecological studies

Stray hatchery-origin spawners (H)

Natural-origin spawners (N)



Erb Creek, Prince William Sound, Alaska



Progression of spawning season →

Proposal submitted to: NFWF