Ocean migration and behavior of steelhead kelts from the Situk River, Alaska

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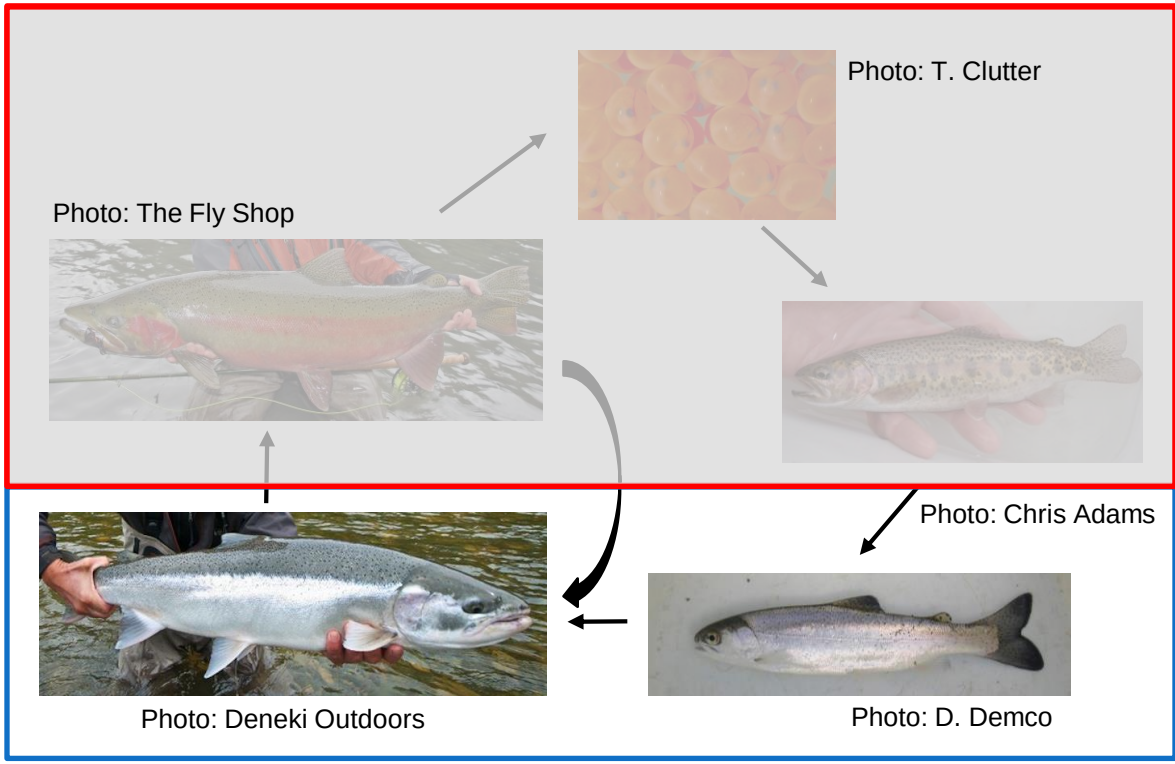
Introduction

- Steelhead is an iconic species found throughout North America
- Anadromous
- Iteroparous

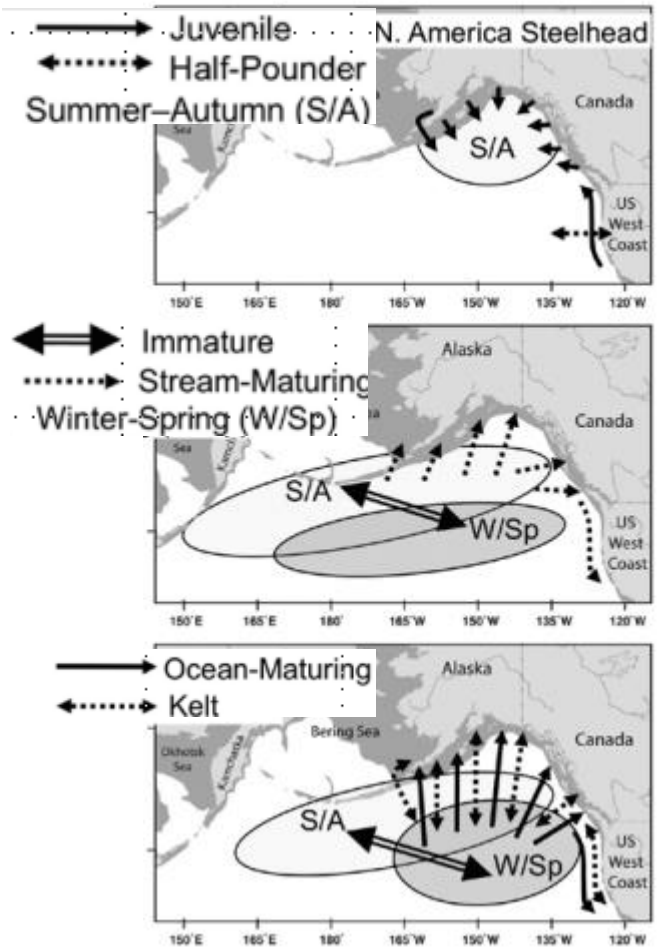
- Most research focused
  - Freshwater juveniles
  - Returning adults

- Little is know about this species' ocean ecology



Introduction

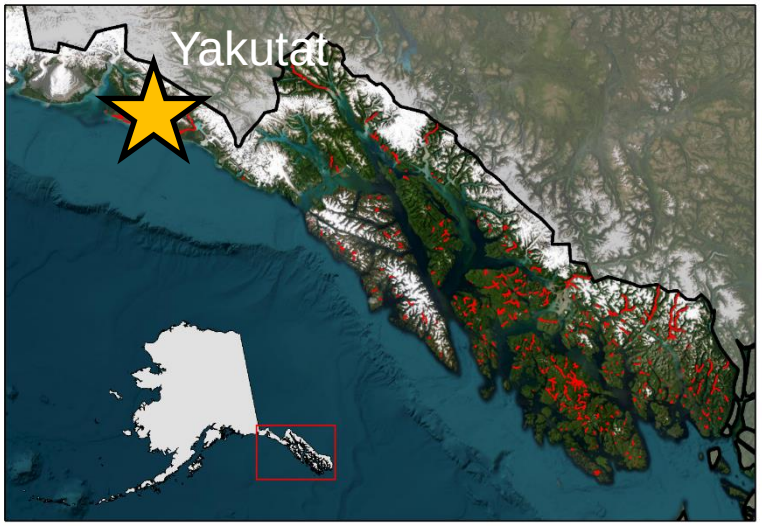
- Ocean ecology knowledge gaps
  - Infrequently encountered
  - Little directed research
- Ocean distribution inferred from
  - Historic high seas research
  - Opportunistic tagging
- Stock-specific and kelt migrations remain speculative and poorly understood
  - Few tag recoveries
  - Insufficient genetic baselines



Myers 2018

Introduction

- Popular sportfish in SE Alaska
- Over 300 populations
- Most populations <200 spawners per run



- Situk River
  - Most prolific steelhead producer in AK
    - Annual downstream kelt counts ~3-15K fish
  - Destination for anglers from around the world

Introduction

- Use satellite telemetry to characterize
  - Movement
  - Survivorship
  - Diving behavior
  - Thermal environment

Methods

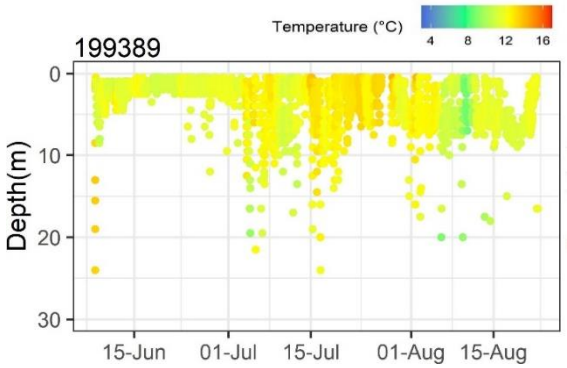
- Pop-up satellite archival tags (PSATs)
  - Measure and archive environmental data
  - Detach, float and transmit archived data
  - End location is determined
  - Fisheries independent!

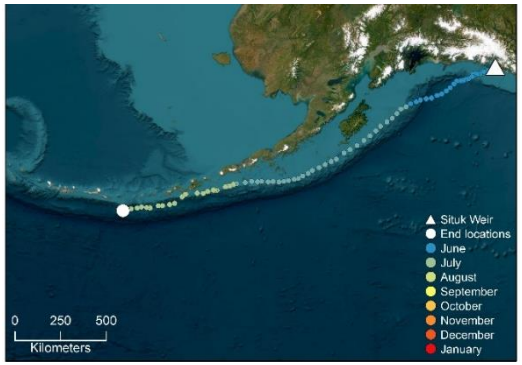
Methods

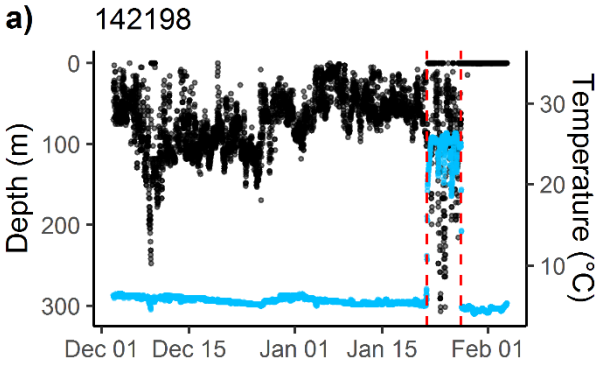
- ADFG Situk River Weir
  - Annual steelhead kelt counts
  - Trap ~20 Kelts daily for ASL
- Opportunistically tagged kelts
  - 2018, 2019, 2020 (n= 63)
  - Mostly female
- Attached PSATs
  - MiniPATs
  - Proven methods used on other salmonids

Methods

- To infer movement and behavior while at liberty, examine:
  - Depth and temperature
  - Hidden Markov Model for individual fish tracks
  - Mortality diagnosis







Seitz et al. 2019

Tolentino *et al. Anim Biotelemetry (2017) 5:3*
DOI 10.1186/s40317-016-0117-4

Animal Biotelemetry

TELEMETRY CASE REPORT Open Access

Was my science project eaten? A novel approach to validate consumption of marine biologging instruments

Emily R. Tolentino[1], Russell P. Howey[1], Lucy A. Howey[1], Lance K. B. Jordan[1*], R. Dean Grubbs[2], Annabelle Brooks[3], Sean Williams[3], Edward J. Brooks[3] and Oliver N. Shipley[3,4]

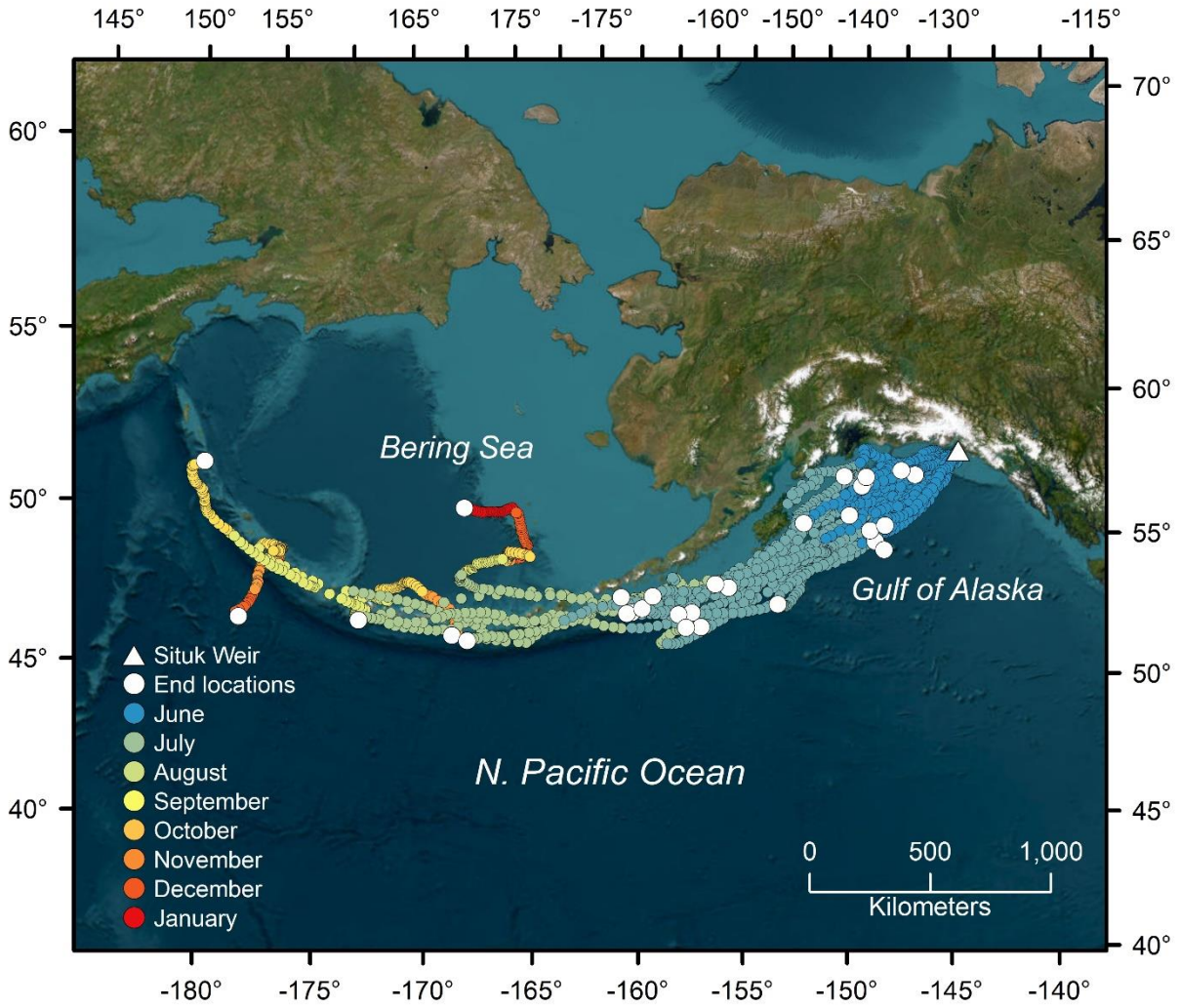
Results

- Summary
  - Of the 63 deployed PSATs
    - 59 PSATs reported to Argos satellites
    - 44 PSATs provided data on the ocean ecology
    - 30 PSATs provided >14 ocean days
  - In sum, PSATs provided over 2,000 days of depth, temperature and location data

Wildlife Computers Inc. MiniPAT

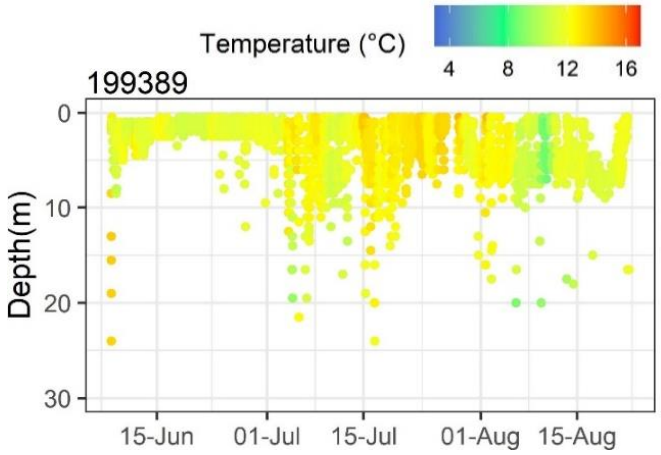
Results

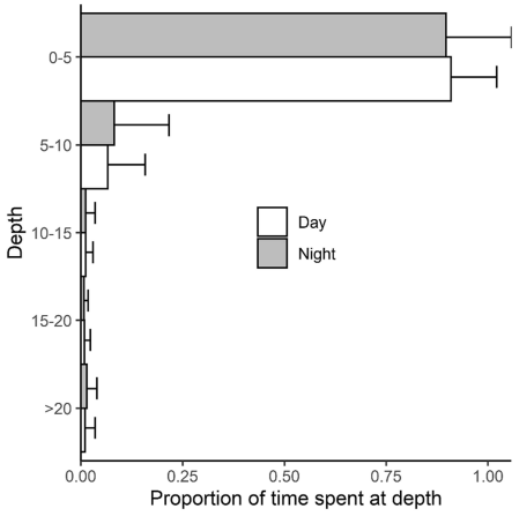
- Net movement west of tagged steelhead
- Similar movement patterns among years
- Track lengths up to 3,800 km



Results

- Depth and temperature occupancy
  - Mostly in the first 5 m of the water column
  - Occasionally dived to 15–20 m
  - Experienced thermal environment of from 4 to 16°C
  - Behaviors similar among years
  - No diel behaviors observed



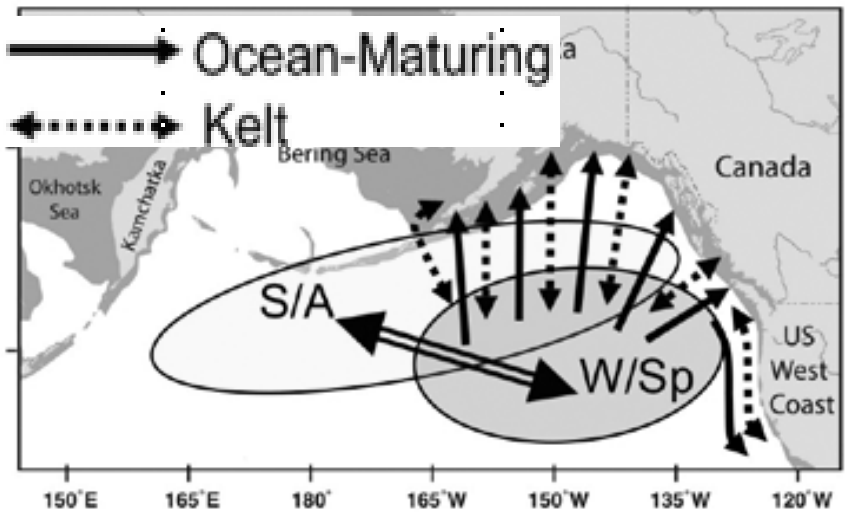


Results

- Ocean mortality (n = 30)
  - Ectothermic (n = 8)
  - Endothermic (n = 2)
  - Unknown (n = 20)

Discussion

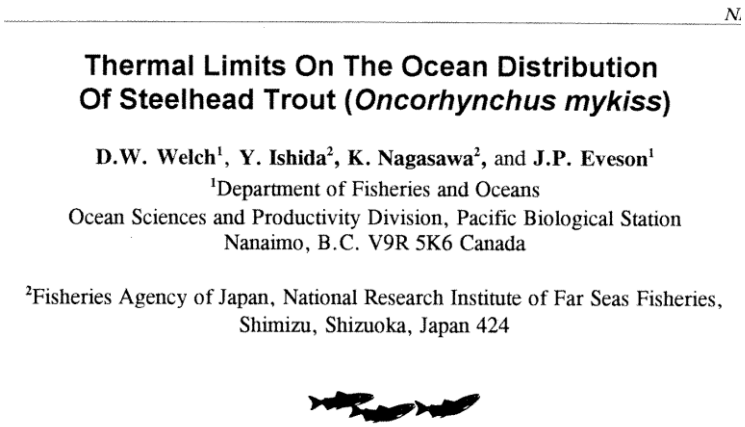
- Valuable step in understanding steelhead ocean ecology
- Steelhead generally follow conceptual migratory pathways
- Kelts may have more extensive migration than previously assumed



Myers 2018

Discussion

- Steelhead distribution influenced by thermal window
  - > 99.9% of all recorded temperatures between 5 and 15°C
  - Vertical distribution may also be related to these thermal limits
- Evidence of overwintering the eastern Bering Sea



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Thermal Limits On The Ocean Distribution Of Steelhead Trout (*Oncorhynchus mykiss*)

D.W. Welch[1], **Y. Ishida**[2], **K. Nagasawa**[2], and **J.P. Eveson**[1]
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Shimizu, Shizuoka, Japan 424

Discussion

- Largely surface oriented
  - Suggests feeding in surface waters
- Results are similar to past inferences on ocean ecology of steelhead
- Ocean diet not clearly understood

Discussion

- Mortality
  - Common
  - Widespread
  - Sharks
  - Pinnipeds

  - This research provides information on the times, locations, and agents of mortality


Photo:ODFW


Photo: Jennifer Idol

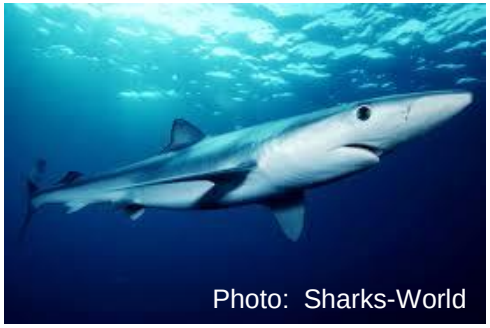
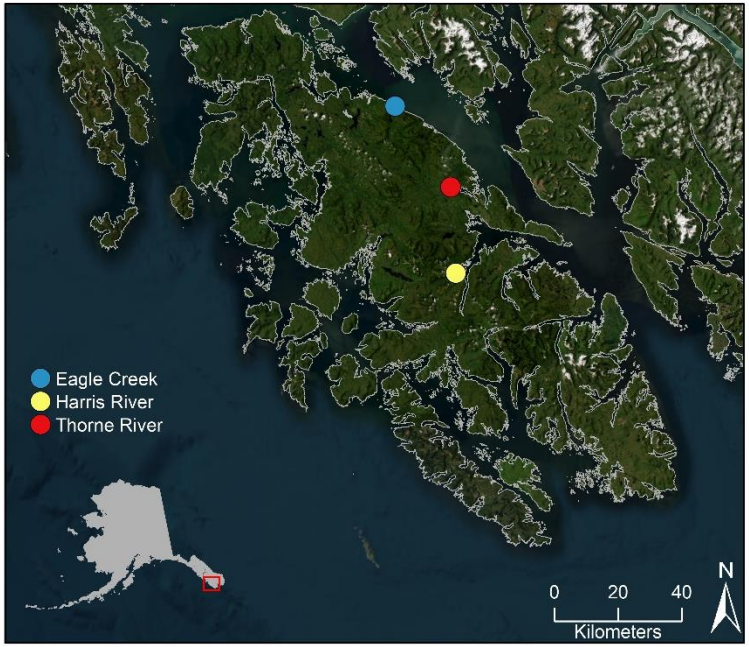


Photo: Sharks-World

Future

- 1) Environmental drivers of migration and distribution of steelhead
  - Led by MBA
  - Pseudo-absence habitat modeling approach
  - Situk River (Alaska) and Scott Creek (California) datasets
- 2) Mechanisms and timing of marine mortality
  - Situk River (Alaska), Scott Creek (California), and future datasets
  - Future datasets?
- 3) Future tagging on other systems throughout Alaska (UAF Seitz Lab)
  - Prince of Wales Island
    - Spring 2023
    - 15 tags on female kelts from three watersheds (n = 5)
    - Plan to conduct research for three seasons, but future funding is unknown



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Alaska Department of Fish and Game

Questions?

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