Reel Survival: Using acoustic telemetry to investigate recreational fisheries post-release survival of Chinook and Coho salmon

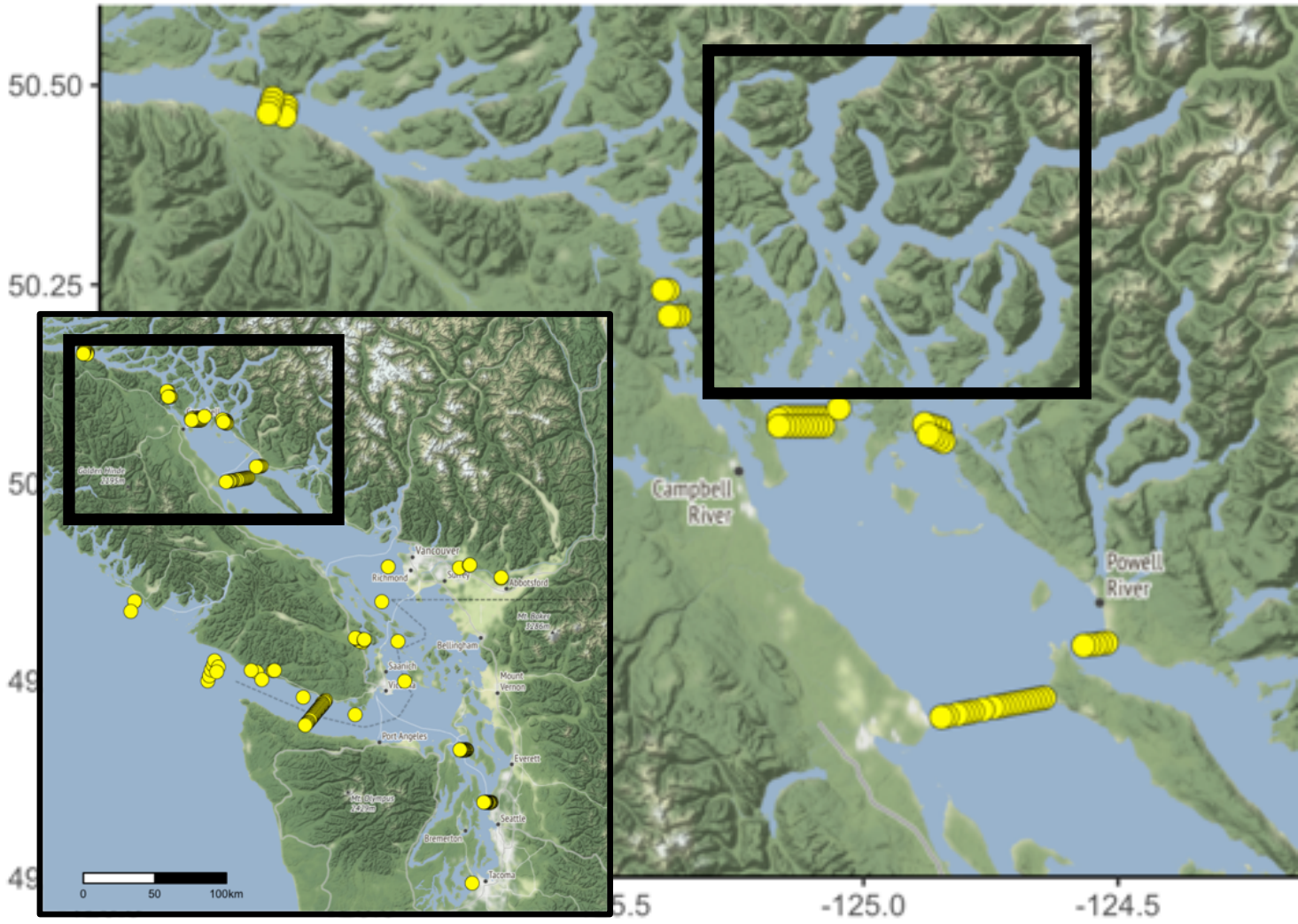
PACIFIC SALMON ECOLOGY & CONSERVATION LABORATORY

Stephen Johnston
stephen.johnston@ubc.ca
Scott Hinch, Brian Hendriks, Emma Cooke,
Aswea Porter, Erin Rechisky, David Welch

Chinook Catch and Release Study Site

- Discovery Islands
  - 44 stationary receivers position within major migration routes
- N. Strait of Georgia
  - 29 receivers on east and west side of Texada Island

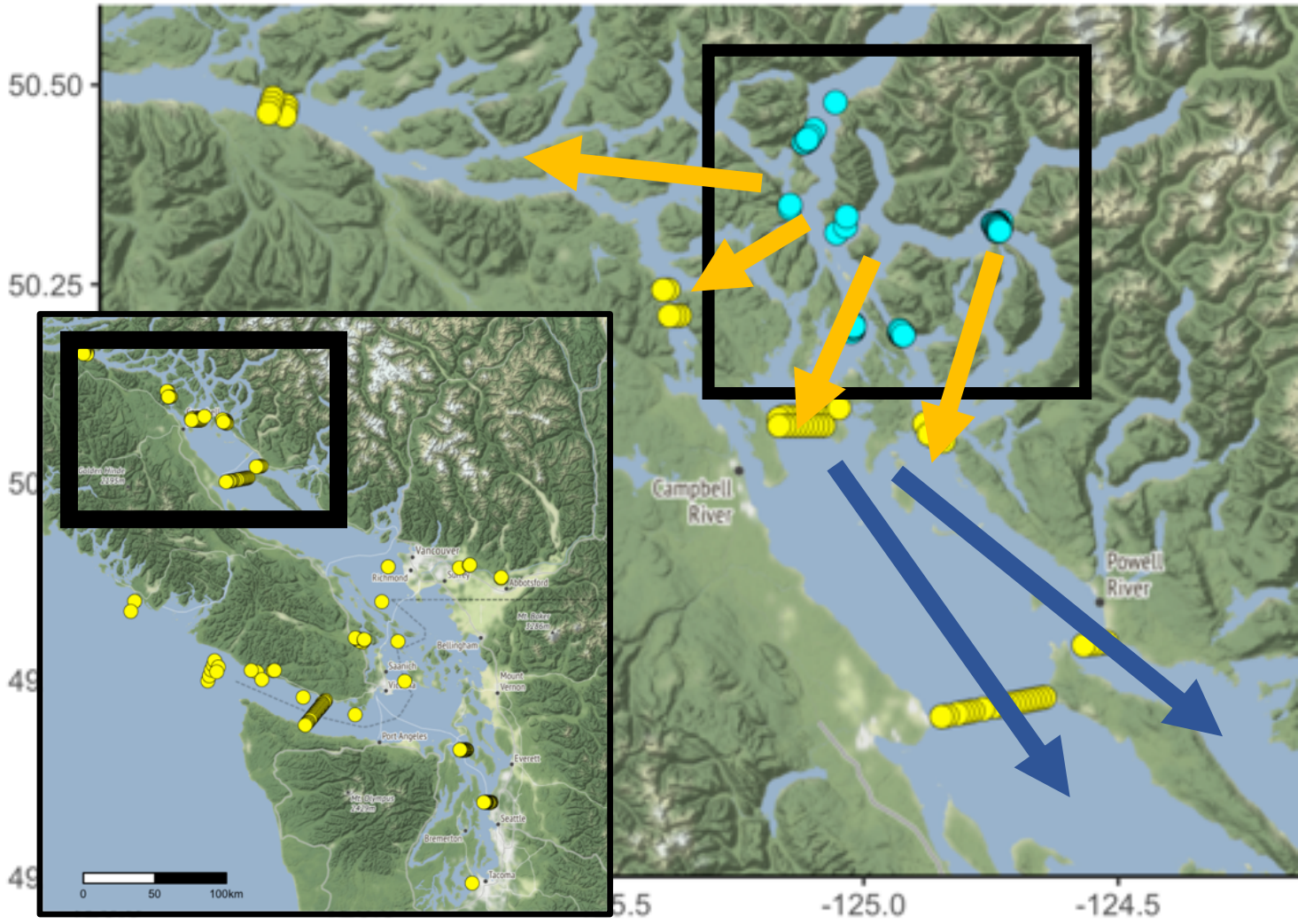
- **Design** and **Density** is ideal for studying Survival



Chinook Catch and Release Study Site

- Capture and tagging occurred within the Discovery Islands among 7 locations

- Paired with Genetic Stock ID we know if these individuals have successfully migrated towards their terminal river and arrays



Capture and Handling Methods

Overarching Objective: **Realism**

- Lacking in previous mortality estimates
- Mimic Public Anglers as much as possible
- Same methods, gear, rods, reels and handling

Air Exposure Treatment

Simulate the process of landing and removing a hook onboard a vessel

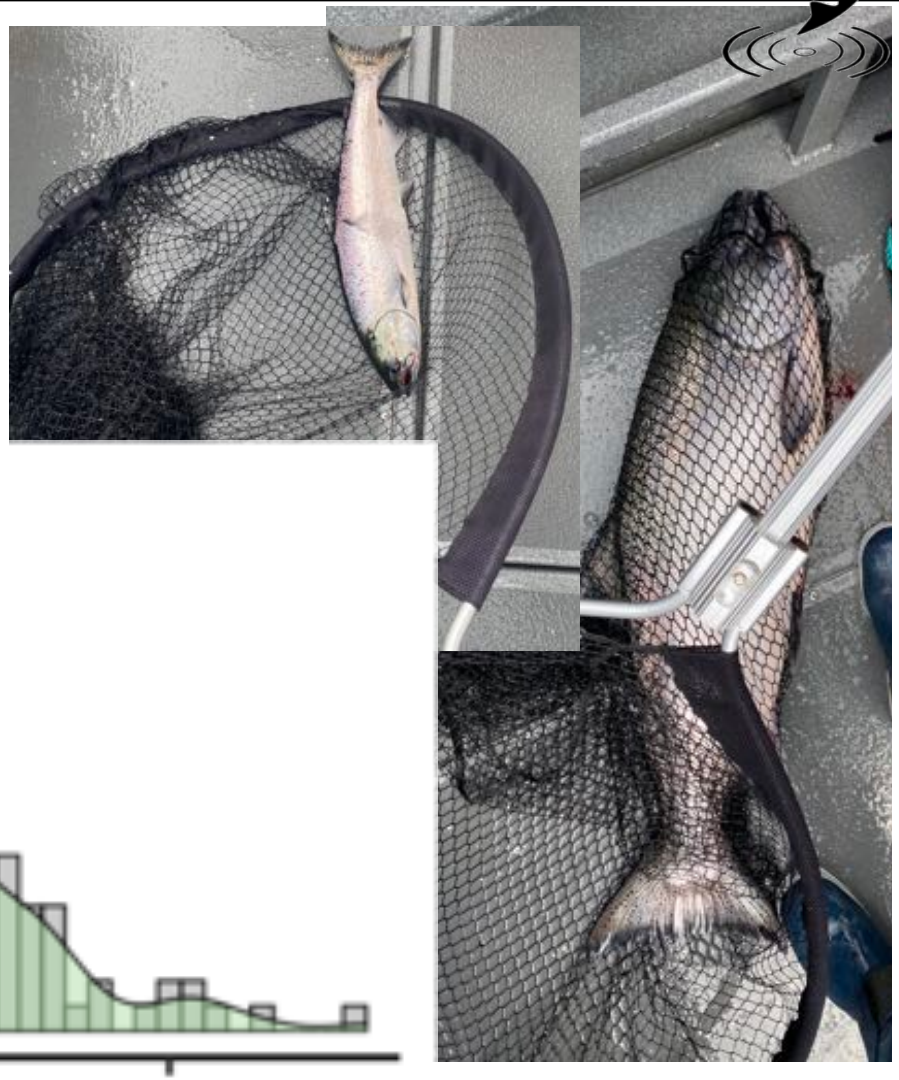
50 Controls – immediate sampling – NO air

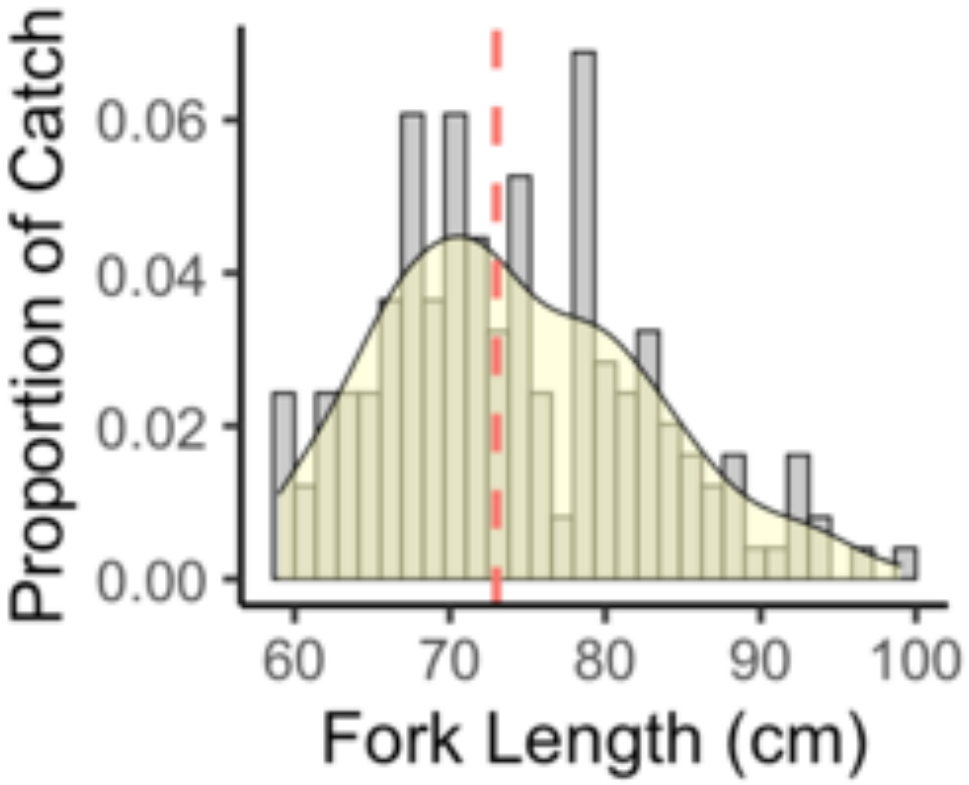
129 Exposures

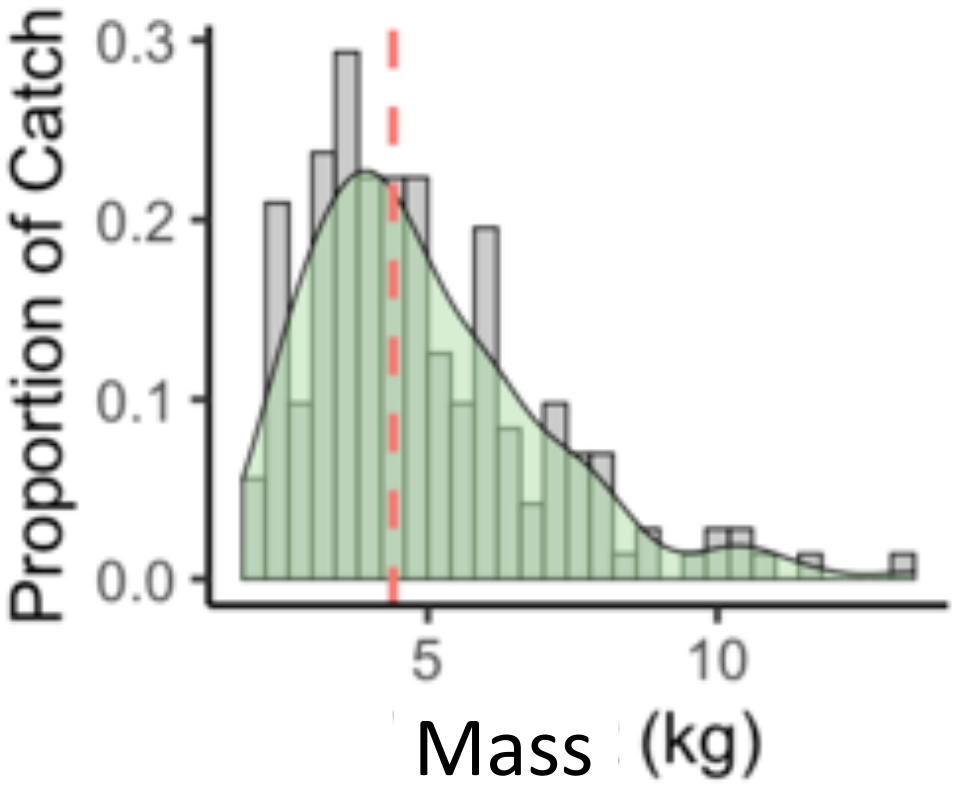
- 10 Groups
- 30 to 120 seconds

Tagging Completed in June 2 - 13, 2020

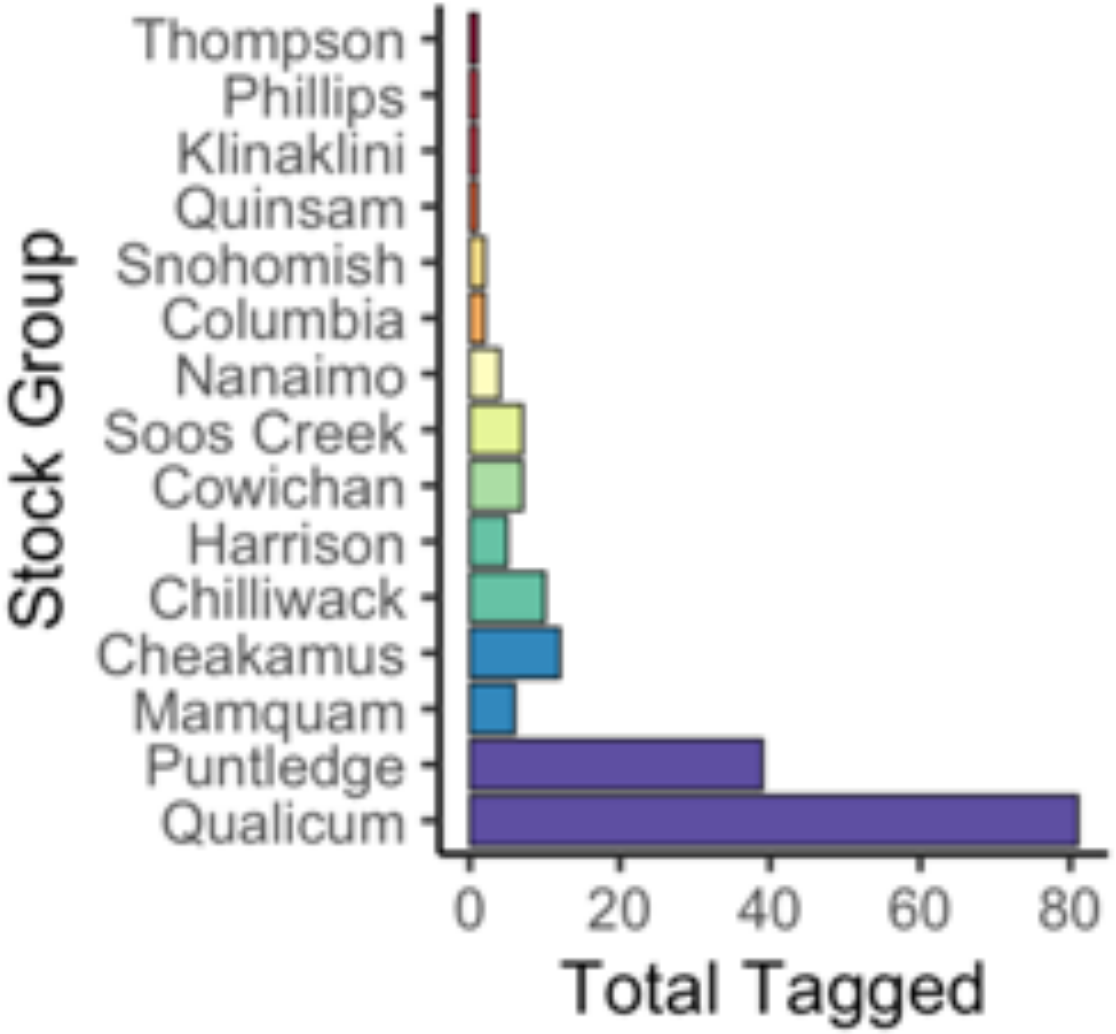
- 179 Tagged Chinook
  - **59 – 99 cm** fork length
  - **1.8 – 13.6 kg** (FL x G^2/12300)







Sampled Populations in Discovery Islands



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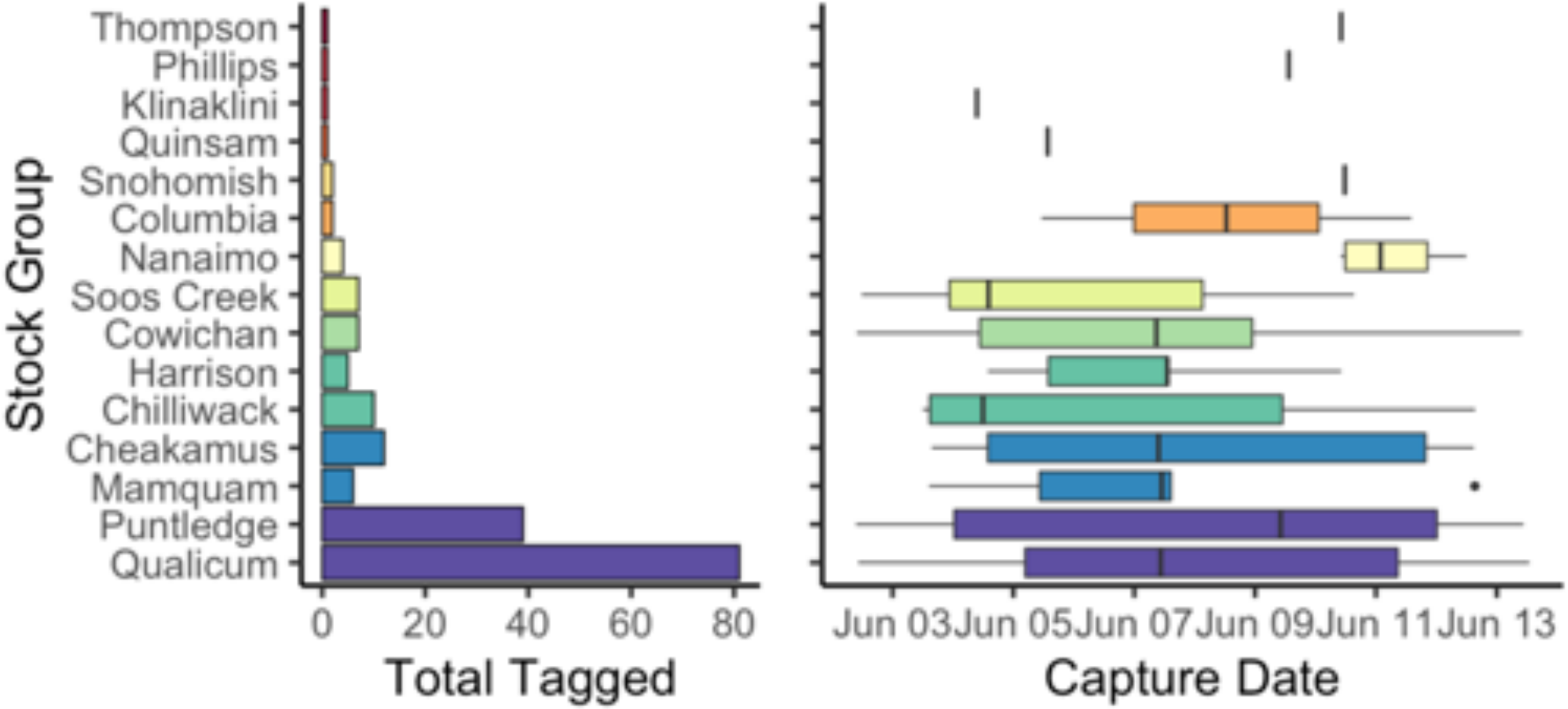


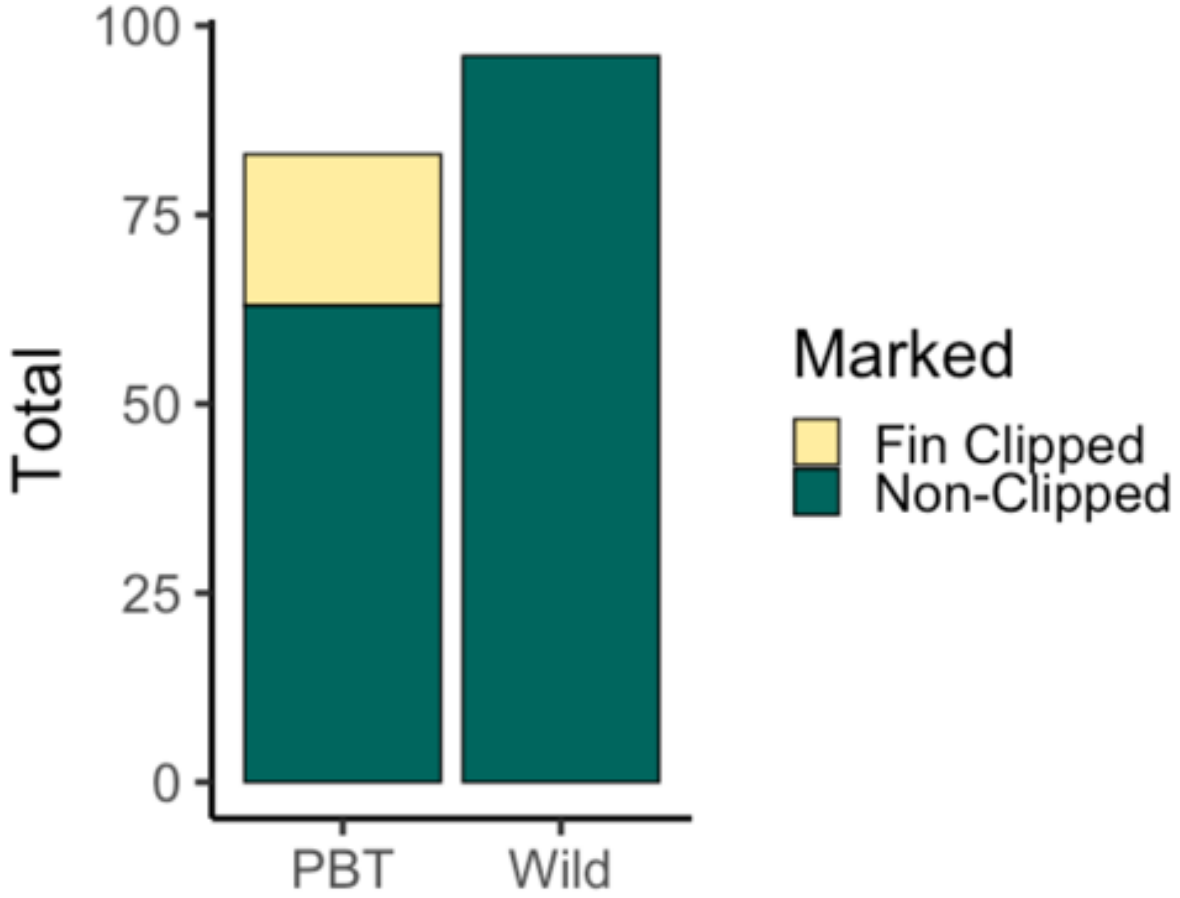
Hatchery, Marked, Wild & PBT

- **11% mark rate**

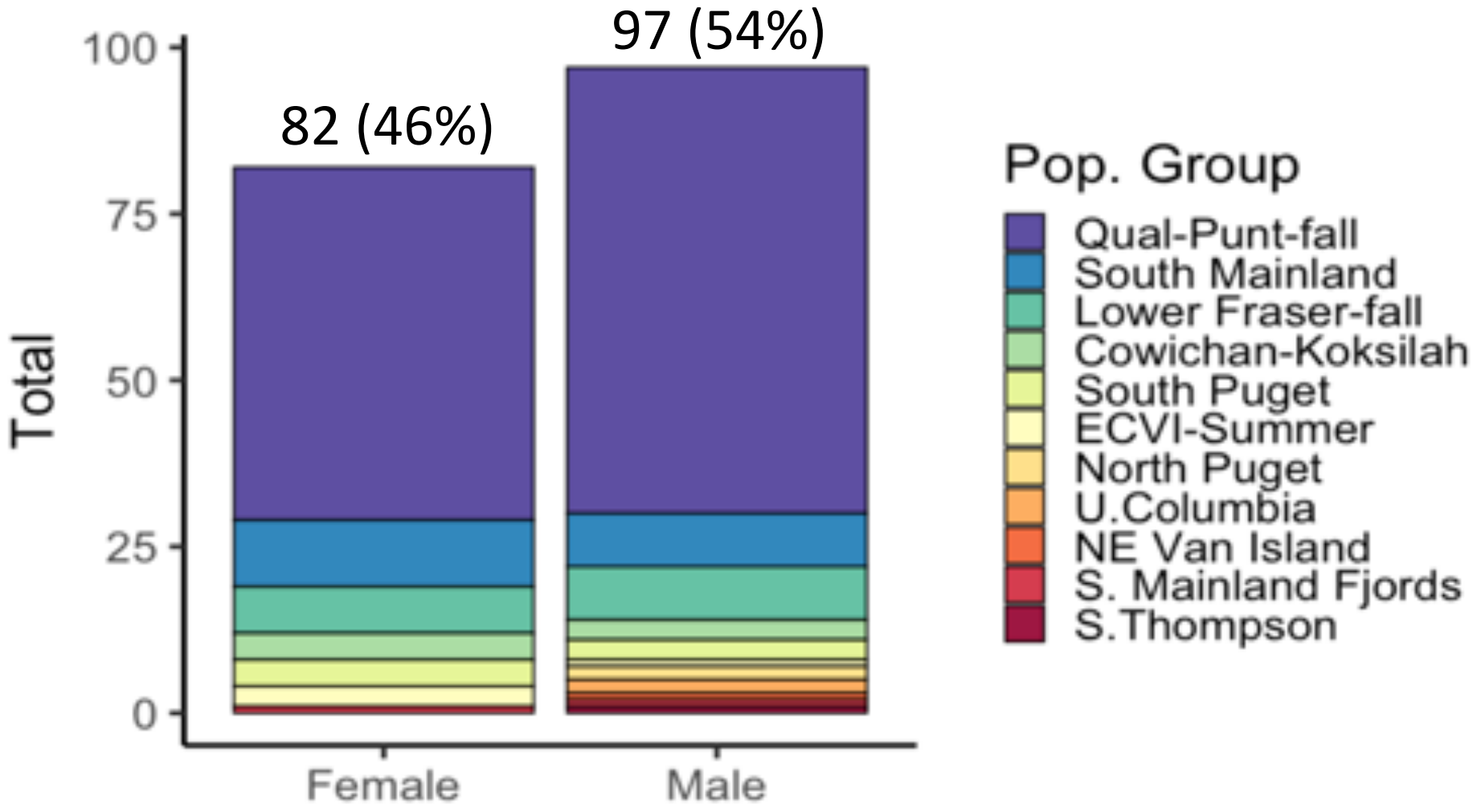
- Parental Based Tagging (PBT)
  - Allows non-marked Hatchery fish to be ID'd

- **47%** were genetically ID'd with PBT = **Hatchery Origin**

- 53% were non-marked and no PBT signature

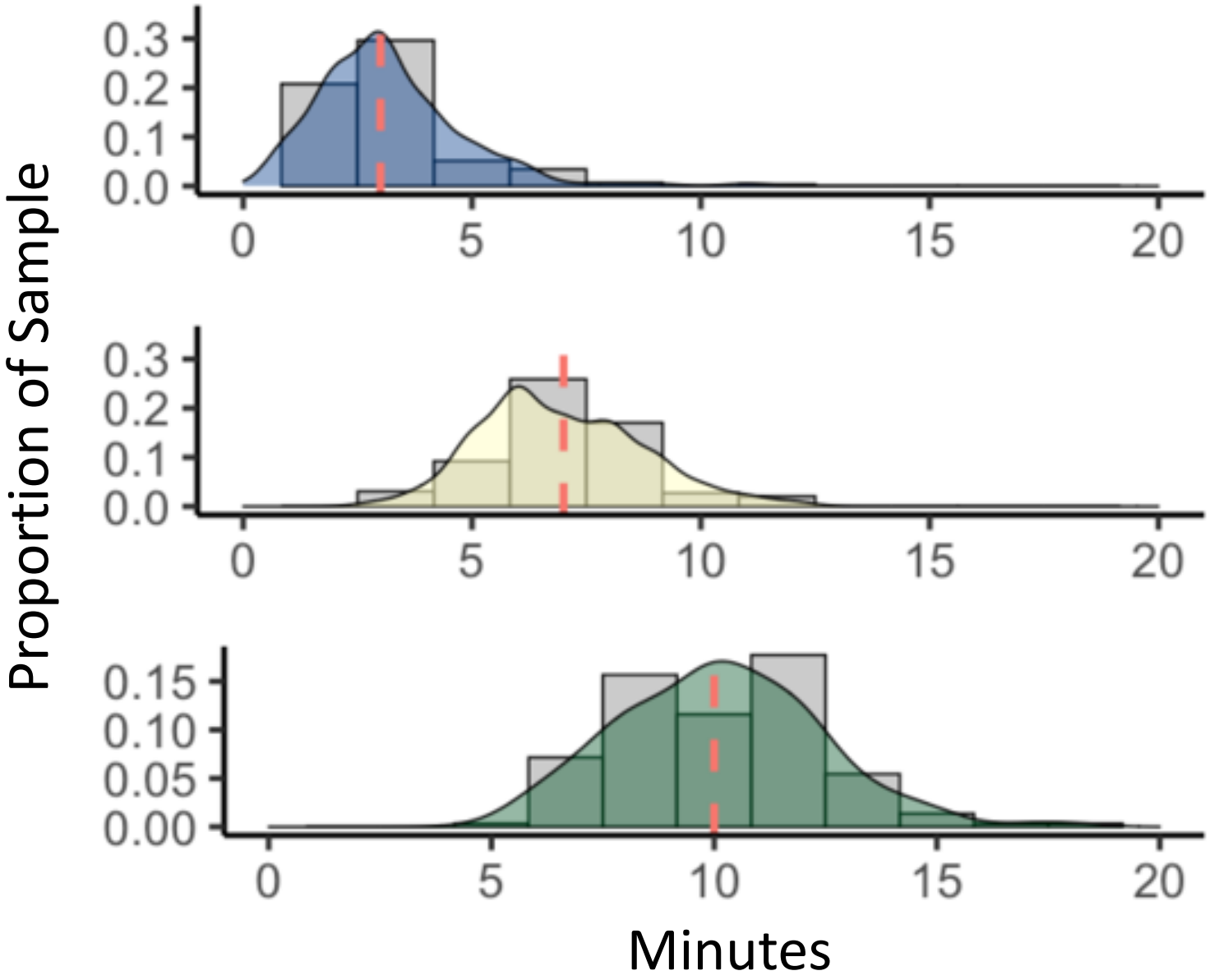


Sex by Population



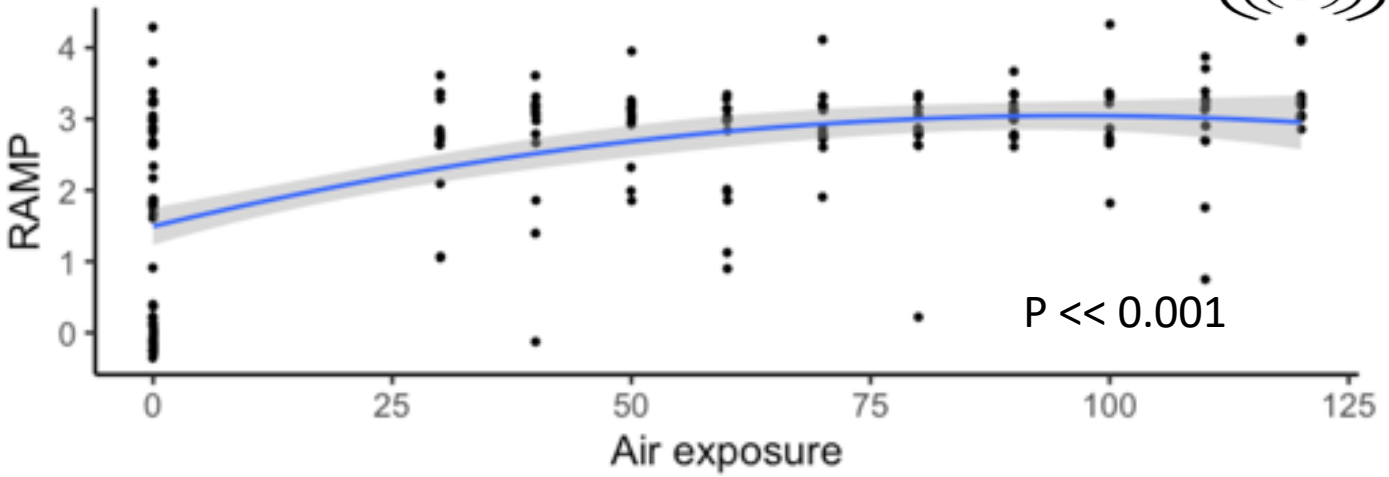
Observations: Handling Data

- Fight Time
  (1 – 11 min)
- Handling Time
  (3– 12 min)
  - Transfer Time
    (0 – 9 min)
  - Tagging Time
    (2 – 7 min)
- Encounter Time
  (5 – 18 minutes)



Observations: Assessments + Samples

- RAMP = Reflex Action Mortality Predictors
  - Assessment of reactions to stimuli



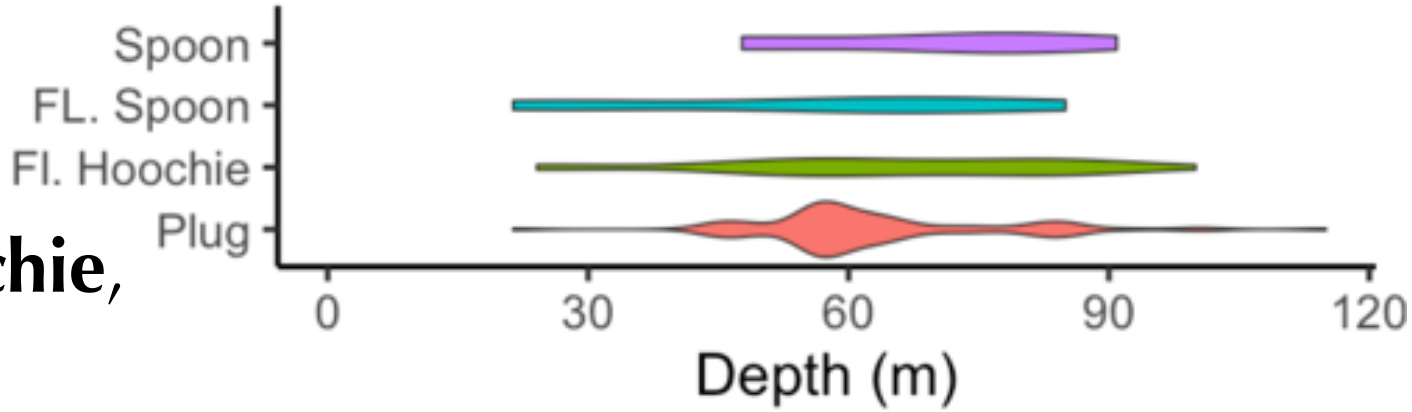
- Fat Probe – relative energy density of fish – related to population and stage of maturity

In Coho beach seine by-catch :
RAMP of 0 – 1 = 93 – 100% Survival
RAMP of 2 – 4 = 44 – 68% Survival
Raby et al. 2012

- Gill Biopsies – Observe the health condition and disease state of individuals – investigate sub-lethal or unobservable links to mortality – specifically the MRS Suite of Genes which I'll hopefully be discussing in more detail next year!

Observations: Capture Data

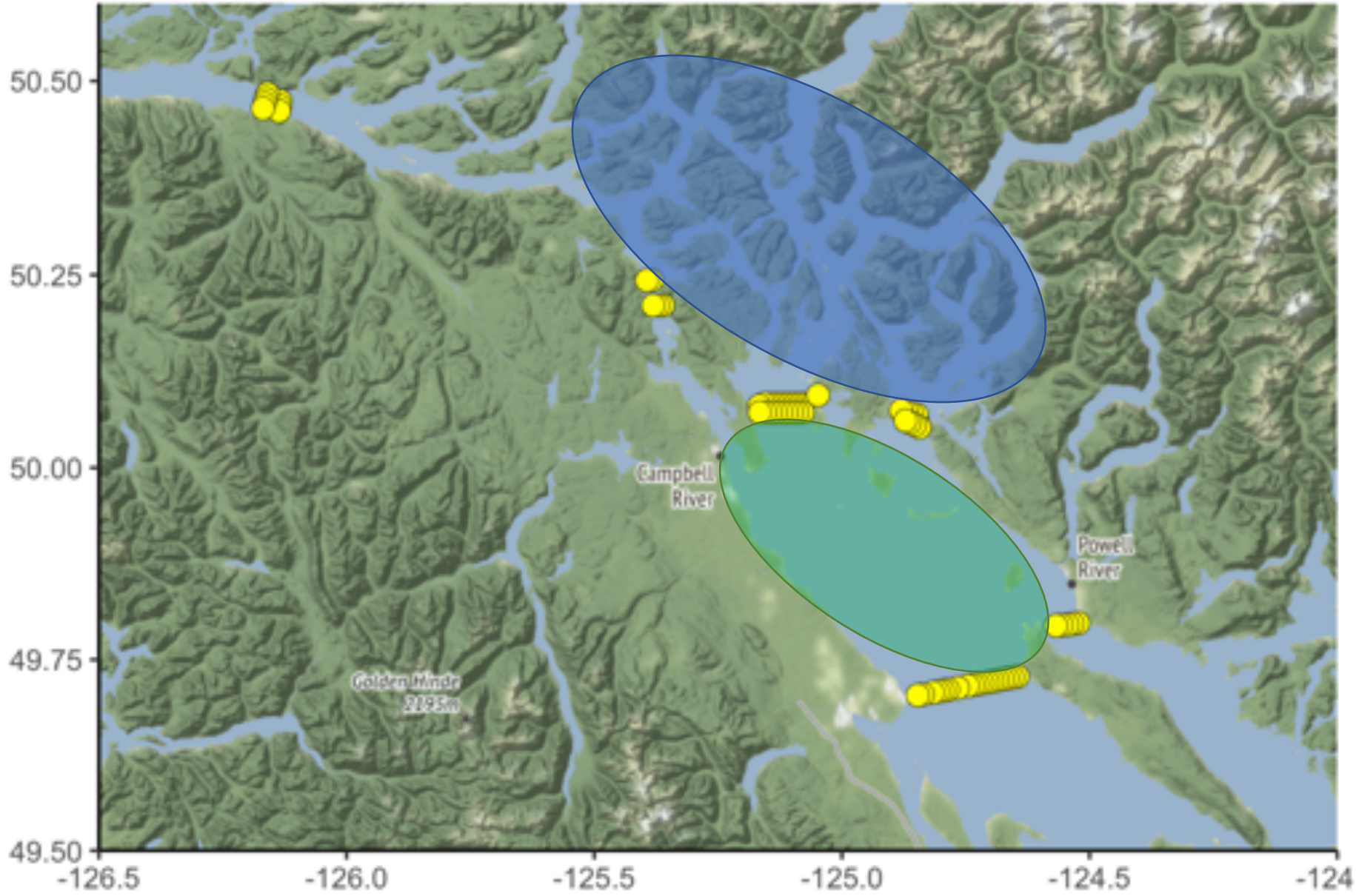
- Depth of Capture (15 – 80 m)
- Gear Type: **Plugs, Flasher-Hoochie**, Spoons, Bait
- Hook Size – ranged from 3/o to 7/o
- Hook Location
  - 43% corner
  - 30% exterior (maxilla)
  - 9% top interior
  - 9% bottom interior



Observations: Fisheries Inflicted Injuries

- 6% Observable Previous Encounter Wounds
- 27% Fisheries Inflicted Eye Wound - related to Hook Size
  - **49% of 6 to 7/o hookings lead to eye injury** – Werthmeier et al. 1989 - 40% with 6/o
  - 17% of 3/o to 5/o hookings lead to eye injury
- 22% Notable Bleeds
  - 28 minor
  - **12 significant bleeds**

Residence Time: DIs and NSOG



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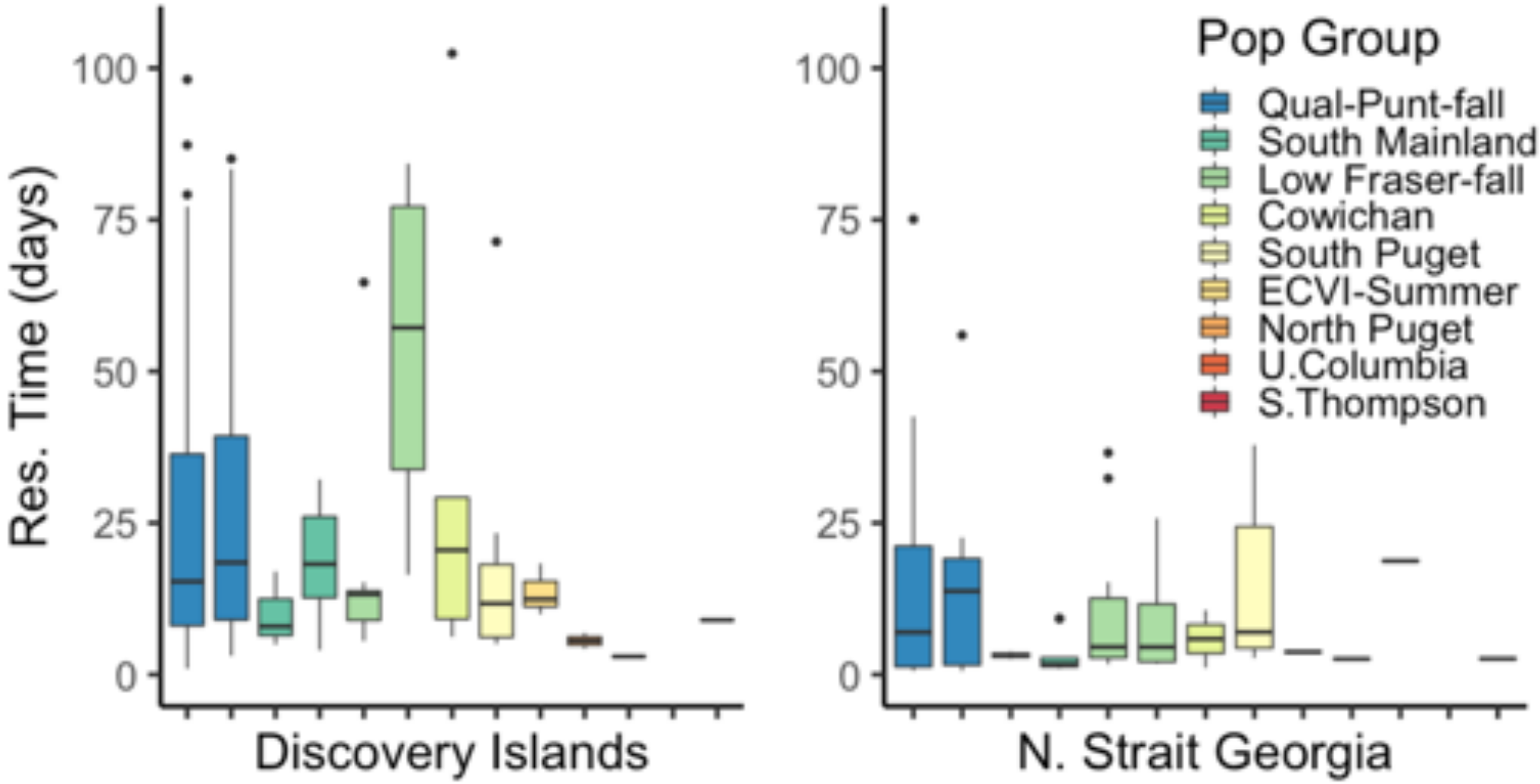


14 (1 – 102) day median

6.5 (0.6 – 75) day median

Total POST-RELEASE Mortality

Total Post-release Mortality =
Natural Mortality + **Fisheries Related** Mortality

TM = NM + FRIM

NM = Disease + Predation + Competition + Environmental Conditions + Straying* + Unreported Captures*

FRIM = Avoidance + Escape + Depredation + On-board + Short-term + Delayed Post-Release Mortality

Our current estimates represent **TOTAL Mortality**

Survival Analysis – CJS Models

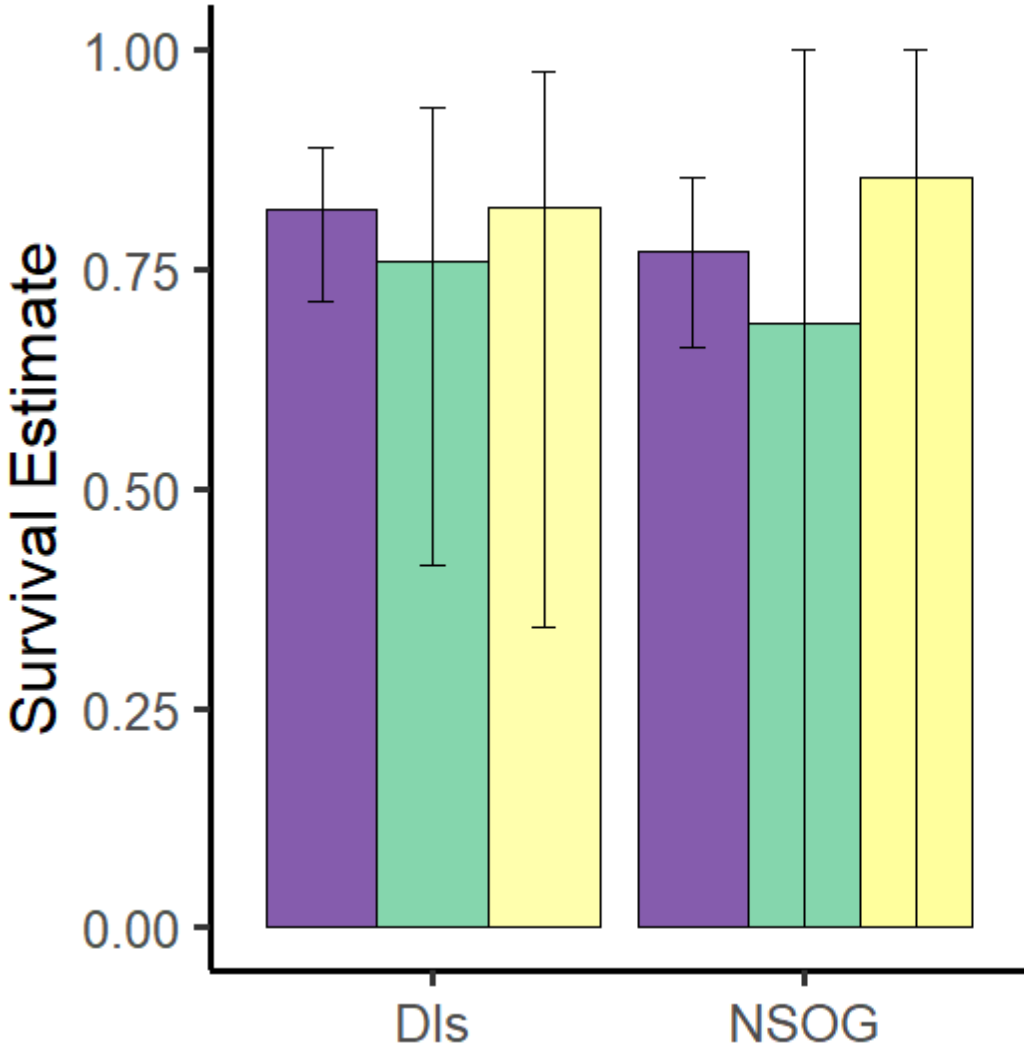
Using Cormack-Jolly-Seber Spatial Mark-Recapture Models to Estimate Survival

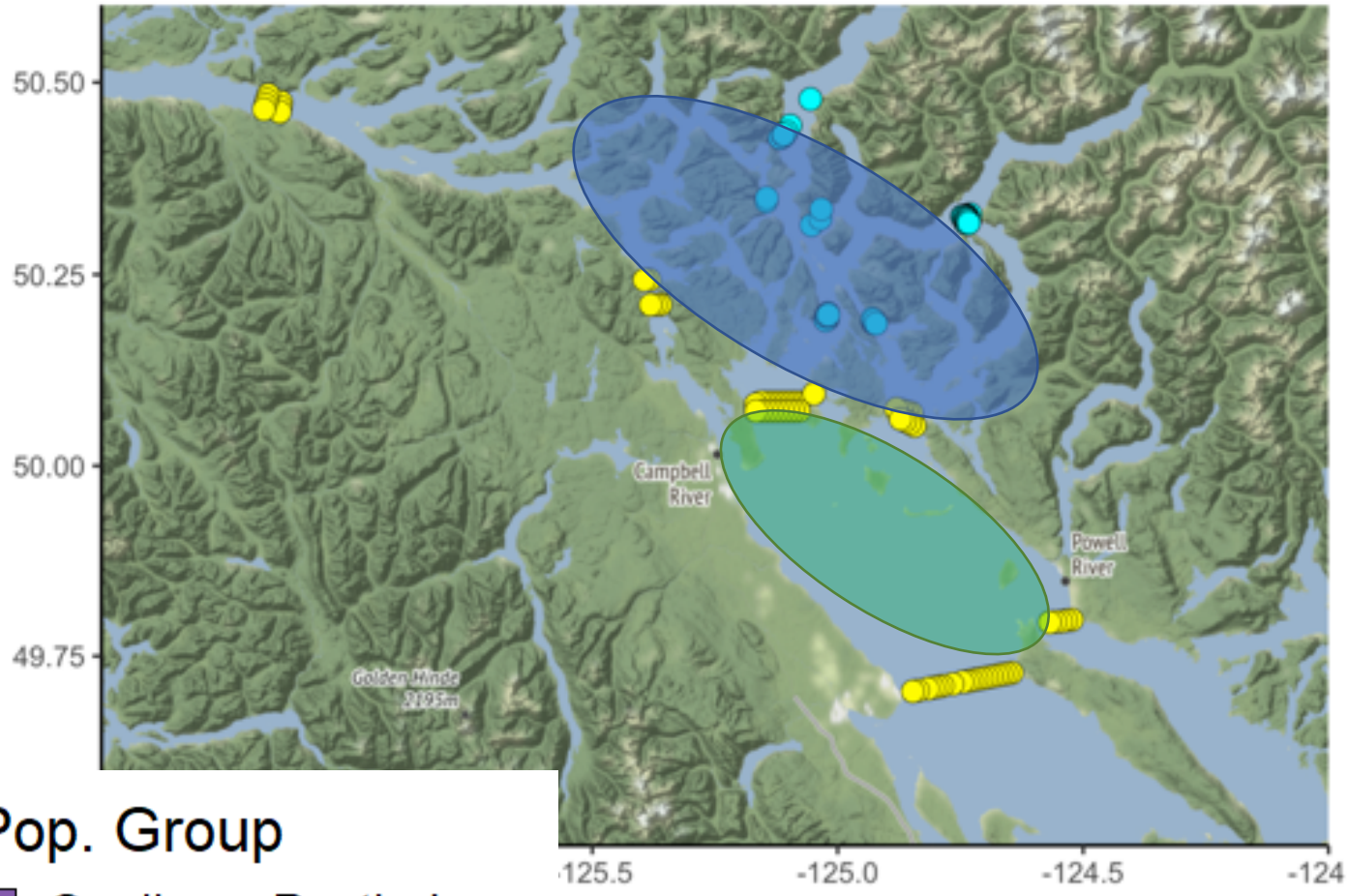
Model averaged results – AIC model ranking indicate that treatment is a non-significant factor of survival – but variation among populations is expressed

Tested with our **3 largest Population Groups**:

- Qualicum and Puntledge Rivers (QP-fall),
- Cheakamus and Mamquam Rivers (SMn-GStr), and
- Chilliwack and Harrison Rivers (LFR-fall)

Total Mortality in DI and N. Strait of Georgia



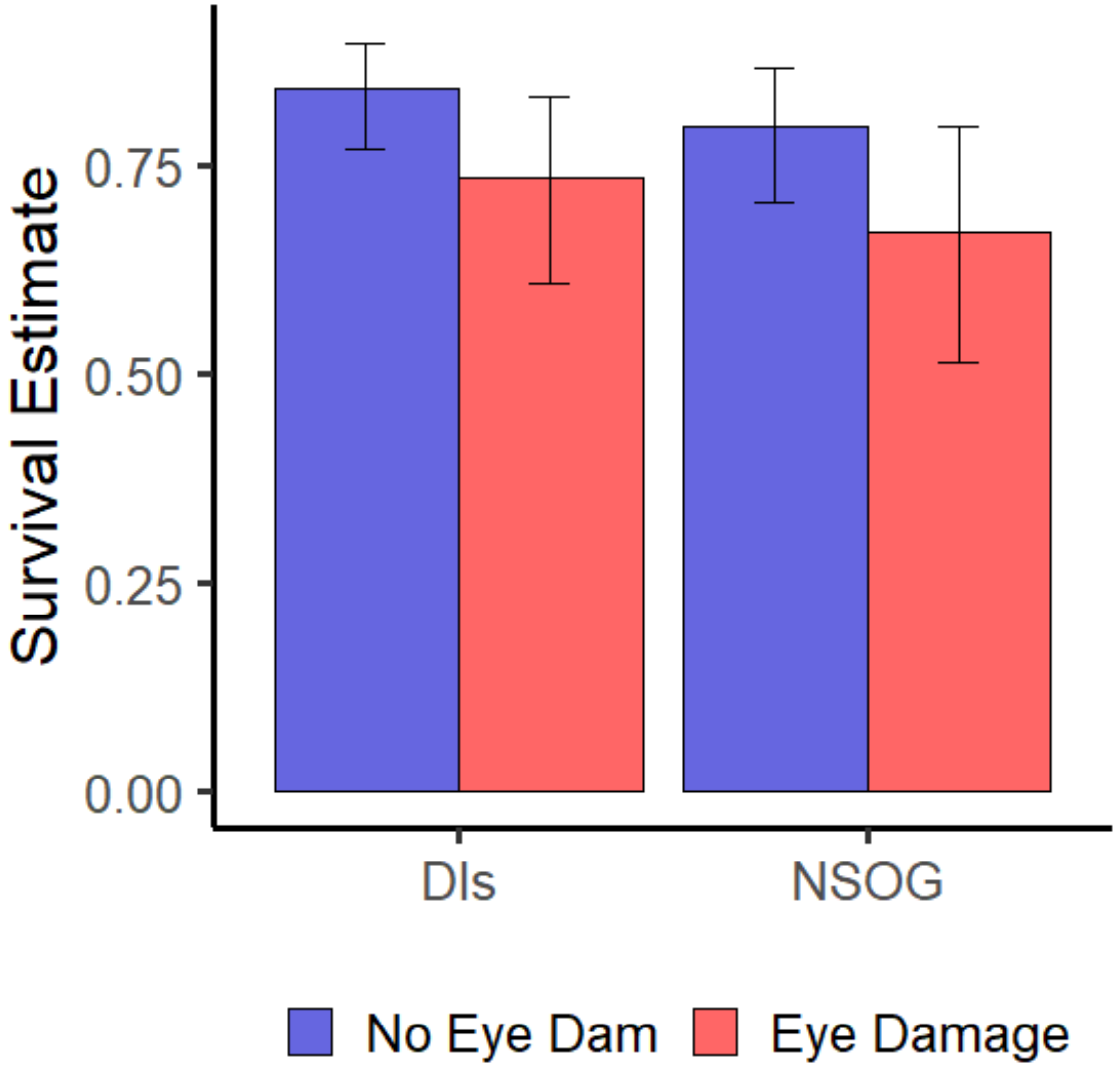


Pop. Group
- Qualicum Puntledge
- Squamish R.
- Lower Fraser

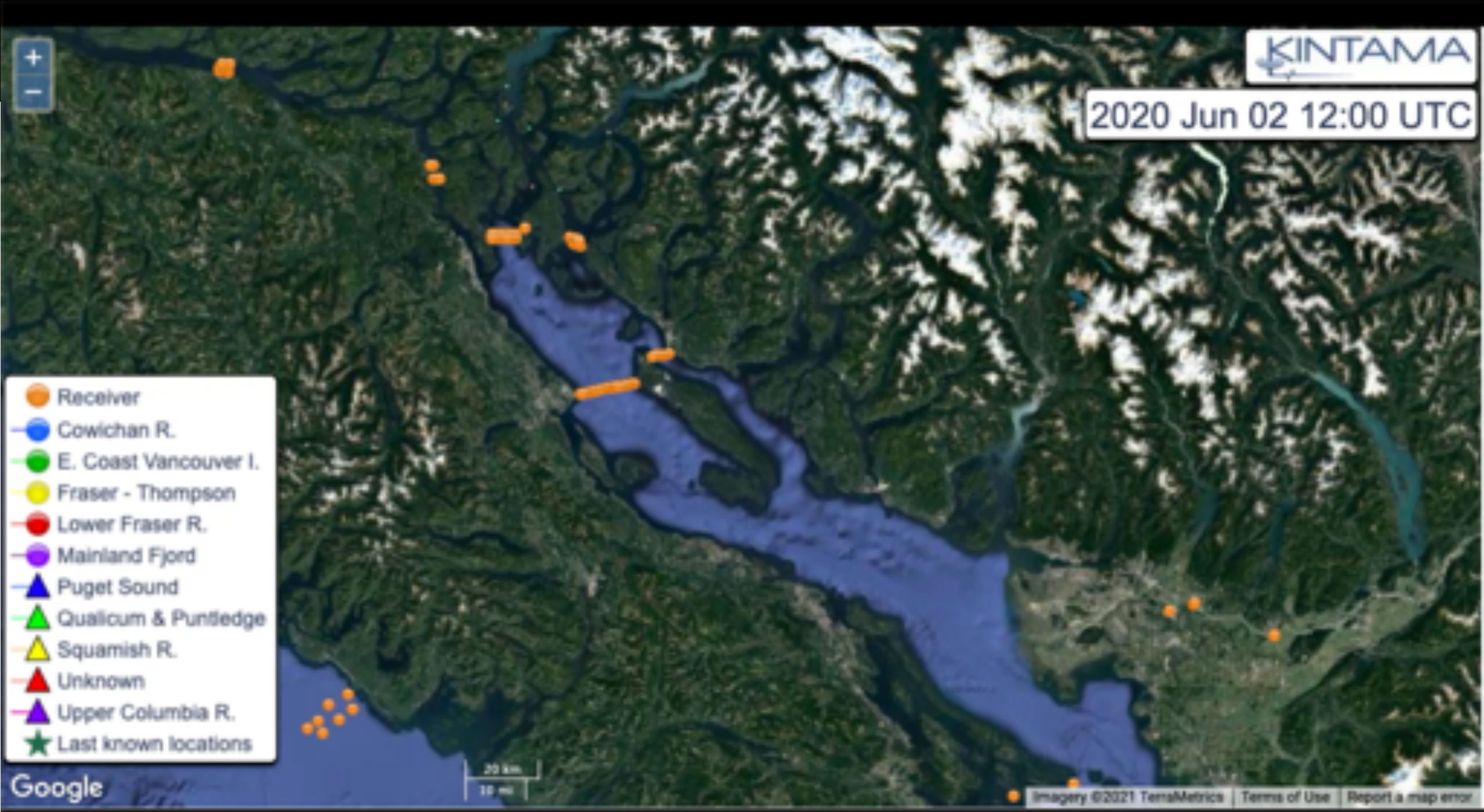
Survival Related to Prior Research?

- Werthmeier et al. 1989 – 81% survival for 66+cm
- Candy et al. 1996 – found 77% survival of Chinook
- Most Mortality Occurs within 24 - 72 Hours
  - Werthmeier et al. 1989; Bendock & Alexandersdottir, 1991

Clues to Fisheries Related Mortality



- 27% of sample expressed Eye Damage
- Relationship to larger Hook Sizes (6/o and 7/o)
- Effect appears to increase over time and space


KINTAMA
2020 Jun 02 12:00 UTC
Receiver
Cowichan R.
E. Coast Vancouver I.
Fraser - Thompson
Lower Fraser R.
Mainland Fjord
Puget Sound
Qualicum & Puntledge
Squamish R.
Unknown
Upper Columbia R.
Last known locations
Google
Imagery ©2021 TerraMetrics
Terms of Use
Report a map error

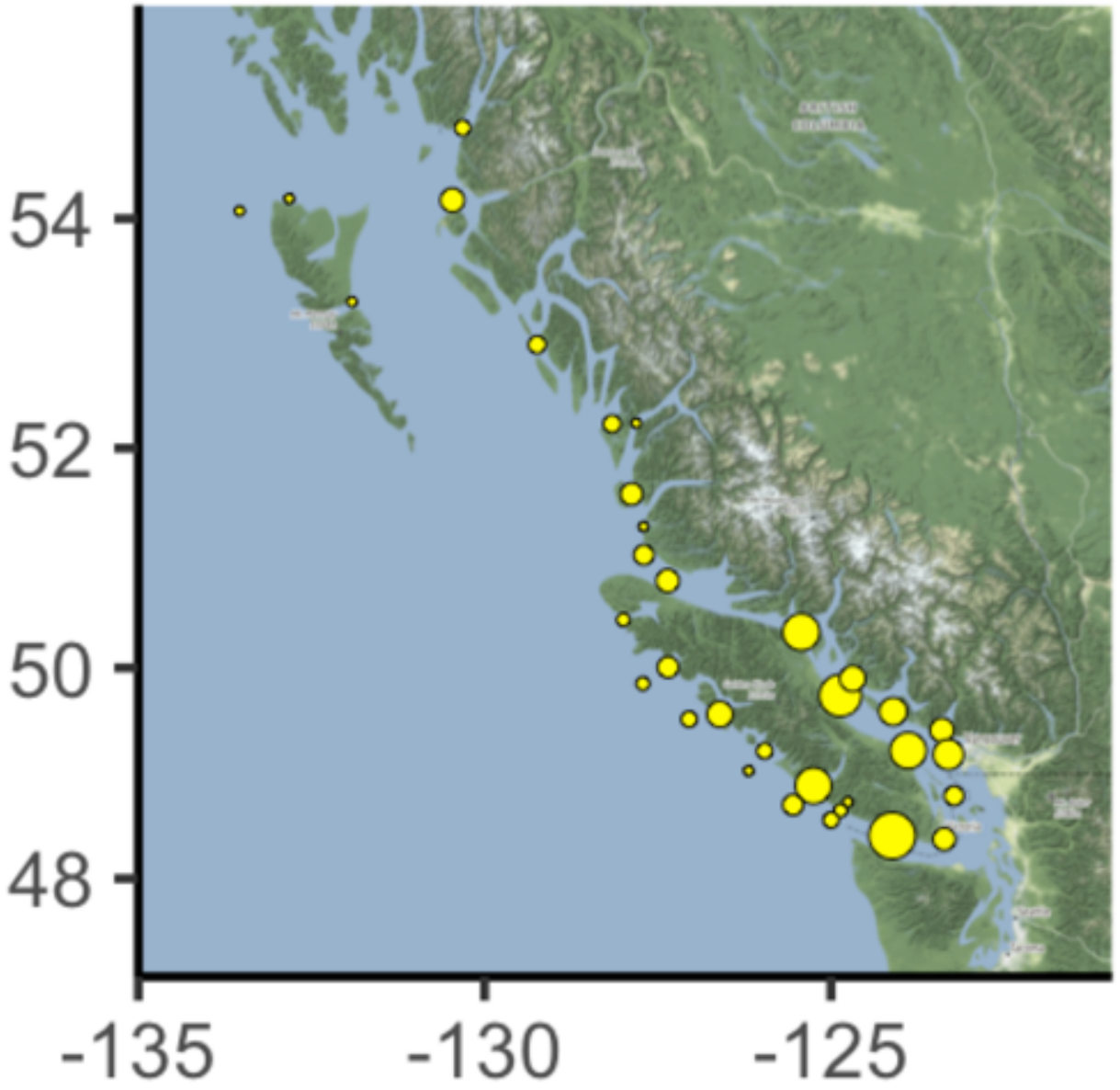
SFI App Data Collection

672 total entries from Public Anglers

Current Entries
- 502 for Chinook
- 170 for Coho

Collecting information on Handling Behaviour:
- Air Exposure
- Fight Time
- Hook Location
- Hook Size
- Gear Type (Artificial or Bait)
- Presence or Absence of Blood

SFI App Contributions



- Nearly every PFMA provided data
- Majority ECVI and SWVI
  - Area 20: 117
  - Area 14: 90
  - Area 13/17/23: 61

Questionnaires Filled

Question	n Answered	n Blank	% Answered
Air Exposure	280	390	42%
Fight Time	409	261	61%
Hook Location	448	222	67%
Hook Size	323	347	48%
Gear Type	655	15	98%
Blood Loss?	494	176	74%

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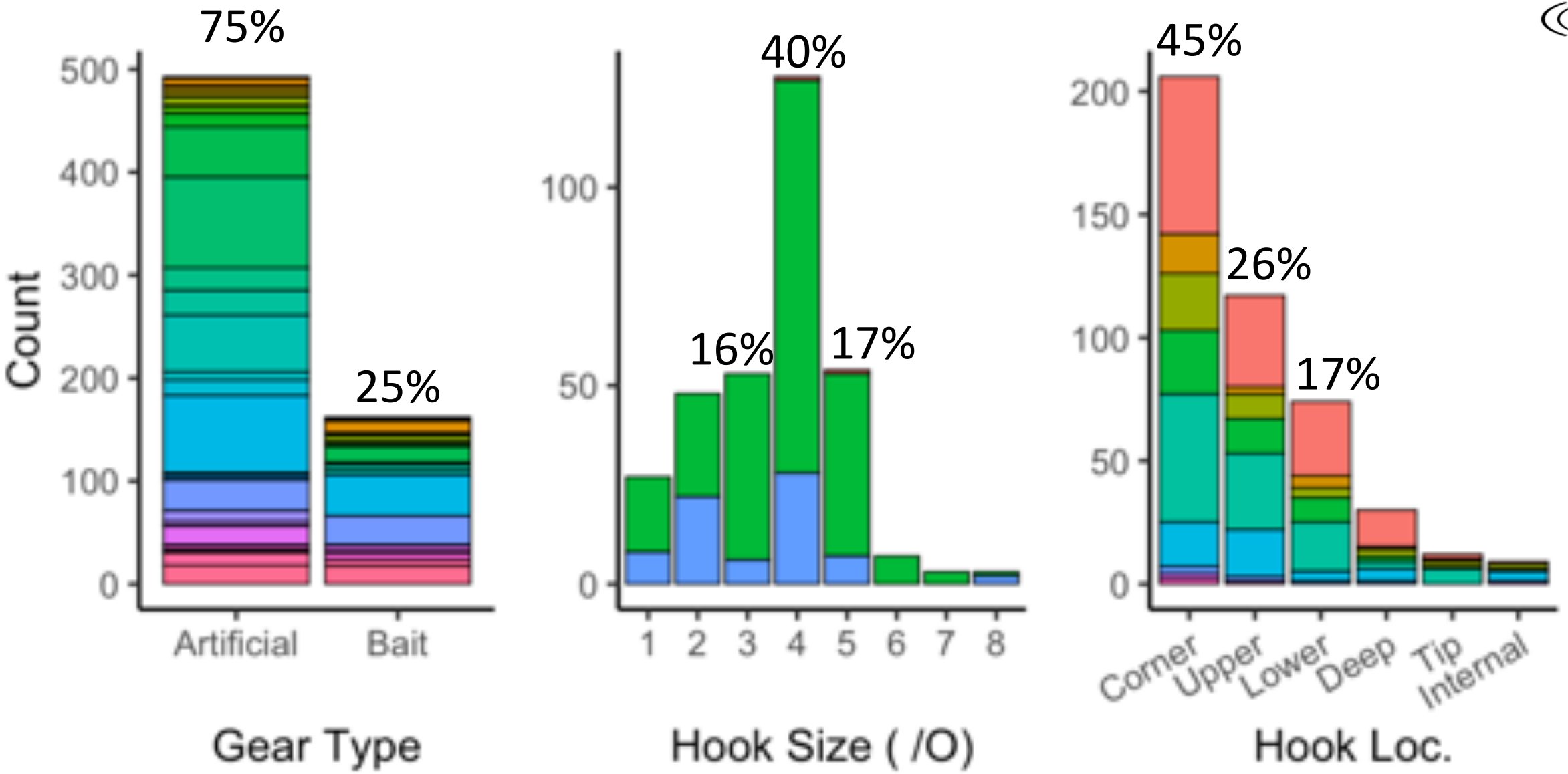
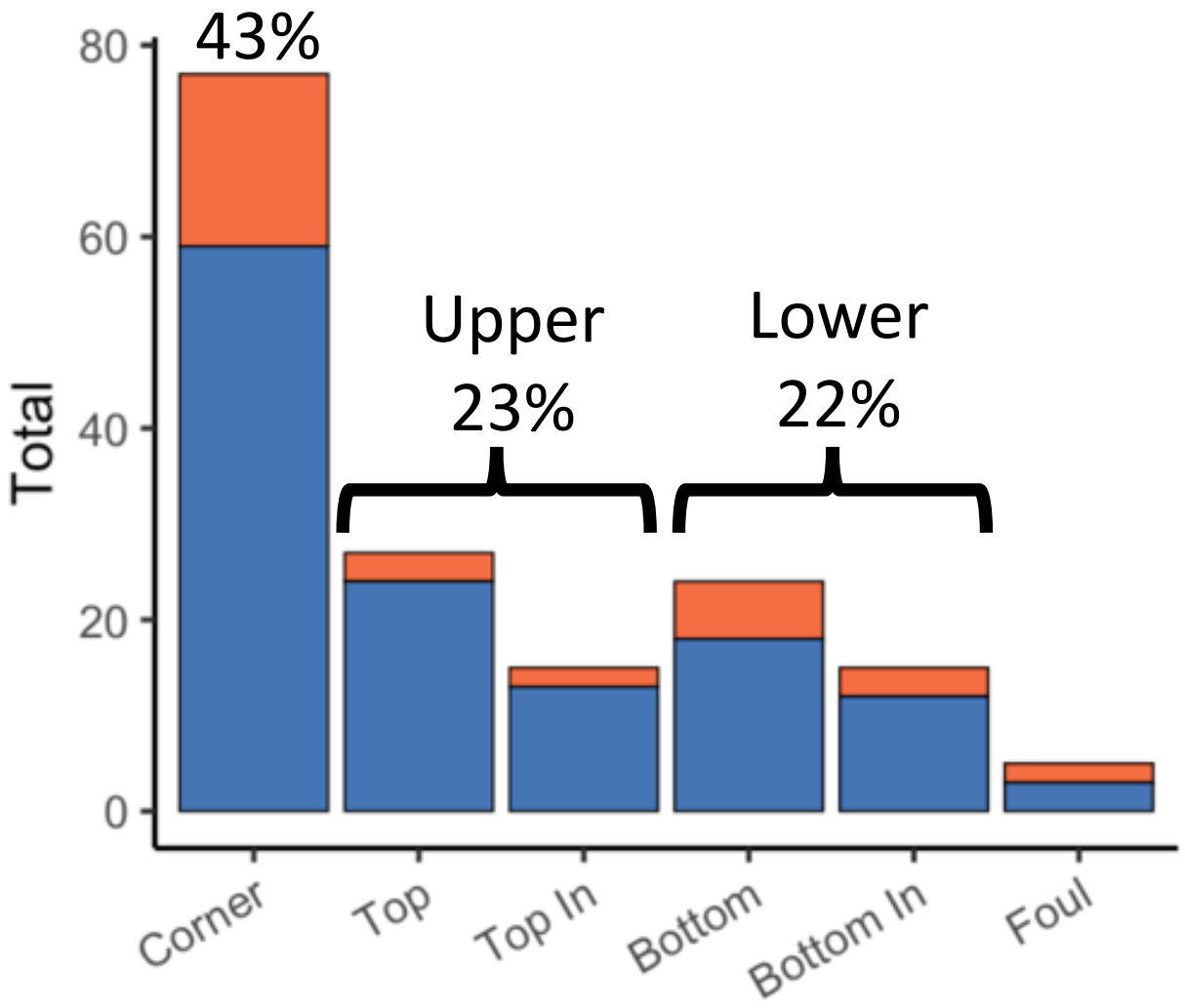
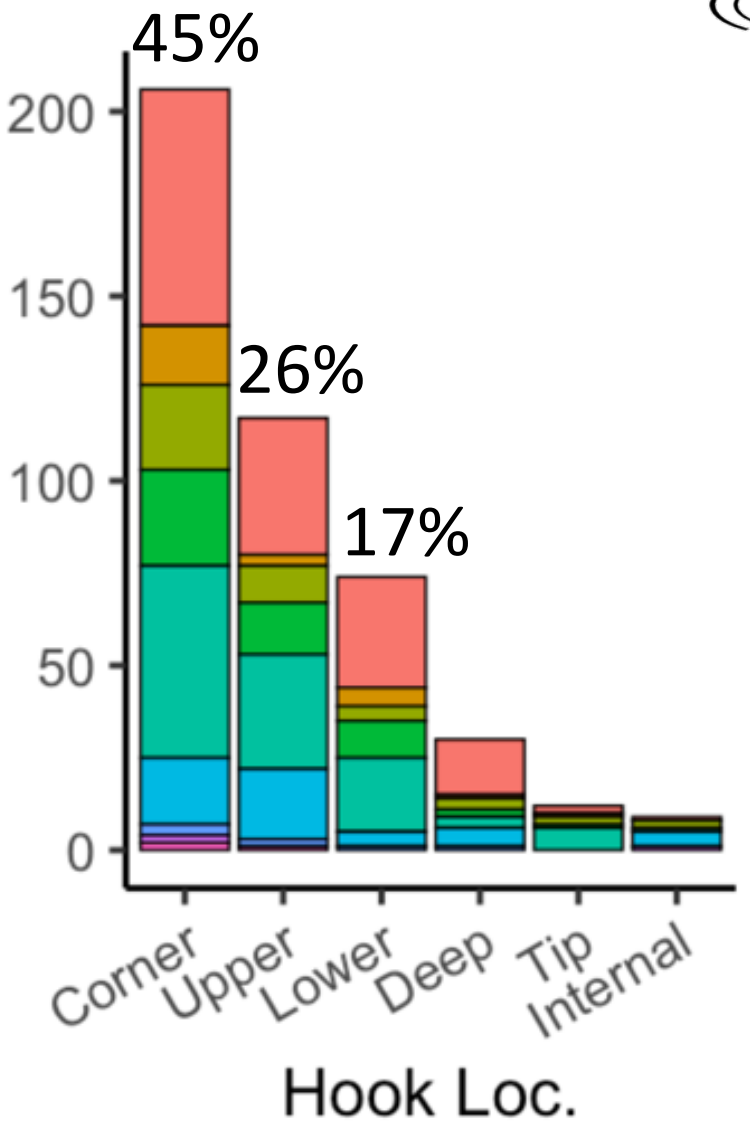
Gear Type, Hook Size and Location



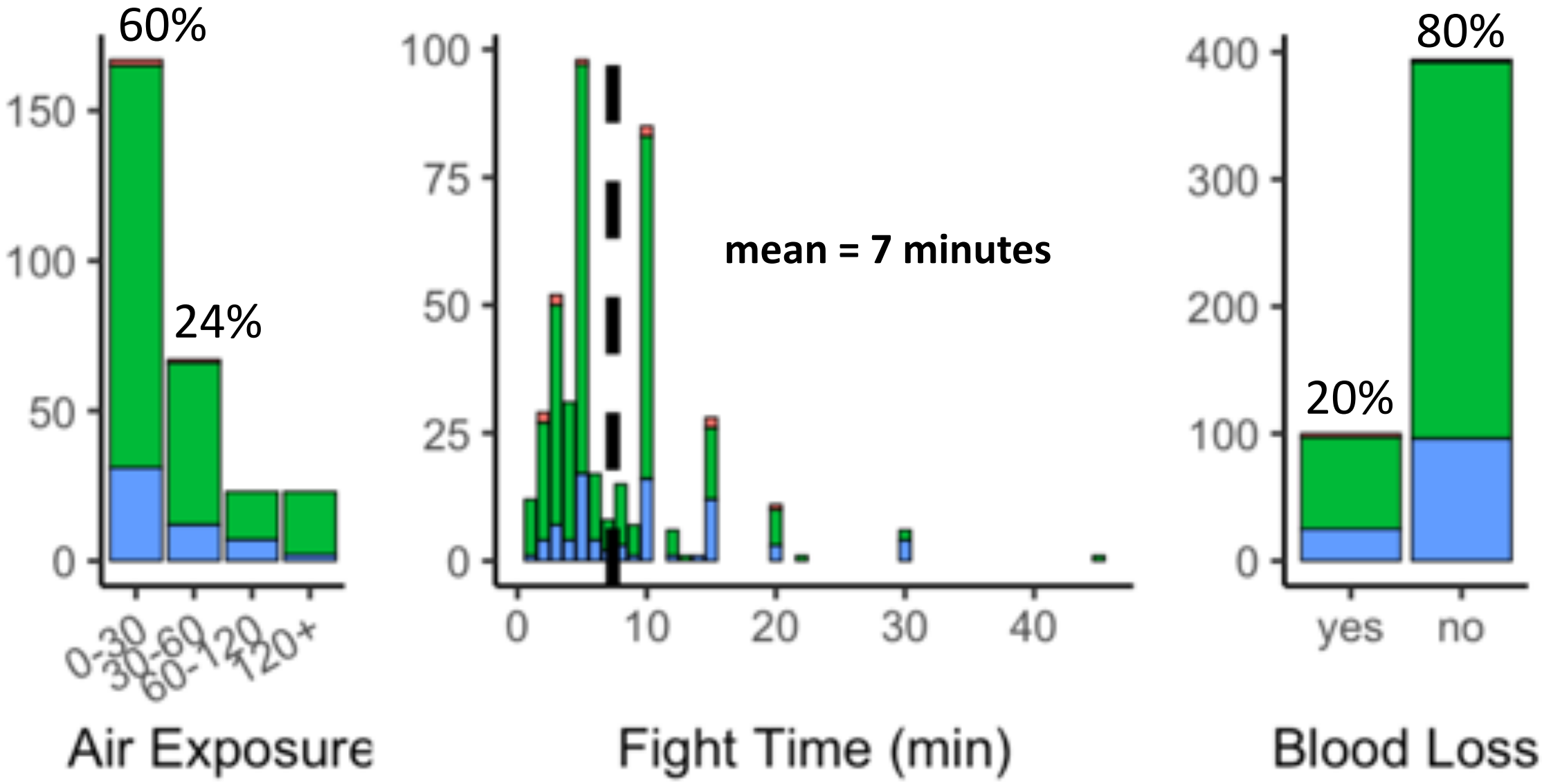
Hook Location – UBC vs App



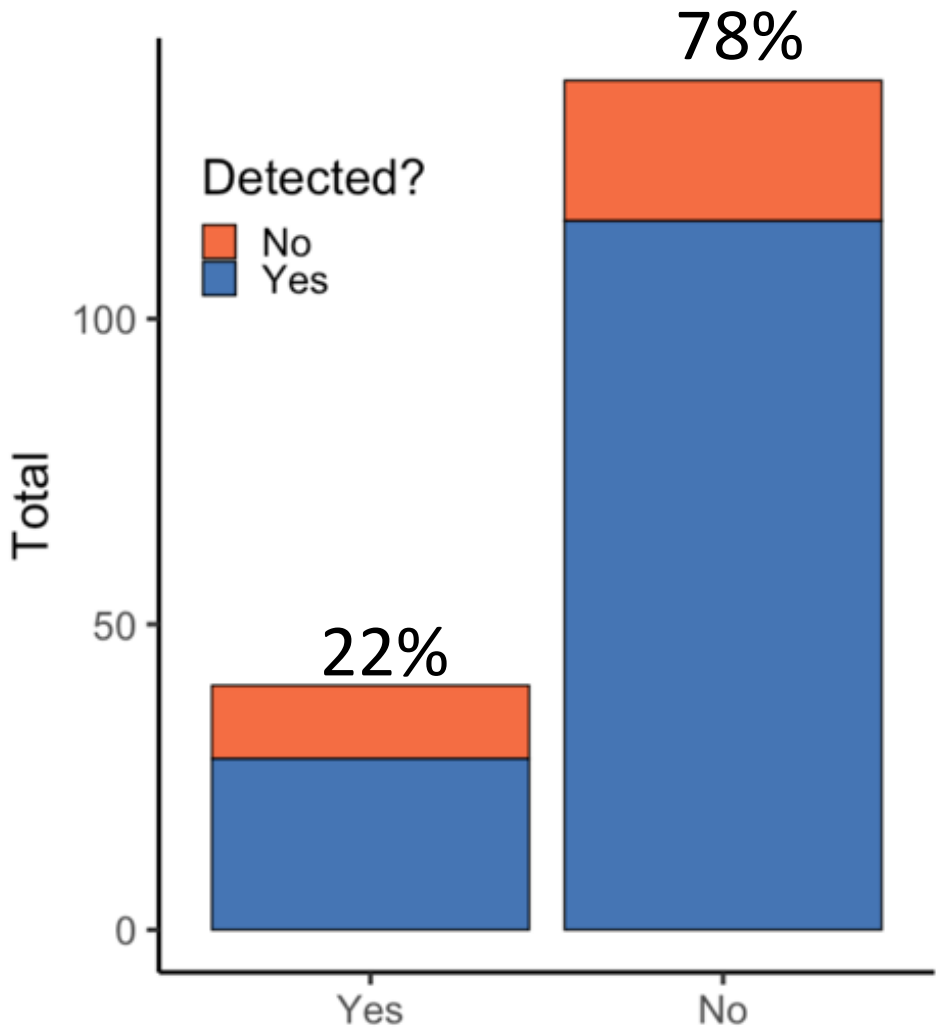
UBC Hook Location



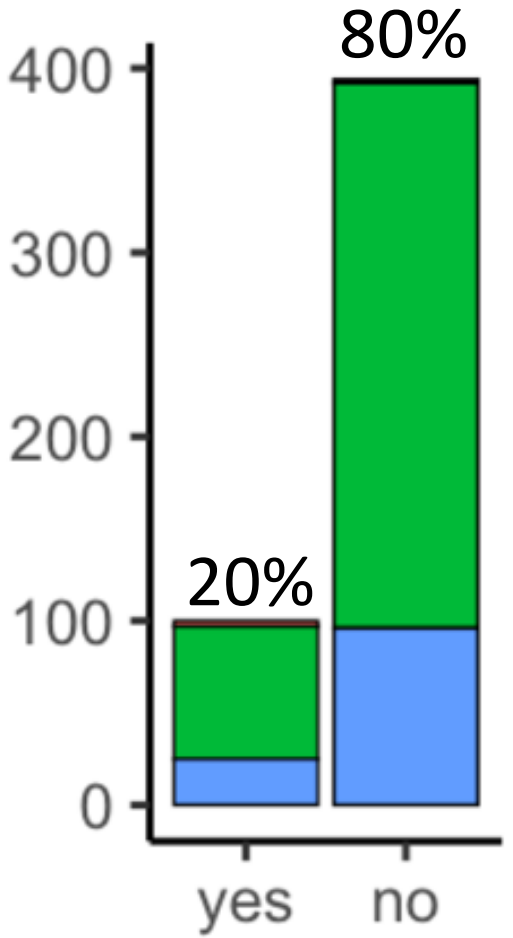
Fight Time, Air Exposure & Blood Loss?



Blood Loss – UBC vs App



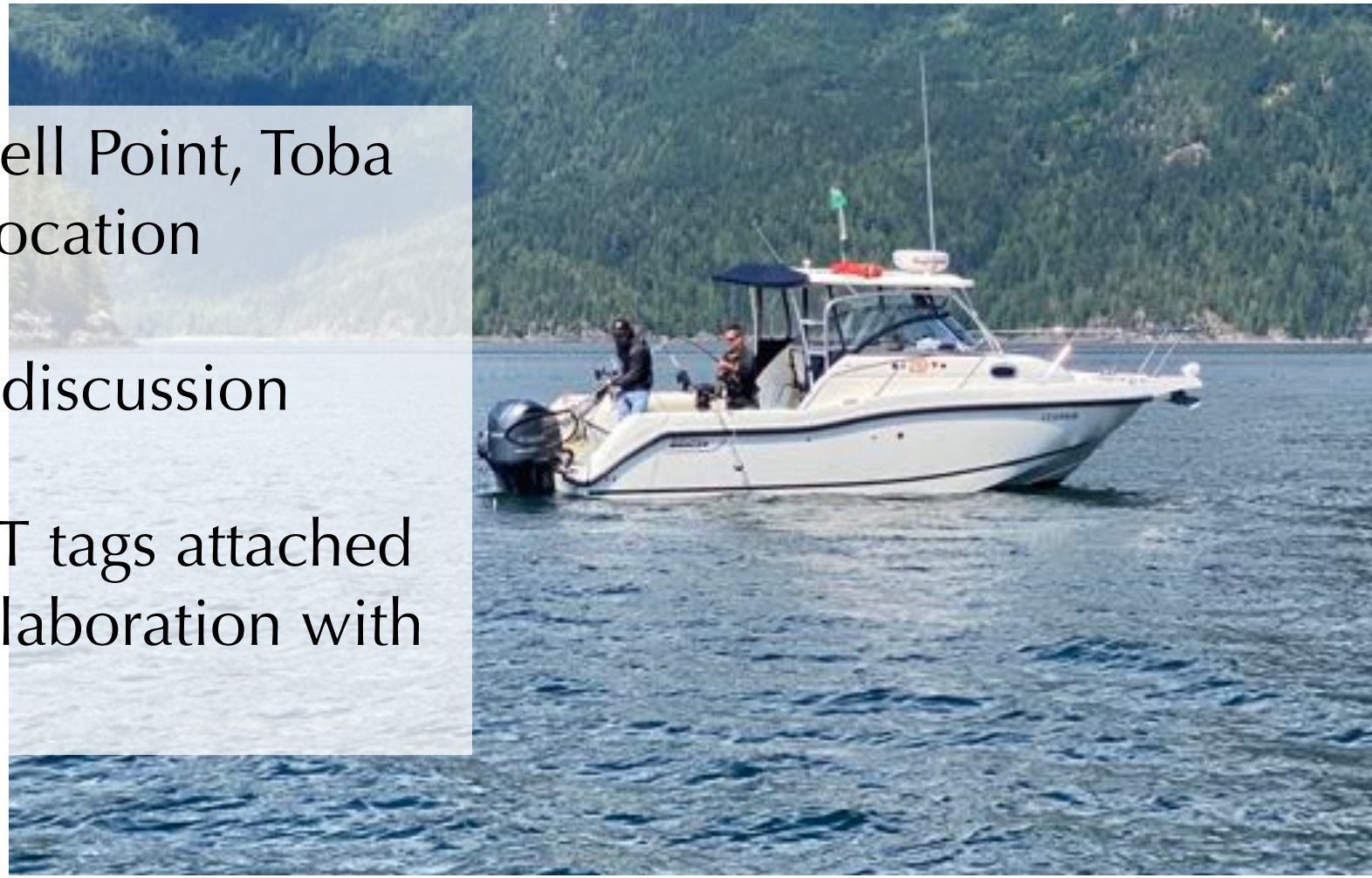
UBC Blood Loss



Blood Loss

Sampling and Tagging 2021

- Back to Stuart Island – Brettell Point, Toba Inlet, will be focal tagging location
- ~ May 25 – June 5 – still in discussion
- 200 Acoustic Tags – with PIT tags attached to our Spaghetti tags for collaboration with DFO's ECVI PIT Program



Study Design for 2021

- Reduce our Scientific Handling Impacts
  - Boat-side tagging – no net, no air exposure
- Increase Handling and Treatment Effects
  - Push the Air Exposure Treatment
- Eye damage linked with Survival – Develop a “treatment”
  - 4/o vs 6/o Hooks - only two hook sizes
- Improve Blood Loss and Injury Assessments and Metrics

Study Design for 2021

- Video Footage of Submarine Encounters
- More Localized Receiver Network – OR – Transects with Mobile Receiver
- Companion Tagging Boats
  - DNA Sampling & Fork Length – Avid Anglers
  - Blood Loss and Injury Assessments
- Deploy terminal receivers in ECVI and potentially Squamish