NOAA FISHERIES
Alaska Fisheries Science Center

Salmon Excluder Research in Alaska Pollock Fisheries

Conservation Engineering Approaches to Bycatch Mitigation

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Alaska Bycatch Review Task Force – Western Alaska Salmon Subcommittee
26 May 2022

Alaska Fisheries Science Center
Conservation Engineering Group

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Group Lead

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Physical Scientist

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- Katherine Hellen-Schneider
- Debbie Sharpe

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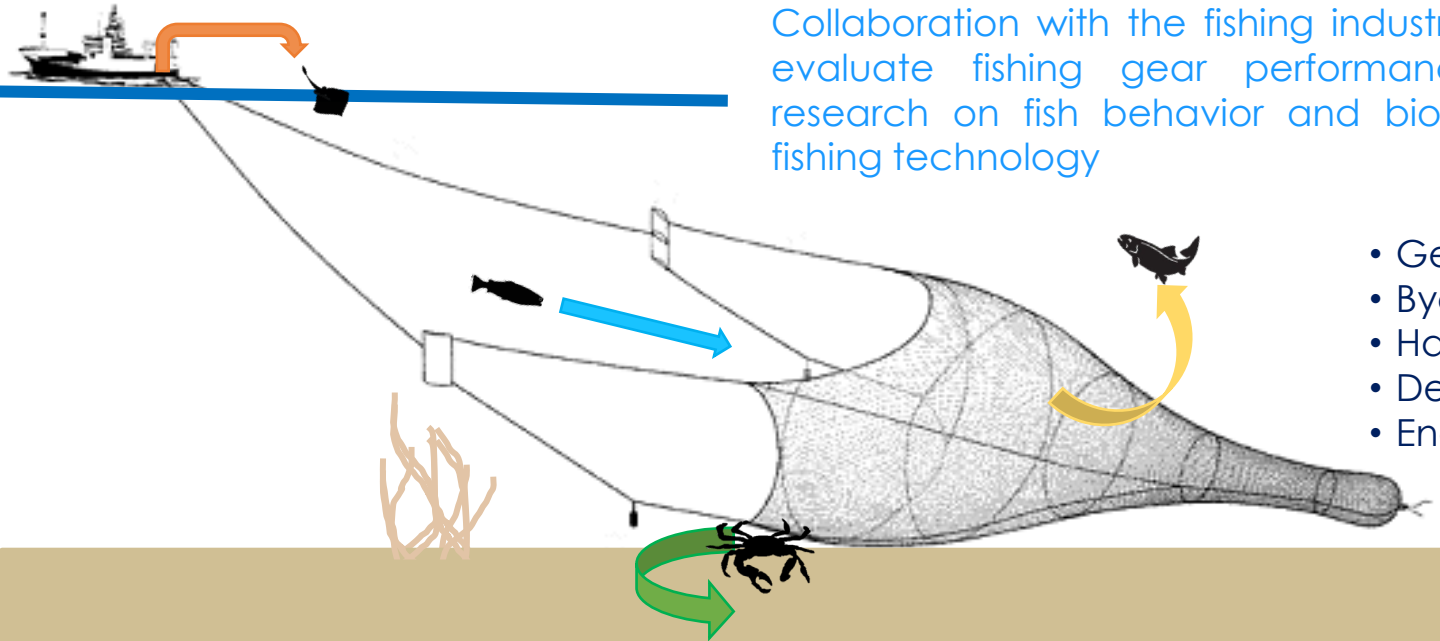
- Michelle Dyroy (BS- APU)
- Derek Jackson (MS-VIMS)
- Sabrina Garcia (PhD-UAF)

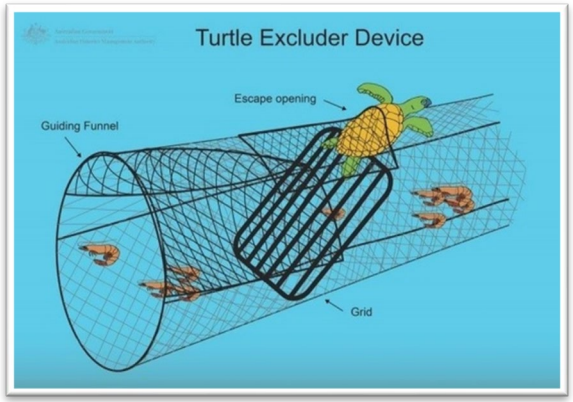


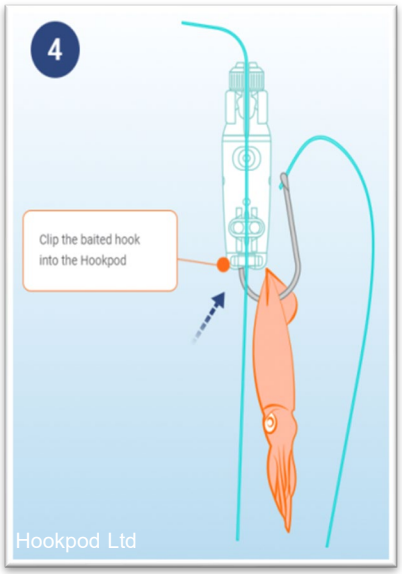
Collaboration with the fishing industry and other partners to evaluate fishing gear performance through innovative research on fish behavior and biology, gear design, and fishing technology

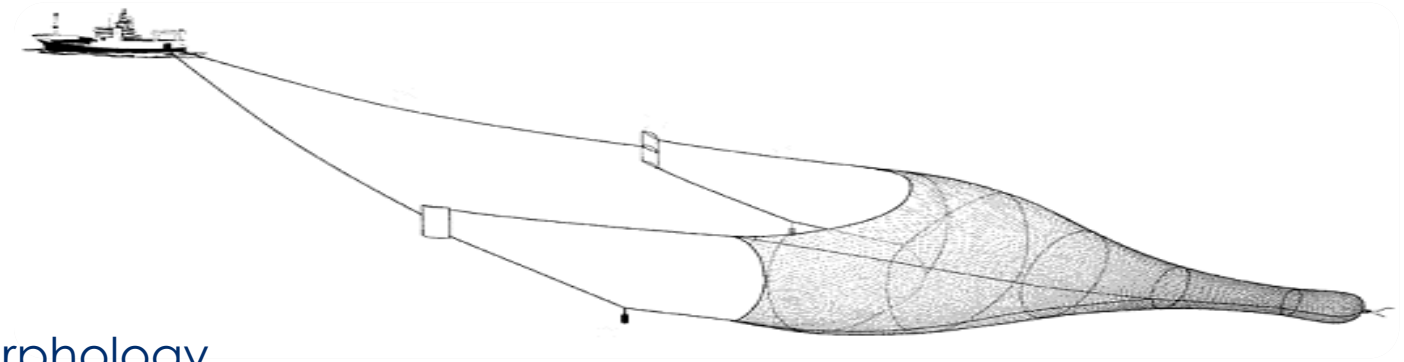
- Gear selectivity
- Bycatch mortality
- Habitat-gear interactions
- Derelict fishing gear
- Energy efficiency

Bycatch Reduction Devices (BRDs)

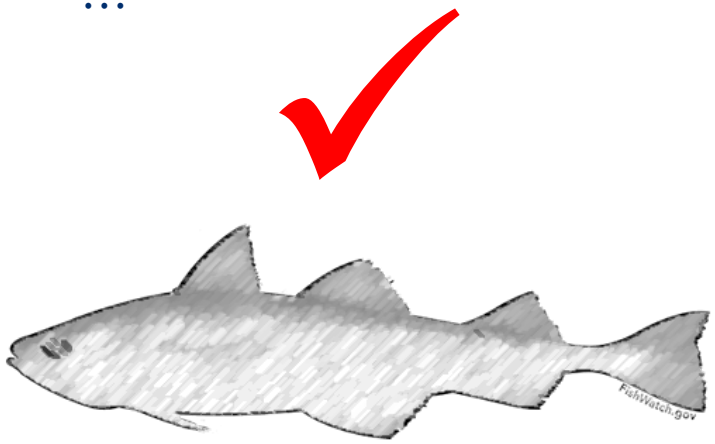
- Fishing gear modification designed to the reduce capture of unintended animals (bycatch)



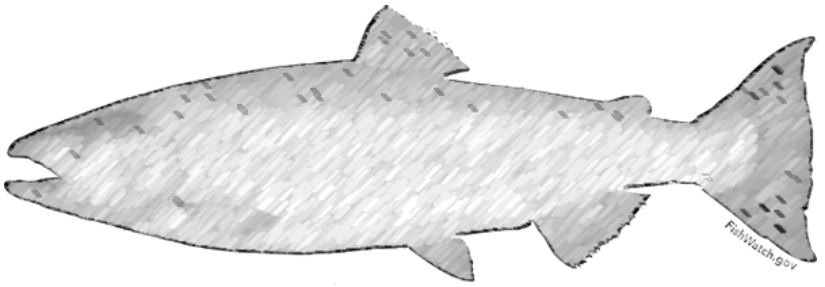




- Morphology
- Physiology
- Sensory Systems
- Behaviour
- …



Target animal



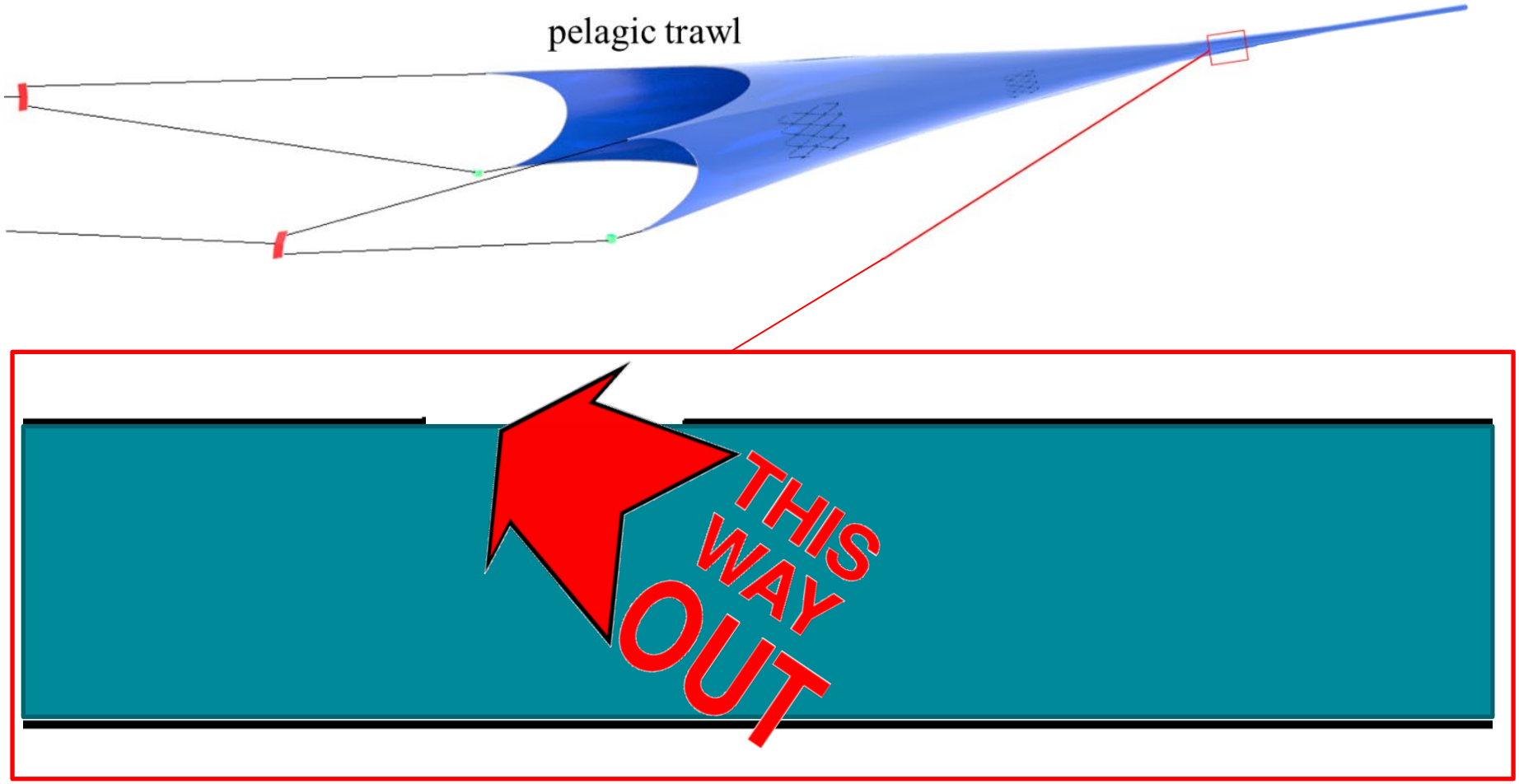
Bycatch animal

Alaska Walleye Pollock Fisheries

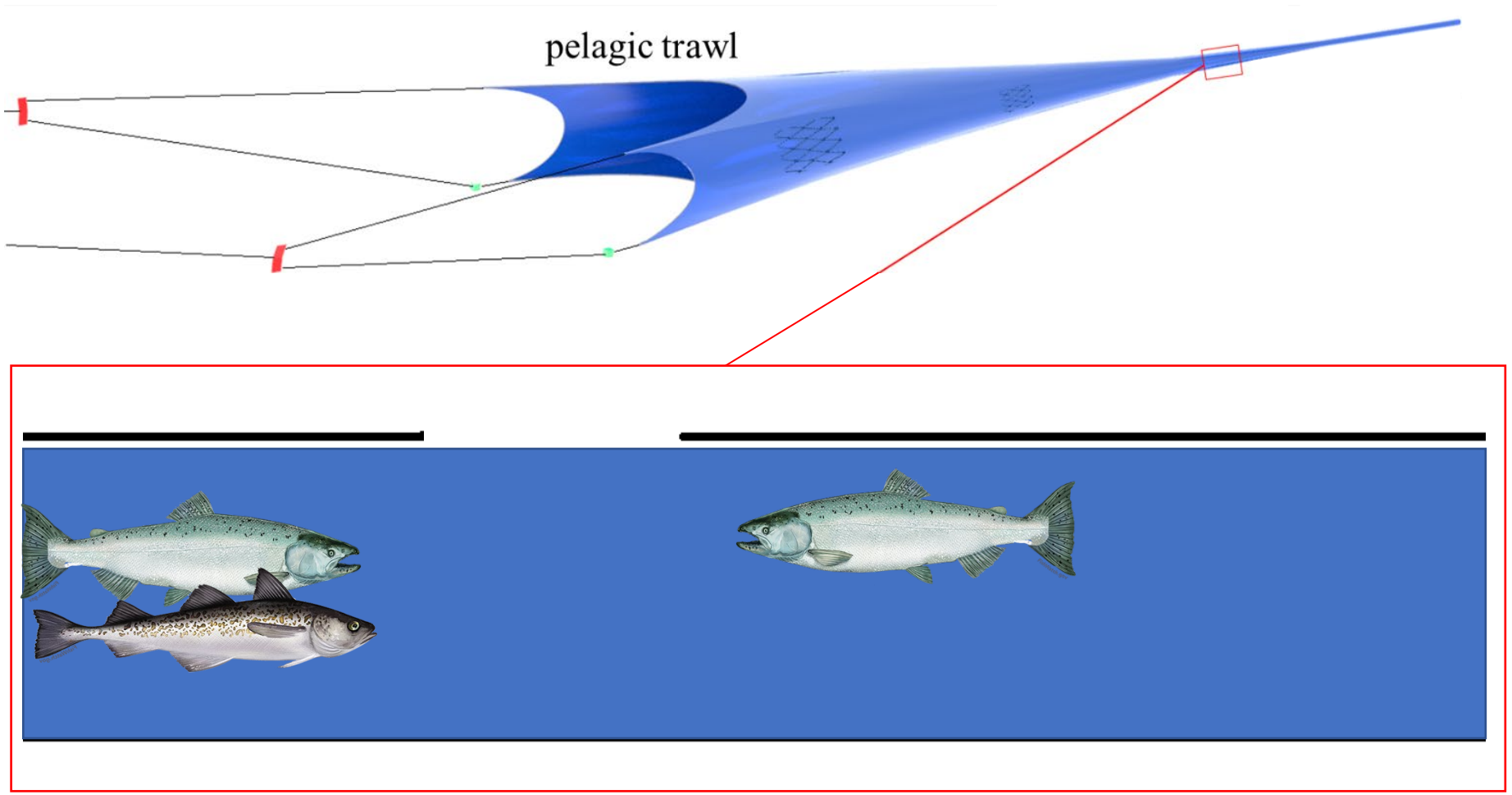
Salmon are stronger swimmers

https://www.visionlearning.com/

Salmon Excluders (2002 – Present)

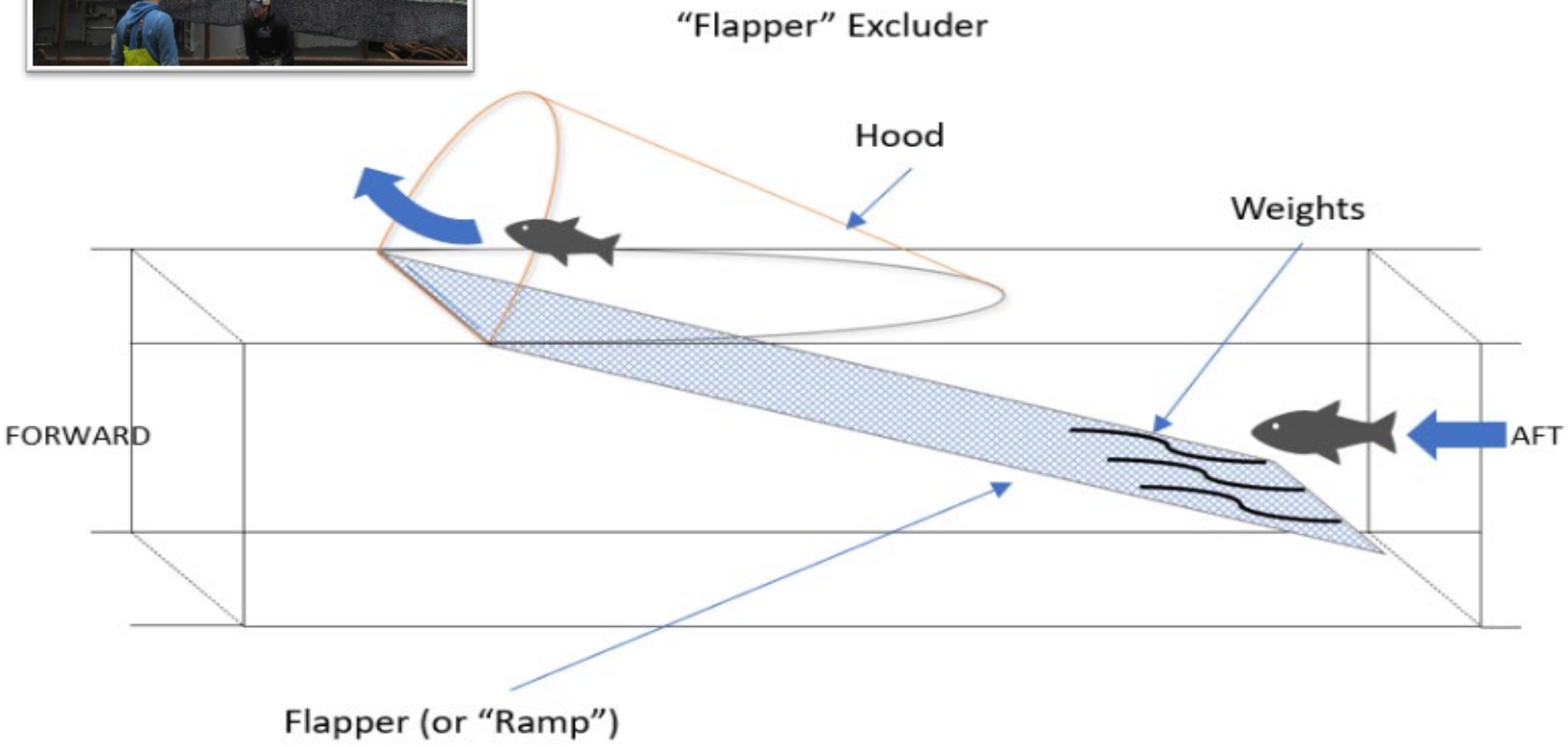


Salmon Excluders (2002 – Present)



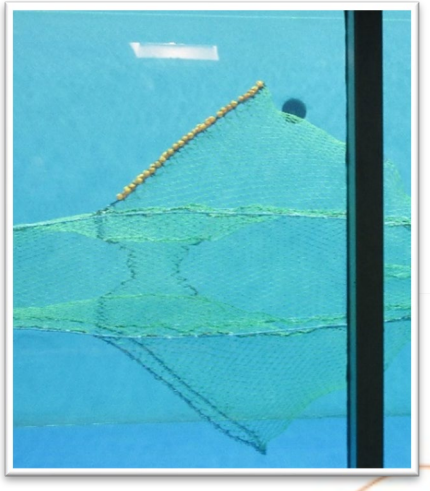
- John Gruver, John Gauvin, Mike Stone, and many others

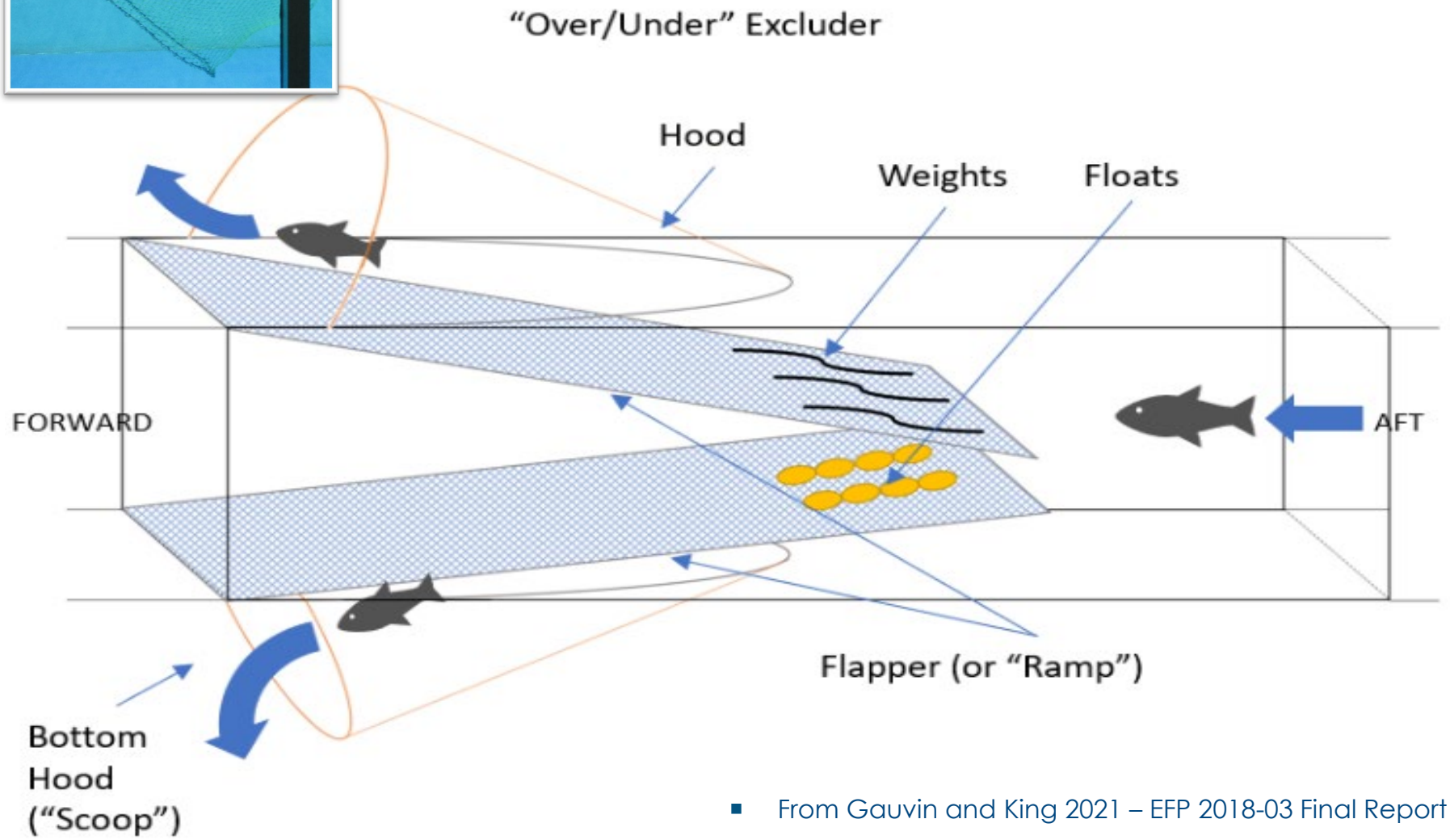
Salmon Excluders (2002 – Present)



- From Gauvin and King 2021 – EFP 2018-03 Final Report

Salmon Excluders (2002 – Present)

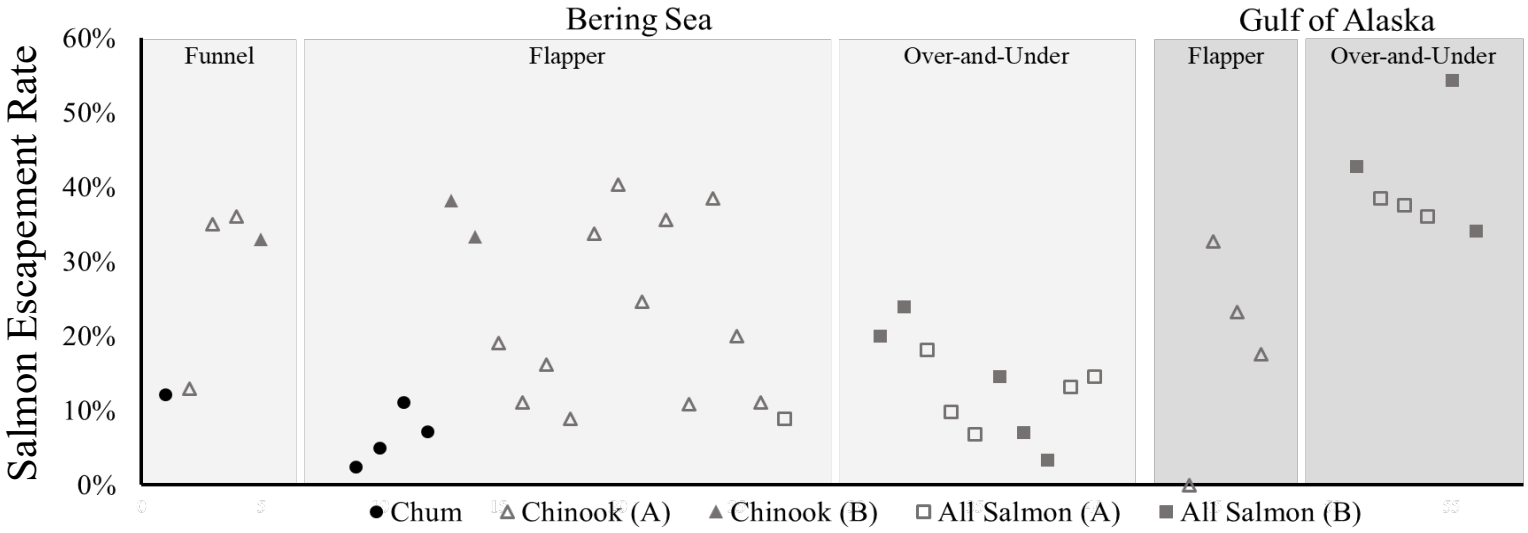




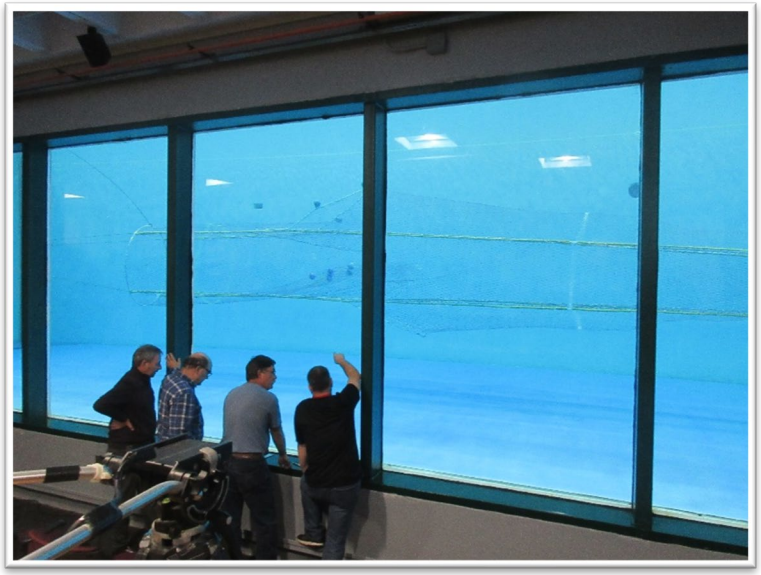
- From Gauvin and King 2021 – EFP 2018-03 Final Report

High Variability

- Variability in salmon escapement rates
- **Goal:** Reliable and high salmon escapement rates, low pollock escapement



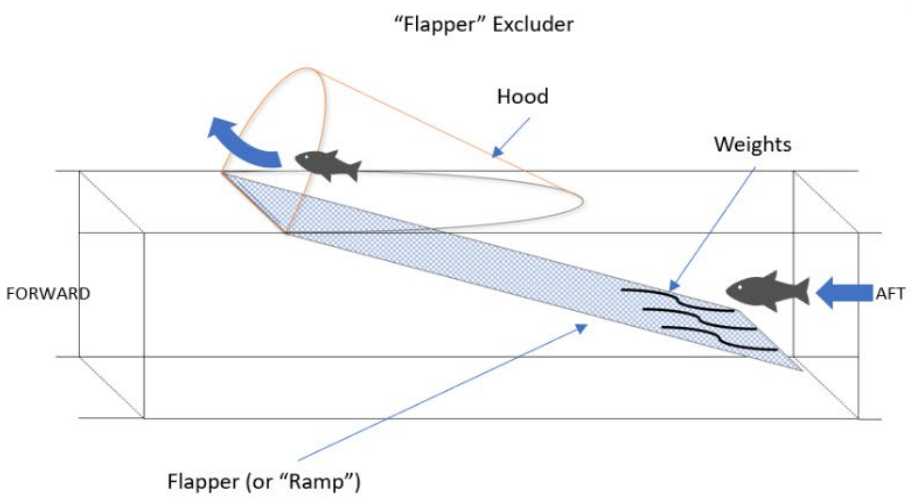
2017 Flume Tank Workshop – John Gauvin/ NPFRF

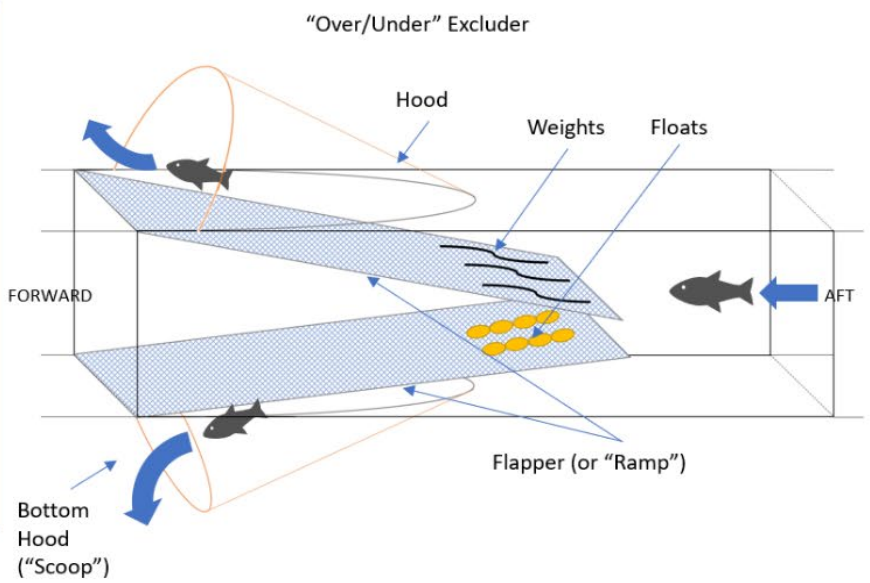


2018 – 2021 Salmon Excluder EFP John Gauvin/NPFRF

- Iterative process for improving flapper and O/U excluders
  - 1: CV <= 1,800 HP
  - 2. CV > 1,800 HP
  - 3. CP

- Patterns in escapement



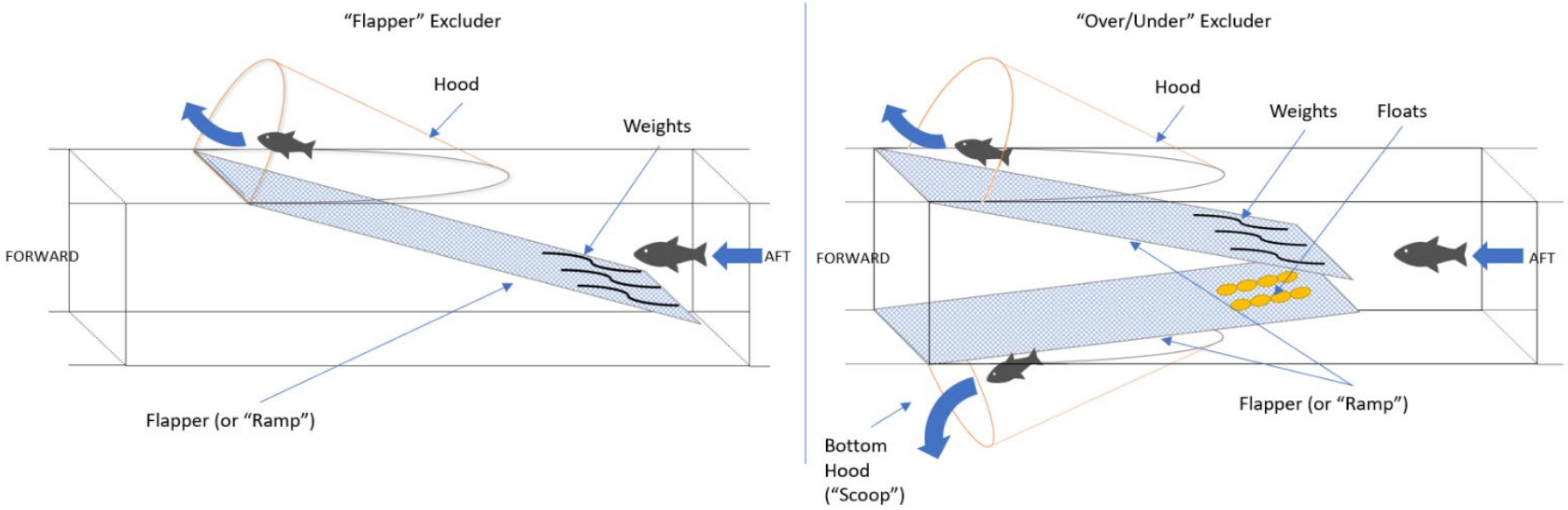


- From Gauvin and King 2021 – EFP 2018-03 Final Report

CE Salmon Excluder Research

- How do excluders work mechanistically/ how do salmon behave in and around them?

- Access
- Perception
- Motivation

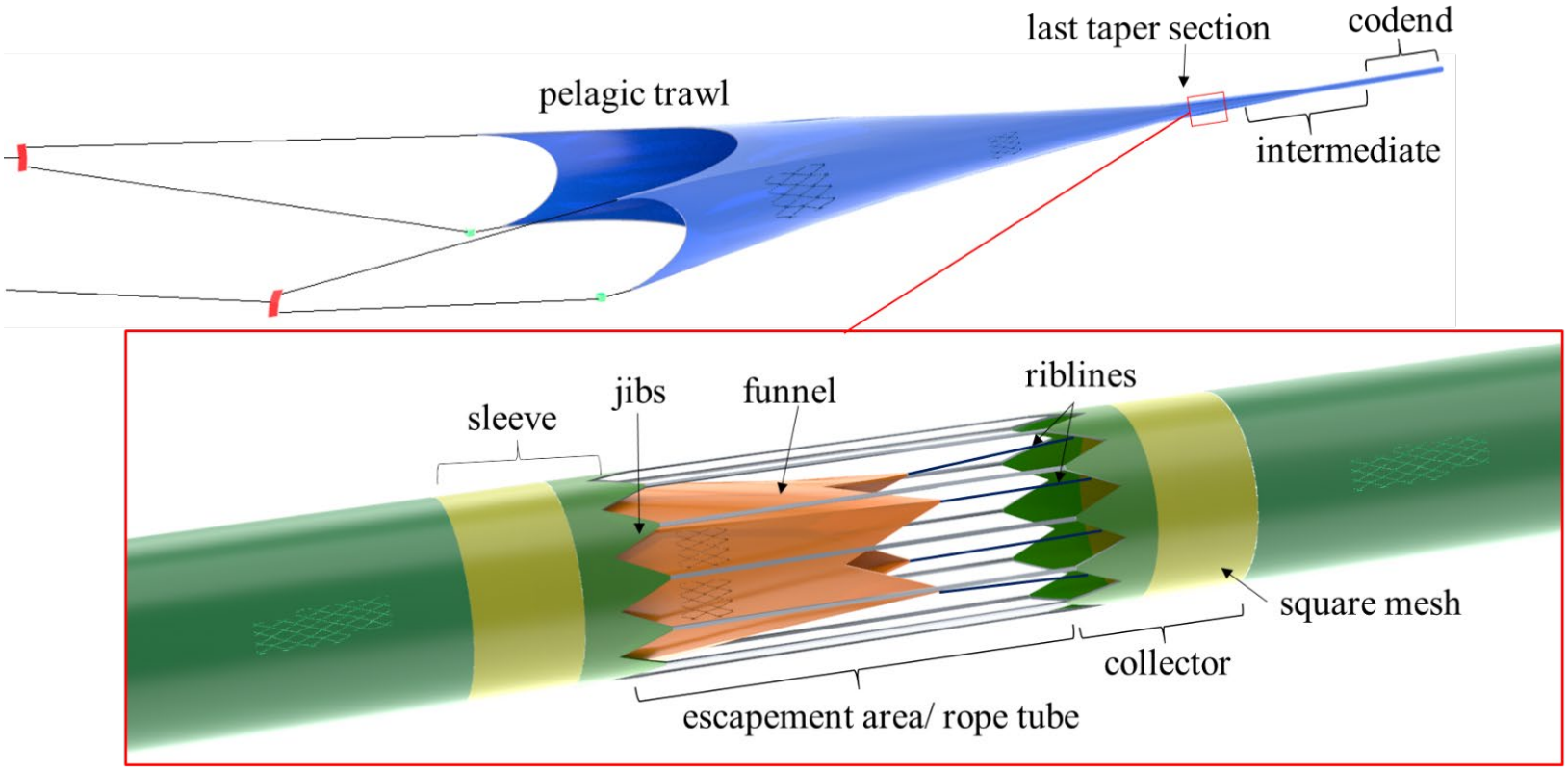


- From Gauvin and King 2021 – EFP 2018-03 Final Report

CE Salmon Excluder Research

Rope Tube & Funnel (RT&F) Excluder

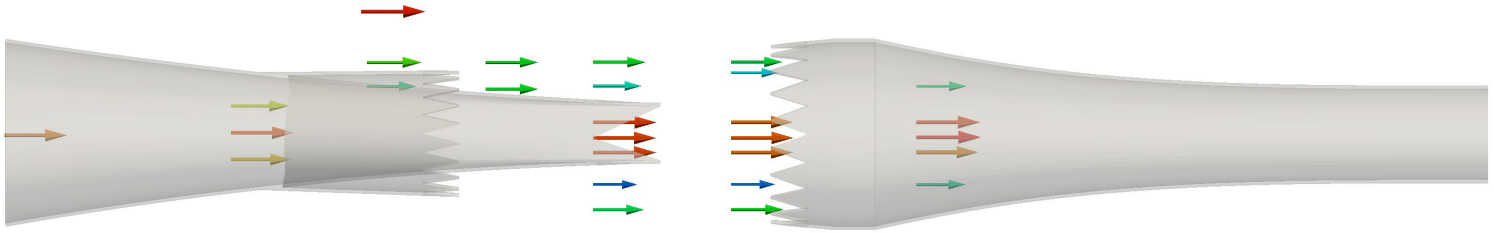
- Access: 360˚ open area
- Perception: Break up the visual pattern, water flow,
- Motivation: Water flow

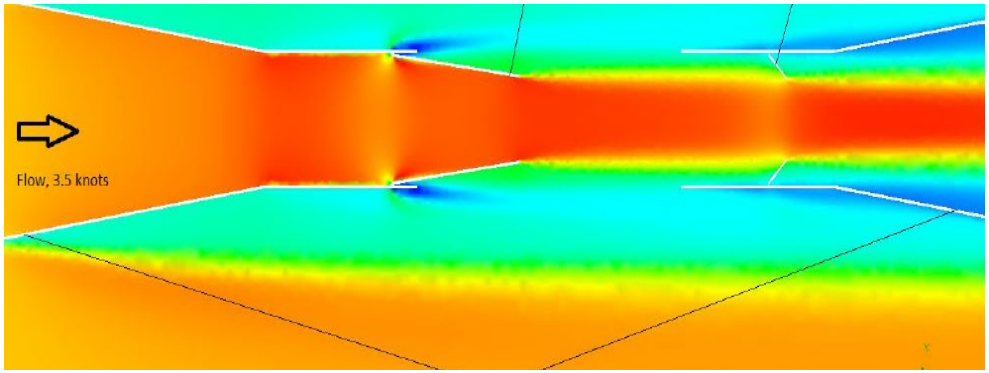


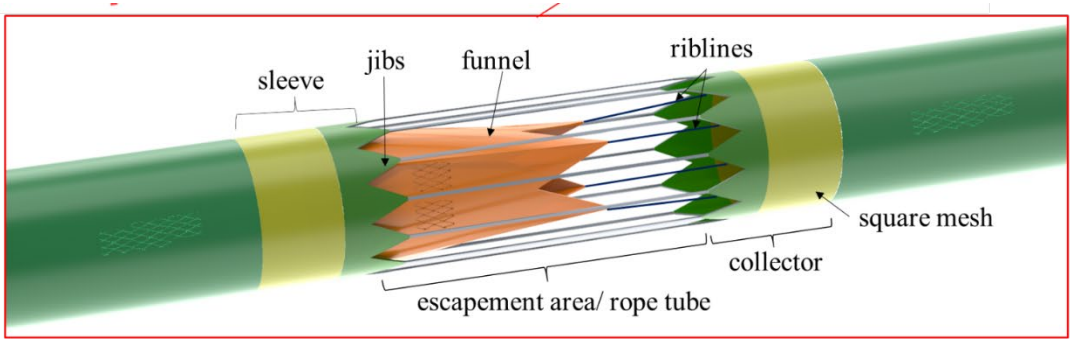
Not to scale

RT&F Excluder- Water Flow

- Perception
- Motivation







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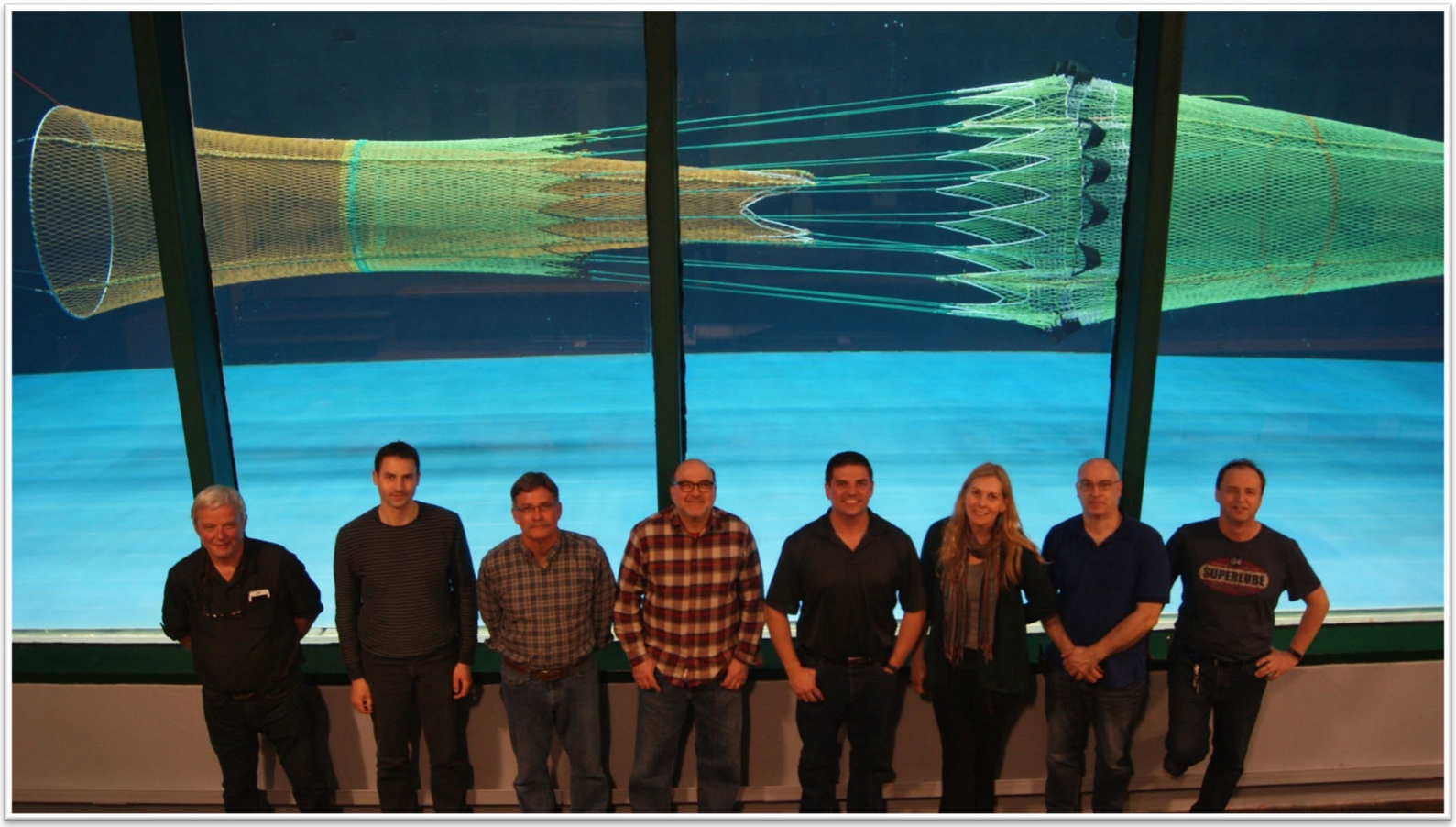
RT&F Excluder



RT&F Excluder

RT&F Excluder

Fisheries Research 236 (2021) 105830

Contents lists available at ScienceDirect

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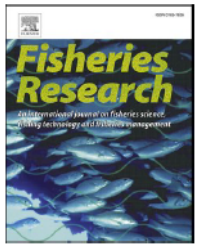
journal homepage: www.elsevier.com/locate/fishres



Check for updates

Evaluating the role of bycatch reduction device design and fish behavior on Pacific salmon (*Oncorhynchus* spp.) escapement rates from a pelagic trawl

Noëlle Yochum [a,*], Michael Stone [b], Karsten Breddermann [c], Barry A. Berejikian [d], John R. Gauvin [e], David J. Irvine [f]

CE Salmon Excluder Research

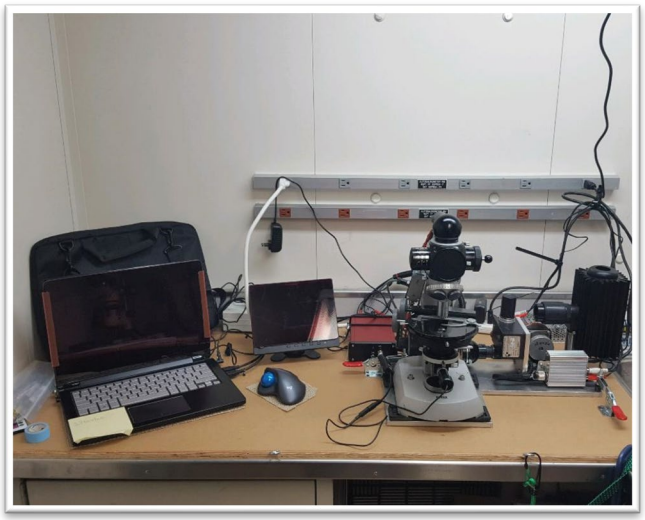
- Access: 42% retention
  - Access (location and design of the escapement area) is not the limiting factor

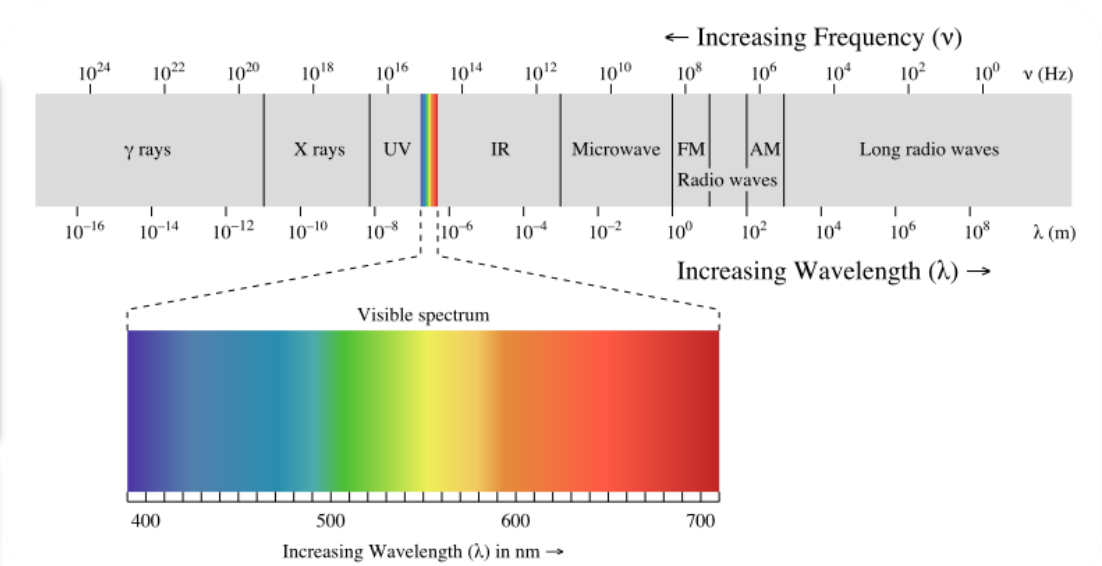
- Perception: Go past the escapement area quickly
  - Try to make escapement area more perceptible
    - Artificial light?

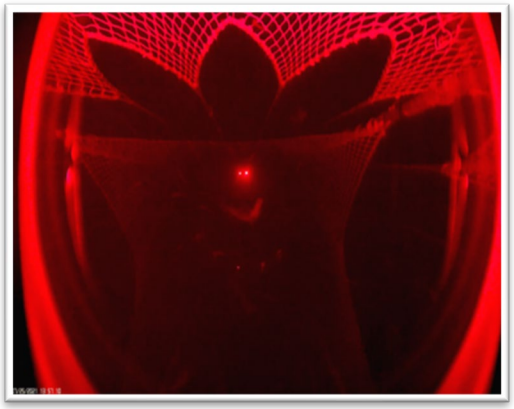
- Motivation: Not 'looking' for escapement opportunities
  - Deter passage into the intermediate
    - Artificial light?
  - Understand what drives forward movement

CE Salmon Excluder Research

- How do we observe behaviour without white camera lights?



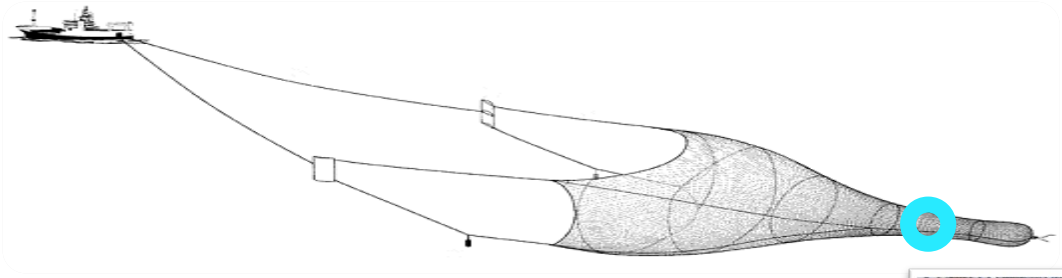


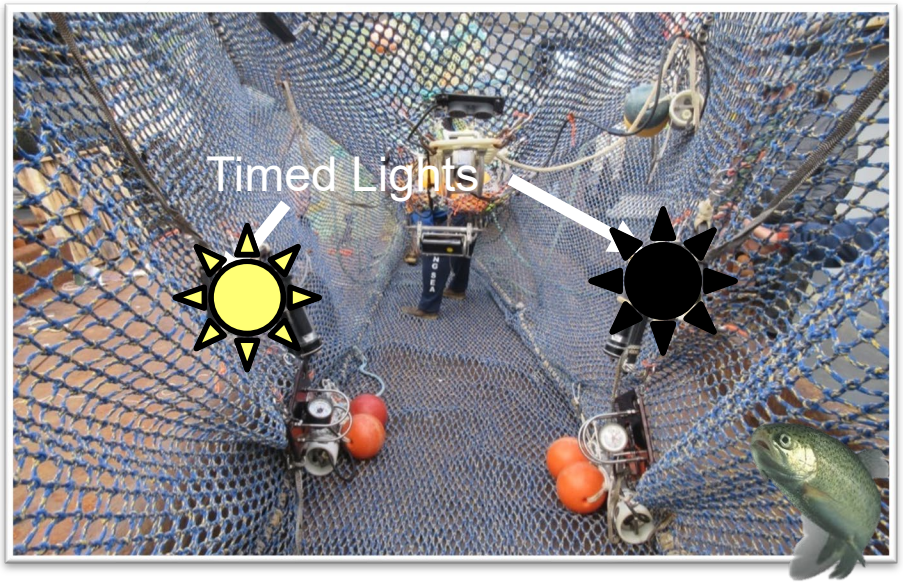


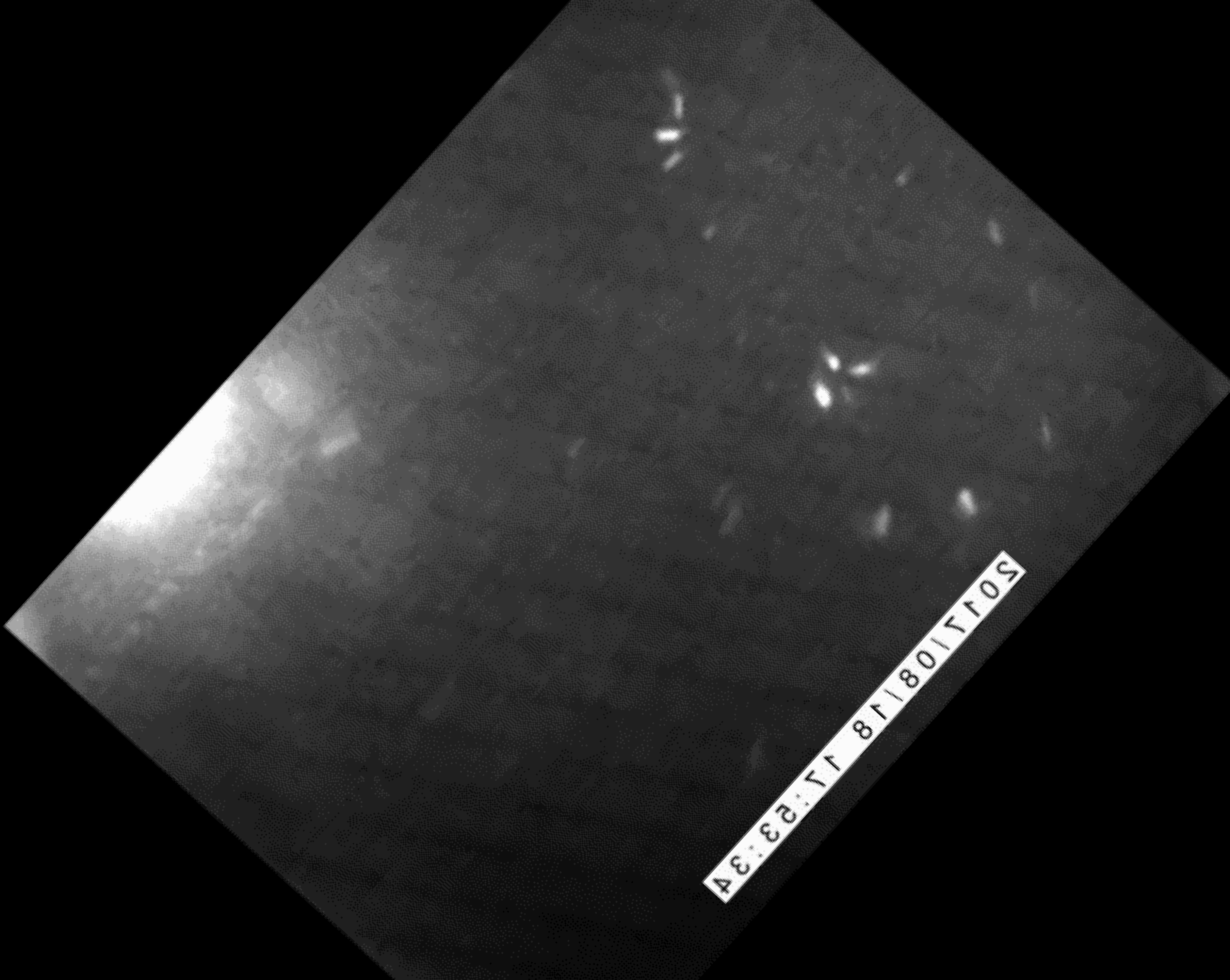
Lyle Britt, Rebecca Haehn, Ellis Loew

CE Salmon Excluder Research

- How do salmon respond to artificial light?



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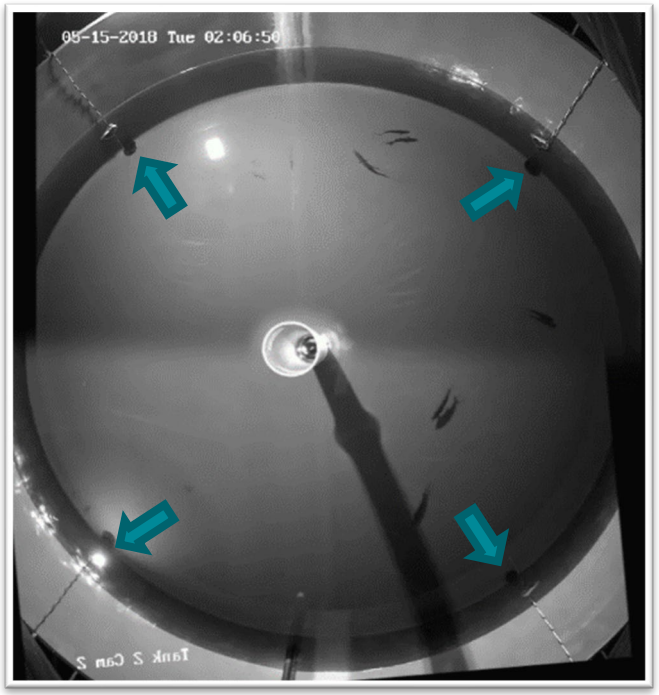
CE Salmon Excluder Research

- How is salmon behaviour affected by light properties?
  - Intensity (white light)
  - Wavelength (white, blue, green, red)
  - Strobe rate



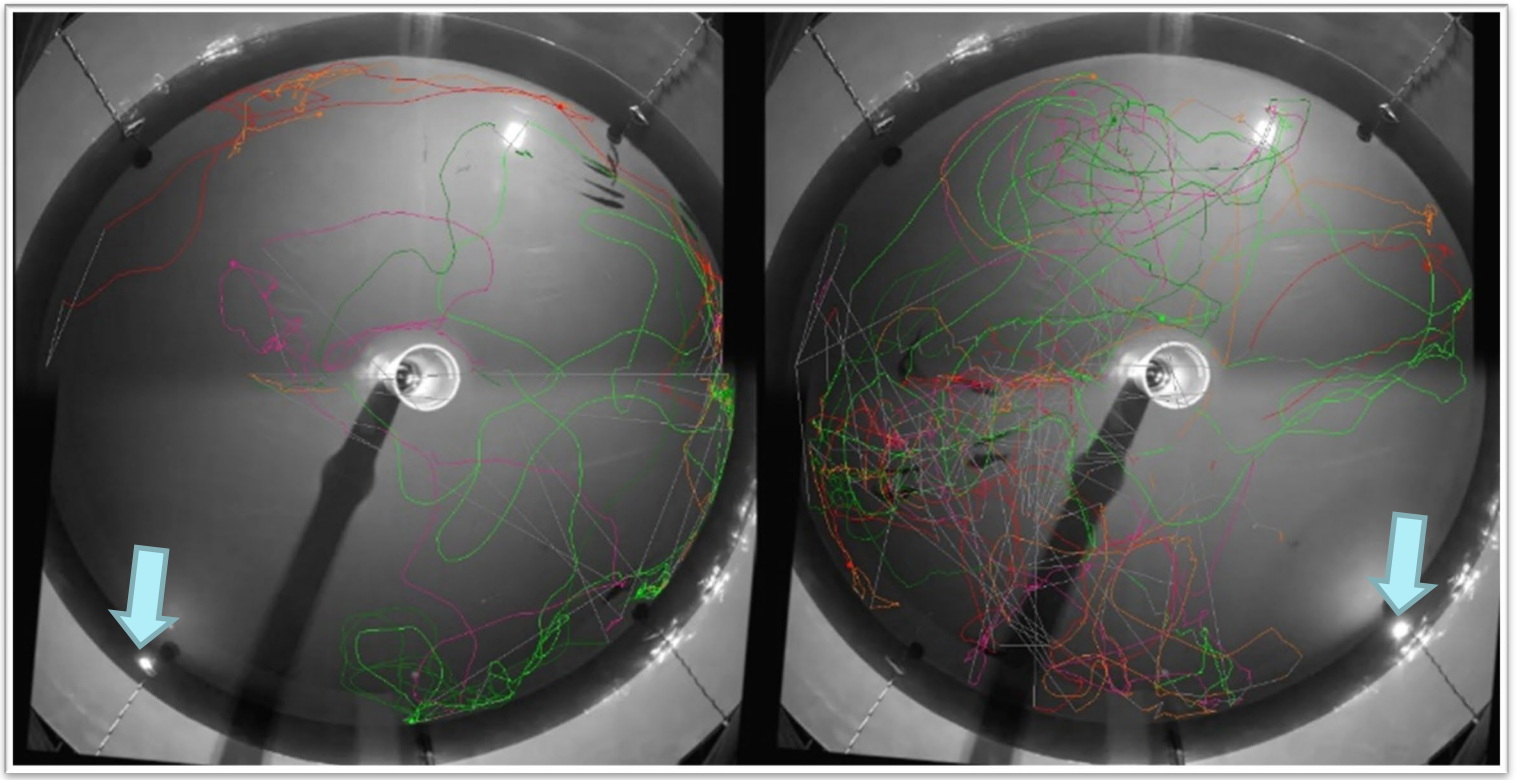
Canadian Science Publishing

ARTICLE

Evaluating Chinook salmon (*Oncorhynchus tshawytscha*) response to artificial light in support of bycatch mitigation

Noëlle Yochum, David R. Bryan, Lyle L. Britt, Barry A. Berejikian, Rebecca Haehn, Scott McEntire, Rick Towler, Jeff Atkins, Brad Gadberry, and Paul Irvin

Abstract: In commercial trawl fisheries in the North Pacific and US West Coast, fishermen and scientists are evaluating if artificial lights facilitate escapement of bycaught Chinook salmon (*Oncorhynchus tshawytscha*) from the trawl by attracting them to an opening provided by a bycatch reduction device. Inconsistent behaviour and escapement rates when lights were used in the trawl led us to conduct a laboratory study to evaluate the role of light properties (intensity, colour, and strobe) on marine Chinook salmon behaviour. Results from this study suggest a negative phototactic response. Light colour and strobe, and the interaction between them, differentially affected behavioural response with regard to mean swimming speed and distance from and habituation to the light. White light intensity had limited influence on response; however, the range of trialed intensities was limited. While behaviour is contextual and responses in a laboratory setting cannot be directly extrapolated to responses in fishing gear, this study highlights the significant role of light properties when trying to affect behaviour for bycatch mitigation and the importance of distinguishing between a response to light and to illuminated surroundings.



Results from this study suggest a negative phototactic response. Light colour and strobe, and the interaction between them, differentially affected behavioural response with regard to mean swimming speed and distance from and habituation to the light.

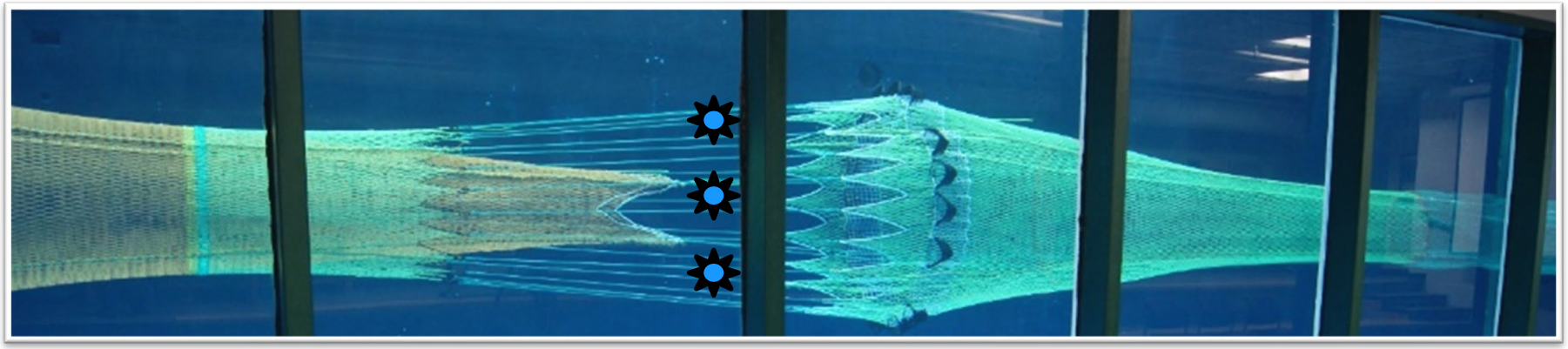
Results from this study suggest a negative phototactic response. Light colour and strobe, and the interaction between them, differentially affected behavioural response with regard to mean swimming speed and distance from and habituation to the light.

CE Salmon Excluder Research

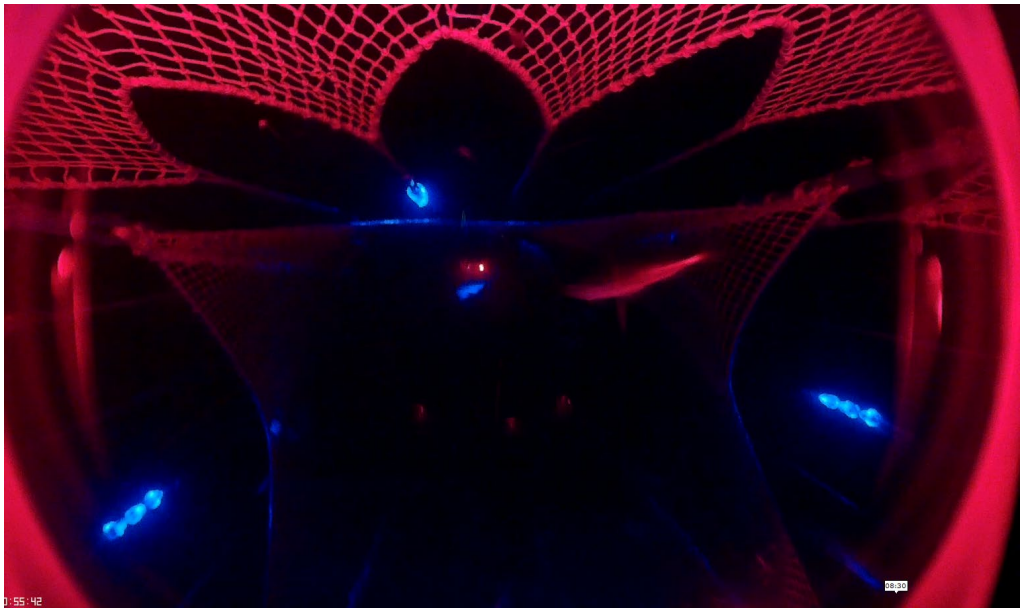
- **Perception**: Try to make the escapement area more perceptible
  - **Blue Light**

- **Motivation**: Deter passage into the intermediate
  - **White strobing Light**

CE Salmon Excluder Research

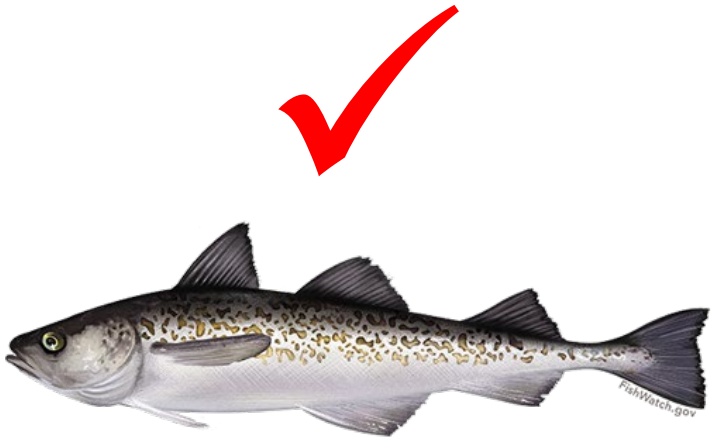


- 2022 Trident Seafoods study



Summary

- More to learn about salmon excluders and salmon behaviour



Target animal

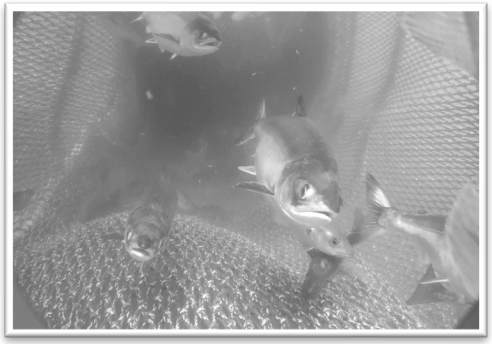
Bycatch animal

Summary

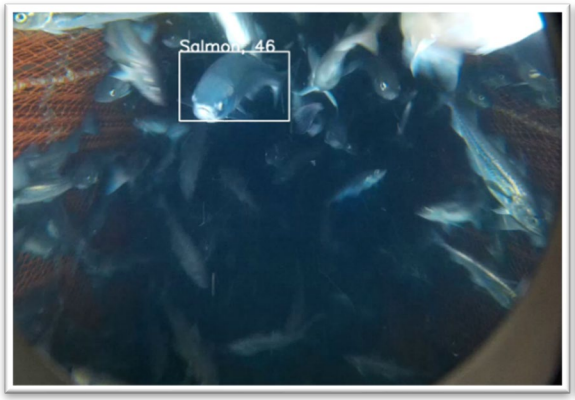
- Industry – government/science collaboration
- Need to understand drivers of escapement better/ to learn about salmon behaviour
- Need to rethink salmon excluder design
  - Location/design of the escapement area less limiting than perception and motivation
- More to learn about artificial light as a bycatch reduction tool- not a "silver bullet"

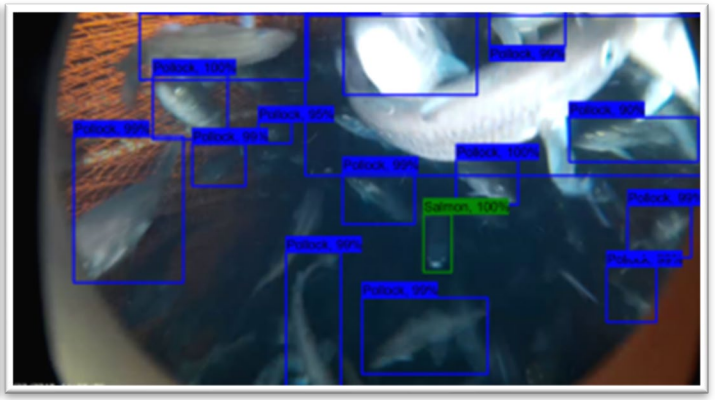
Next Steps

- RT&F blue light study- results
- Salmon behaviour during haulback, drivers of forward movement (David Bryan)



- Salmon behaviour in the escapement area
- Use of AI to expedite video review and estimate pollock loss (Katherine Wilson)





Questions?

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