Letting Pacific halibut off the hook: relating capture and physiological conditions to viability and survival of fish discarded from commercial hook and line gear

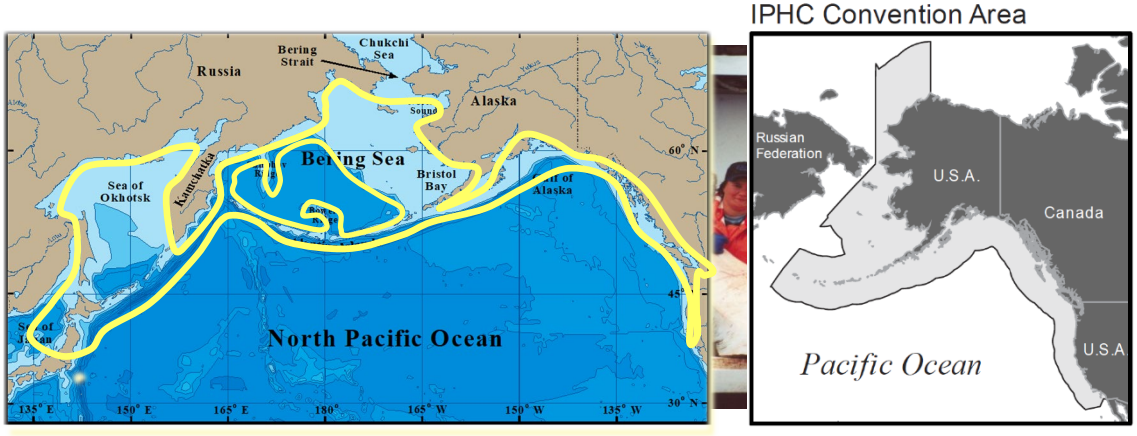
INTERNATIONAL PACIFIC HALIBUT COMMISSION

Claude Dykstra – Research Biologist

International Pacific Halibut Commission, Seattle, WA, USA

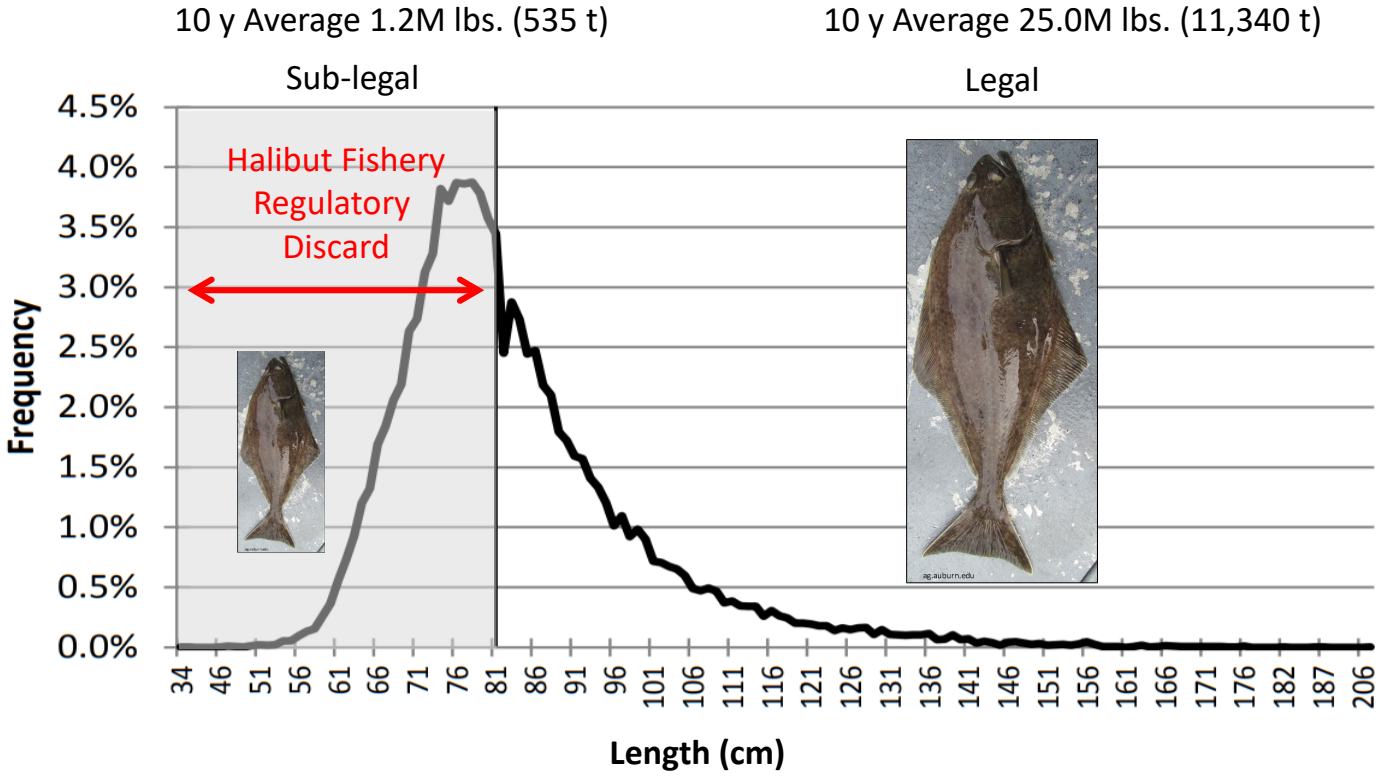
Background

- Pacific halibut (*Hippoglossus stenolepis*)



- Managed by the International Pacific Halibut Commission (IPHC)
- 2022 removals: Directed (26.1 M lbs., 11,838 t), Recreational (6.5 M lbs., 2,968 t), Subsistence (0.96 M lbs., 435 t), Bycatch (3.5 M lbs., 1,579 t).

Pacific halibut – Length Frequency (2022)



Legal

Landings Mortality

Sublegal

Observers:
- Numbers
- Size
- Viability

Discard Mortality Rates (DMRs)

Discard Mortality

Survival

Legal

Landings Mortality

Discard Mortality

= Removals (Fishery mortality)

Sublegal

Observers:
- Numbers
- Size
- Viability

Discard Mortality Rates (DMRs)

Survival

Discard Mortality Rates (DMRs)

Code	Description
NO	No apparent injury.
CO	Cheek only (not through skin).
JO	Jaw only (but not clear through the jaw).
TL	Torn lip (skin covering external portion of jaw), cheek not punctured.
TC	Torn cheek, small hole through cheek only.
TJ	Torn jaw, either side. Little or no tearing in cheek.
CJ	Cheek and jaw. Tear in cheek extending through jaw.
EY	Hook penetrated eye.
TF	Torn face. Torn though cheek and jaw, like above, but large flap of side of head is ripped/missing.
SJ	Split jaw. Lower jaw is split laterally.
JB	Jig body. Fish snagged by hook somewhere on body other than head.
JH	Jig head. Fish snagged by hook in the head (not through mouth).
TS	Torn snout. Upper jaw is split laterally, usually tearing through the snout as well.
UN	Injury unknown or unrecorded.

DMR

- Excellent 3.5%
- Moderate 36.3%
- Poor 66.2%
- Dead 100%

Viability Assessment

Release Viability Class

Studies:

<u>Caging Experiments</u>

Peltonen (1969)
Kaimmer et al. (2012)

<u>Tagging</u>

Peltonen (1969)
Kaimmer (2000)
Kaimmer et al. (2012)

Limitations:

- Sample sizes
- Hook type
- Environmental

- Reporting Rates

Objectives

NOAA FISHERIES Saltonstall – Kennedy Grant NA17NMF4270240

Objective 1. Evaluate the effects of hook release practices on physical injury type in Pacific halibut.

Objective 2. Explore the relationship between physical injury types and release viability classification.

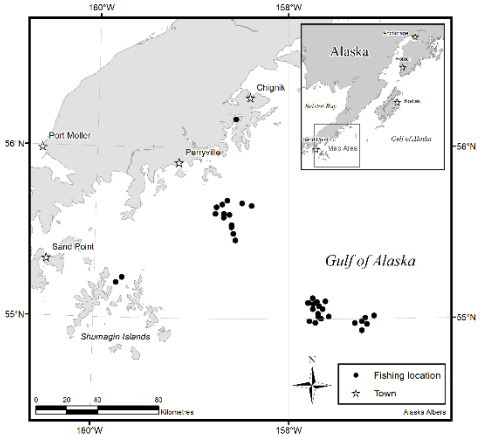
Objective 3. Investigate the influence of individual characteristics (physical, physiological), environmental conditions, and handling practices on viability classifications.

Objective 4. Determine discard mortality rate for Pacific halibut in Excellent condition.

Methods – Field

- Oct/Nov 2017
- F/V Kema Sue
- Chignik area
- 14 fishing days
- 38 sets (800 hooks/set)
  - 6 skates of Careful Shake
  - 1 skate of Gangion Cut
  - 2 skates of Hook Stripping

- 1,269 legal size fish
- 1,139 sub-legal fish

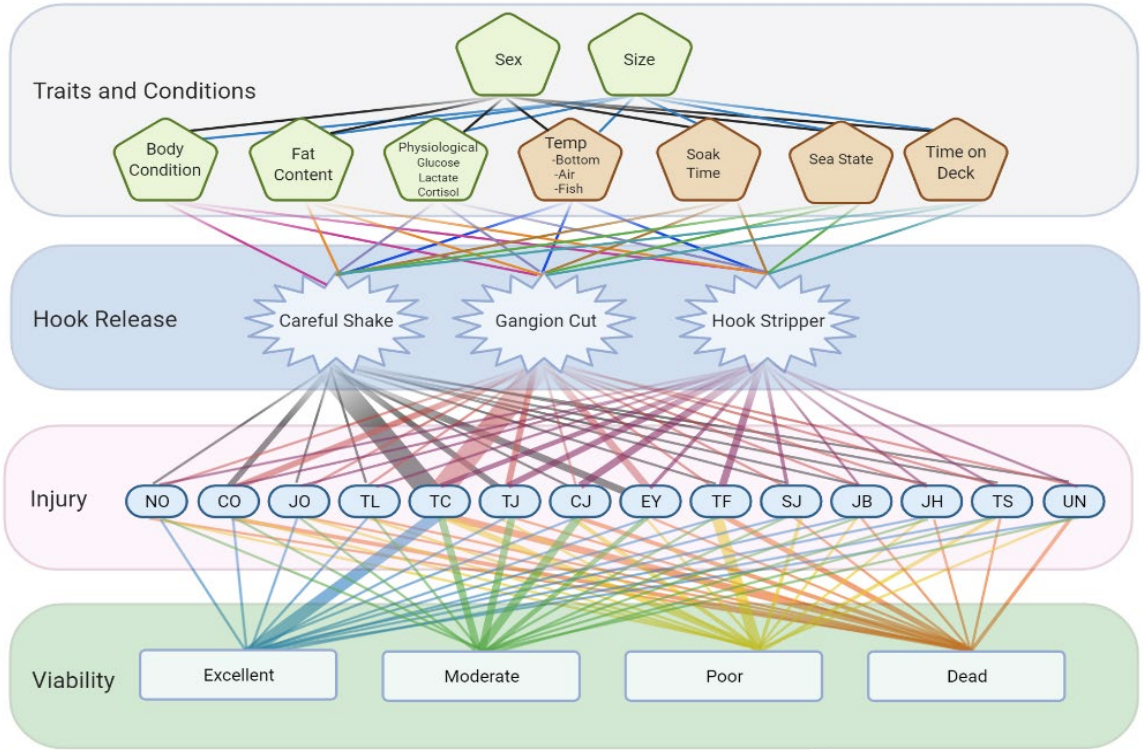


Careful Shake

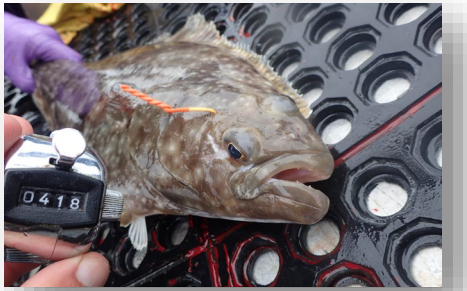
Gangion Cut

Hook Stripper

Methods – Data Collected



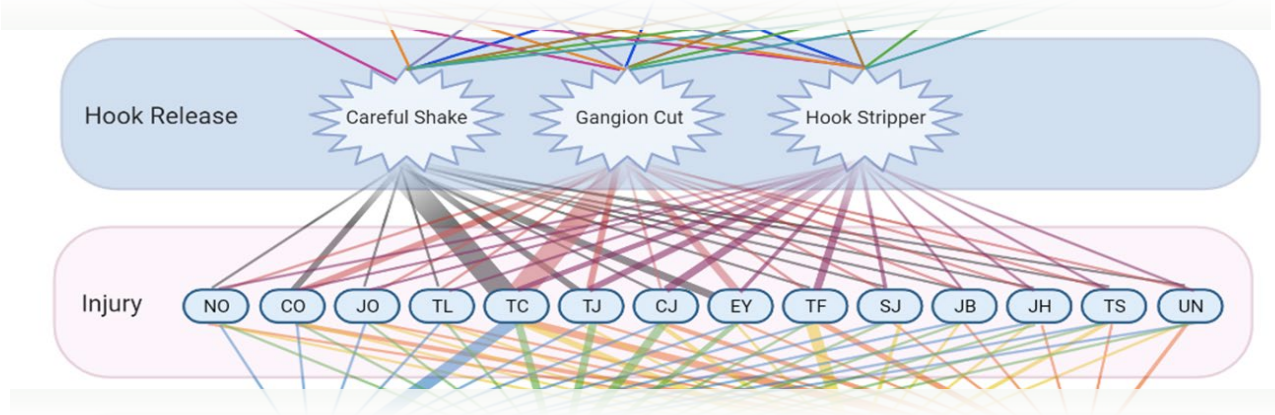
Methods – Survival (by tagging)



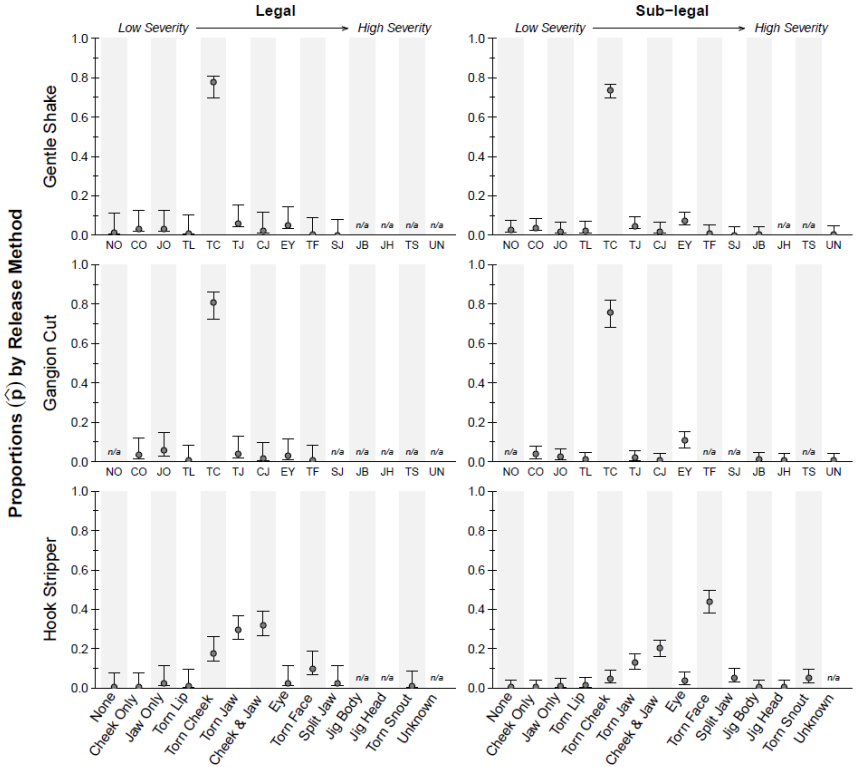
- Wire or archival tagging (sub-legal)

- Viability assessment (sub-legal)
- Other observations (sand fleas, prior injuries)

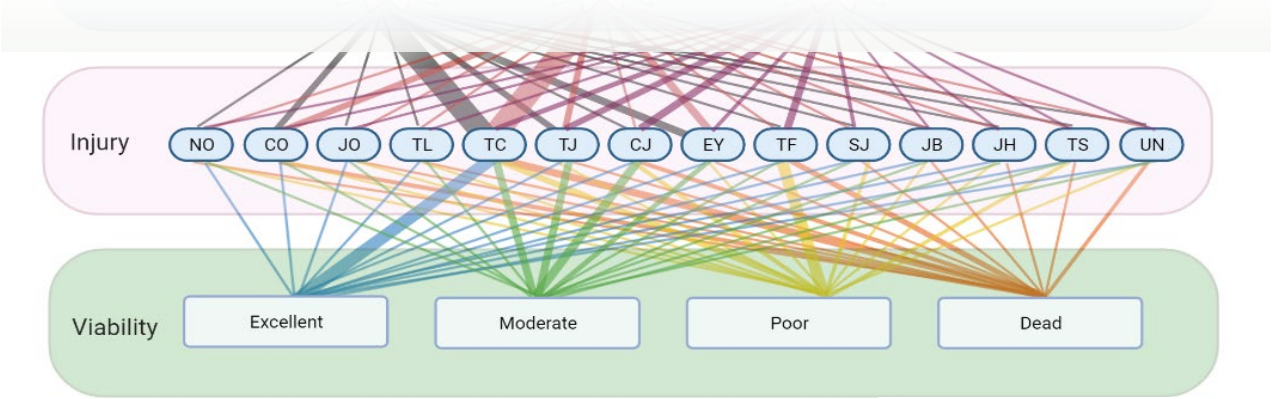
Objective 1. Evaluate the effects of hook release practices on physical injury type in Pacific halibut.



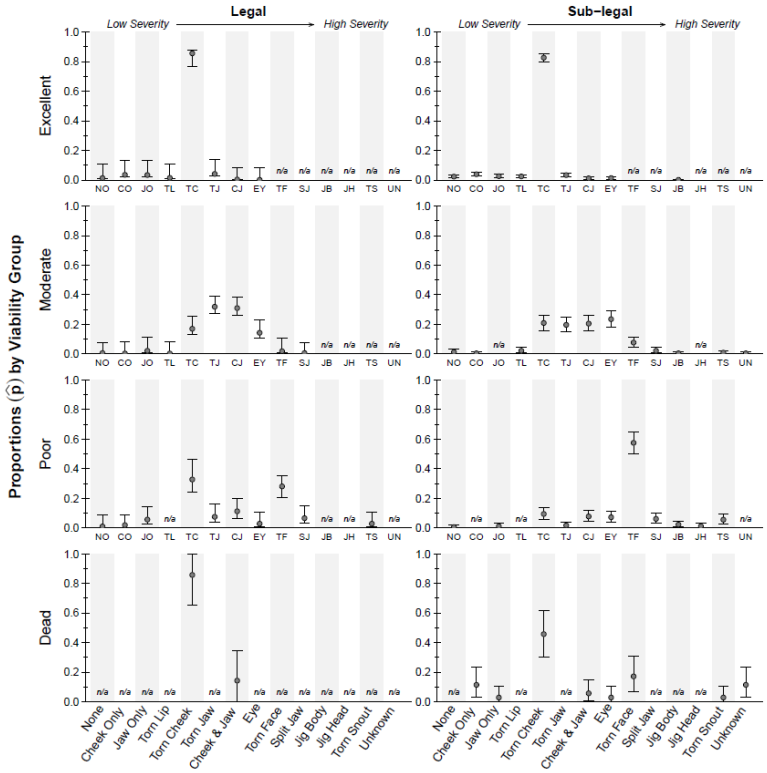
Objective 1. Evaluate the effects of hook release practices on physical injury type in Pacific halibut.



Objective 2. Explore the relationship between physical injury types and release viability classification.



Objective 2. Explore the relationship between physical injury types and release viability classification.



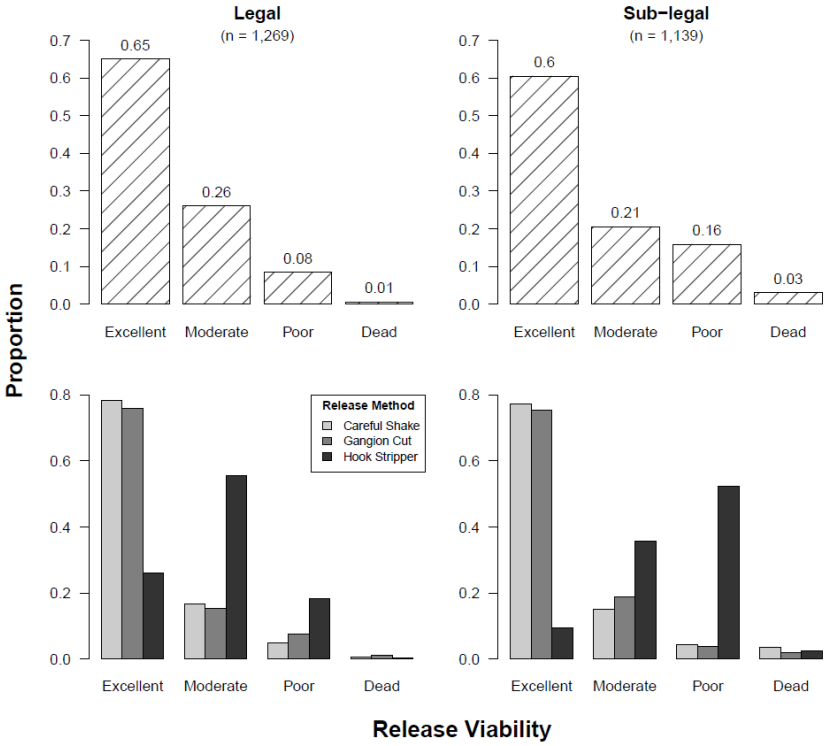
Majority have simple hooking injury

Injuries extending into the jaw / eye / face

Torn face – dominant in sub-legal fish

Torn cheek most common.

Objective 2. Explore the relationship between physical injury types and release viability classification.

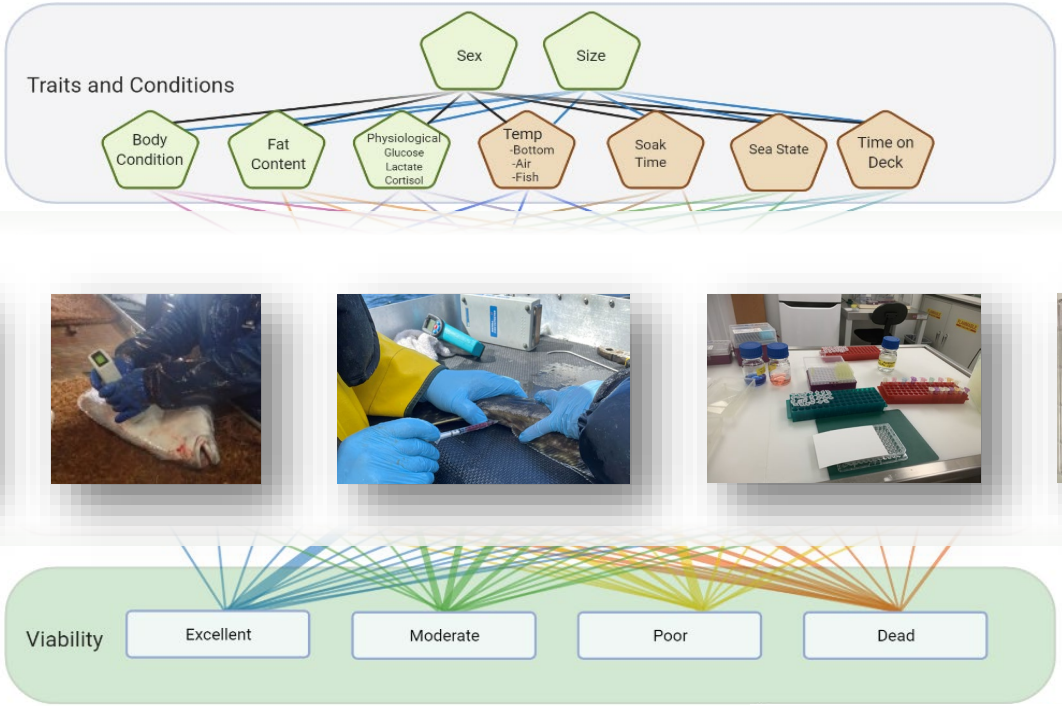


Sub-legal fish with poorer outcomes

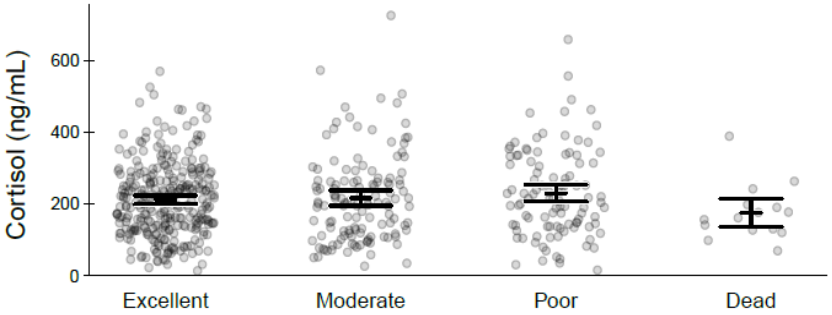
Careful shake and Gangion cut have similar outcomes

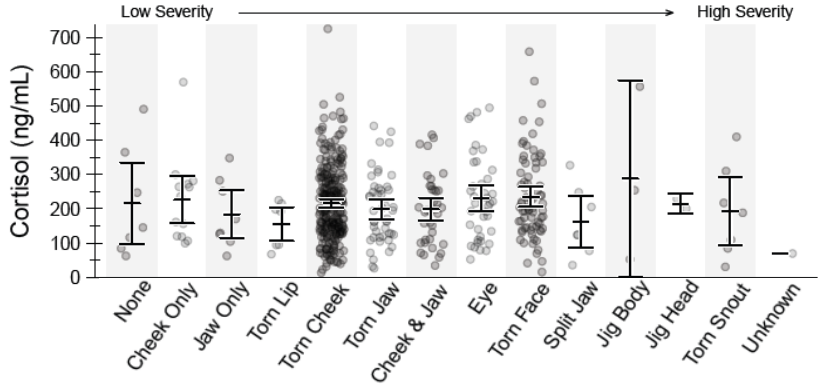
Hook stripper has poorer outcomes
- particularly in sub-legal fish

Objective 3. Investigate the influence of physiological status, environmental conditions, and handling practices on viability classifications.



Objective 3. Investigate the influence of physiological status, environmental conditions, and handling practices on viability classifications.

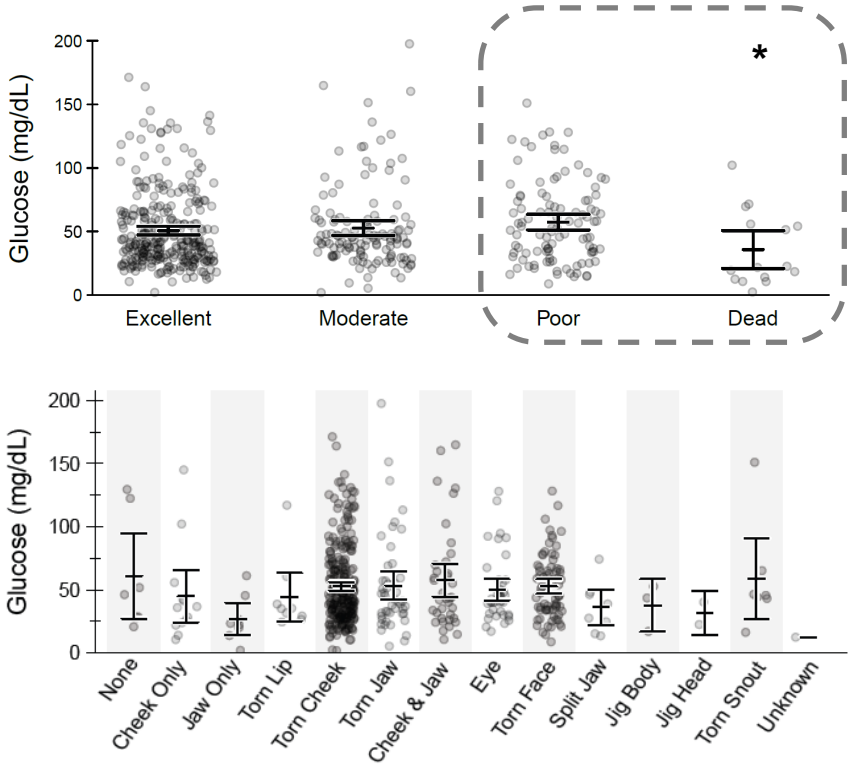




Cortisol:

- No significant differences

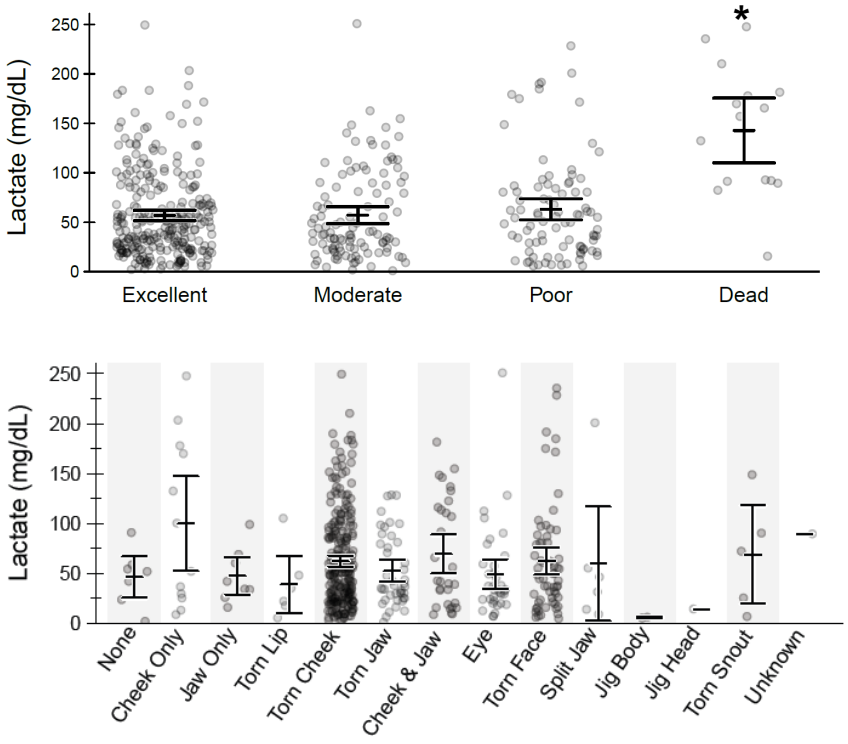
Objective 3. Investigate the influence of physiological status, environmental conditions, and handling practices on viability classifications.



Glucose:

- Significantly lower glucose levels in dead fish compared to poor fish

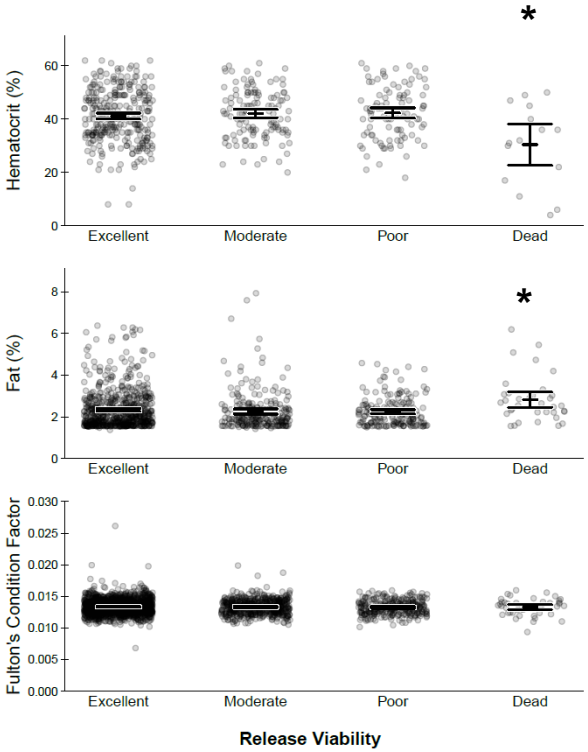
Objective 3. Investigate the influence of physiological status, environmental conditions, and handling practices on viability classifications.



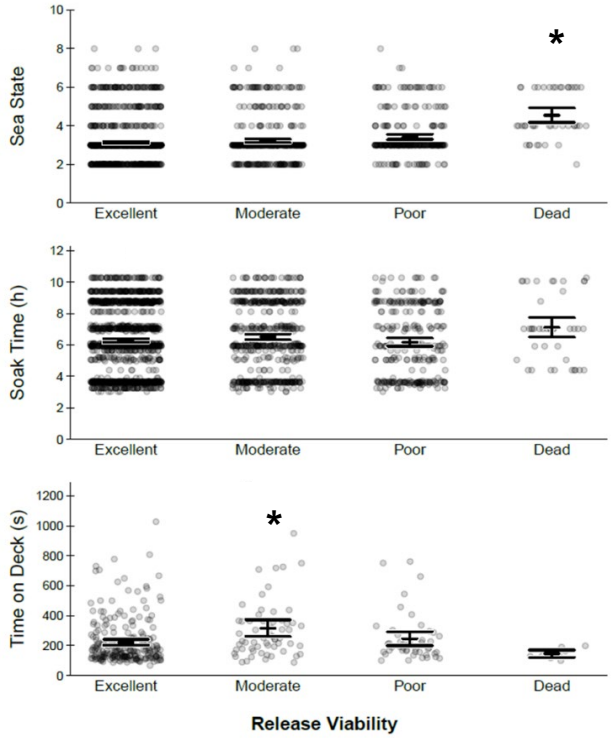
Lactate:

- Dead fish have significantly higher levels

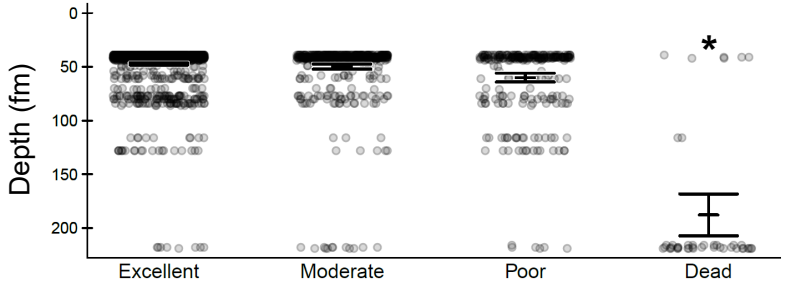
Objective 3. Investigate the influence of physiological status, environmental conditions, and handling practices on viability classifications.

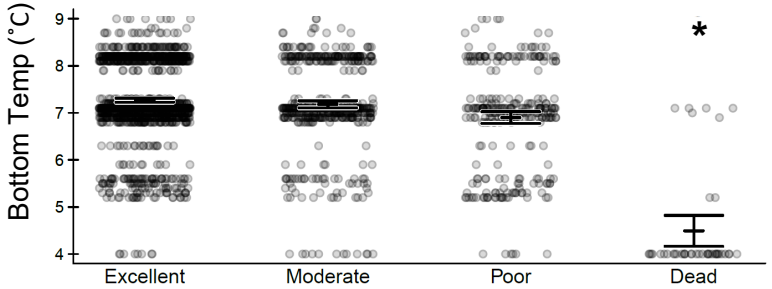


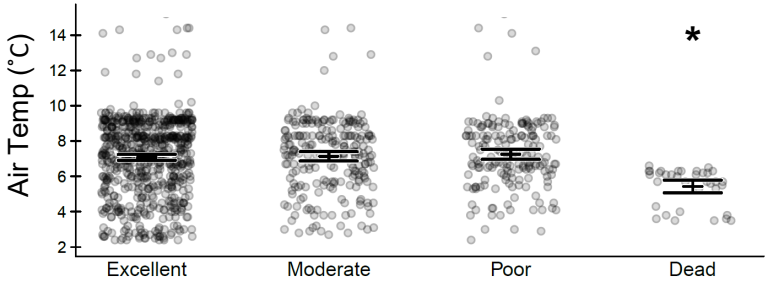
Objective 3. Investigate the influence of physiological status, environmental conditions, and handling practices on viability classifications.

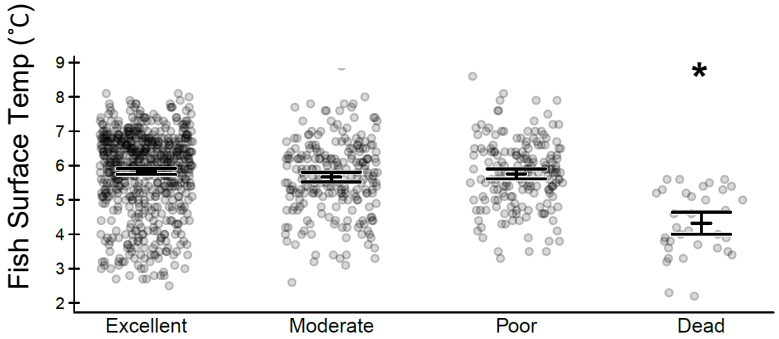


Objective 3. Investigate the influence of physiological status, environmental conditions, and handling practices on viability classifications.

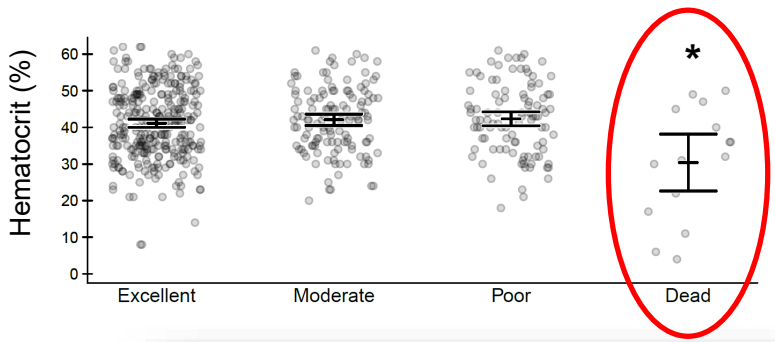


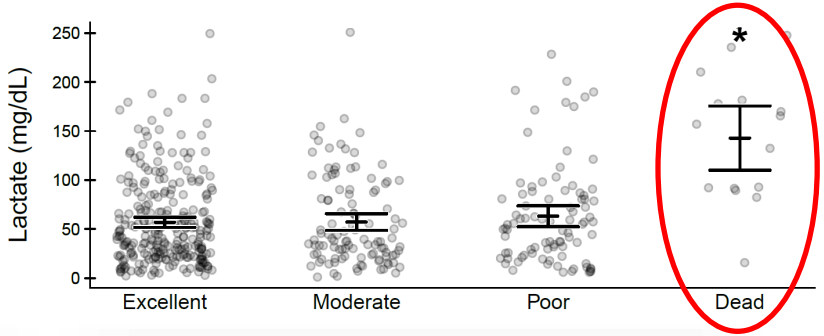






Objective 3. Investigate the influence of physiological status, environmental conditions, and handling practices on viability classifications.





Objective 4. Determine discard mortality rate for Pacific halibut in Excellent condition.

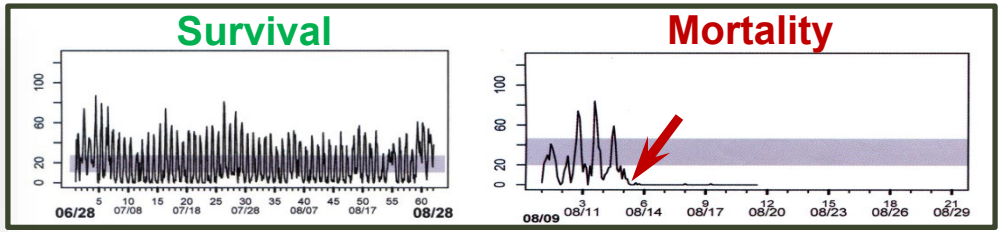
Quantify and Characterize Survival

- Tags
  - Wire = 1,027 releases – 32 recovered to date
  - sPAT = 79 releases on Excellent viability fish

    75 individuals provided functional data

A) Wire Tag

B) sPAT Tag

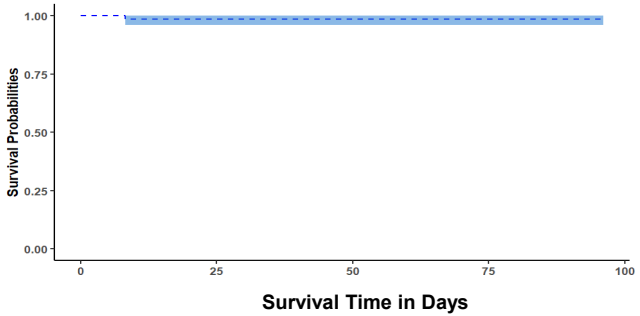


C) Typical acceleration patterns for fish that survive and fish that die

Objective 4. Determine discard mortality rate for Pacific halibut in Excellent condition.

Quantify and Characterize Survival

- sPAT Survival Analysis (R package ‘survival’ – time to event)
  - Minimum mortality rate of 4.2% (95% CI of 0.0 – 8.7%) for fish of ‘Excellent’ viability
  - Consistent with the currently applied DMR of 3.5%



Loher, T., Dykstra, C.L., Hicks, A., Stewart, I.J., Wolf, N., Harris, B.P., Planas, J.V. (**2022**). Estimation of postrelease longline mortality in Pacific halibut using acceleration-logging tags**.** ***North American Journal of Fisheries Management*****,** ***42***, 37-49. doi: 10.1002/nafm.10711

Summary

Commercial DMR

- Current estimate of 3.5% DMR for fish of Excellent viability is consistent with this study
- Careful shake does not produce additional damage over gangion cut
- Hook stripping results in the most severe injuries
- Minimize soak times in areas of sand fleas for best outcomes

Acknowledgements

- IPHC:
  - Dr. Allan Hicks
  - Dr. Ian Stewart
  - Dr. Josep Planas
  - Crystal Simchick
  - Field Staff
- APU
  - Dr. Nathan Wolf
  - Dr. Bradley Harris
  - Felipe Restrepo
  - Anita Kroska
- Saltonstall – Kennedy Grant NA17NMF4270240
- Skipper and crew of the F/V Kema Sue

INTERNATIONAL PACIFIC HALIBUT COMMISSION