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

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)

10 y Average 1.2M lbs. (535 t)  
Sub-legal

4.5%  
4.0%  
3.5%  
3.0%  
2.5%  
2.0%  
1.5%  
1.0%  
0.5%  
0.0%

Length (cm)

Halibut Fishery  
Regulatory  
Discard

10 y Average 25.0M lbs. (11,340 t)  
Legal

Pacific halibut – Length Frequency (2022)
Observers: - Numbers - Size - Viability

Discard Mortality Rates (DMRs)

Landings
Mortality

Survival

Legal

Sublegal

Photo: IPHC

Photo: D. Griffay

2023 Western Groundfish Conference
Observers:
- Numbers
- Size
- Viability

Discard Mortality Rates (DMRs)

Landings Mortality

Removals (Fishery mortality)

Legal

Sublegal
Discard Mortality Rates (DMRs)

Viability Assessment

Studies:

Caging Experiments
Peltonen (1969)
Kaimmer et al. (2012)

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

Limitations:

- Sample sizes
- Hook type
- Environmental

- Reporting Rates

Release Viability Class

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

**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
Methods – Data Collected

![Diagram showing the relationship between traits and conditions, hook release methods, injury levels, and viability categories.](image-url)
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%

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