Overcoming challenges in conducting management strategy evaluation in a multi-species, multi-government fishery system, with application to bycatch harvest policies for Pacific halibut in the Bering Sea and Aleutian Islands

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(in alphabetical order)

National Oceanic and Atmospheric Administration¹, North Pacific Fishery Management Council², and International Pacific Halibut Commission³
Pollock

Pacific cod

Yellowfin sole

N. rock sole

Flathead sole

Arrowtooth flounder

Greenland turbot

Alaska plaice
Eastern Bering Sea Pollock 2018
Catch Limit: 1.4 million t
Final Catch: 1.4 million t
Northern Rock Sole 2018
Final Catch Limit: 47,100 t
Final Catch: 28,000 t
Why are catches < final catch limits for many species?

1. Need to avoid bycatch species and target species that are “choke” species for certain gear types (e.g. Pacific cod caught by trawl)
2. Economic decisions
3. ?
Pacific halibut is both a target and a bycatch species, depending on sector and gear.

2018:
~Eastern Bering Sea and Aleutian Islands:

Final Catch Limit: 3,013 t (fish > 81 cm)
Final Catch: 3,368 t (fish > 81 cm)

Bycatch limit: 3,515 t (all sizes)
The Pacific halibut fishery

Caught by longline only, in a sector just for halibut:

“the directed halibut fishery”
Longline, longline CDQ, AM80, TLAS, pot, and jig

Longline, longline CDQ

AM80, TLAS, trawl CDQ

Yellowfin sole
N. rock sole
Flathead sole
Arrowtooth flounder
Greenland turbot
Alaska plaice

Pollock
Pacific cod
Sablefish
Pacific halibut is managed by the International Pacific Halibut Commission: treaty between the US and Canada (except for bycatch)
International Pacific Halibut Commission

Coastwide survey + stock assessment

U.S. and Canada Negotiate

Coastwide catch limit (66 cm+)

West Coast Canada

Areas in Southeast Alaska and Gulf of Alaska

Areas in Bering Sea and Aleutian Islands

Directed fishery limit = Area Total - Expected 66+cm bycatch
International Pacific Halibut Commission

Coastwide survey + stock assessment

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North Pacific Fishery Management Council (Domestic; Bering Sea/Aleutian Islands)

Static Pacific halibut bycatch limit, all sizes:

Gear and sector allocations
In some years the Pacific halibut bycatch in the Bering Sea and Aleutian Islands is greater than the directed fishery catch limit.
Trawl catches smaller halibut than longline: Directed fishery concerned that bycatch users harvest small halibut that can’t grow to recruit to directed fishery.
These concerns led to the North Pacific Fishery Management Council, “the Council,” to consider halibut bycatch limits that are based on halibut abundance in the Bering Sea and Aleutian Islands.
2017 Ex-Vessel Value of halibut vs. multi-species groundfish

$19 million < $738 million
International Pacific Halibut Commission

Coastwide survey + stock assessment

U.S. and Canada Negotiate

Coastwide catch limit (66 cm +)

West Coast Canada

Areas in Southeast Alaska and Gulf of Alaska

Areas in Bering Sea and Aleutian Islands

Directed fishery limit = Area Total – Expected 66+cm bycatch

North Pacific Fishery Management Council (Domestic; Bering Sea/Aleutian Islands)

New halibut bycatch limit each year, based on halibut abundance, all sizes

Gear and sector allocations
The Council Process
Iterative “pre-analysis” to guide stakeholders and
the Council towards defining objectives and
management procedures

Working group writes discussion paper

Science review board

Industry review board

Council: Decisions, New Instructions and Timeline

Input from public

Input from public

Input from public
The Council Process

Iterative “pre-analysis” to guide stakeholders and the Council towards defining objectives and management procedures

- Working group writes discussion paper
  - Input from public
- Science review board
- Industry review board
  - Input from public
- Council: Decisions, New Instructions and Timeline
  - Input from public

5 Council Objectives
The Council Process
Iterative “pre-analysis” to guide stakeholders and the Council towards defining objectives and management procedures

Working group writes discussion paper

Science review board

Industry review board

Council: Decisions, New Instructions and Timeline

Input from public

10 Candidate Management Procedures
Pre-Analysis:
Provided building blocks for defining bycatch limits based on halibut abundance indices

Bycatch Limits for one alternative

Abundance from longline survey

Abundance from trawl survey

Halibut abundance

PSC limit
6000
4000
2000
0

Bycatch limit

Ceiling
Floor
Slope
Steeper Slope
Pre-Analysis:
Provided historical examples using building blocks

Primary index matches gear type for PSC limit

Secondary index influences PSC limit when above or below threshold

Alternative 2 is only influenced by the primary index while Alts 4 and 6 are influenced by both

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<th>Secondary (longline) index status</th>
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Percent Change in halibut abundance
TWO-AREA HALIBUT MODEL SCHEMATIC

- Calculate bycatch limits among sectors within region
- Approximate IPHC Assessment
- Calculate Bycatch Limits from ABM Control Rules
- Analyze historical impacts to groundfish at these bycatch limits
- Simulate Trawl and Longline Survey Indices
- Movement
- Fishing and Natural Mortality

Allocate catch limits among sectors within region
Calculate coastwide catch limits and distribute regionally

Analyze historical impacts to groundfish at these bycatch limits
The relationship between bycatch limits and actual bycatch is a major source of uncertainty. The IPHC harvest policy is currently evolving.

Allocation of recruitment and movement between areas is a major source of uncertainty.

- Calculate coastwide catch limits and distribute regionally
- Approximate IPHC Assessment
- Bycatch Limits from ABM Control Rules
- Analyze historical impacts to groundfish at these bycatch limits
Challenges

- Modeling fleet behavior
  - ability to adjust to bycatch limit changes
- Consistency with concurrent IPHC analyses
- Council defines next step and timeline, not the science working group
- Stakeholders ability to define objectives
- Changes in harvest strategies for target species occurring concurrently
- Ecosystem changes (e.g., lack of sea ice) affecting targeting by species, gear, and sector, and overlap with halibut
End