

Understanding Behavior and Stock Structure of Pacific Halibut (*Hippoglossus stenolepis*) in the Northern Bering Sea

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Introduction

- According to local knowledge, the abundance of Pacific halibut in the Northern Bering Sea has been increasing in recent years
- Population connectivity between halibut in the Northern Bering Sea and more-southern individuals is unknown
- This information may aid in determining the scale of management needed for the population, and the potential impact of localized fishing efforts
- Currently, the International Pacific Halibut Commission (IPHC) treats the Pacific halibut as a singular stock, but recent tagging studies have suggested that the species may exhibit finer-scale stock structure than currently assumed

Objectives

The objectives of this study are to:

1. Use satellite telemetry to determine movement patterns and identify spawning grounds of Pacific halibut in the Northern Bering Sea
2. Use these findings to evaluate scales of movement in comparison to the scale of current IPHC regulatory areas

Methods



Figure 1. (Left) The Nome sampling vessel with captain Phil Pryzmont running the hauler (Right) The Savoonga vessel with captain Richmond Toolie and his two deckhands accompanied by researcher Dawn Wehde (center)

- Halibut were captured using commercial longlining in two main tagging locations, Nome and Savoonga (Figure 1)
- Five halibut were captured in the NMFS Northern Bering Sea (NBS) trawl survey
- Fish selected for tagging were placed in the workup cradle (Figure 2)



Figure 2. A captured female Pacific halibut placed in the work-up cradle for tagging

Figure 3. Wildlife Computers miniPATs, which records temperature, depth, and ambient light levels while deployed.



- Fish were sexed using ultrasounding techniques (Figure 5) to identifying either ovaries or testes



Figure 5. Tim Loher (Right) of the IPHC ultrasounding before release

- Fish were tagged with Wildlife Computers miniPATs (Figure 3) attached using a nylon tether and titanium dart posterior to the widest part of the fish (Figure 4)
- Tags were anchored into the pterygiophores to ensure the tag remained affixed



Figure 4. A recently tagged halibut, displaying the positioning of the satellite tag

- Fish over 100 cm in fork length were designated mature females if ultrasound was unavailable
- Tag deployments were scheduled to last for either 6-months, 1-year, or 2-years, evenly distributed between the two tagging locations

Preliminary Results

- 44 Pacific halibut were tagged in 2019 (Table 1)
- Premature battery failure caused a large number of non-reports, and only 8 tags reported back both pop-off locations (Figure 6) and time series data
- Tagged fish remained within the NBS, with some individuals migrating into Russian waters during the winter

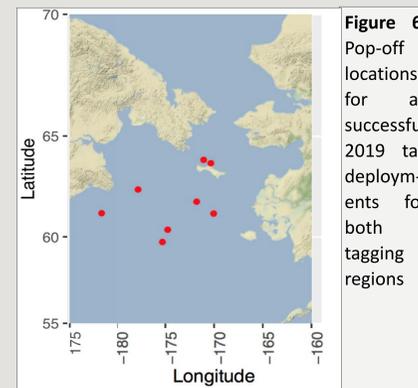


Figure 6. Pop-off locations for all successful 2019 tag deployments for both tagging regions

Location	Six Month	One Year	Two Year	Total
Nome	11	9	4	24
Savoonga	9	3	3	15
NBS Trawl	1	2	2	5
Total	21	14	9	44

Table 1. Tagged halibut in 2019 by tagging location and deployment length

- Halibut began migration in late-fall to early-winter, returning in the early-summer around the beginning of June (Figure 7)
- Temperature profiles indicated halibut utilized various water masses, showing both seasonal and individual variability (Figure 7)

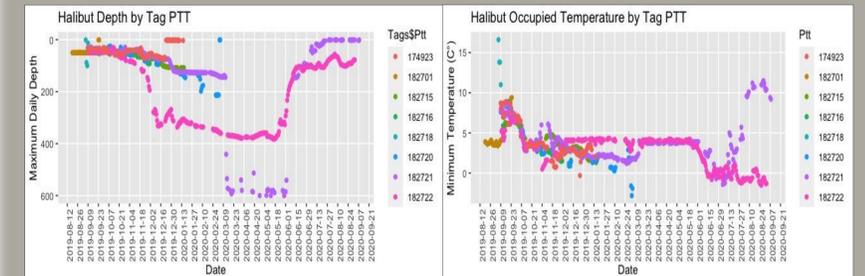


Figure 8. Occupied depths (Left) and temperatures (Right) of Pacific halibut tagged in the 2019 field season. Numbers and corresponding colored circles represent the transmitter IDs attached to individual Pacific halibut.

Future Research

- An additional 25 tags were deployed during the summer of 2020, but these tags have yet to report back any data
- Further tagging efforts will occur out of Nome and Savoonga in the summer of 2021
- Depth profiles will be used to reconstruct movement tracks through Hidden-Markov modeling (HMM) and to identify spawning locations
- Kernel utilization distributions will be constructed from HMM daily locations to evaluate the scale of halibut movements in the NBS, and subsequently compare to the current IPHC management zones in the region

Acknowledgments

- Funds and in-kind contributions for research were provided by Norton Sound Economic Development Corporation and the International Pacific Halibut Commission
- Graduate student tuition and stipend was provided by the Rasmuson Fisheries Research Center (located at UAF) graduate student fellowship
- Special thanks to Captain Phil Pryzmont and Richmond Toolie for providing their vessels for tagging efforts

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