Migratory behavior and distribution of Pacific halibut

PREPARED BY: IPHC SECRETARIAT (L. SADORUS, T. LOHER, J. FORSBERG; 29 JANUARY 2018)

PURPOSE

To provide the RAB with a description of the studies designed to improve our knowledge on distribution and migration of Pacific halibut in the northeast Pacific Ocean and eastern Bering Sea.

BACKGROUND

The IPHC is currently investigating Pacific halibut distribution and migration that encompasses all life stages via three different research projects.

U32 wire tagging

Of specific interest to the IPHC is the movement of juvenile Pacific halibut both within ocean basins (i.e. Gulf of Alaska and Bering Sea) and between them. The timing and distance traveled between nursery grounds to the adult feeding grounds varies over time and was last studied in the 1980s. Sampling platforms already being utilized for other investigations, the fishery-independent setline survey (FISS) and the NMFS trawl survey, are ideal vehicles for tagging and releasing U32 Pacific halibut during the summer months throughout their geographic range, and are currently the platform for a spatially large scale wire tagging effort.

Larval dispersal and connectivity

Unlike juvenile Pacific halibut which are demersal, larvae are pelagic for the first six months of life and are distributed largely based on where they originated (i.e. where they were spawned) and where the currents carry them during their pelagic life stage. Of particular interest to the IPHC is the connectivity of larvae that are spawned in the Gulf of Alaska but settle in the Bering Sea, and the environmental drivers that may affect the magnitude of this connectivity. Note that it has been established that the counter clockwise Alaska Coastal Current in the Gulf of Alaska flows into the Bering Sea via Aleutian Island passes. The IPHC does not conduct larval surveys, but National Oceanic and Atmospheric Administration (NOAA) icthyoplankton (larval) surveys are conducted annually and IPHC has teamed with NOAA to examine these data spanning from 1972-2015.

PAT tagging

The IPHC has conducted a series of pop-up archival transmitting (PAT) tag studies in the Bering Sea and Aleutian Islands (BSAI) region in order to identify winter spawning locations, determine the timing of seasonal movements, and investigate mixing within the BSAI and between the Bering Sea and Gulf of Alaska of adult Pacific halibut. Until 2017, no tagging had been conducted on Bowers Ridge (located in IPHC Regulatory Area 4B) because this region had not been previously surveyed by the IPHC. In 2017, we took advantage of the setline survey expansion onto Bowers Ridge in order to generate data for this region.

DISCUSSION

U32 wire tagging

Each summer IPHC deploys sea samplers on board the NMFS trawl surveys conducted in the Gulf of Alaska, Bering Sea, and Aleutian Islands. Pacific halibut from 20-100 cm fork length are readily captured and sampled. In 2015, a pilot project was initiated on the trawl surveys to test the practicality of tagging and releasing a subsample of the Pacific halibut captured with minimal impact to the regular sampling. The pilot project was considered a success and the program was fully implemented in 2016 going forward. Of the Pacific halibut captured, half are randomly selected as possible candidates for tagging. Within that subsample, a fish is tagged if it is U32 and viability is not assessed as "dead" using observer criteria.

In 2016, the IPHC investigated the practicality of adding U32 tagging to the FISS by conducting a pilot project in one survey region (Area 4D). The pilot project was successful and in 2017 the effort to tag and release U32 Pacific halibut was extended to the FISS in all areas where sampling rates were less than 100 percent (i.e. Areas 2B, 2C, 3A, 3B, 4A, and 4B), and will be continued for the next several years. As in the trawl survey, a subsample of U32 fish are assessed using observer viability criteria and are subsequently tagged and released if not considered "dead".

Additional information can be found in paper IPHC-2017-RARA27-R Chapters 2.5.1 and 2.5.4.

Table 1. Release and recovery information of Pacific halibut tagged and released on board the NMFS trawl and IPHC fishery-independent setline surveys.

Wire tagging project	Years of tagging	Tags released	Tags recovered (as of 1/25/18)
Bering Sea trawl survey	2015, 2016, 2017	1,666	8
Gulf of Alaska trawl survey	2015, 2017	2,204	14
Aleutian Islands trawl survey	2016	170	0
IPHC FISS	2016, 2017	2,097	7
Total		6,137	29

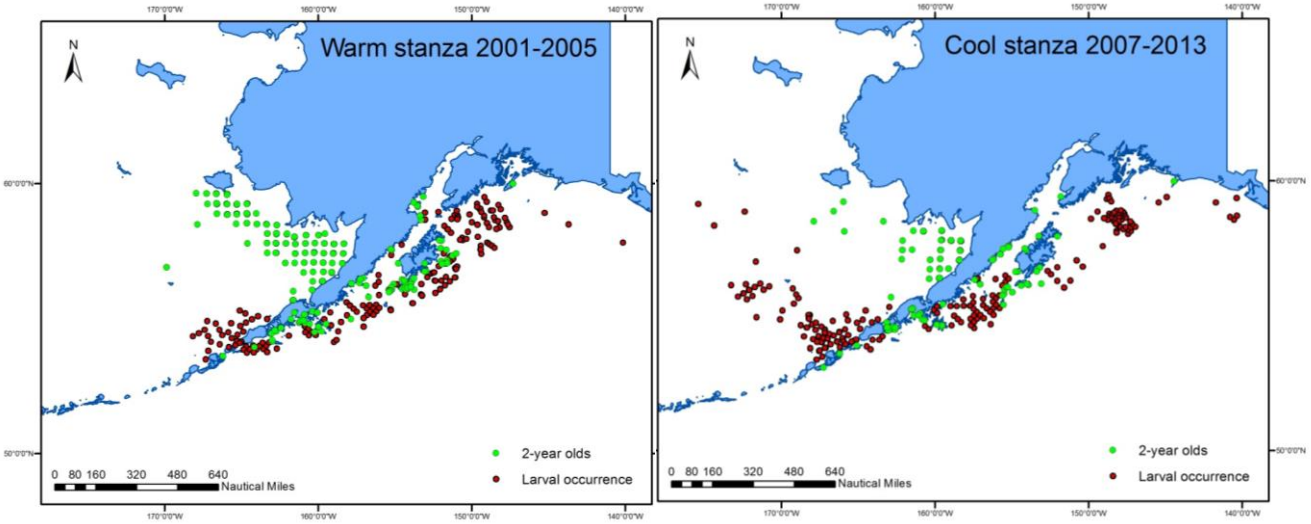
Larval dispersal and connectivity

To date, analyses have been focused on fully describing the ichthyoplankton dataset, and preliminary testing to examine whether connectivity via Unimak Pass may be a significant contributor to larval dispersal between ocean basins. Products from these analyses include: distribution maps, calculation of catch weighted average size by month, the estimation of larval age in each month, a preliminary analysis of factors that may be affecting larval length and

abundance, and recruitment to the eastern Bering Sea settled population. Currently underway is an analysis of the differences in larval size, abundance, and recruitment between warm and cold stanzas. In 2018, the IPHC will work with a modeler from NOAA to answer a number of questions including: 1) to what degree do Gulf of Alaska larvae contribute to the eastern Bering Sea settled population and does it vary with temperature and climatic regime?, 2) to what degree do Bering Sea larvae contribute to the eastern Bering Sea settled population?, and 3) what larvae (geographically) in the Gulf of Alaska are most and least likely to be transported to the Bering Sea?

For more information, refer to paper IPHC-2017-RARA27-R Chapter 2.5.3.

Figure 1. Larval distribution and resulting 2-year-old distribution in the eastern Bering Sea during warm and cold stanzas.



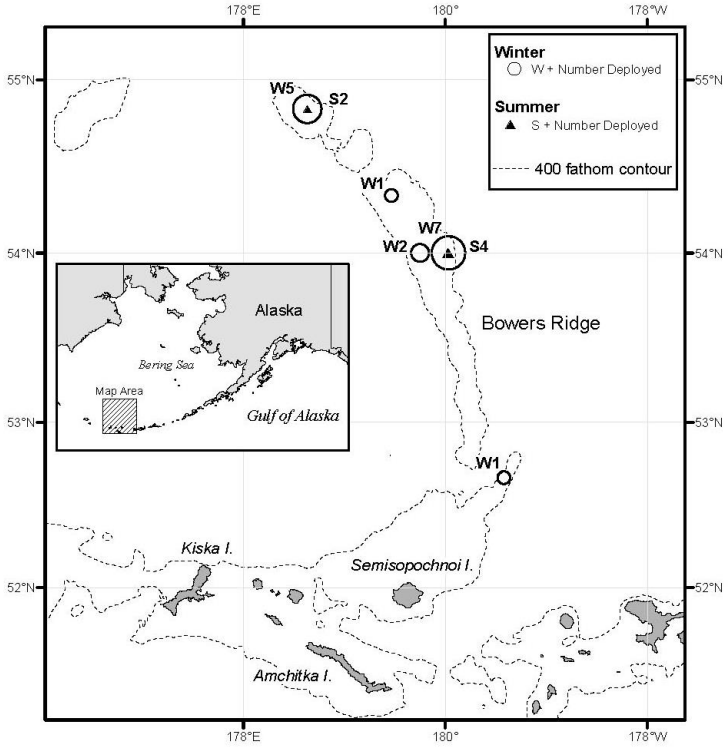
PAT tagging

A total of 22 Pacific halibut were tagged with miniPAT tags (manufactured by Wildlife Computers, Redmond, Washington) in IPHC Regulatory Area 4B. Tagging occurred on dates ranging from 05-10 July 2017. Sixteen Pacific halibut (four male, 11 female, and one of unknown sex) ranging from 117-170 cm FL were tagged with PAT tags scheduled to detach and report on 15 January 2018. Six Pacific halibut (four male, two female) ranging from 117-144 cm FL were tagged with PAT tags programmed to detach after 365 days, resulting in scheduled reporting dates of 5 and 10 July 2018.

As of 25 January 2018, 15 tags had broadcast during the winter spawning season: one on 24 December and 14 on dates ranging from 15-22 January. Eleven of these tags generated transmissions of sufficient strength to determine their locations. Ten fish were located very close to where they had been tagged, on Bowers Ridge and northern Petrel Bank; the eleventh fish had migrated to the central 4D Edge. The tags' environmental data (i.e. depth, temperature, and light-based locations during time at liberty) will be decoded and fully analyzed when all tag data are available.

For more detailed information about the project, refer to paper IPHC-2017-RARA27-R Chapter 2.5.2.

Figure 2. Release locations of Pacific halibut tagged with miniPAT tags in 2017.



RECOMMENDATION/S

That the RAB:

1) **NOTE** paper IPHC-2018-RAB019-11 which outlined the research projects describing studies designed to improve our knowledge on Pacific halibut distribution and migration at all life stages.