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## Reproductive assessment of the Pacific halibut population

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### PURPOSE

To provide the RAB with a description of the studies designed to improve our knowledge on reproductive development in female and male Pacific halibut.

### BACKGROUND

Each year, the fishery-independent setline survey (FISS) collects biological data on the maturity of female Pacific halibut that are used in the stock assessment to estimate spawning stock biomass. Currently used estimates of maturity at age using macroscopic visual criteria collected in the FISS indicate that the age at which 50% of female Pacific halibut are sexually mature is 11.6 years on average. However, female maturity schedules have not been revised in recent years and may be outdated. In addition, the currently used macroscopic visual criteria used to score female maturity in the field have an undetermined level of uncertainty and need to be contrasted with more accurate microscopic (i.e. histological) criteria. In order to address these issues, the IPHC Secretariat has conducted for the first time a thorough histological assessment of the temporal progression of female developmental stages and reproductive phases throughout an entire reproductive cycle. The outcomes of these studies have paved the way for upcoming studies to update and improve the accuracy of maturity schedules based on histological-based data and also to guide efforts towards assessing fecundity in Pacific halibut.

### DISCUSSION

The IPHC Secretariat has completed the first detailed examination of temporal changes in female ovarian developmental stages, reproductive phases, and biological indicators of Pacific halibut reproductive development. The results obtained by ovarian histological examination indicate that female Pacific halibut follow an annual reproductive cycle involving a clear progression of female developmental stages towards spawning within a single year. These results provide foundational information for upcoming studies aimed at updating maturity ogives by histological assessment and at investigating fecundity in Pacific halibut. One of the most important results obtained show that the period of time when gonad samples can be collected in the FISS (June-August) is an appropriate temporal window during which Pacific halibut females that are developing towards the spawning capable reproductive phase and, therefore, considered mature for stock assessment purposes, can be identified. Furthermore, the potential use of easily-obtained biological indicators in predictive models to assign reproductive phase in Pacific halibut was demonstrated. The results of this study have been published in the journal *Frontiers in Marine Science*: <https://doi.org/10.3389/fmars.2022.801759>.

In 2022, the IPHC Secretariat has initiated studies to revise maturity schedules in all four biological regions through histological (i.e. microscopic) characterization of maturity. For that purpose, the IPHC Secretariat has collected ovarian samples for histology in the 2022 FISS coastwide. The sample targets have been to collect 400 ovarian samples from Biological Region 3, 300 from each Biological Regions 2 and 4, and 250 samples from Biological Region 4B. Ovarian samples will be processed for histology in the Fall of 2022 and, subsequently,

histological maturity classifications will be conducted by IPHC Secretariat staff. Maturity ogives will be generated by age and length at a coastwide scale as well as at a biological region scale.

An important existing knowledge gap regarding the reproductive biology of Pacific halibut is the current lack of understanding of fecundity-at-age and fecundity-at-size. Information on these two parameters could be used to replace spawning biomass with egg output as the metric of reproductive capability in the stock assessment and management reference points. For this purpose, the IPHC Secretariat is planning gonadal sample collections for fecundity estimations in the 2023 FISS. The IPHC Secretariat has investigated different available methods for fecundity determinations and, based on the current literature and recommendations from experts in the field, the auto-diametric method was selected as the method of choice (Witthames et al., 2009. *Fish. Bul.* 107:148-164). The IPHC Secretariat is currently designing plans for ovarian sample collection for fecundity estimations within the 2023 FISS.

#### **RECOMMENDATION**

That the RAB:

- 1) **NOTE** paper IPHC-2022-RAB023-09 which outlined the research project describing studies designed to improve our knowledge on reproductive development in female Pacific halibut.