PROPOSAL 157

5 AAC 27.160. Quotas and guideline harvest levels for Southeastern Alaska Area.

Modify harvest rate for Sitka Sound commercial sac roe herring fishery based on forecasted age structure, as follows:

Our recommended solution involves a slight modification of the existing harvest formula in Sitka Sound to reduce risk of harvesting more than 20% of the larger, older component of the population that is selectively harvested by the commercial fishery. This modification could be easily applied to the SEAK herring harvest formula, if it were to be adopted in Sitka Sound.

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(g) The guideline harvest level for the herring sac roe fishery in Sections 13-A and 13-B **shall consider the preseason age structure as a means to prevent exceeding the 20% maximum harvest rate when targeting older herring. The guideline harvest level** shall be established by the department and will be a harvest rate percentage that is not less than **12** percent, not more than 20 percent **on each age group (i.e., "old" and "young" herring)**, and within that range shall be determined by the following **formulas** [FORMULA]:

GHLold fish = (% Old fish) * (Spawning Biomass) * (2 + 8 (Spawning Biomass/20,000))
GHLyoung fish = 0.5 *(%Young fish)* (Spawning Biomass)* (2 + 8 (Spawning Biomass/20,000))
Total GHL = GHLold fish+ GHLyoung fish

[HARVEST RATE PERCENTAGE = 2 + 8 (SPAWNING BIOMASS (IN TONS)/20,000).]

"Old fish" is defined as herring that are age-5 and older; "young fish" is defined as age-3 and age-4 herring. The selectivity correction factor (0.5) should be allowed to change in accordance with future selectivity patterns. The fishery will not be conducted if spawning biomass is less than 25,000 tons.

What is the issue you would like the board to address and why? Many herring captured by commercial purse seines in Sitka Sound are small/young fish that do not meet market demands. Therefore, the sac roe fishery conducts test fisheries and targets the largest, oldest, most fecund herring in the population. Regulations currently allow the harvest rate on specific age components to exceed 20% (i.e., high-grading) as long as the overall harvest rate is 20% or less. Theoretically, under current regulations, the entire guideline harvest level (GHL), or even 100% of the older population, could be taken with the largest most fecund herring leaving few large fish to spawn, if the fishery was efficient when selectively harvesting large herring. This is an obvious, unintended deficiency in the current regulation.

Fortunately, selectivity for larger older herring is not perfect, and analysis of the ADFG ASA model data shows that the harvest rate on age 5+ "old" herring is currently 2X that of younger herring (age 3-4) (Figure 1). In other words, only -0.5 "young" herring are harvested relative to each "old" herring (please see formula below). To avoid overharvest of the biologically imp011ant old, large females as well as to minimize the harvest of young fish that are not economically desirable, the guideline harvest level should consider the proportion of the population that meets

market demands and not the entire population. Furthermore, the current maximum allowed harvest rate on herring (20%) should not be exceeded when targeting the larger, more biologically productive component of the herring population. Our straightforward adjustment to the existing formula to set the guideline harvest level addresses this issue by accounting for the observed (modeled) selectivity of the commercial fishery while setting the maximum annual harvest rate on "old" herring at 20%.

In simple terms, this proposal provides a management tool that reduces the risk of harvesting more than 20% of the larger, older herring that are targeted by the commercial fishery.

What would happen if nothing is changed?
The negative consequences of high-grading the oldest, largest, most fecund females from a population is well known. These large, old fish contribute disproportionately more to future herring generations (Barneche et al. 2018) and they appear to guide younger herring back to suitable spawning areas (MacCall et al. 2018). Furthermore, recent evidence in Sitka Sound supports the "Go with Older Fish" hypothesis that is recognized in both western science and traditional ecological knowledge. For example, in 2019 and 2020 when the herring population was dominated by young fish (age 3 and age 4), few herring spawned in the "core" area where most herring have spawned in recent decades.

If nothing is changed, the sac roe seine fishery would be legally permitted to high-grade fish in a manner detrimental to the population structure and future herring generations. Existing regulations allow the harvest rate on specific age components to exceed 20% (i.e., high-grading) as long as the overall harvest rate is 20% or less. A truncated age structure with fewer experienced spawning adults would likely continue to result in erratic spawn, reduced future production, and the inability of subsistence harvesters to meet their needs.

What are other solutions you considered? Why did you reject them?
This is a less drastic action than a moratorium of the commercial fishery or a significantly reduced maximum annual harvest rate (10%), which has been considered in British Columbia. It is noteworthy that the current annual 20% maximum harvest rate equates to a much higher harvest rate over the life time of each herring year class because herring are harvested over many years.

References
Barneche, D.R., D.R. Robertson, C.R. White and D.J. Marshall. 2018. Fish reproductive energy output increases disproportionately with body size. Science 360:642-645. DOI:
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