PROPOSAL 158

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

Incorporate forecasted age structure into Sitka Sound commercial sac roe herring fishery spawning biomass threshold, as follows:

Managers must ensure there are sufficient old and large fish in the population to lead younger fish to appropriate spawning grounds and increase the potential for successful recruitment to the population.

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

(g) The guideline harvest level for the herring sac roe fishery in Sections 13-A and 13-B 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 and within that range shall be determined by the following formula: Harvest Rate Percentage = 2 + 8 (Spawning Biomass (in tons) / 20,000). The fishery will not be conducted if spawning biomass of is less than 25,000 tons **or the proportion of fish age 5 and older is less than or equal to 0.20, as determined by the pre-season bait fishery or test fishing completed by February 28th in District 13-B.**

What is the issue you would like the board to address and why? The oldest, largest herring are biologically the most important herring in the population. Older fish lead younger, inexperienced fish to appropriate spawning grounds (MacCall et al. 2018). Older, larger fish have relatively more fecundity and more well-provisioned eggs that are more likely to survive (Hixon et al. 2014; Barneche et al. 2018). A population of older, larger fish will have much greater fecundity and reproductive success than an equivalent biomass of younger, smaller fish (Venturelli et al. 2009).

Currently, many herring captured by the Sitka Sound sac roe herring fishery are young and small and do not meet market demands. Consequently, the Sitka Sound sac roe herring fishery consistently targets and harvests the oldest, largest, most fecund females in the population. These are the very fish we should protect to ensure the long-term health of the population. Industrial fishing pressure has been shown to lead to reduced size and truncated age structure in populations (Barnett et al. 2017) and traditional ecological knowledge indicates that the size and age structure of Sitka Sound herring has indeed been truncated since the advent of reduction fisheries in the 1800s. While a 20% harvest rate may not seem high to some, the compounding effects of a harvest of at least 20% annually on a relatively long-lived fish like a herring are quite large. Without older, larger fish in the population, spatiotemporal distribution of spawn has shifted and resulted in the inability of subsistence harvesters to meet their needs.

This proposal is a simple alteration to the current management threshold to ensure there is a minimum of relatively older fish in the population to lead younger fish to better spawning grounds and increase reproductive success of the population. When there aren't enough old fish in the population, fishing should not occur as a means to prevent further decline of these most important large herring.

What would happen if nothing is changed?

Continued fishing pressure on the oldest, largest fish will exacerbate size and age structure truncation issues in the Sitka Sound herring population. The frequency of abnormal spawning

distribution (in terms of space and time) will likely increase and subsistence harvesters will be less likely 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. This is also less drastic than setting higher thresholds using older age classes that would have likely better reflected the pristine age structure.

References
Barnett, L.A.K., T.A. Branch, R.A. Ranasinghe, and T.E. Essington. 2017. Old-growth fishes become scarce under fishing. Current Biology. 27: 2843-2848.

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:
1 O. l 126/science.aab6868 http:/ /science.sciencemag.org/content/360/6389/642

Hixon, M.A., D.W. Johnson, and S.M. Sogard. 2014. BOFFFFs: on the importance of conserving old-growth age structure in fishery populations. ICES Journal of Marine Science. 71(8):2171-2185.

MacCall, AD., T.B. Francis, A.B. Punt, M.C. Siple, D.R. Armitage, J.S. Cleary, S.C. Dressel, R.R. Jones, H. Kitka, L.C. Lee, P.S. Levin, J. McIsaac, D.K. Okamoto, M. Poe, S. Reifenstuhl, J.O. Schmidt, A.O. Shelton, J.J. Silver, T.F. Thornton, R. Voss, and J. Woodruff. 2018. A heuristic model of socially learned migration behaviour exhibits distinctive spatial and reproductive dynamics. ICES Journal of Marine Science, doi: 10.1093/icesjms/fsy091.

Venturelli, P.A., B.J. Shuter, and C.A. Murphy. 2009. Evidence for harvest-induced maternal influences on the reproductive rates of fish populations. Proc R Soc B. 276:919-924.

PROPOSED BY: Sitka Tribe of Alaska (HQ-F20-093)
****