

Submitted by the Alaska Department of Fish and Game at the request of Board Member Carlson-Van Dort. January 13, 2020

At the Kodiak Board of Fisheries meeting on January 11, 2020 following the staff presentation *Presence of Cook Inlet Sockeye Salmon in the Kodiak Management Area Commercial Harvest*, the department received an information request from the Alaska Board of Fisheries (board). This request asked the Alaska Department of Fish and Game (department) to provide information to inform board discussions for board proposals. The request was for the best available information to determine 1) what stocks are likely to contribute to the commercial catch in the Cape Igvak Section; and 2) where Chignik stocks are captured in commercial fisheries. In follow-up conversations with the member who requested the information, the request was clarified to only include 1) what stocks are likely in the commercial catch of the Cape Igvak Section and 2) to provide these results in a graphical form, such as pie charts. In addition, the board member requested an explanation for how the regulatory assumption that 90% of Cape Igvak Section sockeye salmon harvest are assumed to be of Chignik origin was derived. In response, the department is providing the following information:

We provide a brief methods section, a figure with stock proportion pie charts and a table with stock proportions summarizing the result from the two studies that provide information on stocks likely to contribute to commercial sockeye salmon catch in the Cape Igvak Section, and some context for interpreting this information. The first study that provides insights into this question is the tagging study conducted in 1969 and reported in the 1969 Kodiak Area Management report. The second useful study was the genetic stock composition analyses study that examined the commercial catches available from three time/area strata conducted in 2015 and 2016 (Shedd et al. 2017). Finally, we review the origin of the *Cape Igvak Salmon Management Plan* assumption that 90% of Cape Igvak Section sockeye salmon catch are considered to be bound for Chignik River.

#### Methods:

In 1968 and 1969, the department conducted a tagging study at Cape Igvak (ADF&G 1970). In 1968, the department tagged 325 sockeye salmon on June 22. Only 5 recoveries were documented (4 in Chignik and 1 in Cook Inlet). These data were not graphed into a pie chart because the recovery numbers were so low. In 1969, the department tagged 791 sockeye salmon in the Cape Igvak between June 14 and July 6. This tagging effort resulted in 161 tag recoveries from commercial fisheries and spawning grounds. Recovery locations included the Chignik Management Area, Kodiak Management Area, Cook Inlet, and multiple locations West of Chignik.

Between 2014 and 2016, the department conducted a genetic stock composition study of select Kodiak Management Area fishing areas. One of the selected areas was Cape Igvak. The study

was designed to sample June and July (“Early”, and “Middle”, respectively). Due to fishing restrictions, no temporal strata were fished in 2014, only the Middle stratum was fished in 2015 and only the Early and Middle strata were fished in 2016. Samples from these strata were selected in proportion to harvest within strata post season and analyzed using genetic markers with a baseline that included populations from Norton Sound to Washington.

Tag recaptures were reported at seven groupings: 1) Chignik Lagoon and Watershed; 2) Other Chignik Management Area 3) Kodiak Island; 4) Kodiak Mainland, 5) Cook Inlet; 6) West of Chignik; and 7) East of Cook Inlet. To provide better comparisons to the tagging study, the genetic reporting groups were reduced to five stock groups: 1) Chignik Lagoon and Watershed; 2) Kodiak Island (which includes Kodiak Mainland) 3) Cook Inlet; 4) West of Chignik; and 5) Prince William Sound. The additional stock groups for the tagging data were included to contain fish with the most uncertain stock origins.

## Results

Table 1 provides the percentages at recapture locations (for a tagging study) and percentages by stock groups (for stock composition information study) for sockeye salmon tagged or harvested in the Cape Igvak Section. Figure 1 provides a pie chart of proportions of tag recovery locations for tags applied to sockeye salmon in Cape Igvak Section between June 4 and July 6, 1969 (Simon et al. 1969). Figure 2 provides a pie chart of stock composition estimates for sockeye salmon harvested in the in Cape Igvak Section commercial fishery between July 4 and August 1 (“Middle”), 2015 (Shedd et al. 2017). Figure 3 provides a pie chart of stock composition estimates for sockeye salmon harvested in the in Cape Igvak Section commercial fishery between June 1 to 27 (“Early”), 2016 (Shedd et al. 2017). Figure 4 provides a pie chart of stock composition estimates for sockeye salmon harvested in the Cape Igvak Section commercial fishery between June 28 and July 25 (“Middle”), 2016 (Shedd et al. 2017).

Table 1. Percentages at recapture locations (for a tagging study) and percentages by stock groups (for stock composition information study) for sockeye salmon tagged or harvested in the Cape Igvak Section. The 1969 information is derived from a tagging study (Simon et al. 1969) and the 2015 and 2016 information was derived from a genetic stock identification study (Shedd et al. 2016).

Stock Group	1969 <sup>1</sup>	2015 Middle <sup>2</sup>	2016 Early <sup>2</sup>	2016 Middle <sup>2</sup>
Chignik Lagoon and Watershed	80.1	31.2	74.1	5.6
Other Chignik Management Area	3.7			
Kodiak Island	1.9	6.9	9.5	0.8
Kodiak Mainland	7.5			
Cook Inlet	4.3	54.0	6	93.2
West of Chignik	2.5	1.4	7.7	
Prince William Sound	N/A	5.8	2.1	

<sup>1</sup> Simon et al. (1969)

<sup>2</sup> Shedd et al. (2016)

Figure 1. Tag recovery locations for tags applied to sockeye salmon at Cape Igvak between June 14 and July 6, 1969 (Simon et al. 1969). A total of 791 tags were applied and 161 tags were recovered in harvests and watersheds.

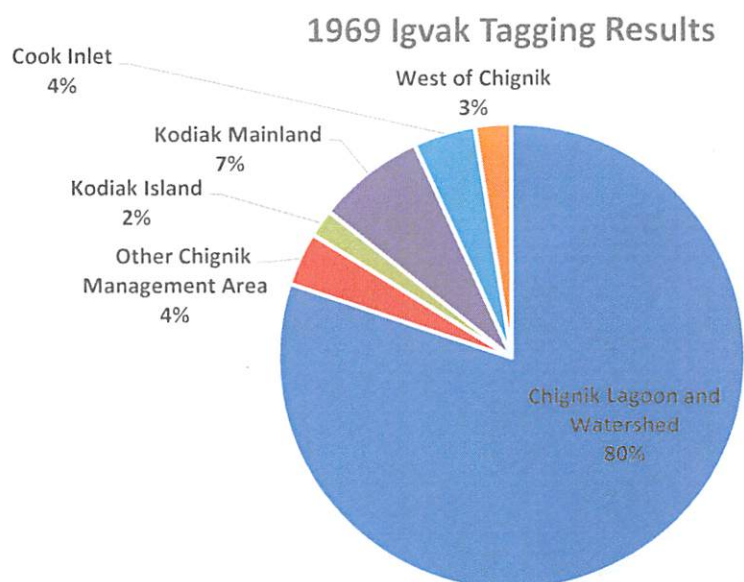


Figure 2. Stock composition estimates for sockeye salmon harvested in the Cape Igvak Section commercial fishery between July 4 and August 1 (“Middle”), 2015 (Shedd et al. 2017). This sample represented a stratum with a harvest of 6,595 fish.

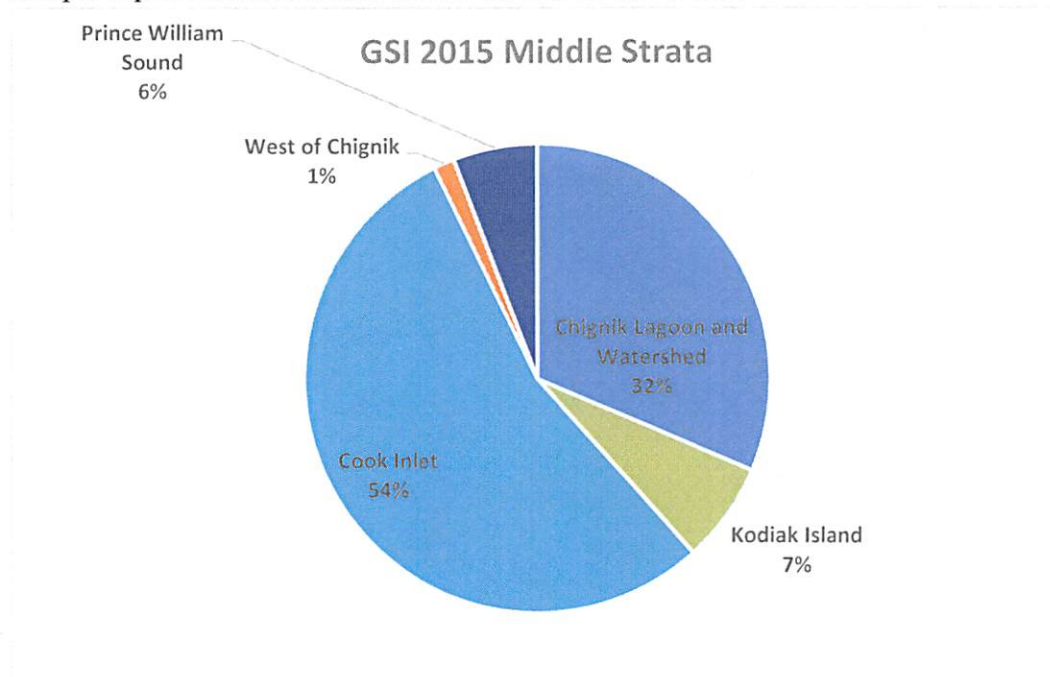


Figure 3. Stock composition estimates for sockeye salmon harvested in the Cape Igvak Section commercial fishery between June 1 to 27 (“Early”), 2016 (Shedd et al. 2017). This sample represented a stratum with a harvest of 154,318 fish.

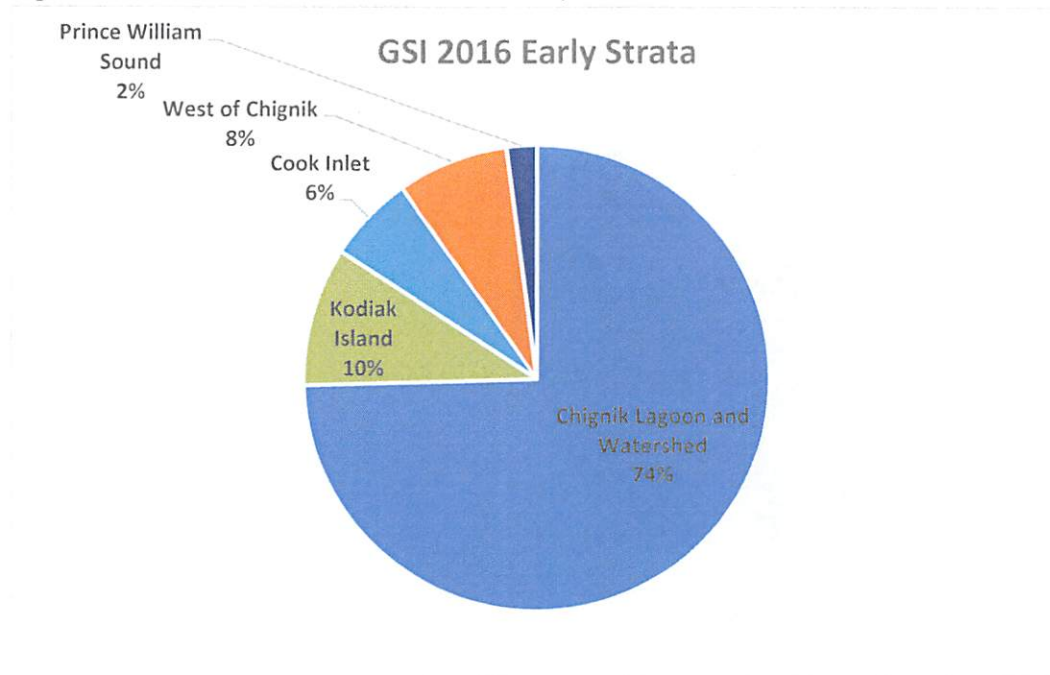
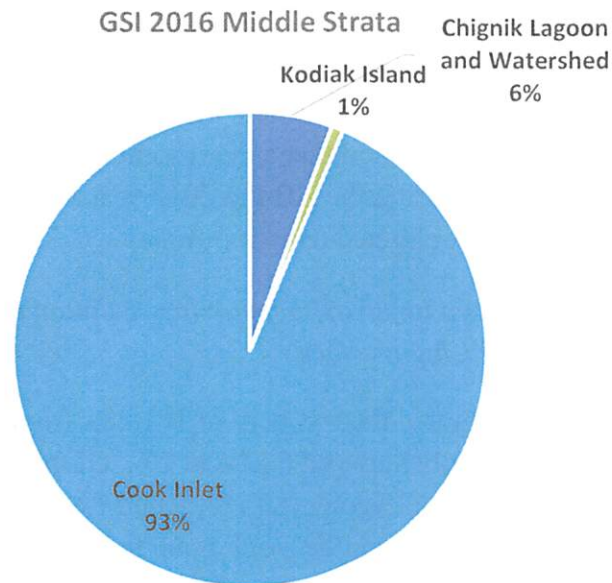


Figure 4. Stock composition estimates for sockeye salmon harvested in the Cape Igvak Section commercial fishery between June 28 and July 25 (“Middle”), 2016 (Shedd et al. 2017). This sample represented a stratum with a harvest of 177,315 fish.



## Discussion

### *Interpretation of data*

Interpretation of both tagging and stock composition data need to take assumptions into consideration.

For tagging studies to provide stock composition information for the sampled strata the following assumptions must be met: Samples must be representative of the unit of interest, recovery of tags must include all likely final destinations, sampling must be consistent across all final destinations, recovery must be documented, tag loss/mortality/emigration must be accounted, and composition at capture and recovery sites must be similar. Of these, the assumptions most likely to have been violated include that some final destinations were not sampled and that sampling was consistent across all final destinations. Finally, when interpreting final spawning location for fish recaptured in commercial fisheries, assumptions must be made that the fish were destined for local streams. This assumption is likely appropriate for *Chignik Lagoon and Watershed* and *Cook Inlet*, which are more terminal fisheries. However, fish caught in other areas may have originated from outside of those areas.

Stock compositions for the sampled strata using genetic methods requires that the capture/sampling represents unit of interest and the baseline includes information for all potential contributors. These assumptions are generally met in this study.

Regardless of the methods, extrapolation to unsampled years requires other assumptions. These assumptions include that the sampled and unsampled years have similar relative stock run sizes, migratory pathways, and harvest methods and management actions. These data show high variability among the sampled strata, an indication that at least some of these assumptions are not met. Full assessment is difficult because during the 2014 to 2016 years, the Cape Igvak Section fishery was only fished during three of six targeted temporal strata.

*Information provided in 2002 that resulted in the assumption in regulation that 90% of Cape Igvak Section sockeye salmon catch are Chignik stock.*

The original 1969 tagging study demonstrated the recovery of 161 tags from a total release of 791 sockeye salmon at Cape Igvak primarily between 6/28 and 7/6. Of those, 129 were recaptured within the Chignik watershed and Lagoon (80.1%; Table 1 and Figure 1). At the January 2002 Kodiak Board of Fisheries meeting, the assumption that 80% of the Cape Igvak Section were Chignik origin was changed to 90%. The change was a result of a reanalysis by Chignik Seiners Association that excluded 12 fish recaptured in the Mainland District of the Kodiak Management Area (which is the general vicinity of the tagging area) and assuming 6 fish captured in Chignik Management Area harvest (those harvested outside Chignik Lagoon) were of Chignik origin. This reinterpretation resulted in 90.6% being assumed to be of Chignik origin.

## References

- Simon, R.J., J. Lechner, M.F. Eaton, and P.B. Jackson. 1970. 1969 Kodiak Area Management Report. Alaska Department of Fish and Game, Kodiak.
- Shedd, K.R., M.B. Foster, T.H. Dann, H.A. Hoyt, M.L. Wattum, and C. Habicht. 2016. Genetic stock composition of the commercial harvest of sockeye salmon in Kodiak management area, 2014-2016. Alaska Department of Fish and Game, Fishery Manuscript Series No. 16-10, Anchorage.