SCALE STUDIES TO IDENTIFY ASIAN AND WESTERN ALASKAN CHINOOK SALMON--
1969 AND 1970 JAPANESE MOTHERSHIP SAMPLES

by

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Submitted to the
INTERNATIONAL NORTH PACIFIC FISHERIES COMMISSION

by the U.S. NATIONAL SECTION

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October 1974
Scale Studies to Identify Asian and Western Alaskan Chinook Salmon: The 1969 and 1970 Japanese Mothership Samples

Document 1616, Scale Studies to Identify Asian and Western Alaskan Chinook Salmon, submitted at the INFFC's 20th Annual Meeting in Tokyo, November, 1973, described the initial phases of our research to identify Asian and western-Alaskan chinook salmon using scale characters. Document 1616 was revised slightly for inclusion in the 1973 Annual Report, the principal change being the separate treatment of samples collected in the Bering Sea and North Pacific Ocean. A summary of the information contained in Document 1616 and the 1973 Annual Report is as follows:

1. The Japanese mothership fleet takes several hundred thousand chinook salmon (mostly immature) each year. A high percentage of the total mothership catch of chinook salmon is taken in the Bering Sea—particularly in recent years (81, 81 and 92% in 1968-70 respectively).

2. Chinook salmon catches in western-Alaska were below average in 1972-73; the 1973 catch probably being the lowest since 1960.

3. Tagging studies show that immature western-Alaskan chinook inhabit the area of the Bering Sea fished by the Japanese mothership fleet.

4. The Kamchatka River (Asia) and the Yukon, Kuskokwim, Nushagak, and Togiak Rivers in western-Alaska were considered to be the prime contributors of chinook salmon to the mothership fishing area in the Bering Sea. These rivers would also appear to be important contributors of chinook salmon to the area of the North Pacific Ocean fished by the mothership fleet.
5. Scale characters taken from samples in western-Alaskan streams and off the Kamchatkan Coast—when used in a discriminant function analysis—provide good separation between the continental stocks (computed theoretical accuracies of 83.33 and 82.35% using functions derived from the 1966 and 1968 inshore samples respectively.

6. Provisional classification of the 1966, 1967, and 1968 high-seas samples using the 1968 discriminant function showed that the percentage of western-Alaskan chinook salmon increased from west to east within the mothership fishing area of the Bering Sea. In the subareas where most chinook are taken, samples ranged from 42-95% western-Alaskan type. The west to east increase also held true in the area of the North Pacific Ocean fished by the mothership fleet, during May and June.

The present report is a follow-up to Document 1616 and the 1973 Annual Report, containing provisional classifications of samples taken in the Japanese Mothership fishery in 1969 and 1970, years when the fishery took exceptionally large numbers of chinook—554 and 437 thousand respectively.

For our analyses we have divided the mothership fishing area into 10 subareas—odd-numbered subareas are in the North Pacific Ocean; even-numbered subareas are in the Bering Sea. This arrangement (shown in Figure 1) enables us to observe east to west variation in the composition of the samples in the two bodies of water separately. This is desirable because Bering Sea chinook appear—on the basis of limited tagging data—to have originated in either Asia or western-Alaska whereas, in addition to those two stocks, chinook salmon from other North American areas have been shown by tagging to occur in the North Pacific Ocean.

Results—pooled by month and subarea, are shown in Table 1 and Figure 2—agree with the results obtained from 1966, 1967, and 1968 samples. Western-Alaskan type chinook salmon increase from west to east within the mothership fishing area.
of the Bering Sea, and in 9 of 10 observations in subareas 6, 8, and 10 (where the greatest catches of chinook are made), western-Alaskan type chinook made up 87-100% of the samples. The same west-east trend also held true in the North Pacific Ocean but the predominance of the western-Alaskan type occurred further eastward.

While the consistency and plausability of these classifications are encouraging and indicative that the classificatory technique is a valid one, they can only be regarded as provisional until additional tests are completed. These tests, now in progress, are concerned with: (1) sources of variation within streams such as age or sex; (2) bias introduced by the presence of fish from areas other than Asia or western Alaska in samples being classified; (3) the degree to which scale characters satisfy requirements of discriminant function analysis; and (4) development of a method for weighing classificatory errors by streams (western Alaska only).

LITERATURE CITED


Table 1.—Classification of immature chinook salmon (from the Japanese whalership fishing area, 1969, 1970) by means of discriminant function analysis (based on scale data from fish taken in 1968) into Western Alaskan-Asian components. Analysis limited to samples of 20 or more fish.

<table>
<thead>
<tr>
<th>Region</th>
<th>Year</th>
<th>Sub Area</th>
<th>June</th>
<th>July</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Size Classification (% of sample)</td>
<td>Size Classification (% of sample)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Western Alaska</td>
<td>Uncorrected</td>
</tr>
<tr>
<td>North Pacific Ocean 1969</td>
<td>1</td>
<td></td>
<td>99 61.5 38.5 33.5 (17-50)</td>
<td>69 76.8 23.2 (10-23)</td>
</tr>
<tr>
<td>3</td>
<td>52</td>
<td></td>
<td>255 69.4 30.6 21.8 (13-29)</td>
<td>51 76.5 23.5 (10-25)</td>
</tr>
<tr>
<td>5</td>
<td>161</td>
<td></td>
<td>50 65.8 34.2 27.1 (18-36)</td>
<td>50 82.0 18.0 (0-26)</td>
</tr>
<tr>
<td>7</td>
<td>61</td>
<td></td>
<td>101 42.5 57.5 61.9 (19-73)</td>
<td>115 28.7 71.3 (0-16)</td>
</tr>
<tr>
<td>9</td>
<td>36</td>
<td></td>
<td>261 55.3 44.7 42.9 (23-63)</td>
<td>199 66.8 33.2 (17-34)</td>
</tr>
<tr>
<td>Bering Sea 1969</td>
<td>4</td>
<td></td>
<td>23 28.4 71.6 76.9 (58-96)</td>
<td>43 27.9 72.1 (67-100)</td>
</tr>
<tr>
<td>6</td>
<td>117</td>
<td></td>
<td>162 19.7 80.3 95.9 (87-100)</td>
<td>303 16.2 83.8 (95-100)</td>
</tr>
<tr>
<td>10</td>
<td>228</td>
<td></td>
<td>59 19.3 80.7 96.5 (90-100)</td>
<td>20.3 79.7 (96-100)</td>
</tr>
<tr>
<td>1970</td>
<td>4</td>
<td></td>
<td>52 48.1 51.9 53.6 (37-71)</td>
<td>63 25.4 74.6 (74-100)</td>
</tr>
<tr>
<td>6</td>
<td>304</td>
<td></td>
<td>120 14.8 85.2 100.0 (95-100)</td>
<td>100.0 (93-100)</td>
</tr>
</tbody>
</table>

1/ Correction formula: \( P = \frac{P_a - Pa}{Pa - P_{ba}} \)

where \( P = \) corrected percentage of western Alaskan-type

\( P_a = \) observed percentage western Alaskan-type

\( P_{ba} = \) percentage of Asian-type standard misclassified as western Alaskan-type

\( P_{ca} = \) percentage of western Alaskan-type standard classified correctly

2/ 90% confidence limits shown in parentheses
Figure 1.--Fishing area of Japanese mothership salmon fleet and designated subareas.
Figure 2.--Percentage of western Alaskan-type chinook salmon in samples from the mothership fishing area, 1969 and 1970, by subarea (immatures only). Sample size appears in parentheses above the dark percentage figure and subarea number in the lower right-hand corner.