RECENT INFORMATION ON DISTRIBUTION OF ASIAN AND WESTERN CHUM AND CHINOOK SALMON IN THE BERING SEA

by

Allan C. Hartt

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Fisheries Research Institute
College of Fisheries
University of Washington
Seattle, Washington 98195

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INTRODUCTION

In recent years the Japanese high seas mothership fishery has caught substantial numbers of chum and chinook salmon in the western Bering Sea. The average annual catch for the years 1968-1972 was 5.7 million chum salmon and 0.3 million chinook salmon (INPFC Statistical Yearbooks). Until the late nineteen sixties information on the origin of chum and chinook salmon in the Bering Sea has been scanty. Since about 1971 tagging research by Japan (INPFC Annual Reports) and scale studies by the United States (Major, et al., 1975a, b) have provided mounting new evidence on the origin of the chum and chinook salmon in this important fishery area.

The purpose of this paper is to briefly summarize the present status of our knowledge of the distribution of continental stocks of chum and chinook salmon in the Bering Sea and to draw attention to the need for continuing efforts to better define the distribution of stocks in the area. The present interpretation will be based principally upon tag returns from Japanese experiments in the years 1973-1976 together with results of both tagging and scale studies in earlier years.

CHUM SALMON

Although only moderate numbers of chum salmon were tagged in the Bering Sea in the early years of INPFC, the experiments by both Japan and the United States were consistent in showing that Asian chum
salmon were dominant east of about 175°W and present to about 169°E in the northern Bering Sea (INPFC Joint Comprehensive Reports - Sheppard, et al., 1968; Neave, et al. MS). The tagging results were in general agreement with the results of studies of identifying scale characters. It is also pertinent to mention that no North American stocks other than those from western Alaska have been found in the Bering Sea, but that nearly all Asian stocks are present either as immature or as maturing fish.

Since the second comprehensive report on chum salmon (Neave, et al., MS) included data through 1971, Figures 1-4 were prepared to summarize and update tag return information for the years 1972-1976 from Japanese tagging experiments in the Bering Sea.

Figure 1 shows ten returns in 1972 of chum salmon released as immature fish in 1971 in the Bering Sea by Japan. The return pattern shows the typical seasonal southward movement into the Pacific Ocean of chum salmon that had been present in the Bering Sea as immature fish the previous year. Those recovered in the Bering Sea one year later presumably had also migrated far southward but were not recovered until they had accomplished a repeat northward migration. The data yield little information on the continent of origin. The scarcity of coastal returns suggests a high rate of interception at sea.

Figure 2 shows release and recovery data for eight chum salmon tagged and recovered in 1972 and two in 1973. The only three coastal returns were from Hokkaido and Honshu illustrating the tendency for these stocks to inhabit the Bering Sea, particularly during their final
homing migration as described in the Comprehensive Reports previously cited.

The 31 returns in 1974 (Figure 3) again illustrate the extremely high dominance of Hokkaido chum salmon among the fish tagged. The only other coastal return was from the northeast coast of the Okhotsk Sea. The high incidence of Hokkaido returns is probably a function of the time and place of release and of the relatively high efficiency of return of tags from Hokkaido.

The five returns in 1975-1976 illustrated in Figure 4 show some significant new information on the migrations of chum salmon in the Bering Sea. One chum salmon tagged near 53°N x 177°E on June 10, 1976 was recovered in the Yukon River on July 8, 1976. This is the southwesternmost release point for a Yukon River chum salmon in the Bering Sea. Two chum salmon tagged near 60°N x 177°W yielded returns from the Yukon River and Kotzebue Sound, respectively. Although these do not extend the range for western Alaska chum salmon in the northern Bering Sea, they supplement previous evidence that western Alaska chums tend to migrate west of 175°W, particularly in the northern part of their range. Additional returns from the Japanese tagging in both 1975 and 1976 will probably be reported at the 1976 Annual INPFC Meeting so that the distribution in Figure 4 is probably incomplete.

Figure 5 illustrates the extreme distribution of Asian and western Alaska chum salmon in the Bering Sea based upon a summary of past and recent tagging information. Obviously, the two stocks mix over a wide area, but the eastward distribution of Asian stocks seems to be much more pronounced than the westward distribution of western Alaska stocks. The western Alaska stocks appear to extend farther west in the northern latitudes and the Asian stocks farther east in
the southern latitudes. The unequal east-west distribution of the two stocks may be a reflection of differing migration habits of the two stocks as they make their annual summer migration from the North Pacific to the Bering Sea.

**CHINOOK SALMON**

Both past and recent information on the distribution of chinook salmon has shown a consistent pattern of widespread distribution of western Alaska chinooks extending in substantial numbers far to the west and Asian chinook salmon being concentrated mainly west of 180° (Mason, 1965; Major, 1975a, b). The latter two references based upon scale characters particularly show the high proportion of western Alaska chinook salmon in some years as far west as 170°E. Although numbers of tag returns have been small, tagging in earlier years (Major, et al., MS) revealed a distribution similar to that shown by recent tag returns as illustrated in Figure 6. Two of the returns illustrated in Figure 6 are of particular significance. An immature chinook salmon tagged at 59°N x 172°E in 1972 and another tagged near 57°N x 179°E in 1974 were recovered in the Yukon River in 1974 and 1976, respectively. Considering the relatively small numbers of chinook salmon as compared to chum salmon in the Bering Sea, the tag results must indicate a high proportion of western Alaska chinook salmon in the far western Bering Sea. The high seas returns in Figure 6 probably illustrate the summer migrations of immature chinook salmon in the Bering Sea. Thus, research continues to show that the oceanic feeding grounds of western Alaska chinook salmon includes almost all of the Bering Sea. Strangely, there have been no returns of chinook...
salmon tagged in the Bering Sea from Asian coastal areas (Major, et al., MS), even though scale studies indicate the presence of Asian chinook salmon, particularly in the far western part of the Bering Sea. This phenomenon is similar to that of sockeye salmon. To date there has not been an Asian coastal return of a sockeye tagged as a mature fish in the Bering Sea. As with chinook salmon, western Alaska sockeye are found throughout much of the Bering Sea and coastal tag returns have been received from releases of both mature and immature sockeye in the far western Bering Sea (French, et al., MS).

The above results illustrate the important principle that by comparing between species, research on the distribution of one species becomes more significant when compared with results for all species. This comparison can be carried one step farther by including results of pink salmon tagging. As has been observed in a number of years, East Kamchatkan pink salmon greatly dominate among tag returns from releases in the Bering Sea and along the south side of the Aleutian Islands in odd-numbered years when the East Kamchatkan stock is abundant. In such years western Alaska returns are scarce or absent. In even-numbered years, however, which are off-cycle years for East Kamchatkan stocks and on-cycle years for western Alaskan stocks, tag returns usually reflect this fact even from moderate numbers of tag returns (Hartt, 1962; Neave, et al., 1967).

In conclusion, the above data have been summarized primarily in an effort to call continuing attention to the need for information on the impact of the high seas fishery in the Bering Sea upon western
Alaska stocks of chinook and chum salmon. These stocks are of continuing importance to resident subsistence fisheries in Alaska and Canada, and of growing importance to developing commercial fisheries in Alaskan estuaries.

LITERATURE CITED


Fig. 1. Release and recovery locations of chum salmon released in the Bering Sea and recovered one year later (1971 releases) (source: INPFC Docs. Nos. 1415 and 1522).
Fig. 2. Release and recovery locations of chum salmon released in the Bering Sea and recovered in the same year (1972 and 1973 releases) (source: INPFC Docs. 1522 and 1583).
Fig. 3. Release and recovery locations of chum salmon released in the Bering Sea and recovered in the same year (1974 releases) (Source: INPFC Docs. 1684 and 1793).
Fig. 4. Release and recovery locations of 5 chum salmon released in the Bering Sea and recovered in the same year (1975 and 1976) (source: INPFC Doc. 1793 and tagging correspondence, 1976).
A = Release location - Asian return
W = Release location - western Alaskan return
--- = smooth line through extreme release points of Asian returns
----- = " " " " " " W. Alaska

(other release locations shown diagramatically for perspective in approximate proportions of stocks)

Fig. 6 Release and recovery locations of 6 chinook salmon released in the Bering Sea in the years 1972-1975. (source: INPFC Docs. 1684 and 1793 and 1976 tagging correspondence with Japan).
Table 1. Release and recovery data for chinook salmon tagged by Japan in the Bering Sea between 1972 and 1975. (see Fig. 6)

<table>
<thead>
<tr>
<th>Data release</th>
<th>Location</th>
<th>Fork length (cm)</th>
<th>Body weight (kg)</th>
<th>Age release</th>
<th>Recovery Maturity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1974 recovery from 1972 tagging</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7/18/72</td>
<td>59°03'N x 172°12'E</td>
<td>70</td>
<td>-</td>
<td>1.3</td>
<td>M</td>
</tr>
<tr>
<td>6/18/72</td>
<td>Yukon R.</td>
<td>78</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>

| 1974 recovery from 1974 tagging |
| 7/1      | 57°31'N x 178°59'E | 56               | 56               | 2.3         | 1.2              |
| 7/7      | 56°55'N x 179°35'E | 58               | 58               | 9           | 1.2              |

| 1975 recoveries from 1975 tagging |
| 6/7      | 56°25'N x 177°18'W | 48               | 54               | 1.8         | -2               |
| 6/16     | 58°16'N x 178°36'W | 59               | 59               | 2.1         | -.2              |
| 6/22     | 59°06'N x 179°46'E | 60               | 58               | 1.8         | 1.2              |

| 1976 recovery from 1974 tagging |
| 7/2/74   | 57°34'N x 178°58'E | Yukon R.         | 14.0             | -           | -                |

(1) Using gonad weights as applied to sockeye and chum salmon per Ishida, et al. (1961).
APPENDIX

This appendix, summarizing the distribution of tagging of chum and chinook salmon in the Bering Sea, has been added as an aid in evaluating the foregoing information on tag returns.

During the years 1956 - 1972 Japan and the U.S. tagged a total of 10,491 chum salmon throughout the Bering Sea as shown by statistical areas in Fig. 7. Most of these were tagged by Japan in the years 1958 - 1972. During the last three years (1973 - 1975) Japan tagged an additional 1,137 chum salmon throughout the Bering Sea which are also illustrated in Fig. 7. Thus, the average annual number of releases of chum salmon in the Bering Sea was 617/year in the early period and 379/year in the past 3 years.

Similar data for chinook salmon are shown in Fig. 8 except that tagging by the U.S. is not included. The U.S. did relatively little tagging of chinook salmon in the Bering Sea. During the years 1958 - 1972 a total of 325 chinook salmon were tagged by Japan or 22 per year. During the past three years (1973 - 1975) the numbers of chinook salmon tagged by Japan in the Bering Sea has totaled 234 or 78 per year which is a substantial increase but still a relatively small number considering the vast area and the numbers of salmon involved.

For a thorough study of the tagging returns it would be necessary to analyze the distribution of tag releases by age and maturity groups and by seasonal distribution of abundance of the respective species. In view of the numbers of releases and recoveries and the omission of age and maturity data on releases, it is obvious that the tagging results provide only a gross estimate of the distribution and migration of chum and chinook salmon in the Bering Sea.
Fig. 7
Numbers of Chum Salmon tagged by Japan and the U.S. in the Bering Sea 1956-1975
(Source: Neave et al. M.S. 1976 Fig. 31, plus INPFC Docs. 1522, 1583)

Japan and U.S.
1956-1972 = 10,491 = 617/yr.
1973-1975 = 1,137 = 379/yr.
FIG. 8

Numbers of Chinook Salmon tagged in the Bering Sea by Japan 1958-1975

Upper Number = 1958-1972 incl. = 325 = 22/yr

Lower Number = 1973-1975 incl. = 234 = 78/yr

Source: INPFC Documents