

**A Preliminary Proposal of Interactive Mapping System for the INPFC/NPAFC  
High-Seas Salmonid Tag-Recovery Database**

by

The Working Group on Salmon Marking (WGSM)  
The Committee on Scientific Research and Statistics (CSRS)

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# **A Preliminary Proposal of Interactive Mapping System for the INPFC/NPAFC High-Seas Salmonid Tag-Recovery Database**

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**Abstract:** Corresponding to the 2016-2020 NPAFC Science Plan and the International Year of the Salmon (IYS) initiative, the Working Group of Salmon Marking has prepared a preliminary proposal to develop an online Interactive Mapping System (IMS) for the effective use of the INPFC/NPAFC High-Seas Salmonid Tag-Recovery Database. By providing a dynamic display of information, the IMS will help users visualize and understand the ocean distribution and movement patterns of Pacific salmon and steelhead trout through graphical representation of tag recovery data. Users will be able employ online drop down boxes to search and display data associated with tag recoveries by species, age class, maturity, origin, and season.

Keywords: High-seas salmonid tag-recovery database, interactive mapping, ocean distribution

## **Introduction**

Data from long-term high seas tagging experiments provide direct information on the specific ocean distribution, migration, and movement patterns of Pacific salmon and steelhead trout. The recoveries of external tags, including disk tags and electronic data-recording tags, have been reported to the International North Pacific Fisheries Commission (INPFC) between 1956 and 1992, and to the North Pacific Anadromous Fish Commission (NPAFC) since 1993. Myers et al. (1996) presented maps of known ocean ranges of major stocks of Pacific salmon and steelhead trout as shown by recoveries of such tagged fish recovered between 1956 and 1995 (Appendix 1).

The INPFC/NPAFC High-Seas Salmonid Tag-Recovery Database is currently managed by the NPAFC Secretariat. Data currently exist in a standardized format within an MS-Excel spreadsheet (NPAFC Secretariat 2012) and contains information from 18,531 recovered tags as of April 2016. These data are available to NPAFC Members in the members' area of NPAFC website, and are made available to the public upon request and with the permission of the Working Group on Salmon Tagging (WGST; currently the Working Group on Salmon Marking).

The current 2016-2020 NPAFC Science Plan includes Research Theme 5; "Integrated Information Systems", whose objective is to improve the ability to share information and collaborate on research efficiently using a modern web-based framework (SSC 2016). Additionally, this theme seeks to integrate data products with existing data systems and use archives of accessible electronic data to support research and increase public understanding of the role of salmon in ocean ecosystems. The International Year of the Salmon (IYS) program has identified a similar theme "Information Systems" to develop an integrated archive of accessible electronic data collected during the IYS and provide tools to support future research and analyses (IYS Working Group 2016).

At the 2016 CSRS, the WGST recommended the INPFC/NPAFC High-Seas Salmonid

Tag-Recovery Database be open to the public without permission to enhance the use of archived tag recovery data for the study of ocean distribution and migration of Pacific salmon and steelhead trout. The WGST also recommended that an “Interactive Mapping System (IMS)” be developed as part of the NPAFC website. The IMS would allow users to create customized maps of ocean distributions and movements of individually tagged fish based on the decades of tag recovery information housed in the online database, which would effectively replace the static ocean distribution maps of major stocks as reported in Myers et al. 1996 (Appendix 1) with a continuously updated web-based mapping system. Such a mapping system would encourage the effective and efficient use of the tag recovery database. Data from tag recoveries will be made public when the IMS is implemented on the website.

## **Purpose**

The IMS will help users, including researchers, educators, and any other interested parties, visualize and study the specific ocean distribution of Pacific salmon and steelhead trout. Users will be able to search tag recoveries stored in the INPFC/NPAFC High Seas Salmonid Tag-Recovery Database by tag type, species, age class, maturity, origin, and season to create customized maps of salmon migrations and movement patterns. High seas tag recovery data will also be fully accessible to the public for download.

## **Design**

### Tag Recovery Database

The IMS will rely on information contained in the INPFC/NPAFC High Seas Salmonid Tag Recovery Database, which currently contains data from the following types of tags:

Disk Tags: A total of 18,531 tags have been recovered from 6,340 pink, 3,792 chum, 6,971 sockeye, 1,173 coho and 166 Chinook salmon, and 89 steelhead trout between 1956 and 2016. The recorded data format was reported by NPAFC Secretariat (2012).

Data Storage Tags (DSTs): A total of 92 DSTs have been recovered from 38 chum, 21 sockeye, 15 coho, 10 pink, 7 Chinook salmon and one steelhead trout. Of the 92 tags, eight tags failed completely and four others experienced partial failures (NPAFC Secretariat 2014).

### Menu for Researching

The data will be searchable by species, age class (freshwater and ocean ages), maturity (immature or maturing), sex, geographical origin, and season (Appendix 2).

### Potential Mapping Programs

There are several computer programs available that can be used to create an online interactive mapping system. Those programs include:

- (1) ArcGIS
- (2) ArcMap
- (3) Google Maps, and
- (4) “R” Programming.

Program selection will be made within the context of the IMS functionality and design. Each program has cost, licensing, and functionality issues that will also need to be considered within the context of the website's design.

### Primary Personnel

The NPAFC Web/Publication Manager Alanna Harlton, along with Working Group on Salmon Marking members Dion Oxman and Hiko Urawa, will oversee IMS design and development. The assistance of a programmer may be required to determine which program will best fit our needs, and an ArcGIS Specialist (ADFG – Sabrina Larsen) may also be needed to assist with data visualization. The IMS will be housed at the NPAFC and its implementation, maintenance and management will be the responsibility of the NPAFC Web Manager. NPAFC staff will be responsible for data entry and software updates.

### **Timeline**

The tentative implementation date may be the end of 2018/2019 fiscal year (before 2019 AM), to coincide with the beginning of IYS activities.

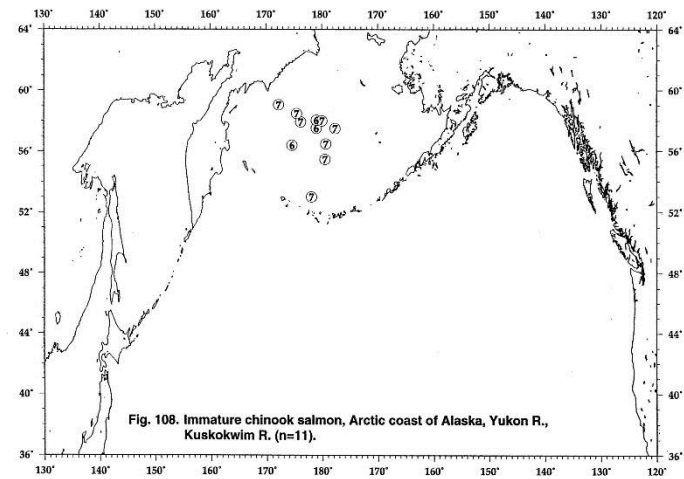
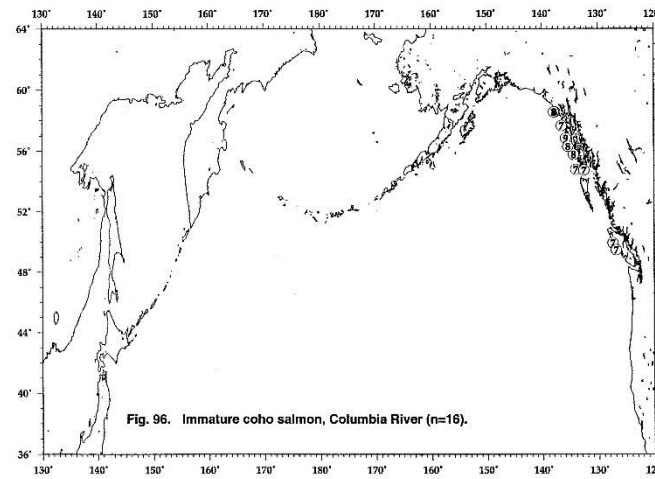
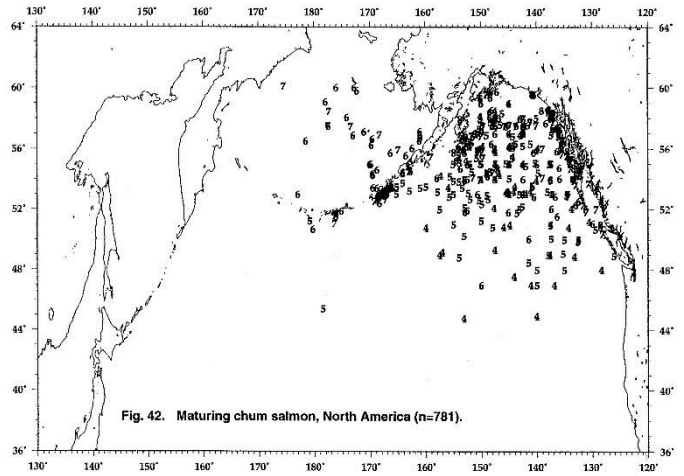
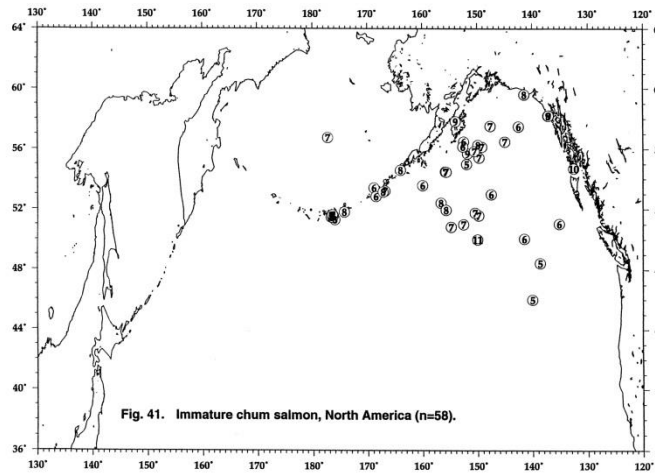
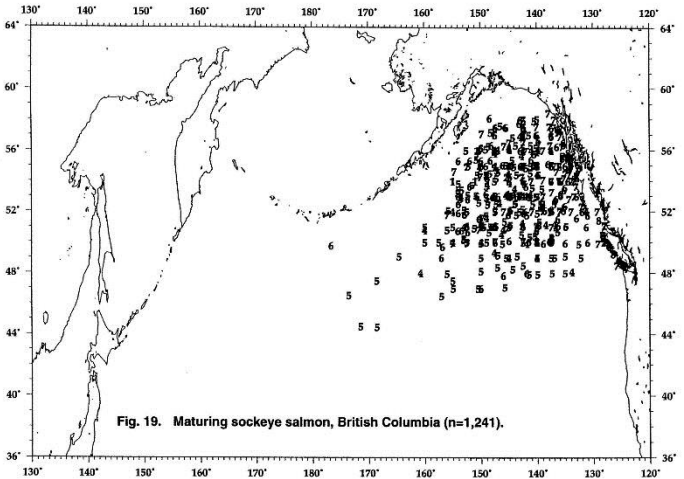
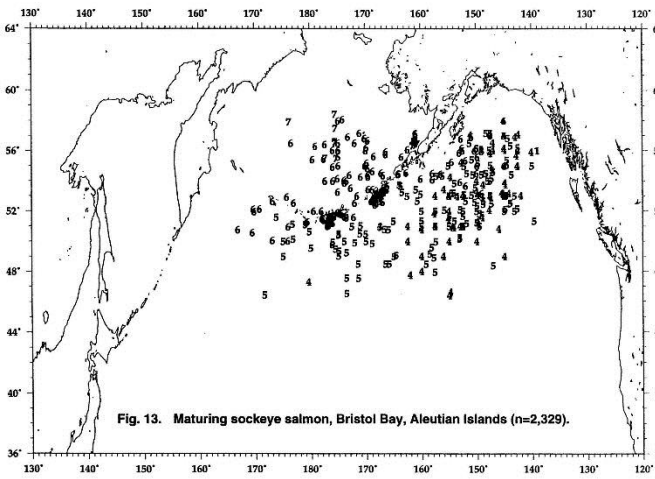
### **Anticipated Budget**

This proposal is in its preliminary planning stage and a detailed budget is unavailable at this time. It will likely include the initial costs needed to design, create, and launch the IMS, as well as provide an accounting of the potential annual costs associated with IMS maintenance, data entry, software licensing fees, and software upgrades. Preliminary estimates from three Canadian software consultants suggest costs could be between \$20K and \$30K CAN. It is anticipated that we will have a detailed budget prepared prior to the 2018 NPAFC Annual Meeting for a funding request to F&A.

## References

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Appendix 1. Samples for Mapping an Ocean Distribution of Specific Salmon  
 Source: Myers et al. (1996)



Appendix 2. Selection Menu for Mapping an Ocean Distribution of Specific Salmon

**Ocean Ranges of Pacific Salmon and Steelhead Trout As Shown by Tagging Experiments: Interactive Visual Mapping System**

Clear All Selections

**Species:**

CHINOOK CHUM COHO MASU PINK SOCKEYE STEELHEAD

**Maturity:**

Immature Maturing Unknown

**Freshwater Age:**

0 1 2  >3 Unknown

**Ocean Age:**

0 1 2 3 4 5  >6 Unknown

**Sex:**

Female (F) Male (M) Unknown

**Seasons:**

Winter (1-3) Spring (4-6) Summer (7-9) Autumn (10-12) All (1-12)  
January (1) February (2) March (3) April (4) May (5) June (6) July (7) August (8) September (9) October (10) November (11) December (12)

**Geographical Origins (INPFC Division Codes\*):**

\*Codes may be deleted from the actual menu.

ASIA

Honshu (01) Hokkaido (02) Kuril Islands (03) Primore (04) Amur R. (05) Sakhalin Island (06) North Okhotsk Coast (07) Shelekova Bay (08) West Kamchatka (09) East Kamchatka/Karaginsky Area (10-12) Siberian Coast/Anadyre (13,14) Korea (16)

NORTH AMERICA

Arctic Coast of Alaska/Yukon River/Kuskowim River (40-44) Bristol Bay (45-50) Aleutian Island (52) Central Alaska (53-60) Southeast Alaska (61-67) Alaska Others/Unknown (68, 69) British Columbia (70-79) Washington/Oregon/California (80-91)

Show A Map

Download Tag Release & Recovery Data