

### **III. Workshop Review**

How to mark small juvenile salmon without injury has long been a concern for salmonid researchers and managers. Thermal otolith marking is a universal way to mark large numbers of hatchery salmon during embryonic and yolk absorption stages, creating distinct mark patterns in the otoliths by water temperature controls. Similar otolith marks are produced by the dry method developed by Russian scientists. This low cost technique can provide high quality otolith marks without special equipment. Chemical otolith marks using strontium or fluorescent substances may be used to supplement mark patterns in hatcheries, because the number of unique thermal or dry marking codes is limited.

In 2000 approximately one billion otolith marked juvenile salmon were released from hatcheries in North Pacific Rim countries. Many marking objectives have been achieved without organized rules for pattern assignment. A standardized system of organizing pattern information on otoliths potentially offers a larger number of patterns, and also provides the opportunity for coordinating marks between countries to avoid mark duplications in mixed-stock fishery analysis. The NPAFC Working Group on Salmon Marking would play an important role by coordinating otolith mark patterns among countries and creating an Internet-accessible database of otolith mark releases.

Application of otolith-marking technologies to the biology and management of salmon is essential. The early applications of otolith marking techniques supported scientific research to distinguish wild and hatchery salmon during early sea life. A recent rapid increase in the number of otolith mark releases has made it possible to track the migration of specific salmon stocks throughout their entire ocean life from coastal waters to the high seas. Current salmon research using otolith marks includes ocean distribution, migration speed, abundance, feeding success, growth, straying of otolith-mark groups, and interactions between wild and hatchery stocks.

Applications of otolith marking for stock assessment and management of terminal fisheries have increased in recent years. In Alaska an otolith marking and recovery program for in-season stock management is well established. Mass otolith marking is an effective tool for estimating the contributions of hatchery fish to overall natural spawning escapement. To minimize the effect of hatchery production on wild salmon populations, this information is critical.

The North Pacific Rim countries (Canada, Japan, Russia, and USA) are successfully conducting mass otolith mark releases under common rules. Otolith mark recovery data will enable us to develop a valuable time series of stock-specific biological information that is indispensable to the sustainable conservation of salmon stocks in North Pacific regions.

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