Alaska Department of Fish and Game Otolith Marking and Recovery Program

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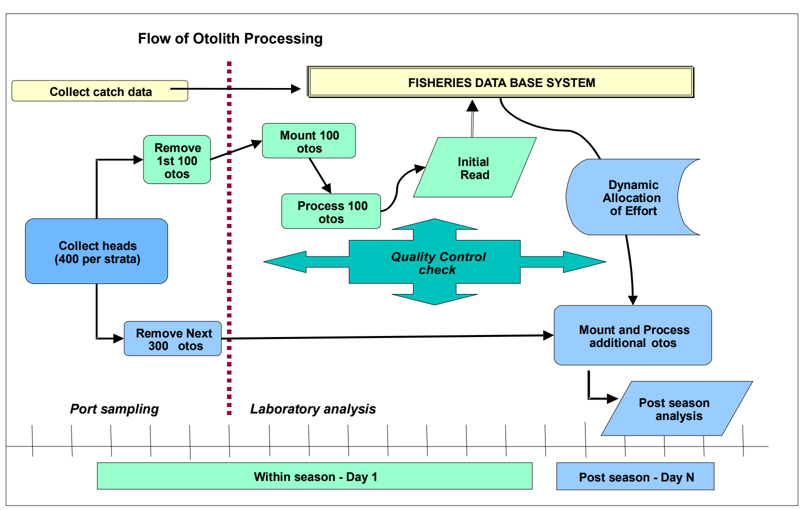
Since the inception of otolith marking in Alaska over ten years ago, approximately 5 billion hatchery salmon have been marked and released. Last year, 37 release groups representing over 900 million salmon (60% of the statewide hatchery production) were thermally otolith marked. The volume and number of marked groups is expected to increase. This paper highlights the role of the Alaska Department of Fish and Game's Mark, Tag and Age laboratory in coordinating the assignment of thermal mark patterns in Alaska, the procedures and methods used in recovering marked fish from commercial fisheries, and the effort made to ensure standardization of methods and reading accuracy by other otolith reading laboratories in Alaska.

When coordinating the assignment of thermal patterns, the Mark Tag and Age lab works closely with hatchery operators, fishery managers, and affected parties to match marking capabilities of each facility with the availability of unique mark patterns. Because there are limitations to the number of unique marking codes (Hagen 1999), and because the facilities can vary in their ability to control water temperatures, assigning unique patterns can be difficult. To help mitigate this problem, the lab looks for ways to ensure that secondary characteristics, such as ring spacing and ring position, can be used to distinguish among marking groups when distinct patterns are not possible. To help design marks, a modeling approach is used which incorporates the anticipated temperature regimes at the hatchery sites and the relationship between temperature and otolith growth. To identify when marking can begin, staff examine the developing otolith from eyed egg stages. Marking can typically begin once the otolith primoridia have coalesced or fused. This usually occurs during the eyed-egg stage at approximately 300 cumulated temperature units (CTUs), though stock specific differences have been observed and must be considered. Upon completion of marking and prior to release of the fish, hatcheries provide representative specimens and associated data for each mark group. These samples constitute the voucher collection. The voucher otoliths are removed from the fish, mounted, and ground to a thin-section. They are examined for mark quality based on the appearance of the thermal rings. Measurements on ring spacing and mark location are taken, and the variability of the mark pattern within a voucher group is identified. The voucher collection provides otolith lab staff with references to identify marks in returning fish and allows feedback on the mark quality to hatchery personnel. The otolith lab is currently developing a digital image library of voucher specimens that enables the transmission of digital images to hatchery operators, other labs and interested parties. Voucher otoliths are maintained according to returning brood years expected in the management season.

Within Alaska, approximately 30,000 otoliths are collected and examined annually by two ADF&G otolith labs: one in Cordova, which provides mark information for Prince William Sound fisheries (Joyce and Evans this volume) as well as the Juneau based Mark, Tag and Age lab which provides mark information in support of the Stikine and Taku sockeye fisheries in Southeast Alaska (Jensen and Milligan this volume). In both laboratories, a two-tiered processing schedule is used to provide in-season management information (Fig. 1) while prioritizing

Fig. 1. Illustration of the two-tiered processing system used by the Alaska Department of Fish and Game otolith processing lab. The first one hundred otoliths from a sample are processed upon receipt of the sample while additional specimens are processed post-season to reduce uncertainty in hatchery contribution estimates.



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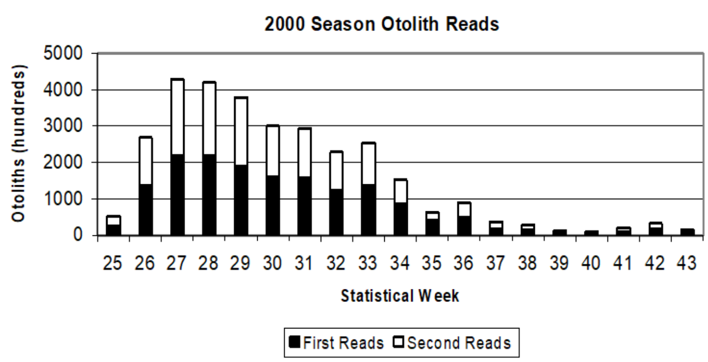
effort between multiple fisheries and maintaining production rates (Hagen et al. 1995). A subsample of otoliths from each stratum is processed within hours of receipt while a portion of the remaining otoliths are processed post-season using an optimizing algorthim designed to minimize the overall uncertainty in the hatchery contribution estimate (Geiger 1994). A bar code label is used to track specimens in the lab. Each reading station is equipped with dissecting and compound microscopes, a grinding wheel, a touch screen data entry computer, and a bar code scanner. The sample and specimen data, as well as the reader observations, are stored in a relational database to enable the rapid reporting of results.

During the 2000 season, over 16,500 otoliths were read in the Mark Tag and Age Lab, providing contribution estimates for 160 strata obtained from commercial fisheries, test fisheries, and escapement surveys. In addition, otoliths were collected on a weekly basis from the Canadian portion of the Stikine and Taku Rivers and processed to identify returning stocks and provide age compositions for returning fish. Additionally, many of the Stikine and Taku River systems otolith specimens are matched to age, weight and length data, scale age data, and brain parasite analysis that further assists in stock and age identification and requires meticulous dissection, data collection and data management.

In addition to the Taku and Stikine fisheries, the Mark Tag and Age Lab examines samples obtained from National Marine Fishery Service's high seas collections (Farley et al., this volume) and conducts second readings on otoliths received from the Cordova laboratory and other otolith reading labs. To monitor the accuracy of the readings, two independent readings were made on most otoliths (Fig. 2) and a third reader resolved reading conflicts. In some cases, otoliths may be independently read three times. Latent class models (Blick and Hagen 1998) are employed postseason to provide an estimate of reading accuracy and agreement. From the 2000 season, specific estimates of reader accuracy for the Taku and Stikine river marks ranged from 0.96 to 0.99 with slightly more accuracy in identifying wild fish than hatchery stocks.

The Alaska Department of Fish and Game's otolith processing lab is involved in otolith research in addition to management and production processing. The lab is developing treatment, processing, and Food and Drug Administration (FDA) protocols to integrate Strontium Chloride marking for remote hatchery marked salmon production. Processing techniques for strontium chloride marking are being investigated for juvenile and adult salmon mark recovery and may be incorporated in elemental analysis applications of other Pacific salmon species and Pacific herring. Salmon straying studies and other investigations continue to challenge the lab to provide vital information on Alaska's salmon resources.

Fig. 2. Tracking graphic of the number of otoliths read per statistical week for the year 2000 management season. The increase in otolith readings between statistical weeks 26 and 33 represent the sockeye otolith contribution, the focus of the lab during the summer season. Following week 33, more attention is devoted to chum and pink salmon otolith reading as well as sockeye salmon escapement survey otolith reading.



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