

Clean otolith archive collection

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Abstract

Recent trends in otolith research include analysis of trace element constituents of the otolith. Samples used in these types of analyses need to be free of contaminants, such as glycerin. The Halibut Commission's otolith archive has primarily been comprised of otoliths collected for age determination, which have been stored in a glycerin/thymol solution to increase readability. A new collection of otoliths was started in 2010 for use in future elemental studies.

Background

Recently, with the advent of new technologies, fisheries researchers have had the ability to study the elemental constituents incorporated in the microstructure of the otolith. The otolith is essentially a recorder of not only time, but the elemental environment that the fish lives within as well. The most commonly measured elements are those that fall under the alkali, alkaline earth, and transitional metals category of the periodic table which include, but are not limited to, beryllium, (Be), magnesium (Mg), calcium (Ca), strontium (Sr), barium (Ba), and manganese (Mn). It has become possible to detect and measure extremely small concentrations of these elements, however any contaminants in the sample, such as glycerin in particular, can make these measurements difficult to interpret.

The International Pacific Halibut Commission (IPHC) otolith archive has by and large been created from samples collected for age determination for input into the annual stock assessment. These structures have been stored in a glycerin/thymol solution that allows for increased readability. As useful as it has been, the existing IPHC otolith archive has limitations for other research purposes. Over the last ten years, otolith-based research has seen a major push in the direction of isotopic and elemental analysis, and more recently, analysis of the elemental constituents of the organic proteins within the otolith. Glycerin/thymol solution maintains readability in stored otoliths, enabling age determination; however, it renders these structures unusable for research involving some isotopic and all elemental analysis. It is without a doubt that studies involving otolith elemental and isotopic analysis will become more mainstream, and the technologies that drive these studies will only become more advanced. To make structures available for future chemical analysis, a new archive has been created.

Collections

The clean otolith archive collection (COAC) will be composed of structures sampled from all IPHC otolith collections. These include the Standardized Stock Assessment survey (SSA), Commercial Port Collection (CPC), National Marine Fisheries Service (NMFS) Trawl Survey, and any special charter that sacrifices halibut for research. These otoliths will be collected and associated data will be recorded following the established collection procedures of that particular program. Otoliths from the COAC will not be used for age determination, but will be cleaned, dried, and stored whole in climate-controlled conditions for future analysis.

The goal is to collect a random sample of 100 otolith pairs from each regulatory area every year. Ideally these otoliths would come from the SSA since sex and exact capture location would be available. However, in areas of lower catch, the otolith sampling rate may already be 100% to achieve the stock assessment otolith target. In these cases, COAC otoliths will be collected from commercial deliveries.

Total SSA collections for 2010 and 2011 were 623 and 479 respectively. An additional 1,609 otoliths were collected for the COAC across all other IPHC platforms in 2011.

Standardized Stock Assessment Survey

Clean otolith collections on the Standardized Stock Assessment survey began in 2010. To achieve a per area target of 100 otolith pairs for the COAC, survey otolith sampling rates were increased by approximately 5% for each regulatory area, excluding those areas that required a 100% sampling rate to meet the stock assessment otolith target. Otoliths were not collected for the clean otolith archive from Areas 2A and 4CD in 2010, or from Areas 2A, 4B, and 4CD in 2011 since those areas were sampled at 100% for the stock assessment collection. Selection of fish to be sampled for the COAC as well as for the stock assessment collection was determined from a random number table. COAC otoliths were placed in black Tray Bien™ otolith collection and storage trays to prevent confusion from the standard blue Tray Biens™ utilized for the SSA. Totals for the SSA portion of the COAC were 623 (Table 1) and 479 (Table 2) for 2010 and 2011 respectively.

Commercial port collection

Commercial Port Collections of clean otoliths began in 2011. Clean otoliths are only collected from commercial deliveries of halibut caught in regulatory areas not sampled on the SSA. The CPC target sample size is 100 otolith pairs per regulatory area. The number of otoliths targeted from commercial deliveries may vary from year to year depending on the ability to collect otoliths for the clean archive on the SSA surveys in a given regulatory area. In 2011, clean otolith samples from the commercial fishery were requested from Areas 2A and 4CD and 100, 76, and 21 otolith pairs were collected from Areas 2A, 4C, and 4D respectively (Table 2). These COAC otoliths were collected by samplers in Newport (2A) and St Paul (4CD). Sample areas for 2011 CPCs were determined from the 2010 SSA sampling rates and only Areas 2A and 4CD were sampled at 100% in 2010. However, the SSA sampling rate was changed to 100% in 2011 for 4B, so clean archive otoliths were not collected on either the SSA survey or from commercial deliveries for Area 4B in 2011. Sampling protocol and rates were established for St Paul and Newport prior to the start of sampling in those ports. In Newport, COAC samples were taken from the same deliveries as the commercial samples used in the stock assessment. In St Paul, the sampler collected COAC otoliths on days when commercial samples for the assessment were not being collected. Sampling rates for both ports were increased in-season in order to realize the COAC target.

National Marine Fisheries Service trawl survey

The National Marine Fisheries Service conducts an annual trawl survey in the Eastern Bering Sea (EBS) and biennial surveys in the Gulf of Alaska (GOA) and Aleutian Islands (AI). In 2011, COAC samples for the clean otolith archive were collected from the NMFS EBS and GOA trawl

surveys. Due to the nature of the trawl survey, a large portion of the catch consists of small halibut that are not represented in the SSA or CPC collections. The 2011 trawl surveys were conducted by four vessels, two in the GOA and two in the EBS. An IPHC sampler was deployed on one of the EBS survey vessels and one of the GOA vessels. For the EBS survey, COAC sampling took place on both vessels. Sampling rate was set at 6 fish per station with a maximum total of 110 fish (50 from Bristol Bay, 30 from Pribilof Islands and 30 from St. Mathews).

On the vessel not staffed with an IPHC sampler, only samples from halibut ≤ 25 cm FL were collected. The IPHC sampler on the other EBS vessel only sampled halibut > 25 cm. For the GOA trawl survey, COAC otoliths were only collected on the vessel staffed with an IPHC sampler. Because the GOA survey area overlaps the IPHC's SSA survey regions, COAC samples were only collected for smaller fish (≤ 82 cm FL). The COAC sample rate on the GOA vessel was six per station up to a total of 30 for each of the 2C/3A East, 3A West, and 4A-GOA regions and six per station to a total of 50 from the 3B region of the GOA survey.

All halibut ≤ 25 cm FL caught on selected NMFS trawl vessels were measured, sexed, then bagged, tagged, frozen, and shipped whole to the IPHC in Seattle. Halibut ≤ 25 cm FL are typically one or two years of age. It is common practice for otoliths representing these age classes to undergo dilution inductively coupled plasma mass spectrometry (ICPMS). Here, the entire otolith is subjected to the process of elemental inspection rather than laser ablation (LA-ICPMS) the internal microstructure of a thin-sectioned otolith, as is common with older specimens. To eliminate any possible contamination via an at-sea removal, otoliths from specimens ≤ 25 cm FL will be extracted in the clean and metal-free environment of the IPHC otolith wet lab.

In 2011, 116 otoliths were collected on the GOA survey and 96 otoliths and 7 whole fish were collected in the EBS (Table 2).

Research collections

In 2011, genetic tissue samples were collected from commercially-caught halibut. An IPHC sampler was deployed on commercial trips on three different vessels in different regulatory areas and at different times of the year (Hauser and Loher 2012). Both right and left otoliths were collected dry (no use of glycerin/thymol solution). Once in the office, the left otoliths were cleared in glycerin/thymol solution and aged, and the right otoliths were added to the COAC. In total, 1,193 otolith pairs were collected, 261 from area 2B, 365 from area 3B, 223 from area 4A, and 344 from area 4D (Table 2).

References

Hauser, L. and Loher, T. 2012. Use of genetic techniques to determine sex ratio of commercial landings and assess population structure in Pacific halibut: progress in 2011. *Int. Pac. Hal. Comm. Report of Assessment and Research Activities 2011*: 425-440

Table 1. COAC otoliths collected by regulatory area in 2010.

Vessel	Regulatory Area									Total
	2A	2B	2C	3A	3B	4A	4B	4C	4D	
PVN		80								80
KSU				22						22
KSU						13				13
CLD					39					39
BDP			27							27
BDP				18						18
PEN			75							75
WFL				63						63
PRE				12						12
VNI					25					25
VNI				11						11
VNI		39								39
PCS							85			85
FTW					47					47
FTW						67				67
	0	119	102	126	111	80	85	0	0	623

Table 2. COAC otoliths collected by regulatory area in 2011.

Vessel	Type	Regulatory Area											Total		
		2A	2B	2C	3A	3B	4A	4B	4C	4D	GOA	BS			
STW	SAS		31												31
STW	SAS			22											22
PVN	SAS		54												54
KSU	SAS					1									1
KSU	SAS						20								20
BDP	SAS				30										30
PEN	SAS			72											72
WFL	SAS				21										21
WFL	SAS					41									41
PRE	SAS				15										15
VNI	SAS				53										53
FTW	SAS					49									49
FTW	SAS						70								70
	CPC	100													100
	CPC								76						76
	CPC									21					21
	Research		226												226
	Research									344					344
	Research							425							425
	Research					375									375
OEX	NMFS										116				116
AKN	NMFS												96		96
ALD	NMFS												7		7
		100	311	94	119	466	515	0	76	365	116	103			2,265

