

Results of the 2003 PIT tagging experiment

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Introduction

In 2003, the IPHC staff carried out a coastwide tagging project utilizing Passive Integrated Transponder, or PIT, tags. The primary objective of this program is an independent determination of the exploitation rate, although additional information on migration and growth is also expected to become available. The tags are implanted subcutaneously in the head of a halibut, leaving no external markings indicating the tag presence and avoiding recurring problems with tag reporting rate noted in earlier tagging studies. Roughly 44,000 tags were released in 2003 from the setline assessment survey vessels in all areas except Area 4E. At offloading sites, scan samplers examined over 583,000 halibut for tags during June-November, locating 86 tags. Plans for 2004 include additional PIT tagging releases in Area 2B and 3A. Scanning will be conducted throughout the fishing season.

What are PIT tags and why use them?

A PIT tag is a radio frequency device that transmits a unique code to a scanner where it is displayed in a numeric or alphanumeric form. The tag has no internal battery, hence the term “passive.” The tag is glass-encapsulated, 11.5 mm x 2 mm in size (Fig. 1), and injected with a 12-gauge hypodermic needle. A handheld scanner powers (excites) the tag circuitry by radio frequency induction and receives the code back from the tag. Optimal read range is 7 to 30 cm. During manufacture, the PIT tag is coded with one of 3.5 billion unique codes.

Although IPHC has conducted many tagging experiments during its history, analyzing the results of these projects has been difficult due problems created by a lack of information on reporting rates, i.e., the rate at which recovered tags are reported to IPHC. Simply stated, not all recovered halibut tags are turned in, and the rate of reporting probably varies among areas of the coast. IPHC decided to use an internal tag which is recovered by a dedicated sampling team, using a prescribed set of sampling protocols, to overcome this problem.

PIT tags are a relatively new technology but have been used in a variety of applications, including product inventory and tracking runners in marathons. Marine fisheries applications have been few but the most notable use is on juvenile Pacific salmon on the Columbia River. Other uses in the region include an experiment being conducted by the Oregon Department of Fish and Wildlife on black rockfish.

Project objectives

The primary objective of the PIT tagging program is to obtain an estimate of the exploitation rate for an area that is independent of the stock assessment model. If the exploitation rate and catch are known, then exploitable biomass can be estimated directly because catch is exploitation rate

times exploitable biomass. Objectives for this program differ from past IPHC tagging studies, which have focused primarily on migration, growth or survival.

Secondary objectives include gaining information on migration rates and additional information on growth. Since tagging is taking place coastwide during a single, narrow time period, the staff expects to get multi-directional movement patterns. To our knowledge, an experiment to tag an entire stock has not been conducted on a marine stock before. Migration rate data can be gathered from whole fish, heads, or both. Migration by size can be determined by initial size alone (i.e., data gathered when the fish is tagged), or through knowledge of both initial and recapture size, when whole fish are sampled.

Growth information will also be gathered in this study. Size at age in the catch is estimated annually from data collected by the port sampling program in every area. This provides a direct measurement of changes in size at age and it is based on a very large sample size (about 2,000 fish per regulatory area). We also get the same information from the survey data (also about 2,000 fish per area). These are then two independent estimates of growth, via size at age. The growth information from tagging acts only as an accuracy check on these other data sources, rather than being the definitive method for how we determine growth.

Project planning

Planning for the project began in 2000 with a series of holding experiments at the Seward Marine Center to locate a satisfactory tagging location and measure the shedding rate for a PIT tag in halibut. Three different tag sites were investigated, and the site ultimately chosen is on the white (left) side of the fish, just posterior to the jaw and below the opercular groove (Fig. 2). Shedding rates were quite low, roughly 3%. The primary factor in tag retention was the proper application of the tag, so IPHC staff spent considerable time developing a simple tagging protocol. Based on expected survey catch rates and a potential scanning rate of 25% of the landings in selected ports, an estimated 45,000 tags were projected for release.

2003 release operation and results

Tagging took place from the IPHC setline assessment survey vessels. Each vessel set an additional three skates at each station, i.e., an additional 300 hooks, to catch halibut for tagging. All viable halibut were expected to be tagged. Each fish was brought aboard carefully, either being lifted up and over the rail by the gangion (small fish) or with a gaff through the “V” of the lower jaw. The halibut were checked for injuries and tagging suitability, with 43,999 fish ultimately tagged throughout the survey range. Table 1 shows the number of fish tagged by regulatory area and survey vessel.

The number released varied by area, as expected, as the tags were released in proportion to abundance in the area. Area 3A had the largest number of tags released (16,434, or 37% of the total tags), with Area 3B close behind (15,292; 35%). The largest halibut tagged was 213 cm in length (roughly 7 feet); the smallest was 38 cm (15 inches). Approximately 38% of the halibut tagged were sublegal in size.

The IPHC staff developed new procedures for data recording during this experiment, necessary in part due to the need to make sure the tag was working prior to releasing the fish back to the

sea. This was accomplished by scanning the tag, which prompts the tag to emit its identification number back to the scanning wand. The wand captured the information, which was sent electronically to a personal digital assistant (PDA) device operated by a sea sampler in the deck recording shack, for data storage. The release data were then transferred to compact flash cards, the same type used by digital cameras, which were mailed to the office upon completion of the survey trip. This process eliminated the need for recording data by hand on paper forms, thereby enabling the tag release data to be available for use by analysts more quickly.

2003 recovery effort and results

Recovering PIT tags in this experiment required that each fish be scanned using a portable handheld scanning device. The ports currently staffed by port samplers account for about 70% of the total pounds landed, so scan samplers were placed in the same ports, with a goal of sampling 25% of the landings from each regulatory area. Scanning began June 1, the same date when tag releases started from the survey vessels.

With the tag placed in the head, scanning could occur on either whole fish or heads. Samplers were instructed to sample whole fish, if possible, when it could be done without causing a disruption to the offload and processing of fish. This would enable the sampler to get a fish length on recovered tagged fish. If sampling whole fish was not possible, scanning only heads was an acceptable alternative, as the primary goal was to locate tags. In this scenario, scan samplers were not required to be present at the actual offload but could arrive later and scan heads from totes. The only requirement was to know the total number of fish scanned and the name of the vessel so a fishing location taken from a log could be assigned to the sample by office staff. By the end of the season, whole-fish scans represented 58% of the total number of scans. After an initial period of orientation and explanation, most processors were very helpful in allowing scan samplers access to vessel offloads.

IPHC hired seasonal staff for the Alaska sampling but contracted with Archipelago Marine Research, Inc. (AMR) of Victoria, B.C. for scanning Canadian landings. AMR already has staff present in most Canadian ports for other duties but some are employed for less than full time, so scanning would enhance their ability to retain those staff. The AMR staff took part in the 2-day training with the Alaskan samplers in Seattle in mid-May.

Scan sampling took place in Vancouver, Port Hardy, Prince Rupert/Port Edward, and Tofino/Ucluelet, B.C. Alaskan ports staffed included Sitka, Petersburg, Juneau, Homer, Kodiak, Seward, Dutch Harbor, Adak, and St. Paul. IPHC office staff conducted sampling in Newport, OR during one of the short commercial openings, then contracted with a local sampler for subsequent openings. Oregon Department of Fish and Wildlife port samplers also scanned sport-landed halibut in Area 2A. Sampling also occurred in Bellingham, mainly on vessels landing halibut from the limited entry sablefish fishery, where halibut retention is allowed.

A total of 86 tags were recovered during the June-November scanning period (Table 2). Most of the recoveries in an area were of fish released in that area. Area 2A was the only area not to have any tags recovered. Almost all of the recoveries of Area 3A releases occurred in Area 3A. The number of recoveries in 2003 was about what was expected for the first year, however the number of recoveries is too few to permit any analysis of exploitation rates. In 2004, 500-600 tags are projected to be recovered.

Future plans

The tagging conducted in 2003 comprises the primary tagging effort of the experiment. Additional releases of approximately 20,000 tags are planned in 2004 in Areas 2B and 3A to provide improved estimates of annual survival and strengthen the statistical basis for estimation of population parameters. Scanning for recoveries will continue at least through 2006 to fully capture as much information as possible about fishery exploitation rates and movements between areas. Scan samplers will be deployed to the same ports as in 2003, with the exception of Adak. Also, additional scanning is anticipated in Area 2A with the assistance of state and tribal representatives.

Table 1. Number of PIT tags released by vessel and IPHC regulatory area in 2003.

Reg. Area	Vessel Name	No. Tags Released
2A	Blackhawk	301
	<i>Area 2A Total</i>	<i>301</i>
2B	Star Wars II	1,620
2B	Viking Joy	806
	<i>Area 2B Total</i>	<i>2,426</i>
2C	Bold Pursuit	2,754
2C	Waterfall	1,221
	<i>Area 2C Total</i>	<i>3,975</i>
3A	Bold Pursuit	910
3A	Free To Wander	7,611
3A	Predator	1,787
3A	Viking Spirit	1,532
3A	Waterfall	4,594
	<i>Area 3A Total</i>	<i>16,434</i>
3B	Free To Wander	5,199
3B	Kristiana	4,513
3B	Norska	2,382
3B	Waterfall	3,198
	<i>Area 3B Total</i>	<i>15,292</i>
4A	Heritage	623
4A	Pacific Sun	2,833
	<i>Area 4A Total</i>	<i>3,456</i>
4B	Heritage	465
4B	Pacific Sun	671
	<i>Area 4B Total</i>	<i>1,136</i>
4D	Heritage	979
	<i>Area 4D Total</i>	<i>979</i>
GRAND TOTAL		43,999

Table 2. Distribution of PIT tag releases and recoveries in 2003, by IPHC regulatory area.

RELEASE			RECOVERY										
			Area	2A	2B	2C	3A	3B	4A	4B	4C	4D	Unkn.
No. of Fish Scanned			2,274	113,502	34,707	158,644	158,382	56,023	30,787	13,591	15,379		583,289
Area	# Tagged	%	Pct of lbs. Scanned										
			45.1	38.6	28.8	40.7	35.2	38.1	40.9	94.3	38.0		37.9
2A	301	0.7											
2B	2,426	5.5		14									14
2C	3,975	9.0		6	7	1							14
3A	16,434	37.4		1		27						1	29
3B	15,292	34.8				1	15						16
4A	3,456	7.9					1	6	2	1			10
4B	1,136	2.6							1				1
4D	979	2.2										2	<u>2</u>
Total	43,999	100.0	0	21	7	29	16	6	3	1	2	1	86

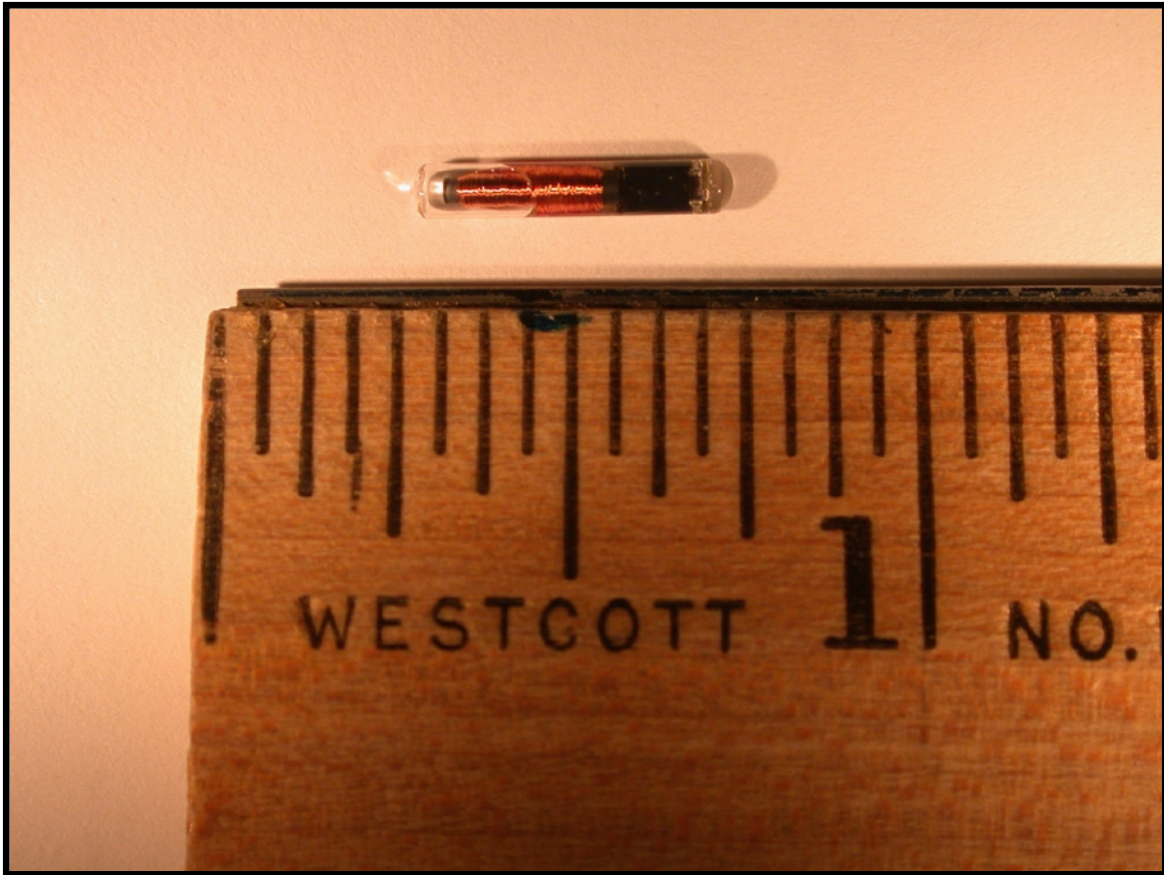


Figure 1. A PIT tag placed alongside a ruler. Actual length is 11.5 mm.

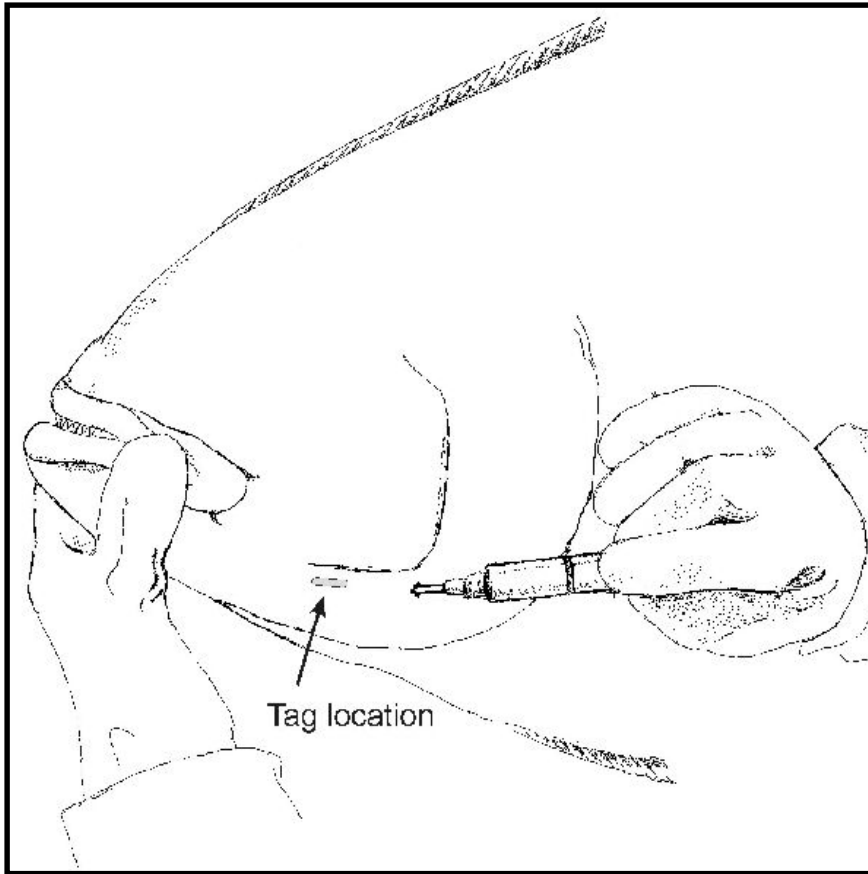


Figure 2. Location of PIT tags in Pacific halibut in the 2003 PIT tag experiment.