

# IPHC Research Program: Review of 2008 Projects and Preliminary Proposals for 2009

## IPHC Staff

### Introduction

This document reviews research conducted by the IPHC staff in the past year and proposed for the upcoming year. The report is divided into two sections, with the first section reviewing the status of research projects conducted in 2008. The second section presents the preliminary staff research proposals for 2009. Information is provided on when each project was initiated, the anticipated completion date, the annual cost, a description of the costs, and the purpose of the project. This report does not include ongoing staff tasks such as data collection and processing that are necessary for the management of the fishery.

Research projects are organized into three funding categories that reflect availability and source of research funds. Limited research requiring direct financial support from the Commission is possible under the basic \$3.64 million (as of 2008) government appropriations, although a number of programs can be conducted using only the staff resources that are supported by the appropriations. The three funding categories are:

- 1) **Funded Research:** Necessary research projects of high priority that can only be conducted with revenues generated by survey fishing in 2008, and/or carry-over from 2007;
- 2) **Contracts and Grants:** Agreements with other parties to conduct specific research. In this case, contracts and grants are shown for projects where the IPHC staff is the principle investigator; and
- 3) **Research conducted without direct funding:** Necessary research projects of high priority that can be conducted within the IPHC budget.

Nearly all of the research done by the staff is directed toward one of three continuing objectives of the Commission:

- i) Improving the annual stock assessment and quota recommendations;
- ii) Developing information on current management issues; and
- iii) Adding to knowledge of the biology and life history of halibut.

In each of these areas our routine work program applies the best information and methods available, and our research program aims to improve the information and methods by answering the most important outstanding questions.

## **SECTION I: REVIEW OF RESEARCH CONDUCTED IN 2008**

Research conducted by the IPHC staff during 2008 continued in three basic areas: life history, fish movements, and general biology. Most of the projects were conducted as part of the normal staff duties, with no additional funding required outside of staff salaries. Funding for projects outside of staff salaries came from supplemental funding, and these projects are outlined below. Detailed reports can be found in the current Report of Assessment and Research Activities (RARA).

### **Overview**

The PIT tag scan sampling program (#413) continued in 2008, with samplers in eight Alaskan and four B.C. ports. Additionally, IPHC received state and tribal assistance in scanning in nine ports in Washington and Oregon. Through 2 November, almost 23 million pounds (40% of total landings) have been scanned. The number of tags recovered in 2008 totals 255 from the 2003 primary experiment and 159 from the 2004 experiment. Once again, very few tags were recovered by the fishery in Area 4. Achieving desired scanning goals for Area 4B trips was a challenge in 2008, as many vessels shifted their landings to unstaffed ports. Overall, the number of recoveries continued to decline from the previous year, which is typical as natural mortality affects the remaining fish at large. 2009 is the last year of scheduled scanning for tags released in this experiment.

Effort on the Genetics project (#621) continued in 2008 with additional sample analysis under the supervision of Dr. Lorenz Hauser at the University of Washington's Marine Molecular Biology Laboratory. The project was initiated in 2002 to investigate the genetic population structure in the northeast Pacific using non-selected nuclear microsatellite markers, and in 2004 the study was expanded to spawning groups from British Columbia, the central Gulf of Alaska, and southeast Bering Sea. Although initial analysis suggested population differentiation, interpretation of results was complicated by very low  $F_{ST}$  values and the fact that genetic studies conducted without temporal replicates are in danger of detecting false positives. In February 2007, winter charters were conducted to resample the locations visited in 2004, and analysis of those samples continued through December, 2007. Increasing the number of microsatellites analyzed and filling gaps in the data set resulted in little change from prior work, although increasing sample sizes did result in increased levels of significance. At the end of 2007 we deemed the microsatellite work to be largely complete, with the conclusion that these markers may simply not be very powerful for detecting population structure in a species, such as halibut, with large amounts of larval mixing. At the same time, we lost our project technician. However, in May of 2008 we were fortunate to find a full-time post-doctoral researcher (Dr. Heather Galindo, formerly at Stanford University) to dedicate herself to the program. During the relatively short period of her employment, she has managed to make considerable progress investigating some other genetic markers that may be more powerful than microsatellites. She has screened 25 "expressed sequence tags", found in regions of DNA that are responsible for coding proteins and that may therefore be driven by evolution in different directions in different ocean basins. She has also sequenced four mitochondrial DNA (mtDNA) regions, which are maternally-inherited and have proven useful in other species for investigating sex-biased migration and demographics in relation to climate change. This work is expected to continue through this fall and winter.

A PAT-tagging project (#622.12) was initiated in 2008 to investigate why so few PIT tags were recovered from Area 4 and investigate the possibility that eastward migration is higher south

of Unimak Pass than north of it. Of particular importance is the fact that PAT tags do not need to be physically recaptured in order to generate accurate endpoint locations, thereby eliminating spatial recovery biases arising from regional differences in reporting, or tag detection. In addition, archived depth data broadcast along with the endpoint locations can be used to determine the timing and duration of seasonal migratory phases between shallow and deep-water habitats, and fine-scale depth data downloaded from physically-recovered tags can be used to define periods of presumed active spawning (that is, egg release). These data can be useful for assessing match-mismatch between commercial fishery season opening and closing dates and the actual timing of seasonal migration and spawning periods, on a regional basis. The latter represents a geographic extension of PAT tag studies conducted in Areas 2 & 3 and recently expanded via external archival tagging. During the 2008 setline survey, 115 halibut were tagged throughout the Bering Sea and Aleutian Islands with tags programmed to report location exactly 365 days after tagging. At the beginning of October, one tag had been recovered by the targeted fishery and another ten had released prematurely, leaving a total of 104 tags still in the water.

The pilot study (Project 650.12) on use of archival tags on halibut, which began in 2006, continued in 2008 with the release of 162 archival tags in Area 2B during August-September. The tags utilized an external mount which allows for easier detection and recovery than internally-implanted tags. Veterinary ultrasound was used to determine gender of fish prior to tagging and proved to be a rapid (approximately 6 seconds per fish) and highly accurate method (0% error in a 45-fish test) of noninvasive sex-determination. An equal number of males and females, ranging from 71-151 cm fork length, were tagged in three regions with temperature-depth logging archival tags: 42 off northwestern Vancouver Island, 60 off the southern Queen Charlotte Islands, and 60 off the northwestern Queen Charlottes. Four fish (all female; 74-108 cm FL) were internally-implanted with temperature-depth-light logging tags that were left over at the end of the 2007 holding experiment. By the end of September, a single tag had been recovered in northern BC (near the Whaleback) by a commercial trawl vessel.

Conducted in tandem with the release of archival tags was a gear experiment examining relative catch rates on swivel and non-swivel gear. This experiment (#655.11) sought to determine whether the presence of swivels on setline gear has an effect on the catch of halibut or bycatch species. With a new charter vessel, the F/V *Van Isle*, we completed 36 gear sets, with each set comprised of 4 pairs of swivel and non-swivel skates. Fishing was conducted in Area 2B, during August and September 2008. The non-swivel gear was the standard gear used on the assessment surveys. The swivel gear used 24-inch gangions made of 400-lb test monofilament with swivels attached to the hook. These in turn were tied to the mainline with a short nylon becket. Both gears used 16/0 hooks. Preliminary analysis suggests that there is no catch difference in terms of weight of legal-sized halibut caught, but there may be a difference in the catch rate of sublegals. We are still conducting the analysis of catches of rockfish and other bycatch species.

Removal sampling can be a useful technique for directly estimating catch probability, so a pilot field experiment (#656.11) was conducted in 2008 to examine the effectiveness for halibut. Sampling was done at 20 setline survey stations in the eastern part of Area 3A. At each station, a sequence of five sets was made on consecutive days following the general setline survey protocol, with the first set being the standard survey set. The expectation was that catch would decrease over the five days of fishing, and the rate of decrease would provide information on catch probability. While standard removal models assume a closed population during the sample period, we anticipated some movement into and out of the catchable population during the five

days, and developed models that allowed for some degree of local migration. A formal analysis is in progress, but the raw data show that, on average, catch did not decrease over the five days as had been expected. Possible explanations are that the local populations were so large that each set removed only a very small fraction of the population, or that local migration was such that the removed fish were replaced with new migrants on a daily basis. Whatever the cause, with no decline in catch, distinguishing catchability from other factors affecting catch size becomes extremely difficult. Although final conclusions will await the results of a formal analysis, the raw data imply that removal sampling is not a promising approach for estimating catchability of Pacific halibut.

A study to verify, by direct observation, the halibut hooking success curve for halibut on setlines took place in 2008 (#652.12) in Area 3A as a follow-up to work conducted in 2007. The goal in this latest experiment was to derive a similar curve for the smaller 14/0 hooks. We completed 65 deployments with the 14/0 hooks, and completed another 40 with the 16/0 hooks. This represents over 64 hours of viewing hooks on bottom. The 2008 data are currently being reviewed and edited, and results from the combined studies will be published next year. Combined with observations on mouth dimensions, the comparison of the two hook sizes should give us valuable insights to the physical parameters which can be used to describe the halibut selectivity curve.

The ability to use electronic (video) monitoring in the halibut fishery off Alaska was the focus of Project 654.11-84. The long term focus of this research is to improve the understanding of the ecosystem impacts of halibut fishing through improved monitoring of longline fishery bycatch and to provide data on mortality of bycatch species for input to stock assessments. In this study, we compared and evaluated the effectiveness of electronic monitoring (EM) and the current North Pacific Groundfish Observer Program (NPGOP) monitoring methods to operate effectively in a commercial longline (hook-and-line) setting in Alaskan waters. This was a cooperative study with the commercial fishing industry, IPHC, NMFS, and PSMFC, and relied on our ability to sample on various vessel configurations. The project was not as successful in getting as many vessels to participate as expected. Only four vessels, three in the Area 3A and 1 in Area 4, took an observer and accompanying video system. Over 230 sets were monitored among the four vessels. Archipelago Marine Research (Victoria BC) is currently analyzing the video data for the subsequent comparison with the observer sampling. We have gained agreement from the NPRB to extend the field activities into 2009, so that additional vessels deployments can be accomplished, which should result in a more complete data set for analysis of applicability of the technology to different vessel size classes. Analytical results should be available in early 2009.

IPHC has been involved in several cooperative studies which utilize the summer assessment survey and the catch of non-halibut species. Since 2002, the IPHC has worked cooperatively with both the Washington Department of Fish and Wildlife (WDFW) and Oregon Department of Fish and Wildlife (ODFW) to collect rockfish (*Sebastes* spp.) bycatch data. All rockfish caught on operations in 2A are retained and marked externally with a Floy T-bar anchor tag and the tag number is recorded with the set (and recently the skate number) information. All marked fish are retained so state biologists can collect additional data shore-side. Marketable fish are sold. IPHC then provides each agency with the effort information collected as part of the normal survey data collection.

In 2008, IPHC worked with WDFW and ODFW to fish supplemental stations designed to further enhance the understanding of rockfish status in these areas. In each state, the stations' locations and design were specified by the state agency involved. Eighteen stations were fished off

Washington (a continuation of similar studies from the previous 2 years) and twenty stations off Oregon. Three skates of gear were fished at each station as a precautionary approach due to the exploratory nature of these stations and concerns about overfishing yelloweye rockfish (*Sebastes ruberrimus*). Activities at each station were identical to those on standard IPHC stations except that halibut were only sampled for length and prior hooking injury and then released alive; rockfish were handled as described above. A summary of this project will be submitted to each state by the end of November 2008. Depending on those results, there may be similar cooperative work conducted in future years.

In 2008, IPHC worked with the Department of Fisheries and Oceans Canada (DFO) to provide a third biologist on IPHC survey vessels to collect hook by hook occupancy information for all species, and otoliths, maturities, and lengths for rockfish except thornyheads. This is the sixth year of this cooperative program and continued collaboration is anticipated.

In 2008, IPHC worked cooperatively with Alaska Department of Fish and Game (ADFG) to provide a third biologist on IPHC survey vessels in the Fairweather, Sitka, Ommaney and Ketchikan charter regions to collect hook by hook occupancy information for all species, and otoliths, sex, and lengths for yelloweye rockfish. This project built upon cooperative work started with ADFG in 2007 and future collaboration is anticipated.

IPHC collected length frequency data on incidentally caught Pacific cod (*Gadus macrocephalus*) in the 4A Edge and 4D Edge charter regions. This project was initiated at the request of NMFS-AFSC Pacific cod assessment team and part of a developing effort to collect bycatch information on Pacific cod in the western regions of our survey, where it makes up the largest component of our survey bycatch.

Finally, IPHC hired an intern (Project 618) in 2008. The intern program generally includes various pre-determined office tasks as well as being assigned a research project which the intern designs and executes. A final report and presentation are given at the conclusion of the employment term and results are included in that year's RARA. In 2008, we went a different direction and hired a film student from the University of Montana to make a port sampling training video. The student constructed a story board, traveled to several ports for footage, conducted interviews, and then put it all together. The project was a success. For 2009, we plan to go back to the traditional science student format, but may seek out specialties in the future if a particular project requires expertise not available on the staff.

## **2008 Grants & Contract Research**

NMFS Auke Bay Lab (ABL) has had a sablefish data collection program for several years and IPHC has assisted NMFS with the program. In 2003/2004, the program was reviewed and modified to meet the IPHC confidentiality policy and to encompass all vessels rather than just vessels greater than 60 feet. Under a Statement of Work (SOW), NMFS contracts IPHC to collect and review information on sablefish catches (Project 628.00) during the IPHC port sampler's logbook interview. Sablefish data are entered by IPHC staff, edited, and an electronic summary provided to the ABL scientists. Vessels are assigned a unique code in the summarized data to preserve confidentiality. The SOW was renewed for 2009.

IPHC also received several grants in 2008. NMFS provided a grant for the incremental increase in port sampling costs due to the IFQ program (Project 300.00-81). IPHC also received a grant from NPRB to partially cover its costs associated with the study examining the use of electronic

monitoring (video) of the halibut fishery off Alaska (#654.11-84). Additional payments from the NPRB grant are expected as the project continues. IPHC also received funds from APICDA and CBSFA to offset a portion of the cost of the large release of PAT tags in Area 4 in 2008 (#622.12).

## Budget Summary for 2008 Projects

Project No.	Project Title	FY08 Budget	FY08 Expenses
<b><i>Field Experiments</i></b>			
413.00	PIT tagging study: Fifth year of tag recovery and scanning	414,235	410,890
416.00	PIT tagging study: Double tag expt.	400	311
419.00	Eastern Bering Sea assessment survey	0 <sup>1</sup>	0 <sup>1</sup>
604.00	NMFS trawl survey: At-sea data collection	21,414	24,483
<b><i>Field Experiments Total</i></b>		<b>\$ 436,049</b>	<b>\$ 435,684</b>
<b><i>Other Research</i></b>			
610.11	Water column profiler (annual survey)	2,550	3,526
610.12	Water column profiler (Oregon grid)	2,050	736
610.13	Water Column profiler (coastwide)	376,142	0
618.00	Undergraduate internships	17,109	13,479
620.00	Otolith elemental fingerprinting	0	498
621.00	Genetic population structure – lab work by UW	101,130	55,412
622.11	PAT Tags: Summer 2006 releases (Areas 4A and 4D)	17,815	2,259
622.12	PAT Tags: Summer 2008 releases (Area 4)	369,370	425,023
630.00	Sleeper shark genetics studies	6,400	5,118
636.00	Analysis of gonad staging on IPHC setline surveys	24,500	0
642.00	Assessment of mercury and contaminants in Pacific halibut	300	423
646.11	PAT tags – summer 2006 releases (Area 2A)	0	500
646.12	PAT tags – summer 2006 releases (Area 2B)	0	2,251
650.11	Archival tags – holding studies	4,424	2,599
650.12	Archival tags – pilot releases (Area 2B)	194,775	185,772
651.00	Effect of magnets and rare metals on catch rates of Spiny dogfish	0	5,815
652.12	Hooking success	49,856	63,732
653.00	Species identification of amphipods frequenting Pacific halibut	1,000	0
654.11	Alaska fishery electronic monitoring – pilot study	94,300	79,849
655.11	Swivel gear comparison	118,439	8,,514
656.11	Removal fishing – pilot study	94,702	193,264
<b><i>Other Research Total</i></b>		<b>\$ 1,474,862</b>	<b>\$ 1,123,409</b>
<b><i>GRAND TOTAL</i></b>		<b>\$ 1,910,911</b>	<b>\$ 1,559,093</b>

*Note: Values shown do not include any revenues generated from the sale of fish or other cost offsets.*

<sup>1</sup> *Eastern Bering Sea Survey approved in concept by Commissioners, contingent on expenses being similar to staff projections (~\$350 k) and availability of vessels. The Commission received insufficient bids to complete survey.*

**Other 2008 Research – Contracts and Grants**

*Granting agency shown in parentheses*

<b>Project No.</b>	<b>Project Title</b>	<b>FY08 Income</b>
300.00-81	AK port sampling grant (NMFS)	225,980
420.00	DFO Rockfish data collection (DFO)	14,968
622.12	PAT Tags: Summer 2008 releases (Area 4) (CBSFA, APICDA)	105,000
628.00	AK catcher vessel logbook and sablefish data collection (NMFS)	35,900
654.11-84	Alaska fishery electronic monitoring – pilot study (NPRB)	11,863
<b>GRAND TOTAL</b>		<b>\$ 393,711</b>

## 2008 Research Publications

IPHC staff noted in **Bold** type.

- Kaimmer, S.M.** and Stoner, A.W. 2008. Field investigation of rare-earth metal as a deterrent to spiny dogfish in the Pacific halibut fishery. *Fish. Res.* 94(1):43-47.
- Loher, T.** 2008. Homing and summer feeding site fidelity of Pacific halibut (*Hippoglossus stenolepis*) in the Gulf of Alaska, established using satellite-transmitting archival tags. *Fish. Res.* 92:63-69.
- Loher, T.** and Seitz, A.C. 2008. Characterization of active spawning season and depth for eastern Pacific halibut (*Hippoglossus stenolepis*), and evidence of probable skipped spawning. *J. Northw. Atl. Fish. Sci.* 41:23-36.
- McElderry, H.I., Reidy, R.D. and Pahti, D.F. 2008. A pilot study to evaluate the use of electronic monitoring on a Bering Sea groundfish factory trawler. *Int. Pac. Halibut Comm. [Tech. Rep. 51](#)*:29p.
- Moukhametov, I.N., Orlov, A.M., and **Leaman, B.M.** 2008. Diet of Pacific halibut (*Hippoglossus stenolepis*) in the northwestern Pacific Ocean. *Int. Pac. Halibut Comm. Tech. Rep. 52*:24p.
- Seitz, A.C., **Loher, T.**, and Nielsen, J.L. 2008. Seasonal movements and environmental conditions experienced by Pacific halibut along the Aleutian Islands, examined by pop-up satellite tags. *Int. Pac. Halibut Comm. Sci. Rep. 85*, 24p.
- Stoner, A.W., and **Kaimmer, S.M.** 2008. Reducing elasmobranch bycatch: Laboratory investigation of rare earth metal and magnetic deterrents with spiny dogfish and Pacific halibut, *Fish. Res.* 92(2-3):162-168.
- Valero J.L.**, Lee, B., Armstrong, D., Orensanz, L., Parma, A., Hilborn, R., Sizemore, B., and Palzer, T. 2008. Population dynamics and historic trends of geoduck clams under episodic low dissolved oxygen conditions in Hood Canal. *J. Shellfish Res.* 2:462-463.
- Valero, J.L.** and Lasta, M.L. 2008. Estimating survival of discarded scallops in the Patagonian scallop fishery: Comment on “Survival of Patagonian scallop (*Zygochlamys patagonica*, King and Broderip, 1832) after the size selection process on commercial fishing vessels”, by Bremec et al. 2004. *Fish. Res.* 90: 313–315.
- Webster, R.A., Clark, W.G.** and **Forsberg, J.** (in prep) Truncated discrete distribution models for migration distance in tag-recovery studies. *Trans. Amer. Fish. Soc.*
- Webster, R.A.**, Pollock, K.H., and Simons, T.R. 2008. Bayesian spatial modeling of data from bird surveys. *Journal of Agricultural, Biological and Environmental Statistics* 13, 121--139.
- Webster, R.A.**, Pollock, K.H., Ghosh, S.K. and Hankin, D.G. 2008. Bayesian spatial modeling of data from unit-count surveys of fish in streams. *Trans. Amer. Fish. Soc.* 137:438-453.
- Yoshizaki, J., Pollock, K.H., Brownie, C., and **Webster, R.A.** (in press), Modeling misidentification errors in capture-recapture studies using photographic tags of evolving marks. *Ecology*.

## **SECTION II: RESEARCH PROPOSED FOR 2009**

**Projects to be carried out in 2009 consist of a continuation of several projects currently underway. Selected continuing projects include:**

- 1. PIT tag scan sampling program (Project 413.00)** - PIT tag recovery efforts will continue in 2009 with the scan sampling program. Scanning will also continue on the assessment survey vessels. Additionally, the staff is looking at adding a sampler to Sand Point for several months in mid-summer to enhance recoveries of 3B tags. No other changes are planned for port coverage or duration of sampling. Planning for this activity is based on a March 1 – November 15 season. At this time, 2009 is expected to be the final year of scanning.
- 2. Water column profilers (Project 610.11 and 610.12)** – The first profiler was deployed on an IPHC survey vessel in 2003, and a second started in 2007. The profilers measure temperature, salinity, dissolved oxygen, pH, and florescence and will be deployed at each station during the summer assessment survey.
- 3. Genetics (Project 621.00)** - The study of the population genetic structure will continue in 2009 with the sample testing and analysis supervised by Dr. Lorenz Hauser (UW Marine Molecular Biology Laboratory). The FY2009 budget will allow for continued sample analysis by a technician in Dr. Hauser's lab. We also are broadening the geographic scope by seeking samples from Atlantic halibut and also samples which have been offered by TINRO scientists in Vladivostok. Additionally, several publications covering the results to date will be authored.
- 4. Bycatch characterization in the Pacific halibut fishery off Alaska: A field test of electronic monitoring technology (Project 654.11-84)** – This study, which began in 2008, is focused on examining the use of electronic monitoring technology in commercial fishing conditions, where a broad range of environmental and physical factors affect the vessel operations. The amount of coverage achieved in 2008 was disappointingly low, and we will continue with additional effort in early 2009. Partial funding for this project has already been secured through the North Pacific Research Board, and is being carried out in cooperation with the NMFS Groundfish Observer Program, the Pacific States Marine Fisheries Commission (PSMFC), and the Fishing Vessel Owner's Association of Seattle.

Staff will also continue with other long-standing projects in 2009. These include the collaborative work on contaminants with ADEC (#642.00), placement of IPHC staff on the NMFS summer trawl surveys (#604.00), and the undergraduate internship program (#618.00). Projects for estimating bycatch on the setline surveys in Area 2A with WDFW and ODFW, Area 2B with DFO, and in Area with ADF&G will continue in 2009. Additionally, IPHC will collect Pacific cod information for NMFS in predetermined areas within the Bering Sea.

In addition, projects conducted under contract to other agencies or through research grants will be continued in 2009. IPHC port sampling activities in Alaska will continue being augmented by a grant from NMFS (Project 300.00-81), and IPHC port samplers in Alaska will collect sablefish

logbook data for the NMFS Auke Bay lab (Project 628.00). NPRB has provided a grant to offset some of the costs associated with the electronic monitoring pilot study (Project 654.11-84).

**Six new funded projects are proposed for 2009:**

- 1. Coastwide use of water column profilers** – IPHC was awarded a NOAA grant to acquire a sufficient number of water column profilers such that they can be deployed on every IPHC survey vessel, and we will begin this coastwide collection of oceanographic data in 2009. The profilers will measure temperature, salinity, dissolved oxygen, pH, and florescence and will be deployed at each station during the summer assessment survey, accompanying the existing profilers owned by IPHC. The grant provides funding through FY2010 and covers the costs for acquiring and maintaining the devices as well as editing and publishing the data. The total value of the grant is \$537,035 through September 2011. This project replaces the deferred FY2008 610.13 project with the award of the grant.
- 2. Bering Sea age validation study utilizing <sup>14</sup>C radiocarbon** - Radiocarbon, or <sup>14</sup>C bomb carbon, has been used successfully in the past on several fish species as a validation of absolute age assignment. This project would be a collaborative study between IPHC and the NMFS Alaska Fishery Science center as a follow-up to the 2003 aging study conducted on Gulf of Alaska halibut otoliths. Costs to complete the study are based on otolith preparation and accelerated mass spectroscopy (AMS) time, with expenses shared by both agencies.
- 3. Holding tank experiments examining mounting protocols for external archival tags** – This study will investigate alternate mounting protocols for the externally-mounted archival tags. The staff is anticipating utilizing facilities and staff at the Oregon Coast Aquarium, as was done in 2006. The results would support the anticipated future use of this type of technology.
- 4. Pacific Ocean Shelf Tracking (POST) study collaboration** – IPHC staff have jointly proposed funding with POST, ADF&G, and NMFS to collaborate on the set-up of a line of remote receivers placed on the shelf in southern Area 2C. The receivers would track movements of halibut and other species carrying transponding tags. The 2009 work would include a pilot project to test the technical capability of the tag-receiver configuration for deepwater species such as halibut and sablefish.

## 2009 Proposed Projects - Budget Summary

Project No.	Project Title	FY09 Budget
<b>Field Experiments</b>		
413.00	PIT tagging study: Year 6 of tag recovery and scanning	447,433
416.00	PIT tagging study: Double tag expt.	400
419.00	Eastern Bering Sea assessment survey	466,067
604.00	NMFS trawl survey: At-sea data collection	43,413
<b>Field Experiments Total</b>		<b>\$ 957,313</b>
<b>Other Research – Continuing</b>		
610.11	Water column profiler (General survey)	1,500
610.12	Water column profiler (Oregon)	3,700
618.00	Undergraduate internships	9,375
621.00	Genetic population structure – lab work by UW	137,770
622.12	PAT tagging: Summer 2008 releases (Area 4)	29,835
636.00	Histology: Analysis of gonad staging	24,500
642.00	Assessment of mercury and contaminants in Pacific halibut	1,000
650.12	Archival tags: Pilot studies (2008 releases in Area 2B)	18,000
653.00	Species identification of amphipods frequenting Pacific halibut	1,000
654.11-84	Alaska fishery electronic monitoring: Pilot study	14,000
<b>Subtotal</b>		<b>\$ 240,680</b>
<b>Other Research – New</b>		
1	Water column profiler (Coastwide)	395,301
2	Bering Sea age validation study utilizing <sup>14</sup> C radiocarbon	14,900
3	Archival tags: Mounting protocols	37,283
4	POST study: IPHC participation	40,000
<b>Subtotal</b>		<b>\$ 487,484</b>
<b>Other Research Total</b>		<b>\$ 728,164</b>
<b>GRAND TOTAL</b>		<b>\$ 1,685,447</b>

Note: Values shown do not include any revenues generated from the sale of fish or other cost offsets.

## 2009 Proposed Projects - Budget Summary (cont'd)

### Other 2009 Research – Contracts and Grants

*Granting agency shown in parentheses*

Project No.	Project Title	FY09 Income
300.00-81	AK port sampling grant (NMFS)	\$ 200,757
610.13-81	Water column profiler grant (NMFS)	395,301
628.00	AK catcher vessel logbook and sablefish data collection (NMFS)	40,000
654.11-84	Alaska fishery electronic monitoring – pilot study (NPRB)	32,638
	<b>GRAND TOTAL</b>	<b>\$ 668,696</b>

## Continuing Research

**Project 413.00: PIT tagging study: Year 6 of tag recovery and scanning**

Cost: \$ 447,433

Start Date: 2003

Anticipated ending: 2009

Personnel: J. Forsberg, C. Blood, G. Williams, S. Hare, A. Ranta, scan samplers

Scanning for PIT tags will continue in 2009. IPHC will hire samplers for Alaskan ports, while contracting with AMR for the Canadian ports and continuing to seek state and tribal assistance in Area 2A. Sampler duties include scanning commercial deliveries for PIT tags, and conducting regular tests of detection and piece (fish) counts to measure accuracy of sample data. Project costs are expected to be about the same as last year. Modest increases are expected in salaries (cola), our contract with AMR for sampling in Area 2B, and the possible addition of scanning in Sand Point.

**Project 419.00: Eastern Bering Sea assessment survey**

Cost: \$ 466,067

Start Date: 2006

Anticipated ending: continuing

Personnel: C. Dykstra, T. Geernaert, E. Soderlund, sea samplers

IPHC proposes to conduct a standardized grid survey of the eastern Bering Sea to better characterize the biology, relative abundance, and range of halibut in that area. The survey also serves to calibrate results from the long-term NMFS trawl survey, to provide an index of halibut abundance in the area. The area, which was first surveyed in 2006, stretches from the shelf edge eastward to inner Bristol Bay and from the Alaskan Peninsula northward to 60 nmi north of St. Matthew Island (55° 20' N to 61° 30' N and from 159° 33' W to 177° 23' W). To survey such a vast area efficiently, the systematic station layout has been altered to enable completion of these charter regions in a time frame comparable to that of the standard survey. Additionally, in the interests of efficiency, trip length restrictions as well as requirements for fish retention have been altered. For the majority of the area covered, paired stations, 10 nmi apart, are placed at 60 nmi by 60 nmi intervals. One station of each pair corresponds to a trawl station on the annual National Marine Fisheries Service (NMFS) Eastern Bering Sea trawl survey, thereby enabling comparison between the two surveys. An additional 29 stations were placed on the standard 10 nmi by 10 nmi configuration of our traditional surveys around St. Matthew (nine stations), St. Paul (10 stations), and St. George (10 stations) Islands. These island stations were incorporated into the annual surveys in 2007 and 2008. The entire area was split into three regions for bidding purposes, each containing stations from both design layouts. Bids for this survey were requested in 2008 but sufficient bids were not received.

**Project 604.00: NMFS trawl survey: At-sea data collection**

Cost: \$ 43,413

Start Date: 1996

Anticipated ending: Continuing

Personnel: L. Sadorus, A. Ranta, S. Hare

A series of NMFS trawl survey data on halibut, parallel to our setline data, is extremely valuable to IPHC as a second fishery-independent data source for stock assessment. Trawl data are particularly useful because they include large numbers of juveniles (ages 3-7 yr) that do not appear in large numbers in the setline survey. Otoliths have been collected on the NMFS surveys since 1996 and provide relevant age information. These data are incorporated into a copy of the NMFS haul data, expanded to estimates of relative abundance and age/size composition by IPHC area (NMFS calculates estimates by INPFC area), and stored in a database at IPHC. Project cost is comprised of personnel and travel. In 2009, NMFS will be conducting both the Bering Sea and Gulf of Alaska shelf surveys and the IPHC plans to have one biologist aboard each survey.

**Project 610.11: Water column profiler project (General survey)**

Cost: \$ 1,500

**Project 610.12: Water column profiler project (Oregon)**

Cost: \$ 3,700

Start date: 2000, 2007 (respectively)

Anticipated ending: Continuing

Personnel: L. Sadorus, S. Hare, P. Stabeno (NMFS PMEL)

The IPHC maintains one of the most extensive sampling platforms in the north Pacific. This platform provides enormous potential for collection of valuable oceanographic data. In particular, understanding the dynamics of the structure of the mixed layer depth – a major GLOBEC goal - requires *in situ* vertical profiling. Since 2001, IPHC has successfully deployed a SeaBird SBE-19 water column profiler during the annual stock assessment survey (#610.11). A second profiler was added to the program in 2007 (#610.12). Annual costs are directed towards maintenance and calibration of the profilers.

**Project 618.00: Undergraduate Internship**

Cost: \$ 9,375 (One intern)

Start Date: 2002

Anticipated duration: Continuing

Personnel: L. Sadorus, T. Loher, other staff support as needed

One undergraduate will be selected through the intern/co-op programs at regional universities and colleges to do a combination of office and at-sea work based out of the Commission offices during the summer months. The program includes various pre-determined office tasks as well as being assigned a research project then designing and executing said project. A final report and presentation are given at the conclusion of the employment term.

**Project 621.00: Genetic population structure of Pacific halibut assessed via nuclear microsatellite diversity – lab work by UW**

Cost: \$ 137,770

Start: 2002

Anticipated Ending: Continuing

Personnel: T. Loher, L. Hauser (UW-MMBL), other staff as needed

The eastern north Pacific halibut resource is presently managed under the assumption that a single fully mixed population exists from California through the eastern Bering Sea. This belief rests largely upon studies that indicate that drift of larvae to the northwest is balanced by migration of juveniles and adults to the southeast, over broad geographic expanses. In 2002, a project was initiated to investigate genetic population structure in the northeast Pacific using non-selected nuclear microsatellite markers, and in 2004 the study was expanded to spawning groups from British Columbia, the central Gulf of Alaska, and southeast Bering Sea. Although initial analysis suggested population differentiation, interpretation of results was complicated by very low  $F_{ST}$  values and the fact that genetic studies conducted without temporal replicates are in danger of detecting false positives. In February of 2007, winter charters were conducted to resample the locations visited in 2004, and analysis of those samples continued through December, 2007. Increasing the number of microsatellites analyzed and filling gaps in the data set resulted in little change from prior work, although increasing sample sizes did result in increased levels of significance. At the end of 2007 we deemed the microsatellite work to be largely complete, with the conclusion that these markers may simply not be very powerful for detecting population structure in a species, such as halibut, with large amounts of larval mixing. At the same time, we lost our project technician. However, in May of 2008 we were fortunate to find a full-time post-doctoral researcher (Dr. Heather Galindo, formerly at Stanford University) to dedicate herself to the program. During the relatively short period of her employment, she has managed to make considerable progress investigating some other genetic markers that may be more powerful than microsatellites. She has screened 25 “expressed sequence tags”, found in regions of DNA that are responsible for coding proteins and that may therefore be driven by evolution in different directions in different ocean basins. She has also sequenced four mitochondrial DNA (mtDNA) regions, which are maternally-inherited and have proven useful in other species for investigating sex-biased migration and demographics in relation to climate change. This work is expected to continue through this fall and winter.

**Project 622.12: PAT tagging: summer 2008 releases (Area 4)**

Cost: \$ 29,835

Start: 2008

Anticipated Ending: 2010

Personnel: T. Loher, A. Seitz (UAF), sea samplers

A PAT-tagging project was initiated in 2008 to investigate why so few PIT tags were recovered from Area 4 and investigate the possibility that eastward migration is higher south of Unimak Pass than north of it. During the 2008 setline survey, 115 halibut were tagged throughout the Bering Sea and Aleutian Islands with tags programmed to report location exactly 365 days after tagging. At the beginning of October, one tag had been recovered by the targeted fishery and another ten

had released prematurely, leaving a total of 104 tags still in the water. Project costs in 2009 are for anticipated satellite transmission time when the tags pop to the surface 365 days following release.

**Project 636.00: Histology: Analysis of gonad staging**

Cost: \$ 24,500

Start: 2004

Anticipated Ending: Continuing

Personnel: T. Geernaert, C. Dykstra, other staff as needed

The IPHC Stock Assessment surveys assess maturity of halibut based on visual criteria established in the early 1990's and modified in 1995. These survey data combined with the age data are important components in the stock assessment model. Four maturity stages are presently assigned to female halibut; immature (F1), maturing (F2), spawning (F3) and resting (F4). Once a female halibut has spawned, the gonad transitions to a resting phase, back to maturing, and then to spawning again. Our criteria for classification also assume that the immature (F1) stage is only seen with immature fish but we are seeing anomalies during the survey that could question this assumption. Mature females are seen as small as legal size (82 cm) but, area-wide, there have been several large 100+ cm females whose gonadal characteristics classify them as immature (never spawned). The SSA survey data also suggest that fish in the southern latitudes (Area 2B) mature earlier and possibly spawn earlier than fish in the northern latitudes (Area 3A and west). The timing and duration of these events are not clearly understood. We would like to re-evaluate our classification criteria and examine the stages and gonadal tissue development more closely.

In 2003 preliminary histological work on the female gonads was initiated. We developed a sampling design and collection protocols for the 2004 surveys. In 2004, during winter and summer surveys, female gonads from three different regions, in each stage of development, were collected. Three different histological subsamples have been prepared and we are presently standardizing the sample sites on the gonad for the final slide preparation. We have collected nearly 240 gonad pairs and will be analyzing multiple sites from each sample.

**Project 642.00: Assessment of mercury and contaminants in Pacific halibut**

Cost: \$ 1,000

Start Date: 2002

Anticipated ending: Continuing

Personnel: C. Dykstra, Alaska Department of Environmental Conservation (ADEC)

For the last few years, health officials and media have raised the profile of pollutant contamination in fish (methyl mercury, PCB's, pesticides). Since 2002, the IPHC has been working collaboratively with the Alaska Department of Environmental Conservation (ADEC) to collect halibut tissue samples to be analyzed for heavy metal and organic pollutant loading. The principal results from the 2002 collection led the Alaska Division of Public Health in 2003 to conclude that the concentrations of heavy metals in Alaskan Pacific halibut are not a public health concern. In 2004 the first results regarding organic pollutants (PCB's, pesticides) were released demonstrating

that halibut had the lowest concentrations of the five species (including salmon and sablefish) examined. The Alaska Division of Public Health updated their advice on fish consumption in 2007 with some restrictions on the number of meals of halibut for women of child bearing age and young children.

Since 2002 the IPHC has submitted 981 samples for testing by ADEC. The mean level of total mercury for these samples has been 0.340 ppm (for comparison the FDA limit of concern for methyl mercury is 1.000 ppm, the EPA and the CFIA level of concern is 0.500 ppm) ranging from non-detectable to 1.947 ppm. The IPHC and ADEC are continuing to qualify the data with physical parameters (age, size, and weight) and additional analyses will be done on the samples. ADEC and EPA planned on going ahead with this study regardless of IPHC input. Our involvement in the project has allowed us to provide input on study design, sampling protocols in the field, etc., which will make the resultant information much more robust.

Sampling continued in 2008 with a targeted collection of 60 samples (15 fish between 10-20 lbs, 15 fish between 20-40 lbs, 15 fish between 40-100 lbs, and 15 fish greater than 100 lbs.) from each of three regions (Sitka, Prince William Sound, and upper Cook Inlet) during the setline survey. ADEC has expressed interest in further assessments of contaminant occurrence in halibut in 2009.

**Project 650.12: Archival tagging: Pilot studies (Area 2B releases)**

Cost: \$ 18,000

Start Date: 2006

Anticipated ending: Continuing

Personnel: T. Loher

This study is investigating migratory behavior and environmental conditions experienced by two components of stock: small adult (primarily male) and late pre-recruit halibut, as well as larger adults including reproductive females. The work is a complement to PAT (satellite) tagging studies and seeks to expand our knowledge to components of the population that have not been studied with PAT tags due to apparent size constraints (i.e., males and pre-recruits) and to obtain multi-year data for larger fish. The objectives for each stock component are slightly different, but do not require separate studies. Externally attached, rather than surgically implanted, archival tags are being used. The tags were applied to all females above 90 cm and all fish above 100 cm during August-September, 2008 in Area 2B. Project costs in 2009 are for the anticipated recoveries. Premium rewards are being offered to encourage recoveries.

**Project 653.00: Species identification of amphipods frequenting Pacific halibut**

Cost: \$ 1,000

Start Date: 2006

Anticipated ending: Continuing

Personnel: B. Leaman, E. Soderlund

The project intends to document the occurrence and virulence of attacks by predatory amphipods on halibut caught on IPHC surveys and, by inference, the commercial fishery. The

commercial industry suffers annual losses of product due to amphipod predation and must adjust its fishing locations and practices in response to predation. Harvester discussions indicate that predation sites are both known and ephemeral, and the virulence may vary interannually at a given site. The specific identity of the amphipods has not been established and it is probable that more than one species is involved. Harvesters are interested in both documentation of predation areas for avoidance, as well as gaining an understanding of the dynamics of the species at given sites, i.e., are there cycles of abundance that respond to other factors. Data were collected on all stations during the 2004, 2005, and 2006 stock assessment surveys as part of standard protocol, recording incidence of sand flea predation, and the extent and virulence of the predation. The 2006 was the last year of data collection for this stage of the project. The 2007 summer intern performed initial analysis of interannual occurrence and virulence. Additional work will be directed at correlated variables.

**Project 654.11-84: Alaska fishery electronic monitoring – pilot study**

Cost: \$ 14,000 in 2009 (\$94,300 for total project)

Revenue: \$43,220 (grant from NPRB)

Start Date: 2008

Anticipated ending: 2009

Personnel: G. Williams, B. Leaman, B. Karp and J. Cahalan (NMFS Observer Program)

Bycatch rates of other species in the Pacific halibut fishery are not well estimated, so electronic monitoring has been suggested as one option to collect such information. The majority of vessels operating in this fishery are not required to have observer monitoring due to their size. The long term focus of this research is to improve the understanding of the ecosystem impacts of halibut fishing through improved monitoring of longline fishery bycatch and to provide data on mortality of bycatch species for input to stock assessments. In this study, we will be comparing and evaluating the effectiveness of electronic monitoring (EM) and the current North Pacific Groundfish Observer Program (NPGOP) monitoring methods to operate effectively in a commercial longline (hook-and-line) setting in Alaskan waters. This was a cooperative study with the commercial fishing industry and relied on our ability to sample on various vessel configurations.

The project was not as successful in 2008 in getting many vessels to participate as expected. Only four vessels, three in the Area 3A and 1 in Area 4, took an observer and accompanying video system. Over 230 sets were monitored among the four vessels. Archipelago Marine Research (Victoria BC) is currently analyzing the video data for the subsequent comparison with the observer sampling. Additional vessel monitoring has been approved for spring 2009, which should provide a more complete data set for analysis during 2009.

## Proposed New Research

### 1. Coastwide deployment of water column profilers

Cost: \$ 395,301

Revenue: \$395,301 (NOAA Grant)

Start date: 2009

Anticipated ending: Continuing, although the grant ends in Sept., 2011

Personnel: L. Sadorus, S. Hare, P. Stabeno (NMFS PMEL)

In 2008, IPHC was awarded a grant from NOAA which for the purchase of water column profilers for each survey vessel and therefore coastwide collection of oceanographic data. The profilers will measure temperature, salinity, dissolved oxygen, pH, and florescence at each station. These data will provide an annual snapshot of near shore oceanic conditions as well as valuable observational data for modeling and biological studies on recruitment and growth variability. IPHC staff will be working with the Pacific Marine Environmental Lab (PMEL) on data processing and storage. The grant provides funding through FY2011 and covers the costs for acquiring and maintaining the devices as well as editing and publishing the data. The total value of the grant is \$537,035 through September 2011. This project replaces the deferred FY2008 610.13 project with the award of the grant.

### 2. Bering Sea age validation study utilizing $^{14}\text{C}$ radiocarbon

Cost: \$ 14,900

Start Date: 2009

Anticipated ending: 2010

Personnel: S. Wischniowski, T. Loher, NMFS personnel

Radiocarbon, or  $^{14}\text{C}$  bomb carbon, has been used successfully in the past on several fish species as a validation of absolute age assignment. This project would be a collaborative study between IPHC and the NMFS Alaska Fishery Science center as a follow-up to the 2003 aging study conducted on Gulf of Alaska halibut otoliths. Costs to complete the study are based on otolith preparation and accelerated mass spectroscopy (AMS) time, with expenses shared by both agencies.

### 3. Archival tags: Holding tank experiments examining mounting protocols

Cost: \$ 37,283

Start Date: 2009

Anticipated ending: 2010

Personnel: T. Loher

This study will investigate alternate mounting protocols for the externally-mounted archival tags. The 2008 releases in Area 2B were our first experience with using an external mount, and that process suggested some revisions and improvements could be possible which would reduce any

effect the tags may have on the fish's behavior. Additional improvements to tag design may also be helpful in creating a different mounting device. A total of 30 halibut ranging from 75-90 cm FL will be captured via hook-and-line and transported live to an appropriate holding facility. The IPHC staff is anticipating utilizing facilities and staff at the Oregon Coast Aquarium, as was done in 2006. Following tagging, fish will be reared for 12-18 months, treated regularly for parasites, examined regularly to assess healing and/or relative infection rates among mounting types, and behavior monitored. At the end of the holding period, fish will be measured to assess relative growth among treatment groups, and tags will be removed to examine the effects of the tag mounts on the tissue and musculature at the attachment site, or internal interactions in the case of an internal-external-streamer modification. The results would support the anticipated use of this type of technology in subsequent years.

#### **4. POST Study: IPHC participation**

Cost: \$ 40,000

Start Date: 2009

Anticipated ending: Continuing

Personnel: B. Leaman, other staff as needed, ADF&G, NMFS

The Pacific Ocean Shelf Tracking (POST) Project, part of the Census of Marine Life and flagship for the international Ocean Tracking Network, provides a tool for scientists to track the movement of marine animals along the West Coast of North America. POST uses acoustic transmitters implanted in various species and a series of receivers running in lines across the continental shelf to provide movement data.

A recent call for proposals by the North Pacific Research Board for an Integrated Ecosystem Research Program (IERP) creates a funding opportunity for a collaborative effort by IPHC with NMFS and ADF&G to become participants in the Pacific Ocean Shelf Tracking (POST) initiative. The POST program seeks agencies to purchase the receivers to equip a sensor track, or lines, with matching funds available. For IPHC, the idea is to conduct a proof-of-concept study, to see if the receivers can indeed pick up a demersal fish like a halibut. ADF&G and NMFS are interested in the applications to sablefish. The agency group agreed the benefits were sufficient to move forward with a range test - as a first step - focused primarily in the area around Cape Ommaney. Funding would be used for purchase of acoustic tags and/or deployment of receivers. If this concept proves sound, a joint proposal by the three agencies to the NPRB and POST would occur for 2010.

## Other 2009 Research – Contracts and Grants

### **Project 300.00-81: Alaska port sampling**

Cost: Staff salaries

Revenue: \$ 200,757

Granting agency: NMFS

Start Date: 2002

Anticipated ending: Continuing

Personnel: H. Gilroy, M. Larsen, L. Hutton

The commercial fishery port sampling program hires samplers to collect otoliths, halibut lengths, fishing logbook information and landed weight data. The U.S. program includes staffing eight Alaskan ports and Bellingham, Washington. The samplers act as the liaison between the fishing industry and the Commission staff in Seattle. The Commission is responsible for the overall assessment and management of the halibut fishery and the data collected are necessary for stock assessment. The U.S. Government adopted the Individual Fishing Quota (IFQ) allocation program in 1995. This grant provides funds to the IPHC for the incremental cost to the Commission sampling program due to the IFQ program. The grant is generated from the NMFS IFQ Fee Collection Program.

### **Project 610.13-81: Coastwide deployment of water column profilers**

Cost: \$ 395,301

Revenue: \$395,301 (NOAA Grant)

Start date: 2009

Anticipated ending: Continuing, although the grant ends in Sept., 2010

Personnel: L. Sadorus, S. Hare, P. Stabeno (NMFS PMEL)

In 2008, IPHC was awarded a grant from NOAA which for the purchase of water column profilers for each survey vessel and therefore coastwide collection of oceanographic data. The profilers will measure temperature, salinity, dissolved oxygen, pH, and florescence at each station. These data will provide an annual snapshot of near shore oceanic conditions as well as valuable observational data for modeling and biological studies on recruitment and growth variability. IPHC staff will be working with the Pacific Marine Environmental Lab (PMEL) on data processing and storage. The grant provides funding through FY2011 and covers the costs for acquiring and maintaining the devices as well as editing and publishing the data. The total value of the grant is \$537,035 through September 2011. This project replaces the deferred FY2008 610.13 project with the award of the grant.

**Project 628.00: Alaska catcher vessel logbook and sablefish data collection**

Cost: Staff salaries

Revenue: \$ 40,000

Granting agency: NMFS

Start Date: 1999

Anticipated ending: Continuing

Personnel: L. Hutton, H. Gilroy, A. Taheri, port samplers

IPHC and NMFS Auke Bay Lab (ABL) have a sablefish data collection program. The program was reviewed and modified in 2003/2004 to meet the IPHC confidentiality policy and to encompass all vessels rather than just vessels greater than 60 feet. Under a Statement of Work, NMFS contracted IPHC staff to interview the IFQ fishers to review and collect the sablefish information in addition to the halibut information. Logbook data are entered by IPHC staff, matched with landings records, and provided electronically with a summary to the ABL scientists. In the summarized data, the vessels are assigned a unique code to preserve confidentiality.

**Project 654.11-84: Alaska fishery electronic monitoring – pilot study**

Cost: \$ 14,000 in 2009 (\$94,300 for total project)

Revenue: \$ 32,638 in 2009 (Grant from NPRB for \$43,220)

Start Date: 2008

Anticipated ending: 2009

Personnel: G. Williams, B. Leaman, B. Karp and J. Cahalan (NMFS Observer Program)

This study compares and evaluates the effectiveness of electronic monitoring (EM) and the current North Pacific Groundfish Observer Program (NPGOP) monitoring methods to operate effectively in a commercial longline (hook-and-line) setting in Alaskan waters. This was a cooperative study with the commercial fishing industry. IPHC is partnering with the NMFS North Pacific Groundfish Observer Program and Pacific States Marine Fish Commission in this study.

## **Research Conducted Without Direct Funding**

### **1. The 2008 stock assessment**

Cost: Staff salaries

Personnel: S. Hare, B. Clark

The annual stock assessment process comprises a large amount of work including preparation of IPHC data, estimation of bycatch by length in other fisheries, model development and validation, model fitting, examination of residuals, comparison of alternative model specifications, sensitivity tests, evaluation of harvest strategy, incidental analyses, and reporting.

## **2. Development of IPHC harvest policy**

Cost: Staff salaries

Personnel: S. Hare, J. Valero

Staff quota recommendations are calculated by applying a judiciously chosen harvest rate to an estimate of present exploitable biomass. The constant harvest rate policy was developed on the basis of its performance over a long time horizon and with the explicit goal of avoiding reaching the minimum stock sizes seen in the 1930s and 1970s. In 2003 the staff proposed a conditional constant catch policy under which total removals would be capped at a chosen ceiling level at high biomass levels, while a constant harvest rate policy would continue to be employed at low and intermediate stock levels. The Commission did not adopt the proposed policy at the 2004 annual meeting, and a staff/industry workshop on harvest policy alternatives in September 2004 showed general satisfaction with the present policy, as mediated in practice by the judgment exercised by the Director in developing staff recommendations and by the Commission in finally setting catch limits. In 2004, an explicit lower limit on spawning biomass and a threshold below which the harvest rate will be reduced—were added to the constant harvest rate policy. As a result the target constant harvest rate for the core IPHC areas (2B, 2C, and 3A) was lowered to 22.5% from 25%. The staff will continue to evaluate the constant harvest rate policy. In particular, we will recalculate the optimum harvest rate itself in light of our present understanding of stock dynamics and new information on commercial length-specific selectivity coming from the PIT tag experiment.

## **3. Development of a robust management procedure**

Cost: Staff salaries

Personnel: S. Hare, B. Leaman, J. Valero

Staff catch limit recommendations are derived from the annual stock assessment by applying a constant harvest rate to the estimates of exploitable biomass, in the belief that the assessment model is correctly specified and the estimates are accurate. In fact there are a number of structural uncertainties about the model, and the assessment itself has become highly complicated, so it is vulnerable to any small error in data compilation or programming. The aim of this project is to develop a procedure for deriving catch limit recommendations that would achieve the desired harvest policy, potentially relying on much simpler calculations and at the same time be effective across a range of uncertainties about stock, fishery and management behavior. Such procedures have been developed for other fisheries and it is appropriate to investigate their application to halibut management.

## **4. Estimation of halibut abundance from mark-recapture data**

Cost: Staff salaries

Personnel: R. Webster, B. Leaman, S. Hare

The IPHC has conducted many tagging programs since the 1920s. IPHC has also conducted at least five reviews of these programs, again with differing objectives. However, many of these reviews did not account for the issues of non-reporting or differential reporting of tags by areas,

fishing effort effects on recovery probabilities, the relationship of initial tag releases and the density of fish in given areas, and the effect of seasonal migratory patterns on the analysis of recoveries were not always considered. A changed paradigm for the area-specific impacts of juvenile bycatch, questions concerning the effects of changing seasonal distribution of fishing effort, potential halibut distribution changes with climatic shifts, and the utility of juvenile surveys in specific areas have all prompted concerns about halibut movements.

The staff marked the catch of three skates at each survey station coastwide in 2003 and in Areas 2B and 3A in 2004. Preliminary analysis of the 2004 recoveries showed good agreement with the stock assessment in Areas 2B and 2C, but farther west the mark-recapture estimates were much higher than the assessment estimates. Recoveries in 2005-2007 followed a similar pattern. The 2008 recoveries will be added to the analysis this year.

## **5. Whales sightings by the commercial fishery off Alaska while hauling gear**

Personnel: L. Hutton, port samplers

Cost: Staff Salaries

Start: 2007

End Date: Under review

Beginning in 2007, IPHC U.S. commercial fishery logbooks were modified to facilitate the collection of whale sightings while hauling gear. This is a pilot project to determine if sighting information can be collected and if accurate information can be obtained. This information could help to set a baseline for sightings. A review of other programs will be conducted to see where information is collected, available, and stored. Additionally whale sighting data collected during the grid survey can be reviewed along with known depredation activity on the grid survey sets. Data will be reviewed and results provided in the 2009 RARA.

## **6. Seabird occurrence project**

Cost: Staff salaries

Start Date: 2002

Anticipated ending: Continuing

Personnel: T. Geernaert, Washington State Sea Grant

During the stock assessment surveys, sea samplers count the number of seabirds in the vicinity of the vessels following gear retrieval. Sampling after the haul addresses the question of where and when certain seabird species occur. These data have been used to identify appropriate seabird deterrent requirements in certain geographic locations. Data have also been collected, using the same protocol, on the NMFS and ADF&G sablefish surveys. IPHC has developed a database to store seabird occurrence data and the collection project is ongoing.

## **7. Seabird data repository (Project 643.00)**

Cost: Staff salaries

Start Date: 2005

Anticipated ending: Continuing

Personnel: T. Geernaert

This project encompasses the storage by IPHC of various types of seabird data collected on agency surveys, including the seabird occurrence project conducted on the assessment surveys. Although IPHC has been collecting these data on its assessment survey since 2002, other agencies are just beginning the same procedure. IPHC's head-start with these types of data led other programs to seek the efficiencies provided by IPHC in data management for optimal use by analysts and managers. A grant from Washington Sea Grant funded this activity in previous years.

## **8. Estimates of bycatch on the assessment surveys**

Cost: Staff Salaries

Revenue: To be determined

Start Date: 2003

Anticipated ending: Continuing

Personnel: C. Dykstra, Survey Team, DFO, ADF&G, WDFW and ODFW personnel

### ***Area 2A***

Since 2002, the IPHC has worked cooperatively with both the Washington Department of Fish and Wildlife (WDFW) and Oregon Department of Fish and Wildlife (ODFW) to collect rockfish (*Sebastes* spp.) bycatch data. All rockfish caught on operations in 2A are retained and marked externally with a Floy T-bar anchor tag and the tag number is recorded with the set (and recently the skate number) information. All marked fish are retained so state biologists can collect additional data shore-side. Marketable fish are sold. IPHC then provides each agency with the effort information collected as part of the normal survey data collection.

In 2008, IPHC worked with WDFW and ODFW to fish supplemental stations designed to further enhance the understanding of rockfish status in these areas. In each state, the stations' locations and design were specified by the state agency involved. Eighteen stations were fished off Washington (a continuation of similar studies from the previous 2 years) and twenty stations off Oregon. Three skates of gear were fished at each station as a precautionary approach due to the exploratory nature of these stations and concerns about overfishing yelloweye rockfish (*Sebastes ruberrimus*). Activities at each station were identical to those on standard IPHC stations except that halibut were only sampled for length and prior hooking injury and then released alive; rockfish were handled as described above. A summary of this project will be submitted to each state by the end of November 2008. Depending on those results, there may be similar cooperative work conducted in future years.

### ***Area 2B***

In 2008, IPHC worked with the Department of Fisheries and Oceans Canada (DFO) to provide a third biologist on IPHC survey vessels to collect hook by hook occupancy information for all species, and otoliths, maturities, and lengths for rockfish except thornyheads. This is the sixth year of this cooperative program and continued collaboration is anticipated.

### ***Area 2C and eastern 3A***

In 2008, IPHC worked cooperatively with Alaska Department of Fish and Game (ADFG) to provide a third biologist on IPHC survey vessels in the Fairweather, Sitka, Ommaney and Ketchikan charter regions to collect hook by hook occupancy information for all species, and otoliths, sex, and lengths for yelloweye rockfish. This project built upon cooperative work started with ADFG in 2007 and future collaboration is anticipated.

### ***Area 4***

IPHC collected length frequency data on incidentally caught Pacific cod (*Gadus macrocephalus*) in the 4A Edge and 4D Edge charter regions. This project was initiated at the request of NMFS-AFSC Pacific cod assessment team and part of a developing effort to collect bycatch information on Pacific cod in the western regions of our survey, where it makes up the largest component of our survey bycatch.

## **9. Electronic reporting project for commercial landings in Alaska**

Cost: \$30,000 (covered under Catch Statistics budget: A30-7131-30)

Start Date: 2002

Anticipated ending: Continuing

Personnel: H. Gilroy, L. Hutton, T. Kong, A. Tesfatsion, H. Tran

IPHC, ADF&G, and NMFS staffs have continued to refine the web-based Interagency Electronic Reporting System (IERS). For halibut, the system reduces duplicative reporting resulting from the current requirements of completing ADF&G fish tickets, NMFS/RAM quota share reports, and has been operational since May 2006. The application (eLandings) records data elements required by regulations, prints fish tickets, and connects with the NMFS quota share database. The appropriate data from IERS is being sent to the agencies for their internal databases. Industry personnel and agency staff have provided feedback on the operation and the application is continuously being modified including incorporation additional fisheries and tender landings. Agency staffs have been to yearly trainings or workshops on the program. In 2009, the focus will be on continued training with the processors. Costs represent system maintenance costs, software purchase and development, steering committee and travel costs.

## **10. Electronic logbooks**

Cost: \$50,000 (Covered under Catch Statistics budget: A10-7131-30)

Start: 2009 (postponed from 2008)

End Date: Pilot project

Personnel: H. Gilroy, L. Hutton, K. MacTavish

IPHC and NMFS/AKR are collaborating to determine the feasibility of an electronic logbook and establish the specifications needed for contractors. The Commission will also be reviewing other programs to decide if another geographic location (Area 2B or 2A) is an appropriate place to start an electronic logbook program.

## Research Topics for 2010

### 1. Design of experiment to examine coastwide catchability of longline survey gear

Personnel: B. Leaman, S. Hare, R. Webster, J. Valero

The issue of common catchability for IPHC setline survey gear across all areas of the coast is a key component of the use of survey data for biomass apportionment. While we have no indication that catchability is highly biased in any area, we acknowledge that the existing data comparisons with which catchability has been assessed are highly variable. This high variance contributes to questions about the validity of the assumed commonality of catchability across the coast. Historical evaluations of catchability have employed trawl-setline comparison fishing. However, those experiments produced the high variance noted, plus the fact that trawls cannot be used in all areas where longline fishing occurs and that trawls have their own separate gear selectivity by halibut size. Thus, the trawl-setline comparisons are both spatially and selectivity compromised. It therefore is highly unlikely that any experiment using a trawl-setline comparison will produce results that will be either convincing or spatially inclusive.

The staff believes that a different approach to estimating setline catchability is required. Its fundamental feature must include a method to obtain an unbiased estimate of halibut density, wherever halibut are fished, so that fishing using IPHC survey gear can then be evaluated coastwide. At present, we do not know what that method might be. It could include, among other approaches, remote sensing, short-term tag-recapture fishing, acoustic tagging, or other technology-based methods. We believe that such an experiment demands careful planning and may include pilot studies of candidate methods. In any event, the results of such a coastwide experiment are important to the Commission's management process and it should be only be conducted after adequate planning, and using methods with a higher probability of producing accurate results than those methods presently available.