IPHC research program: Review of 2003 projects and proposals for 2004

The International Pacific Halibut Commission 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 2003. The second section presents the staff research proposals for 2004. Information is provided on when each project began, the anticipated completion date, the annual cost and total 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 cash outlay is possible under the basic $3.048M (as of 2004) 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) **Appropriations:** Necessary research projects of high priority that can be conducted under the basic $3.048 million budget;
2) **Supplemental:** Necessary research projects of high priority that can only be conducted with revenues generated by survey fishing in 2004, grants or contributions, or carry-over from 2003; and
3) **Contract and Externally Funded:** Agreements to conduct specific research projects. In this report, contracts are shown for projects where the IPHC staff is the principle investigator, and projects that IPHC has contracted to other investigators.

Throughout this report the status of projects is stated as being either completed, continuing, or deferred. To be completed, a project has been fully analyzed and the results reported in the RARA, the IPHC report series or an outside peer-reviewed journal. Continuing projects are those which are still underway, with the staff performing analysis or writing the report. A project is deferred when it is postponed until the following or subsequent year.

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;
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.

Contents

Section I:
Review of research conducted in 2003

Research conducted by the IPHC staff during 2003 covered a myriad of subjects, from the coastwide PIT tagging project, archival tags, collection of tissue and otolith samples, to issues that bear on the stock assessment. 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.

Staff research in 2003

The staff completed several projects during 2003, but most of the work was on projects that will continue into 2003 and beyond. Substantial time was applied to the PIT tagging project: preparing, training and conducting the releases, and hiring, training, and conducting the recovery efforts through the scan samplers. A vessel cruise took place in March on the *F/V Heritage* to finalize tagging protocols. Other projects, including programs for undergraduate internships and deploying water column profilers on the survey vessels were completed in 2003. At-sea research looking at spatial recruitment dynamics from otolith elemental composition (i.e., fingerprinting) also took place. Samples were collected in June and again in September outside of Sitka (Area 2C), attempting to see if seasonal patterns occur. Samples from other regions around the north Pacific were also obtained. Only one NMFS trawl survey was staffed in 2003, but we expect to resume staffing of two vessels in 2004.

2003 contract and externally funded research

IPHC was involved with three contracts in 2003. The first (#617) had IPHC port samplers picking up copies of the NMFS hook-&-line catcher vessel and sablefish logbook sheets during their dockside logbook interviews. The samplers perform some editing to the logs, which are then sent to the Seattle office and forwarded on to the NMFS lab in Auke Bay, Alaska. This was the sixth year in which IPHC port samplers have performed this task. IPHC was paid $7,000 in 2003.

The second project (#801) involved Dr. S. Hare of the IPHC staff in a project in collaboration with Dr. N. Mantua of JISAO and Dr. C. Marzban of the UW Dept. of Statistics. In order to better understand the role of climate in the dynamics of Alaska's western and eastern Steller sea lion (SSL) populations, researchers conducted a retrospective study of time series for SSL abundance, distribution and recruitment, multiple components of Alaska SSL marine ecosystems, local environmental conditions, and large scale climate forcing. The contract covered one month of Dr. Hare's salary.

The third project was with DFO to have IPHC Canadian port samplers collect information on bycatch of other species during halibut fishing. The project is funded by the revenues generated from the sale of bycatch species on the assessment surveys in Area 2B. The data will be summarized to maintain confidentiality and provided to DFO. This is the second year of the project and the funding mechanism is under review by IPHC staff and DFO.

Budget Summary for 2003 Projects Funded Through Supplemental Revenues

Project Acct #	Project Title	Proposed	Actual
	Field Experiments[1]		
410	Chalky halibut investigations	$ 43,649	0
411	PIT Tagging Study – Tag selection & retention	146,706	117,714
412	PIT Tagging Study – Field tagging	266,805	266,419
413	PIT Tagging Study – Dockside detection	436,072	169,631
	Sub-Total	***$ 893,232***	***$ 553,764***
	Other Research		
602	Spatial and ontogenetic variability in the trophic status of Pacific…	$ 15,000	$ 28,215
604	NMFS trawl survey: at-sea data collection & IPHC data base…	32,207	37,874
607	Graduate student	22,840	18,872
608	Update halibut viability video used in NMFS observer training	500	0
610	Water column profiler	0	778
618	Undergraduate internships	23,500	11,481
620	Analysis of spatial recruitment dynamics using otolith…	77,000	54,111
621	Genetic population structure assessed via mitochondrial DNA…	141,293	16,217
622	Pop-up, satellite-transmitting archival tags (PSTAT)…	6,000	2,946
624	Halibut age validation proposal utilizing ^{14}C radiocarbon	20,365	1,582
626	Otolith marginal increment analysis	900	0
627	Seabird video analysis	14,750	14,753
628	Comparing laser ablation vs. solution-based mass spectroscopy…	15,510	0
629	Pribilof Island bottom temperature study	6,000	24,484
630	Sleeper shark aging study	200	0
631	Delta sub diving in SE Alaska	18,077	17,739
	Sub-Total	***$ 394,142***	***$ 229,052***
	GRAND TOTAL	***$1,287,374***	***$ 782,816***

[1]Proposed budget amounts do not include any expected revenue generated from the sale of fish or other cost offsets.

Other 2003 Research – Contracts and External Funding

Project Acct #	Project Title	Income	Expense
617	NMFS catcher vessel logbook and sablefish data collection	$ 7,015	0
801	Retrospective studies of climate impacts on Alaska Steller sea lions	6,000	0
--	Area 2B logbook program and bycatch	16,362	0
	GRAND TOTAL	***$ 29,377***	**0**

Section II:
Research proposed for 2004

Projects proposed for 2004 consist primarily of a continuation of projects currently underway. The largest is the second year of PIT tagging. The staff is planning on conducting additional tagging in 2004, but only in Areas 2B and 3A. This is in response to suggestions made by the Peer Review (conducted in 2002), which put forth that estimates of annual survival rates could be verified by additional tagging in key areas. With the experience gained in 2003, tagging in 2004 is expected to be somewhat easier for the staff to implement. Tag recovery efforts will also continue in 2004 with the scan sampling program. In contrast to 2003's 5.5 month sampling effort (June through mid-November), scanning in 2004 will occur throughout the season. Planning for this activity is based on a March 1 – November 15 season.

Other at-sea projects in 2004 consist of charters planned for January-February to collect tissue samples for the genetic project (#621). Bids have been accepted and plans are underway for three vessel charters (*F/V Free To Wander* – Area 2B, *F/V Nopsa* – Area 3A, and *F/V Kema Sue* – Area 4A) to complete the collections. This project was approved for 2003, but deferred to 2004 when inadequate bids were received. Staff is also proposing to continue the deployment of additional PSTAT tags in 2004 (#622). Two areas of interest have been identified: (1) identification of Bering Sea spawning areas; and (2) summer-to-summer movements within Areas 2B, 2C. The Bering Sea experiment holds the greatest interest, insofar as the least is known about Bering Sea spawning than the questions addressed by the other experiment. We are also proposing continuing the otolith elemental fingerprinting (OEF) work (#620) with additional collections in 2004, primarily in the inside waters of Area 2C. Finally, a project initiated in 2003 examining the water temperature gradients around the Pribilof Islands and the effect on the catch and distribution of halibut will continue (#629).

Several long-standing projects are proposed for continuation. These include placing staff on the NMFS trawl surveys (#604), graduate student support (#607), data collections with water column profilers on the assessment surveys (#610), and the undergraduate internship program (#618). The project looking at spatial and ontogenetic variability in the trophic status of halibut (#602) will use 2004 to analyze tissue samples collected in prior years. Two lab/office projects will be concluded in 2004: an otolith marginal increment analysis (#626) and a training video for NMFS observers on assessing the viability of halibut bycatch (#608). Finally, interest in the large number of sleeper sharks caught during the summer assessment surveys has created an opportunity for research into age determinations and stock compositions on this species which have not been previously investigated (#630).

Three new projects are being proposed to begin in 2004. Proper identification of the stage of maturity of halibut ovaries has been a challenge for vessel staff and a project has been designed to resolve this through histology work to establish a time line of gonadal development. Also, a second project involving collaborative work with the NMFS research lab in Newport, Oregon will look at issues raised by the Research Advisory Board (RAB) about the potential for catching halibut with traps or pots. The industry is facing problems with marine mammal predation of their longline catch in some areas in Alaska, and pots have been suggested as one means to minimize such predation. Canadian halibut fishers are facing problems with the bycatch of rockfish, and pots with properly designed escape openings were suggested by RAB as one means to reduce the bycatch.

Staff would work with the researchers at the NMFS facility as different pot designs are tested. Finally, a third new project will investigate whether species richness and evenness is correlated with bottom temperature and depth. The project will take place on a survey vessel and incorporate some of the video technology IPHC has used in the past couple of years to monitor and sequentially tally the catch from each hook.

Two projects conducted under contract to other agencies will be continued in 2004. IPHC port samplers in Alaska will collect sablefish logbook data for the NMFS Auke Bay lab, and port samplers in Canada will collect data on the bycatch of other species for DFO.

2004 Project Budget Summary

Line No.	Project Title	Proposed
Field Experiments[1]		
S.1	PIT Tagging Study – Field experiment/releases (#412)	$ 51,102
S.1	PIT Tagging Study – Dockside detection/recoveries (#413)	386,630
	Sub-Total	***$437,732***
Other Research		
S.2	Spatial and ontogenetic variability in the trophic status…(#602)	$ 15,000
S.3	NMFS trawl survey: at-sea data collection & IPHC data base mgmt (#604)	17,507
S.4	Graduate student (#607)	17,500
S.5	Update halibut viability video used in NMFS observer training (#608)	500
S.6	Expansion of the water column profiler (#610)	1,000
S.7	Undergraduate internships (#618)	23,928
S.8	Analysis of spatial recruitment dynamics using otolith elemental…(#620)	73,005
S.9	Genetic population structure assessed via mitochondrial DNA and…(#621)	137,685
S.10	Pop-up, satellite-transmitting archival tags (PSTAT)…(#622)	247,424
S.11	Otolith marginal increment analysis (#626)	1,100
S.12	Pribilof Island bottom temperature study (#629)	25,220
S.13	Sleeper shark investigations (#630)	1,270
S.14	Analysis of gonad staging on IPHC setline surveys	21,939
S.15	Collaborative research: Trap/pot design for catching halibut	50,000
S.16	Associating environmental variables with species richness and evenness	45,034
	Sub-Total	***$ 678,112***
	GRAND TOTAL	***$1,115,844***

[1]Proposed budget amounts do not include any expected revenue generated from the sale of fish or other cost offsets.

Other 2003 Research – Contracts

Line No.	Project Title	Income	Expense
C.1	NMFS catcher vessel logbook and sablefish data collection (#628)	7,000	0
C.2	Area 2B logbook program and bycatch	***TBD***	0
	GRAND TOTAL	***$ 7,000***	0

Research projects funded through supplemental revenues

S.1 PIT Tagging Study: Second Year Of Tag Releases And Dockside Detection

Project Account No.: 412 (Field experiment/releases)
413 (Dockside detection/recoveries)
Status: Continuing
Cost: Project 412 - $ 51,102
Project 413 - $ 386,630
Anticipated ending: 2006
Personnel: Williams, Kaimmer, Geernaert, Chen, Clark, Blood, Forsberg, Dykstra, Van Wormer, Soderlund, Ranta, sea samplers, scan samplers.

IPHC will be undertaking the second year of the PIT (Passive Integrated Transponder) tag experiment in 2004. In 2003, a total of 44,494 (prelim.) were successfully released in the large-scale coast-wide release from the setline surveys. For 2004, tags will be released only in Areas 2B and 3A to measure annual survival.

In 2004, recoveries will continue to be obtained by the scan sampling program, which began in 2003. IPHC will hire samplers for Alaskan ports, while contracting with AMR for the Canadian ports.

S.2 Spatial And Ontogenetic Variability In The Trophic Status Of Pacific Halibut

Project Account No.: 602
Status: Continuing
Cost: $15,000 and staff salaries
Start Date: 1999
Anticipated ending: Continuing
Personnel: Hare, Kline

This project attempts to define spatial and ontogenetic variability in the trophic status of Pacific halibut using natural stable isotope abundance of carbon and nitrogen which is hypothesized to vary over its distribution in the northeast Pacific. Natural stable isotope abundance is a useful research tool for fish ecology because of the predictable relationships of isotope signatures among food web constituents and isotopic gradients existing in the study area. Increase in trophic level is hypothesized to explain the large decrease in growth rate exhibited by halibut since the 1976-1977 regime shift that also affected many species in the region. Ontogenetic shifts in isotope signature are expected to indicate a shift to feeding offshore as adults. This will provide a linkage to the regime shift because changes in zooplankton abundance have been noted offshore near the continental shelf break. Showing a relationship to this carbon source through isotope matching will provide the first line of evidence for a mechanism for explaining changing halibut growth patterns. 2003 was the fourth year of sample collection; analysis of these data will begin to allow us to estimate interannual variability in trophic level. No collections are expected in 2004, in order to process the backlog of samples collected thus far.

S.3 NMFS Trawl Survey: At-Sea Data Collection And Data Base Management

Project Account No.: 604
Status: Continuing
Cost: $ 17,507 for at-sea otolith collection; staff salaries for database work
Start Date: 1996
Anticipated ending: Continuing
Personnel: Sadorus, Ranta, Clark

A series of NMFS trawl survey data on halibut, parallel to our setline data, would be 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) that do not appear in large numbers in the setline survey. Since 1996 IPHC staff have collected otoliths on the triennial surveys. The halibut age 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.

S.4 Graduate Student

Project Account No.: 607
Status: Continuing
Cost: $ 17,500
Start Date: 2003
Anticipated ending: 2004
Personnel: Ames, Leaman, Williams

Funding of a graduate student (Mr. Rob Ames, Roads Rhodes Univ., Victoria) will continue in FY 2004. The project is looking at the potential for using video monitoring systems for enumerating the hook by hook catch on the stock assessment survey vessels. Video was gathered in 2002 during the NMFS seabird video project, so the student will be analyzing the data and reporting on the potential of such systems to gather data.

S.5 Update Halibut Viability Video Used In NMFS Observer Training

Project Account No.: 608
Status: Continuing
Cost: $500
Anticipated ending: 2004
Personnel: Williams, Kaimmer, other staff

A training video was prepared several years ago by IPHC staff with the purpose of improving consistency in observer determination of viability of halibut bycatch on longlines. Changes in viability categories which were implemented in 2000 render the video ineffective as a training tool. Staff will revise the audio portion of the tape, and add additional video footage taken on trawlers to expand the usefulness of the tape.

S.6 Expansion Of The Water Column Profiler Project

Project Account No.: 610
Status: Continuing
Cost: $1,000 for calibration, Staff salaries, outside funding for additional hardware
Start date: 2000
Anticipated ending: Continuing
Personnel: Hare, Loher, Stabenco (NMFS PMEL)

The IPHC maintains one of the most extensive sampling platforms in the north Pacific. This platform offers 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. Use of this platform for oceanographic data collection capabilities not only would benefit the scientific community at large, but demonstration of sampling feasibility may also create other funding opportunities for collaborative research. From 2001 to 2003, the IPHC successfully deployed a SeaBird SBE-19 water column profiler from a commercial fishing vessel participating in the annual stock assessment survey. Additional funding for this work is being sought through the North Pacific Research Board.

S.7 Undergraduate Internships

Project Account No.: 618
Status: Continuing
Cost: $23,928 for two interns
Start Date: 2004
Anticipated duration: May-August, 2004
Personnel: Sadorus, Van Wormer, Chen, Vienneau, other staff support as needed

Two undergraduates 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.

S.8 Analysis Of Spatial Recruitment Dynamics In Pacific Halibut Using Otolith Elemental Fingerprints: Phase 2

Project Account No.: 620
Status: Continuing
Cost: $73,005
Start Date: 2002
Anticipated Ending: Continuing
Personnel: Loher, Wischniowski, temporary staff

Sampling in 2004 seeks to expand our understanding of eastern Gulf nursery dynamics. It is now clear that the eastern Gulf represents excellent nursery habitat, but we have little knowledge of

where those nurseries exist due to the prior lack of attention to this region. Ideally, we would like to establish sites in both inside waters and on the outer coast at a spacing of about 1.5° of latitude. During 2004, we hope to establish sites in the northern Queen Charlottes and Chatham Sound, and scout for potential sites in Clarence Strait and western Prince of Wales Island.

S.9 Genetic Population Structure Of Pacific Halibut Assessed Via Mitochondrial DNA And Nuclear Microsatellite Diversity: Phase 2

Project Account No.: 621
Status: Continuing
Cost: $137,685
Start: 2002
Anticipated Ending: 2004
Personnel: Loher, Kaimmer, other staff

Collections during winter 2004 charters will seek to specifically address the question of whether or not Bering Sea spawners are reproductively isolated from those in the Gulf. However, we intend to expand the scope of the project to include analyses of stability in genetic composition over time, comparisons between summer distribution and winter spawning groups, and links between spawning populations and juvenile nurseries. In order to achieve this, tissue samples were collected from adult halibut at 12 sites during the 2003 setline survey from Attu Island to the Fairweather Grounds, and additional samples were collected via the port sampling program at six ports in southeast Alaska, British Columbia, and Oregon. Early juvenile tissue samples have been collected over the last two summers during the course of the juvenile OEF project (see below); this tissue collection now contains approximately 1,800 samples from dozens of sites throughout the eastern North Pacific.

S.10 Pop-Up, Satellite-Transmitting Archival Tags (PSTATs) To Study Halibut Movements

Project Account No.: 622
Status: Continuing
Cost: Area 4D & Bowers Bank expt - $ 88,606
Areas 2B/2C/3B expt - $ 158,818
Total - $ 247,424
Start: 2002
Anticipated Ending: Continuing
Personnel: Loher, Blood, sea samplers

Electronic pop-up, satellite-transmitting archival tags (PSTATs) can record ambient temperature, depth, and a number of other water-column parameters while attached to fish. The tags are programmed to release from the fish on a pre-determined date, float to the surface, and emit a satellite signal that indicates the tag location and downloads all of the temperature and depth data to the satellite. The result is a record of the fish's spawning location, along with important environmental and behavioral data throughout the fish's time at liberty.

For 2004, two releases of 24 tags each are proposed. The first would occur in Area 4D and the Bowers Basin area in the Bering Sea during the summer, with the tags scheduled for a winter pop-up, designed to identify spawning areas within the Bering Sea. The second release would occur in late summer in Areas 2B, 2C and 3B, with pop-ups scheduled for the following spring and early summer to establish the seasonal timing of migration to and from the spawning grounds in those areas.

S.11 Otolith Marginal Increment Analysis

Project Account No.: 626
Status: Continuing
Cost: $ 1,100
Star Date: 1999
Anticipated ending: 2004
Personnel: Blood, Wischniowski, Forsberg

This project has the objective of improving reliability of the age determination for Pacific halibut. Timing of annulus formation was first studied in the 1930s by Dunlop. Recent research on halibut age validation suggests Dunlop's early results were incomplete. Otoliths are being collected coast wide by IPHC surveys and domestic observers. Timing of annulus formation is critical to assigning accurate age and prevent smearing of strong year classes over weak ones. For this study, we are collaborating with observer programs in both Canada and the United States. Selected observers on board groundfish vessels will collect several halibut otoliths per month. Data collection and otolith processing occur in 1999-2003. Analysis will occur in 2003-4. We will use the otoliths collected to observe when during the year the halibut deposit annual growth rings. We will also investigate whether the timing varies by area and sex.

S.12 Analysis Of Onshore-Offshore Movement Patterns Of Pacific Halibut Along The Southeast Bering Sea Shelf Edge

Project No.: 629
Status: Continuing
Start Date: 2003
Cost: $ 25,220
Anticipated ending: 2004
Personnel: Loher, McCarty

The objective of this study is to compare changes in CPUE in Area 4C with variability in ocean temperature. The project began in 2002 with support from the Central Bering Sea Fishermen's Association, which provided funds to purchase ten Water Data Recorders to monitor bottom temperature during commercial sets. The pilot project demonstrated the feasibility of deploying loggers from the commercial fleet, and generated a small amount of baseline temperature data. A grant was obtained from the North Pacific Research Board during the winter of 2003 that will allow an expanded scope of the project and the increase the amount of data collected each year. The grant will fund two years of research, beginning May 1, 2003. Using these funds, 24 Vemco data loggers

were purchased in the early summer of 2003; the new units record depth as well as temperature. The loggers were deployed this past summer, have since been returned to the Seattle office and the data downloaded. The monitoring program will continue in 2004 and presumably farther into the future. Analysis of CPUE in relation to ocean temperature will be conducted on a number of temporal and spatial scales, ranging from seasonal to interdecadal, using the logger data from the fleet (for small-scale patterns) as well as oceanographic data from the National Oceanic and Atmospheric Administration (for larger-scale patterns).

S.13 Sleeper Shark Investigations

Project Account No.: 630
Status: Continuing
Cost: $ 1,270
Start Date: 2003
Anticipated ending: 2004
Personnel: Wischniowski, Williams

The Pacific sleeper shark (*Somniosus pacificus*) age determination program has collected, in the 2003 sampling year, enough samples to begin the pilot study. Historical ageing studies on this species have been plagued by the lack of visible microstructure within the centra of the vertebrae. An attempt will be made to expose any growth increments by way of an etching and staining experiment. Communications with other shark aging programs suggest that more focus should be directed towards age determination through a chemical approach. Consequently selected vertebra will be prepared for LA-ICPMS (laser ablation-inductively coupled plasma mass spectrometry) in an attempt to correlate the bimodal peeks of calcium and phosphate known to occur during the summer and winter growth seasons. If successful a request for a randomized sample of structures from the IPHC General Survey will be put forward. It is understood that sleeper shark research is not a mandate of the IPHC, and that this program is of lower priority. However, with the recent concerns of bycatch, we feel it is necessary to obtain basic life history parameters of this species to add to the general pool of knowledge. It is hopeful that this and other concurrent research may help reduce sleeper shark bycatch.

The objective of a second component of research into Pacific sleeper sharks is to determine if these sharks comprise a single population within the northeast Pacific Ocean. The population dynamics of sleeper sharks within the northeast Pacific is not well documented. Preliminary tagging studies have indicated that at least some sleeper sharks display a resident behavior, and likely have relatively small home ranges. To test this assumption it is proposed that tissue samples be collected from live and dead sharks by way of biopsy darting during the IPHC General Survey. A simply test of homogeneity will compare samples collected from regions of high occurrence to peripheral regions of lesser occurrence.

S.14 Analysis Of Gonad Staging On IPHC Setline Surveys

Project Account No.: *TBD*
Status: New
Cost: $ 21,939
Start: 2004
Anticipated Ending: 2004
Personnel: Geerneart, Loher

The IPHC standard stock assessment (SSA) surveys assess maturity of halibut based on visual criteria established in the early 1990's and modified in 1995. This 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 assumes 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 suggests that fish in the southern latitudes (Area 2B) mature earlier and possibly spawn earlier that 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 are presently evaluating collection protocol for upcoming surveys and establishing standardized sample sites on the gonad for the slide preparation.

In 2004, during winter and summer surveys, females gonads in each stage of development will be collected and histological preparations will be prepared. The objectives are to establish a time line of gonadal development of the female halibut from the immature stage to spawning throughout the year and from the south to north of the range.

S.15 Collaborative Research: Trap/Pot Design For Catching Halibut

Project Account No.: *TBD*
Status: New
Cost: $ 50,000
Start Date: 2004
Personnel: Leaman, Williams, staff

The staff is proposing to contract with the NMFS facility in Newport, Oregon to conduct research on trap designs that would allow for halibut to be harvested and avoid interactions and predation loss to marine mammals and sharks, a problem experienced with increasing frequency in Alaska. A concurrent problem affecting the fishery in Area 2B is rockfish bycatch. Properly designed traps may also allow rockfish to escape, thereby reducing rockfish bycatch and lessening the regulatory conflicts with the directed rockfish fishery.

S.16 Associating environmental variables with species richness and evenness: a case study

Project Account No.: *TBD*
Status: New
Cost: $ 45,034
Anticipated ending: 2004
Personnel: Van Wormer, Leaman (other staff as needed)

The proposed study will investigate whether species richness and evenness is correlated with bottom temperature and depth. Historical data from the stock assessment survey (SSA) and data from a directed field experiment will be analyzed. During the 2004 SSA, one vessel will be chosen to deploy temperature and depth recorders on each skate of gear. In addition, electronic monitoring equipment will be installed on the vessel deck above the roller to record a sequential tally of all catch for each station. Post season, a video analyst will determine the numbers and species encountered. The final analysis will examine the spatial distribution and relative abundance of species relative to the temperature and depth profiles.

Research funded through appropriations

A.1 The 2004 Stock Assessment

Status: Continuing
Cost: Staff salaries
Start Date: 1926
Anticipated ending: Continuing
Personnel: Clark, Hare, Chen

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.

A.2 Development Of A Medium-Term Harvest Policy

Status: Continuing
Cost: Staff salaries
Start Date: 2001
Anticipated ending: Continuing
Personnel: Hare, Clark

Staff quota recommendations are calculated by applying a judiciously chosen harvest rate to an estimate of present exploitable biomass. The 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. On the basis of recent work, new insights have been developed on the factors controlling growth and recruitment which together determine productivity of the stock. During the past year, a new harvest policy – termed the "Conditional Constant Catch" policy was developed and proposed for adoption by the Commission. The robustness of this policy will continue to be investigated via simulation and, concurrent with the stock assessment, be expanded to a sex-specific policy. The ongoing aim of this project is to continually refine the harvest policy with the dual goals of projecting expected harvest levels over the next 5-7 years and stabilizing the quotas, while continuing to avoid driving the stock near its historical minimum size.

A.3 Development Of A Formal Medium-Term Recruitment Forecast

Status: Continuing
Cost: Staff salaries
Start Date: 2002
Anticipated ending: Continuing
Personnel: Hare, Clark, Chen

Confidence in projected safe harvest levels over the medium term requires confidence in projections of expected recruitment over the next 1-7 years. Industry and stakeholders also have great interest in the IPHC recruitment predictions. A number of new methods of predicting recruitment

have been developed over the past few years. The goal of this project is to create a forum for assembling and describing these models and evaluate them in a formal time series analysis framework. It is expected that an official IPHC best guess recruitment forecast will be produced along with associated confidence bounds. This project was deferred in 2003 in anticipation of a retooled assessment for 2004. Several of the forecast methodologies rely upon assessment estimates of historical spawning biomass and recruitment.

A.4 Estimation Of Halibut Abundance From Mark-Recapture Data

Status: Continuing
Cost: Staff salaries (analysis only)
Start Date: 2001
Anticipated ending: Continuing for several years at least
Personnel: Chen, Clark, Leaman

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.

During 2003 work was done on a detailed simulation of the experiment to investigate the behavior of the proposed estimation methods. That work will continue in 2004 using the 2003 PIT tag releases. The verified estimation method will be used to estimate exploitation, migration and natural mortality rates in 2004 with the tag recoveries from 2003 and 2004.

A.5 Density-Dependent And Independent Control Of Halibut Growth And Recruitment

Status: Continuing
Cost: Staff salaries, some travel
Start Date: 1998
Anticipated ending: Continuing
Personnel: Hare, Clark, Loher

The specific mechanisms driving the observed interdecadal trends in halibut growth and recruitment remain largely unexplained though more specific hypotheses have been developed in the past two years. Work towards better understanding whether density-dependent (intra- or inter-specific) or density-independent factors are responsible continues and remains the core research focus of the fisheries oceanography project. In keeping with the NOAA movement towards ecosystem considerations in fisheries management, we will attempt to derive a framework whereby the results of fisheries oceanography investigations can provide useful input for management purposes, such as determining safe harvest levels or forecasting near-term recruitment. Part of this project includes

maintenance of the near bottom "Ocean Bottom Properties" database, first assembled in 1997 (and described in the 1997 RARA) and maintained and updated as additional data become available. This database has proven to be extremely useful to researchers around the north Pacific.

A.6 The Effects Of Changing Gear In The Halibut Fishery Following IQs

Status: Deferred in 2003
Cost: Staff salaries
Start Date: 2001
Anticipated ending: 2004
Personnel: Leaman, Gilroy, Kong

Many more vessels now fish for combinations of sablefish and halibut, and to a much lesser extent, Pacific cod and rockfish. This has resulted in associated changes in the type and quantity of gear used in harvesting halibut, particularly as it concerns hook size and spacing. The second major issue is the distribution and timing of fishing effort within the 8-month season. GIS will aid in the analysis of fishing distribution. These issues have been previously examined for the Area 2B fishery after Canada implemented IVQs, but it is time to examine the impact of these changes on data obtained from the fishery off Alaska and used in the stock assessment.

A.7 IPHC Statistical Area Documentation And Automated Statistical Area Assignment

Status: Part 1: Complete
Part 2: Continuing
Cost: Staff salaries
Start Date: 1999
Anticipated ending: 2004
Personnel: Kong, Gilroy, Leickly

Part 1: The project to document the IPHC baseline and statistical areas was completed in 2003 with a report written and the GIS shapefiles of IPHC statistical areas being made available to other agencies. The report will be published in 2004.

Part 2: The project for implementing an automated system for assigning statistical areas to latitude/longitude locations collected from fishing logs was started in 2003 and will be operational in 2004.

A.8 Review Of Port Sampling, 1994 To Present

Status: Deferred in 2003
Cost: Staff salaries
Start Date: 2002
Anticipated ending: 2004
Personnel: Hutton

Report on the changes that have occurred in the commercial catch sampling and port sampling program from 1994 to the present. For example, the report will review the changes made to the

program due to the implementation of the IFQ fishery in Alaska, the changes in the method of logbook data collection in the U.S., as well as changes in the Canadian program. This is an update of Technical Report 32.

A.9 Development Of A Cooperative Interagency Electronic Fishery Information Collection And Management Program In Alaska

Status: Continuing
Cost: Staff salaries and travel costs if not included in grant ($3,000)
Start Date: 2002
Anticipated ending: Continuing
Personnel: Gilroy, Vienneau, Hutton, Kong

IPHC, ADF&G, and NMFS staffs are involved in the development of a cooperative interagency electronic fishery information collection and management program in Alaska. In 2003, the interagency steering committee worked with a contractor hired by the Pacific States Marine Fisheries Commission (PSMFC) to implement and test a technology demonstrator. The technology demonstrator evaluated actual field conditions of communication infrastructure and processor computerized reporting capabilities in Alaska. The completed report will document measured performance and summarize processor's feedback on perceived performance.

Additionally, a facilitator was hired to conduct two meetings to present the program, and get input from the individuals outside the steering committee on their needs and the proposed program structure. The first meeting was held in October 2003 with staff from all agencies and the facilitator will prepare a report. The second meeting will occur in 2004 with a wider interest group including the processors. The goal is to have a memorandum of understanding (MOU) signed by the Directors of the Agencies prior to the second meeting. The goal of the MOU is to ensure the individual agency's interests are protected and that the agencies are committed to work toward a cooperative electronic fishery information system. After the completion of the above projects, the next phase will be to design a prototype and test it on a small scale.

A.10 Preliminary Assessment Of Mercury Incidence In Pacific Halibut

Status: Continuing
Cost: Staff salaries and possibly costs of assays
Start Date: 2002
Anticipated ending: Continuing
Personnel: Dykstra, Alaska Department of Environmental Conservation

For the last few years, health officials and media have raised the profile of mercury contamination in fish. In 2002, the Alaska Department of Environmental Conservation (ADEC) in conjunction with the EPA, launched an environmental contamination study looking into levels of organochlorine pesticides, dioxins, furans, polybrominated diphenyl ethers, PCB congeners, methyl mercury and heavy metals (arsenic, selenium, lead, cadmium, nickel, chromium) within 13 Alaskan fish species including halibut. During the setline surveys in 2002, the Commission collected 60 halibut muscle and liver tissue samples from eight locations within Alaska for the principal ADEC

study and 58 flesh samples for additional methyl mercury analyses. In 2003 the principal samples were analyzed for heavy metals and the preliminary data have been released. According to the Alaska Division of Public Health, the concentrations of heavy metals detected in these samples are not a public health concern. 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.

The sampling continued in 2003 with the collection of 60 samples (30 from fish weighing between 20 – 40 lbs. and 30 from fish weighing between 40 – 100 lbs.) from each of three regions (SE Alaska, Gulf of Alaska, and the Bering Sea) during the setline survey. Results will be published as they become available.

ADEC has expressed interest in further assessments of contaminant occurrence in halibut in 2004.

A.11 Seabird Occurrence Project

Status: Continuing
Start Date: 2002
Cost: Staff salaries
Anticipated ending: Continuing
Personnel: Van Wormer, Geernaert, Washington State Sea Grant

During the 2003 stock assessment surveys, sea samplers counted the number of seabirds in the vicinity of the vessels following gear retrieval. This is the second year the seabird occurrence data was collected on IPHC surveys. Sampling after the haul addresses the question of where and when certain seabird species occur. Ultimately these data might be used to identify appropriate seabird deterrent requirements in certain geographic locations, especially for the halibut fleet. IPHC has developed a database to store seabird occurrence data from the IPHC stock assessment surveys as well as the NMFS and ADF&G sablefish surveys.

The data are being analyzed. IPHC, in coordination with Washington Sea Grant, will be presenting a joint paper on the results of analysis of the 2002 data at the North Pacific Fishery Management Council meeting in February 2004. The collection project is ongoing.

A.120 Swivel Snap-On And Snap-On Gear In The Commercial Halibut Fishery

Status: Continuing
Start Date: 2003
Cost: Staff salaries
Anticipated ending: 2004
Personnel: Hutton, Geernaert, and port samplers

For the last several years there appears to be an increased use of swivels on snap-on gear during commercial halibut fishing. Additional data on swivel gear has been collected during the logbook interviews in British Columbia since 2001. The program was expanded to cover all areas of the coast in 2003. The type of snap-on gear (swivel snap-on vs. snap-on gear) fished by area will be summarized in the 2004 Report of Assessment and Research Activities. The program will be reviewed prior to 2004 and the necessary changes will be implemented.

A.13 Interaction Of Whales And Sharks With Halibut During Commercial Fishing

Status: Continuing
Cost: Staff Salaries
Start Date: 2003
Anticipated ending: 2004
Personnel: Hutton, Geernaert, Kong, port samplers.

At the 2002 Research Advisory Board meeting, the Board asked the staff to determine if logbooks could be an effective tool for documenting whale and shark interactions with halibut during fishing. In 2003, the logbook interview program was expanded to include incidence of hooking predation and whale interaction. For the first year of the program, the information was collected by fishing trip and included: no interaction, no information (not asked), or interaction with either dogfish, sleeper sharks, miscellaneous sharks, sperm whales, or killer whales. In this case, interaction was defined as interaction sufficient to effect the catch rate for halibut. The data will be summarized in the 2004 Report of Assessment and Research Activities. The program will be reviewed prior to 2004 to determine if the program will be continued and if so, determine necessary changes.

A.14 Impacts Of Extending The Commercial Halibut Fishery Season

Status: Continuing
Cost: Staff salaries and meeting costs
Start Date: 1999
Anticipated ending: Continuing
Personnel: Gilroy, Leaman, agency staffs, processing plant personnel, and harvesters

In 1999, the Commission started to evaluate the implications of extending the halibut season. Since then the biological and administrative issues have been reviewed and summarized at different forums. At the 2003 Annual Meeting the industry asked the Commission to task a work group to review the issues associated with a halibut season extension. In July 2003, IPHC held a two-day meeting with agency staffs, processing plant personnel, and harvesters to discuss the administrative issues that would require modification for a halibut season extension. Other issues discussed included logistics, enforcement, data collection and fishery interactions. Two season options (10.5 and 12-month) were reviewed. The initial report will be presented to the Commissioners at the Interim meeting.

A.15 Estimates Of Bycatch On The Setline Surveys In Area 2B

Status: Continuing
Cost: Staff Salaries
Start Date: 2003
Anticipated ending: Continuing
Personnel: Dykstra, survey team, and DFO personnel

Rockfish bycatch in the halibut fishery can be a constraint in conducting halibut fishing in some areas. In 2003, IPHC worked with DFO to allow a third biologist on IPHC survey vessels to sample rockfish and sablefish bycatch. The program was funded by DFO and the industry. Data

collected included hook by hook information, otoliths, maturities, and lengths for rockfish and sablefish.

A.16 Incidence Of Crystallized Otoliths From The 1998-99 Setline Surveys

Status: Continuing
Cost: Staff salaries
Start Date: 2000
Anticipated ending: 2004
Personnel: Tobin, Forsberg

Crystallization of the otolith, a defect that occurs throughout the range of Pacific halibut, impairs the readability of the earbone to the point of rejection from the age reading collection. The cause of crystallization is unknown though various hypotheses have been suggested ranging from pollution effects to genetic defects. In 1998 and 1999 the incidence of crystallized otoliths was recorded during otolith collection on the stock assessment surveys. This project will examine the occurrence rate among areas and years, and with sex and age of fish. The project was deferred in 2002 due to a change in staff responsibilities.

A.17 Incidence Of "Double Ring" Pattern In Halibut Otoliths

Status: Continuing
Cost: Staff salaries
Start Date: 2003
Anticipated ending: 2004
Personnel: Tobin, Forsberg

A double ring pattern is fairly common in halibut otoliths. "Double ring" refers to a pattern in which two rings are closer together than either ring to the previous or following ring. Sometimes readers count the two rings as separate annuli, sometimes one as an annulus and one as a check, depending on the sharpness of the rings, regularity of the rest of the otolith pattern, and where on the otolith the double ring occurs. Presence of double rings and their location within the otolith will be recorded for otoliths in 2003 and occurrence by area and/or year class will be analyzed.

A.18 Documentation Of Historical Special Setline Experiments

Status: Continuing
Cost: Staff salaries
Start Date: 2001
Anticipated ending: 2004
Personnel: Kaimmer

The Commission has conducted a number of special experiments – those with specific objectives separate from stock assessment surveys – over the years. We will consolidate into a single source the objectives, results, data formats, and caveats for each experiment, and evaluate the over-

all performance of the special experiments. The report will also summarize or give references to any written reports resulting from the experiments. This effort will include an investigation of the IPHC data base, and more properly archiving some data sets which do not fit into the current IPHC data format (including camera observations, hook timer data, and mortality study information).

A.19 Analysis Of 1998-1999 Special Setline Experiments

Status: Continuing
Cost: Staff salaries
Start Date: 2001
Anticipated ending: 2004
Personnel: Kaimmer, Williams

The first phase summarizes fishing effort and results from special setline experiments conducted during the summer of 1998. These experiments included bait size, bait type, bait quality and gear type comparisons. The report will include analyses of catches by numbers, pounds, and size of fish caught. The second phase summarizes the winter/summer experiment comparing a standard chum salmon bait to two sizes each of squid and pollock bait, and discussing the usefulness of these baits as possible alternates to the chum currently used in the grid surveys.

Contract and externally funded projects

C.1 NMFS Catcher Vessel Logbook And Sablefish Data Collection

Project Account No.: 628
Status: Continuing - under review
Revenue: $7,000 - to be reviewed
Start Date: 1999
Anticipated ending: 2004
Personnel: Hutton, port samplers

IPHC and NMFS have a joint IFQ catcher vessel logbook program for vessels 60 ft and greater. NMFS contracted IPHC staff to interview the IFQ fishers to review and collect the sablefish information in addition to the halibut information. Copies of the log sheets are sent to the NMFS scientists at the lab in Auke Bay, Alaska. The program was continued in 2003, however, IPHC and NMFS are reviewing the program to determine and agree on the acceptable release policy of the data. Additionally, IPHC and NMFS are reviewing the logistics of collecting data from vessels under 60 feet and whether there will be an additional cost. The continuance of the program will depend on the outcome of the discussions.

C.2 Area 2B Expanded Logbook Program

Project Account No.: 18000
Status: Continuing
Start Date: 2002
2002 Cost: Bycatch revenues from the 2002 setline surveys in Area 2B
Anticipated ending: Continuing
Personnel: Geernaert, Gilroy, Leickly, Taheri

IPHC expanded the B.C. port sampler's tasks to include interviewing skippers and edit information on the bycatch of other species during halibut fishing. These data were entered into the IPHC log database tables. The latitude/longitude location was converted using Geographical Information Systems (GIS) to DFO statistical areas and vessels were assigned a unique identifier to maintain the confidentiality of the vessels. In 2003, the 2002 bycatch catch and discard information from the logbooks was summarized and electronically provided to DFO. The data provided had a skipper's signature acknowledging that IPHC would provide the information to DFO. The 2003 data will be provided to DFO with additional bycatch landing weights collected by port samplers at the time of the log interview. This information should assist DFO with validation of the log data.