IPHC 5-year Biological and Ecosystem Science Research Program: update

PREPARED BY: IPHC SECRETARIAT (J. PLANAS, 6 DECEMBER 2017)

PURPOSE

To provide the Commission with a description of the new and continuing research projects proposed by IPHC Secretariat and contemplated within the 5-year Biological and Ecosystem Science Research Program.

BACKGROUND

Since its inception, the IPHC has had a long history of research activities devoted to describing and understanding the biology of the Pacific halibut (*Hippoglossus stenolepis*). At the present time, the main objectives of the Biological and Ecosystem Science Research Program at IPHC are to:

1) identify and assess critical knowledge gaps in the biology of the Pacific halibut;

2) understand the influence of environmental conditions; and

3) apply the resulting knowledge to reduce uncertainty in current stock assessment models.

Traditionally, IPHC staff propose new projects annually that are designed to address key biological issues as well as the continuation of certain projects initiated in previous years. Proposals are based on their own input as well as input from the Commissioners, stakeholders, and specific subsidiary bodies to the IPHC such as the Scientific Review Board (SRB) and the Research Advisory Board (RAB). Proposed research projects are presented to the Commissioners for feed-back and subsequent approval. Importantly, biological research activities at IPHC are guided by a Five-Year Research Plan that is put forward by the Program Head identifying key research areas that follow Commission objectives. As described in the Five-Year Research Plan for the period 2017-2021, the primary biological research activities at IPHC can be summarized in five main areas:

1) Reproduction
2) Growth and Physiological Condition
3) Discard Mortality and Survival
4) Distribution and Migration
5) Genetics and Genomics

These research areas have been selected for their important management implications. The studies conducted on Reproduction are aimed at providing information on the sex ratio of the commercial catch and to improve current estimates of maturity. The studies conducted on Growth are aimed at describing the role of some of the factors responsible for the observed changes in size-at-age and to provide tools for measuring growth and physiological condition in Pacific halibut. The proposed work on Discard Mortality and Survival is aimed at providing updated estimates of discard mortality rates in both the longline and the trawl fisheries. The studies conducted on Distribution and Migration are aimed at further understanding larval and juvenile dispersal, distribution of all life stages in relation to the environment, and reproductive

and seasonal migration and identification of spawning times and locations. The studies conducted on Genetics and Genomics are aimed at describing the genetic structure of the Pacific halibut population and at providing the means to investigate rapid adaptive changes in response to fishery-dependent and fishery-independent influences.

In this document, we present an outline of the new and continuing projects proposed by IPHC staff for the coming year.

DISCUSSION

For 2018, four new projects are proposed that cover specific research needs (Appendix I).

Project 2018-01 ("*Influence of thermal history on growth*") proposes to study the thermal profile experienced by fish at sea as assessed by archival tagging and otolith microchemistry in order to investigate the relationship between growth patterns (or productivity) and both spatial and temporal variability in environmental conditions for growth.

Project 2018-02 ("*Adult captive holding studies*") proposes performing studies on captive adult Pacific halibut to establish or validate measures or protocols required for other ongoing projects, such as (1) determining the permanence of individual tail markings for tracking individual movement rates, (2) calibrating measures of fat content for condition factor determinations and of stable isotope (C^{13} and N^{15}) ratios for inferring growth and dietary information and (3) calibrating O^{18} otolith signatures with environmental temperature.

Project 2018-3 ("*Whale detection methods*") proposes testing electronic monitoring-based methods to detect whale presence in the directed longline Pacific halibut fishery.

Project 2018-04 ("*Larval connectivity*") proposes to study the movement and connectivity of Pacific halibut larvae both within and between the Gulf of Alaska and the Bering Sea.

In addition to the new projects, thirteen continuing projects are proposed (Appendix I).

Project 621.16 ("*Development of genetic sexing techniques*") is the continuation of the project dealing with genetic sex identification of the commercial catch that will entail the testing and application of the recently developed genetic assays for sex identification.

Projects 642.00 ("*Assessment of mercury and other contaminants*") and **661.11** ("*Ichthyophonus incidence monitoring*") represent the continuation of projects monitoring the prevalence of heavy metal contamination and *Ichthyophonus* infection in the Pacific halibut population, respectively.

A total of four projects will continue migration-related studies. Three of these projects involve tagging and include: **Project 650.18:** "*Archival tags: tag attachment protocols*", **Project 650.21:** "*Investigation of halibut dispersal in Area 4B*"; and **Project 670.11:** "*Wire tagging of halibut on NMFS trawl and setline surveys*". A fourth migration-related project, **Project 675.11** ("Tail pattern recognition"), is investigating the identification of individual tail markings in U32 fish through the collection of tail images from IPHC's fishery-independent setline survey.

Project 669.11 ("*At-sea collection of halibut weight to reevaluate conversion factors*") will continue to collect weights at sea to improve estimation of the weight-length relationship in adult Pacific halibut.

Project 672.12 ("*Condition Factors for Tagged U32 Fish*") will continue to study the relationship between the physiological condition of fish and migratory performance and growth as

assessed by tagging in U32 fish in order to better understand the potential use of quantitative physiological indicators in predicting migratory performance and growth.

Project 673.13 ("*Sequencing the Pacific halibut genome*") will continue to characterize for the first time the genome of the Pacific halibut and provide genomic resolution to genetic markers for sex, reproduction, and growth that are currently being investigated.

Project 673.14 (*"Identification and validation of markers for growth in Pacific halibut"*) will continue to identify and validate molecular and biochemical profiles that are characteristic of specific growth patterns and that will be used to identify different growth trajectories in the Pacific halibut population and evaluate potential effects of environmental influences on growth patterns. This project has also received funding from the North Pacific Research Board under project number 1704 (Appendix II).

Project 672.13 ("*Discard mortality rates and injury classification profile by release method*") will continue to study the relationship between hook release methods in the longline fishery and associated injuries with the physiological condition of fish and with post-release survival in order to update current estimates of discard mortality rates in the directed longline Pacific halibut fishery. This project has also received funding from the Saltonstall-Kennedy NOAA grant program under project number NA17NMF4270240 (Appendix II).

Project 674.11 will continue to characterize the annual reproductive cycle of male and female Pacific halibut in order to improve our understanding of sexual maturation in this species and to improve maturity assessments and maturity-at-age estimates.

In addition to the new and continuing proposed projects at IPHC, we note the participation of IPHC in an externally-funded and coordinated project entitled "*Survival of Pacific halibut released from Bering Sea flatfish trawl catches through expedited sorting*". This project will continue to study the efficacy of expedited release as a method for reducing Pacific halibut discard mortality following trawl capture and the development of methods for the estimation of discard mortality rates without the need for fish-by-fish vitality estimation. This project is funded by the Saltonstall-Kennedy program under project number 15AKR013 and by the North Pacific Research Board under project number NPRB 1510.

RECOMMENDATION/S

That the Commission:

1) **NOTE** paper IPHC-2018-AM094-13 which outlined the research projects proposed by IPHC staff and provided an overview of the 5-year research program.
2) **ENDORSE** the proposed new and continuing research projects.

APPENDICES

Appendix I: Summary of research projects proposed for 2018.

Appendix II: Summary of research projects awarded for external funding in 2017.

APPENDIX I

Summary of research projects proposed for 2018

Project #	Project Name	Priority	Budget ($US)	External funding for FY2018 ($US)	Management implications
New Projects					
2018-01	Influence of thermal history on growth	High	136,004	-	Changes in biomass/size-at-age
2018-02	Adult captive holding studies	High-Medium	58,395	-	Changes in biomass/size-at-age/distribution
2018-03	Whale detection methods	High	37,511	-	Mortality estimation
2018-04	Larval connectivity	High	20,000	-	Larval distribution
Continuing Projects					
621.16	Development of genetic sexing techniques	High	33,928	-	Sex composition of catch
642.00	Assessment of mercury and other contaminants	Medium	8,600	-	Environmental effects
650.18	Archival tags: tag attachment protocols	High	800	-	Adult distribution
650.21	Investigation of halibut dispersal in Area 4B	High	6,800	-	Spawning areas
661.11	*Ichthyophonus* incidence monitoring	Medium	8,755	-	Environmental effects
669.11	At-sea collection of halibut weight to reevaluate conversion factors	High	7,645	-	Length-weight relationship
670.11	Wire tagging of halibut on NMFS trawl and setline surveys	High	12,840	-	Juvenile and adult distribution
672.12	Condition factors for tagged U32 Fish	High	9,116	-	DMR estimates
672.13	Discard mortality rates and injury classification profile by release method	High-Medium	1,037	255,402	DMR estimates
673.13	Sequencing the Pacific halibut genome	High	32,500	-	Environmental effects
673.14	Identification and validation of markers for growth	High	25,681	57,773	Changes in biomass/size-at-age
674.11	Full characterization of the annual reproductive cycle	High	121,488	-	Maturity assessment
675.11	Tail pattern recognition	High	3,900	-	Juvenile and adult distribution
	Total - New Projects ($US)		**$251,910**		
	Total - Continuing Projects ($US)		**$273,090**		
	Overall Total (all projects) ($US)		**$525,000**		
	External Funding (for FY2018) ($US)			**$313,175**	

APPENDIX II

Summary of research projects awarded for external funding in 2017

Project #	Grant agency	Project name	Partners	IPHC Budget ($US)	PI	Management implications	Grant period
1	**S-K NOAA**	Improving discard mortality rate estimates in the Pacific halibut by integrating handling practices, physiological condition and post-release survival (Award No. NA17NMF4270240)	Alaska Pacific University, Anchorage, AK	$286,121	Planas (lead PI) Dykstra Loher Stewart Hicks	Bycatch estimates	September 2017 – August 2019
2	**NPRB**	Somatic growth processes in the Pacific halibut (*Hippoglossus stenolepis*) and their response to temperature, density and stress manipulation effects (Award No. 1704)	AFSC-NOAA-Newport, OR	$131,891	Planas (lead PI) Rudy Loher	Changes in biomass/size-at-age	September 2017 – August 2019
			Total awarded ($)	**$418,012**			