



IPHC 5-year Biological and Ecosystem Science Research Program

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PURPOSE

To provide a description of the new and continuing research projects proposed by IPHC staff and with an overview of 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 describe and understand 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) to identify and assess critical knowledge gaps in the biology of the Pacific halibut;
- 2) to understand the influence of environmental conditions; and
- 3) to apply the resulting knowledge to reduce uncertainty in current stock assessment models.

Traditionally, IPHC staff propose annually new projects designed to address key biological issues as well as the continuation of certain projects initiated the previous year, based on their own input as well as input from the Commissioners, stakeholders and specific advisory bodies to IPHC such as the Scientific Review Board (SRB) and the Research Advisory Board (RAB). Proposed research projects are evaluated internally by IPHC staff and 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 and that identifies key research areas that follow Commission objectives. In this document, we present an outline of the research projects that will be conducted by IPHC staff during 2017, a list of research projects submitted for external funding and a new Five-Year Research Plan for the period 2017-21. A full description of these activities can be found in Chapter 1.1 of the 2016 RARA ("2017 IPHC Biological and Ecosystem Science Research Plan").

DISCUSSION

For 2017, seven new research projects will cover specific research needs related to key aspects of the biology of the Pacific halibut: reproduction (Projects 674.11, 650.21), migration (Projects 650.21, 675.11, 672.12), growth (Project 673.14), viability assessment and survival post-capture (Projects 672.12, 672.13) and genetics (Project 673.13) ([Appendix I](#)). Project 674.11 ("Full characterization of the annual reproductive cycle in adult female Pacific halibut") proposes to study the annual reproductive cycle of Pacific halibut females in order to further our understanding of sexual maturation in this species and to improve maturity assessments and maturity-at-age estimates. Project 650.21 ("Investigation of halibut dispersal on Bowers Ridge via Pop-up Archival Transmitting (PAT) tags") proposes to study the migratory behavior of females prior to the spawning season in order to identify potential spawning areas in Regulatory Area 4B. Project 675.11 ("Tail pattern recognition analysis in Pacific halibut") is a pilot study that proposes to identify individual fish by ways of photographic recognition of tail patterns to complement migratory studies. Project 672.12 ("Condition Factors for Tagged U32 Fish") proposes to

study the relationship between the physiological condition of fish and migratory performance as assessed by tagging in U32 fish in order to better understand the potential use of quantitative physiological indicators in predicting migratory (as well as other types of) performance. Project 673.14 ("Identification and validation of markers for growth in Pacific halibut") proposes to identify and validate molecular and biochemical profiles that are characteristic of specific growth patterns and that will be instrumental to describe different growth trajectories in the Pacific halibut population and evaluate potential effects of environmental influences on growth. Project 672.13 ("Discard mortality rates and injury classification profile by release method") proposes to study the relationship between hook release methods in the longline fishery and associated injuries with the physiological condition of fish in order to improve our understanding of factors influencing post-release survival in the directed fishery. Project 673.13 ("Sequencing of the Pacific halibut genome") proposes 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 in other projects.

Furthermore, eight continuing research projects will be conducted, including two projects dealing with sex identification (621.15, 621.16), two projects monitoring the Pacific halibut population for mercury and *Ichthyophonus* contamination (642.00, 661.11), three projects continuing migration-related research with the use of wire and satellite tagging (650.18, 650.20, 670.11) and one project finalizing work conducted on the reevaluation of the weight-length relationship (669.11) ([Appendix I](#)).

In addition to the new and continuing research projects that are being implemented during 2017, five research projects have been submitted for external funding ([Appendix II](#)). One project (Project 1) was submitted to the Saltonstall-Kennedy Competitive Research Program on the topic of discard mortality rates of Pacific halibut in the directed and non-directed longline fisheries and is still under evaluation. Two projects were submitted to the North Pacific Research Board, one on the topic of factors driving somatic growth involved in the decline in size-at-age in Pacific halibut (Project 2) and another project on the topic of Pacific halibut larval connectivity between the Gulf of Alaska and the Bering Sea (Project 3). Project 2 has been awarded but Project 3 has been rejected. A fourth project was submitted to the Essential Fish Habitat Research Implementation Plan for Alaska (NOAA) on the topic of growth performance indicators for juvenile Pacific halibut in nursery habitats (Project 4) and is still under evaluation. Finally, a fifth proposal was submitted to the Washington-Sea Grant Program on the topic of early life history characteristics in Pacific halibut related to larval sex acquisition and swimming capabilities (Project 5) but it was recently rejected.

Finally, the new proposed Five-Year Research Plan for the period 2017-21 includes extensive studies covering five major research areas:

- 1) Reproduction (i.e. sex identification, maturity estimates),
- 2) Growth (i.e. decrease in size-at-age, temperature effects),
- 3) Discard mortality rates (i.e. physiological condition and survival post-release of bycatch),
- 4) Migration (i.e. larval dispersal, adult and reproductive migrations) and
- 5) Genetics and Genomics (i.e. genetic population structure, genome characterization).

These studies are intended to provide information on factors that influence the biomass of the Pacific halibut population (e.g. distribution and movement of fish among regulatory areas, growth patterns and environmental influences on growth in larval, juvenile and adult fish, drivers of changes in size-at-age)

and, specifically, of the spawning (female) population (e.g. reproductive maturity, skipped spawning, reproductive migrations) and resulting changes in population dynamics. Furthermore, these studies are also intended to provide information on the survival of bycatch and wastage fish and eventually refine current estimates of discard mortality rates. An overarching objective of the Five-Year Research Plan is to promote integration and synergies among the various research activities led by IPHC in order to significantly improve our knowledge of key biological inputs that are introduced into the stock assessment ([Appendix III](#)).

APPENDICES

[Appendix I](#): List of new and continuing research projects proposed for 2017

[Appendix II](#): List of research projects submitted for external funding

[Appendix III](#): Summary diagram of IPHC research projects for 2017, their interactions and their relationship to the major research areas identified in the 5-year research program.

APPENDIX I

Summary of research projects to be conducted in 2017

Project #	Project Name	Priority	Budget (US\$)	Principal Investigator	Management implications
<i>New Projects</i>					
674.11	Full characterization of the annual reproductive cycle	High	91,098	Planas	Maturity assessment
650.21	Investigation of Pacific halibut dispersal on Bowers Ridge	High-Medium	124,527	Loher	Spawning areas
675.11	Tail pattern recognition analysis in Pacific halibut	High	2,370	Dykstra	Adult distribution
672.12	Condition Factors for Tagged U32 Fish	High	13,000	Dykstra	DMR estimates
673.14	Identification and validation of markers for growth	High	27,900	Planas	Changes in biomass/size-at-age
672.13	Discard mortality rates and injury classification profile by release method	High-Medium	16,123	Dykstra	DMR estimates
673.13	Sequencing the Pacific halibut genome	High	22,500	Planas	Population estimate
<i>Continuing Projects</i>					
621.15	Voluntary at-sea sex marking	High	18,120	Loher	Stock spawning biomass
621.16	Development of genetic sexing techniques	High	146,107	Loher	Sex composition of catch
642.00	Assessment of Mercury and other contaminants	Medium	8,400	Dykstra	Environmental effects
650.18	Archival tags: tag attachment protocols	High	2,800	Loher	Adult distribution
650.20	Investigation of Pacific halibut dispersal on the 4D Edge	High	5,500	Loher	Spawning areas
661.11	<i>Ichthyophonous</i> Incidence Monitoring	Medium	8,055	Dykstra	Environmental effects
669.11	At-sea Collection of Pacific Halibut Weight to Reevaluate Conversion Factors	High	1,500	Soderlund	Length-weight relationship
670.11	Wire tagging of Pacific halibut on NMFS trawl and setline surveys	High	12,000	Forsberg	Juvenile and adult distribution
	Total - New Projects		297,518		
	Total - Continuing Projects		202,482		
	Overall Total (all projects)		500,000		

APPENDIX II

List of research projects submitted for external funding for 2017

Project #	Grant agency	Project name	Partners	IPHC Budget (US\$)	PI	Management implications	Submission status
1	S-K NOAA	Improving discard mortality rate estimates in the Pacific halibut by integrating handling practices, physiological condition and post-release survival	Alaska Pacific University	223,220	Planas (lead PI) Dykstra Loher Stewart Hicks	Bycatch estimates	Under evaluation
2	NPRB	Somatic growth processes in the Pacific halibut (<i>Hippoglossus stenolepis</i>) and their response to temperature, density and stress manipulation effects	AFSC-NOAA-Newport	122,264	Planas (lead PI)	Changes in biomass/size-at-age	Awarded
3	NPRB	Larval transport, supply, and connectivity of Pacific halibut between the Gulf of Alaska and the Bering Sea	AFSC-NOAA-Seattle UAF	8,000	Sadorus Planas Stewart	Biomass distribution	Rejected
4	EPH NOAA	Validating biochemical markers of growth for habitat assessment in flatfishes	AFSC-NOAA-Newport	35,000	Planas	Changes in biomass/recruitment	Under evaluation
5	WA-Sea Grant	Understanding critical early life history events in the Pacific halibut and implications for its fishery	University of WA, NWFS-NOAA	121,840	Planas (lead PI) Sadorus Loher	Larval distribution/ population sex ratios	Rejected
Total requested (\$)				510,724			

APPENDIX III

Summary diagram of IPHC research projects for 2017

