

Ongoing AFSC Research related to Pacific Halibut

- *International Pacific Halibut Commission Data Exchange*: The AFSC contracts with the IPHC to collect and edit sablefish logbook data, use IPHC survey data in some AFSC stock assessments, provide the IPHC with data from the AFSC's annual longline survey, and regularly communicate with IPHC assessment scientists on methodology based on the similarity of the sablefish and halibut fisheries. The AFSC has worked with the IPHC to collect halibut food habits data since 1990; the IPHC has provided the AFSC with a research permit to collect 500-1000 stomachs annually during groundfish surveys, and the resulting data are used by both agencies. **Collaboration with IPHC**
- *Scientific Review and Support to the IPHC from AFSC Scientists*: The AFSC provides the Science Advisor to the Halibut Commission. The Advisor provides science research oversight and reviews all the documents submitted for publication by the Commission. The AFSC provides other scientific expertise to the Halibut Commission on a as need basis. Examples are observer sampling issues, surveys issues, advisor on the ad-hoc Scientific Review Board, and serving as an external member of the hiring committee to hire a new lead scientist for the IPHC. **Collaboration with IPHC**
- *Fish Ageing*: The AFSC is working with IPHC staff on developing a new bomb-radiocarbon reference chronology in the Bering Sea and evaluating halibut age determination bias. Historically collected otoliths from early IPHC longline surveys are being used, as well as and using bomb-radiocarbon assays to evaluate ageing bias of other species. **Collaboration with IPHC**
- *Halibut Discard Mortality Rates*: The AFSC is working with the trawl Industry to develop an EFP to test the efficacy of on-deck sorting and discard of halibut in real time to decrease time out-of-water reduce discard mortality rates. A camera chute system and flow scale will be used to image, count, length and/or weigh each individual fish prior to discard with information transmitted in real time.
- *Improving Halibut Estimates*: The AFSC is conducting electronic monitoring (EM) with the NPFMC EM work group and the IPHC to evaluate the efficacy of EM systems to deliver scientific data that can be used to estimate halibut and groundfish discard in the small-vessel fixed gear IFQ fleet. **Collaboration with IPHC**
- *Halibut visual impairment*: The AFSC is currently using electro-physiological and behavioral techniques to study recovery from light-induced visual impairment of Pacific halibut.
- *Socioeconomics of quota leasing market*: Under the Halibut Catch Sharing Plan (CSP) that formalizes the process of allocating catch between the commercial and charter sectors, there is now an allowance for leasing commercial halibut quota by eligible charter businesses to relax harvest restrictions for their angler clients. A survey developed by the AFSC will be fielded in 2015, collecting data from the eligible participants in this market to determine their attitudes towards, and behavior in, the lease market and attitudes and preferences towards alternative programs.
- *Socioeconomics of charter boat fisheries*: The AFSC is conducting an ongoing survey of anglers who utilize the for-hire charter boat recreational fishing sector in Alaska that is being subjected to new bag/possession and halibut size limits. The goal is to provide insights into how economic values for charter boat fishing trips are affected by these regulations.
- *Impacts of active participation measures*: The AFSC is assessing the impacts of active participation measures in the Alaskan halibut and sablefish individual fishing quota (IFQ) program, including a prohibition on IFQ leasing, limitations on the acquisition of quota shares by non-individual entities (corporations, partnerships, etc.), and restrictions on the use of hired skippers.
- *Targeting behavior*: A study is underway to examine how vessels in the Amendment 80 (A80) fishery develop different targeting strategies to attempt to maximize revenue from target species while not exceeding halibut prohibited species catch (PSC) limits. This modeling work is a pilot project that will contribute to the spatial economics toolbox for fisheries (FishSET).

- *Efficacy of Halibut Excluders*: The AFSC is currently working with the pollock fleet in the Bering Sea to examine the efficacy of a new halibut excluder design made by Greenline Fishing Gear.
- *Flatfish Settlement Success*: An NPRB project predicting settlement success of two slope-spawning flatfish (halibut and Greenland turbot) in the eastern Bering Sea is underway. Collaboration with Oregon State University.
- *Bioenergetics and Ecosystem Modeling*: An NPRB project is underway to study fishery, climate, and ecological effects on halibut Size-at-age. Including diet analyses and bioenergetics modeling. **IPHC collaboration.**
- *Fishery Technical Interactions*: The AFSC is developing a management strategy evaluation with a multispecies groundfish fishery technical interactions model for the Bering Sea that includes halibut bycatch as a constraint in determining Annual Catch Limits for groundfish.
- *Spatial Connectivity*: The AFSC is studying the connectivity between spawning and nursery areas of halibut over the EBS slope and shelf.
- *Larval Transport*: The AFSC is investigating climate-mediated oceanographic variability of currents modulating transport of halibut larvae/juveniles over the Bering Sea shelf. **IPHC collaboration.**
- *Settlement and Recruitment*: The AFSC is studying factors influencing settling and age-0 recruitment success of halibut in the Bering Sea.

Previous AFSC Research Related to Pacific Halibut

- *Halibut excluder development*: The AFSC, IPHC, and industry developed video systems to observe fish (particularly halibut) behavior in trawls, starting in 1990. The AFSC documented behavior of halibut and target species encountering conventional and modified trawls, demonstrating differences both ahead of and within the net. Halibut excluders were developed through industry collaboration and are routinely used and improved in many trawl fisheries. **IPHC collaboration.**
- *On-deck measurements*: The AFSC cooperated with the Amendment 80 fleet to evaluate the efficacy of length-ing and imaging halibut on the deck of a factory trawler using a camera chute system.
- *Visual impairment of halibut*: The AFSC conducted a laboratory study of halibut recovery time after light-induced visual impairment, showing that bright light (such as on the deck of a boat on a sunny day) can impair halibut vision, potentially influencing survival of discards.
- *Sport Fishing Economics*: AFSC surveyed Alaska saltwater anglers in 2007 and 2012 and estimated (1) demand for and economic value of saltwater sport fishing trips for halibut, salmon, and other primary sport fish species, (2) the value of charter boat fishing trips targeting halibut under alternative harvest restrictions for halibut (e.g., bag/possession and size limits). Economic impacts associated with changes to angler harvest restrictions were estimated.
- *Economic Impacts of IFQs*: The AFSC and UC Davis researched the economic efficiency impacts resulting from features of the Alaskan halibut and sablefish individual fishing quota (IFQ) program, such as blocking and vessel class restrictions on quota share.
- *Charter Boat Economics*: AFSC conducted surveys of Alaska charter boat businesses to study the economics of the guided sport sector. Collected costs, earnings, and employment information were collected for the 2011-2013 fishing seasons. Population-level estimates for total costs, revenues, and employment were generated to provide information about the sector; firm-level modeling is expected to provide insights into how behavior may change under alternative management actions.
- *Catch share evaluation*: An extensive set of economic data tables on halibut was reported in the 2013 Economic SAFE. (Section 4, Tables 51-63); economic performance metrics for the halibut IFQ program were calculated and reported in the 2013 Economic SAFE (Section 7.2).

Future AFSC Research Related to Pacific Halibut (planned and/or pending funding availability): Additional IPHC Collaboration Opportunities

- *The AFSC plans to maintain data exchange collaborations with the IPHC in future years.*
- *Survey Improvements:* Collaborative work with the IPHC comprised of an extended IPHC survey in the Bering Sea connected to the AFSC trawl survey with the goal of improved density of IPHC survey stations and improved estimates of halibut catchability by size/age classes in our trawl survey.
- *Efficacy of Halibut Excluders:* The AFSC plans to work cooperatively with the pollock fleet to study the efficacy of currently used halibut excluder devices by using underwater video cameras to monitor the escape hole in the excluder device and to count the fish escaping in the video. This work is expected to occur in late January to March 2015, during A season for pollock. (Submitted to AFSC Cooperative Research RFP)
- *Scientific Review and Support to the IPHC from AFSC Scientists:* The AFSC provides the Science Advisor to the Halibut Commission. The Advisor provides science research oversight and reviews all the documents submitted for publication by the Commission. The AFSC provides other scientific expertise to the Halibut Commission on a as need basis. Examples are observer sampling issues, surveys issues, stock assessments, impacts of halibut interactions with groundfish resources and the environment.
- *Fishery Technical Interactions and Spatial Modeling:* Multi-species, spatial, technical interaction management strategy evaluation (MSE) to study potential impacts of alternative halibut management strategies on groundfish fisheries in the GOA and BSAI. (Funding source not identified).
- *Spatio-Temporal Overlap of halibut and other groundfish:* Conduct a study using generalized additive models (GAMs) to evaluate spatio-temporal overlap of halibut and other groundfish species in the GOA and BSAI. This information could be used to evaluate whether “rolling hot-spot closures” may have the potential to reduce halibut bycatch in groundfish trawl fisheries. (This work can be accomplished by the AFSC through internal prioritization of tasking.)
- *Bioenergetics and Multispecies/Ecosystem Modeling:* Add halibut to an existing multispecies statistical model for the Bering Sea, to examine the effects of halibut (including bycatch specifically) in a multispecies fishery. (Funding source not identified).
- *Local Environmental Conditions and Halibut Bycatch Rates:* Evaluate relationships between environmental conditions and rates of halibut bycatch in the groundfish fisheries. Purchase and initiate the use of miniature data loggers to measure temperature and salinity at depth on longline and trawl groundfish fishing vessels operating in the Gulf of Alaska and Bering Sea and Aleutian Islands areas. (Submitted to AFSC Cooperative Research RFP).
- *Sport Fishery Socioeconomic Survey:* The AFSC plans to regularly conduct the survey of Alaska saltwater anglers to collect updated information on saltwater angler demand and economic values of fishing trips under current harvest restrictions. Funds have been requested to enable the survey to be conducted during 2016-2017. (Submitted to NMFS S/T)
- *Charter Sector Socioeconomic Survey:* The AFSC has received funding from the NMFS Office of Science and Technology to continue collecting costs, earnings, and employment information from the saltwater guided (charter) sector. The survey is expected to be fielded during 2016 and 2017 to collect data for the 2015 and 2016 fishing seasons. These data will be used to evaluate the economic effects of the implementation of the CSP on the charter sector. (Funded by NMFS S/T)
- *Halibut Growth Hot-Spots in Alaska:* The AFSC will apply a recently developed bioenergetics model for Pacific Halibut (Holsman and Aydin in prep) to identify Pacific halibut growth hot-spots in AK.

Survey-based diet and temperature data for the GOA, AI, and EBS ecosystems will be used. (Funding source not identified).

- *Modeling Alaska Flatfish Recruitment-Environment Linkages*: A two-year modeling effort with IPHC, UW, and UMass Dartmouth collaboration that has been submitted to the Fisheries and the Environment (FATE) program is the use of simulation testing to explore methods for incorporating recruitment-environment linkages into flatfish assessment models to evaluate methods of selecting among models, and to use the models developed to conduct forecasts of flatfish populations under future climate scenarios. (Submitted to FATE). **IPHC Collaboration**
- *Ecopath Food Web Models*: The AFSC plans to conduct an impact analysis of changes in the multispecies groundfish fishery (using Ecopath food web models currently containing bycatch by fleet and gear). (Funding source not identified).
- *Genetic Population Structure of Halibut*: The AFSC proposes using a next-generation sequencing technique, Restriction site Associated DNA (RAD tags), to provide a genomic assessment of population structure of halibut. (submitted to FATE).
- *Halibut Stomach Analysis*: The AFSC plans to collect and analyze halibut stomachs (there is no set funding for this, as these stomachs have generally been a lower priority compared to our other key groundfish). (Funding source not identified).
- *Diet Analysis to Inform Trophic Models*: The AFSC would like to examine diets of larval Pacific halibut and other fish in the Bering Sea and Gulf of Alaska that can be used to refine trophic models of energy transfer in the most vulnerable stages of the population.
- *Economic Metrics for Halibut*: An extensive set of economic data tables and economic performance metrics for the halibut IFQ program will be reported in future Economic SAFEs.