

INTERNATIONAL PACIFIC



HALIBUT COMMISSION

# Development of the 2021 stock assessment

Agenda item 5

IPHC-2021-SRB018-06



# Outline

- 2021 updated stock assessment
- Software updates
- Commission and SRB requests
- Research planning integration
- 2021 prospectus



# 2021 Assessment

- 2019 – Full assessment, independent and SRB review. New information: commercial sex-ratio at age 2017-2018.
- 2020 – Update. New information: recreational sex-ratio at age, 2019 commercial sex-ratio at age.
- 2021: Update. New information: 2020 commercial sex-ratio at age.



# Stock synthesis version update

- Time-series extended based on 2021 projections
  - No changes to final 2020 models
- 3.30.15.09 → 3.30.16.02
  - No changes to any features used in the Pacific halibut models
    - Increased memory/disk usage
    - 22% increase in run times



# SRB requests

- SRB016
  - 1) Investigate logistic-normal for composition data
- SRB017
  - 2) Update data weighting
  - 3) Investigate simple logistic-normal without correlation structure
  - 4) Continue to evaluate stock synthesis for use as the primary IPHC assessment framework



# Logistic-normal

- The primary issues are:
  - Iteratively tuning the multinomial is inefficient and does not propagate the variance associated with the effective sample size.
  - The Dirichlet-multinomial has several previously identified shortcomings:
    - Increased weighting of small samples (method not scale independent)
    - Nominal sample sizes occur at a parameter bound
    - Standardized residuals inconsistent with likelihood assumption
  - Neither likelihood has the ability to allow for correlations among bins



# Logistic-normal

- Francis (2014) developed a compelling basis for the logistic-normal
- Previously, we identified a number of potential benefits
- However, scaling of the likelihood based on the nominal (maximum) sample size as a ‘minimum variance’ was not considered



# Logistic-normal

- Estimating (iteration or otherwise) requires a ‘minimum variance’, generally accepted to be proportional to the number of samples (not individual fish)
- Without this, process error can be increased and observation error decreased with unstable results
- The logistic-normal does not have a logical minimum bound





# Compositional likelihoods

Likelihood property	Multinomial	Dirichlet-multinomial	Logistic-normal
Self-weighting (no iteration)	No	Yes	Yes
Includes correlations among ages	No	No	Possibly
Includes annual sample size variation	Yes	Yes	Yes
Maintains relative sample sizes (scale independent)	Yes	No	Yes
Allows for zeros	Yes	Yes	No
Provides internally consistent residuals	Yes	No	Unknown
Includes nominal maximum sample size	Yes	Yes	No
Currently available in stock synthesis	Yes	Yes	No



# Logistic normal

- Mapping a minimum bound to sigma will create the same estimation issue as in the Dirichlet
- Priors have been used to allow estimation in this case, but is this a good idea?
- Further investigation, perhaps via a student project seems warranted



# Data weighting

- 2019 External review recommended updating the data weighting each year and tracking the degree of change
- Preliminary retrospective in 2019 indicated this was a good idea to keep weighting consistent with model fit as data are updated
- Completed again for 2020



# Data weighting

	2019 Assessment	2020 Assessment	Change from 2019
<b>Coastwide short</b>			
Directed commercial fishery	38	43	5
Directed discards <sup>1</sup>	9	9	0
Non-directed discards <sup>1</sup>	5	5	0
Recreational <sup>1</sup>	5	5	0
FISS	263	264	1
<b>Coastwide long</b>			
Directed commercial fishery	136	140	4
Directed discards <sup>1</sup>	6	6	0
Non-directed discards <sup>1</sup>	2.5	2.5	0
Recreational <sup>1</sup>	2.5	2.5	0
FISS	65	63	-2



# Data weighting

	2019 Assessment	2020 Assessment	Change from 2019
<b>AAF short</b>			
Region 2 directed commercial fishery <sup>2</sup>	538	531	-7
Region 3 directed commercial fishery <sup>2</sup>	278	273	-5
Region 4 directed commercial fishery <sup>2</sup>	26	24	-2
Region 4B directed commercial fishery <sup>2</sup>	22	22	0
Directed discards <sup>1</sup>	6	6	0
Non-directed discards <sup>1</sup>	5	5	0
Recreational <sup>1</sup>	5	5	0
Region 2 FISS	7	10	3
Region 3 FISS	22	18	-4
Region 4 FISS	88	83	-5
Region 4B FISS	42	43	1
<b>AAF long</b>			
Region 2 directed commercial fishery <sup>2</sup>	271	272	1
Region 3 directed commercial fishery <sup>2</sup>	167	166	-1
Region 4 directed commercial fishery <sup>2</sup>	30	29	-1
Region 4B directed commercial fishery <sup>2</sup>	22	22	0
Directed discards <sup>1</sup>	6	6	0
Non-directed discards <sup>1</sup>	2.5	2.5	0
Recreational <sup>1,3</sup>	5	7.5	2.5
Region 2 FISS	8	6	-2
Region 3 FISS	15	8	-7
Region 4 FISS	97	86	-11
Region 4B FISS	54	54	0



# Assessment platform

- Ease of use/review vs. custom features
- Stock synthesis code now publicly available



# Assessment platform

- MSE, assessment and MP all important to the choice of platform
  - Operating models may refine assessment needs
  - Assessment frequency/timing informs complexity of analyses
  - Type of MP (annual, survey-based or multi-year) will dictate the role of the assessment models
- Tactical assessment must remain focused on the specific management needs
- Upcoming decisions on the IPHC's MP will inform the needs and assessment approach



# Research planning

- Following SRB guidance, assessment priorities are integrated with the 5-year research plan
- Deliverables are identified
- Specific description of the importance and use of these deliverables is included in both the assessment update and the research documents
- Separate (but overlapping) with MSE priorities





# Research planning

- Three general categories:
  - Data collection and processing
  - Biological inputs
  - Fishery yield



# Data collection and processing

- Commercial fishery sex-ratios: recent and historical
- Whale depredation accounting and avoidance tools



# Biological inputs

- Maturity, skip-spawning, fecundity
- Stock structure – IPHC Regulatory Area 4B
- Basic understanding of meta-population dynamics
  - Larvae, juveniles, adults



# Fishery yield

- Biological interactions with fishing gear (mechanisms of discard mortality)
- Guidelines for reducing discard mortality

Both of these have the dual goals of increasing retained yield and decreasing uncertainty/potential for bias.



# 2021 Prospectus

- Excellent FISS coverage
- Fisheries likely to more closely achieve limits than in 2020



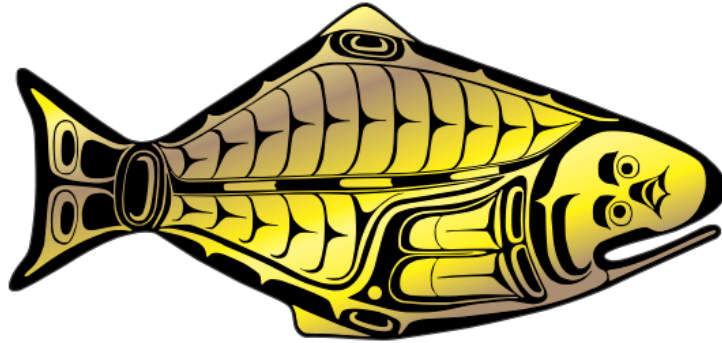
# Recommendations

That the SRB:

- **NOTE** paper IPHC-2021-SRB018-06 which provides a response to requests from SRB016 and SRB017, and an update on model development for 2021.
- **REQUEST** any further analyses to be provided at SRB019, September 2021.



**INTERNATIONAL PACIFIC**



**HALIBUT COMMISSION**

