

NOAA FISHERIES

Alaska Fisheries Science Center

Use of posterior predictive intervals in complex statistical agestructured assessment models

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https://apps-afsc.fisheries.noaa.gov/Plan_Team/2021/EBSPollock.pdf

Diagnostics

- $\circ~$ Some data preview
- Visual diagnostics

Survey work



170°W





170°W



170°W

Recent bottom trawl surveys





2021 survey catch rate difference from mean



2021 survey catch rate difference from mean



2021 survey catch rate difference from mean

Age composition

• From NOAA's bottom-trawl survey





990

Vertical scale is relative to survey population estimate

Age composition

From NOAA's bottom-trawl survey





Vertical scale is relative to survey population estimate



- Opportunistic acoustic data
- Can show young fish abundance off bottom

Acoustic data

Opportunistically collected from chartered bottomtrawl survey boats The AVO index

-180 -175 -170 -165 -16080 -175 -170 -165 -16

-175 -170 -165

Acoustic data

Model details

- Tuning indices
 - Acoustic Trawl survey (even years)
 - Annual fixed-station bottom trawl survey
 - Acoustic vessel of opportunity (AVO index)
 - Foreign trawler CPUE (in 1970s)
- Fishery data
 - Total catch
 - Catch-at-age
 - Mean fishery weights-at-age

Model details

- $\circ~$ Age specific schedules
 - Natural mortality
 - Maturity
- \circ Other
 - Conditioned on catch biomass (F's estimated)
 - Selectivity varies in fishery
 - Slightly in surveys
 - Ricker
 - Projection options built in to evaluate policy trade offs
- \circ Complicated?
 - Multiple random-effects models used to process available data

New data impact on model

Data considerations									
Name	Updated catch to 2021	2020 fishery age data	Bottom trawl survey	Acoustic from Bottom trawl transits (AVO)					
Fishery	Х	Х							
+ BTS	Х	Х	Х						
+ AVO	Х	Х	Х	Х					

Fit to survey age compositions

Biomass trend

Subsample of posterior (from MCMC)

Yellow is the model "predictions" from the posterior

Grey are "simulated" data from posterior (using obs variance)

Black dots are actual obervations

Steps as part of ACLIM project

Model selection and prediction of new data?

What things affect FMSY?

	fishery		index		model	
1980						
		0.17 0.24 0.26 0.23 0.18 0.26 0.29	0.35 0.43 0.67 1.02 0.36 0.49 0.58 0.72 0.36 0.48 0.62 0.76 0.4 0.49 0.62 0.77 0.36 0.44 0.62 0.77 0.36 0.46 0.64 0.72 0.35 0.43 0.52 0.7 0.35 0.44 0.52 0.62	1.13 1.2 1.38 1.07 1.12 1.01 1.02 1.21 1.4 0.9 1.41 1.11 0.84 1 1.28 0.79 0.88 0.98 0.75 0.85 0.99 0.66 0.92 0.92	0.35 0.45 0.59 0.68 1.07 1.11 1.45 0.39 0.47 0.57 0.71 0.79 1.18 1.22 0.44 0.53 0.62 0.72 0.85 0.93 1.32 0.46 0.55 0.65 0.73 0.83 0.96 1.04 0.38 0.53 0.63 0.72 0.8 0.9 1.03 0.42 0.47 0.62 0.72 0.81 0.89 0.97 0.39 0.51 0.55 0.7 0.81 0.89 0.98 0.39 0.51 0.55 0.7 0.81 0.89 0.97	1.57 1.55 1.34 1.41 1.1 1.1 1.06
1990	0.29 0.48 0.6 0.73 0.84 0.87 0.39 0.46 0.65 0.7 0.81 0.98 0.5 0.61 0.65 0.7 0.81 0.98 0.46 0.65 0.7 0.81 0.98 0.41 0.65 0.73 0.71 1.06 0.38 0.5 0.74 0.84 0.86 0.99 0.32 0.43 0.68 0.79 0.95 0.95 0.32 0.47 0.56 0.75 0.89 1.07	0.17 7 1.01 1.13 0.16 8 1.03 1.21 0.29 1.21 1.23 0.31 1.39 1.35 0.22 1.22 1.31 0.14 5 1.02 1.1 0.14 5 1.09 1.24 0.23 1.47 0.5	0.38 0.44 0.52 0.62 0.38 0.5 0.57 0.61 0.35 0.49 0.58 0.69 0.38 0.51 0.62 0.77 0.45 0.5 0.55 0.66 0.47 0.57 0.63 0.71 0.38 0.49 0.63 0.71 0.38 0.49 0.63 0.65 0.32 0.5 0.59 0.73 0.34 0.44 0.54 0.69	0.00 0.32 0.32 0.72 0.78 1.04 0.74 0.87 0.91 0.83 0.89 0.98 0.79 0.98 1.03 0.97 1.16 1.12 0.8 0.93 1.16 0.81 0.97 1.06 0.79 0.97 1.02	0.35 0.47 0.39 0.64 0.79 0.89 0.87 0.29 0.46 0.61 0.73 0.78 0.92 1.01 0.28 0.4 0.58 0.72 0.84 0.89 1.02 0.4 0.43 0.57 0.74 0.89 1 1.04 0.48 0.61 0.75 0.74 0.89 1 1.04 0.48 0.61 0.65 0.79 0.96 1.1 1.2 0.4 0.6 0.74 0.78 0.91 1.08 1.21 0.4 0.6 0.74 0.78 0.91 1.08 1.21 0.32 0.49 0.7 0.84 0.88 1 1.17 0.37 0.41 0.59 0.8 0.93 0.97 1.08 0.44 0.48 0.53 0.71 0.92 1.05 1.08	1.04 1.08 1.11 1.16 1.22 1.3 1.29 1.25 1.2 A pomply
0002 کوھر	0.37 0.39 0.63 0.62 0.78 1.03 0.4 0.51 0.64 0.7 0.73 0.89 0.35 0.53 0.63 0.73 0.78 0.81 0.33 0.5 0.67 0.79 0.96 0.99 0.39 0.51 0.67 0.79 0.91 1.03 0.49 0.55 0.65 0.77 0.86 0.95 0.41 0.55 0.65 0.77 0.86 0.92 0.35 0.51 0.64 0.76 0.89 0.92 0.35 0.51 0.64 0.76 0.89 0.92 0.35 0.51 0.64 0.76 0.89 0.92 0.35 0.51 0.64 0.76 0.89 0.92 0.35 0.51 0.64 0.78 0.96 1.1	1.17 1.25 0.18 1.04 1.25 0.21 0.97 1.01 0.23 1.06 1.12 0.17 3 1.1 1.09 0.25 5 1.08 1.2 0.33 1.06 1.12 0.17 5 1.08 1.2 0.33 5 1.06 1.1 0.22 5 1.06 1.1 0.22 5 1.06 1.1 0.22 1.06 1.12 0.23	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	0.81 0.9 0.97 0.77 0.97 1 0.71 0.78 0.95 0.77 0.85 0.91 0.8 0.89 0.92 0.84 0.89 0.96 0.79 0.94 0.95 0.8 0.87 0.91 0.81 0.91 1.04 0.84 0.92 1.08	0.4 0.53 0.58 0.64 0.68 0.73 0.91 1.1 0.38 0.5 0.64 0.68 0.73 0.91 1.1 0.38 0.5 0.61 0.75 0.79 0.92 0.95 0.93 0.42 0.54 0.66 0.77 0.92 0.95 0.93 0.43 0.54 0.66 0.79 0.92 0.95 0.99 0.43 0.54 0.66 0.79 0.9 1.01 1.13 0.45 0.53 0.65 0.77 0.9 1.01 1.13 0.45 0.53 0.65 0.76 0.88 1 1.11 0.32 0.47 0.66 0.75 0.86 0.98 1.1 0.32 0.47 0.66 0.75 0.86 0.98 1.11 0.33 0.55 0.64 0.75 0.86 0.97 1.06	1.16 Anomaly 1.22 0.4 1.09 0.2 1.15 0.2 1.15 0.0 1.15 0.0 1.15 0.2 1.19 0.0 1.19 0.2 1.19 0.2 1.19 0.2
2010	0.33 0.52 0.65 0.77 0.9 1.05 0.34 0.53 0.7 0.88 1 1.13 0.38 0.49 0.66 0.92 1.12 1.26 0.29 0.51 0.67 0.81 0.98 1.22 0.27 0.41 0.64 0.82 0.97 1.17 0.29 0.44 0.56 0.78 1.13 1.28 0.32 0.45 0.62 0.76 0.89 1.15 0.4 0.56 0.78 1.13 1.28 0.32 0.45 0.62 0.79 0.89 0.41 0.53 0.56 0.65 0.73 0.8 0.41 0.53 0.56 0.65 0.73 0.8 0.44 0.57 0.65 0.69 0.75 0.83 0.44 0.57 0.65 0.79 0.83 0.44 0.57 0.83	5 1.12 1.28 0.23 3 1.4 1.49 0.22 5 1.37 1.59 0.24 1.37 1.52 0.23 1.31 1.52 0.22 5 1.31 1.52 0.22 5 1.31 1.52 0.22 5 1.31 1.37 0.22 1.31 1.37 0.22 1.31 1.37 0.22 1.31 1.37 0.22 0.94 1.04 0.23 0.94 0.04 0.23 0.94 0.95 0.91	0.41 0.52 0.64 0.76 0.41 0.55 0.68 0.84 0.4 0.54 0.68 0.9 0.42 0.55 0.65 0.8 0.36 0.53 0.67 0.81 0.42 0.49 0.62 0.83 0.36 0.48 0.6 0.60 0.39 0.52 0.6 0.72 0.44 0.51 0.61 0.7 0.44 0.51 0.61 0.7	0.86 0.92 1.07 0.91 0.96 1.17 0.98 1.02 1.11 1 1.15 1 0.95 1.21 1.23 0.98 1.09 1.22 0.89 0.98 1.12 0.81 1.05 1.08 0.78 0.84 0.93 0.74 0.82 0.83	0.24 0.46 0.64 0.78 0.94 1.11 1.15 0.34 0.51 0.74 0.92 1.06 1.2 1.36 0.3 0.51 0.74 0.92 1.06 1.2 1.36 0.3 0.51 0.69 0.92 1.1 1.23 1.36 0.27 0.45 0.66 0.84 1.07 1.24 1.37 0.31 0.42 0.6 0.82 0.99 1.22 1.36 0.37 0.47 0.58 0.77 0.98 1.15 1.37 0.45 0.62 0.73 0.91 1.12 1.28 0.37 0.49 0.55 0.66 0.77 0.95 1.16 0.44 0.49 0.55 0.66 0.77 0.95 1.16 0.39 0.53 0.58 0.64 0.75 0.86 1.04 0.39 0.53 0.58 0.64 0.75 0.85 0.95 </td <td>1.28 1.42 1.52 1.49 1.49 1.52 1.49 1.52 1.49 1.32 1.23 1.13</td>	1.28 1.42 1.52 1.49 1.49 1.52 1.49 1.52 1.49 1.32 1.23 1.13
2020	0.38 0.47 0.57 0.73 0.81 0.83 0.42 0.57 0.64 0.76 0.88 0.96 0.39 0.52 0.64 0.72 0.8 0.95	6 1.01 1.06 0.23 5 1 1.06 0.21 0.21	0.37 0.59 0.61 0.7 0.43 0.54 0.63 0.71 0.37 0.49 0.61 0.7	0.79 0.84 0.93 0.77 0.89 1.03	0.30 0.47 0.58 0.72 0.77 0.83 0.93 0.4 0.55 0.64 0.76 0.89 0.94 0.95 0.36 0.53 0.69 0.78 0.89 1.02 1.06 0.36 0.55 0.67 0.83 0.91 1.02 1.05 0.36 0.5 0.67 0.83 0.91 1.02 1.15 0.36 0.5 0.63 0.8 0.96 1.04 1.14 0.36 0.5 0.63 0.77 0.94 1.09 1.17	1.08 1.08 1.1 1.18 1.26 1.26
	4 6 8	10	4 6 Age	8 10	4 6 8	10

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Contributions

- $\circ~$ Argued some aspects of complexity
- Demonstrated some graphical diagnostics
- $\circ~$ Offered next steps towards using these approaches for model selection

