EAFM Summer Flounder Recreational Discards MSE

Performance Metrics

June 2022

"Final" performance metrics that have been updated to reflect input from core stakeholder group following workshop #4 on May 2-3, 2022, and then some additional clarification and attempt at notation based from modeling group input and subsequent interpretation.

most quantities are calculated as:

$$\mathbf{X_{s,m}} = \mathbf{median}\left(X_{s,m,i=1}, X_{s,m,i=2}, \ldots, X_{s,m,i=100}\right)$$

$$X_{s,m,i} = \frac{1}{10}\sum_{2036}^{2045} X'_{s,m,i,t}$$

i.e. the median (over simulations) average annual value for a quantity,

also

$$X_{s,m,i} = \frac{1}{10}\sum_{2036}^{2045} \mathrm{if}(X'_{s,m,i,t} = Z_X, 1, 0)$$

where Z_{X} is some threshold or condition associated with metric X. In this case, the metric is the median (over simulations) number of years in which a quantity is true.

Management Objective 1: Improve the quality of the angler experience

1. Percent of trips taken where the number of kept fish is greater than or equal to one.

$$X'_{s,m,i,t} = \frac{1}{N^T_{s,m,i,t}} \sum_{j=1}^{N^T_{s,m,i,t}} \mathrm{if}(N^{keep}_{s,m,i,t,j} \geq 1, 1, 0)$$

2. Relative change in average annual numbers of kept fish per trip compared to that in management alternative 1.

$$X_{s,m,i} = \frac{\frac{1}{10}\sum_{2036}^{2045} X'_{s,m,i,t}}{\frac{1}{10}\sum_{2036}^{2045} X'_{s,1,i,t}}$$

$$X'_{s,m,i,t} = \frac{\sum(N^{keep}_{s,m,i,t})}{N^T_{s,m,i,t}}$$

3. Expected change in consumer surplus from 2019 expectation per trip

$$X'_{s,m,i,t} = \frac{\sum(\Delta CS_{s,m,i,t})}{N^{T}_{s,m,i,t}}$$

4. Proportion/number of fish caught greater than 28 inches

$$X'_{s,m,i,t} = \frac{\sum(N^{keep}_{s,m,i,t,l=28+})}{\sum(N^{keep}_{s,m,i,t})}$$

Management Objective 2: Maximize the equity of anglers' experience

5. Ability to retain a fish (metric option 1).

a. Relative change in the proportion of trips in each state that catch at least one fish compared to the baseline (status quo management alternative) for that state. (state subscripts not shown)

$$X_{s,m,i} = \frac{\frac{1}{10}\sum_{2036}^{2045} X'_{s,m,i,t}}{\frac{1}{10}\sum_{2036}^{2045} X'_{s,1,i,t}}$$

$$X'_{s,m,i,t} = \frac{1}{N^{T}_{s,m,i,t}} \sum_{j=1}^{N^{T}_{s,m,i,t}} \text{if}(N^{keep}_{s,m,i,t,j} \geq 1, 1, 0)$$

6. Ability to retain a fish (metric option 2).

a. Range (over states) in the proportion of trips in each state that catch at least one fish compared to the baseline (status quo management alternative) range over states.

$$X_{s,m,i} = \frac{\max_{state}(5_{s,m,i}) - \min_{state}(5_{s,m,i})}{\max_{state}(5_{s,1,i}) - \min_{state}(5_{s,1,i})}$$

7. Retention rate (metric option 1).

a. Relative change in the proportion kept:(kept+released) fish in each state compared to the baseline (status quo management alternative) for that state. (state subscript not shown)

$$X_{s,m,i} = \frac{\frac{1}{10}\sum_{2036}^{2045} X'_{s,m,i,t}}{\frac{1}{10}\sum_{2036}^{2045} X'_{s,1,i,t}}$$

$$X'_{s,m,i,t} = \frac{1}{N^{keep}_{s,m,i,t}} N^{keep}_{s,m,i,t} + N^{release}_{s,m,i,t}$$

8. Retention rate (metric option 2).

a. Range (over states) in the proportion kept:(kept+released) fish in each state compared to the baseline (status quo management alternative) range over states.

$$X_{s,m,i} = \frac{\max_{state}(7_{s,m,i}) - \min_{state}(7_{s,m,i})}{\max_{state}(7_{s,1,i}) - \min_{state}(7_{s,1,i})}$$

There are other quantities we might be interested in (here for the relative changes, the range could also work):

1. *relative change in the proportion of trips in each state that catch at least one fish compared to the calibrated baseline (2019) for that state.*
2. *relative change in the proportion of trips in each state that catch at least one fish compared to the annual coastwide value under that management alternative*
3. *relative change in the proportion of trips in each state that catch at least one fish compared to the calibrated (2019) coastwide value under that management alternative*
4. *relative change in the proportion kept:(kept+released) fish in each state compared to the calibrated baseline (2019) for that state.*
5. *relative change in the proportion kept:(kept+released) fish in each state compared to the annual coastwide value under that management alternative*
6. *relative change in the proportion kept:(kept+released) fish in each state compared to the calibrated (2019) coastwide value under that management alternative*

Management Objective 3: Maximize stock sustainability

9. Proportion of years where SSB is less than 0.5 BMSY.

$$X_{s,m,i} = \frac{1}{10}\sum_{2036}^{2045} \text{if}(SSB_{s,m,i,t} < 0.5BMSY_{s,m,i,t}, 1, 0)$$

10. Proportion of years where F is greater than FMSY.

$$X_{s,m,i} = \frac{1}{10}\sum_{2036}^{2045} \text{if}(F_{s,m,i,t} > FMSY_{s,m,i,t}, 1, 0)$$

11. Relative change in average annual SSB compared to the average annual SSB under management alternative 1/status quo.

$$X_{s,m,i} = \frac{\frac{1}{10}\sum_{2036}^{2045} SSB_{s,m,i,t}}{\frac{1}{10}\sum_{2036}^{2045} SSB_{s,1,i,t}}$$

12. Relative change in average annual numbers of released fish per trip compared to that in management alternative 1/status quo, calculated for each state and region (state/region subscripts not shown)

$$X_{s,m,i} = \frac{\frac{1}{10}\sum_{2036}^{2045} X'_{s,m,i,t}}{\frac{1}{10}\sum_{2036}^{2045} X'_{s,1,i,t}}$$

$$X'_{s,m,i,t} = \frac{\sum(N^{release}_{s,m,i,t})}{N^{T}_{s,m,i,t}}$$

13. Relative change in average annual biomass of removals (retained and dead discard) compared to that in management alternative 1/status quo

$$X_{s,m,i} = \frac{\frac{1}{10}\sum_{2036}^{2045} X'_{s,m,i,t}}{\frac{1}{10}\sum_{2036}^{2045} X'_{s,1,i,t}}$$

$$X'_{s,m,i,t} = B^{keep}_{s,m,i,t} + B^{deaddiscard}_{s,m,i,t}$$

14. Proportion by numbers of the recreational removals (retained and dead discards) that are made up of female fish.

$$X'_{s,m,i,t} = \frac{C^{female}_{s,m,i,t}}{C^{female}_{s,m,i,t} + C^{male}_{s,m,i,t}}$$

where \$C_{s,m,i,t}^{female}\$ is the recreational removals (catch) in numbers for females.

Management Objective 4: Maximize the socio-economic sustainability of fishery

15. Relative change in the average annual number of trips compared to management alternative 1/status quo, for each state and region (state and region subscripts not shown).

$$X_{s,m,i} = \frac{\frac{1}{10}\sum_{2036}^{2045} N^{T}_{s,m,i,t}}{\frac{1}{10}\sum_{2036}^{2045} N^{T}_{s,1,i,t}}$$

16. Average annual change in consumer surplus compared to 2019 expectation, for each state and region (state and region subscripts not shown).

$$X_{s,m,i} = \frac{1}{10}\sum_{t=2036}^{2045} \Delta CS_{s,m,i,t}$$

17. Relative change in annual average sales/income/employment/GDP compared to management alternative 1/status quo, by state/region/coast. (state/region subscripts not shown)

$$X_{s,m,i} = \frac{\frac{1}{10}\sum_{2036}^{2045} X'_{s,m,i,t}}{\frac{1}{10}\sum_{2036}^{2045} X'_{s,1,i,t}}$$