South Atlantic Dolphinfish MSE

6. Data Simulation

a. Catches

b. Indices

c. Lags

27th July 2026

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6a. Indices

Available Indices

Standardized U.S. pelagic longline CPUE in area 1 (winter; Caribbean and S. Florida)

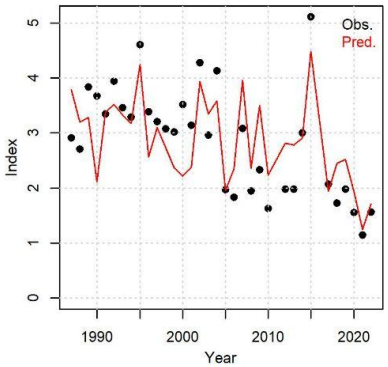
Assumed to be proportional to vulnerable biomass of fleet #1 ‘USCom’

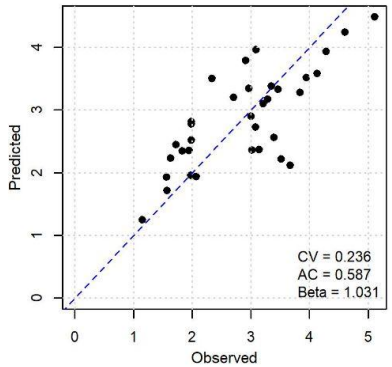
Historical Indices

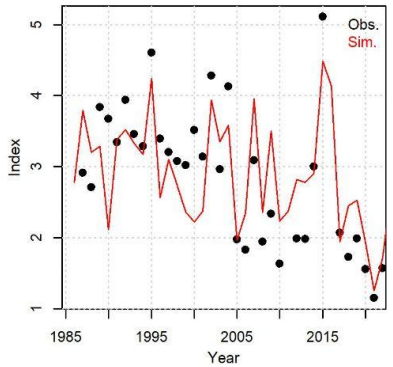
Fixed at observed values

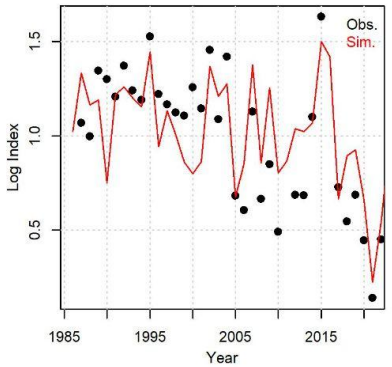
Projected, simulated indices

Adopted the approach of MSE frameworks elsewhere: the constant of proportionality (catchability, q), log-normal error (CV) and lag-1 autocorrelation (AC) were derived from historical fit of model predicted vulnerable biomass (Sim) to the U.S. pelagic longline index (Obs). These are then preserved in future simulated indices. Statistical properties can be user-defined in the mahiMP for exploratory purposes.









6a. Indices

Red line ‘Sim’, is the true simulated vulnerable biomass for the pelagic longline fleet.

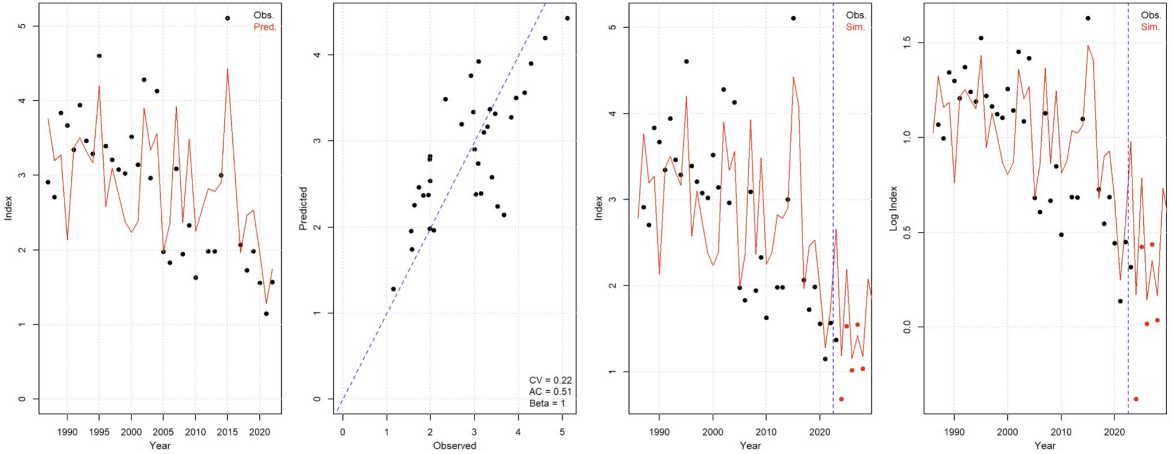
Black points Obs are historical observations from the pelagic longline.

Red points in projection years a simulated observations with the statistical properties of the historical period.

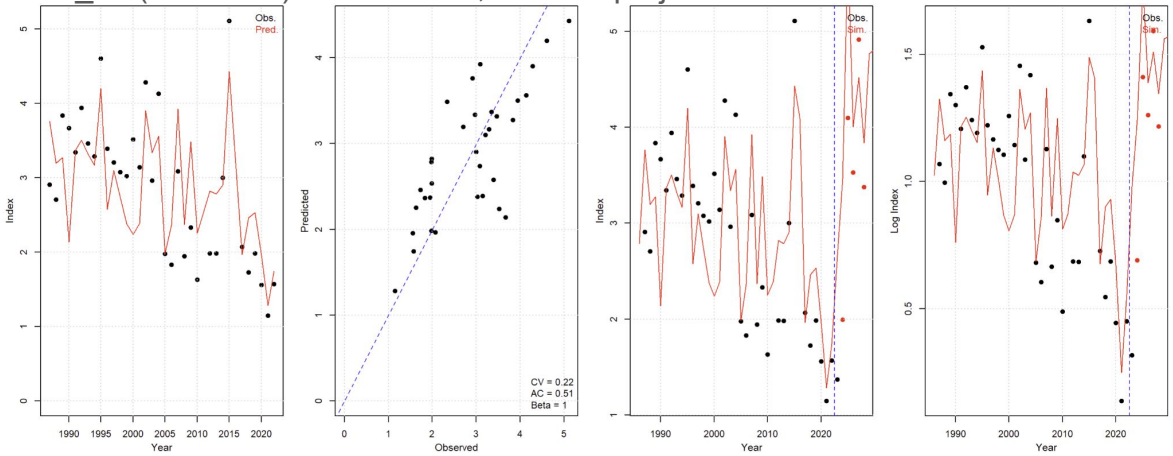
Two left-most panels are identical between top row (high F in future) and bottom row (low F in future).

Only the projected redlines and points on the right-most plots change among rows.

OM_29 (Ref Case) Simulation 1, high F in projection



OM_29 (Ref Case) Simulation 1, low F in projection



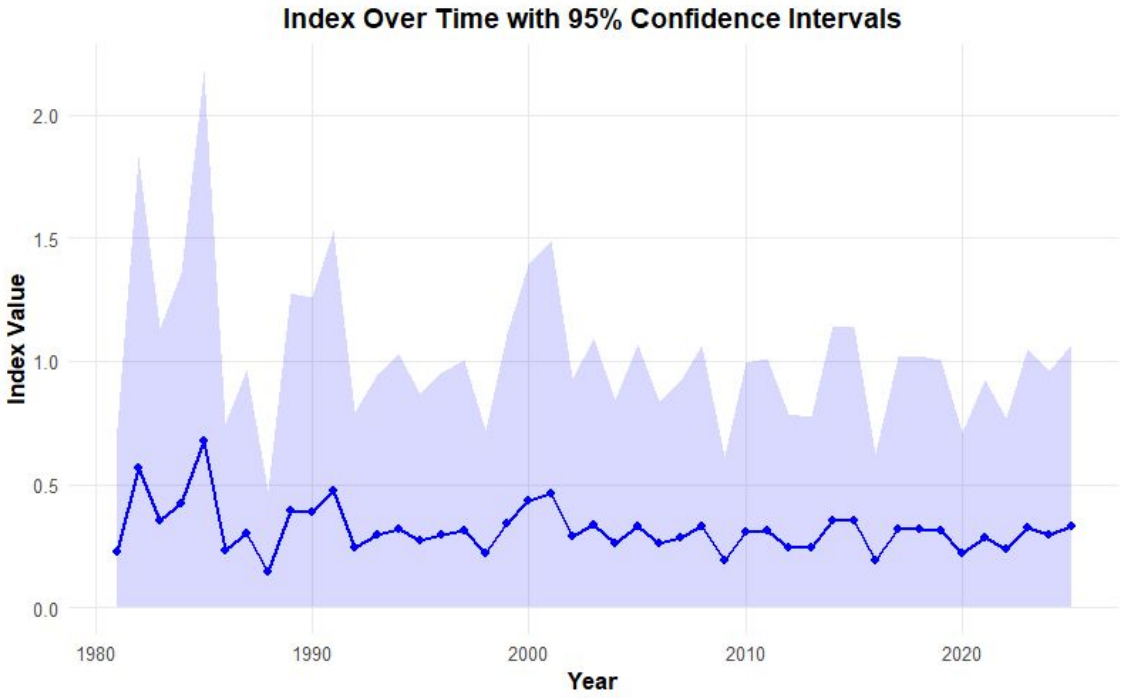
6a. Indices

Future Additional Indices

- MRIP Index (vulnerable biomass index of US recreational fleets; N & S private and for-hire)
- Puerto Rico Tournament (vulnerable biomass index, USCom in Caribbean & S. Florida)
- ‘Blue blob’ (unclear how to functionally relate this to OM dynamics)
- ‘ENSO’ (unclear how to functionally relate this to OM dynamics)

6a. Indices: MRIP index

- Fishery-dependent index based on US recreational removals
- Dockside interviews to determine trip-level catch
- Index calculated from all catches (including releases) of dolphin from dolphin-directed trips in May - Oct. Effort offset calculated as angler-hours
- MRIP data generally not recommended for index generation unless under data-limited scenarios (Fitzpatrick and Williams, 2022). High uncertainty.

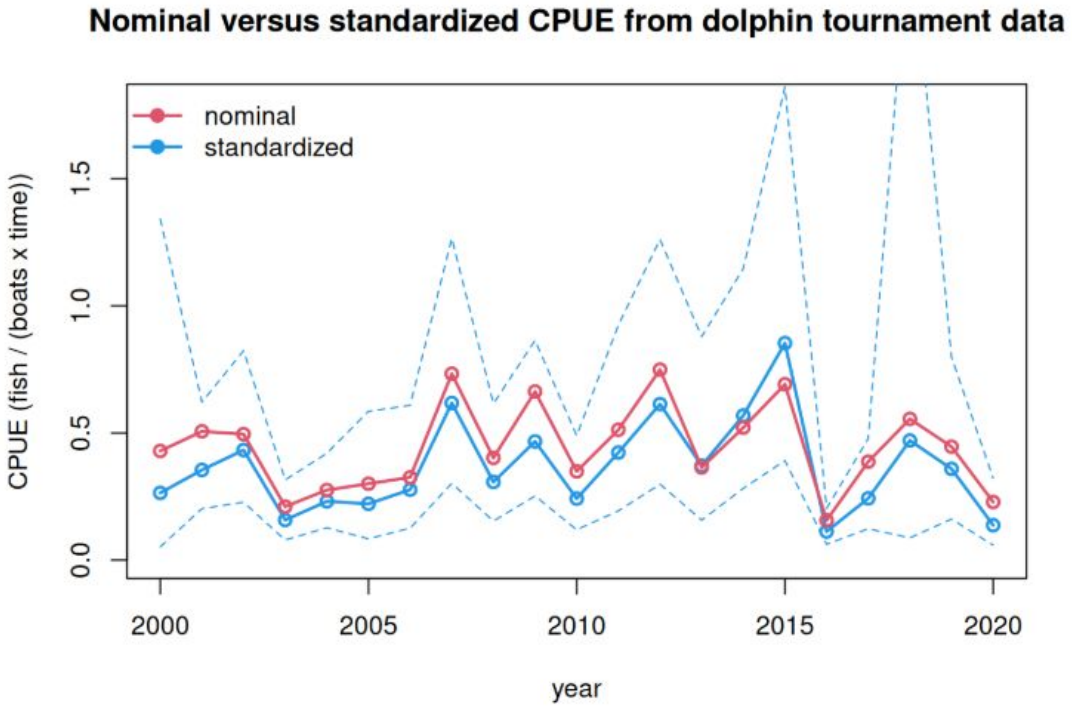


Fitzpatrick, Eric and Erik Williams. 2022. Evaluation and Limitations of MRIP Intercept Data for Developing a Gray Triggerfish Abundance Index. SEDAR82-WP06. SEDAR, North Charleston, SC. 17 pp.

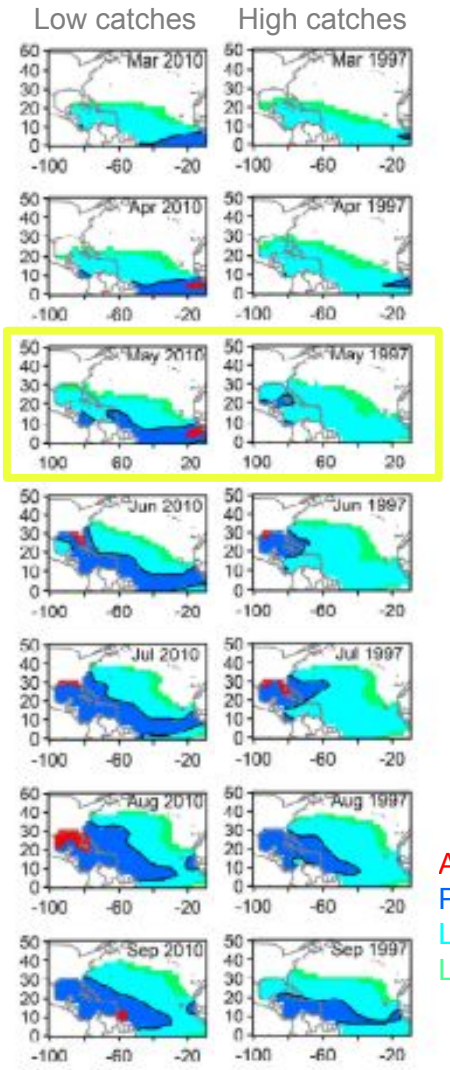
Private repository: https://github.com/CassidyPeterson-NOAA/dolMRIP_SFD-DAAS-GenRec_Indices

6a. Indices: Puerto Rico tournament data

- Tournament data are available from Puerto Rico's Departamento de Recursos Naturales y Ambientales, División de Pesquería Recreativa y Deportiva, going back to the year 2000
- Indicative of Caribbean abundance. US Atlantic fisheries are "downstream" Caribbean, and therefore tournament data may be in-season predictive of the US fishery abundance
- Relatively few tournaments per year (<10 events)



M Karnauskas: https://sefsc.github.io/SEFSC-dolphin-analyses/PRtournament.html



6a. Indices: SST “blue blob” indicator

- Recreational & commercial US dolphin catches are higher in years where preferred temperature (blue blob; Schlenker et al. 2021) is constrained to US EEZ in May
- “Patterns of May temperature distribution, as well as CPUE rates of the PLL fleet during this month, may be indications of the total availability of dolphinfish in the SAFMC’s jurisdiction throughout the year and could perhaps serve as a proxy index of availability for a management procedure.”
- Migration patterns driven by temperatures off S FL; high FL temps drive northward migration, resulting in higher proportions of catch in
- Caution related to managing based on environmental drivers
- Related to relative availability, not necessarily biomass. Challenge to appropriately link with a population dynamics parameter.

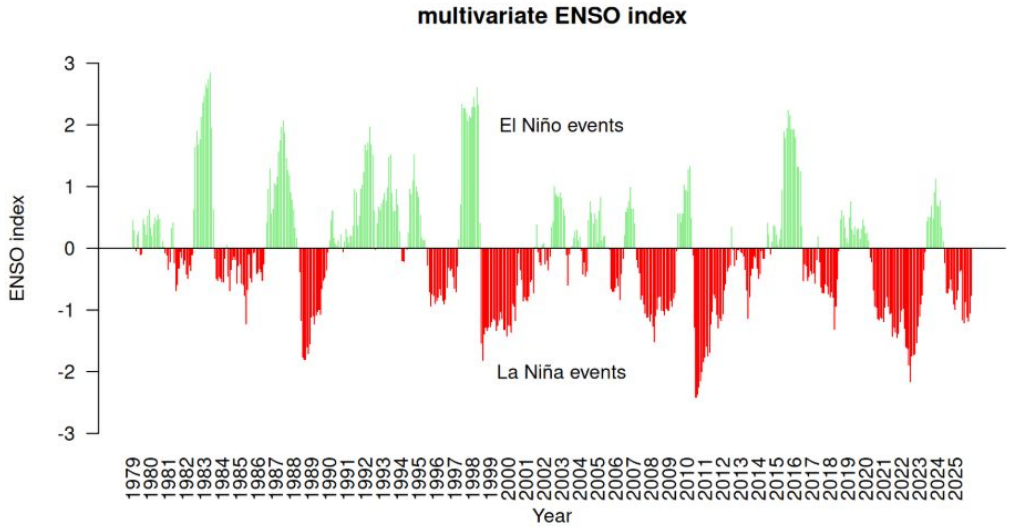
Above temp threshold
Preferred temperature
Less preferred temperature
Less preferred temperature

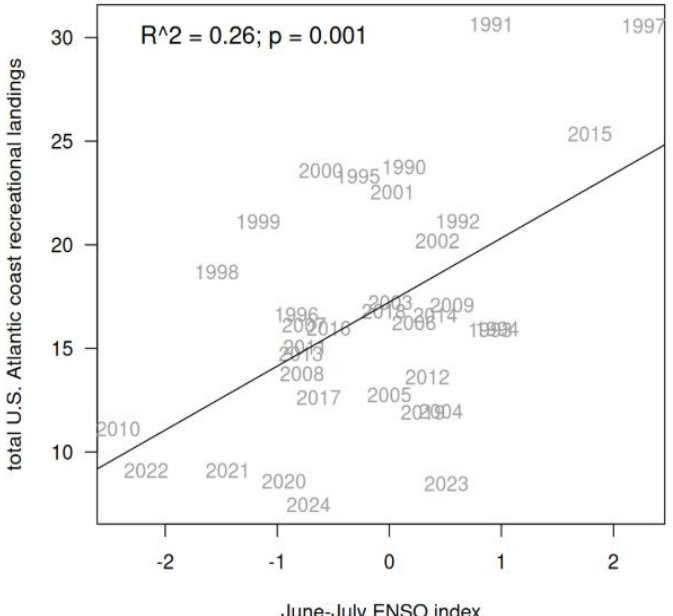
M Karnauskas: https://sefsc.github.io/SEFSC-dolphin- analyses/blue_blob_index.html

Schlenker LS, Faillettaz R, Stieglitz JD, Lam CH, Hoenig RH, Cox GK, Heuer RM, Pasparakis C, Benetti DD, Paris CB and Grosell M (2021) Remote Predictions of Mahi-Mahi (Coryphaena hippurus) Spawning in the Open Ocean Using Summarized Accelerometry Data. Front. Mar. Sci. 8:626082. doi: 10.3389/fmars.2021.626082

6a. Indices: ENSO

- Correlation between strong El Niño events and peaks of US Atlantic recreational landings
- El Niño has some predictive capacity (3-6 months)
- Related to relative availability, not necessarily biomass. Challenge to appropriately link with a population dynamics parameter.





M Karnauskas: https://sefsc.github.io/SEFSC-dolphin-analyses/indices_intro.html

6b. Catches

Current empirical management procedures do not use simulated catches

TACs are set according to the last historical observation of catch (e.g., 2022) and vary according to an index of abundance relative to ‘now’ (e.g., 2022).

There may be a desire to test the performance of ‘model-based’ MPs which would require simulated catches. The following model based MPs are coded and ready to use:

SPiCT (Pella-Tomlinson, state space surplus production model)

Age-structured surplus production model (statistical catch at length with specified vectors for selectivity, maturity, somatic growth etc).

Options for catch simulation

The current MSE framework simulates landings according to the residual ‘errors’ of the simulated historical landings relative to those observed. These are relatively precise, recalling the fit of the numerical tatonnement algorithm to observed spatial catches.

As with indices, statistical properties can be overridden and user-specified if necessary.

6c. Lags

MPs can be run on any management interval (the number of years management advice is fixed before update). Currently MPs have been implemented with a 1-year management interval (the minimum, in-season advice is not considered feasible). However managers have expressed an interest in an management interval as long as 3 years (i.e., catch limit advice is held constant in three year blocks (e.g., 2027-2029, 2030-2032 etc).

In this application we assume a 1-year lag: that catch advice in year *t* is based on data available in year *t-1*. However, it may be more realistic to have 2 year lag where advice in t is calculated in year *t-1* from data available up to *t-2* (e.g. catch advice in 2027 based on indices up to 2025).

Given that few Dolphinfish are expected to live much longer than 18 months, lags can be expected to be particularly influential in determining the performance of responsive MPs. Large economically important fisheries of similar longevity very often seek to implement in-season management (e.g., Peruvian Anchoveta).

Applicable TORs

3. Evaluate operating model conditioning.
    a. Did conditioning the operating model on available data result in simulated data with reasonable statistical properties relative to what would be available to the management procedure?
4. Evaluate MSE projections.
    a. Did the operating models project data that would be available to the management procedure?
    b. Were projection assumptions reasonable and appropriate for the stock (e.g., decisions about future parameter estimates and uncertainty; resampling approaches to generate future data; future nonstationarity, productivity, etc.)?