Turtle Impact Tool

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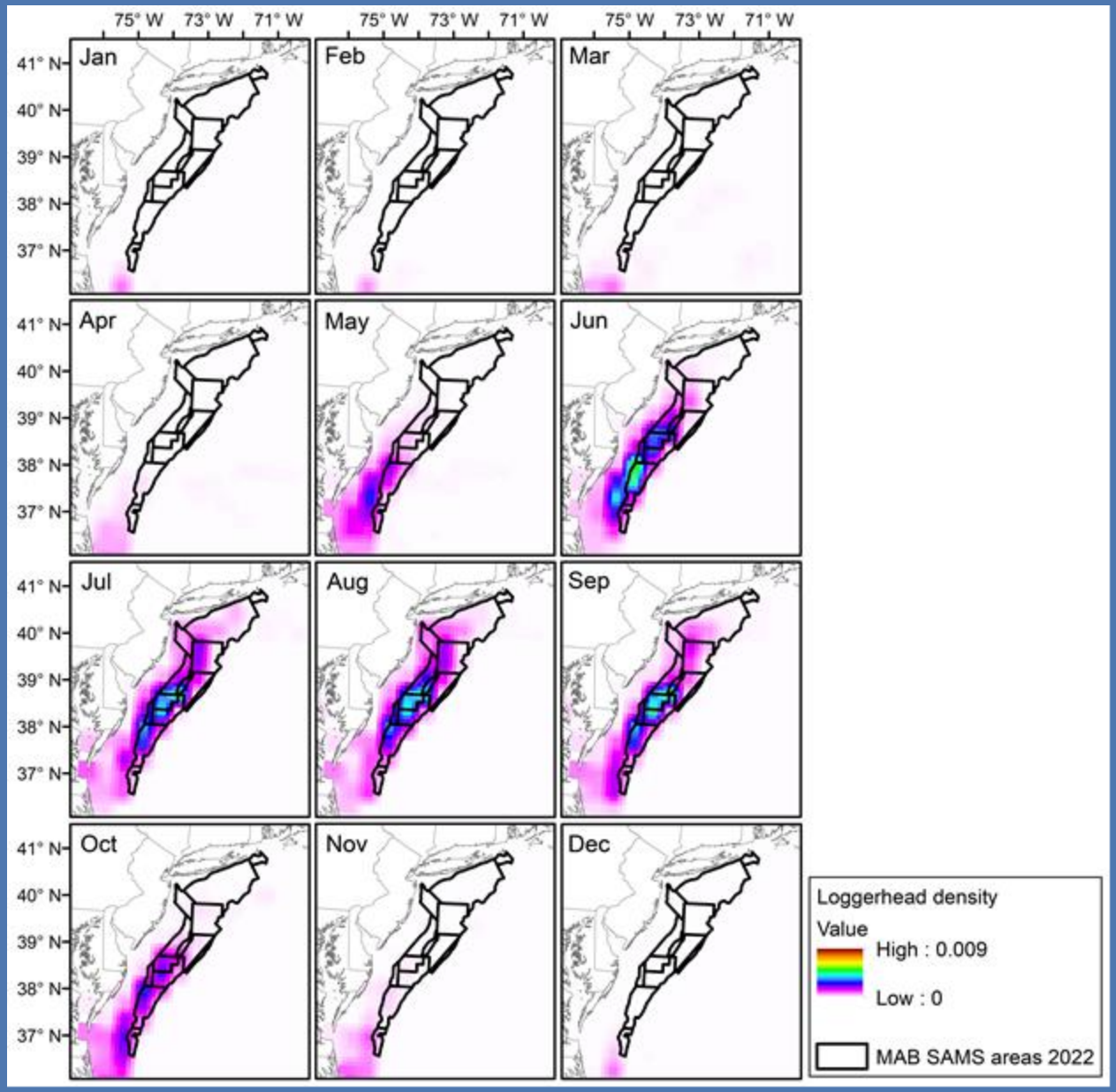
Project overview

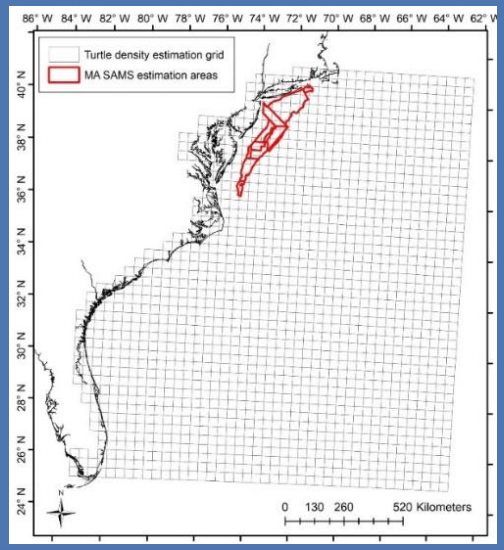
- **OBJECTIVE:** Create a user-friendly tool to provide conservative estimates for the impact of different scallop fishery management alternatives on loggerhead sea turtles
- The tool incorporates spatially and temporally specific data for **monthly turtle densities**, derived from loggerhead tagging programs (*Winton et al. 2018*), and for **scallop fishing effort**, derived from scallop survey programs, Vessel Trip Reporting data, and Vessel Monitoring System data.
- No assumptions are made about the likelihood of scallop dredges interacting with co-occurring turtles.
- Impact estimates are based on estimates for the number of days that scallop vessels are fishing in each Mid-Atlantic Bight SAMS area and the number of turtles that are in the same MAB SAMS area each month.

Winton MV, Fay G, Haas HL, Arendt M, Barco S, James MC, Sasso C, Smolowitz R. 2018. Estimating the distribution and relative density of satellite-tagged loggerhead sea turtles using geostatistical mixed effects models. Marine Ecology Progress Series 586: 217-32.

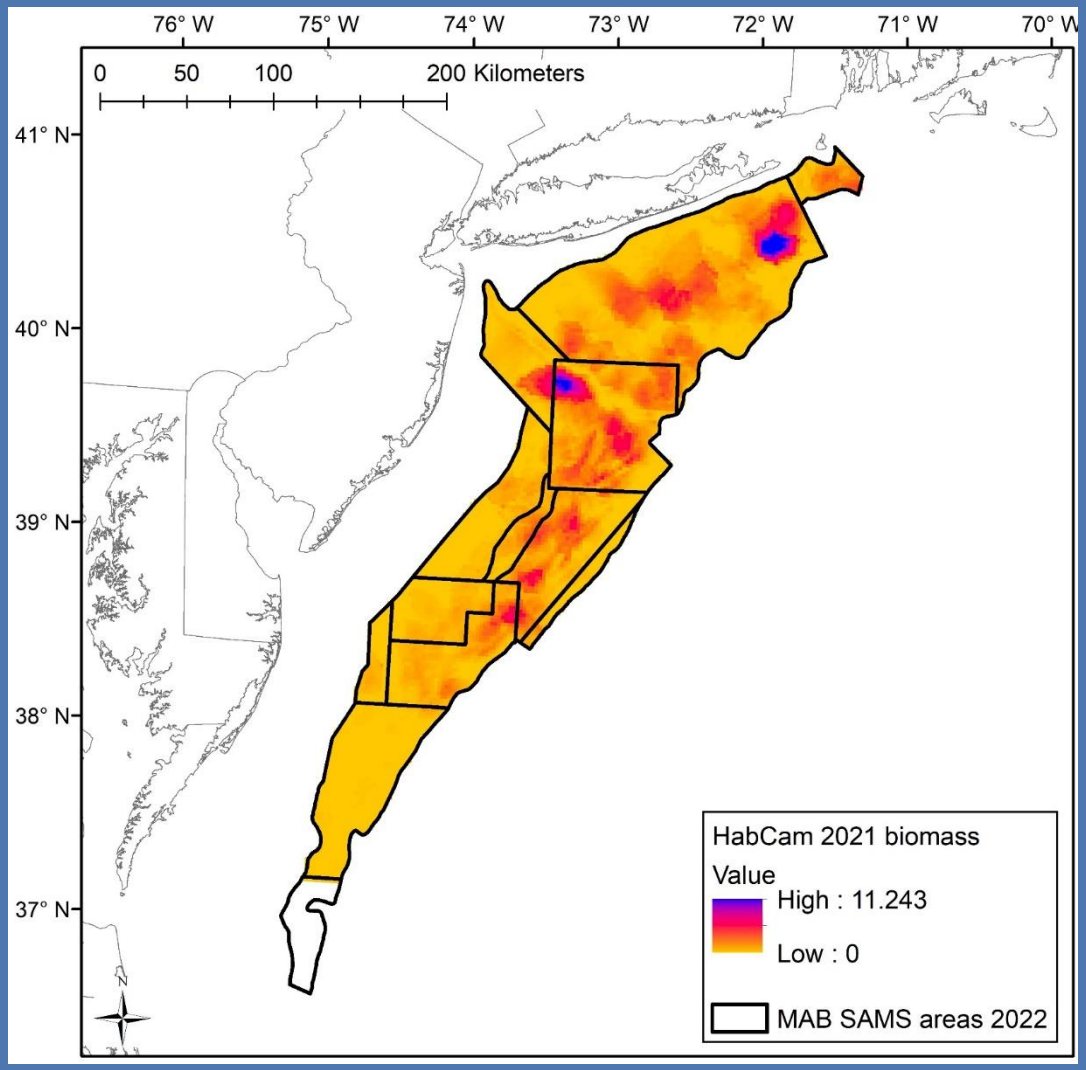
Monthly distributions of loggerheads



- Units in each cell in the turtle rasters are the percentage of all Mid-Atlantic turtles in each cell for each month
- Grid used for the extent of the Mid-Atlantic turtle distribution runs from MA to FL

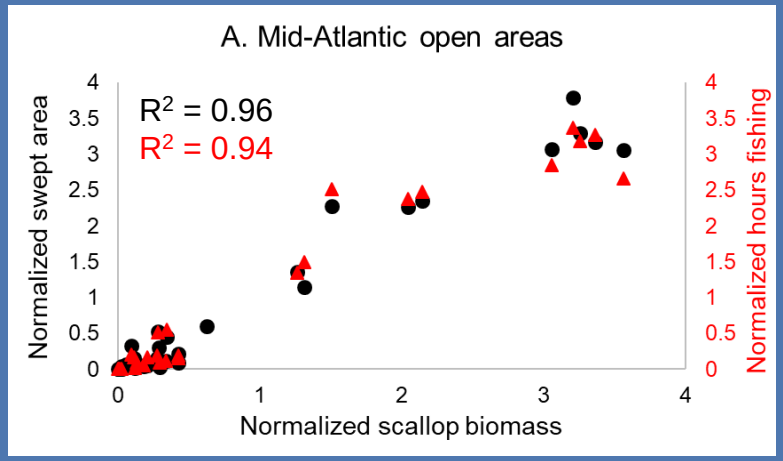


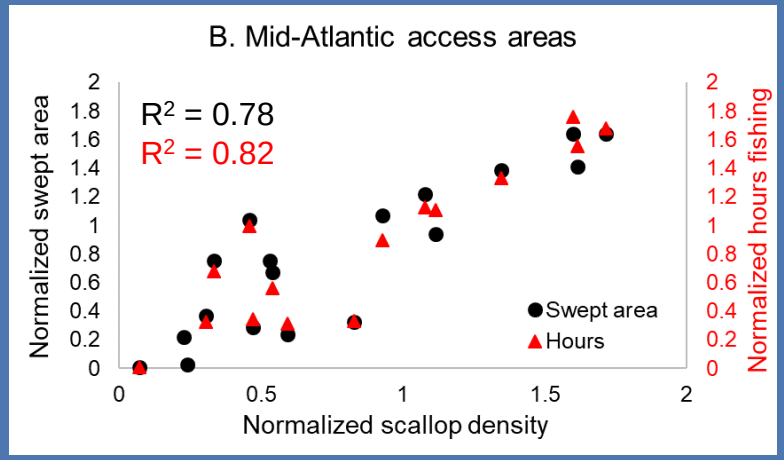
Scallop biomass



- Tool includes a default scallop biomass raster based on data from the CFF 2021 HabCam survey
- Biomass was estimated using a generalized additive mixed model with depth and location coupled with ordinary kriging of the model residuals
- Users can select their own scallop biomass rasters instead of the included default raster

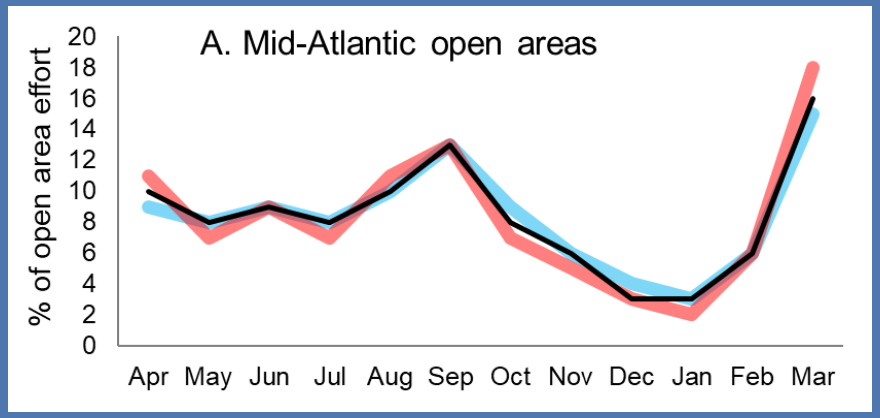
Estimating effort based on scallop biomass and density

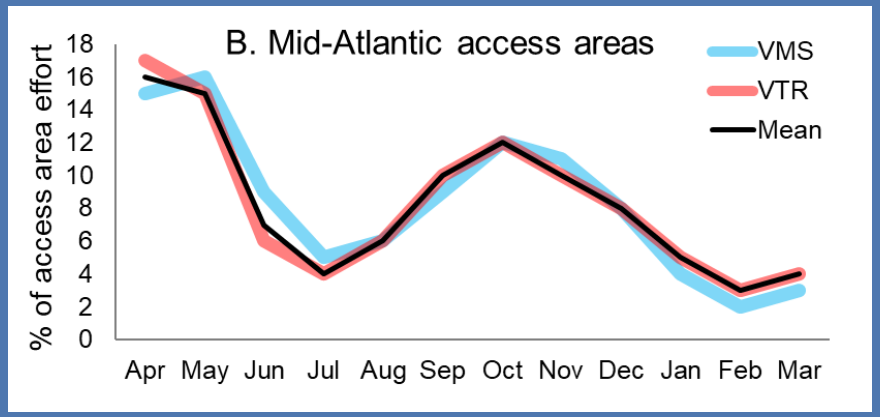




- Fishing effort was estimated using VTR data (swept area) and VMS data (hours fishing).
- Scallop biomass was based on the combined estimates from multiple scallop surveys, with scallop density calculated using the area of each SAMS area in square km.
- Looked at the relationship between fishing effort estimates and scallop biomass and density to determine which scallop parameter had the strongest linear relationship with effort.

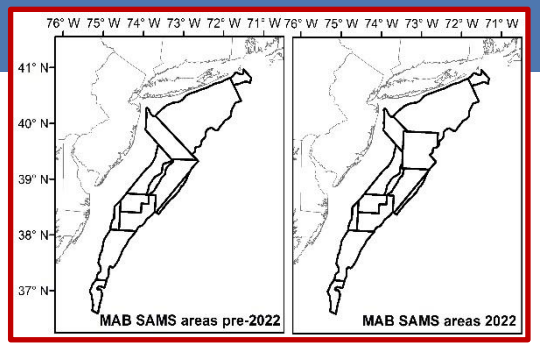
Shifting effort over the fishing year





- The tool includes a default table for proportional fishing effort by month for Mid-Atlantic open and access areas.
- Fishing effort was estimated using VTR data (swept area) and VMS data (hours fishing) from FYs 2018 – 2020 and averaged over the three years.
- Users can select their own tables with different values for proportional fishing effort by month.

Tool Components



- Open area DAS
- Number of vessels
- MAB SAMS area boundaries and designations
- % of open-area effort in MAB
- % of MAB open-area effort by month
- % of MAB open-area effort by SAMS area based on scallop biomass

Default estimate of **0.55** based on VTR and VMS data from 2016 - 2020

- Turtle distributions by month
- Number of turtles
- MAB SAMS area boundaries

Number of turtles / month / SAMS area

Default estimate of **7.5 days per trip** based on VTR and VMS data from 2016 - 2020

Fleet open area DAS / month / SAMS area

- MAB access area trips
- Length of access area trips
- Number of vessels
- MAB SAMS area boundaries and designations
- % of MAB access-area effort by month
- % of MAB access-area effort by SAMS area based on scallop density

Fleet access area DAS / month / SAMS area

Fleet DAS / month / SAMS area

Impact

$$= \sum_{\text{SAMS areas and months}} \text{Fleet DAS x Number of turtles}$$

Estimate for the co-occurrence of scallop fishing activity and loggerheads by month for each SAMS area

Demo

- **Framework 33 vs Framework 34 specifications** – addition of NYB closure and opening of the MAB access areas.
- **Impact of changing relative fishing effort in the Mid-Atlantic vs Georges Bank open areas and the size of the loggerhead population** – default 55% in the MAB with 24 DAS, 40% in the MAB with 24 DAS, and 40% in the MAB with 24 DAS and a 25% larger turtle population

lsiemann.shinyapps.io/tit2/

www.coonamessettfarmfoundation.org/turtle-impact-tool