



# Developing a Tool to Quantify the Impact of the Scallop Fishery on Loggerhead Sea Turtles

Liese Siemann and Samir Patel

Coonamessett Farm Foundation, Inc.



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## 1.0 EXECUTIVE SUMMARY

**Project Title:** Developing a Tool to Quantify the Impact of the Scallop Fishery on Loggerhead Sea Turtles

**Year Awarded:** 2021

**RSA Priorities Addressed By This Research:** Scallop RSA High Priority #2 – Turtles

The Turtle Impact Tool was created to provide conservative estimates for the impact of different scallop fishery management alternatives on loggerhead sea turtles. This tool incorporates spatially and temporally specific data for monthly turtle densities, derived from loggerhead tagging programs, and for scallop fishing effort, derived from scallop survey programs, Vessel Trip Reporting (VTR) data, and Vessel Monitoring System (VMS) 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 (MAB) Scallop Area Management Simulator (SAMS) area and the number of turtles that are in the same MAB SAMS area each month.

## 2.0 TOOL OVERVIEW

Users can change key components of scallop fishery management plans for the limited access (LA) fleet, including the open area days-at-sea (DAS) allocations, the number of trips in Mid-Atlantic Access Areas (MAAAs), and the shapefile used to define the MAB SAMS areas and therefore the boundaries for open, closed, and rotational access areas. Values entered into the tool can be adjusted to incorporate additional fishing effort from part-time and occasional vessels by increasing the number of vessels above just those with full-time permits.

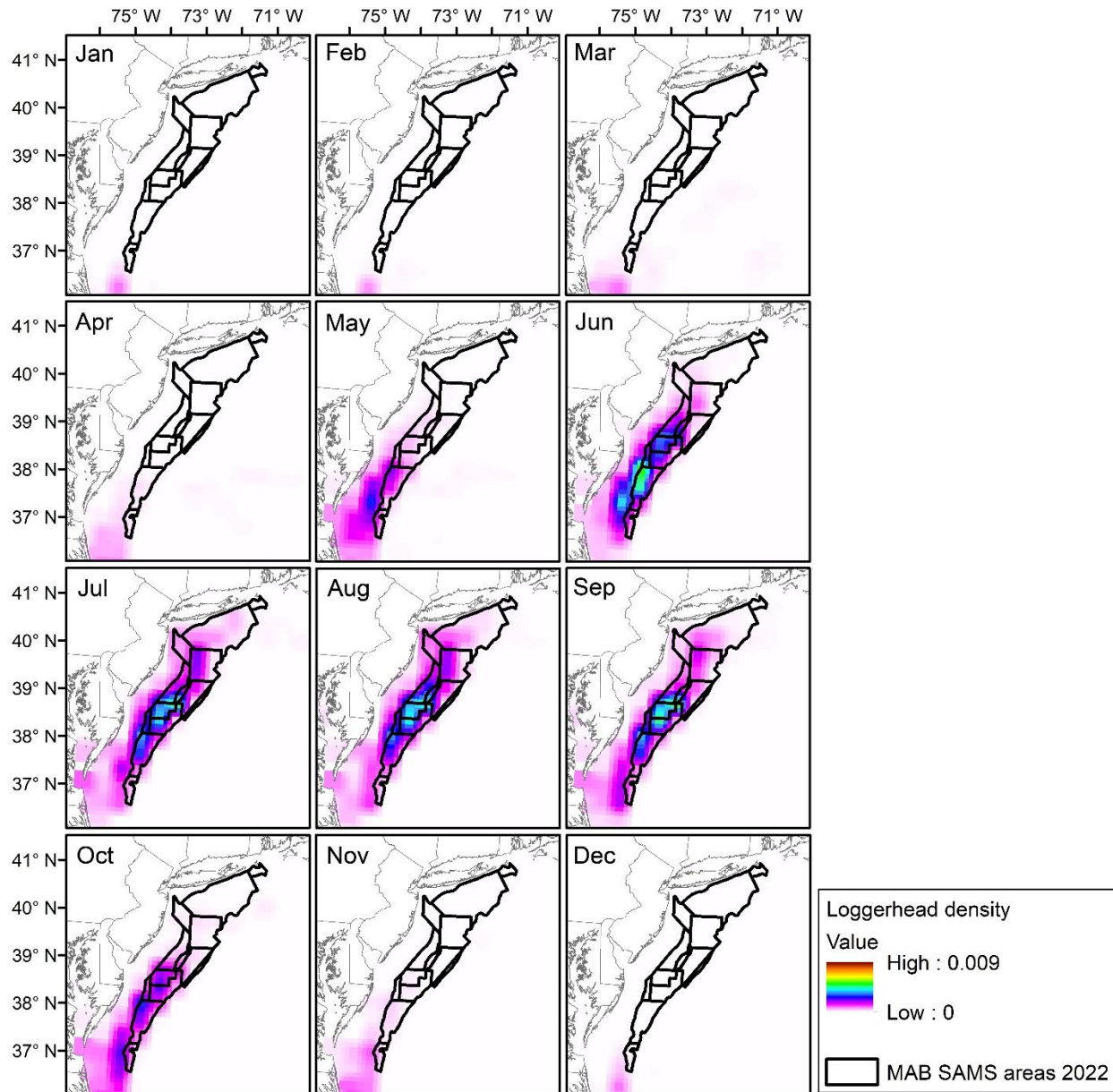
The tool offers two options for users to compare impacts from scallop fishery management alternatives. Two management alternatives can be assessed by entering model parameters directly into the graphical user interface (GUI). Tool results, including impact maps and a table showing the relative impacts of the two alternatives, are displayed on the GUI if this option is used. Users can also opt to enter data for multiple management alternatives by putting together data tables (csv files) for these alternatives. Users can download impact data tables and reports that include impact tables and maps when this option is used.

Tool components include:

- Loggerhead sea turtle monthly density (**Figure 1**). The tool includes a set of monthly turtle density rasters based on monthly densities derived from a geostatistical model that was developed using 2004-2016 tagging data from 271 tags deployed by six tagging programs in the western North Atlantic, including the RSA-funded loggerhead tagging research ([Winton et. al. 2018](#)).
- Mid-Atlantic Bight (MAB) Scallop Area Management Simulator (SAMS) areas. The tool includes two shapefiles for the most recent MAB SAMS areas (with and without the New York Bight closure that was added for fishing year 2022).
- Scallop biomass across the MAB. The tool includes a default scallop biomass raster based on data collected during the 2021 Coonamessett Farm Foundation (CFF) HabCam v3 survey.
- Management designations for each SAMS area. Users can define the management designations for each SAMS area (open, closed, or rotational access area).



- Relationships between scallop biomass/density and fishing effort. Estimated scallop biomass and yearly effort data by SAMS area for 2016-2020 was used to derive best-fitting linear relationships between scallop biomass or density and fishing effort for open and access areas.
- Estimated proportional fishing effort by month. The tool includes a default table of proportional fishing effort by month for MAB open and access areas based on VTR and VMS data from 2016-2020.



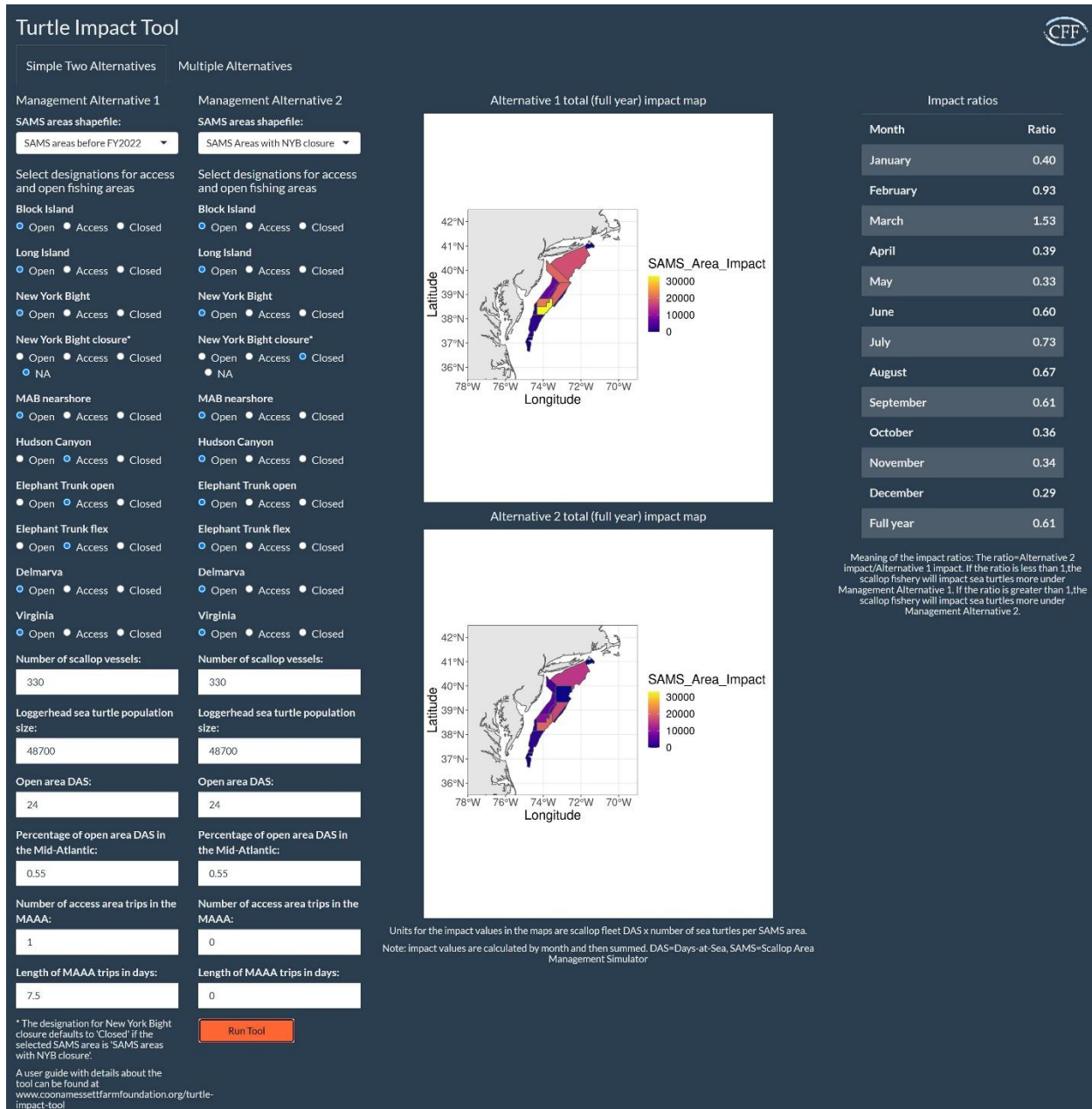
**Figure 1. Monthly normalized turtle density maps based on the Winton et. al. 2018 model.**

### *The R Shiny app*

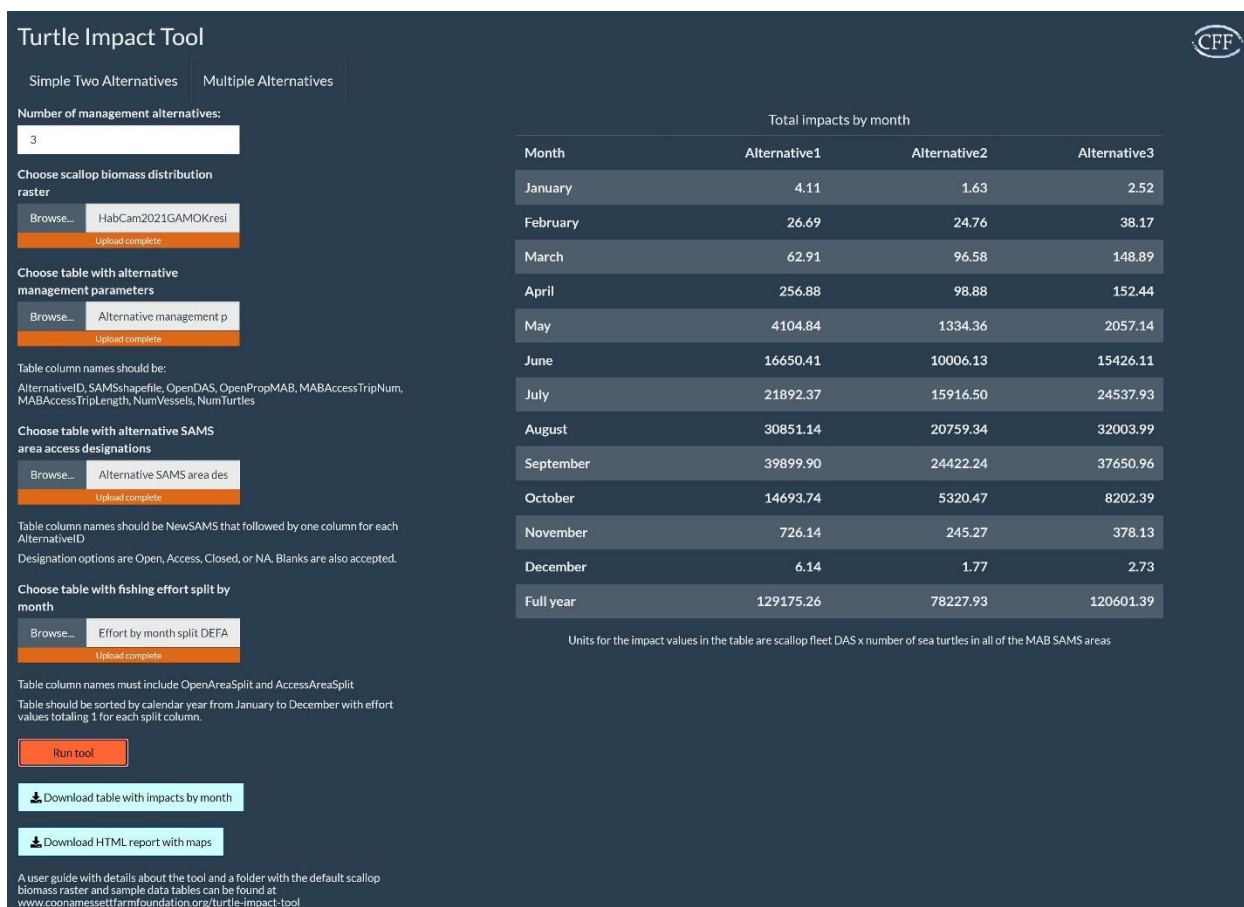
The original version of the tool allowed users to compare two management alternatives using SAMS area designations that corresponded to those used during recent fishing years. The



upgraded version of the R Shiny app allows users to compare two or multiple management alternatives at once (different tabs), designate the management status of each SAMS area independently, input user-supplied scallop biomass data, and select alternative SAMS area boundaries. Recent changes in the MAB SAMS area boundaries required the addition of the latter capability and altered the way scallop biomass data is entered into the tool (*i.e.* as a biomass raster instead of biomass estimates by SAMS area). **Figures 2 and 3** show the tool outputs for each tab (Simple Two Alternatives and Multiple Alternatives) after the tool completes an analysis.



**Figure 2. The Turtle Impact Tool User Interface. This shows the appearance of the “Simple Two Alternatives” tab of the GUI after the tool finishes an analysis.**



**Figure 3. The Turtle Impact Tool User Interface. This shows the appearance of the “Multiple Alternatives” tab of the GUI after the tool finishes an analysis. Users can download the impacts table or a report that includes the table and maps for each alternative.**

### 3.0 SPECIAL COMMENTS

The tool is available at <https://lsiemann.shinyapps.io/tit2/> More information about tool inputs and outputs and the data analysis that forms the basis for the tool can be found in the user guide available at <http://www.coonamesettfarmfoundation.org/turtle-impact-tool> A folder with sample input tables and the included default scallop biomass raster can also be downloaded on this webpage.

#### *Literature cited*

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.