Beaching Probability Index (BPI): Introduction

The BPI focuses on the fate of deceased or impaired sea turtles that are floating at the sea surface where they are susceptible to drift and discovery. The BPI is used to predict how the current environmental conditions influence strandings by calculating the likelihood that floating sea turtles will wash ashore in the Gulf of America. The outputs help users understand environmental factors that influence stranding patterns and trends and can inform stranding surveillance efforts.

How does it work?

Data (NetCDF files) from the Americas Seas Region (AMSEAS) of the Regional Navy Coastal Ocean Model (NCOM) is used in conjunction with the probability of a carcass stranding based on oceanographic factors such as surface current and wind. AMSEAS gives a 3 hr, ~2.8 km resolution, 1000×1510 grid domain of the Gulf of America and the Caribbean Sea, and includes tidal, geostrophic, and atmospheric-driven water motion.
Within the BPI simulation, surface currents and winds from AMSEAS are used to push pseudo-floating objects (particles) for an 8 day lifespan. Each day, at 0 h Greenwich Mean Time (GMT), new particles are seeded onto the uniform starting grid of 84,044 points spaced 1 nm apart. This uniform grid extended from the coast to 60 nm offshore (Figure 1), which is the furthest distance sea turtle carcasses were likely to drift based on observations. The system maintains a running tally such that on any given day all objects that are still in motion and less than 8 days old are pushed forward. Particles that encounter shallow water (<25 cm depth) stop moving and are counted as “beached.” The system is suitable to estimate the ocean and wind influence on the stranding of seaweed, sea turtles, or any other drifting object. The leeway value, the amount of “push” the wind gives a floating object is set at 3.5% (Nero et al. 2013), a value roughly applicable to sea turtles or any other object floating at about 50% exposed at the sea surface.

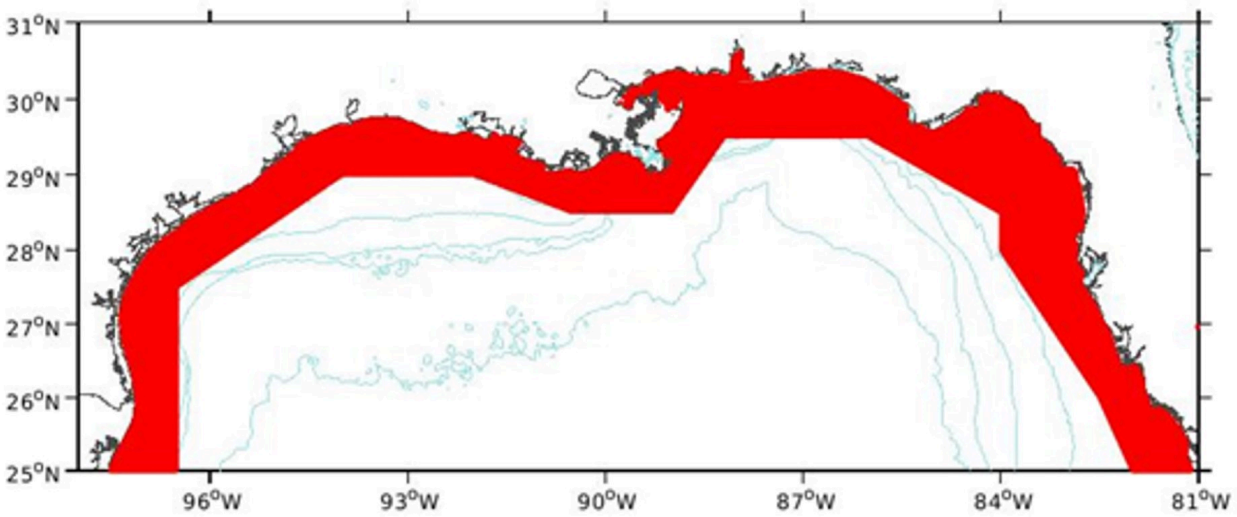

Figure 1. Beaching Probability Index (BPI) Start Grid for the northern Gulf of America.

Because the system assumes a uniform grid from near the coast to outwards of 60 nm, the particle counts on any particular shoreline are somewhat arbitrary in that coast geometry, such as bays and islands, greatly influences particle availability to that shoreline. However, particle counts at one location or region over time do reflect a true relative index of beaching likelihood for that region.

BPI output maps are a gridded summary of particle strandings showing the likelihood of beach strandings based on the accumulation of particles that impinge on the shoreline over the last 8 days from the date selected. For example, the BPI map from March 29, 2018 (Figure 2) shows the logistical likelihood of sea turtles (carcasses in this example) stranded in the northern Gulf of America between March 22-29, 2018. Areas likely to see more strandings (if they are occurring) are indicated by orange and red dots.

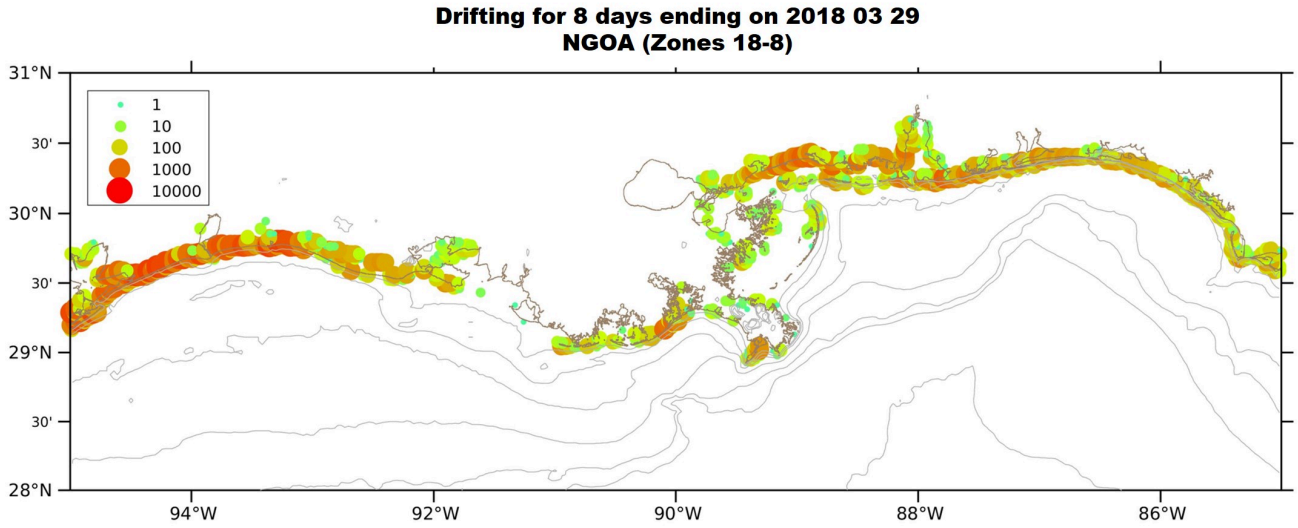

Figure 2. Beaching Probability Index (BPI) for the northern Gulf of America on March 29, 2018.

The BPI for 9 different predefined regions in the Gulf of America has been calculated daily and archived since January 1, 2017.

Figure 3 shows a map of these regions including the Gulf of America (GOA), northern Gulf of America (NGOA), south Texas (TX_S), north Texas (TX_N), Louisiana (LA), Mississippi (MS), Alabama (AL), north Florida (FL_N), and south Florida (FL_S).

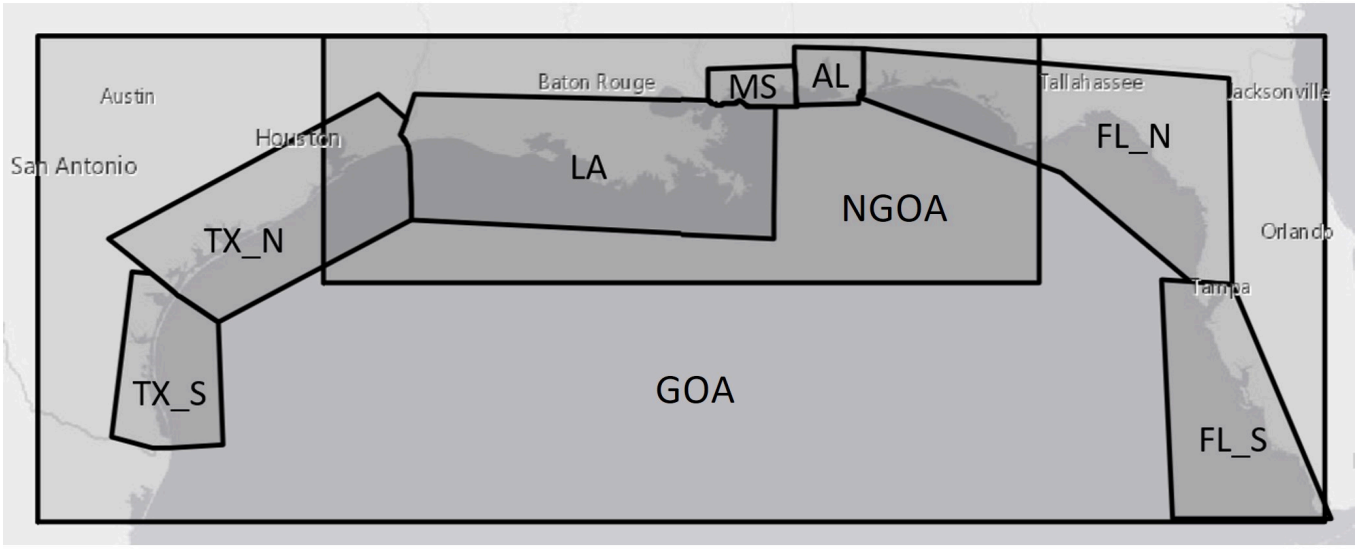

Figure 3. Pre-defined 9 Beaching Probability Index (BPI) Regions for Daily BPI Archive.

Inside the BPI web application, users can define new regions of interest for comparisons as well as draw time series to compare BPI over time using the daily data in the archive. Figure 4 shows the BPI accumulated in the pre-defined Alabama, Mississippi, and Louisiana regions between 2017 and 2019.

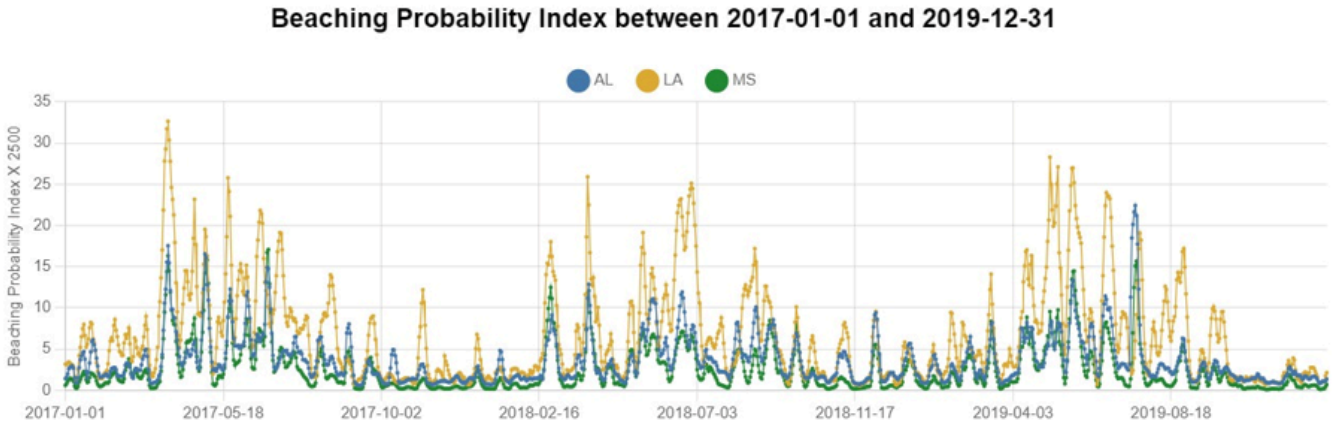

Figure 4. Accumulated Beaching Probability Index in the pre-defined Alabama, Mississippi, and Louisiana Regions from January 1, 2017 to December 31, 2019.

Nero, R.W., Cook, M., Coleman, A.T., Solangi, M. and Hardy, R., 2013. Using an ocean model to predict likely drift tracks of sea turtle carcasses in the north central Gulf of Mexico. Endangered Species Research, 21(3), pp.191-203. https://doi.org/10.3354/esr00516

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