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FAQs about the Swept Area Seabed Impact (SASI) model

Q1: How does SASI relate to designated EFH?

A1: The spatial domain of the SASI model includes the entire EEZ from Maine to the North Carolina/South Carolina border, further than 3 nautical miles from shore. This domain encompasses most of the designated EFH for species managed by the NEFMC, with the exception of inshore areas. Because adverse effects to EFH can accrue both within and outside of designated EFH, the SASI model approach considers adverse effects throughout the domain, rather than as they relate to individual EFH designations.

Q2: How are habitats classified in the model?

A2: In the SASI model, habitat refers to: (1) a dominant substrate type, either mud, sand, granule-pebble, cobble, or boulder; (2) an energy classification, either high (shallower than 60 meters and/or a critical shear stress at the seabed that is sufficient to move coarse sand) or low (deeper than 60 meters and a lower critical shear stress); and (3) a set of living (biological) and non-living (geological) structural features associated directly with the seabed.

For example, one of the ten habitat types is a high energy granule-pebble habitat with scattered granule-pebble, granule-pebble pavement, shell deposits, actinarian anemones, cerianthid burrowing anemones, ascidians, brachiopods, bryozoans, hydroids, macroalgae, *Filograna implexa* tube worms, other tube-dwelling polychaetes, sponges, mussels, and scallops. Another is a low energy mud habitat with biogenic burrows, biogenic depressions, surface/subsurface sediments, cerianthid burrowing anemones, sea pens, hydroids, mussels, and tube-dwelling amphipods.

The locations of different dominant substrates in the model domain are based on various data sources, including grab samples and video, and shear stress values are modeled. Feature distributions by substrate and energy type were based on literature review, in some cases corroborated by video data. It is important to note that these habitat definitions are averages, and that all features are not going to be present everywhere.

Q3: How are adverse effects calculated?

A3: Adverse effects are quantified by first summing the total area swept by each fishing gear within uniform size grid cells. We use a ten by ten kilometer grid, with a total area of $100km^2$. In a given year, this area swept value represents the sum of all fishing effort for one or more gear types that occurred in the cell. This value may be greater than $100km^2$, because it is assumed that individual tows (or sets of fixed gears) may overlap. Next, area swept is adjusted downward to account for the reduced contact of some gear types with the seabed. For example, the area swept in a cell that corresponds to raised footrope trawl gear would be reduced. Then, area swept is adjustedaccording to the susceptibility values from the Vulnerability Assessment that apply to the seabed habitat features found within each grid cell. In cases of high susceptibility, a higher proportion of the area swept is retained, and vice versa. Finally, the effect of the area swept will decay over time according to the recovery values estimated for those features.

Q4: What do susceptibility (S) and recovery (R) scores represent?

A4: Susceptibility is defined as the percentage of total habitat features encountered by fishing gear during a hypothetical single pass fishing event that have their functional value reduced. Recovery is defined as the time required for the functional value of those habitat features to be restored. Whenever possible, these values were estimated for each gear-feature-energy-substrate combination using results of scientific studies. However, the professional judgment of the PDT was relied on when the data were inconclusive, conflicting, or lacking.

Q5: What kind of fishing effort information is used in the area swept estimates?

A5: Area swept estimates are generated almost entirely based on vessel trip report (VTR) data. Some parameters, such as average towing speed and tow duration, are derived from the subset of fishing trips that carry an at-sea observer, and then these estimates are applied to all observed and unobserved trips. Vessel monitoring system data were not used because they are not available for all trips and all years. Subsequent versions of the model will utilize observer and VMS data as appropriate.

Q6: What is the difference between a simulation model run and a realized model run?

A6: The simulation model runs are intended to show the spatial variation of structure-forming habitat's vulnerability to fishing gears, independent of actual fishing effort. We simply add the same amount of area swept to each cell in each year for each gear type, and run the model until it reaches equilibrium. The resulting adverse effect value in each cell in the last year of the model run can be thought of as the vulnerability of that cell to a particular type of fishing gear, and the resulting maps show the spatial distribution of gear-specific vulnerability. The realized model runs use actual fishing effort data to calculate annual area swept estimates as described above. These annual maps represent past, spatially specific estimates of area swept.

Q7: Why are the grid cells so large?

A7: Our grid cells are intended to balance the varying resolutions of the underlying substrate data and the coarse resolution of fishing effort data. Importantly, we are able to retain the underlying variation in substrates and energy regimes within a 100 km2 grid cell when the model is run. The SASI model is a useful tool for comparing the relative locations and magnitudes of area swept in various fisheries, and for comparing which locations are relatively more vulnerable to fishing. However, it is important to remember the model was designed for use at a small scale (i.e. regionally) vs. a large scale (i.e. locally) because the inputs (seabed habitat features, VTR-based area swept) are not highly resolved spatially.

Q8: How many years of effort data are incorporated in the analysis?

A8: Data for fishing area swept from 1996 to 2009 are used in the model.

Q9: How does SASI estimate the cumulative adverse effect on EFH from fishing?

A9: SASI estimates cumulative adverse effects from fishing on EFH by combining the estimated adverse effects from different fishing gears to generate totals that can be broken down by FMP, region, gear type, etc. This is possible because all area swept estimates are calculated in the same units, square kilometers.

Q10: Can SASI be used as a predictive tool, in addition to as a retrospective tool?

A10: Yes. Using SASI to make predictions about the magnitude and location of adverse effects that would result from a particular management scenario requires estimates of how the magnitude and location of area swept might change, but given these assumptions, the model can be used to evaluate the future impacts of alternatives.

Q11: Is there an economic component to SASI and what is it useful for?

Q11: Yes. Each of the trip-level area swept estimates has a revenue value associated with it. This will allow managers to examine the costs (adverse effects) and benefits (revenues) within the model. A simple metric such as the ratio of revenue to adverse effect can be compared across grid cells in order to evaluate the practicability of proposed measures.

Q12: Will the model allow managers to evaluate reducing rather than prohibiting fishing in a particular area as a mechanism for reducing adverse effects?

A12: Yes. Because the adverse effect estimates are derived from area swept values, a reduction in area swept will lead to a reduction in the magnitude of the adverse effect estimate. Adverse effects might also be reduced by fishing with gears that have reduced seabed contact. Of course, the location of fishing will also influence the magnitude of the adverse effect estimate due to the differential vulnerability of the various habitat types.

Q13: Can SASI be used to evaluate adverse effects on a seasonal basis?

A13: No. The area swept data is compiled in annual time steps, and the minimum recovery time estimated is less than one year. Thus, the model cannot account for differential susceptibility and/or recovery of features by time of year. This also means that a constant low level of fishing will have the same adverse effect as a more intense but pulse fishery. Specifically, given the same amount of annual area swept in a cell, the resulting adverse effect estimate will be the same whether all fishing effort occurs in the first month of the year, or is evenly spread across the year.