PCMHAB: Seasonal forecasting of *Karenia brevis* blooms in the eastern Gulf of Mexico

Institutions: University of South Florida, Fish and Wildlife Research Institute

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Total Budget: $899,105 (Yr1: $249,985 + $50,000 ship = $299,985; Yr2: $249,185 + $50,000 ship = $299,185; Yr3: $249,935 + $50,000 ship = $299,935)

Budget Period: 09/01/2015 – 08/31/2018

Abstract/Summary:

Upwelling is a necessary condition for *Karenia brevis* HABs along the west Florida coastline and elsewhere, but too much upwelling may obviate such occurrences. Upwelling results from local (wind-driven) and deep-ocean (Loop Current driven) forcing. Local forcing is what generally accounts for *K. brevis* bloom onsets in fall months, and once a bloom is detected it may be tracked short-term via model simulations. Anomalously persistent and intense upwelling of new inorganic nutrients across the shelf slope (as may occur when the Loop Current contacts the shelf slope near the Dry Tortugas) favors diatoms over dinoflagellates, thereby suppressing HAB development. These findings were successfully employed to explain why there was no *K. brevis* bloom in 2010 and then subsequently to predict several months in advance that a major bloom would not occur 2013, but then would occur in 2014. These accomplishments form the basis for our PCMHAB proposal, the objectives of which are to: (1) develop quantitative predictor and predictand relationships for seasonal prediction, transferrable to management agencies for their use and (2) further refine an existing short term prediction tool that is already in daily automated use (in collaboration with FWC) by adding biochemistry to the inert 3.5 day particle trajectories. This work will allow management agencies (e.g., FWC resource managers, Florida Department of Health, Florida Department of Agriculture and Consumer Services and county agencies) to better mitigate the negative effects of blooms. Improved understanding of bloom behavior and pathways may also provide a basis for prevention and control. No such viable basis can exist without such understanding.

The existing tools that we will use for both short term (3.5 day) and seasonal predictions include satellite altimetry, winds, *K. brevis* cell counts, numerical circulation (WFCOM) model simulations, supplemented by ocean color. We will develop indices that best represent predictor-predictand relationships. We will add new information to an existing scheme by coupling a biochemical and species interaction (HABSIM) module to WFCOM to produce a complete ecological model, advance an observational program targeted toward testing the predictor-predictand relationships to be developed and we will extend the existing data and model simulations over a much longer interval (1993-2018).

In summary we will take a well-defined and established hypothesis and rationale for short-term and season prediction of *K. brevis*, quantify predictor-predictand relationships, test these with observations and model simulations and couple biology with physics, a necessary condition for WFS HAB prediction. Working together, our results will be seamlessly transferred to managers.