



## The SCeMFiS Technology Roadmap

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The technology roadmap is a tool to provide general guidance for the Science Center for Marine Fisheries (SCeMFiS) projects as part of the overall goals of the Center. In developing the roadmap it is valuable to start with the overarching goals of SCeMFiS. These are:

1. SCeMFiS provides academic research products essential for the sustainable management of shellfish and finfish resources
2. SCeMFiS seeks to simultaneously achieve the goals of sustainable fish and shellfish stocks and sustainable fish and shellfish fisheries

Attaining sustainable fish stocks and sustainable fishing industries requires: (a) the assessment process that determines the status of the stock and (b) the regulatory process that provides the vehicle by which the fishery is managed to optimize stock status while supporting a robust industry. The continuum from species (=fishery, at this time management has not progressed to multi-species management although this is an eventual goal) identification to data collection to management action is the proverbial backbone of the roadmap. Each node on the backbone engages a different data base (these are often overlapping and not mutually exclusive) and expertise. Progression of a new data, such as that generated by a single SCeMFiS science project, through the entire process depicted in the roadmap backbone, can take several years. The timetable is dictated by schedules of assessment as set by federal entities, through data collection, assessment analysis and presentation/consideration by the federal fishery management councils under the umbrella of guidance provided by the Magnuson Stevens Fisheries Conservation and Management Act.

There are multiple opportunities for feedback loops within the roadmap. The time frames of these vary from months (e.g., research feedback as frequently as 4x/y based on IAB meeting and quarterly phone conferences of the entire IAB with Directors) to several years depending on the nature of the assessment provided to the regional management councils (assessment typically occur every 3-4 years, updates are common between major assessment, councils have flexibility to respond at both time frames). The strengths of SCeMFiS are that we have, from the outset, active participation at all nodes on this backbone from academic research through industry and federal assessment structure to the management councils. This was considered critical at the outset, and we have built on this expert base since our Centers beginnings. Equally important is that we have used internal planning, through conversations across the IAB membership and management structure, to identify future expert needs on pending assessments and recruit, from an international pool of expertise, individuals who will lead assessment needs with species of concern. We avoid weakness through this forward planning and recruitment process.

Opportunities to supplement the above described structure are generated across the entire participant foundation of SCeMFiS. This is a very important element of our long term growth and expansion plans. At the academic “end” (we use this term of convenience in that the interaction is communal, not unidirectional) of the conversation SCeMFiS funds are and have been used to leverage other federal and philanthropic funding sources. To date this has been successful in our projects on marine mammals, finfish and clams. These actions liberate IAB originated funds to address newly emerging challenges. Building this broad expertise and research base allows anticipation of threats and thus their neutralization at source. In some instance the neutralization is as simple as facilitating a conversation that might otherwise not have occurred, in others it is the provision of novel data or methods that would otherwise have unavailable (see examples below with black sea bass and flounder).

Progression along the backbone of the roadmap identifies research gaps. Notable in recent SCeMFiS efforts has been the growing realization of the need for parallel economic impact analysis. This is important for both investment decisions at the individual IAB member level and compliance with the Magnuson Act requirement that management decisions must avoid possible “significant economic harm to the fishery.” Economic impact is now an element of all SCeMFiS projects – indeed the initial foray into comprehensive impact for the combined surfclam and ocean quahog fisheries illustrated that prior estimates were woefully low!

In examining the structure of the roadmap it is important to appreciate that it depicts a long standing and respectful working collaboration between current IAB members and a nucleus of academic researchers that pre-dated SCeMFiS. IAB members were critical to development of the original collaborative structure, thus extension of that structure to the roadmap as SCeMFiS evolved was a modest increment. The coalescence of efforts by this nucleus with IUCRC support has fostered an expansion of the collaboration to the broader footprint of current SCeMFiS activity by recruitment of **both** academic expertise and IAB membership. The fact that the virtual roadmap that guided those original interactions remains a living document that is very little changed speaks to its appropriate structure for the complex tasks at hand and those envisaged into the near future.

Examples of the technology roadmap as a driver of focused research are plentiful. Assessments for both black sea bass and flounder have historically been less than optimal with respect to providing management advice: one species presents an assessment challenge through aggregated distribution (that also happens to be changing with climate impacts) while the other exhibits dimorphism between the sexes (the large females so important to egg production are targeted over the smaller males). SCeMFiS support for targeted research on both species is providing science that would have otherwise been unavailable to the long term management goals. The now well recognized (in part because of prior SCeMFiS supported science) changing footprint of the surfclam resource in the Middle Atlantic and Georges Bank region has prompted examination of regional stock importance to overall recruitment patterns – for example are clam stocks off New Jersey dependent on parent stock off Long Island, and if so how are they both managed to maximize benefit of the whole? Similarly, management strategy evaluation of mid Atlantic surfclam stocks suggest that prudent spatial management over periods of ~5years could substantially and sustainably increase improve harvest with little or no increase in effort. Each of the above projects has emerged from consideration of various sections or feedback loops within the roadmap. Critically important as we consider the cumulative impact of SCeMFiS since its inception four years ago is that this time interval approximates a complete cycle of data from science design and field data collection through management action and implementation (this is the time frame for “benchmark assessments” and associated management actions as described above) so, as a Center, we are observing the impact of our initial research projects in the management process. To date, these actions have all been positive.

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