Science Center for Marine Fisheries Science (SCeMFiS)

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Dredge Targets Juvenile Clams: Leads to More Sustainable Fisheries

A fundamental challenge in marine benthic ecology and fishery assessment is to quantitatively collect small infaunal (within the sediment) target species that have non-uniform distribution and/or low mean density (number per unit area). The surfclams and ocean quahogs of the mid Atlantic and Georges Bank regions, both of which support substantial fisheries with combined at the dock values in excess of $50 million annually. These are prime examples of such species. Estimates of stock size are essential to responsible management of these clam fishery resources. Getting the estimates is made difficult by the longevity of the target species (30 years and >200 years, respectively, for surf clams and ocean quahogs) and the desire to demonstrate regular recruitment to the exploited stocks.

(Clockwise for top left). The Dameron-Kubiak dredge on the port gantry of the Fishing Vessel E.S.S Pursuit. Juvenile ocean quahogs with between 10 and 45 mm shell lengths from dredge collections illustrate regular recruitment to the fishery resource. The variable bar space mechanism operates by elevating alternate bars in the floor of the dredge. High pressure hoses vent into the dredge body to wash catch and sediment in situ.
Images provided by Roger Mann, Virginia Institute of Marine Science.

Previously available sampling gear has been either grabs or cores that are limited in sample area. For this reason, there was a high statistical probability of missing target species because of low density; meaning lined dredges capable of covering large areas (integrating density) that produce high retention of accompanying sediment but damage target species. The lined dredge also presents other non-trivial challenges in deployment. Retrieval from a sediment-filled dredge can weigh several tons. This challenging winches and aboard ship resources that often result in marginal safety conditions for on-deck crew. SCeMFiS industry members designed and fabricated a research dredge that has variable bar spacing. This offers the ability to change the target size of species under examination. It also makes in situ sample washing possible by washing sediment from the sample as it is collected on the sea floor. This improves assessments of pre recruitment of fishery-sized clams.

The dredge design was finalized between March and May 2014, fabricated in May-July 2014, and tested at sea in August 2014. The design was a modification of a commercial hydraulic dredge that operated from a commercial vessel in water depths of 35-56 meters. A two-minute dredge tow at 3 knots sampled over 700 square meters of bottom - a three order of magnitude increased sampling area compared to traditional grabs or cores, thus allaying fears of missing targets at low density and underestimating stock size. The dredge performance exceeded expectations, providing high sample retention with little sample damage in a safer and tractable operating environment. The dredge was named the Dameron-Kubiak (DK) dredge after its designer (Captain T. Dameron) and lead fabricator (Mr. Kubiak).

The primary user of the DK dredge will initially be the National Marine Fisheries Service (NMFS), the federal agency tasked with fishery assessment and management under the Magnuson Stevens Fisheries Conservation and Management Act. The DK dredge was employed as a standard selectivity and juvenile survey dredge in the 2015 NMFS survey. It is anticipated to become a primary survey tool indefinitely into the future. Researchers foresee the variable bar spacing design used in the DK dredge being adopted globally for resource surveys in support of both fishery targeted species, and benthic communities in threatened or endangered ecosystems such as Arctic shelf ecosystems that support walrus populations.

> **Economic impact**: Uncertainty in the assessment process of offshore clams, notably uncertainty of recruitment process, has been a concern in managing clam resources. The increased retention capabilities of the DK dredge have been a positive demonstration of more sustainable management of the targeted resources. When uncertainties exist federal regulators take extremely precautionary approaches when setting catch quotas; 40% reductions for the ocean quahog alone were considered - this could have amounted to > $10 million annually in dock side value - several times more so in terms of overall economic impact, and possible loss of many jobs in both at sea and within portside sectors. Results generated by this breakthrough work with the DK dredge have removed much of the uncertainly that otherwise would have led to large quota reductions; thus negatively impacting both income and jobs. The DK dredge should continue to help fill the recruitment data gap, thereby increasing the accuracy of assessments, and stabilizing fishing quotas.

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