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Contribution to the Themed Section: 'The Value of Coastal Habitats for Exploited Species' Introduction

Value of coastal habitats for exploited species: introduction to a theme set of articles

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Many exploited fish and invertebrate species use coastal habitats during one or more life-history stages as spawning, feeding, and nursery areas; yet, the value of these habitats has not been adequately characterized. As habitat availability can be a bottleneck for many populations, concerns about habitat effects on exploited species have been increasing. We have compiled nine articles presenting the state of knowledge and future research priorities regarding the importance of habitat for exploited species. Reviews from European habitats and several geographical locations throughout the United States demonstrate the influence of coastal habitats on survival, growth, and movement, especially during the early life-history stages, in a wide variety of species, spatial scales, and habitats. Moreover, many of these species contribute substantially to commercial landings, highlighting the importance of coastal habitats to population persistence and fishery yields. Management of fishery species can also be enhanced through modelling efforts incorporating habitat. Finally, there is a need for more effort in quantifying population demographics rates, creating comprehensive habitat maps, and developing better census techniques for complex hard bottom habitats; thus, future work is needed on the value of coastal habitats for exploited species.

Keywords: coastal habitats, exploited species, ecological value.

Coastal habitats are important for many exploited fish and invertebrate species; yet, the value of these habitats has not been adequately characterized. Coastal human populations are increasing faster than ever and associated changes with coastal aquatic systems will follow. The abundance of many commercially important marine, estuarine, and freshwater species has declined; yet, the relative impact of habitat loss due to anthropogenic and natural factors on these declines is unknown.

Concerns about habitat effects on exploited species have spurred scientific collaborations such as a workshop sponsored by the International Council for the Exploration of the Sea (ICES) on “The value of coastal habitats for exploited species” (ICES, 2012), and a symposium at the American Fisheries Society annual meeting in 2012 on “Making the connection: land, water, and sustainable fisheries”. Several participants from these collaborations, and other scientists conducting related work, have contributed to this article theme set to present the state of knowledge and future research priorities regarding the importance of habitat for exploited species.

The nine articles in this theme set begin with a focus on European habitats. Vasconcelos *et al.* present a literature review that highlights quantitative assessments of habitat-specific rates of immigration, emigration, growth, mortality, and abundance of exploited species. In their article, the influence of coastal habitats on survival, growth, and movement, especially during the early life-history stages, is demonstrated in a wide variety of geographic areas, species, spatial scales, and habitats. The need for more effort in quantifying population demographics rates is emphasized. Notably, a follow-up ICES Working Group on the value of coastal habitats for exploited species (WGVHES) has been created, which will continue to work towards attaining these objectives.

In another contribution, Seitz *et al.* review and synthesize literature on the value of coastal habitats (i.e. seagrass beds, shallow subtidal and intertidal habitats, kelp beds, shallow open water habitats, saltmarshes, mussel beds, macroalgal beds, rocky bottom, and mariculture beds) as feeding grounds, nursery areas, spawning areas, and migration routes of 59 fish taxa for which ICES gives management

advice and another 12 commercially or ecologically important invertebrate species. They conclude that 44% of all species governed by ICES utilize coastal habitats, and these stocks contributed 77% of the commercial landings of species for which ICES gives advice. This underscores the importance of coastal habitats to population persistence and fishery yield of these species.

Next, Sundblad *et al.* quantify the contribution from coastal nursery habitats to exploited fish population sizes by relating adult density to the amount of nursery habitat available in an archipelago of the Baltic Sea. They conclude that a substantial proportion of the potential production of adult fish could be estimated by mapping essential nursery habitat distribution. Their results further suggest that habitat protection has the greatest effects where there is little available habitat.

Next, a few studies from the Chesapeake Bay show clear impacts of habitat on fisheries species. In a review by Jones, the value of seagrass as nursery habitat is summarized, and recent juvenile-fish studies that address research at the long-term and landscape levels (with an emphasis on Chesapeake Bay) are presented. One conclusion from this review is that predicting the effects of climate change on fisheries in this system is complex. In addition, Davias *et al.* use stable isotope analyses to examine trophic and habitat relationships in three common mid-Atlantic fish species. Their data point to differences in stable isotope signatures for fish next to marshes vs. beaches or habitats with developed structures, and increases in $\delta^{15}\text{N}$ in fish from watersheds with greater urban and agricultural land use. In another contribution, Townsend incorporates an ecosystem-based modelling approach to integrate analysis of ecosystem stressors by using existing water quality and fisheries-ecosystem models. The coupling of these models allows connections to be made between water quality and commercially and recreationally important species and subsequently used to assess trade-offs between water quality management goals and fisheries management goals.

The geographic focus of the next group of articles in the theme set then moves to other areas of the United States. Carey *et al.* consider ecosystem-based management (EBM) in Puget Sound, Chesapeake Bay, and Galveston Bay. They explore the utility of loop analysis related to two goals: increasing crab fishery production and reducing eutrophication in coastal foodwebs. In their analyses, crab-related management actions propagated through the foodweb, with positive and negative impacts, and several of the negatively impacted species were those supporting important fisheries, illustrating the challenge of developing multispecies plans. Simulations indicated that management actions that decreased eutrophication concurrently reduced most functional groups; however, these predictions were unreliable,

suggesting weak bottom-up control in the foodwebs. They conclude that despite some limitations, loop analysis can be a useful tool for informing EBM, especially in situations with limited data. In another contribution, Toft *et al.* used modelling to estimate how harvest of Dungeness crab (*Metacarcinus magister*) and Pacific oysters (*Crassostrea gigas*) in Hood Canal, Washington, may change given predictions of future land use and effects of climate change. In their analyses, Dungeness crab harvest levels responded strongly to future effects of climate change, as mediated by increased ocean temperature, whereas Pacific oyster harvest levels were more responsive to projected change in land use/land cover, due to increased nutrient loading to the marine system. Finally, Bowden moves to freshwater systems, where she addresses the influence of habitat for River herring (alewife and blueback herring), which are important ecologically and have comprised major fisheries in the past. She suggests that core populations coastwide need to be protected and strengthened to recover the species. The Taunton River, located in the fastest developing region of Massachusetts, is presented as a case study of a potential core population where a linked freshwater-marine conservation strategy is underway. She concludes that habitat protection and restoration must occur in many different ecosystems and also must consider both the aquatic systems and the land use in the surrounding watershed, because of the complex life cycle of the fish.

Since many species use coastal habitats during one or more life-history stages—as spawning, feeding, and nursery areas—habitat availability may be a bottleneck for many populations. To assess this, comprehensive habitat maps are required. We must also develop census techniques that can be applied to complex hard bottom habitats (e.g. kelp forests, rocky shores) so that their use by fish and shellfish can be characterized. We hope that this set of contributions will be instrumental in focusing attention, triggering opinions, and stimulating ideas, discussion, and activity on the topic of the value of coastal habitats for exploited species.

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Reference

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