UNDERSTANDING THE ECOLOGICAL LINKAGES BETWEEN SALT MARSH ECOSYSTEMS AND NEARSHORE FISHERIES

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BACKGROUND

In Nova Scotia, 60% of salt marshes are thought to have been destroyed province-wide, with 85% of Bay of Fundy salt marshes having been lost. Salt marshes are intertidal ecosystems and despite only being accessible to fish during periods of tidal inundation, they are known for providing critical habitat for a diversity of fish and crustacean species. Many species that hold commercial, recreational, and cultural value rely on salt marshes for a certain stage of their life history (e.g., as juveniles or during seasonal migrations), which makes understanding and quantifying their importance to nearshore fisheries difficult. When fish and other nekton (living organisms capable of swimming in the water) move between salt marshes and nearshore environments, they act as biological vectors moving energy and nutrients mainly in the form of their biomass.

RESEARCH

An extensive literature review was conducted to synthesize research examining connections between salt marsh ecosystems and nearshore fisheries. The literature review can be broken down into two main components: the energy and nutrient linkages mediated by biotic vectors (e.g., fish and other nekton); and the energy and nutrient linkages mediated by abiotic vectors (e.g., the tides).

A pilot study was conducted at two salt marshes (Kingsport and Hantsport) located within the Southern Bight of the Minas Basin, Bay of Fundy, in Nova Scotia. The pilot study purpose was to get a rough estimate of the amount of fish biomass entering each salt marsh with the flooding tide and leaving with the ebbing tide. This study was carried out during an internship with CB Wetlands & Environmental Specialists (CBWES Inc.).

RESULTS

The results from the pilot study support the assumption that similar numbers of fish would be moving in both directions since many fish take advantage of salt marsh resources during the flood tide. Since 78% of the sampled fish leaving the salt marsh in the landward-facing net weighed 5 g or less, it is possible that the additional biomass from a full stomach was negligible and not picked up by either scale.

Figure 1. Fyke net deployed in a salt marsh intertidal creek in Kingsport, NS

Ecological linkages mediated by biotic and abiotic vectors exist between salt marshes and nearshore fisheries; however, it remains unclear as to which vector type is more critical in mediating energy and nutrient linkages between these two systems. The extent of the linkages appears to be system dependent and varies based on many factors. Salt marshes that are flooded more frequently and for longer durations of time are directly more accessible to fish and will have stronger linkages with adjacent subtidal ecosystems. More frequent and extensive tidal flooding may also draw out more energy and nutrients in the form of organic matter; however, this may vary based on the productivity of the marsh itself. Linkages mediated by biotic vectors are species-specific as certain species use salt marshes at different life-history stages, for different purposes, and rely on them for varying durations of time. It is difficult to separate the relative contribution from abiotic or biotic vectors and there are cases where both vector types function together to mediate ecological linkages between salt marshes and nearshore fisheries.

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APPLICATION & CONCLUSION

While fish can only utilize the flooded area of coastal ecosystems, the remainder of these ecosystems still contribute to the flooded habitat. Therefore, it would be prudent for marine protected areas (MPA) boundaries to encompass theentire salt marsh area, and include buffer zones, to provide further protection to coastal wetland ecosystems. Salt marshes and other coastal wetlands that function as nurseries should be incorporated alongside nearshore ecosystems into MPA networks to help protect mobile fish species throughout their various life history stages. It is also essential to acknowledge the bidirectional linkages as nearshore fishery species directly influence the trophic structure of coastal ecosystems (Box 1). One example from our literature review described the case of striped bass (*Morone saxatilis*), which are top predators within North Atlantic salt marshes along the coasts of the U.S.A. The removal of this species through overfishing has been associated with the decimation of some salt marshes due to overgrazing by herbivorous crabs resulting in mass die-offs of salt marsh macrophytes. Since salt marsh macrophytes are the main structural component of salt marsh ecosystems, it is not surprising that overgrazing resulted in the collapse of the ecosystem. Fishing quotas and stock levels of target species in both recreational and commercial fisheries should, therefore, not only reflect the numbers required to maintain a sustainable fishery, but also take into consideration the implications that may result from disrupting important ecological linkages.

The restoration of salt marshes should be considered a nature-based solution in regions currently experiencing or expected to face climate change. These ecosystems provide crucial habitats for various fish species and are likely contributing substantially to certain fish stocks. Restored salt marshes have been shown to provide important habitats and are utilized by multiple fish species. As a bonus, salt marshes and other coastal wetlands provide numerous other ecosystem services to humans, especially in terms of climate change mitigation.

Figure 2. Female (top) and male (bottom) mummichog (Fundulus heteroclitus), captured in fyke nets

Policies should build on current Acts and regulations to protect salt marshes globally focusing on adaptive capacity to account for predicted future climate-related changes in coastal areas. Restoration potential is extremely high for saltmarshes that have been converted into agricultural lands, and many restoration efforts are already underway all around the province. This has the potential to improve coastal fisheries, including lobster fisheries, by reconnecting prime nursery and feeding grounds to adjacent ocean waters.

More research is needed in the Bay of Fundy region to evaluate the energy and nutrient linkages that exists between nearshore fisheries and salt marshes in this region. Research would also contribute to improving our understanding of the impact of a megatidal (>8 m) range on these ecological linkages. Our knowledge of the economics associated with salt marsh-nearshore fishery linkages remains limited but improving our ability to quantify these linkages would likely incentivize the conservation and restoration of salt marsh ecosystems.

We acknowledge the support of the Natural Sciences and Engineering Research Council of Canada (NSERC), funding reference number NSERC NETGP 523374-18. [Cette recherche a été financée par le Conseil de recherches en sciences naturelles et en génie du Canada (CRSNG), numero de référence CRSNG NETGP 523374-18].

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Endresz, K (2020). *Understanding the Ecological Linkages Between Salt Marsh Ecosystems and Nearshore Fisheries*. [Graduate Project,Dalhousie University]. Dalhousie University