

Human dimensions of ecosystem-based management: Lessons in managing trade-offs from the Northern Shrimp Fishery in Northern Peninsula, Newfoundland

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ABSTRACT

Fisheries can have significant impacts on the structure and function of marine ecosystems, including impacts on habitats and non-target species. As a result, management agencies face growing calls to account for the ecosystem impacts of fishing, while navigating the political and economic interests of diverse stakeholders. This paper assesses the impacts of two specific factors on the attitudes and well-being of shrimp fishers in the context of a selective fisheries closure designed to protect crabs in the Northern Peninsula of Newfoundland and Labrador, Canada: (1) the species portfolios of fishers; and (2) democratic rulemaking. The results of this analysis suggest that shrimp fishers were more likely to support selective closures for the shrimp fishery if they also fished for crab, and felt they had an influence on the management of the fishery. The results further indicate that species portfolio diversification had a positive and statistically significant impact on the subjective economic well-being of fishers. This study contributes to an emerging literature on the human dimensions of ecosystem-based fisheries management, highlighting opportunities to address trade-offs in fisheries through species diversification and by enhancing the role and influence of fishers in management processes.

1. Introduction

Fisheries managers are increasingly tasked with moving beyond conventional single-species management and towards an ecosystem-based approach to fisheries [75,60,37,63,21]. Ecosystem-based management is an approach that explicitly considers the interactions among the components of an ecosystem to address the cumulative impacts of human activities on the environment [57]. Consequently, ecosystem-based approaches tend to recommend the adoption of strategies to avoid or minimize the impacts of fishing on a diverse portfolio of ecosystem goods and services. These strategies can include controls on the exploitation of forage species to account for the needs of dependent predators [80,35,90], rules to limit non-target mortality and bycatch [75,74], and creation of marine protected areas to protect critical habitats [52,61]. However, progress has been slow [77] as broad support for the general notion of ecosystem-based management [6,64] masks opposition to specific policies such as marine protected areas, fisheries closures, and reductions in catch limits that give rise to trade-offs

among different actors, activities or objectives [12,4,14]. This paper therefore examines factors influencing stakeholder support for the inclusion of ecosystem considerations in fisheries by considering the impacts of species portfolios and democratic rulemaking on the attitudes of shrimp fishers towards a selective closure in the Northern Peninsula of Newfoundland and Labrador, Canada.

The sustainability of resources has long been understood to depend upon the ability of groups to develop strategies to address social dilemmas [44,48]. Common-pool resources, such as fish, present governance challenges because of a mismatch between public and private interests, generating incentives that promote excessive short-term exploitation at the expense of resource conditions and the long-term interests of fishers and society. These problems can be addressed by assigning secure and enforceable harvesting rights to individuals or groups, providing incentives for sustainable use and conservation of resources [72,78,50,45,22,10,46,79]. However, unlike the single resource context where actors primarily face trade-offs between short and long-term gains, ecosystem considerations tend to give rise to more

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significant trade-offs among different actors, activities and objectives [57,17,27]. Unfortunately, most research on ecosystem-based management has emphasized ecological and oceanographic aspects, providing limited guidance for addressing the social, economic and political dimensions of ecosystem-based management [71].

Trade-offs refer to situations involving an asymmetric distribution of benefits and costs, often resulting from heterogeneous preferences among actors for ecosystem goods and services [49]. Protected areas, for instance, appear to prioritize conservation interests at the expense of fishers [66], while selective fisheries closures and reductions in catch limits for lower trophic level species (i.e. forage fish) deliver benefits to sub-groups of fishers at the potential expense of other sub-groups [68,80]. Consequently, policies designed to address the ecosystem impacts of fishing tend to result in political trade-offs and conflicts, potentially undermining their adoption as key stakeholders organize to resist them and reducing the legitimacy of the management system. Indeed, the politics of fisheries management is often highlighted as a key barrier for achieving sustainability in fisheries, as fishers and the politicians seeking their votes have sometimes exploited scientific uncertainties in pursuit of short-term economic and electoral returns [9,29]. Absent the political will to address the ecosystem impacts of fishing, there is a need to better understand how stakeholders might come to support, or perhaps self-organize to demand the adoption of corresponding strategies. Section 1.1 provides a brief introduction to conflicts among northern shrimp (*Pandalus borealis*) and crab (*Chionoecetes opilio*) fishers in the Northern Peninsula of Newfoundland and Labrador, Canada, while Section 1.2 continues by turning to theory to consider factors that might facilitate the management of ecosystem trade-offs in fisheries.

1.1. Background on the Northern Shrimp Fishery

Northern shrimp and crab fisheries became increasingly important to the resource-based economy of rural Newfoundland and Labrador following the collapse of more traditional groundfish stocks, which was accompanied by a rapid increase in the abundance of invertebrate species [58]. As a result, the Department of Fisheries and Oceans determined that shrimp were underexploited by the existing offshore shrimp fleet and initiated a process by which inshore operators affected by the groundfish closure could obtain a permit for shrimp. Temporary permits were issued to affected fishers that chose to gear up for the shrimp fishery (i.e. acquired suitable vessels and gear) by a specified date, which were later converted to regular licenses [41]. However, an expanding inshore shrimp fishery led to increased conflict with crab fishers who argued that shrimp trawling was having a variety of negative impacts on crab, including damage to habitats, leg loss, damaged carapaces and mortality [30,33,56]. As a result, the crab fishers successfully lobbied for a selective fisheries closure in the Hawke Channel, which prohibited trawling in a 1370 km² area of shrimp fishing area (SFA) 6. This closure was later expanded to approximately 8800 km² in 2004 and was joined by the approximately 7300 km² Funk Island Deep closure in 2005, both of which are shown in Fig. 1 below.

The case of the selective closures for the shrimp fishery in Newfoundland provides a clear example that it is possible for stakeholders and governments to implement policies to address the ecosystem impacts of fishing [56]. It is worth noting that these closures were introduced during a period of relative abundance (Fig. 2), potentially contributing to the lack of significant political conflict over their adoption. However, since then crab and shrimp stocks have been on the decline as part of a more general shift in the species composition of the North Atlantic ecosystem [18,67,34], and the shrimp fishery in particular has experienced a number of political conflicts over the allocation of fishing rights [40,84,39]. Although the selective closures have played a relatively minor role in conflicts thus far; they provide no direct benefits to shrimp fishers, increase opportunity costs by displacing them from potential fishing grounds, and contribute to increased

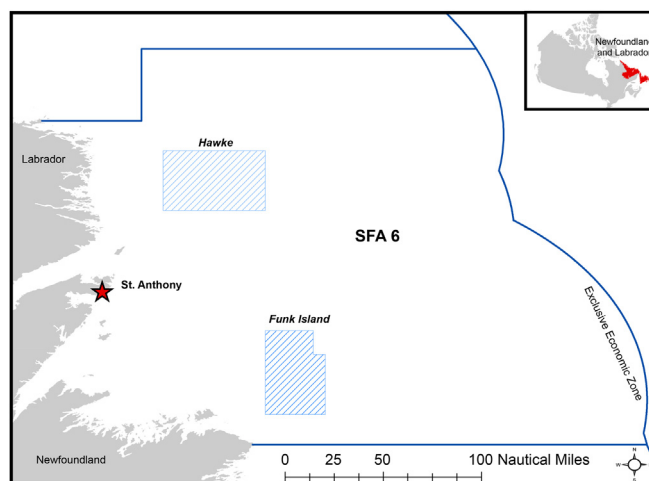


Fig. 1. Map of closed areas and shrimp fishing area (SFA) 6. Star indicates location of field research.

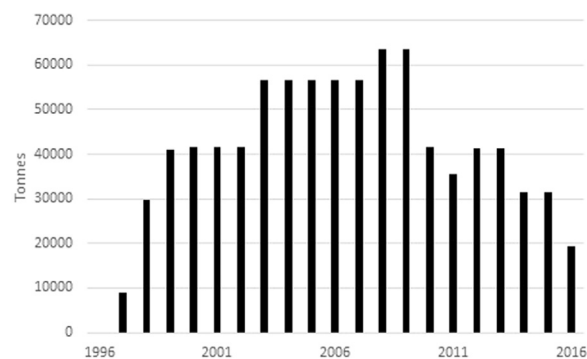


Fig. 2. Inshore shrimp quotas in shrimp fishing area (SFA) 6. Source: Compiled by author from DFO [33] and stock assessment reports (i.e. DFO [34]).

travel time and operational costs [55]. Whereas there is clear and ongoing support among local crab fishers to maintain these closures [56], important questions remain regarding the perspectives of the shrimp fishers most affected by these closures.

1.2. Managing the ecosystem impacts of fisheries

The ecosystem impacts of fishing are a classic example of an externality, wherein a mismatch between public and private interests result in costly impacts and outcomes for society [13,65]. Externalities underlie a wide range of environmental problems including over-exploitation of fisheries and other common-pool resources, pollution and climate change, and the broader impacts of human activities on natural ecosystems. Private actors are compelled to contribute to these problems because they face only a fraction of the total costs of their actions. Thus, in the absence of additional incentives they are typically better off ignoring them to pursue their own individual self-interest. A considerable body of research has therefore developed to better understand the ways in which incentives might be provided to align private interests with those of society [44,48,72,45]. While the specific source of these incentives can vary immensely, recent research highlights two general classes of incentives; namely internalization of economic costs through rights-based or price-based policies, and intrinsic motivation through meaningful participation in rulemaking processes.

Rights-based approaches in fisheries generally include strategies such as individual transferable quotas (ITQ's) and territorial use rights for fishing (TURF's) that provide long-term rights for some actors to use resources, while excluding others. This in turn provides incentives for

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