

## **Linking driving forces of vulnerability to the consequences of regulations in New England fishing communities: a causal model to inform fisheries management**

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Those engaging in fishing-related activities and the communities in which they live face many and varied pressures, which threaten the viability of fishing communities as well as fish populations. Resource depletion and associated regulatory responses imposing constraints on fishing activities can exacerbate economic and social pressures on those involved in commercial fisheries. Other factors such as increasing coastal development and shifting demographics have brought additional threats to the sustainability of fisheries and those dependent on them. In the course of its efforts to protect fish populations the National Marine Fisheries Service (NMFS) is required to assess potential benefits and costs of its regulations. These requirements include consideration of vulnerabilities and risks to fishermen and fishing communities from regulations to protect fish stocks and habitats. For example, Fishery Management Plans are required to assess the fairness and equity of management measures (National Standard #4) and their potential economic impacts (National Standard #8). Section 303(b)(6) establishes a requirement that NMFS examine the economics of the fishery, the capability of fishing vessels used in a fishery to engage in other fisheries, and the cultural and social framework relevant to a fishery and any affected fishing communities.

Of great concern to decision-makers are the special vulnerabilities and potential for disproportionate impacts from the introduction of new regulations that restrict the activities of fishermen or the amounts of fish they can harvest. Rules or regulations may differentially impact some participants in commercial fishing activities because of myriad factors, including vessel size, species fished, gear requirements, and demographic factors. Vulnerability arises from the ways that people are exposed to stressors (e.g., cap on fish catch), their sensitivities to the stressors (e.g., access to loans, liquidity of assets, skills), and their ability to cope with the impacts of the stressors (i.e., purchase of new permits, switch sectors).

We have operationalized a hazard management framework that highlights cause-effect relationships in an interactive JAVA-based computer program. This model illustrates the linkages among regulatory changes, sensitivities, coping activities, and consequences of different types. Models are informed by interviews with key stakeholders, and then validated with the interviewees. We implemented this framework in three New England communities participating in the groundfishing sector: New Bedford, MA; Chatham, MA; Portsmouth, NH. We will present preliminary findings about the range of causes and consequences that are of concern and the factors that affect vulnerabilities at different scales, including individual fishermen, sectors, and communities. The value of vulnerability assessments to inform management of marine fisheries will be discussed.