

# Research Priorities and Recommendations to Support Interjurisdictional Fisheries Management

## NORTHERN SHRIMP

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### Fishery-Dependent Priorities

#### **High**

- Continue to quantify the magnitude of bycatch of other species in the shrimp fishery by area and season and take steps necessary to limit negative impacts.<sup>1</sup>
- Improve separator and excluder devices to reduce bycatch and discard of non-targeted species and small shrimp in the shrimp fishery and fisheries targeting other species.<sup>2</sup>
- Evaluate selectivity of shrimp by traps and trawls.

#### **Moderate**

- Continue sea sampling efforts.
- Evaluate commercial fishery sampling design. Increase and/or redistribute sampling of commercial catches as necessary, ensuring good allocation of samples among ports and months, to provide better estimates of size composition.

### Fishery-Independent Priorities

#### **High**

- Continue summer shrimp survey to track abundance and size/stage composition of the population.
- Evaluate effectiveness of summer shrimp survey statistical design, including geographic coverage.

#### **Moderate**

- Explore ways to quantify age 1 and younger shrimp.

#### **Low**

- Verify that summer shrimp survey tow bottom tending times have been consistent.

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<sup>1</sup> Some work has been done evaluating bycatch (Eayrs 2009) and bycatch in traps (Moffet 2012).

<sup>2</sup> Some work has been done, see He and Balzano (2007) and Pinkham et al. (2006).

## **Modeling / Quantitative Priorities**

### ***High***

- Continue refinement of the UME size-structured model for northern shrimp.
- Evaluate adequacy of the current BRPs, possibly through management strategy simulations
- Explore inclusion of the shrimping effort time-series and/or a commercial CPUE time-series standardized for environmental effects in the CSA model.
- Continue research to refine annual estimates of consumption by predators, and include in models as appropriate.

### ***Moderate***

- Explore explicit inclusion of temperature effects in stock assessment models.
- Expand the time series of stock and recruitment data using catchability estimates from the production model.
- Continue examination of methods for age determination to develop the possibility of using age based assessment methods.
- Develop a bioeconomic model to study the interactions between four variables: movements of shrimp, catchability of shrimp, days fished, and market price.

## **Life History, Biological, and Habitat Priorities**

### ***High***

- Investigate application of newly developed direct ageing methods to ground truth assumed ages based on size and stage compositions.
- Evaluate larval and adult survival and growth, including frequency of molting and variation in growth rates, as a function of environmental factors and population density.<sup>3</sup>
- Study the effects of oceanographic and climatic variation (i.e., North Atlantic Oscillation) on the cold water refuges for shrimp in the Gulf of Maine.
- Explore the mechanisms behind the stock-recruitment and temperature relationship for Gulf of Maine northern shrimp.<sup>4</sup>

### ***Moderate***

- Determine the short and long-term effects of mobile fishing gear on shrimp habitat.<sup>5</sup>
- Study specific habitat requirements and develop habitat maps for early life history stages.
- Evaluate effects of potential habitat loss/degradation on northern shrimp.
- Identify migration routes of immature males offshore and ovigerous females inshore.<sup>6</sup>
- Evaluate maturation, fecundity, and lifetime spawning potential. Estimates of fecundity at length should be updated and the potential for annual variability should be explored. Examine variability of egg quality with female size and stage over time.

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<sup>3</sup> Some work has been done by Stickney and Perkins.

<sup>4</sup> Some work has been done, see Richards et al. (2012).

<sup>5</sup> Short term effects have been studied, see Simpson and Watling (2006).

<sup>6</sup> Some migration work has been done, see Schick et al. (2006) NEC

- Investigate changes in transition and maturation as a function of stock size and individual size and temperature.<sup>7</sup>
- Investigate diet of northern shrimp for different life history stages.

## **Management, Law Enforcement, and Socioeconomic Priorities**

### ***High***

- Characterize demographics of the fishing fleet by area and season. Perform comparative analysis of fishing practices between areas.<sup>8</sup>
- Develop an understanding of product flow and utilization through the marketplace. Identify performance indicators for various sectors of the shrimp industry. Identify significant variables driving market prices and how their dynamic interactions result in the observed intra-annual and inter-annual fluctuations in market price for northern shrimp.
- Explore new markets for Gulf of Maine shrimp, including community supported fisheries.<sup>9</sup>
- Develop a framework to aid evaluation of the impact of limited entry proposals on the Maine fishing industry.<sup>67,10</sup>
- Develop a socioeconomic analysis assessing the importance of the northern shrimp fishery in annual activities of commercial fishing.
- Determine the relative power relationships between the harvesting and processing sector and the larger markets for shrimp and shrimp products.
- Develop an economic-management model to determine the most profitable times to fish, how harvest timing affects markets, and how the market affects the timing of harvesting.

### ***Moderate***

- Perform cost-benefit analyses to evaluate management measures.

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<sup>7</sup> Some work has been done, see Wieland (2004, 2005).

<sup>8</sup> Dunham and Muller at the University of Maine conducted an economic study characterizing demographics of the fishing fleet by area and season in 1976. This study should be updated.

<sup>9</sup> Maine Fishermen's Forum panel discussions, 2006 and 2007

<sup>10</sup> Maine Coastal Fishery Research Priorities, 2001, online at [http://www.maine.gov/dmr/research/table\\_of\\_contents.htm](http://www.maine.gov/dmr/research/table_of_contents.htm)