

ICES CM 2016/D:394

**Ecosystem effects on productivity of northern shrimp in the Gulf of Maine: hypotheses for a population collapse**

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The northern shrimp *Pandalus borealis* supports important fisheries across the North Atlantic, including one in the Gulf of Maine (GOM) where the species reaches its southern limit. Productivity of the GOM stock is linked to temperature through recruitment processes and possibly also growth of individuals. Early life survival has declined steadily since 1998, and in 2012 the population experienced a sudden decline of all life history stages. It is now considered collapsed, and fisheries have been closed since 2014.

We will describe our current understanding of ecosystem processes linked to the productivity of the GOM northern shrimp population and examine hypotheses for its sudden collapse. Temperature (correlated with NAO) has been shown to impact timing of the larval hatch and early life survival during two distinct periods in early life, one around the time of the larval hatch and another in late summer when temperature and stratification reach their annual peak. The match or mis-match in timing of the larval hatch and the phytoplankton bloom was not significantly associated with early life survival. An index of predation pressure on shrimp has approximately doubled during the past 3 decades; however, a major change in predation pressure was not seen in 2012 when the shrimp population collapsed. Further hypotheses related to predation will be examined. Overall evidence to date suggests the population has been impacted by ecosystem changes operating through multiple mechanisms.

**Keywords:** marine productivity, temperature effects, NAO, northern shrimp, early life survival, bloom phenology, match-mis-match, predation

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