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### Reproductive maturation and diel reproductive periodicity in western Gulf of Maine haddock

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## Abstract

A new macroscopic ovarian reproductive maturity index for haddock, *Melanogrammus aeglefinus* L, was developed to improve field collection of reproductive stage data. The index was tested, validated and revised based on a comparison with a laboratory histological staging method. The comparison of field and histological observations helped to improve the field index and methodologies and provided useful insight into the reproductive biology of Haddock. Although laboratory staging based on histology is inherently more accurate than any macroscopic field staging method, field observations can reveal weaknesses in the laboratory approach due to sampling bias. The revised field index includes three new macroscopic stages that represent a progression in final oocyte maturation from early to late, which were found to be reliable for staging spawning readiness in the field. This index was then used to study a population of Haddock in the Gulf of Maine to determine if it exhibits diel spawning periodicity. Commercial fishing vessels were chartered for 25 dedicated longlining trips to collect sexually mature haddock in the Southwestern Gulf of Maine at locations identified by commercial fishers as having spawning aggregations. In order to examine diel effects on haddock reproduction, the change in catch per unit effort and percentage of male and female haddock of all reproductive maturity stages together with the gonadosomatic index were observed across a 24 hour diel cycle. Only females in hydration stage 3 (defined as late final oocyte maturation stage ovaries with 50-75% of oocytes hydrated) were significantly affected by time of day with significant increases in both catch per unit effort and percentage of hydration stage 3 haddock during the night. Because H3 is the most advanced reproductive stage observed prior to a spawning event and therefore the best indicator of imminent spawning these results demonstrate that female haddock in Southwestern Gulf of Maine primarily spawn during night hours with a peak between 2100 and 0100 hours. No diel trend was observed for any male reproductive stages. Additionally, no diel trend was observed in male or female reproductive stages unrelated to spawning including immature, spent and resting.

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