

This paper presents an approach to incorporate a rigorous correction for the spatially structured day/night variation of northern shrimp density, in computing biomass estimates from a series of random stratified groundfish surveys realised in the Gulf of St. Lawrence during the 1990s.

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## **ICES CM 2001/Q:22**

### **Impact of herring spawning behaviour on acoustic estimates**

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A cross-scale acoustic study on the spawning dynamics of Norwegian spring-spawning herring was carried out in southwestern Norway in April 2000. A diurnal spawning rhythm was found, with egg deposition at the bottom starting shortly after dusk and continuing until the break of dawn. The results showed a directional horizontal movement of spawning herring with egg deposition starting in the northwest and proceeding in a southeastern direction, presumably caused by spawn gradually filling up the most suitable substrate. The spawning behaviour was shown to strongly affect the acoustic biomass estimates. The lowest backscattering values were measured while the herring were staying close to the bottom in the acoustic dead-zone during the act of spawning, while the highest values were measured when schools were "landing" on the bottom in the evening or "taking off" in the morning. The substantial diurnal variation in density and distribution of herring shown here can be corrected for by adjusting design and timing of surveys to small-scale changes in addition to large-scale changes.

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## **ICES CM 2001/Q:23**

### **The influence of fish behaviour on acoustic abundance estimates during the spawning season in Norwegian spring-spawning herring**

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The Norwegian spring-spawning herring stock has for several years been covered acoustically during the spawning season in order to estimate the abundance. However, the estimates have varied considerably and are not in consistence with other estimates. It seems that a change in this abundance index could reflect variations in availability as well as a stock change. This stock has a characteristic migration between wintering grounds in northern Norwegian fjords (68°N) and the spawning grounds located along the coast at a range of ca. 1500 km (68°N–58°N). Covering the stock acoustically during this migration and spawning period has proved to be a rather difficult task, since the area is so large, since it is moving most of the time, and since it has a different behaviour day and night, factors which clearly influence the acoustic availability. In year 2001, during a period from 15 February to 13 March, a cross section area at the most important spawning grounds of western Norway were covered acoustically 17 times with a ca. 10-hour survey track, shifting between daytime and nighttime. The present paper reports the recorded variations in these acoustic abundance estimates related to the migration behaviour of the stock.

Keywords: acoustic, abundance, behaviour, herring, migration, survey.

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