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Using hydroacoustic technology to detect and track ultrasonic tagged lake trout (*Salvelinus namaycush*)

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Previous work has shown that the target strength (TS) of a fish is sensitive to a number of factors including fish size, activity, changes in depth, swimbladder morphology and swimming angle. However, few studies have demonstrated the ability to directly measure the cumulative effect of these factors on the TS of wild, free ranging fish. In this study, we present a TS and frequency response model for lake trout (*Salvelinus namaycush*) that incorporates fish size and activity under day and nighttime conditions. During the summer of 2007, 16 ultrasonic tags pinging at 200 kHz every 2.5 seconds were surgically implanted into lake trout that were subsequently released. To locate tagged fish, we then surveyed the study area with a vertically mounted SM20 multibeam sonar and an EK60 multi-frequency split-beam echosounder. When a tagged fish was encountered, the tag pulse radiating from the target was observed on the multibeam sonar and the tag was identified using an omni-directional hydrophone. We used the observed position of the target within the multibeam sonar to steer the survey vessel directly over the tagged fish for the purpose of capturing the target within the 120 kHz & 70 kHz split-beam array for in situ TS measurements. The results of our study have implications for estimating the size distribution and abundance of fish from hydroacoustic surveys. This work provides a unique opportunity to describe the spatial distribution and foraging patterns of lake trout as they relate to the schooling behaviour of their prey.