Abstract

The sagittal otolith is shown to be an ideal tool for assessing growth variation in silver hake larvae and is used to examine patterns of growth variation among temporal cohorts, and among individuals within monthly cohorts, in relation to temporal and spatial variation in oceanographic conditions on and around Western Bank, Scotian Shelf. Larvae collected in September and October 1997 and October and November 1998 defined 4 temporal cohorts (1,2, A and B respectively) identified using inferred hatchdates. Hypotheses developed using data collected in 1997 were tested using data collected in 1998.

Length-at-age relationships were developed for each temporal cohort to examine variation in growth rate throughout the Autumn. In 1997, length-at-age relations were not significantly different between temporal cohorts (slopes 0.18 and 0.17 $mm \cdot d^{-1}$; $p=0.62$) despite large differences in growing degree days (GDD; 435 vs. 318°C·d) and average potential prey concentration (0.14 vs. 0.27 $g \cdot m^{-3}$). However, in 1998, the larval cohort hatched early in the season (cohort-A) had a significantly ($p<0.001$) greater growth rate (0.24 vs. 0.15 $mm \cdot d^{-1}$) relative to the later cohort (cohort-B). This was consistent with higher GDD (427 vs. 275°C·d) and higher average potential prey concentration (0.30 vs. 0.17 $g \cdot m^{-3}$) earlier in the Autumn of 1998. The variation in length-at-age among temporal cohorts in 1997 and 1998 is most easily reconciled by the combination of temperature and prey concentration. From this, a conceptual model is developed to predict relative cohort growth rates from temperature and zooplankton biomass estimates.

Individual average somatic and otolith growth rates were calculated for a subset of larvae collected in each month to examine spatial variation in growth rates in relation to water mass characteristics. In September 1997, larvae collected off-bank had a growth rate advantage of >0.1 $mm \cdot d^{-1}$ relative to similar aged larvae collected on-bank. Analyses of daily growth trajectories suggested that larvae collected on- and off-bank likely shared a common origin and larvae swept off-bank incurred a growth advantage relative to those that were retained on-bank. This suggests that variations in the flow field on and around Western Bank may be important for the prediction of spatial variation in growth rates. In 1998, no significant differences ($p>0.05$) in growth rate were observed for larvae collected on- and off-bank. Density and temperature, representing water mass structure, were each able to explain >35% of the variance in somatic growth rates within the November 1998 cohort. Within all monthly cohorts potential prey concentration explained <10% of the spatial variation in growth rates. These results suggest that variation in physical oceanographic variables (particularly variation in flow) are likely to be the best predictors of spatial variation in larval growth rates within cohorts in this region.