SIZE DEPENDENT GROWTH IN LARVAL FISH IS NOT AN ISSUE IN A WORLD OF PLENTY

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Abstract

Nutritional situation, and consequently larval fish growth rates, are of paramount importance for larval survival rates. On the basis of 6 consecutive spring seasons biochemically derived growth rates of larval herring originated from Kiel Canal (western Baltic Sea) were analyzed to evaluate size dependent growth, a phenomenon which has been observed in several species. For each season the slope of the regression line of G_i versus larval standard length was calculated and compared to seasonal mean prey abundance. We found decreasing size effects on larval growth with increasing prey abundances. We conclude that large larvae are more successful at meeting their food requirements at suboptimal prey abundances compared to small larvae, while no differences between small and large larvae at high prey abundances exist.

Keywords: Growth, Ichthyoplankton, Zooplankton , Baltic Sea, Brackish water

Introduction. Generally, it is acknowledged that the nutritional conditions fish larvae experience are of crucial importance concerning larval survival rates. Bigger larvae suffer from lower mortality rates as they are further developed and more effective to cope with suboptimal conditions, leading to lower predation rates [1]. The larvae´s RNA:DNA ratio is a condition index with short reaction times [2], which ensures comparability between the prey field observed during sampling and the nutritional condition of the larvae analyzed. Size dependent growth has been reported for larvae of several fish species, including Atlantic herring, Argentinean hake, Atlantic anchovy, red drum, and European pilchard [3]. In the present study, we tested the relationship between size dependent growth and prey availability for herring larvae from the field.

Material and Methods. Time series analyses of six consecutive spring seasons (2007 to 2012) in Kiel Canal at a station 13 km inland to the open Baltic Sea (54°20'45 N, 9°57'02 E) were conducted. RNA and DNA concentrations of whole individual larval Atlantic herring (*Clupea harengus* L.) were fluorimetrically measured [4]. Instantaneous growth rates of larval herring were calculated using the best-fit multi species growth model [5] and analyzed in relation to prey abundance (sampled with WP2-net, 200 µm mesh-size), consisting of copepods and cirriped nauplii.

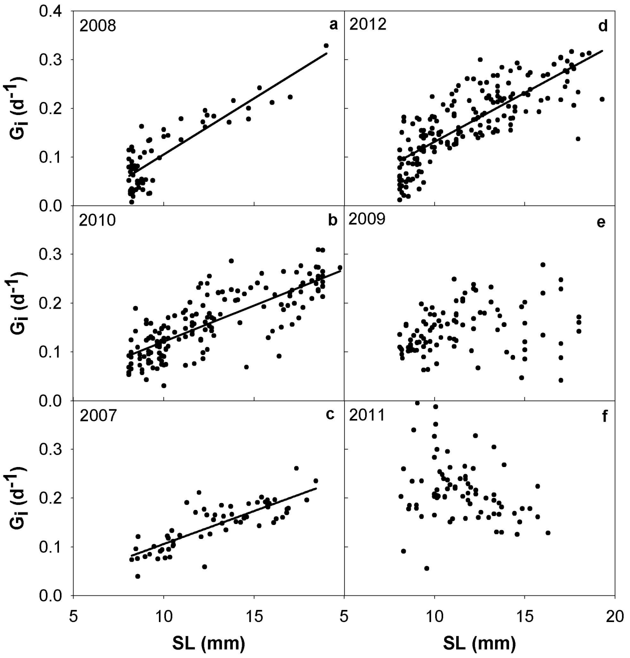

Fig. 1. Instantaneous growth rate (Gi) vs. standard length (SL). The graphs are arranged with respect to mean seasonal prey abundance from (a) lowest to (f) highest prey abundances observed.

Results and Conclusions. Our results show a decreasing trend in size dependency in larval growth rates with increasing prey abundances (Fig. 1) reflected by a decreasing slope (Fig. 2). While at low to intermediate prey abundances a linear positive relationship (Fig. 1 a-d) was observed, at high prey abundances no relationship existed (Fig. 1 e, f). This illustrates that size dependent growth of larval fish does not occur when prey availability is high, indicating that small larvae are able to feed well in such situations, despite worse swimming and hunting capabilities compared to large larvae. Therefore, if size dependency is observed, this might point to suboptimal nutritional situations for larval fish.

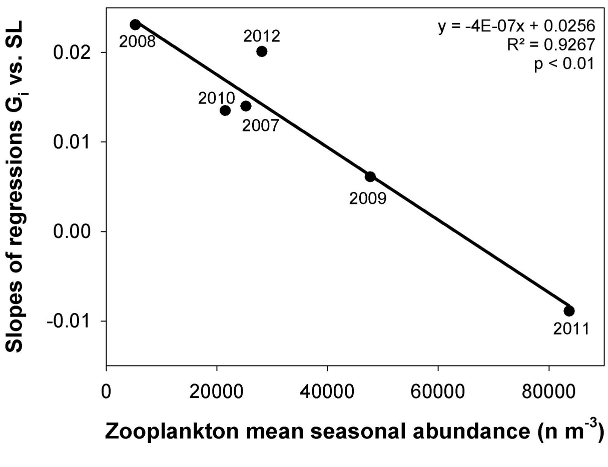

Fig. 2. Slopes of regressions (instantaneous growth rate (Gi) vs. standard length (SL)) versus mean seasonal zooplankton prey abundance.

References

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