Spatial and temporal variability in recruitment of decapod megalopae in the Duplin River, Georgia

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ABSTRACT

Callinectes sapidus (blue crab) populations have declined in Georgia’s coastal waters over the last decade. Commercial landings in 2002 were only 22% of those in 1995. Recruitment studies of this valuable species in Georgia’s Duplin River estuary (a large tidal slough adjacent to Sapelo Island) have been conducted at only one site (Marsh Landing Dock) and showed poor settlement. The dock fouling community may have interfered with settlement cues and/or high water velocities may have made settlement difficult. Our study provides a more complete account of spatial and temporal variability of decapod recruitment in the Duplin estuary. We deployed cylindrical ‘hops’ hair’ founer filter samplers at two depths in 12 locations from the mouth to the headwaters of the Duplin River. The megalopae were collected from August 17 to August 22, 2003. Larvae of seven crab species were collected over a six day period in August 2003 from Marsh Landing Dock and open water collectors in the Duplin River, GA.

Of 1727 megalopae collected, ~ 16% were Callinectes sapidus. Uca spp. were numerically dominant. Panopeus herbstii and Eurypanopeus depressus were also abundant.

The recruitment of C. sapidus to distant, up river sites was enhanced by southward winds providing enhanced transport into the Duplin River.

Strong rainstorms at low tide in the upper Duplin, along with the usual ebb-dominated flow, may have shifted peak settlement to down river sites. C. sapidus, P. herbstii and E. depressus showed preference for bottom samplers. Uca spp. showed no preference.

Our results caution against predicting blue crab recruitment levels based on a single location and supports the use of open water deployment methods.

INTRODUCTION

The average annual harvest of blue crabs in Georgia from 1956-2002 was 8.54 million pounds. The 2003 forecast was for only 1.51 million pounds and in May 2003, a fishery resource disaster was declared by the National Marine Fisheries Service. Suggested causes for the declines of harvestable adults are continued drought, increasing energy costs and acid rain. Continued overfishing of the fishery resource was declared by the National Marine Fisheries Service.

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Other Megalopae

Our study was specifically designed to:

- Determine spatial and temporal variability of recruitment in the Duplin River
- Assess recruitment at Marsh Landing compared to other sites
- Determine important environmental influences on settlement patterns

MATERIALS AND METHODS

Our study took place in the Duplin River (Fig. 1, a 12-15 km tidal slough, bordering the western side of Sapelo Island, GA). Passive settlement collectors ‘hops’ filter material attached to cylindrical PVC pipes (Fig. 2) were deployed at two depths in 12 locations from the mouth to the headwaters of the Duplin. Top samplers were designed to float just below the water surface.

Bottom samplers were designed to remain 1 m from the sediment surface. Sites were chosen to represent a range of hydrodynamic conditions and for comparison to previous studies. Samplers were retrieved every 24 hours over a six day period (August 17-22, 2003). Organisms were removed, preserved, identified to species and counted.

RESULTS AND DISCUSSION

We collected a total of 1727 megalopae over all sites and depths during the six day period of this study. Megalopae of seven crab species were collected. Uca spp. were numerically dominant. Other species collected were C. sapidus, Panopeus herbstii, Eurypanopeus depressus, Ocypode quadrata and Ocypode quadrata. We also found area of the invasive porcelain crab, Parasilphus armatus, but no megalopae. C. sapidus recruitment was spatially variable (Fig. 3) and accounted for almost 16% (270) of the total number of megalopae collected. This represented 6.4% of the total number of blue crab megalopae collected during seven months of sampling by Werna et al. (1995). In our study, Marsh Landing collectors had fewer blue crab megalopae (15.6% of C. sapidus) than open water samplers, except for those at the upstream reaches of the Duplin. These results suggest caution should be used in estimating blue crab recruitment levels based on a single sample location and supports the use of open water deployment methods.

Winds favorable for enhanced transport of larvae into the estuary only increased the number of larvae within the Duplin, but also resulted in peak settlement of C. sapidus megalopae further up river on August 17-18 (Fig 3a-b). As wind direction changed and speed decreased during August 19-22 (Fig. 6), peak megalopae recruitment shifted down river (Fig 3c-d). Recruitment of C. sapidus may have been aided by heavy rainfall at low tide on the evening of August 18 (~ 18 mm). Similar rain events, which occur the exposed marsh surface and cause down river displacement of normally distinct and stable water masses (Ragotzkie and Bryson, 1955), have been documented by Chaloner et al. (1985). The net effect would have been to decrease recruitment on the upper river samplers although southward winds continued. Numbers of C. sapidus juveniles were highest at up river sites after the increased megalopae recruitment events and the rainfall (Fig 8c-d). Settlement cases may have been enhanced by the marsh runoff resulting from the rainfall.

Use spp., P. herbstii and E. depressus also displayed increased recruitment during southward winds (Fig 9a-c). However, they did not show greatly increased recruitment at up river sites (Fig 10a-c) in C. sapidus. Uca spp. did not display a strong preference between top or bottom samplers (Fig 9a). P. herbstii, E. depressus, C. sapidus and Uca spp. settled preferentially at bottom samplers throughout the river. Water salinity and temperature were not correlated with settlement patterns.

CONCLUSIONS

- Larvae of seven crab species were collected over a six day period in August 2003 from Marsh Landing Dock and open water collectors in the Duplin River, GA.
- Of 1727 megalopae collected, ~ 16% were Callinectes sapidus. Uca spp. were numerically dominant. Panopeus herbstii and Eurypanopeus depressus were also abundant.
- Crab larval recruitment was variable across spatial and temporal scales.
- The recruitment of C. sapidus to distant, up river sites was enhanced by southward winds providing enhanced transport into the Duplin River.
- Strong rainstorms at low tide in the upper Duplin, along with the usual ebb-dominated flow, may have shifted peak settlement to down river sites. C. sapidus, P. herbstii and E. depressus showed preference for bottom samplers. Uca spp. showed no preference.
- Our results caution against predicting blue crab recruitment levels based on a single location and supports the use of open water sampler deployment.