Marine Biology (1997) 129: 79–85 © Springer-Verlag 1997

C. A. Acosta · T. R. Matthews · M. J. Butler IV

Temporal patterns and transport processes in recruitment of spiny lobster (*Panulirus argus*) postlarvae to south Florida

Received: 24 January 1997 / Accepted: 4 March 1997

Abstract We used time-series analysis to identify weekly and annual patterns in the supply of spiny lobster, *Panulirus argus* (Latreille, 1804), postlarvae to the Florida Keys, USA, over an 8 yr period. We also investigated the relationship between postlarval influx and wind forcing as a transport mechanism using the complex vector-scalar correlation analysis. Postlarval supply had a lunar phase periodicity at 4.5 wk intervals, with postlarval abundance peaking between the new moon and first-quarter lunar phases. A distinct annual cycle of postlarval supply with two peak periods was also apparent. Cross-correlation analysis between relative postlarval abundance and a 12 mo cycle showed that the annual peak occurs in spring, centered around March. With the 12 mo periodicity removed, a smaller peak at 5 mo intervals was also well defined. Wind-forcing for 7 d prior to the time of postlarval collection was marginally correlated with postlarval abundance through the entire time-series; the association was strongest during the late fall to early spring months. The analysis indicated that postlarval supply was correlated with winds from the northeast (ca. 45°), which are associated with winter atmospheric fronts. In contrast to results reported for other spiny lobster populations, these patterns suggest that recruitment of lobster postlarvae to south Florida is predictable only at a gross level and is presumably affected by the temporally inconsistent structure of regional oceanic gyres and variability in the timing of lobster spawning in the Caribbean.

Communicated by N.H. Marcus, Tallahassee

C.A. Acosta · M.J. Butler IV (✉)
Department of Biological Sciences,
Old Dominion University,
Norfolk, Virginia 23529-0266, USA

T.R. Matthews
Florida Marine Research Institute,
Florida Department of Environmental Protection,
2797 Overseas Highway, Marathon, Florida 33050, USA

Introduction

Recruitment of marine fish and invertebrate larvae is often highly variable, and identification of patterns requires quantification of biotic and abiotic influences on survival, an understanding of physical transport mechanisms, and long-term settlement data. Many variables may contribute to the temporal and spatial variability in recruitment. Larval behavior, such as vertical migration and response to changes in hydrostatic pressure, may place larvae in proximity to onshore-moving water masses (Sulkin 1984; Cronin and Forward 1986; Shanks 1995). The timing of larval influx to coastal habitats is often associated with lunar and tidal signals (Robertson 1992; DeVries et al. 1994; Thorrold et al. 1994), and settlement patterns can be linked to the movement of the wind-driven surface waters (McConaugha et al. 1984; Farrell et al. 1991; Herrnkind and Butler 1994; Thorrold et al. 1994). Due to interactions between these factors, predicting the interannual variability in the supply of marine larvae to coastal habitats is a difficult process requiring long-term data and an integrated approach to the study of processes affecting recruitment (Underwood and Fairweather 1989).

Palinurid lobsters have a complex life history, with a lengthy larval phase lasting from a few months to nearly two years, and are thus subject to widespread dispersal (Phillips and McWilliam 1986). The puerulus is the transition postlarval stage linking the planktonic phyllosoma larva to the benthic juvenile, and postlarvae settle in shallow nearshore nursery habitats often around the new-moon lunar phase (Little 1977; Herrnkind and Butler 1986; Butler and Herrnkind 1991). The nearshore supply of postlarvae for certain palinurid species has been linked to large-scale oceanic processes. For example, the supply of postlarvae of the Australian spiny lobster *Panulirus cygnus* inshore is greatly reduced when the Leeuwin Current weakens during El Niño years (Pearce and Phillips 1988; Phillips et al. 1991). Transport of pueruli across the Leeuwin Current to nearshore