Preliminary Analysis of Reef Fish Settlement Patterns in Eleuthera, The Bahamas

Análisis Preliminary de Tendencias de Asentamiento de Peces de Arrecife en Eleuthera, Las Bahamas

Analyse Préliminaire de Tendances de Recrutement de Poissons de Récif à Eleuthera, Les Bahamas

SKYLAR MILLER[1,2*], HENRI VALLÈS[3] and HAZEL A. OXENFORD[1]
[1]Centre for Resource Management and Environmental Studies, University of the West Indies, Cave Hill Campus, Barbados.
[2]Cape Eleuthera Institute, P.O. Box 29, Rock Sound, Eleuthera, The Bahamas. *skylar.e.miller@gmail.com .
[3]Department of Biological and Chemical Sciences, University of the West Indies, Cave Hill Campus, Barbados.

EXTENDED ABSTRACT

In order to fully understand changes in reef fish populations, it is imperative that entire life processes of reef fishes are considered. The majority of coral reef fishes exhibit a biphasic life history, occupying pelagic waters as larval plankton before undergoing a critical transition to the benthic, reef-associated environment, defined as settlement (Leis 1991). Settlement of reef fishes is complex and highly variable across different temporal and spatial scales, and understanding this critical process can provide valuable insight into factors ultimately determining local population size (Jones 1991).

This study is the first to investigate patterns of reef fish settlement in Eleuthera, The Bahamas, so as to help identify important spatial and temporal factors contributing to the supply of reef fish larvae to the reef fish populations of Eleuthera. Monitoring of reef fish settlement was carried out using benthic standard monitoring units for the recruitment of fishes (SMURFs) (Valles et al. 2006), a sampling tool that helps circumvent some of the challenges associated with monitoring recently settled fishes, given that settlement occurs predominantly at night and many taxa are too small, hidden or cryptic to be detected during this transitional stage.

The study was conducted from The Cape Eleuthera Institute (CEI) where SMURFs were deployed at four study sites across two habitat types including deep (20 m) continuous reefs and shallow (3 m) patch reefs to examine differences in reef fish settlement across locations, taxa and months. Up to eight units were sampled every seven days at each of the four study sites from April through October, 2013. Each SMURF comprised a 59.7 cm diameter circular plastic containment ring; a 91.4 x 91.4 cm wire mesh basket (chicken wire of 1.9 cm mesh size) containing a standard amount of coral rubble; and an exchangeable 71 cm diameter fibreglass mesh (mosquito mesh) collection bag following Valles et al. (2006). At each study site, eight SMURF units were arranged in a 2 x 4 pattern over a 20 m x 60 m grid to aid in efficient collection. Units were placed within or adjacent to the reef, and on clear, sandy substrate to avoid disturbance of any coral, sponge or seagrass.Collections of all SMURFs at each site were performed using SCUBA. A mixture of diluted clove oil and isopropyl alcohol (1:5) was used as a natural anesthetic to temporarily immobilize organisms during the collection process. Collection bags were processed at the laboratory within 24 hours, which involved removal and documentation of all marine organisms collected. All organisms were identified to the lowest taxonomic level and standard length measurements were recorded. Collections at all sites yielded a total of 1050 recently settled (< 2 cm SL) reef fishes across 42 taxa. A nested ANOVA across all taxa combined with location and sampling period (month) revealed significant variability in both temporal and spatial patterns ($p < 0.001$). More than twice as many fishes settled in SMURFs located on continuous reef habitat compared with the patch reef sites (Figure 1), although there appeared to be significant species-specific variability in this pattern. For example, barred cardinalfish (*Apogon binotatus*), goby spp. (*Gnatholepis thompsoni, Coryphopterus personatus/hyalinus, Coryphopterus glaucofraenum*), parrotfish spp. (mainly and most likely, *Scarus iserti*) and soapfish p. (*Rypticus saponaceus*) were more often collected at continuous reef sites, while beaugregory damselfish (*Stegastes leucostictus*) were found only in collections taken from patch reef sites. Settlement was also highly variable over time, with a clear peak in August and September across all taxa combined (Figure 2), although there were differences among species in this temporal pattern. Further analysis is planned to examine potential drivers of these settlement patterns, including water temperature, lunar cycle, conspecific adult abundance and other habitat features.

KEY WORDS: Settlement, reef fish, Bahamas

LITERATURE CITED

Jones, G.P. 1991. Post-recruitment processes in the ecology of coral reef fish populations: a multifactorial perspective. Pages 294-327 in: P.F. Sale (ed.) *The Ecology of Fishes on Coral Reefs.* Academic Press, Inc., San Diego, California, USA.

Leis, J.M. 1991. The pelagic stage of reef fishes: the larval biology of coral reef fishes. Pages 283-230 in: P.F. Sale (ed.) *The Ecology of Fishes on Coral Reefs.* Academic Press, Inc., San Diego, California, USA.

Vallès, H., D.L. Kramer, and W. Hunte. 2006. A standard unit for monitoring recruitment of fishes to coral reef rubble. *Journal of Experimental Marine Biology and Ecology* **336**(2):171-183.
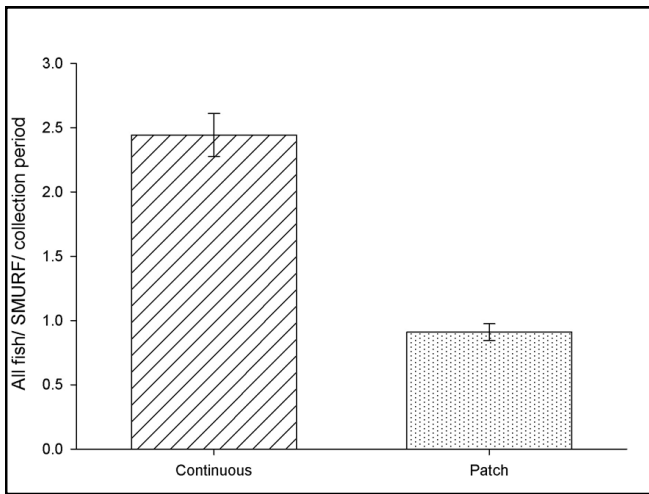
Figure 1. Preliminary comparison of overall mean settlement rates of all fish taxa combined between continuous reef and patch reef locations off Cape Eleuthera, The Bahamas from April to October 2013. Sampling period represents 7 days, and SE of overall means is shown.
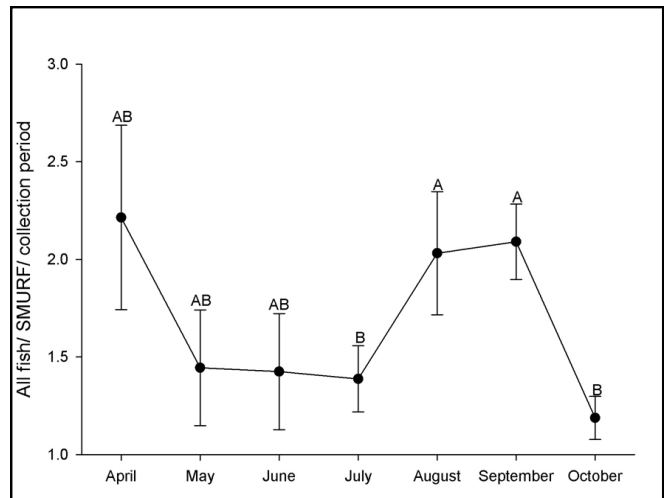
Figure 2. Preliminary comparison of overall mean settlement rates of all fish taxa combined, shown by month (April to October 2013) across all sites and reef locations off Cape Eleuthera, The Bahamas. Sampling period represents 7 days, and SE of monthly means is shown. Letters represent those months which do not differ significantly from each other.