Trophodynamics and Ecology of Pelagic Early-juvenile Nassau Grouper, *Epinephelus striatus,* During Recruitment into Bank Habitats, in the Bahamas

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ABSTRACT

Larvae and early juveniles represent precarious stages in the life history of demersal fishes, as they are highly vulnerable to fluctuations in oceanographic conditions and food resources (Grover and Olla, 1987). Survival beyond these stages is dependent on successful feeding, avoidance of predation, and favorable transport (Sinclair *et al.*, 1985), at a time when habitat and ecology are transitional between pelagic and demersal. Until quite recently, little was known about the dynamics or ecological significance of this transitional phase of recruitment (Bailey and Houde, 1989; Kaufman *et al.*, 1992).

INTRODUCTION

This study examined ecological aspects of the transitional recruitment period in Nassau grouper, *Epinephelus striatus*, a species that supports an important fishery in the Bahamas (Colin, 1992) and much of the Caribbean, although many of its stocks are declining (Bannerot *et al.*, 1987). In the Bahamas, *E. striatus* gather to form spawning aggregations around the full moon in December and January (Colin, 1992). Eggs, spawned at 20 - 35 m, float to the surface where embryos develop as they are transported by prevailing currents. A 35 - 40 day pelagic larval period is followed by recruitment from an oceanic environment into demersal bank habitats, through tidal channels (Colin, 1992). This recruitment process is brief and intense, and is apparently driven by prevailing winds, currents, and lunar phase (Shenker *et al.*, in prep.). Tremendous inter-annual variability in recruitment has been observed. Over 4 years, total recruitment off Lee Stocking Island, Bahamas, ranged from 8 fish in 1989 to 1335 fish in 1991 (Colin, unpubl. data; Shenker *et al.*, in prep).

Collections from 1991 and 1992 were utilized to investigate trophic capabilities and ecology during the recruitment process.

METHODS

Pelagic early-juvenile *E. striatus* were collected 4 - 12 February 1991, and 22 January - 22 February 1992, using channel nets that were continuously fished in 6 - 8 m deep tidal passes between Lee Stocking Island and adjacent islands in the southern Exuma Cays, Bahamas (Shenker *et al.*, in prep.). These passes separate Exuma Sound, a deep, oceanic basin that lies to the east, from the broad, shallow Exuma Bank to the west. The 2 mm mesh channel nets with a 2 or 4 m^2 mouth area, were constructed with a PVC cod end bucket, and were fished 0-1 and 2-4 m deep. Samples were collected after dawn, before dusk, and in the middle of the night during recruitment events (Shenker *et al.*, in prep). Of 1335 specimens that were collected in 1991, 341 were utilized for examination of feeding ecology during the recruitment process. All intact specimens (N = 63) that were collected in 1992 were utilized for a between-year comparison of diet.

RESULTS AND DISCUSSION

In 1991, the guts of 26.1% of *E. striatus* contained recognizable prey that had been ingested shortly before the fish were collected, 73.3% contained well digested, unrecognizable prey remnants, and 0.6% were empty (Table 1). Non-thecate dinoflagellates were ingested by 12.4% of the fish with guts that were not empty, 15.6% ingested prey other than dinoflagellates, and 1.8% ingested both dinoflagellates and other prey. In 1992, the guts of 49.2% of *E. striatus* contained recently-ingested, recognizable prey, 47.6% contained well digested, unrecognizable prey remnants, and 3.2% were empty (Table 1). Dinoflagellates were ingested by 29.5% of the fish with guts that were not empty, 26.2% ingested non-dinoflagellate prey, and 3.3% ingested both dinoflagellates and other prey. By number, dinoflagellates were the dominant prey in both years, followed by copepods. The maximum number of dinoflagellates ingested by a single fish was > 2500, while the maximum number of non-dinoflagellate prey ingested by a single fish was < 100. In terms of volume, the dominant prey items were fish larvae in 1991 and mysids in 1992.

Pelagic *E. striatus* recruits demonstrated uncommon trophic breadth: feeding habits ranged from filter feeding to particulate feeding and piscivory. Their prey ranged in size from dinoflagellates < 100 Ê in length to fish larvae > 9 mm SL. Grouper may also be capable of performing as cleaners. This trophic flexibility may impart some advantage to the recruits during a critical period in their life history. The ability to switch between filter feeding and particulate feeding has been shown to enable other species, to maximize prey intake over a wide range of prey concentrations (Gibson and Ezzi, 1992).

Table 1. Summary of gut contents of pelagic early-juvenile *Epinephelus striatus* in the Bahamas, by year, with size ranges, where N = total sample size, E = number of fish with empty guts, and Dinos = dinoflagellates.

	Percentage of all fish		**Percentage of fish with guts not empty that ingested:**		
	With recognizable prey remnants	**With well-digested prey**	**Dinos**	**Other prey**	**Dinos and Other prey**
1991 20.2 - 27.8 mm N = 341 E = 2	26.1	73.3	12.4	15.6	1.8
1992 19.3 - 26.2 mm N = 63 E = 2	49.2	47.6	29.5	26.2	3.3

Dinoflagellates did not contribute much to the total diet in terms of volume, however, as dinoflagellates were the only prey ingested by 10.6% of grouper in 1991 and 26.2% in 1992, their contribution cannot be summarily dismissed. High concentrations of small prey particles have been required to elicit filter feeding in other species (Durbin and Durbin, 1975; Hunter and Dorr, 1982; James and Findlay, 1989; Gibson and Ezzi, 1990). This suggests that a small dinoflagellate bloom or a localized concentration may have "turned on" filter feeding in *E. striatus*. Although large non-thecate dinoflagellates have been shown to be extremely important in the diet of some first-feeding larvae, accounting for as much as 60 - 90% of their daily caloric intake (Scura and Jerde, 1977; Theilacker, 1987), it is unclear what advantage pelagic early-juvenile *E. striatus* may have derived from the ingestion of dinoflagellates. This represents the first record of filter feeding at any stage in the life history of *E. striatus*. The fact that filter feeding occurred in both 1991 and 1992 suggests that the phenomenon is not anomalous, but is within the ecological capabilities of pelagic early juveniles during the transitional recruitment process. Further investigation is required to understand why a species that feeds primarily as a visually oriented feeder throughout its life history would utilize filter feeding during this transitional period.

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