COMUNICACIONES

Composition and abundance of ichthyoplankton in a Gulf of Nicoya mangrove estuary

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(Rec. 17-VII-1989. Acep. 23-II-1990)

Resumen: Se realizó muestreos mensuales de ictioplancton, en la superficie de tres sitios del Estero Punta Morales, Golfo de Nicoya, Costa Rica, de febrero a setiembre de 1985. Se recolectó alrededor de 51,000 huevos y 12,000 larvas de peces, principalmente de las familias Engraulidae, Gobiidae, Clupeidae, Sciaenidae, y Haemulidae, cuyas formas juveniles y adultas son comunes en el área. Las densidades de huevos fueron menores dentro del manglar, mientras que no hubo diferencias significativas en las densidades de larvas entre los tres sitios. No se encontró evidencia de que este manglar juegue un papel general como sitio de desove, o zona de crianza para larvas.

Key words: ichthyoplankton, mangroves, nursery grounds, larval fishes.

The Gulf of Nicoya is a large, estuarine embayment that supports valuable commercial fisheries in Costa Rica (Kolberg *et al.* 1981). Its inner shoreline is bordered primarily by mangroves that penetrate the coast in the form of inlets, or *esteros*. These areas are thought to be important spawning and nursery grounds of fishes and invertebrates (Araya 1984). Ichthyoplankton research in the Gulf has only recently begun (Ramírez, Szelistowski & López 1989, López & Arias 1987, Ramírez 1986), and few data are available to evaluate the importance of mangroves to the early life history stages of fishes.

The purpose of this study is to describe the composition of the ichthyoplankton of a Gulf *estero*, and begin to assess the role of *esteros* as spawning and larval nursery grounds.

We worked in the vicinity of Estero Punta Morales, a small (327 ha), mangrove estuary on the eastern shore of the inner Gulf of Nicoya (Fig. 1). the Estero is approximately 250 m wide at its mouth, but narrows as it extends about 2.4 Km along a main channel, which branches frequently to penetrate mangrove forest (primarily *Rhizophora harrisonii*, *R. racemosa*, and R. *mangle*). It is fed by a small creek at its head during the rainy season, but receives no source of freshwater other than direct rainwater. Surface currents at the estero mouth reach approximately 1 m/sec during changing, spring tides.

We made monthly plankton collections (February through September, 1985) at three sites: in the main channel approximately 1 km inside the estuary, at the estuary entrance, and approximately 500 m offshore of the Punta Morales peninsula about 2 km from the estuary mouth (Fig. 1). Mean depths at the sites were 4.1, 4.7, and 15.4 m, respectively. Four replicate tows were taken at each site during incoming tides between 2030 and 0500 hours, using a 0.5 m diameter plankton net of 333 mm mesh, and fitted with a flowmeter (calibrated monthly). We buoyed the net with a plastic gallon bottle and towed it behind the boat so that its upper rim was maintained approximately 10 cm the water surface, at 1.0 -1.5 m/sec, for two minutes per tow. Samples were preserved in 10% formalin.

Twenty-five per cent aliquots of all samples were sorted visually under a dissecting microscope. Identifications were made at the lowest taxonomic level possible.

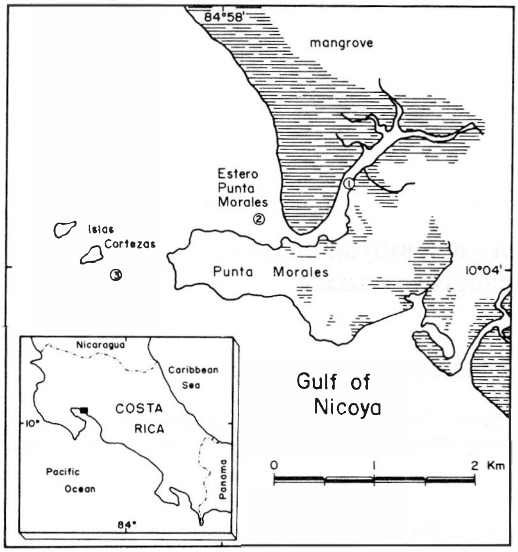

Fig. 1: Sampling stations at Punta Morales, Gulf of Nicoya: (1) estuary interior, (2) estuary mouth, and (3) offshore.

To analyze the distributions of specific taxa, we used the four replicates from each site's monthly samples to calculate mean densities per month. Friedman's method for randomized blocks (referred to as FMRB) tested for overall differences between sampling locations. When significant variation occurred, a Wilcoxon signed-ranks test ("WSR") identified differences between individual stations.

We collected a total of 51,640 eggs, and classified them as either oval engraulid (Ramírez *et al.* 1989), or unidentified spherical eggs (Table 1). Oval engraulid eggs made up a major portion (28.6-63.0%) of the egg assemblage at each station. These percentages represent conservative estimates, however, since some species of anchovies in the area possess spherical eggs (Ramírez *et al.* 1989).

Larval fishes collected included 12,306 individuals, identified from 19 families, 12 genera, eight species, and two entities termed "Costa rica Tipo 9" and "Costa Rica Tipo 50" (Table 1). There were also 1,804 (14.7%) very small or damaged larvae that were not possible to identify. Fishes identifiable at the specific level included the gobies *Gobionellus sagittula* (Günther) and *Microgobius tabogensis* (Meek & Hildebrand), the grunt *Pomadasys macracanthus* (Günther), the sleeper *Erotelis armiger* (Jordan), the silverside *Melaniris guatemalensis* (Günther), the pipefish Syngnathus auliscus (Swain), and the jacks *Oligoplites altus* (Günther) and *O. saurus* Gill.

Relative abundances of major groups were similar for all three stations, with engraulids, gobiids, clupeids, sciaenids, and haemulids being the most common families at all stations, and representing 99.3% of larvae identifiable at the family level (Table 1). These families are common either as juveniles and adults in the shallow waters of the mangrove estuary (engraulids, gobies and the haemulid *P. macracanthus;* Szelistowski 1990), or as adults in the inner zone of the Gulf (engraulids, sciaenids and clupeids; Bartels *et al.* 1984, Peterson 1956). Additionally, all fishes identifiable at the specific level occur in the mangroves as either juveniles or adults, or both (Szelistowski 1990) It is possible that larvae from other families are common at Punta Morales, but were not collected due to our inability to sample the entire water column, or throughout the year.

We found a difference in total egg density (number's per m^3) between the three stations ($P < 0.01$, FMRB; Table 1), with densities lower within the estuary than at both its mouth ($P < 0.01$, WSR) and offshore ($P < 0.05$, WSR). When tested individually, engraulid eggs also showed this pattern. Although spherical eggs were reduced in the mangroves relative to the estuary mouth ($P < 0.05$, WSR), no other interstation differences were found ($P > 0.05$ in both cases, WSR). Total larval densities did not differ between stations ($P > 0.05$, FMRB; Table 1). Likewise, no differences between stations were found when the common families (Engraulidae, Gobiidae, Clupeidae, Sciaenidae) were tested individually ($P > 0.05$ in all cases, FMRB).

This study found no evidence indicating that the mangroves at Punta Morales serve a general function as spawning or larval nursery grounds, relative to adjacent, offshore waters. In contrast, perhaps the most striking findings were the low numbers of eggs in the system, and the similarity of the larval compositions at the three sampling stations. Our findings parallel results of research on early life history stages of fishes in the Gulf of Nicoya (Ramírez *et al.* 1989), east Africa (Little, Reay & Grove 1988) and India (Krishnamurthy & Jeyaseelan 1981). These studies have suggested that although mangroves may provide an important habitat for the juveniles of many fish species, their use by larvae and as spawning grounds is reduced. Further work is necessary to adequately assess the importance of mangroves to early life history stages of fishes in the Gulf of Nicoya.

TABLE 1

Ichthyoplankton abundance at Punta Morales, Gulf of Nicoya

Taxon	Station 1 (mangroves)		Station 2 (estuary mouth)		Station 3 (offshore)		Total individuals	
	#	%	#	%	#	%	#	%
Eggs:								
Engraulidae (oval)	908	(29.0)	10,395	(28.6)	7,663	(63.0)	18,966	(36.7)
Spherical eggs	2,220	(71.0)	25,963	(71.4)	4,491	(37.0)	32,674	(63.3)
Total eggs	3,128	(100.0)	36,358	(100.0)	12,154	(100.0)	51,640	(100.0)
Total eggs/m^3	11.0		157.1		55.4			
Larvae:								
Muraenidae	0	(0.0)	1	(<0.1)	0	(0.0)	1	(<0.1)
Engraulidae	1,297	(44.4)	2,899	(61.6)	2,998	(64.1)	7,194	(58.5)
Clupeidae	410	(14.0)	169	(3.6)	40	(0.9)	619	(5.0)
Hemiramphidae								
Hyporamphus sp.	1	(<0.1)	0	(0.0)	0	0.0	1	(<0.1)
Atherinidae								
Melaniris guatemalensis	4	(0.1)	5	(0.1)	2	(<0.1)	11	(0.1)
Syngnathidae								
Syngnathus auliscus	0	(0.0)	1	(<0.1)	1	(<0.1)	2	(<0.1)
Centropomidae								
Centropomus sp.	0	(0.0)	2	(<0.1)	0	(0.0)	2	(<0.1)
Carangidae								
Oligoplites spp.	1	(<0.1)	0	(0.0)	8	(0.2)	9	(0.1)
Hemicaranx sp.	0	(0.0)	0	(0.0)	1	(<0.1)	1	(<0.1)
Gerreidae	1	(<0.1)	2	(<0.1)	1	(<0.1)	4	(<0.1)
Haemulidae								
Pomadasys macracanthus	16	(0.5)	50	(1.1)	31	(0.7)	97	(0.8)
Sciaenidae	32	(1.1)	104	(2.2)	115	(2.5)	251	(2.0)
Blenniidae	0	(0.0)	1	(<0.1)	0	(0.0)	1	(<0.1)
Eleotridae								
Erotelis armiger	2	(0.1)	2	(<0.1)	0	(0.0)	4	(<0.1)
Gobiidae	735	(25.1)	559	(11.9)	965	(20.6)	2,259	(18.4)
Microdesmidae								
Microdesmus sp.	2	(0.1)	14	(0.3)	2	(<0.1)	18	(0.1)
Gobiesocidae	13	(1.1)	3	(0.1)	0	(0.0)	16	(0.1)
Soleidae								
Achirus sp.	1	(<0.1)	0	(0.0)	2	(<0.1)	3	(<0.1)
Cynoglossidae	0	(0.0)	0	(0.0)	1	(<0.1)	1	(<0.1)
Tetraodontidae	0	(0.0)	1	(<0.1)	0	(0.0)	1	(<0.1)
Costa Rica "Tipo 9"	0	(0.0)	2	(<0.1)	0	(0.0)	2	(<0.1)
Costa Rica "Tipo 50"	3	0.1	2	0.1	0	0.0	5	(<0.1)
Unidentified	405	(13.9)	889	(18.9)	510	(10.9)	1,804	(14.7)
Total larvae	2,923	(100.0)	4,706	(100.0)	4,677	(100.0)	12,306	(100.0)
Total larvae/m^3	11.6		19.8		21.6			

ACKNOWLEDGMENTS

We thank the ichthyoplankton group at the Museo de Zoología, Universidad de Costa Rica, for assistance with the many samples sorted during this study. Members included M. Kruger, I. Naranjo J. Solera and A. Segura. We also thank C. Arias for helpful discussions, M. Murillo and R. Lavenberg for logistic support, A. León for drawing Figure 1, and R. Lavenberg, C. Arias, R. Rojas, and two anonymous reviewers for commenting on a draft of the manuscript. Financial assistance was provided by the Universidad de Costa Rica, the ARCS Foundation (administered through the University of Southern California), and the Natural History Museum of Los Angeles County.

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