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Relative Abundance and Distribution of the *Mojarra* (*Cichlasoma citrinellum*) in Lake Nicaragua

Sergio Martínez C.

INTRODUCTION

Sixteen families and at least forty-five species of fishes have been reported from Lake Nicaragua (Astorqui, 1971; Villa, 1971). The National Development Institute of Nicaragua (INFONAC) has investigated the potential fish resources and their distribution in the lake in order to implement a program of development and a rational management of the fisheries of the lake (INFONAC, 1974). The study at hand was conducted in connection with that investigation to define the abundance and natural habitat of the mojarra, *Cichlasoma citrinellum*. This fish belongs to the family Cichlidae, which is represented in the lake by several species.

Cichlasoma citrinellum exhibits great intraspecific variability in color and in certain morphological features. The author is aware of the difficulties of field identification of the species and its separation from closely allied forms, especially *C. labiatum* (see Astorqui, 1971; Villa, 1971, 1976; Barlow and Munsey, 1976). He is confident of his identifications and, in view of conflicting advice, chooses to treat his collected specimens as belonging to the single species, *C. citrinellum*. The major features of the natural history of this species have been presented by Barlow (1976) in a study based on populations living in the crater lakes, not the Great Lakes.

METHODS

The data were obtained from exploratory fishing cruises of the INFONAC vessel, M/N Gaspar. Two types of areas were sampled in the lake, the *central zone*, with depths greater than 1½ fathoms, and the *coastal zone*, with depths less than 1½ fathoms.

In the central zone a 45-ft trawl net of two-inch (stretched) mesh was used. The trawl was towed at a speed of two knots for a period of 30 minutes. During the study 94 stations were sampled. They were separated from each other by a distance of five nautical miles (Fig. 1). To obtain the relative abundance of each species, the catch was placed in 40-lb baskets. One basket was taken as a representative sample and the rest were discarded. The total catch was determined by multiplying the number of baskets by the weight of the representative sample. The species contained in the sample were sorted and weighed to obtain their respective percentages. The apparent distribution of *C. citrinellum* was determined by plotting the areas of the lake where the sample percentage was greater than the calculated average percentage for all stations sampled.

In the coastal zone, floating monofilament and multifilament gill nets were used. The nets were 50 by 1.6 m and had a mesh of 2½, 3½ or 4½ in. The nets were never in one

location longer than 24 hours and were re-set every six hours.

RESULTS

During the trawl operations 12 species were caught (Table 1), of which *C. citrinellum* made up 8.7% of the total weight. *Sabalete* (*Dorosoma chavesi*), was the most abundant species (Fig. 2) and was distributed almost uniformly in the lake. Besides *D. chavesi* three other species were also more abundant than *C. citrinellum*: *Rhamdia* sp., *C. nicaraguense* and *C. longimanus*. *Rhamdia* sp. and *C. nicaraguense* were found, especially at great depths, in the central zone, while *C. longimanus* was more abundant in the coastal zone at depths of 1½ to 5 fathoms. *C. citrinellum* was present in higher frequencies in shallow waters and in areas near the coast and was not found in large numbers in the central zone.

In Fig. 3 we can observe the distribution of *C. citrinellum* as determined from trawling. Area B, which corresponds to the north and northeast coast of the lake, is the most extensive. Here the bottom is muddy, with some rocky promontories. This zone is well protected from the winds that generally blow from the northeast throughout the year. Zones C, E and H have similar ecological characteristics; all of them have muddy bottoms and lie near the rocky outcroppings that form the islands of San Bernardo, Mancarron and Zapatera, respectively.

With respect to depth, *C. citrinellum* was present in high percentages in areas from 1½ to 5 fathoms. In Fig. 4 we see how this factor influences the species' distribution. As the depth increases, abundance declines notably, whereas other patterns are shown by *C. nicaraguense* and *Rhamdia* sp. It is presumed that depth is a factor limiting the distribution of this species in the lake.

The mojarra catches in the southeast end of the lake were relatively low, but *C. longimanus* was abundant there. This

TABLE 1. Species taken in trawls.

Common name	Scientific name	Family
Sabalete	<i>Dorosoma chavesi</i>	Clupeidae
Bagre, chulin	<i>Rhamdia</i> sp.	Pimelodidae
Moga	<i>Cichlasoma nicaraguense</i>	Cichlidae
Carate	<i>C. longimanus</i>	"
Mojarra	<i>C. citrinellum</i>	"
Mojarrita	<i>C. centrarchus</i>	"
Pica culo	<i>Neetroplus nematopus</i>	"
Guavina	<i>Gobiomorus dormitor</i>	Eleotridae
Sabalito	<i>Roeboides guatemalensis</i>	Characidae
Sabalito	<i>Bramocharax transfordi</i>	Characidae
Sabalito	<i>Astyanax</i> sp.	Characidae

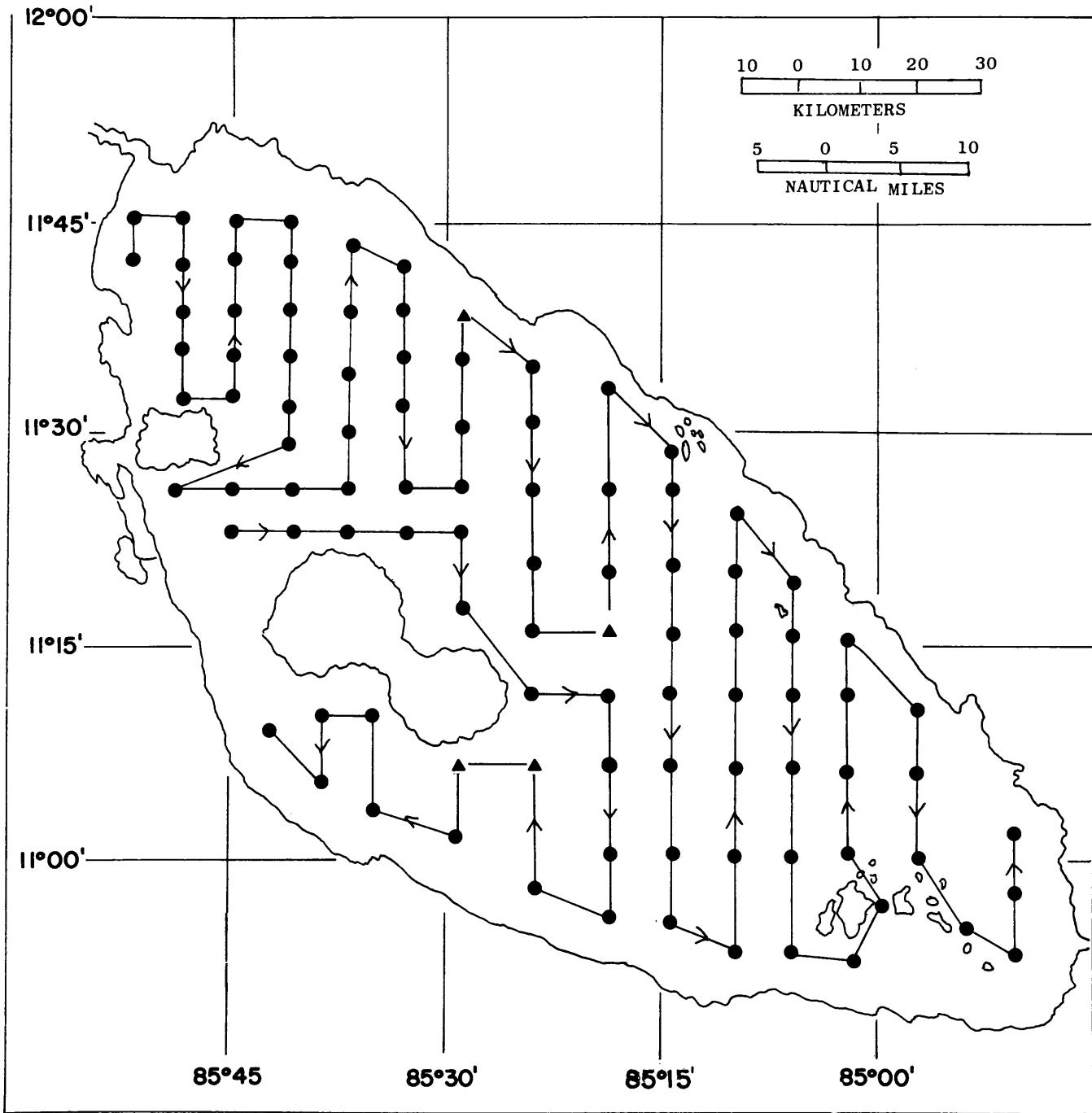


FIG. 1. Map of Lake Nicaragua indicating the route of the M/N Gaspar (arrows), collecting stations (closed circles), and stations not reached (triangles).

could signify interspecific competition, but a more detailed study must be done to affirm this.

In the coastal zone, *C. citrinellum* was common in every area investigated by gill netting, representing 23.6% of the total number of collected specimens. The gill net stations are listed in Fig. 5, along with the number of collected specimens from each location. The largest catches of mojarras were from the Solentiname Islands. They were found mainly over rocky bottoms and in areas with floating plants such as water hyacinth (*Eichornia* sp.).

Seven other species taken by gill net in the coastal zone are listed in Table 2.

TABLE 2. Species taken in gill nets.

Common name	Scientific name	Family
Gaspar	<i>Lepisosteus tropicus</i>	Lepisosteidae
Guapote	<i>Cichlasoma managuense</i>	Cichlidae
Mojarra	<i>Cichlasoma citrinellum</i>	Cichlidae
Machaca	<i>Brycon guatemalensis</i>	Characidae
Róbalo	<i>Centropomus parallelus</i>	Centropomidae
Roncador	<i>Pomadasys grandis</i>	Pomadasytidae
Sábalo real	<i>Megalops atlanticus</i>	Elopidae
Pez sierra	<i>Pristis perotteti</i>	Pristidae

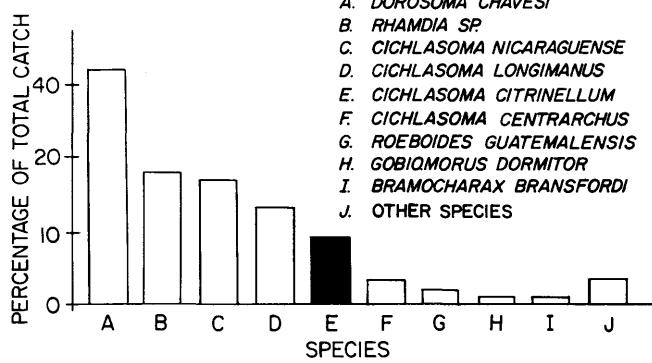


FIG. 2. Percentage of total catch, represented by species, taken in trawls in the central zone of the lake.

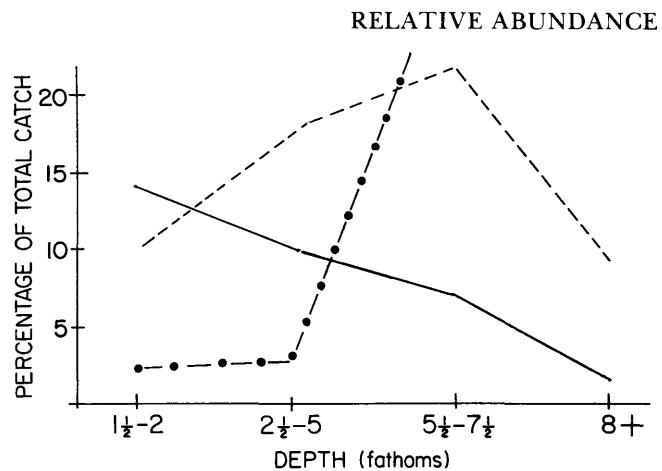


FIG. 4. Relation between depth and relative abundance of *Cichlasoma citrinellum* (solid line) compared with *C. nicaraguense* (broken line) and *Rhamdia* sp. (dots and dashes).

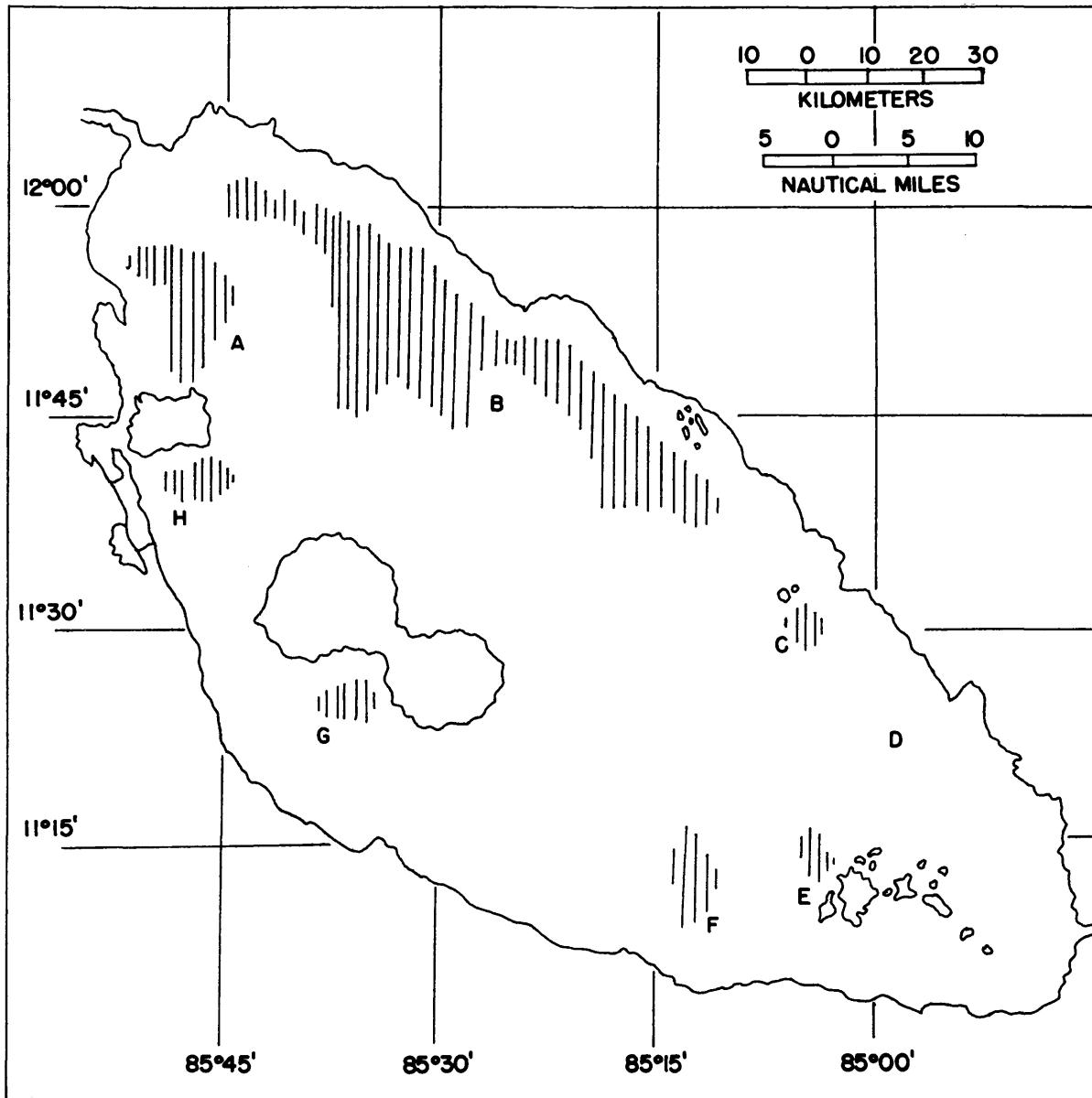


FIG. 3. Distribution of the mojarra, *Cichlasoma citrinellum*, determined by trawling. Hatching indicates areas in which their concentration was greater than 8.7% of the total catch, by weight.

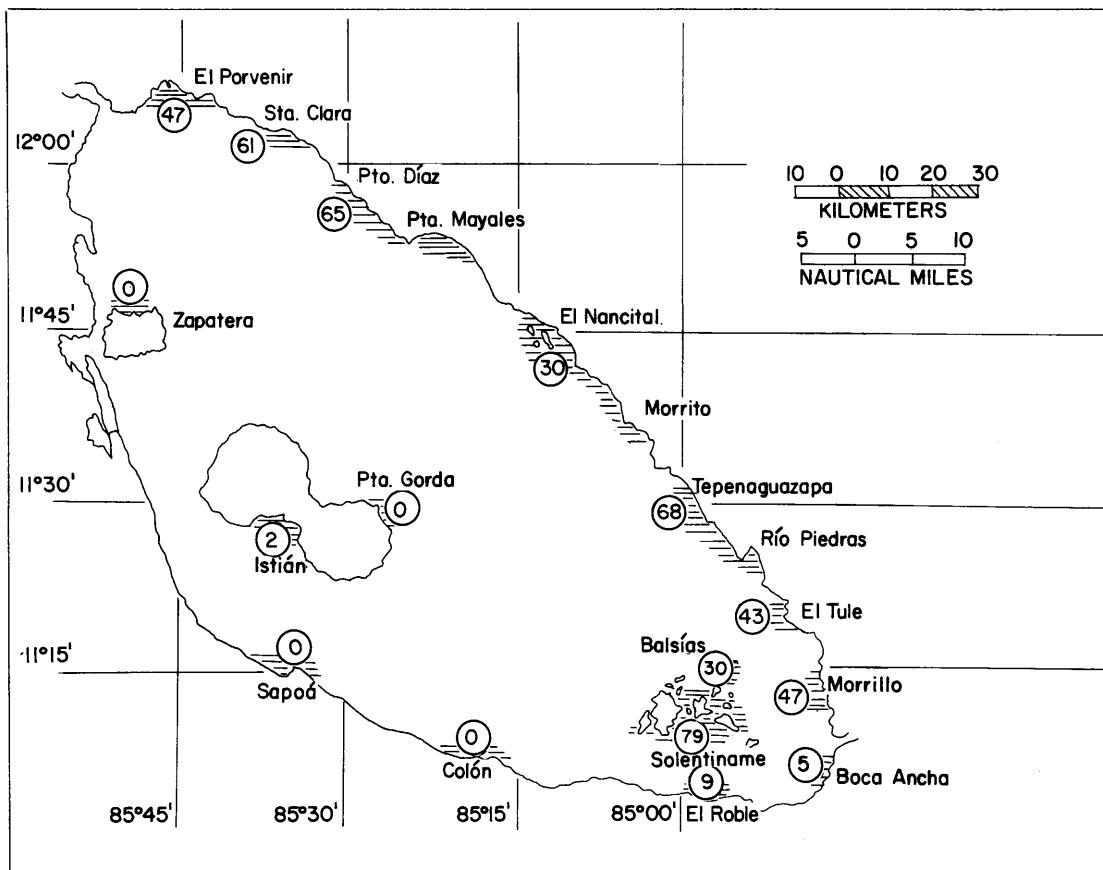


FIG. 5. Gill net stations. Numbers encircled are the number of specimens of *Cichlasoma citrinellum* taken at each location.

ACKNOWLEDGMENT

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SUMMARY

The mojarra (*Cichlasoma citrinellum*) is found inhabiting mainly the north and northeast coasts of Lake Nicaragua, areas to the south of Ometepe and Zapatera Islands and to the west of the Solentiname Islands. Small local concentrations are found near San Bernardo Island and elsewhere. This species prefers rocky bottoms, which offer the best conditions for its reproductive behavior. It also inhabits areas with muddy bottoms and aquatic plants near the surface. The species prefers depths of less than five fathoms and especially the areas near islands and rocky promontories where depths are less than 1½ fathoms. The average relative abundance of *C. citrinellum* was 8.7% of the total catch, by weight, at the trawling stations in the central zone of the lake. The average abundance in the coastal zone, where it was collected by gill netting, was 23.6% of the total specimens collected.

RESUMEN

En el Lago de Nicaragua la mojarra (*Cichlasoma citrinellum*) se encuentra principalmente en las costas del norte y el noreste, en áreas al sur de las Islas de Ometepe y Zapatera, y al oeste del archipiélago de Solentiname. En la Isla de San Bernardo, y en otras localidades, se encuentran

poblaciones locales concentradas. La especie prefiere fondos rocosos, que le ofrecen las mejores condiciones para su comportamiento reproductor. Ocasionalmente también habitan áreas de fondo lodoso con plantas acuáticas cerca de la superficie. Prefiere profundidades menores de 5 brazas y, especialmente, áreas cercanas a islas o promontorios rocosos a menos de 1.5 brazas. Su abundancia relativa promedio fué del 8.7%, por peso del muestreo total, en las estaciones de arrastre en la zona central del Lago. En la zona costera, donde se colectó con red de agalla, representó en promedio el 23.6% del total de los especímenes colectados.

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