Preliminary Investigations of Reproductive Activity of the Jewfish, *Epinephelus itajara* (Pisces: Serranidae)

PATRICK L. COLIN
Caribbean Marine Research Center
100 East 17th Street
Riviera Beach, Florida 33404, USA
Author's mailing address: CMRC, c/o FSU Marine Laboratory, Rt. 1, Box 456, Sopchoppy, Florida, 32358, USA

ABSTRACT

During August and September 1990 numerous large jewfish between 60 and 150 kg were present for purposes of reproduction on a wreck in the eastern Gulf of Mexico at 33 m depth. Presumed males exhibited a pale head and dark body coloration when courting. Courtship activities occurred throughout much of the day and consisted of the male nuzzling of the vent area of females and males and females rising and turning together in the water column. Loud low frequency sounds ("booms") were often produced and may be related to courtship and territorial defense. Spawning was not observed, but may occur in mid-day. Pairs of fish may spawn within a haremic social system, similar to that of *Epinephelus fulvus*.

KEYWORDS: courtship, reproduction, sonic activity, jewfish.

INTRODUCTION

The jewfish, *Epinephelus itajara* (Lichtenstein), is the largest of the western Atlantic groupers, reaching weights of at least 310 kg and 2.4 m in total length (Robins *et al.* 1986). Despite its previously common occurrence in Florida and many areas of the West Indies, little is known of the biology of this fish. Sexually active jewfish are reported to aggregate at some locations during the summer and it is assumed spawning occurs at these locations (Bullock, in prep.). The present paper is a preliminary report of investigations during summer 1990 of the activity of a group of jewfish, almost certainly aggregated for reproduction, on a wreck in the eastern Gulf of Mexico.

MATERIALS AND METHODS

The study was carried out at the wreck of an unidentified wooden shrimp boat in 33 m of water approximately 140 km NW of Key West and 93 km W of Naples, Florida (Figure 1). This site was visited on 4-6 August and 5-7 September 1990 (full moon was 6 Aug and 5 September). The wreck is on a flat, largely sandy, bottom with some nearby patches of hard substratum.

Observations and video recording of jewfish activity were made by SCUBA divers working from the F/V *Misteriosa*. Nitrox diving was used to allow longer

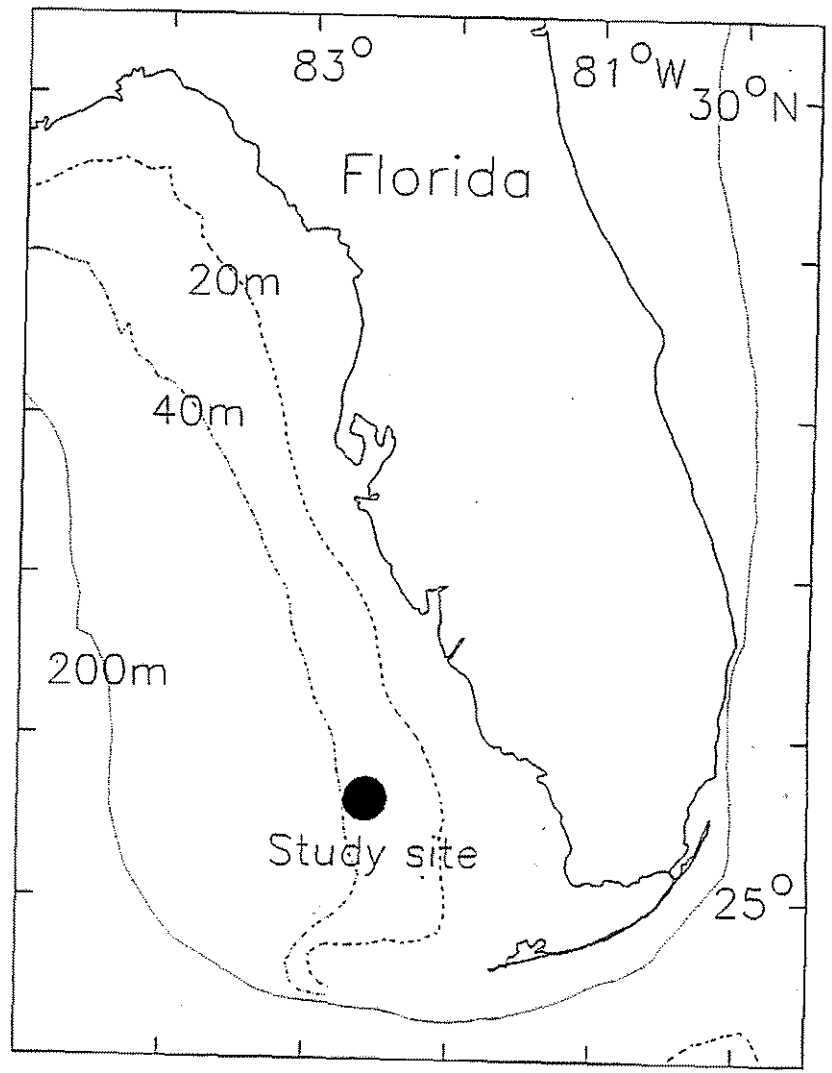

Figure 1. Location of study site at 33 m depth off the southwestern Florida coast.

bottom times than would be possible with compressed air diving at the depths of the wreck and approximately 90-120 min of total observations each day were tallied using several divers. Over 4 hours of video tapes were made during August and 2 hours during September. In general the video camera was started once the diver reached the bottom and was run continuously so the time of any activity recorded could be correlated with real time. Temperatures were determined using a digital thermometer with an accuracy of 0.5°C.

Because no specimens were collected, we could not positively assign sexes to any of the fish observed during this study. In a few cases, because of behavior or coloration observed, I have assigned presumed sexes to these individuals based on experience with coloration and activity of other groupers where sex was known. Hopefully, additional studies will allow verification of sex with given coloration and behavior.

RESULTS

Conditions at the study site

The bottom 6-9 m of the water column had a layer of cooler, more turbid water. Visibility ranged from about 8–18 m in the lower layer and 25–30 m in the warmer water above it. During August, water temperatures were 25–26°C near the bottom and 30°C above about 25 m depth with temperatures up to 0.5°C lower on the bottom during September.

Numbers and Location

There were a maximum of 12 *E. itajara* present in August and 8 during September. Because of the turbidity of the water near the bottom, at any given time fewer than the maximum numbers of individuals were generally found. During August usually 6–8 and during September 4–6 fish could be observed on a given dive. In August the size of individuals observed was estimated to be between 60 and 150 kg (D. Demaria, pers. comm.).

In August a few fish were identifiable as individuals by scrapes or other characteristics. One of these, a large (estimated 150 kg) presumed male appeared to be the dominant fish, apparently holding the area of the wreck with the most cover as a territory. If another fish was present in this shelter after this fish had been absent, upon returning, it often came alongside the other fish, boomed loudly (described subsequently) and behaved somewhat aggressively towards it until the intruding fish moved from the shelter.

Eight fish were tagged at the end of the August observations. During September only two tagged individuals were seen and it is likely these were the only tagged individuals present. A large, presumed male, which was active during August and readily identifiable by a torn caudal fin and scrapes on the opercle, was not seen in September.

At different times fish were either close to the bottom, around the wreck or over open bottom at some distance from it, or were 3–6 m above the water swimming into the current. When in the water column and not interacting with other fish, they congregated at the upcurrent end of the wreck and moved to the opposite end when the current, possibly related to tidal phase, switched direction. They remained in the cooler, more turbid water overlying the bottom.

Coloration

The large presumed male exhibited rapid color changes associated with presumed courtship. He would become extremely dark on the body with the head becoming pale. This "pale head" color phase was usually associated with presumed intersexual interactions. The presumed females during courtship did not change color, remaining in the typical mottled pattern (Figures 2 and 3).

Activity during day

The courtship activities described subsequently were seen throughout much of the day on August 4 and 5. These activities seemed to be most common from late morning to mid-afternoon. No apprent courtship activity was observed during one dive made at dawn nor during others in the early morning.

There were a few possible courtship encounters during sunset periods on 4 and 5 August. On one evening, the large presumed male remained in its sheltered location on the wreck while 6 other fish, presumed females, hovered in the water column at the upcurrent end of the wreck about 6 m off the bottom from about 15 minutes before to 15 min after sunset. At that point, it was too dark to see what was occurring. During September 5 and 6 similar dives were made at sunset and again no courtship activity was seen nor were fish observed to be hovering in the water column before sunset.

Courtship

Two presumed courtship movements were seen on numerous occasions. The first is termed a "vent nuzzle". The male approached the female from behind and alongside, gradually closing the distance between them, as though it was attempting to nuzzle the female on her ventral surface in the area of the vent (Figures 4 and 5). The females often responded to this by rolling towards the male, in effect moving the vent away from the head of the male. In such cases the male usually then passed underneath the female immediately reversing directions, approaching the vent from the opposite side, and repeated the vent nuzzle. The female usually responded similarly and often attempted to swim forward and away. A maximum of 3 vent nuzzles, one quickly following another, by a male to a single female were seen.

The second presumed courtship behavior is termed a "turn and rise". In this case the male approached the female laterally and came alongside her. The male

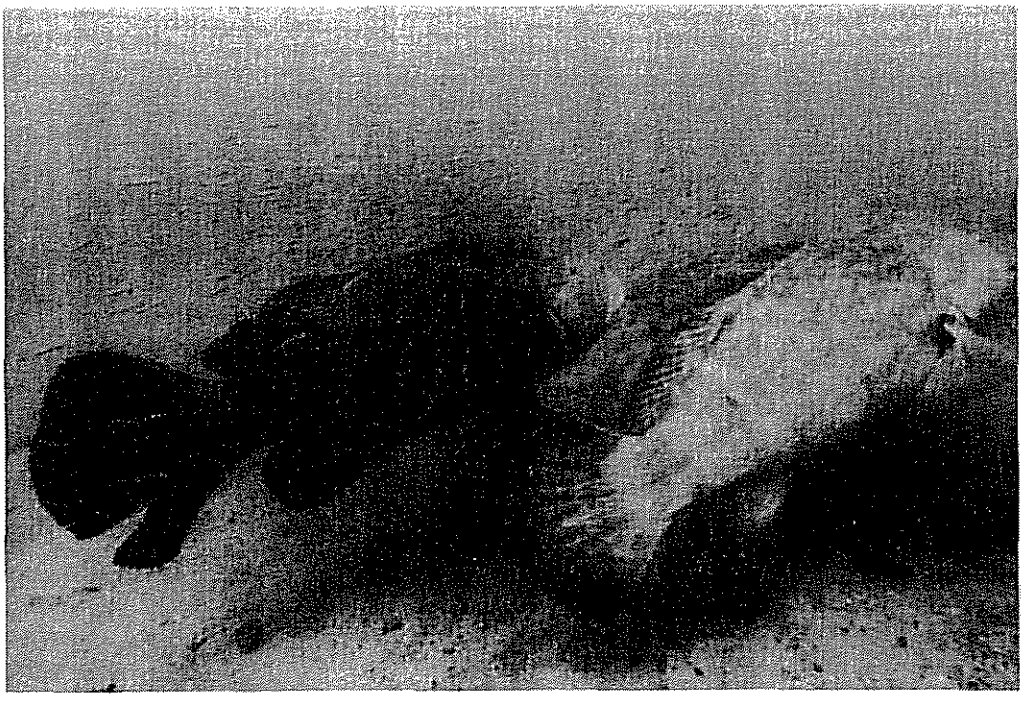

Figure 2. Possible courtship of *Epinephelus itajara* with a presumed male (left) with pale head and dark body coloration swimming alongside a presumed female (right) in normal coloration. (Photograph by Doug Perrine, ©1990).

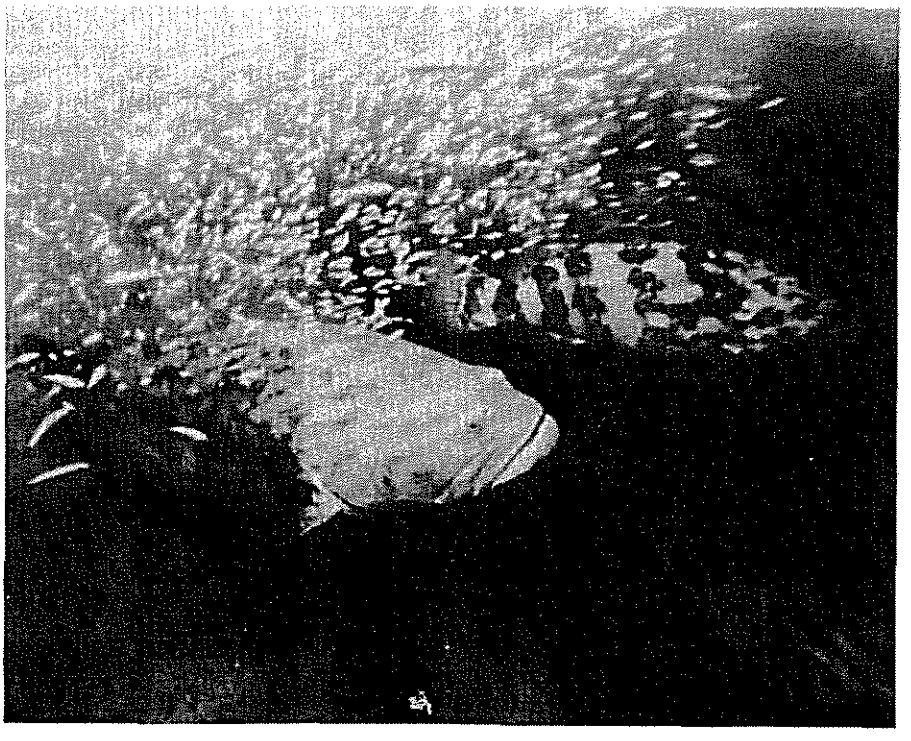

Figure 3. Head on view of the pale color phase of a presumed male *Epinephelus itajara* (foreground) alongside presumed female (rear) in normal coloration. (Photograph by Doug Perrine, ©1990).

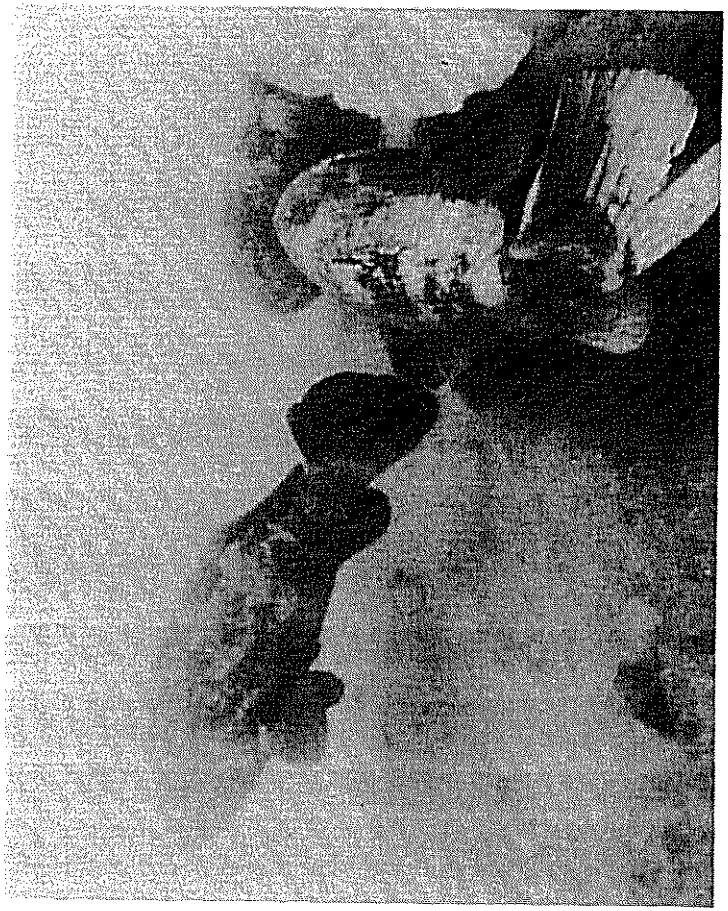

Figure 4. Possible courtship behavior of *Epinephelus itajara* with presumed male (center) "vent nuzzling" a presumed female (right) while over open sand bottom. A second possible female is to the left of the male. (Photograph by Doug Perrine, ©1990).

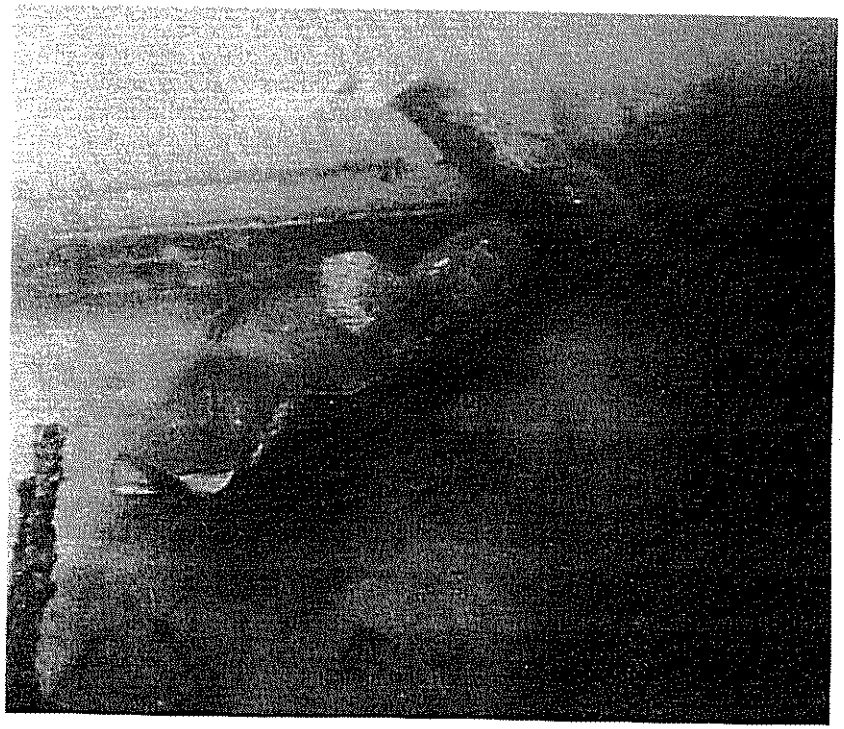

Figure 5. Possible "vent nuzzling" by male *Epinephelus itajara* (center) towards presumed female (upper right) on the shrimp boat wreck, 33 m depth. (Photograph by Doug Perrine, ©1990).

was often either already in the pale head color phase or acquired this phase immediately before approaching the female. The females being approached were usually in the water column or rose at the approach of the male. Once alongside the male would slowly turned laterally towards the female's side and often started rising in the water column. The pair then turned through 90-180°, taking a few seconds to accomplish that turn, and then one fish, usually the female, broke off. In some cases a third smaller fish, a presumed female, was close by and partially duplicated the movements of the pair.

Some potential aggressive encounters were also seen between two presumed males, although no active fighting was observed at any time. Two presumed males did, however, have scrapes on their opercles and splits in the caudal fin rays, indicating some aggressive encounters may occur which result in minor injuries. Additionally the two fish sometimes came side by side, head to head, with frequent booming.

Sonic Activity

During August there was a great deal of sonic activity among the jewfish on the wreck. The sounds produced can be described as "booms", loud low frequency sounds of sufficient intensity that they were easily heard by divers 30-50 m from the fish. Visible movement of the swim bladder area often was seen in conjunction with the booming, and I assumed that these sounds were produced as a result of muscular vibration of the swim bladder.

Sonic activity was associated with presumed courtship behavior. During August the large presumed male approached presumed females and boomed several times as he came alongside. He then often moved on to another fish and repeated the booming while alongside. As many as 50—100 booms were heard during a single 20-30 minute dive. During September, however, booming was almost non-existent and the few possible booms that were heard did not have nearly the strength of those heard during August.

DISCUSSION

There were major differences in the behavior of fish at the wreck between the two observation periods around the full moons of August and September. Presumed courtship behavior was observed only during the August period. During September there was a reduced number of fish, which were much less easily approached, and no sonic activity was noted.

Whether the courtship activity observed during August is truly related to lunar phase can not yet be answered. Gonad data from Bullock (in prep) indicates that spawning of *E. itajara* in Florida probably occurs during both August and September. If spawning is closely related to lunar phase, I would have expected during September to have seen definite courtship activity similar to that of August, which was not the case. The full moon of September occurred

early in the month and if there was a definite August-September spawning, activity should have been high at that time.

It may be that spawning is seasonal and not associated with a particular lunar phase. This appears to be the case for *Epinephelus fulvus* in the Bahamas (Colin, unpublished) where the same population spawned on nearly identical dates, but on different lunar phases in successive years. *E. fulvus* also had hiatuses of several days between periods of spawning and it is possible that my September observation period might have occurred during a similar hiatus by *E. itajara*.

The observations of presumed courtship during mid-day and a lack of similar activity levels during the period leading up to sunset, indicate it is possible the species spawns during mid-day to late afternoon, rather than near the time of sunset, as has been documented for other groupers (Colin *et al.* ,1987; Colin, in press; Colin, unpublished) in the field. Actual spawning observations are needed to test this hypothesis.

I believe that *E. itajara* will prove to pair spawn within what may be a haremic social system. The interactions in which males moved alongside females, then turned laterally on the side of the presumed female while rising is similar to the preliminary spawning behavior of *E. fulvus* (Colin, MS). In the latter species spawning is accomplished by a continuation of the lateral twisting and rising, culminating in gamete release at the peak of the ascent. I believe *E. itajara* will spawn similarly, continuing upward from the rise and turn movement described here.

ACKNOWLEDGMENTS

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