

Tag and Recapture Study of Red Hind and Coney at Three Spawning Aggregation Sites Off the West Coast of Puerto Rico

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ABSTRACT

A pilot study of mark-recapture for red hind (*Epinephelus guttatus*) and coney (*Cephalopholis fulva*) was started at three closed spawning aggregations off the West Coast of Puerto Rico. It is expected that the closed season and area, will provide for the population, to recover from the heavy fishing pressure to which they are submitted. Also it will provide a better understanding of the movement behavior during the spawning aggregation period of red hinds through other research methods, such as tag and release. A study of this type provides information on the ability of the species to identify their spawning site (homing) and their distribution. Luckhurst (personal communication) has shown that red hinds have the ability to home and identify particular spawning sites.

A total of 374 red hinds and 579 coneys were tagged and released between January and June 1999. At the beginning of the study (first two months) the animals were released, approximately nine kilometers from the area of capture. Thirty-five (35) recaptures of red hinds have been recorded, representing 7.49% of total tagged individuals. A few red hinds have been recaptured more than once, for instance one individual has been caught three (3) times at the site of first capture. To maximize the probability of recapturing coneys, a single site (Abrir La Sierra) was selected to capture and release the last 193 individuals. Thus far, no coney has been recaptured.

KEY WORDS: Coneys, red hinds, tagging

INTRODUCTION

Red hind has become the serranid of great commercial importance in Puerto Rico (Matos 1997). This species gained commercial value after the commercial extinction of the Nassau grouper in Puerto Rico fisheries. These two species of serranids share a common factor that could lead to the commercial extinction of the red hind also. They do aggregate to reproduce in very specific areas and time. This factors make them highly susceptible to be overfished, before they have the opportunity of reproducing. Red hinds are of great commercial importance through its range of distribution in the Caribbean. It is believed to be over fished in many areas besides Puerto Rico and the U.S. Virgin Islands (Beets and Friedlander 1992, Sadovy and Figuerola 1992, Sadovy 1994). The species

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composition of fisheries-independent surveys carried out by the Fisheries Research Laboratory by the end of the 1960s and beginning of the 1970s, placed red hinds as the fourth species of importance (Juhl 1969, Juhl 1972, Juhl and Suárez-Caabro 1972, 1973). Due to the sharp decline of the major serranid species and the increase in landings of red hinds, there has been an increased interest in studies regarding the reproduction, and age and growth. Among those are Sadovy et al. (1992, 1994) and Shapiro et al. (1993).

One aspect of the red hind spawning aggregation that has yet to be defined is whether red hind travel to spawn to a determined area, every year. Sadovy et al. (1992) showed that red hind does not necessarily moves to the nearest spawning site. Shapiro et al. (1993) showed that specific sites of fish concentrations within identified areas may vary from year to year and even during an annual aggregation. Whether this situation is an artifact of over-exploitation of the aggregation or an intrinsic characteristic of it, is unknown. Once again, this situation poses a great constraint to management, since one may close a spawning aggregation site thinking that it will help the species, while it might be possible that the fish are no longer aggregating at that area to spawn. Reproductive strategies of red hinds are of particular interest to many researchers since they appear to represent an intermediate between the extremes shown by other species. Red hinds are protogynous hermaphrodites, which form short-term spawning aggregations (Burnett-Herkes 1975, Colin et al. 1987, Sadovy et al. 1992). Individuals may live for 18 years or more and, during the non-reproductive season, live in overlapping home ranges (García-Moliner 1986).

Coneys are members of the serranidae exploited with red hinds. Commercial landing data of this species are not as specific as for red hinds since they are reported under the groupers classification. Overall coneys fluctuate in being among the three most caught species in fisheries-independent surveys. They also make up the second most important grouper species in commercial landings data. In contrast to red hinds, coneys have not been reported to form spawning aggregations, although, they do often spawn at the same area of red hinds. During spawning aggregations of the red hind that occurred from December to March 1995, ripe coneys, both males and females, were collected from September thru March. The peak of ripe individuals was recorded in December (1994) and January (1995). Data suggested that coneys spawned in the same area used by red hinds, with a week of difference between them. Data also suggested that two spawning activities occurred, one in January and a second one during February. Colin et al. (1987) also reported spawning activity of coneys near a red hind spawning site off the south coast of Puerto Rico. In 1993-1994 was the first time we could prove that coneys spawn in the same area and in a similar period as red hinds (Rosario 1994). One factor that has made this possible was the monitoring of an area off the west coast platform, besides the site usually

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monitored at the Bajo de Cico. As proven by the data obtained (Rosario 1989), coney are not as abundant at the Bajo de Cico (stations 95 and 96). Therefore, data collected at previous red hind spawning aggregations in that area did not show a clear pattern of coney reproductive strategies. The Abrir La Sierra area for sampling the red hind aggregation corresponded to the station that yielded the highest number of coney in our surveys.

The Fisheries Research Laboratory (FRL) has monitored for the last ten (10) years a red hind spawning aggregation off the west coast of Puerto Rico (Rosario 1989, 1992, 1994, 1996). The area is known as the Bajo de Cico bank, located 28 km west northwest from Mayagüez. Two other aggregation sites have been monitored sporadically - the Abrir La Sierra found 28 km southwest of Mayagüez, and the Tourmaline Reef approximately 15 km west of Mayagüez. This monitoring has been used to characterize the reproduction of the red hinds in western Puerto Rico (Sadovy et al. 1994). Nevertheless, certain aspects remain unclear regarding the reproductive strategies of this species. Maintaining a close monitoring of these areas is important now that they are to be closed to all fishing during the spawning aggregation period. The closed season and protected areas will provide an opportunity for the population to recover from the heavy fishing pressure, as well as provide a better opportunity to understand the movement behavior during the spawning aggregation period of the red hinds through other research methods, such as tag and release. A study of this type will give the opportunity to detect the ability of the species to identify spawning sites (homing), and to determine the distribution of the species. Luckhurst (personal communication) has shown that red hinds have the ability of homing and identify particular spawning sites. Mark-recapture experiments provide important information on movement behavior during the reproductive period.

The objectives of the project were to characterize the movement behavior during reproductive period of red hinds and coney at three spawning aggregations sites thru mark and release methods during the spawning periods of January, February and/or March 1999 and to collect a minimum of thirty gonads samples per species (red hinds and coney) to assess spawning activity.

METHODS AND MATERIALS

Sampling was carried out using fish hooks (size #06) with squid as bait. Specimens were marked and released at three aggregation sites. Some details of sampling were subject to minor modifications that depended on logistics and prevailing conditions of weather and boats. For instance, extreme weather conditions forced the decision to include a sampling area known as Macamba or station 7, located southwest (15 km), of the intended areas. Logistics to improve the rate of survival required that fishing took place in waters less than 30 m.

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Efforts were directed to tag approximately 500 individuals of each species. Specimens were first measured (in millimeters), and "vented" if necessary. (In this process the air in the gas bladder that had expanded when the specimen is brought to the surface is released by inserting a 18-gauge needle through the body wall under the pectoral fin until it penetrated the gas bladder. Gentle pressure is applied to the abdominal area that forced the air out of the bladder.) All fishes were doubly tagged with a numbered Floy anchor tag (FD-94) inserted on each side into the musculature at an angle of about 45°, 1 - 2 cm below the origin of the second dorsal fin. Ideally, the tag is anchored behind the second dorsal fin rays supports (pterygiophores). The specimens then were placed in standard fishers' ice chest filled with sea water and allowed to recover before released. The water in the container was pumped every 10 minutes to ensure that the specimens were in fully oxygenated water. Red hinds and coney were released at sites individually at a distance about 5 km from the collection site. Coordinates of capture and release sites were taken with a GPS (global positioning system) and these sites were plotted on a chart of the area. The tagging methodology has been successfully used with red hinds (*Epinephelus guttatus*) in Bermuda (Luckhurst 1996, Luckhurst and Hateley MS).

A notice to the public (commercial and recreational fishers) was issued notifying of the intention on tagging and releasing red hinds and coney at these sites. It was requested if any tagged specimen were captured outside the closed areas to return the fish and/or the tag to the Fisheries Research Laboratory.

RESULTS

A total of 579 coney and 374 red hinds were marked and released in 52 trips between January 1999 and the 10 of June 1999. Although the intention was to tag fish in the closed areas off the West Coast of Puerto Rico, other areas were included due to logistics. Most individuals were sampled in two stations. The Abrir La Sierra spawning aggregation area was where most of the individuals were tagged and released. A total of 264 red hinds (70.6%) and 395 coney (68.2%) were sampled in Abrir La Sierra. Macamba was the other area where the rest of the individuals were sampled. A total of 34 red hinds (9.1%) and 128 coney (22.1%) were collected in Macamba. The approximated distance between these two areas is 18km.

Sampled coney ranged from 120 to 296 mm TL, with an average of 210.5 mm \pm 23.4. Individuals captured at Abrir La Sierra (station 59) ranged from 150 to 296 mm, with an average of 208.9 \pm 30.0. Meanwhile, sampled coney at Macamba (station 7) ranged in size from 158 to 270 mm, with an average of 212.8 mm \pm 23.3 (Figure 1).

Not a single coney has been recaptured by our crew or by fishers. Efforts to mark and release coney at a single location (Abrir La Sierra) to maximize the

probability of recapture has not resulted in recaptures.

Red hinds sample ranged in size from 153 to 416 mm TL with a mean size of 278.7 mm \pm 47.7. Red hinds sampled at Macamba ranged in size from 200 to 416 mm TL, with an average size of 278.7 mm \pm 43.1. Those sampled at Abrir La Sierra ranged from 172 to 403 mm TL, with a mean size of 276.9 mm \pm 47.0 (Figure 2).

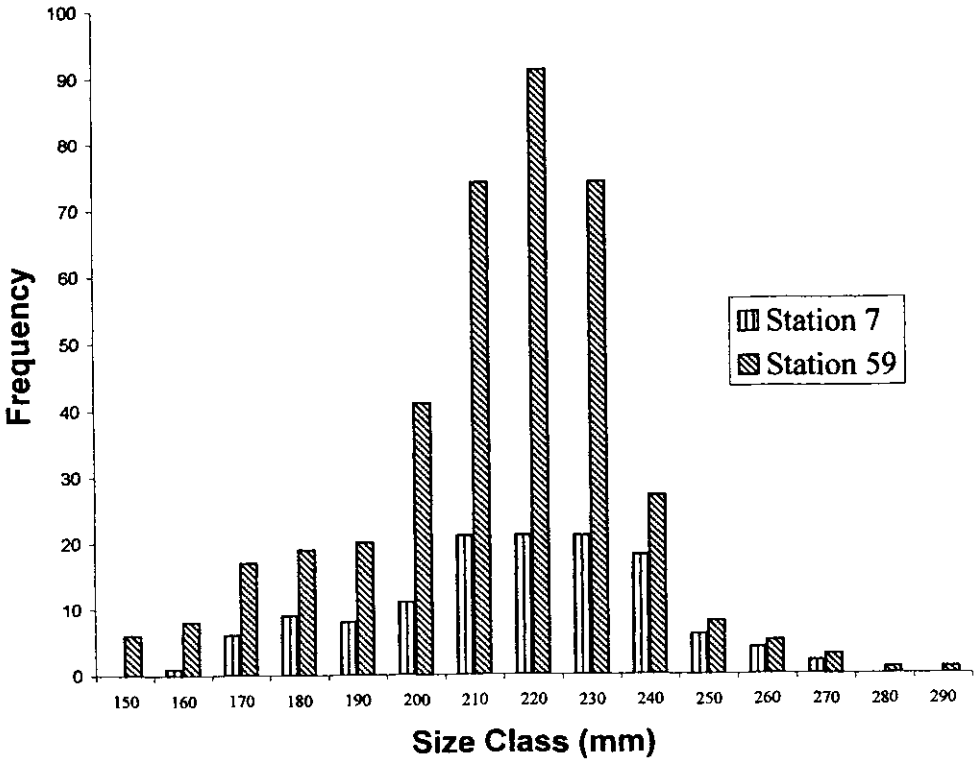


Figure 1. Size frequency distribution of sampled coney (*Cephalopholis fulva*) at two red hinds spawning aggregation sites off the West Coast of Puerto Rico. Sampled sites are station 7 or Macamba and station 59 or Abrir La Sierra.

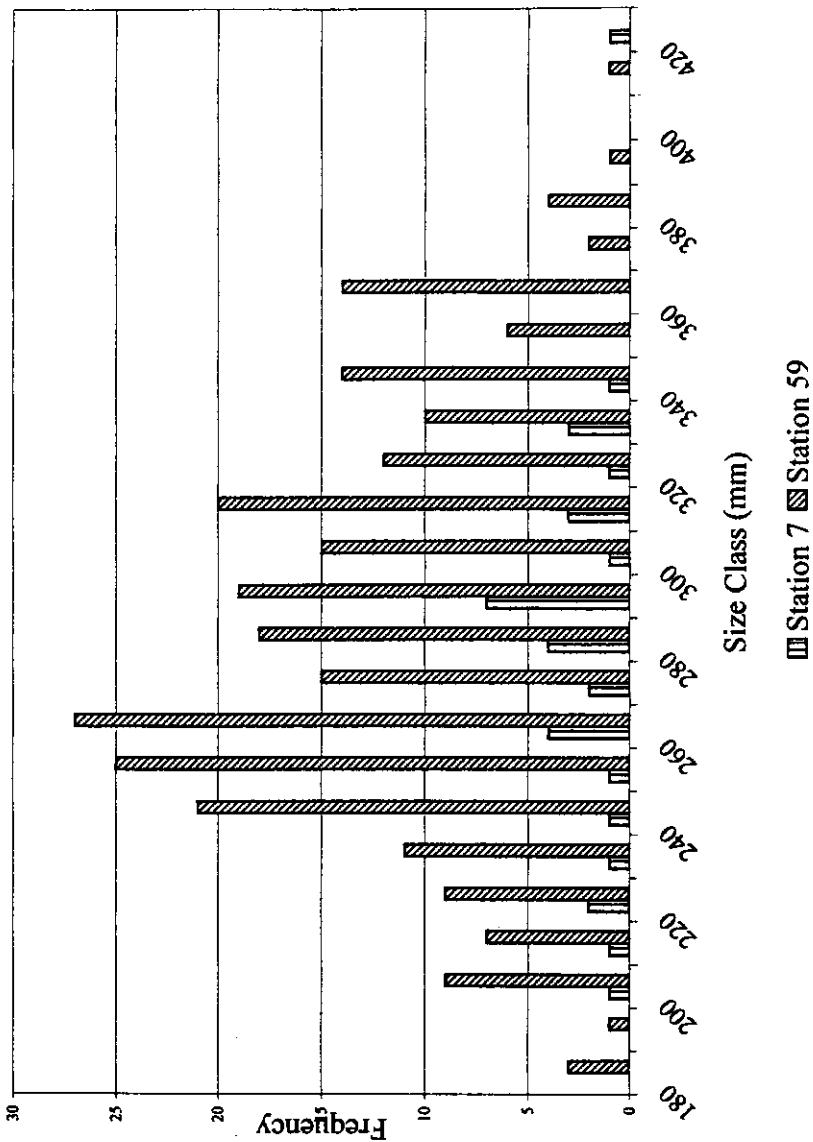


Figure 2. Size frequency distribution of sampled red hinds (*Epinephelus guttatus*) at two spawning aggregation sites off the West Coast of Puerto Rico. Sampled sites are station 7 or Macamba and station 59 or Abrir La Sierra.

A total of twenty-eight (28) red hinds accounted for thirty-five (35) recaptures between the period of February 8, 1999 and September 23, 1999. The number of days from the time of mark and release to recapture ranged from 2 to 191 days, with an average of 53.9 days. One individual was recaptured three times. The first time was 22 days between release and recapture; the second time was 28 days, and the third time 35 days between recaptures. Six individuals were recaptured two times. The number of days between recaptures of those red hinds ranged from 2 to 53 days. The size of the recaptured red hinds ranged from 204 to 337 mm TL, with a mean size of 267.0 ± 36 mm (Figure 3).

Twenty-seven of the red hinds were marked at Abrir La Sierra and released either at the same area of first capture or at approximately 5nm from the area of first capture. A single red hind marked at Macamba has been recaptured. The individual was released 5 km north of the area of first capture. All individuals returned to the area of first capture or very close to that area (Figure 4a). After first recapture the animals were set free at the same area of recapture. One red hind was recapture by a fisher, which was tagged at Abrir La Sierra, liberated 9.3 km northeast of Abrir La Sierra and recaptured 24.1 km south of the area in which was released (Figure 4b). The time span between the tag and recapture was 187 days. The exact area of recapture was reported by the fisher using a GPS.

DISCUSSION

In this study, red hinds were recaptured when they returned to the spawning area during the spawning season, suggesting a homing ability. These results are compatible with those obtained by Sadovy *et al.* (1992) in which they reported that red hinds do not necessarily move to the nearest spawning site. The red hind that was recaptured 24 km south of the tag and release area, suggested that this individual did not, move to the nearest area, Macamba. What we can not establish is if the animal after being released, returned to Abrir La Sierra, before moving south to the area where it was recaptured.

Few tagged fish have been recovered in this study, suggesting that post tagging mortality may be high. Efforts to tag and release red hinds will continue for the next year and half through a proposal to determine the demography of the species off the West Coast of Puerto Rico. We expect to expand our knowledge on the reproductive biology of this species, as well as gather additional information on the coney.

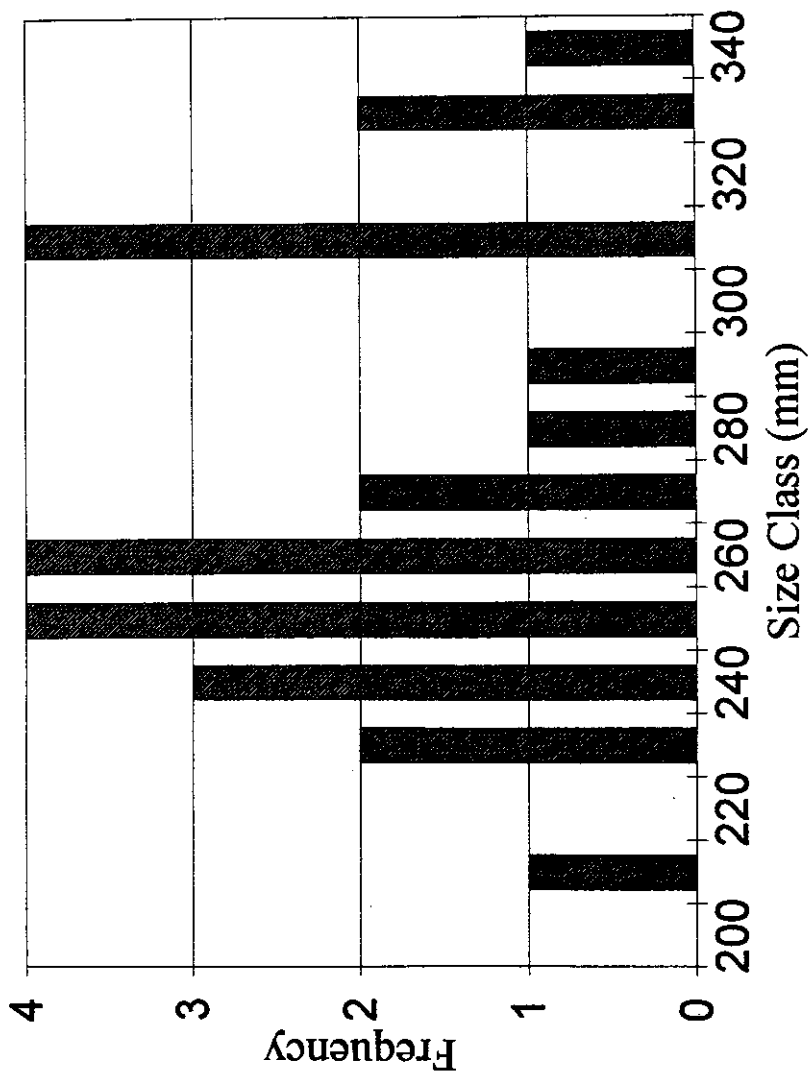


Figure 3. Size frequency distribution of recaptured red hinds (*Epinephelus guttatus*) at two spawning aggregation sites off the west coast of Puerto Rico. Sampled sites are station 7 (Macamba) and station 59 (Abrir La Sierra).

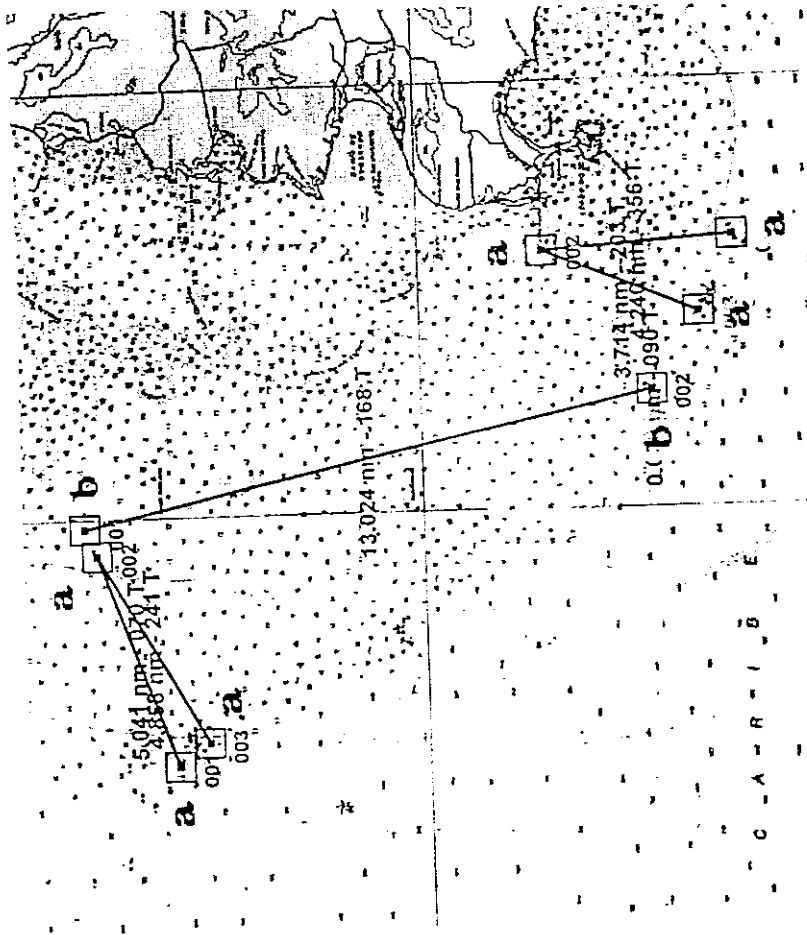


Figure 4. Map showing the two main capture-recapture areas visited during the study. A.) Areas where individuals returned to the same zone of first capture. B) Area where one individual was released after being tagged at Abrir La Sierra and released 9.3 km north, and recaptured 24 km south of the released area.

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released 9.3 km north, and recaptured 24 km south of the released area.

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