Florida's Halfbeak, *Hemiramphus* spp., Bait Fishery

RICHARD MCBRIDE, LISA FOUSHEE, and BEHZAD MAHMOUDI

Introduction

In Florida, ballyhoo, *Hemiramphus brasiliensis*, and balao, *H. balao*, form the basis of an important bait fishery (Berkeley et al., 1975; Berkeley and Houde, 1978). They are harvested with modified lampara nets, a type of surrounding net (Nedelic, 1982), and are sold as bait to anglers seeking pelagic and benthic gamefishes (e.g., billfishes and groupers). In the western Atlantic, both species are found from at least New York to Brazil (Collette, 1965), but the only significant fishery for either species is in southeastern Florida. Neither species is common north of Florida (Hildebrand and Schroeder, 1928; Hardy and Johnson, 1974; Hardy, 1978; Burgess et al., 1979), and only nominal landings are reported elsewhere, in South America (Collette, 1978), Puerto Rico (Kimmel, 1991), and the Virgin Islands (Beets and La Place, 1991).

Ballyhoo and balao are both known as halfbeaks (Hemiramphidae; Collette et al., 1984), and because they are equally acceptable as bait, the fishery does not sort the catch by species (Berkeley et al., 1975). Still, they can be readily distinguished by the length of the pectoral fin and by their coloration when alive (Fig. 1; Berkeley et al., 1975; Collette, 1978; Böhlke and Chaplin, 1993). Both halfbeak species frequently occur together in individual fishing hauls, but ballyhoo constitutes the majority of the catch during summer and nearly all of the catch during winter (Berkeley et al., 1975). Mixed samples from throughout the year contained only 9.8% balao (Berkeley and Houde, 1978). Although other species also known as halfbeaks (e.g. *Hyporhamphus* spp.) are suitable for bait, they are not part of the fishery because they occupy different habitats and are not found in concentrated schools (Tabb and Manning, 1961; Banford and Collette, 1993; Reintjes[1]). Florida's halfbeak fishery is highly selective, and only low numbers of flyingfishes (Exocoetidae) and needlefishes (Belonidae) are consistently caught as bycatch (Berkeley et al., 1975).

This halfbeak fishery dates back to the 1950's (Siebenaler, 1955), and annual landings increased rapidly in the late 1960's because demand for bait from marine recreational anglers had increased (Berkeley et al., 1975). Also during this time, the fishery increased its fishing power; this was accomplished by using larger nets with long ropes attached at the ends to herd the fish. This rapid increase in landings during the late 1960's was a reason for the investigations by Berkeley et al. (1975) and Berkeley and Houde (1978). They concluded that overfishing was not occurring during the early 1970's, but no assessment of the commercial fishery has been made since.

In this paper we describe landings, markets, and fishing methods for halfbeaks in Florida. We also assess the current state of the fishery based on species composition and on measurements of catch, fishing effort, and size frequencies. The data available for analysis are historical landings for 1950–94, as well as onboard observations and dockside interviews completed during 1988–91. These data are compared with historical data reported by Berkeley et al. (1975) and, in particular, are used to evaluate their prediction that exploitation of halfbeaks would increase in the future because of an expanding recreational fishery in Florida.

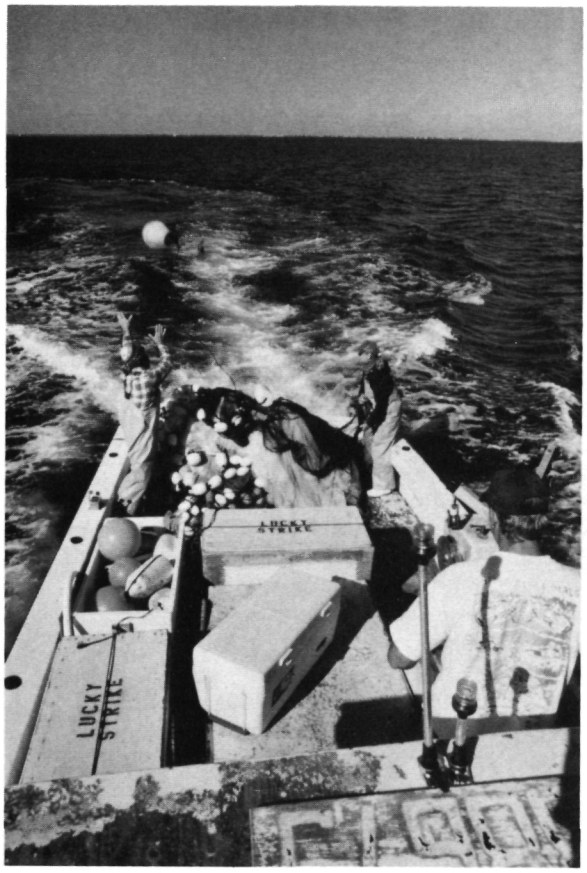
Materials and Methods

Commercial landings have been monitored in Florida since 1950 by the State of Florida in cooperation with the U.S. Fish and Wildlife Service or the

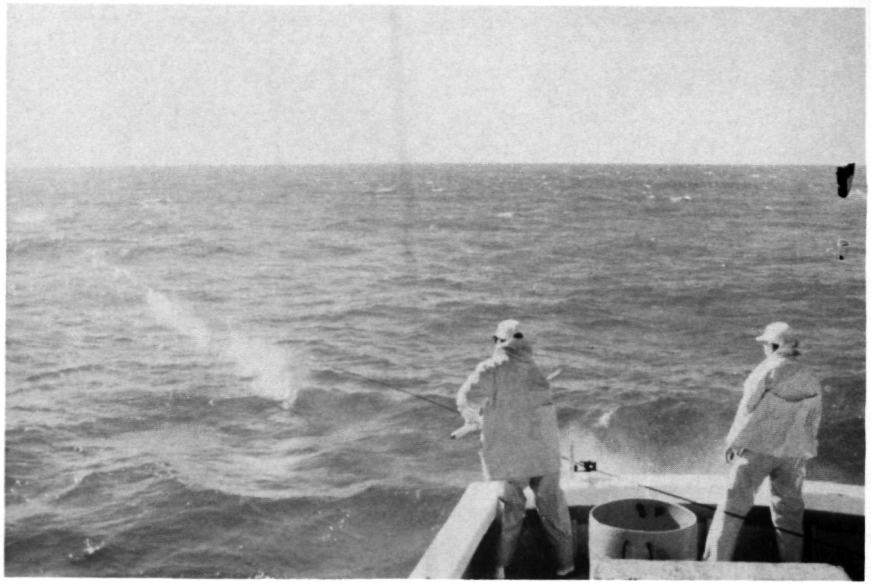
The authors are with the Florida Marine Research Institute, Florida Department of Environmental Protection, 100 Eighth Avenue S.E., St. Petersburg, FL 33701-5095. Telephone 813-896-8626; Fax 813-823-0166; Corresponding email: mcbride_r@harpo.dep.state.fl.us. All photographs are by and courtesy of the senior author, Richard McBride.

ABSTRACT—Two species of halfbeaks, ballyhoo, Hemiramphus brasiliensis, *and balao,* H. balao, *form the basis of a relatively small but valuable bait fishery in southeastern Florida. Halfbeak landings increased rapidly in the late 1960's but are now relatively stable (about 450,000 kg or 1 million lb annually), and their ex-vessel price is about $600,000. Fishing methods, which had changed in the late 1960's when landings increased, have changed little since the 1970's. Data from a fishery-dependent survey (1988–91) show that catch rates were highest from October to February, when catches were dominated by large ballyhoo (>200 mm or 8 inches fork length (FL)); rates were lowest from May to September, when catches contained both species in more equal numbers and the size range was greater (about 150–250 mm FL) than it was for winter landings. There was little bycatch, and only flyingfishes (Exocoetidae) and needlefishes (Belonidae) occurred consistently. Comparisons of the 1988–91 data with similar data reported from 1974 indicated that halfbeak populations have remained relatively stable.*

[1]Reintjes, J. W. 1979. Coastal herrings and associated species: a profile of species or groups of species, their biology, ecology, current exploitation with economic and social information. Rep. prep. for Gulf Mex. Fish. Manage. Counc., Southeast Fish. Sci. Cent., NMFS, NOAA, Beaufort, N.C., 170 p. All footnoted reports are on file at the Florida Marine Research Institute, 100 Eighth Avenue S.E., St. Petersburg, FL 33701-5095.



Above: Setting the lampara net with a marker buoy off Key Largo. When all the net and ropes are paid out the area swept can be more than a square mile.



Above: Striking the net lines during haulback to keep the surface-oriented halfbeaks from escaping.

Right: Close-up of halfbeaks in the purse of the lampara net.

Left: Halfbeaks in the purse of the lampara net. A needlefish is being removed from the net purse and released alive.

Below: Halfbeacks are immediately layered in ice and brine to preserve their condition for trolling bait.

Above: Halfbeaks are sorted by size and condition, not by species, at the fish house. The largest sizes are rigged with one or two hooks and a wire leader before being flash frozen.

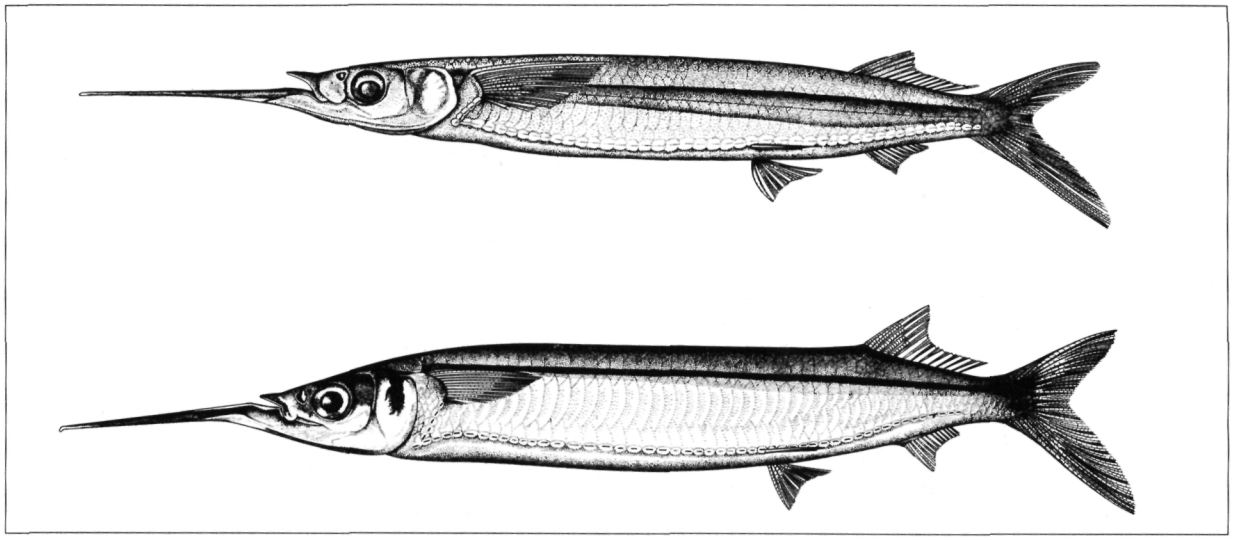


Figure 1.—*Hemiramphus balao*, balao (top); when alive the upper lobe of the caudal fin is bluish-violet with a red tip and the lower lobe is bluish. *Hemiramphus brasiliensis*, ballyhoo (bottom); when alive the upper lobe of the caudal fish is yellowish orange and the lower lobe is dusky. Illustrations provided by Bruce Collette, NMFS National Systematics Laboratory.

National Marine Fisheries Service. From 1950 to 1985, large foodfish processors were the sources of these data. In 1985, a new survey design, the Marine Fisheries Information System (MFIS), was implemented by the Florida Department of Environmental Protection (FDEP) (Muller and Murphy[2]). Florida's MFIS requires that records be kept of every wholesale transaction of marine organisms landed in Florida, so estimates of baitfish landings since 1985 are more accurate than previous estimates were.

From November 1988 to August 1991, the FDEP also completed a survey of the halfbeak fishery independent of the MFIS program. We made onboard observations (33 vessel days) and dock-side interviews (an additional 70 vessel days), which covered 26 of the 34 months in the survey period. Samples were obtained in Florida's southeastern counties, where the state's halfbeak landings are greatest, and sampling effort was apportioned between three subregions: Martin County to Palm Beach County, Broward County to Dade County, and Monroe County (Fig. 2). The survey monitored 1) species composition and abundance of target and bycatch species based on subsamples of 3–11 kg of a set's catch or up to 23 kg of a day's catch; 2) fishing effort (i.e., frequency and duration of fishing days; frequency and duration of individual hauls for onboard observations); and 3) length-frequency of ballyhoo and balao based on subsamples (100–300 fish per fishing day) of the catch. Fork lengths (FL) were measured to the nearest millimeter from the tip of the upper jaw to the fork of the tail. Individual fish from some subsamples were also weighed to the nearest 0.1 g to establish length-weight relationships. Catch rates were calculated as:

$$\text{CPUE} = C/f, \qquad (1)$$

where CPUE = catch per unit of effort,
C = catch in numbers or weight of fish
f = one vessel-day (one day of fishing by one vessel).

Catch is reported by weight unless otherwise noted. Notes regarding fishery markets and fishing methods were also recorded during 1988–91.

Results and Discussion

Landings and Markets

Annual halfbeak landings have progressed through three phases during the past four decades: 1) a phase when fishing rates and demand were low from 1950 to about 1965, 2) a phase during which the annual landings rapidly increased—1966–70, and 3) a phase when landings have been relatively high and stable since about 1971 (Fig. 3). The threefold to fourfold increase in landings during the late 1960's was attributed by Berkeley et al. (1975) to increasing demand for bait as well as to the use of larger and more efficient nets. Another threefold increase between 1985 and 1986 was largely an artifact of a change in data collection methods associated with the implementation of the Florida's MFIS program.

Since landings prior to 1986 were only from large foodfish processors, there was great potential to underestimate landings of halfbeaks and other baitfish species (Broadhead, 1951; Reintjes[1]; Johnson[3]). Annual landings during 1976–81 averaged 164,000 ±

[2]Muller, R. G., and M. D. Murphy. 1994. Report on inshore finfish trends. Rep. prep. for Fla. Mar. Fish. Comm., Dep. Environ. Prot., Fla. Mar. Res. Inst., St. Petersburg, June 13, 1994, 16 p. Prior to 1994 the FDEP was known as the Florida Department of Natural Resources.

[3]Johnson, L. E. 1974. Commercial fisheries of Florida, 1973. *In* Summary of Florida commercial marine landings, 1973. Fla. Dep. Nat. Resour., St. Petersburg, 62 p.

40,000 kg (360,000 ± 87,000 lb; mean ± standard deviation) compared to 477,000 ± 86,000 kg (1,049,000 ± 189,600 lb) during 1986–91. The change in reporting methods had the effect of tripling the landings. Based on the assumption that halfbeak landings have been relatively stable since 1971, then landings during this third and most recent phase have been maintained at about 480,000 kg (1.05 million lb) per year.

Since 1950, halfbeaks have been landed almost exclusively in southeastern counties of Florida (Fig. 3, 4). Effort was also greatest in southeastern counties, principally in Palm Beach, Dade, and Monroe counties (Fig. 4). Notable landings and effort also occurred in the Florida panhandle, but this constituted bycatch from other bait fisheries there.

The markets have changed little since being described by Siebenaler (1955) and Berkeley et al. (1975). Halfbeaks are frequently the preferred bait for marine anglers seeking billfishes (Istiophoridae), dolphin, *Coryphaena hippurus*, groupers (Serranidae), and other gamefishes (de Sylva, 1974; Nakamura and Rivas, 1974; Gentle, 1977; Jolly, 1977). The Gulf Stream is very close to Florida's southeast coast, so offshore fishing for pelagic gamefishes is very accessible. Wholesale fish houses sell halfbeaks to charter boat operators, tackle shops, and individual anglers primarily within Florida, but markets also exist out of state and abroad. Small halfbeaks are used for drift fishing for mackerels and snappers, whereas larger sizes are used more commonly for trolling for offshore, pelagic gamefishes. In the Pacific, halfbeaks (*Arrhamphus*, *Hemiramphus*, and *Hyporhamphus*) are sold as both bait and food (Collette, 1974), but to our knowledge halfbeaks landed in Florida are not sold for food.

Ex-vessel prices (e.g. those paid directly to fishermen) varied principally in relation to fish size-class and seasonal availability. Halfbeaks were usually sold by the piece (instead of by weight), which differs from marketing of other baitfishes. Conversions between numbers and weight in this study used an

Figure 2.—Florida's coastal counties and areas of major fishing activity for halfbeaks surveyed in 1988–91. Counties mentioned in the text or Figure 3 are identified; Monroe County includes all of the Florida Keys. Resolution for identifying fishing zones while at sea was 5' lat. × 5' long.

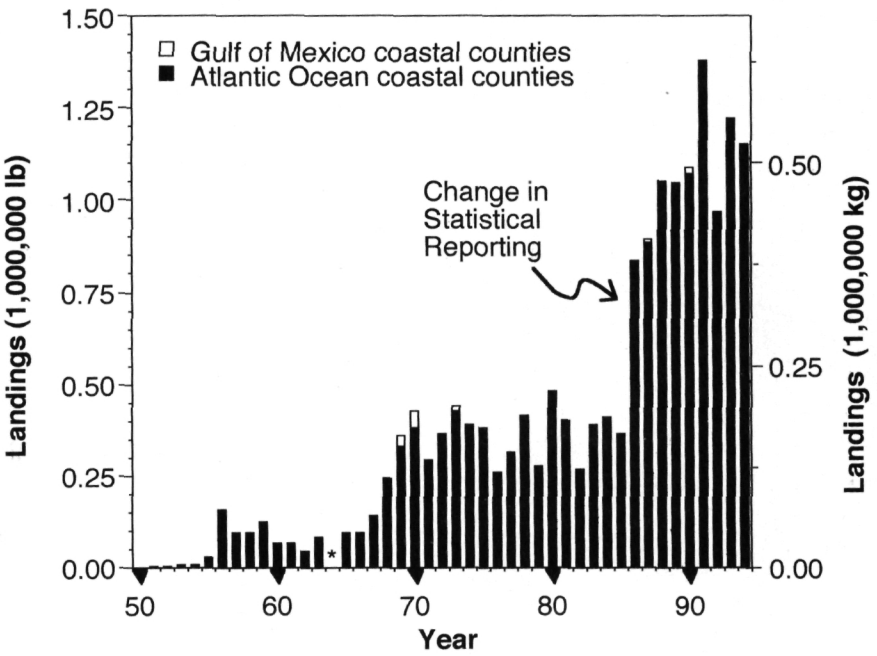


Figure 3.—Florida's annual landings of halfbeaks (ballyhoo and balao combined), 1950–1994. Data for the years 1950–85 were collected from commercial fish processors by the State of Florida. Data for 1986–94 were based on Florida's MFIS. Atlantic coastal counties include Monroe and all others east; Gulf coastal counties include Collier and all others to the west (Fig. 2). Landings for Gulf coast counties equal zero for 16 of 45 years, but Gulf coast landings are frequently not visible here unless greater than or equal to 5,000 lb because of the range of the ordinate (left axis=lb, right axis=kg). The annual landing for 1964, 917,000 lb(*), is anomalous and cannot be explained.

average value of 13.7 fish/kg (6.2 halfbeaks/lb), which was based on unsorted samples from the fishery collected year-round (n = 3524). Some of each day's catch was sold as fresh bait, which was not sorted by size and consistently commanded a high price of $0.15/fish (about $2.00/kg or $0.90/lb) during 1989–90. Except during busy sportfishing seasons, when demand for fresh bait was high, a majority of halfbeaks were sorted by size and then frozen. Representative size categories[4] were small (85 g or <3 ounce [oz]), medium (85–127 g or 3–4.5 oz,), large (127–156 g or 4.5–5.5 oz), horse (156–184 g or 5.5–6.5 oz), and jumbo (184+ g or 6.5+ oz). The ex-vessel prices ranged from $0.02–0.03/fish for small sizes to $0.12–0.20/fish for horse or jumbo sizes. In addition, some very small (about 1 oz) or damaged fish were typically sold at a bulk price, which was consistently $0.33/kg ($0.15/lb). The average value for halfbeaks landed in 1989 was $1.43/kg ($0.65/lb) based on ex-vessel transactions in Palm Beach and Dade counties. The 1990 price was estimated as $1.19/kg ($0.54/lb), but this was not significantly different between years based on 95% confidence intervals of $1.06–1.80/kg ($0.48–0.82/lb) in 1989 and $0.79–1.58/kg ($0.36–0.72/lb) in 1990.

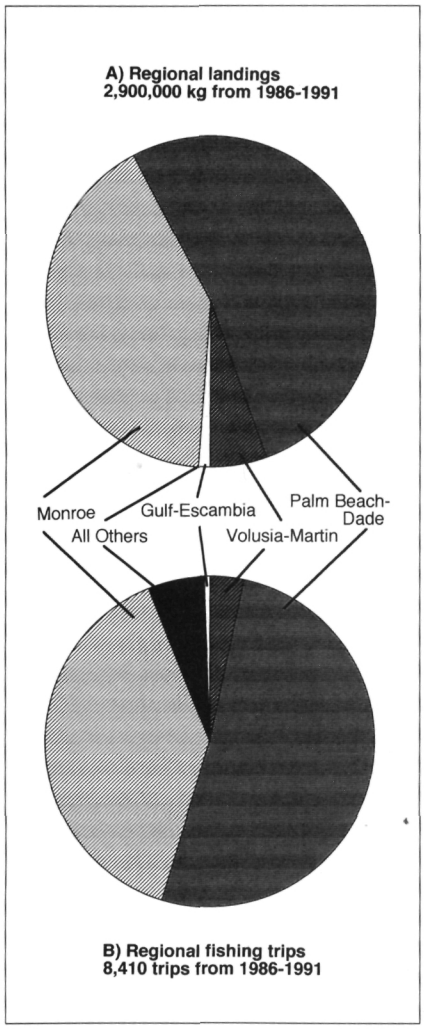


Figure 4.—Regional halfbeak (ballyhoo and balao combined) landings (A) and number of fishing trips (B) by county or groups of counties. See Figure 2 for county locations. Data are for 1986–1991 from Florida's MFIS.

Ex-vessel prices during 1989–90 were considerably higher than values reported by Berkeley et al. (1975) but were similar after adjustment for inflation. In 1974, ex-vessel prices were $0.03–0.08/fish compared to the average range of $0.03–0.15/fish in 1989–90. Retail prices in 1974 were $1.75–3.00/dozen ($0.15–0.25/fish) compared to $4.50–5.00/dozen (0.38–0.42/fish and as high as $1.00/fish for the larger sizes) in 1989–90. Inflation alone would cause an ex-vessel price of $0.05 in 1974 to rise to $0.12 in 1989,[5] whereas the retail value would rise from $0.20 in 1974 to $0.48 in 1989.

Compared with Florida's other baitfish species, halfbeak landings were relatively small but the value was quite high. In 1989–90, annual ex-vessel value of the commercial fishery was about $600,000, based on landings of 0.477 million kg (1.05 million lb) multiplied by the estimated prices above. Relative to other important baitfishes in Florida, only one-fourth as many halfbeaks as thread herring, *Opisthonema oglinum*, were landed, and only half as many halfbeaks as Spanish sardines, *Sardinella aurita*, were landed in 1989–90 (comparisons done by weight[2]). However, the 1989–90 value of these two clupeid species was only $0.22–0.33/kg ($0.10–0.15/lb), so the annual ex-vessel value of Atlantic thread herring was only about $500,000 and Spanish sardine was only about $350,000.

Fishing Methods

During 1988–91, ten vessels were operating in southeast Florida, each with a captain and two or three crew members. These boats ranged from 7.3 m to 10.4 m (24–34 ft) long and were powered by 250–350 horsepower engines. Their holding capacities were limited to six–eight 0.45 m^3 (16-ft^3) boxes; each box could hold about 230 kg (500 lb) or about 2,000–3,000 individual fish. Fish were captured with modified lampara nets, a type of surrounding net (Nedelec, 1982). The nets measured 410–640 m (450–750 yd) in length and had wings that hung 1.2–2.4 m (4–8 ft) deep; the wings are cut to fish only the upper water column because halfbeaks are found near the surface in association with reef habitat. A pocket 10.0- to 12.1-m (33–40 ft) deep was sewn in at one end of the net. The mesh used ranged from 1.9 cm to 3.8 cm (0.75–1.5 in) stretch mesh. These nets were modified from a typical lampara design, by having purse lines in the pocket. An additional 550–3,660 m (600–4,000 yd) of line was attached to the net to increase the area swept when fishing the net.

Ballyhoo and balao school in coastal waters near and between reef structures (Tabb and Manning, 1961; Stark and Davis, 1966), where they can be observed near the surface. An average day of fishing on the vessels surveyed occurred during daylight and lasted slightly more than seven hours. Shallow inshore waters were searched out to 9 km (5 n.mi.) from shore and to a depth of about 18 m (60 ft). The primary fishing grounds identified during our survey were the nearshore patch reefs in the Palm Beach and Biscayne

[4]Up to seven categories could be used at different fish houses. Berkeley et al. (1975) reported four categories: <185 mm, 185–235 mm, 235–265 mm, and >265 mm fork length. Those categories are similar to these reported here and correspond approximately to <50 g, 50–110 g, 110–160 g, and >160 g, based on length-weight conversions from Berkeley and Houde (1978).

[5]Inflation is adjusted for a price difference of 2.42 between 1974 and 1989, using the Economic Report of the President, January 1993, Table b–3: Implicit price deflator for gross domestic product, 1959–1992.

Bay regions and the offshore reefs of the Biscayne Bay and Florida Keys regions (Fig. 2). Fishing depths were greater in Palm Beach County (about 9–15 m or 30–50 ft), where the continental shelf is narrower, than in Dade or Monroe counties (<9 m or 30 ft). More area was searched during April–September when fish were relatively scarce, but in general only one or two 5' × 5' (minutes of latitude and longitude) grids were searched during a single day. The grids searched were farther south during the winter and more to the north during summer, which presumably followed the seasonal movements of the halfbeaks.

Once a school was located, the net and lines were set to surround it. The lines skimmed the water surface as the net was drawn in, and less line was required when the fish were more closely aggregated. Fish were loaded onto the boat with a dip net and immediately placed in layers of crushed ice and brine. Setting and hauling lasted about one hour, and three hauls were made per fishing day on average. The mean number of hauls made per day was lowest in summer and highest in autumn (January to March = 2.9, April to June = 3.0, July to September = 2.3, and October to December = 3.5, based on onboard observations only).

Only subtle changes in fishing methods have been made recently. The size, storage capacity, and horsepower of the vessels observed by Berkeley et al. (1975) were slightly less than those observed during 1988–91. Larger vessels can hold more fish, but because many fish are sold as fresh bait, daily catch is closely associated with daily demand at the fish houses and bait shops. The nylon nets used during 1988–91 were similar to those reported by Berkeley et al. (1975) but were much larger than the cotton nets described by Siebenaler (1955). Nets used in the early 1970's were 370–600 m (400–650 yd) long, whereas nets used in the 1950's were only 180–275 m (200–300 yd) long. The use of extra line to herd the fish during the fishing operation also began in the 1960's. Thus, the most notable changes in halfbeak fishing technology occurred during the 1960's.

Species Composition

The percentage composition of ballyhoo and balao changed seasonally (Fig. 5), similar to the changes reported by Berkeley et al. (1975). Pure catches of ballyhoo occurred (45 of 89 observed hauls, 50.5%), principally in winter months. Ballyhoo and balao occurred together in 35 hauls (39.3%), principally during spring–autumn. Pure catches of balao occurred only twice (2.2%). The remaining seven observed hauls (7.8%) caught neither species because of entangled nets, difficult weather conditions, or fish becoming spooked and escaping.

The fishing gear and methods used were highly selective for fish in the upper water column, so bycatch was generally low. The only species frequently collected besides halfbeaks were flyingfishes (Exocoetidae: *Cypselurus* and *Parexocoetus*) and needlefishes (Belonidae: *Ablennes* and *Tylosaurus*). Flyingfishes occurred most frequently during spring and summer (maximum of 16.6%, by numbers, in any observed haul). Flyingfishes could be sold as bait and were therefore not always discarded. Needlefishes appeared sporadically (maximum of 5.1%, by numbers, in any observed haul). Other species occurred only rarely and did not include gamefish or foodfish species.

Abundance

Catch rates of ballyhoo peaked during winter, whereas catch rates of balao peaked during summer (Fig. 6). Ballyhoo catches during October–March ranged from 360 to 1,720 kg/d (800–3,800 lb/d), but balao catches rarely exceeded 450 kg/d (1,000 lb/d) at any time of the year. These seasonal variations in catch rates appear to be affected by both the absolute abundance and the availability of fish. Winter catches were higher in part because age-0 fish grow fast enough to become exploited (see below). Fish behavior is also a factor, because halfbeaks are more aggregated and in larger schools during winter on these fishing grounds. Interspecific differences in abundance are not understood but we are now (i.e. 1996) collecting data that may clarify the extent

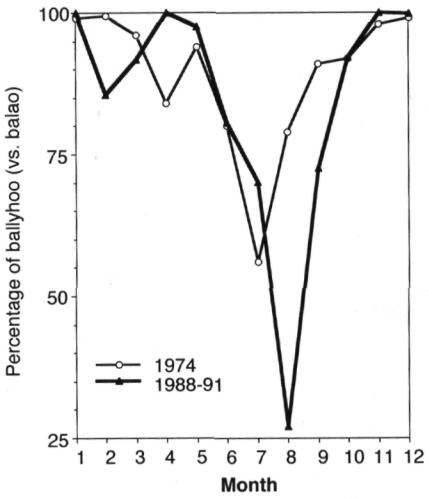


Figure 5.—Percentage composition of halfbeaks, ballyhoo vs. balao by month, in the southeast Florida lampara net fishery. Data source is based on onboard observations of 8,504 fish from 80 different hauls made on 32 days, 1988–1991. Background data for 1974 is from Berkeley et al. (1975).

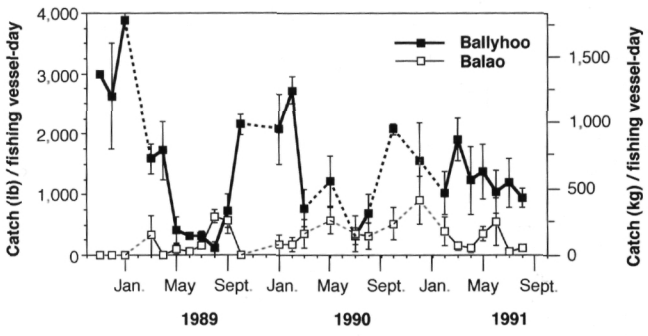


Figure 6.—Mean daily catch/vessel-day for 26 months sampled from November 1988 to August 1991 (left axis=lb, right axis=kg). Data depicts catch rates of ballyhoo and balao separately; dashed lines indicate sampling across nonconsecutive months. Error bars are ± 1 s.e.

of habitat specificity and seasonal migration patterns by each halfbeak species.

Catch rates for both halfbeak species combined declined in summer, which also was the seasonal trend observed in 1974 (Fig. 7). Monthly catch rates during 1988–91 were, however, consistently higher than they were during 1974. Daily catch rates in winter, a peak fishing season, appeared to be limited principally by vessel capacity, and the slightly larger vessels used in recent years have allowed for larger winter landings. It is even possible that demand for halfbeaks rose slightly in the late 1980's (Fig. 3), and because no additional boats entered the fishery, each boat made bigger catches. Berkeley et al. (1975) noted that 11 fishing vessels operated in the halfbeak fishery in 1974, and each vessel carried only four boxes for holding fish, whereas during 1988–91, 10 vessels operated and each usually carried six to eight boxes. By late spring or during the summer, "fresh" bait supplies occasionally become saturated and frozen fish are stockpiled, so boats carry fewer boxes to match the daily demand. If a haul exceeds the holding capacity of the vessel the fish are released, and this creates small differences between actual catch and landed catch values reported. Such occasions are rare, however, and we observed this only once when an estimated 1.5 boxes of fish were released live after 3 boxes were packed during a March fishing trip.

Size Composition

The size ranges of the two halfbeak species overlapped but ballyhoo were typically larger than balao (Fig. 8). In this survey, ballyhoo ranged from 108 mm to 313 mm FL (209 ± 26.3; mean ± s.d.; n = 20,307) and balao ranged from 131 mm to 273 mm (194 ± 24.3; n = 6,791). After truncating the extreme tails of the length distributions, about 95% of the ballyhoo harvested were 150–260 mm (5.9–10.2 in) long and 95% of balao captured were 145–240 mm (5.7–9.5 in) long. Ballyhoo also weighed more, on average, than balao (76.8 g vs. 61.2 g), based on year-round samples from the fishery (n = 3,524).

At least two size classes were evident for both species (Fig. 8). Small, age-0 fish were evident and often dominant in July, about four months after spawning begins (Berkeley and Houde, 1978). A descriptive growth model, based on analysis of scale-determined ages, suggests that ballyhoo grows fairly fast during its first year and that both species reach 209–231 mm (8.2–9.1 inches) FL at annulus I (Berkeley and Houde, 1978). Berkeley and Houde also compared growth rates from the laboratory and field and concluded that the size-frequency of age-0 fish in the fishery is probably biased until October or November, because only the larger and faster-growing fish are harvested during the summer and early autumn. The mean size of ballyhoo at the time annulus II was formed was 264 mm (10.4 in) FL (Berkeley and Houde, 1978), a size well represented in the fishery during the winter months of 1988–91. Because few ballyhoo live longer than two years and few balao live longer than one year, the fishery exploited all age classes of both species (Berkeley et al., 1975).

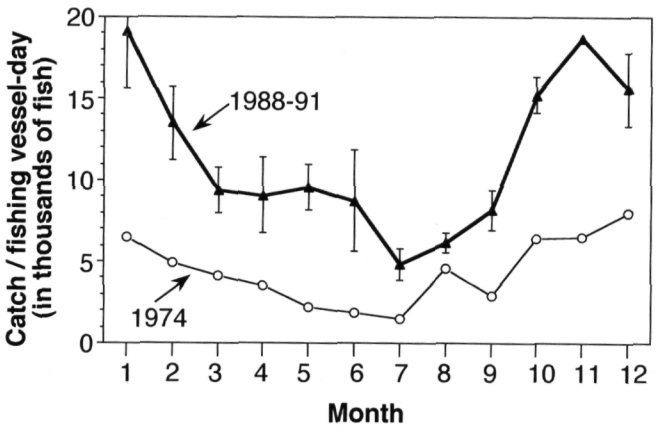


Figure 7.—Comparison of monthly catch rates of halfbeaks (ballyhoo and balao combined) caught during 1988–91 with those caught during 1974, as reported in Berkeley et al. (1975). Data for 1988–91 were converted to numbers of fish per trip based on the average value of 13.7 fish/kg (6.2 fish/lb). There are no standard error bars for November because we surveyed only one vessel fishing during this month in all years. All other months (1988–90) are represented by >4 fishing-vessel days. Measures of variance were not reported in Berkeley et al. (1975), and their catch rates for January were combined from data collected in 1974 and 1975.

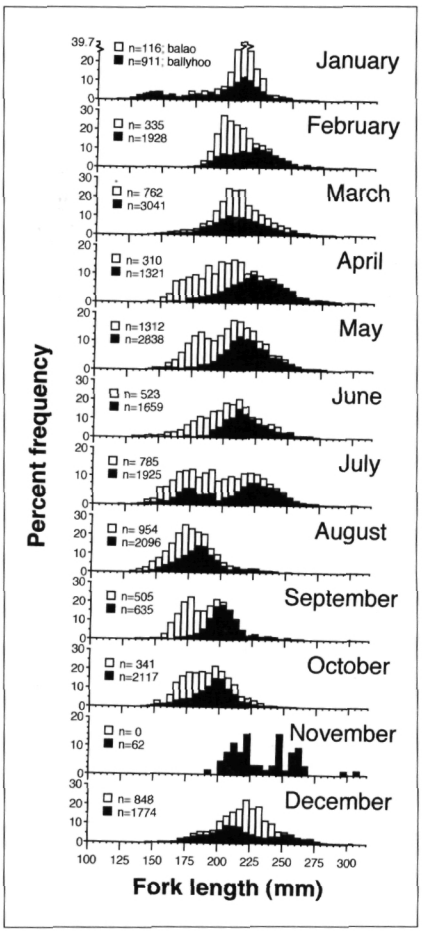


Figure 8.—Monthly length-frequency of ballyhoo and balao, based on pooled data for 1988–91 and plotted as a stacked histogram. N = number of fish measured. The ordinate has a maximum of 20% or 30% for graphical clarity.

Management Implications

The higher catch rate observed for 1988–91 is the most compelling evidence that the fishery did not overexploit halfbeak populations during the 1970's and 1980's. The absence of changes in species composition also supports this conclusion, but this argument is less tractable because the fishery does not distinguish between species. The general length-frequency of fish was also similar between 1974 and 1988–91, and age-0 fish were observed in all years examined, suggesting that no major year-class failure occurred during this 3-year period.

Estimates of recreational fishing effort indicate that general demand for bait probably increased little during the 1980's. In Monroe County specifically, the average number of headboats was relatively constant from 1981 to 1992 (Bohnsack et al., 1994). The estimated total number of recreational fishing trips made along Florida's Atlantic coast also did not increase during the 1980's (1980 = 10.5 million trips; 1985 = 12.5 million trips; 1990 = 8.8 million trips; Holliday, 1984; NMFS, 1986; Van Voorhees et al., 1992). However, it may be that demand for halfbeaks has grown while demand for other baitfishes has been level or declined. During the late 1980's some fish processing plants switched to flash freezing and vacuum packing halfbeaks, and this has helped maintain the quality of halfbeak bait (which is particularly important for trolling the whole fish). If so, then this would increase consumer demand, and it may explain the apparent increase in halfbeak landings between 1986 and 1994 (1991 peak = 0.626 million kg).

Continued monitoring of the commercial halfbeak fishery through Florida's MFIS program and occasional special surveys are cost-effective for tracking halfbeak populations. This approach, however, does not monitor halfbeaks harvested by anglers, who use cast nets, and occasionally small hooks, to catch fish that are attracted with oatmeal or chum. The numbers of ballyhoo harvested directly for bait by anglers (including those on charter and party boats) has not been well documented, but Bohnsack et al. (1994) suggested that private anglers in Monroe County harvested 5,000–35,000 halfbeaks (about 400–2,500 kg) annually during the 1980's.

Recent changes in fishing regulations, accomplished through Florida's constitutional "net ban" referendum (enacted July 1995), should affect the proportions of halfbeak harvested between Palm Beach and Monroe counties. The surrounding nets used in the ballyhoo fishery are now prohibited within 1 or 3 miles of shore, on the Atlantic and Gulf coasts, respectively; because the continental shelf adjacent to Palm Beach county is relatively narrow, most of the fishing grounds there have been eliminated. Monroe County (which includes the Florida Keys) has a large number of reefs beyond these limits. Monroe County's proportion of the total landings for Florida has already increased from 35% in 1986 to 52% in 1991 and to 75% in 1994, but this occurred principally because Dade County's landings have declined proportionally. If Palm Beach landings decline as well, then Monroe County's proportion of landings will increase further. Increases in halfbeak landings in Monroe County represent both a geographic shift and absolute growth of halfbeak landings, because total Florida landings have also increased from 380,300 kg (836,600 lb) in 1986 to 523,000 kg (1,150,700 lb) in 1994. More location-specific information about the fishery is being collected, and this will assist us in understanding the current and potential changes in the fishery.

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