SPAWNING OF BLUEFISH, *Pomatomus saltator,* IN THE NORTHEASTERN GULF OF MEXICO[1]

The bluefish, *Pomatomus saltator,* is an important sport and commercial fish in the United States. During 1970, 1.4 million anglers caught 54,799 metric tons of bluefish in U.S. waters making it the number one recreational fish (Deuel 1973). Commercial landings of bluefish in 1978 exceeded 5,244 metric tons; over 1,032 metric tons were caught in Florida waters during 1977 (U.S. Department of Commerce 1979 and in press).

Bluefish spawning is well documented from the Atlantic coast (Lund 1961; Norcross, Richardson, Massmann and Joseph 1974; Wilk 1977), but only one probable spawning area in the Gulf of Mexico has been reported, that by Barger, Collins and Finucane (1978). They collected bluefish larvae over the continental shelf off the Texas coast during the fall of 1976 and 1977.

The objectives of our study were to define seasonal maturation and spawning of bluefish. Data on maturation and probable spawning time were derived from analysis of gonads collected from bluefish caught in the Panama City area of northwest Florida. This is the first report of bluefish spawning in the northeastern Gulf of Mexico.

MATERIALS AND METHODS

Bluefish were obtained from recreational and gill net fishermen in bay and Gulf waters. Collections were made during April and May and August through December 1979. The fish were kept on ice until the gonads were removed and the following measurements taken: fork length (FL) to the nearest 1 mm, total fish weight to the nearest 1 g and gonad weight to the nearest 0.1 g. Gonads were preserved in about 10% Formalin.

Stages of maturity were determined by a visual macroexamination technique described by Orange (1961) and modified by Manooch (1976). The stages were I-S: infantile, gonad ribbonlike; I: immature, gonads elongate, slender, sex determination possible, in females, individual ova not visible to naked eye; II: gonads slightly enlarged, in females individual ova not visible to naked eye except for larger stage III ova; III: late maturing, gonads enlarged and turgid, in females individual ova visible to naked eye; IV: ripe, gonads greatly enlarged, in females many ova translucent and easily dislodged from follicles, or loose in lumen of ovary; V: spawned or spent, includes recently spawned fish, and females with mature ova occurring as remnants in various stages of reabsorption.

The macroexamination of the female gonads did not always reflect the true stage of these fish but by determining the oocyte development microscopically under a stereoscopic microscope at 500X magnification, we were able to verify, or correct if necessary, the visual staging. Only the visual staging technique was used for the males, since microscopic staging of these gonads could not always be done accurately. Sex was determined by visual or microscopic examination for all bluefish used in this study.

The gonad index was computed by dividing the fresh weight of the gonad by the body weight of the fish. Mean values of this index were plotted monthly by sex to indicate the time and peak period of spawning. These indices supplemented the staging techniques.

RESULTS AND DISCUSSION

Data presented in this paper were de-

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rived from 82 male and 129 female adult bluefish. Males ranged from 263 to 765 mm (FL) and averaged 385 mm; weights ranged from 182 to 5,039 g and averaged 851 g. Females ranged from 255 to 775 mm (FL) and averaged 391 mm; weights ranged from 259 to 4,812 g and averaged 1,068 g (Table 1).

In the spring (April and May) most of the gonads examined were immature (Fig. 1). Only 4 of 54 females and 1 of 36 males were mature (Stage III). None was ripe (Stage IV) and none had spawned (Stage V).

Bluefish in the Panama City area became sexually mature in the fall. Gonads increased in size from August to October (Fig. 2). Oocyte stages changed from immature (Stage I) in August to mostly mature and ripe (Stages III and IV) in October (Fig. 1). In November about 75% of the ovaries were flaccid, and eggs were in the process of being absorbed. By December all ovaries were in the immature stage of development. The gonad index decreased from a mean of 3.0 in October to a mean of 0.2 in December (Fig. 2). Based on these data the major spawning period occurred in the fall from late September through early November.

Our conclusion coincides with that of Barger *et al.* (1978) who inferred fall spawning of bluefish in the northwestern Gulf from the capture of larvae of 2.8 to 7.7 mm (SL) off the Texas coast during early November. Along the Atlantic coast, Kendall and Walford (1979) found larval bluefish offshore between Cape Cod, Mass., and Palm Beach, Fla., during every season of the year. They reported two main spawnings: one during the spring along the western edge of the Gulf Stream in the South Atlantic Bight and the other during summer over the continental shelf of the middle Atlantic Bight. They also indicated that fall and winter spawnings occur offshore south of Cape Hatteras. The presence of mature bluefish in the spring may indicate that some fish spawn at this time in other areas of the Gulf.

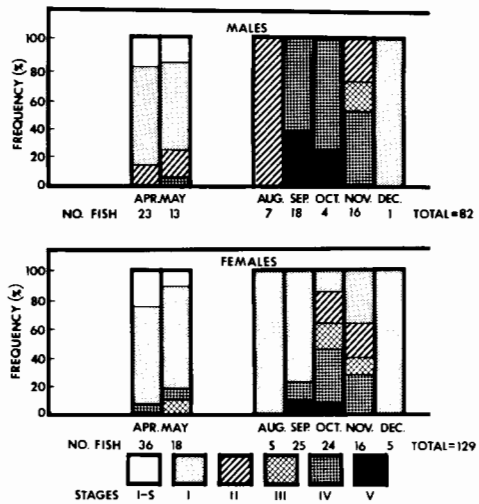

Figure 1. Percentage of male and female bluefish at various stages of sexual maturity by month for 1979 in the northeastern Gulf of Mexico.

TABLE 1. Fork lengths, weights and numbers of bluefish by sex for 1979.

	Males					Females				
	Fork length (mm)		Weight (g)			Fork length (mm)		Weight (g)		
1979	Range	X	Range	X	No.	Range	X	Range	X	No.
Apr	280-464	336	314-1,224	543	23	299-459	350	370-1276	597	36
May	325-765	388	450-5,039	967	13	323-885	439	442-4,912	1,368	18
Aug	263-442	366	182-1,260	729	7	271-434	363	259-1,145	713	5
Sep	355-430	407	635-1,455	994	18	357-404	398	635-1,862	1,057	25
Oct	295-442	372	266-1,130	816	4	373-530	442	707-2,032	1,271	24
Nov	405-429	418	886-1,360	1,052	16	255-502	372	300-1,712	1,213	16
Dec	311	311	425		1	292-348	312	342-600	421	5
Summary	263-765	385	182-5,039	851	82	255-775	391	259-4,812	1,068	129

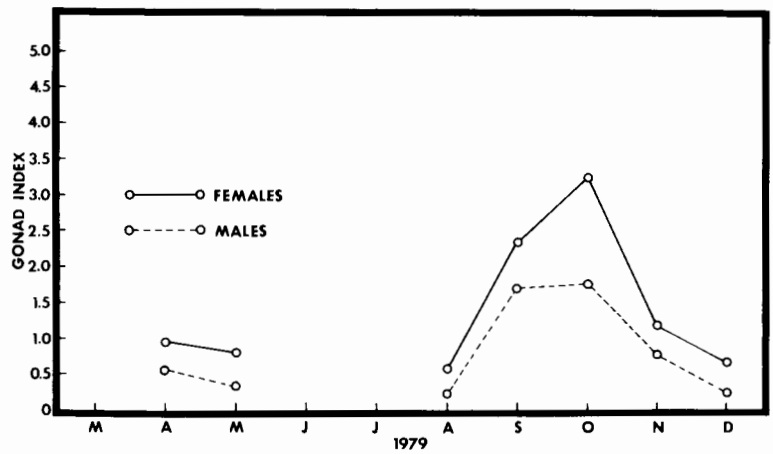

Figure 2. Monthly means of gonad indices for male and female bluefish for 1979 in the northeastern Gulf of Mexico.

Barger *et al.* (1978) reported that ripe and spent females and running-ripe males were caught by anglers off Empire, La. in April 1978.

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