The Fish Population of a Small, Periodically Inundated Island Pond in Lake Texoma, Oklahoma[1]

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In the part of Lake Texoma located in Marshall County, Oklahoma, a chain of islands approximately eight miles long lies roughly parallel to

[1] Contribution of the University of Oklahoma Biological Station, Lake Texoma.

the Oklahoma shore and along the north bank of the old Red River channel. Most of these islands are very long and slender, but the second from the west end (it is also the second island southeast of the University of Oklahoma Biological Station, and therefore called "Island 2") is almost half as wide as long (Fig. 1). Its area is variable, depending on the level of the lake, but is about 155 acres when the lake level is 614 feet above sea level (f.s.l.).

There are ten depressions on Island 2 (Fig. 1) in which water stands at all times when the lake level is above 604 f.s.l. The ponds so formed are isolated from Lake Texoma when the lake level falls to about 614 f.s.l. (this varies with the elevation of the bottoms of the connecting inlets and the changing size and shape of the sand bars which have formed across the mouths of these inlets), are connected to it by inlets of varying width, depth, and length when the lake level is from 615 to 618 f.s.l., and are essentially covered by the lake, and thus a part of it, when the lake level is above 618 f.s.l. As isolated ponds, the areas vary from approximately 0.5 to 5 acres. This too varies with the level of the lake since the soil of Island 2 is primarily of sand. The ponds have been connected with the lake every spring and summer since Texoma was filled (1945), and have been isolated from it during the winters of 1947 through 1952.

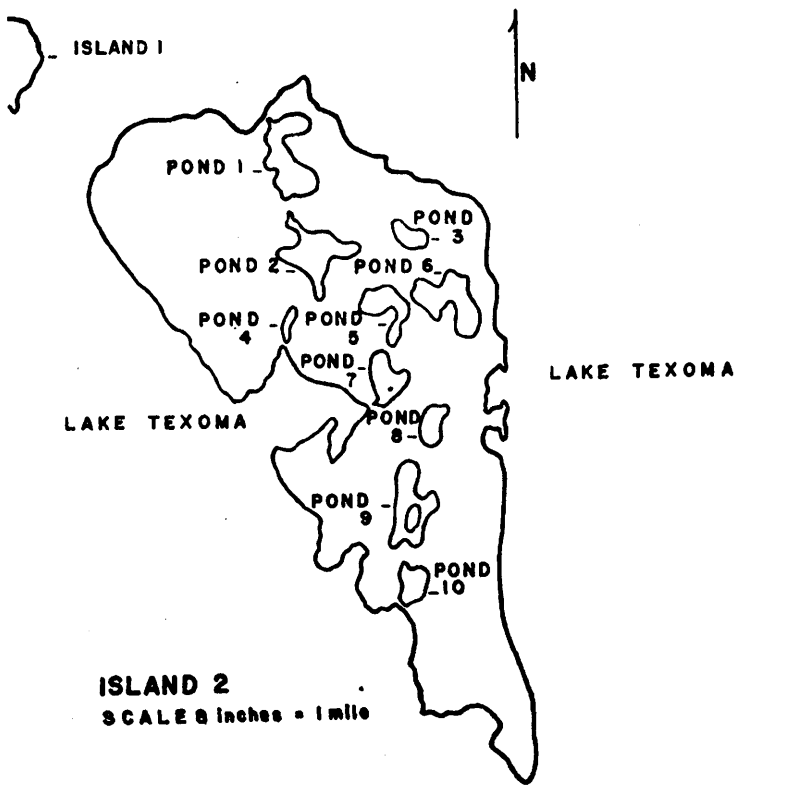

FIGURE 1.

In July, 1949, with the help of several graduate students, Riggs seined and gill-netted two of these ponds (Fig. 1, ponds 1 and 6). The results of this collecting indicated that the fish population consisted chiefly of rough fishes (gizzard shad, smallmouth buffalo, river carpsucker, and carp), bluegill, and white crappie (Table 1). Five other species were also taken, including two black bullhead. These were the first and only bullhead taken by us in Lake Texoma in spite of seven weeks of extensive gill-netting and seining in both the Red River and Washita River arms of the lake. Night seining also indicated that schools of young-of-year gizzard shad and white bass moved in and out of the ponds still connected with Texoma. There is no reason to doubt that this was true for other species.

TABLE I

Kinds and Numbers of Fishes Taken in Gill Nets from Island 2, Ponds 1 and 6, July 25, 1949.*

KIND OF FISH	NUMBER OF FISH	TOTAL-LENGTH RANGE (INCHES)
SPOTTED GAR (*Lepisosteus productus*)	2	23.7-27.0
GOLDEYE (*Hiodon alosoides*)	1	10.7
GIZZARD SHAD (*Dorosoma cepedianum*)	54	7.5- 9.6
SMALLMOUTH BUFFALO (*Ictiobus bubalus*)	6	10.1-13.0
RIVER CARPSUCKER (*Carpiodes carpio*)	41	12.4-13.4
CARP (*Cyprinus carpio*)	13	9.7-10.9
BLACK BULLHEAD (*Ameiurus melas*)	2	8.4- 8.6
LARGEMOUTH BASS (*Micropterus salmoides*)	1	5.9
BLUEGILL (*Lepomis macrochirus*)	7	4.6- 9.7
WHITE CRAPPIE (*Pomoxis annularis*)	23	6.5-11.7
FRESHWATER DRUM (*Aplodinotus grunniens*)	1	8.5
TOTAL (11 SPECIES)	151	

*Three nets were used once each: one 1-inch square mesh net, 150/8 feet; two "experimental" nets of five 25-foot sections of 3/4-, 1-, 1 1/4-, 1 1/2-, and 2-inch square mesh. All nets set overnight.

During July and August, 1950, and June and July, 1951, when the lake level rose above 620 f.s.l., Riggs saw large numbers of gar (*Lepisosteus* spp.), carp, and gizzard shad swimming and feeding over the inundated parts of Island 2. During these times fishermen made good catches of channel catfish, white bass, spotted bass, largemouth bass, white crappie, and freshwater drum over most of the inundated parts of this island. When the water receded many of these fish could have been, and probably were, trapped in the island ponds.

In addition to the possible sources just mentioned (i.e., entering the ponds through connecting inlets, or being stranded in the ponds by receding high water), the ponds' fish populations might also have been partially derived from reproduction within the ponds, and from introductions of species from fishermen's bait buckets.

In July, 1952, after the lake level dropped below 615 f.s.l., Smithpeter reported that one of the ponds (Pond 7) on the south side of Island 2 was isolated from Texoma except for a narrow channel less than four feet wide and six inches deep at its mouth. This pond, approximately two acres in area, was about 5½ feet deep in its deepest place, had a gently sloping bottom of sand, or silt and sand, only a small amount of emergent aquatic vegetation (*Polygonum lapathifolium*), and only a few stumps and snags.

On July 14, with the help of several graduate students from the Biological Station, we closed the inlet to Pond 7 with several feet of sand and applied rotenone (powdered derris root) to this pond at a concentration of six ppm. This high concentration was used in order to be doubly

certain that all fishes would be killed, especially gar (*Lepisosteus* spp.) and mosquitofish, both of which we had seen in the pond. These two species are very hard to kill with rotenone.

The rotenone was applied by first thoroughly mixing the powder with water in a large tub, then pouring it from a boat into the prop wash of an outboard motor. Cans full of the mixed rotenone were also thrown onto the surface of the pond, and some was sprayed along the edges and among the emergent plants with a small hand spray. A very strong south wind, the outboard motor, and seven men constantly wading about helped mix the pond water and rotenone thoroughly.

It was a hot sunny day (air 96°F.; water 87°F.) and as soon as the rotenone was applied, dead and dying fish appeared at the surface. These were picked up in dip nets and taken to shore where they were identified, counted, and weighed. Maximum and minimum total-lengths were taken, and several hundred fish were preserved in 10 per cent formalin for further study.

The gizzard shad was the first species to start dying. White crappie, parrot minnow, white bass, and bluegill followed in that approximate order. The entire population of gizzard shad was apparently killed within a few minutes, before such other species as spotted gar, smallmouth buffalo, channel catfish, and freshwater drum began to die. It was surprising that all carp were apparently killed within the first hour.

The rotenone was applied at 9:00 A.M., and fish were collected until 7:00 P.M. By this time all fish had been dipped from the surface of the pond and picked up from the shore except for an occasional few that were still rising to the surface. Since many fish sank before they could be dipped, and then could not be found because of the turbidity of the water, it was necessary to return on the following day after the accumulation of decomposition gasses within the bodies of the fish had caused them to float.

Fish collected on the second day were not weighed, since the weights would not have been an accurate measure of their living weight. Instead, they were grouped into 5-millimeter intervals of total-length (for separate species) and their weights considered to be the same as those of fish of the same length intervals taken on the previous day. All fish over three inches in total-length were either gathered from the water or from the beach and counted and measured, or accurately counted along the beach at the end of the second day. Fish below this length were too numerous to gather or count individually—especially gizzard shad, bullhead minnow, warmouth, and several sunfishes (*Lepomis* spp.)—and their numbers were estimated in the following manner. All fish were counted (excepting those over three inches long) in eight areas, each six feet long (parallel with the water's edge), and the average number per area was figured. This average was divided by six and the quotient multiplied by the total number of feet of shoreline where fish were found. This was simplified by the continuous south wind and the shape of the north shoreline which caused the fish to be concentrated along two parts of the north shore. These estimates were carefully made, and were conservative rather than excessive.

By late afternoon of the second day no fish had risen to the surface for over two hours in spite of persistent wading, and stirring about with the dip nets. We were convinced that only an insignificant number of fish were yet undiscovered, and made final counts.

(Footnotes for Table II.)

* These fish were killed by the application of 6 ppm. of rotenone to the water of the pond.

** In addition to the species listed here, three forms taken with this collection are not yet identified and might be additional species.

*** For adult and juvenile fish. Several small species, and young-of-year of several others were not measured or weighed.

TABLE II

*Kinds, Numbers, and Approximate Total Weights of Fishes Taken from Island 2, Pond 7, July 14, 1952.**

KIND OF FISH**	TOTAL NUMBER OF FISH COUNTED	NUMBER OF YOUNG COUNTED	NUMBER OF ADULTS AND JUVENILES COUNTED	TOTAL-LENGTH RANGE*** (INCHES)	WEIGHT RANGE*** (POUNDS)	TOTAL WEIGHT OF ADULTS AND JUVENILES	ESTIMATED NUMBER OF FISH NOT COUNTED	GRAND TOTAL FISH KILLED
SPOTTED GAR (*Lepisosteus productus*)	10	1	9	6.6-28.7	0.7-2.9	6.9	0	10
GIZZARD SHAD (*Dorosoma cepedianum*)	2953	539	2414	4.0-11.9	0.6	388.4	2440	5393
BANDED TETRA (*Astyanax fasciatus*)	1	0	1	2.2			0	1
SMALLMOUTH BUFFALO (*Ictiobus bubalus*)	33	0	33	7.9-15.2	0.8-2.8	38.7	0	33
RIVER CARPSUCKER (*Carpiodes carpio*)	12	4	8	8.3-15.7	0.8-2.0	7.7	0	12
CARP (*Cyprinus carpio*)	137	0	137	10.2-19.2	0.5-3.0	120.6	0	137
SILVER CHUB (*Hybopsis storerianus*)	1	0	1				0	1
PLAINS SHINER (*Notropis percobromus*)	7	7	0				0	7
SPOTTAIL SHINER (*Notropis venustus*)	1	0	1				0	1
RED SHINER (*Notropis lutrensis*)	158	0	158				260	418
GHOST SHINER (*Notropis buchanani*)	100	0	100				110	210
PARROT MINNOW (*Pimephales vigilax*)	1141	0	1141				1020	2161
CHANNEL CATFISH (*Ictalurus punctatus*)	16	1	15	9.3-17.5	0.5-1.8	8.1	0	16
FLATHEAD CATFISH (*Pilodictus olivaris*)	1	0	1	17.7	2.1	2.1	0	1
MOSQUITOFISH (*Gambusia affinis*)	14	0	14				70	84
WHITE BASS (*Morone chrysops*)	122	47	75	6.3- 9.5	0.1-0.5	16.5	30	152
LOG PERCH (*Percina caprodes*)	3	0	3				0	3
SPOTTED BASS (*Micropterus punctulatus*)	2	2	0				0	2
LARGEMOUTH BASS (*Micropterus salmoides*)	67	37	30	4.9-18.7	4.5	10.3	20	87
WARMOUTH (*Chaenobryttus coronarius*)	125	108	17	3.3- 5.1		0.9	490	615
GREEN SUNFISH (*Lepomis cyanellus*)	36	30	6			0.3	50	86
ORANGESPOTTED SUNFISH (*Lepomis humilus*)	9	0	9	2.1- 3.2			10	19
LONGEAR SUNFISH (*Lepomis megalotis*)	156	82	74	2.3- 5.2		3.8	650	806
BLUEGILL (*Lepomis macrochirus*)	811	352	459	2.5- 7.7			0	1
BLUEGILL x ORANGESPOTTED SUNFISH	1	0	1		0.4	3.2	30	80
WHITE CRAPPIE (*Pomoxis annularis*)	50	8	42	3.9- 8.9	0.3	54.6	1180	1991
BROOK SILVERSIDES (*Labidesthes sicculus*)	24	0	24				50	74
FRESHWATER DRUM (*Aplodinotus grunniens*)	352	0	352	4.7-13.4	1.1	55.8	110	462
GRAND TOTAL (27 species; 1 hybrid)	6343	1227	5116			717.9	6520	12,863

On the morning of the third day, Smithpeter revisited the pond. A thorough search revealed no new fish over three inches long, and few smaller fish. The results of Riggs' visit late in the afternoon of this same day were similar except that at least two living spotted gar were seen to come to the surface and gulp air in the manner typical of this genus. This surprising observation was later verified by Smithpeter who visited Island 2 on December 13, 1952, and found all ponds almost dry (the lake level was 604.4 f.s.l. on this date). In the mud and shallow water that remained of Pond 7, were at least 12 living spotted gar. No other species were present. The remains of several of the other ponds contained many of the species found in Pond 7 at the time when the rotenone was applied.

Altogether 27 species and one hybrid (bluegill x orangespotted sunfish) were identified from the pond (Table II). Three other forms (possibly additional species) were also taken, but have not yet been identified.

Of the number of fish actually counted (Table II) the ten most abundant species were, in order: gizzard shad (2953), parrot minnow (1141), bluegill (811), freshwater drum (352), red shiner (158), longear sunfish (156), carp (137), warmouth (125), white bass (122), and ghost shiner (100). These were also the first ten when the estimated numbers were added to those actually counted, but the order was slightly different (Table 2): gizzard shad (5393), parrot minnow (2161), bluegill (1991), longear sunfish (806), warmouth (615), freshwater drum (462), red shiner (418), ghost shiner (210), white bass (152), and carp (137).

Of the fish that were weighed, the gizzard shad weighed most (388.4 lbs.); carp (120.6 lbs.), freshwater drum (55.8 lbs.), bluegill (54.6 lbs.), and smallmouth buffalo (38.7 lbs.) followed in that order (Table 2). Small species, such as the minnows, mosquitofish, brook silversides, etc., and the young of the gizzard shad and several sunfishes (*Lepomis* spp.), were not weighed because of lack of time, and because they decomposed rapidly.

The total weight of the portion of the population that was weighed was 717.9 pounds, or 358.9 pounds per acre. The weight of all fish killed would probably not have exceeded this by more than 60 pounds since all of the fish not weighed or estimated for weight were small.

A yield of 358.9 pounds of fish per acre is very high, but not necessarily surprising in this case. As was previously mentioned, undoubtedly one of the ways that the fish got into these ponds was by being trapped by receding high water. As the ponds decreased in size as the lake level fell, the fish populations became increasingly concentrated. All fish examined were apparently normal and healthy, and there were no visible signs of stunting, although the fish were not aged nor were "K" or "C" factors calculated. The great abundance of small fish should have furnished ample food for the carnivorous fishes, and the obviously abundant plankton and invertebrate fauna should have provided for the bottom feeders and plankton feeders as well as some of the carnivorous forms.

In general, the species composition of the fish population of Pond 7 was what was expected. All but the banded tetra are common fishes of Lake Texoma. The large numbers of the parrot minnow and the bluegill were rather surprising. We have never taken the bluegill in such abundance during the four years of collecting in Lake Texoma, and large collections of the parrot minnow have only been made (in Texoma) in the mouths of tributary streams. According to previous Texoma collections, the red shiner and the spot tail shiner are by far the most abundant minnows, and theoretically, therefore, should have been more abundant in Pond 7. The complete absence of the redear sunfish (*Lepomis microlophus*) was also unexpected.

The high ratio of adult and juvenile fish to young-of-year suggests either that little reproduction occurred within the pond, or that predation of young-of-year is very high. The complete absence of young of several species suggests the former, and the great abundance of small fishes con-

travenes the latter. The warmouth, longear sunfish, and bluegill probably did spawn in the pond, and many young-of-year of these species were killed. The lake level had not been above 616 f.s.l. since August, 1951, and therefore the ponds had not been inundated since that time. Since the inlet to Pond 7 was small and shallow, a large immigration seems improbable. Most, if not all, of the young gizzard shad and white bass were undoubtedly recent immigrants, but much of the population must have inhabited the pond for at least a year.

If the ponds refill during the spring of 1953, the fish populations will be entirely new. Similar population studies will then be made in several or all of the ponds with special effort directed toward more accurate counts of individuals and total weights of each species. Age and growth studies will also be made and compared with similar studies of Texoma fishes. A comparison of these pond populations over several years should divulge interesting and valuable information on their consistency, and on which species are most likely to be trapped by receding water.