USE OF A TRAWL FOR SAMPLING FRESHWATER IMPOUNDMENTS IN TEXAS[1]

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ABSTRACT

A study was undertaken to determine the value of a small otter trawl as a collection tool in 11 reservoirs in Northeast Texas.

The collection unit consisted of four sets of 150-foot experimental gill nets, two drags with a 26-foot bag seine and two runs with a 10-foot trawl. The seine and trawl collections were made both during the day and at night.

Seining accounted for most of the 44 species of fish taken, while trawling produced the greatest number of specimens. Four species were taken only from gill nets, six only by seining and trawling added two exclusive species of fish to the collection list.

Trawling has certain limitations and does not replace either gill nets or seines, but serves as a supplement to these two standard methods of collection.

INTRODUCTION

While conducting lake surveys in Northeast Texas, it became apparent that some species of fish are not often taken with normal collecting methods. Until they are large enough to be caught in 1-inch mesh gill nets, such fish as channel catfish, crappie, goldeye, buffalo and gar are seldom taken from open waters.

Massman, Ladd and McCutcheon (1952) found that conventional methods such as minnow seines, fyke nets and hoop nets, failed to collect clupeoid fishes in tidal areas of Virginia.

In 1964 numerous crappie fry and small fingerlings were turned up from deep water seismograph operations at Lake Texoma after repeated seining collections yielded only an occasional specimen from the same general area. Thus, it became clear a different method of collection was needed to take small, young fish in deeper open waters.

The otter trawl has long been a proven commercial tackle and, in many cases, modifications have been made to adapt its use for biological collections. Heimann (1963) reported 53 species of saltwater fishes taken with commercial gear in Monterey Bay, California. Barkuloo (1957) collected 31 species of marine and freshwater fishes using a trawl in Florida.

Much freshwater trawl work has been done in the Great Lakes and Canada with large gear similar to that used in salt water. Kinney (1957) used a 30-foot trawl for 12 minute collections in Lake Erie. Ferguson and Regier (1963) experimented with various cod mesh sizes while studying the harvest of smelt in Lakes Erie and Ontario. Chapoton (1964) designed a surface trawl for collecting juvenile American shad and pulled it with a 16-foot boat, powered by a 10-or 18-hp outboard motor. Rupp and DeRoche (1960) found trawls to be a satisfactory method for collecting fish at depths to 80 feet in the freshwater lakes of Maine.

METHODS

Trawls of three sizes were tried in Northeast Texas waters but it soon became apparent that the 33-and 16-foot gear were too large to handle without a power winch and boom. This specialized equipment could not readily be adapted to the average outboard motorboat used by fishery workers in Texas.

Nelson (1968) used both 16-and 27-foot otter trawls while studying sauger on the Missouri River. His best catches of young-of-the-year were made with 27-foot gear in 3 to 12 feet of water, but no mention was made of the power supply for this tackle.

[1]Contribution of Dingell-Johnson Project F-8-R, Texas.

A trawl of 1/2-inch mesh nylon was constructed with a mouth 10 feet wide and 2 feet deep. The gear was 16 feet long and the cod was lined with a 1/8-inch mesh nylon sock. This gear rigged for fishing, but without boards and towlines, cost about $90.

This trawl was used with a 16-foot boat powered by a 33-hp outboard motor. A towbar was made from 1-inch galvanized pipe fitted into eyebolts mounted on the stern of the boat. When not in use, the towbar could be easily removed (Figure 1).

In shallow water the trawl was towed with a 75-foot bridle. For water deeper than 12 feet, an additional 75-foot towline was added to permit the gear to run at a greater depth. All lines were fitted with rings and snap swivels to permit quicker handling and adjustment.

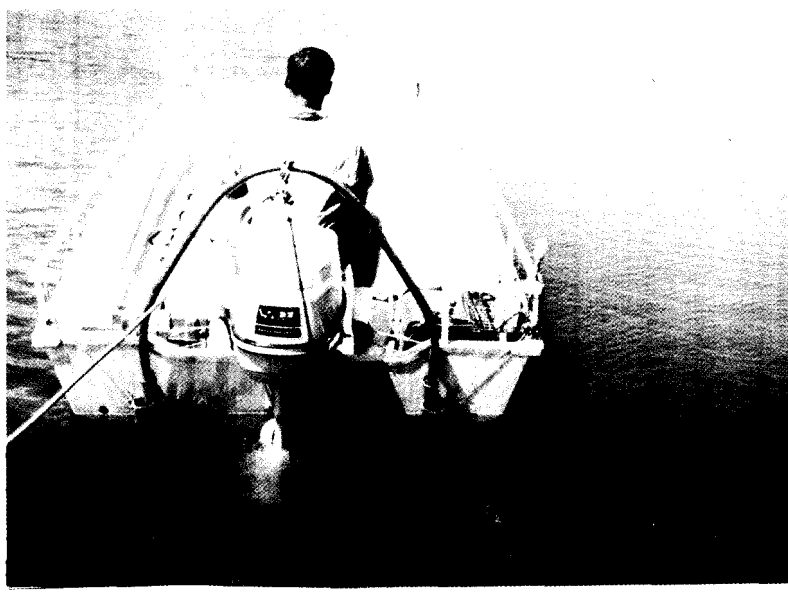

FIGURE 1. Trawl tow bar mounted in eye bolts for easy removal when not in use.

Before selecting an area in which to make a trawl collection, a check was made of available aerial photos and clearing maps of the reservoirs. Old fields and meadows were found to be most suitable in locating a cleared tract about 1 mile in length.

When the site was located in the lake, a dry run was made if no previous trawling had been attempted in that area. This was accomplished by replacing the trawl with a 15-foot length of rope between the trawl boards. Buoys, painted with reflective material, were placed at intervals so the run transection could be located for night collections.

In an attempt to compare the collections from trawls with those from nets and seines, a standard collection unit was established. For netting samples, four 150-foot experimental gill nets, with square mesh from 1 to 3-1/2 inches, were set overnight. Seining consisted of making two drags from water shoulder deep to the bank with a 26-foot, 1/4-inch mesh bag seine. A trawl collection was made from two runs of 10 to 15 minutes duration at a satisfactory speed using the gear previously described. These same seining and trawling procedures were repeated between 8 and 10 p.m. for night collections.

When trawling, the towing speed is satisfactory when the volume of the water entering the trawl mouth is passed evenly through the mesh to extend, or bloom, the cod and not create a pressure wave in front of the moving trawl. This speed is influenced by many factors such as length of towing warp, depth of water, speed and direction of water currents, angle of the otter boards, weight of the foot line, floats on the headline, power of the motor, and amount of silt or algae inside the trawl. Thus, a satisfactory towing speed must be established from experience rather than a definite motor speed.

Specimens from the seine and trawl were preserved in 10 per cent formalin for later sorting, identification and counting in the laboratory. The gill nets were picked up early the following morning and the specimens were sorted and counted by species.

A single unit collection was made on Lakes Coffee Mill and Fort Parker while the larger reservoirs were worked for 2 nights each. Double collections were made on Lakes Crook, Texoma, Lavon, Hogsett, Texarkana, Tawakoni, Bardwell, Navarro Mills and Mexia. A collection was made at each of the lakes during the period June through September, 1966. In an effort to make a cold weather comparison, a second collection was made at Lake Texoma in December.

Since water chemistry was not believed to be a significant factor, no water tests were made. Weather conditions, turbidity, bottom type and depth were recorded for each collection. A comparison of the physical conditions of the 12 collections made at 11 reservoirs is given in Table 1.

The common names of fish used in this report are those accepted by the American Fisheries Society.

RESULTS

Only 6 species of fish were taken with nets from Lake Crook, while 11 kinds were collected by all methods. All species except spotted gar were taken in seines. Trawling took fewer kinds of fish, but greater numbers than other gear. Crappie, channel catfish and gizzard shad are the three most abundant species in Crook and these were taken with all five collection methods.

The June collections made in the warm, murky waters at the upper portions of Lake Texoma (Table 2) produced good samples. More than 3,000 specimens, representing 21 species of fish were taken. Over 2,000 young shad, about equally divided between gizzard and threadfin, were taken in the day trawl collections.

By December, the shad had grown and moved out of the flats at the head of the lake where they had been so abundant (Table 3). Water temperatures had dropped and both trawls and seines made poor collections in the shallow waters. Only 11 species, totaling about 150 fish, were taken in the cold weather sample.

Collections at Lake Lavon were more evenly represented with the 3,300 specimens. Although more fish were taken in the day seine sample, the night trawl and seine collections were very close with almost 800 specimens taken by each method. Day seining also produced the most species, 14 in all.

A collection made at Lake Coffee Mill is a good example of the value of a trawl. Included in the gill net catch were 21 channel catfish that ranged from 70 to 409 mm standard length. No catfish were taken with the 26-foot seine during the day and 2 (27 and 42 mm standard length) were taken after dark. A single 10-minute run with the trawl produced 8 channel catfish from 37 to 97 mm standard length.

Gizzard shad were taken in each of the five collections at Lake Hogsett. Twenty species of fish were found in these samples. Other than the catch of shad, results of trawling collections were poor in this newly impounded reservoir. The lake basin lies in a heavily timbered area and cleared sites are scarce. In the old fields where the trawl could be used, flooded terrestrial weeds rapidly clogged the trawl throat.

At Lake Texarkana, 16 species of fish were taken in gill nets, while seines took 13 kinds during the day and 15 species after dark. However, trawl collections were needed to provide samples of young crappie. Three black crappie and 33 white crappie were taken in trawls; with night collections being the most productive. In all, 27 species were taken from this Northeast Texas impoundment on the Sulphur River.

TABLE 1.
Physical conditions of lakes worked.

Name of Lake	*Location (county)*	*Area (acres)*	*Volume (acre feet)*	*Average depth (feet)*	*Depth of trawl site (feet)*	*Average turbidity (inches secchi)*	*Month of collection*
Crook	Lamar	1,290	11,500	8.9	6-12	7.5	June
Texoma	Grayson-Cooke	91,200	1,730,000	19.0	8-12	5.0	June
Lavon	Collin	11,000	100,000	9.1	12-28	9.5	July
Coffee Mill	Fannin	715	8,580	12.0	12-15	18.5	July
Hogsett	Henderson-Kaufman	34,000	678,000	19.9	6-20	38.0	July
Texarkana	Bowie-Cass	20,300	145,300	7.2	12	9.0	August
Tawakoni	Hunt-Rains-Van Zandt	36,480	930,000	25.5	10-21	23.0	August
Bardwell	Ellis	3,200	42,800	13.4	4-20	21.0	September
Navarro Mills	Navarro	5,070	53,200	10.5	4-18	17.5	September
Fort Parker	Limestone	700	4,200	6.0	7	6.0	September
Mexia	Limestone	1,200	10,000	8.3	2-10	5.0	September
Texoma	Grayson-Cooke	91,200	1,730,000	19.0	8	9.0	December

TABLE 2.
Number of fish taken by various collection methods, Lake Texoma, June 1966.

Species	*Day trawl*	*Night trawl*	*Gill nets*	*Day seine*	*Night seine*
Shortnose gar			5		
Longnose gar		1	20		
Threadfin shad	1,052	153		41	36
Gizzard shad	1,018	70	51	3	2
Goldeye	1		9		
Smallmouth buffalo		2		1	21
River carpsucker			17	5	4
Carp			6		1
Emerald shiner				1	2
River shiner				2	9
Chub shiner				14	27
Blacktail shiner				5	1
Red shiner					2
Channel catfish			1		
Blue catfish			1	23	
Mississippi silverside	10	18			106
White bass	23	7	12	2	26
Bluegill		11	5	5	14
White crappie		2	2	1	7
Logperch		1			
Freshwater drum	42	397	4	3	30
Total	2,146	662	133	106	288

TABLE 3.
Number of fish taken by various collection methods, Lake Texoma, December 1966.

Species	*Day trawl*	*Night trawl*	*Gill nets*	*Day seine*	*Night seine*
Gizzard shad	6	12	8		
Goldeye			2		
Smallmouth buffalo			4		
River carpsucker			26		
Silver chub	6				
Chub shiner				6	
Bullhead minnow				1	5
Mississippi silverside	1	2		1	5
White bass	2		64		
White crappie			4		
Freshwater drum	1				
Total	16	14	108	8	10

Trawling collections at Lake Tawakoni took large numbers of young threadfin shad, indicating this species prefers open water. This method also took good numbers of sunfish, yellow bass and small channel catfish. Based on the seine collections, gizzard shad fingerlings were abundant in shallow water during the day. However, they apparently moved to deeper open water after dark.

The collection sites at Lake Bardwell were areas selected and cleared before impoundment as a part of the management recommendations for this new Corps of Engineers reservoir. Trawl gear worked very well in these areas and only slight interference was given by flooded terrestrial plants. Gizzard shad, carp and white crappie were abundant in all methods of collection.

At Navarro Mills Reservoir, the night collections were 4 to 10 times as productive as those made during the day. A day trawl collection made near the head of the lake took only a few bluegill from a good, clean trawl site. The night sample, made some 4 hours later, produced a good catch of white crappie, gizzard shad and bluegill. This indicates that either the fish were not present during the daylight hours or that they saw the trawl moving through the clear water and managed to escape it.

The catches at Lake Fort Parker indicate that night seining was the best method of collection. Good trawl collections were made during the single, night survey. Hand-sized white crappie were caught in open water trawling during the day in this murky lake, but not at night. The reverse was found in the seine collections. This indicates that the crappie moved into the shallow water after dark.

Lake Mexia was built by damming the Navasota River and flooding rough, brushy, pasture land, much of which was left uncleared. As a result, trawling locations are very scarce and below average catches were made. Near the head of the lake, the trawl was operated in water 2 feet deep and fish were observed moving away from the mouth of the trawl. It is also possible the turbulence from the motor disturbed the fish in this shallow water.

The combined results of 12 collection units made in 11 reservoirs (Table 4) show that 44 species of fish were taken by all methods. Night seining accounted for 34 kinds and day seining took 33. Gill netting and night trawling each produced 25 species of fish, while day trawling produced 22 kinds.

In numbers, trawling accounted for more fish than any of the other methods of collection. Seining was next most productive and the fewest number of fish were taken in gill nets. However, these 2,542 fish were larger and, in many cases, were adult fish. In most fish populations, this class is greatly outnumbered by the younger age groups.

Gizzard shad, smallmouth buffalo, carp, channel catfish, white bass, bluegill, orangespotted sunfish, longear sunfish, white crappie and freshwater drum were taken by all five methods of collection but not in equal quantities or times.

Gizzard shad and white crappie were taken in all 12 net collections, while carp, channel catfish and drum were taken in 11 gill net samples. Spotted gar, bowfin, bigmouth buffalo, and flathead catfish were taken exclusively with nets.

Seines accounted for most of the minnows and sunfish found in Table 4. Red shiners were collected in 11 of the 12 night seine samples. River shiners, blacktail shiners, chub shiners, madtoms, top minnows, brook silversides and mosquitofish taken during this study were found only in seine collections.

Trawling took large numbers of open water fish, principally shad, and accounted for more fish but fewer kinds than all other methods of collection. Silver chub and black crappie were collected only with trawling gear from the 11 lakes worked during this study. Kinney (1957) found trawling a good method of sampling silver chub in his study at Lake Erie.

While similar collections were made in all 11 impoundments, young largemouth bass were collected at only 4 lakes, small white crappie were taken at 8, young white bass at 5, and channel catfish fingerlings at 7 reservoirs. In addition, a sample of small black crappie was taken from Lake Texarkana and a good collection of young yellow bass was made in Lake Tawakoni.

DISCUSSION

Gill nets with experimental mesh have long been a standard method of collection. However, many species of fish do not grow to a size large enough to be taken in the smallest mesh of such gear. This includes such fish as many of the minnows, madtoms, topwaters, silversides and darters.

Seines, with various modifications, have been used to collect these species. But sometimes shoreline obstructions or steep banks prohibit this method of sampling. In addition, some species of fish prefer open water and do not frequent the shorelines.

The use of a small trawl pulled with an outboard motorboat can be of value in freshwater surveys. Trawling is especially useful over the soft mud flats found at the heads of most lakes in Texas. These areas are sometimes too shallow to set gill nets and too silty to seine.

TABLE 4.

Composite comparison of 1966 collections. (Giving total number of fish taken in 12 collection units from 11 lakes. Figure in parenthesis is number of times species was taken.)

Species	*Day Trawl*	*Night Trawl*	*Gill Nets*	*Day Seine*	*Night Seine*
Shortnose gar			55 (5)		1 (1)
Spotted gar			28 (5)		
Longnose gar		1 (1)	34 (3)		
Bowfin			1 (1)		
Threadfin shad	1,716 (4)	572 (4)		119 (4)	118 (3)
Gizzard shad	2,117 (10)	3,130 (11)	361 (12)	2,528 (11)	1,450 (11)
Goldeye	1 (1)		11 (2)		
Bigmouth buffalo			1 (1)		
Smallmouth buffalo	2 (1)	2 (2)	104 (6)	7 (3)	34 (4)
River carpsucker			107 (8)	22 (3)	6 (2)
Carp	58 (1)	138 (2)	178 (11)	2 (1)	7 (4)
Golden shiner		1 (1)		11 (5)	12 (3)
Pugnose minnow		1 (1)		22 (2)	12 (2)
Silver chub	6 (1)				
Emerald shiner	3 (1)	3 (1)		1 (1)	14 (2)
River shiner				2 (1)	9 (1)
Chub shiner				20 (2)	24 (1)
Blacktail shiner				5 (1)	9 (2)
Red shiner	13 (1)	2 (1)		368 (10)	572 (11)
Ghost shiner	4 (1)			12 (1)	37 (1)
Silvery minnow		2 (1)		13 (1)	63 (1)
Bullhead minnow	2 (2)	3 (3)		86 (7)	187 (10)
Channel catfish	32 (4)	22 (5)	188 (11)	13 (4)	29 (7)
Blue catfish			2 (2)	23 (1)	
Black bullhead	38 (3)	102 (3)	92 (6)		33 (2)
Yellow bullhead		1 (1)	10 (3)	1 (1)	1 (1)
Flathead catfish			2 (2)		
Tadpole madtom				1 (1)	1 (1)
Blackstripe topminnow				1 (1)	
Mosquitofish				42 (6)	20 (5)
Mississippi silverside	12 (3)	24 (4)		135 (3)	184 (5)
Brook silverside				6 (1)	21 (2)
White bass	79 (3)	16 (3)	202 (7)	31 (4)	304 (6)
Yellow bass		27 (1)	35 (1)	3 (1)	21 (1)
Largemouth bass			47 (6)	41 (6)	45 (5)
Warmouth	65 (1)		9 (2)		5 (4)
Green sunfish	2 (1)	8 (1)	6 (1)	3 (3)	25 (4)
Bluegill	26 (4)	55 (5)	41 (10)	214 (8)	176 (9)
Orangespotted sunfish	29 (4)	57 (4)	1 (1)	34 (5)	69 (7)
Longear sunfish	7 (3)	2 (2)	3 (2)	38 (8)	30 (7)
White crappie	451 (8)	460 (11)	721 (12)	140 (4)	109 (9)
Black crappie	1 (1)	2 (1)			
Logperch		1 (1)		3 (2)	3 (2)
Freshwater drum	148 (4)	424 (5)	303 (11)	3 (1)	67 (7)
Total	4,812	5,056	2,542	3,950	3,698

However, the effectiveness of the trawl as a method of collection is limited by the areas where it can be used. The bottom must be flat, or gently rolling, without channels or abrupt dropoffs. The run tract should be at least one-half mile in length and clear of such obstacles as rocks, stumps, snags and submerged trash. Trotlines and commercial nets should be avoided for obvious reasons. Submerged vegetation, such as pondweeds and mosses, as well as flooded terrestrial weeds, also prevent good catches of fish. Areas which can be selected, cleared and marked before the basin is flooded, make good trawl sites if they can be kept clean and free of trash and trotlines.

Physical conditions of the water also influence trawl catches. In clear water, fish apparently see the trawl coming and attempt to escape it. The best trawl catches have been made in murky or turbid water with Secchi readings of 20 inches or less. As with seining, the best trawl collections in clear shallow waters are made after dark.

Based on the results of this study, it is apparent that trawls do not replace either gill nets or seines, but will serve as a supplement to these two standard methods of collection and it is concluded that trawling in freshwater can provide a useful additional method of sampling for fishery workers.

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FIELD OBSERVATIONS ON THE USE OF SODIUM CYANIDE IN STREAM SURVEYS

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ABSTRACT

Sodium cyanide has been an effective method for sampling the stream fish populations in Eastern Tennessee. Its portability makes it a practical stream management tool. Cyanide is an excellent cold weather sampling method. Three ounces of cyanide in trout streams and 6 ounces in warmwater streams per cubic foot a second flow will sample 100 yards. In water colder than 55°F mortality of fish is not acute. Rainbow trout and various warmwater fish collected with cyanide and held in aquaria showed no deleterious effects from exposure to the chemical. Reduction in stream invertebrate populations after cyanide application is evident.