

FINAL REPORT
RESEARCH AND SURVEYS



FEDERAL AID PROJECT NO. F-39-R

LARGEMOUTH BASS INVESTIGATIONS

JOB NO. 9

EVALUATION OF BRUSH PILE INSTALLATION AS A METHOD TO INCREASE
CATCH RATES OF LARGEMOUTH BASS AND OTHER SPORT FISHES

OCTOBER 1, 1981 THROUGH FEBRUARY 28, 1983

FINAL REPORT

STATE: Oklahoma PROJECT NUMBER: F-39-R

PROJECT TITLE: Largemouth Bass Investigations

STUDY TITLE: Evaluation of Brush Pile Installation as a Method to Increase
Catch Rates of Largemouth Bass and Other Sport Fishes

PERIOD COVERED: October 1, 1981 - February 28, 1983

OBJECTIVE NUMBER: 9 JOB NUMBER: 9

ABSTRACT

Electrofishing along with a standardized creel were conducted in each of four sections on Liberty Lake prior to and after artificial habitat was added to two of the four sampling areas. Catch rates by electrofishing for largemouth bass and white crappie were greater in areas with habitat added than in control areas. Creel estimates showed higher catch rates for white crappie and channel catfish in areas where artificial habitat was added. No differences in the creel estimates for largemouth bass between sampling areas were found following brush addition. A drastic rise in water level in May, 1982 left much of the lake inaccessible to bank anglers and had adverse effects on electrofishing efficiency. Therefore, field sampling was discontinued prior to schedule.

I. Objective:

Determine if installation of artificial habitat (brush shelters) will increase the catch per unit effort (CPUE) of largemouth bass (Micropterus salmoides), white crappie

(Pomoxis annularis), sunfish (Lepomis spp.), and channel catfish (Ictalurus punctatus) by electrofishing as well as angler catch and harvest rates for bass, white crappie, sunfish, and channel catfish.

II. Introduction:

As lakes age, much of the cover initially inundated deteriorates leaving barren shorelines. This loss of cover is believed to be related to observed declines in standing crops of centrarchid species such as largemouth bass which are dependent on stable and sheltered shorelines (Brouha and von Geldern 1979). This lack of cover may result in reduced food availability and higher predation on young-of-the-year fishes.

Work on the addition of artificial structures to concentrate fish began in the 1930's (Hubbs and Eschmeyer 1938). Since that time, researchers have attempted to evaluate the attraction of fishes to various structure types and locations (Rodeheffer 1940; Petit 1972; Prince and Maughn 1979). Angler use of areas with cover is higher than in areas devoid of cover (Bartholemew 1972). Catch and harvest rates have been increased in areas where artificial habitat has been added (Petit 1972; Wege and Anderson 1979).

This study was conducted on Liberty Lake, Logan County, Oklahoma. Liberty Lake is a 81.8 ha municipal water supply

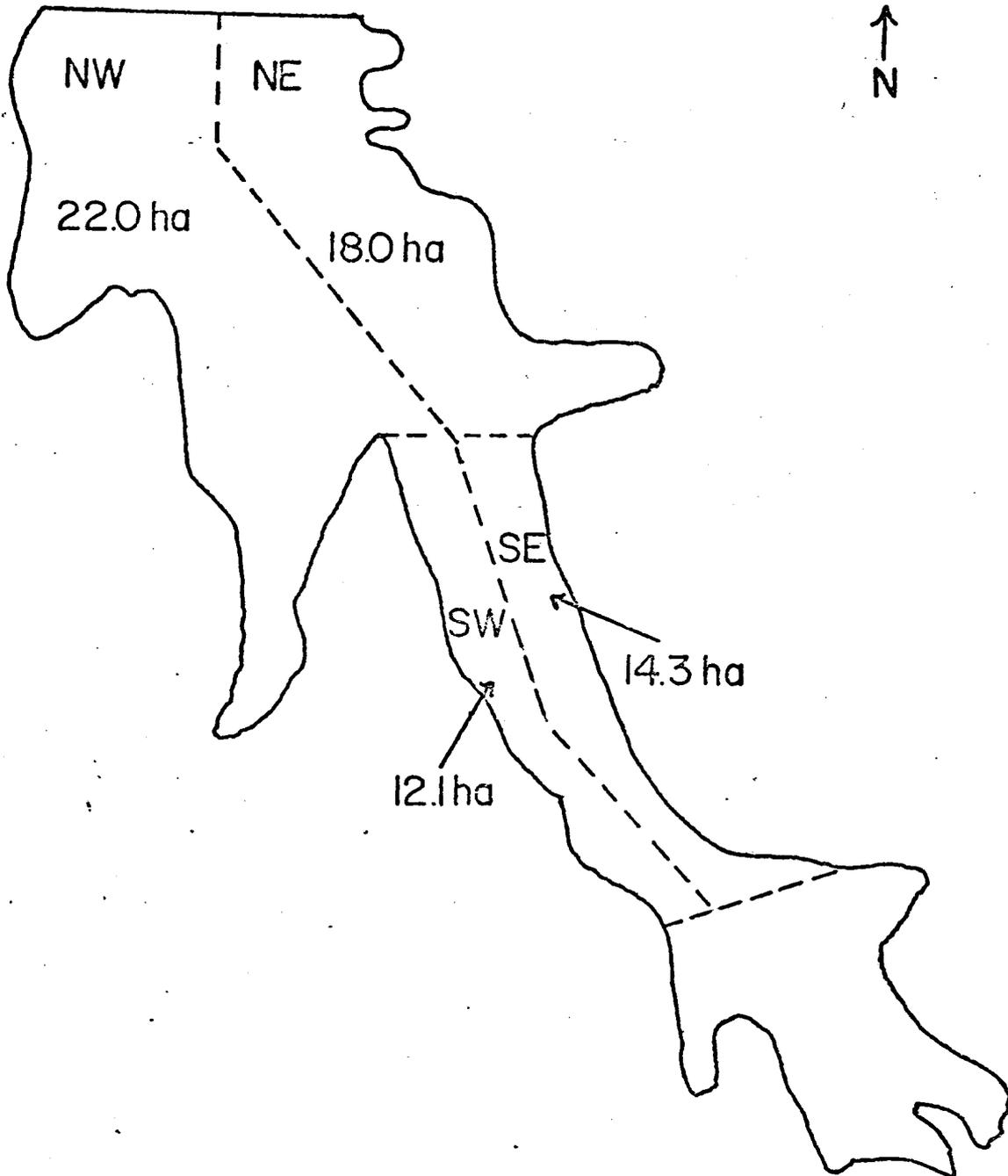
facility for the city of Guthrie. The lake was impounded on an unnamed tributary of Cottonwood Creek in 1949. The watershed drainage area is 4.5 km² and is comprised of rangeland and unirrigated pastureland. Sediment loads from the watershed have caused heavy siltation of the upper end of the lake which has led to a decline in available habitat.

III. Methods:

Liberty Lake was divided into four sampling areas (Figure 1). The north and south areas of the lake were divided into a matched experimental and control area (NW and NE, SE and SW). One hour of standardized electrofishing was conducted in each of the four areas once monthly from April through July, 1981. Catch rates were determined and lengths and weights were taken on largemouth bass, white crappie, sunfish, and channel catfish from each of the four sampling areas. The August, September, and October samples could not be collected due to low water levels. A standardized daytime creel was conducted from April through August. Fishing pressure, catch rates, and harvest rates for largemouth bass, white crappie, sunfish, and channel catfish were estimated for each of the four sampling areas.

Artificial habitat, consisting of oak tree tops and cedar trees, was placed in sections NW and SE in March 1982. Oak and cedar trees were cut and anchored with concrete blocks and situated so as to be accessible to bank anglers. Eight groups of four cedar trees each were placed along the dam and a row of

Figure 1
-4-
SAMPLING AREAS FOR ELECTROFISHING
AND CREEL ON LIBERTY LAKE



26 cedar trees with 12 groups of three oak tree tops each being placed at approximately the 1 m depth contour in section NW. A total of 2161.5 m² of artificial habitat was installed in section NW comprising 1.02% of the surface area. Approximately 221 m² of oak tree tops were placed in section SE. Due to a prolonged drought and resulting drop in lake level, the surface area of section SE was reduced to approximately 1.6 ha by the time the habitat was added. The area covered by the brush comprised approximately 1.6% of the surface area.

Electrofishing samples and the creel survey were repeated according to the 1981 sampling guidelines. Samples were collected in April and May, 1982. Electrofishing effort was concentrated around the brush piles in sections NW and SE.

Electrofishing samples were scheduled to be collected through October, 1982 with the creel scheduled to run through August, 1982. However, heavy rains in May resulted in an approximate 5 m rise in the water level. The artificial habitat was hence situated in about 6 m of water where it could not be effectively sampled with the shockerboat. In addition, water was backed up into the willow trees on the shoreline, thereby making the sections where the habitat was added inaccessible to bank anglers. Attempts were made to relocate some of the brush in shallower water. Subsequent sampling showed that fish were not concentrating

around the relocated brushpiles. Apparently, the abundance of recently inundated terrestrial vegetation provided adequate cover for the fish in the area and the additional artificial habitat was ineffective in concentrating fish. For these reasons, it was decided to discontinue sampling after May and terminate the field portion of the study.

IV. Results:

The catch rates (CPUE) by electrofishing for largemouth bass and sunfish were higher in 1981 than in 1982 (Table 1). Catch rates for white crappie were higher in 1982 with too few channel catfish being sampled to base any yearly comparisons. CPUE's for all species sampled were generally higher in section NE than the other three sampling areas in 1981. Sections NW and SW had the highest CPUE's for largemouth bass with the areas with brush added (sections NW and SE) yielding the most white crappie in 1982. CPUE's for sunfish were greatest in sections NW and NE in 1982. CPUE's for largemouth bass, white crappie, and sunfish declined 73.4%, 86.7%, and 85.8%, respectively from the April to May, 1982 samples.

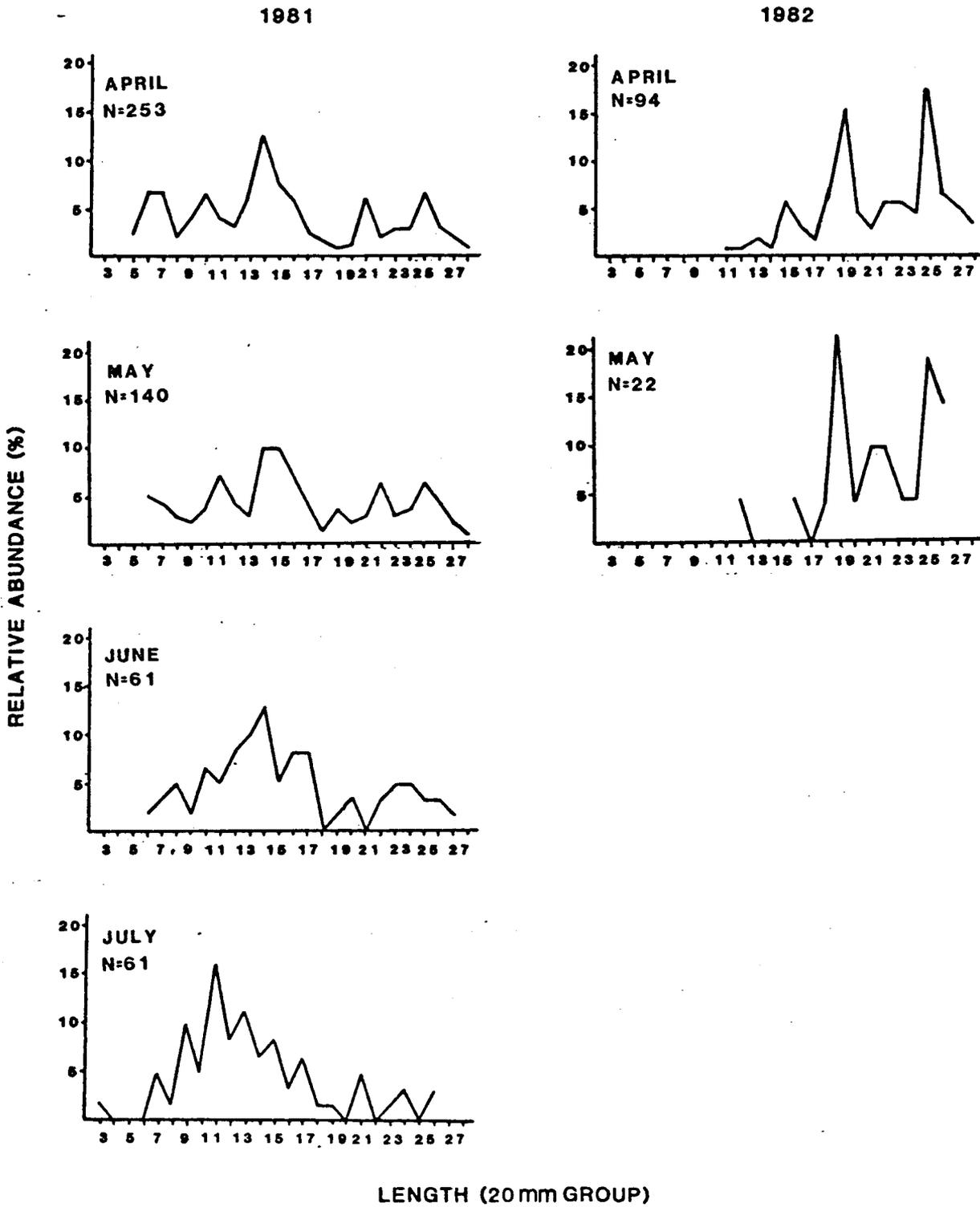
The length-frequency distribution of largemouth bass collected in 1982 was dominated by larger size fish than the 1981 sample (Figure 2). The PSD for the combined April and May, 1981 sample was 56% with the respective samples in 1982 having a PSD of 92%.

Table 1. Catch per unit effort (no./15 minutes) by electrofishing by month and section of selected sport fishes before (1981) and after (1982) artificial habitat was added to Liberty Lake.

	Month	NE		NW*		SE*		SW	
		1981	1982	1981	1982	1981	1982	1981	1982
Largemouth bass	April	22.50	2.00	13.50	10.50	10.00	0.00	9.00	9.00
	May	19.50	2.25	5.75	3.00	5.25	0.00	5.50	1.00
	June	4.25	-	4.25	-	2.75	-	4.00	-
	July	5.00	-	3.25	-	3.50	-	3.50	-
White crappie	April	5.25	0.75	0.50	11.00	0.50	36.00	0.75	3.00
	May	3.00	2.25	1.75	1.50	1.00	0.25	1.75	0.00
	June	1.25	-	0.75	-	2.25	-	8.00	-
	July	1.25	-	3.00	-	0.75	-	1.00	-
Sunfish	April	24.50	8.75	9.50	9.75	7.00	1.00	5.50	5.00
	May	36.00	2.00	21.00	0.75	9.25	0.75	6.25	1.00
	June	24.75	-	11.75	-	6.50	-	16.00	-
	July	19.75	-	15.75	-	11.00	-	10.50	-
Channel catfish	April	4.75	0.25	0.75	1.50	1.25	0.00	0.25	1.00
	May	0.50	0.25	0.25	0.25	0.25	0.25	0.00	0.50
	June	0.50	-	0.00	-	0.25	-	1.00	-
	July	0.25	-	0.00	-	1.00	-	1.00	-

*Artificial structure added.

Figure 2. Length-frequency of largemouth bass prior to (1981) and after (1982) the addition of artificial habitat.



The length distribution of the 1981 and 1982 spring samples for white crappie were relatively similar (Figure 3), with PSD's of the combined April and May samples for 1981 and 1982 being 60% and 65%, respectively. The length-frequency distributions for sunfish from the 1981 and 1982 samples showed similar trends (Figure 4). All species of sunfish were grouped in the analysis. Sunfish species collected included bluegill (Lepomis macrochirus), warmouth (Lepomis gulosus), green sunfish (Lepomis cyanellus), longear sunfish (Lepomis megalotis), and redear (Lepomis microlophus). PSD's were not calculated due to the grouping of the different species. Length-frequency data were not analyzed for channel catfish due to the small sample size.

Fishing pressure for each section creeled declined in 1982 (Tables 2 & 3). Fishing pressure was highest in section NE for both years creeled. This is due to the ease of bank access on this portion of the lake. Catch rates for bass were highest in the south control area (section SW; 0.270/angler-hr for all anglers and 2.256/angler hr for bass anglers) in 1981. Catch rates for all anglers were highest in the control area (section NE; 0.003/angler-hr) whereas anglers seeking bass had the highest catch rates in a brush added area (section NW; 0.010/angler-hr) in 1982. No bass were creeled in either sections SW or SE in 1982. Catch rates, catch/ha, and harvest/ha of largemouth bass declined in 1982 in all sections. Catch rates, catch/ha, and harvest/ha of bass were greater in section NE (control) than section NW (habitat added) in both years creeled.

Figure 3. Length-frequency of white crappie prior to (1981) and after (1982) the addition of artificial habitat.

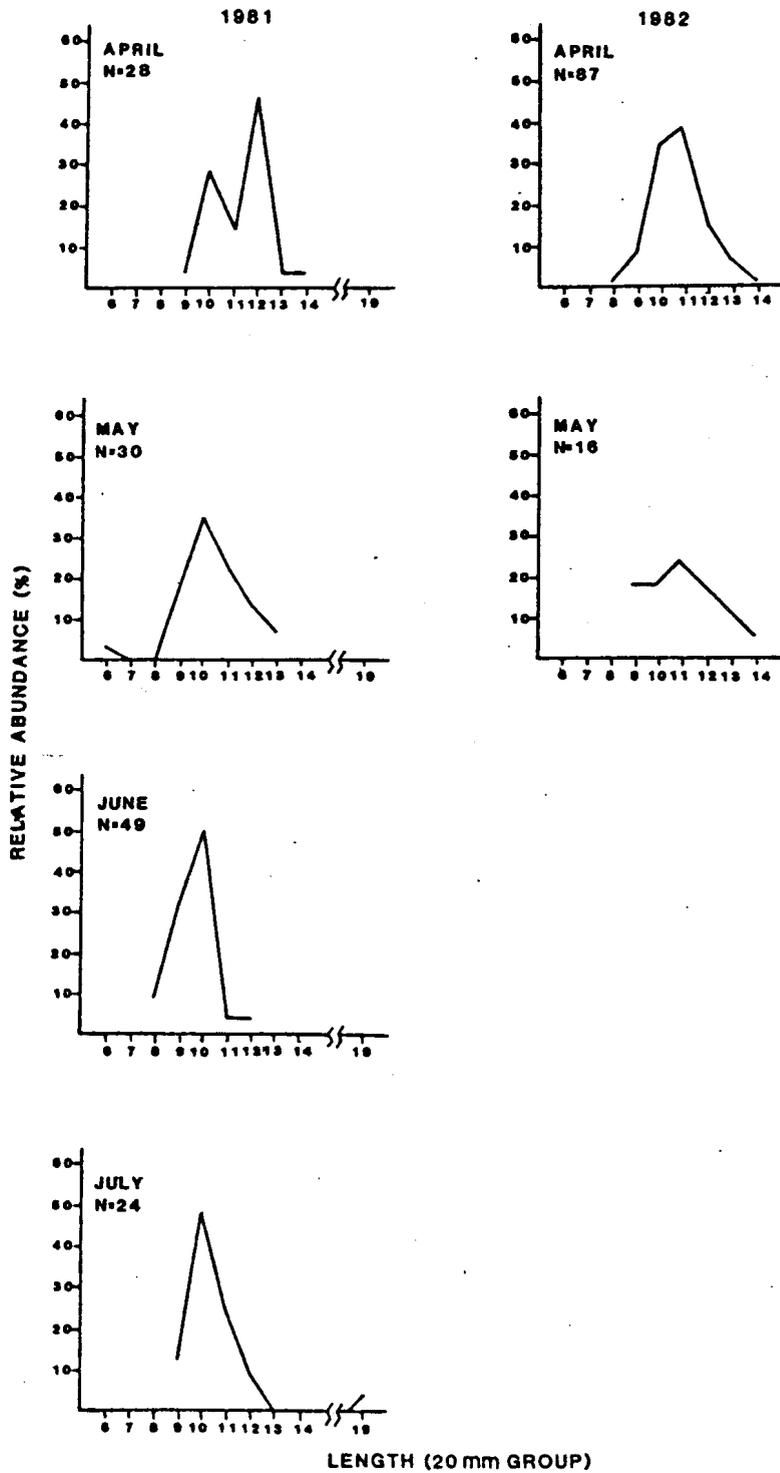


Figure 4. Length-frequency of sunfish sp. prior to (1981) and after (1982) the addition of artificial habitat.

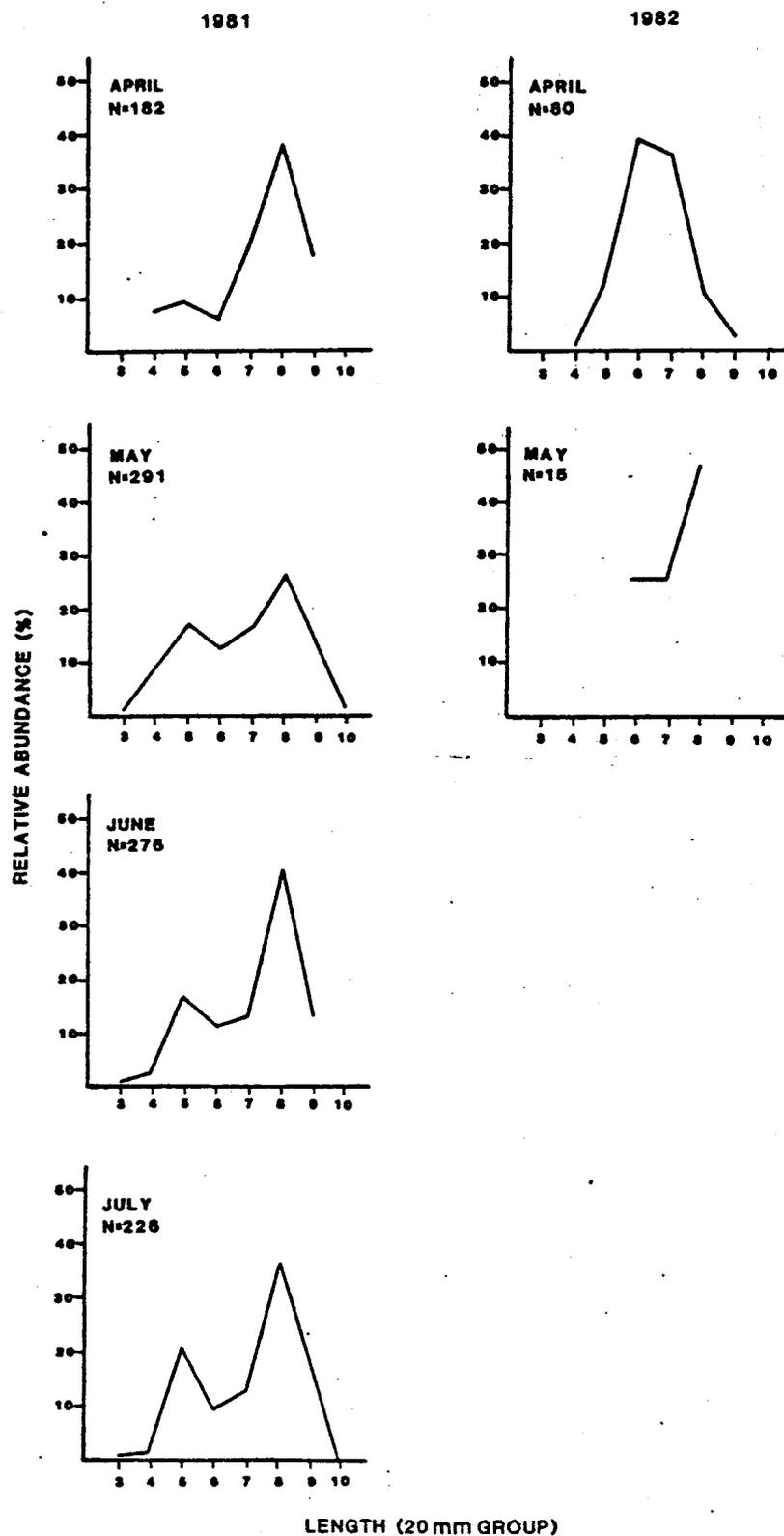


Table 2. Fishing pressure, catch rates, and harvest of sport fishes by section for all anglers in Liberty Lake before (1981) and after (1982) installation of artificial habitat.

Section	Species caught	Angler-hrs		Angler-hr/ha		Catch rate		Catch/ha		Harvest/ha	
		1981	1982	1981	1982	1981	1982	1981	1982	1981	1982
NE (Control)	Largemouth bass	17815.2	9494.0	989.73	527.44	0.092	0.003	96.43	1.49	30.83	0.92
	White crappie					0.104	0.007	103.14	3.77	84.70	3.77
	Channel catfish					0.055	0.042	54.70	22.23	33.79	8.39
	Sunfish sp.					0.259	0.011	258.25	6.10	228.44	4.72
NW (Habitat added)	Largemouth bass	9664.5	2971.2	439.30	135.05	0.051	0.001	23.31	0.09	12.39	0.05
	White crappie					0.086	0.757	37.95	10.23	31.80	1.52
	Channel catfish					0.079	0.090	34.76	12.11	23.96	4.95
	Sunfish sp.					0.890	0.000	43.80	0.00	32.96	0.00
SE (Habitat added)	Largemouth bass	2748.8	321.2	192.2	199.14	0.051	0.000	9.73	0.00	0.00	0.00
	White crappie					0.000	0.000	0.00	0.00	0.00	0.00
	Channel catfish					0.088	0.161	16.92	32.18	10.95	32.18
	Sunfish sp.					0.006	0.000	1.15	0.00	1.15	0.00
SW (Control)	Largemouth bass	3504.0	667.3	289.59	413.73	0.270	0.000	78.10	0.00	8.47	0.00
	White crappie					0.000	0.004	0.43	1.83	0.00	0.00
	Channel catfish					0.081	0.087	23.39	36.03	14.76	36.03
	Sunfish sp.					0.049	0.000	14.05	0.00	14.05	0.00

Table 3. Fishing pressure, catch rates, and harvest of sport fishes by section for anglers seeking specific species in Liberty Lake before (1981) and after (1982) installation of artificial habitat.

Section	Species sought/ caught	Angler-hrs		Angler-hrs/ha		Catch rate		Catch/ha		Harvest/ha	
		1981	1982	1981	1982	1981	1982	1981	1982	1981	1982
NE (Control)	Largemouth bass	1480.4	47.7	82.24	2.65	0.788	0.000	64.95	0.00	13.99	0.00
	White crappie	1021.9	46.3	56.77	2.57	0.981	0.667	55.73	1.71	43.06	1.71
	Channel catfish	3968.4	3789.3	220.47	210.52	0.135	0.089	29.88	18.64	13.57	7.24
	Sunfish sp.	770.0	0.0	42.78	0.0	3.371	-	144.14	-	144.14	-
NW (Habitat added)	Largemouth bass	1120.0	206.8	50.91	9.40	0.208	0.10	10.57	0.09	9.60	0.05
	White crappie	317.4	159.0	150.79	7.23	1.395	0.768	20.11	5.55	16.41	0.78
	Channel catfish	4075.0	1094.4	185.23	49.75	0.159	0.099	29.51	4.95	21.18	3.68
	Sunfish sp.	64.5	0.0	2.93	0.0	31.500	-	6.53	-	2.18	-
SE (Habitat added)	Largemouth bass	456.1	0.0	31.90	0.0	0.285	-	9.09	-	1.15	0.00
	White crappie	0.0	0.0	0.00	0.0	-	-	-	-	0.00	-
	Channel catfish	1441.3	140.6	100.79	87.17	0.155	0.251	15.70	21.90	10.95	21.90
	Sunfish sp.	0.0	0.0	0.00	0.0	-	-	-	-	-	-
SW (Control)	Largemouth bass	373.4	0.0	30.86	0.0	2.256	-	69.63	-	0.00	-
	White crappie	0.0	0.0	0.00	0.0	-	-	-	-	-	-
	Channel catfish	2244.4	404.2	185.49	250.60	0.124	0.144	22.95	36.03	14.76	36.03
	Sunfish sp.	0.0	0.0	0.00	0.0	-	-	-	-	-	-

Catch rates for crappie declined in a control area (section NE) from 1981 to 1982 (0.104 to 0.007) for all anglers, whereas they increased in an area with brush added (section NW; 0.086 to 0.757). Catch/ha and harvest/ha of crappie declined in sections NE and NW in 1982, whereas catch increased in section SW. Catch rates and catch/ha were greater in the section with brush added (NW) than the control area (NE) in 1982 but more crappie were harvested/ha from the control area (NE).

Catch rates, catch/ha, and harvest/ha of channel catfish were greater in 1981 in section NE, whereas the respective data for sections SE and SW were greater in 1982. Catch rates for channel catfish in section NW increased over similar 1981 estimates, whereas catch/ha and harvest/ha declined in 1982. Most anglers fishing Liberty in 1981 and 1982 were seeking catfish.

Catch rates for sunfish by all anglers was highest in section NW (0.890/angler-hr) in 1981, whereas catch rates for anglers seeking sunfish were greatest in section NW (31.500/angler-hr). Total catch of sunfish was highest in section NE (258.25/ha) in 1981. Sunfish were creel only from section NE in 1982 with catch rates, catch/ha, and harvest/ha being 0.011, 6.10, and 4.72, respectively.

The effects of the rise in water levels during May, 1982 had a drastic effect on the creel results (Tables 4 & 5). Fishing pressure was higher in the brush section (NW) than the control (NE) in April, 1717.6 angler-hrs and 1105.0, respectively. Following

Table 4. Fishing pressure, catch rates, and harvest of sport fishes by section for all anglers in Liberty Lake before (April) and after (May) rise in water level.

Section	Species caught	Angler-hrs		Angler hr/ha		Catch rate		Catch/ha		Harvest/ha	
		April	May	April	May	April	May	April	May	April	May
NE (Control)	Largemouth bass	[]		[]		0.009	0.005	0.57	0.92	0.00	0.92
	White crappie	1105.0	3227.0	61.39	179.28	0.037	0.006	2.28	1.16	2.28	0.32
	Channel catfish	[]		[]		0.033	0.064	2.06	11.40	0.57	7.82
	Sunfish sp.	[]		[]		0.071	0.005	4.34	0.81	3.77	0.00
NW (Habitat added)	Largemouth bass	[]		[]		0.001	0.000	0.09	0.00	0.09	0.00
	White crappie	1717.6	963.7	78.07	43.80	0.068	0.111	5.35	4.88	5.35	4.88
	Channel catfish	[]		[]		0.060	0.152	4.67	6.66	3.83	5.58
	Sunfish sp.	[]		[]		0.000	0.000	0.00	0.00	0.00	0.00
SE (Habitat added)	Largemouth bass	[]		[]		-	-	-	-	-	-
	White crappie	152.0	0.0	94.24	0.00	-	-	-	-	-	-
	Channel catfish	[]		[]		-	-	-	-	-	-
	Sunfish sp.	[]		[]		-	-	-	-	-	-
SW (Control)	Largemouth bass	[]		[]		-	-	-	-	-	-
	White crappie	225.3	210.0	139.69	130.20	-	0.141	-	1.84	-	0.00
	Channel catfish	[]		[]		0.000	0.277	0.00	36.03	0.00	36.03
	Sunfish sp.	[]		[]		-	-	-	-	-	-

Table 5. Fishing pressure, catch rates, and harvest of sport fishes by section for anglers seeking specific species in Liberty Lake before (April) and after (May) rise in water level.

Section	Species sought/ caught	Angler-hrs		Angler-hr/ha		Catch rate		Catch/ha		Harvest/ha	
		April	May	April	May	April	May	April	May	April	April
NE (Control)	Largemouth bass	47.7	0.0	2.65	0.00	0.000	-	0.00	-	-	-
	White crappie	46.3	0.0	2.57	0.00	0.667	-	1.72	-	1.71	-
	Channel catfish	194.2	1593.6	10.79	88.53	0.000	0.122	0.00	10.82	0.00	7.24
	Sunfish sp.	0.0	0.0	0.00	0.00	-	-	-	-	-	-
NW (Habitat added)	Largemouth bass	206.8	0.0	9.40	0.00	0.010	0.00	0.09	0.00	0.09	0.00
	White crappie	56.5	102.5	2.57	4.66	1.315	0.466	3.38	2.17	3.38	2.17
	Channel catfish	520.5	380.5	23.66	17.29	0.018	0.217	0.42	3.75	0.42	3.75
	Sunfish sp.	0.0	0.0	0.00	0.00	-	-	-	-	-	-
SE (Habitat added)	Largemouth bass	0.0	0.0	0.00	0.00	-	-	-	-	-	-
	White crappie	0.0	0.0	0.00	0.00	-	-	-	-	-	-
	Channel catfish	35.9	0.0	22.26	0.00	0.46	-	10.28	-	10.28	-
	Sunfish sp.	0.0	0.0	0.00	0.00	-	-	-	-	-	-
SW (Control)	Largemouth bass	0.0	0.0	0.00	0.00	-	-	-	-	-	-
	White crappie	0.0	0.0	0.00	0.00	-	-	-	-	-	-
	Channel catfish	208.4	195.7	129.21	121.33	0.000	0.297	0.00	36.03	0.00	36.03
	Sunfish sp.	0.0	0.0	0.00	0.00	-	-	-	-	-	-

the May rains and the resulting restrictions of bank access, pressure was higher in the control section (NE; 3227.0 angler-hrs) than the section with brush added (NW; 963.7 angler-hrs). No anglers were creeled in section SE during May. However, fishing pressure was relatively unaffected by the rise in water level in section SW. This area had relatively steep banks and bank access was not limited by the rising water.

Catch rates for largemouth bass were higher in the control (NE; 0.009) than in the experimental (NW; 0.001) in April. However, anglers seeking bass spent most of their effort in areas of artificial habitat (section NW) during April. No anglers fished for bass during May.

Catch rates for crappie in the section with brush added (NW) were approximately double those in the control (NE) during April. Catch rates increased in the experimental section (NW) in May but declined in the control (NE). Catch/ha and harvest/ha were higher in the area with brush added (NW) than in the control (NE) during April and May.

Catch rate and catch/ha for channel catfish was higher in sections NE, NW and SW in May whereas catch rates in section SE were greater in April.

V. Discussion:

The effects of the addition of artificial structure to Liberty Lake on the catch rates by electrofishing and anglers

were masked by the extreme rise in water levels during May, 1982. Nonetheless, the limited amount of data that we were able to collect did indicate that largemouth bass and white crappie concentrated around the added structure. Even though catch rates by electrofishing declined from 1981 to 1982 for bass and sunfish, more bass were collected from section NW (brush added) than section NE (control area) during 1982. CPUE of bass from section SW (control area) were higher than section SE (brush added) in 1982. However, all bass collected in April, 1982 from section SW were near some brush that was added by anglers. Nearly all bass collected in the sections with brush were found to be closely associated with the hardwood structures.

The length-distribution of largemouth bass in 1982 was dominated by larger fish than in 1981. Since most fish collected in 1982 were associated with the added structure, competition for a limited amount of preferred habitat may have excluded the smaller size fish from these areas. The increase in PSD from 1981 to 1982 (56% vs. 92%) may be the result of concentrating our electrofishing effort in areas from which smaller size bass were excluded.

Catch rates by electrofishing for white crappie increased following the addition of the added structure. Nearly all crappie collected in section NW were concentrated around the cedar brush rows. CPUE by electrofishing for crappie in cedar brush piles was 19.3 whereas CPUE in hardwood brush piles was 6.4. However, crappie did concentrate around the hardwood brush piles added to

section SE. No cedar trees were placed in section SE. It appears that when given a choice between cedar and hardwood habitat, crappie prefer the cedar.

Catch rates for sunfish were relatively unaffected by the addition of artificial habitat. Most sunfish collected were found on the riprap of the dam and off rocky points in section SE and SW in both years sampled.

After the rise in water level during May, 1982 catch rates for all species were relatively the same for control areas and areas with habitat added. The brush piles were in approximately 6 m of water and could not be effectively sampled with the electroshocker. In addition, new habitat was created in all sections with the terrestrial vegetation being inundated with fish becoming dispersed throughout the lake.

The decline in fishing pressure during 1982 can be blamed at least in part on the drastic rise in water level. Many areas of the lake were inaccessible to bank anglers after the water level rose. In addition, turbidity increased which made the angling experience less aesthetically pleasing for many of the anglers.

There was a shift in fishing pressure between sections following the May rains. Pressure was greatest in section NE during April. Following the rise in water levels, fishing

pressure was greatest in section NE where bank access was not limited by the rising water.

The creel showed little effect of brush addition on the catch of largemouth bass. Catch rates were extremely low during April and May, 1982 and declined in all sections over 1981 estimates. No anglers fished specifically for bass during May.

Angler catch rates for crappie declined in 1982. However, catch rates were greater in brush added (section NW) than the respective control area (section NE) in 1982. The rise in water level had less of an adverse effect on crappie angling than on bass angling. It is not known if angler catch rates varied between hardwood and cedar brush piles.

Catch rates for channel catfish increased following brush pile installation whereas catch rates in the control areas remained relatively the same or declined slightly. Catch and harvest increased during May with catfish becoming more active as water temperatures increased.

Too few sunfish were creeled in 1982 on which to base any conclusions as to the effect of habitat addition on the creel.

VI. Recommendations:

Because of the abbreviated sampling schedule following brush installation, it is difficult to adequately quantify its effects on the fishery of Liberty Lake. However, we were able

to see some differences in CPUE of electrofishing of certain species and effects on the creel which could be related to the addition of artificial habitat. They are as follows:

1. Based on electrofishing samples, largemouth bass do concentrate around hardwood brush structures. However, creel estimates did not substantiate this.
2. White crappie seem to prefer cedar over hardwood brush.
3. Angler catch rates for white crappie and channel catfish were greater in areas where artificial habitat was added than in control areas.

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VIII. Date: 6-27-83

IX. Approved by: Harold Namminga
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D - J Coordinator

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