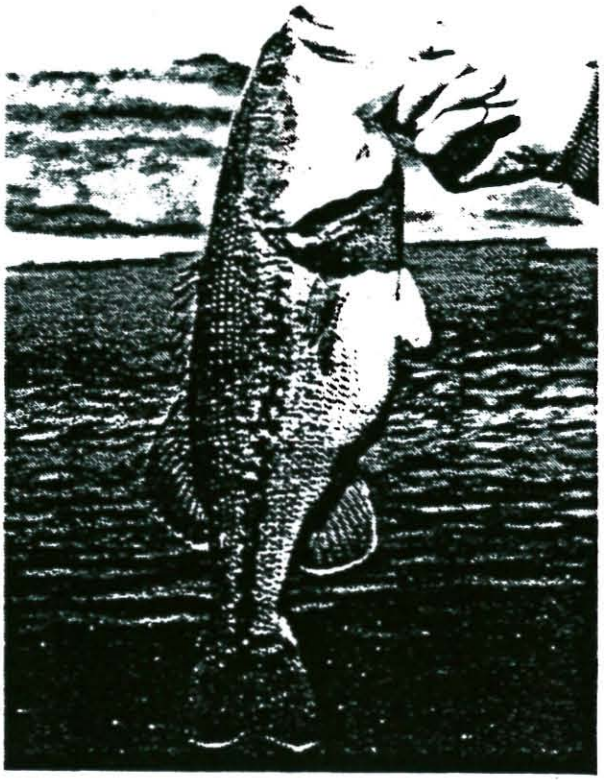
Lake Powell Fisheries Investigations



1988 (Segment 4) Annual Report

Dingell-Johnson Project F-46-R-4

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NATURAL RESOURCES
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LAKE POWELL FISHERIES INVESTIGATIONS

1988 Performance Report

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ABSTRACT

For the fourth consecutive year threadfin shad, Lake Powell's only pelagic forage species, produced a very small year class. Reproduction was quite low and there was virtually no recruitment of young-of-the-year (yoy) shad into the pelagic zone of Lake Powell. Poor forage conditions caused the striped bass population to decrease in mean total length for the fourth consecutive year. Sport fish were caught at an average rate of 0.41 fish per hour with the majority of these fish being striped bass. Fishing pressure decreased from previous surveys.

Relative abundance of sport fish sampled by trend gill netting was the lowest reported since sampling began. Production of yoy sport fish was low for all species except smallmouth bass, whose population continued to expand.

A total of 71,000 fingerling smallmouth bass was produced at the Wahweap Warmwater Hatchery. All of these fish were stocked at five locations in Lake Powell. Smallmouth bass yoy grew at rates similar to largemouth bass yoy.

FORAGE CONDITION STUDY

JOB I

METHODS

Threadfin shad (Dorosoma petenense) spawning was monitored with ichthyoplankton net collections, which began in May and continued until October. Weekly samples were taken in the backs of bays at Wahweap Creek, Warm Creek, Bullfrog Creek and Halls Creek. Biweekly samples were collected at Piute Farms Wash, Piute Farms Red Wall, the San Juan River inflow and Navajo Canyon (Figure 1).

Recruitment of young-of-the-year (yoy) threadfin shad into the pelagic areas of Lake Powell was monitored by monthly midwater trawl collections and eight-minute sonar transects. Sampling was conducted from July through September at Wahweap, Bullfrog and Good Hope bays (Figure 1). A complete description of both the ichthyoplankton and trawling sampling methods can be found in Gustaveson et al. 1985.

RESULTS AND DISCUSSION

Ichthyoplankton netting began in May and continued until October, when shad spawning ended. At the lower lake stations spawning was quite similar to 1987. Wahweap Creek showed a slight increase in spawning production over 1987. Shad spawning peaked at the same level in Warm Creek but the peak came in June 1988 compared to the previous year's peak in May (Figure 2). Mid-lake stations also experienced a similar spawn of shad over the last two years with a little improvement at the Bullfrog station in 1988 (Figure 3).

Shad spawning in Navajo Canyon showed two peaks during 1988, one in May and one in July (Table 1). Shad spawning in the San Juan River arm peaked in June but at lower levels than 1987 at Piute Red Wall. No definite peak was noted at Piute Farms Wash in 1988. A new marina was constructed at Piute Farms Wash during 1987 but it is unlikely that marina activity was responsible for the decrease in spawning activity. A few shad larvae were collected from the San Juan River, mostly in August samples, indicating that at least some shad used the inflow for spawning in 1988 (Table 2).

Midwater trawl catches of yoy shad during 1988 were among the lowest observed since trawling began at Lake Powell eleven years ago (Figure 4). Echograms made during each sample period also reflected the lack of shad in the open water zone. Although it was anticipated that a peak in the pelagic population of threadfin shad might be seen in 1987, no recovery of shad numbers occurred in 1987 or 1988. Striped bass (Morone saxatilis) predation in the open water has been intense enough to all but

eliminate the pelagic shad population in Lake Powell. Unless the striped bass population suffers a dramatic reduction, or other forage items become available to reduce predation on threadfin shad, the pelagic population of shad will most likely continue to be depressed in the future.

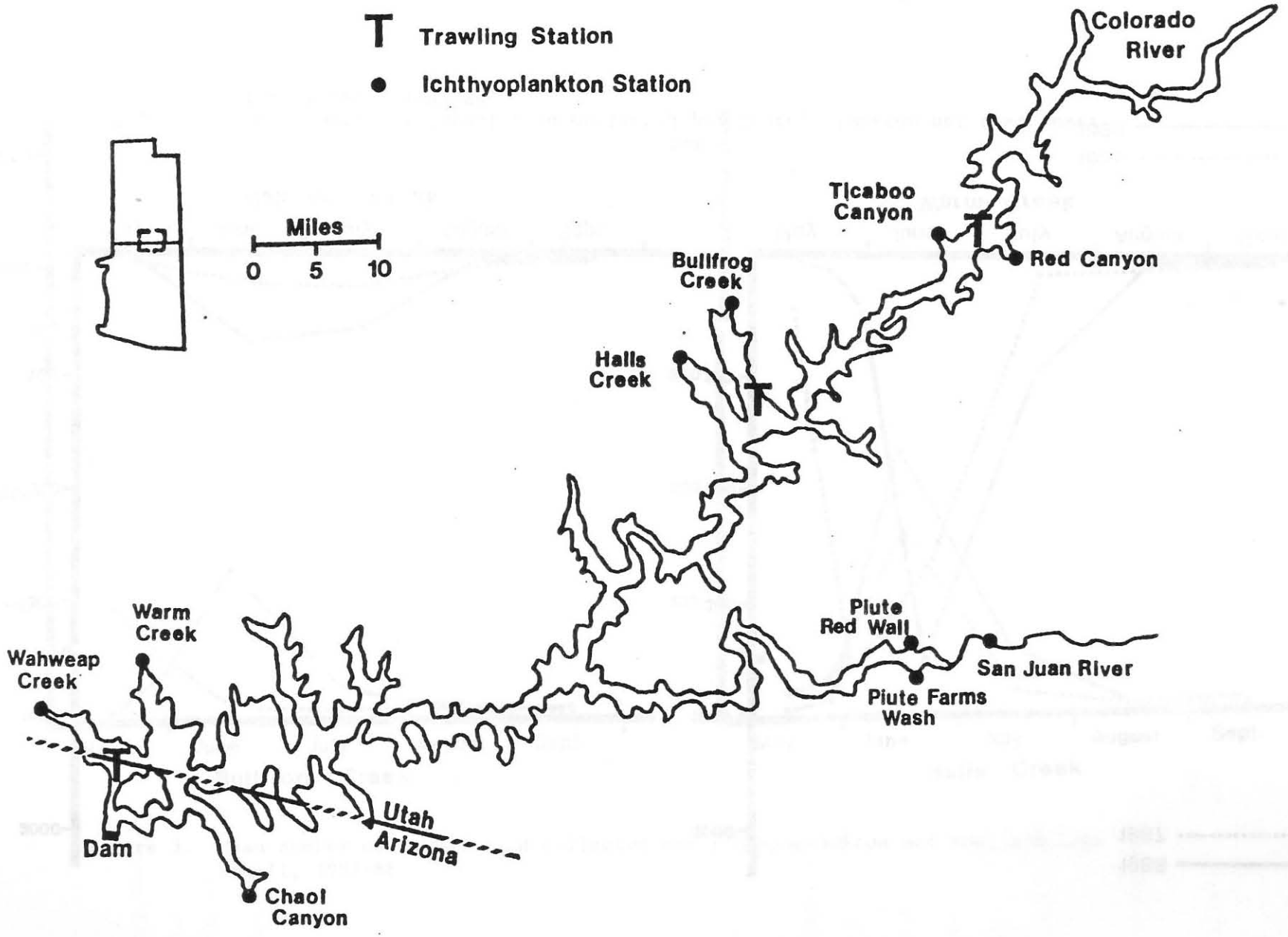

Figure 1. Map of Lake Powell showing trawling and ichthyoplankton netting stations for threadfin shad.

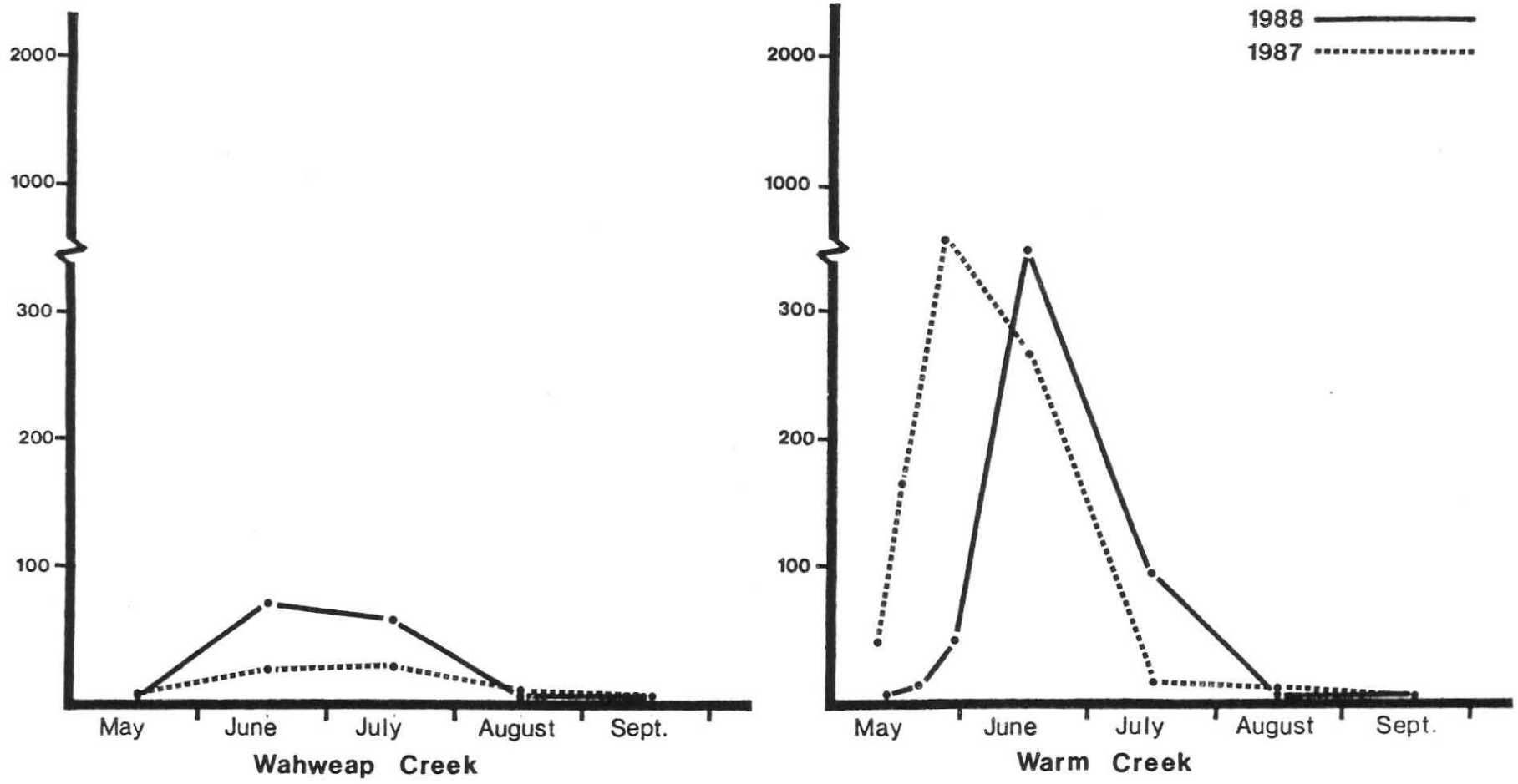

Figure 2. Mean number of larval shad collected per ichthyoplankton net tow, lower Lake Powell, 1987-88.

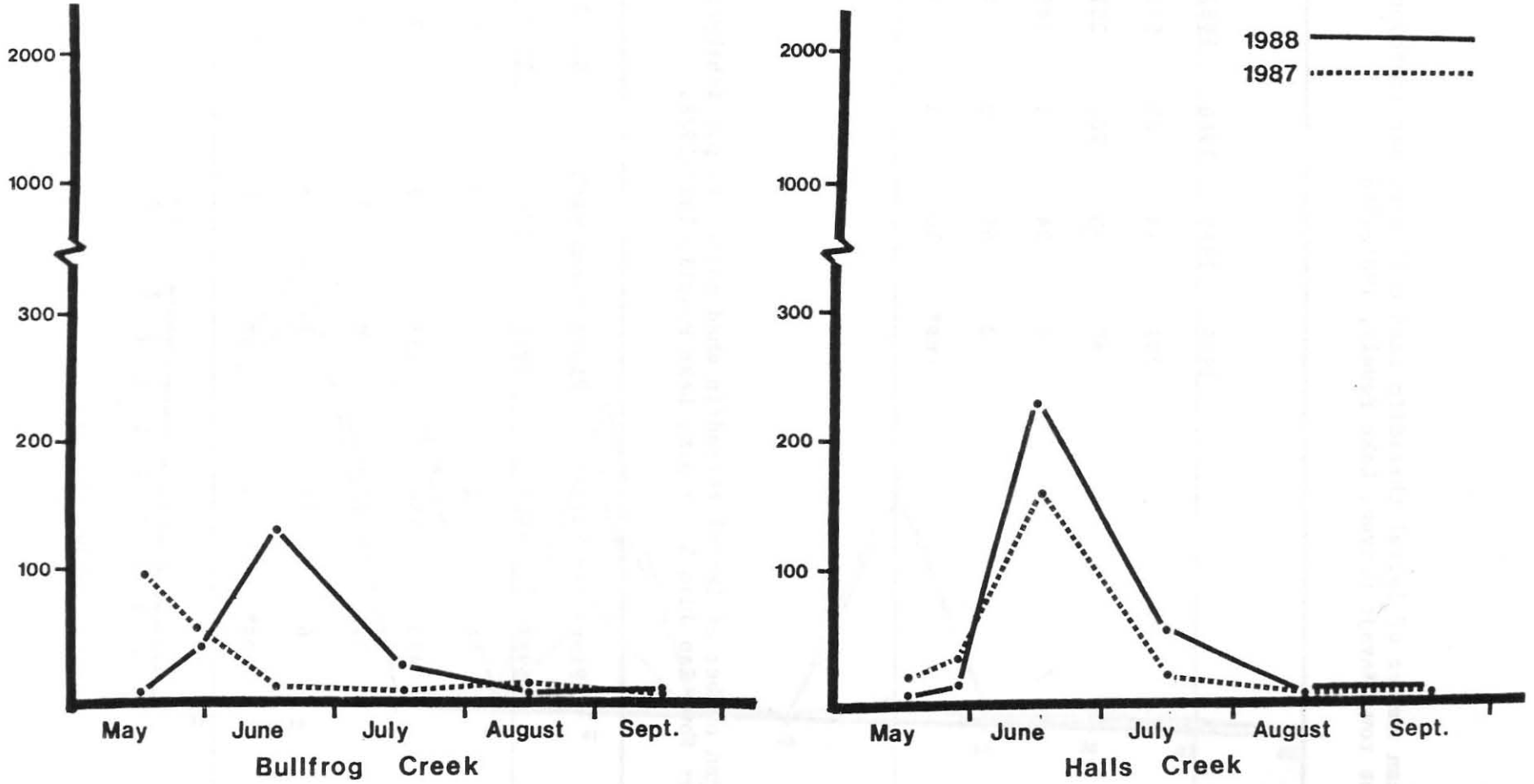

Figure 3. Mean number of larval shad collected per ichthyoplankton net tow, mid Lake Powell, 1987-88.

Table 1. Mean number of larval threadfin shad collected per ichthyoplankton net tow, Navajo Canyon, Lake Powell, 1984-1988.

Sample Month	1984	1985	1986	1987	1988
May	791	48	23	551	273
June	47	40	702	251	59
July	4	24	2	149	209
August	2	65	0	4	4
September	ns*	10	1	1	0

*not sampled

Table 2. Mean number of larval threadfin shad collected per ichthyoplankton net tow, San Juan River Arm, Lake Powell, 1987-1988.

Sample River Month	Piute Red Wall		Piute Farms Wash		San Juan	
	1987	1988	1987	1988	1987	1988
May	16	4	3	3	0	1
June	473	156	151	1	7	0
July	37	24	0	12	3	3
August	6	14	1	16	1	25
September	ns*	6	ns	0	ns	1

*not sampled

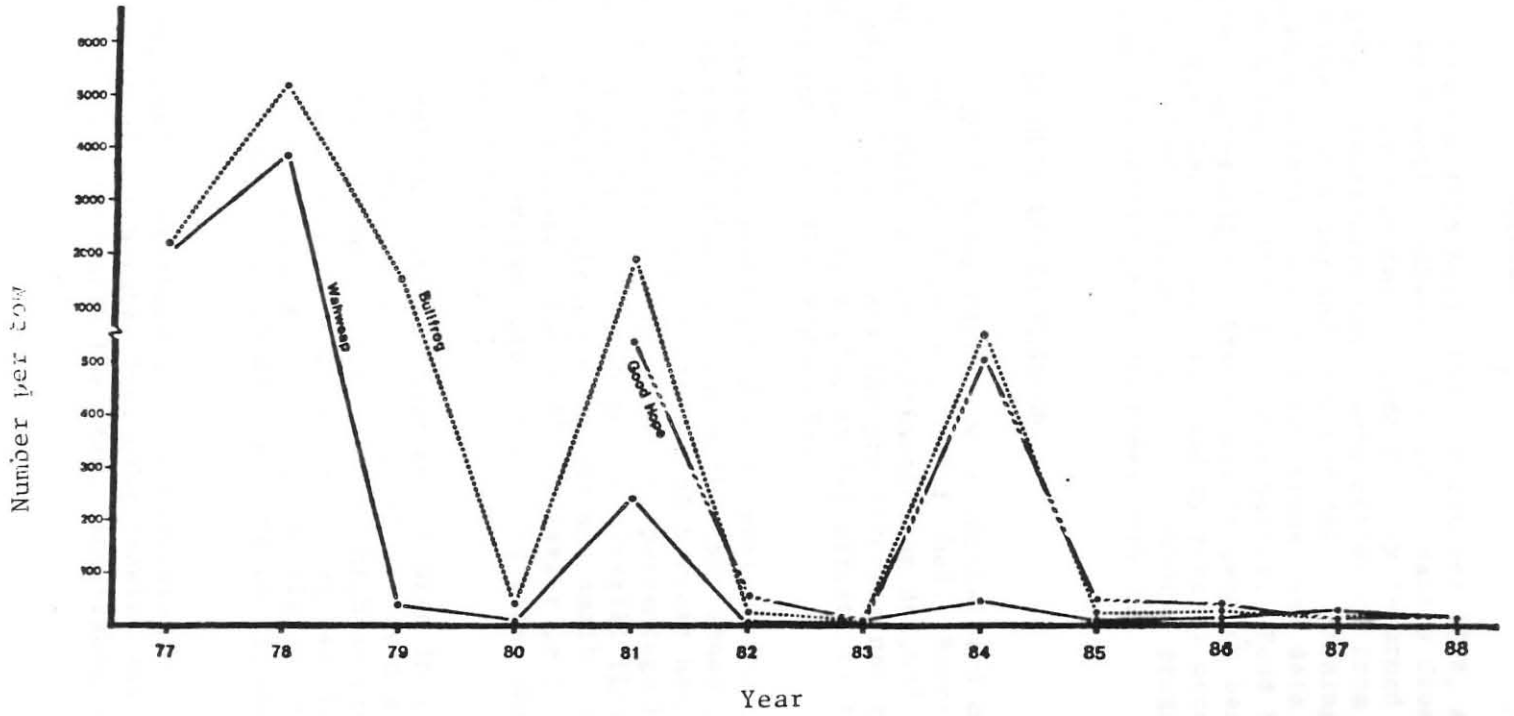

Figure 4. Mean number of threadfin shad collected per trawl tow, July-September, Lake Powell, 1987-88.

MEASUREMENT OF FISHERY HARVEST, PRESSURE AND SUCCESS

JOB II

METHODS

Creel census was conducted from April through October 1988, at five major access areas on Lake Powell: Wahweap, Bullfrog, Hall's Crossing, Piute Farms, and Hite. Anglers were interviewed as they returned to launch ramps. Catch rates (fish/angler hour) were estimated from data reported by anglers for the census day and previous day of fishing. Estimates of angling pressure were based on recreational use data collected by National Park Service (NPS) at access points. Food habits of striped bass, walleye (Stizostedion vitreum) and largemouth bass (Micropterus salmoides) were observed and recorded by percent occurrence and presented in Jobs III and IV of this report. A computer program was utilized to summarize data collected from the creel survey.

RESULTS AND DISCUSSION

In 1988, a total of 3,224 boating parties were interviewed by creel clerks. A total of 737 parties (22.9 percent) had fished. Recreational boating use (fishing and non-fishing) has increased from 342,887 boat-days in 1985 to 429,347 in 1988. Angling pressure has not kept pace. Fishing boat-days has fallen from 128,186 (41 percent of total) in 1985 to 98,148 (22.9 percent) in 1988 (Figure 5).

The decline in percentage of fishing boats may reflect the change that has occurred in Lake Powell fisheries since the last census. Percentage of walleye and black crappie in the total harvest has declined. Largemouth bass, and striped bass harvest percentage has stayed essentially the same while the percentage of bluegill (Lepomis macrochirus), channel catfish (Ictahirus punctatus) and smallmouth bass (Micropterus dolomieui) has increased (Table 3). A larger percentage of boaters fished in 1985 when the average size of striped bass, the most commonly harvested fish, was larger (Job IV).

The lake wide mean creel rate was the same as measured in 1985 at 0.41 fish/hour (Table 4). The highest creel rate was observed at the Bullfrog access area at 0.53 fish/hour. Hite had the highest creel rates for largemouth bass (0.06) and bluegill (0.11). Bullfrog had the highest rate for striped bass (0.40) while Piute Farms had the highest rates for black crappie (Pomoxis nogromaculatus) (0.03), walleye (0.03) and channel catfish (0.11).

Many fish that are caught by anglers are not harvested but returned to the lake alive. The total catch rate, including creeled and released fish, was 0.81 fish/hour which is double the creel rate (Table 5).

Largemouth bass are released at an equal rate to those that are kept (0.04 fish/hr) while smallmouth bass are released (0.04 fish/hour) much more often than they are kept (0.01 fish/hour). Striped bass are kept more often than released while bluegill are released more often.

The majority of anglers interviewed (45 percent) were willing to harvest any species of fish while 37 percent were actively pursuing striped bass (Table 6). Anglers specifically seeking largemouth bass and smallmouth bass comprised 13 percent.

The fisheries at Hite and Bullfrog were used most often by Utah anglers, while Hall's Crossing had more fishermen from Colorado. Piute Farms and Wahweap were used primarily by anglers from Arizona (Table 7). Lakewide, only 30 percent of the anglers were from Utah. Clearly, Lake Powell is an important recreation area and sport fishery for the states of Utah and Arizona and many surrounding states.

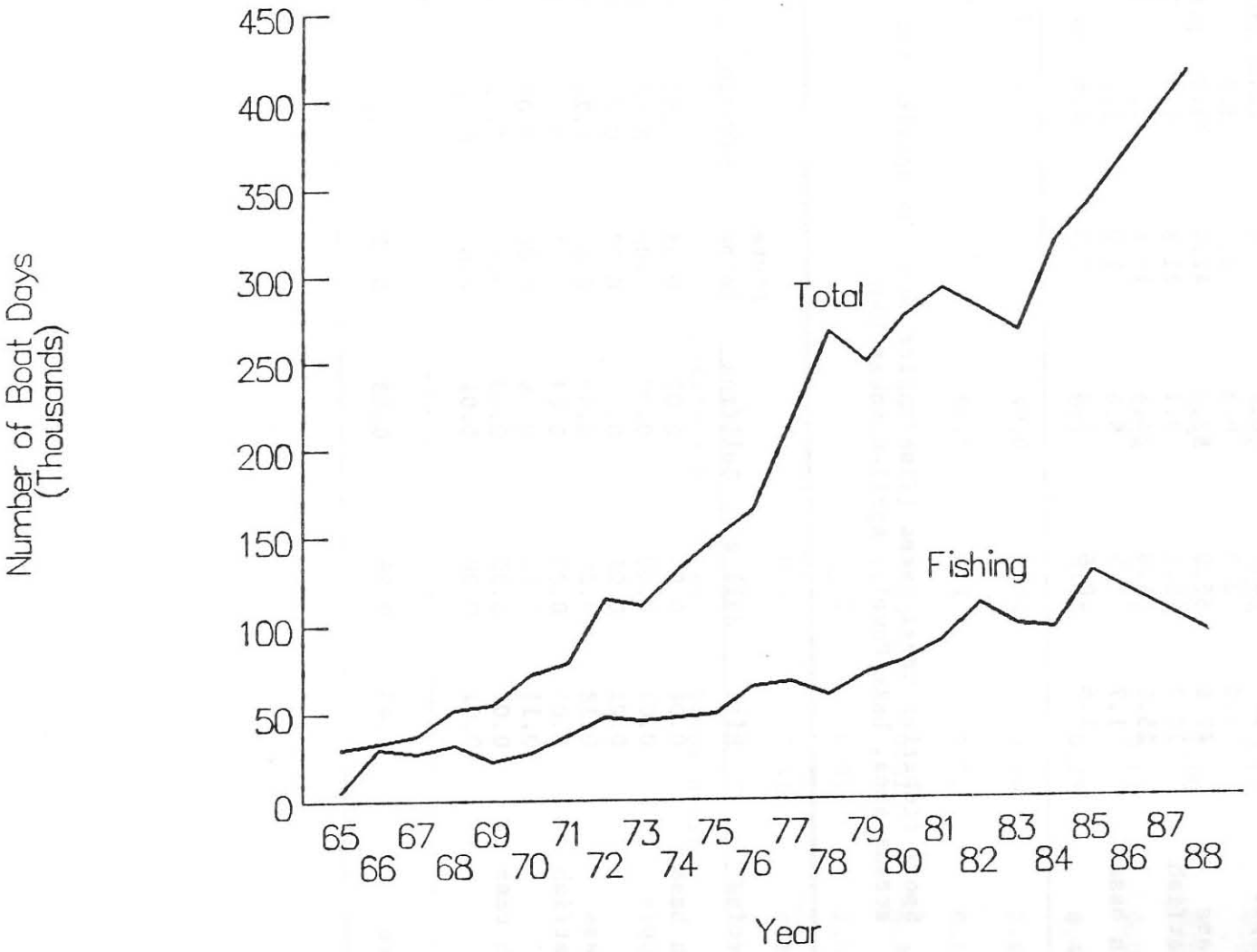

Figure 5. Indices of total recreational boat use and angling pressure, Lake Powell, 1965-1988.

Table 3. Species composition (percent) of total angler harvest at Lake Powell April through October, 1988.

Species	Hite	Hall's	Bullfrog	Piute Farms	Wahweap	Total
Largemouth bass	13.1	12.0	6.2	9.8	8.1	8.7
Black crappie	1.3	0.0	0.1	5.8	1.4	1.2
Walleye	1.8	2.3	0.3	6.0	3.2	2.5
Striped bass	42.8	65.8	52.4	42.9	73.8	60.3
Channel catfish	12.7	12.0	9.1	21.8	8.9	10.9
Bluegill	25.0	5.5	24.6	10.8	1.3	13.4
Smallmouth bass	1.7	1.3	5.6	1.2	1.7	1.4
Other	1.6	0.6	1.8	1.9	1.6	1.6

Table 4. Sport fisheries creel rates (fish/angler hour) by species and access area, Lake Powell, April-October 1988.

Species	Hite	Hall's	Bullfrog	Piute Farms	Wahweap	Total
Largemouth bass	0.06	0.04	0.02	0.05	0.03	0.04
Black crappie	0.01	0.00	0.00	0.03	0.00	0.00
Walleye	0.01	0.01	0.01	0.03	0.01	0.01
Striped bass	0.18	0.24	0.40	0.22	0.24	0.25
Channel catfish	0.05	0.04	0.03	0.11	0.03	0.04
Bluegill	0.11	0.02	0.06	0.06	0.00	0.05
Smallmouth bass	0.01	0.00	0.00	0.01	0.01	0.01
Other	0.01	0.00	0.01	0.01	0.01	0.01
All species	0.43	0.36	0.53	0.51	0.33	0.41

Table 5. Catch rate, including fish released, by species, Lake Powell, April-October 1988.

	Percent Released	Released (fish/hr)	Creeled (fish/hr)	*Catch (fish/hr)
Largemouth Bass	56.0	0.04	0.04	0.08
Black crappie	44.7	0.00	0.00	0.01
Walleye	19.4	0.00	0.01	0.01
Striped Bass	37.9	0.15	0.25	0.40
Channel Catfish	49.0	0.04	0.04	0.09
Bluegill	66.5	0.11	0.05	0.16
Smallmouth bass	87.9	0.04	0.01	0.05
Other/any	63.0	0.01	0.01	0.02
Total		0.41	0.41	0.81

*Catch = total fish/hr = No. Creeled + No. Released / Total hours

Table 6. Species sought by anglers (percent) at Lake Powell, April-October 1988.

Species	Hite	Hall's	Bullfrog	Piute Farms	Wahweap	Total
Largemouth bass	13	14	11	13	13	13
Black crappie	0	0.6	0.0	1	0.0	0.2
Walleye	2	2	2	5	2	2
Striped bass	24	31	52	24	45	37
Channel catfish	3	3	0.4	7	2	3
Bluegill	1	0.6	0.4	0.0	0.4	0.7
Smallmouth bass	0.3	0.0	0.4	2	1	0.7
Any	56	48	34	48	36	45

Table 7. Angler residence (percent) listed by access area, Lake Powell, April through October, 1988.

Lake Location

Residence	Hite	Hall's	Bullfrog	Piute Farms	Wahweap	Total
Arizona	1.2	13.2	1.3	50.0	55.0	27.5
California	5.2	10.5	4.0	10.7	23.5	12.6
Colorado	30.8	40.1	36.3	9.3	5.2	21.4
New Mexico	3.4	6.6	0.9	11.7	3.5	3.7
Utah	53.5	23.0	54.9	16.3	10.9	30.9
Other	5.9	6.6	2.7	2.3	2.0	3.95

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JOB III

ANNUAL NETTING

METHODS

Methods for standardized gillnetting are described in Gustaveson et al. 1985.

Stomachs from largemouth bass, walleye, and striped bass were examined to quantify food habits by percent occurrence.

RESULTS AND DISCUSSION

A total of 130 fish was collected in 80 net-days. Catch rate was highest at the Rincon, which was the only station where fish were caught at the same level as in 1987 (Table 8). The total catch rate for 1988 was 1.62 fish/net-day, which is lower than the previous two years, 2.18 and 2.16 fish/net-day, respectively.

Walleye were the most frequently sampled fish in 1988. Walleye catch rates remained stable (Figure 6), while striped bass continued a decline of recent years, to only 0.18 fish/net-day in 1988. Largemouth bass catch rates remained stable maintaining the small gains of recent years (Figure 7).

The percent of stomachs with food was greater in 1988 than in 1987. All three species sampled had a higher percent of stomachs with food, walleye being the lowest at 58%. In 1987 crayfish (Orconectes virilis) was the dominant food item for all three species, while in 1988 threadfin shad dominated the diet of striped bass and walleye at 46% and 76% occurrence, respectively. Crayfish was still the most common food item for largemouth bass at 96% (Table 9).

Table 8. Catch rates (fish/net day) during annual gillnetting, Lake Powell, March 1988.

Species	Good Hope	Good Rincon	San Juan	Padre Bay	Total	% of Catch
Striped bass	0.20	0.50	0.00	0.00	0.18	10.8
Walleye	0.50	1.25	0.60	0.15	0.63	38.6
Largemouth bass	0.55	0.25	0.50	0.25	0.39	24.1
Channel catfish	0.00	0.35	0.10	0.05	0.13	7.7
Carp	0.25	0.25	0.10	0.25	0.21	13.0
Yellow bullhead	0.05	0.00	0.00	0.00	0.01	0.6
Bluegill	0.00	0.00	0.05	0.10	0.04	2.3
Green sunfish	0.00	0.00	0.10	0.05	0.04	2.3
Smallmouth bass	0.00	0.05	0.00	0.00	0.01	0.6
Total	1.55	2.65	1.45	0.85	1.62	100

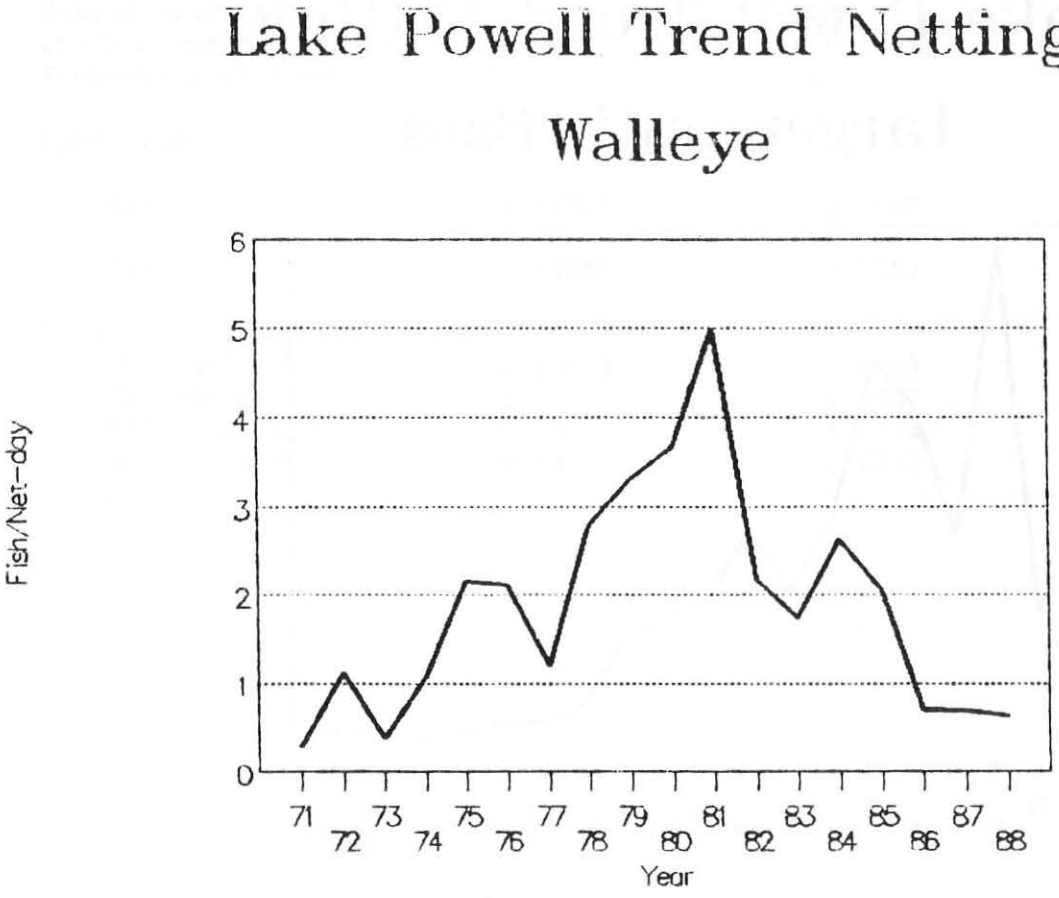

Figure 6. Catch rates (fish/net day) for walleye annual netting, Lake Powell, 1971-88.

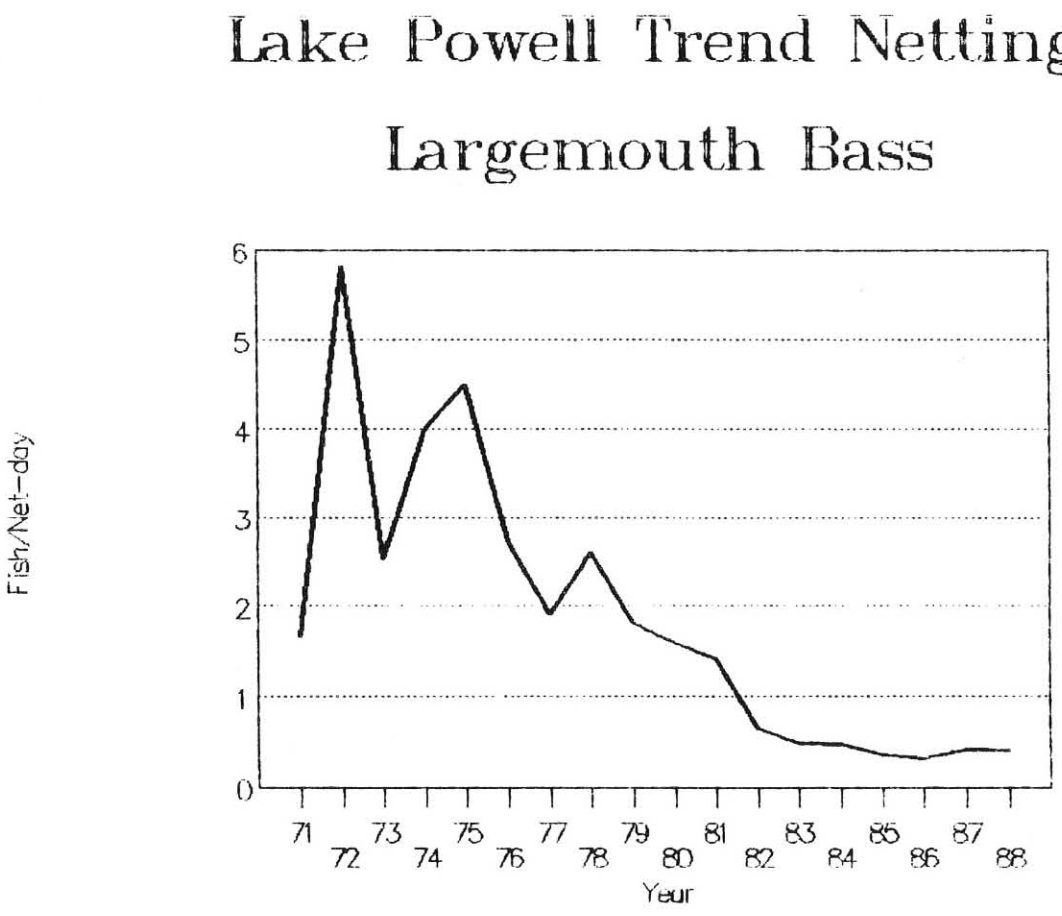

Figure 7. Catch rates (fish/net day) for largemouth bass annual netting, Lake Powell 1971-1988.

Table 9. Percent occurrence of food items in fish stomachs collected in gill nets, Lake Powell, March 1988. (Percentages based only on number of stomachs containing food.)

	Striped bass	Largemouth bass	Walleye
Sample size (n)	14	31	50
Empty Stomachs	1 (7%)	8 (26%)	21 (42%)
Stomachs with food	13	23	29
Food Item			
Crayfish	3 (23%)	22 (96%)	0 (0%)
Plankton	5 (38%)	0 (0%)	1 (3%)
Fish			
Threadfin shad	6 (46%)	2 (9%)	22 (76%)
Centrarchids	1 (8%)	2 (9%)	4 (14%)
Green sunfish	0 (0%)	3 (13%)	1 (3%)
Unknown fish	0 (0%)	0 (0%)	3 (10%)

ELECTROFISHING

METHODS

Electrofishing procedures were similar to those described by Gustaveson et al. 1985. Each of five stations was sampled for one hour. Index of species abundance at each location was mean catch rate (fish/hr of electrofishing).

RESULTS AND DISCUSSION

A total of 1,558 fish was collected during 5 nights of electrofishing. This value is down from 2,217 fish caught in 1987, with the San Juan station having the greatest decline. The San Juan station fell from 826 fish/hr in 1987 to only 175 fish/hr in 1988 (Table 10) with most of the decline represented by fewer green sunfish. Largemouth bass yoy, bluegill and green sunfish all declined in relative abundance. Largemouth bass yoy fell from 4.8 percent of the catch in 1987 to 0.6% in 1988; bluegill fell from 18.7% to 6.7% and green sunfish (Lepomis cyanellus) fell from 50.7% to 35.3%.

Smallmouth bass was the the only species to show a significant gain. They rose from 16.0% of the catch in 1987 to 42.5% of the catch in 1988. Smallmouth bass continue to show good reproduction and an expanding population (Job V).

Lakewide the yoy smallmouth bass had a mean length of 115 mm (Table 11). This compares favorably with largemouth bass with a lake-wide mean of 90 mm total length.

Table 10. Mean catch rate (fish/hr) of fish collected by electrofishing, Lake Powell, September, 1988.

Species	Good Hope Bay	Stanton Creek	Rincon	San Juan	Warm Creek	% of Total Catch
Largemouth bass, yoy	0	1	0	0	8	0.6
Largemouth bass, age 1 and older	3	2	0	0	0	0.3
Black crappie, yoy	0	0	0	1	5	0.4
Striped bass, yoy	41	3	0	1	0	2.9
Smallmouth bass, yoy	108	425	96	35	59	46.4
Smallmouth bass, age 1 and older	2	8	0	2	0	0.8
Bluegill, all ages	10	11	17	9	59	6.8
Green sunfish all ages	85	174	143	123	34	35.9
Channel catfish, all ages	4	1	14	4	69	5.9
Yellow bullhead, all ages	1	0	0	0	0	0.0
All species	254	625	270	175	234	100.0

Table 11. Mean total length (mm) measured by subsampling young-of-year fish collected by electrofishing, Lake Powell, September, 1988.

Species	Good Hope Bay TL (mm)	Stanton Creel (TL (mm)	Rincon TL (mm)	San Juan TL (mm)	Warm Creek TL (mm)	Mean % of Total Catch TL (mm)
Largemouth bass	-	130	0	0	85	90
Smallmouth bass	147	118	108	126	79	115
Striped bass	104	123	-	105	-	107
Black crappie	-	-	-	82	67	69

Table 12. Percent occurrence of food items in striped bass stomachs collected during summer creel census and fall gill netting, Lake Powell, 1988 (percentage based only on number of stomachs containing food).

	Uplake creel census	Downlake creel census	Fall gill net (4 stations combined)
Sample size (n)	298	273	402
Empty stomachs	22%	30%	54%
Stomachs with food	233	190	187
Food Items			
Zooplankton	46%	29%	71%
Crayfish	17%	18%	13%
Fish			
Shad	14%	6%	8%
Sunfish spp.	0.4%	0.5%	3%
Unknown fish	7%	16%	11%
Bait (Anchovy)	46%	37%	0
Debris	1%	3%	0.5%

PROJECT AGREEMENT NARRATIVE
OPMENT

Job IV

METHODS

Biological information was obtained from all striped bass sampled during normal field collections. Data necessary to determine age and growth, food habits, maturity, and condition (Kfl) were routinely taken as described in Gustaveson et al. 1985.

RESULTS AND DISCUSSION

Striped bass spawning began 13 April and continued through 26 May 1988. Spawning occurred when calm weather allowed rapid warming of the water surface layers in a short time. A five degree surface temperature rise on one day triggered spawning activity. Spawning occurred from 17-22 C^{o}. Windy conditions which mixed the lake and cooled surface temperatures curtailed spawning activity. The spawning season exhibited at least three distinct peaks in activity during April and May.

Relative abundance of yoy striped bass sampled by electrofishing was lower than other years with only 4 fish captured at mid and down lake stations. Some 41 striped bass were sampled at Good Hope Bay near the inflow of the Colorado River which was less than collected at that station last year (Table 10). These data suggest that reproduction from the tributaries was more important than in-lake spawning during 1988.

Young-of-year sampled during annual trend netting was the lowest reported in any year except 1985. In contrast, relative abundance of striped bass yearlings was the second highest reported and abundance of older striped bass was the highest reported (Figure 8). The large population of juvenile striped bass is advancing in age but not in size. Average total length of striped bass captured during annual fall netting was 348 mm. Total length of striped bass collected during this survey continued to decline. Respective size of fish sampled has decreased from 555 mm, to 423 mm, 393 mm, and 348 mm over the past four years.

Some 973 striped bass stomachs examined in 1988 showed zooplankton to be the most commonly used food item (Table 12). Fish taken by angling or by netting during all season of the year at any location were most likely to have zooplankton in their stomachs. Crayfish continued to be an important secondary food item. Shad and fish digested beyond recognition were third in importance. Piscivorous striped bass continued to be unable to effectively exploit centrarchids as an alternative food source. In the absence of a pelagic schooling forage fish (Job I), striped bass have used plankton as their primary food instead of consuming other fish species. Some 9% of all stomachs examined contained

an ulcerous lesion. It is theorized that stomach ulcers are a symptom of chronic stress that occurs in the striped bass population during periods of low food availability. Incident of ulcers increased with age of fish.

Physical condition of striped bass sampled with gill nets in 1988 was essentially the same as in 1986 and 1987 (Figure 9). Juvenile fish (<500 mm) had an average condition factor (Kf1) of 1.17. Only 21 striped bass larger than 500 mm (range 503-583) were captured during annual netting and had an average Kf1 of 0.94. Larger fish taken by anglers during the summer had an average K factor of 1.02 while striped bass under 500 mm had a Kf1 of 1.10. In both groups of fish, condition declined as fish size increased.

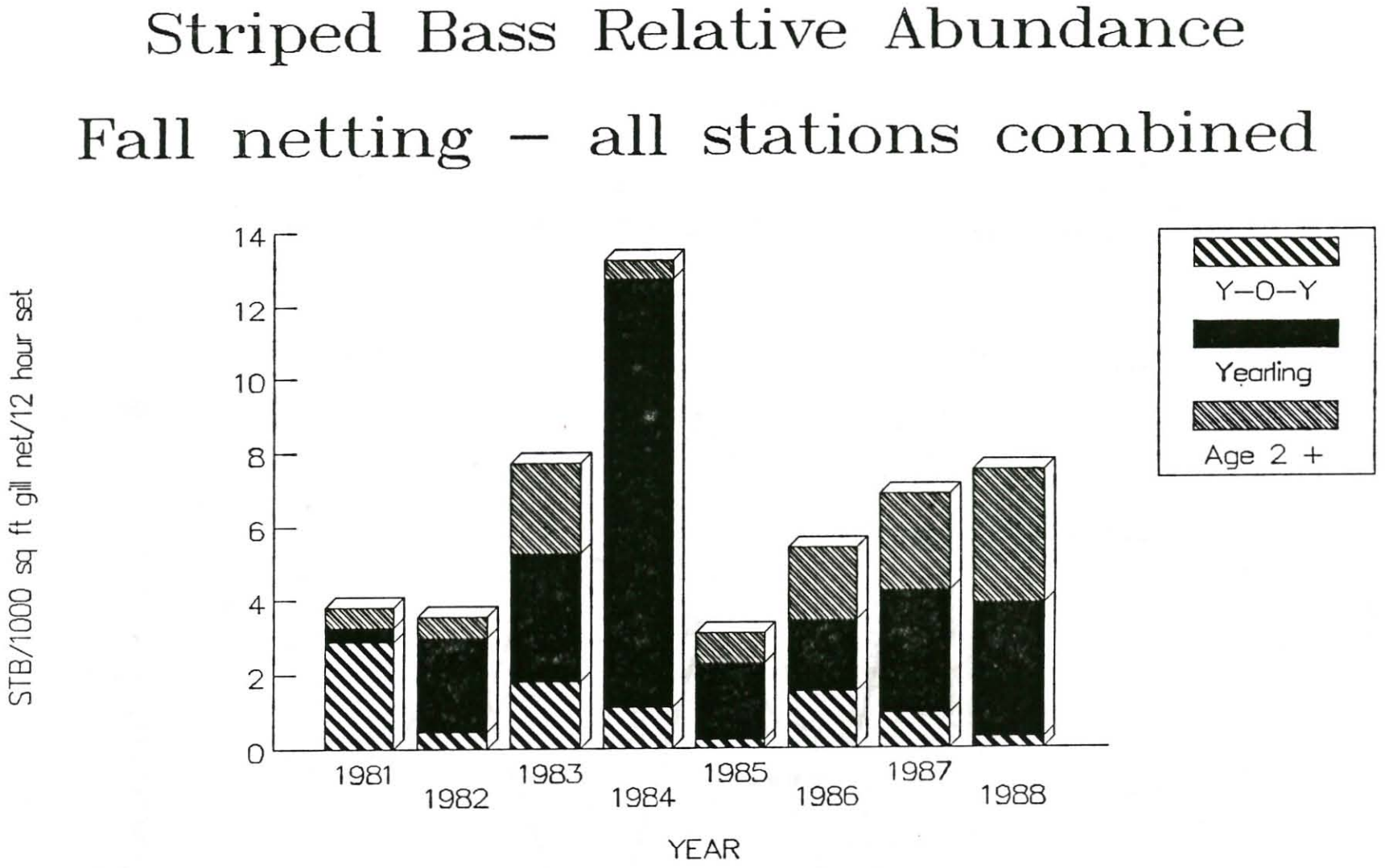

Figure 8. Average number of striped bass caught during fall gill netting on Lake Powell, expressed as fish caught/1000 ft^2 of net/12 hr set, 1981-1988.

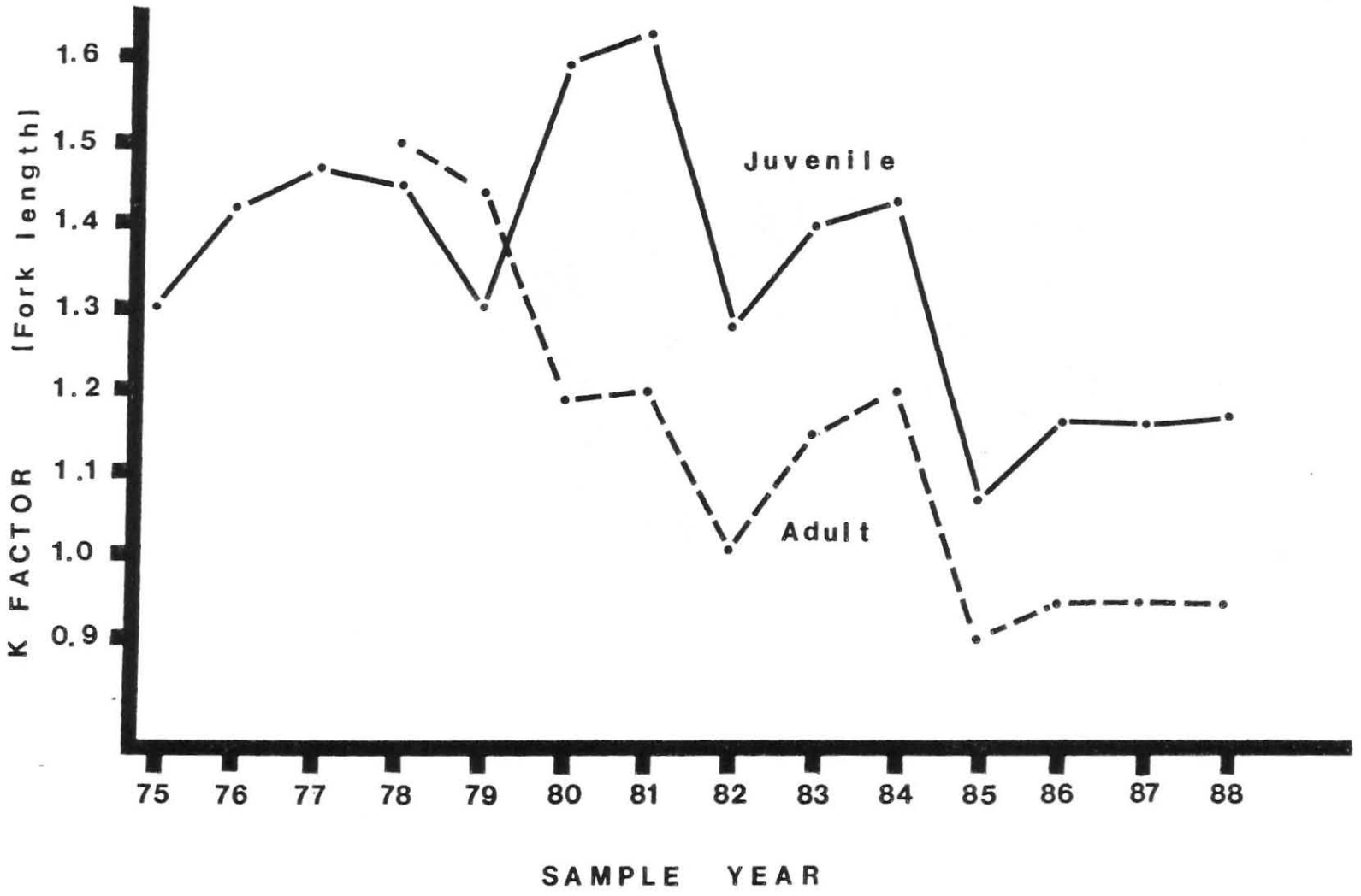

Figure 9. Average condition factor (Kfl) of adult and juvenile striped bass at Lake Powell, 1975-1988.

SMALLMOUTH BASS POPULATION DEVELOPMENT

JOB V

METHODS

Smallmouth bass population development was monitored through collections made in Jobs I-IV. Stockings were made from fish raised at the Wahweap Warmwater Culture Facility located near Big Water, Utah.

RESULTS AND DISCUSSION

A total of 71,111 fingerling smallmouth bass was stocked in Lake Powell during 1988 (Table 13). New release sites include Knowles/Cedar Canyon, Llewellyn/Cottonwood Canyon, Middle Rock Creek, Navajo Canyon and the mouth of the San Juan. Since 1982, when smallmouth bass were first stocked in Lake Powell, a total of 270,967 fish has been stocked in 17 different lake locations. Smallmouth bass have restricted home ranges in lakes and do not move even modest distances (Coble 1975). The goal of multiple stocking sites is to establish as many satellite populations of smallmouth bass as possible to facilitate quicker development of the fishery throughout the lake.

Natural reproduction of smallmouth bass was first observed at Lake Powell in 1985 and 23 active nests were located during 1986 (Gustaveson et al. 1986, 1987). Many active nests have been observed since that time in most of the stocking zones within two years of the plantings. No sampling, however, was conducted during 1988 to document new spawning areas.

A total of 685 smallmouth bass was collected during the September electrofishing survey (Table 14). Most of the yoy fish were collected at Stanton Creek (425), however, good numbers of yoy smallmouth were taken at all other sample sites. Condition factors (Ktl) recorded for adult smallmouth bass (1.41) and largemouth bass (1.46), collected by angling and gillnetting, were quite similar in 1988.

Interspecific competition for habitat has not been observed between smallmouth bass and largemouth bass at Lake Powell. No largemouth bass nests have been observed in areas found to have nesting smallmouth bass. From results of the electrofishing survey it appears that yoy smallmouth prefer points with gravel or rocks; whereas, yoy largemouth bass prefer the brushy habitat in the backs of shallow coves and bays. As the smallmouth bass population becomes firmly established at Lake Powell, interspecific competition will be studied more fully.

Stomach samples were taken from both largemouth and smallmouth bass during creel census and gill net sampling in 1988. In general, food

habits of the two species were quite similar with largemouth bass utilizing forage fish more heavily than smallmouth. The main food items found in largemouth stomachs were crayfish (46% occurrence) and fish remains (24%), mostly centrarchids and threadfin shad. Smallmouth bass stomachs contained mainly crayfish (46%) and fish remains (11%).

Table 13. Smallmouth bass stocking history, Lake Powell, 1982-88.

Year	Number	Size	Location	Method
1982	3,100	2-4"	Warm Creek	Truck
	59	10-15"	Warm Creek	Truck
1983	199	2-4"	Wahweap Creek	Truck
	26	10-15"	Wahweap Creek	Truck
1984	26,600	2-4"	Wahweap-Warm Creek	Truck
	4,000	2-4"	Stanton Creek	Aerial
1985	13,289	2-4"	Wahweap Creek	Truck
	12,389	2-4"	Antelope Canyon	Truck
	22	10-15"	Antelope Canyon	Truck
	31,995	2-4"	Rincon	Aerial
	19,360	2-4"	Good Hope Bay	Aerial
	26,328	2-4"	Neskahi Canyon	Aerial
	702	10-15	Hite-Dirty Devil River	Truck
1986	6,123	2-4"	Wahweap Creek	Truck
	8,136	2-4"	Piute Farms	Truck
	12,758	2-4"	Escalante River	Aerial
1987	220	3-6"	Wahweap-Warm Creek	Truck
	24,200	2-3"	West Canyon	Aerial
	7,200	2-3"	Nokai Canyon	Truck
	3,150	2-4"	Piute Farms	Truck
1988	20,536	2"	Knowles/Cedar Canyon	Aerial
	24,643	2"	Llewellyn/Cottonwood	Aerial
	4,307	2"	Middle Rock Creek	Aerial
	10,745	2"	San Juan (mouth)	Aerial
	10,880	2"	Navajo Canyon	Aerial
Total	270,976		Lake Powell	

Table 14. Mean catch rate* (fish/hour) of young-of-the-year smallmouth bass collected by electrofishing, Lake Powell, 1982-88 (1+ and older fish in parenthesis).

Year	Good Hope Bay	Stanton Creel	Rincon	San Juan	Warm Creek	Total yoy & adult
1982	0	0	0	0	22	22
1983	0	0	0	0	0 (3)	3
1984	0	5	0	0	46	51
1985	4	0 (1)	36	5	5 (1)	52
1986	1 (2)	81	0 (2)	0 (17)	10	13
1987	131 (1)	74	68 (7)	53 (4)	28	366
1988	108 (2)	425 (8)	46	35 (2)	59	685

*Total fish divided by total hours of electrofishing.

1988 SMALLMOUTH BASS CULTURE SUMMARY

WAHWEAP WARMWATER CULTURE FACILITY, BIG WATER, UTAH

(Not an element of F-46-R)

A total of 275,650 smallmouth bass fry were produced at the Wahweap Warmwater Hatchery during 1988 (Table 15). Of these, 81,111 (29.4%) survived to fingerling size. Except for a few fish lost during harvest, all of the 1988 production was stocked into five new areas in Lake Powell (Job V). Neither the culture or stocking of smallmouth bass was funded by Federal Aid.

BROOD FISH

On 4 and 19 April 1988, 240 adult smallmouth bass were collected from the overwintering ponds at D.I. Ranch. No fish were lost in transport, and they were placed 90 in spawning pond 1, 88 in spawning pond 2 and 62 in rearing pond 6.

After the 1988 culture season, 145 brood fish were recovered from the Wahweap Facility ponds and transported back to the overwintering ponds at the D.I. Ranch. Of these, 59 died in transport, while 86 were placed in the lower pond. Most of the smallmouth that died in transport were in poor condition from the long spawning season. The added stress of hauling in warm water (24.5 ^{o}C) from the culture ponds contributed to the high mortality. Brood fish hauled a week later using 19.4 ^{o}C well water from our pumphouse experienced no mortality. In the future, all brood fish hauled during the hot summer season will be transported in this cooler water to reduce mortality.

Two new overwintering ponds were located in 1988 on the Deer Springs Ranch Property in Kane County, 30 miles northeast of Kanab, Utah. The ponds are considerably higher elevation (6,700 ft.) than the D.I. Ranch ponds (2,600 ft.), so it was felt that an experimental overwintering of some brood fish would be necessary to evaluate the usefulness of these ponds for overwintering brood stock. Therefore, 35 adult smallmouth bass were placed in Meadow Canyon pond and 38 were stocked in Slide Canyon pond. These fish will be monitored for spawning success in 1989 to evaluate the suitability of the Deer Springs Ranch for overwintering brood stock.

Forage was provided at the overwintering ponds at the D.I. Ranch, the Deer Springs Ranch ponds and the spawning ponds at Wahweap during 1988. The following forage was provided (RBT = rainbow trout Oncorhynchus mykiss.)

Date of stocking	Location	Forage Provided
4 Feb. 1988	D.I. Ranch ponds	31,973 RBT (147/lb)
15 April 1988	Ponds 1 & 2, Wahweap	10,070 RBT (201/lb)
25 Aug. 1988	Deer Springs ponds	10,497 RBT (45/lb)
15 Nov. 1988	D.I. Ranch ponds	7,618 RBT (33/lb)

To help maintain optimum body condition of our brood fish, forage will continue to be provided for brood fish in 1989.

Table 15. Smallmouth bass production at the Wahweap Warmwater Hatchery, 1988.

Pond #	# of fry stocked	# of fing. harvested	% survival	Size of fing.	Pounds harvested
1 & 2	----	3,500	----	500/lb	7.0
3	64,800	49,286	76.1	957/lb	51.5
3 (refill)	10,650	3,000	28.1	250/lb	12.0
4	61,900	900	1.5	320/lb	2.8
5	73,400	17,180	23.4	320/lb	53.7
6	64,900	7,245	11.2	315/lb	23.0
Total	275,650	81,111	29.4	----	150.0

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