

Lake Powell Fisheries Investigations



1985 (Segment 11) Annual Report

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LAKE POWELL FISHERIES INVESTIGATIONS

Annual Performance Report
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A. Wayne Gustaveson, Project Leader
Bruce L. Bonebrake, Project Biologist
Steven J. Scott, Project Biologist
James E. Johnson, Fisheries Program Coordinator

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Utah Department of Natural Resources
Division of Wildlife Resources
1596 West North Temple
Salt Lake City, UT 84116

William H. Geer
Director

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ABSTRACT

Threadfin shad, Lake Powell's major forage species, produced a very small year class in 1985. There was virtually no recruitment of young-of-the-year shad into the pelagic zone of Lake Powell. Physical condition of striped bass declined in direct response to lack of adequate forage. Anglers harvested striped bass and walleye in record high numbers, probably as a result of low forage availability.

Measurement of adult game fish population trends showed numbers of walleye and largemouth bass to be essentially the same as 1984, while striped bass numbers increased dramatically. Young-of-the-year largemouth bass and black crappie experienced a modest production peak while striped bass were captured at the highest rate recorded.

More than 100,000 smallmouth bass were introduced in Lake Powell at six different locations to help establish a lake-wide population. Natural reproduction of smallmouth bass was documented for the first time.

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FORAGE CONDITION STUDY

JOB I

METHODS

Threadfin shad (Dorosoma petenense) spawning was monitored with ichthyoplankton net collections, beginning in May and continuing into 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 Red, Ticaboo and Chaol Canyons, while monthly monitoring was conducted at Piute Farms Wash, Piute Farms Red Wall and the San Juan River Inflow (Figure 1). A one-meter, 505 micron net was towed just below the water's surface. Three tows, two minutes in duration, were taken at each station, sampling an average volume of 102 m³ of water per tow. Previous findings have demonstrated that shad in Lake Powell prefer to spawn in turbid waters (Gustaveson et al. 1982), therefore, the shallow, turbid water areas at the backs of canyons and bays were chosen for sampling. Sample locations were adjusted periodically to compensate for fluctuating water levels.

Recruitment of young-of-the-year (y-o-y) threadfin shad into 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 ichthyoplankton and trawl 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. Compared to 1984, threadfin shad spawning decreased at all lake locations (Figures 2, 3 and 4). Spawning in the

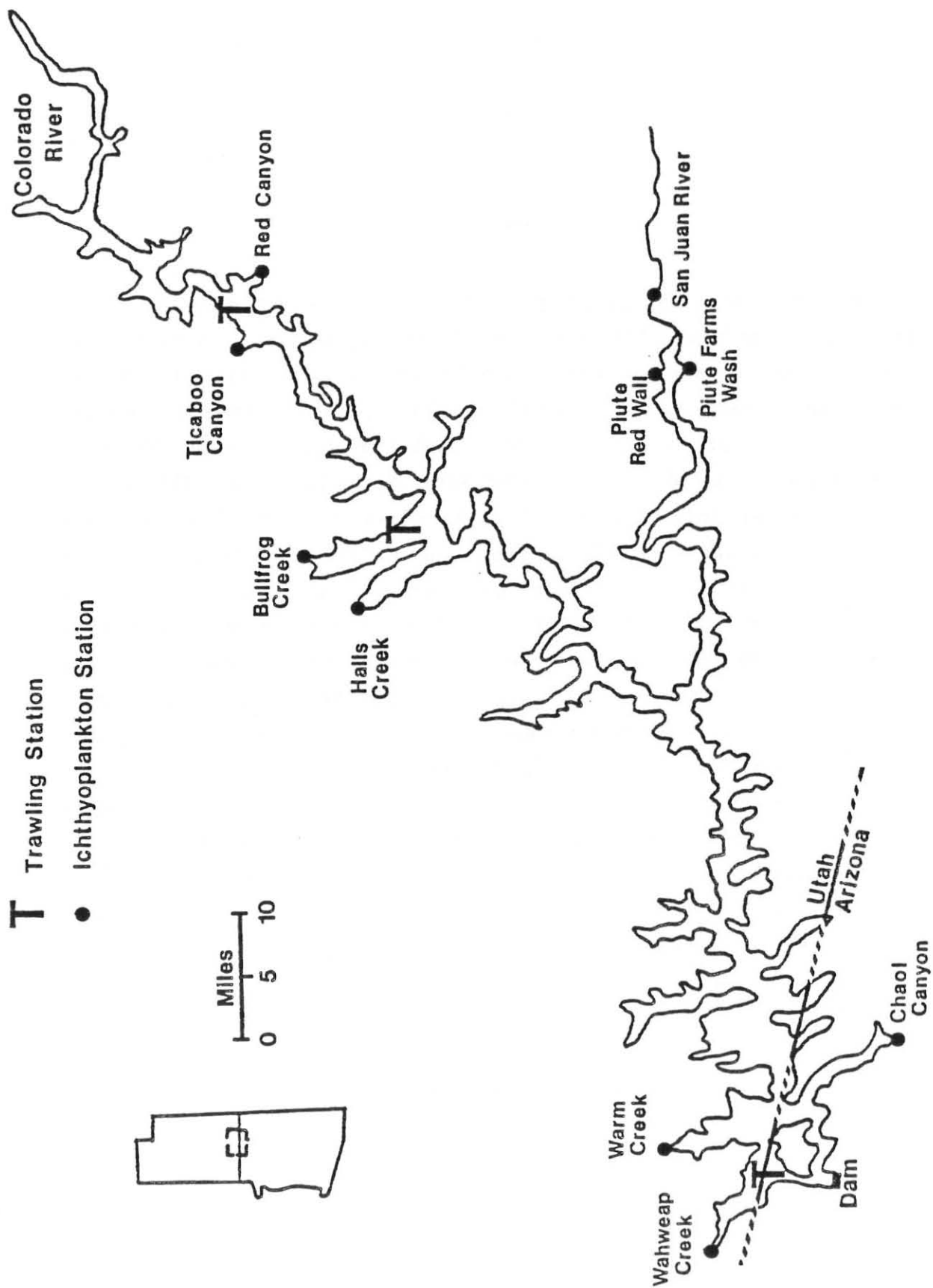


Figure 1. Map of Lake Powell showing trawling and ichthyoplankton netting stations for threadfin shad, 1985

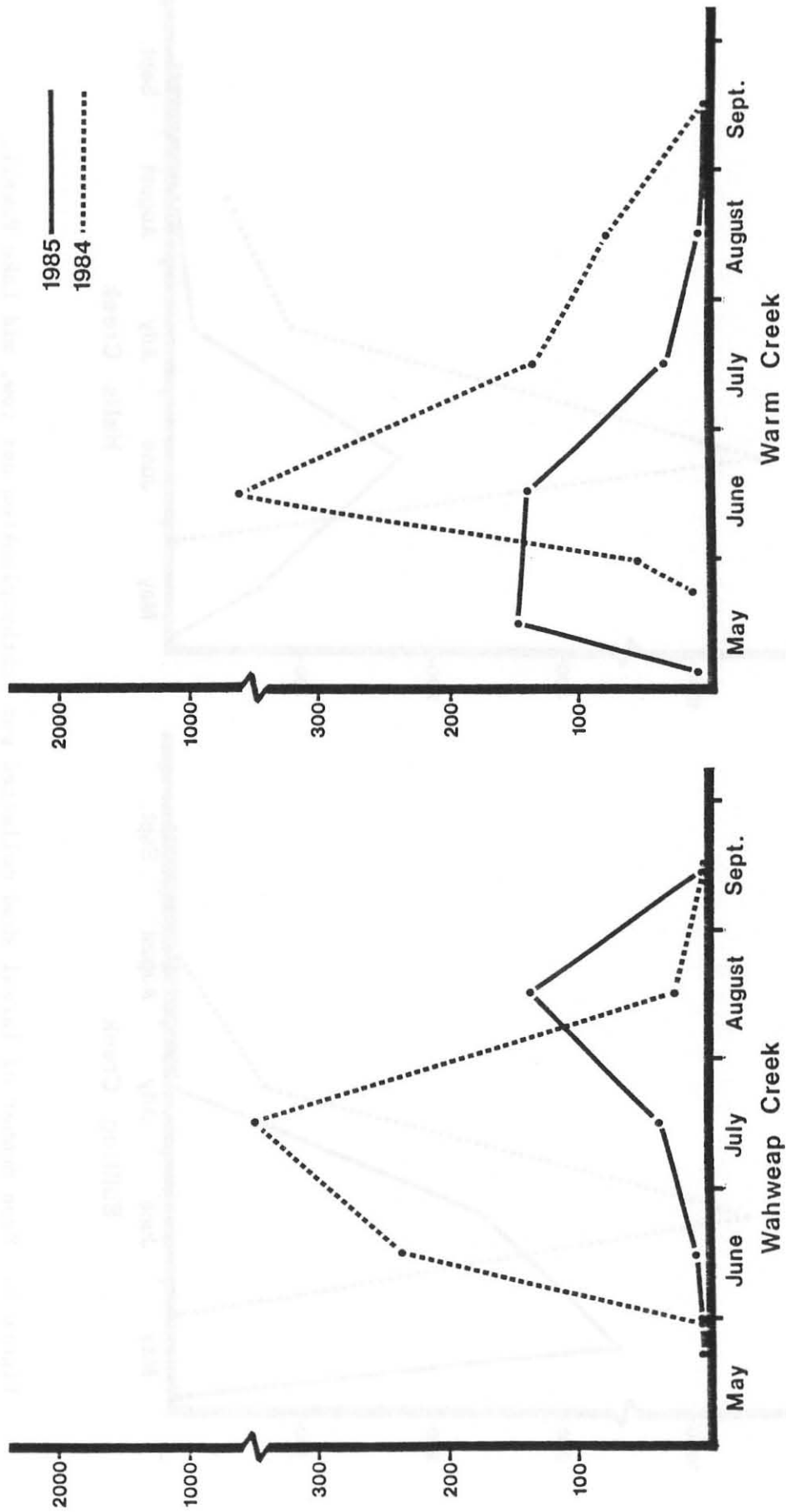


Figure 2. Mean number of larval shad collected per ichthyoplankton net tow, lower Lake Powell, 1984-85.

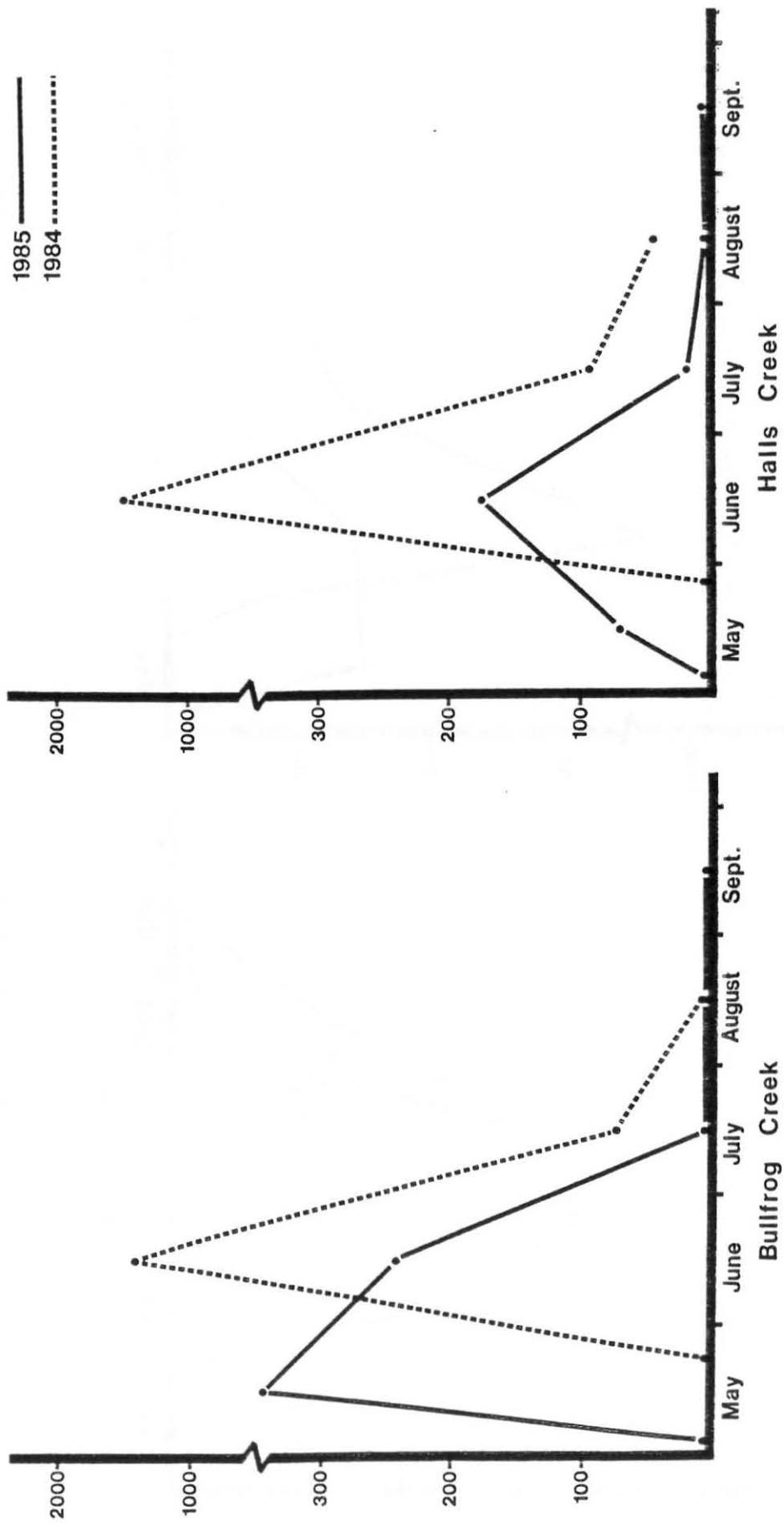


Figure 3. Mean number of larval shad collected per ichthyoplankton net tow, mid Lake Powell, 1984-85.

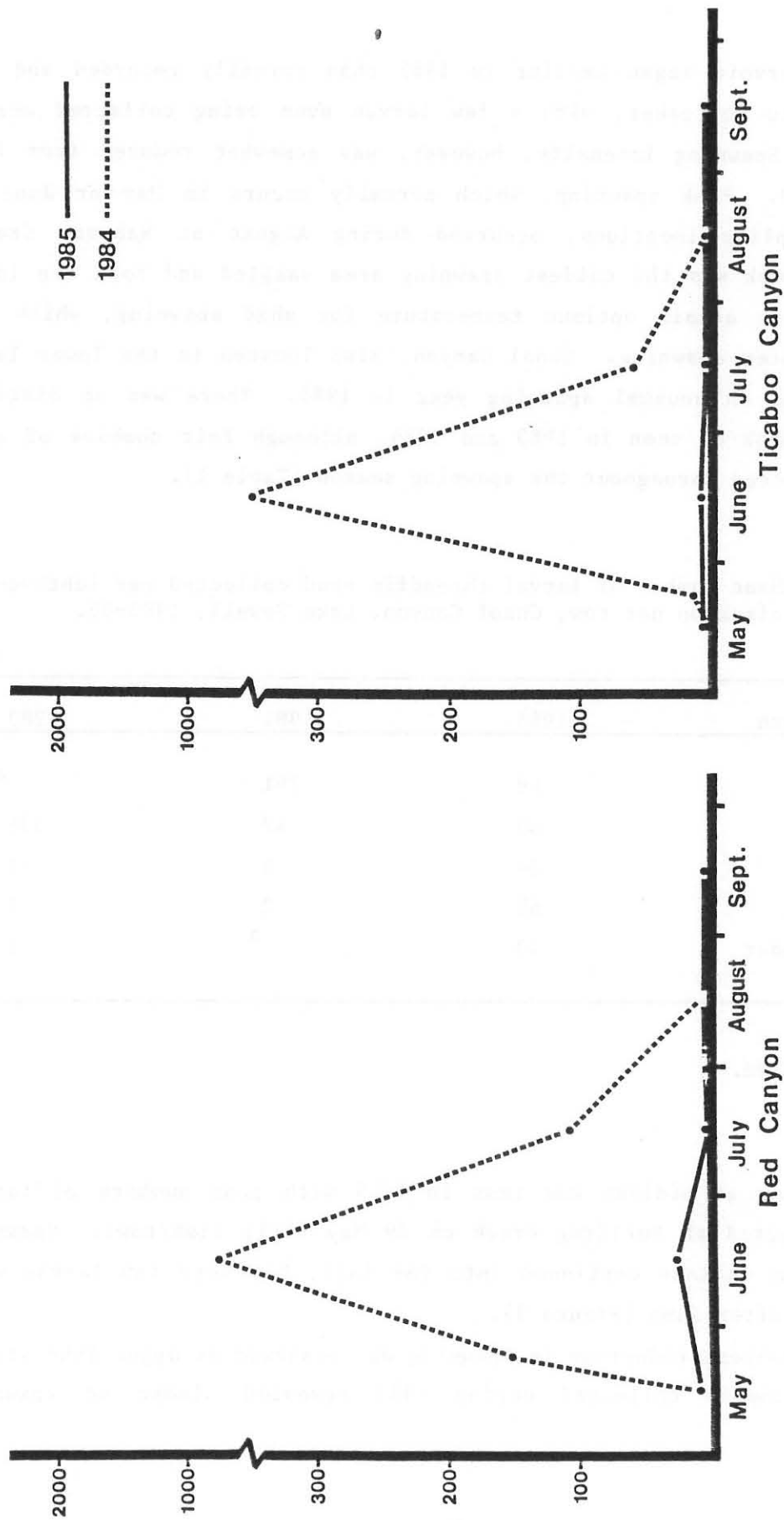


Figure 4. Mean number of larval shad collected per ichthyoplankton net tow, upper Lake Powell, 1984-85.

lower reservoir began earlier in 1985 than normally recorded and extended into September, with a few larvae even being collected during October. Spawning intensity, however, was somewhat reduced from 1984 (Figure 2). Peak spawning, which normally occurs in May or June at other sampling locations, occurred during August at Wahweap Creek. Wahweap Creek was the coldest spawning area sampled and took the longest time to attain optimum temperature for shad spawning, which explained later spawning. Chaol Canyon, also located in the lower lake, experienced an unusual spawning year in 1985. There was no distinct spawning peak as seen in 1983 and 1984, although fair numbers of shad were collected throughout the spawning season (Table 1).

Table 1. Mean number of larval threadfin shad collected per ichthyoplankton net tow, Chaol Canyon, Lake Powell, 1983-85.

Sample Month	1985	1984	1983
May	48	791	^a
June	40	47	335
July	24	4	1
August	65	2	1
September	10	^a	1

^a Not sampled.

Spawning at midlake was less in 1985 with peak numbers of larval shad collected at Bullfrog Creek on 29 May (1111 fish/tow). Spawning activity at midlake continued into the fall, but very few larvae were collected after June (Figure 3).

The greatest reduction in spawning was observed at upper lake stations. Samples collected during 1985 revealed almost no spawning

activity at Red and Ticaboo canyons, which are normally productive, as evidenced by the 1984 samples (Figure 4). Samples collected in the San Juan Arm were also low during 1985 (Table 2). The highest numbers of shad collected were 69 fish/tow at Piute Red Wall and 17 fish/tow at Piute Farms Wash, compared to 252 fish/tow and 1200 fish/tow, respectively, collected during 1984.

Table 2. Mean number of larval threadfin shad collected per ichthyoplankton net tow, San Juan River Arm, Lake Powell, 1984-85.

Sample Month	Piute Red Wall		Piute Farms Wash		San Juan R. Inflow	
	1985	1984	1985	1984	1985	1984
May	69	252	17	1200	1	36
June	31	3	6	1	1	1
July	1	0	1	1	0	1
August	1	0	0	0	0	0
September	5	a	0	a	1	a

^a Not sampled.

Midwater trawl catches of y-o-y shad were also low during 1985. A few y-o-y were captured during August at Bullfrog and during July at Good Hope Bay, but almost no fish were collected in any other samples (Figure 5). Echograms run during each sample period also reflected the lack of shad in the pelagic zone of the lake.

Some evidence indicates threadfin shad populations at Lake Powell may be cyclic (Gustaveson et al. 1985). Since 1977, trawl catches have exhibited three distinct, but decreasing, peaks occurring at three year intervals, 1978, 1981 and 1984 (Figure 6). Years between peaks have been characterized by low shad recruitment in most areas of the lake.

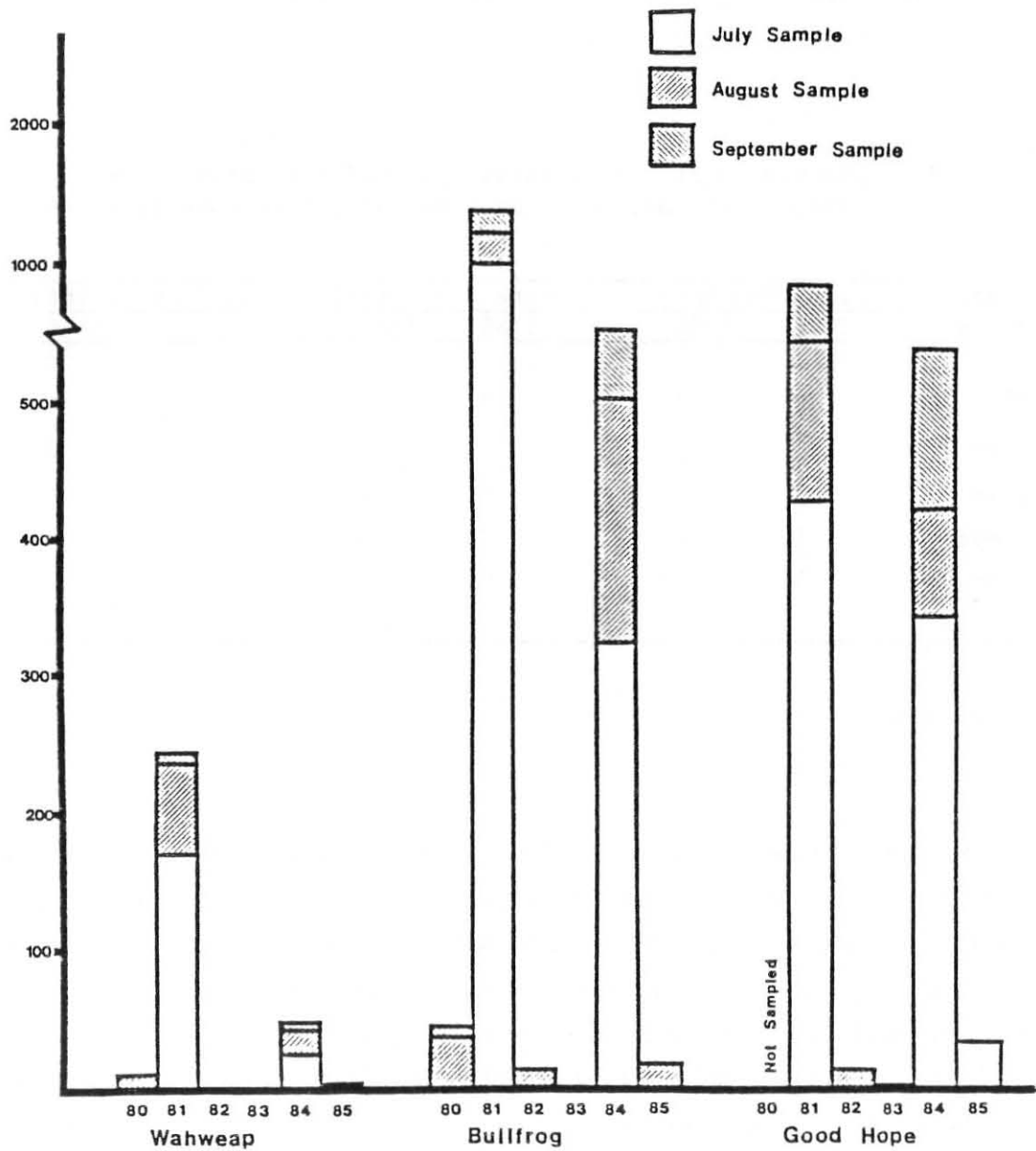


Figure 5. Mean number of shad collected per trawl tow, Lake Powell, 1980-85. (The top of each bar represents the cumulative total catch for July-September for each year.)

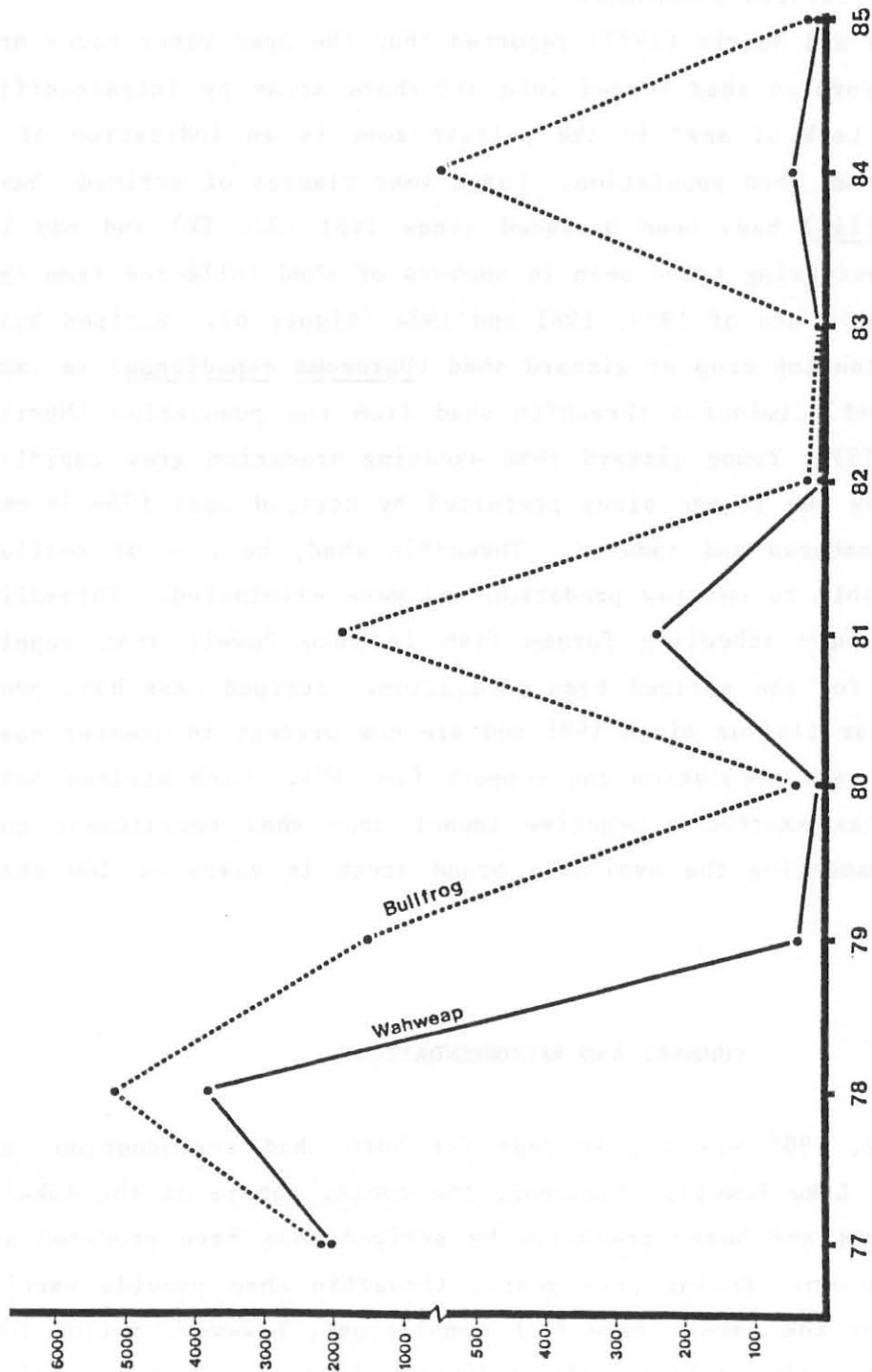


Figure 6. Mean number of threadfin shad collected per trawl tow, July-September, Lake Powell, 1977-1985.

Extremely low numbers of shad collected during 1985 represent a continuation of this three year cycle and could project another low shad year in 1986 if the pattern continues.

Moczygemba and Morris (1977) reported that the open water zones are inhabited by surplus shad forced into off-shore areas by intraspecific competition. Lack of shad in the pelagic zone is an indication of a predator-impacted shad population. Large year classes of striped bass (Morone saxatilis) have been produced since 1981 (Job IV) and may be causing the decreasing trend seen in numbers of shad collected from the population peak years of 1978, 1981 and 1984 (Figure 6). Striped bass reduced the standing crop of gizzard shad (Dorosoma cepedianum) in Lake E.V. Spence and eliminated threadfin shad from the population (Morris and Follis 1978). Young gizzard shad escaping predation grew rapidly. After exceeding the forage sizes preferred by striped bass (76-178 mm) gizzard shad matured and spawned. Threadfin shad, because of smaller size, were unable to outgrow predation and were eliminated. Threadfin shad are the only schooling forage fish in Lake Powell that supply suitable prey for the striped bass population. Striped bass have produced large year classes since 1981 and are now present in greater numbers than the shad population can support (Job IV). High striped bass reproduction has exerted a negative impact upon shad recruitment and may also be impacting the available brood stock in years of low shad production.

SUMMARY AND RECOMMENDATIONS

In summary, 1985 was a poor year for both shad reproduction and recruitment at Lake Powell. Together, the cyclic nature of the lake's shad populations and heavy predation by striped bass have produced an unstable situation. During peak years, threadfin shad provide excellent forage for the lake's game fish populations, however, during low cycle years game fish suffer. The addition of another forage species could help remedy this situation by providing not only better diversity

to the system, but also stability to the highly cyclic populations of shad by buffering predatory pressure.

Ichthyoplankton netting and midwater trawling should be continued as established. Ichthyoplankton netting has proven useful in monitoring seasonal and annual larval shad production. Midwater trawling has been useful in evaluating y-o-y shad recruitment into the pelagic zone of the lake as well as determining available forage for striped bass. Use of echosounding to supplement trawling data should also be continued. Echosounding has proven a valuable tool when equipment breakdowns have prevented trawl sampling. In addition, echosounding is presently the only effective technique for monitoring adult populations of threadfin shad in the winter.

MEASUREMENT OF FISHERY HARVEST, PRESSURE AND SUCCESS

JOB II

METHODS

Creel census was conducted from April through October 1985, at four major access areas on Lake Powell: Wahweap, Bullfrog, Hall's Crossing 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 1985, a total of 2,403 boating parties was checked by creel clerks during seven months of census. A total of 994 parties (41 percent) had fished. Mean number of anglers per fishing boat was 2.5 and each angler spent an average of 4.3 hours fishing per day.

Both angling pressure and recreational boat use increased during 1985 (Figure 7). Angling pressure was 128,186 fishing boat days, an increase of 32 percent from 1984. Total recreational boat use (including fishing and nonfishing boats) was 342,887 boat days in 1985. Bullfrog/Hall's Crossing produced the highest angler use (58 percent) of the three access zones, while angler use at Wahweap and Hite made up the remaining pressure, 29 and 13 percent, respectively.

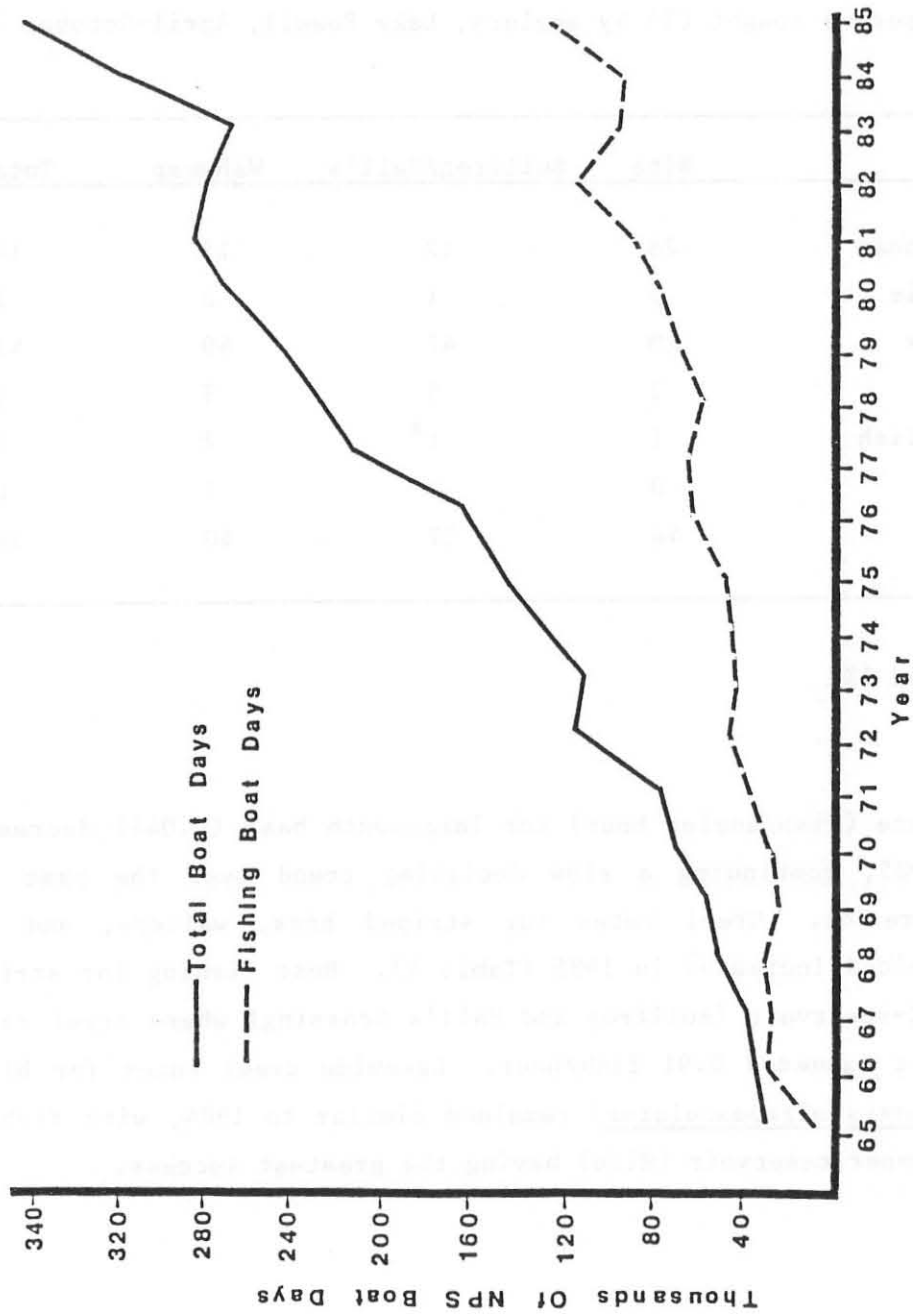


Figure 7. Indices of total recreational boat use and angling pressure, Lake Powell, 1965-1985.

Most angling pressure was directed specifically at striped bass and largemouth bass (Table 3). Many anglers were indiscriminate and did not target a single species.

Table 3. Species sought (%) by anglers, Lake Powell, April-October 1985

Species	Hite	Bullfrog/Hall's	Wahweap	Total
Largemouth bass	28	12	12	14
Black Crappie	5	1	2	2
Striped bass	20	47	40	41
Walleye	2	3	3	3
Channel catfish	1	t ^a	2	1
Bluegill	0	t	1	t
Any	44	37	40	39

^a = less than 1%

Creel rate (fish/angler hour) for largemouth bass (0.044) decreased again in 1985, continuing a slow declining trend over the past six years (Figure 8). Creel rates for striped bass, walleye, and all species combined increased in 1985 (Table 4). Best fishing for striped bass was mid-reservoir (Bullfrog and Hall's Crossing) where creel rates during August exceeded 0.91 fish/hour. Lakewide creel rates for black crappie (Pomoxis nigromaculatus) remained similar to 1984, with fishermen in the upper reservoir (Hite) having the greatest success.

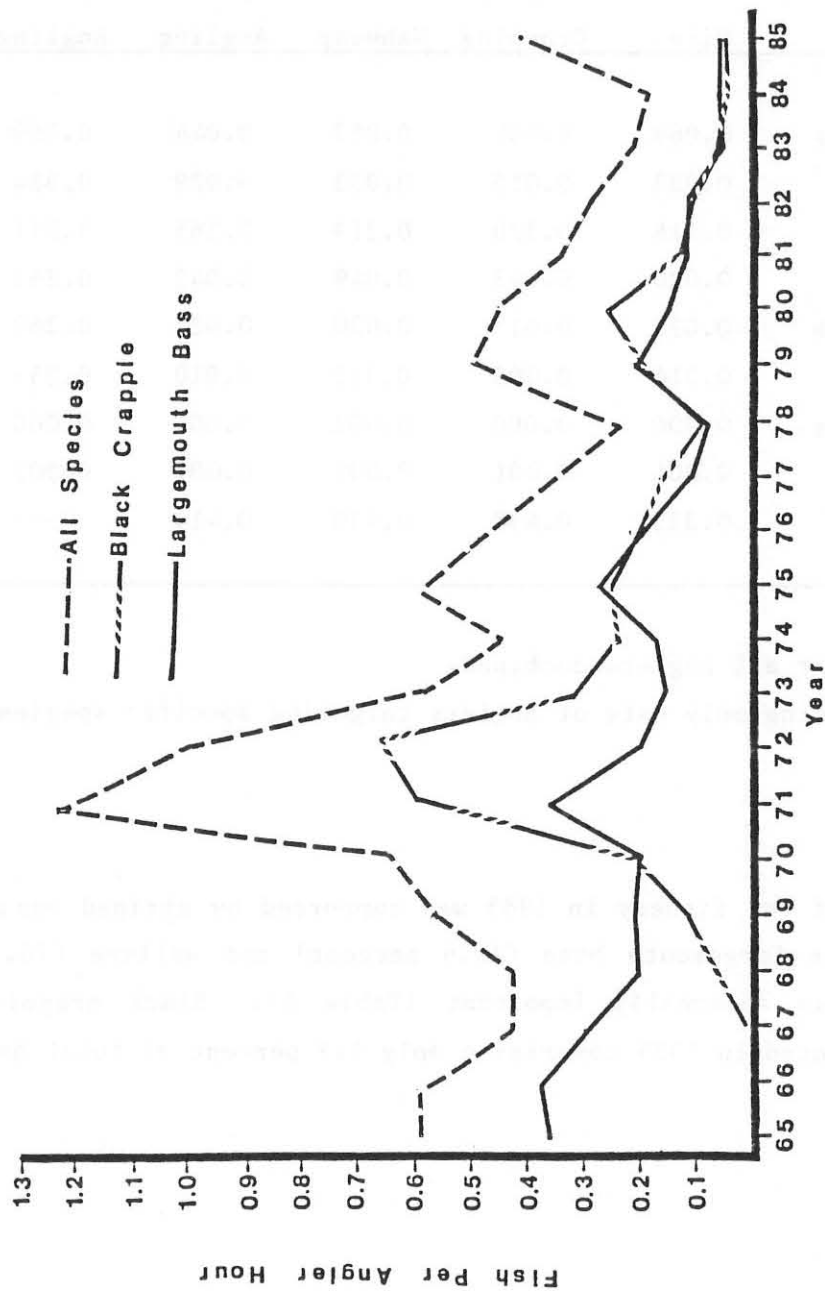


Figure 8. Creel rates (fish/angler hour) for largemouth bass, black crappie and all species, Lake Powell, April-June 1965-1985.

Table 4. Sport fishery creel rates (fish/angler hour) by species and access area, Lake Powell, April-October 1985.

Species	Hite	Bullfrog Hall's Crossing	Wahweap	Lakewide Average	
				Nonspecific ¹	Specific ²
				Angling	Angling
Largemouth bass	0.069	0.034	0.053	0.044	0.169
Black crappie	0.083	0.015	0.033	0.029	0.684
Striped bass	0.118	0.320	0.219	0.265	0.511
Walleye	0.020	0.043	0.049	0.042	0.263
Channel catfish	0.027	0.017	0.030	0.022	0.260
Bluegill	0.014	0.008	0.012	0.010	0.053
Smallmouth bass	0.000	0.000	0.002	0.001	0.000
Other	0.001	0.001	0.001	0.001	0.002
All species	0.333	0.438	0.400	0.414	---

¹Creel rates for all anglers combined.

²Creel rates using only data of anglers targeting specific species.

The bulk of the fishery in 1985 was supported by striped bass (63.9 percent), while largemouth bass (10.6 percent) and walleye (10.2 percent) were also seasonally important (Table 5). Black crappie were poorly represented in 1985 comprising only 6.9 percent of total harvest.

Table 5. Species composition (%) of the total creel, Lake Powell, April-October 1985.

Species	Apr	May	Jun	Jul	Aug	Sep	Oct	Mean
Largemouth bass	37.4	15.1	9.9	8.8	1.4	8.0	8.4	10.6
Black crappie	23.0	17.2	1.4	0.0	1.5	6.5	3.8	6.9
Striped bass	13.9	24.9	50.4	69.1	90.3	75.6	79.6	63.9
Walleye	19.0	28.4	25.7	8.7	1.3	3.2	2.4	10.2
Channel catfish	2.5	9.9	6.4	10.3	4.1	6.4	3.0	5.4
Bluegill	3.8	3.4	6.1	2.8	1.2	0.0	2.5	2.4
Smallmouth bass	0.3	0.1	0.0	0.0	0.0	0.5	0.0	0.1
Other	0.1	1.0	0.1	0.4	0.1	0.1	0.3	0.2

Most striped bass harvested in 1985 were three and four year old fish with some of two year old fish. Mean lengths of largemouth bass, black crappie, and striped bass in 1985 were 348 mm, 239 mm, and 555 mm, respectively.

At all locations, creel rates for striped bass in 1985 exceeded previous highs. Anglers discovered a large, striped bass population in mid-reservoir and harvested over 100,000 fish during August. Low numbers of pelagic threadfin shad (Job I) may have increased catchability of striped bass. Game species tend to be more catchable in the absence of suitable forage fish (Anderson and Heman 1969). Anglers with a full creel limit (10 fish per angler) were common.

Anglers also harvested walleye in record numbers in 1985. Walleye in Lake Powell tend to be less dependent on threadfin shad and display more diverse feeding habits than striped bass. However, the reduction in shad numbers in 1985 may have helped increase catchability of walleye and subsequently contributed to the record harvest.

INDEX TO ANNUAL FISH POPULATION TRENDS

JOB III

ANNUAL NETTING

METHODS

Methods for standardized gillnetting were described in Gustaveson et al. 1985. Four stations were sampled in 1985 (Figure 9) during the last three weeks in March, using 20 net-days per station. Sampling was reduced from 30 net-days in 1984.

Samples of largemouth bass, walleye and striped bass were used to quantify food habits by percent occurrence.

RESULTS AND DISCUSSION

A total of 493 fish was collected in 80 net-days. Catch rate was highest at the Rincon followed by the San Juan, Padre Bay, and Good Hope Bay, respectively (Table 6). Overall catch for 1985 doubled at the Rincon and substantially increased at the San Juan and Padre Bay stations, while catch rates at Good Hope Bay were less than 1984. Total catch rate for all species and stations combined (6.16 fish/net day) was appreciably higher than 1984 (4.35 fish/net day).

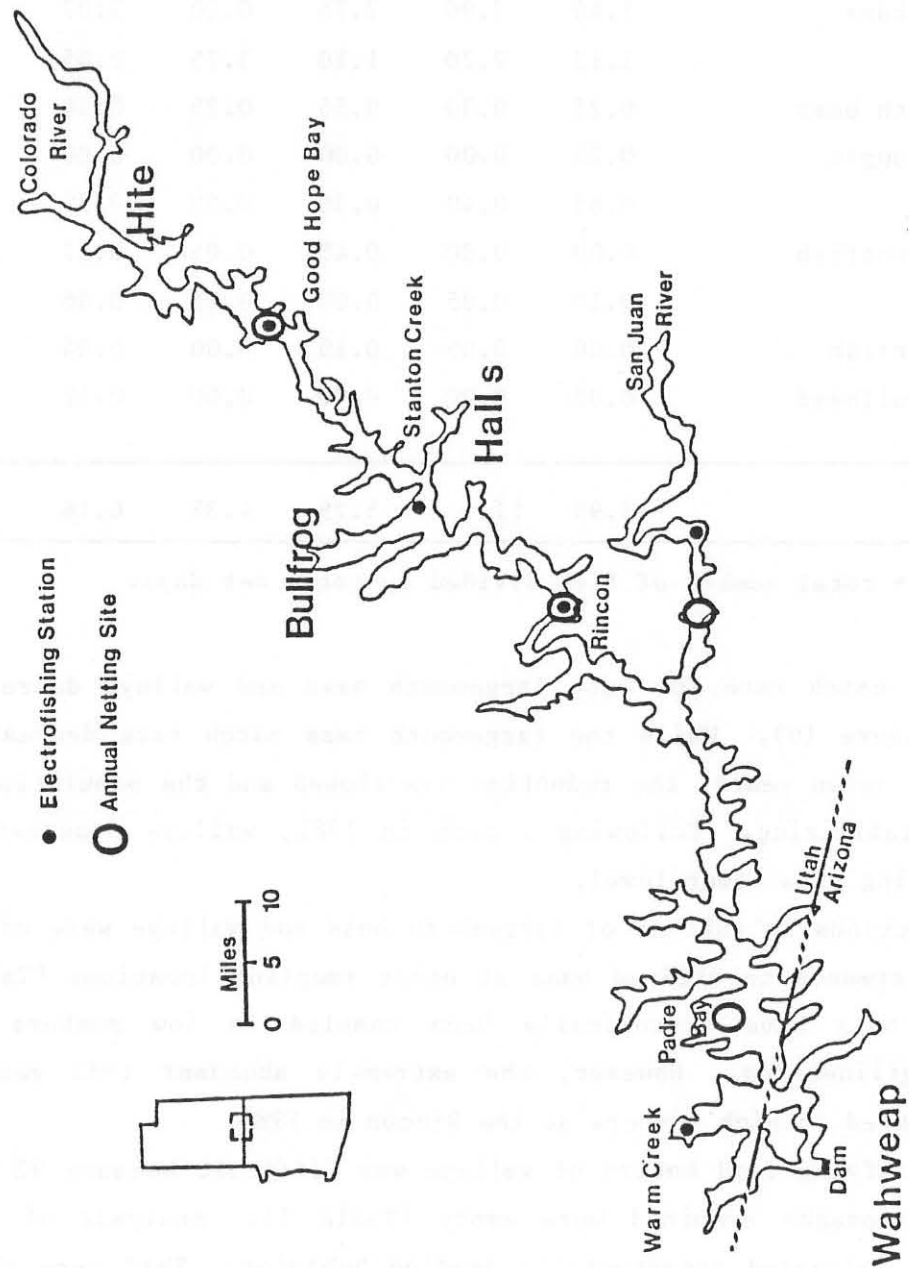


Figure 9. Map of Lake Powell, Utah-Arizona, showing annual netting sites (circles) and electrofishing transects (dots).

Table 6. Catch rates (fish/net day) during annual gillnetting, Lake Powell, March 1985.

Species	Good Hope Bay	Rincon	San Juan	Padre Bay	Total ^a	% of Catch
Striped bass	1.45	7.90	2.75	0.20	3.07	49.8
Walleye	1.15	2.20	1.10	3.75	2.05	33.3
Largemouth bass	0.25	0.30	0.55	0.25	0.34	5.5
Black crappie	0.25	0.00	0.00	0.00	0.06	1.0
Carp	0.65	0.40	0.30	0.05	0.35	5.7
Channel catfish	0.00	0.20	0.45	0.05	0.17	2.8
Bluegill	0.15	0.05	0.00	0.05	0.06	1.1
Green sunfish	0.00	0.05	0.10	0.00	0.04	0.6
Yellow bullhead	0.05	0.00	0.00	0.00	0.12	0.2
Total	3.95	11.1	5.25	4.35	6.16	---

^a Total = total number of fish divided by total net days.

Mean catch rate for both largemouth bass and walleye decreased in 1985 (Figure 10). While the largemouth bass catch rate decreased for the past seven years, the reduction has slowed and the population seems to be stabilizing. Following a peak in 1981, walleye appeared to be stabilizing at a lower level.

Reductions in catches of largemouth bass and walleye were offset by large increases in striped bass at other sampling locations (Table 6). Striped bass have historically been sampled in low numbers during spring gillnetting. However, the extremely abundant 1983 year-class was captured in high numbers at the Rincon in 1985.

Quantifying food habits of walleye was difficult because 92 percent of the stomachs examined were empty (Table 7). Analysis of stomach contents suggested opportunistic feeding behavior. Shad were the most

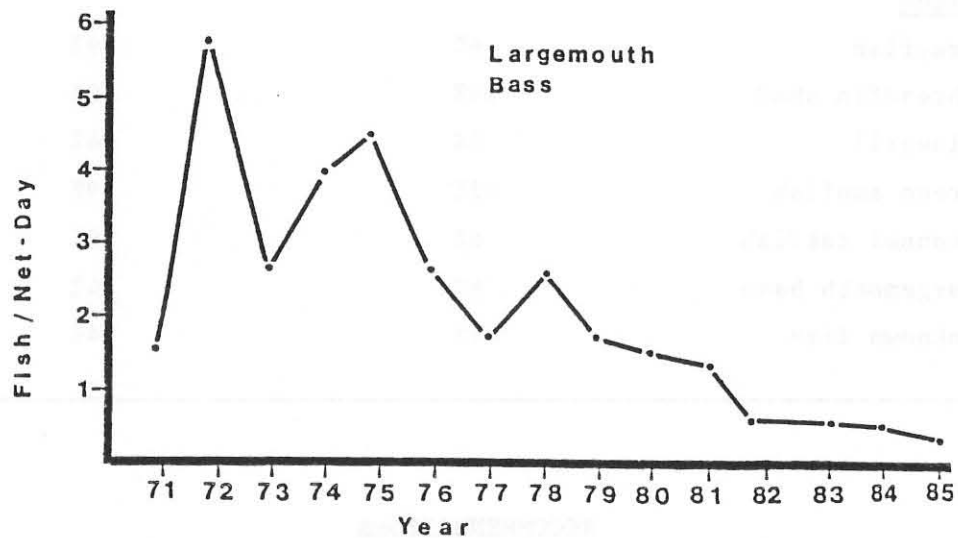
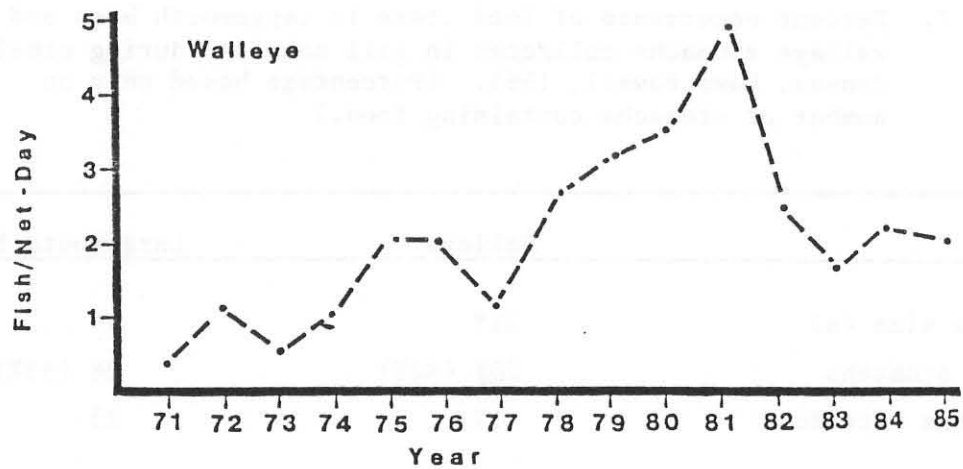


Figure 10. Catch rates (fish/net day) for walleye and largemouth bass from annual netting, Lake Powell, 1971-1985.

commonly consumed food item. Largemouth bass commonly consumed crayfish (Orconectes virilis) (Table 7). Both walleye and largemouth consumed centrarchid species.

Table 7. Percent occurrence of food items in largemouth bass and walleye stomachs collected in gill nets and during creel census, Lake Powell, 1985. (Percentage based only on number of stomachs containing food.)

	Walleye	Largemouth bass
Sample size (n)	218	49
Empty stomachs	201 (92%)	26 (53%)
Stomachs with food	17	23
<u>Food Item</u>		
Crayfish	6%	79%
Threadfin shad	29%	0%
Bluegill	0%	4%
Green sunfish	12%	9%
Channel catfish	6%	0%
Largemouth bass	6%	4%
Unknown fish	41%	4%

RECOMMENDATIONS

The annual netting program should be continued for fish population trend data during March. Location selection should remain as consistent as possible in habitat type and depth between all lake areas.

ELECTROFISHING

METHODS

Electrofishing procedures were similar to those described by Gustaveson et al. 1984. Each of the five stations were sampled by approximately one hour of electrofishing. Index of species abundance at each location was mean catch rate (fish/hour of electrofishing).

RESULTS AND DISCUSSION

A total of 3,019 fish was collected during 5 nights of electrofishing. Catch rates for all species were highest at Good Hope Bay, followed by Stanton Creek, the San Juan, the Rincon, and Warm Creek, in descending order (Table 8). A trend of higher catch rates at the more productive inflow area and declining rates with progression downstream was again observed in 1985. Compared to 1984, the mean catch rates increased substantially at all stations except at Good Hope Bay where a slight decrease was observed.

Table 8. Mean catch rate (fish/hour) of fish collected by electro-fishing, Lake Powell, September 1985.

Species	Good Hope Bay	Stanton Creek	Rincon	San Juan	Warm Creek	% of Total Catch
Young-of-the-year Largemouth bass	85	65	74	104	178	16.7
Age I and older Largemouth bass	6	3	10	2	1	0.7
Young-of-the-year Black crappie	10	1	0	1	77	2.9
Young-of-the-year Striped bass	563	23	13	0	1	19.9
Age I and older Striped bass	1	0	0	0	0	0.1
Young-of-the-year Smallmouth bass	4	0	36	5	5	1.7
Age I and older Smallmouth bass	0	1	0	0	1	0.1
Y-o-y and older Bluegill	186	281	126	54	164	26.9
Y-o-y and older Green sunfish	92	159	225	336	18	27.5
Y-o-y and older Channel catfish	55	11	10	21	7	3.4
All species	1005	544	495	523	452	----

Lakewide catch rate of y-o-y largemouth bass increased in 1985. However, the amplitude of this peak in the largemouth bass abundance

was lower than observed in 1980 and 1982 (Figure 11), suggesting a decreasing trend in largemouth bass. Black crappie trends have been similar. Crappie peaks in 1983 and 1985 have been much smaller than recorded in 1980.

Largemouth bass numbers may be linked to threadfin shad recruitment in Lake Powell (Figure 12). Peaks in y-o-y largemouth bass numbers only occurred during low points in pelagic threadfin shad abundance. Black crappie responded in the same way. Some studies suggested adverse impacts by threadfin shad on largemouth bass recruitment (von Geldern and Mitchell 1975) and black crappie recruitment (Beers and McConnell 1966). Detrimental influences by gizzard shad on largemouth bass recruitment has been well documented (Jahn 1983, Brummett 1983, and Kirk et al. 1983).

Although data suggests an inverse relationship between bass and shad populations at Lake Powell, a mechanism has not been identified. With the decreases observed in shad populations since 1978 (Job I), it seems unlikely that shad numbers alone have affected bass numbers. Yearly environmental conditions (i.e. water temperatures, inflow of nutrients, annual plankton production, lake levels, etc.) favoring largemouth bass may be detrimental to threadfin shad recruitment, and vice versa.

Catch rates of striped bass was the highest recorded since the electrofishing survey was initiated. Y-o-y striped bass were sampled at rates exceeding 560 fish/hour in the upper reservoir. Catch rates have been increasing since striped bass were first sampled in 1980. Y-o-y smallmouth bass (Micropterus dolomieu) were sampled in low numbers at all stations where they were stocked in 1985. Yearling smallmouth bass collected at both Stanton Creek and Warm Creek confirmed survival of bass stocked in 1984. Average lengths of y-o-y largemouth bass, striped bass, and smallmouth bass collected in 1985 were 96 mm (N=315), 78 mm (N=94), and 92 mm (N=50), respectively.

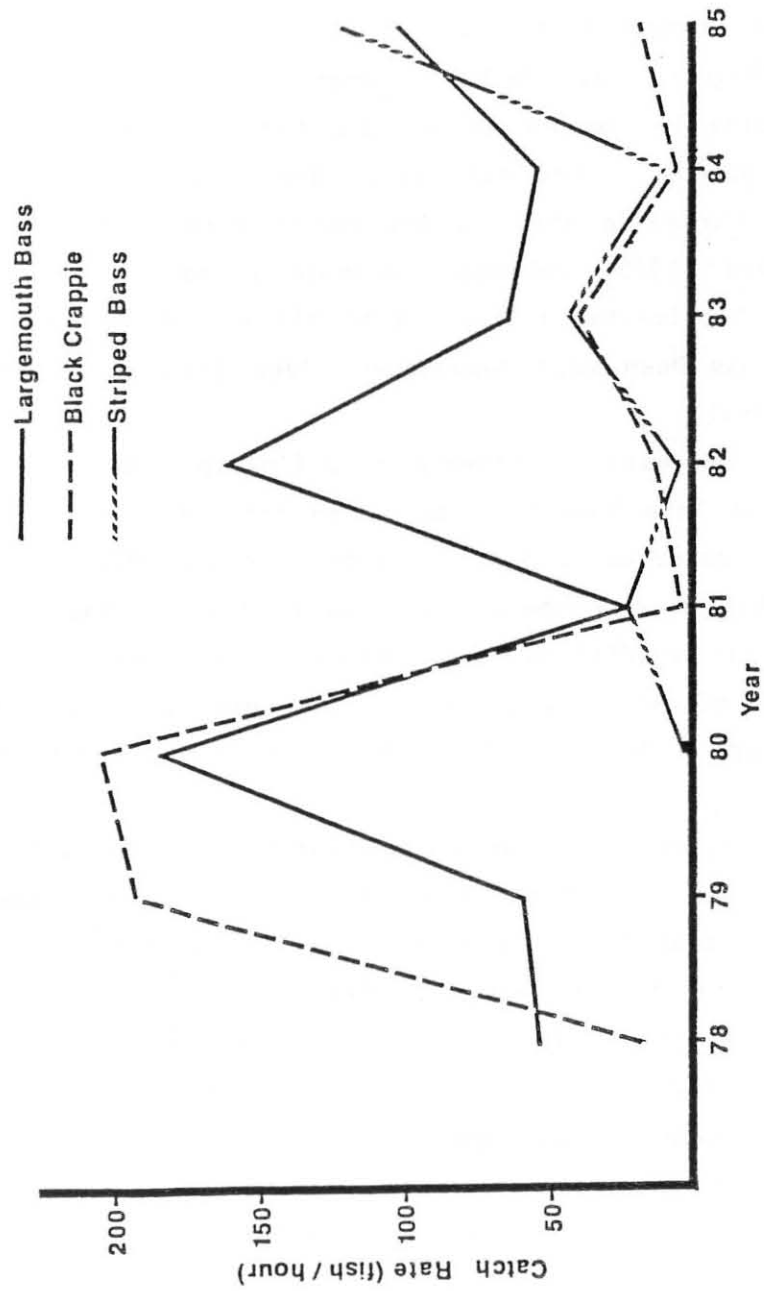


Figure 11. Mean catch rates (fish/hour) for largemouth bass, black crappie and striped bass collected by electrofishing, Lake Powell, August-September, 1978-1985.

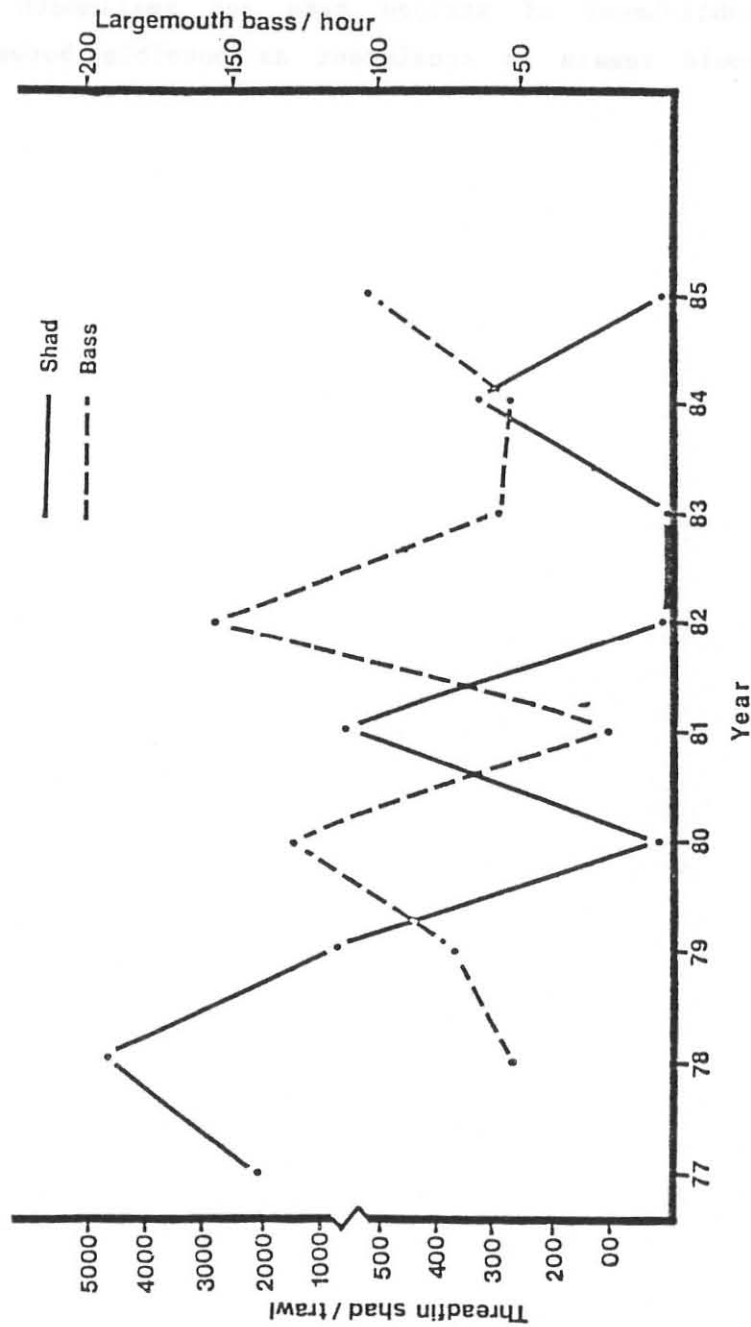


Figure 12. Relationship between largemouth bass catch rates (lakewide electrofishing average) and threadfin shad recruitment (Bullfrog and Wahweap trawling average), Lake Powell, 1977-85.

RECOMMENDATIONS

Continue the electrofishing survey during August-September to determine recruitment trends of game fish. The survey should also monitor the lakewide establishment of striped bass and smallmouth bass. Site selection should remain as consistent as possible between all lake areas.

STRIPED BASS POPULATION DEVELOPMENT

JOB IV

METHODS

Biological information was obtained from striped bass collected in gill nets, by angling, electrofishing and during regular creel census interviews. Data necessary to determine age and growth, food habits, maturity and condition (K_{fl}) were routinely taken from all fish sampled. A complete description of sampling methods can be found in Gustaveson et al. 1985. In 1985, stomach analysis was conducted in the field according to percent occurrence, a departure from previous years. Fall gillnet sampling locations included Warm Creek Bay, Rincon, Piute-Neskahi Canyon area of San Juan Arm, and Red Canyon (Figure 9).

RESULTS AND DISCUSSION

Striped bass reproduction was again documented in 1985 for the seventh consecutive year. Mature striped bass were observed staging near Glen Canyon Dam in early April prior to spawning. Spawning grounds, previously determined to be near Castle Rock in Wahweap Bay, were occupied by mature fish during May. The first ripe female was collected 23 May. Striped bass eggs were seen floating near the spawning grounds and collected with ichthyoplankton nets on 28 May 1985. Angler catches of gravid females and unconfirmed reports of egg sightings indicated spawning probably occurred midlake near Dangling Rope Marina at approximately the same time. Spawning is suspected to have peaked lakewide and in the Colorado River during the last two weeks of May. Spawning was completed and fish moved to other areas after 1 June 1985.

Two young-of-the-year striped bass were collected in shad trawling samples (Job I) during July in Good Hope Bay. Six y-o-y striped bass were also seined in Wahweap Bay during August. The annual electrofishing survey showed a high relative abundance of y-o-y striped bass in Good Hope Bay, the station nearest the Colorado River inflow. Relative abundance of y-o-y striped bass in the electrofishing sample decreased with distance from the inflow area (Table 8).

Striped bass condition (K_{fl}) averaged 1.25 for adults and 1.35 for juvenile fish in March 1985 prior to spawning. Following spawning an immediate decline in condition of older fish was noted. Juvenile fish maintained good condition throughout the summer months but showed a rapid decline in the fall. By November 1985 condition of adults averaged 0.90 while juvenile fish were averaging 1.07 (Figure 13). The drastic decline in condition was in direct response to the absence of a pelagic shad population (Job I). Most alarming was a decline in condition of juveniles to the lowest point recorded at Lake Powell.

Food habits surveys found most striped bass stomachs to be empty. Striped bass with food in their stomachs most often contained zooplankton (Table 9). Crayfish were an important food item during summer months. Shad were most often consumed in late summer but diminished in occurrence by fall and winter. Striped bass y-o-y were consumed by older striped bass in Good Hope Bay, an area previously shown to be extremely high in y-o-y abundance. Bluegill (Lepomis macrochirus) and green sunfish (Lepomis cyanellus) were also important food items during November sampling at Good Hope Bay. Stomach samples taken from other lake areas at the same time did not contain centrarchids. The high occurrence of zooplankton in stomachs was mainly confined to Age I and Age II striped bass. The majority of adult striped bass had empty stomachs. The ability of young striped bass to utilize plankton when shad were not available probably explains the consistently higher condition factor of juvenile striped bass in Lake Powell.

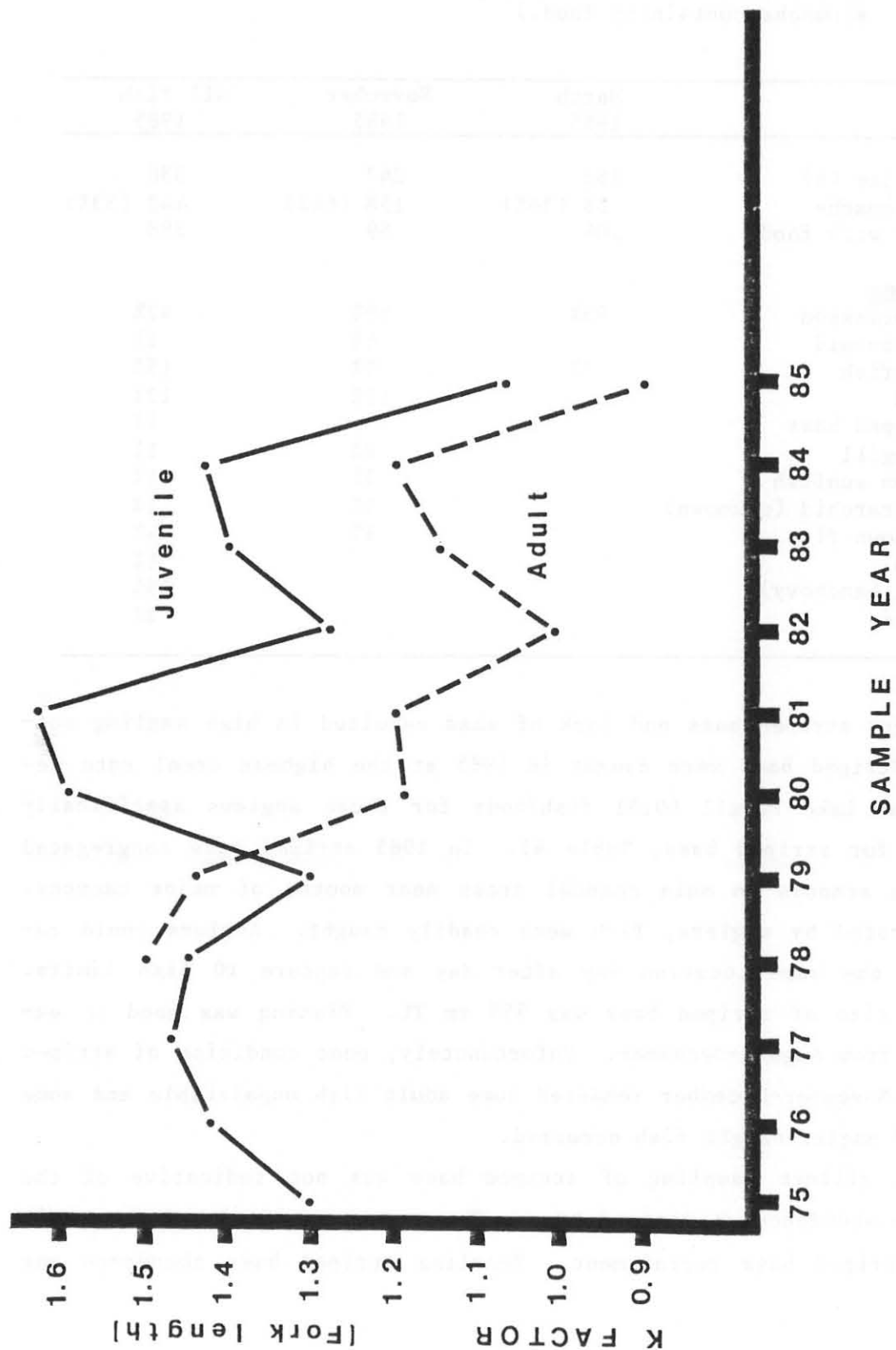


Figure 13. Year-end (November) average condition factor (K) of adult and juvenile striped bass, Lake Powell, 1975-1985.

Table 9. Percent occurrence of food items in striped bass stomachs, Lake Powell, 1985. (Percentage based only on number of stomachs containing food.)

	March 1985	November 1985	All fish 1985
Sample size (n)	162	247	830
Empty stomachs	58 (36%)	158 (64%)	442 (53%)
Stomachs with food	104	89	388
<u>Food Items</u>			
Zooplankton	93%	69%	42%
Chironomid		4%	1%
Crayfish	7%	9%	15%
Shad		11%	17%
Striped bass			1%
Bluegill		2%	1%
Green sunfish		3%	1%
Centrarchid (unknown)		1%	1%
Unknown fish		5%	4%
Carp			1%
Bait (anchovy)			19%
Debris			1%

Hungry striped bass and lack of shad resulted in high angling success. Striped bass were caught in 1985 at the highest creel rate recorded at Lake Powell (0.51 fish/hour for those anglers specifically fishing for striped bass, Table 4). In 1985 striped bass congregated in large schools in main channel areas near mouths of major canyons. Once located by anglers, fish were readily caught. Anglers could return to the same location day after day and capture 10 fish limits. Average size of striped bass was 555 mm TL. Fishing was good to excellent from August-December. Unfortunately, poor condition of striped bass in November-December rendered some adult fish unpalatable and some waste of angler-caught fish occurred.

Fall gillnet sampling of striped bass was not indicative of the relative abundance of striped bass. The survey was designed to sample Age I striped bass recruitment. Yearling striped bass abundance was

2.05 fish/1000 sq. ft. gill net/12 hour set (Table 10), the lowest catch of Age I fish since sampling began in 1981. Shoreline set gill nets have proven ineffective in capturing striped bass in years of low shad abundance (Gustaveson et al. 1984). During 1982 and 1985, years of low shad abundance, striped bass were sampled in low numbers. Food habits data showed that striped bass were eating plankton and not feeding on shad which normally frequent brushy shallows during November at Lake Powell. It is possible that record high numbers of striped bass produced in 1983 inhibited recruitment of the 1984 year class. It is more likely that trend netting in 1985 underestimated the 1984 year class due to the pelagic feeding nature of the young fish.

Table 10. Summary of striped bass caught during fall gillnet sampling, expressed in terms of fish caught per 1000 square feet of gill net per 12 hour set, Lake Powell, 1981-85. (Data is an average of four sampling locations).

Age	1981	1982	1983	1984	1985
0+	2.88	0.45	1.81	1.10	0.23
1+	0.38	2.55	3.44	11.63	2.05
2+ and older	0.56	0.57	2.48	0.51	0.82

SUMMARY AND RECOMMENDATIONS

Fall gillnetting catch rates of striped bass reached its highest point in 1984. Low shad numbers in 1985 were not adequate to feed the large striped bass population. Striped bass condition declined to the lowest levels recorded for adult and juvenile fish. Anglers

were very successful, with the highest creel rate and harvest ever recorded for Lake Powell. The majority of striped bass sampled were foraging on plankton due to a lack of pelagic threadfin shad.

It will be necessary to monitor the striped bass population in 1986 to document the over-winter survival. The striped bass population may be reduced in numbers, and spawning could be effected because fish in poor condition may not be capable of producing viable eggs. It will be important to monitor striped bass growth and food habits to determine changes if numbers of shad increase. If the shad population remains low, further degradation of the striped bass population could occur and results should be documented.

SMALLMOUTH BASS POPULATION DEVELOPMENT

JOB V

METHODS

Smallmouth bass population development was monitored through collections made in Jobs I-IV, as well as by snorkel surveys used to document natural reproduction. Nests were located by angling in areas previously stocked with smallmouth bass and then snorkeling in the locations where adult bass were caught. Comparisons with captive smallmouth bass broodstock held at the Wahweap Warmwater Culture Facility near Big Water, Utah were also used for determining spawning periods in Lake Powell.

Since 1982 a total of 137,853 smallmouth bass have been stocked in Lake Powell (Table 11). Most of the original stockings were in the lower portion of the reservoir. However, in 1985 smallmouth bass were stocked near the inflow of the Colorado River, at mid portions of the lake and in the San Juan River Arm. 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 a fishery throughout the lake.

Table 11. Smallmouth bass stocking history, Lake Powell, 1982-85.

Year	Number	Size	Location	Method
1982	3,100	2-4 "	Warm Creek	Truck
	59	10-15"	Warm Creek	Truck
1983	---No Stocking---			
1984	26,600	2-4 "	Wahweap-Warm Creek	Truck
	4,000	2-4 "	Stanton Creek	Aerial
1985	13,289	2-4 "	Wahweap Creek	Truck
	12,398	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
Total	137,853	-----	Lake Powell	-----

RESULTS AND DISCUSSION

Aerial stocking of 2-4" smallmouth bass proved successful. Seining conducted eleven days after aerial stocking at the Rincon produced 14 healthy fingerlings. Some y-o-y smallmouth bass were also collected near other stocking sites during the 1985 September electrofishing survey (Table 12). The Rincon appeared to have the greatest survival, with 36 y-o-y collected.

Table 12. Mean catch rate^a (fish/hour) of young-of-the-year smallmouth bass collected by electrofishing, Lake Powell, 1982-85. (Adults denoted by brackets.)

Year	Good Hope Bay	Stanton Creek	Rincon	San Juan	Warm Creek	Total y-o-y & adult
1985	4	0 (1)	36	5	5 (1)	52
1984	0	5	0	0	46	51
1983	0	0	0	0	0 (3)	3
1982	0	0	0	0	22	22

^a Total fish divided by total hours of electrofishing.

The first natural reproduction of smallmouth bass in Lake Powell was documented in April 1985. Three nests were located alongside a west facing sandstone wall in the Crosby Canyon arm of Warm Creek Bay when surface temperatures were 65F. Nests were about 1.5 feet in diameter over angular gravel (2 inches in diameter) and in 10-15 ft of water. Each nest was guarded by a male bass and contained black fry. Eggs took approximately 9 days to develop to black fry in 60F water under culture conditions at the Wahweap Ponds (unpublished data, UDWR POB 1446, Page, AZ). Assuming a 9-day development period for fry found in Crosby Canyon, spawning would have occurred about 21 April 1985.

Snorkeling conducted in Crosby Canyon on 16 May 1985 revealed some of the fry had survived to swim-up. Approximately 2,000 advance fry were observed swimming along the shoreline near previously located nest areas. Rising water levels and decreased visibility, however, made subsequent snorkel observations impossible. Smallmouth bass are known to be multiple nesters in wild environments (Pflieger 1966). It is presently unknown if the nests observed in April were reused later in the year.

Since 1982 a total of 783 adult smallmouth bass has been stocked in the lake (Table 11). Stocked adult smallmouth bass, along with maturation of original introductions should allow natural reproduction to increase in 1986.

Smallmouth bass were creeled for the first time in significant numbers in 1985 (Job II). The creel survey estimated a total of 632 smallmouth bass were harvested lakewide. At least one adult smallmouth bass has also been collected at Wahweap during each fall gillnet survey since 1982, with two fish being collected in 1984 (Job IV). Occurrence of adult smallmouth bass in all surveys should continue to increase as the population becomes established.

SUMMARY AND RECOMMENDATIONS

Smallmouth bass appear to be establishing a reproducing population at Lake Powell. As both stocked fingerling and naturally reproduced bass mature, the importance of smallmouth in the sport harvest should increase.

Monitoring of stocking and natural reproduction should continue. As smallmouth bass numbers increase, food habit studies should be conducted to assess not only utilization of available food organisms, but also to identify any possible conflicts with other game species.

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