MONTANA DEPARTMENT OF FISH, WILDLIFE AND PARKS
FISHERIES DIVISION

JOB PROGRESS REPORT

State: Montana

Project No. F-33-R-20 Title: Lake Fisheries Inventory

Job. No. I-a Title: Seasonal area and depth distribution of cutthroat, bull trout (Dolly Varden) and lake trout in Flathead Lake

Period Covered: July 1, 1985 to June 30, 1986

ABSTRACT

Additional area and depth distribution records, fish measurements, scale collections and catch indices of the target fish species were accumulated through angler contact and interviews conducted during the summer census program.

The summer census of boat anglers was conducted on Flathead Lake from 16 June through 7 September, 1985. Information from this census was analyzed to determine use and harvest of gamefish and characteristics of the anglers. Pressure estimate was based upon aerial fish-boat counts and direct interviews. A total of 724 fishing parties were interviewed with 2,499 fish-boats being enumerated during 77 aerial flights.

Fishing boats represented 60.1 percent of all boat use enumerated on the lake during the summer period.

Anglers expended 174,811 hours in 53,895 trips and harvested 135,507 fish of which 95.4 percent were kokanee. Half of the angling pressure occurred on the weekend or holidays. The number of trophy sized trout represented 1.7 percent of the total fish harvested which included 1,600 lake trout and 655 bull trout. An approximate equal number of large trout were also caught but were released back to the water. Cutthroat trout, perch, and "other species" made up the remainder of the catch. The average size of the fish harvested was 12.8 inches for kokanee, 14.1 inches for cutthroat, 19.9 inches for bull trout and 27.5 inches for lake trout.

Specialized fishing techniques, shallow- and deep-trolling, were analyzed separately. Catch rates for shallow-trolling,

primarily seeking kokanee, averaged 0.765 fish/hour while deep-trolling, for large trophy trout, averaged 0.167 fish/hour.

BACKGROUND

Flathead Lake is one of the largest natural lakes in northwest United States and is noted for its high quality water and angling opportunities (Graham and Fredenberg 1982). In 1966, the Flathead Lake fisheries study was initiated to gather baseline information on the fishes of the lake (Hanzel 1970 and 1972). After this initial work the study program was split into two segments; one to address trend in the kokanee population and the other to included other game fish species in the lake.

Information on the game fish populations, other than kokanee, has included initial age and growth summaries and detailed food habits of cutthroat and bull trout along with other associated species (Leathe and Graham 1982). Other related Department projects on the lake have been detailed by Graham et al. (1980).

Angling pressure on the lake ranks second in all state waters and provides an economic stimulus to the Flathead Valley (Graham and Fredenberg 1982).

OBJECTIVES

It shall be the primary objective of this job to determine growth rates of lake trout and to assess annual and seasonal comparisons of growth.

PROCEDURES

It was the intent of this job to continue to accumulate growth and seasonal distribution data on lake trout (Salvelinus namaycush), cutthroat trout (Salmo clarkii lewisi) and bull trout (Salvelinus confluentus) during the summer, fall, and winter periods. Fish growth data were primarily collected during creel checks made during the summer, fall and winter periods. Additional data were collected from target fish species taken in gill netting efforts primarily for kokanee (Oncorhynchus nerka). Age analysis was made by reading scale collections and verifying age by otolith bones.

The glass-bottom pram was used during the fall to monitor numbers of lake trout utilizing major spawning areas.

A specific segment of this job was to assist and help coordinate an angler pressure and total fish harvest census conducted on the lake during the summer and fall of 1985. Coordination of this program was with a contract study funded by the Bonneville Power Administration through the Northwest Power Planning Act.

Pressure and Harvest Procedures

A census was conducted on Flathead Lake from 16 June through 7 September, 1985. The procedure used was a modified version of the direct interview and count technique established by the Montana Department of Fish, Wildlife and Parks (1985). This creel program was designed to measure only angling from boats since shore angling represented such a small portions (4.7 percent) of the total summer pressure expended on the lake (Graham and Fredenberg 1982) and would require a larger work force to sample the entire fishery.

Census data were collected and analyzed in bi-weekly intervals (a total of six sample periods) with weekend and weekdays treated separately. Sampling schedules were randomly selected for the six two-week periods with each sample period covering four weekday and three weekend days (Figure 1). Holidays were treated as weekend days and included Thursday, 4 July (Independence Day) and Monday, 2 September (Labor Day).

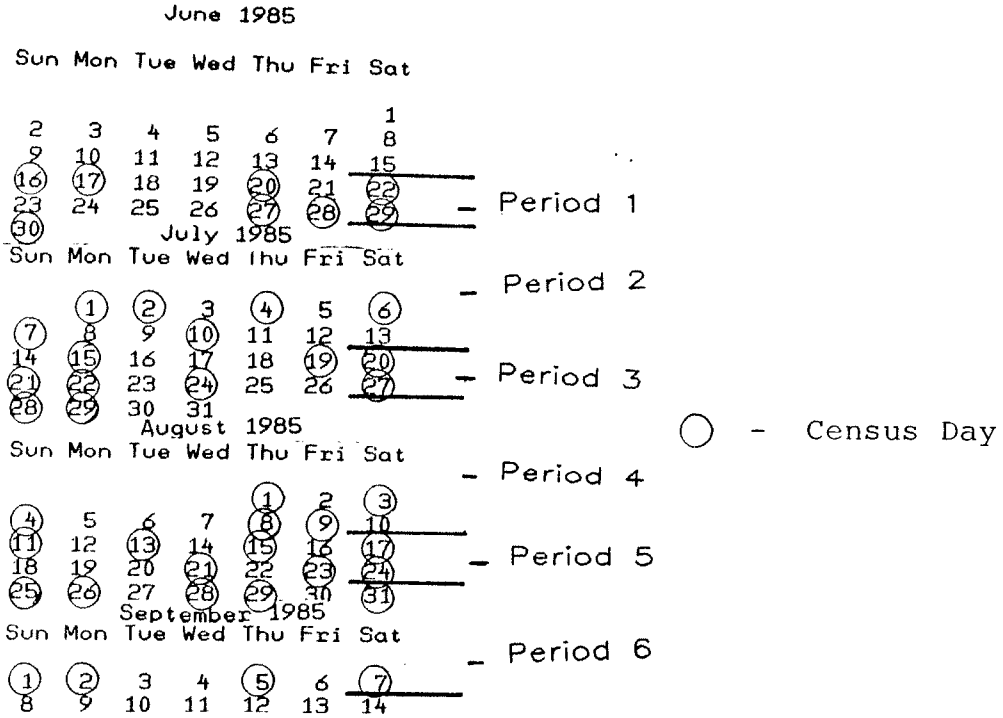

Figure 1. Flight and interview schedule, census days, and bi-weekly periods for Flathead Lake, 1985.

The lake was divided into five areas (Figure 2) to assess differential use patterns. The main portion of the lake (north of "The Narrows") was first bisected north-south and then split into four areas (Areas A,B,D,E); the remaining area (Area C) being the isolated bay area (Polson Bay) located in the most southern part of the lake.

Pressure data was gathered as instantaneous fishing boat counts made from a low flying plane (500 feet above the water). Although only fishing boats were used to calculate the pressure estimate, all boat use (fish, motor and sail) observed in each use area during the 1-hour flight was counted and recorded. A fish-boat was differentiated from other boats as being a slow moving boat (no wake); often fishing rods could be distinguished from the plane. Two flights were made daily, with the exception of the first sample period, 16 June to 29 June when only one daily flight was made . Flight times were randomly selected within the two major fishing periods; 0600 hours to 1230 hours and 1230 hours to 1900 hours. The afternoon flight was scheduled seven hours after the start of the morning flight to similarly sample both fishing periods.

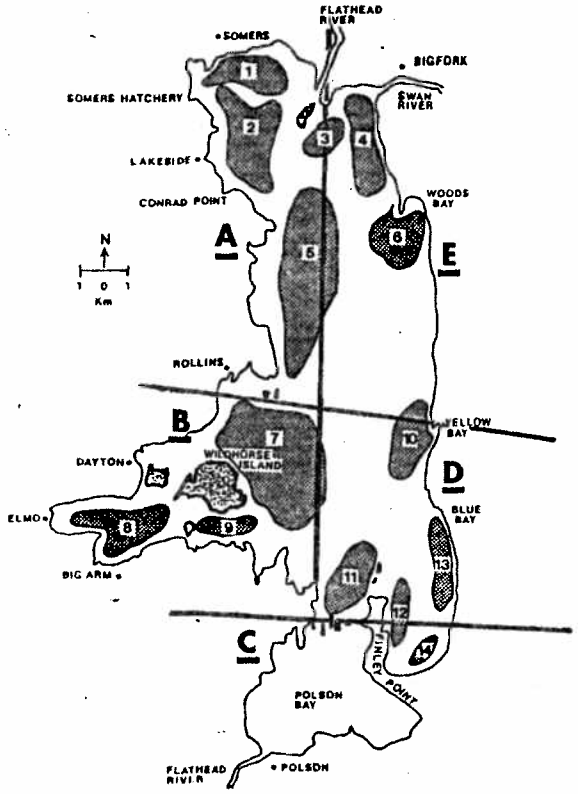

Figure 2. Map of Flathead Lake depicting five major use areas and 13 popular fishing locations.

The census was conducted by two creel clerks working 10 hour days. Starting time of both clerks was determined by the early flight time. While one clerk conducted the aerial count, the other drove to fishing areas and conducted interviews. Flights were alternated between the clerks. Interviews were conducted both on shore and by boat. To maximize interview data with minimal crews on this large lake, clerks communicated after the flights and directed their interview efforts toward the heavy use areas. However, during each sample period interviews were also directed to the less used areas to maintain proportionality between contacts and use. Assistance was occasionally given the creel clerks by Department personnel when conducting boat interviews.

Clerks interviewed anglers on a party basis. Although emphasis was directed toward collection of completed trips, contacts were also made with anglers who had not completed their trips to maximize data gathering during the boat interview times. Interview information gathered included: number of anglers, origin, total hours fished (distinguishing whether angling was "SHALLOW" (using surface or leaded line) or "DEEP" (using steel line or down rigger), time fishing started, trip completed or not, what particular fish species (if any) they were attempting to catch, and number of fish caught and kept or released.

No interviews were conducted in Area C, Polson Bay, due to the limited trout and salmon fishery during the summer in this area (Graham and Fredenberg 1983). Aerial boat counts from this area were excluded in estimates of the total pressure and total fish harvested.

Sampling was accomplished on 23 weekdays and 21 weekend days or holidays. Weather cancelled 4 flights; 3 occurred on weekdays and 1 on a weekend day. Due to the bad weather there were no boats on the lake and these "zero" boat counts were included into the calculations of average boat count per period. The earliest flight was started at 0610 hrs and resulted in a count of four fish-boats, while the latest afternoon flight was started at 1905 hrs with 55 fish-boats. Weather also was severe enough to cancel interview schedules on four days during the season: one during Period 1; one in Period 4; and two during Period 6, on the last two days of the census.

Data gathered from the interviews and aerial counts were entered into the Department's regional computer system and were analyzed with a program developed by the Department that had been modified to run on microcomputers by Roche (1985).

Average catch rates were calculated at bi-weekly intervals and the seasonal rate was then calculated by combining all average catch rates of the anglers. Pressure estimates by

sample period were obtained by calculating the average number of fishing boats per count and expanding it by the fishable hours per day and the number of days per period. A total of 16 fishable hours each day (0600 hrs to 2100 hrs) was used throughout the season. Weekend and weekday pressure was calculated separately and then totaled for the season. Total harvest estimates were made by adding bi-weekly harvests which were calculated by multiplying average catch rates times pressure for each sample period. Fishing effort was summarized by species for the two angling techniques; "shallow or deep".

FINDINGS

Scales, otoliths, and length and weight data from the target species were collected through the report period. The data has been stored in regional files and will be summarized in a later report.

Excessive wind during November, the lake trout spawning period, did not allow the use of the glass-bottom pram or aerial flights to aid in enumeration of lake trout on shoreline spawning areas.

Several acoustical reconnaissance cruises were made during the summer and fall periods to document seasonal distributional patterns of bull and lake trout. These data are stored in the regional echogram file.

Elements of the cooperative summer creel program such as measurements of deep trolling effort and success were designed to accumulate specific fishery data on the target species in comparison to the total fishery of the lake.

1985 Summer Angling Census

A total of 724 party interviews and 77 aerial flight counts were conducted on 44 sample days during the 84-day summer fishing season.

Aerial Boat Counts and Use

A total of 5,677 boats were classified as "fish-boats", 2,499 as "motor-boats" and 1,271 as "sail-boats"; representing 60.1, 26.5 and 13.4 percent of the total boats, respectively (Table 1) (Figure 3). It was recognized that motor-boats could be fish-boats as well and the term was only used here to described the non-fishing use of such boats during the aerial counts. Only fish-boats were interviewed and used to calculate

total pressure. Total boat numbers by the three classes will be discussed first. This will be the first record or comparison of boat use other than for fishing on Flathead Lake.

Table 1. Aerial boat counts on Flathead Lake by weekend and weekday, boat classification and by area, June-September, 1985.

	Fish Boats			Motor Boats			Sail Boats		
Area	Wkday	Wkend	Total	Wkday	Wkend	Total	Wkday	Wkend	Total
A	392	869	1,261	169	326	495	116	342	458
B	350	746	1,096	202	454	656	60	400	460
C	99	206	305	129	354	483	26	95	121
D	218	348	566	137	290	427	20	90	110
E	938	1,511	2,449	122	316	438	38	84	122
Total	1,997	3,680	5,677	759	1,740	2,499	260	1,011	1,271

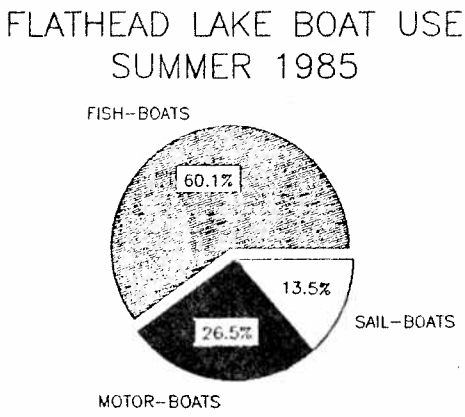

Figure 3. Boat use on Flathead Lake by percent of boat type during the summer of 1985.

The highest instantaneous boat count of 372 boats occurred on 1 September during the 1400 hrs flight. During this same

flight the highest fish-boat and sail-boat counts also occurred; they were 229 and 73, respectively. The highest count of motor-boats was 158 and occurred on 4 July during the 1415 hrs flight. Lake use, as indicated by total boat count, was lowest during the first period, 16 June - 29 June, and was highest during the sixth period, 25 August - 7 September, (Table 2) (Figure 4). Fish-boat counts peaked during the close of summer (period six) while motor-boats hit their high count during early summer (period two) 30 June - 13 July. Sail boats peaked at summer's end but were the most consistent use count throughout the season.

Table 2. Total aerial boat counts by census period and boat type on Flathead Lake, June-September, 1985.

		Boat Classification Type			
Period	Dates	Fish	Motor	Sail	Total
1	6/19 - 6/29	441	186	112	739
2	6/30 - 7/13	913	546	227	1,686
3	7/14 - 7/27	1,091	508	230	1.829
4	7/28 - 8/10	727	399	192	1,318
5	8/11 - 8/24	1,179	390	234	1,803
6	8/25 - 9/07	1,326	470	276	2,072
Total		5,677	2,499	1,271	9,447

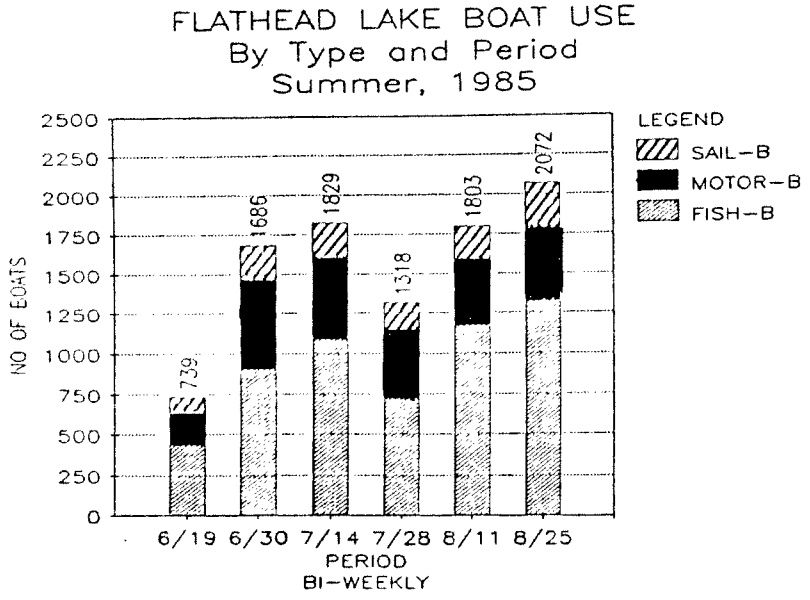

Figure 4. Number of boats counted during aerial flights, by boat type and census period, summer 1985, Flathead Lake.

Over half of all boat use of each classification type occurred during the weekend days, with each class was represented by 65 percent or more of their total use. The highest weekend use was exhibited by sail boaters, when 79.5 percent of their total use occurred.

The highest number of fish-boats (43.1 percent of total) occurred in Area E while the use of the remaining areas in decreasing percent of total fish-boats, were Area A (22.2 percent), B (19.3 percent), D (10.0 percent), and C (5.4 percent). Sail boaters selected Areas A and B equally as their preferred use area. Their seasonal counts were nearly identical and collectively they represented 72.2 percent of area use. These two heavy sailing use areas both have established sail boat mooring docks which would tend to concentrate use. Motor-boat use was more evenly distributed about the lake with Area B showing the highest count of 26.1 percent of the use of the 5 areas of the lake.

It is recognized that misidentification of fish- and motor-boats may have occurred during the flights or that counts of motor-boats could have included fish-boats on their way to or from their fishing areas. No attempt was made to correct for possible counting errors. However, consistency in identification of these two boat types between the two creel clerks was stressed throughout the season.

Fishery Parameters

Average Boat Count. - The average number of 94.4 fish-boats per count per weekend day was nearly double that of the average count for weekdays of 47.6 boats. This pattern was consistent throughout the sample period (Table 3). The highest average count per flight of 122.3 fish-boats occurred during period 5 (8/11 - 8/24) with the lowest average count of 35.3 boats occurring during period 4 (7/28 - 8/10).

Table 3. The average number and variance fish boats per aerial count by sample period by weekdays and weekend days Flathead Lake, June-September, 1985.

Period	No. of Flights	Days*	Average Fish boats	Variance
1	4	W	39.25	160.23
	3	E	94.67	484.11
2	6	W	42.17	128.76
	8	E	82.50	459.07
3	8	W	48.88	93.94
	6	E	116.67	584.64
4	8	W	35.25	77.74
	6	E	74.17	170.49
5	8	W	55.63	478.50
	6	E	122.33	637.11
6	8	W	58.63	204.43
	10	E	85.70	415.89
Total	42	W	47.55	33.00
	39	E	94.36	80.85
Combined	81		70.09	34.10

*: W = weekdays, E = weekend days

Trip Length and Party Size. - The average trip length of 3.26 hours and average party size of 2.1 anglers per boat was calculated from angler interview data. Trip length was calculated from 360 completed trip interviews (49.3 percent of all interviews) while party size of was calculated from all interviews. During the season, length of trip was longest during census Period 1 and the shortest during Period 3 (Table 4.) The mean number of anglers per party or boat was 2.1 anglers. Size of party between weekday and weekend days, between areas and between fishing techniques were consistent within each sample periods were not discussed separately.

Table 4. Average length of trip and average party size for fishing boats by census period on Flathead Lake, summer, 1985.

Period	Avg.Trip Lgth. -Hours-	Avg.Angler/Boat
1	3.48	2.0
2	3.37	2.2
3	2.88	2.1
4	3.30	2.0
5	3.34	2.1
6	3.23	2.2
Total	3.26	2.1

Temporal and Area Use Patterns. - The distribution of interviews conducted on the lake followed the general area use pattern of fish-boats (Table 5). The majority (68.1 percent of total) of interviews were collected in Area E, followed by Areas B (14.2 percent), A (9.3 percent), and D (8.4 percent) respectively. The scattered fishing distribution use in Area A required more time to make boat contacts so less boat interviews were completed, creating the greatest disproportion between number of interviews and boat use.

Table 5. The distribution of interviews by lake area by sample period on Flathead Lake, June - September, 1985.

	Lake Areas				
Period	Area A	Area B	* Area D	Area E	Total
1	7	7	10	50	74
2	12	21	17	95	145
3	16	8	23	75	122
4	8	8	1	88	105
5	2	48	7	110	167
6	22	11	3	75	111
Total	67	103	61	493	724

*Area C was omitted; no interviews were conducted in this area.

Angling Preference. - Nearly all (99.5 percent of total) interviews were categorized by the species of fish they were pursuing. Anglers pursuing kokanee showed a predominance of 80.7 percent among all the interviews (Figure 5). The low angling preference for bull trout is masked partially since many of these anglers were seeking several fish species and were placed in the "Combined" category. Within any of the designated categories other fish or techniques could have been pursued or used but the primary pursuit of the boat that day determined its classification.

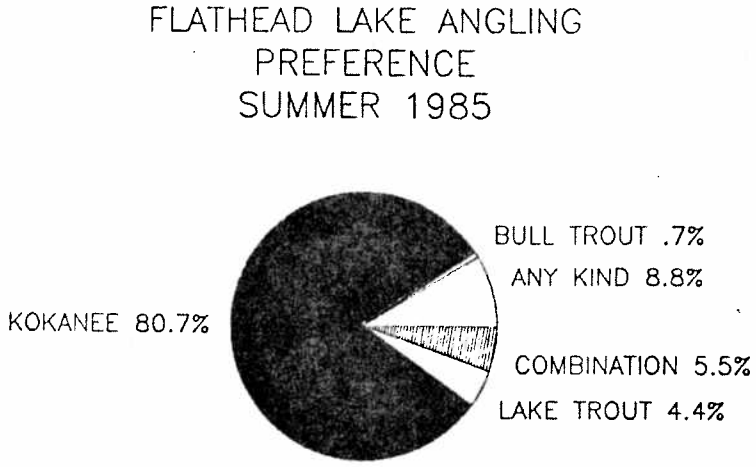

Figure 5. Angling preference, by percent of interviewed boats on Flathead Lake, summer, 1985.

Angler Origin and Dock Usage. - Collectively, Montana residents accounted for 77.9 percent of the 1,496 anglers interviewed on the lake. A total of 910 anglers (60.8 percent of total) were designated "local" when they resided in the two counties (Lake and Flathead) that encompass the lake. Other resident inhabitants from west of the continental divide added another 131 anglers (8.8 percent) with an additional 135 anglers (9.0 percent) from the eastern portion of the state.

Nearly three-fourths (70.6 percent) of Flathead Lake's non-resident anglers (320 individuals) came from western states, while eastern state residents and foreigners (principally Canadians) accounted for 13.1 and 16.3 percent of the total non-resident anglers respectively.

Public docks provided over half (60.3 percent) of the total 711 boats declaring their entry dock during the summer period. The 11 public docks available to boaters, exclusive of one area in Area C (Polson Bay), are evenly distributed around the lake with 5 areas located along the east shore and 6 areas along the west shore.

Catch Rates. - The 1985 summer interview information from 724 boat contacts recorded data on 1,550 anglers who had fished

5,062.5 hours (4,620.5 hrs "shallow" and 442 hrs "deep") and caught a total of 3,767 fish. This summer catch was dominated by kokanee (94.9 percent) followed by lake trout (1.8 percent), yellow perch (Perca flavescens) (1.4 percent), bull trout (0.9 percent), cutthroat trout (0.7 percent) and others (0.3 percent). The "other" category included lake whitefish (Coregonus clupeaformis), mountain whitefish (Prosopium williamsoni), and squawfish (Ptychocheilus oregonensis). The complete dominance of kokanee both in angling effort and catch precludes much discussion of the harvest or average catch rate by species without calculating effort specifically expended for each species. The catch rate for all fish, kokanee and deep troller anglers, was calculated and is presented by census period and use area in Table 6.

Table 6. The number of interviews and average catch rate for all fish caught, kokanee, and fish caught deep trolling (lake and bull trout) by census period and use area for Flathead Lake, summer, 1985.

Period	No. Intv.	Catch Rates					
		All Fish	Kokanee		Deep Trollers	
		Fish/Hour	No.	Fish/Hr.	No.	Fish/Hr.
1	74	0.715	65	0.741	18	0.185
2	145	0.730	136	0.685	13	0.345
3	122	0.614	113	0.626	13	0.095
4	105	0.882	104	0.892	8	0.007
5	167	0.831	161	0.827	10	0.192
6	111	0.798	111	0.802	5	0.000
Total	724	0.765	689	0.765	67	0.167

Area	No. Intv.	All Fish	Kokanee		Deep Trollers	
		Fish/Hour	No.	Fish/Hr.	No.	Fish/Hr.
A	67	0.426	61	0.445	14	0.058
B	103	0.485	92	0.465	19	0.165
D	61	0.459	53	0.290	14	0.160
E	493	0.907	483	0.892	20	0.251
Total	724	0.765	689	0.765	67	0.167

Kokanee, cutthroat trout, yellow perch and the "others" category were always taken by the shallow effort while lake trout were predominately (75.0 percent of total) caught by deep trolling effort. Bull trout showed a wider distribution pattern

and were taken readily by both "shallow" and "deep" trollers. Shallow fishing effort produced 58.8 percent of the total numbers of bull trout caught. The combined seasonal catch rate for "shallow" fishing was 0.765 fish/hr while "deep" effort yielded 0.167 fish/hr.

Flathead Lake kokanee anglers are similar to most other kokanee fisherman in that they tend to keep the salmon they catch. In 1985, kokanee fishermen caught salmon at an average rate of 0.765 fish/hr and kept over 98 percent. This "harvest" tendency was also followed by the catch of cutthroat trout, yellow perch and "others" with release percentages less than 10 percent of the catch for each species. Seasonal catch rates for these species were: cutthroat trout 0.006, yellow perch 0.014 and "others" 0.005 fish/hr.

Salmon angling success, determined from 689 interviews, generally increased as the season progressed with the lowest success occurring during the month of July (Periods 2 and 3, Table 6). High kokanee catch successes were experienced from late July to the end of the census season, September 7. The highest kokanee catch rate was during late July when it reached 0.892 fish/hr.

The harvest of "large trout - trophy" fisheries is generally governed by the fishing regulation imposed on the waters. On Flathead Lake during the 1985 summer season the lake trout limit was 2 lake trout per day regardless of size, and the bull trout limit was 1 bull trout per day regardless of size. Lake trout fishermen released one-third (32.4 percent) of their fish; while bull trout fishermen released one half (50.0 percent) their catch. Numbers of released bull trout by shallow fisherman (40.0 percent of total) was less than the released bulls caught while fishing deep (64.3 percent).

Deep trollers (anglers fishing with steel lines and/or downriggers) were fishing at depths ranging from 70 to 180 feet and catching both bull and lake trout. This specialized fishing type represented a small fraction of the total anglers (9.3 percent of total) but comprised the majority of anglers seeking the large trophy size trout. Periodic catch rates for "deep trollers" showed best success rates during late-June and again in mid-August. These catch rates for deep trollers are the first records for such specialized angling for Flathead Lake and represent considerably higher success rates than those for bull or lake trout if considered as only a part of the total fish catch. The 1985 "deep troller" catch rate averaged 0.17 fish/hr; however success fluctuated from 0.00 to 0.35 fish/hr during the season. The average catch rate represents one large or trophy size trout for every 6 hours of effort and the highest rate results in a fish every 3 hours of fishing.

Catching of cutthroat trout by anglers in Flathead Lake is more accidental than by a specific design of gear or area. Most cutthroat trout taken during the summer period are taken by kokanee fishermen using salmon terminal tackle. The 1985 catch rate for cutthroat trout was 0.01 fish/hr. Graham and Fredenberg (1982) found spring fishing along the shoreline to be more successful for cutthroat; however, such success would not be experienced during this summer season.

The highest angling success for all fish taken in any use area was 0.91 fish/hr in the northeast portion of the lake (Area E). The angling success in the remaining portions of the lake, excluding the most southern area (Polson Bay) were similar but were about half the success enjoyed in Area E. Kokanee anglers followed this same success pattern with the exception that catch rates in Area D dropped to 0.29 fish/hr (Table 6).

Deep trollers also enjoyed their highest success of 0.25 fish/hr in Area E and lowest success of .058 fish/hr in Area A. both of these areas are found in the northern half of the lake. Southern deep trolling successes were similar on both sides of the lake with a catch rate of 0.167 fish/hr.

Three-fourths of all boats engaging in fishing on Flathead Lake during the summer of 1985 were successful in catching at least one fish. Area E (northwest quarter of the lake) had the highest catch rate for all fish but also accounted for the greatest percentage of anglers (52.8 percent) that did not catch at least one fish.

Angling Pressure

A total of 174,811 hours were expended by 53,895 anglers on Flathead Lake during the 84-day 1985 summer season from 19 June-7 September (Table 7). Peak use during the accumulation of pressure occurred during Period 3 (mid-July) when 10,919 days of angling were expended on the lake (Figure 6). The lowest bi-weekly use of 6,446 angler days occurred during Period 4, a period when the lake was buffeted with wind and rain for six of the 14 days within the sample period.

Table 7. Angling pressure by hours, angler days, and by census period and weekday-weekend found on Flathead Lake, summer, 1985.

Period	Day*	Angling Hrs.	Angler Days
1	W	12,478	3,586
	E	12,039	3,459
	C	24,517	7,045
2	W	13,353	3,962
	E	14,513	4,307
	C	27,866	8,269
3	W	16,087	5,586
	E	15,359	5,333
	C	31,446	10,919
4	W	11,551	3,500
	E	9,722	2,946
	C	21,273	6,446
5	W	19,083	5,713
	E	16,786	5,026
	C	35,869	10,739
6	W	18,675	5,782
	E	15,165	4,695
	C	33,840	10,477
Total	W	91,227	28,129
	E	83,584	25,766
	C	174,811	53,895
Combined One Period	W	93,548	28,696
	E	83,218	25,527
	C	176,766	54,223

*: W = weekday, E = weekend, C = combined

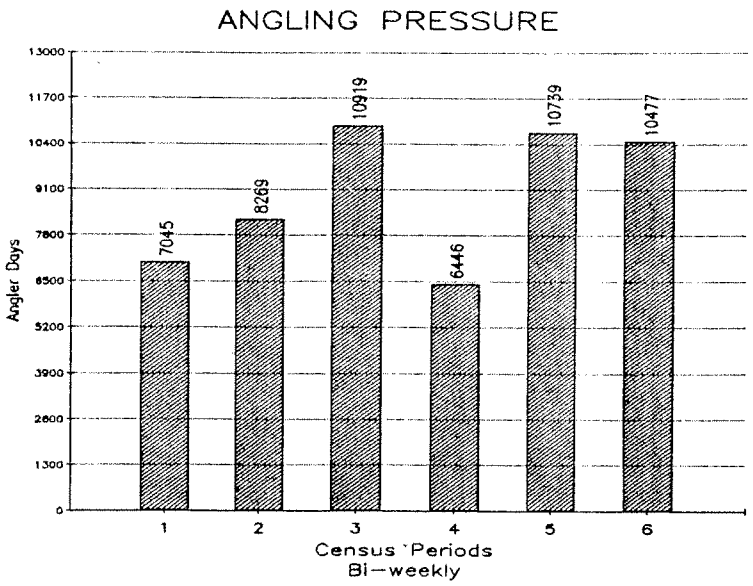

Figure 6. Number of angler days by census period on Flathead Lake, summer 1985.

Nearly half (47.8 percent) of the total angling pressure occurred on weekends and holidays which was exerted on 30 percent of the total number of days in the census. Once an estimated number of angler days during 1985 were established (Table 7), daily fish-boat use values could be obtained (Figure 7)--i.e., angler days/ number of days in census period. Weekdays showed an average fish-boat use per day of 761 boats while weekend days showed 1,510 fish-boats per day.

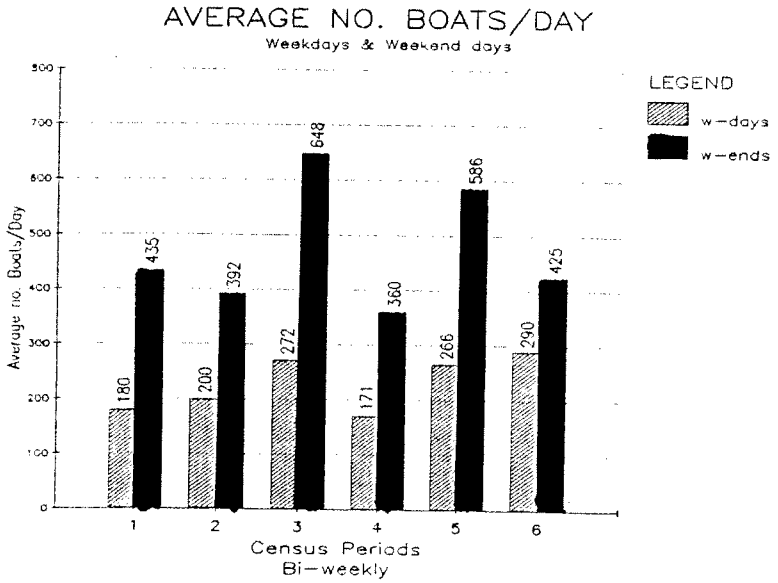

Figure 7. Average number of boats per day for week and weekend days for Flathead Lake, summer, 1985.

Fish Harvest

Total harvest of fish during the 1985 summer period on Flathead Lake was 135,507 fish (Table 8) and represented 96.5 percent of all fish caught. A total of 129,304 kokanee (95.4 percent of all fish) represents the largest number of any species harvested. Other fish harvested included 2,250 yellow perch, 1,600 lake trout, 884 cutthroat trout, 655 bull trout, and 814 fish of "other" species.

Table 8. Total estimated number of fish harvested and released in Flathead Lake, 19 June through 7 September, 1985.

	Number of Fish						
Shallow Angling	Kok	Lt	Dv	Ct	Yp	Others	Total
Harvested	129,304	460	482	884	2,250	814	134,194
Released	3,389	138	334	121	--	--	3,982
Total	132,693	598	816	1,005	2,250	814	138,176
Deep Angling							
Harvested		1,140	173				1,313
Released		690	276				966
Total		1,830	449	2,279			
All Angling							
Harvested	129,304	1,600	655	884	2,250	814	135,507
Released	3,389	828	610	121			4,948
Total	132,693	2,428	1,265	1,005	2,250	814	140,455

Catch Distribution and Fish Sizes

Seasonal and spacial catch patterns of the target species, can be drawn when comparing the estimated catch figures summarized for the six census periods and for the four lake areas (Table 9 and Table 10).

Table 9. Estimated catch of fish by census period (bi-weekly) for Flathead Lake, summer, 1985.

Census Period	Fish Species — Numbers of Fish: Bull Trout	Lake Trout	Cutthroat Trout	Kokanee	Total
1	224	786	155	18,168	19,333
2	595	1,000	386	19,094	21,075
3	186	214	193	19,670	20,263
4	37	107	0	18,972	19,116
5	74	286	155	29,649	30,164
6	149	35	116	27,140	27,440
Total	1,265	2,428	1,005	132,693	137,391

Table 10. Estimated catch of fish by lake area (quadrants) for Flathead Lake, summer, 1985.

Lake Area	Fish Species — Numbers of Fish: Bull Trout	Lake Trout	Cutthroat Trout	Kokanee	Total
A	260	464	77	8,997	9,798
B	37	500	233	6,465	7,235
D	149	536	270	3,089	4,044
E	819	928	425	114,142	116,314
Total	1,265	2,428	1,005	132,693	137,391

An average of 22,115 kokanee were caught each bi-weekly period during the 1985 season. The largest salmon catch occurred during census Period 5, when 29,649 fish were caught. It was during this same period that the highest fishing pressure was experienced. Area E, the north eastern quadrant, yielded 114,142 salmon or 86.0 percent of all salmon caught.

The average size of kokanee during the summer creel census was 12.8 inches (326 mm total length - T.L.), and ranged from 9.6 to 14.0 inches T.L. The majority (90 percent) of the salmon caught were 4-year old fish which ranged in size between 11.4 and 14.0 inches (Hanzel 1986).

Nearly three-fourths of all lake trout were caught by mid-July, or during Periods 1 and 2, with Area E yielding the largest catch. The lake trout catch was similar between the remaining lake areas.

The lake trout caught averaged 27.5 inches and ranged in size from 16.5 to 42.1 inches. The heaviest lake trout checked weighed 30 pounds. Several other 30-plus pound lake trout were reported to have been caught during the census. Small lake trout, measuring less that 28 inches and/or weighing less than 10 pounds, represented 63.3 percent of the total catch. Although measurements of released lake trout were not recorded interviewed anglers said most fish released were in the 10-pound or less size range. The frequency of small lake trout in the catch has progressively increased during the last 5-years inferring either an increase in the numbers of small lake trout or a decrease in the number of larger trophy sized fish.

Fishing regulations for the large trophy size lake and bull trout were changed in 1982 from a daily limit of ten pounds and one fish, not to exceed two fish (all trout species included in limit) to one bull trout and one lake trout daily. This change was implemented to protect the larger sized trophy trout fishery. Again in 1984, to offer some protection for the large trout the regulations were changed to one bull trout and one lake trout or two lake trout. With this regulation in effect during the 1985 fishing season, census clerks found that most anglers keep only large fish which prompted a change; the present daily limit for the large trout is one bull trout and five lake trout, one of which can be larger than 28 inches.

Catch figures for the bull trout showed more fish were caught during the earlier census periods and reaching a peak during mid-July, Period 2. Catch thereafter tapered off with a slight increase in early September, Period 6. Over eighty-five percent of all the bull trout were caught in the two northern quadrants of the lake, Areas A and E.

The average size of the bull trout caught was 19.9 inches and ranged from 13.5 to 26.0 inches. Although the heaviest bull trout weighed 7.0 pounds, catches of larger fish (largest 16.5 pounds) were reported. The catch of bull trout was evenly distributed within the size range.

Season catch success for cutthroat trout resembled the catch pattern of the other target species; that of showing more fish being caught during the early part of the census and then dropping off at it conclusion. Kokanee did not follow this catch pattern.

The average length of cutthroat trout caught was 14.1 inches and ranged from 9.1 to 18.5 inches. The largest cutthroat trout weighed was 4.0 pounds. Although rumors of a reported catch of a

7-pound cutthroat trout along the west shore could not be substantiated, it is worthy mentioning since a fish this large has never been previously reported or described being caught in Flathead Lake. Thirty percent of cutthroat trout were within a size group from 11.5 to 12.0 inches.

DISCUSSIONS

The 1985 summer pressure estimate of 53,895 angler days represents a 104 percent decrease from the 110,155 angler days estimated in 1981 (Graham and Fredenberg 1982). This 1981 summer pressure estimate is an extraction of the their total boat angling pressure for the months of June through September. The technique for calculating angling pressure was the major difference between these two census programs. Graham and Fredenberg,1982 estimated pressure by expanding car counter data accumulated at 10 state-owned access sites. If the car count data is an indicator of general visitor use and in turn a trend in angling use around the lake, then a comparison of these annual use figures (Pacini 1986) would reflect changes in fishing use (Table 11). A comparison of these car count figures for the years 1981 and 1985 showed that general use on Flathead Lake increased 23.2 percent, contrary to the 2-fold decrease in angling pressure estimates. The data also showed that general use decreased 3.8 percent in 1982 which was followed by increases of 2.3, 17.4 and 3.2 percent for the years 1983,1984,1985, respectively. It should be noted that in 1984 the State started to charge for both day and overnight use in their access sites around Flathead Lake. Such a change could show use changes when only comparing car counter data. Charges for overnight use only in parks around the lake was initiated sometime prior to 1980.

Table 11. Estimates of annual use* by recreationists from nine state owned accesses around Flathead Lake and Glacier National Park, 1985. Use figures in millions (1,000,000).

Year	9 State Owned Accesses		Glacier National Park	
1980	0.224		1.475	
1981	0.183	-	1.786	+
1982	0.176	-	1.666	-
1983	0.180	+	2.204	+
1984	0.218	+	1.946	-
1985	0.225	+	1.580	-

*--Visitor days; State Accesses- Memorial Day to Labor Day; Glacier National Park - annual visitation.
+ or -: increase or decrease trend from previous year.

Other factors that could cause changes in the fishing use estimates from car count data might include: 1) average number of persons per car; and 2) percentage of fishing boats that utilize state owned access areas. Average number of persons per car ranged from 2.10 to 3.35 between 1981 and 1985, respectively; a change of 1.25 persons/car. If the 1981 total recreational use, from car-count data was expanded using the same number of persons per car found during 1985 of 3.35 person per car; then total recreational use in 1981 would be nearly 20,000 more recreational vehicles or 67,000 more recreationists than was estimated in 1985. Such a difference would suggest that there was a decrease in general use around the lake and in turn reflect a decrease in angling pressure experienced in 1985. Care should be used in selecting the method of calculating the number of persons per car; particularly when attempting to compare estimates using car counter data.

Interviewed boat anglers in 1981 indicated that 24 percent used state-owned access (were counted by the car counters) whereas boat anglers in 1985 expressed 60.3 percent used state owned access sites.

An additional aspect that could contribute to pressure estimate differences might be a change in the percent of recreational users that engage in angling. Knupp (1986) found that during 1985, 35 percent of the summer recreational users engaged in fishing. This angling percentage ranged from 23 to 68 percent within six state-owned accesses. Non-recreational use in 1981 totaled 24.4 percent of state owned park car count use.

The annual trend count of fishing boats in the vicinity of Wildhorse Island, south west area of the lake, followed the decreased usage by fishing boats when comparing counts of 3,045 and 709 fishing boats for 1981 and 1985, respectively (Thomas 1985). These counts were derived from a summary of boat counts made during the summer (June through mid-September) while a park warden was patrolling the 1,165 acre island two times per day; mid-morning and mid-afternoon. Patrols were normally scheduled for both weekend days and all holidays, weather permitting, and on two week days.

General visitor use trends to the Flathead Valley has sometimes been based upon recreational visitor use in Glacier National Park (Brock, et al. 1984). A comparison of use in the park from 1981 to 1985 (Glacier National Park 1985) did show a decrease of 11.6 percent in use; a use pattern different than that shown around Flathead Lake (Table 11).

There were similarities in the 1981 and 1985 census programs. Catch rates for kokanee and percentage of fish caught and released were comparable between the two census programs as well as the length of trip and persons per boat.

The Department's angler mail census pressure estimates (Montana Dept. Fish Wildlife & Parks 1986) for Flathead Lake were 168,729; 91,944; 103,496; and 77,734 man-days for the years 1981-82 through 1984-85, respectively. These estimates are the annual angler use for the period, May through April the following year; as compared to the period, mid-June through mid-September for the 1985 summer census.

Robbins (1965) estimated 129,000 angler days during the 1962-63 fishing year and 117,000 angler days during the period May through November, 1963. Summer fishing represented 74.5 percent of the total annual pressure in both the 1962-63 and 1981 census programs. This percentage could be used as a factor to calculate summer use from a annual total pressure estimate. If so applied to the 1985 summer data, total annual angling pressure would be estimated as 234,331 hours or 72,117 angler days. Such a total is possible, when considering that 15,000 angler-days of pressure were exerted during a winter kokanee fishery (January through March) in a southern bay area--Skidoo Bay (Beattie 1986). The only fishery not yet included in this 1985 annual estimate for Flathead Lake is the pressure expended on the southern portion of the lake (Polson Bay). This fishery occurs primarily during the winter and is wholly for perch. Estimates of pressure in Polson Bay total 5,165 hours on 1,308 angler days (Pajak, et al. 1986). The revised angling pressure for the entire lake would then total 239,496 hours or 73,425 angler days for 1985.

Based on analysis of past creel surveys, it is believed that the most accurate pressure estimate would be derived from direct count data. The best estimate of summer pressure was made in 1985 when instanteous aerial boat counts were made. Direct counts were used in the specialized winter fisheries of Skidoo and Polson Bays.

RECOMMENDATIONS

It is recommended that if a census is repeated it should start in mid-April and continue through the first week of September. This time frame would cover the two-month spring fishery for cutthroat, bull, and lake trout.

Changes in age, growth and distributional patterns in the target species should be assessed in relation to the recent dynamic increases of the lakes' mysis shrimp population.

Changes in age composition and size of lake and bull trout should be monitored in relation to changes in angling regulations.

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