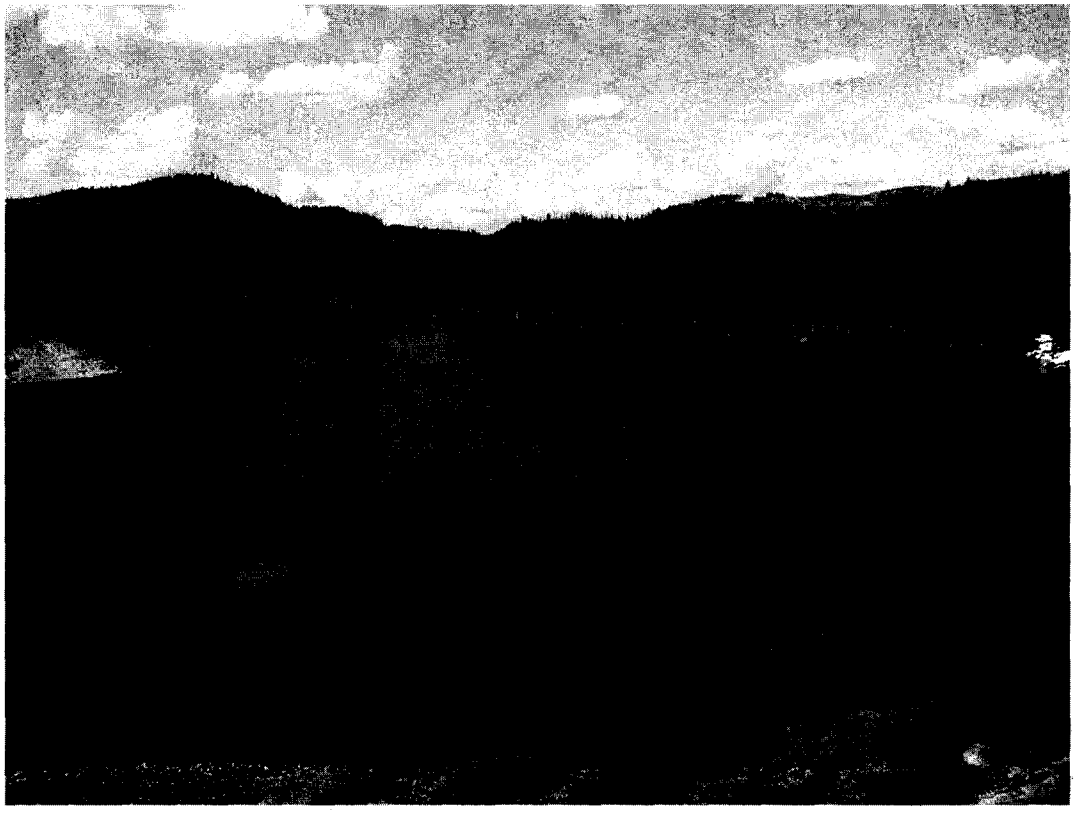
2006 CLEARWATER REGION LOWLAND LAKES AND RESERVOIR MANAGEMENT PLAN



By

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2006 Clearwater Region Lowland Lakes and Reservoir Management Plan

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2006 Clearwater Region Lowland Lakes and Reservoir Management Plan

ABSTRACT

The Idaho Department of Fish and Game (IDFG) Clearwater Region has a diversity of fishing opportunities. However, many of these fisheries have restrictive harvest regulations or access. Because of these restrictive regulations and access, the lowland lake and reservoir management program has been designed to provide additional fishing and harvest opportunities for anglers.

In these waterbodies, fisheries personnel conduct fish community surveys on a three-year rotating schedule utilizing electrofishing, gill nets, and trap nets. An intensive creel survey is conducted every six years, consisting of a minimum of two weekend surveys and two weekday surveys at each reservoir or lake every week for a calendar year. Additional data collected includes monthly dissolved oxygen readings, and temperature profiles.

Catchable size hatchery trout are used extensively in this program. These fish provide an easily accessible harvest opportunity and meet high angler demand. They are managed to provide a catch rate of 0.5 fish/hour. In 2005, catch rates ranged from 0.8–1.5 fish/hour for hatchery trout on surveyed waters. Creel survey results have shown they account for an average of 72.3% of the fish harvested from the region's lowland lakes and reservoirs.

Several of the region's lowland reservoirs and ponds are experiencing excessive aquatic vegetation and algae growth which can limit fishing and/or boating opportunities, and adversely affect the predator-prey balance. It has also led to oxygen depletion. Poor water quality in Winchester Lake and Waha Lake are being addressed with hypolimnetic aeration systems. In Elk Creek Reservoir, barley straw has been utilized to combat excessive algae growth. The barley straw has met with limited success and should be discontinued in favor of more effective treatments. The use of other herbicides, and mechanical or biological control should be explored to determine more effective ways of controlling aquatic vegetation in Elk Creek Reservoir, Moose Creek Reservoir, Spring Valley Reservoir, and Winchester Lake.

Introduction

The IDFG Clearwater Region has a diversity of fishing opportunities. However, many of these fisheries are restrictive in nature: large rivers with anadromous fisheries, high elevation rivers and streams with restrictive regulations to manage wild cutthroat trout populations, and mountain lakes with difficult access. Because of these restrictive regulations and access, the lowland lake program has been designed and managed to provide additional fishing and harvest opportunities with easy access. Managing this program is a priority for the Clearwater Region fisheries staff.

In 2003, IDFG conducted a statewide survey of Idaho's anglers. The results of this survey indicated that anglers fished 3,908,747 days in Idaho, generating $437,631,734 in statewide retail sales, not including $12.3 million spent on fishing licenses and permits (Grunder et al. 2008). These numbers illustrate how important fishing is to Idaho's economy. In the Clearwater Region alone, anglers fished 599,331 days, and spent $82,513,962 during 2003 (Table 1). The Clearwater Region manages fisheries in nine lowland lakes and reservoirs: Deer Creek Reservoir, Elk Creek Reservoir, Mann Lake, Moose Creek Reservoir, Soldier's Meadow Reservoir, Spring Valley Reservoir, Tolo Lake, Waha Lake, and Winchester Lake. Eight of these waters (Deer Creek Reservoir was not completed in 2003) accounted for 88,579 days of fishing and over $3.6 million in economic value to the region in 2003 (Table 2).

Creel surveys indicate that the lowland lakes in the Clearwater Region account for approximately 148,065 hours (average of surveys conducted in 1993, 1999, and 2005) of fishing effort annually. Individually, the lakes range from a low of 3,877 hours of effort annually at Waha Lake to a high of 43,097 hours of effort annually at Winchester Lake (Figure 1). On average, this effort consists of 74.4% bank, 20.6% boat, and 5.0% ice fishing hours. Anglers average 234,096 fish caught and 149,139 fish harvested (Figure 2) annually. Average catch rates range from 1.3–2.2 fish/hour (Figure 3), and average harvest rates range from 0.8–1.6 fish/hour (Figure 4).

Due to their recreational and economic importance, lowland lakes and reservoirs are an integral part of the state's fisheries management program (IDFG 2007). Therefore, several objectives have been developed to guide the management of these bodies of water. They are:

1. Provide a diversity of angling opportunities of types desired by the public.

2. Maintain or enhance the quality of fish habitat.

3. Fully utilize fish habitat capabilities by increasing populations of suitable fish species to carrying capacity of the habitat.

4. Maintain or improve angler success rates for fishable species.

To meet these goals and angler needs, a variety of management tools are utilized by the region's fisheries management staff. A diversity of angling opportunity has been created through the stocking of various fish species, the use of special regulations, and the development of a family fishing water program.

Figure 1. Estimated angler effort from creel surveys of eight lowland lakes and reservoirs in the Clearwater Region in 1993, 1999, and 2005.

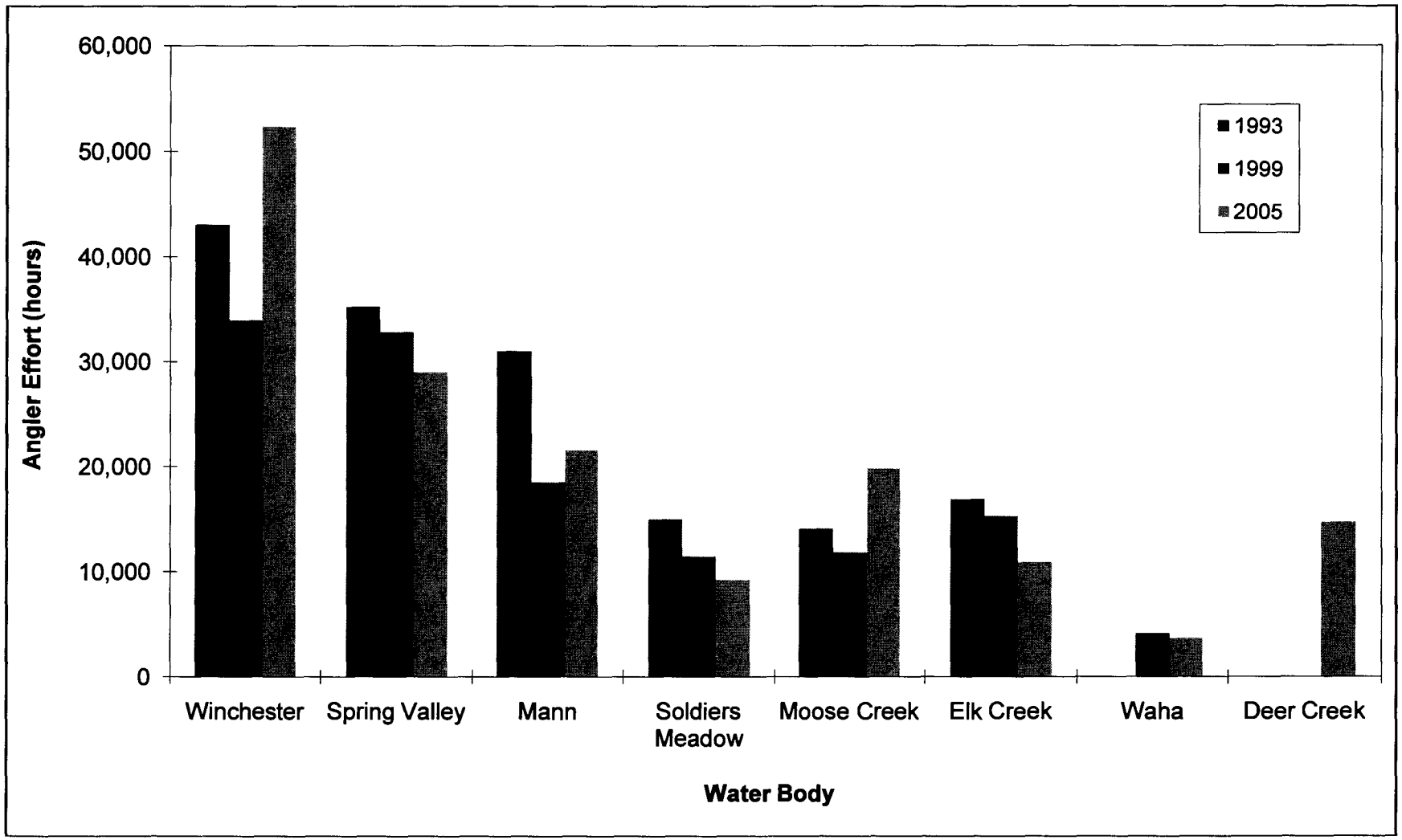


Figure 2. Estimated angler harvest from creel surveys of eight lowland lakes and reservoirs in the Clearwater Region in 1993, 1999, and 2005.

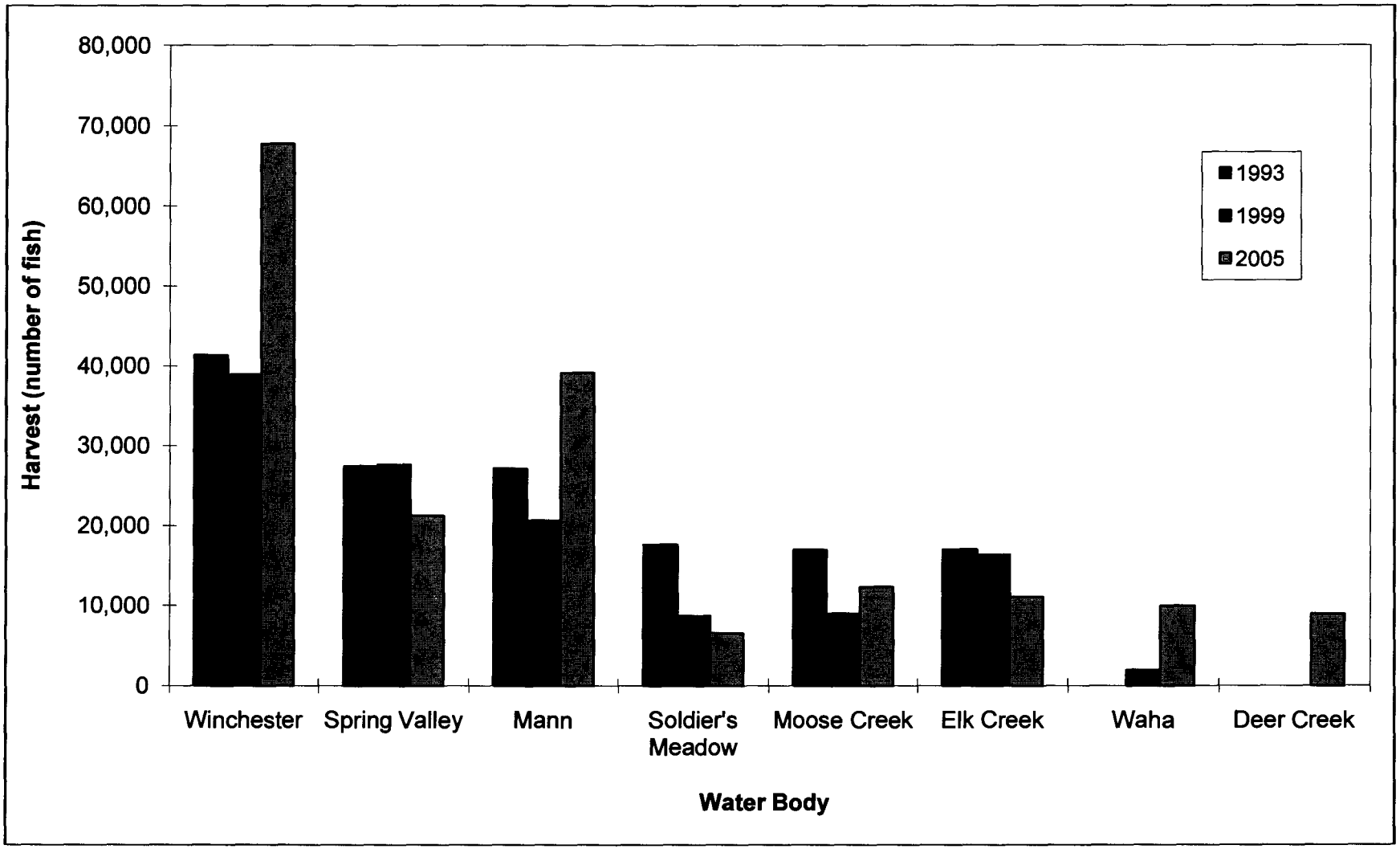


Figure 3. Estimated overall catch rates from creel surveys of eight lowland lakes and reservoirs in the Clearwater Region in 1993, 1999, and 2005.

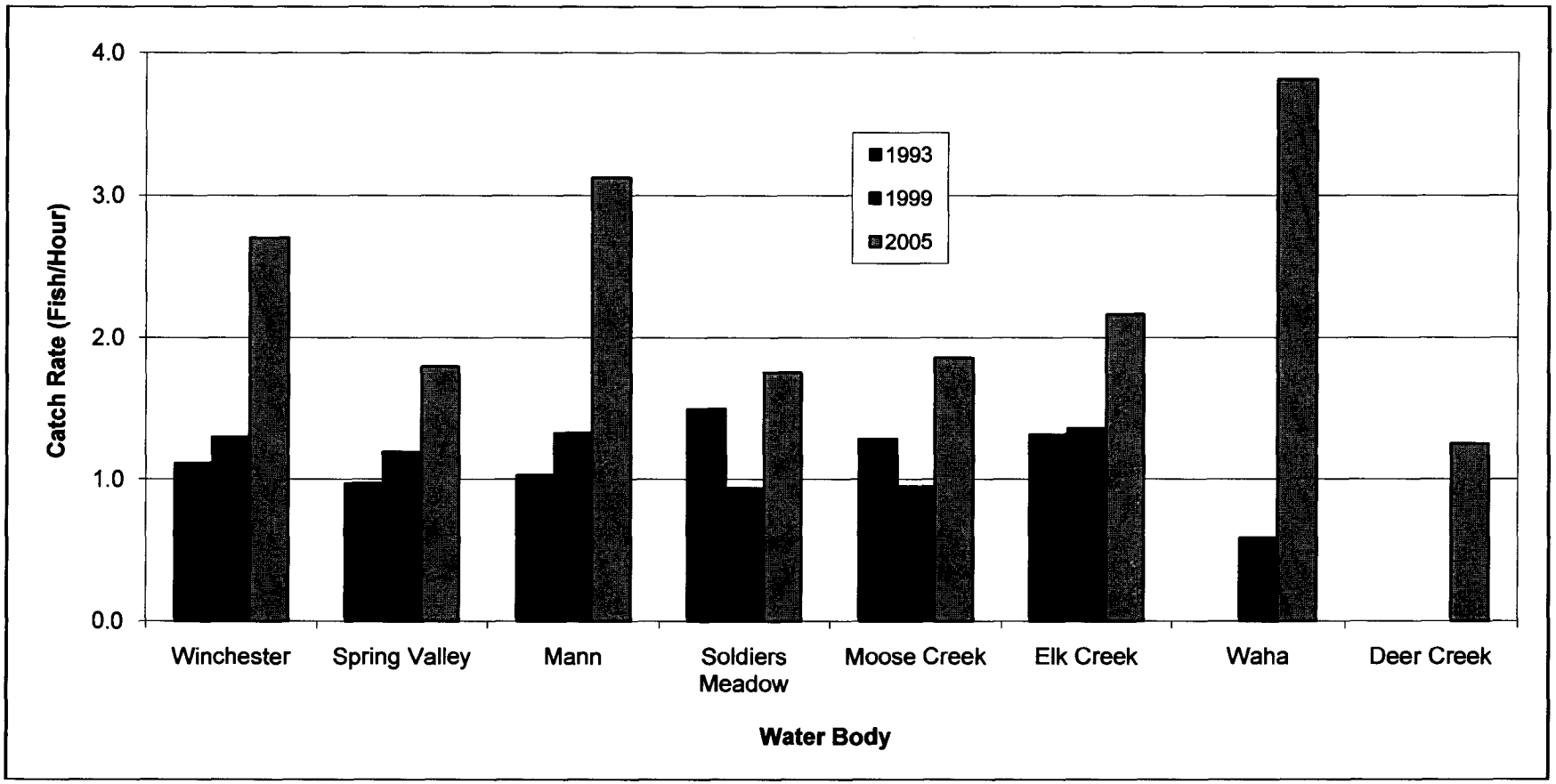
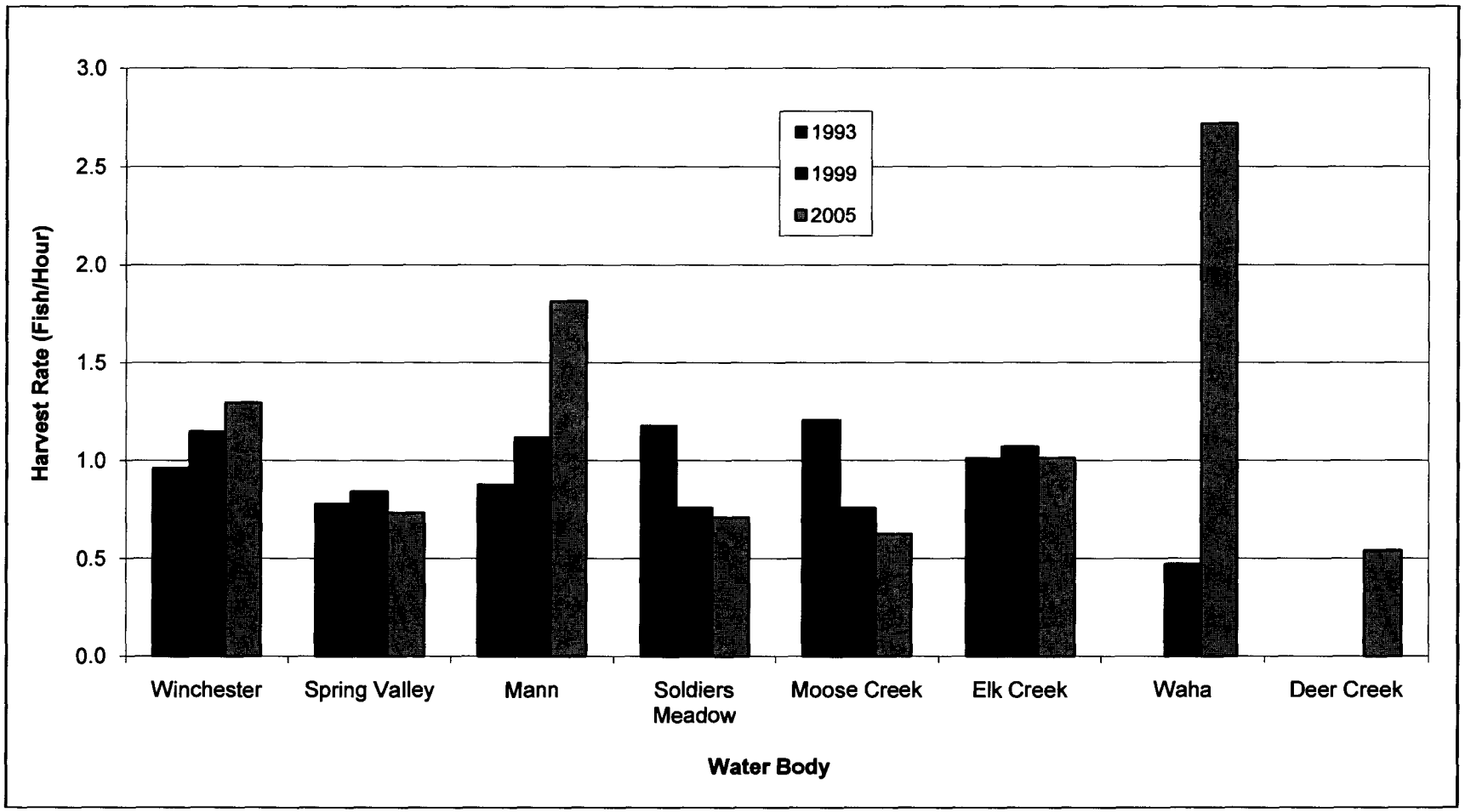


Figure 4. Estimated total harvest rates from creel surveys of eight lowland lakes and reservoirs in the Clearwater Region in 1993, 1999, and 2005.



The regional hatchery trout stocking program is primarily utilized in the lowland lake and reservoir program. This is due to the general failure of stocking hatchery trout in rivers and streams to meet pressure demands, and the low return to creel that makes these stockings economically infeasible. As part of the lowland lake program, hatchery trout provide an easily accessible harvest opportunity, they create an "instant" fishery when they are stocked, and they meet very high angler demand in areas where natural reproduction is unable to match the harvest pressure. Catchable size (203 mm – 254 mm) hatchery rainbow trout *Oncorhynchus mykiss* are stocked at the times and places where they will be most available to anglers. They are the primary fishery in the lowland lake program, and are managed with a goal of maintaining a catch rate of 0.5 fish/hour for all fish in each waterbody. In 2005, catch rates for hatchery trout alone in individual lakes ranged from 0.8 – 1.5 fish/hour (Figure 5), all above the 0.5 fish/hour overall catch rate goal for lowland lakes. Creel survey results have shown hatchery trout account for an average of 72.3% of the fish harvested from the region's lowland lakes and reservoirs (Table 3).

In addition to hatchery catchable trout, fingerling trout are also stocked in our lowland lakes and reservoirs. The fingerling program is funded by the Lower Snake River Compensation Plan as mitigation for the loss of fisheries due to the construction of the lower Snake River dams. By stocking fingerling trout, we can utilize the natural production that occurs in the lakes to facilitate a put-grow-take fishery. Because these fish are raised in a natural setting, they are often a more desirable fish for anglers. Although these fish return to the creel at lower rates than the catchables, they are substantially cheaper to stock. Fingerling rainbow trout are stocked in most of the area lowland lakes. Additionally, fingerling westslope cutthroat trout are stocked in Deer Creek Reservoir to provide diversity of opportunity.

The lowland lakes in the Clearwater Region also provide excellent fishing opportunities for warmwater species such as largemouth bass *Micropterus. salmoides*, yellow perch *Perca flavescens*, bluegill *Lepomis macrochirus*, pumpkinseed *L. gibbosus*, crappie *Pomoxis sp.*, channel catfish *Ictalurus punctatus*, and black bullhead *Ampiurus melas*. Largemouth bass in the region are managed to provide a diversity of opportunity based on the fishery each body of water is capable of producing. Tiger muskie *Esox lucius* X *E. masquinongy*, have been stocked into Winchester Lake to provide a trophy component in the lowland lake program. These fish have a 1,016 mm minimum size limit.

Family fishing waters were developed in response to angler's requests for more family-oriented fishing opportunities and simplified regulations. These locations were selected to provide settings for a great fishing trip for families, children, and first time anglers. The simplified regulations include: year round seasons, no length limits, general six fish limit for trout and bass, no creel limits for other species, and no restrictions on fishing gear. Six of the Clearwater Region lowland lakes have been designated as family fishing waters: Deer Creek Reservoir, Soldier's Meadow Reservoir, Spring Valley Reservoir, Moose Creek Reservoir, Tolo Lake, and Winchester Lake.

An important component of creating and maintaining good fisheries is managing the habitat in which they live. Currently, the region has several projects aimed at improving habitat conditions in the region's lowland lakes. Many of the lowland lakes are experiencing eutrophication, which is a continued increase in nutrient levels (mostly phosphorus) in a water body. These nutrients primarily come from human sources, (referred to as cultural eutrophication) and result in algae blooms, dense littoral vegetation, and reduced water transparency. Excessive macrophyte growth can inhibit fishing and boating, and adversely affect the predator-prey balance by providing too much cover for prey. The entire fish

Figure 5. Estimated catch rates of hatchery rainbow trout from creel surveys of eight lowland lakes and reservoirs in the Clearwater Region in 2005.

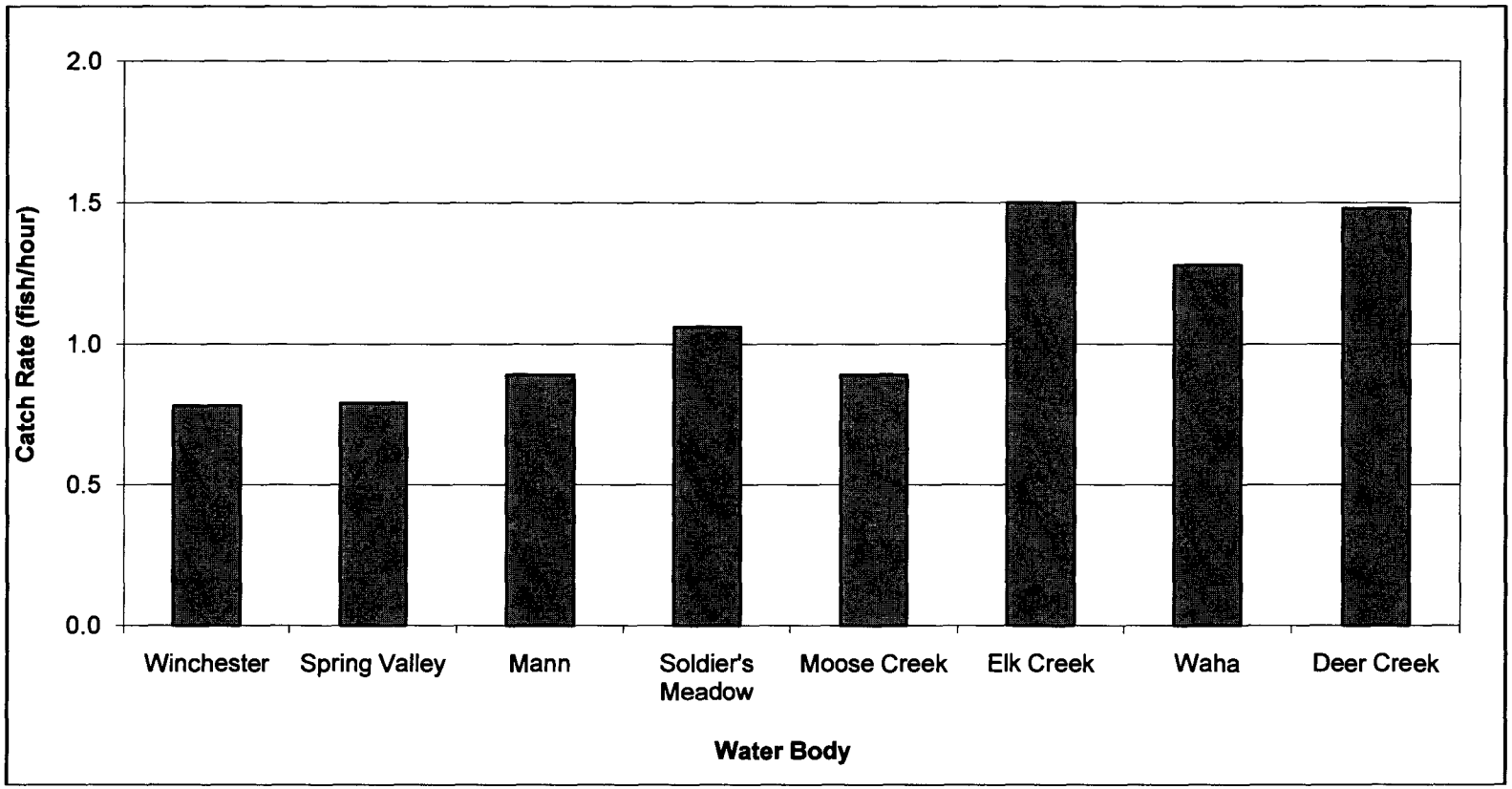


Table 3. Estimates of return rate to creel and percent of fishery supported by hatchery rainbow trout for lowland lakes and reservoirs in the Clearwater Region in 1993, 1999, and 2005.

1993

Lake	Total Harvest (all fish)	Hatchery Rainbow Trout							
		Hatchery trout harvested	Catchables Stocked	Catchables Harvested	fingerling trout % of trout harvest	Catchable Return Rate	% of fishery supported by	Catch Rate (fish/hour)	Harvest Rate (fish/hour)
Winchester Lake	41,317	40,739	42,288	25,543	37	0.60	98.6	-----	0.95
Spring Valley Reservoir	27,417	26,924	45,000	26,116	3	0.58	98.2	-----	0.76
Mann Lake	28,471	24,365	42,290	24,203	1	0.57	85.6	-----	0.79
Soldier's Meadow Reservoir	17,620	15,893	15,070	11,888	25	0.79	90.2	-----	1.06
Moose Creek Reservoir	16,990	14,187	20,650	14,187	0	0.69	83.5	-----	1.01
Elk Creek Reservoir	17,027	16,755	30,210	15,900	5	0.53	98.4	-----	0.95
Total	148,842	138,863	195,508	117,837	11.8	0.63	92.4	-----	0.92

1999

Lake	Total Harvest	Hatchery Rainbow Trout							
		Hatchery trout harvested	Catchables Stocked	Catchables Harvested	fingerling trout % of trout harvest	Catchable Return Rate	% of fishery supported by	Catch Rate (fish/hour)	Harvest Rate (fish/hour)
Winchester Lake	39,171	21,622	35,000	21,622	0	0.62	55.2	-----	0.64
Spring Valley Reservoir	27,668	22,826	32,530	22,826	0	0.70	82.5	-----	0.70
Mann Lake	21,085	12,546	35,000	12,546	0	0.36	59.5	-----	0.68
Soldier's Meadow Reservoir	8,667	8,407	13,391	8,407	0	0.63	97.0	-----	0.74
Moose Creek Reservoir	9,057	7,961	17,450	7,961	0	0.46	87.9	-----	0.67
Elk Creek Reservoir	16,337	10,962	27,500	10,962	0	0.40	67.1	-----	0.72
Waha Lake	1,934	1,582	5,500	1,582	0	0.29	81.8	-----	0.39
Total	123,919	85,906	166,371	85,906	0	0.49	75.9	-----	0.65

2005

Lake	Total Harvest	Hatchery Rainbow Trout							
		Hatchery trout harvested	Catchables Stocked	Catchables Harvested	fingerling trout % of trout harvest	Catchable Return Rate	% of fishery supported by	Catch Rate (fish/hour)	Harvest Rate (fish/hour)
Winchester Lake	67,741	23,560	32,225	23,560	0	0.73	34.8	0.84	0.45
Spring Valley Reservoir	21,246	13,907	33,126	13,907	0	0.42	65.5	0.79	0.48
Mann Lake	39,122	8,271	34,600	8,271	0	0.24	21.1	0.89	0.38
Soldier's Meadow Reservoir	6,531	4,791	21,800	4,791	0	0.22	73.4	1.06	0.52
Moose Creek Reservoir	12,347	10,222	12,210	10,222	0	0.84	82.8	0.89	0.52
Elk Creek Reservoir	11,047	10,392	34,342	10,392	0	0.30	94.1	1.50	0.95
Waha Lake	9,919	2,357	8,400	2,357	0	0.28	23.8	1.28	0.65
Deer Creek Reservoir	8,929	8,929	20,387	8,929	0	0.44	100.0	1.43	0.59
Total	176,882	82,429	197,090	82,429	0	0.43	61.9	1.09	0.57

community can be jeopardized when dense plant growth decomposes, as this creates a large biological oxygen demand and can result in depleted oxygen levels in lakes and reservoirs.

Elk Creek Reservoir suffers from an annual filamentous algae bloom in the upper third of the reservoir due to excess nutrients. These nutrients originate primarily from the effluent of the town of Elk River's waste treatment plant. Over the past four years, this algae problem has been addressed through the use of barley straw as a natural algaecide. In the past, commercial algaecides have not been used due to the copper compounds they contain, which would be lethal to trout in the water conditions found in the reservoir. However, new algaecides have been developed that utilize peroxide compounds that are not lethal to trout. These new products could effectively control nuisance algae in trout waters.

Another project is aimed at addressing poor water quality in Winchester Lake. High phosphorus levels in both the water and the bottom sediments are causing excessive algae blooms and aquatic vegetation growth, poor water clarity, and low dissolved oxygen levels. Many options were carefully considered for reducing the amount of phosphorus in the lake, including several aeration methods, chemical treatment, dredging, and hypolimnetic water withdrawals. Of these, hypolimnetic aeration was determined to be the best option. This system works by taking water from the bottom of the lake, bringing it to the surface where it is oxygenated by contact with air, then returning it to the bottom of the lake. By increasing the level of oxygen in the hypolimnion, we reduce the amount of phosphorus that can be released into the water, thus reducing the amount of "fertilizer" available for algae. This in turn reduces the loss of oxygen in the hypolimnion due to decomposition of aquatic vegetation, breaking the phosphorus cycle. The result is less algae and vegetation growth and more habitat available for fish. Eight aeration units have been placed in the deeper areas of Winchester Lake. Two additional units have been installed in Waha Lake to improve oxygen levels in the hypolimnion.

Methods

Fish community surveys are performed using IDFG standard survey protocol (Appendix A). Results are reported in catch-per-unit-effort (CPUE). One "unit" of effort consists of: one hour of boat electrofishing, one floating and one sinking gill net, and one trap net. All standard lowland lake surveys in the Clearwater Region utilize one unit of effort per survey. Boat mounted electrofishing is conducted using pulsed D.C. current from a portable generator and a Coffelt VVP-2E pulsator. Standard floating and sinking experimental gill nets are 46 meters long by two meters deep with six panels of different size mesh. Mesh sizes are 2 cm, 2.5 cm, 3.2 cm, 3.8 cm, 5.1, and 6.4 cm square. Indiana style trap nets consist of a front box maze of two 0.76 m wide by two meter high steel frames with center braces and four 0.76 m diameter hoops with two 20 cm throats, and a 15 m long x 1 m high leader. Mesh size is 2 cm throughout. Fisheries management personnel also utilize these standard electrofishing, trapping, and netting techniques for trapping and transplanting fish.

Creel surveys were conducted over one calendar year. Uniform sampling with one day period (from 0.5 hours before sunrise to 0.5 hours after sunset) was utilized. Sampling intervals were two weeks long. In 1993 and 1999 surveys, interviews and angler counts were conducted a minimum of 2 weekdays and 2 weekend days per interval. For the 2005 survey, interviews and angler counts were conducted a minimum of 4 weekdays and 4 weekend days per interval. Instantaneous counts of anglers, total hours fished, number of fish caught, fish species, and fish lengths were all recorded. We used the creel census computer program developed by MacArthur (2005) to calculate estimates and confidence intervals.

Deer Creek Reservoir

Introduction

Deer Creek Reservoir is a 47 hectare reservoir located in Clearwater County near the town of Headquarters at an elevation of 1,006 meters.

Species Composition

The reservoir contains three species of game fish: 1) westslope cutthroat trout, 2) brook trout, and 3) rainbow trout. Dace *Rhinichthys sp.* are the only non-game fish found in the reservoir.

Current Management

Deer Creek Reservoir is a coldwater fishery. It is managed for a put-and-take rainbow trout fishery, and a put-grow-and-take cutthroat trout fishery. Catchable rainbow trout and fingerling westslope cutthroat trout are stocked annually to maintain an overall catch rate of 0.5 fish/hour. The reservoir is designated as a Family Fishing Water with simplified regulations including year-round seasons, no length limits, general six fish limit for trout and bass, no creel limits for other species, and no restrictions on fishing gear. Gas motors are allowed, but may only be operated in such a way as to not create a visible wake. Deer Creek Reservoir is open to fishing year- round; however, road access is restricted from October 1–May 19.

Management Objectives

1. Meet seasonally high angler demand with catchable size rainbow trout stockings.
2. Maintain overall catch rate of 0.5 fish/hour.
3. Provide a put-and-grow cutthroat trout fishery.

Current Population Data

Creel Surveys

Total angler effort on Deer Creek Reservoir during 2005 (May 20–September 30) was estimated at 14,709 hours. The creel survey was conducted only during this time period due to the closure of road access from October 1–May 19. The effort consisted of 63.4% bank and 36.6% boat (Figure 6). No ice fishing was observed during the survey; however, limited ice fishing does occur on the reservoir. Deer Creek Reservoir supported 313 angler effort hours per hectare (127 hours per acre).

Anglers caught an estimated 21,838 fish from Deer Creek Reservoir during 2005, resulting in a catch rate of 1.4 fish/hour (Figure 3). Anglers harvested 8,929 fish from Deer Creek Reservoir during 2005 (Appendix B), 40.9% of the total fish caught. The harvest rate was estimated to be 0.6 fish/hour (Figure 4). Hatchery rainbow trout accounted for 100% of the harvest (Figure 7). Anglers released 12,908 (59.1%) of the hatchery trout they caught.

In addition to the catchable size rainbow trout, fingerling westslope cutthroat trout have also been stocked into the reservoir. These fish should begin appearing in the creel in 2006. Brook trout are also present in the reservoir, but none were observed in the creel survey.

Stocking

A stocking history for Deer Creek Reservoir is shown on Table 4.

Limnology

Historical temperature and dissolved oxygen profiles are shown in Table 5. A bathymetric map is shown in Figure 8.

Management Recommendations

1. Maintain annual stocking of 20,000 catchable rainbow trout and 5,000 fingerling westslope cutthroat trout.

   Justification: Provide harvest opportunity for rainbow trout, a westslope cutthroat trout fishery, and maintain the total catch rate objective of 0.5 fish/hour.

2. Conduct standard management surveys and monitoring:
   a. Standard lowland lake population survey every three years.
   b. Creel survey every six years.
   c. Monthly water quality monitoring: Dissolved Oxygen (D.O)/temperature profiles (April–Oct.); Zooplankton Index (ZPI) (August) (Teuscher 2001).

   Justification: Provide the population, effort, harvest, and limnological data needed to maintain the objectives of a harvest fishery for rainbow trout and a quality westslope cutthroat trout fishery, and to direct future management decisions.

Figure 6. Estimated angler effort, by type, from a creel survey of Deer Creek Reservoir, 2005.

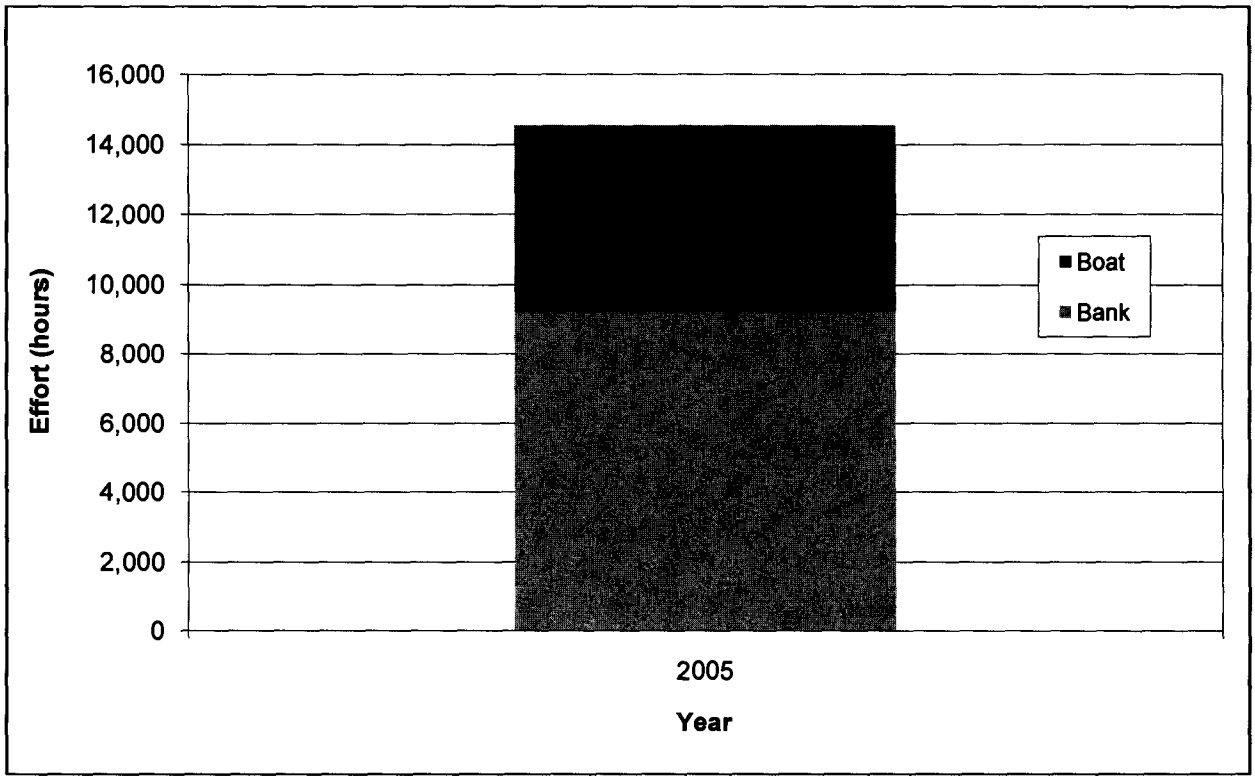


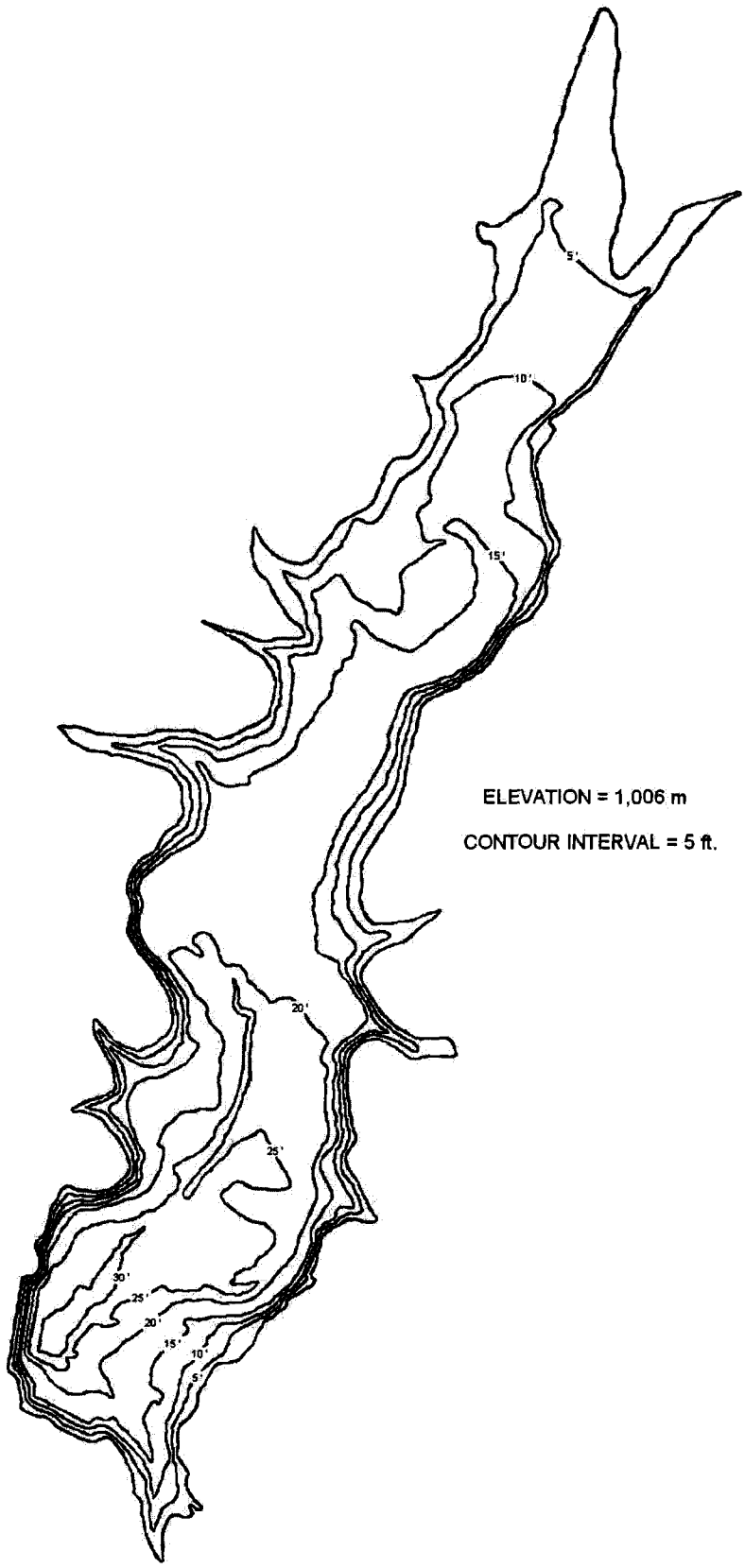
Table 4. Stocking history for Deer Creek Reservoir.

Year	Catchable Rainbow	Fingerling Cutthroat
2004	20,000	14,994
2005	20,387	4,881

Table 5. Historical temperature and dissolved oxygen profiles (mg/l) for Deer Creek Reservoir.

2005					
Depth (m)	May	June	July	August	September
0	8.3	9.5	7.0	6.4	3.4
1	7.5	9.8	6.7	6.1	3.5
2	6.7	10.1	6.9	6.0	3.6
3	4.6	4.6	3.3	5.9	3.6
4	3.0	1.1	0.2	3.6	3.8
5	0.5	0.3	0.2	0.1	3.7
6	0.2	0.2	0.1	0.1	0.1
7	0.2				0.1
8	0.2				0.1

Figure 8. Bathymetric map of Deer Creek Reservoir (47 ha).



Elk Creek Reservoir

Introduction

Elk Creek Reservoir is an 18.7 ha reservoir located in Clearwater County 3.2 km southeast of Elk River, Idaho at an elevation of 945 meters. Potlatch Corporation originally constructed Elk Creek Reservoir as a log-holding pond. The original dam washed out in 1937 and was reconstructed in 1950. The reservoir was chemically treated in October 1950 prior to refill. The IDFG reconstructed the dam and spillway most recently in 1987. IDFG owns the land surrounding Elk Creek Reservoir, while the Elk River Recreation District manages it for camping and day-use recreation such as fishing, swimming, overnight camping, and organized boat races.

Species Composition

Elk Creek Reservoir contains eight species of game fish: (1) brook trout, (2) pumpkinseed, (3) smallmouth bass *Micropterus dolomieu*, (4) largemouth bass, (5) black bullhead, (6) black crappie *P. nigromaculatus*, (7) bluegill, and (8) rainbow trout. The only non-game fish species documented is the redside shiner *Richardsonius balteatus*.

Current Management

Elk Creek Reservoir contains a mixed fishery, with both coldwater and warmwater species present. It is managed as a put-and-take trout fishery, with catchable rainbow trout stocked annually to maintain a catch rate of 0.5 fish/hour. The reservoir is managed under statewide general fishing regulations with the exception of brook trout. Harvest for these fish in the reservoir and in Elk Creek has been limited by including them in the six trout bag limit in order to enhance the fishery in the reservoir. Additionally, fishing activity on Elk Creek Reservoir is limited to electric motors only.

The current management priority is to improve water quality. The upper end of Elk Creek Reservoir has been experiencing excessive algae and aquatic vegetation growth due to high nutrient levels. Uncontrolled algae growth can color the water green or brown, lead to nuisance surface scum, poor water clarity, noxious odors and an overall reduction in a lake's recreational value. When excessive levels or "blooms" of algae occur, it is often desirable to control the algae growth directly. Typically this is accomplished by treating the lake with commercial algaecides containing copper compounds. These chemical treatments are effective short-term controls of algae, however, re-application of these chemicals several times each year is often necessary and the long-term buildup of copper in the lake sediments is an environmental and health concern. However, copper compounds are also toxic to non-target organisms such as zooplankton and insect larvae that are important food sources for fish. Some fish species, especially trout, are highly sensitive to copper compounds, making the use of chemical treatments difficult or impossible in some lakes. In Elk Creek Reservoir, water chemistry is such that to effectively treat the algae, the concentrations of copper compounds used would be lethal to trout. Other side effects of these chemicals are long waiting periods after application before the water is again safe for irrigation, drinking, and recreational activities.

In recent years, however, the use of barley straw as an alternative method of algae control has received increased publicity. The technique of using barley for algae control was developed in England in the early 1990's, where it is widely used in many bodies of water,

including large reservoirs and canals. Barley straw works as it decomposes and releases many compounds, one of which *may* control algae populations. As "old" algae cells naturally die off, few new algae cells are produced and the algae population is controlled as long as the compound is being produced. These chemical compounds are called algistatics, meaning that they do not eliminate existing algae cells but interfere with and prevent the growth of new algae cells. Barley straw is often incorrectly referred to as an algaecide, meaning that it kills existing algae. The specific chemical(s) have not been identified, and it is unknown whether the chemicals are released by the barley itself, or if they are the produced by the fungi that decompose the straw.

The decomposition process depends on temperature and occurs faster in warmer water. When the water temperature is below 10°C, it takes approximately six to eight weeks for the decomposing straw to produce enough of the growth inhibiting chemical to effectively control algae. However, it only takes one to two weeks when the water temperature is above 20°C. Once the straw begins to produce sufficient amounts of the chemical, it is likely to control algae for four to six months. Therefore, the straw is applied in mid-late April in order to control summer algal growth in Idaho ponds and lakes. As opposed to copper based algaecides, the chemicals resulting from the decomposition of barley straw have not resulted in any documented ill effects to fish, waterfowl, or humans. The chemicals produced during this process are naturally occurring, which provides a safer control of nuisance algae in reservoirs, ponds and lakes.

Thus, over the past five years, fisheries management personnel have implemented the use of barley straw to control algae growth in Elk Creek Reservoir. However, this strategy has meet with limited results due to high fluctuations in water level, the large amount of water flowing into the reservoir, the high nutrient content of the water, and lack of a consistent management approach.

Management Objectives

1. Meet seasonally high demand with catchable size rainbow trout stockings.
2. Maintain total catch rate of 0.5 fish/hour.
3. Maintain bass and brook trout fisheries.
4. Improve aquatic habitat and water quality by controlling nuisance aquatic vegetation.

Current Population Data

Population Surveys

Clearwater Region fisheries management personnel conducted a standard lake survey of Elk Creek Reservoir on June 6, 2005. This survey resulted in the capture of 367 fish, including smallmouth bass (N = 83), largemouth bass (N = 38), black crappie (N = 100), pumpkinseed (N = 109), black bullhead (N = 28), bluegill (N = 6), and brook trout (N = 3). A comparison of catch per unit effort and percent composition between samples collected in 1995, 1997, 2001, and 2005 are shown in Figures 9 and 10, respectively. Largemouth bass, smallmouth bass, crappie, and pumpkinseed numbers have all increased since the last sample in 2001. The smallmouth bass length frequency shows that not only was there an increase in numbers, but that there was a shift toward larger fish with numerous fish over 300 mm (Figure 11). There were no smallmouth bass collected over 300 mm in the previous two samples. The largemouth bass collected were primarily in the 130 - 330 mm length range, with a few fish over 450 mm (Figure 12). In contrast to the previous two samples, no largemouth bass less than 130 mm were collected in 2005. Similarly, black crappie have also experienced a shift in size

structure toward larger fish (Figure 13). Even though pumpkinseed have seen increased in number, their length frequency distribution has stayed relatively constant over the last three surveys (Figure 14). Black bullhead numbers have increased slightly over the 2001 sample, but as with pumpkinseed, their length frequency distribution has stayed constant over the last three surveys (Figure 15). Bluegill were collected for the first time since 1997. These fish ranged in length from 60-159 mm (Figure 16). Substantially fewer brook trout were collected in 2005 than in previous samples. The three fish collected ranged from 190-259 mm in length (Figure 17).

Creel Surveys

Total angler effort on Elk Creek Reservoir during 2005 was estimated at 10,912 hours. This is a 29% decrease from the level of effort in 1999, and a 35% decrease from the level of effort in 1993 (Figure 1). The effort consisted of 70.8% bank, 27.1% boat, and 2.1% ice anglers (Figure 18). Elk Creek Reservoir supported 584 hours of angling effort per hectare (236 hours per acre) in 2005.

Anglers caught an estimated 23,591 fish from Elk Creek Reservoir during 2005, resulting in a catch rate of 2.2 fish/hour (Figure 3). This is higher than catch rates of 1.3 fish/hour during 1993 and 1.4 fish/hour in 1999. Anglers harvested 11,047 fish from Elk Creek Reservoir during 2005 (Appendix B), 47% of the total fish caught. The harvest rate was estimated to be 1.0 fish/hour (Figure 4). The harvest composition consisted of 94.1% hatchery trout, 3.3% black crappie, 1.1% bluegill, 0.9% naturally produced brook trout, 0.3% black bullhead, and 0.1% each smallmouth bass and largemouth bass (Figure 19). Brook trout harvest decreased substantially from an estimated 5,097 in 1999 to 103 in 2005.

Harvest of hatchery rainbow trout decreased slightly from an estimated 11,224 in 1999 to 10,392 in 2005 (Appendix B). While the number of hatchery trout stocked in Elk Creek Reservoir has remained fairly constant, the number of those fish harvested has been declining. Some of this may be due to anglers' releasing 6,017 (36.7%) of the hatchery trout they caught. As a result, the hatchery trout return to creel has dropped from 53% in 1993 to 30% in 2005 (Table 3). Harvest rates for hatchery rainbow trout have ranged from 0.74-0.95 fish/hour over the three creel surveys, and the catch rate in 2005 was 1.5 fish/hour, three times the management goal of 0.5 fish/hour. Additionally, the percent of the fishery supported by hatchery trout has remained high (Table 3). This indicates the importance of these fish in the reservoir. However, the decline in return to creel and angler effort, combined with the high catch rate indicates a potential need to reduce the annual stocking in the reservoir.

Stocking

A stocking history for Elk Creek Reservoir is shown on Table 6.

Limnology

Historical temperature and dissolved oxygen profiles are shown on Table 7. A bathymetric map in shown in Figure 20.

Management Recommendations

1. Reduce annual stocking of catchable rainbow trout from 27,500 to 20,000.

Justification: The reservoir has seen a continued drop in angling effort and hatchery trout return to creel over the last decade. During this time, however, catch rates have remained consistently above the management goal of 0.5 fish/hour. A reduction in stocking numbers will reduce cost and the waste of hatchery product, and increase food resources for other fish species.

2. Conduct standard management surveys and monitoring:

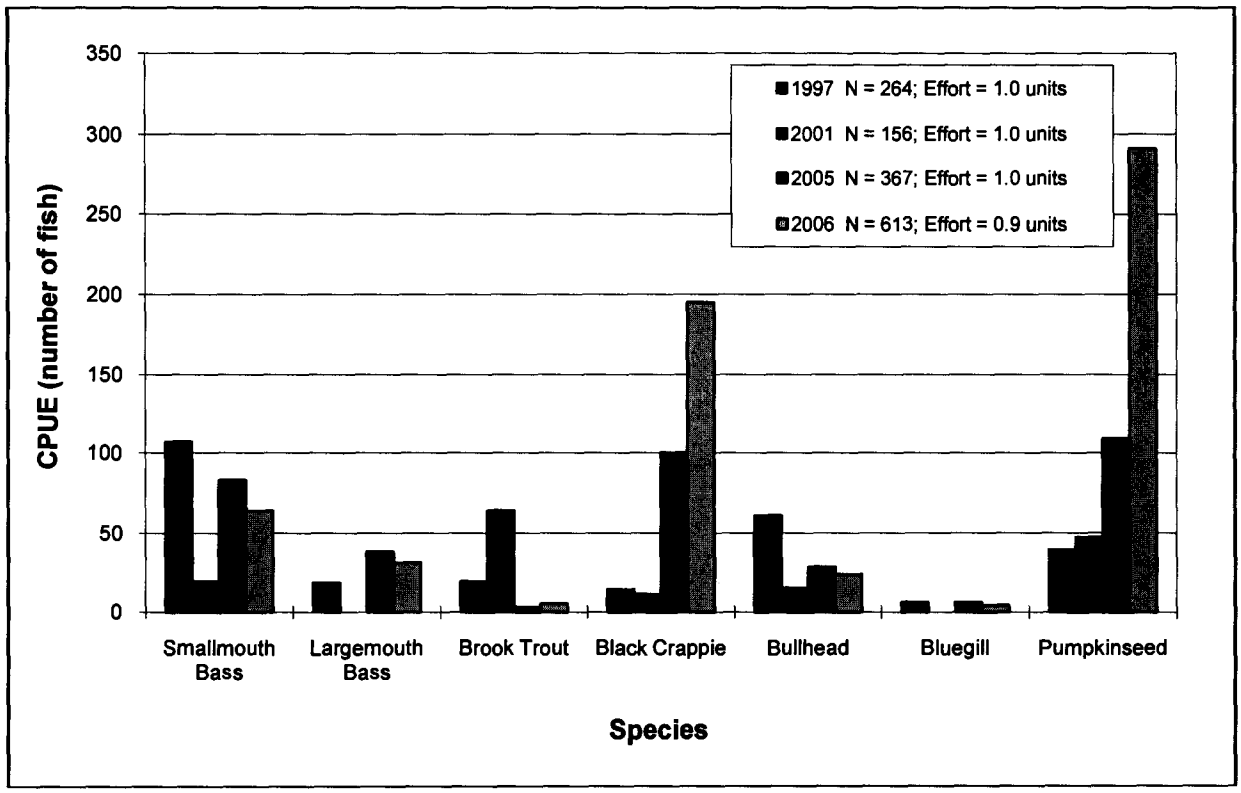
    a. Standard lowland lake population survey every three years.
    b. Creel survey every six years.
    c. Monthly water quality monitoring: D.O/temperature profiles (Jan. – Dec.); vegetation mapping (April-Sept.); ZPI (August) (Teuscher, 2001).

    Justification: Provide the population, effort, harvest, and limnological data needed to maintain the objectives of a quality bass and brook trout fisheries, and to direct future management decisions.

3. Control approximately 30% of the excessive aquatic plant growth annually using the aquatic herbicide Reward® and aquatic algaecide GreenClean Pro®, and discontinue the use of barley straw.

    Justification: The use of aquatic herbicides would prevent excess vegetation growth in shoreline areas utilized by fishermen and around the boat ramp in order to improve recreational access to the reservoir. Additionally, the reduction of aquatic plant material will lower the amount of organic material decaying in the reservoir. This will minimize the biological oxygen demand, resulting in better D.O. levels in the reservoir, better recreational access, and improved habitat quality for fish. Due to highly variable water levels and large quantity of moving water, barley straw has proved ineffective at treating the nuisance algae and should be discontinued.

Figure 9. Catch per unit effort (CPUE) of fish collected from standard lake surveys of Elk Creek Reservoir in 1995, 1997, 2001, and 2005, by number of fish and biomass.



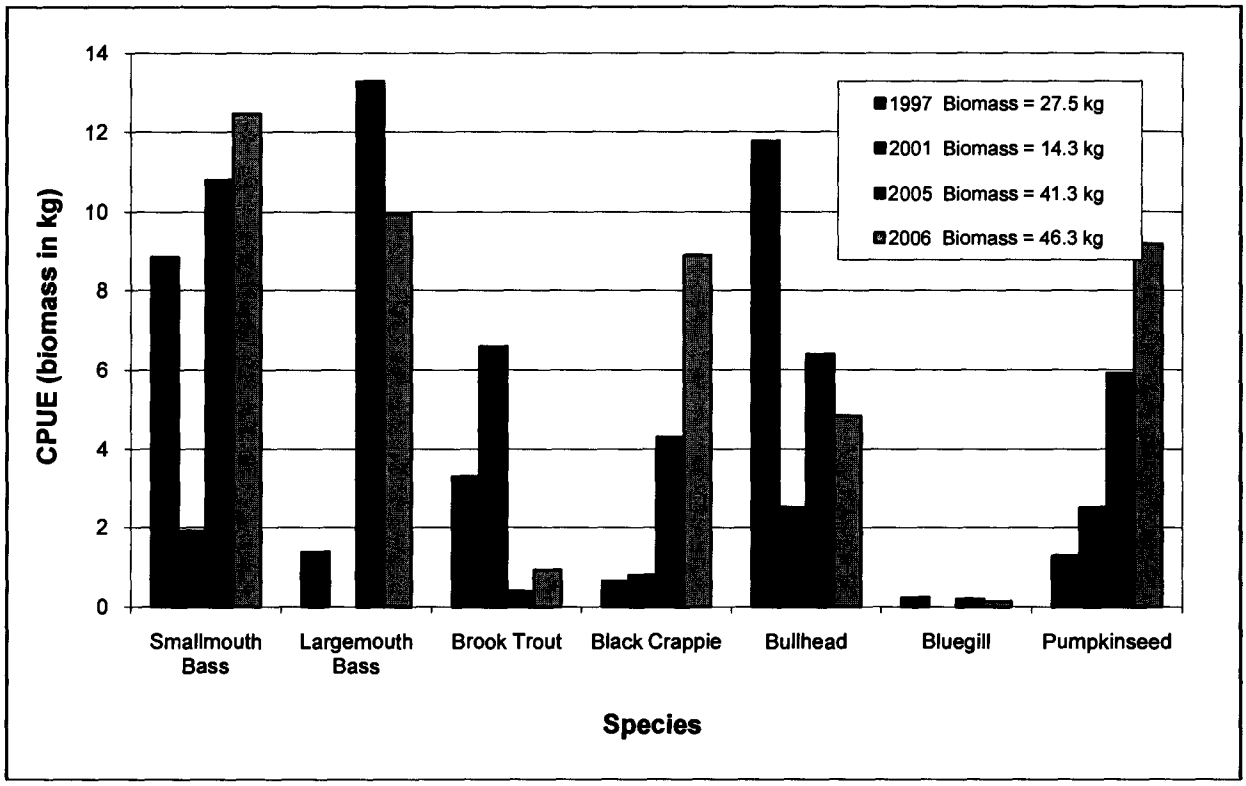
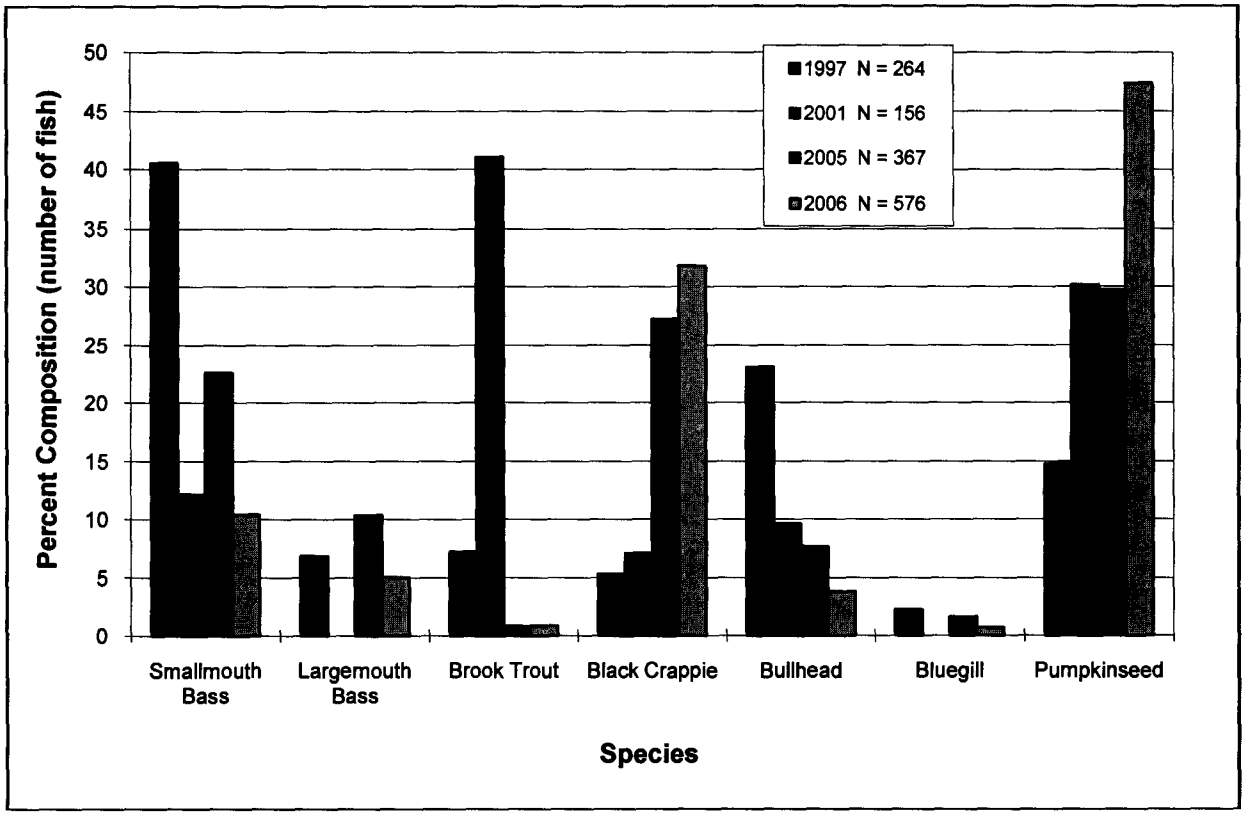
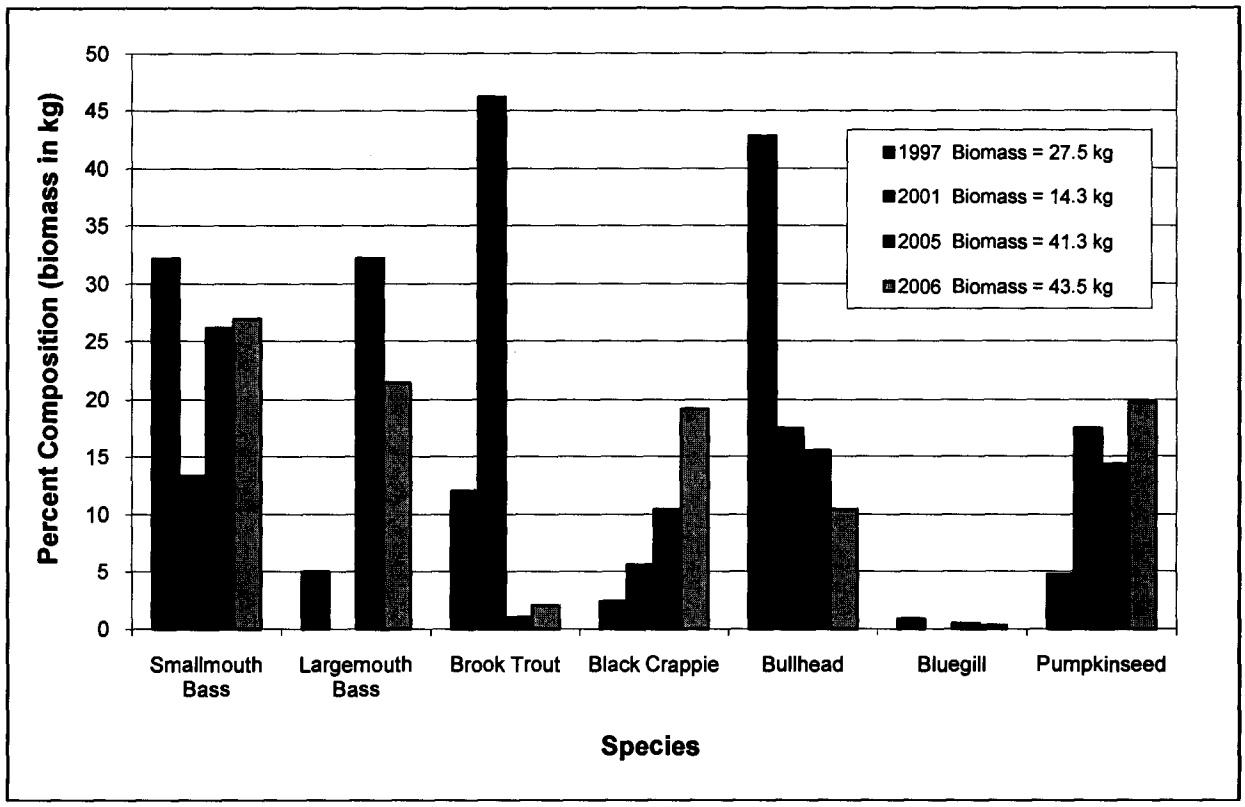


Figure 10. Percent composition of fish collected from standard lake surveys of Elk Creek Reservoir in 1995, 1997, 2001, and 2005, by number of fish and biomass.





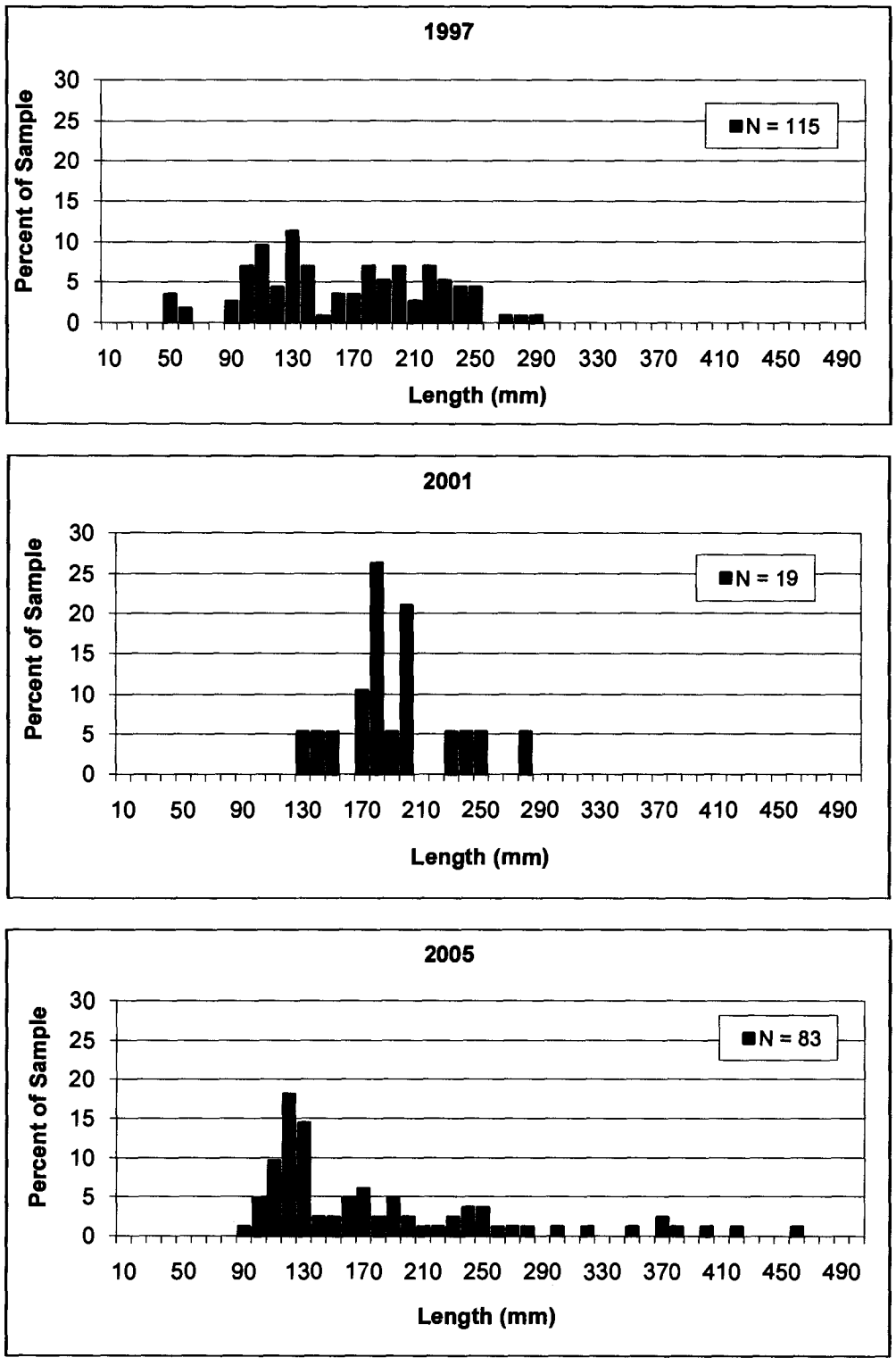


Figure 11. Length frequency distributions of smallmouth bass collected from standard lake surveys of Elk Creek Reservoir in 1997, 2001, and 2005.

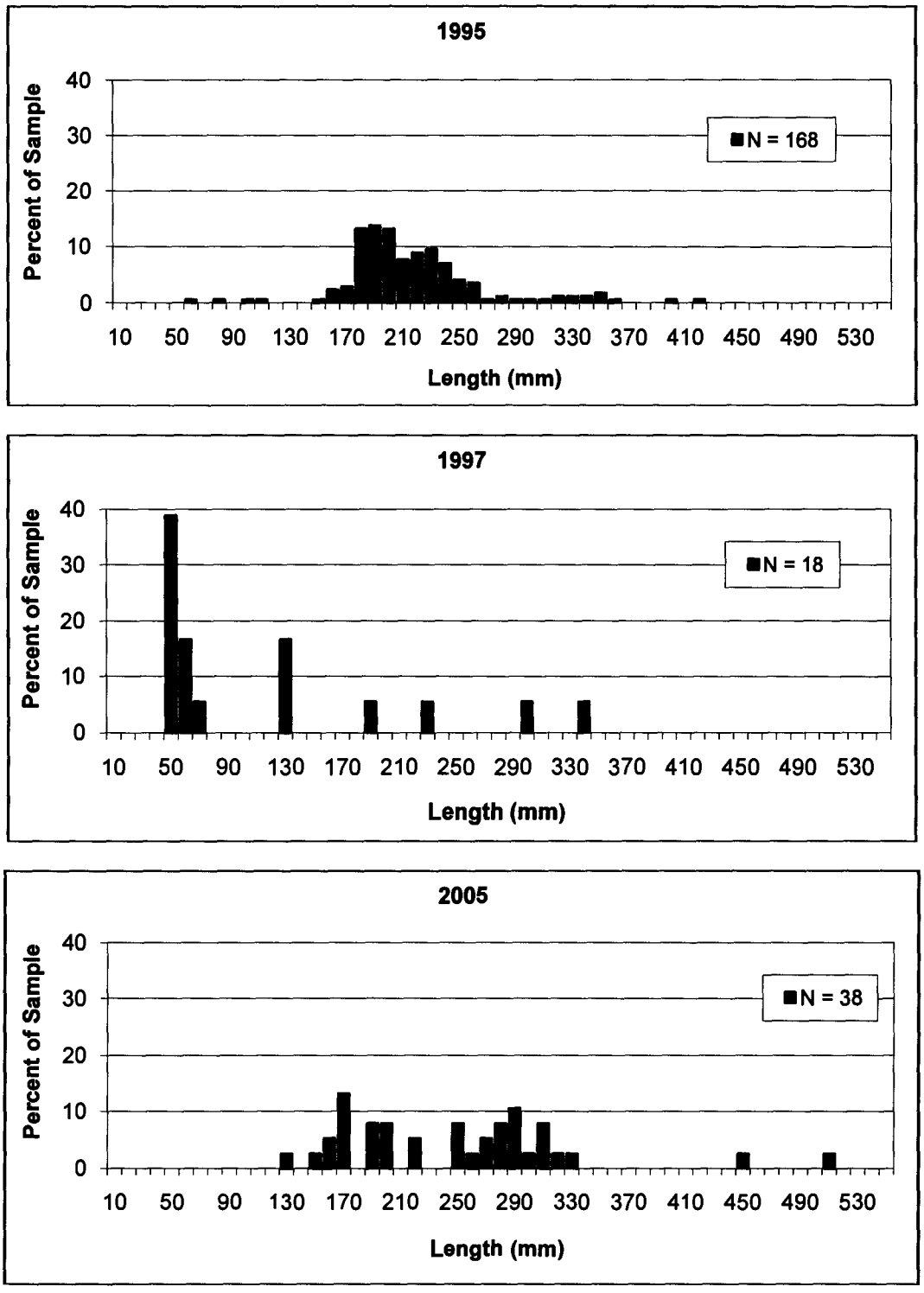


Figure 12. Length frequency distributions of largemouth bass collected from standard lake surveys of Elk Creek Reservoir in 1995, 1997, and 2005.

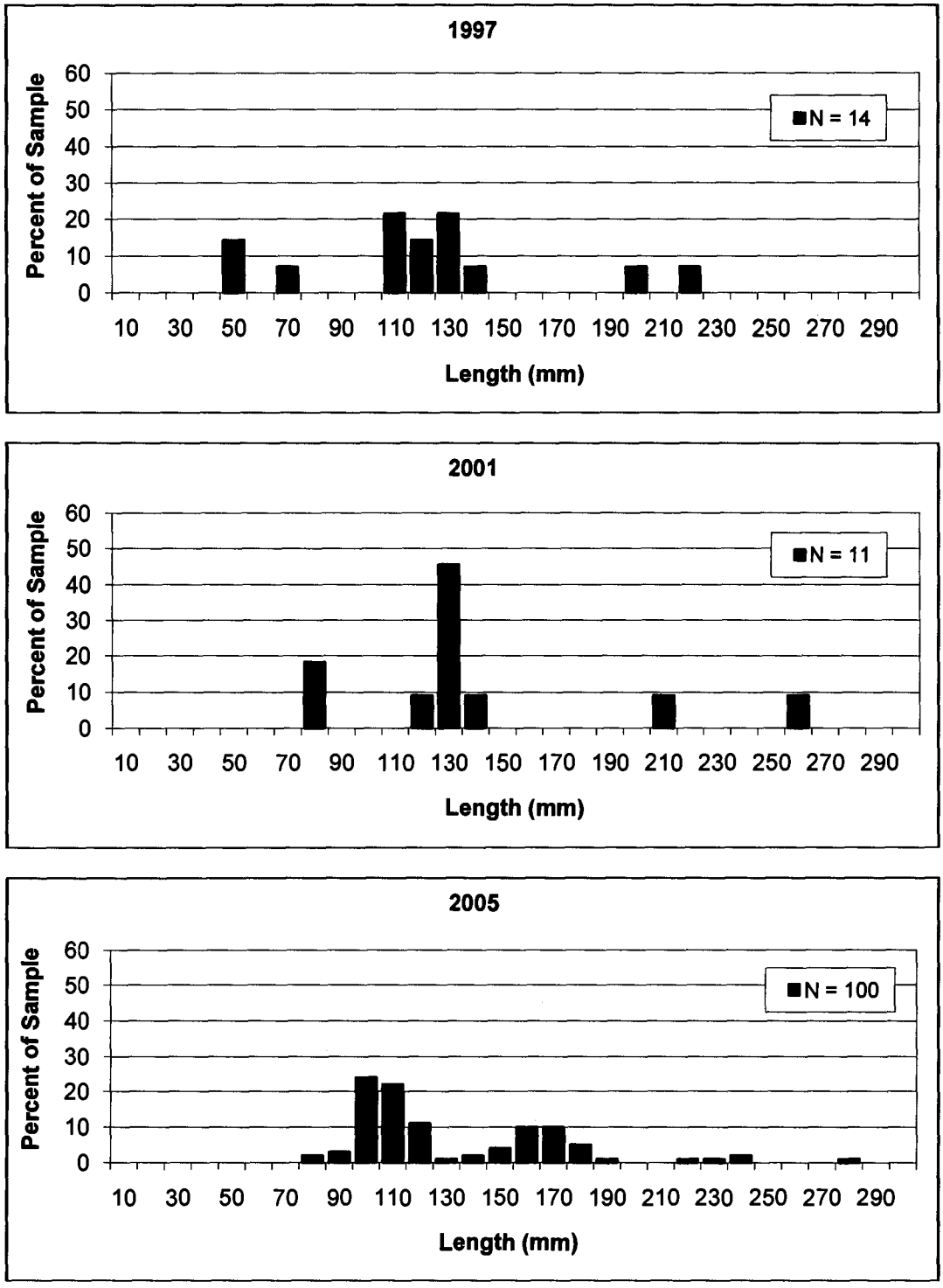


Figure 13. Length frequency distributions of black crappie collected from standard lake surveys of Elk Creek Reservoir in 1997, 2001, and 2005.

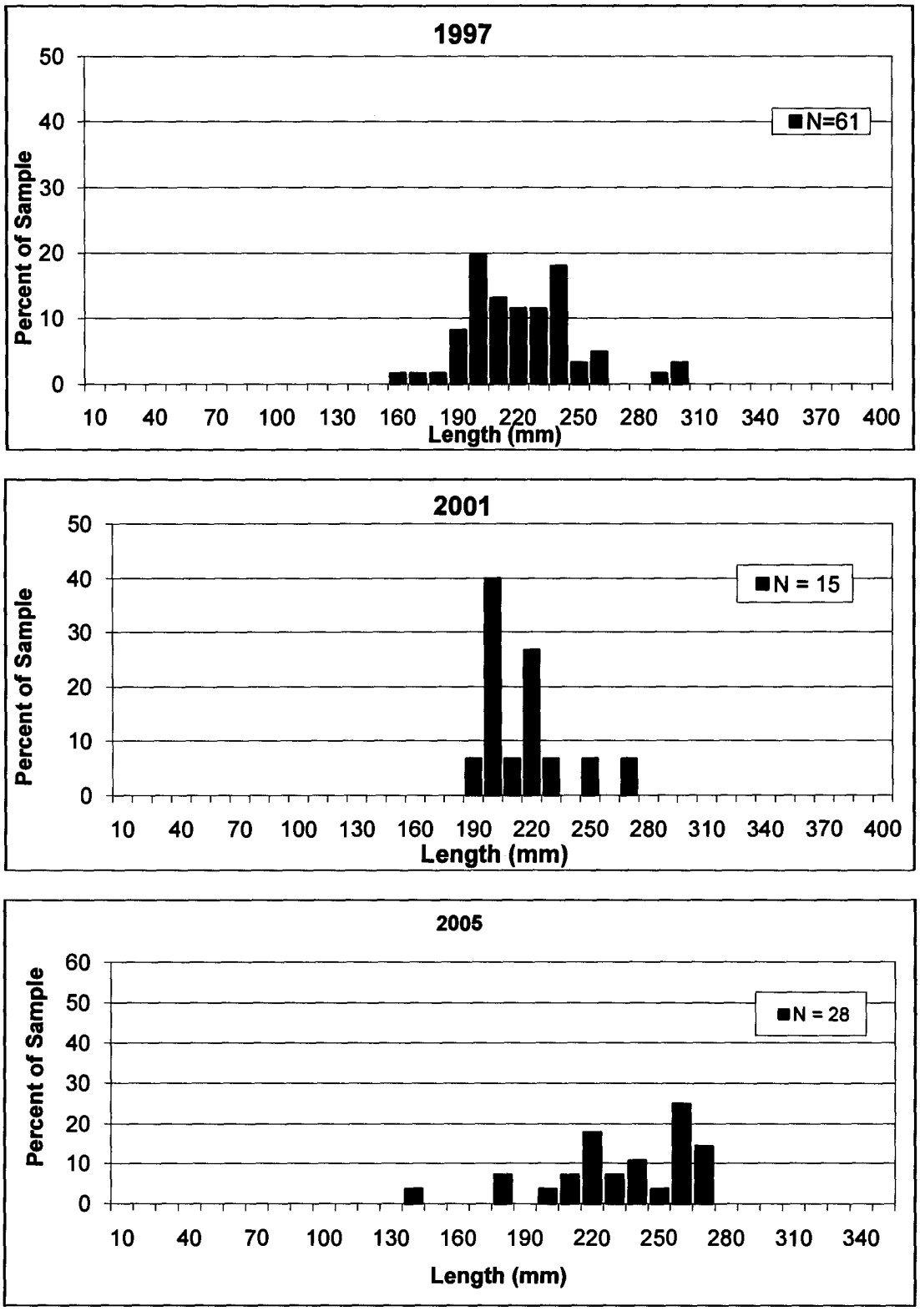


Figure 15. Length frequency distributions of black bullhead collected from standard lake surveys of Elk Creek Reservoir in 1997, 2001, and 2005.

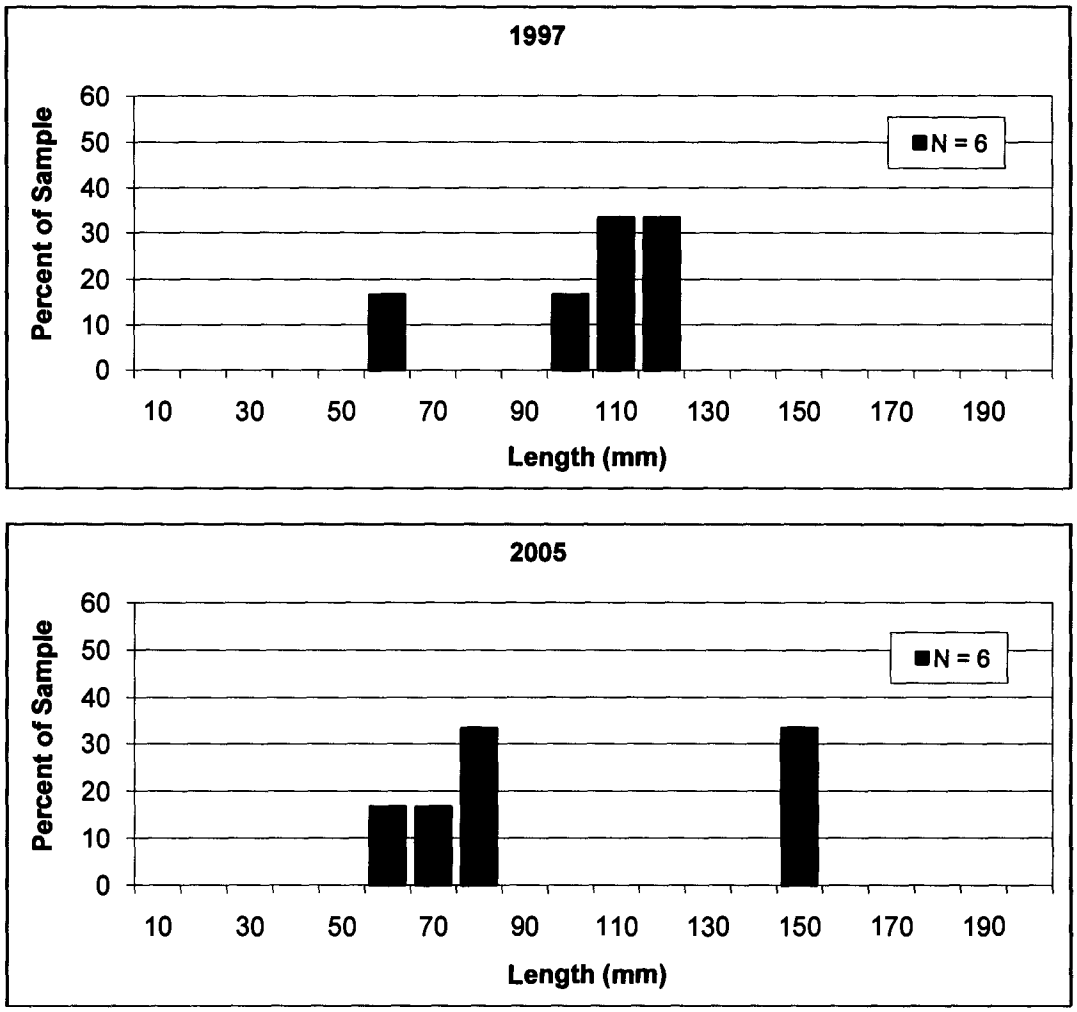


Figure 16. Length frequency distributions of bluegill collected from standard lake surveys of Elk Creek Reservoir in 1997 and 2005.

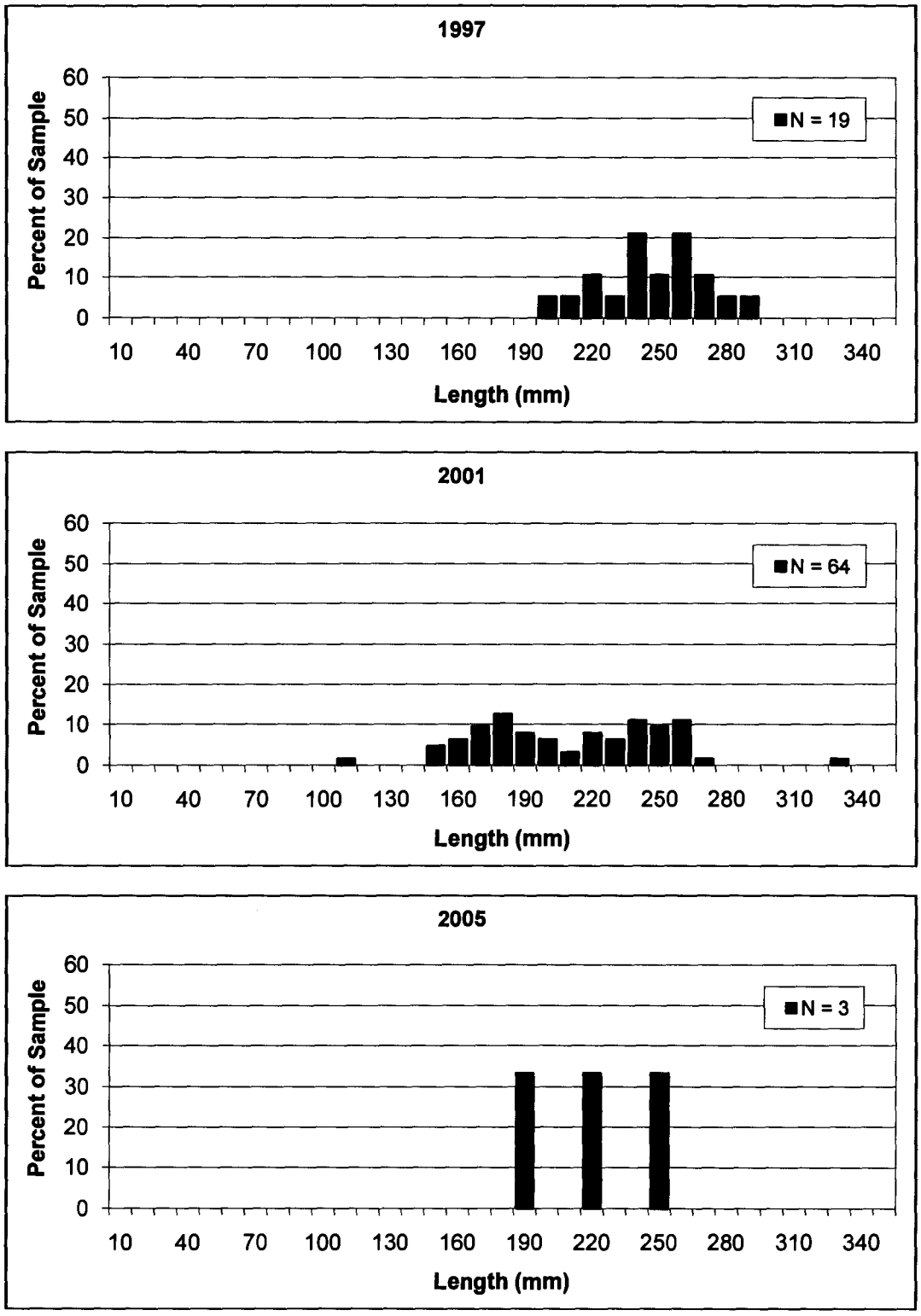


Figure 17. Length frequency distributions of brook trout collected from standard lake surveys of Elk Creek Reservoir in 1997, 2001, and 2005.

Figure 18. Estimated angler effort, by type, from creel surveys of Elk Creek Reservoir, 1993, 1999, and 2005.

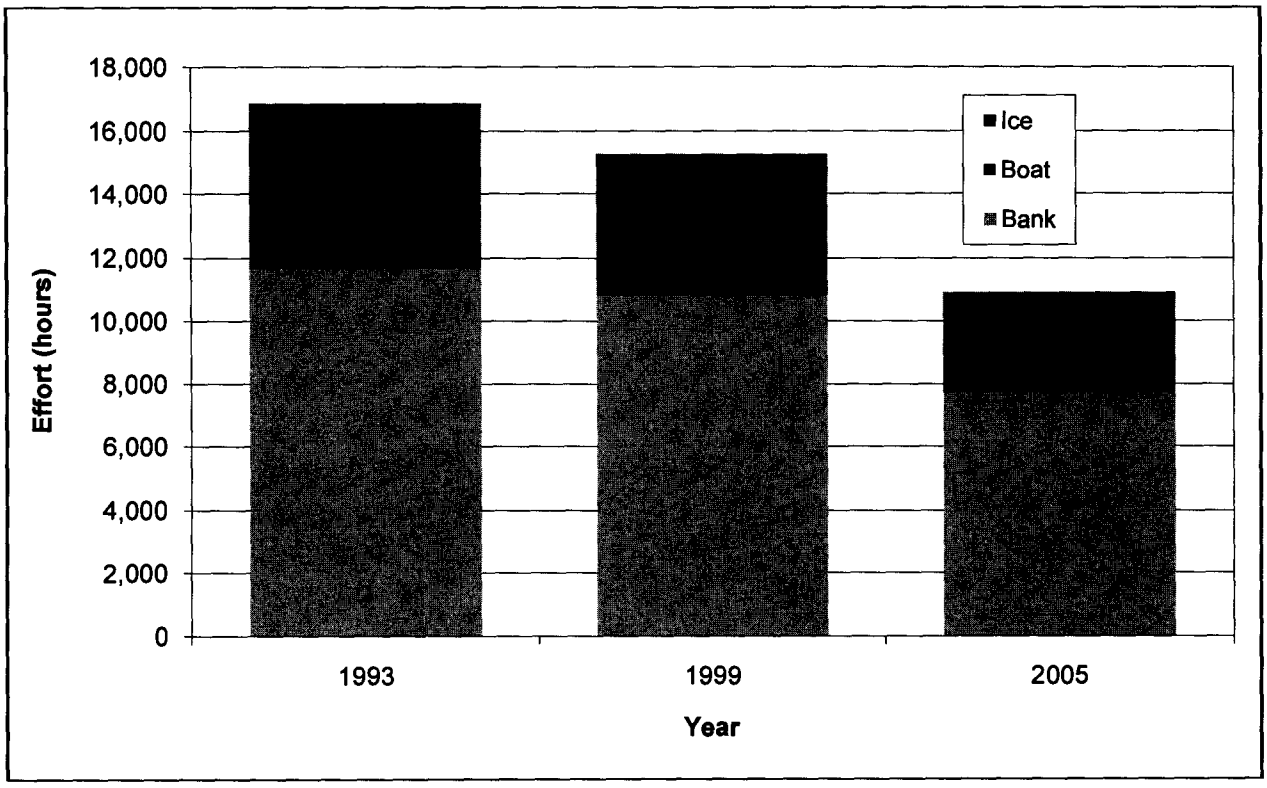


Figure 19. Catch composition of fish harvested during creel surveys of Elk Creek Reservoir in 1993, 1999, and 2005.

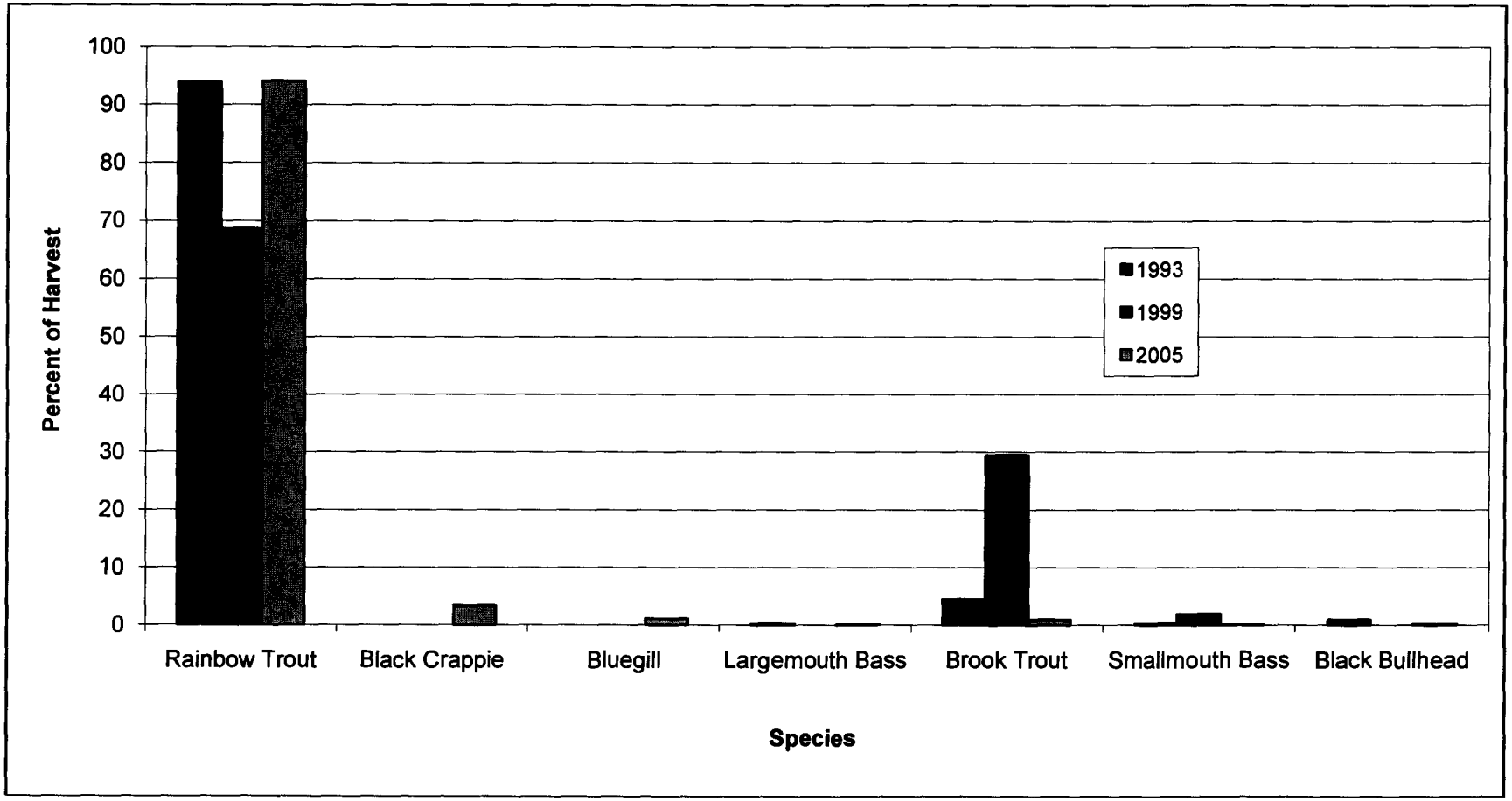


Table 6. Stocking history for Elk Creek Reservoir.

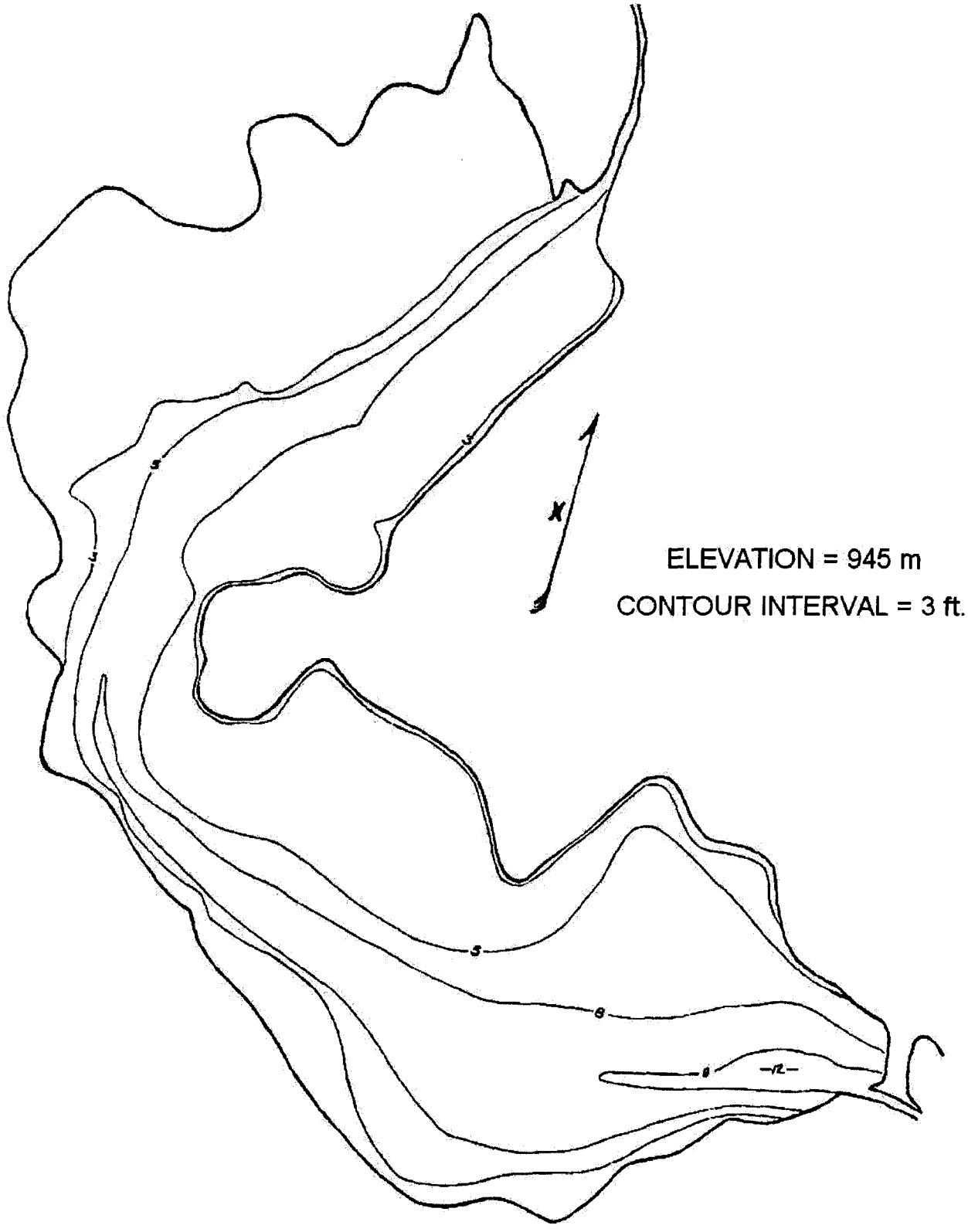
Year	Catchable Rainbow	Fingerling Rainbow	Fingerling Cutthroat	Fingerling Brook Trout	Smallmouth Bass
1968	3,400				
1969	3,885				
1970	7,880				
1971	1,805			15,600	
1972	650				
1973	10,751				
1974	5,915			35,170	
1975	7,950			10,476	
1976	9,690				
1977	7,200	6,090			
1978	14,120			8,120	
1979	11,220				
1980	16,740				
1981	17,520				
1982	9,428	12,240			
1983					
1984	5,040	20,887			14
1985	17,880				35
1986	12,261				
1987	8,100	10,035			
1988	14,719	17,644			
1989	6,400	10,333			333
1990	8,800		1,650		
1991	11,635		2,814		
1992	18,010	24,990			
1993	30,210				
1994	27,500				
1995	27,598				
1996	35,690				
1997	30,495				
1998	37,250				
1999	27,500				
2000	25,000				
2001	53,914				
2002	23,934				
2003	24,672				
2004	21,531				
2005	34,342				

Table 7. Historical temperature (°C) and dissolved oxygen profiles (mg/l) for Elk Creek Reservoir.

2005

Depth (m)	April	May	June	July	August	September	October	November
0	11.5	10.7	7.9	8.0	10.4	8.5	11.0	12.0
1	11.4	12.1	8.9	9.1	13.5	8.4	10.8	11.5
2	11.5	11.9	9.6	10.0	10.4	7.9	8.3	11.5
3	11.5	11.5	10.1	10.1	5.1	5.9	7.6	11.4
4	11.4	9.8	9.3	9.5	0.1	3.5		

Figure 20. Bathymetric map of Elk Creek Reservoir (18.7 ha).



Mann Lake

Introduction

Mann Lake is a 58 hectare reservoir located approximately 3.2 km east of Lewiston, Idaho at an elevation of 549 meters. The reservoir has a mean depth of 6.4 meters and a maximum depth of 15.0 meters. It was originally constructed in 1907. Additional height was added to the dam in the 1950's. Mann Lake was most recently drained for repair in 1984. It is the final storage basin for the Lewiston Orchards Irrigation District's (LOID) watershed. Annual water level fluctuations are common in Mann Lake. The magnitude of these fluctuations depends on the water yield of the LOID-managed watershed and irrigation demands. Water level generally falls during the summer months when residential irrigation demands are high. The reservoir will remain below full pool until the following spring run-off. Spawning success and recruitment of warm water species can be greatly affected by annual water level fluctuations. Largemouth bass production and predator/prey interactions are both benefited by these drops in water level late in the summer because prey species are more vulnerable.

Species Composition

Mann Lake contains seven species of game fish: (1) largemouth bass, (2) black crappie, (3) pumpkinseed, (4) bluegill, (5) black bullhead, (6) channel catfish *I. punctatus*, and (7) rainbow trout. The only non-game fish species documented is the largescale sucker *Catostomus macrocheilus*.

Current Management

Mann Lake is a mixed fishery, containing both coldwater and warmwater species. It is managed as a put-and-take trout fishery with catchable rainbow trout stocked annually to maintain a catch rate of 0.5 fish/hour. The lake is also managed for bass and a yield fishery on black crappie. Channel catfish are stocked periodically to provide an additional fishing opportunity. In fact, the Idaho state record channel catfish was caught in Mann Lake in 2001. General fishing regulations apply with the exception of a 12" minimum size limit for bass. Boat activity on Mann Lake is restricted to electric motors only, and no boats are allowed from October 1–December 31.

Management Objectives

1. Meet seasonally high demand with catchable rainbow trout stockings.
2. Maintain total catch rate of 0.5 fish/hour.
3. Maintain bass fishery and yield fishery for black crappie.

Current Population Data

Population Surveys

Clearwater Region fisheries management personnel conducted a standard lake survey of Mann Lake on June 7, 2005. This survey resulted in the capture of 210 fish, including largemouth bass (N = 81), black crappie (N = 37), bluegill (N = 22), pumpkinseed (N = 67), channel catfish (N = 3), and black bullhead (N = 2). A comparison of catch per unit effort and percent composition between samples collected in 2001, 2003, and 2005 are shown in Figures

21 and 22, respectively. Largemouth bass numbers and biomass have increased steadily since the 2001 survey. The length frequency distribution shows multiple strong age classes and a marked increase in the numbers of larger fish (Figure 23). This suggests a substantial improvement in the largemouth bass population over the last five years. In contrast, the number of black crappie collected has declined over the last three surveys. However, the length frequency distribution (Figure 24) shows a shift towards larger fish, with an average size increasing from 150-160 mm in 2001 to 190-200mm in 2005. This increase in size may be the result of increased harvest and the annual removal of pre-spawning fish by IDFG personnel for the Washington Department of Fish and Wildlife. Bluegill numbers have fluctuated over the last three surveys; however, their biomass has stayed constant suggesting a change in size structure over time. This is confirmed by comparing the length frequency distributions (Figure 25) from the last three surveys. A similar situation is seen with pumpkinseed. Their numbers increased substantially in the 2005 survey, while the biomass of those fish remained similar to that of the 2001 and 2003 surveys. This can be seen in the length frequency distributions (Figure 26), which show a shift towards smaller fish in the 2005 sample. Only nine channel catfish have been collected during the three surveys. These fish have ranged in length from 190-640 mm. Black bullhead were collected for the first time, indicating that they have recently been introduced into the reservoir, or have been present in such low numbers that they have avoided capture during sampling.

Creel Surveys

Total angler effort on Mann Lake during 2005 was estimated at 21,562 hours. This is a 17% increase from the level of effort in 1999, and a 30% decrease from the level of effort in 1993 (Figure 1). The effort consisted of 57.4% bank and 42.6% boat anglers (Figure 27). While no ice fishing surveys were conducted in 2005, there was limited ice fishing in December. Mann Lake supported 532 hours of angling effort per hectare (216 hours per acre) in 2005.

Anglers caught an estimated 67,407 fish from Mann Lake during 2005, resulting in a catch rate of 3.1 fish/hour (Figure 3). This is substantially higher than catch rates of 1.0 fish/hour during 1993 and 1.3 fish/hour in 1999. Anglers harvested 39,122 fish from Mann Lake during 2005 (Appendix B), 58% of the total fish caught. The harvest rate was estimated to be 1.8 fish/hour (Figure 4). The harvest composition consisted of 71.7% black crappie, 21.1% hatchery trout, 4.2% pumpkinseed, 2.5% bluegill, 0.4% largemouth bass, and 0.1% channel catfish. (Figure 28). Harvest in Mann Lake has shifted from hatchery trout to warm-water fish, likely due to the improvement of the crappie fishery. In 1993, angler harvest was 100% rainbow and lake trout. In 2005, trout accounted for only 21% of the harvest. The biggest change has occurred in the black crappie harvest, which has increased from no harvest in 1993 to account for 72% of the harvest in 2005. This increase is likely due to a slow but steady increase in the average size of black crappie from 160 mm in 1993 to approximately 203 mm in 2005.

Harvest of hatchery rainbow trout decreased from an estimated 24,365 in 1999 to 8,271 in 2005 (Appendix B). While the number of hatchery trout stocked in Mann Lake has remained fairly constant, the number of those fish harvested has been declining. This may be partially due to anglers releasing 10,912 (56.9%) of the hatchery trout they caught. As a result, the hatchery trout return to creel has dropped from 58% in 1993 to 24% in 2005 (Table 3). A decline in harvest rates of hatchery trout has also been seen, dropping from 0.9 fish/hour in 1993 to 0.4 fish/hour in 2005. However, the catch rate in 2005 was 0.9 fish/hour, still almost twice the management goal of 0.5 fish/hour. Additionally, the percent of the fishery supported by hatchery trout has dropped considerably, from 90% in 1993 to 21% in 2005 (Table 3). This is partially due to a shift in angler preference from hatchery trout to black crappie. The harvest of

rainbow trout becomes less important in the presence of good crappie fishing. The decline in return to creel, harvest rate, and percent of the fishery supported by hatchery trout, combined with the high catch rate indicates a potential need to reduce the annual stocking of rainbow trout in the reservoir.

Stocking

A stocking history for Mann Lake is shown on Table 8.

Limnology

Historical temperature and dissolved oxygen profiles are shown on Table 9. A bathymetric map is shown in Figure 29.

Management Recommendations

1. Reduce annual stocking of catchable rainbow trout from 32,500 to 28,000, and reduce annual stocking of fingerling rainbow trout from 30,000 to 25,000.

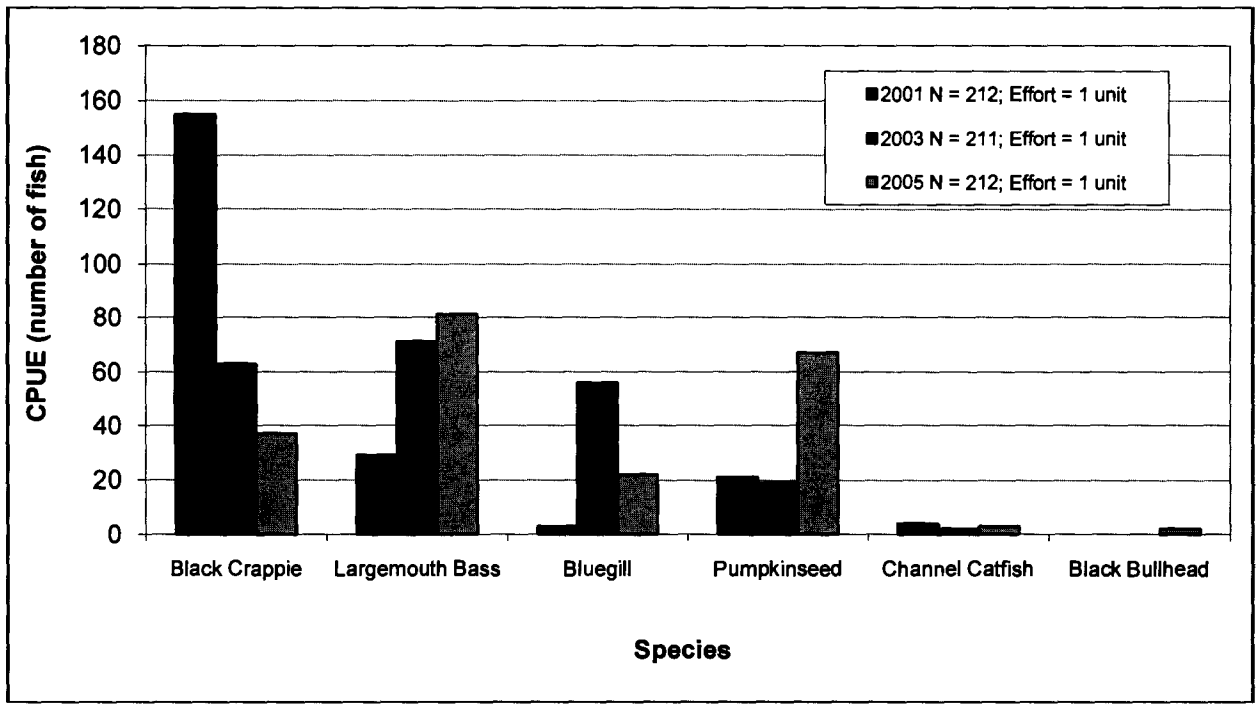
   Justification: The reservoir has seen a continued drop in angling effort and hatchery trout return to creel over the last decade. During this time, however, catch rates have remained consistently above the management goal of 0.5 fish/hour. A reduction in stocking numbers will reduce cost and the waste of hatchery product, and increase food resources for other fish species. No rainbow trout stocked as fingerlings were encountered during the 1999 or 2005 creel survey, suggesting that fingerling plants are contributing little or nothing to the harvest. This is likely due to competition and predation by crappie and bass.

2. Conduct standard management surveys and monitoring:

   a. Standard lowland lake population survey every three years.
   b. Creel survey every six years.
   c. Monthly water quality monitoring: D.O/temperature profiles (Jan. – Dec.); ZPI (August).

   Justification: Provide the population, effort, harvest, and limnological data needed to maintain the objectives of a quality largemouth bass fishery and a yield fishery for black crappie, and to direct future management decisions.

Figure 21. Catch per unit effort (CPUE) of fish collected from standard lake surveys of Mann Lake in 2001, 2003, and 2005, by number of fish and biomass.



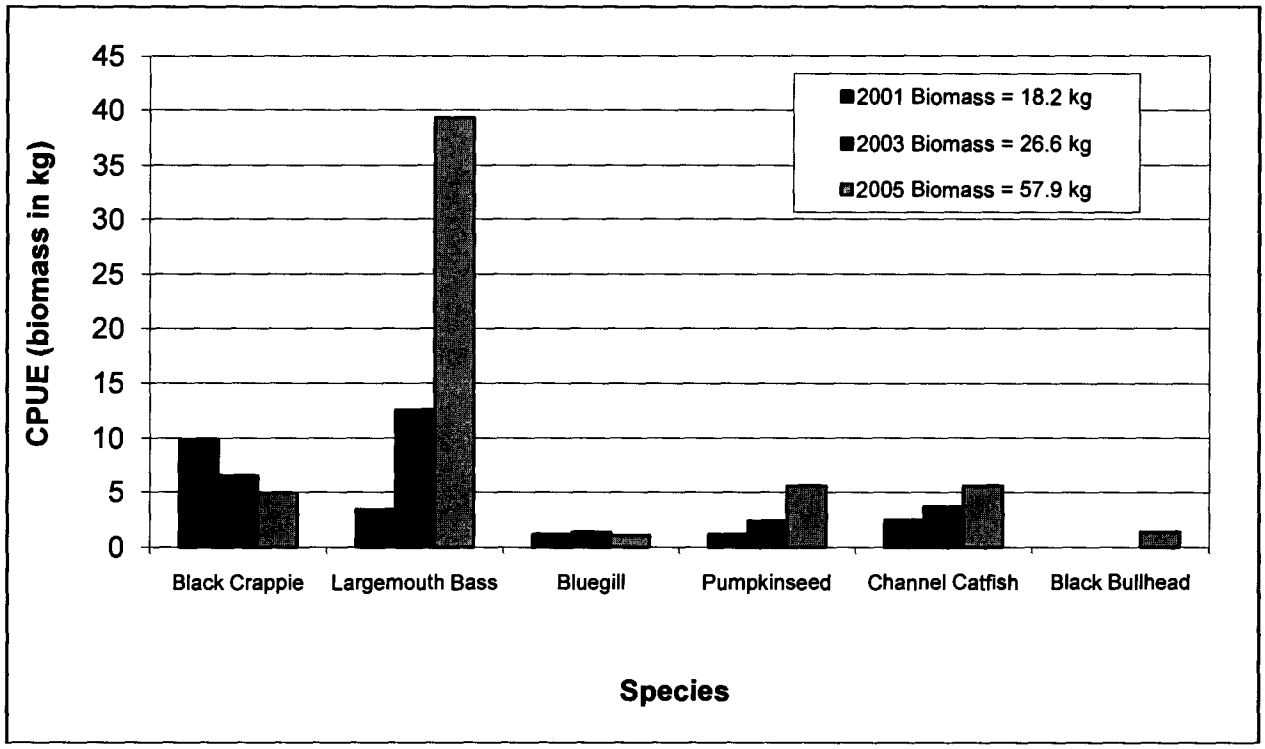
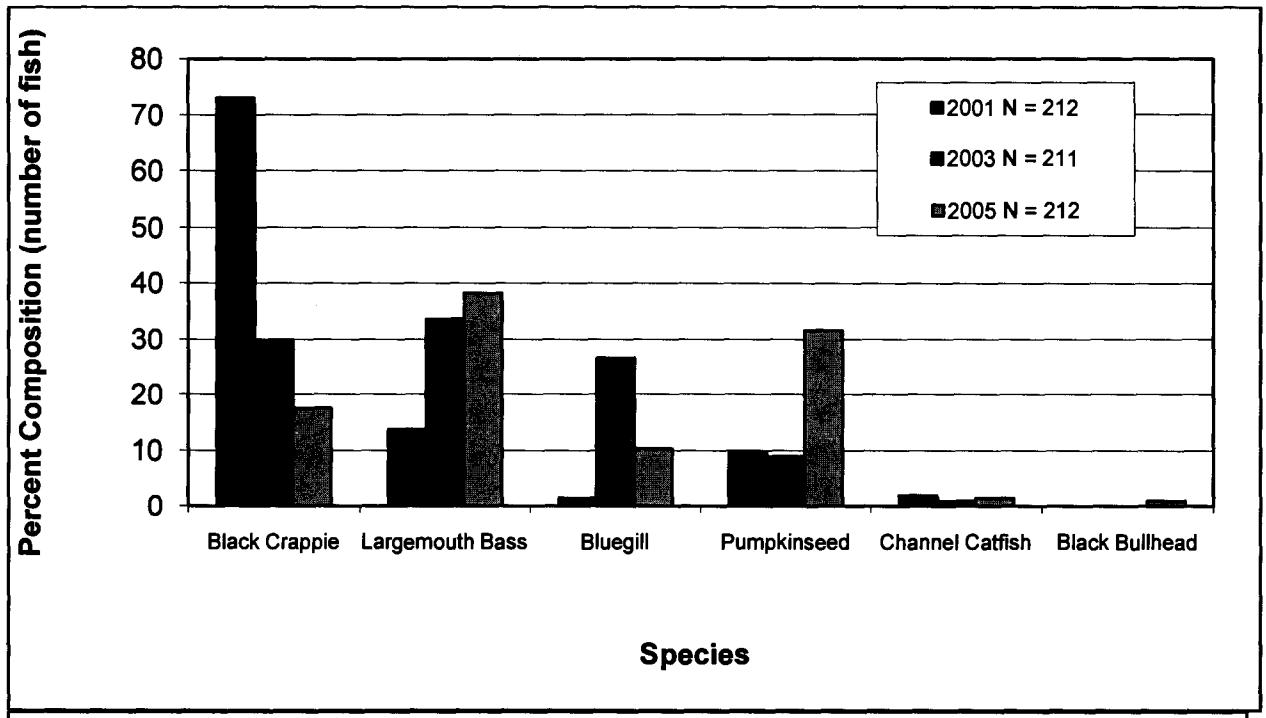
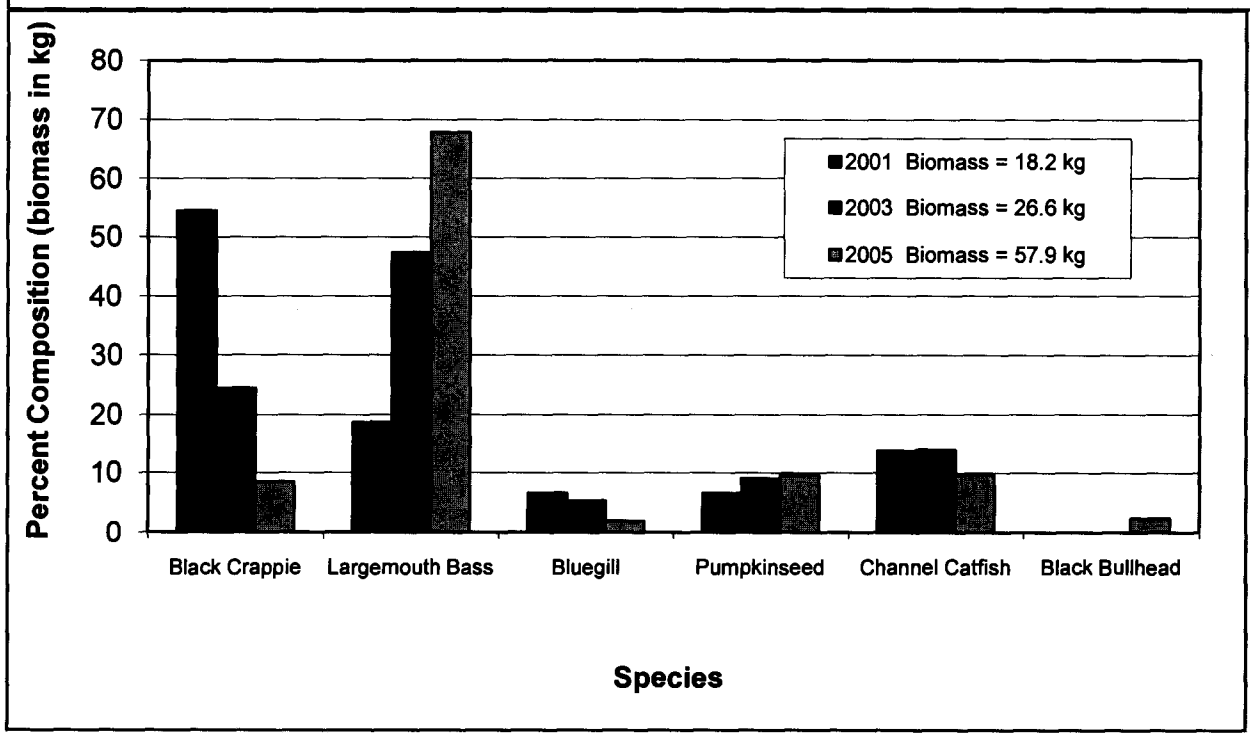


Figure 22. Percent composition of fish collected from standard lake surveys of Mann Lake in 2001, 2003, and 2005, by number of fish and biomass.





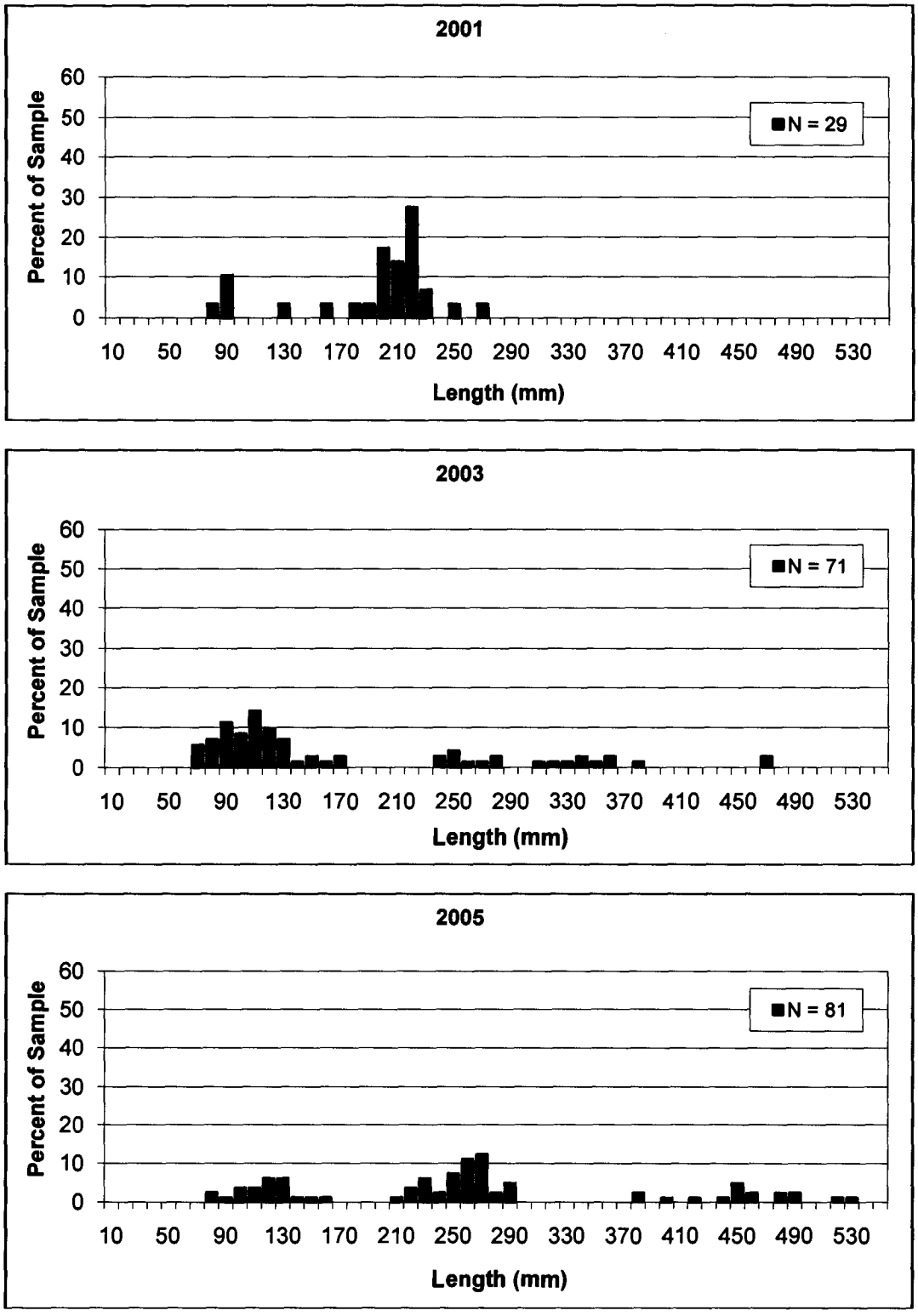


Figure 23. Length frequency distributions of largemouth bass collected from standard lake surveys of Mann Lake 2001, 2003, and 2005.

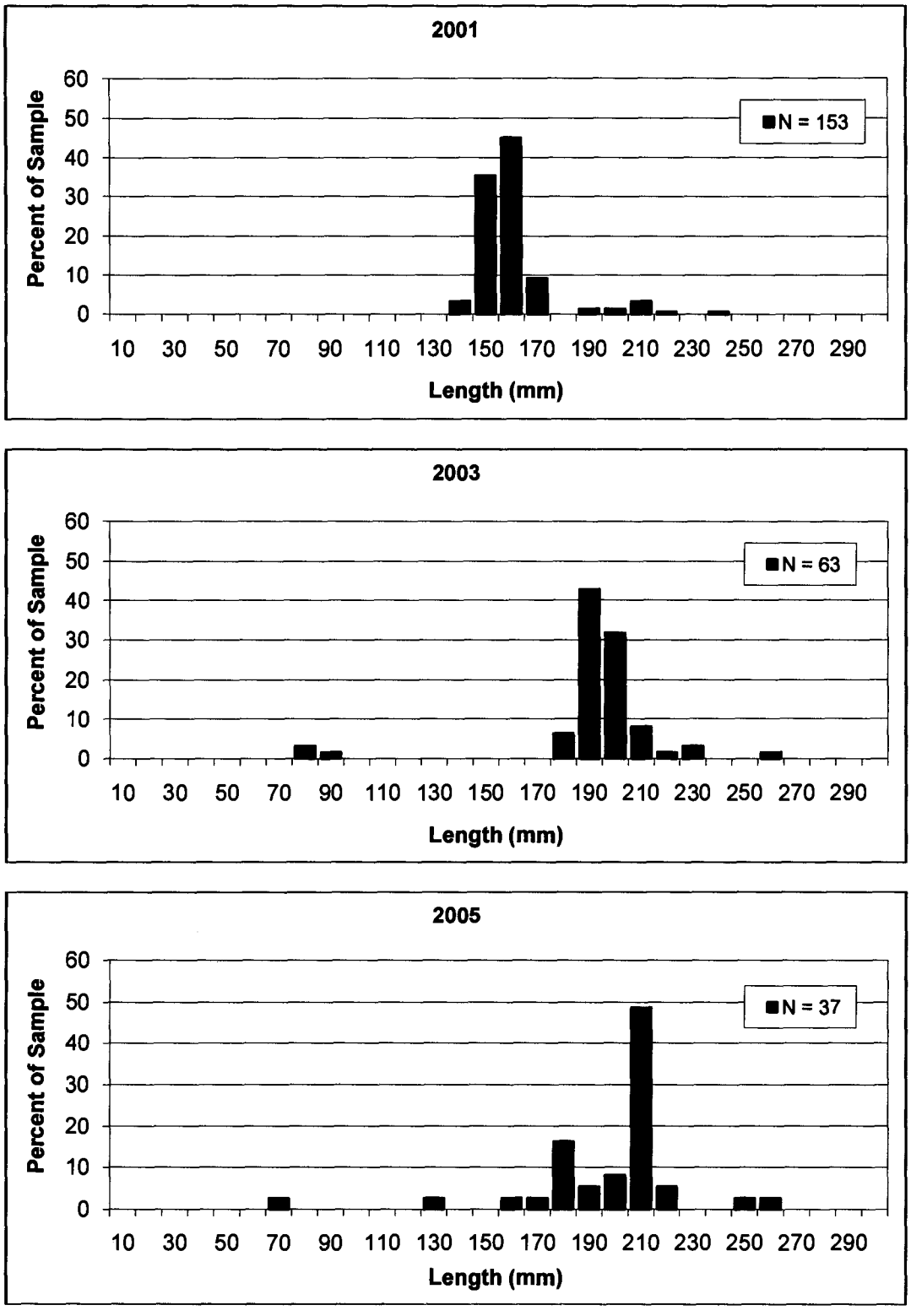


Figure 24. Length frequency distributions of black crappie collected from standard lake surveys of Mann Lake 2001, 2003, and 2005.

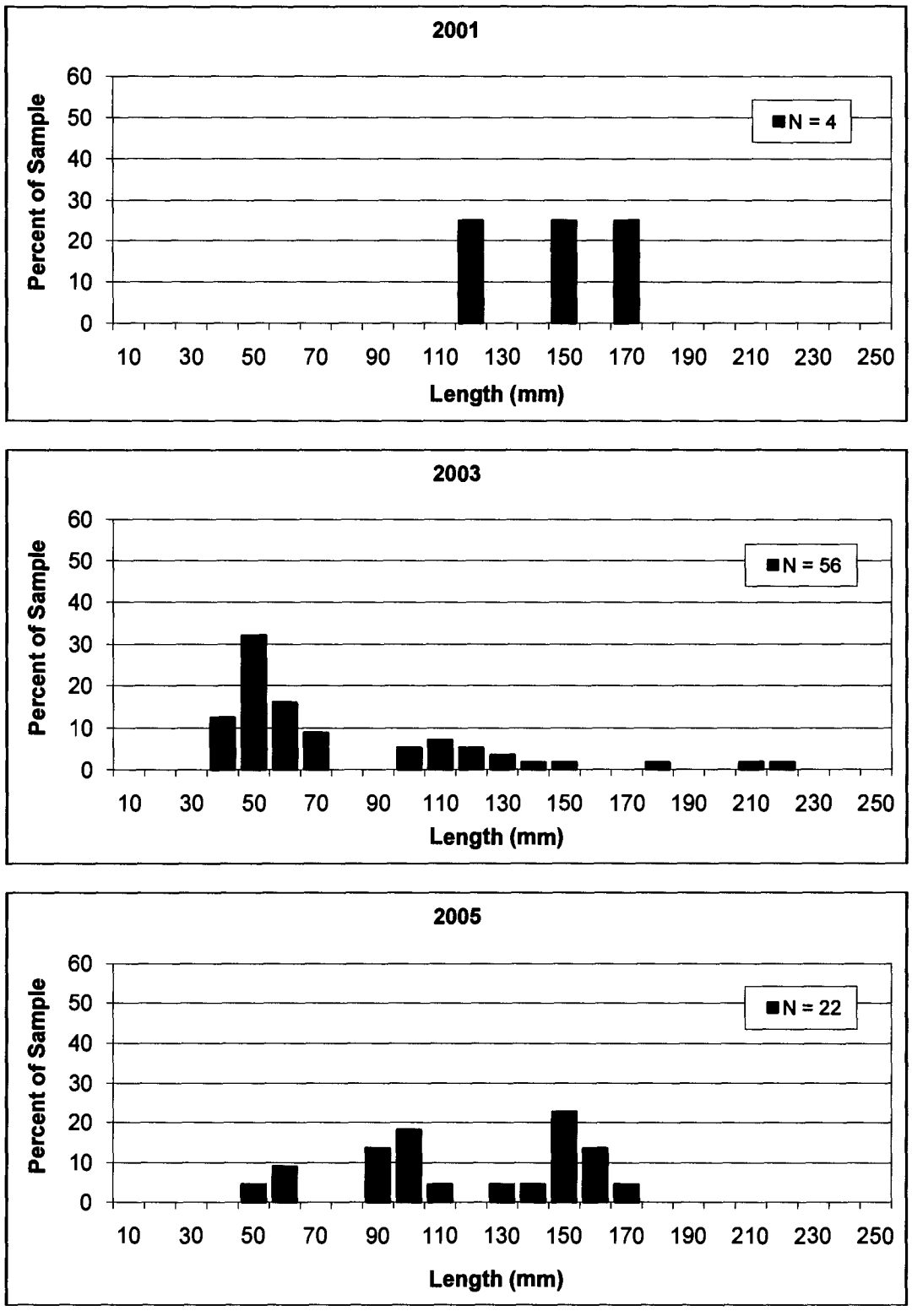


Figure 25. Length frequency distributions of bluegill collected from standard lake surveys of Mann Lake 2001, 2003, and 2005.

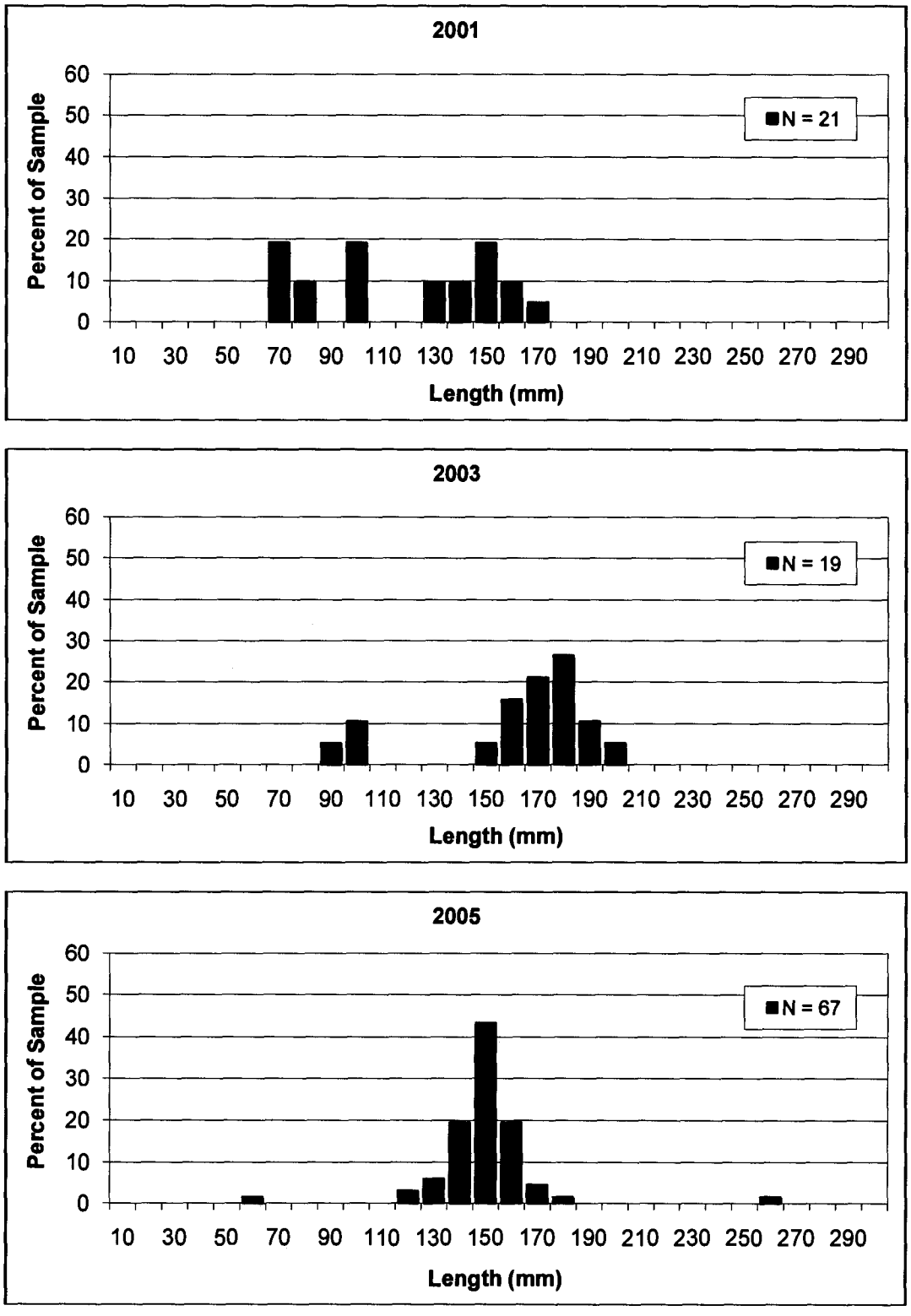


Figure 26. Length frequency distributions of pumpkinseed collected from standard lake surveys of Mann Lake 2001, 2003, and 2005.

Figure 27. Estimated angler effort, by type, from creel surveys of Mann Lake 1993, 1999, and 2005.

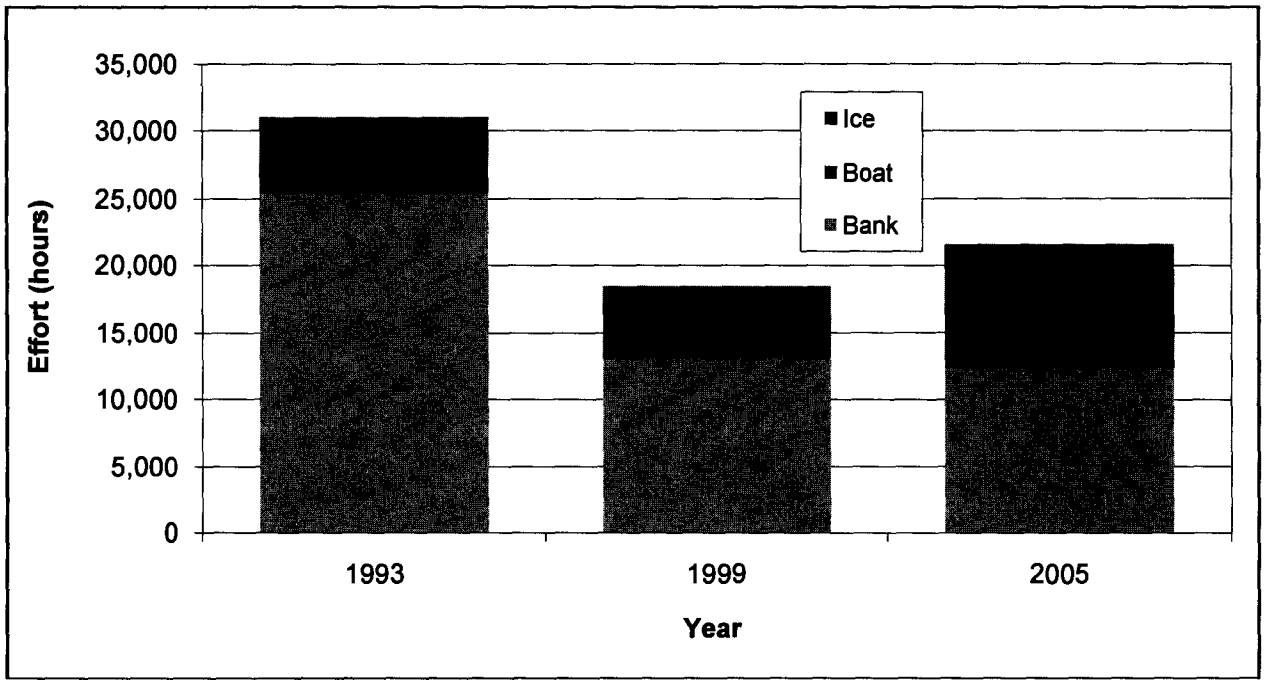


Figure 28. Catch composition of fish harvested during creel surveys of Mann Lake in 1993, 1999, and 2005.

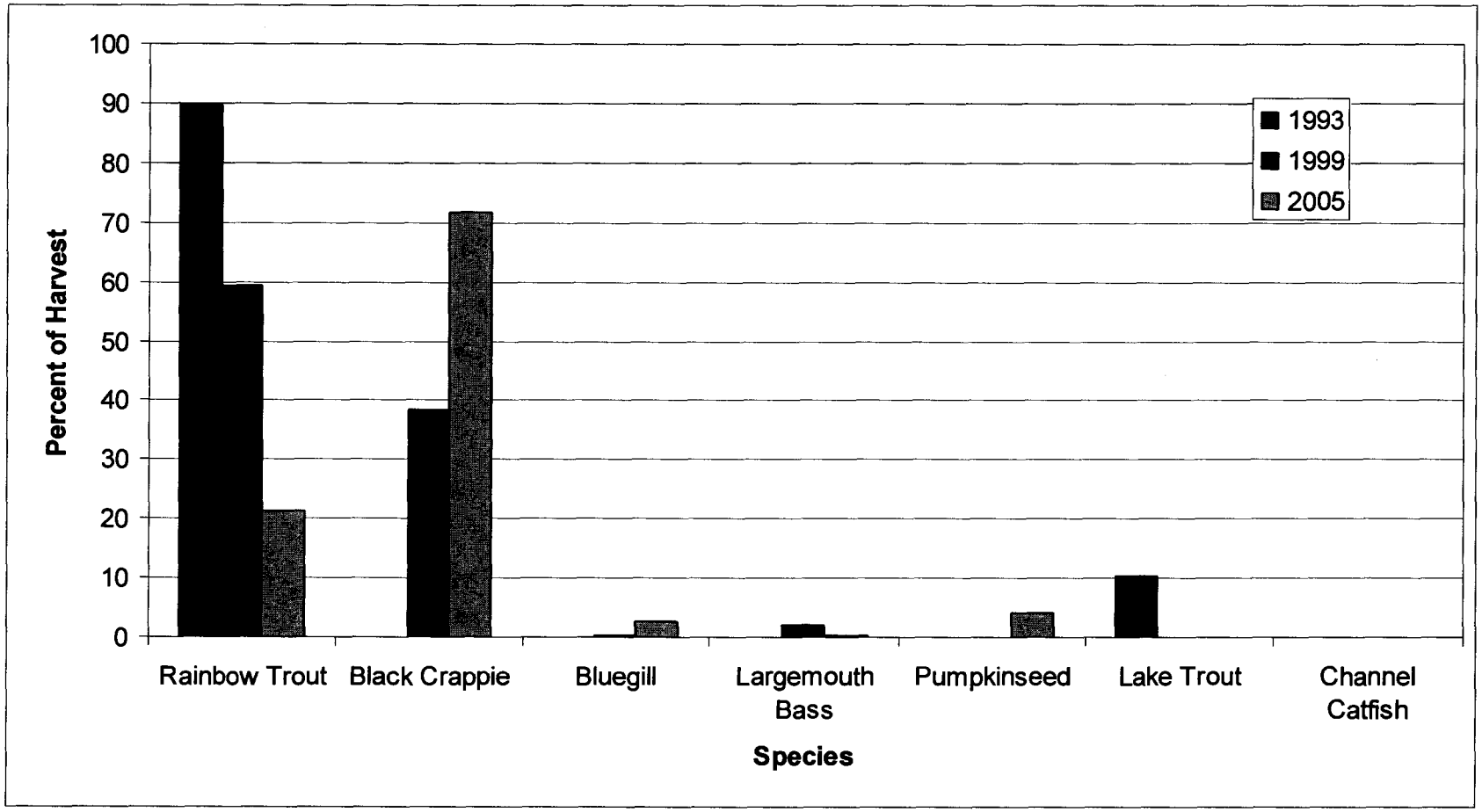


Table 8. Stocking history for Mann Lake.

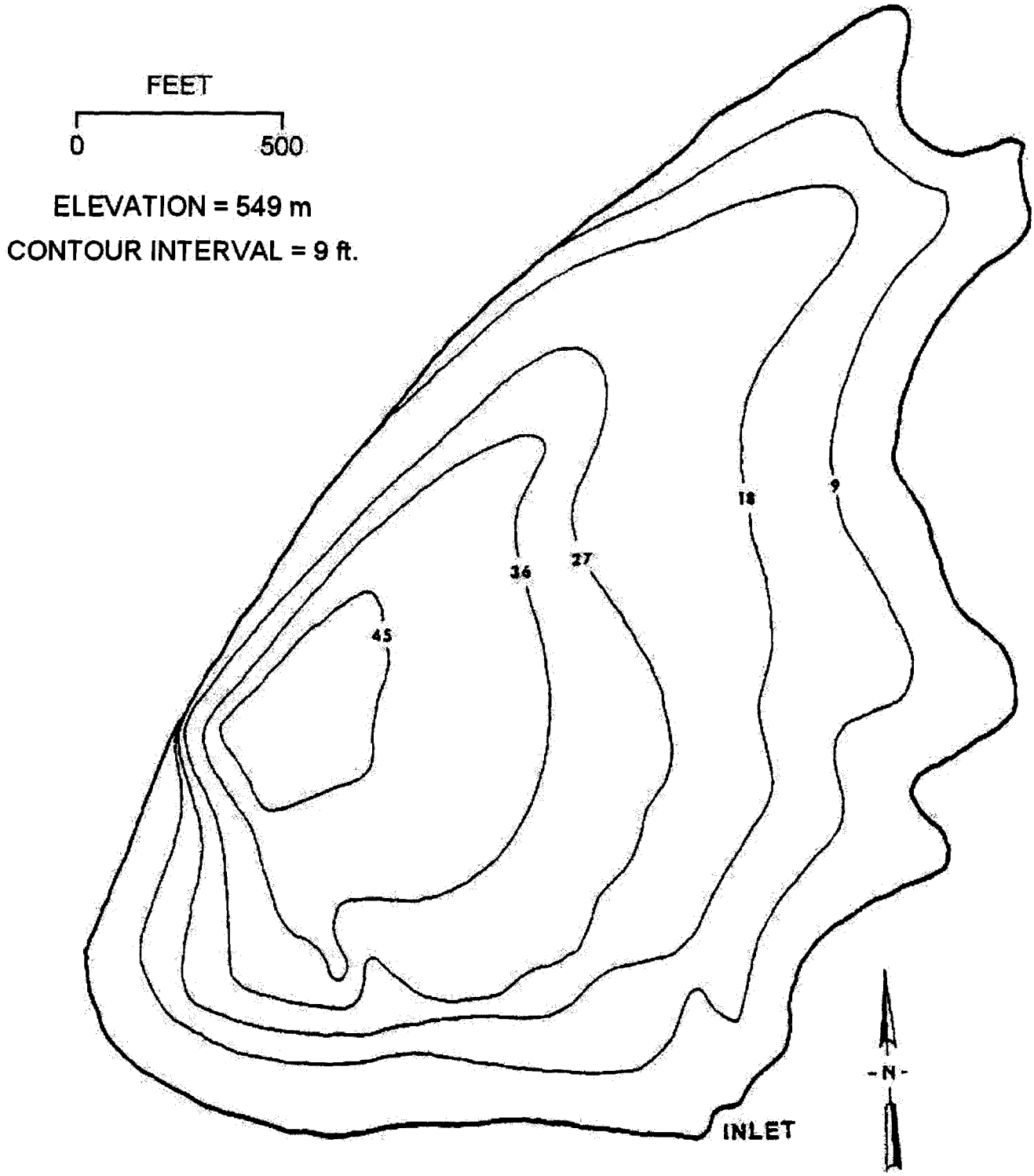
Year	Catchable Rainbow	Fingerling Rainbow	Kokanee	Largemouth Bass	Black Crappie	Bluegill	Channel Catfish	Lake Trout
1968	5,520							
1969	8,565							
1970	8,640							
1971	10,540							
1972	4,170	24,400						
1973	8,880	24,900						
1974	7,925	24,900						
1975	15,370	25,520						
1976	21,210	34,684						
1977	9,480	40,176						
1978	18,580	50,000						
1979	17,700	42,868						
1980	6,480	54,040						
1981	9,555	40,500						
1982	26,190	26,000						
1983	31,950							
1984	25,920							
1985	25,065	30,000		1,592				
1986	13,960	66,000			62			
1987	10,128	40,000						
1988	38,038	49,920						
1989	32,770	75,141				450		
1990	27,660	60,003					3,000	
1991	16,000	76,110						
1992	32,700	40,000						6,300
1993	42,290	50,000						1,742
1994	30,038	87,691						
1995	40,680	78,990						
1996	32,050	10,125	10,050					
1997	37,068	20,000	11,200					
1998	29,858	55,000						
1999	35,000	54,970	10,000					
2000	34,062	55,080	10,170				2,197	
2001	20,067	55,502	10,001					
2002	35,120	39,996	10,032					
2003	22,500	19,976						
2004	34,570	29,472						
2005	34,600	39,984						

Table 9. Current dissolved oxygen (mg/l) profile for Mann Lake.

2005

Depth (m)	April	May	June	July	August	September	October
0	11.1	9.4	10.0	10.0	6.7	8.7	8.6
1	11.1	9.4	11.2	11.2	5.5	8.8	8.5
2	11.2	9.4	11.0	10.6	5.6	8.4	8.4
3	11.1	9.4	10.5	9.4	5.8	7.8	8.3
4	11.1	9.3	9.7	9.0	7.5	6.3	8.1
5	10.4	8.5	7.4	7.8	5.3	5.7	8.0
6	9.8	6.8	4.8	6.9	4.8	5.5	8.0
7	9.8	5.1	3.9	4.7	5.7	5.1	7.5
8	9.5	4.6	2.6	4.3	6.0	4.6	7.0
9	9.5	4.4	1.8				6.8
10	9.5	3.7	1.4				
11			0.7				

Figure 29. Bathymetric map of Mann Lake (58 ha).



Moose Creek Reservoir

Introduction

Moose Creek Reservoir is a 10.9 ha reservoir located in Latah County 12.9 km northwest of Bovill, Idaho at an elevation of 878 meters. The reservoir has a maximum depth of 3.9 meters with approximately 90% of the reservoir less than 2.4 meters deep. During the summer, a large portion (80-90%) is densely vegetated with a growth of aquatic macrophytes. The reservoir was drained and reconstructed in 1999. Moose Creek Reservoir, the site of an abandoned clay mining operation, is located on land owned by the Idaho Department of Lands. The Latah County Recreation District manages camping and day-use recreation on approximately 28 ha surrounding the reservoir.

Species Composition

Moose Creek Reservoir contains six species of game fish: (1) largemouth bass, (2) black crappie, (3) pumpkinseed, (4) bluegill, (5) black bullhead, and (6) rainbow trout. The only non-game fish species documented is the largescale sucker.

Current Management

Moose Creek Reservoir is a mixed fishery, containing both coldwater and warmwater species. It is managed as a put-and-take trout fishery with catchable rainbow trout stocked annually to maintain a catch rate of 0.5 fish/hour. The reservoir is designated as a Family Fishing Water with simplified regulations including year round seasons, no length limits, general six fish limit for trout and bass, no creel limits for other species, and no restrictions on fishing gear. Boat activity on Moose Creek Reservoir is restricted to electric motors only. The current management priority is to improve aquatic habitat and water quality.

Management Objectives

1. Meet seasonally high demand with catchable rainbow trout stockings.
2. Maintain total catch rate of 0.5 fish/hour.
3. Maintain warmwater fishery for largemouth bass, black crappie, and bluegill.
4. Improve water quality by controlling nuisance aquatic vegetation.

Current Population Data

Population Surveys

Clearwater Region fisheries management personnel conducted a standard lake survey of Moose Creek Reservoir on June 23, 2005. This survey resulted in the capture of 155 fish, including largemouth bass (N = 73), bluegill (N = 58), black crappie (N = 10), pumpkinseed (N = 12), and brown bullhead (N = 2). A comparison of catch per unit effort and percent composition between samples collected in 2001, 2004, and 2005 are shown in Figures 30 and 31, respectively. Largemouth bass and bluegill saw increase in both numbers and biomass in the 2005 sample, an indication that these populations are improving. For bass, this is evidenced by an increase in the number of middle and larger size fish (Figure 32). Bluegill have seen a shift in length frequency distribution towards larger fish (Figure 33). After seeing substantial increases in numbers, black crappie and pumpkinseed both experienced drops to the lowest

levels seen over the last three surveys. Even though fewer fish were collected, black crappie have continued to see a shift toward larger fish (Figure 34). Little change has been seen in the pumpkinseed length frequency during the last three samples (Figure 35).

Creel Surveys

Total angler effort on Moose Creek Reservoir during 2005 was estimated at 19,874 hours. This is a 67% increase from the level of effort in 1999, and a 41% increase from the level of effort in 1993 (Figure 36). The documented effort in 2005 consisted of 74.7% bank, 13.1% boat, and 12.2% ice anglers. Moose Creek Reservoir supported 1,823 hours of angling effort per ha (738 hours per acre) in 2005.

Anglers caught an estimated 36,753 fish from Moose Creek Reservoir during 2005, resulting in a catch rate of 1.9 fish/hour. This is higher than catch rates of 1.38 fish/hour during 1993 and 1.0 fish/hour in 1999. Anglers harvested 12,347 fish from Moose Creek Reservoir during 2005 (Appendix B), 34% of the total fish caught. Harvest rate was estimated to be 0.6 fish/hour. The harvest composition consisted of 82.8% hatchery trout, 11.3% bluegill, 3.0% black crappie, 2.6% pumpkinseed, and 0.3% largemouth bass (Figure 37).

Harvest of hatchery rainbow trout increased from an estimated 7,993 in 1999 to 10,222 in 2005 (Appendix B). Anglers also released an additional 7,334 (41.8%) hatchery trout. Both the number of hatchery trout stocked in Moose Creek Reservoir and the number of those fish harvested have fluctuated. Harvest has not shown a general trend either up or down. The hatchery trout return to creel has ranged from 46% 1999 to 84% in 2005. Harvest rates of hatchery trout have dropped from 1.0 fish/hour in 1993 to 0.5 fish/hour in 2005. The catch rate in 2005 was 0.9 fish/hour, almost twice the management goal of 0.5 fish/hour. The percent of the fishery supported by hatchery trout has stayed consistent, ranging from 83% in 2005 to 89% in 1999.

Stocking

A stocking history for Moose Creek Reservoir is shown on Table 10.

Limnology

Current temperature and dissolved oxygen profiles are shown on Table 11. A bathymetric map is shown in Figure 38.

Management Recommendations

1. Maintain annual stocking of approximately 17,500 catchable rainbow trout.

   Justification: Provide harvest opportunity for rainbow trout and maintain the catch rate objective of 0.5 fish/hour.

2. Conduct standard management surveys and monitoring:

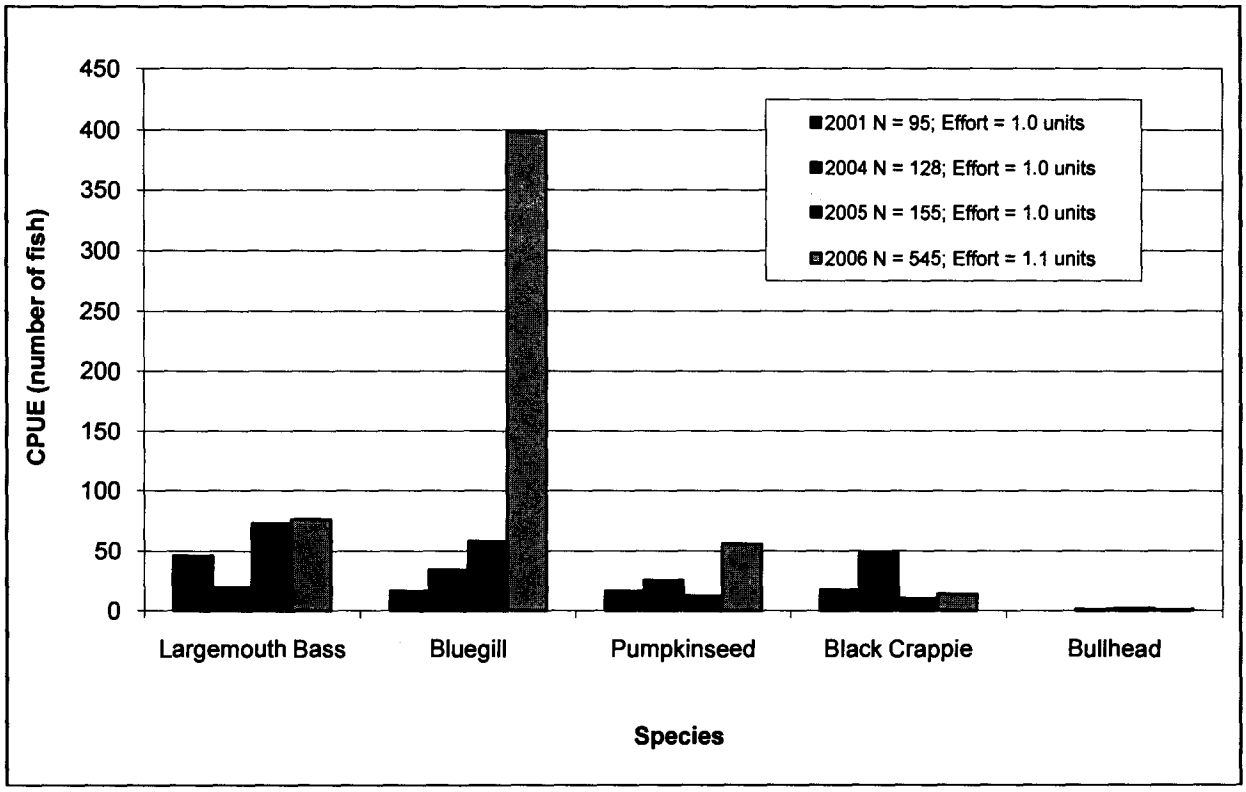
   a. Standard lowland lake population survey every three years.
   b. Creel survey every six years.
   c. Monthly water quality monitoring: D.O/temperature profiles (Jan.–Dec.); vegetation mapping (April-Sept.); ZPI (August).

Justification: Provide the population, effort, harvest, and limnological data needed to maintain the objective of a quality bass fishery, and to direct future management decisions.

3. Control approximately 30% of the excessive aquatic plant growth annually using the aquatic herbicide Reward®.

   Justification: The use of aquatic herbicides would prevent excess vegetation growth in shoreline areas utilized by fishermen and around the boat ramp in order to improve recreational access to the reservoir. Additionally, the reduction of aquatic plant material will lower the amount of organic material decaying in the reservoir. This will minimize the biological oxygen demand, resulting in improved D.O. levels, recreational access, and habitat quality for fish.

Figure 30. Catch per unit effort (CPUE) of fish collected from standard lake surveys of Moose Creek Reservoir in 2001, 2004, 2005, by number of fish and biomass.



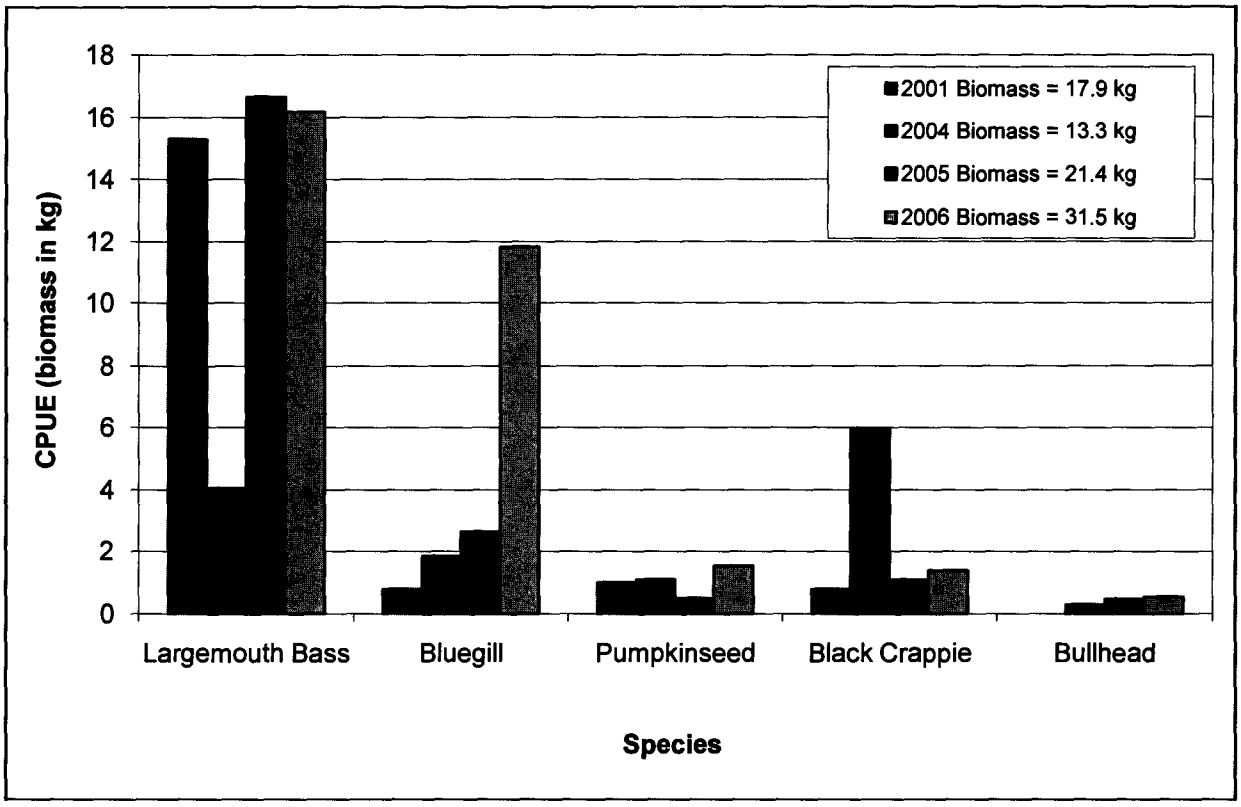
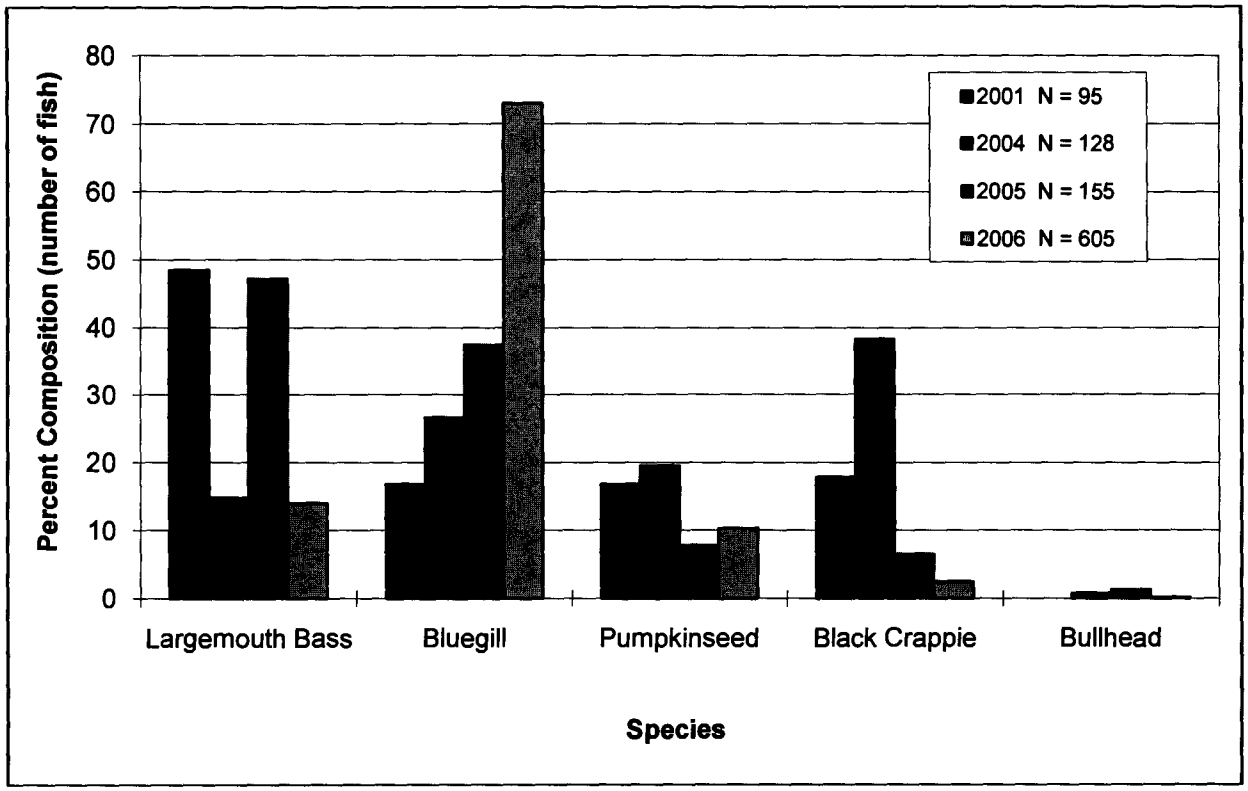
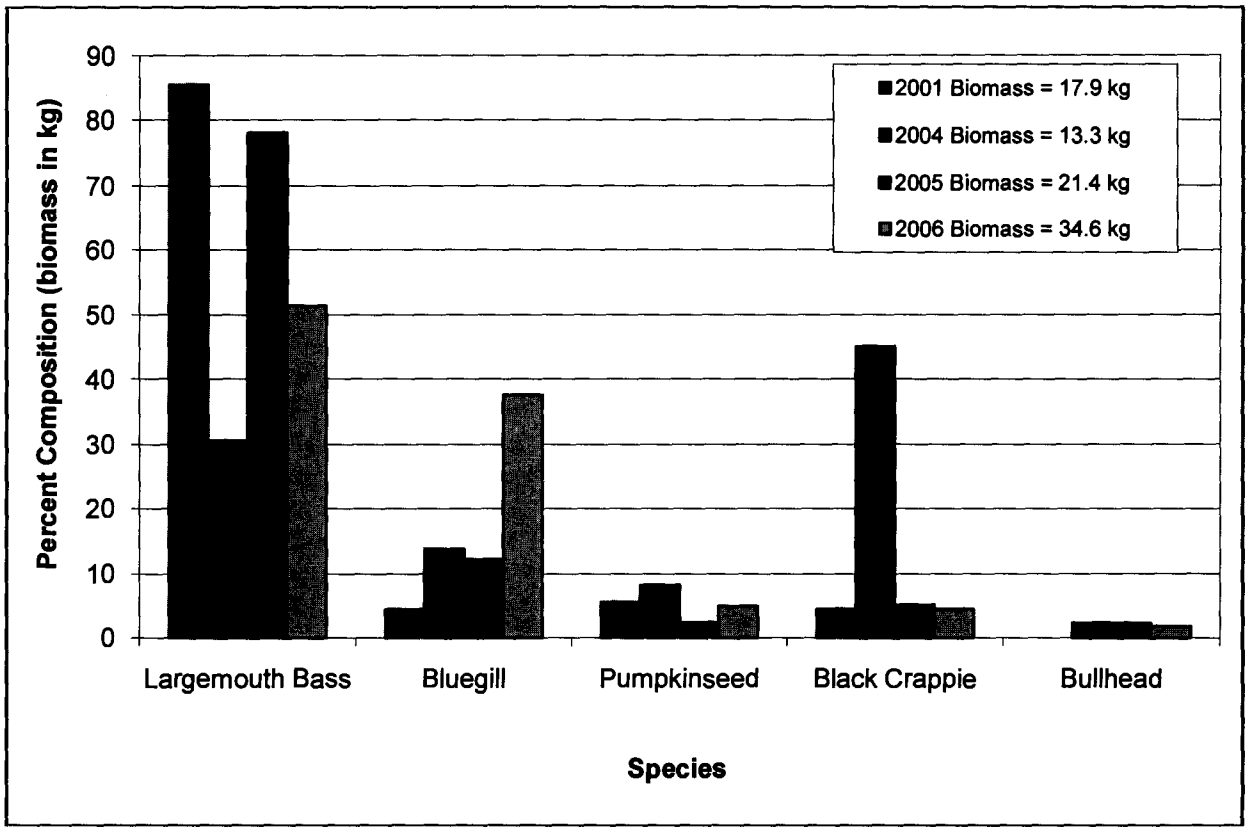


Figure 31. Percent composition of fish collected from standard lake surveys of Moose Creek Reservoir in 2001, 2004, and 2005, by number of fish and biomass.





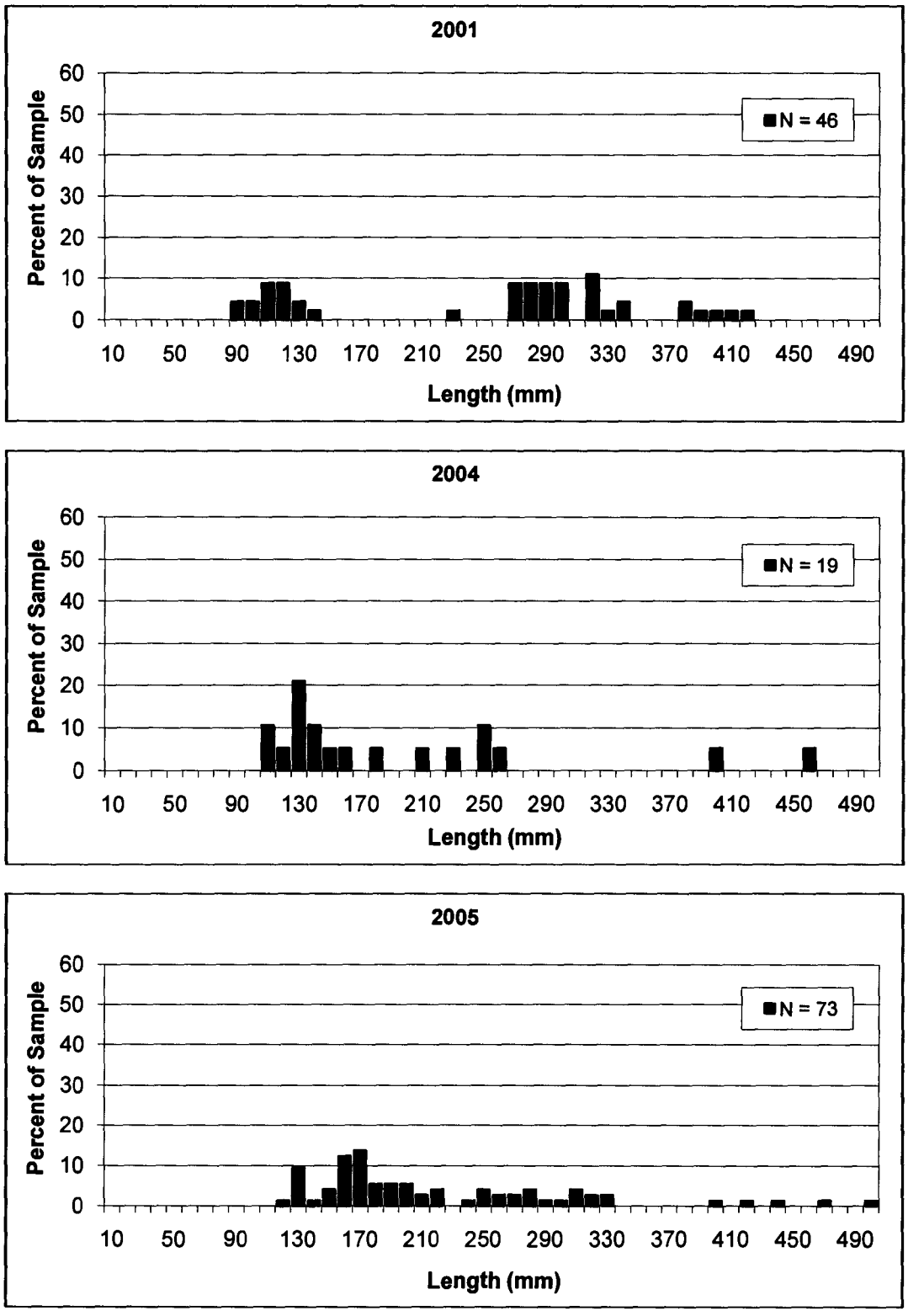


Figure 32. Length frequency distributions of largemouth bass collected from standard lake surveys of Moose Creek Reservoir in 2001, 2004, and 2005.

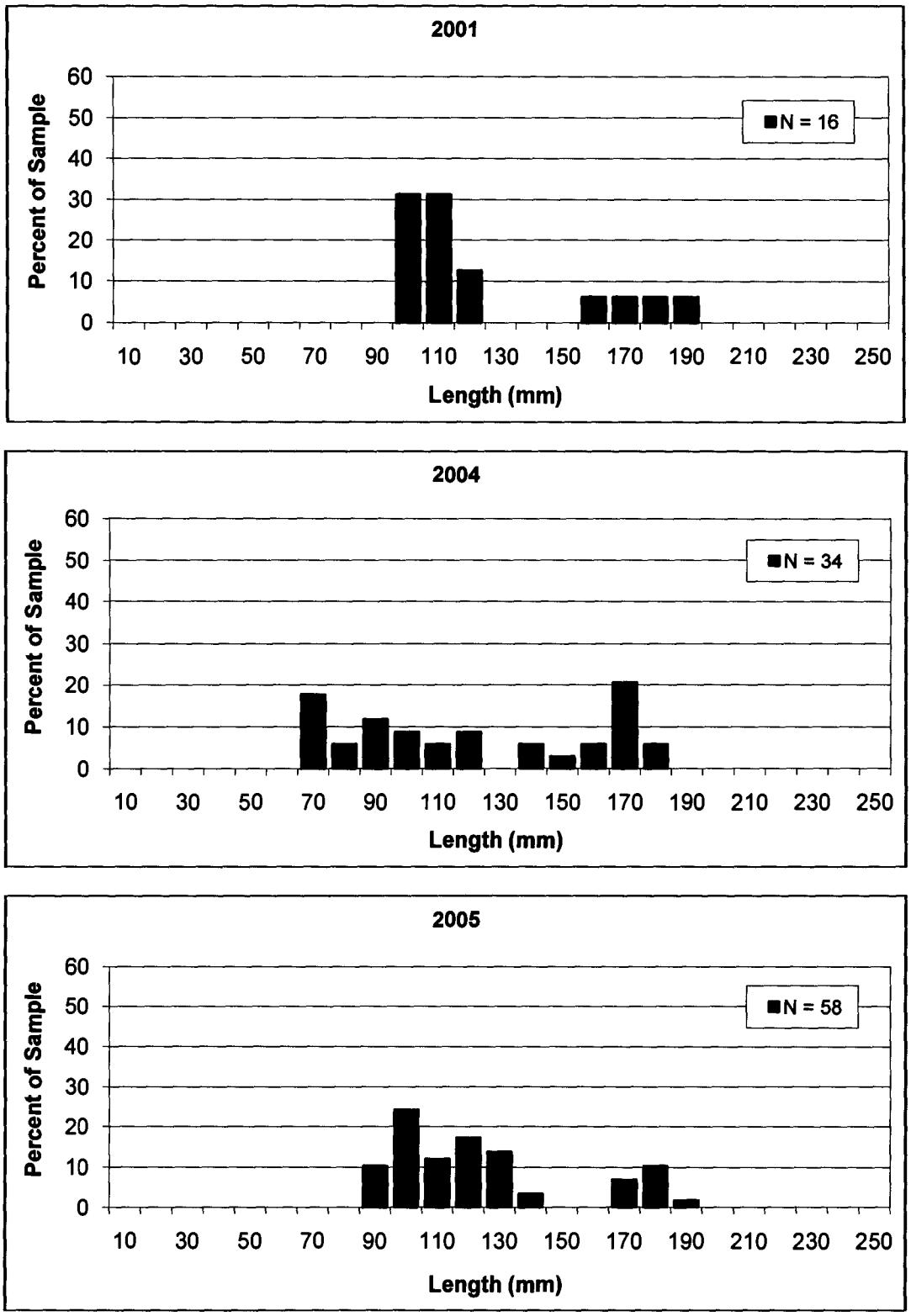


Figure 33. Length frequency distributions of bluegill collected from standard lake surveys of Moose Creek Reservoir in 2001, 2004, and 2005.

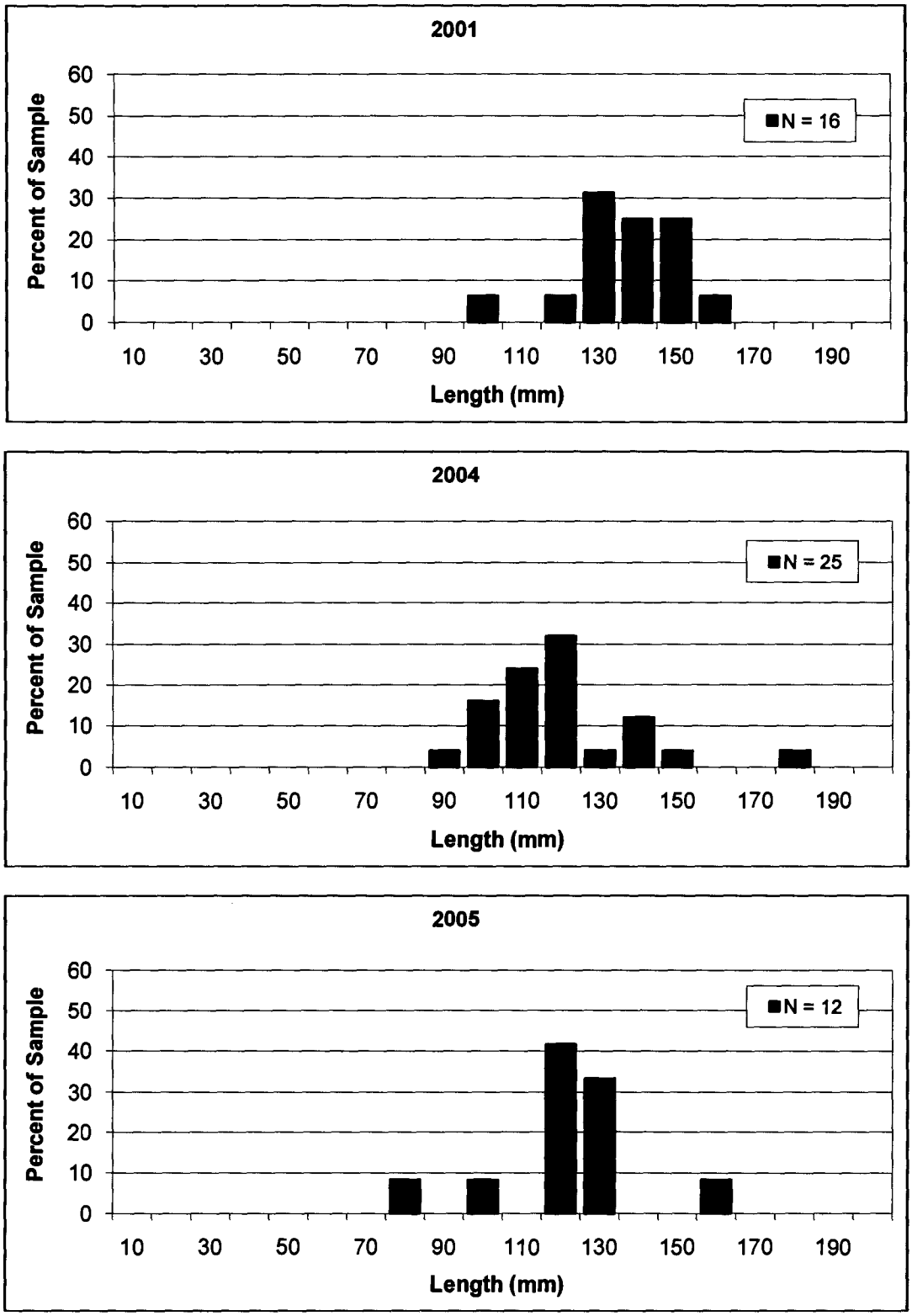


Figure 35. Length frequency distributions of pumpkinseed collected from standard lake surveys of Moose Creek Reservoir in 2001, 2004, and 2005.

Figure 36. Estimated angler effort, by type, from creel surveys of Moose Creek Reservoir in 1993, 1999, and 2005

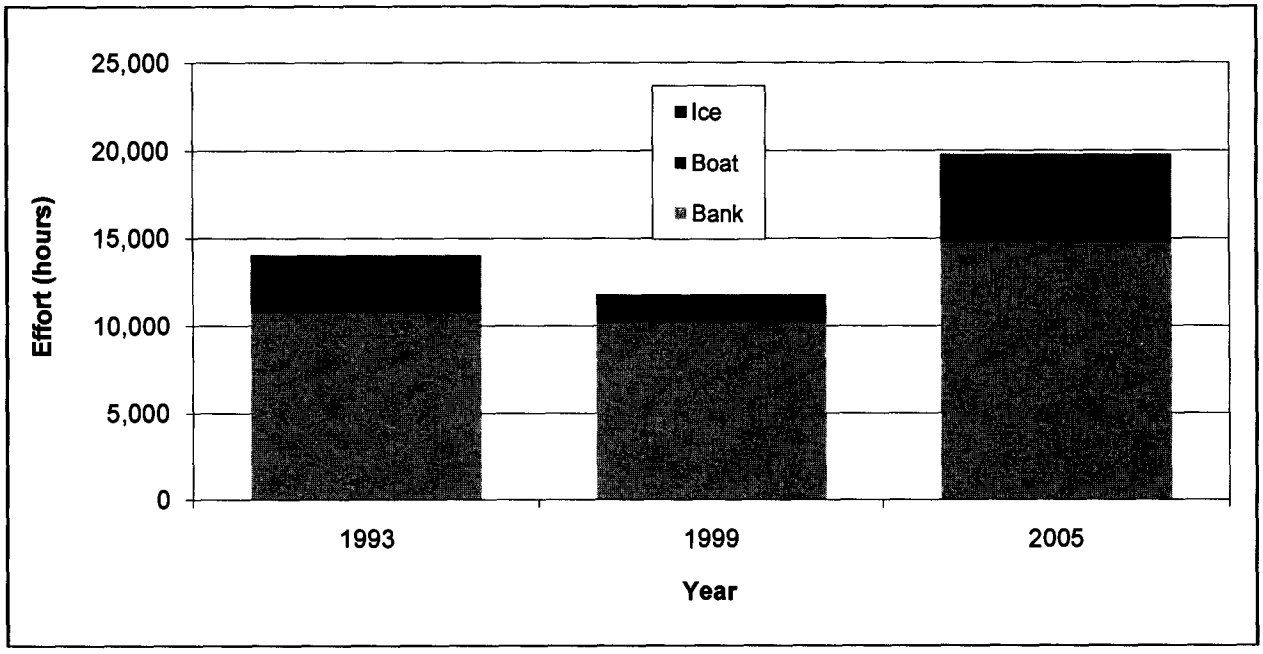


Figure 37. Catch composition of fish harvested during creel surveys of Moose Creek Reservoir in 1993, 1999, and 2005.

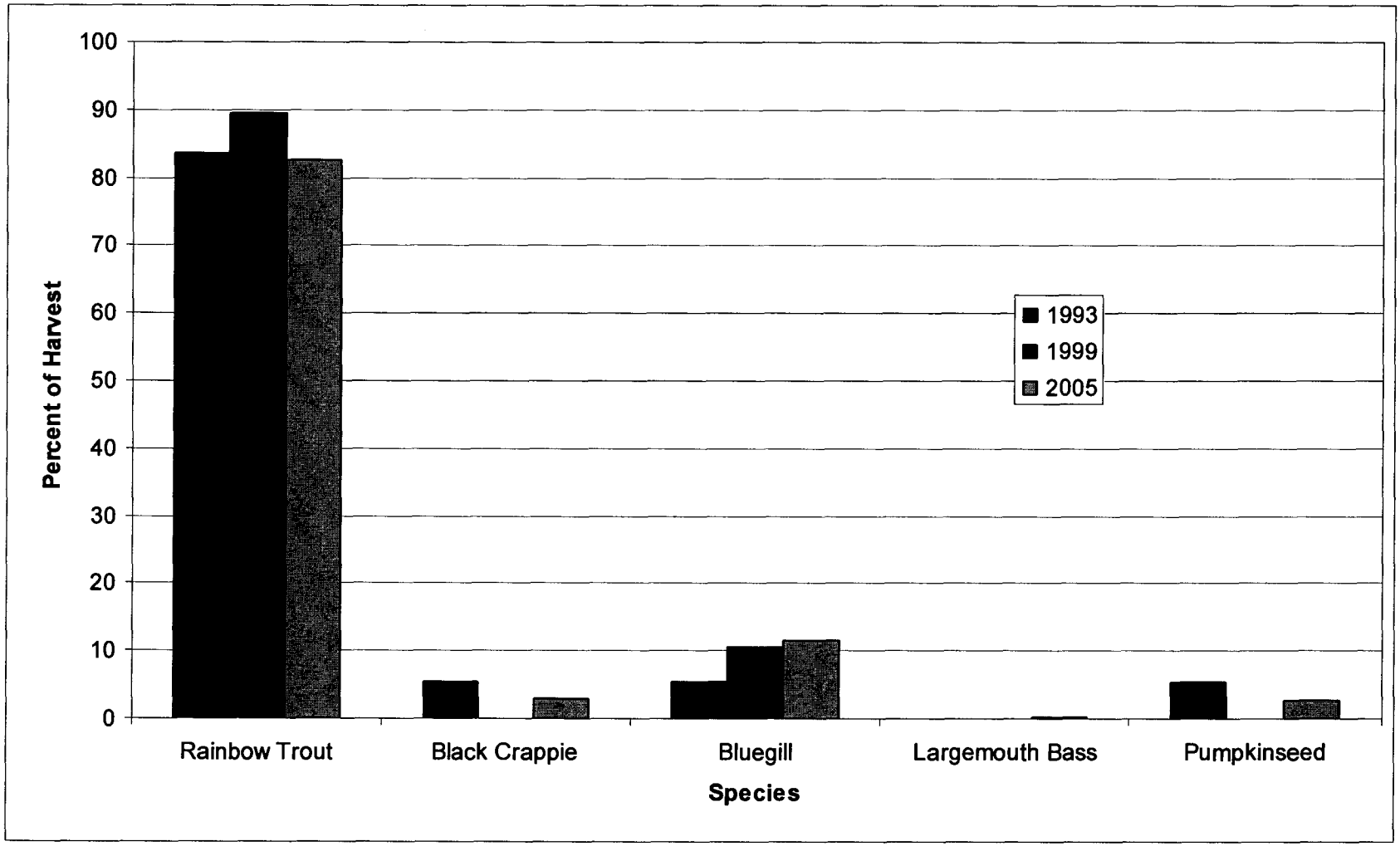


Table 10. Stocking history for Moose Creek Reservoir.

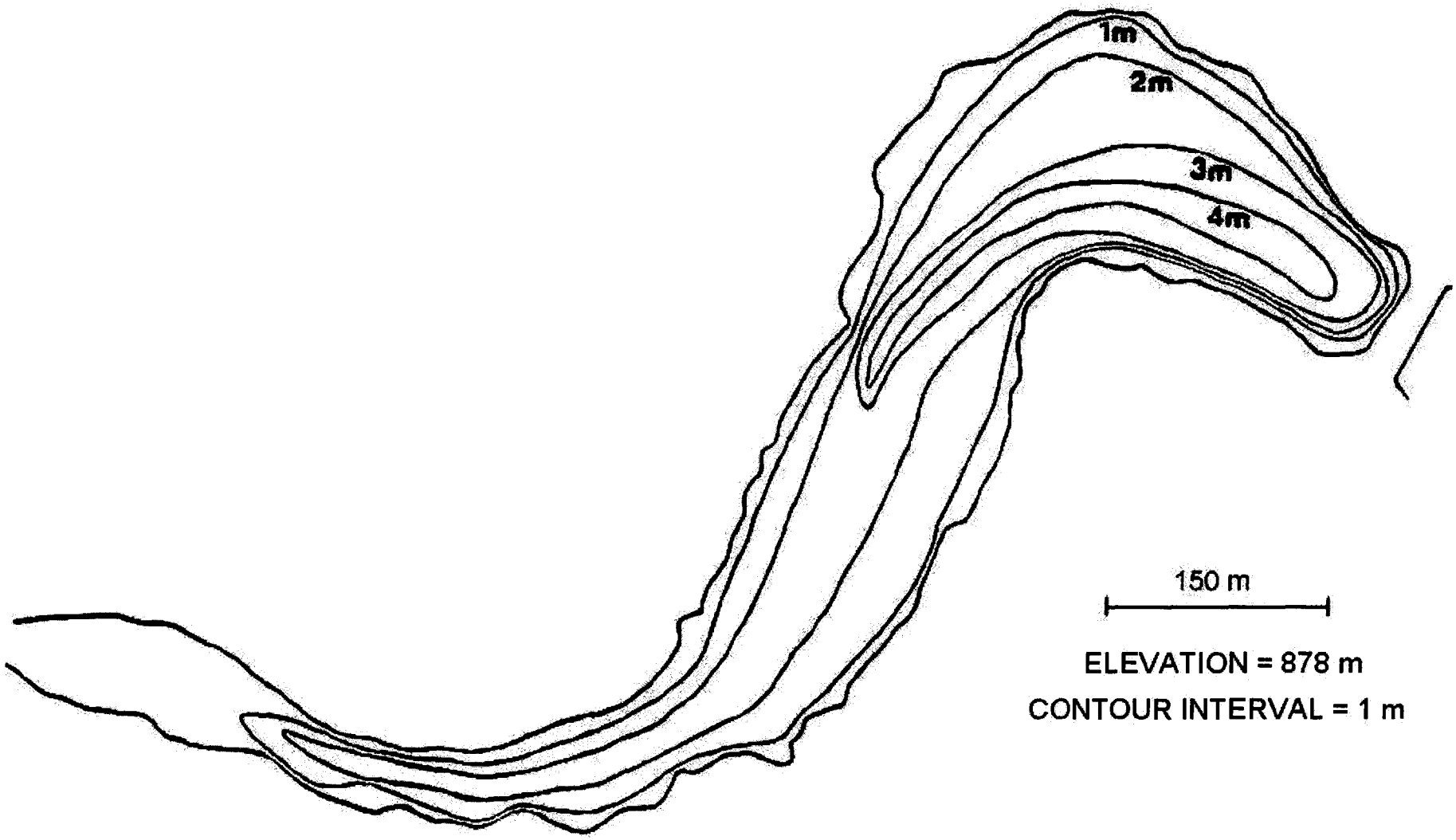
Year	Catchable Rainbow	Fingerling Rainbow	Fingerling Brook Trout	Largemouth Bass	RBT x WCT Hybrid	Bluegill
1968	4,880					
1969	1,820					
1970	4,920					
1971	1,615					
1972	1,170					
1973	4,700					
1974	3,120		3,036			
1975	5,470	4,268		300		
1976	5,610					
1977	6,280					
1978	8,940	2,552				
1979	9,250					
1980	14,050					
1981	18,284		2,818			
1982	5,000		3,760			225
1983	12,255	4,240				
1984	26,735		2,610			
1985	22,120	18,700				
1986	17,955					
1987	8,370	11,520				
1988	12,943					
1989	13,200	10,000				
1990	5,560	10,000			2,475	
1991	11,475					
1992	14,175					
1993	20,230	11,220				
1994	17,500					
1995	10,140	11,560				
1996	17,620					
1997	17,510					
1998	5,140					
1999	17,450					
2000	20,190					
2001	23,603					
2002	16,700					
2003	21,210					
2004	34,676					
2005	12,210					

Table 11. Current dissolved oxygen (mg/l) profile for Moose Creek Reservoir.

2005

Depth (m)	February	March	April	May	June	July	August	September	October	November
0	14.3		10.9	10.9	6.0	11.2	7.8	5.7	7.5	10.5
1	13.6		10.9	11.0	7.0	10.6	7.8	5.5	7.0	10.0
2	11.7		10.8	10.8	7.5	9.4	7.4	4.3	2.5	9.9
3	7.7		10.7	6.4	7.3	7.4	0.3	2.7	1.7	9.9
4	1.8		10.4	4.7	5.8	4.7	0.3	0.4		9.7
5	0.3									
6	0.1									
7										
8										
9										

Figure 38. Bathymetric map of Moose Creek Reservoir (10.9 ha).



Soldier's Meadow Reservoir

Introduction

Soldier's Meadow Reservoir is a 40.5 hectare reservoir located in Nez Perce County 11.2 km southeast of Waha, Idaho at an elevation of 1,378 meters. It has a mean depth of 5.6 meters and a maximum depth of 14.0 meters. Soldier's Meadow Reservoir was constructed for the LOID to retain water for irrigation purposes. Its primary water supply is from Webb and Captain John creeks. Water level fluctuations on an annual basis are commonplace. Severe water reductions usually begin by late June or early July as water is discharged for storage in Mann Lake. Low pool generally occurs during late fall towards the end of the irrigation season. Severity and timing of water level fluctuations is dependent on water yield in the LOID-managed watershed and irrigation demand. The timing of annual variations in water level can have major effects on the spawning success of warmwater species. Also, low pool levels through the winter have a negative effect on carrying capacity.

Species Composition

Soldier's Meadow Reservoir contains five species of game fish: (1) largemouth bass, (2) black crappie, (3) black bullhead, (4) kokanee *O. nerka*, and (5) rainbow trout.

Current Management

Soldier's Meadow Reservoir is a mixed fishery, containing both coldwater and warmwater species. It is managed as a put-and-take trout fishery with catchable and fingerling rainbow trout stocked annually to maintain a catch rate of 0.5 fish/hour. The reservoir is designated as a Family Fishing Water with simplified regulations including year-round seasons, no length limits, general six fish limit for trout and bass, no creel limits for other species, and no restrictions on fishing gear.

Management Objectives

1. Meet seasonally high demand with catchable rainbow trout stockings.
2. Maintain total catch rate of 0.5 fish/hour.
3. Maintain a warmwater fishery for largemouth bass and black crappie.

Current Population Data

Population Surveys

Clearwater Region fisheries management personnel conducted a standard lake survey of Soldier's Meadow Reservoir on June 8, 2005. This survey resulted in the capture of 124 fish, including black crappie (N = 92), and black bullhead (N = 32). A comparison of CPUE and percent composition between samples collected in 2003 and 2005 are shown in Figures 39 and 40, respectively. The 124 fish collected in 2005 is twice the number of fish collected in the 2003 sample. However, the biomass of fish collected was lower in 2005. This is primarily due to sharp decreases in black crappie and largemouth bass numbers and biomass. A comparison of black crappie length frequency distributions shows that while their numbers decreased, there was no change in the size structure (Figure 41). Black bullhead, on the other hand, saw a sharp increase in numbers and biomass from 2003 to 2005. However, the fish collected in 2005 only

ranged in length from 100 - 170mm (Figure 42). The large increase in numbers, combined with the decrease in average size and the narrow length frequency distribution, indicates the black bullhead population has become severely stunted.

Creel Surveys

Total angler effort on Soldier's Meadow Reservoir during 2005 was estimated at 9,215 hours. This is a 19% decrease from the level of effort in 1999, and a 38% decrease from the level of effort in 1993. The effort consisted of 76.0% bank, 22.4% boat, and 1.6% ice anglers (Figure 43). Soldier's Meadow Reservoir supported 228 hours of angling effort per ha (92 hours per acre; at full pool) in 2005.

Anglers caught an estimated 16,161 fish from Soldier's Meadow Reservoir during 2005, resulting in a catch rate of 1.8 fish/hour. This is higher than catch rates of 1.5 fish/hour during 1993 and 0.9 fish/hour in 1999. Anglers harvested 6,531 fish from Soldier's Meadow Reservoir during 2005 (Appendix B), 40% of the total fish caught. The harvest rate was estimated to be 0.7 fish/hour. The harvest composition consisted of 73.4% hatchery trout, 25.2% black crappie, 1.1% black bullhead, and 0.3% kokanee (Figure 44). Black crappie are becoming an important component of the fishery, having gone from 4.8% of the harvest in 1993 to 25.2% of the harvest in 2005.

The number of hatchery rainbow trout harvested from Soldier's Meadow Reservoir has been declining over the last decade, decreasing from an estimated 15,893 in 1993 to 4,791 in 2005 (Appendix B). The extremely low harvest in 2005 occurred despite stocking twice the requested number of fish. This may be partially due to anglers releasing 5,001 (51.1%) of the hatchery trout they caught. The return to creel has dropped from 79% in 1993 to 22% in 2005. Harvest rates of hatchery rainbow trout have also dropped, from 1.1 fish/hour in 1993 to 0.52 fish/hour in 2005. However, the catch rate in 2005 was 1.1 fish/hour, twice the management goal of 0.5 fish/hour. Additionally, the percent of the fishery supported by hatchery trout has fluctuated, but has not shown an overall downward trend. The decline in angler effort and hatchery trout return to creel, combined with the high catch rate indicates a potential need to reduce the annual stocking in the reservoir.

Stocking

A stocking history for Soldier's Meadow Reservoir is shown on Table 12.

Limnology

Current temperature and dissolved oxygen profiles are shown on Table 13. A bathymetric map is shown in Figure 45.

Management Recommendations

1. Reduce annual stocking of catchable rainbow trout from 10,000 to 8,000.

   Justification: The reservoir has seen a continued drop in angling effort and hatchery trout return to creel over the last decade. During this time, however, catch rates have remained consistently above the management goal of 0.5 fish/hour. A reduction in stocking numbers will reduce cost and the waste of hatchery product, and increase food resources for other fish species.

2. Conduct standard management surveys and monitoring:

    a. Standard lowland lake population survey every three years.
    b. Creel survey every six years.
    c. Monthly water quality monitoring: D.O/temperature profiles (Jan. – Dec.); ZPI (August) (Teuscher 2001).

    Justification: Provide the population, effort, harvest, and limnological data needed to meet the objective of maintaining a warmwater fishery, and to direct future management decisions.

3. Remove Family Fishing Water designation.

    Justification: The reservoir does not satisfy the intent of a Family Fishing Water designation. It has difficult access, no docks or picnic areas, and is often the site of activities that are not family friendly.

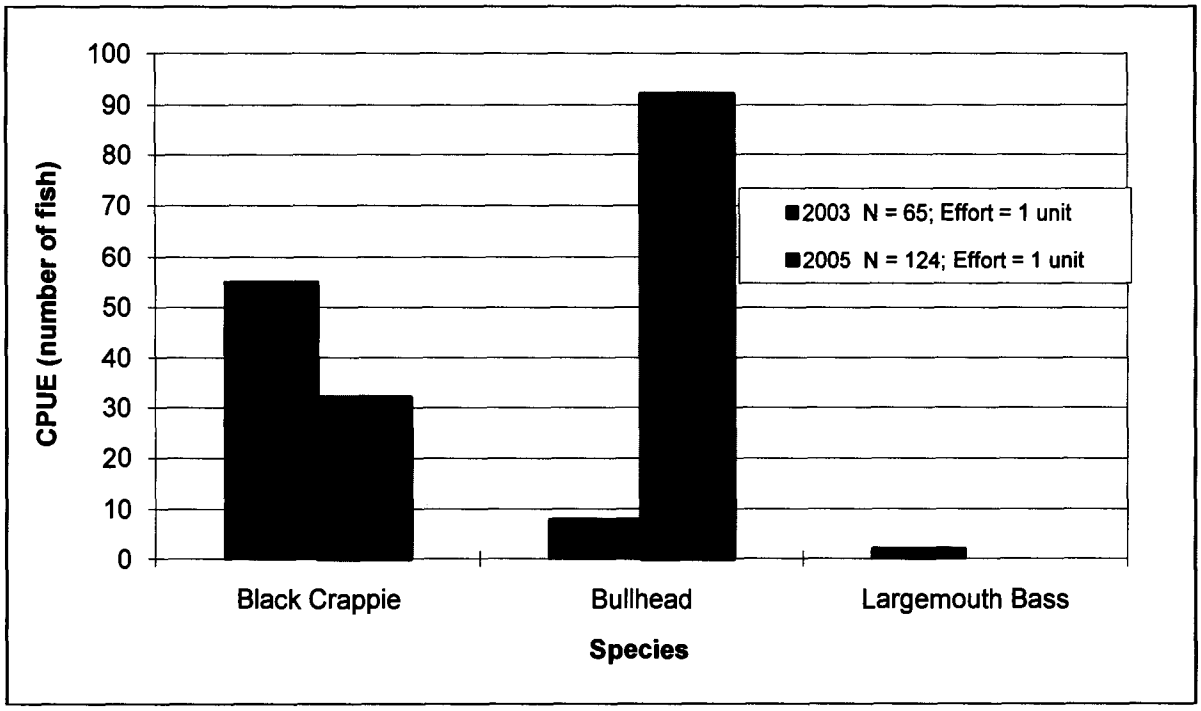
4. Reintroduce largemouth bass.

    Justification: Reestablishing the largemouth bass population could provide natural control of the stunted bullhead population.

5. Determine relationship of water level and timing of water withdrawal with relative success of hatchery trout program.

    Justification: This information would provide guidance as to the times when stocking hatchery fish is most and least efficient, thus allowing fisheries managers to concentrate stocking efforts when it would be the most successful.

Figure 39. Catch per unit effort (CPUE) of fish collected from standard lake surveys of Soldier's Meadow Reservoir in 2003 and 2005, by number of fish and biomass.



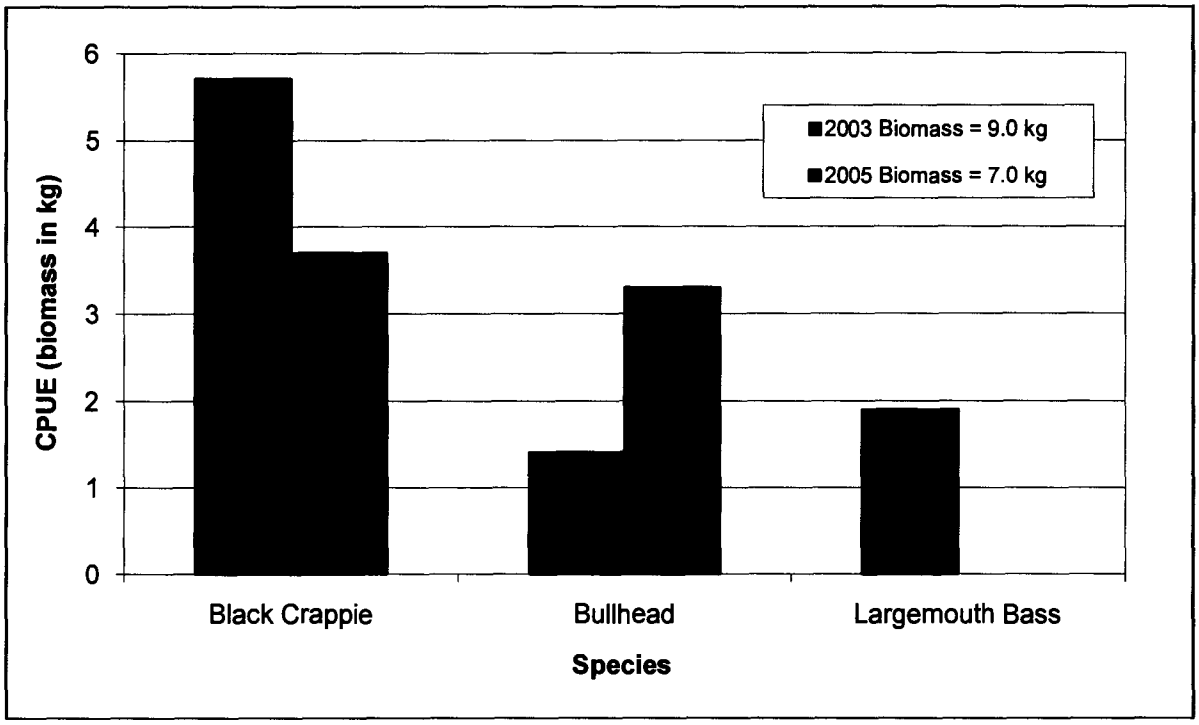
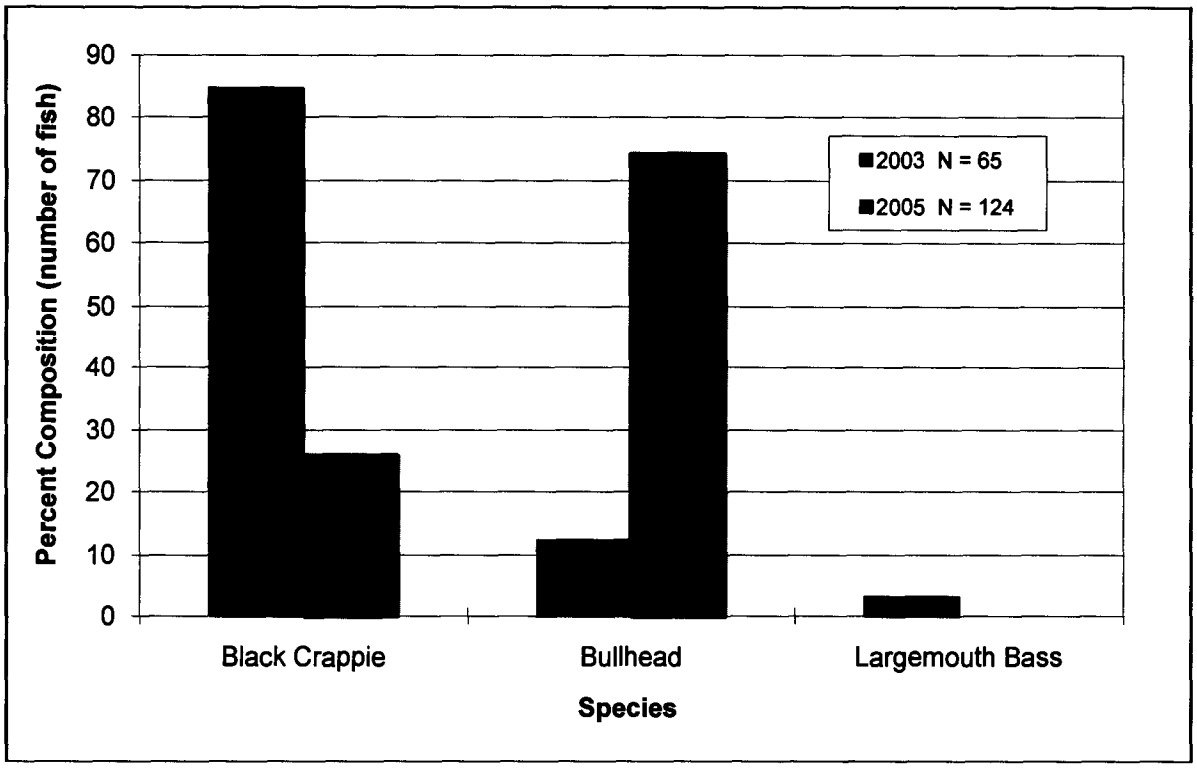
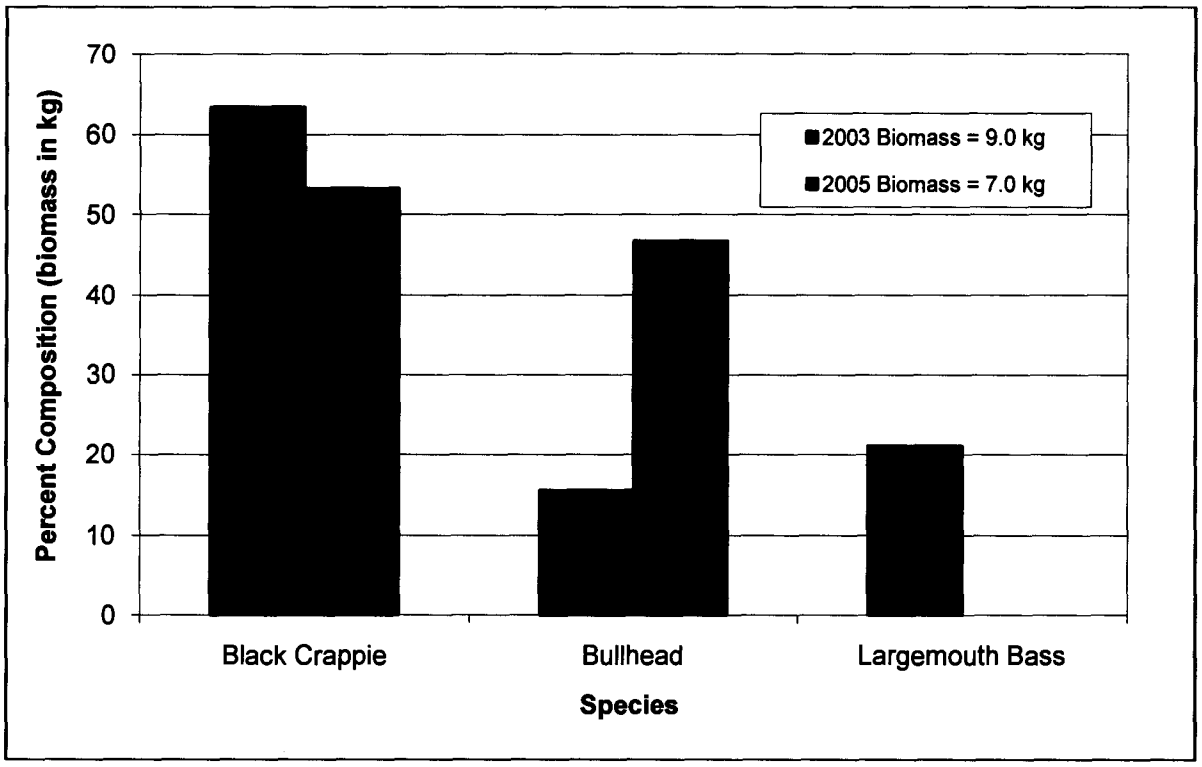


Figure 40. Percent composition of fish collected from standard lake surveys of Soldier's Meadow Reservoir in 2003 and 2005, by number of fish and biomass.





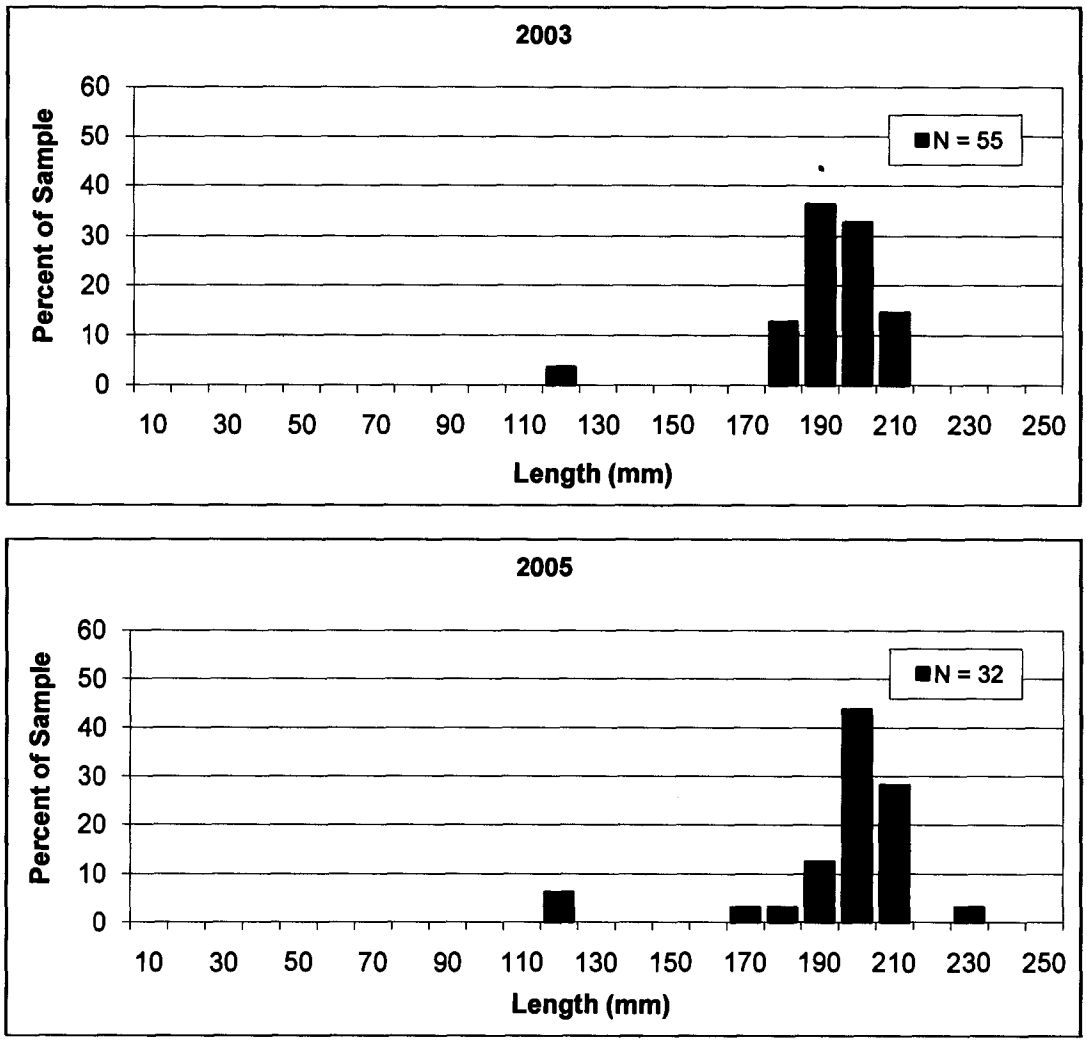


Figure 41. Length frequency distributions of black crappie collected from a standard lake survey of Soldier's Meadow Reservoir in 2003 and 2005.

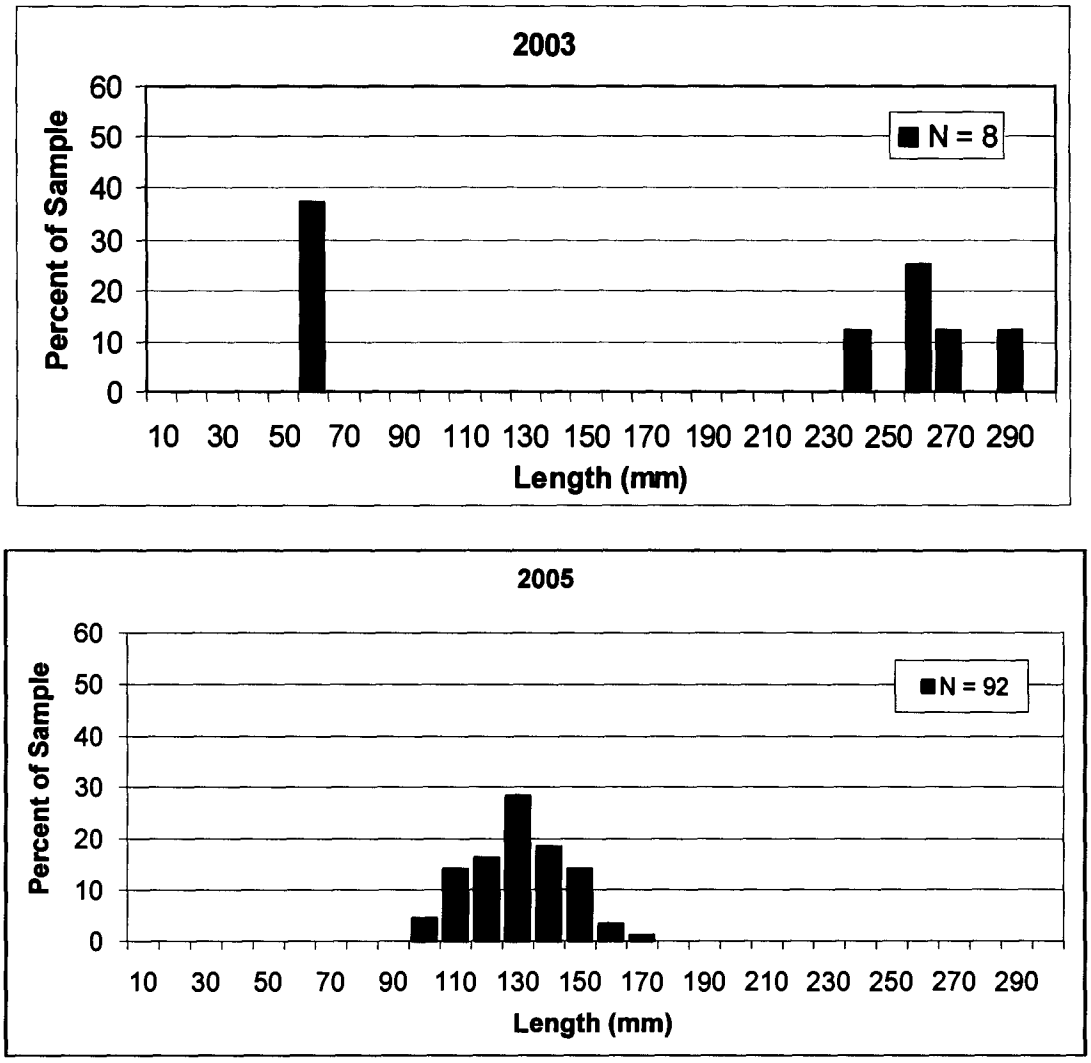


Figure 42. Length frequency distributions of black bullhead collected from a standard lake survey of Soldier's Meadow Reservoir in 2003 and 2004.

Table 12. Stocking history for Soldier's Meadow Reservoir.

Year	Catchable Rainbow	Fingerling Rainbow	Fingerling Cutthroat	Kokanee	RBT x WCT Hybrids
1968	5840	28000	47400		
1969	8560	23340			
1970	4700	24888			
1971	8480				
1972	1200	15400			
1973	3700	14950			
1974	4720				
1975	9760	45000			
1976	16760	43240	34000		
1977	8670				
1978	21600	7840			
1979	27985				
1980	36720				
1981	28285				
1982	13130				
1983	21660				
1984	32550				
1985	24238	33730			
1986					
1987	25340				
1988	5040				
1989	10230				
1990	5439	33706		15000	7200
1991	275	24183		16630	
1992	3000	33340		5057	
1993	20872	25013		5042	
1994	9500	10000		5040	
1995	10100	21352		5750	
1996	13025			5025	
1997	11901			5600	
1998	14005	10000			
1999	13391	15820		5000	
2000	25329	14960			
2001	15922	15485		5000	
2002	15741	20000		5016	
2003	10240	7500			
2004	20339	19632			

Table 13. Current dissolved oxygen (mg/l) profile for Soldier's Meadow Reservoir.

2005								
Depth (m)	February	March	April	May	June	July	August	September
0	9.5		10.5	11.3	10.5	9.1	8.6	8.2
1	6.8		10.5	11.5	10.2	9.2	7.6	7.7
2	6.7		10.5	11.6	10.1	8.8	7.5	7.5
3	6.5		10.4	11.1	8.6	6.9	7.7	7.5
4	5.2		10.4	10.9	5.7	2.9	7.6	7.0
5	5.3		10.3	8.5	4.9	1.8	5.7	6.4
6	4.4		10.3	8.4	4.7	1.2	1.4	5.8
7	2.9		10.3	8.3	4.6	1.0	0.2	5.1
8	0.3		10.2	8.0				4.4
9	0.2		10.2	7.3				3.3
10	0.2		10.2	6.6				
11			9.5					

Figure 43. Estimated angler effort, by type, from creel surveys of Soldier's Meadow Reservoir in 1993, 1999, and 2005.

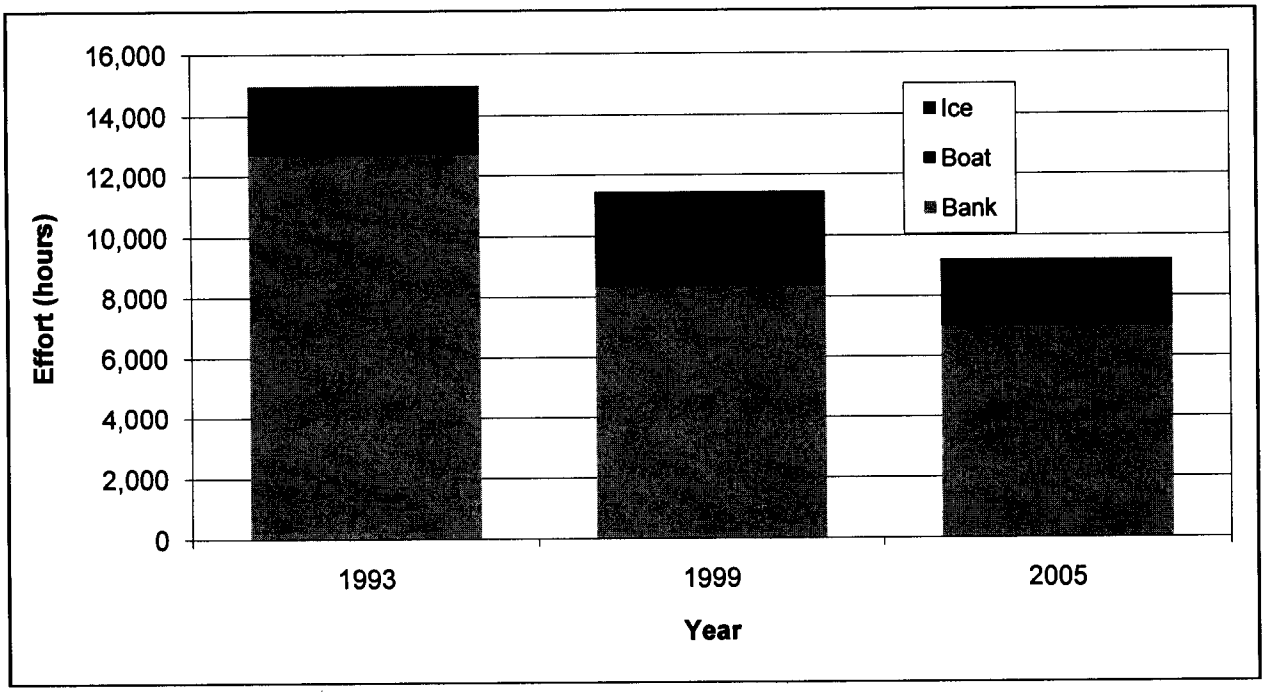
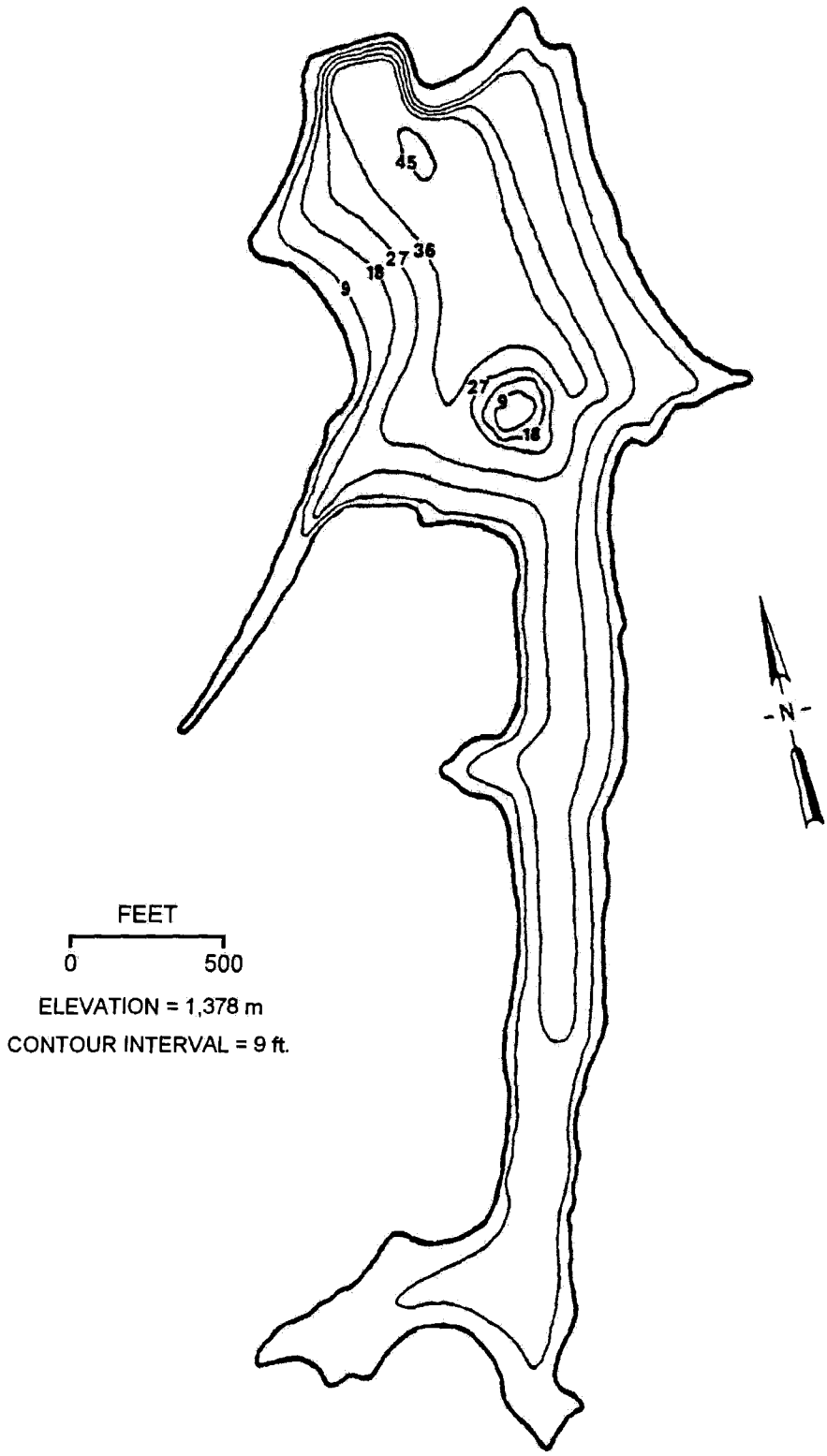


Figure 45. Bathymetric map of Soldier's Meadow Reservoir (40.5 ha).



Spring Valley Reservoir

Introduction

Spring Valley Reservoir is a 19.8 hectare reservoir located in Latah County about 12.9 km east of Troy, Idaho at an elevation of 726 meters. It has a mean depth of approximately 3.6 meters with a maximum depth of 8.8 meters. Spring Valley Reservoir was originally constructed in 1961 by IDFG to create a recreational fishery. In 1993, the spillway was reconfigured to meet the dam safety specifications of the Idaho Department of Water Resources.

Species Composition

Spring Valley Reservoir contains four species of game fish: (1) largemouth bass, (2) bluegill, (3) black crappie, and (4) rainbow trout.

Current Management

Spring Valley Reservoir is a mixed fishery, containing both coldwater and warmwater species. It is managed as a put-and-take trout fishery with catchable and fingerling rainbow trout stocked annually to maintain a catch rate of 0.5 fish/hour, and for yield fisheries for black crappie and bluegill. The reservoir is designated as a Family Fishing Water with simplified regulations including year round seasons, no length limits, general six fish limit for trout and bass, no creel limits for other species, and no restrictions on fishing gear. Boat activity on Spring Valley Reservoir is restricted to electric motors only. The current management priority is to improve aquatic habitat and water quality.

Management Objectives

1. Meet seasonally high demand with catchable rainbow trout stockings.
2. Maintain total catch rate of 0.5 fish/hour.
3. Maintain warmwater fishery including yield fisheries for black crappie and bluegill.
4. Improve aquatic habitat and water quality by controlling nuisance aquatic vegetation.

Current Population Data

Population Surveys

Clearwater Region fisheries management personnel conducted a standard lake survey of Spring Valley Reservoir on May 28, 2004. This survey resulted in the capture of 297 fish, including largemouth bass (N = 127), bluegill (N = 120), and black crappie (N = 50). Due to the large number of fish collected during electrofishing, only 0.5 units of electrofishing effort were conducted. A comparison of CPUE and percent composition between samples collected in 1997, 2001, and 2004 are shown in Figures 46 and 47 respectively. When comparing catch per unit effort, the number of largemouth bass collected in 2004 was similar to the number collected in 1997, but only half of the number collected in 2001. However, the 2004 sample had a substantially larger biomass than the 1997 and 2001 samples, indicating that the fish collected in 2004 were larger than in previous years. This is confirmed by comparing length frequency distributions of the bass collected during these three years (Figure 48). The number of bluegill collected was lower in 2004 than in the previous two samples; however a comparison of length frequency distributions shows a shift towards larger fish in the 2004 sample (Figure 49). In

2004, the black crappie collected ranged in length from 110-210 mm (Figure 50), and accounted for 16.8% of the number of fish collected and 5.4% of the biomass. In contrast, only one black crappie was collected in 1997 and 2001 combined. As a recent introduction, it is apparent that these fish are becoming an important component of the fishery.

Creel Surveys

Total angler effort on Spring Valley Reservoir during 2005 was estimated at 28,997 hours. This is a 12% decrease from the level of effort in 1999, and an 18% decrease from the level of effort in 1993 (Figure 1). The effort consisted of 81.4% bank, 11.2% boat, and 7.4% ice anglers (Figure 51). Spring Valley Reservoir supported 1,464 hours of angling effort per hectare (593 hours per acre) in 2005.

Anglers caught an estimated 52,031 fish from Spring Valley Reservoir during 2005, resulting in a catch rate of 1.8 fish/hour (Figure 3). This is higher than catch rates of 1.0 fish/hour during 1993 and 1.2 fish/hour in 1999. Anglers harvested 21,246 fish from Spring Valley Reservoir during 2005 (Appendix B), 41% of the total fish caught. The harvest rate was estimated to be 0.7 fish/hour (Figure 4). The harvest composition consisted of 65.5% hatchery trout, 21.2% bluegill, 11.5% black crappie, and 1.8% largemouth bass (Figure 52). Angler preference has been shifting from hatchery trout to warm-water fish. Warm-water species accounted for only 1.8% of the harvest 1993, but accounted for 34.5% of the harvest in 2005. This shift has been a result of an improved fishery for black crappie, bluegill, and largemouth bass, all of which have seen substantial increases in number and percent of harvest.

While the number of hatchery trout stocked in Mann Lake has remained fairly constant, the number of those fish harvested has been declining. Harvest of hatchery rainbow trout has decreased from an estimated 24,365 in 1993 to 13,907 in 2005 (Appendix B). The hatchery trout return to creel has fluctuated, but dropped to its lowest point at 42% in 2005, down from a high of 67% in 1999 (Table 3). This may be partially due to anglers releasing 8,904 (39%) of the hatchery trout they caught. A decline in harvest rates of hatchery trout has also been seen, as harvest has dropped from 0.8 fish/hour in 1993 to 0.5 fish/hour in 2005. Additionally, the percent of the fishery supported by hatchery trout has dropped considerably, from 96% in 1993 to 66% in 2005 (Table 3). This is partially due to the shift in angler preference from hatchery trout to warm-water species. However, the catch rate in 2005 was 0.8 fish/hour, above the management goal of 0.5 fish/hour. The decline in angling effort, return to creel, harvest rate, and percent of the fishery supported by hatchery trout indicates a potential need to reduce the annual stocking of rainbow trout in the reservoir.

Stocking

A stocking history for Spring Valley Reservoir is shown on Table 14.

Limnology

Historical temperature and dissolved oxygen profiles are shown on Table 15. A bathymetric map is shown in Figure 53.

Management Recommendations

1. Reduce annual stocking of catchable rainbow trout from 32,500 to 28,000.

   Justification: The reservoir has seen a continued drop in angling effort and hatchery trout return to creel over the last decade. During this time, however, catch rates have remained consistently above the management goal of 0.5 fish/hour. A reduction in stocking numbers will reduce cost and the waste of hatchery product, and increase food resources for other fish species.

2. Conduct standard management surveys and monitoring:

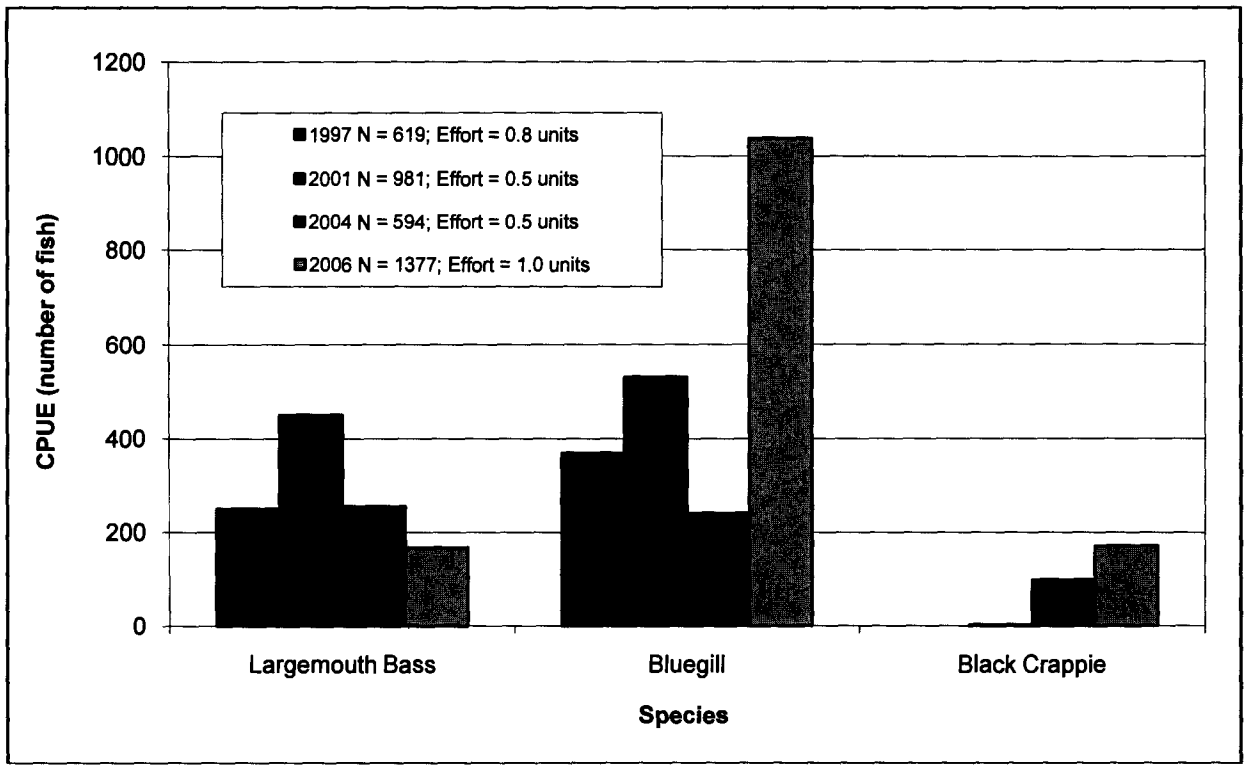
   a. Standard lowland lake population survey every three years.
   b. Creel survey every six years.
   c. Monthly water quality monitoring: D.O/temperature profiles (Jan. – Dec.); vegetation mapping (May-Sept.); ZPI (August).

   Justification: Provide the population, effort, harvest, and limnological data needed to maintain a warmwater fishery including yield fisheries for black crappie and bluegill, and to direct future management decisions.

3. Control approximately 30% of the excessive aquatic plant growth annually using the aquatic herbicide Reward®.

   Justification: The use of aquatic herbicides would prevent excess vegetation growth in shoreline areas utilized by fishermen and around the boat ramp in order to improve recreational access to the reservoir. Additionally, the reduction of aquatic plant material will lower the amount of organic material decaying in the reservoir. This will minimize the biological oxygen demand, resulting in improved D.O. levels, recreational access, and habitat quality for fish.

Figure 46. Catch per unit effort (CPUE) of fish collected from standard lake surveys of Spring Valley Reservoir in 1997, 2001, and 2004, by number of fish and biomass.



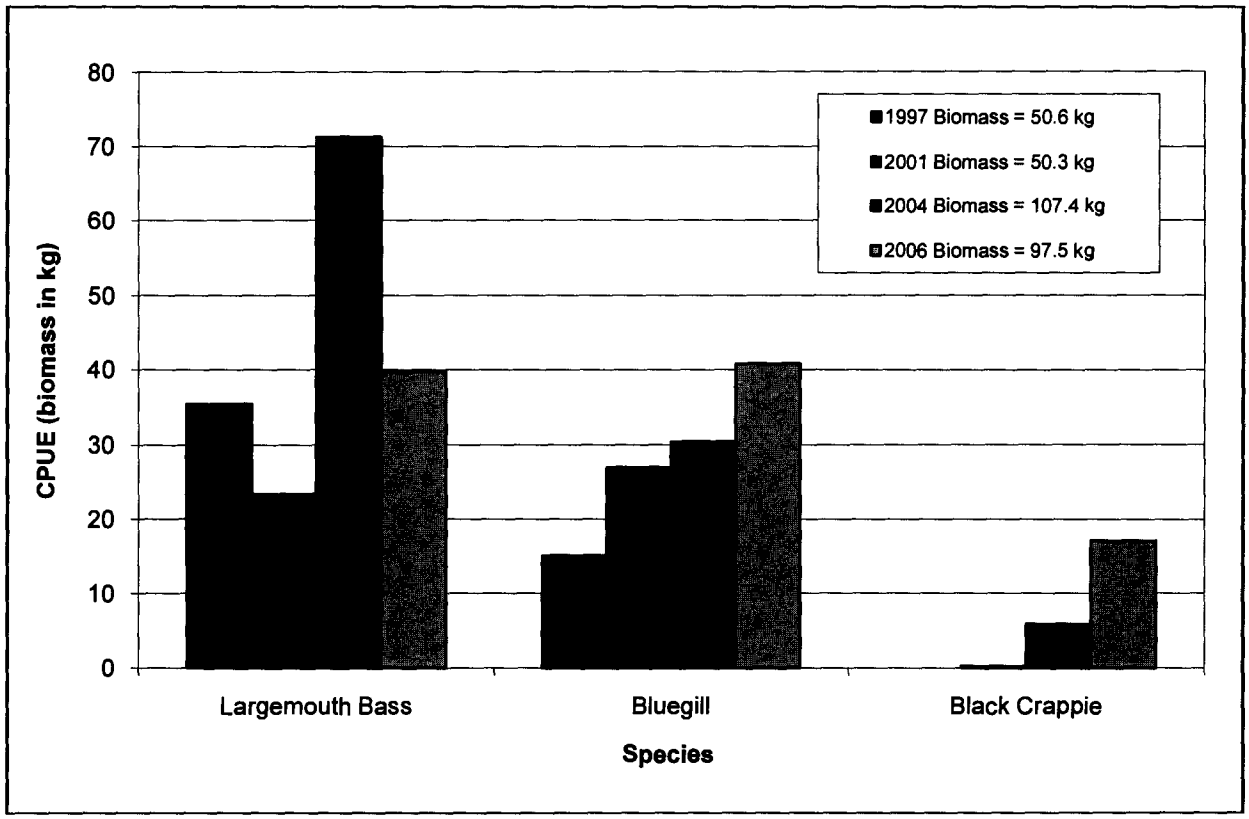
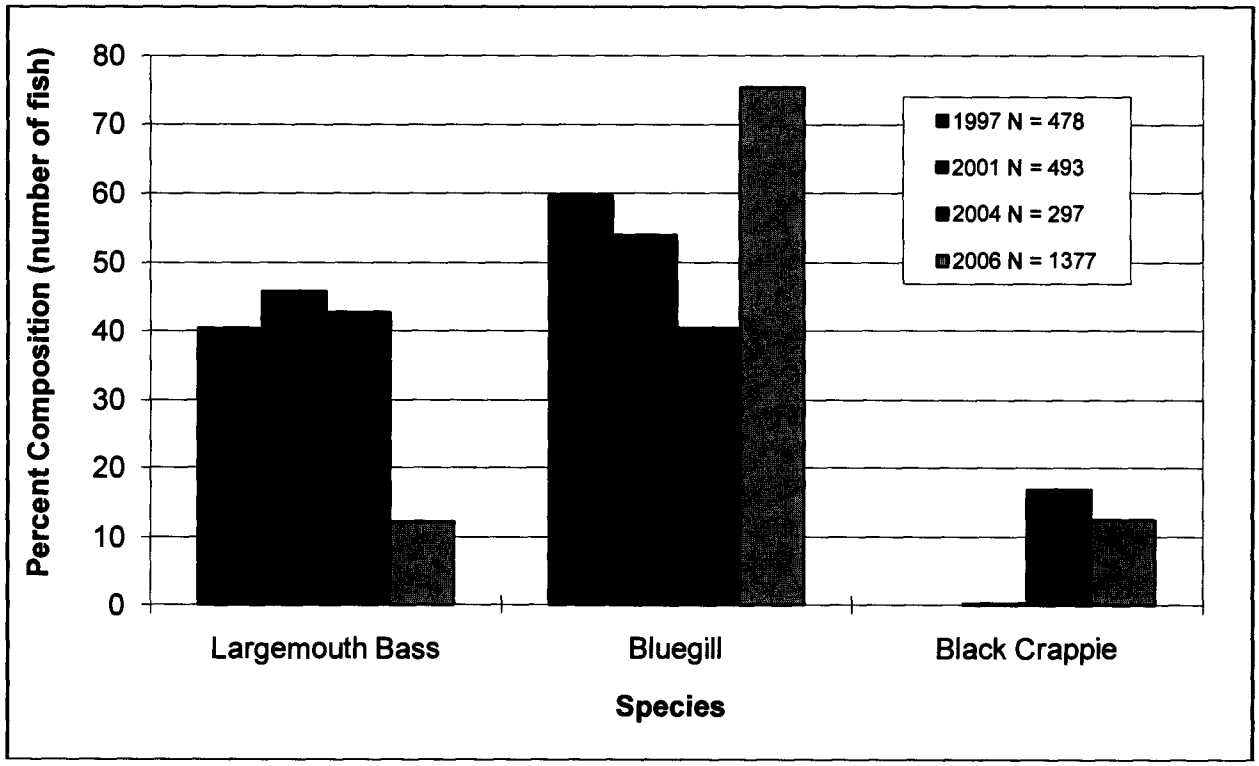
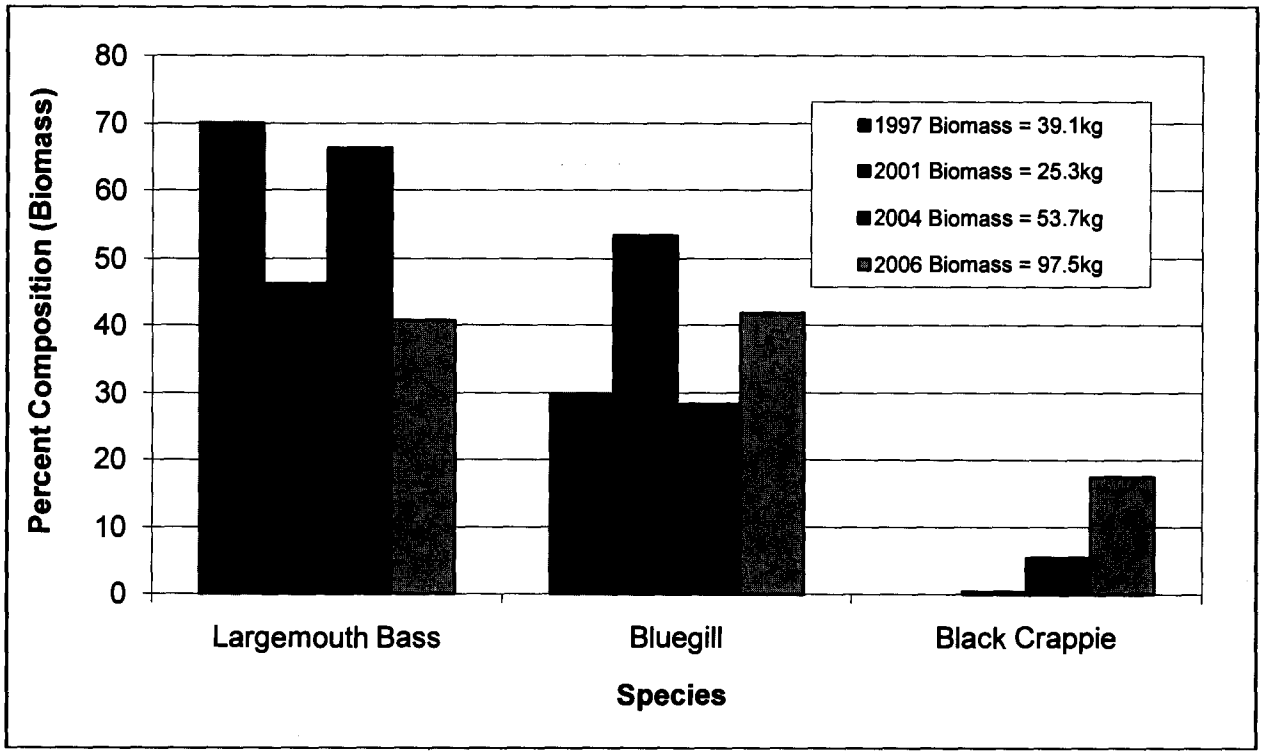


Figure 47. Percent composition of fish collected from standard lake surveys of Spring Valley Reservoir in 1997, 2001, and 2004, by number of fish and biomass.





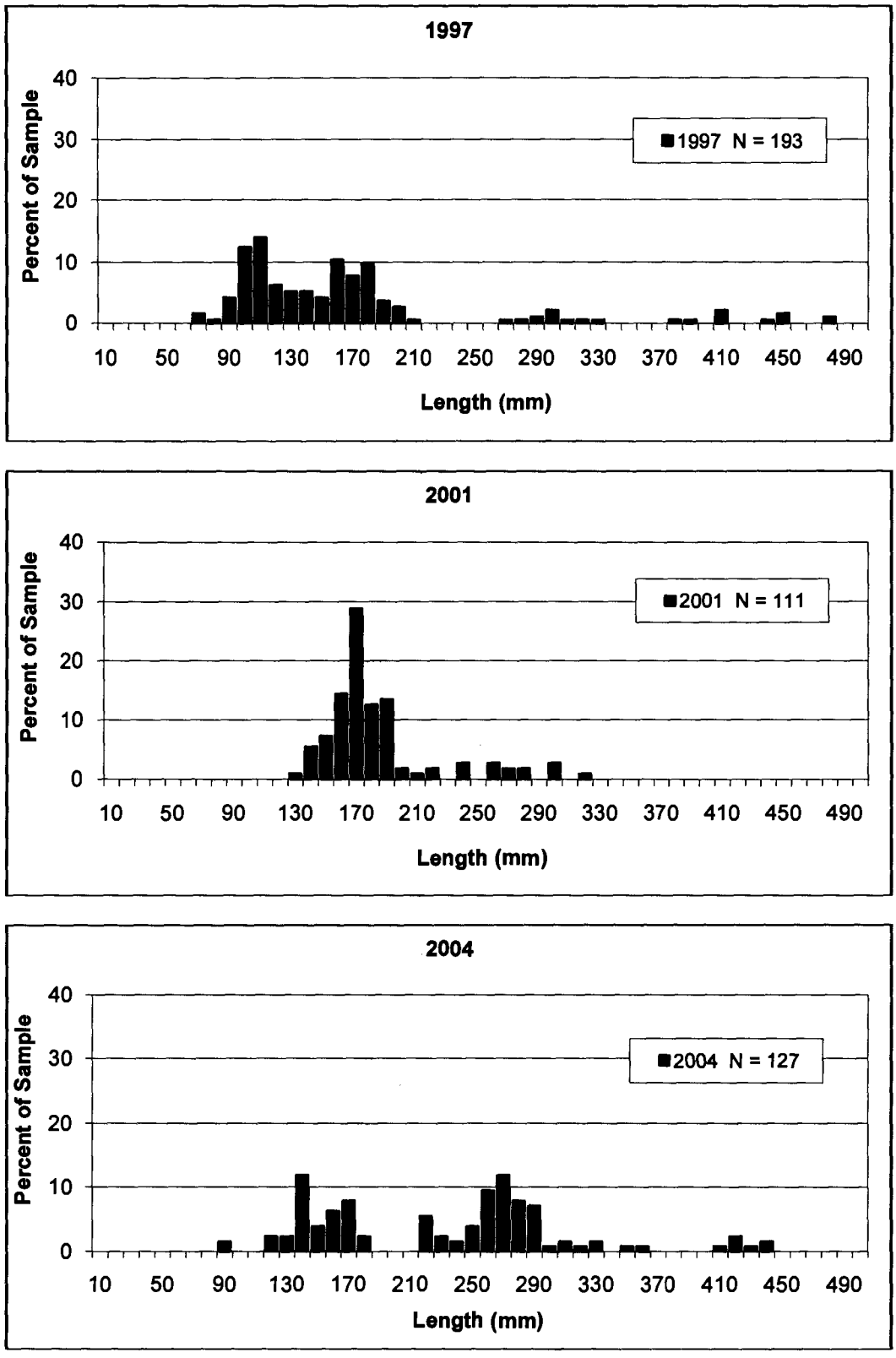


Figure 48. Length frequency distributions of largemouth bass collected from a standard lake survey of Spring Valley Reservoir in 1997, 2001, and 2004.

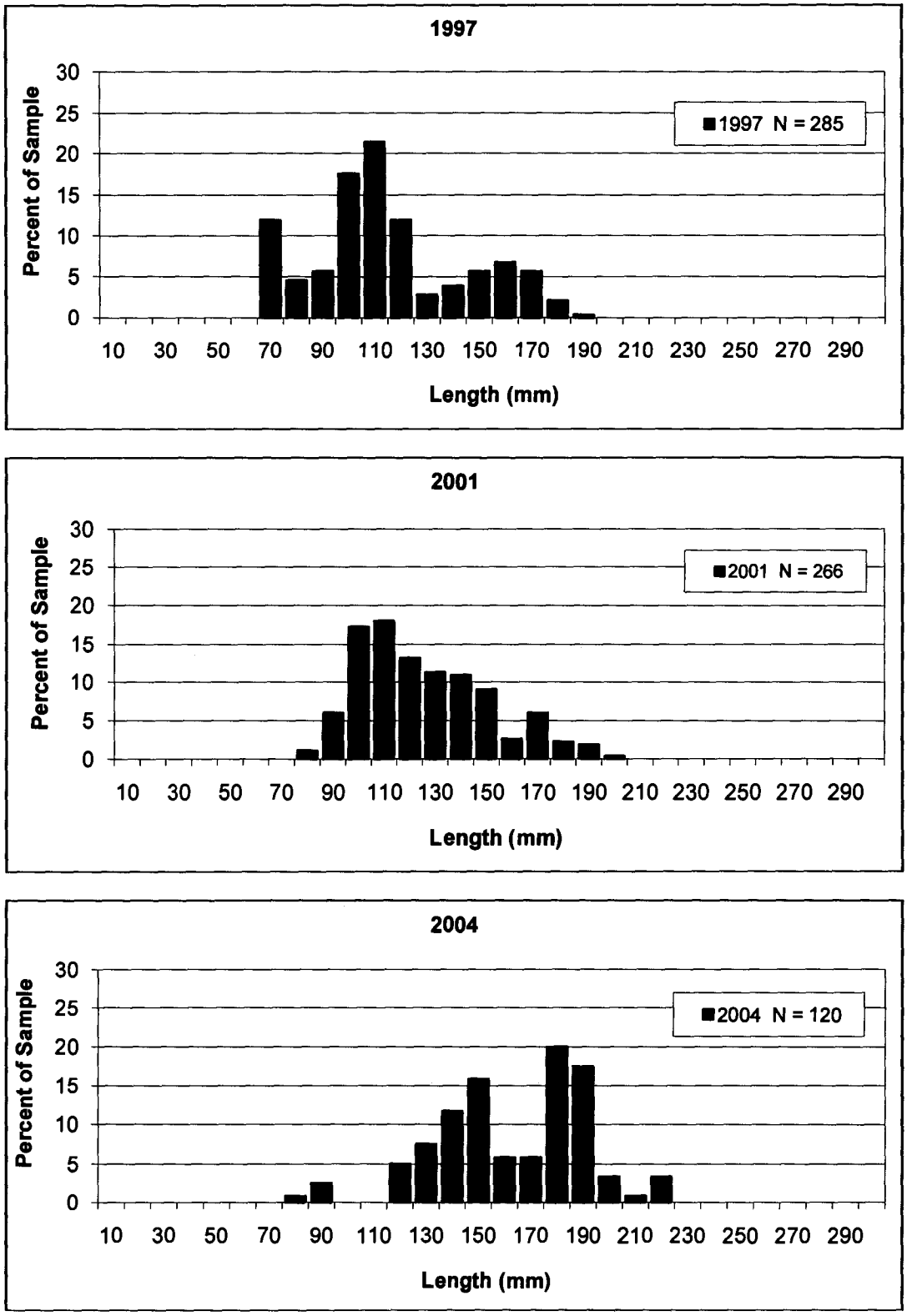


Figure 49. Length frequency distributions of bluegill collected from a standard lake survey of Spring Valley Reservoir in 2001, and 2004.

Figure 50. Length Frequency distributions of black crappie collected from a standard lake survey of Spring Valley Reservoir in 2004.

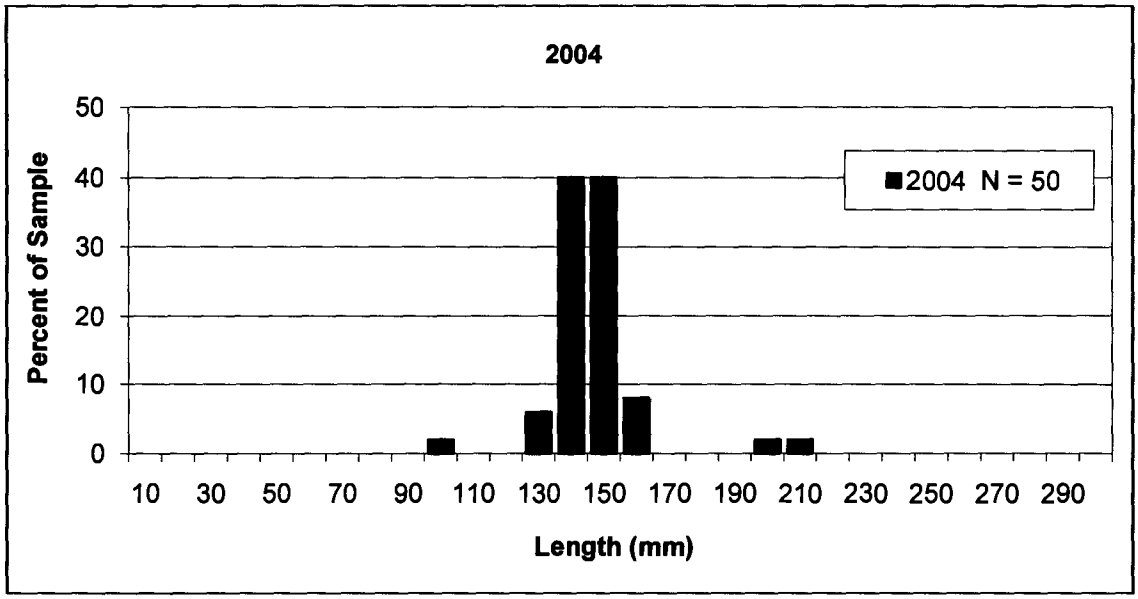


Figure 51. Estimated angler effort, by type, from creel surveys of Spring Valley Reservoir in 1993, 1999, and 2005

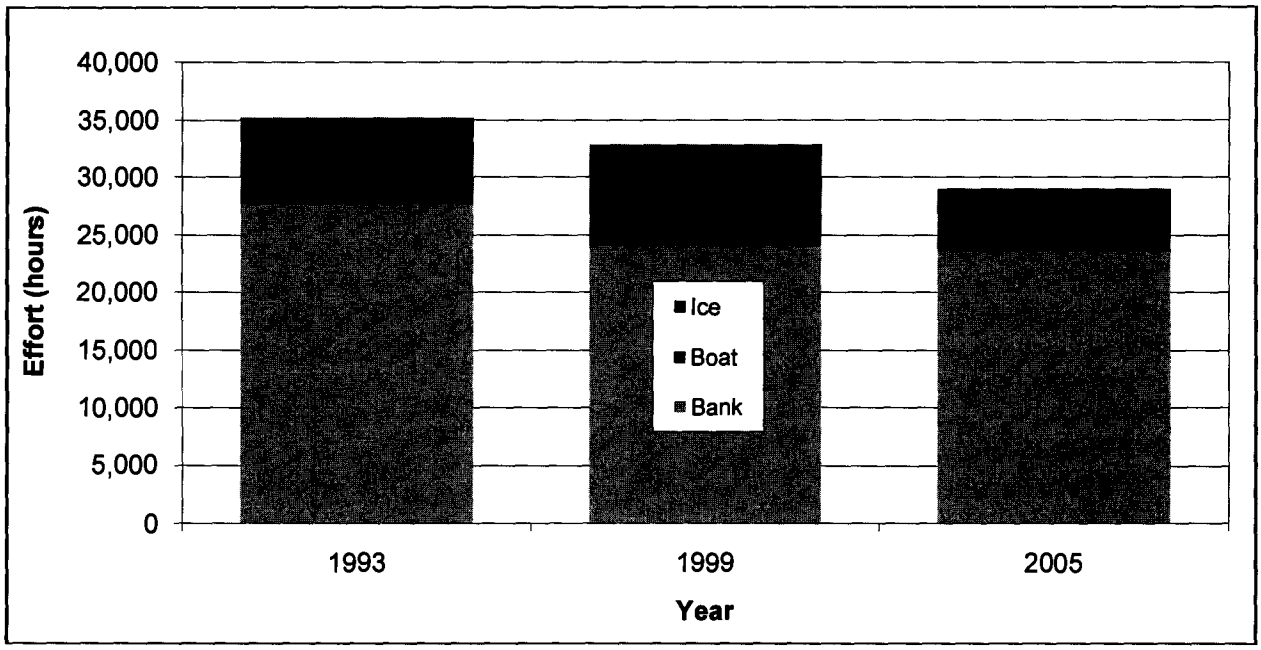


Figure 52. Catch composition of fish harvested during creel surveys of Spring Valley Reservoir in 1993, 1999, and 2005.

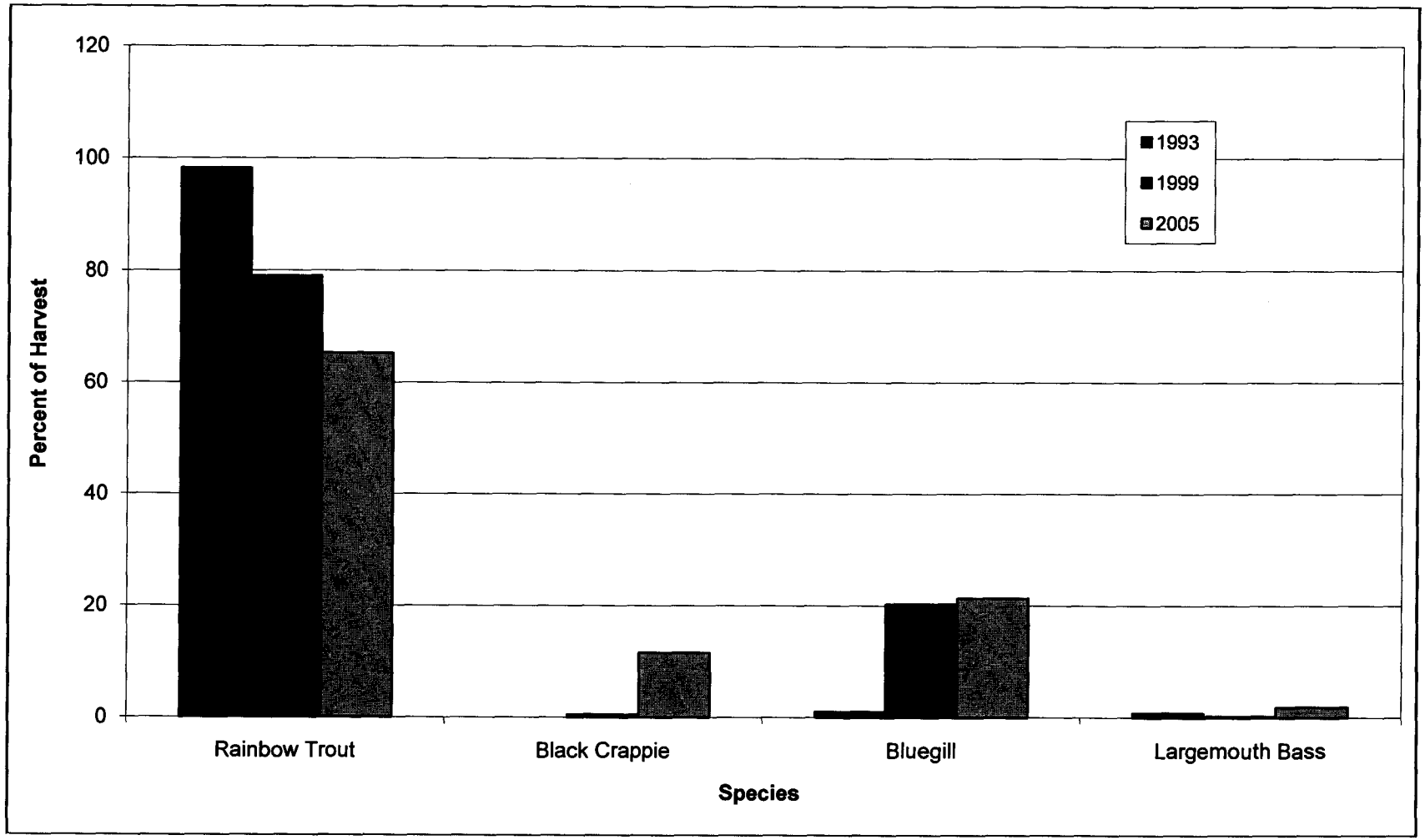


Table 14. Stocking history for Spring Valley Reservoir.

Year	Catchable Rainbow	Fingerling Rainbow	Fingerling Cutthroat	RBT x WCT Hybrids	Tiger Muskie	Bluegill
1968	22,730	26,496	16,224			
1969	14,625	35,520	53,760			
1970	21,940	28,500	35,989			
1971	16,115	35,000				
1972	16,280	34,892				
1973	16,121	34,928				
1974	8,440	34,950				
1975	30,305	34,912				
1976	37,180	50,178	24,000			
1977	18,080	62,114				
1978	31,520	50,244				
1979	33,510	49,980				
1980	34,260	50,400				
1981	31,070	52,800				
1982	41,720	12,615				
1983	40,560	4,860				
1984	58,340					
1985	38,296	11,000				
1986	39,050	40,000				
1987	33,859	44,800				
1988	43,183					
1989	33,500					240
1990	32,518	60,095		17,730	154	
1991	15,000	56,329			150	
1992	32,680	33,980				
1993	45,000	35,000				
1994	36,320	25,000				
1995	38,515	26,350				
1996	22,370	9,900				
1997	13,472	80,051				
1998	37,188	35,000	2,000			
1999	32,530	29,970				
2000	34,005	30,056				
2001	36,240	30,562				
2002	36,937					
2003	46,940	56,729				
2004	32,570	27,948				
2005	33,126					

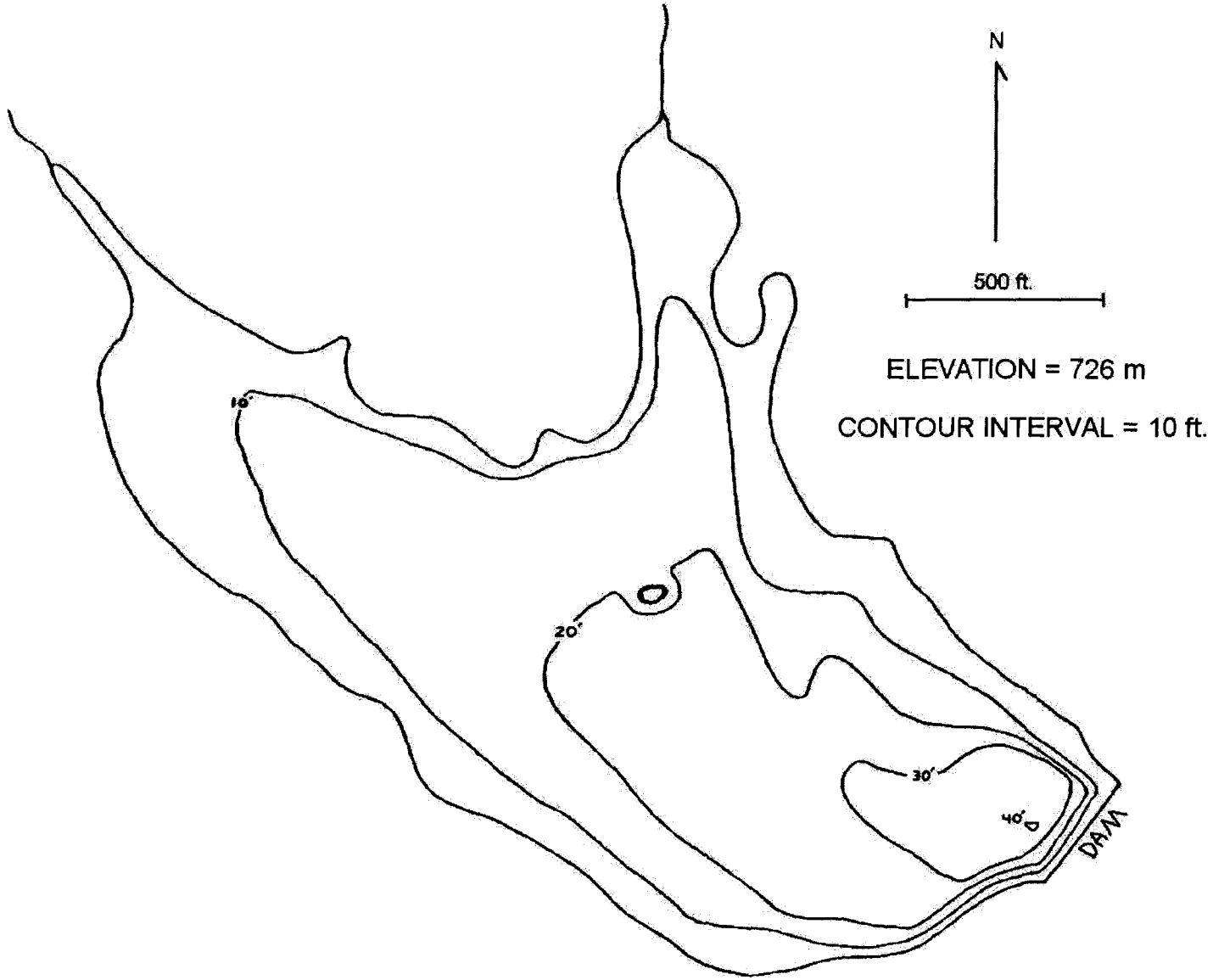
Table 15. Current dissolved oxygen (mg/l) profile for Spring Valley Reservoir.

2005

Depth (m)	January	February	March	April	May	June	July	August	September
0	12.1			13.9	10.3	5.1	12.8	6.3	*
1	6.7			13.9	10.6	6.9	14.6	6.4	
2	4.6			13.9	11.0	7.4	15.0	6.3	
3	3.9			12.7	4.3	5.3	3.9	6.1	
4	2.6			12.0	1.4	0.5	0.2	0.3	
5	0.8			11.6	0.3	0.4	0.1	0.1	
6	0.3			10.9	0.3	0.3	0.1		
7	0.1			9.9	0.2	0.3	0.1		
8					0.2				
9									

*couldn't launch boat due to poor ramp conditions

Figure 53. Bathymetric map of Spring Valley Reservoir (19.8 ha).



Tolo Lake

Introduction

Tolo Lake is an 8.1 hectare reservoir located in Idaho County approximately 8 km west of Grangeville at an elevation of 985 meters. It was drained and dredged in 1995 to enhance fishery and waterfowl habitat. After refilling in 1996, the lake was stocked with 200 white crappie *P. annularis*, 181 largemouth bass, 159 bluegill, and 32 black crappie. Additional stockings of largemouth bass have been made since to provide continued fishing opportunities.

Species Composition

Tolo Lake contains five species of game fish: (1) largemouth bass, (2) black crappie, (3) white crappie, (4) bluegill, and (5) channel catfish.

Current Management

Tolo Lake is a warmwater fishery. The reservoir is designated as a Family Fishing Water with simplified regulations including year round seasons, no length limits, general six fish limit for trout and bass, no creel limits for other species, and no restrictions on fishing gear. Boat activity on Tolo Lake is restricted to electric motors only.

Management Objectives

1. Maintain largemouth bass and channel catfish fisheries.

Current Population Data

Population Surveys

Clearwater Region fisheries management personnel conducted a standard lake survey of Tolo Lake on June 21, 2005. This survey resulted in the capture of 336 fish, including white crappie (N = 312), largemouth bass (N = 15), and black crappie (N = 9). A comparison of CPUE and percent composition between samples collected in 1997, 2003, and 2005 are shown in Figures 54 and 55, respectively. White crappie numbers saw a substantial decline from 2003 to 2005 as a function of CPUE. These fish have seen drastic changes in length frequency distributions over the last three samples (Figure 56), with very few fish over 200 mm in any of these samples. This is indicative of a stunted population with highly variable recruitment. Largemouth bass numbers have remained low and steady. This population does not see appreciable spawning and recruitment, and is therefore maintained by routine stocking of catchable size fish. A comparison of length frequency distributions of largemouth bass shows little change over time with most fish in the 180-280mm range with a few larger fish present (Figure 57). Black crappie were present again in low numbers in 2005. These fish ranged in length from 80-219 mm in length (Figure 58).

Stocking

A stocking history for Tolo Lake is shown on Table 16.

Limnology

A bathymetric map is shown in Figure 59.

Management Recommendations

1. Stock approximately 200 catchable size channel catfish annually and 75 largemouth bass from 250-350 mm every three years.

   Justification: Provide harvest opportunity for largemouth bass and channel catfish.

2. Conduct standard management surveys and monitoring:

   a. Standard lowland lake population survey every three years.
   b. Water quality monitoring: D.O/temperature profiles (when possible); ZPI (August).

   Justification: Provide the population, and limnological data needed to meet the objective of maintaining a warmwater fishery, and to direct future management decisions.

3. Remove Family Fishing Water designation.

   Justification: The reservoir does not satisfy the intent of a Family Fishing Water designation.

Figure 54. Catch per unit effort (CPUE) of fish collected from standard lake surveys of Tolo Lake in 1997, 2003, and 2005, by number of fish and biomass.

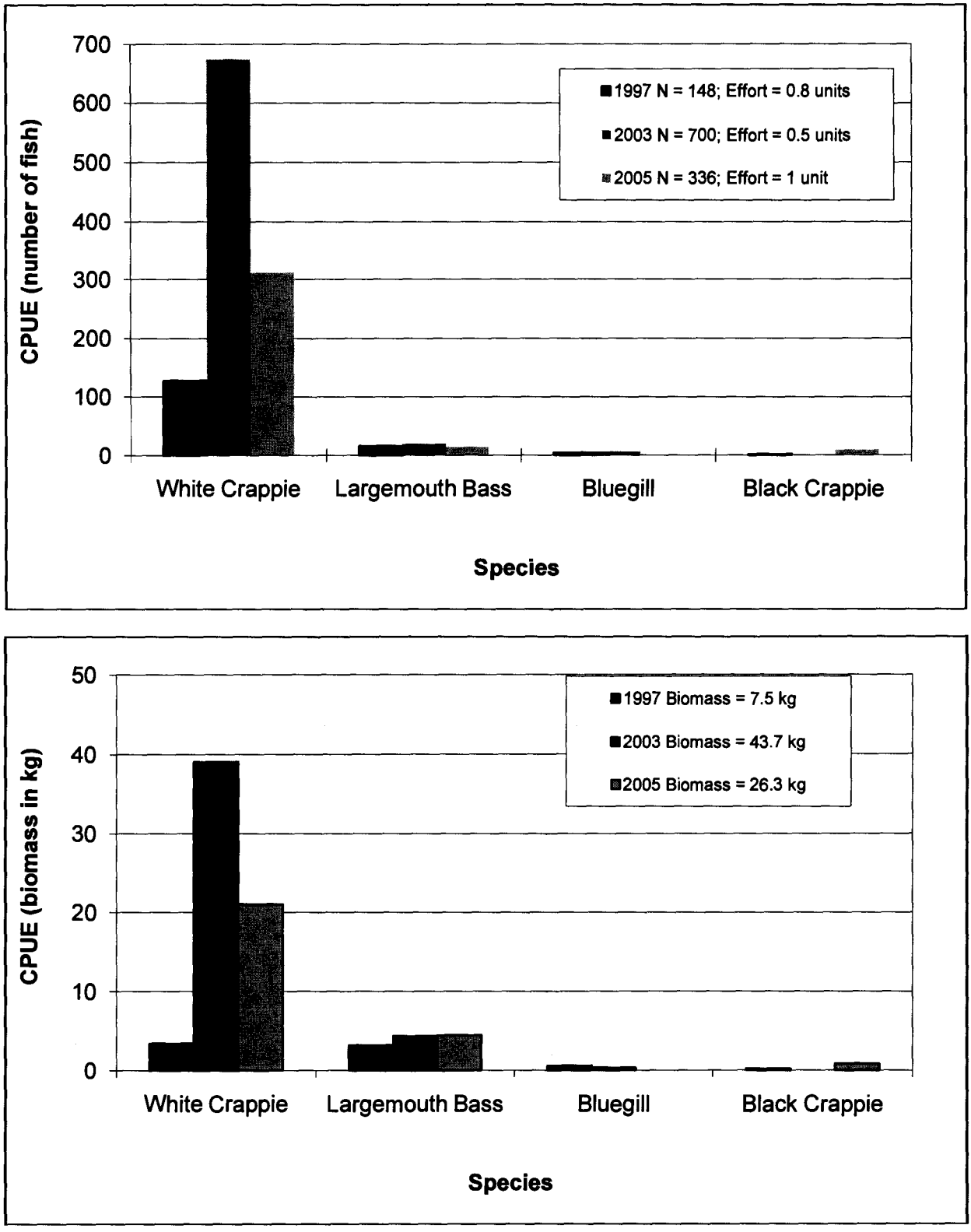
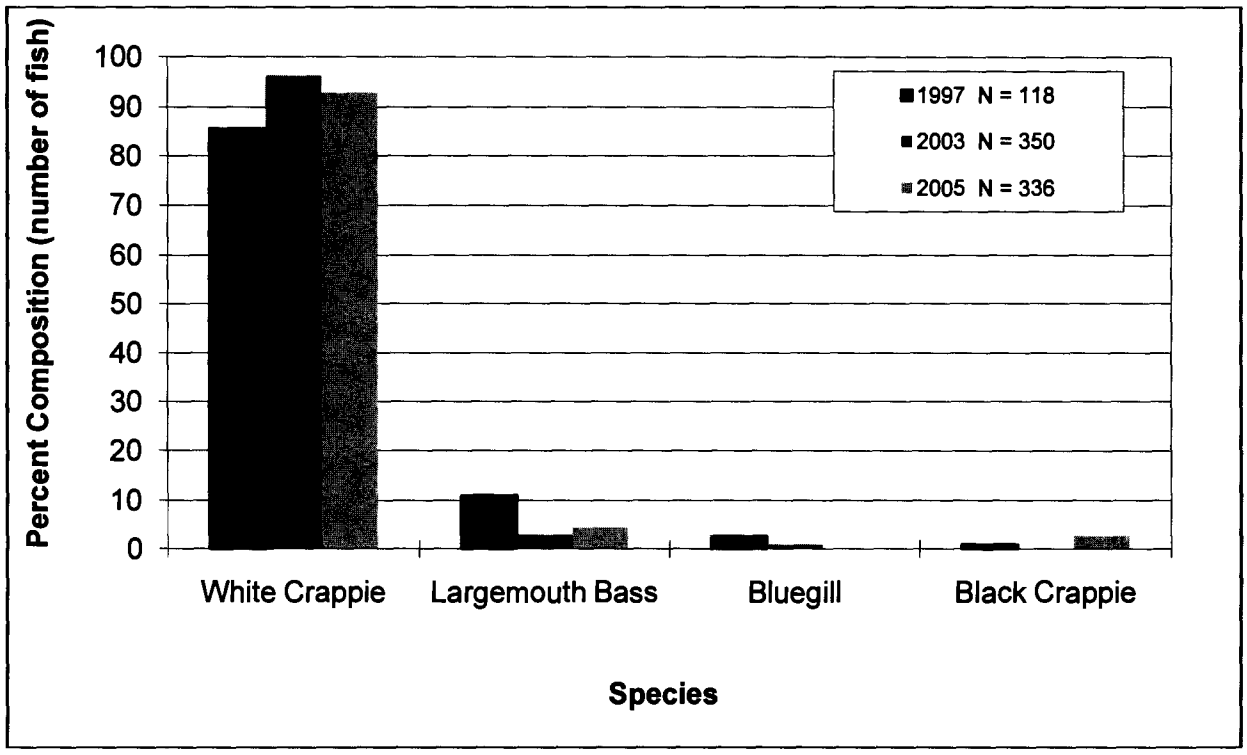
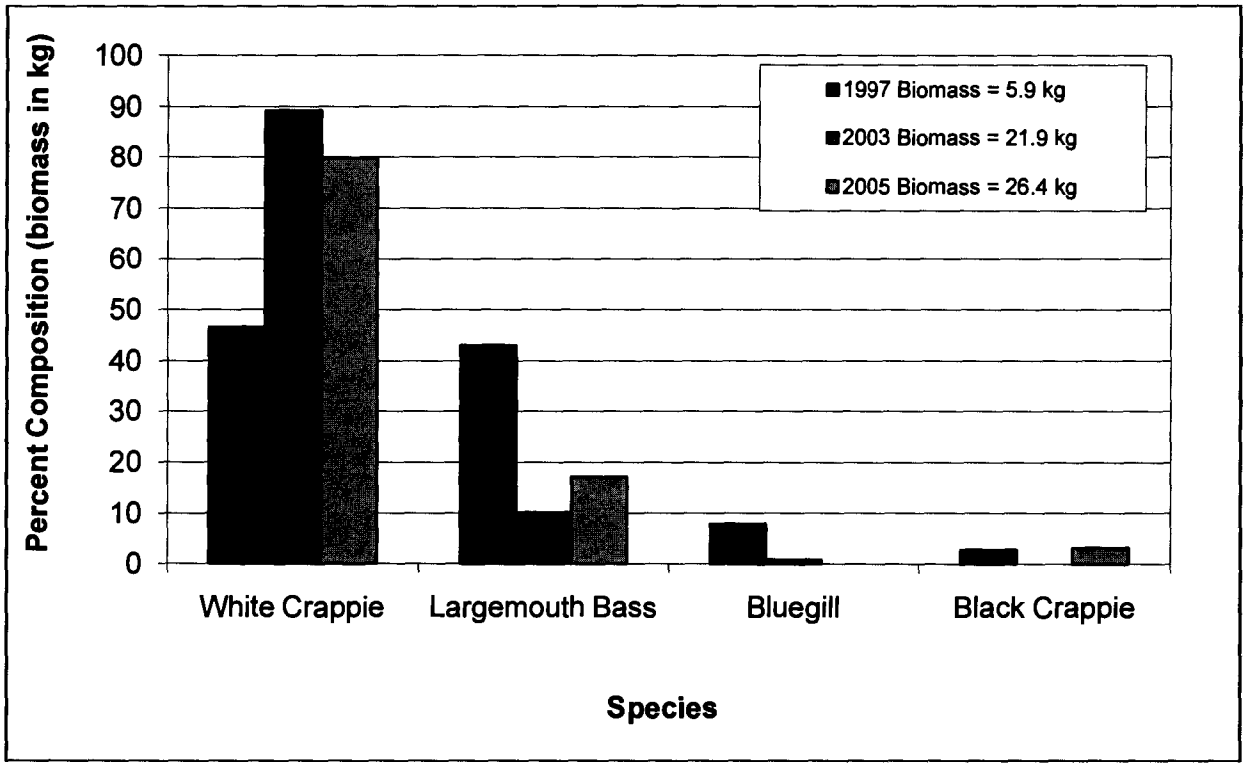


Figure 55. Percent composition of fish collected from standard lake surveys of Tolo Lake in 1997, 2003, and 2005, by number of fish and biomass.





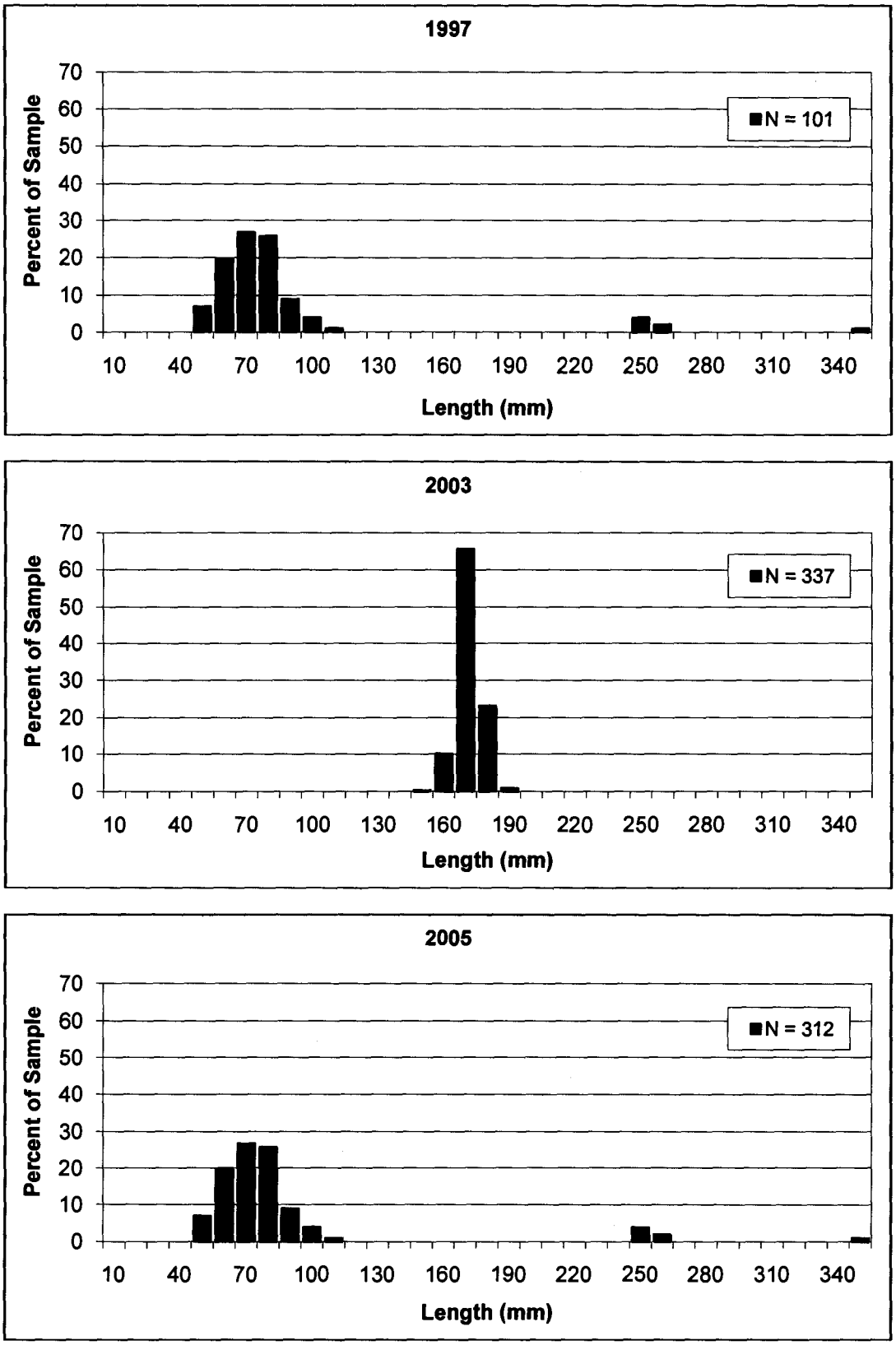


Figure 56. Length frequency distributions of white crappie collected from standard lake surveys of Tolo Lake in 1997, 2003, and 2005.

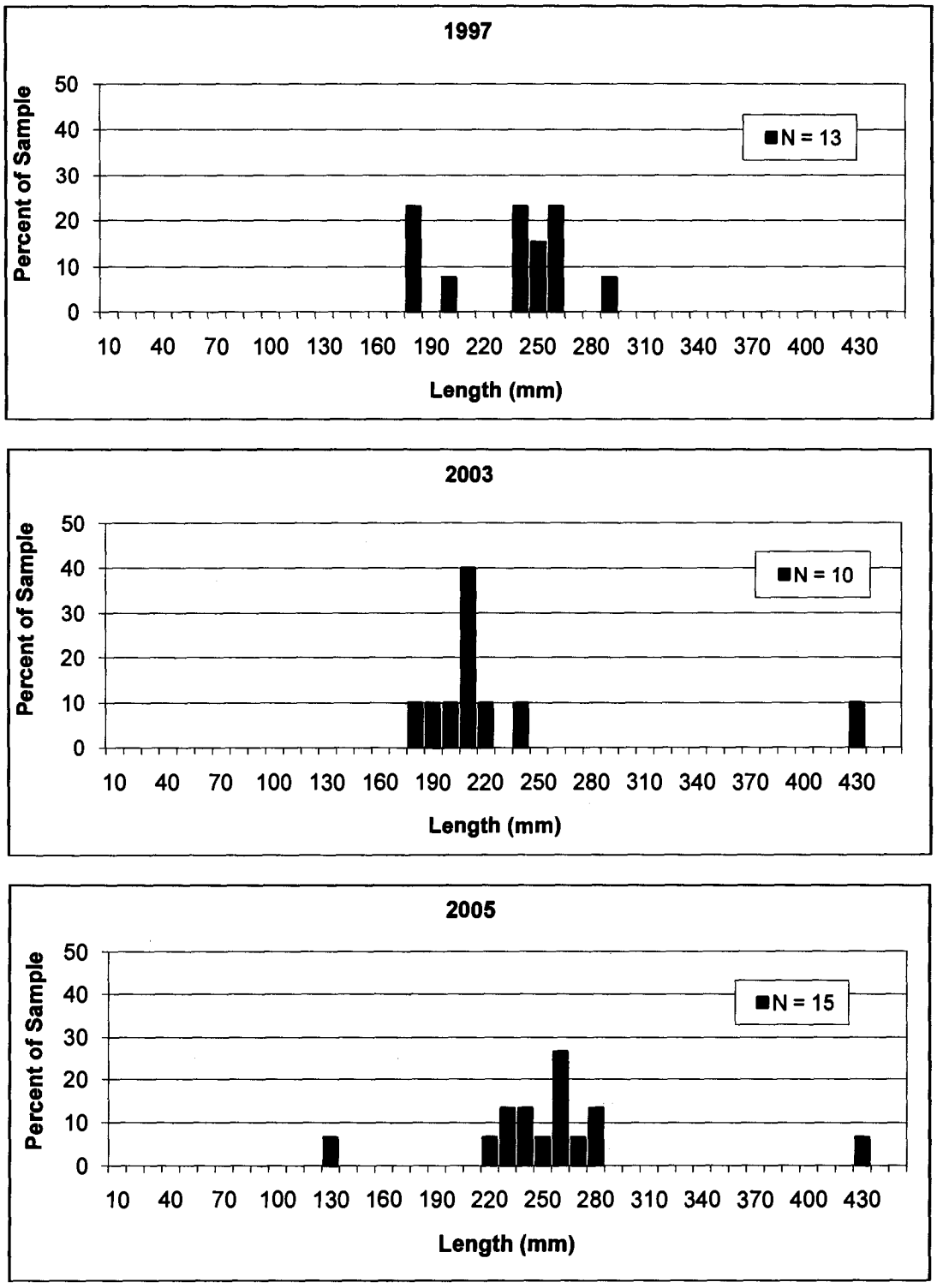


Figure 57. Length frequency distributions of largemouth bass collected from standard lake surveys of Tolo Lake in 1997, 2003, and 2005.

Figure 58. Length Frequency distribution of black crappie collected from a standard lake survey of Tolo Lake in 2005.

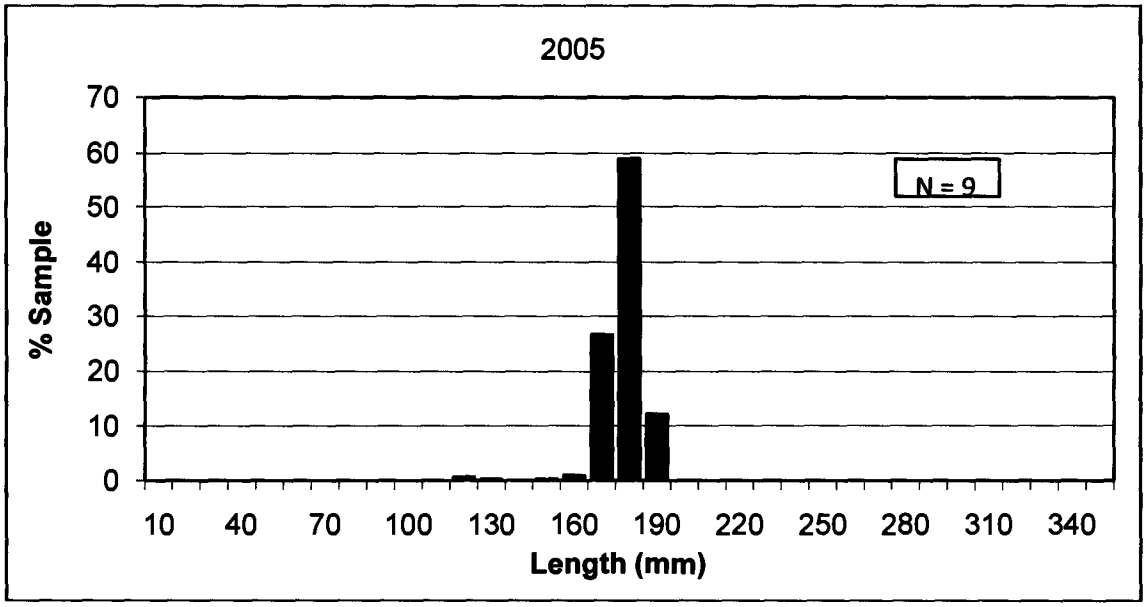
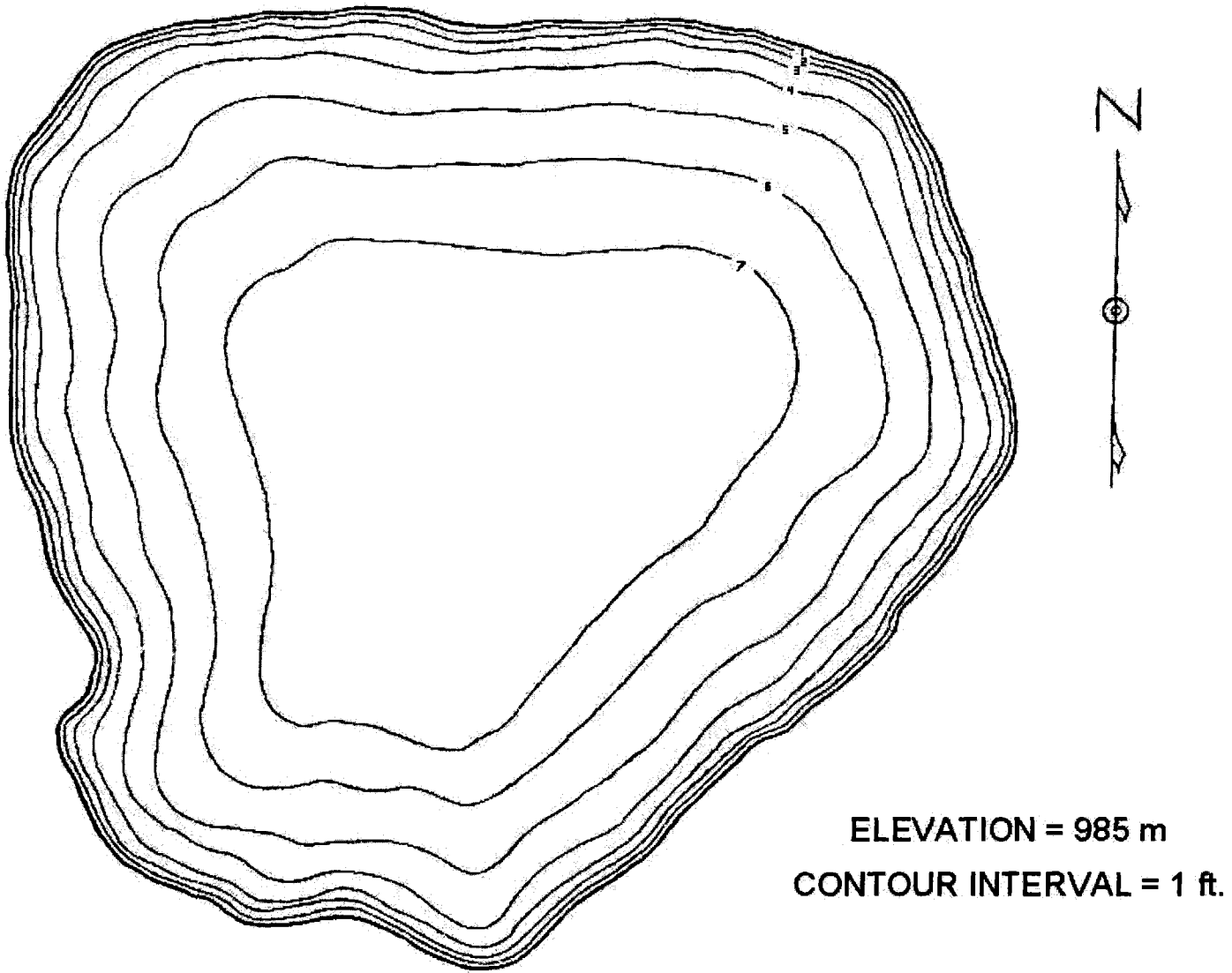


Table 16. Stocking history for Tolo Lake.

Year	Catchable Rainbow	Channel Catfish	Largemouth Bass
1996	4,950		
1997	4,968		
1998			
1999			
2000			
2001			
2002			
2003		98	104
2004		200	
2005		202	60

Figure 59. Bathymetric map of Tolo Lake (8.1 ha).



Waha Lake

Introduction

Waha Lake is a 37.9 ha naturally formed lake located approximately 16.1 km southeast of Lewiston, Idaho at an elevation of 1,032 meters. It is the deepest of the region's lowland lakes with a mean depth of 19.6 meters and maximum depth of 33 meters. The LOID manages the water level at Waha Lake. The lake's primary inlet is located on the West Fork of Sweetwater Creek where LOID created a diversion dam. Waha Lake takes time to reach full pool, which is often not reached until early June. Minimum pool usually occurs in January when water level is reduced by subsurface outflow and pumping for summer irrigation.

Species Composition

Waha Lake contains six species of game fish: (1) yellow perch, (2) smallmouth bass, (3) splake *Salvelinus fontinalis X S. namaycush*, (4) black crappie, (5) kokanee, and (6) rainbow trout.

Current Management

Waha Lake is a mixed fishery, containing both coldwater and warmwater species. It is managed as a put-and-take trout fishery with catchable and fingerling rainbow trout stocked annually to maintain a catch rate of 0.5 fish/hour. General fishing regulations apply with the exception of a 12" minimum size limit for bass.

Poor water quality has been a problem in Waha Lake. This is due to high phosphorus levels, which cause algae blooms, poor water clarity, and low dissolved oxygen for fish. During spring and summer months, sunlight and warm air temperature heat the surface water of a lake. Cold water, due to its higher density, sinks to the bottom, creating a condition called thermal stratification in which the warm and cool layers of water don't mix. In the warm surface water, sunlight allows tiny plants to grow. As these plants die and sink, their decomposition uses up the oxygen in the deeper cool water (called the hypolimnion).

Hypolimnetic aeration is being utilized to remedy the problem. This system works by taking water from the bottom of the lake, bringing it to the surface where it is oxygenated by contact with air, then returned to the bottom of the lake. A compressor releases air at the bottom of a vertical pipe. As the air rises, it forces water up the pipe into an attached trough. As the level of the water increases in the trough, gravity forces water back down a second pipe to the bottom of the lake. Two aeration units have been placed in the lake. Increasing the levels of oxygen in the hypolimnion will provide additional habitat for fish and other aquatic organisms. The result should be better fishing, especially for trout, which need the cooler water to survive through the summer.

Management Objectives

1. Maintain catch rate of 0.5 fish/hour for trout.
2. Maintain a warmwater fishery for smallmouth bass, yellow perch, and black crappie.
3. Improve water quality.

Current Population Data

Population Surveys

Clearwater Region fisheries management personnel conducted a standard lake survey of Waha Lake on June 9, 2004. This survey resulted in the capture of 92 fish, including smallmouth bass (N = 15), yellow perch (N = 65), splake (N = 4), and kokanee (N = 8). A comparison of CPUE and percent composition between samples collected in 1997, 2001, 2003, and 2004 are shown in Figures 60 and 61, respectively. CPUE shows a steady decline in the total number of fish and biomass collected over the past four surveys. Smallmouth bass accounted for 16.3% of the number of fish and 10.9% of the biomass collected in 2004. The number of smallmouth bass collected dropped substantially from the 2001 and 2003 samples, and the biomass collected has declined since the 2001 survey. Length frequency distributions have remained fairly constant over the last three surveys (Figure 62). Additionally, PSD values have declined steadily since 1997 (Figure 63). Yellow perch numbers and biomass increased slightly from the 2003 sample, but are still substantially lower than in 1997 and 2001. The length frequency distribution of yellow perch collected in 2004 is similar to the sample collected in 2003 (Figure 64). Splake and kokanee numbers remain low, however, more kokanee were collected in the 2004 sample than the three previous samples combined. The eight kokanee collected this year ranged in length from 210-249 mm in length (Figure 65). Black crappie accounted for 5.4% of the fish collected in 1997 and 0.9% in 2001, however no fish were collected during the 2003 and 2004 samples.

Creel Surveys

Total angler effort on Waha Lake during 2005 was estimated at 3,649 hours. This is an 11% decrease from the level of effort in 1999 (Figure 1). The effort consisted of 62.6% bank and 37.4% boat anglers (Figure 66). Waha Lake supported 96 hours of angling effort per hectare (39 hours per acre) in 2005.

Anglers caught an estimated 13,914 fish from Waha Lake during 2005, resulting in a catch rate of 3.8 fish/hour (Figure 3). This is substantially higher than catch rate of 0.6 fish/hour during 1999. No catch rate estimates from Waha Lake were generated in 1993. Anglers harvested 9,919 fish from Waha Lake during 2005 (Appendix B), 71% of the total fish caught. Harvest rate was estimated to be 2.7 fish/hour (Figure 4), substantially higher than the harvest rate of 0.5 fish/hour in 1999. The harvest composition consisted of 72.7% yellow perch, 23.8% hatchery trout, 2.8% smallmouth bass, 0.5% splake, and 0.3% kokanee (Figure 67). No harvest estimates were generated from Waha Lake in 1993.

Harvest of hatchery rainbow trout increased slightly from an estimated 1,737 in 1999 to 2,357 in 2005 (Appendix B). The catch rate of hatchery rainbow trout was 1.3 fish/hour, well above the management goal of 0.5 fish/hour. However, the hatchery trout return to creel was only 28% in 2005, slightly lower than the 32% in 1999 (Table 3). This may be partially due to anglers releasing 2,341 (49.8%) of the hatchery trout they caught. The percent of the fishery supported by hatchery trout has dropped considerably, from 90% in 1999 to 24% in 2005 (Table 3). This is due to the harvest of over 7,000 yellow perch in 2005 as compared to no harvest of these fish in 1999.

Stocking

A stocking history for Waha Lake is shown on Table 17.

Limnology

Historical temperature and dissolved oxygen profiles are shown on Table 18. A bathymetric map is shown in Figure 68.

Management Recommendations

1. Reduce annual stocking of catchable rainbow trout from 7,500 to 6,000. Discontinue annual stocking of 5,000 kokanee fingerlings.

   Justification: Creel surveys have shown that hatchery rainbow trout are returned to creel at an average rate of only 30%, while catch rates are over twice the management goal of 0.5 fish/hour. A reduction in stocking rate will reduce cost and the waste of hatchery product while maintaining the catch rate management goal. Currently, 5,000 kokanee are stocked annually in Waha Lake. However, only 26 of these fish were harvested in 2005, and no kokanee were estimated to have been harvested in 1999. These fish are not producing a justifiable return on investment.

2. Conduct standard management surveys and monitoring:
   a. Standard lowland lake population survey every three years.
   b. Creel survey every six years.
   c. Monthly water quality monitoring: D.O/temperature profiles (Jan. – Dec.); ZPI (August).

   Justification: Provide the population, effort, harvest, and limnological data needed to maintain the objectives of providing a fishery for smallmouth bass, yellow perch, and black crappie.

3. Continue operation and monitoring of hypolimnetic aeration system through 2007, with a project evaluation occurring at year's end.

   Justification: Provide data on the efficiency and effectiveness of the hypolimnetic aeration system for a project evaluation in December 2007.

Figure 60. Catch per unit effort (CPUE) of fish collected from standard lake surveys of Waha Lake in 1997, 2001, 2003, and 2004, by number of fish and biomass.

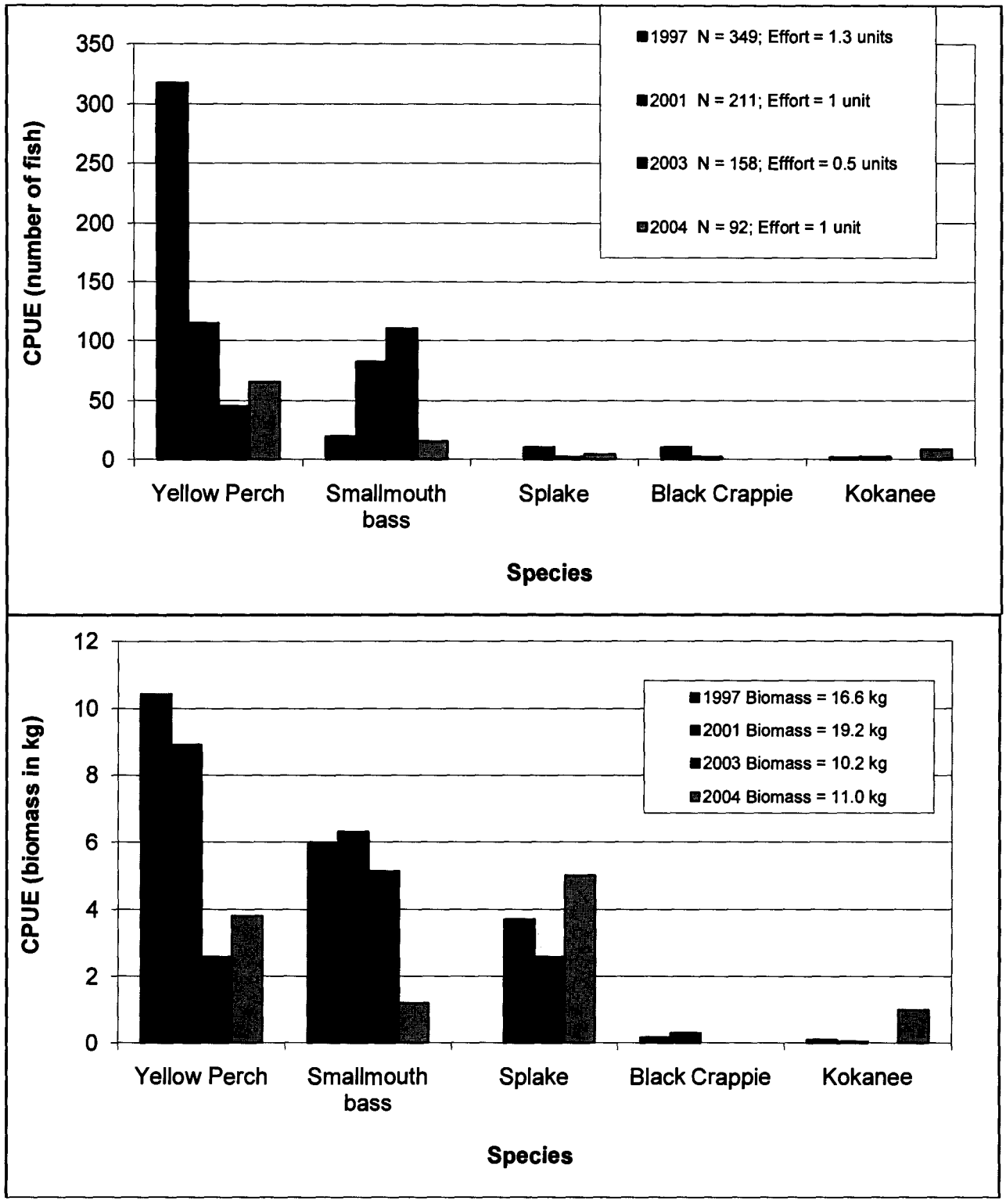
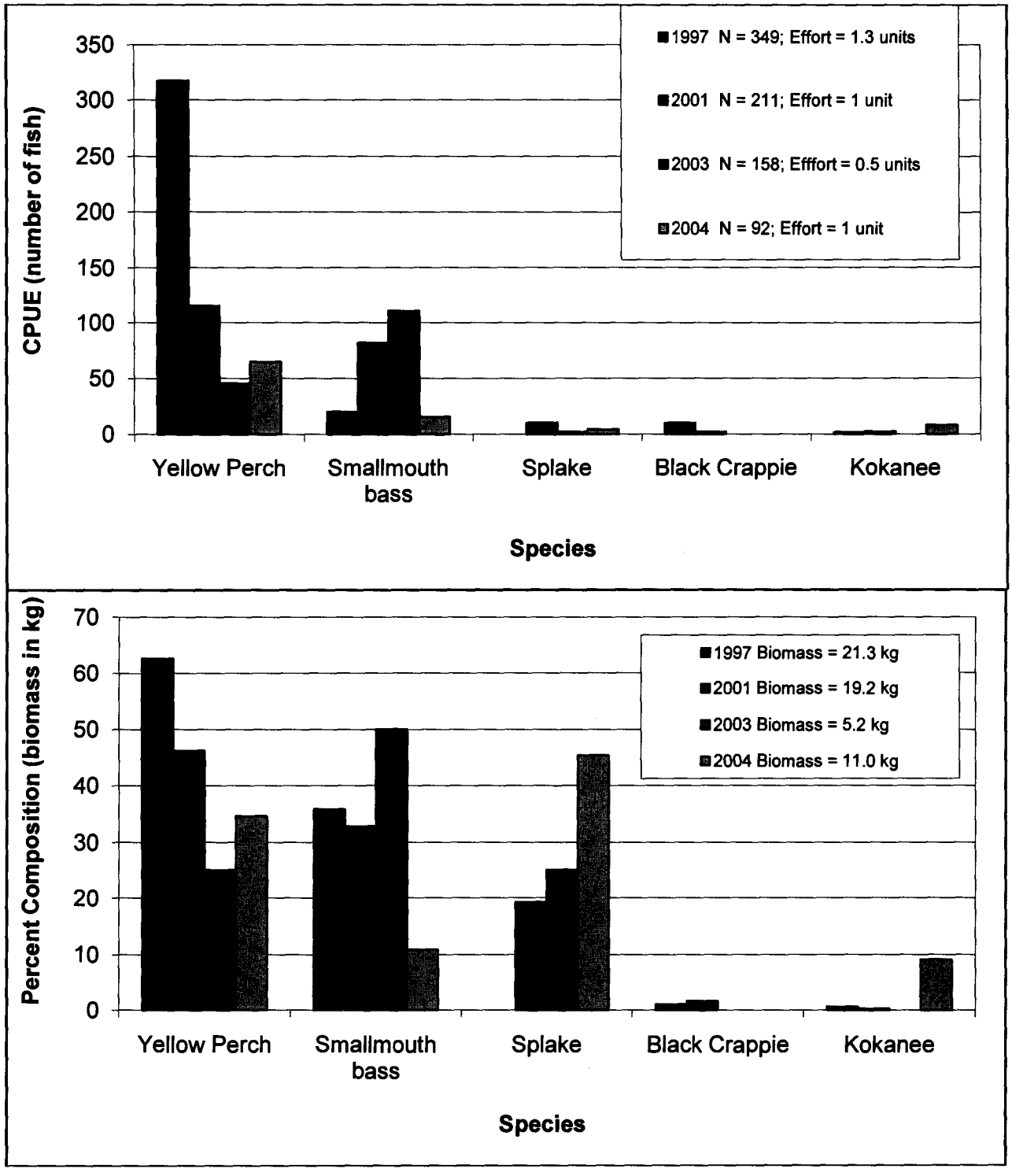


Figure 61. Catch composition of fish collected from standard lake surveys of Waha Lake in 1997, 2001, 2003, and 2004, by number of fish and biomass.



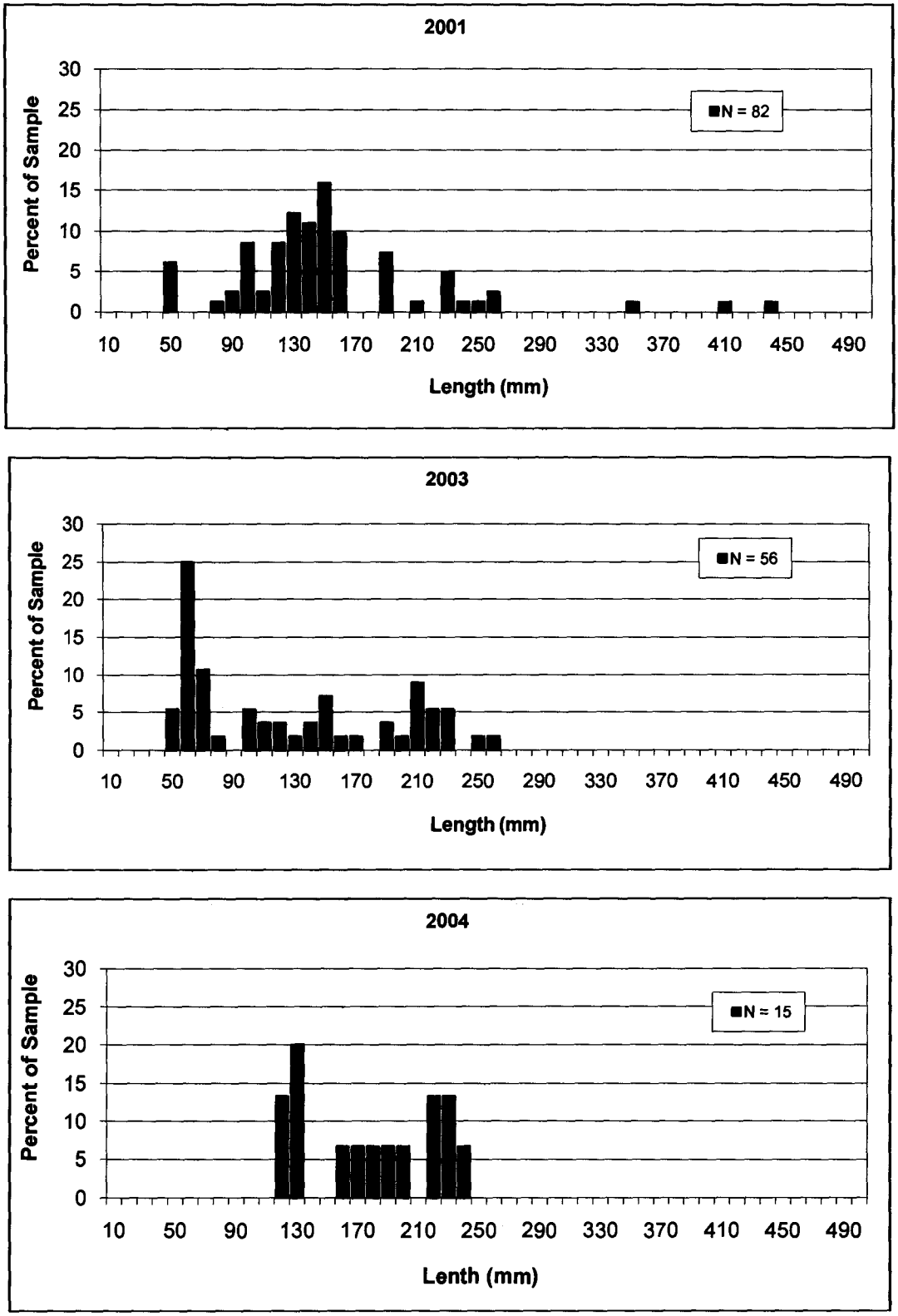
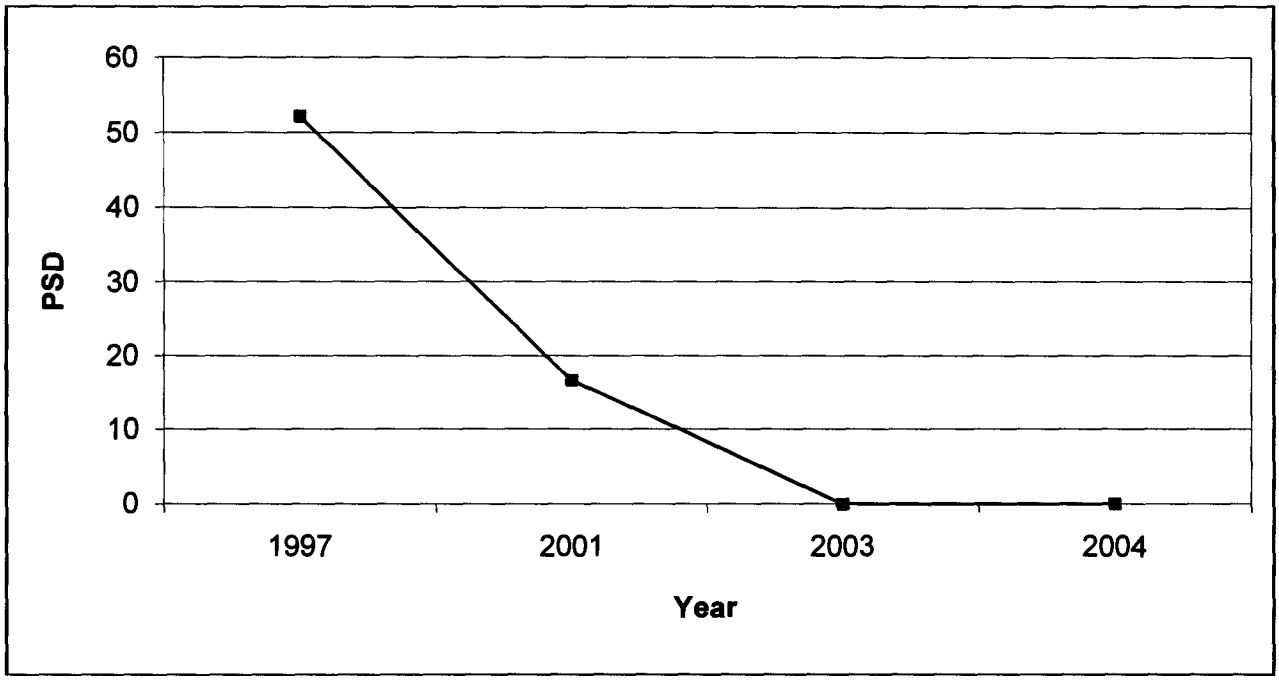


Figure 62. Length frequency distributions of smallmouth bass collected from standard lake surveys of Waha Lake in 2001, 2003, and 2004.

Figure 63. Proportional Stock Density (PSD) values of smallmouth bass collected in Waha Lake 1997-2004.



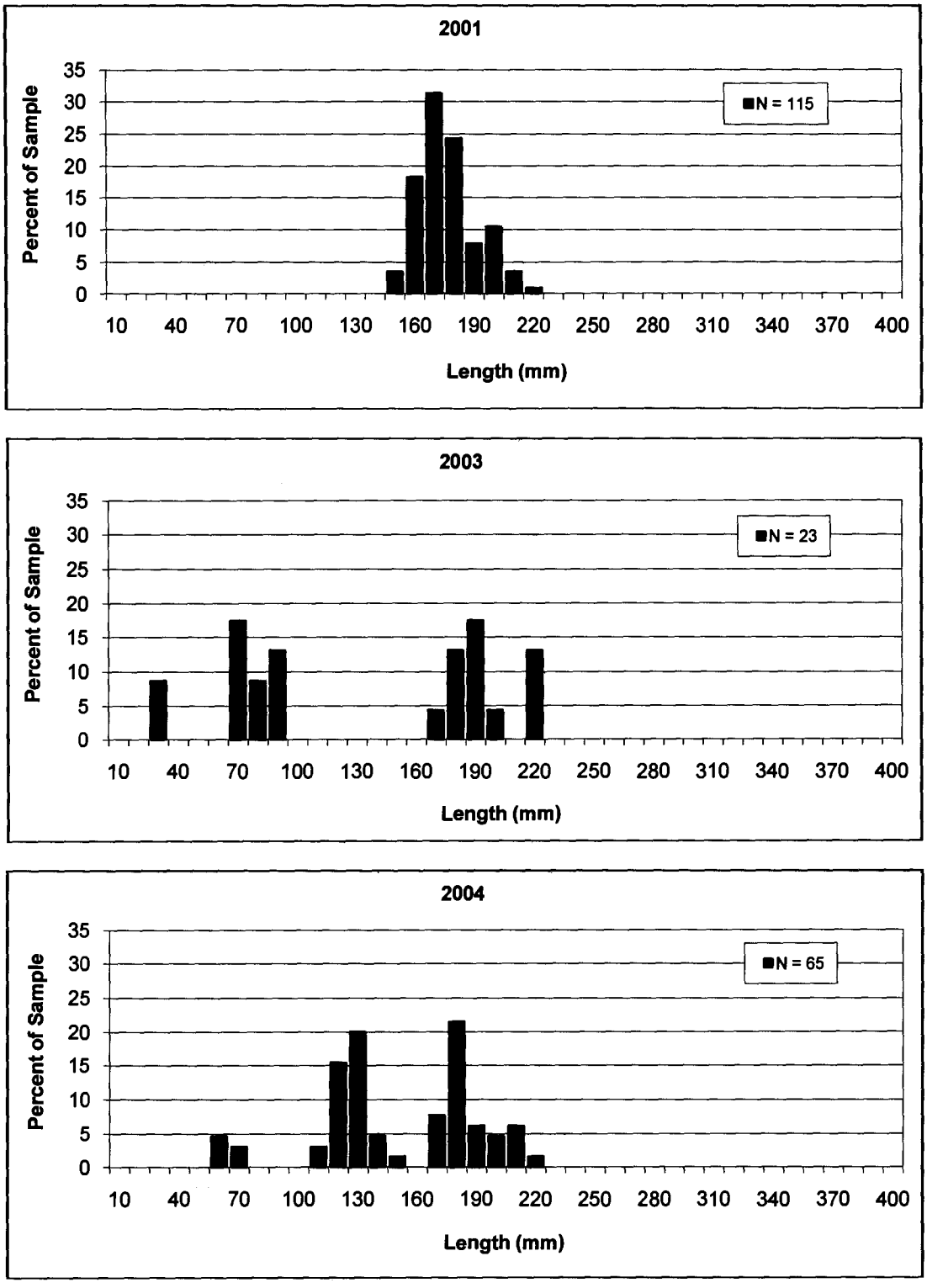


Figure 64. Length frequency distributions of yellow perch collected from standard lake surveys of Waha Lake in 2001, 2003, and 2004.

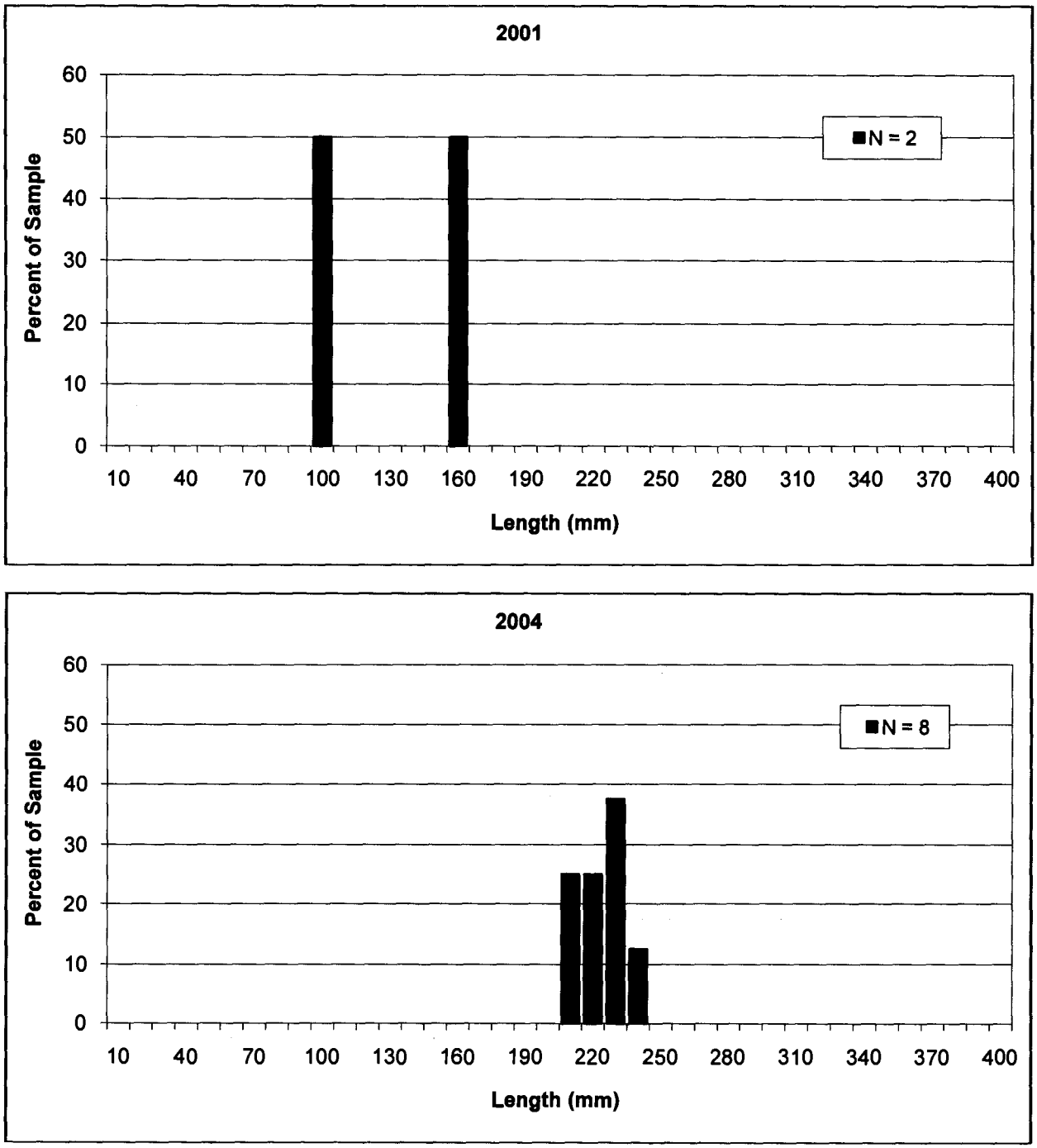


Figure 65. Length Frequency distributions of kokanee collected from standard lake surveys of Waha Lake in 2001 and 2004 (no kokanee collected in 2003).

Figure 66. Estimated angler effort, by type, from creel surveys of Waha Lake in 1999 and 2005.

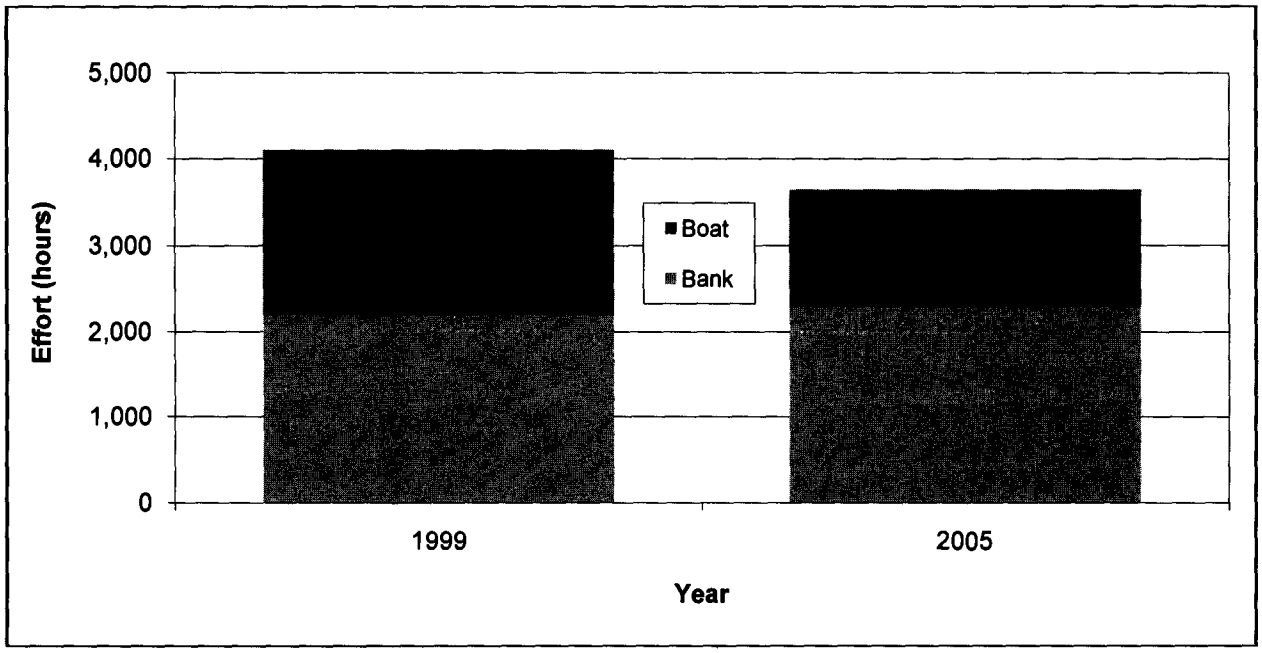


Figure 67. Catch composition of fish harvested during creel surveys of Waha Lake In 1999 and 2005.

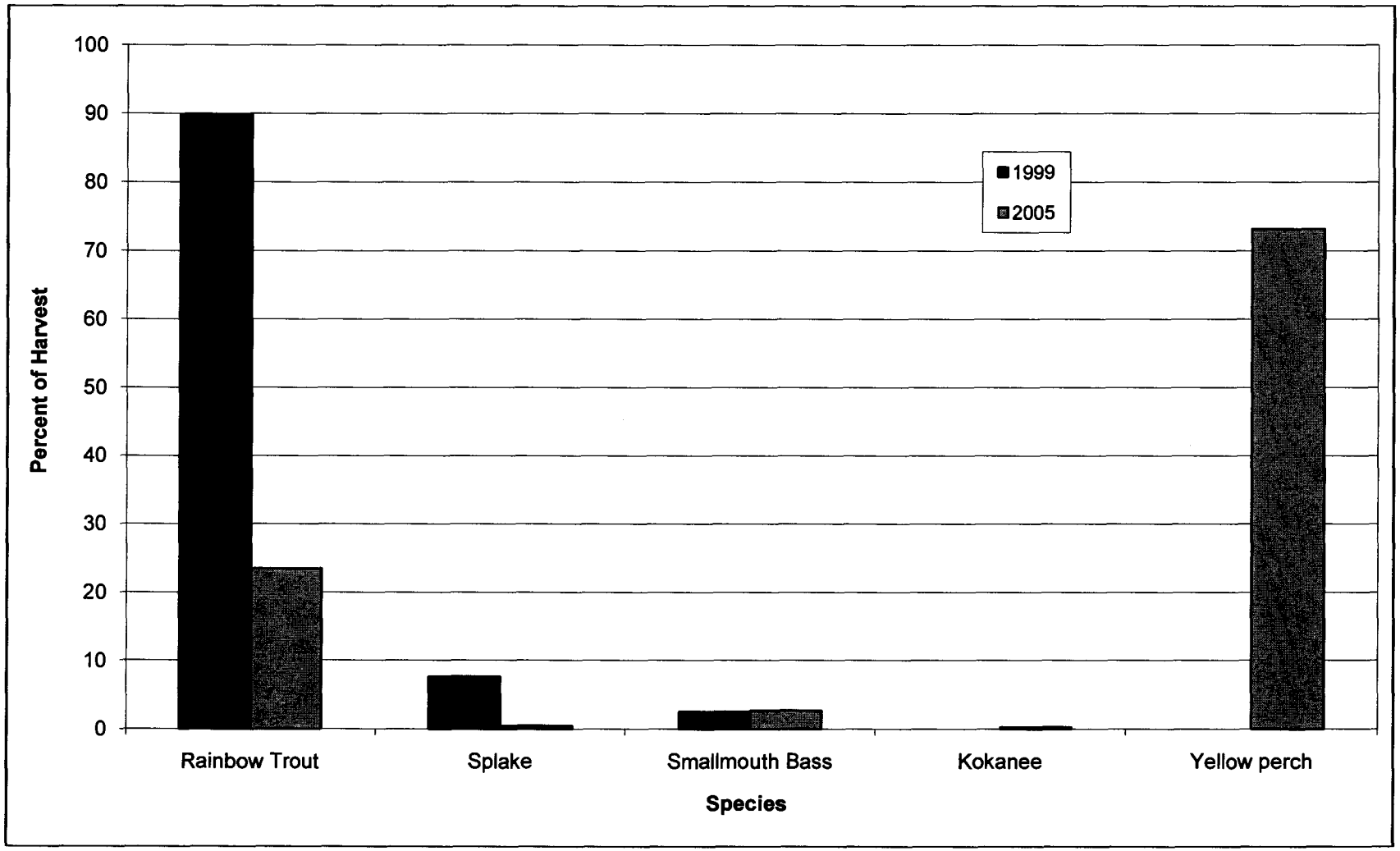


Table 18. Historical dissolved oxygen (mg/l) profiles for Waha Lake.

2004

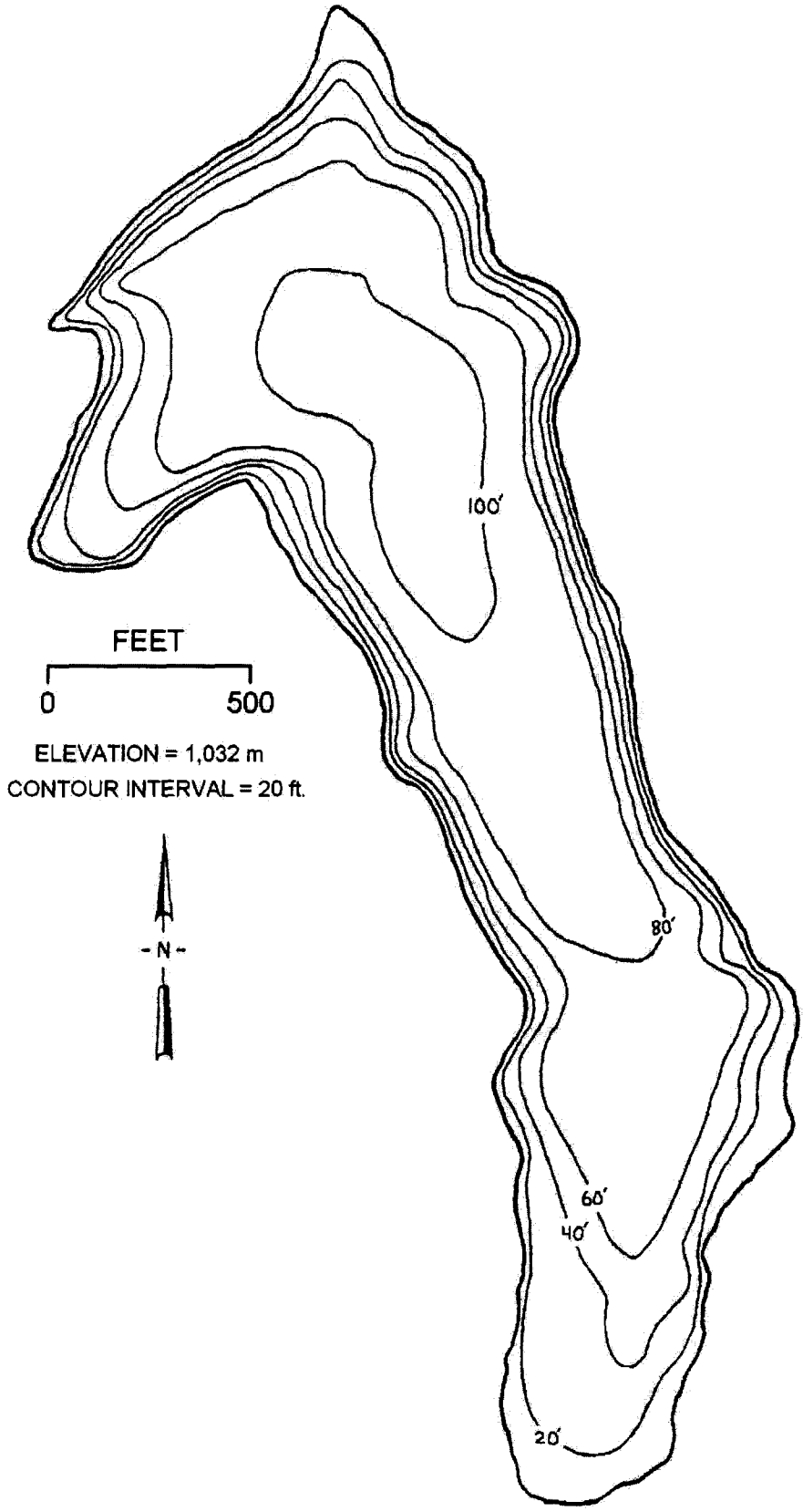
Depth (m)	April	May	June	July	August	September
0		9.7	9.5	7.8	7.6	
1		9.2	9.8	8.1	7.7	
2		8.9	10.4	8.2	7.3	
3		8.4	10.3	8.5	7.6	
4		8.3	9.6	8.4	8.9	
5		8.0	7.1	5.1	5.7	
6		7.8	7.0	5.0	5.1	
7		7.8	7.0	4.9	5.0	
8		7.7	7.0	4.7	5.2	
9		7.4	4.6	4.5	4.8	
10		7.1	4.4	4.1	4.5	
11		4.3	4.2	4.0	4.2	
12		4.1	4.0	3.8	4.2	
13		3.8	3.7	3.4	3.8	
14		3.4	3.2	3.1	3.6	

2005

Depth (m)	April	May	June	July	August	September
0	12.5	12.5	10.8	8.9	8.7	*
1	12.5	12.9	11.2	9.0	8.8	
2	12.5	12.8	13.6	9.0	8.7	
3	12.5	12.3	13.2	8.9	8.3	
4	12.4	12.3	11.3	7.9	8.9	
5	12.3	12.4	9.9	7.6	6.6	
6	12.3	12.1	9.8	6.2	6.3	
7	12.3	11.8	9.9	6.1	6.7	
8	12.3	11.5	10.0	6.2	7.0	
9	12.2	11.3	9.9	6.2	7.4	
10	12.2	11.4	9.9	6.2	7.6	
11	12.1	11.4	10.0	6.3	7.6	
12	12.0	11.3				
13	11.7	11.2				
14	11.7	11.1				

*couldn't launch boat due to poor ramp conditions

Figure 68. Bathymetric map of Waha Lake (37.9 ha).



Winchester Lake

Introduction

Winchester Lake is a 40.5 ha reservoir located approximately 48.3 km southeast of Lewiston, Idaho, and 0.8 km south of the town of Winchester at an elevation of 1,189 meters. It has a maximum depth over 12 m and was created in 1910 by the damming of Lapwai Creek. The reservoir is used extensively by boaters, fishermen, and waders, and is the focal point for Winchester Lake State Park, which receives up to 37,000 visitors per year. The Winchester Lake watershed is used for grazing, timber harvest, and recreation.

Species Composition

Winchester Lake contains eight species of game fish: (1) largemouth bass, (2) bluegill, (3) yellow perch, (4) black crappie, (5) rainbow trout, (6) channel catfish, (7) tiger muskie, and (8) black bullhead.

Current Management

Winchester Lake is a mixed fishery, containing both coldwater and warmwater species. It is managed as a put-and-take trout fishery with catchable and fingerling rainbow trout stocked annually to maintain a catch rate of 0.5 fish/hour. The lake is also managed for a largemouth bass fishery, and a yield fishery on black crappie, bluegill, and yellow perch. Channel catfish are stocked periodically to provide an additional fishing opportunity. The reservoir is designated as a Family Fishing Water with simplified regulations including year-round seasons, no length limits, general six fish limit for trout and bass, no creel limits for other species, and no restrictions on fishing gear. Boat activity on Winchester Lake is restricted to electric motors only. The current management priority is to improve aquatic habitat and water quality.

Poor water quality has become a significant problem in Winchester Lake. This is due to high phosphorus levels, which cause algae blooms, poor water clarity, and low dissolved oxygen for fish. IDFG and Idaho Department of Environmental Quality have implemented a project to address the problem. Throughout the summer, oxygen levels in the hypolimnion continue to decline until no oxygen is present (anoxic conditions). This oxygen depletion, combined with warm water in the lake's upper layer, reduces the volume of the water in the lake that supports a cold-water fishery to less than 16 percent of the total lake volume. Additionally, these periods of no oxygen allow the release of phosphorus from lake sediments into the waters of the hypolimnion.

During the fall, colder air temperatures cool the lake's surface waters. When this surface water becomes cooler than the deep water, it sinks and the lake "turns over". This turnover allows the high concentrations of phosphorus in the hypolimnion to mix throughout the lake. The lake is thus fertilized for abundant plankton growth to occur the next summer and cycle is repeated.

Many options were carefully considered for reducing the amount of phosphorus in the lake, including several types of aeration, chemical treatment, dredging, and hypolimnetic water withdrawals. In the end, hypolimnetic aeration was determined to be the best option. This system works by taking water from the bottom of the lake, bringing it to the surface where it is

oxygenated by contact with air, then returned to the bottom of the lake. A compressor releases air at the bottom of a vertical pipe. As the air rises, it forces water up the pipe into an attached trough. As the level of the water increases in the trough, gravity forces water back down a second pipe to the bottom of the lake. By increasing the level of oxygen in the hypolimnion, we reduce the amount of phosphorus that can be released into the water, thus reducing the amount of "fertilizer" available for algae. This in turn reduces the loss of oxygen in the hypolimnion due to decomposition, thus breaking the cycle. Less algae also means clearer water.

Eight aeration units have been placed in the deeper areas of Winchester Lake. Increasing the levels of oxygen in the cooler layer of the lake will provide additional habitat for fish and other aquatic organisms. The result should be better fishing in Winchester Lake, especially for trout, which need the cooler water to survive through the summer.

Management Objectives

1. Maintain catch rate of 0.5 fish/hour for hatchery rainbow trout.
2. Maintain a bass fishery, and yield fisheries for bluegill, black crappie, and yellow perch.
3. Diversify fishery with periodic stockings of channel catfish and tiger muskie.
4. Improve water quality by controlling nuisance aquatic vegetation.

Current Population Data

Population Surveys

Clearwater Region fisheries management personnel conducted a standard lake survey of Winchester Lake on June 22, 2005. This survey resulted in the capture of 451 fish, including largemouth bass (N = 180), bluegill (N = 119), yellow perch (N = 128), black crappie (N = 16), black bullhead (N = 7), and channel catfish (N = 1). A comparison of CPUE and percent composition between samples collected in 2001, and 2003-2005 are shown in Figures 69 and 70, respectively. The 2005 sample saw a drop in numbers and biomass for largemouth bass, bluegill, black crappie, and black bullhead from the 2004 sample. However, there appears to be a general increase in numbers in these populations and yellow perch over the last four samples. Largemouth bass are showing a shift in length frequency distribution toward larger fish (Figure 71). The PSD value for bass was 29.0 (Figure 72), a slight drop from 2004, but much higher than the 2000-2003 samples. The bluegill length frequency distribution is similar to previous samples except for a lack of fish under 100 mm (Figure 73). This may indicate very poor spawning success or even the loss of this year class. Yellow perch numbers and biomass have stayed fairly constant over the last three years. Additionally, there has been little change in their length frequency distribution over that time period (Figure 74). Black crappie have seen a slight shift in length frequency distribution toward larger fish (Figure 75). Black bullhead and channel catfish were present in low numbers, while no tiger muskie were collected in 2005.

Creel Surveys

Total angler effort on Winchester Lake during 2005 was estimated at 52,335 hours. This is a 54% increase from the level of effort in 1999, and a 22% increase from the level of effort in 1993 (Figure 1). The effort consisted of 67.8% bank, 29.8% boat, and 2.4% ice anglers (Figure 76). Winchester Lake supported 1,292 hours of angling effort per ha (698 hours per acre) in 2005. It is the most intensely fished water in the region.

Anglers caught an estimated 141,374 fish from Winchester Lake during 2005, resulting in a catch rate of 2.7 fish/hour (Figure 3). This is more than twice the catch rates of 1.1 fish/hour during 1993 and 1.3 fish/hour in 1999. Anglers harvested 67,741 fish from Winchester Lake during 2005 (Appendix B), 48% of the total fish caught. Harvest rate was estimated to be 1.3 fish/hour (Figure 4). The harvest composition consisted of 34.8% hatchery trout, 32.0% yellow perch, 24.2% bluegill, 7.9% black crappie, 0.9% largemouth bass, and 0.2% channel catfish (Figure 77). Angler preference has been shifting from hatchery trout to warm-water fish since 1993 due to the establishment of illegally introduced yellow perch and black crappie. Warm-water species accounted for 38% of the harvest in 1993 but accounted for 65% of the harvest in 2005.

While the number of hatchery trout stocked in Winchester Lake has remained fairly constant, the number of those fish harvested has been declining. Harvest of hatchery rainbow trout has decreased from an estimated 40,739 in 1993 to 23,560 in 2005 (Appendix B). This may be partially due to anglers releasing 17,364 (42.4%) of the hatchery trout they caught. However, the hatchery trout return to creel has increased from 60% in 1993 and 1999 to 73% in 2005 (Table 3). A decline in harvest rates of hatchery rainbow trout has been seen, as harvest has dropped from 1.0 fish/hour in 1993 to 0.5 fish/hour in 2005. However, the catch rate in 2005 was 0.8 fish/hour, above the management goal of 0.5 fish/hour. Additionally, the percent of the fishery supported by hatchery trout has dropped considerably, from 62% in 1993 to 35% in 2005 (Table 3). This is partially due to the shift in angler preference from hatchery trout to warm-water species. Even though there has been a decline in the number of hatchery trout harvested, the harvest rate, and the percent of the fishery supported by hatchery trout, the increase in return to creel to 73% and the catch rate slightly above the management goal indicated no need to reduce the number of catchable size trout stocked in Winchester Lake. Conversely, observations made in the field concluded that no rainbow trout stocked as fingerlings were harvested during creel surveys in 1999 or 2005. This failure of fingerling establishment in Winchester Lake is likely due to competition and predation from perch, crappie, and largemouth bass.

Stocking

A stocking history for Winchester Lake is shown on Table 19.

Limnology

Historical temperature and dissolved oxygen profiles are shown on Table 20. A bathymetric map is shown in Figure 78.

Management Recommendations

1. Maintain annual stocking of 35,000 catchable rainbow trout and 5,000 catchable channel catfish. Reduce annual stocking of fingerling rainbow trout from 30,000 to 20,000.

Justification: Provide harvest opportunity for rainbow trout and maintain the catch rate objective of 0.5 fish/hour. Provide harvest opportunity for channel catfish. A reduction in stocking numbers of fingerling rainbow trout will reduce cost and the waste of hatchery product.

2. Conduct standard management surveys and monitoring:
    a. Standard lowland lake population survey every three years.
    b. Creel survey every six years.
    c. Monthly water quality monitoring: D.O/temperature profiles (Jan. – Dec.); vegetation mapping (May-Sept.); ZPI (August).

    Justification: Provide the population, effort, harvest, and limnological data needed to maintain the objectives of a quality bass fishery and yield fisheries for black crappie, bluegill, yellow perch, and catfish, and to direct future management decisions.

3. Control approximately 30% of the excessive aquatic plant growth annually using the aquatic herbicide Reward®.

    Justification: The use of aquatic herbicides would prevent excess vegetation growth in shoreline areas utilized by fishermen and around the boat ramp in order to improve recreational access to the reservoir. Additionally, the reduction of aquatic plant material will lower the amount of organic material decaying in the reservoir. This will minimize the biological oxygen demand, resulting in improved D.O. levels, recreational access, habitat quality for fish, and the efficiency of the hypolimnetic aeration system.

4. Continue operation and monitoring of hypolimnetic aeration system through 2007, with a project evaluation occurring at year's end.

    Justification: Provide data on the efficiency and effectiveness of the hypolimnetic aeration system for a project evaluation in December 2007.

Figure 69. Catch per unit effort (CPUE) of fish collected from standard lake surveys of Winchester Lake in 2001, and 2003-2005, by number of fish and biomass.

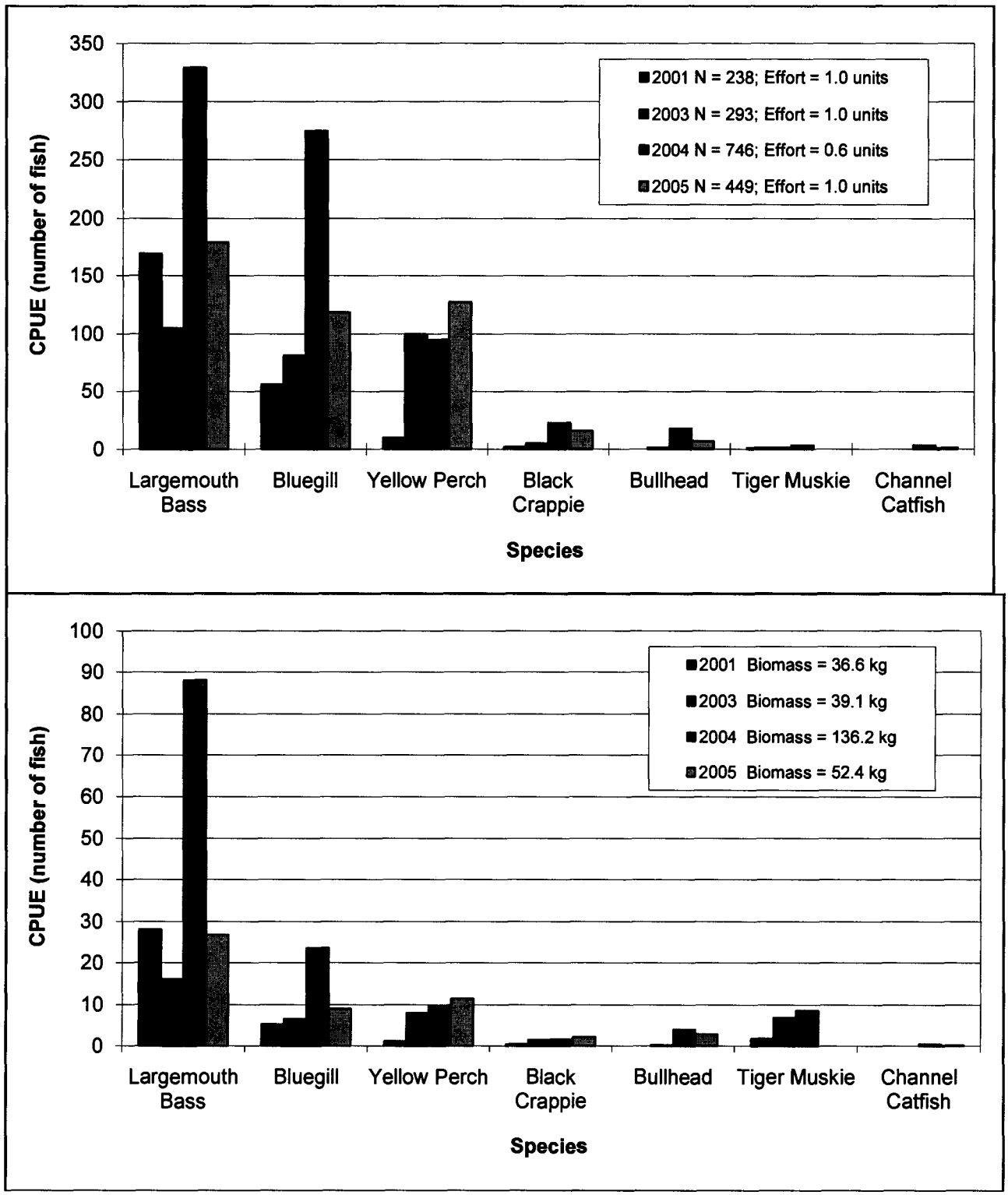
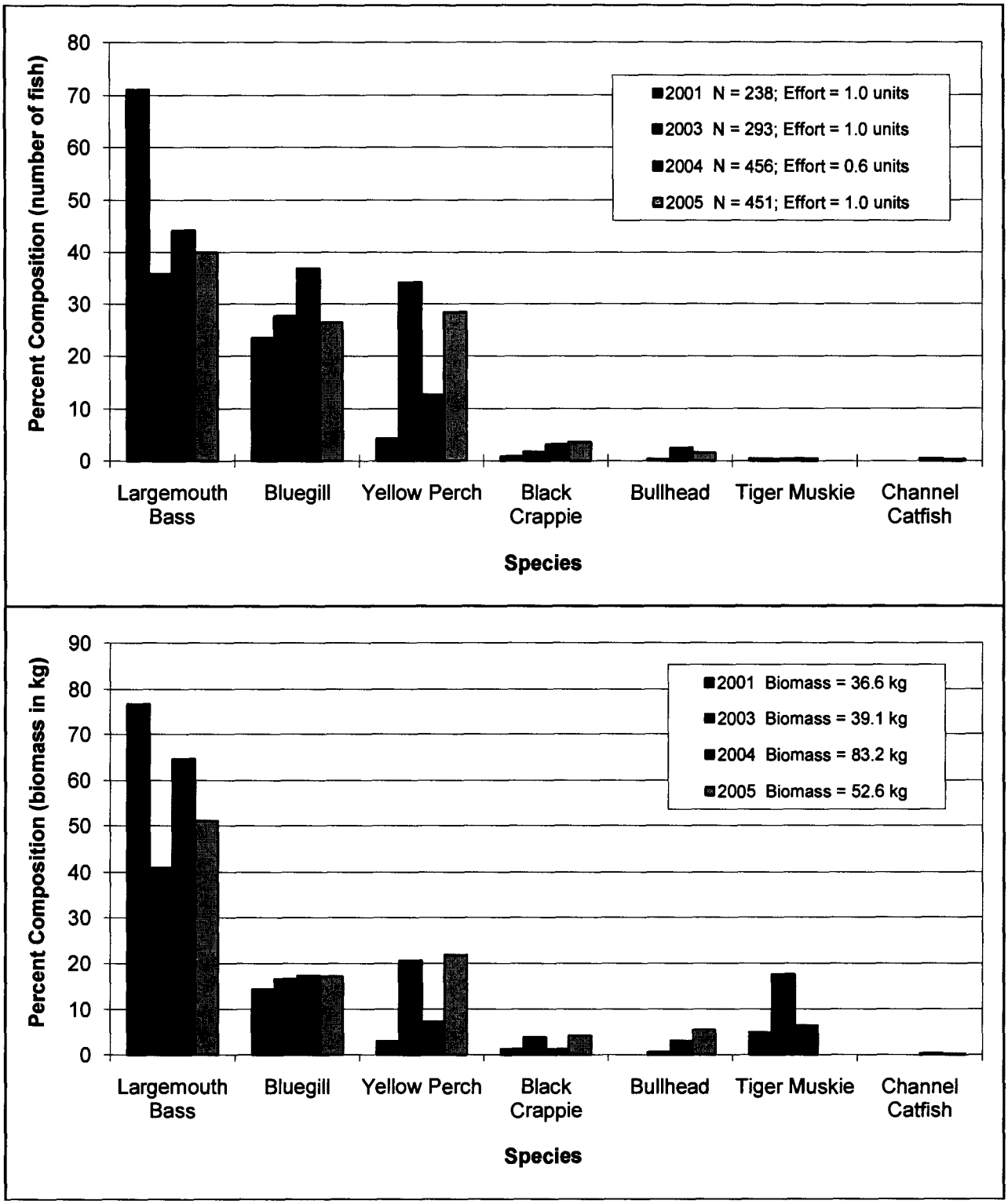


Figure 70. Percent composition of fish collected from standard lake surveys of Winchester Lake in 2001, 2003-2005, by number of fish and biomass.



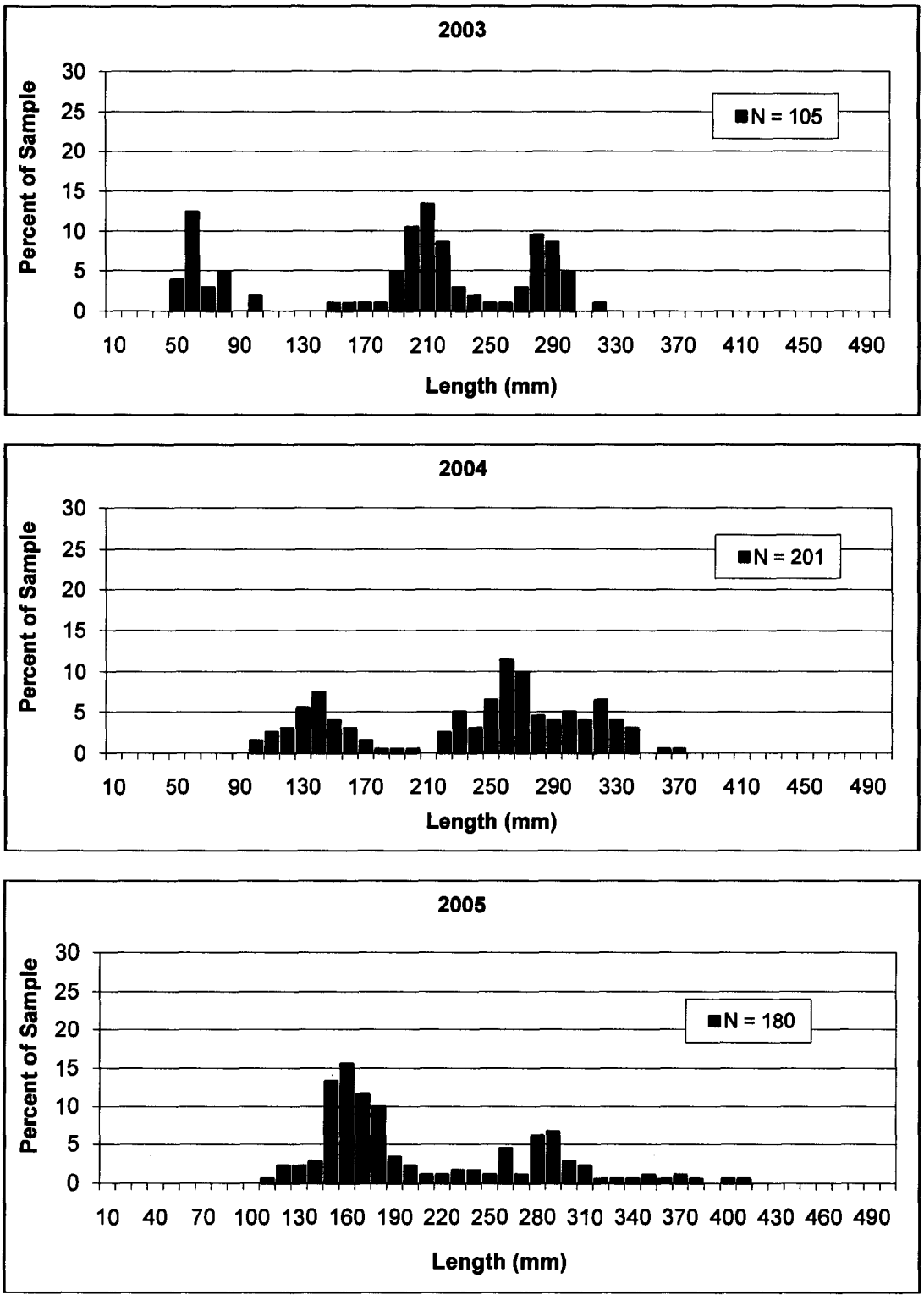
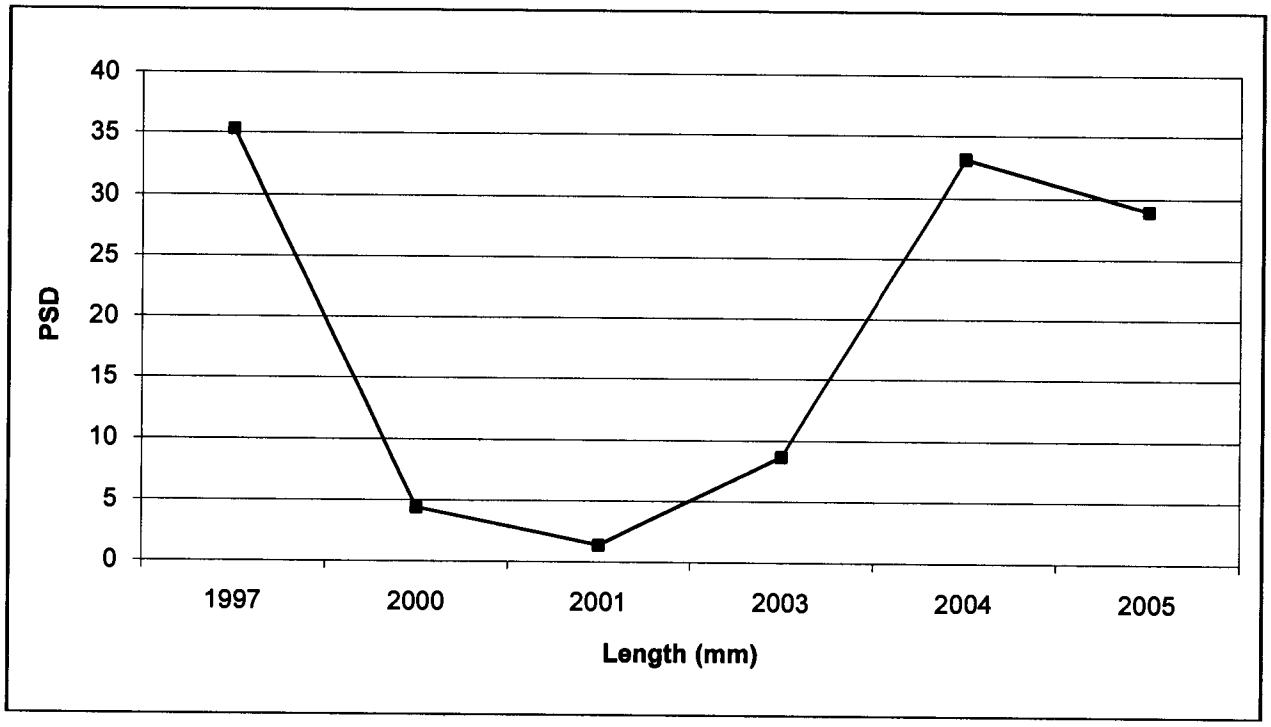


Figure 71. Length frequency distributions of largemouth bass collected from standard lake surveys of Winchester Lake in 2003-2005.

Figure 72. Proportional Stock Density (PSD) values of largemouth bass collected in Winchester Lake 1997-2005.



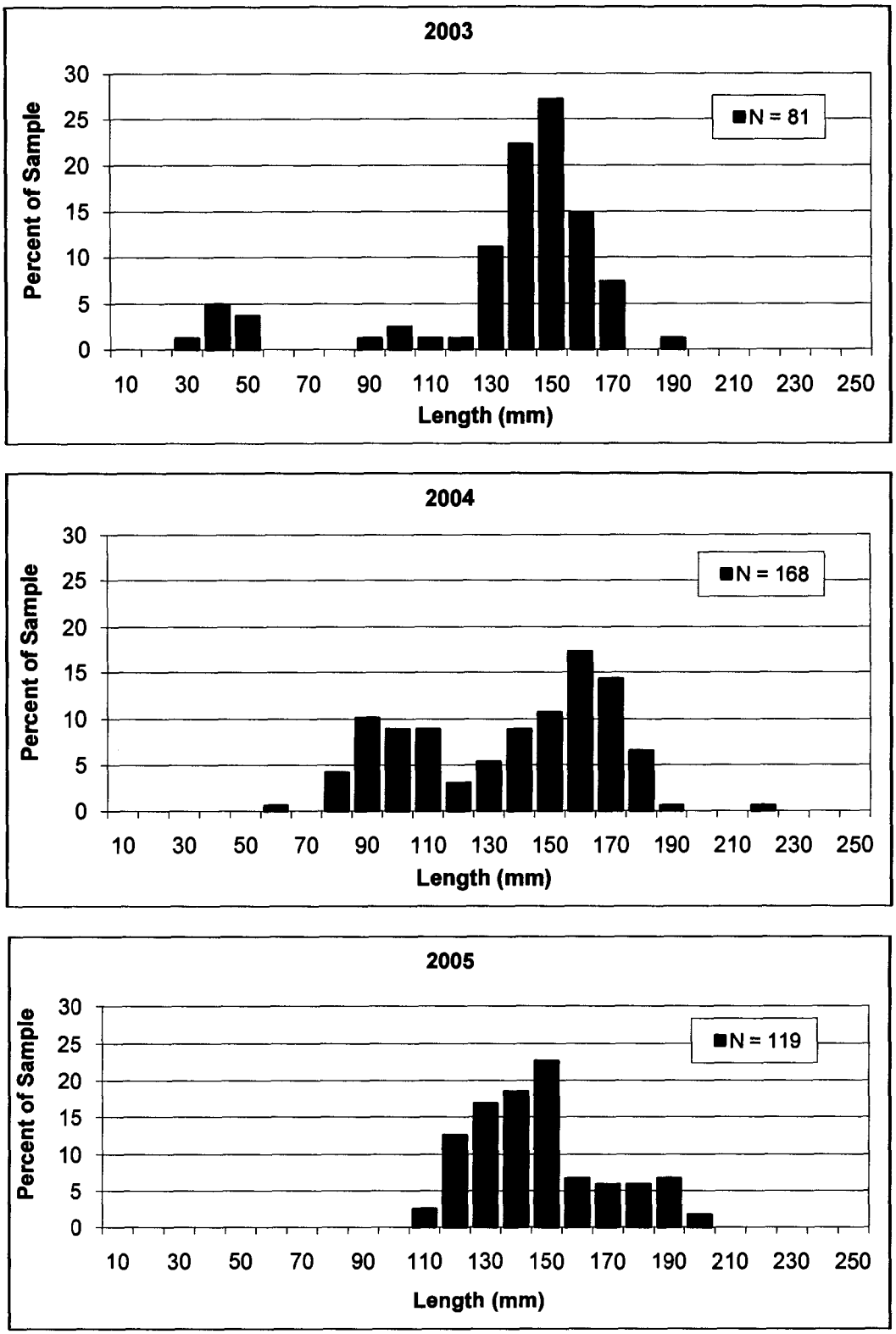


Figure 73. Length frequency distributions of bluegill collected from standard lake surveys of Winchester Lake in 2003-2005.

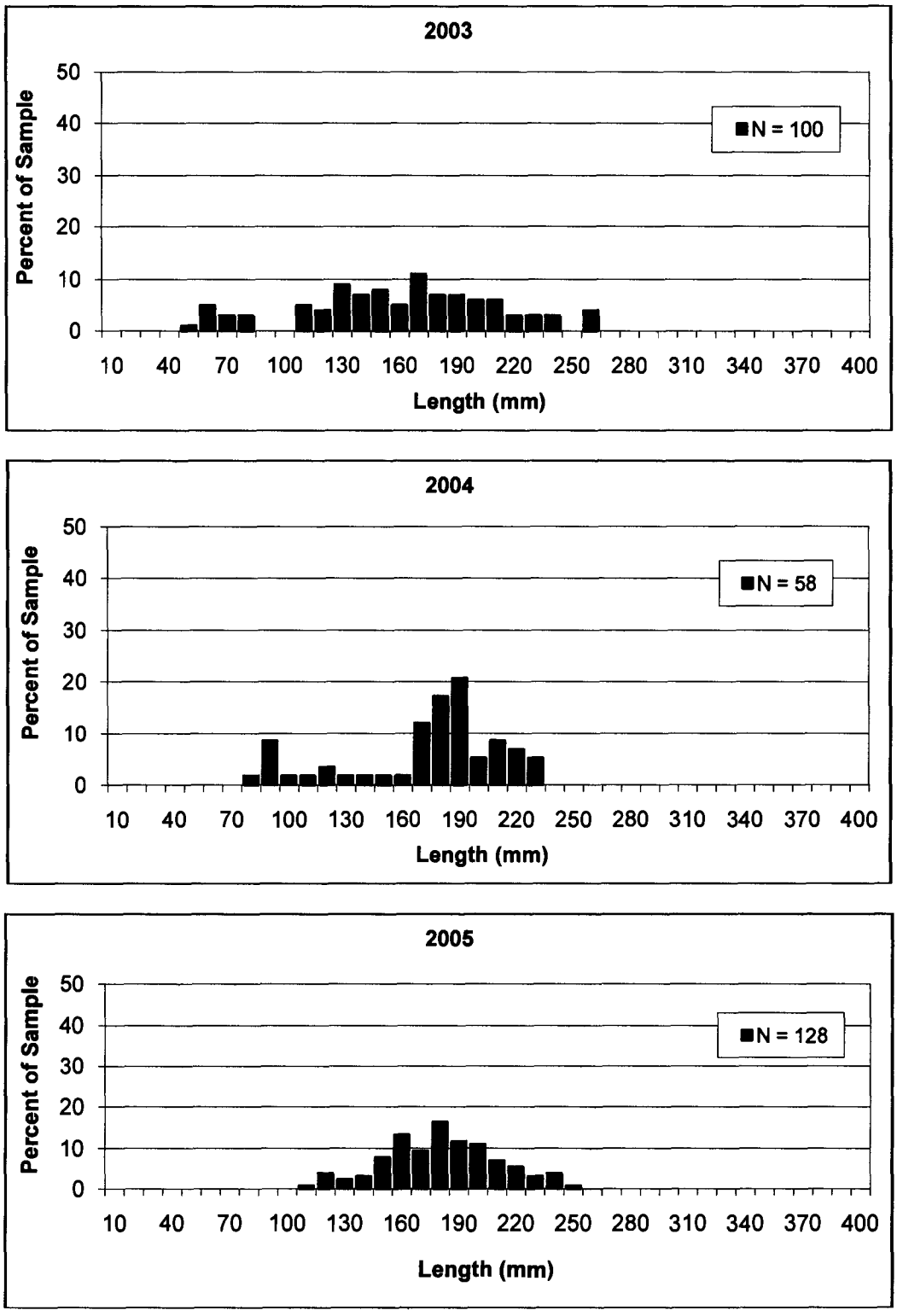


Figure 74. Length frequency distributions of yellow perch collected from standard lake surveys of Winchester Lake in 2003-2005.

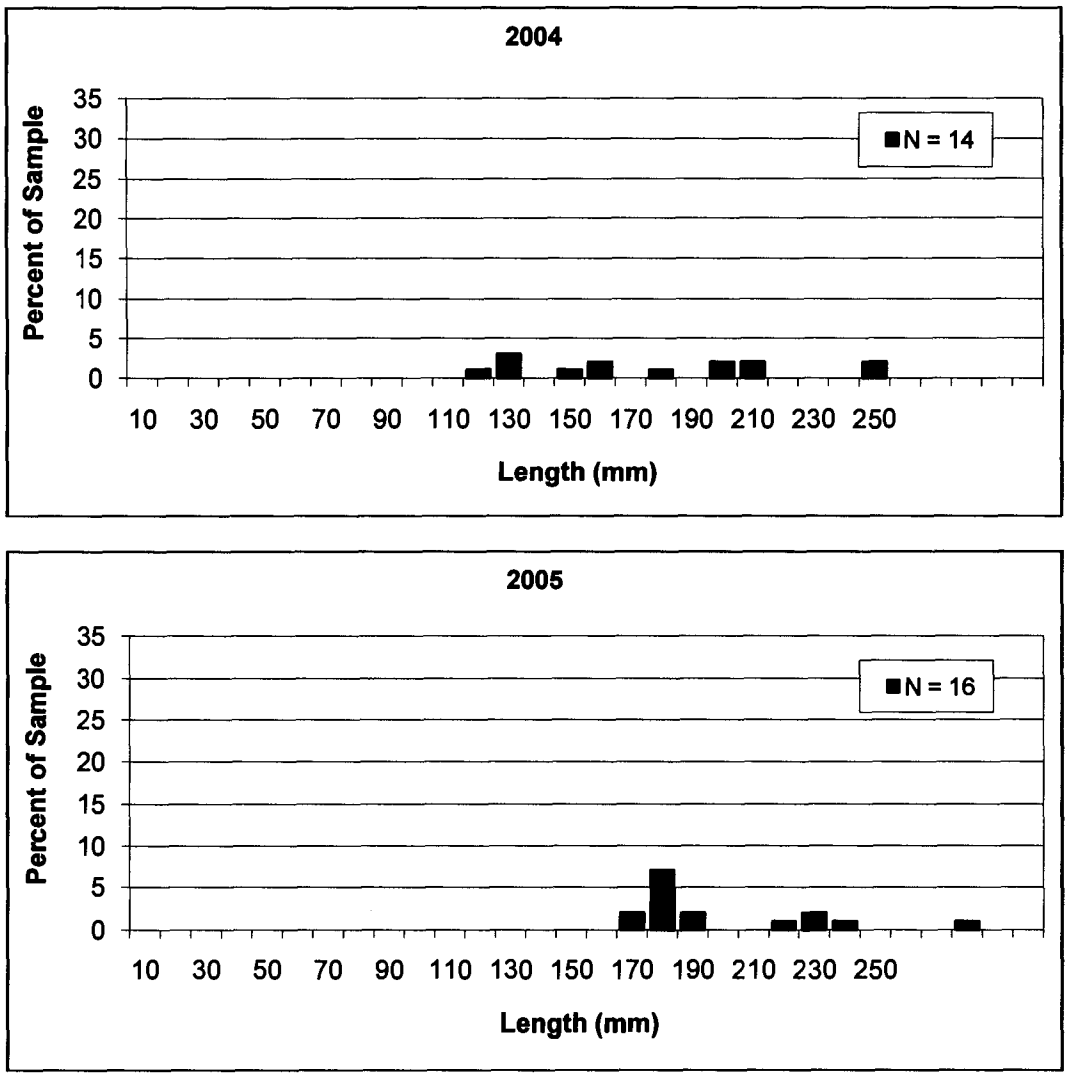


Figure 75. Length frequency distributions of black crappie collected from standard lake surveys of Winchester Lake in 2004-2005.

Figure 76. Estimated angler effort, by type, from creel surveys of Winchester Lake in 1993, 1999, and 2005.

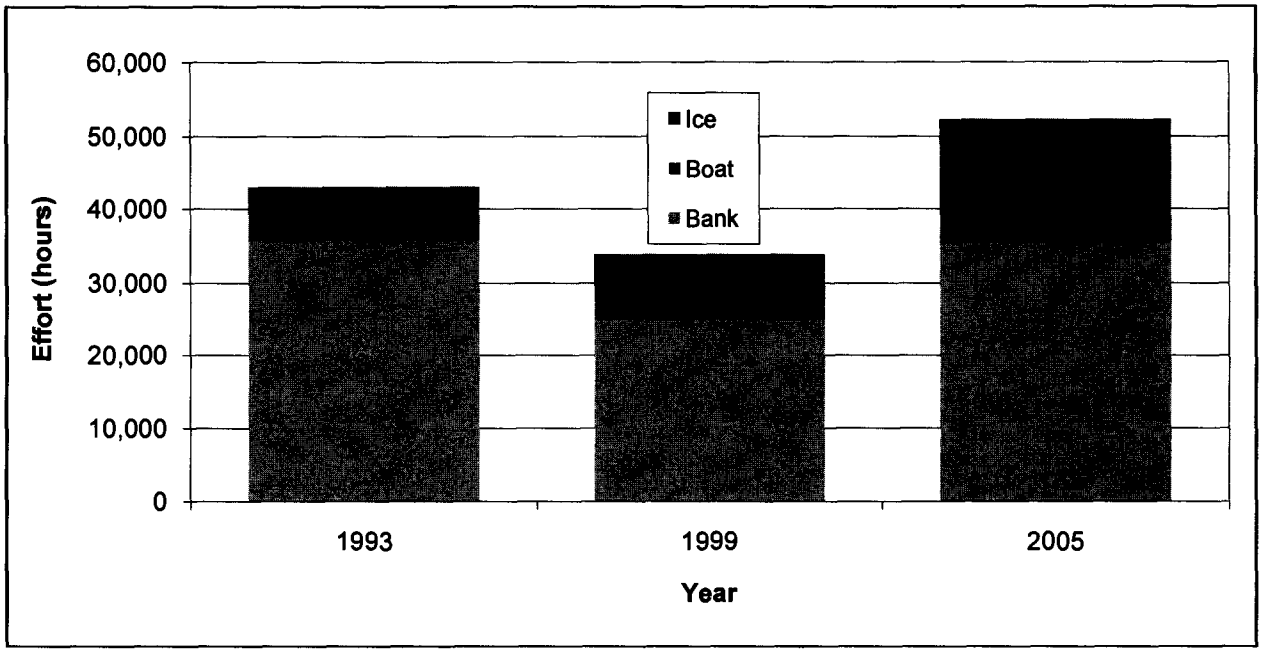


Table 19. Stocking history for Winchester Lake.

Year	Catchable Rainbow	Fingerling Rainbow	Fingerling Cutthroat	Kokanee	Tiger Muskie	Channel Catfish
1968	29,310	37,110	82,650			
1969	24,630	49,660	92,800			
1970	26,840	112,310	81,600			
1971	18,310	119,500	72,128			
1972	30,945	90,510	74,200			
1973	27,120	105,055	74,800			
1974	14,640	125,600	70,560			
1975	27,840	91,915	14,708			
1976	26,160	84,330	21,300			
1977	16,380	34,830	23,226			
1978	21,240	40,032				
1979	25,050	41,170				
1980	41,470	40,000				
1981	37,970		18,056			
1982	43,015	14,400				
1983	42,320	4,860				
1984	46,980					
1985	25,080					
1986	26,230					
1987	36,445	30,000				
1988	53,408	57,625				
1989	44,750	85,000	5,025			
1990	32,160	44,980	5,250			
1991	17,600	70,488	21,000			
1992	35,130	57,152				
1993	42,288	45,049				
1994	32,891	75,005				
1995	35,640	45,000	10,200			
1996	30,975	10,000				
1997	27,930	30,014			100	
1998	40,260	35,000	5,400			
1999		35,030		5,000	100	
2000	24,990	36,720		5,085		1,196
2001	27,399	35,534		5,000		
2002	38,197	35,625		5,016	69	
2003	35,793	38,458				3,268
2004	36,220	29,172				2,670
2005	32,225					

Table 20. Historical temperature and dissolved oxygen (mg/l) profiles for Winchester Lake.

1985

Depth (m)	February	March	April	May	June	July	August	September	October
0					9.5				7.8
1					9.8				7.9
2					6.8				7.8
3					4.6				7.9
4					1.3				7.9
5					0.6				8.0
6					0.5				7.9
7					0.3				7.9
8					0.2				8.0
9					0.1				7.8

1986

Depth (m)	February	March	April	May	June	July	August	September	October
0						11.4			
1						11.8			
2						7.0			
3						1.0			
4						0.5			
5						0.4			
6						0.5			
7						0.5			
8						0.5			
9						0.5			

1988

Depth (m)	February	March	April	May	June	July	August	September	October
0				7.4	9.4	8.7	9.6	7.7	8.9
1				7.4	9.2	8.7	9.5	8.2	8.9
2				7.4	9.1	8.7	8.4	6.9	8.8
3				6.4	8.2	3.5	4.0	6.3	2.6
4				5.3	5.7	0.8	0.5	4.4	0.7
5				3.4	0.6	0.6	0.5	0.8	0.5
6				2.2	0.6	0.6	0.4	0.3	0.5
7				0.6	0.5	0.5	0.2	0.3	0.5
8				0.3	0.5	0.5	0.3	0.3	0.5
9				0.2	0.4	0.5			

Table 20 (cont). Historical temperature and dissolved oxygen (mg/l) profiles for Winchester Lake.

1989

Depth (m)	February	March	April	May	June	July	August	September	October
0	9.4	9.4	10.2						
1	6.2	8.5	9.6						
2	4.6	7.2	8.2						
3	3.8	4.6	6.0						
4	3.4	1.8	6.0						
5	2.6	1.4	6.0						
6	1.3	0.8	5.8						
7	0.8	0.6	5.6						
8	0.6	0.6	5.0						
9	0.6	0.6	4.0						

1991

Depth (m)	February	March	April	May	June	July	August	September	October
0							13.7		
1							14.7		
2							9.6		
3							7.0		
4							1.4		
5							0.9		
6							0.6		
7							0.5		
8							0.5		

1992

Depth (m)	February	March	April	May	June	July	August	September	October
0									
1							11.0		4.8
2							10.0		4.2
3							7.6		4.1
4							4.5		4.0
5							2.2		2.8
6							2.0		2.8
7							2.0		3.4
8							2.0		3.3

Table 20 (cont). Historical temperature and dissolved oxygen (mg/l) profiles for Winchester Lake.

1993

Depth (m)	February	March	April	May	June	July	August	September	October
0	3.8						7.9		
1	2.2				12.5	10.4	7.7	7.2	
2	0.7				12.5	10.4	7.7	6.7	
3	0.4				10.0	9.0	6.0	6.0	
4	0.3				2.5	5.0	4.9	4.7	
5	0.2				0.5	1.5	3.7	4.2	
6	0.2				0.4	1.5	4.0	3.8	
7	0.1				0.4	1.4	4.1	3.7	
8	0.2				0.4	1.3	4.0	3.8	
9					0.3	1.2	4.0	3.8	

1994

Depth (m)	February	March	April	May	June	July	August	September	October
0				7.0	11.2	15.0	10.6	15.0	1.3
1				7.0	11.6	12.9	8.3	14.2	1.0
2				6.8	11.8	11.4	7.3	6.7	0.9
3				5.9	8.7	2.7	0.9	4.6	0.8
4				2.7	5.6	0.3	0.0	3.5	0.8
5				2.6	3.9	0.1	0.0	0.4	0.5
6				2.5	3.4	0.0	0.0	0.0	0.5
7				2.5	3.5	0.0	0.0	0.0	0.3
8				2.5	3.5	0.0	0.0	0.0	0.2
9				2.5	3.4	0.0	0.0	0.0	0.1

1995

Depth (m)	February	March	April	May	June	July	August	September	October
0				9.9					
1				9.6	6.8	8.1	8.3	8.7	8.5
2				9.8	6.7	8.4	8.0	8.4	8.3
3				5.7	6.4	4.0	7.8	7.0	8.3
4				4.0	1.8	0.4	5.8	6.7	8.3
5				3.3	0.6	0.2	2.3	6.3	8.2
6				2.6	0.1	0.0	0.3	5.1	8.2
7				1.4	0.0	0.0	0.0	0.4	8.1
8				0.6	0.0	0.0	0.0	0.2	8.0
9				0.2		0.0	0.0		8.0

Table 20 (cont). Historical temperature and dissolved oxygen (mg/l) profiles for Winchester Lake.

1997

Depth (m)	February	March	April	May	June	July	August	September	October
0						10.0			
1						10.0			
2						6.0			
3						1.8			
4						0.5			
5						0.2			
6						0.1			
7						0.1			

1999

Depth (m)	February	March	April	May	June	July	August	September	October
0			12.3	10.7	9.8	14.9		10.8	3.0
1			12.0	10.8	9.8	14.8		11.7	2.2
2			11.9	9.0	9.8	9.5		9.4	2.1
3			8.8	7.8	5.1	4.5		8.6	2.2
4			7.2	7.1	2.4	0.8		4.8	2.2
5			5.8	6.5	0.7	0.3		1.8	2.1
6			5.2	5.7	0.3	0.1		0.7	1.9
7			2.7	5.0	0.3	0.1		0.4	1.6
8			1.1	4.1	0.2			0.3	0.9
9				3.5	0.1			0.1	0.7

2003

Depth (m)	February	March	April	May	June	July	August	September	October
0				8.5	9.8	10.0	13.8	5.3	12.7
1				8.4	9.8	10.1	15.3	5.2	12.9
2				8.3	11.9	10.0	12.7	5.1	12.9
3				8.2	8.3	10.3	10.7	5.1	8.0
4				6.2	0.1	6.0	2.1	5.0	6.2
5				6.1	0.3	0.6	0.3	5.0	4.8
6				6.0	0.2	0.4	0.1	5.0	4.6
7				5.5	0.2	0.4	0.1	4.9	4.5
8				5.0	0.1	0.2	0.1	1.7	4.2
9						0.1	0.1	0.8	0.8

Table 20 (cont). Historical temperature and dissolved oxygen (mg/l) profiles for Winchester Lake.

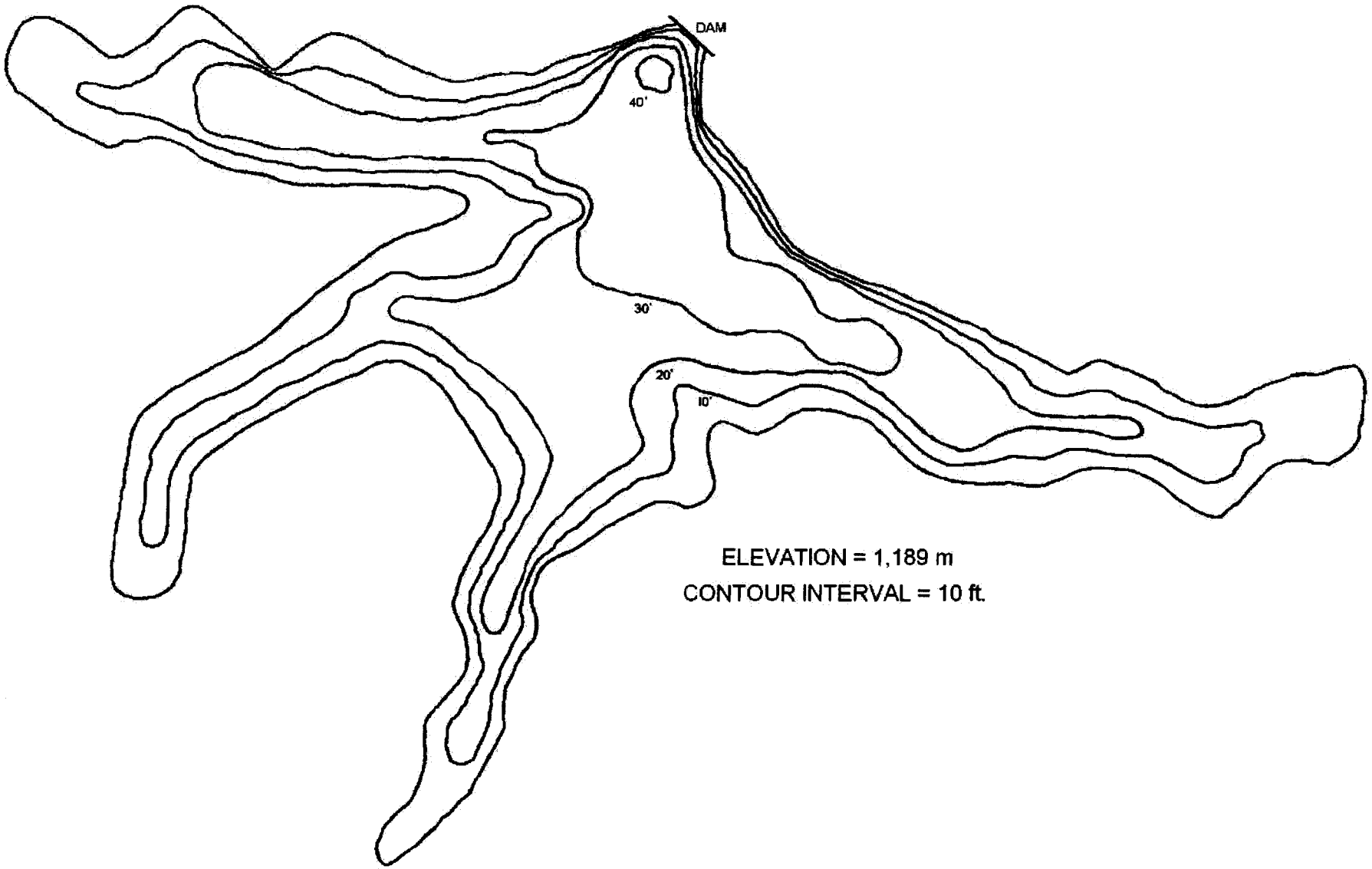
2004

Depth (m)	February	March	April	May	June	July	August	September	October
0				9.8	10.9	10.5	9.5	9.7	12.5
1				9.8	10.8	10.5	9.9	9.7	12.5
2				8.5	10.4	10.3	9.6	9.5	12.1
3				9.0	9.5	6.4	2.8	8.5	9.6
4				8.5	6.9	1.0	0.4	8.4	7.1
5				8.1	4.5	0.9	0.4	8.2	5.1
6				7.1	3.6	0.8	0.5	6.4	5.1
7				6.5	3.6	0.7	0.6	6.3	4.9
8				5.4	3.4	0.6	0.6	6.2	4.5
9				5.1	2.1	0.4	0.2	5.0	0.8

2005

Depth (m)	February	March	April	May	June	July	August	September	October	November
0	4.9	7.2	9.7	9.1	13.6	9.2	7.8	9.1	8.9	10.5
1	4.8	7.2	9.7	9.1	13.9	9.3	8.3	9.1	9.0	10.5
2	4.8	7.1	9.7	9.1	13.3	8.5	8.2	7.8	8.7	10.3
3	4.9	7.0	9.7	8.5	10.3	6.8	6.9	4.3	8.5	10.2
4	4.8	7.0	9.6	7.6	7.2	3.4	3.2	4.2	8.6	10.1
5	4.7	6.9	9.4	4.6	1.9	1.5	0.2	3.7	8.5	10.1
6	4.7	6.9	9.3	2.7	1.2	0.5	0.1	3.3	8.2	
7	4.5	6.8	9.0	1.2	0.6	0.2	0.1	2.6	8.3	
8	1.8	3.1	9.5	0.5	0.5	0.2	0.1		8.1	

Figure 78. Bathymetric map of Winchester Lake (40.5 ha).



LITERATURE CITED

Boydstun, R., and T. McArthur. 1993. Creel Census System. Lewiston, ID: Idaho Department of Fish & Game. 1993; 97 p. Statewide Angler Opinion and Harvest Surveys Study: I, Job No.: 2. April 1, 1991 to March 31, 1993. Available from: Idaho Dept. of Fish & Game, Region 2: Lewiston..

Cochnauer, T., P. Murphy, E. Schriever, T. Biladeau, and J. Brostrom. 2002. 1999 Regional Fisheries Management Investigations. Idaho Department of Fish and Game. Federal Aid in Fish and Wildlife Restoration, F-71-R-18, Job I-b, Job Performance Report, Boise.

Grunder, S.A., T.J. McArthur, S. Clark and V.K. Moore. 2008. 2003 Economic Survey Report. Idaho Department of Fish and Game Report 08-129. Boise.

Idaho Department of Fish and Game. 2001. Fisheries Management Plan 2001 - 2006. Boise.

McArthur, T. 2005. Statewide Angler Opinion and Harvest Surveys: Creel Census System. Idaho Department of Fish & Game. Region 2: Lewiston.

Schriever, E., J. Brostrom, and T. Cochnauer. 1996. 1993 Regional Fisheries Management Investigations. Idaho Department of Fish and Game. Federal Aid in Fish and Wildlife Restoration, F-71-R-18, Job I-b, Job Performance Report, Boise.

Teuscher, D. 2001. Project 5–Lake and Reservoir Research. Idaho Department of Fish and Game. Federal Aid in Fish and Wildlife Restoration Job Performance Report F-73-R-23. Boise.

APPENDIX A. Standard lowland lake survey sampling effort guidelines.

Lake Size (ac)	Effort: Gill Net Units*	Effort: Trap Net 1m x 2 m	Effort: Hours Electrofishing*	Approximate Time Needed
1-25	1	1	1	1 night
25-100	2	2	2	1 night
100-500	4	4	4	1-2 nights
500-1000	6	6	6	2 nights
1000+***	6+	6+	6+	2-3+ nights

* gill net unit = one floating and one sinking gill net; 46 m long x 2 m deep ; with 1.9 cm, 2.5 3.2 cm, 3.8 cm, 5 cm, and 6.4 cm square mesh

** hours of actual shocking time, or 50% of shoreline, whichever is less

*** use best judgement on effort needed to sample various habitat zones

APPENDIX B. Harvest summary from creel surveys conducted on lowland lakes in the Clearwater Region in 1993, 1999, and 2005.

1993			HARVEST													
Lake	Fish Caught	Fish Released	Rainbow trout	Black crappie	Bluegill	Largemouth bass	Pumpkin seed	Brook trout	Splake	Smallmouth bass	Kokanee	Yellow perch	Black bullhead	Lake trout	Channel catfish	TOTAL
Winchester	47,901	6,584	40,739			496							82			41,317
Spring Valley	34,164	6,747	26,924		274	219										27,417
Mann	31,885	3,414	24,365	1,026		284								2,768	28	28,471
Soldier's Meadow	22,385	4,765	15,893	846							881					17,620
Moose Creek	18,082	1,092	14,187	935	934		934									16,990
Elk Creek	22,155	5,128	16,001			60		754		59			153			17,027
Total	176,572	27,730	138,109	2,807	1,208	1,059	934	754	0	59	881	0	235	2,768	28	148,842

1999			HARVEST													
Lake	Fish Caught	Fish Released	Rainbow trout	Black crappie	Bluegill	Largemouth bass	Pumpkin seed	Brook trout	Splake	Smallmouth bass	Kokanee	Yellow perch	Black bullhead	Lake trout	Channel catfish	TOTAL
Winchester	44,227	5,057	21,622	12,966	39	392						3,251	901			39,171
Spring Valley	39,251	11,552	22,826	55	4,621	166										27,668
Mann	24,959	3,874	12,546	7,970	189	380										21,085
Soldier's Meadow	10,702	2,035	8,407	260												8,667
Moose Creek	11,323	2,266	7,961		1,096											9,057
Elk Creek	20,702	4,365	10,962					5,097		278						16,337
Waha	2,409	473	1,582						234	118						1,934
Total	153,573	29,622	85,906	21,251	5,945	938	0	5,097	234	396	0	3,251	901	0	0	123,919

2005			HARVEST													
Lake	Fish Caught	Fish Released	Rainbow trout	Black crappie	Bluegill	Largemouth bass	Pumpkin seed	Brook trout	Splake	Smallmouth bass	Kokanee	Yellow perch	Black bullhead	Lake trout	Channel catfish	TOTAL
Winchester	141,392	73,633	23,560	5,364	16,394	600						21,708			133	67,759
Spring Valley	52,031	30,785	13,907	2,452	4,494	393										21,246
Mann	67,407	28,285	8,271	28,041	984	166	1,628								32	39,122
Soldier's Meadow	16,161	9,630	4,791	1,646							20		74			6,531
Moose Creek	36,753	24,406	10,222	373	1,401	36	315									12,347
Elk Creek	23,591	12,544	10,392	370	122	12		103		15			33			11,047
Waha	13,914	3,995	2,357						48	273	26	7,215				9,919
Deer Creek	21,837	12,908	8,929													8,929
Total	373,086	196,186	82,429	38,246	23,395	1,207	1,943	103	48	288	46	28,923	107	0	165	176,900

APPENDIX C – Historical and current lowland lake standard survey schedule.

YEAR	Deer Cr.	Elk Cr.	Moose Cr.	Soldier's M.	Spring V.	Tolo	Mann	Waha	Winchester
1995		X			X				
1996					X			X	X
1997		X			X	X		X	X
1998					X				
1999		X	X	X	X		X	X	X
2000									X
2001		X	X		X		X	X	X
2002									
2003				X		X	X	X	X
2004			X		X			X	X
2005		X	X	X		X	X		X
2006		X	X		X				
2007							X	X	X
2008				X	X	X			
2009	X	X	X						
2010							X	X	X

APPENDIX D. Clearwater Region fish stocking request list through 2007.

Catchable Rainbow Trout

Water	March	April	May	June	July	August	September	October	Grand Total
Burling Pond	400	400	400	400	400		400	400	2,800
Campbell's Pond		2,000	2,000	2,000					6,000
Deer Creek Reservoir		5,000	7,500	7,500					20,000
Elk Creek Reservoir			7,500	7,500	7,500			5,000	27,500
Mann Lake	10,000	7,500	7,500					7,500	32,500
Moose Creek Reservoir		5,000	5,000	2,500				5,000	17,500
Robinson's Pond		1,000	1,000	2,000					4,000
Soldier's Meadow Reservoir			5,000	5,000					10,000
Spring Valley Reservoir		10,000	7,500	7,500				7,500	32,500
Waha Lake		5,000	2,500						7,500
Winchester Lake		10,000	7,500	7,500				10,000	35,000
Grand Total	10,400	45,900	53,400	41,900	7,900	0	400	35,400	195,300

Fingerling stockings

Water	Species	Number	Date
Deer Creek Reservoir	Westslope Cutthroat Trout	5,000	May
Soldier's Meadow Reservoir	Rainbow	7,500	May
Spring Valley Reservoir	Rainbow	25,000	May
Waha Lake	Kokanee	50,000	May
Winchester Lake	Rainbow	30,000	May
Mann Lake	Rainbow	30,000	May/June
Mann Lake	Channel Catfish	5,000	May/June
Waha Lake	Rainbow	5,000	May/June
Waha Lake	Splake	2,500	October

APPENDIX E. Effort and catch rate summary from creel surveys conducted on lowland lakes in the Clearwater Region in 1993, 1999, and 2005.

1993

Lake	Catch Rate	Harvest Rate	Ice Hours	Boat Hours	Bank Hours	Total
Winchester	1.11	0.96	2,151	5,164	35,715	43,030
Spring Valley	0.97	0.78	1,867	5,707	27,652	35,226
Mann	1.03	0.88	186	5,393	25,415	30,994
Soldiers Meadow	1.50	1.18	150	2,111	12,712	14,973
Moose Creek	1.28	1.21	366	2,943	10,771	14,080
Elk Creek	1.31	1.01	101	5,075	11,683	16,859
Waha	---	---	---	---	---	0
Deer Creek	---	---	---	---	---	0
			4,821	26,393	123,948	155,162

1999

Lake	Catch Rate	Harvest Rate	Ice Hours	Boat Hours	Bank Hours	Total
Winchester	1.30	1.15	4,693	4,304	24,929	33,926
Spring Valley	1.19	0.84	5,412	3,318	24,093	32,823
Mann	1.33	1.12	0	5,432	13,060	18,492
Soldiers Meadow	0.94	0.76	296	2,777	8,363	11,436
Moose Creek	0.95	0.76	110	1,520	10,191	11,821
Elk Creek	1.36	1.07	855	3,587	10,824	15,266
Waha	0.59	0.47	0	1,915	2,190	4,105
Deer Creek	---	---	---	---	---	---
			11,366	22,853	93,650	127,869

2005

Lake	Catch Rate	Harvest Rate	Ice Hours	Boat Hours	Bank Hours	Total
Winchester	2.70	1.29	1,239	15,580	35,516	52,335
Spring Valley	1.79	0.73	2,150	3,257	23,590	28,997
Mann	3.13	1.81	0	9,192	12,370	21,562
Soldiers Meadow	1.75	0.71	144	2,065	7,006	9,215
Moose Creek	1.86	0.62	2,410	2,596	14,778	19,784
Elk Creek	2.16	1.01	231	2,955	7,726	10,912
Waha	3.81	2.72	0	1,366	2,283	3,649
Deer Creek	1.25	0.54	0	5,377	9,332	14,709
	2.31	1.10	6,174	42,388	112,601	161,163

APPENDIX F. Annual work plan for Region 2 lowland lakes.

Month	D.O/Temp Monitoring	ZPI	Vegetation Mapping	Aeration Monitoring	Population Surveys	Herbicide/Algaecide Spraying	Crappie Collections
January	All but D			Wa, Wi			
February	All but D			Wa, Wi			
March	All but D			Wa, Wi			
April	All		E, Mo, Sp, Wi	Wa, Wi		Wi, Sp, Mo, E	Ma
May	All		E, Mo, Sp, Wi	Wa, Wi			
June	All		E, Mo, Sp, Wi	Wa, Wi	See Appendix C		
July	All		E, Mo, Sp, Wi	Wa, Wi		Wi*, Sp*, Mo*, E*	
August	All	All	E, Mo, Sp, Wi	Wa, Wi			
September	All		E, Mo, Sp, Wi	Wa, Wi			
October	All			Wa, Wi			
November	All			Wa, Wi			
December	All but D			Wa, Wi			

* if ncecessary

D = Deer Creek Reservoir
E = Elk Creek Reservoir
Ma = Mann Lake
Mo = Moose Creek Reservoir
So = Soldier's Meadow Reservoir
Sp = Spring Valley Reservoir
T = Tolo Lake
Wa = Waha Lake,
Wi = Winchester Lake

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