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An Update on the Status of Fish Populations in Hebgen Lake

SUBMITTED TO

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Region 3 Fisheries Manager
Montana Department of Fish, Wildlife and Parks
Bozeman, Montana 59772

AND

Gary L. Benes
District Ranger - Hebgen Lake Ranger District
USDA Forest Service
West Yellowstone, Montana 59758

PREPARED BY

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&
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Hebgen Lake Ranger District
P.O. Box 520
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Summary

The current management goal for the fishery of Hebgen Lake is to create self-sustaining populations of wild trout. Brown trout, first introduced to Hebgen Lake in the 1930's, have established successful spawning runs in several of the lake's pristine tributary streams. Since the last hatchery plant of brown trout in Hebgen Lake in 1956, the quality brown trout fishery has been solely dependent upon natural reproduction. In 1979, the Department phased out stocking of domesticated rainbow trout in Hebgen Lake and began planting wild-strain McBride cutthroat trout with the intention of creating a second self-sustaining salmonid population. Intense stocking of the McBrides in Hebgen as well as in its numerous tributary streams resulted in little to no successful spawning runs. As a result, in the late 1980's the Department stopped planting the McBrides and switched to stocking DeSmet and Eagle Lake rainbow trout in Hebgen Lake, both of which are also genetically wild stocks.

In the late 1980's, following plants of several thousand young-of-the-year and overwintered DeSmet and Eagle Lake rainbow trout, gill net catch rates peaked at approximately 4 times the catch rate that occurred under the domesticated rainbow stocking program. Over the past six years, however, catch rates of rainbow trout in gill nets have steadily declined, coinciding with an increase in complaints from anglers and local businesses. In comparing stocking during this period of decline to that which occurred during its upswing in the 1980's, two differences stand out:

- No plants of overwintered fish have occurred in Hebgen Lake since 1987
- No significant plants of Eagle Lake rainbow trout have occurred since 1988.

Two management objectives need to be addressed regarding the declining trend of the rainbow trout fishery of Hebgen Lake. The first needs to focus on stocking fish with the highest chance of survival to increase angler catch rates up to an acceptable level. The second goal should be to identify the strain or strains of rainbow trout that are spawning in the lake's numerous tributary streams. Once identified, future stocking should focus on those wild strains that have proven to be reproductively viable in the Hebgen Lake system. If neither the DeSmet or Eagle Lake strain are significantly reproducing in Hebgen Lake's tributaries, we will also consider the option of introducing a different wild-strain salmonid. Stock assessment data, however, is critical in making these management decisions aimed at creating self-sustaining populations of rainbow trout that will complement the wild brown trout fishery.

Introduction

The current focal point of management for the fishery of Hebgen Lake, initiated by the Montana Department of Fish, Wildlife and Parks in 1979, is to establish self-sustaining populations of wild trout. To obtain this management goal, the Department began stocking wild-strain trout in Hebgen Lake with the intent of establishing successful spawning runs that would, under natural conditions, exceed recruitment into the fishery previously maintained by stocking of domesticated fish. This change developed in response to the short life span of the domesticated strains of rainbow trout (*Oncorhynchus mykiss*) planted in Hebgen Lake prior to 1979 coupled with the lake's limited growth season. The poor survival and growth of the domesticated rainbow trout resulted in low angler catch rates (0.24 - 0.41 fish/hr) of fish having an average maximum total length of only 12.0 in. In addition, the domesticated rainbow trout did not establish significant spawning runs in any of the numerous tributaries of Hebgen Lake. During this period, however, runs of brown trout (*Salmo trutta*) in tributaries such as Black Sands Spring, South Fork of the Madison, mainstem Madison, Duck Creek, etc., were very successful, reflecting the high quality of spawning conditions in these streams and the potential for establishing a self-sustaining populations of other strains of wild trout. In addition, it was anticipated that wild-strain trout would have a higher survival rate than the domesticated rainbows, resulting in increased angler catch rates of fish having a greater average maximum total length.

The wild-trout management goal established in 1979 lead to the cessation of stocking domesticated hatchery rainbow trout (Figure 1). Instead, the Department switched to planting genetically wild cutthroat trout, primarily the Lake McBride strain (*O. clarki)*. The plants occurred mainly in Hebgen Lake but attempts were also made to imprinted fry in the lake's numerous tributary streams with hopes of establishing natural spawning runs (Table 1). The McBride cutthroat exhibited high survival and growth rates but did not effectively reproduce in tributaries of Hebgen Lake, as was the case with the domesticated rainbows. This lack of natural

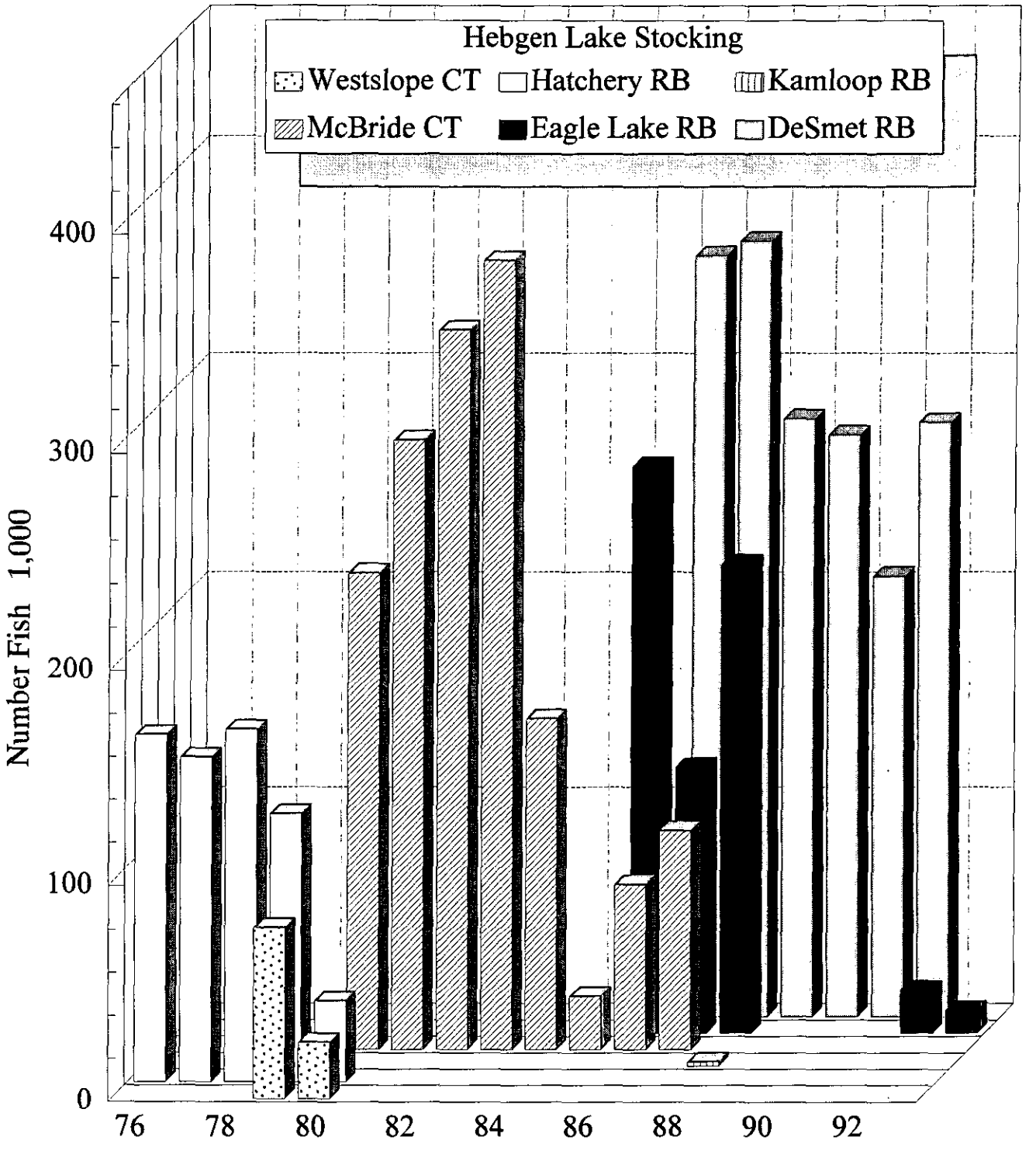

Figure 1. Stocking of salmonids (young-of-the-year and overwintered fish combined) in Hebgen Lake during 1976-1993. Hatchery RB refers to Arlee and Shasta, two strains of domesticated rainbow trout.

Table 1. Hatchery plants of cutthroat trout in tributary streams of Hebgen Lake from 1970 to 1994 - no rainbow trout were planted in Hebgen Lake tributaries during this period.

STREAM	1979	1980	1981	1982	1986
Grayling Cr.	26,030 wct	27,450 wct	2,023 mb		9,664 mb
Black Sands					11,694 mb
Cherry Cr.					1,208 mb
Cougar Cr.					9,964 mb
Duck Cr.					10,550 mb
Madison Rv	10,370 wct	27,594 wct			
Rumbaugh					725 mb
S.F. Madison		125,483 mb	75,894 mb	12,648 mb	
Trapper Cr.					9,665 mb
Watkins Cr.					9,664 mb
TOTALS	30,400 wct	55,044 wct 125,483 mb	77,917 mb	12,648 mb	63,134 mb

wct = Westslope Cutthroat Trout
mb = McBride Cutthroat Trout

reproduction is evident as shown by their declining catch rates in gill nets after 1988 when the Department stopped planting the McBrides (Figure 2). At present, cutthroat trout represent less than 1% of the gill net catch of *Salmo sp.* (rainbow and cutthroat trout).

In the late 1980's the Department initiated a stocking program of Eagle Lake and DeSmet rainbow trout in Hebgen Lake, both of which are also wild-strain fish (Figure 1). The original stock of Eagle Lake rainbow is a piscivore obtained from Eagle Lake, California where it feeds primarily on lake chubs. The DeSmet rainbow stock is primarily a plankton feeder and was obtained from Lake DeSmet, Wyoming. The DeSmet strain has since been established in Willow Creek Reservoir located near Harrison, Montana which serves as the egg source for stocking in Hebgen Lake. From 1986 to present, several hundred thousand young-of-the-year Eagle Lake and DeSmet rainbows were stocked in Hebgen Lake. To a lesser extent, overwintered fish were also stocked in 1984, 1986, and 1987. As was the case for the McBride cutthroat, the intent of stocking these wild-strain rainbow trout was to build populations that would reproduce naturally, thereby providing ample recruitment to sustain a productive fishery without the dependence and expense associated with annual stocking.

Gill Net Catch Data

The success of the rainbow trout stocking peaked in 1989 with gill net catch rates reaching over 8 fish/net (Figure 2). This was a substantial increase over catch rates observed in the early 70's (approximately 1-2 fish/net) under the domesticated rainbow stocking program. However, gill net catch rates of rainbow trout have steadily declined since 1989 to a catch rate in the fall of 1993 of approximately 4 fish/net. Brown trout gill net catch rates also increased following the cessation of stocking the domesticated rainbow trout (Figure 3). Based on spring catch rates in sinking gill nets which are a better indicator of trends for brown trout than the floating gill net data, brown trout catch rates peaked in the 80's but appear to have declined somewhat in the 90's . This may, in part, be a response to the declining population of rainbow trout in Hebgen Lake. Fewer rainbow trout in the lake may have decreased the food base

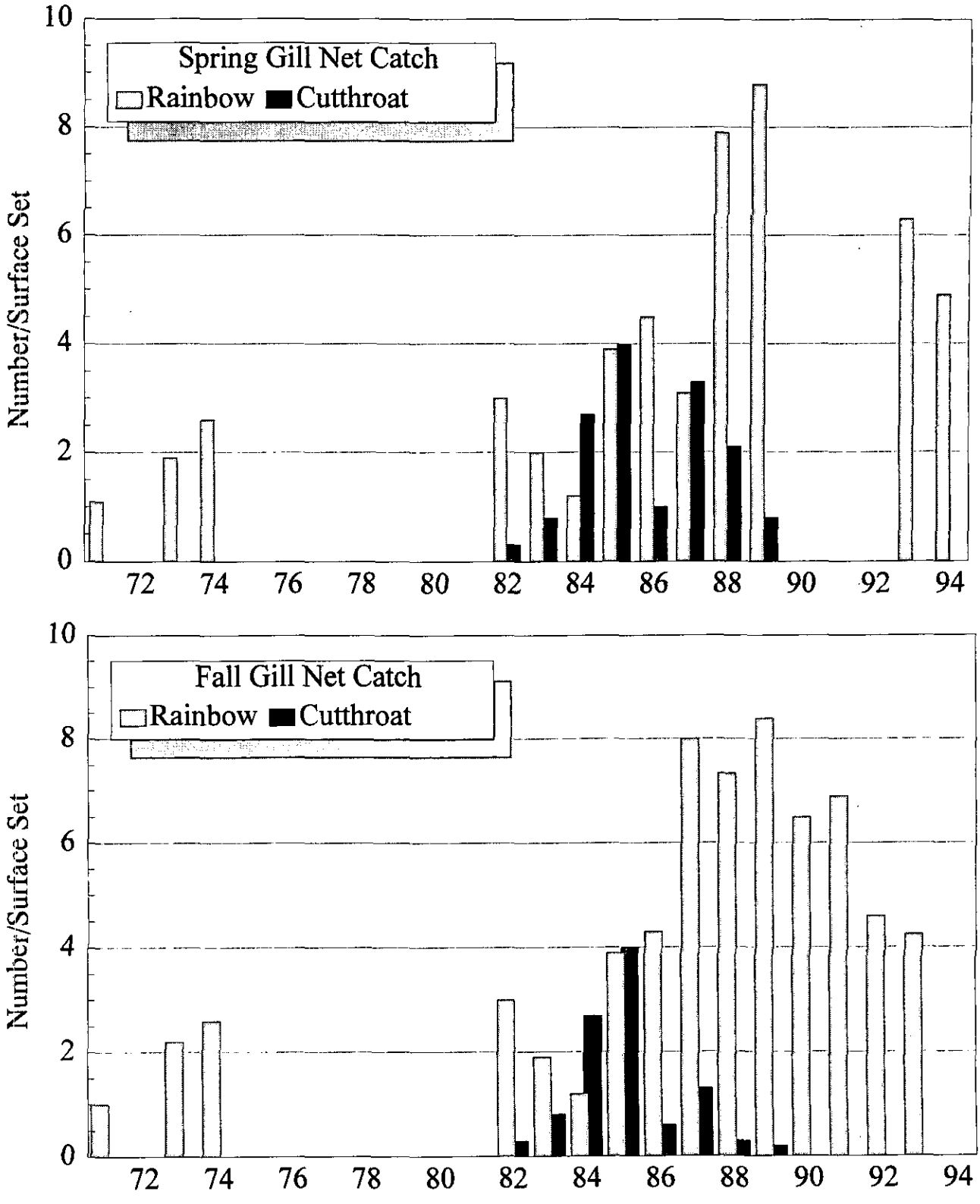

Figure 2. Average catch of rainbow and cutthroat trout in floating experimental gill nets set in the spring (top) and in the fall (bottom) in Hebgen Lake during the period 1971 to 1994. Zero values reflect a lack of data for that sampling period.

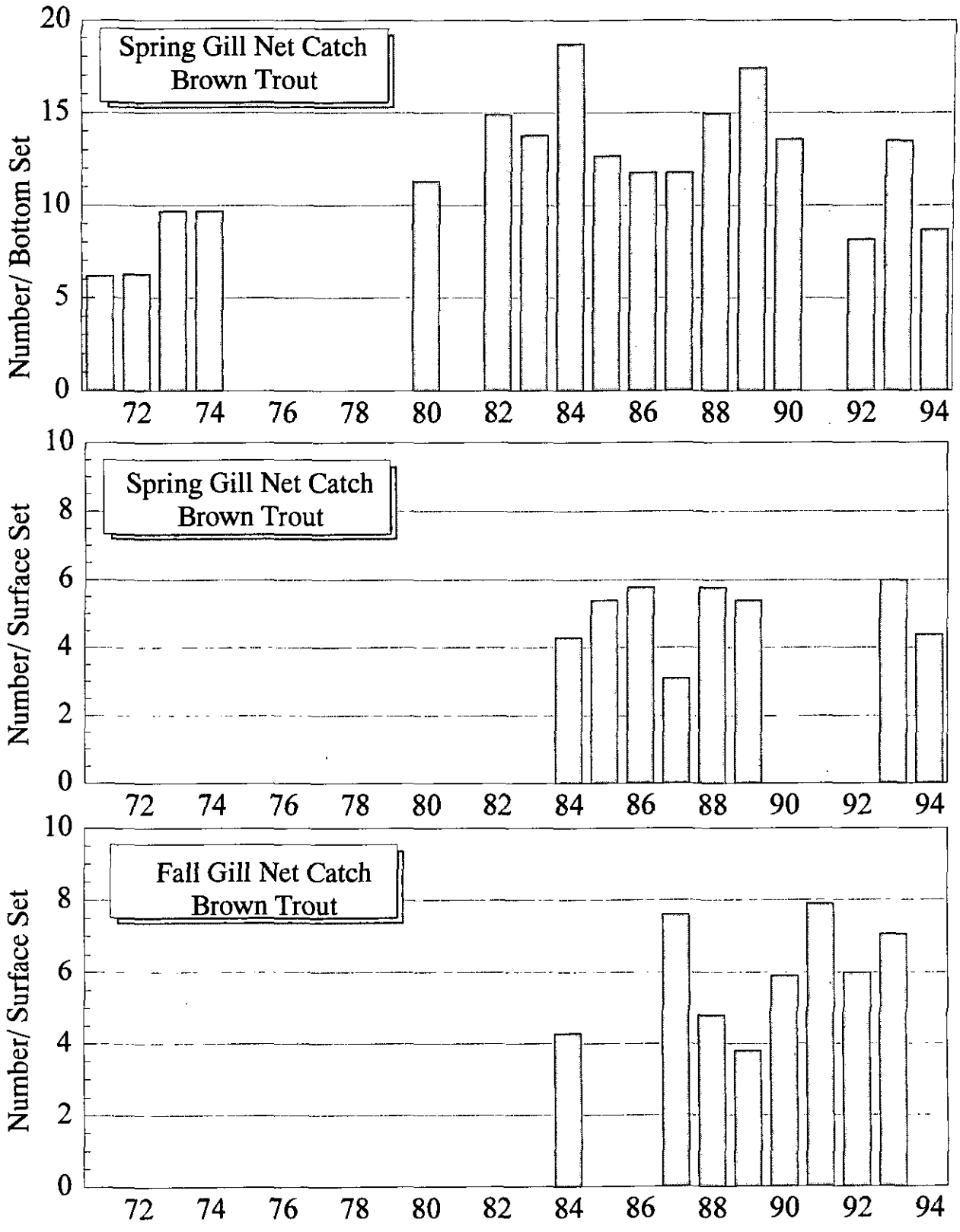

Figure 3. Average catch of brown trout in sinking (top) and floating (middle) experimental gill nets set in early spring and floating experimental gill nets set in the fall (bottom) in Hebgen Lake during the period 1971 to 1994. Zero values reflect a lack of data for that sampling period.

available for the adult brown trout. In addition, poor angler catch rates of rainbow trout have caused anglers to switch to gear that is selective towards catching brown trout, resulting in increased harvest of the brown trout population.

In the early-to-mid 70's during the domesticated rainbow trout stocking program, the catch rates of mountain whitefish (*Prosopium williamsoni*) in spring sinking gill nets were high, peaking at about 22 fish/net in 1974 (Figure 4). The whitefish population declined somewhat in the 80's and has further declined to its lowest level in the 90's. The Utah chub (*Gila atraria*) population tends to be more cyclic than the salmonid populations (Figure 4). Analysis of Utah chub catch data collected since the early 60's indicates their population size steadily increases for about a 5-6 yr period that is followed by a sharp decline in numbers. After the population crashes, the cycle begins again. At present, the chub population appears to be midway in this repeating cycle.

While catch rates of rainbow trout in gill nets have continued to decline since 1989, the average length of the catch has steadily increased (Figure 5). Length frequently charts show that fewer 14 in and under rainbow trout and more 18 in and larger rainbow trout were captured in the nets during the last few years as compared to previous years (Figure 6). The average length of brown trout has also shown a steady increase over time (Figure 5). Length frequency charts for brown trout show a shift towards larger fish in the dominate size classes of the population (Figure 7).

A comparison of rainbow gill net catch rates with stocking levels of young-of-the-year fish shows that in the years immediately following plants of the Eagle Lake strain, gill net catch rates increased (Figure 8). In the late 80's to present, very few Eagle Lake rainbows have been stocked. Instead, stocking has consisted of approximately 200,000 plus young-of-the-year DeSmets per year. During this period of stocking young-of-the-year DeSmets, however, gill net catch rates have continued to decline. While this suggests that the young-of-the-year Eagle Lake plants took better than the DeSmet plants, we also need to incorporate overwintered (age 1 fish) stocking levels in the comparison with gill net catch data.

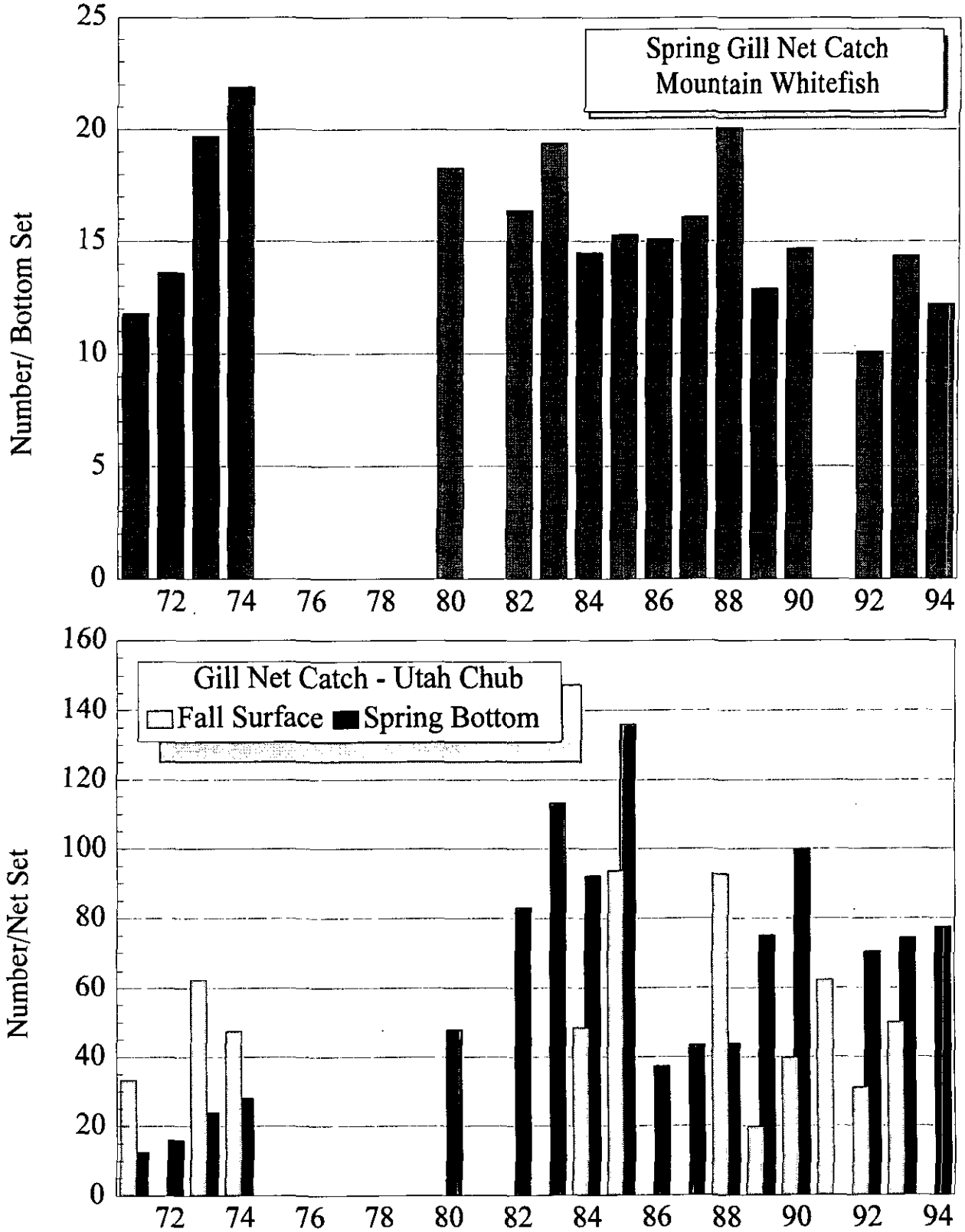

Figure 4. Average catch of mountain whitefish in sinking experimental gill nets set in the spring (top) and of Utah cubs in floating experimental gill nets set in the fall and sinking experimental gill nets set in the spring (bottom) in Hebgen Lake during the period 1971 to 1994. Zero values reflect a lack of data for that sampling period.

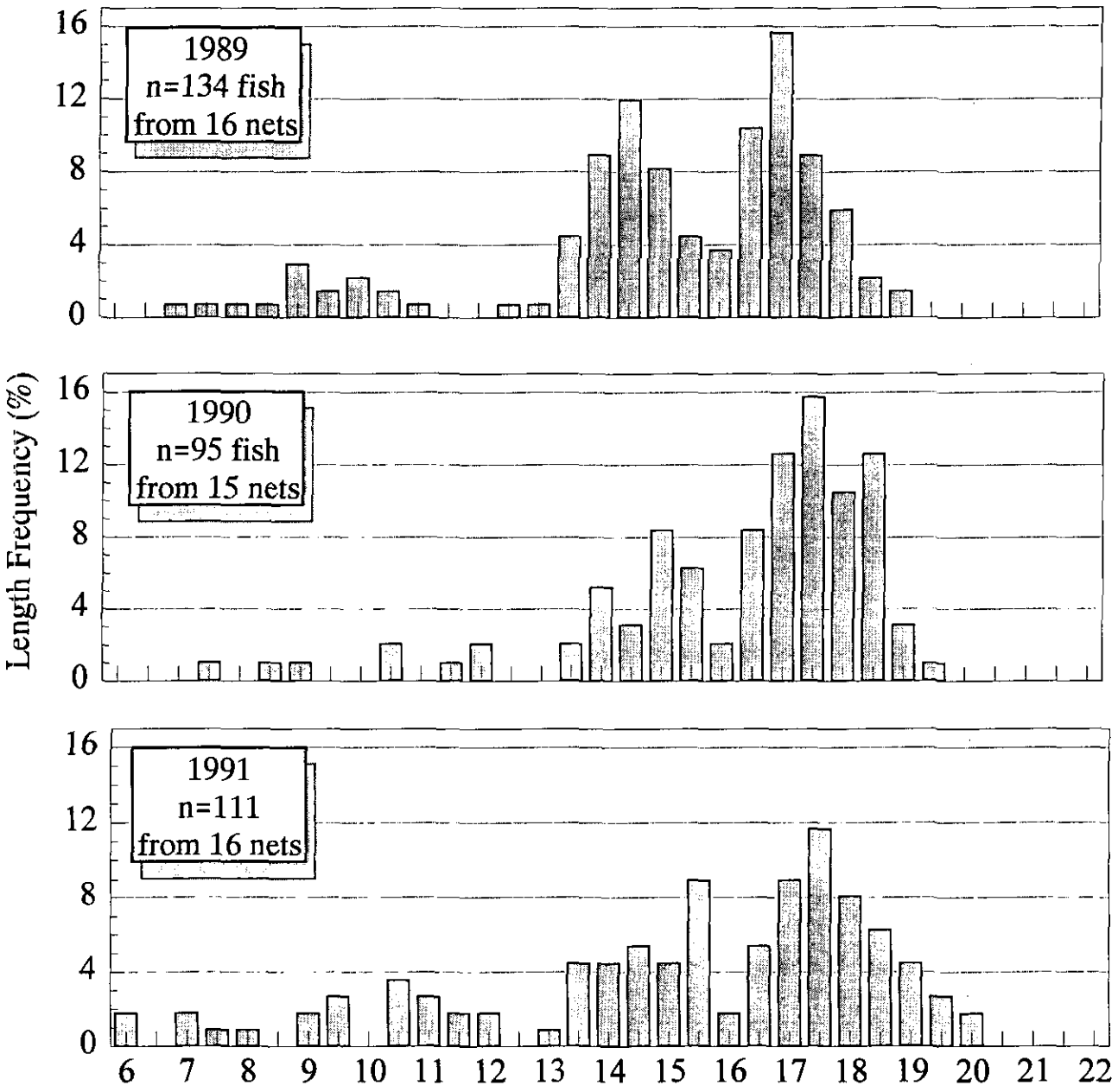

Figure 6. Length frequency of rainbow trout captured in floating experimental gill nets set in the fall in Hebgen Lake during the period 1990 to 1993.

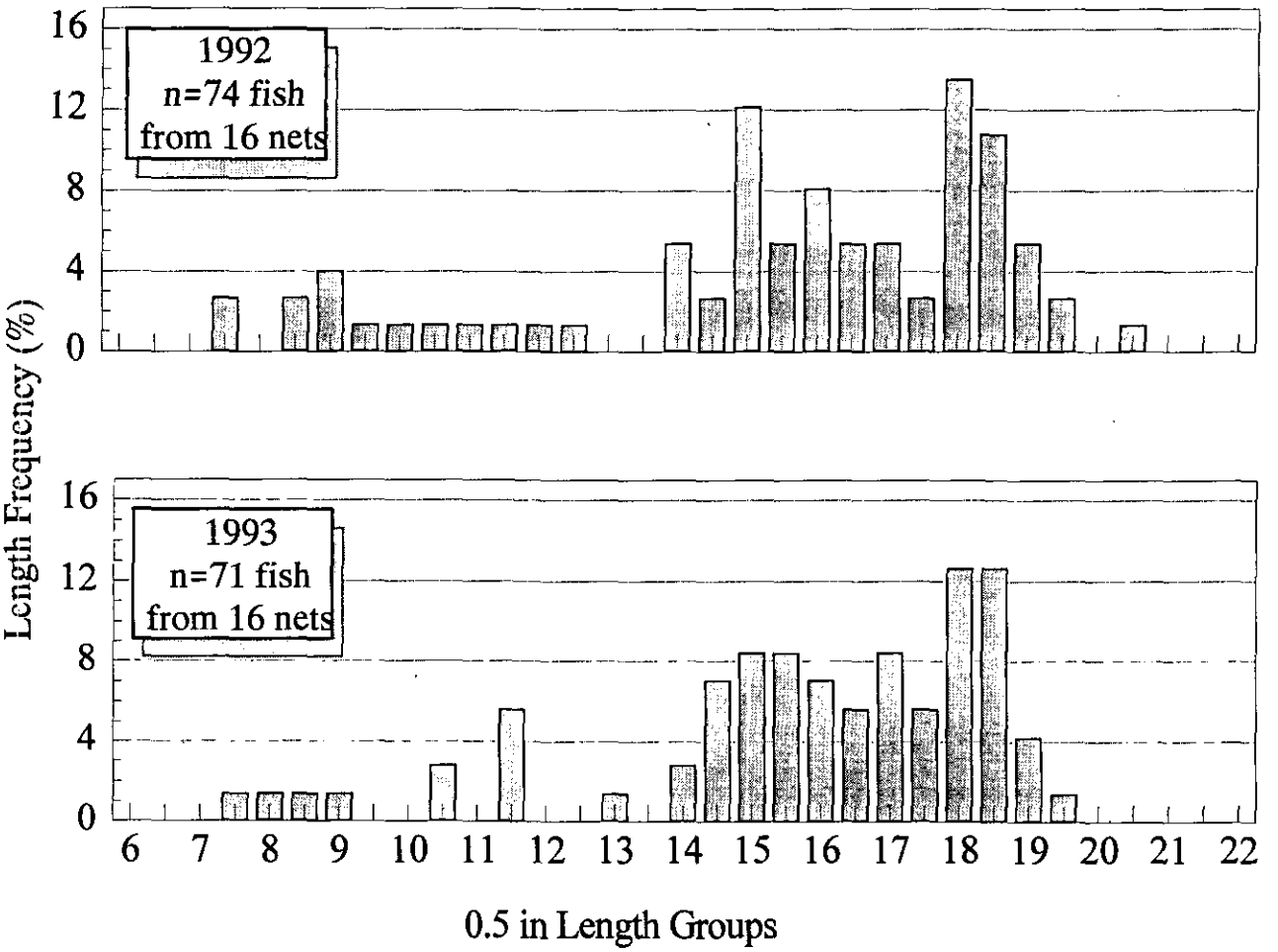

Figure 6, continued. Length frequency of rainbow trout captured in floating experimental gill nets set in the fall in Hebgen Lake during the period 1989 to 1994.

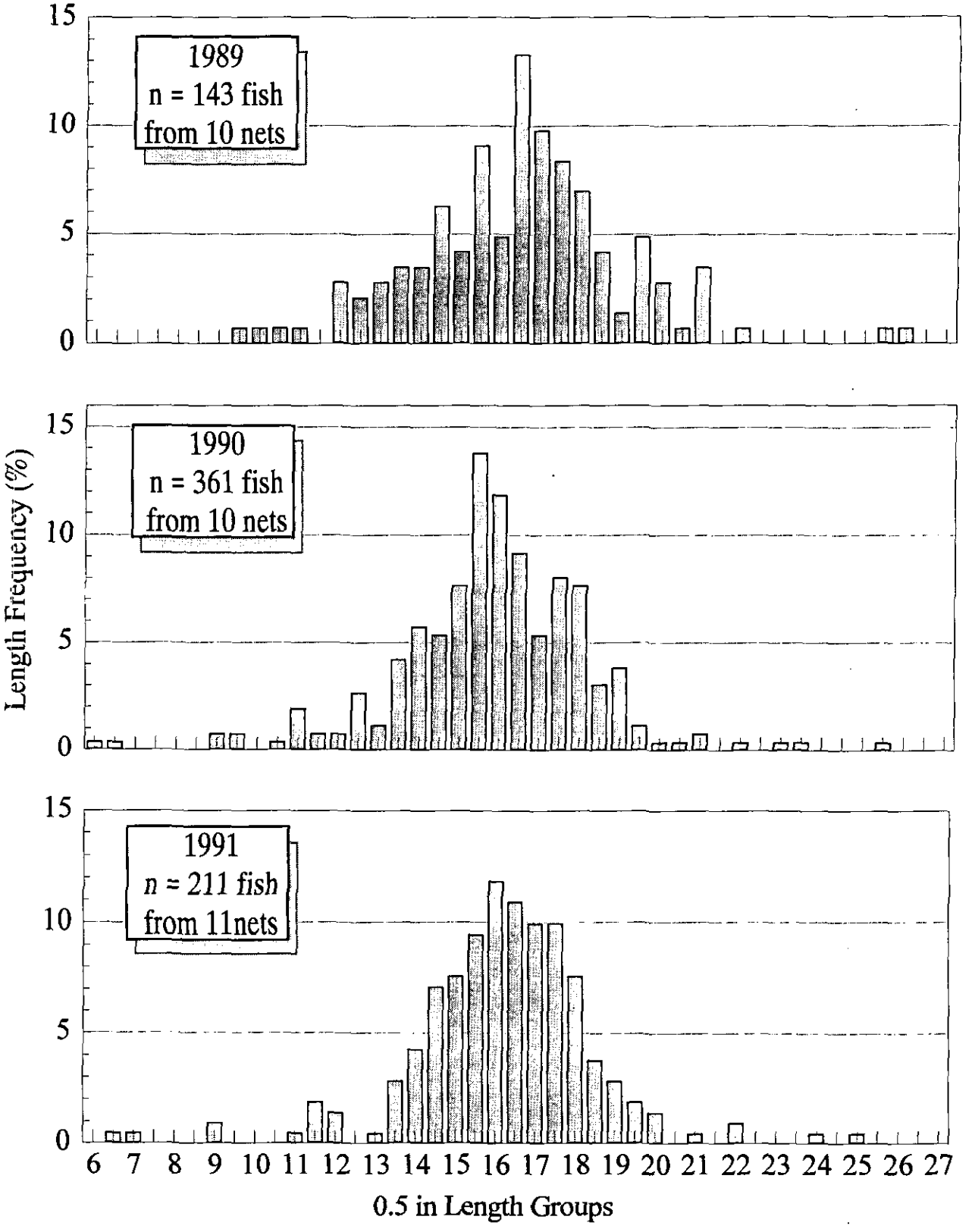

Figure 7. Length frequency of brown trout captured in sinking experimental gill nets set in the spring in Hebgen Lake during the period 1989 to 1994.

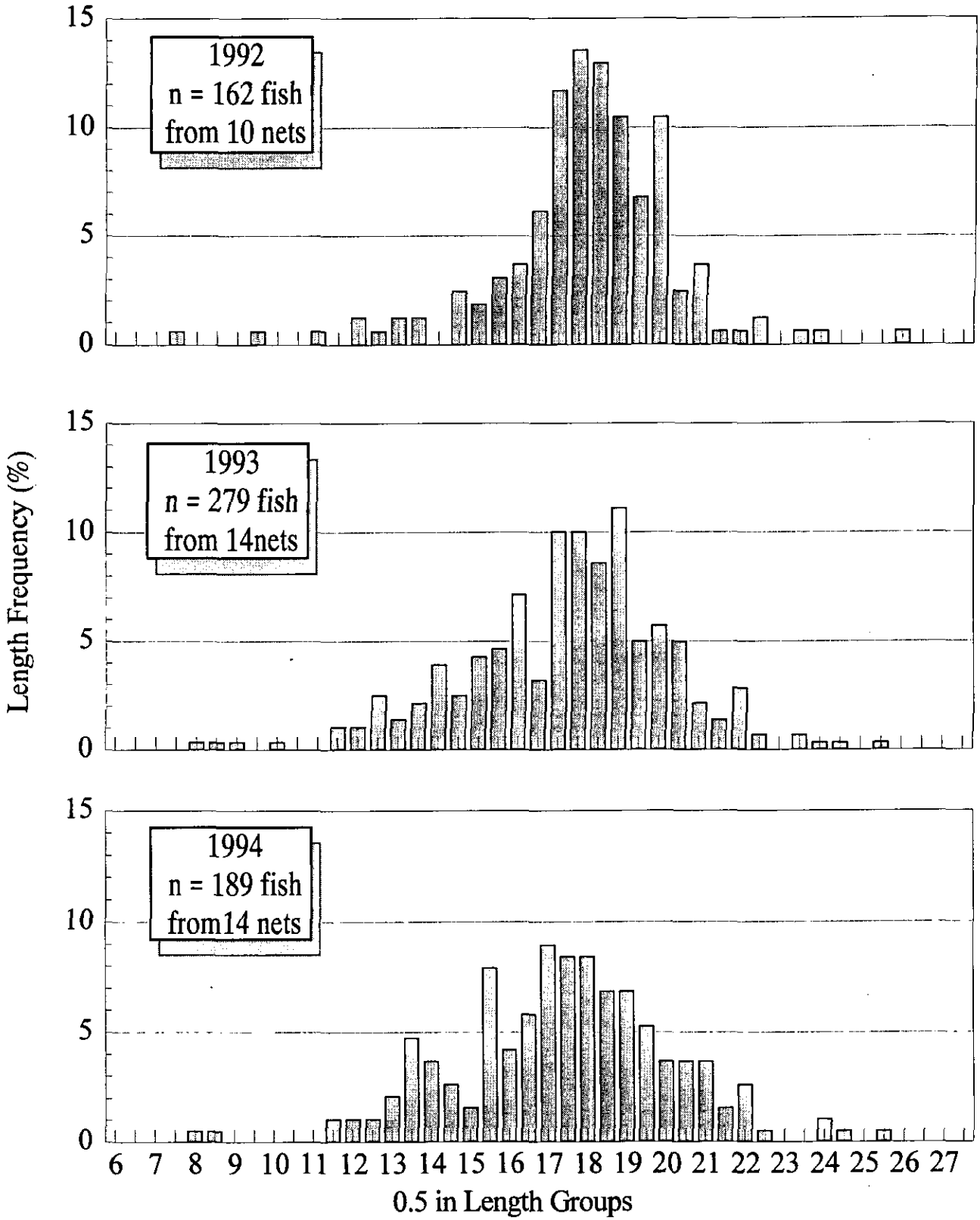

Figure 7, continued. Length frequency of brown trout captured in sinking experimental gill nets set in the spring in Hebgen Lake during the period 1989 to 1994.

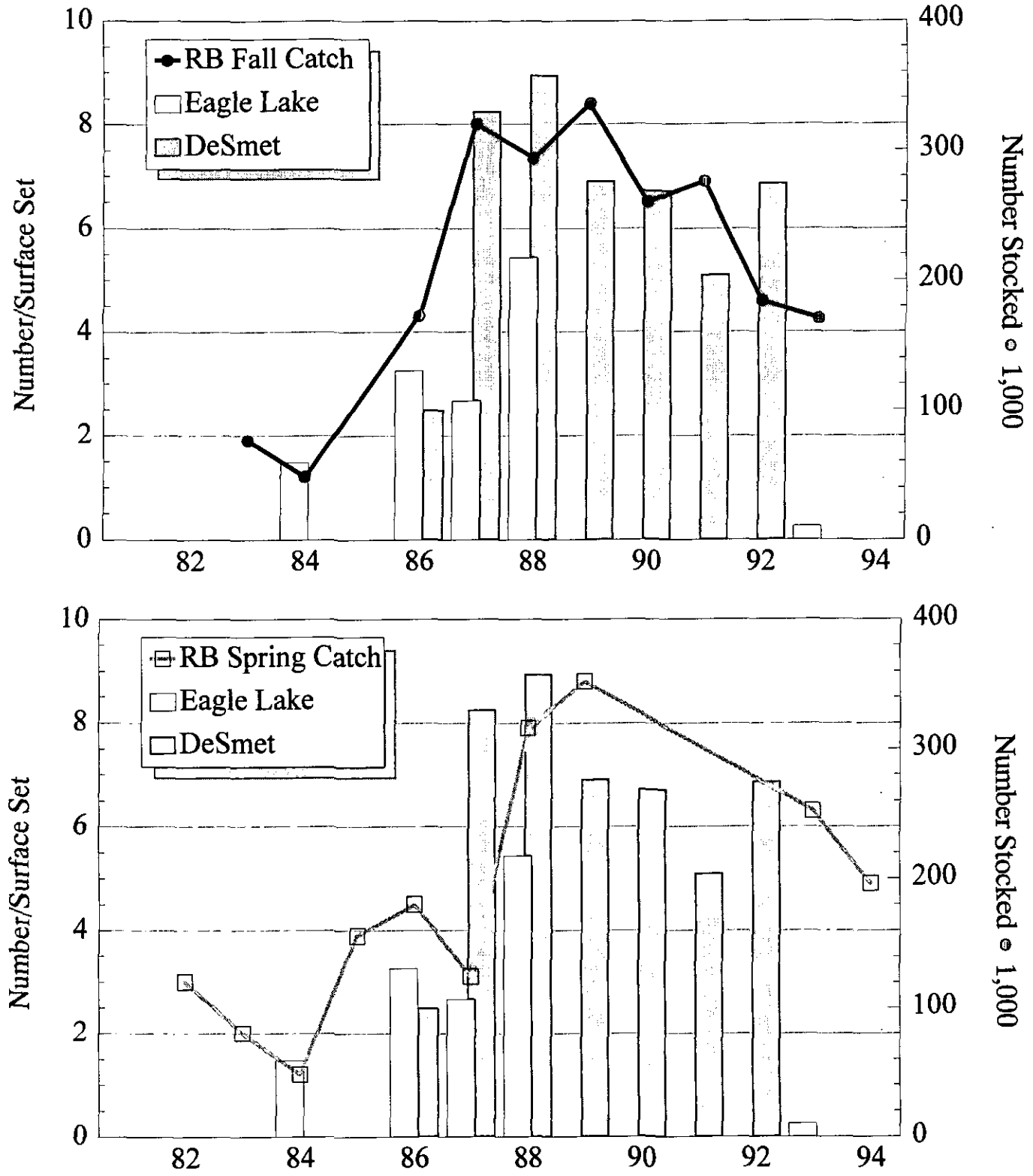

Figure 8. Catch of rainbow trout in floating experimental gill nets set in the fall (top) and spring (bottom) plotted against stocking levels of young-of-the-year Eagle Lake and DeSmet strains of rainbow trout in Hebgen during the period 1981 to 1994.

In 1984, approximately 59,000 young-of-the year and 11,000 overwintered Eagle Lakes were stocked in Hebgen Lake; DeSmets were not planted until 1986 (Figure 9). For the two years following this plant, gill nets catch rates doubled, indicating a good survival of the plant. Following another plant of approximately 130,000 young-of-the-year and 34,000 overwintered Eagle Lakes and 100,000 young-of-the-year DeSmets in 1986, gill net catch rates again doubled, reaching over 8 fish/net. In 1987, approximately 107,000 young-of-the-year and 16,500 overwintered Eagle Lakes and 330,000 young-of-the-year and 21,000 overwintered DeSmets were stocked in Hebgen Lake. Two years after this plant, gill net catch rates again increased, but to a much lesser degree than following the 1984 and 1986 Eagle Lake plants. If both the overwintered Eagle Lake and DeSmet rainbows stocked in 1987 had good survival rates, we would expect a greater increase in gill net catch rates than actually occurred, similar to the increases that were documented following the 1984 and 1986 plants. These data indicate that the overwintered plants of Eagle Lake rainbow trout may have a higher survival rate than the overwintered DeSmet plants. It also appears that planting overwintered Eagle Lake rainbow trout contributes more to the fishery than planting significantly higher numbers of young-of-the-year Eagle Lakes or DeSmets. In fact, the overwintered plants of DeSmets may be carrying the fishery of Hebgen Lake. This idea is supported by the steady increase in average length of the rainbow trout in the gill net catch combined with the steady decrease in the rainbow trout numbers in the catch during the past 6 years. However, age structure and genetic analyses of the rainbow trout population is necessary to determine the validity of this idea.

Management Goals and Alternatives

Considering the declining status of the rainbow trout population in Hebgen Lake, two management objectives need to be met. The first should focus on a short-term solution to the poor angler catch rates of rainbow trout that have lead to a general dissatisfaction with the Hebgen lake fishery expressed in numerous letters and phone calls from anglers and local businesses as well as in discussions with the angling public on the lake. This goal should

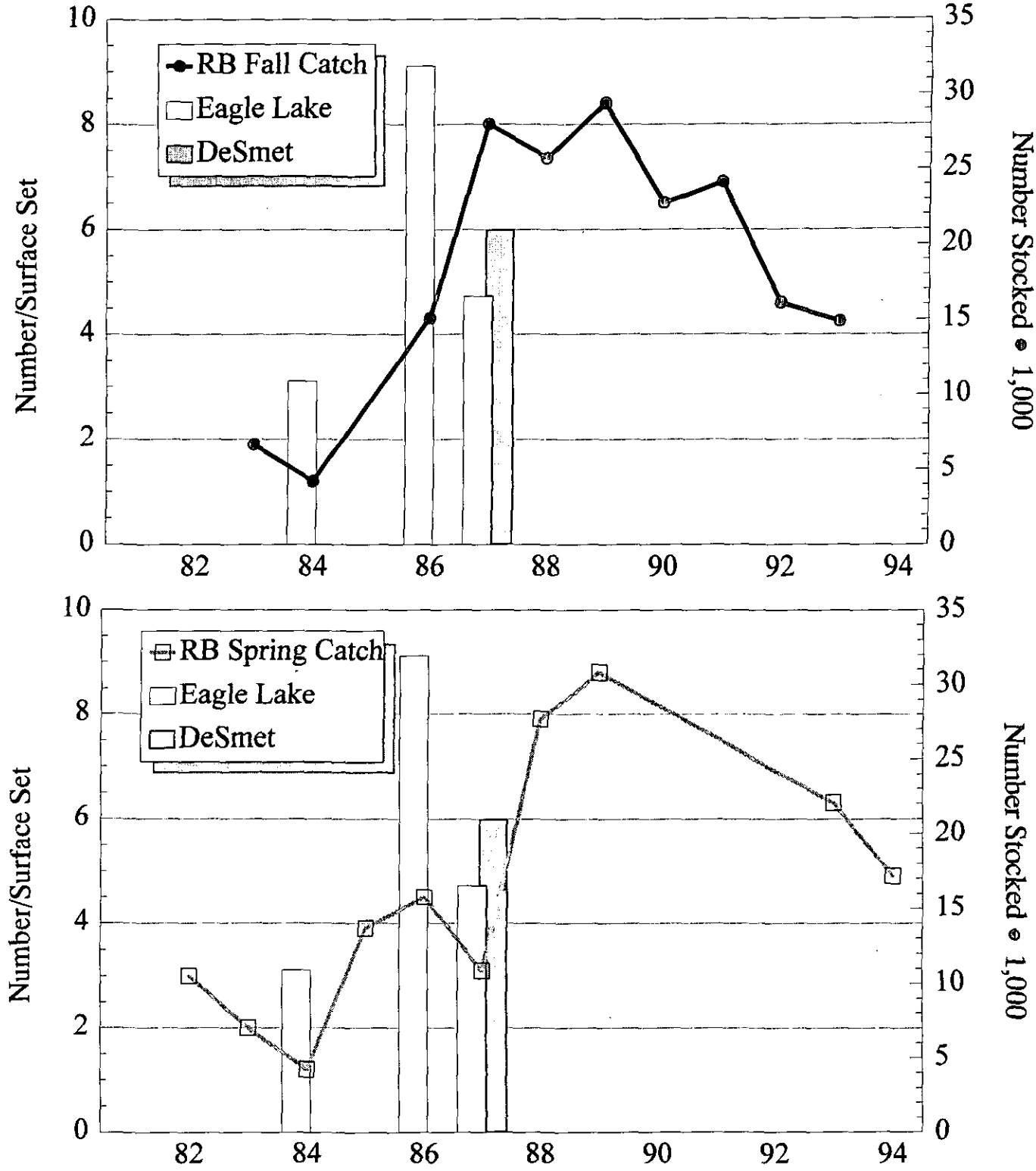

Figure 9. Catch of rainbow trout in floating experimental gill nets set in the fall (top) and spring (bottom) plotted against stocking levels of overwintered Eagle Lake and DeSmet strains of rainbow trout in Hebgen during the period 1981 to 1994.

to optimize survival. Egg plants are an attractive option as we would not be dependent upon the hatchery system whose demands for fish far exceed their supply.

concentrate on stocking fish that would have the highest survival rate and therefore, contribute to the fishery in the near future. To accomplish this goal, we need to plant the right strain at the proper size at the optimal water temperature in an effort to achieve maximum survival. Based on the comparison of gill net catch data with past fish plants, we feel that optimum survival would be achieved by stocking overwintered Eagle Lake fish. In addition, it may be necessary to implement special regulations to protect, or at least limit, harvest of reproductive-sized rainbow trout.

To address the long-term goal, we need to reconsider the management goal for Hebgen Lake established by the Department in 1979. That goal is to establish self-sustaining populations of wild trout. In 1994, Hebgen Lake is scheduled for stocking of approximately 50,0000 Eagle Lake and 70,000 DeSmet rainbow trout. The rationale behind the near equal split of stocking these two wild stains of rainbow trout is that little information exists on which strain, if either, is reproducing naturally and to what extent natural reproduction contributes to recruitment of the Hebgen Lake fishery. In 1993-94, we began to address this question by conducting the South Fork of the Madison River Salmonid Escapement Study, a project jointly funded by the Department, the USDA Forest Service, the Montana Trout Foundation, and the Federation of Flyfishers. The objectives of this ongoing study are to determine escapement (numbers of spawning adults) for the South Fork of the Madison River system and to genetically identify the strain of rainbow trout that are spawning through gel electrophoretic analysis. Further escapement and strain evaluations, however, are needed for other tributaries of Hebgen Lake. These studies are planned in the future but are dependent upon continued funding of the fisheries program based in West Yellowstone that is cooperatively funded by the Department and the USDA Forest Service. Once it is determined if the Eagle Lake or DeSmet stock, if either, is establishing successful spawning runs, future fish plants should focus on that strain. These plants could include imprint plants of fry or eggs in tributary streams as was done with the McBrides in 1986 as well as stocking of fish of the right size and at the proper water temperature