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QUANTIFICATION OF HUNGRY HORSE RESERVOIR WATER LEVELS NEEDED TO MAINTAIN OR ENHANCE RESERVOIR FISHERIES

Annual Report 1986

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Annual Report
1986

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The author gratefully acknowledges the assistance of numerous persons associated with the study. John Fraley served as project manager and reviewed the manuscript. Steve Glutting, Gary Michael, Chuck Weichler and Beth Morgan spent many long hours in the field collecting data under adverse conditions and many tedious hours in the laboratory. Beth had overall responsibility for processing collections of fish food organisms, stomach samples, and mounting scales. Steve was responsible for analyzing stream habitat, electrofishing data and zooplankton collections. Gary aged fish scales, summarized growth and fish movement data and prepared graphics for the report. Paul Suek and John Wachsmuth were able field hands. They helped collect field data and maintain equipment, boats and vehicles. Paul was responsible for processing Schindler trap and benthos samples and John analyzed the surface insect collections. Chuck Weichler assisted with the processing of zooplankton samples, data entry and data summaries for the food habits and fish food parts of the report. He wrote several data summary programs and helped develop the data base management system. Tim Thompson entered and summarized data.

Delano Hanzel assisted in computer work, and he and Scott Rumsey aided in the preparation of the boat and barge for purse seining. Joe Huston provided background information on reservoir fish populations and tributary habitat. Dennice Hamman and Fran Silva typed this and other manuscripts. Rich Clark provided data on reservoir operation and water levels in Hungry Horse Reservoir. Lloyd Reesman and Bob Anderson (Hungry Horse Ranger District) provided a storage area and allowed us use the cabins at Anna and Betty Creek.

EXECUTIVE SUMMARY

The Hungry Horse Reservoir study is part of the Northwest Power Planning Council's resident fish and wildlife plan. The plan is responsible for mitigating damages to the fish and wildlife resources caused by hydroelectric development in the Columbia River Basin. The major goal of our study is to quantify seasonal water levels needed to maintain or enhance the reservoir fishery. This study began in May 1983 and is scheduled for completion in 1988.

This report contains a summary of the limnological, food habits, fish abundance and fish distribution data collected primarily in 1986. A thorough statistical analysis of the data will be presented in the completion report in 1988.

Hungry Horse Reservoir was isothermal during 1986 from approximately December to mid April. Water temperatures warmed earlier in the spring than in previous years. The surface temperature at the end of May 1986 was 17.5^{o}C as compared to 11.1^{o}C for the same date in 1985. Dissolved oxygen concentrations and pH values were within the optimum range for production of westslope cutthroat and bull trout.

Daphnia, Diaptomus and Cyclops comprised approximately 90 percent of the biomass of zooplankton populations in 1986 with Daphnia pulex accounting for 13 percent of the standing crop. The warmer water temperatures in spring1986 advanced the seasonal progression of zooplankton abundance.

Downstream loss of zooplankton was significant only in November and December when the reservoir was isothermal. The zooplankton abundance in December of 1.592 ($N \cdot M^{-3}$) in the South Fork Flathead River downstream from the dam was approximately 27 percent of zooplankton densities in the forebay. It appeared that large drawdowns during the period when the reservoir was not thermally stratified could significantly increase downstream loss.

The biomass of aquatic dipterans was 4.0 to 7.0 times greater in the reservoir zones that were continually wetted than in the shallow areas which were annually dewatered. The adverse effect of reservoir drawdown on benthic macroinvertebrates has been well documented during this study.

The abundance of aquatic insects on the surface film was lower than in previous years with dipterans having only one peak in the spring. The biomass of terrestrial insects was highest from May through August, decreased in September and declined to almost zero in November.

Analysis of stomachs from fish collected in 1985 indicated that food habits of all species were similar to previous years with some exceptions. Westslope cutthroat trout and mountain whitefish fed more on aquatic dipteran larvae in the spring than in previous years. Bull trout fed more on westslope cutthroat trout in May. Terrestrial insects comprised the majority of the food ingested by cutthroat trout, whereas bull trout fed mostly on fish, and zooplankton dominated the diet of mountain whitefish.

The catch of fish in gill nets has been relatively stable indicating that the populations have varied little during the study. The catch of westslope cutthroat trout in floating nets had a mean of 2.6 and 1.4 fish per net in the spring and fall. respectively. Bull trout catches in sinking nets were also higher in the spring, averaging 5.3 fish per net as compared to 4.3 fish per net in the fall. The catch of both species was higher in the Sullivan area than in the Emery and Murray areas. Gill net catches of mountain whitefish were highest in the fall, averaging 13.0 fish per sinking net. Northern squawfish and suckers were caught primarily in the summer when water temperatures were above 15°C.

The spawning runs of westslope cutthroat trout into Hungry Horse Creek have declined from a high of 1,160 fish in 1968 to approximately 322 in 1986. This long-term reduction in spawners appears to have been influenced primarily by the drawdown beginning in August or September and habitat degradation in the stream caused by road building and logging activities. Reservoir drawdown in the late summer may increase mortality of juvenile cutthroat by increasing competition and making the juveniles more accessible to predators.

The recruitment of juvenile cutthroat to the reservoir from Hungry Horse Creek has declined during this period. The catch of juveniles in the fish trap has ranged from 2.700 fish in1969 to 912 in 1984. A study of the substrate composition in the stream indicated that fine sediment concentrations are high enough to be adversely affecting incubation success of cutthroat eggs. In a natural stream channel high concentrations of fines may be mitigated by groundwater upwellings in spawning areas.

Estimating the annual recruitment of westslope cutthroat trout to Hungry Horse Reservoir was a difficult task, because of the number of tributary streams and the complex life cycle. We estimated the standing crop of adfluvial juveniles at 81,946 fish in tributaries utilized for spawning by reservoir cutthroat. Approximately 30 percent of these juveniles or about 24,600 fish should be recruited to the reservoir annually.

Movement patterns and catch rates of westslope cutthroat trout, indicated that cutthroat preferred the habitat in the upper part of the reservoir. This area of the reservoir has a preponderance of the shallow, more productive littoral habitat and cooler water temperatures.

The catch rate of 0.19 fish per angler hour of effort in 1986 was comparable to the 1985 rate of 0.17 fish per hour. The total harvest of cutthroat and bull trout in 1985 was estimated to be 4,425 and 887. respectively.

Steady progress was made during the year on development of the quantitative fisheries model. The physical framework component was completed, except for the integration of the thermal model which has lagged behind schedule. Data bases from the Hungry Horse study have been made compatible with the state computer system and sent to Bozeman for incorporation in the model.

INTRODUCTION

The Pacific Northwest Electric Power Planning and Conservation Act, passed in 1980 by Congress, has provided a mechanism which integrates and provides for stable energy planning in the Pacific Northwest. The Act created the Northwest Power Planning Council and charged the Council with developing a comprehensive fish and wildlife program to protect and enhance fish and wildlife impacted by hydroelectric development in the Columbia River Basin. The Bonneville Power Administration (BPA) is one of the many agencies implementing the Council's program. The Hungry Horse Reservoir (HHR) study is part of the Council's program.

A maximum drawdown of 85 feet was recommended by Graham et al. (1982) for HHR. This recommendation was subsequently adopted by the Council as part of its fish and wildlife program. The maximum drawdown proposal and timing of drawdown will be reviewed at the end of this study. Changes in operation will be integrated with data from the HHR study, "water budget" requirements, resident fish flow needs, irrigation demands and changing power loads in the northwest.

Reservoir operation affects game fish production by altering the physical environment through changes in reservoir morphometrics such as surface area, water volume, mean depth and shoreline length. Annual drawdown for flood control and power production adversely affects primary productivity (Woods 1982). benthos production (Benson and Hudson 1975). and fish production in reservoirs (Jenkins 1970). Graham et al. (1982) indicated that increased levels of drawdown in HHR from 1965 to1975 adversely affected the growth and survival of westslope cutthroat trout (*Salmo clarki lewisi*).

We hypothesize that reservoir operation may affect the production of game fish by:

1) Controlling the amount of reservoir area which collects incoming solar energy and terrestrial insects;

2) Controlling the quantity and quality of habitats available to phytoplankton and zooplankton (volume of water) and benthic invertebrates (wetted reservoir bed);

3) Weakening the thermal structure of the reservoir by passing large inflow and outflow volumes which subsequently reduces zooplankton production;

4) Reducing the availability of food organisms and littoral zone habitat for game fish species.

OBJECTIVES

This study proposes to quantify seasonal water levels needed to maintain or enhance principal game fish species in Hungry Horse Reservoir. The specific study objectives are:

1) Estimate the impact of reservoir operation on major game fish species:

2) Develop relationships between reservoir drawdown and reservoir habitat use by fish and fish food organisms:

3) Quantify the amount of reservoir habitat available at different water level elevations;

4) Estimate recruitment of vestslope cutthroat trout juveniles from important spawning and nursery areas;

5) Determine the abundance, growth, distribution and use of available habitat by major game species in the reservoir;

6) Determine the abundance and availability of fish food organisms in the reservoir;

7) Quantify the seasonal use of available food items by major fish species.

DESCRIPTION OF THE SYUDY AREA

Hungry Horse Dam was completed in 1952 and the reservoir reached full pool elevation of 3,560 ft msl in July 1953. The dam impounded the South Fork of the Flathead River eight km upstream from its confluence with the Flathead River (Figure 1). Hungry Horse is a large storage reservoir operated by the Bureau of Reclamation. The primary benefits of the project are flood control and power production with the principal power benefit coming from generation at downstream projects. Water passes through 19 downstream projects, generating approximately 4.6 billion kilowatt hours of energy annually as compared to 1.0 billion at the Hungry Horse project.

The South Fork drains an area of approximately 4,403 km^2 on the west side of the Continental Divide in northwestern Montana. The basin is underlain principally by sedimentary rocks. The drainage is almost entirely within lands administered by the U.S. Forest Service with the upper part in the Bob Marshall Wilderness Area.

WATER QUALITY

Water quality data collected during 1978 indicated that Hungry Horse Reservoir was oligotrophic with low nutrient input and primary productivity. Low nutrient concentrations, transparent water and low algal standing crops are a result of the basin's geology, comparatively pristine nature of the South Fork watershed, and reservoir morphology. Most of the drainage area is underlain by nutrient-poor Precambrian sedimentary rock which is frequently deficient in carbonates and phosphorus (Simons and Rorabaugh 1971).

MORPHOMETRICS

At full pool, the reservoir is 56 km in length with an area of 23,800 acres and a volume of 3,468,000 acre-feet. Usable storage for power production starts at elevation 3,336 msl and includes 2,982.000 acre-feet which is 86.0 percent of total full pool volume. Maximum drawdown of 224 ft. would leave only 14.0 percent of full pool capacity (Table 1). The maximum drawdovn on record of 128 ft. in 1972 reduced the volume to 37 percent of full pool. The recommended drawdown of 85 ft. shrinks reservoir volume to 53 percent of full pool capacity.

RESERVOIR OPERATION

Reservoir operation has varied considerably since HHR was first filled. Historic operation can be classified into three periods based on average annual maximum drawdown: 1) 1955-1964

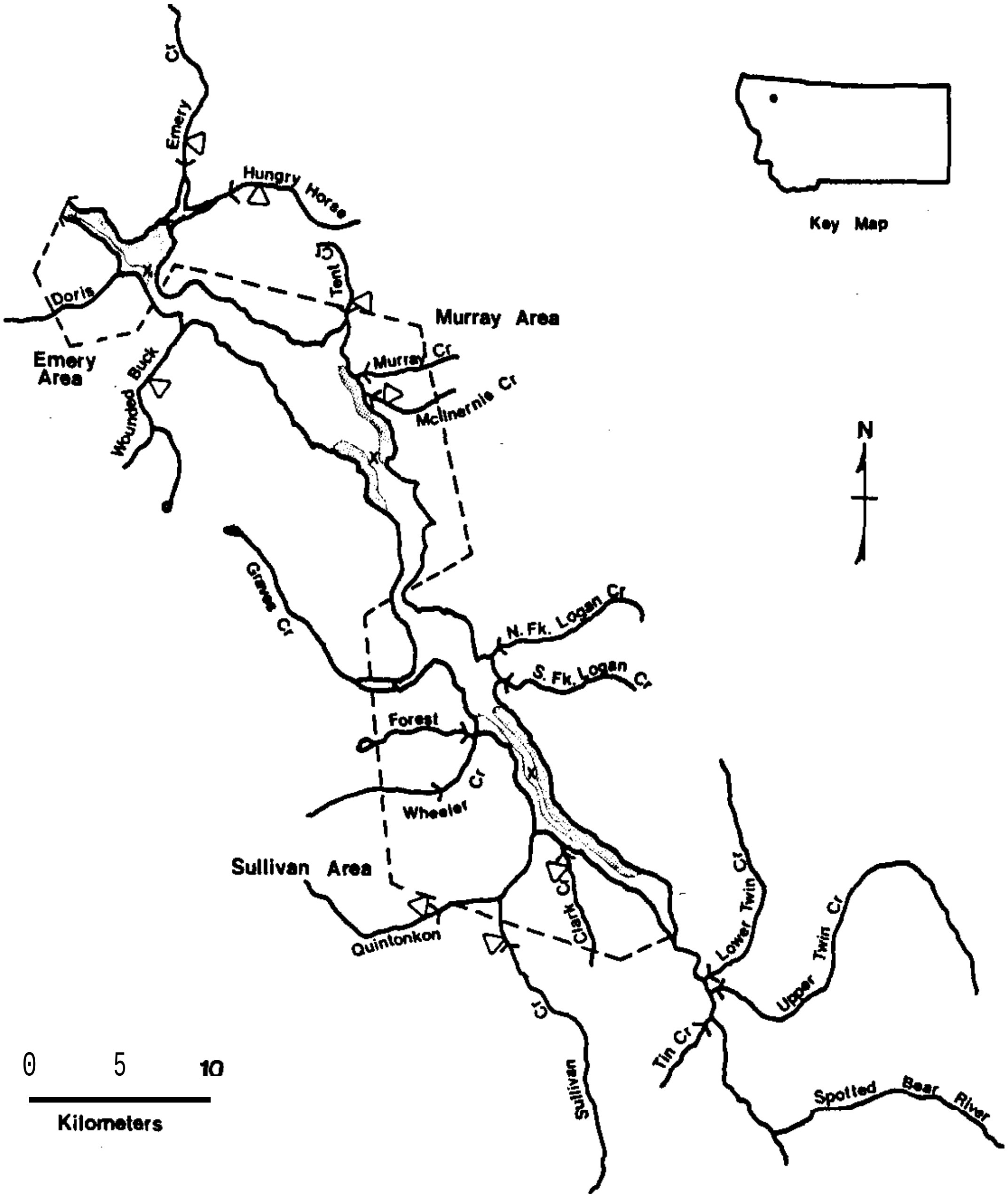


Figure 1. Map of Hungry Horse Reservoir showing study areas, netting areas (▩), water quality, vertical net and zooplankton stations (x), fish trap location (>), and electrofishinq sections (△).

Table 1. Morphometric data for Hungry Horse Reservoir.

Drainage area (sq. miles)	1.700 (4,403 sq. km)
Average annual discharge (acre-ft.)	2,386,918 (2.95 cubic km)[a]
Surface area (acres)	23.800 (9,632 ha)
Pool length (miles)	35 (56 km)
Shoreline length (miles)	133 (213 km)
Shoreline development	5.95
Mean depth (ft.)	146 (44.5 m)
Storage capacity (acre-ft.)	3.468.000 (4.24 cubic km)
Useable storage (acre-ft.)	2.982.000 (3.68 cubic km)
Storage ratio	1.45
Elevation at full pool (ft.)	3.560 msl (1,085.8 m)
Elevation at minimum pool (ft.)	3,316 msl (1,011.4 m)

[a] Based on unregulated flow from 1929-51.

when drawdown averaged 64 ft; 2) 1965-1975 when drawdown averaged 92 ft. and when drawdown for advance power began: and 3) 1976-1986 when drawdown averaged 66 ft. Maximum drawdown has ranged from 31 ft. in 1963 to 128 ft. in 1972, with a mean of 76 ft. (Figure 2). Maximum drawdown has been below the proposed 85-ft. level in eight of 30 years of record. Water requirements for fish mitigation efforts and changing power loads may modify reservoir operation in the future.

The operation of HHR is controlled by a combination of interacting factors including: flood control, generation of hydro-electric power, recreational use of the reservoir, resident fish flows for the Flathead River and water budget flows. The reservoir is drafted in the fall to provide advance power for direct service industries. The major evacuation of water occurs from December through March for flood control and power production. The reservoir is usually filled by the end of July and remains at full pool until after Labor Day to provide summer recreation. Operation is also regulated to provide flows for kokanee spawning and incubation of eggs in the Flathead River downstream from the mouth of the South Fork. From October 15 to December 15, flows in the Flathead River near Columbia Falls are maintained between 3,500-4,500 cfs. A minimum flow of 3,500 cfs is maintained the remainder of the year for incubation of kokanee eggs and for spawning and rearing of other fish species, and aquatic invertebrate production.

FISH SPECIES

Prior to construction of Hungry Horse Dam in 1952, the South Fork Flathead River drainage was considered the major spawning area for adfluvial fish stocks from Flathead Lake. Substantial numbers of bull trout and westslope cutthroat trout spawned in the South Fork drainage along with smaller numbers of mountain whitefish and kokanee salmon (*Oncorhynchus nerka*). Native fish species in the South Fork drainage prior to dam construction included westslope cutthroat, bull trout (*Salvelinus confluentus*), mountain whitefish (*Prosopium williamsoni*), northern squawfish (*Ptychocheilus* oregonensis), largescale sucker (*Catostomus macrocheilus*). longnose sucker (*Catostomus catostomus*). pygmy whitefish (*Prosopium caulteri*) and sculpins (*Cottus sp.*).

The fish population in HHR is unique because native species comprise almost the entire fish community. They are considered abundant except for pygmy whitefish which is rated as rare (Table 2). Pygmy whitefish may be more abundant than net data indicates, because they are not vulnerable to being caught in shoreline net sets.

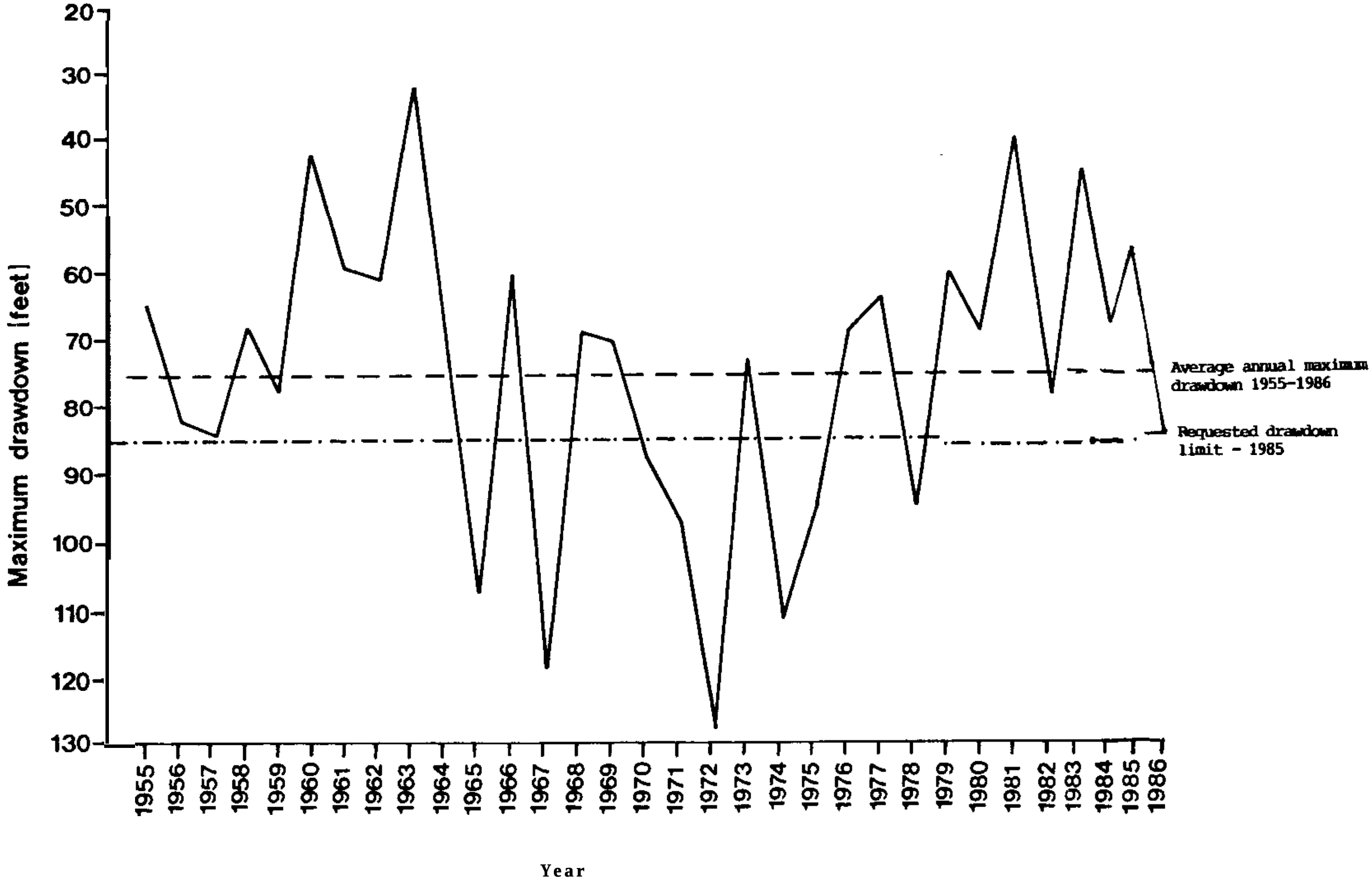


Figure 2. Annual maximum drawdown of Hungry Horse Reservoir for the years 1955-1986. Includes drafting for flood control as well as power production. Reservoir did not fill during 1973 and 1977.

Table 2. The relative abundance of fish species in Hungry Horse Reservoir as determined by gill net catches and creel surveys from 1958 to 1986. Abbreviations are given in parentheses.

Species	Scientific name	Relative abundance[a]
	Native Species	
Westslope cutthroat trout (WCT)	Salmo clarki lewisi	A
Bull trout (DV)	Salvelinus confluentus	A
Mountain whitefish (MWF)	Prosopium williamsoni	A
Pygmy whitefish (PWF)	Prosopium coulteri	R[b]
Northern squawfish (NSQ)	Ptychocheilus oregonensis	A
Largescale sucker (CSU)	Catostomus machrocheilus	A
Longnose sucker (LnSU)	Catostomus catostomus	A
Sculpin species	cottus sp.	R
	Exotic Species	
Rainbow trout (RB)	Salmo gairdneri	R
Yellowstone cutthroat trout (YCT)	Salmo lewisi bouvieri	R
Arctic grayling (GR)	Thymallus arcticus	R

a/ Relative abundance: A = abundant, C - common, R = rare.

b/ Pygmy whitefish may be more abundant than net catches indicated because they inhabit deep offshore waters and are not vulnerable to shoreline net sets.

METHODS

General descriptions of methods used to collect and analyze data are presented in this report. Detailed methods for the Hungry Horse Reservoir study were given in the 1985 annual report (May and Zubik 1985).

SEASONS

For the purposes of sampling, the year was stratified into four seasons based on reservoir operation and surface water temperatures.

1) Winter (mid November through April) - when the reservoir is evacuated for flood control and power production, surface water temperatures are below 8.0°C and the reservoir is isothermal;

2) Spring (May and June) - when the reservoir is refilled and surface water temperatures are between 8-15°C and increasing:

3) Summer (July through mid September) - when the reservoir is near full pool, surface water temperatures are between 16-22°C and the reservoir is thermally stratified;

4) Fall (mid September through mid November) - when drafting of the reservoir begins for power production and surface water temperatures are between 8-15°C and declining.

RESERVOIR HABITAT

HHR was segregated into the Emery, Murray and Sullivan areas based on reservoir morphometry and the effects of drawdown (Figure 1). Within each of these study areas a permanent station was selected for water quality and zooplankton data collection. Vertical fish distribution and benthic macroinvertebrate samples were collected near these permanent sites. In addition to permanent sampling sites, transects were established across the reservoir at visual landmarks where randomly selected zooplankton, surface insect and purse seine samples were collected.

The reservoir habitat was divided into nearshore (littoral) And offshore (limnetic) zones. The littoral zone included the area less than the depth of the euphotic zone (approximately 20 meters) and less than 100 meters from the shoreline.

Contour maps of the reservoir were digitized by 10-foot contour intervals for each geographic area.

Monthly lake-filling and hydraulic-residence times were calculated using the formulas adapted from Woods (1982). Lake-filling time represents the time required to replace the volume of a reservoir at a given inflow, whereas hydraulic-residence time represents the time required to replace the volume of a reservoir at a given outflow.

PHYSICAL LIMNOLOGY

Water temperature (^oC), dissolved oxygen ($mg \cdot l^{-1}$), pH and specific conductivity (umhos'cm^{-1}) were measured at the permanent sites. Measurements were taken biweekly from May through October with a Martek Mark V digital water quality analyzer, and monthly from November through March when access to the reservoir was available, The vertical profile data were collected immediately below the water surface, 1. 2, 3, 5. 7, 9. 11, 13, 15, 18, 21 m and every three meters down to 60 m, then every five meters from 60 m to 100 m or the bottom. Calibration of the meter was done in the field from May through October and in the laboratory immediately prior to field measurements from November through March when ambient air temperatures were below freezing.

Light transmittance was measured in foot candles using a Protomatic photometer. Incident light was measured immediately above the water's surface. Light penetration was measured at depths of 90, 60, 30, 15, 5, 1 and 0.1 percent of the incident light. Greeson et al. (1977) defined the lower boundary of the euphotic zone as the 1.0 percent of incident light depth.

Water temperature, dissolved oxygen, pH, conductivity and light transmittance profile data were entered into computer data files and transferred to the U.S. Geological Survey WATSTORE system and the Environmental Protection Agency STORET system. Isopleth diagrams were generated using the USGS program STAMPEDE.

FISH FOOD AVAILABILIYY

Zooplankton

Zooplankton densities were determined using Wisconsin plankton nets. Three 30-m vertical tows were made biweekly in the Emery, Murray and Sullivan areas. The Emery area was sampled through the ice in February. In each area samples were collected at the permanent limnolgical buoy and two randomly selected transects.

Vertical distribution of zooplankton was assessed using a 30-liter plexiglass Schindler plankton trap (Schindler 1969). A plankton trap sample series consisted of duplicate samples collected from the surface and every three meters down to 15 m.

then every five meters down to 30 m. Plankton trap sample series were collected monthly in the three areas at the permanent limnological buoys.

Zooplankton was collected in the South Fork of the Flathead River with drift nets approximately 2.5 kilometers downstream from Hungry Horse Dam. The net consisted of a one meter wide by 0.5 meter deep angle iron frame attached to 103 micron nitex mesh material, which tapered back to a collar. A removable plexiglass bucket with panels of 103 micron mesh netting was attached to this collar. The net was anchored by iron stakes driven into the substrate through rings attached to the side of the frame.

Duplicate samples were taken biweekly. The water velocity through each net was recorded along with water depth and temperature. Instantaneous river flows were taken from a USGS gauging station located immediately upstream.

All zooplankton samples were preserved in the field with a four percent formalin and sucrose solution. Five 1.0 ml subsamples were counted and identified to genus in a Sedgewick-Rafter counting cell using a binocular compound microscope at 40x total magnification.

Surface Insects

Surface insects were collected with a net attached to a one-meter wide frame with a removable plexiglass bucket. Three randomly selected sites were sampled in each area biweekly from May through November. One tow was made within 100 m of the shore and one further than 100 m from shore. Each collection sampled approximately 600 m^2 of water surface. All insects were identified to order and weighed in the laboratory.

Benthos

Benthos collections were made monthly from May through November using a Peterson dredge which sampled 0.092 m^2 of reservoir bottom. Three replicate samples were taken from each of the following depth intervals for a total of nine samples: 1) full pool elevation (3,560 ft.) to recommended drawdown elevation of 3,475 feet; 2) recommended drawdown to maximum drawdown on record at elevation 3.432 feet; and 3) below elevation 3,432 feet.

All macroinvertebrates were sorted from the samples, identified to order or class and weighed.

EMERGENCE TRAPS

Emerging dipteran were sampled with a one square meter emergence trap constructed of l/2-inch thick acrylic (Figure 3). styrofoam strips were attached to the bottom of the trap for floatation and the trap was anchored to a five gallon bucket filled with concrete. Holes, approximately 150 mm in diameter, were cut in each side of the trap and the top of the catch basin to allow for evaporation and reduce the condensation problem on the inside surfaces of the trap. The holes were covered with nitex cloth having 102 micron openings. Anti-freeze was used as the preservative in the catch basin.

Five traps were placed in nearshore areas at water depths of between four to ten meters below full pool. These areas have been dewatered annually during the study. The other five traps were placed in offshore areas at water depths greater than 30 meters below full pool. The traps were checked weekly, insects removed and placed in vials with labels. All macroinvertebrates were picked from the sample and identified to order. Number and total wet weights were determined and densities expressed as $N \cdot m^{-2}$ and $g \cdot m^{-2}$ caught per week.

FOOD HABITS

Fish for food habits analysis were collected with gill nets from each area of the reservoir during the seasonal gill net series. Approximately twenty westslope cutthroat, bull trout, and northern squawfish were collected from each area seasonally, along with six mountain whitefish.

Zooplankton were identified to genus, insects to order and fish to species. The number, frequency of occurrence, and weight of each food item was calculated and combined into an index for relative importance (IRI). The IRI values range from 0 to 100, with a value of 100 indicating exclusive use of the food item.

FISH ABUNDANCE AND DISTRIBUTION

Horizontal Gill Nets

Standard experimental floating and sinking gill nets were used to sample fish in near-shore areas seasonally in each area. A floating net set consisted of two floating nets tied end to end (double floater) and fished perpendicular from shore. A sinking net consisted of a single net fished perpendicular from shore. In each area, seven double floaters and five sinkers were set in the evening and retrieved the next morning for two consecutive days (Figure 1).

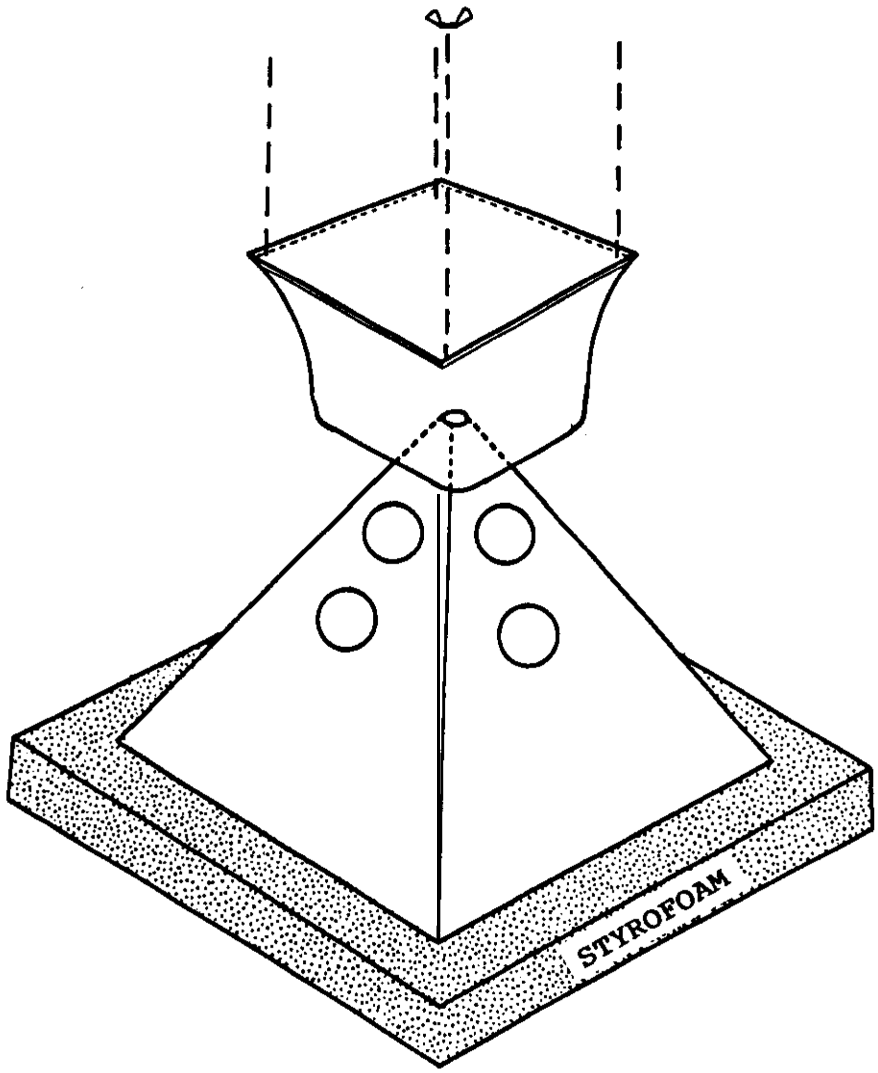


Figure 3. **Emergence trap.**

All fish were removed from the nets, identified to species, and length (mm) and weight (g) recorded for each fish. Sex and state of sexual maturity (ripe. spent, mature, immature) were recorded for game fish. Scale samples were taken from all game fish and representative numbers from nongame fish. Otoliths were collected from westslope cutthroat trout beginning in December, 1984.

Fish Trapping

A downstream fish trap and leads covered with 6.4 mm square mesh hardware cloth was fished in Emery Creek (Figure 1). An upstream and downstream trap was operated in Hungry Horse Creek. Traps were checked twice daily and all fish were removed, anesthesized, measured and weighed. Species, length, weight, tag number and tag type were recorded for each fish. All fish longer than 250 mm were tagged with numbered floy anchor tags and fish 100 to 250 mm in length were tagged with numbered flow dangler tags. Scales were taken for age determination from representative samples of fish from each stream.

Redd Counts

In order to better assess the adfluvial westslope cutthroat runs in the Hungry Horse Creek Drainage, stream trapping information was supplemented with total spawning site inventories following completion of the 1986 run. Westslope cutthroat spawning sites (redds) are extremely difficult to identify and count, since spawning generally occurs during spring peak flows. These high flows and associated bedload movement combine with large volumes of suspended sediment to limit observation of redds. The low spring peak flows in 1986 provided a rare opportunity to complete these surveys.

Progression of the spawning run was closely monitored at the trap site to insure proper timing for inventories. Final counts were conducted from June 23 through June 25. Redds were identified, classified and pace located based on criteria presented by Shepard et al.(1982) by trained observers walking along the stream channel.

Areas surveyed included 4.8 km of Hungry Horse Creek from the trap site upstream to the access at stream kilometer 6.2, the lower 1.6 km of Margaret Creek (junction with Hungry Horse Creek up to the Highline Loop Road crossing) and the lower 2.7 km of Tiger Creek (junction with Hungry Horse Creek up to the Highline Loop Road crossing). The lower 0.5 km of Lost Mare Creek was also surveyed.

Physical measurements of parameters believed to be important in distinguishing adfluvial redds from those constructed by other cutthroat stocks were also collected. Redd length was measured from the upstream edge of the depression to the downstream end of the tailspill. Redd width was documented at the widest point of the depression. These measurements were compared to identical measurements taken on fluvial and resident westslope cutthroat redds in Middle Fork tributaries by Shepard et al. (ibid).

Substrate Composition

In addition to spawning site inventories, low spring flows during 1986 allowed fields crews to locate areas where redds were concentrated for substrate sampling. Successful incubation of salmonid,embryos in these areas requires gravels that are relatively free of silt and sand. Laboratory studies and field experiments have repeatedly shown that embryo survival is inversely related to the amount of fine sediment in the spawning substrate. Spawning gravel quality in the Hungry Horse Creek Drainage was assessed using the technique developed by Tappel (1981) and Tappel and Bjornn (1983).

Substrate samples were collected from several cutthroat spawning areas in the drainage. A standard hollow core sample (McNeil and Ahnell 1964) was used following methods described by Shepard and Graham (1982). Sampling areas were located in high-use spawning areas documented during the 1986 cutthroat spawning site inventories in Hungry Horse, Margaret and Tiger creeks. Twelve core samples were collected from each sampling area.

Two areas were selected for sampling in Hungry Horse Creek. The downstream area (Lower Hungry Horse) was approximately 200 m above the mouth of Margaret Creek at stream kilometer 2.1. The upstream area (Upper Hungry Horse) was above the mouth of Lost Mare Creek at stream kilometer 4.3. Margaret Creek was sampled below the access at stream kilometer 1.6 and Tiger Creek was sampled just above the east side road crossing at stream kilometer 0.3.

Natural adfluvial cutthroat redds were present within each sampling area and were actually sampled to compare sites "worked" by fish with undisturbed gravel. Samples were placed in labeled bags and transported to the Flathead National Forest Soils Lab in Kalispell for drying and sieve analysis. After drying, each core sample was passed through the following sieve series:

76.1 mm	(3.00 inches)
50.8 mm	(2.00 inches)
25.4 mm	(1.00 inch)
16.0 mm	(0.62 inch)
12.7 mm	(0.50 inch)
9.52 mm	(0.38 inch)

6.35 mm	(0.25 inch)
2.00 mm	(0.08 inch)
0.85 mm	(0.03 inch)
0.063 mm	(0.002 inch)
pan	(<0.002 inch)

All material retained on each sieve was weighed and the percent dry weight in each size class was calculated. Material remaining in suspension within the corer was sampled using a 1.0 liter Imhoff settling cone, following procedures described by Shepard and Graham (1982). This amount was added to the material in the pans to obtain the total amount smaller than 0.063 mm.

Gravel composition was expressed as the cumulative percentage smaller than each size class and plotted against sieve size on log-probability paper, to determine if the plot of material smaller than 25.4 mm resembled a straight line. Data was then transformed and regressed, by taking the natural logarithm of sieve size as the independent variable and the inverse probability transform value of cumulative percentage as the dependent variable. Equations were obtained for each sample. The coefficient of determination (r^2) for these regression equations should be close to 1.0 if the gravel particles were log normally distributed. An r^2 value close to 1.0 showed that the slope and intercept of the regression line could be used to describe the entire range of particles in the spawning gravel (Tappel 1981, Tappel and Bjornn 1983). The two points selected for this study were the percent smaller than 6.35 mm and the percent smaller than 1.70 mm.

Cutthroat embryo survival to emergence was predicted using the laboratory developed relationship reported by Irving and Bjornn (1984). The actual predictive equation used was:

$$\text{Survival} = 106.10029 - 0.4460803\,(56.35) - 7.7660173\,(51.70) + 0.1694598\,(S1.70)^2$$

where: (S6.35) = percentage smaller than 6.35 mm;
(51.70) = percentage smaller than 1.70 mm; and
$(S1.70)^2$ - percentage smaller than 1.70 mm squared.

Results of the 12 predictions from each spawning area were averaged to obtain the mean predicted survival to emergence for each area.

Population Estimates

The two-pass procedure (Zippin 1958) was used to make estimates in streams with flows less than 10-12 cfs. For streams with higher flows, the mark-and-recapture method was utilized (Vincent 1971). The section length for the mark-recapture estimate was 300 m as compared to 150 m for the two-pass method. In general, methods outlined by Shepard and Graham (1983a) were used.

WESTSLOPE CUTTHROAT TROUT MOVEMENT

Westslope cutthroat trout adults were tagged with Ploy anchor tags and the juveniles were tagged with Floy dangler tags. Fish were captured with electrofishing gear, purse seine and gill nets in the reservoir. Fish traps and angling were used to collect cutthroat in reservoir tributaries and the South Fork of the Flathead River. Tag returns were provided by voluntary angler returns, creel census interviews and fish sampling activities in the reservoir and tributary streams.

CREEL CENSUS

A partial creel census was conducted on Hungry Horse Reservoir from May through October. Anglers were interviewed at checking stations established at the west abutment of the dam and at the junction of the east side road (FS38) and Desert Mountain Road (FS590). The east side station was used exclusively in May and June because the only low-water boat ramp was located on the east side at Abbot Bay. From July through October each checking station was used on alternate census days.

All weekend and holiday days were sampled, plus one weekday per week. A census day began at 10:OO am and continued until sunset.

Creel clerks interviewed fishermen on a party basis with emphasis on the collection of complete trip interviews. Creel data collected included: 1) area of reservoir fished, 2) number of anglers in party, 3) total hours fished, 4) type of lure or bait used. 5) angler origin, 6) whether fishing was from shore or boat, 7) was fishing trip, incomplete or complete, 8) species of fish sought, and 9) number of each species caught. In addition, total lengths in millimeters and weight in grams were taken on all game fish, scales collected from westslope cutthroat trout and tag returns recorded.

RESULTS AND DISCUSSION

RESERVOIR HABITAT

Operation of the reservoir impacts the habitat of fish food organisms and fish through the changes in surface area, water volume, amount of littoral area and thermal stability. The latter is influenced by hydraulic residence times (Mayhew 1977 and Woods 1982). Hydraulic-residence times of less than one year were associated with weak thermal structure and reduced zooplankton populations. The large outflow volumes resulted in cooler water-temperatures and a corresponding linear decrease in zooplankton populations.

Annual hydraulic-residence times in HHR varied considerably from year to year (Table 3) but were generally above 1.0. The monthly residence times, however, were below 1.0 during 19 months from 1983-86. These low residence times were generally associated with the months of reservoir drawdown. The variance in retention times was a result of differences in inflow volumes among the year coupled with reservoir operation (Figure 4). Low water years such as 1986 generally have fewer months with a retention time of less than 1.0 than years with above average inflows.

Maximum annual drawdown during the study has ranged from 45 feet in 1983 to 85 feet in 1985. The period that the reservoir has been at full pool ranged from one week in 1985 to nine weeks in 1983 (Figure 4). The stream flows in1985 were below average in the Columbia Basin, resulting in storage reservoirs being drafted to meet power loads.

PHYSICAL LIMNOLOGY

Surface water temperatures ranged from 0.0° to 20.6% during 1986 (Figures 5, 6 and 7). The entire reservoir was frozen by January 1 and remained ice-covered until approximately April 20. Thermal stratification was present by the end of May and continued through September. The reservoir was isothermal from January through April and from mid November until the end of December. Dissolved oxygen levels were above the optimal level of 7 mg/liter (Hickman and Raleigh 1982) required by cutthroat trout and should not have had limited fish distribution (Appendix Al, A2 and A3). The pH (Appendix A4, A5 and A6) and conductivity values (Appendix A7. A8 and A9) were also within normal ranges recommended for the development of healthy aquatic communities (Thurston et al. 1972).

Table 3. Monthly lake-filling and hydraulic-residence times for low (1973). median (1980) and high (1974) water years in Hungry Horse Reservoir and for 1983-86.

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Annual mean	Maximum drawdown (ft)	Cumulative discharge (AF)
	Month														
	Lake-Filling Time (years)														
1973	3.02	5.75	2.97	1.26	0.33	0.47	2.05	5.29	7.28	5.24	1.65	2.13	3.12	63	1.871.000
1974	1.12	2.37	1.62	0.38	0.22	0.16	0.64	3.03	5.31	6.59	4.20	4.53	2.51	111	3.574.000
1980	5.54	5.47	3.99	0.50	0.30	0.59	1.86	4.47	3.79	5.43	3.08	1.40	3.04	69	2.351,000
1983	3.87	4.88	2.41	1.05	0.35	0.47	0.97	3.67	5.40	4.27	2.57	4.55	2.87	45	2.872.300
1984	1.98	3.50	2.31	0.73	0.37	0.34	1.34	4.60	4.61	3.89	3.58	4.38	2.64	68	2.202.900
1985	5.35	4.67	3.51	0.51	0.22	0.48	2.62	3.86	1.19	1.13	1.11	3.23	2.32	85	2.928.110
1986	3.24	1.89	0.75	0.65	0.36	0.56	2.27	5.76	4.26	3.52	2.53	3.76	2.16	57	2.358.190
	Hydraulic Residence-Time (years)														
1973	0.62	0.57	1.94	1.53	4.14	26.21	1.14	0.87	7.23	0.89	1.54	4.18	4.24		
1974	0.74	0.54	0.36	0.21	0.82	1.47	0.87	2.15	1.15	0.70	0.47	0.57	0.84		
1980	3.92	6.31	11.99	16.81	14.37	1.03	2.11	2.19	1.18	1.89	1.25	0.72	5.31		
1983	1.15	0.88	1.03	0.54	0.87	4.92	1.08	2.58	0.80	0.79	3.73	0.71	1.59		
1984	1.02	0.59	0.77	1.92	1.24	3.50	8.99	1.38	1.03	1.27	2.22	0.80	2.06		
1985	0.54	0.53	0.62	3.66	13.00	1.88	0.96	0.58	0.62	0.97	6.41	0.66	2.54		
1986	0.65	1.65	5.46	1.80	1.37	0.91	2.65	1.62	0.69	1.64	2.24	2.17	1.90		

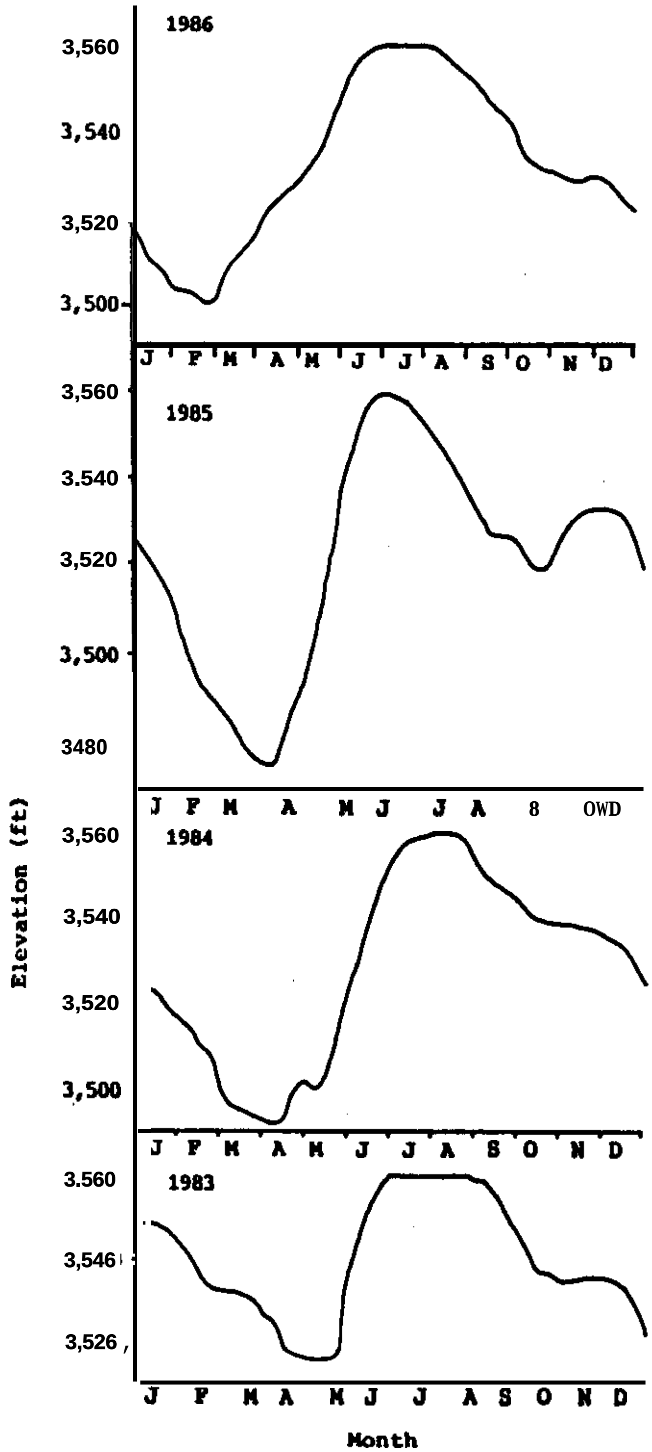


Figure 4. Reservoir elevations in Hungry Horse Reservoir from 1983-86.

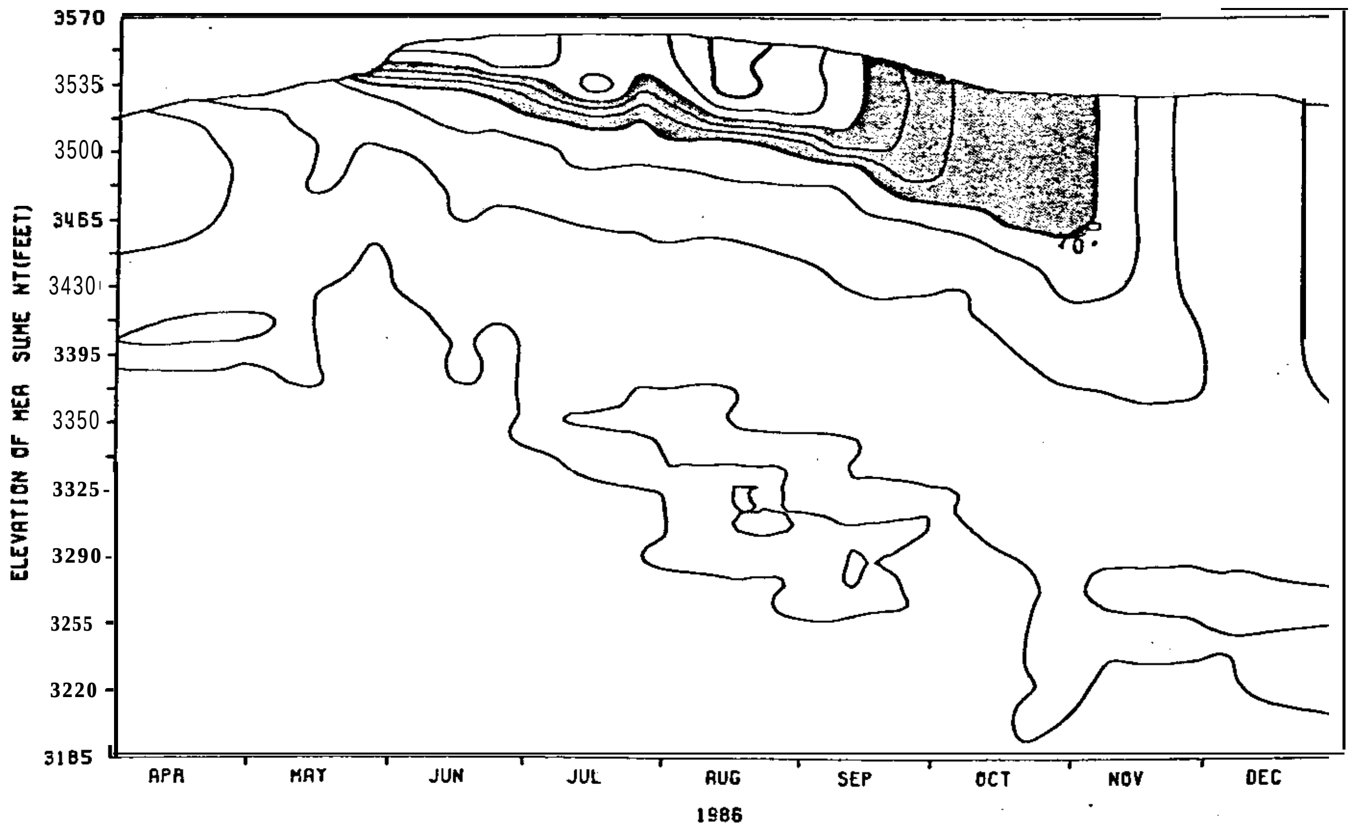


Figure 5. Isopleths of water temperature (2°C) from the Emery station, Hungry Horse Reservoir, 1986. Shaded areas are the preferred temperature strata for cutthroat trout (10°-16°C).

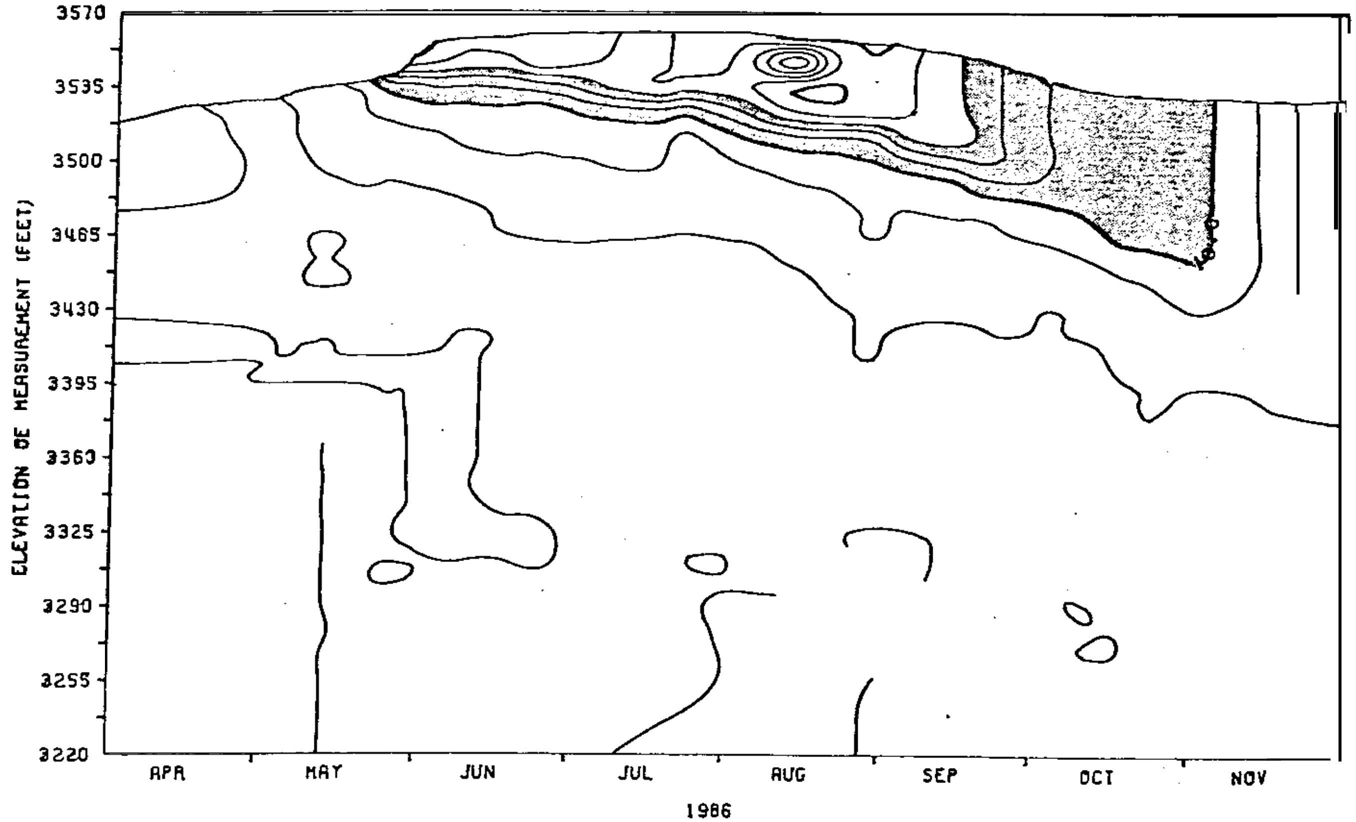


Figure 6. Isopleths of water temperature ($2^{o}C$) from the Murray station, Hungry Horse Reservoir, 1986. Shaded areas are preferred temperature strata for cutthroat trout (10^{o}-$16^{o}C$).

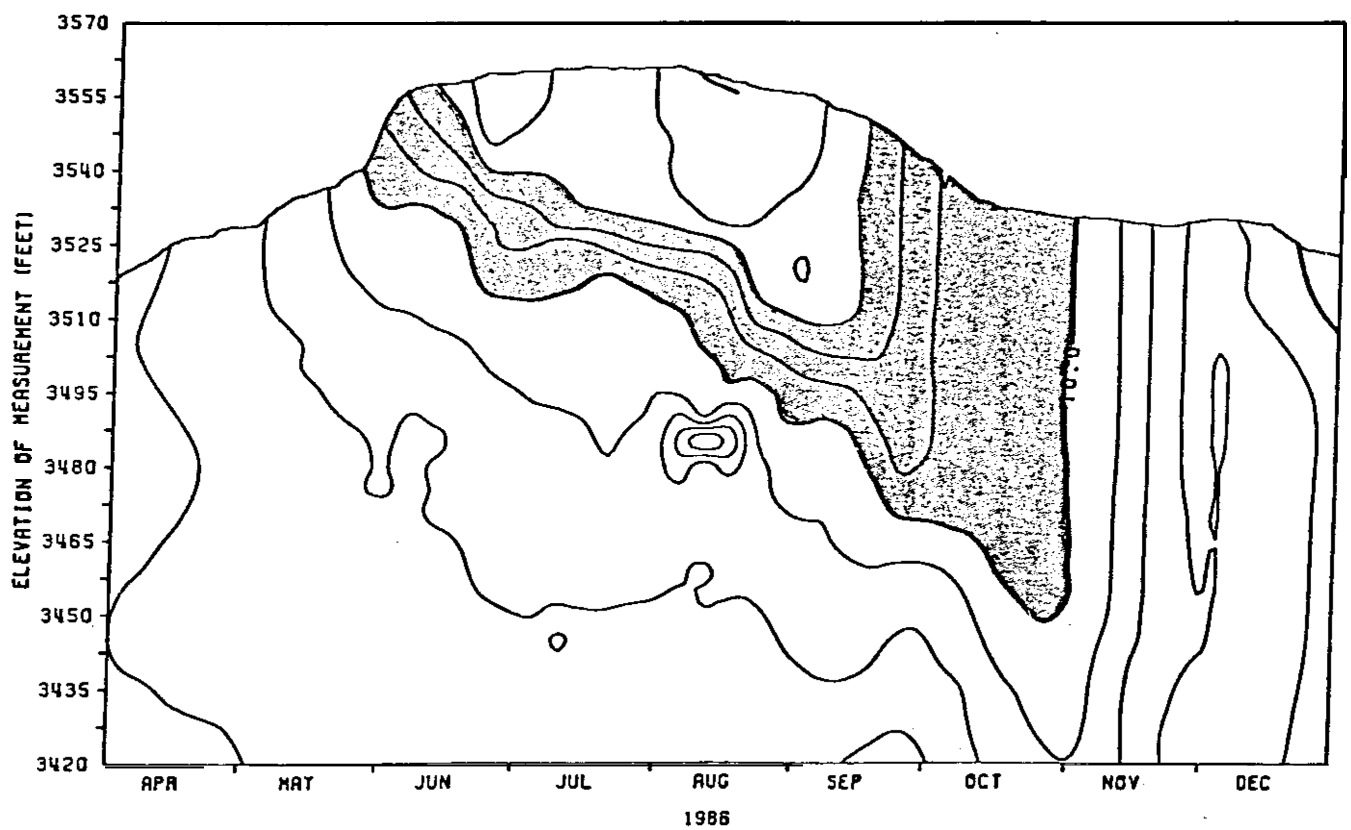


Figure 7. Isopleths of water temperature ($2^{\circ}C$) from the Sullivan station, Hungry Horse Reservoir, 1986. Shaded areas are preferred temperature strata for cutthroat trout (10°-$16^{\circ}C$).

FISH FOOD AVAILABILITY

zooplankton

The zooplankton community during 1985 and 1986 was dominated by Daphnia, Cyclops and Diaptomus (Figure 8). These genera comprised over 90 percent of the zooplankton biomass (Appendix Bl and B2). Daphnia pulex, the primary zooplankton consumed by game fish accounted for 18 and 13 percent of the biomass in1985 and 1986, respectively. Cyclops was the most numerous genera followed by Diaptomus. Daphnia and Bosmina Bosmina was important numerically, comprising 15 percent of the total number of zooplankton in 1985 and 1986, but it contributed relatively little to the total biomass (Figure 9).

The seasonal progression of abundance was different between the two years. Daphnia populations in 1985 were low in May and June. and achieved their maximum biomass in August. During 1986, Daphnia biomass was much higher in May and June than in 1985, and reached its peak in September. These differences in seasonal abundance were affected by water temperature variability between the two years. Winter temperatures were higher during spring, 1986 than during the same period in 1985. Surface water temperatures in the Murray area at the end of May, 1985 were 11.1°C as compared to 17.5°C in1986. Martin et al. (1981) found that water temperatures played an important role in influencing the seasonal development of zooplankton populations in reservoirs.

The length distributions of the more important zooplankton genera are given in Appendix B3. The frequency of Daphnia pulex above 1.5 mm was highest from August through November. The average mean length of Daphnia pulex for the year was highest in the Sullivan area as were densities in October and November when cutthroat begin feeding intensively on this species of zooplankton.

The vertical distribution of zooplankton in HHR during1985 and 1986 is given in Appendix B4 and B5. As in previous years, zooplankton densities were concentrated during the day above fifteen meters. In general, the concentrations of Daphnia pulex in the fall were in the upper 10-12 meters, making them available as food for cutthroat trout.

The downstream loss of zooplankton from HHR was evaluated by sampling with drift nets in the South Fork of the Flathead River, approximately 2.5 km downstream from the dam (Table 4). The mean density for the period from May through December, 1986 was approximately 379 zooplankton $N \cdot M^3$, which was approximately 3.6 percent of the mean standing crop of zooplankton in the Emery area during this period. The densities of zooplankton in the river varied from zero to 27 percent of the populations in the Emery area. The numbers were generally low from May through October during the period when the reservoir was thermally stratified.

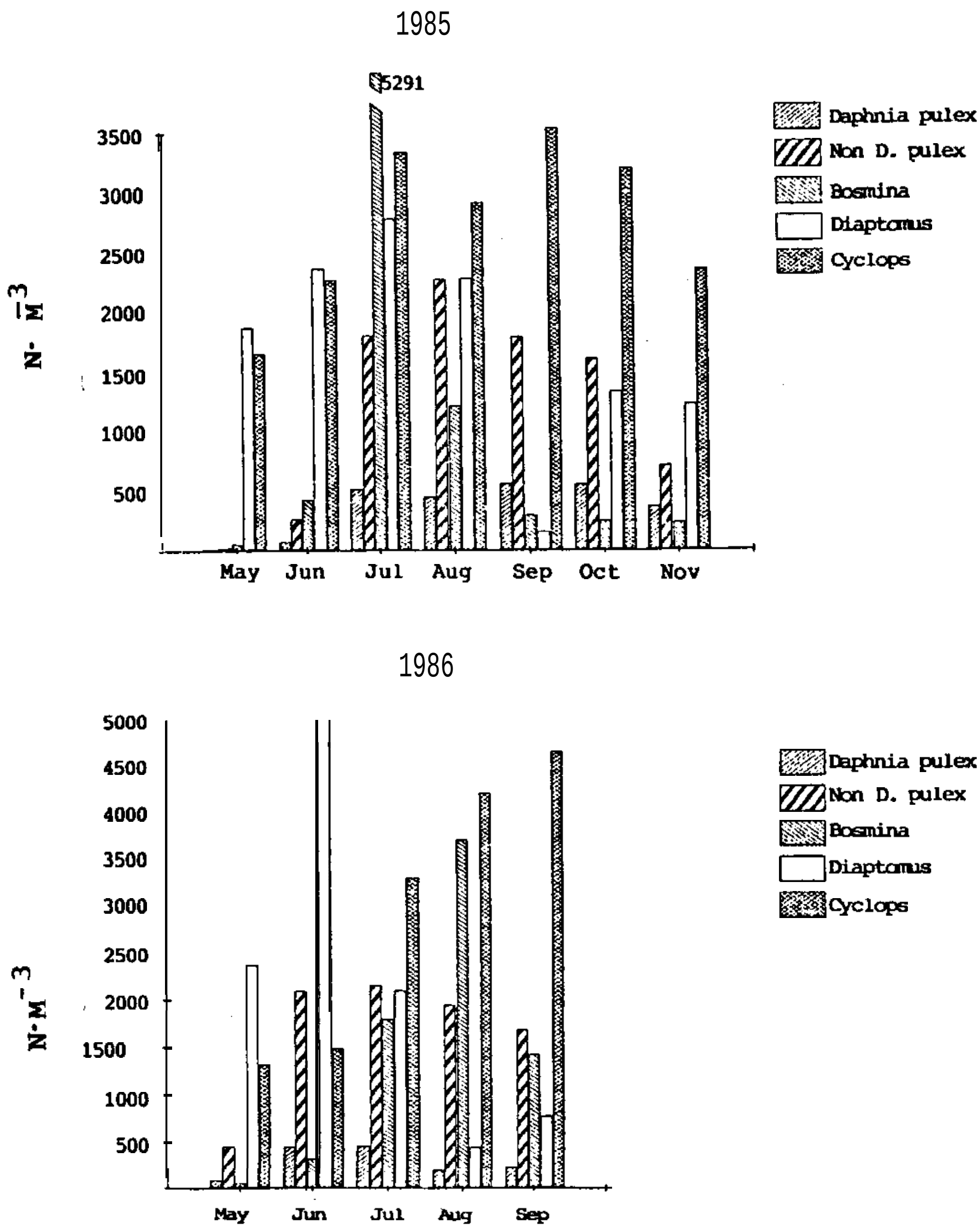
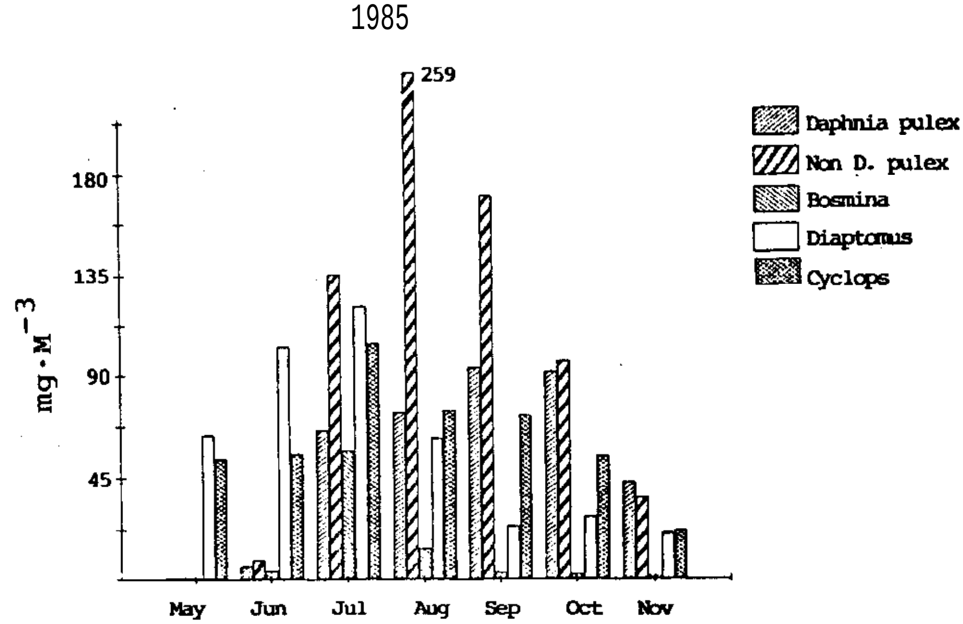


Figure 8. Seasonal abundance ($N \cdot M^{-3}$) of the five most abundant genera of zooplankton in Hungry Horse Reservoir, 1985 and 1986.



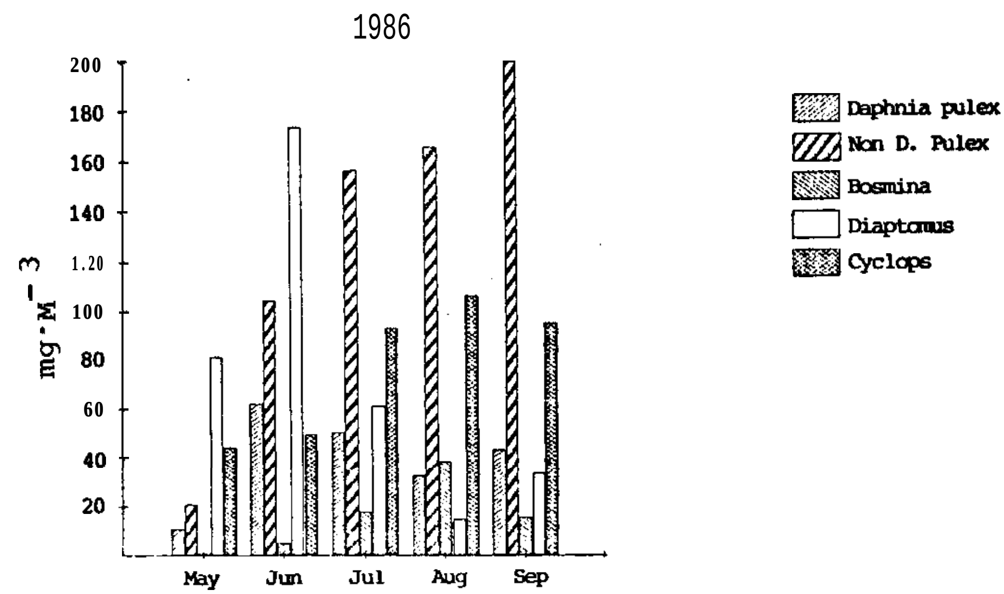


Figure 9. Seasonal biomass ($mg \cdot m^{-3}$) estimates of the five most abundant genera of zooplankton in Hungry Horse Reservoir 1985 and 1986.

Table 4. Mean zooplankton densities $(N \cdot M^{-3})$ and weights $(mg \cdot M^{-3})$ estimated from drift net samples taken in the South Fork of the Flathead River approximately 2.5 km downstream from Hungry Horse Dam. 1986 The instantaneous river flow during sampling is given in meters cubed per second $(M^{-3} \cdot S)$.

Month	Number of Samples	River Flow $(M^{-3} \cdot S)$	Reservoir Elevation	Zooplankton Daphnia	Bosmina	Cyclops	Diaptomus	Epischura	Total	Total Zooplankton Emery Area of the Reservoir
				Number						
May	2	8.2	3.542	0.0	0.0	0.0	0.0	0.0	0.0	5 281
June	4	107.5	3,557	4.0	0.4	6.3	11.4	<0.1	22.0	16.290
July	4	116.7	3,560	193.7	2.6	17.6	66.4	0.4	280.7	13.290
August	6	94.4	3.558	47.0	10.4	39.7	6.4	0.7	104.1	12.890
October	5	140.5	3,532	9.1	3.6	106.4	2.8	0.3	122.3	11.530
November	4	33.6	3,529	204.9	19.1	253.3	64.0	1.2	542.5	7.199
December	4	133.8	3,529	250.0	14.4	1,033.0	294.3	0.0	1.592.0	5,839
Year	29	98.3		101.3	7.8	207.3	62.0	0.4	378.8	10.400
				Weight						
May	2	8.2	3,542	0.00	0.00	0.00	0.00	0.00	0.00	231.7
June	4	107.5	3.557	0.20	0.00	0.18	0.33	0.00	0.70	693.8
July	4	116.7	3.560	12.10	0.03	0.38	1.85	0.10	14.45	481.3
August	6	94.4	3,558	3.77	0.08	0.83	0.18	0.10	4.97	351.5
October	5	140.5	3,532	0.60	0.02	1.10	0.06	0.10	1.86	423.8
November	4	33.6	3,529	13.15	0.28	4.63	1.73	0.05	19.82	219.7
December	4	133.8	3.529	16.02	0.20	18.92	7.95	0.00	43.10	195.0
Year	29	98.3		6.60	0.09	3.69	1.68	0.06	12.12	569.4

Downstream loss of zooplankton increased markedly during November and December when the reservoir was isothermal and zooplankton were circulated into the deeper waters.

This data will be used in the "washout effect" part of the zooplankton model component to estimate total annual loss of zooplankton downstream from HHR. Initially, it appears that losses will only be significant during the periods when the reservoir isn't thermally stratified. Even these losses were unexpected, because the penstock openings were 241 feet below full pool elevation of 3,560 feet. Deep drawdowns in the winter will probably increase downstream loss of zooplankton.

Benthos

Dipteran larvae comprised approximately 83 percent of the benthic community biomass in 1986 (Appendix B6). Dipteran biomass was lower from May to July than from August to November (Figure 10). Peak emergence occurred in the spring, reducing the standing crop which then gradually increased during the summer. The biomass in the wetted zones was 3.0 to 7.4 times greater than in the zone which was annually dewatered. These results are similar to those recorded from 1983-1985 (May and Fraley 1986) and provide additional documentation of the adverse effects of drawdown upon the benthic community.

Emerging insects were sampled from the end of May to November in the Murray area (Table 5). Peak numbers of aquatic dipteran were caught in May in the shallow traps. Emergence of dipteran was comparatively stable in June and July, increased in August and September then declined to almost zero in November. Although densities of dipteran larvae were higher in benthos samples from offshore areas, inshore emergence traps caught more dipteran adults than the offshore traps. Additional emergence trap data is needed to determine if this disparity is real or a result of sampling error.

Dipterans from the family Anthomyiidae were caught primarily in one offshore trap. These dipterans are part of a large family which generally live in bogs and shoreline areas of lakes (Merritt and Cummings 1978). It is unusual to find them emerging from the bottom of a lake or reservoir. Harold Mundie (Canada Department of Fisheries and Oceans, pers. comm.) believes the flies are terrestrial forms which were attracted to the traps where they feed on very small chironomid adults.

Surface Insects

The distribution of insects on the surface film varied considerably during the year. Aquatic dipteran comprised almost all of the aquatic insects collected. The peak of abundance for

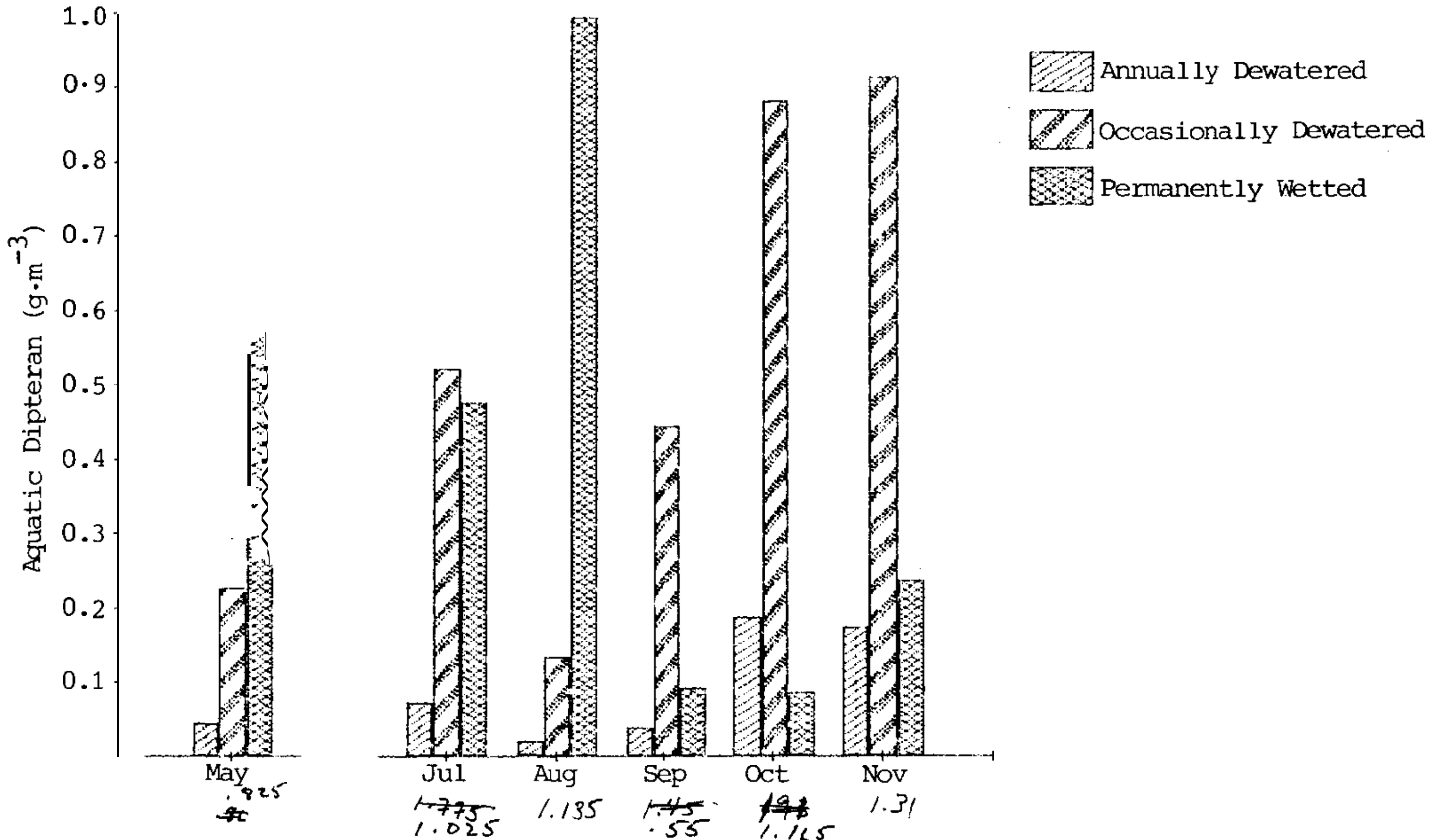


Figure 10. Estimated biomass ($g \cdot m^{-2}$) of aquatic dipteran larvae in benthos samples from Hungry Horse Reservoir areas combined, 1986.

Table 5. The number and weight (g) of aquatic macroinvertebrates (m^{-2}·week) caught in emergence traps from the Murray area of Hungry Horse Reservoir, 1986. **Standard** deviations are given in parentheses.

Month	Mean Depth (m)	Aquatic Diptera No.		Aquatic Diptera Wt.		Other Aquatic NO.		Other Aquatic Wt.		Anrhomviidse NO.		Anrhomviidse Wt.		Total Aquatics NO.		Total Aquatics Wt.	
May (Nearshore)	8.7	213.2		0.200		0.0		0.000		0.3		0.004		213.5		0.204	
Hay (Offshore)	37.0	17.4		0.013		0.0		0.000		0.0		0.000		17.4		0.013	
June	7.8	28.9		0.014		0.0		0.000		0.0		0.000		28.9		0.014	
June	43.4	22.1		0.012		0.0		0.000		0.0		0.000		22.1		0.012	
July	7.7	27.2		0.020		0.6		0.003		0.4		0.002		28.2		0.025	
July	44.9	25.5		0.025		0.0		0.000		20.9		0.039		46.4		0.084	
August	8.3	48.1		0.026		2.4		0.001		0.5		0.001		51.0		0.028	
August	45.5	25.1		0.006		0.0		0.000		12.8		0.037		37.9		0.043	
September	9.7	52.6		0.015		0.4		<O.OOl		0.2		<O.OOl		53.2		0.015	
September	48.3	31.6		0.012		0.0		0.000		3.6		0.010		35.2		0.022	
October	14.1	23.6		0.005		0.1		0.001		0.0		0.000		23.7		0.006	
October	50.0	7.3		0.003		0.0		0,000		0.2		0.001		7.5		0.004	
November	14.3	0.5		0.001		0.0		0.000		0.3		0.005		0.8		0.006	
November	50.0	0.0		0.000		0.0		0.000		0.0		0.000		0.0		0.000	
Year	9.6	40.7	(72.0,	0.022	(0.062)	0.5	(1.7)	0.001	(0.005)	0.2	(0.6)	0.001	(0.001)	41.4	(72.3)	0.024	(0.063)
Year	46.3	21.7	(26.3)	0.012	(0.023,	0.0	(0.0,	0.000	(0.000)	7.1	(38.0)	0.020	(0.102)	28.8	(47.7)	0.032	(0.104)

aquatic insects occurred in May and June ranging from 0.29 to 0.74 $g \cdot ha^{-1}$ then declined markedly in July and remained low the rest of the year (Figure 11). There was little difference between the biomass of aquatics in nearshore and offshore samples except in May when the offshore samples were about 8 times greater.

The majority of the terrestrials consisted of, in decreasing order, Coleoptera Hymenoptera, Homoptera and Hemiptera (Appendix B7). Biomass was relatively high from May through August averaging **0.83** $g \cdot ha^{-1}$, decreased dramatically in September, increased in October and then declined markedly in November and December. The seasonal progression of the biomass of surface insects was similar to previous years, except that dipterans did not have a second peak of emergence in the fall and terrestrial insects were very abundant in September.

FOOD HABITS

Westslope cutthroat Trout

The food habits of westslope cutthroat trout in 1985 were similar to those recorded in 1983 and 1984 (Appendix Cl-C12). The index of relative importance (IRI) range from 0 to 100 with a value of 100 indicating exclusive use of the food item. There was little difference between food ingested by adults and juveniles (Figure 12). Terrestrial insects were the most important food item consumed by cutthroat on an annual basis, followed by aquatic insects and zooplankton. The diet varied considerably among the seasons with aquatic dipteran and terrestrial insects the dominate food eaten in May. During the summer. terrestrial insects comprised up to 74 percent of the index of relative important value (IRI) with aquatic dipteran consisting most of the remainder of the summer diet. In November, when terrestrial insects were no longer available on the surface film, cutthroat ate primarily Daphnia with aquatic dipteran second in importance. Daphnia pulex comprised over 99 percent of the Daphnia consumed with cutthroat selecting for larger Daphnia pulex over 1.5 mm in length (May and Zubik 1985).

Bull Trout

Fish was the principal component of the bull trout diet in 1985 comprising approximately 99 percent of the biomass ingested (Figure 13 and Appendix C13-C24). Adult bull trout fed primarily upon suckers, mountain whitefish and northern squawfish, whereas juveniles ingested principally unidentified fish, westslope cutthroat trout, suckers and northern squawfish The importance of cutthroat in the diet of juveniles was biased, because the high rating is based on the consumption of one large fish in May (Appendix C13). In addition 26 percent of the stomachs were empty which reduced the sample size used to determine food habits.

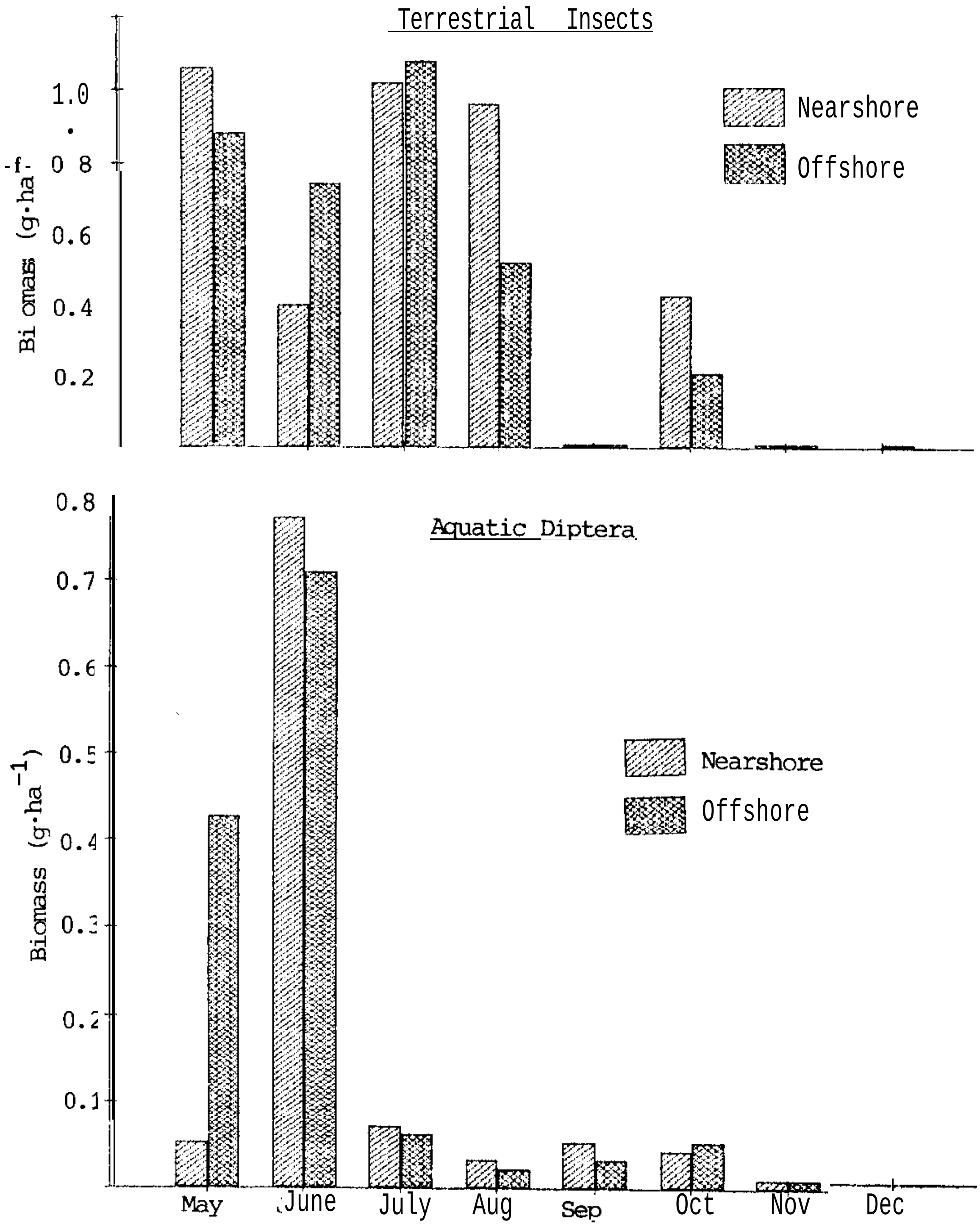


Figure 11. The mean monthly biomass of terrestrial and aquatic insects ($g \cdot ha^{-1}$) collected in nearshore (<100 m) and offshore (>100 m) areas from Hungry Horse Reservoir, 1986, areas combined.

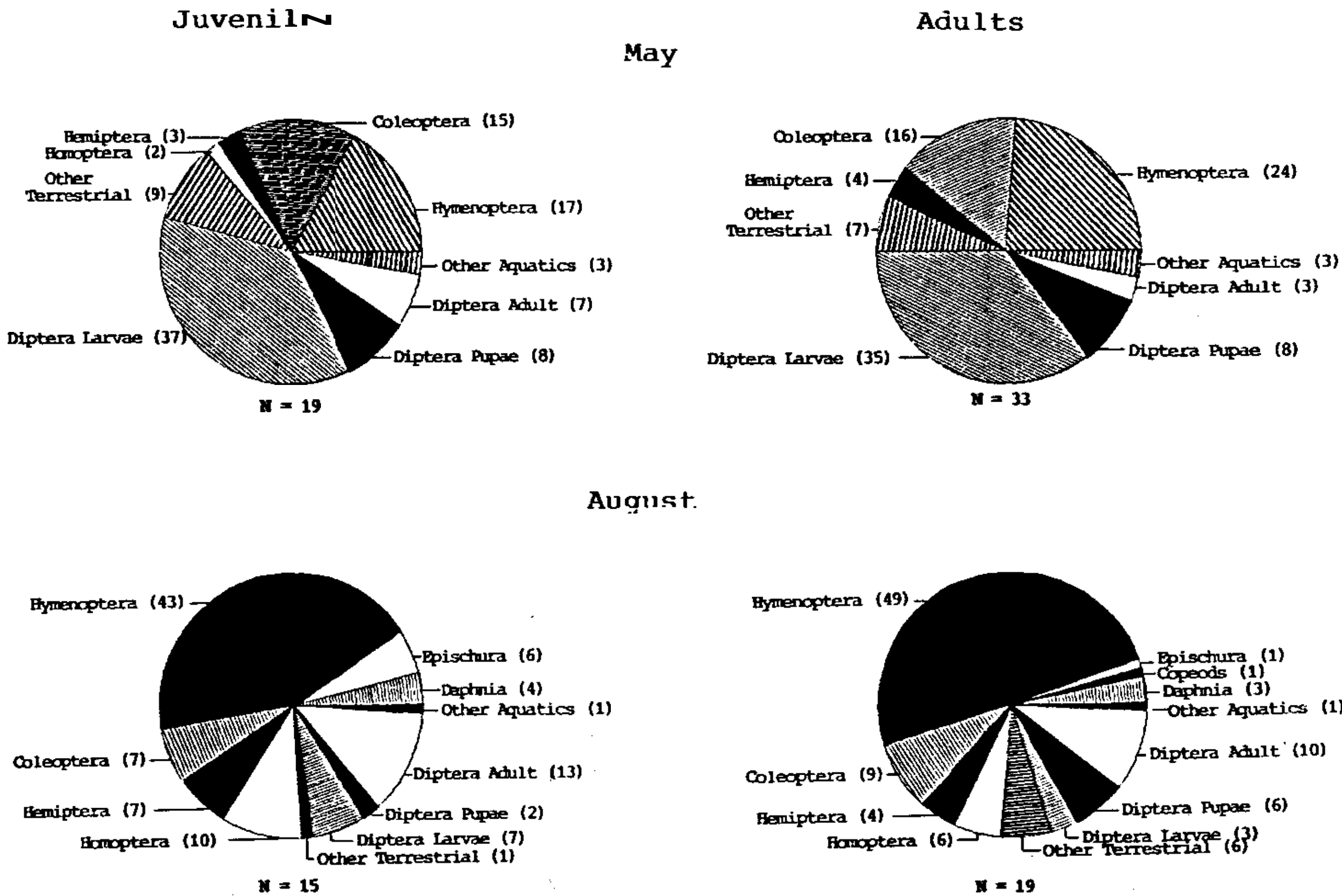


Figure 12. Percent indices of relative importance (IRI) for Westslope Cutthroat trout juveniles and adults collected in Hungry Horse Reservoir (areas combined) during 1985.

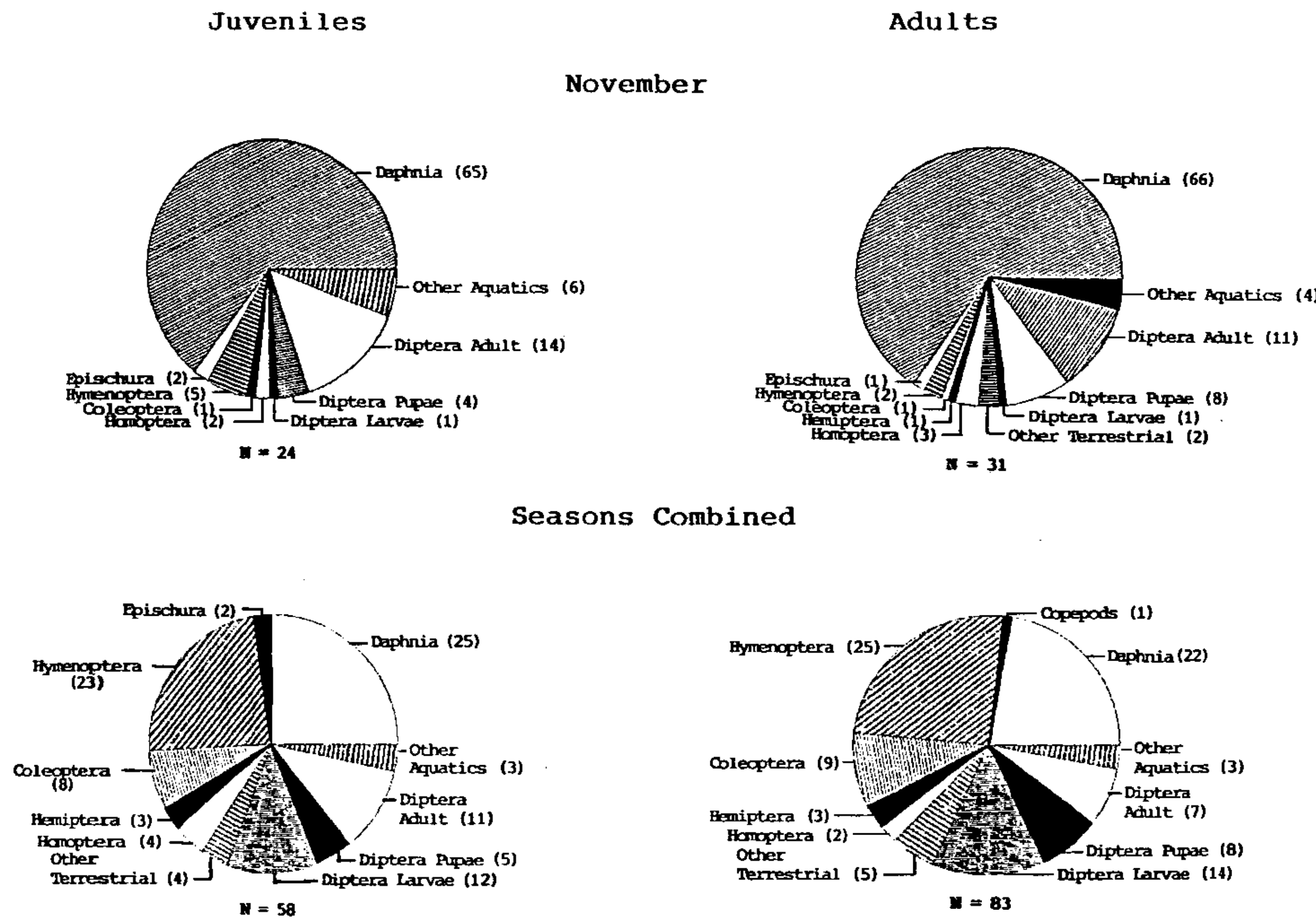


Figure 12. Continued

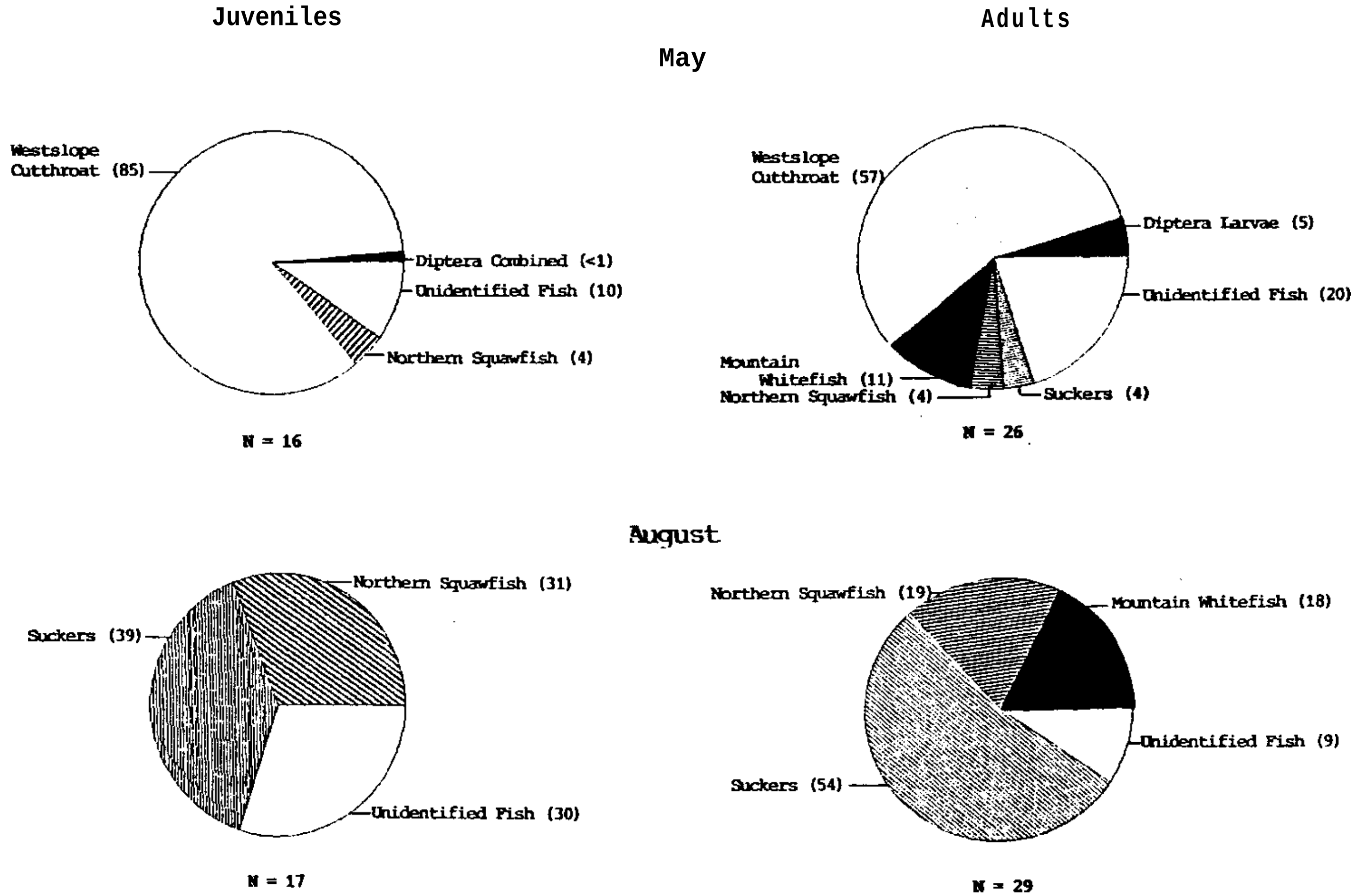


Figure 13. Percent wet weight of food items consumed by juvenile and adult bull trout from Hungry Horse Reservoir during 1985.

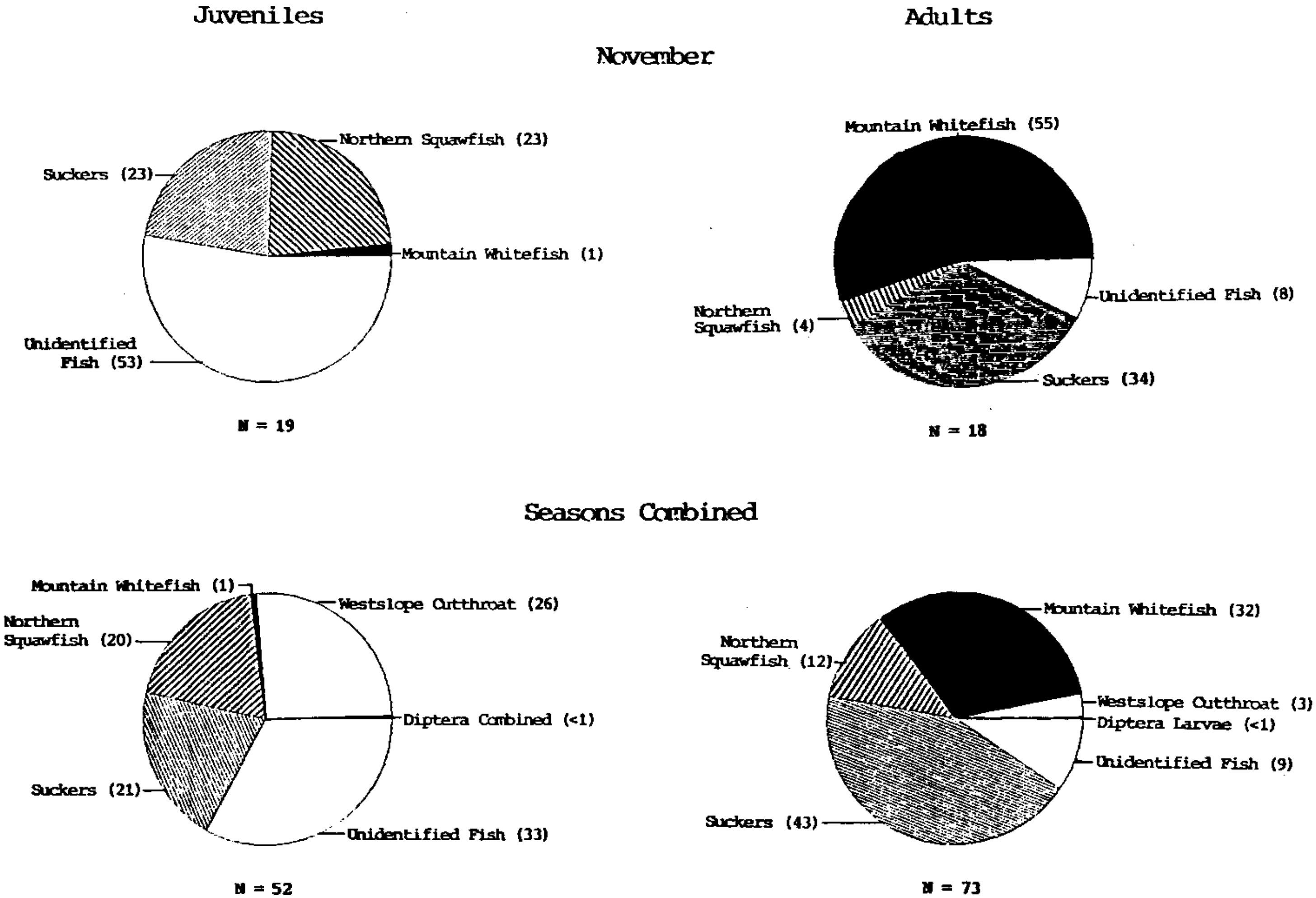


Figure 13 Continued

The diet varied seasonally with adults feeding primarily on cutthroat trout in May, suckers in August and mountain whitefish in November. Juveniles ate principally cutthroat in May, suckers in August, and suckers and squawfish in November. The food habits of bull trout in 1985 were similar to 1983 and 1984, except that cutthroat comprised an important component of the spring food (May and Fraley 1986).

Mountain Whitefish

The food habits of mountain whitefish in 1985 were similar to those recorded in 1983 and 1984, except that aquatic dipteran comprised most of the food eaten in May (Appendix C25-C36). Daphnia had an IRI value of 96 and 97 for the summer and fall collections with an annual mean of 88. Daphnia pulex comprised almost 100 percent of the Daphnia ingested. The seasonal IRI values for dipteran ranged from 10 to 83 with the annual average 18.

Northern Squawfish

Northern squawfish are opportunistic predators with a varied diet (Appendix C37-C48). Assessing their food habits is complicated because of the high rate of regurgitation of their stomach contents when the fish are caught in gill nets. Annually the most important food ingested was fish followed by Daphnia, terrestrial insects and aquatic dipteran. Only one cutthroat trout was found in the stomach contents. The seasonal diet varied considerably with fish dominating the diet in May; Daphnia, terrestrial insects and fish important in August; and Daphnia and fish the primary food items ingested in November. Overall. juveniles consumed more Daphnia but ate less fish than adults.

FISH ABUNDANCE AND DISTRIBUTION

Horizontal Gill Nets

Westslope cutthroat trout have comprised most of the catch in floating nets throughout the study followed by northern squawfish (Table 6). The catch of cutthroat was highest in the spring and fall while squawfish numbers are highest in the summer net sets. Mountain whitefish have dominated the sinking net catches followed by bull trout. northern squawfish and suckers. A substantial catch of pygmy whitefish was recorded for the first time in fall, 1986. The ripe spawning condition of the fish captured indicated that we had set several nets over their spawning beds. The catch composition of sinking and floating nets has been relatively stable through the years.

Table 6. Percent composition by species and net type for gill net catches from Hungry Horse Reservoir in 1983, 1984, 1985 and 1986.

Species	Percent of Catch							
	Floating Nets				Sinking Nets			
	1983	1904	1985	1986	1903	1984	1905	1986
Westslope cutthroat trout (WCT)	43.9	41.8	54.1	42.1	2.3.	1.4	0.8	1.4
Bull trout (DV)	3.4	5.8	8.4	7.9	9.4	14.0	16.5	18.0
Mountain whitefish (MWf)	11.5	4.2	8.4	10.3	40.4	36.7	38.3	40.1
Northern squawfish (NSQ)	39.6	45.7	26.6	37.4	22.8	22.8	23.1	16.6
Largescale suckers (CSU)	1.4	2.2	2.4	1.7	10.1	9.1	8.7	9.1
Longnose sucker (LNSU)	0.2	0.3	0.1	0.6	15.0	15.9	12.5	13.1
Pygmy whitefish (PW)	--	--	--	--	<0.l	<0.1	<0.1	1.7
Total fish caught	712	1,147	711	828	963	2.110	1,772	2,132

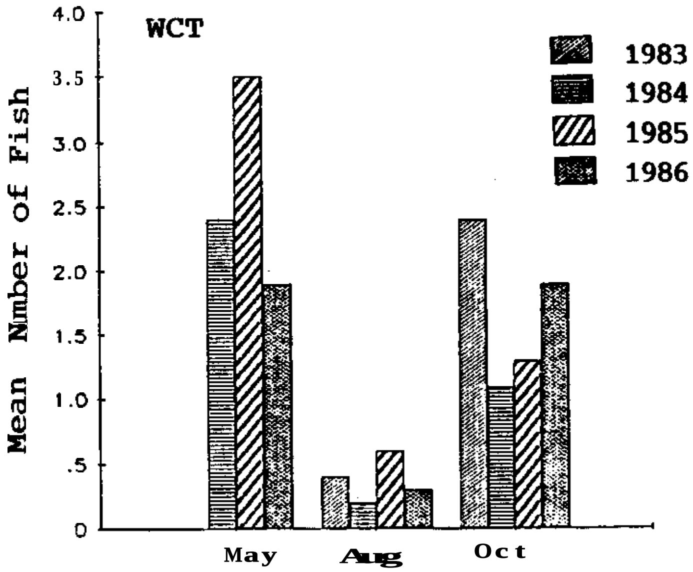
Catches of westslope cutthroat trout in floating gill nets in the spring and fall of 1986 were comparable to previous years (Figure 14). The spring catch of1.9 fish per net was lower than in 1984 and 1985, but the fall catch of 1.9 fish was higher than in the two previous years. Nets set in the Sullivan area continued to record higher catches thaninthe Emery and Murray areas (Appendix Dl). Overall, the net data suggests that the relative abundance of cutthroat in HHR has fluctuated little during the study. Cutthroat trout caught in gill nets during 1986 varied in length from 176 to 421 mm (Appendix El).

Bull trout catches in sinking nets varied seasonally in a pattern similar to cutthroat (Figure 15). The mean catches were largest in the spring, intermediate in fall and lowest in the summer. The overall catch rate for HHB of 5.8 and 4.8 fish per net in the spring and fall of 1986, respectively, were higher than in the previous three years, but there was not a discernable trend in abundance among the years. Catches were highest in the Sullivan area, followed by the Emery area then the Murray area. The median length of bull trout caught in nets during 1986 was 365 mm (Appendix E2).

Mountain whitefish have comprised 37 to 40 percent of the sinking net catch from 1983-86. Catches in the spring have varied between 12.3 to 13.1 fish per net as compared to 6.8 and 22.3 in the fall (Figure 15 and Appendix D1). The differences in the fall catches were influenced by the variability in the spawning seasons and water temperature during the sampling period (Table 7). The catch of whitefish in the Sullivan area was higher than in Emery or Murray areas. Overall, the gill net catches from 1983-86 for the entire reservoir didn't indicate a major change in abundance. The median length of the fish caught in 1986 varied from 285 mm in the spring to 304 mm in the fall (Appendix E3).

Northern squawfish catches were substantial in both sinking and floating gill nets, with the highest catches recorded in the summer (Figures 14 and 15). Squawfish catches were generally higher in the Emery and Murray areas than in the Sullivan area. Net catches indicated that the population numbers have been relatively stable during the study. Squawfish caught in 1986 varied from 166 mm to 521 mm in total length (Appendix E4).

Suckers comprised an important part of the catch in sinking nets during the summer, but were uncommon in floating nets (Figure 15). The catch in 1986 was 3.4 and 5.6 fish per net for largescale and longnose suckers, respectively. Length frequencies of the 1986 catch are presented in Appendix E5.



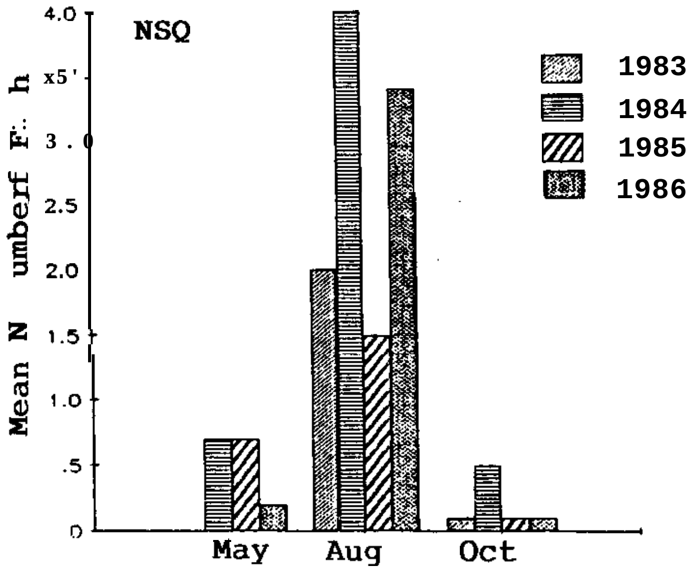


Figure 14. Seasonal catches of westslope cutthroat trout and northern squawfish caught in floating gill nets set in Hungry Horse Reservoir, 1983-86, areas combined.

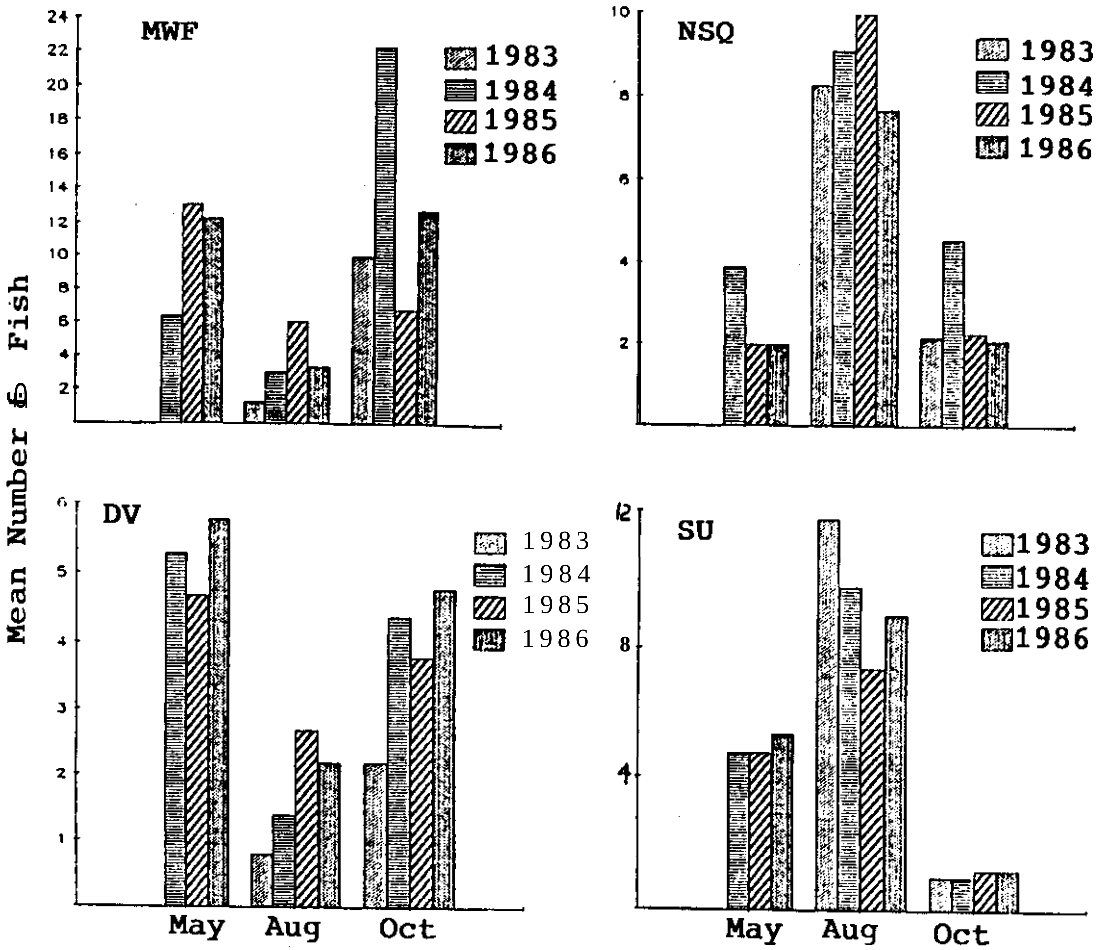


Figure 15. Seasonal catches of fish caught in sinking nets set in Hungry Horse Reservoir, 1983-86, areas combined.

Table 7. Reservoir elevations, surface water temperatures and water transparency for gill net sampling dates in Hungry Horse Reservoir, 1983-86.

Date	Reservoir Elevation (ft.)	Surface water temperature (°C) Emery	Murray	Sullivan	Depth euphotic zone (m) Emery	Murray	Sullivan
			1983				
7/26-28	3.560	16.6	17.8	17.2	--	--	--
8/23-25	3,560	20.6	20.6	20.0	18.3	19.1	18.9
9/27/29	3,547-49	14.7	14.8	13.9	26.0	18.5	20.5
10/31-11/2	3,534	8.6	0.4	8.0	23.0	lb.5	19.3
11/29-30	3,536	7.1	6.5	--	20.5	14.0	—
12/14-16	3,534			4.3	20.3	lb.5	19.1
			1984				
4/24-27	3,500	4.2	5.6	5.7	15.1	10.3	5.2
5/30-31	3,519-23	10.5	9.9	8.6	14.5	13.0	5.8
6/26-28	3,549-51	17.0	19.6	18.4	17.8	14.3	8.3
8/13-22	3,557-59	20.0	21.0	20.0	18.3	16.7	lb.3
10/11-15	3,541-40	--	12.6	12.1	17.8	19.6	14.6
			1985				
5/14-21	3,512-22	7.2	8.1	7.1	12.0	7.5	3.9
8/14-20	3,544-45	20.1	18.3	20.1	15.8	14.0	17.0
10/31-11/4	3,524-27	7.9	8.3	8.0	13.6	14.8	11.4
			1986				
5/16-22	3.536-39	7.9	10.0	7.9	16.0	15.1	15.0
8/12-20	3.557-59	20.1	20.0	19.9	17.7	15.5	15.4
10/30-11/7	3,530	9.4	9.7	9.7	17.5	11.5	15.2

Hungry Horse Creek

Spawning Runs and Recruitment

The upstream trap in Hungry Horse Creek was installed in 1986 on April 9 and ran through May 20. No fish were caught during this period. From May 21 through June 2, the trap was not operated due to high flows. A considerable portion of the spawning run moved upstream during this period. The upstream trap was operated from June 2 through the end of the month with the last spawners captured on June 25 (Figure 16).

Flows declined sufficiently for the downstream trap to be installed on June 13, and it was operated until October 3. Spent spawners were captured immediately and they continued to move downstream until July 6 (Figure 16). A total of 61 mature cutthroat were caught and released upstream as compared to 243 spent adults caught in the downstream trap. The median length of the spawners caught in the upstream and downstream traps was 373 mm (Appendix Fl).

The estimated run in 1986 declined from previous years to approximately 322 spawners (Table 8). The gradual decline in the spawning run from 1,160 fish in 1968 to 322 in 1986 is a result of several factors, including poor survival of juveniles their first year of life in the reservoir and possible habitat deterioration resulting from logging activities in the drainage (May and Fraley 1985). In addition, removal of juveniles for brood stock rehabilitation of the Murray Springs Hatchery in 1983 and 1984 resulted in a reduction of approximately 500 smolts to the reservoir in 1984. The loss of these juveniles should have diminished the 1986 run by approximately 100 spawners.

Juvenile cutthroat emigrating downstream to the reservoir were trapped from June 13 to the end of September (Figure 16). A total of 1,870 juveniles were trapped during this period (Table 8) with 70 percent of the fish caught in June. The median lengths of the juveniles in June and July were 137 mm and127 mm, respectively (Appendix F2). The number of juveniles trapped in 1986 was much larger than recorded in 1984 or 1985. The estimated emigration in 1985 and 1986, based on trap efficiency tests, was 1,865 and 2,403 juveniles, respectively. Lower than normal stream flows in 1986 may have increased competition for food and space, causing additional fish to move downstream in search of less crowded conditions. A strong 1984 year class may also have contributed to the increased smolt production.

Redd Counts

A total of 121 adfluvial westslope cutthroat redds were observed in the Hungry Horse Creek Drainage during 1986 (Table 9 and Figure 17). An estimated SO to 85 percent of all adfluvial

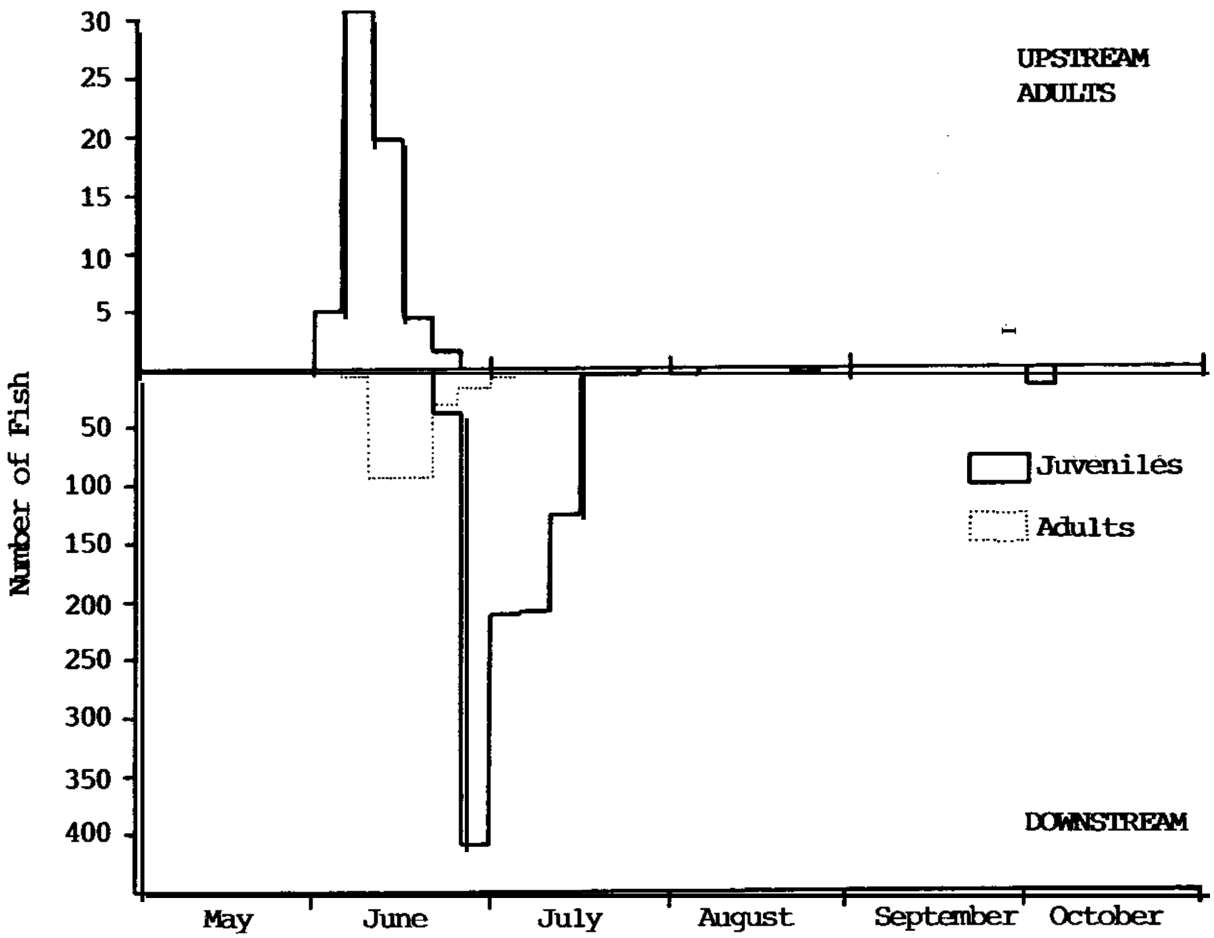


Figure 16. Upstream and downstream trap catches of westslope cutthroat trout in Hungry Horse Creek trap by five-day periods, 1986.

Table 8. Estimated number of spawners and outmigrantjuvenile westslope cutthroat trout in Hungry Horse Creek, 1968-1986. The 95 percent confidence limits for the spawning run is given in parentheses as percent of the point estimate.

Year	Estimated Run		Mean Length (MM) Male	Female	Number Outmigrant Juveniles Total Caught	Estimated
1968	1,160		373	368	2,110	---
1969	1,050	(3.7)	368	371	2,680	---
1970	1,001	(3.9)	358	361	2,040	
1971	702	(3.2)	350	358	1,951	---
1972	590	(3.6)	371	358	---	---
1984	388	(13.8)	375	370	980	---
1985	370	(14.8)	374	374	1,212	1,865
1986	322	(29.1)	370	369	1,870	2,403

Table 9. Numbers of adfluvial westslope cutthroat redds observed in the Hungry Horse Creek Drainage and other tributaries during late June, 1986.

Creek	Number of redds
Hungry Horse	
Lower (below Tiger Creek)	44
Upper (above Tiger Creek)	49
Margaret	18
Tiger	10
Lost Mare	0
	121

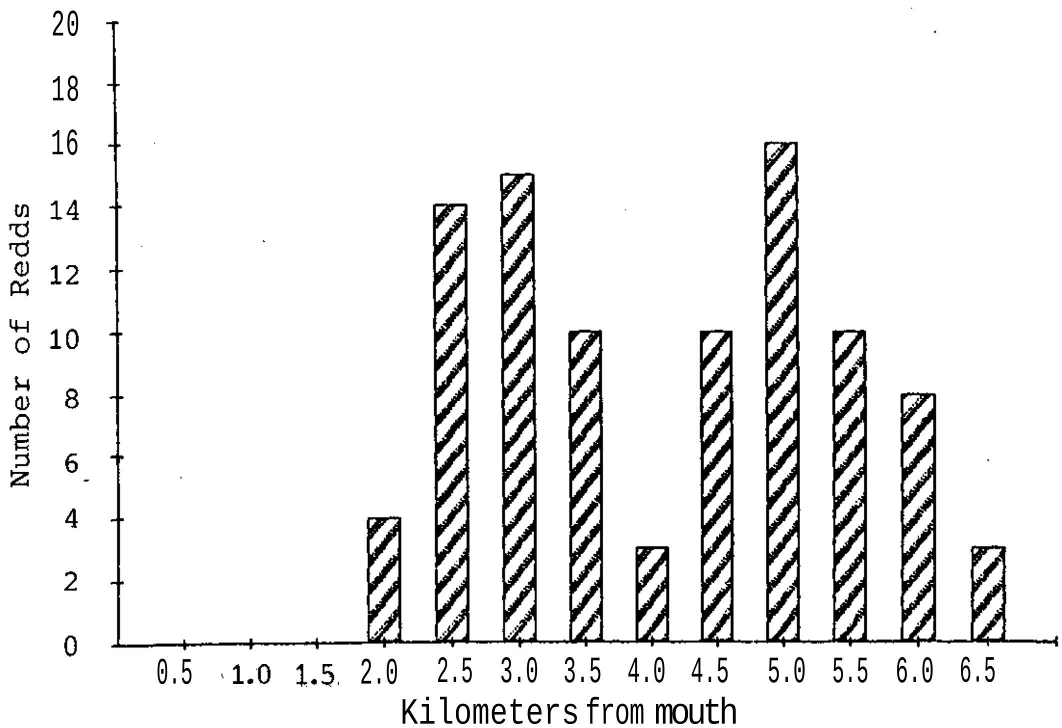


Figure 17. Adfluvial westslope cutthroat trout redd distribution in Hungry Horse Creek during spring, 1986.

redds were observed during surveys. Some spawning may have occurred upstream from the area surveyed in Hungry Horse Creek, although flows there were extremely low (J. Huston, pers. comm.). Bedload movement may have obscured some redds prior to surveys, but this was not a major problem this spring due to the overall low peak flows. No adfluvial spawning was believed to take place in Lost Mare Creek or in Margaret and Tiger Creeks above the Highline Loop Road crossings, due to high gradient and large substrate. Based on redd numbers and estimated spawners from the trap, there was approximately 2.7 spawners per redd.

The average length of adfluvial redds measured was 1.36 m and average width was 0.80 m. A comparison of these averages with those from fluvial and resident redds in Middle Fork tributaries suggested that redds of the different cutthroat stocks may be distinguished by size (Table 10). Resident redds were smaller than fluvial redds and adfluvial redds were largest, although some minor overlap was observed.

Three redds were observed in the lower portion of Lost Mare Creek but were not included in the adfluvial counts due to their small size. These redds were believed to have been constructed by resident cutthroat trout. In addition to the Hungry Horse Creek drainage, Emery and McInernie creeks appeared to be important cutthroat spawning streams. Emery Creek contained 80 adfluvial and 8 resident redds, while 167 adfluvial redds were observed in McInernie Creek. Murray, Harris and the North Fork of Logan Creeks were also lightly used by spawning cutthroat trout during 1986.

Substrate Composition

By plotting substrate data on log-probability paper, we found that spawning gravel samples from the Hungry Horse Creek drainage had particle size distributions appearing close to lognormal For the 48 samples, we obtained an average coefficient of determination (r^2) of .995 for the least squares regression lines through the data. The range of r^2 values observed was from .969 to .999.

The mean percentage of material smaller than 6.35 mm was similar in all four spawning areas (Table 11). reiser and Bjornn (1979) reported that embryo survival drops sharply when spawning gravel is comprised of 20 to 25 percent material less than 6.35 mm. The overall range observed was from 17.2 to 49.7 percent and approximately 60 percent of the 48 sites sampled exceeded 25 percent smaller than 6.35 mm.

Average predicted survival to emergence of 33 percent in the Hungry Horse Creek drainage reflected the high level of fine material. Average survival predictions were lowest for upper Hungry Horse Creek and highest for Margaret Creek. Except for the lowest individual prediction in Margaret Creek (23 percent), the

Table 10. Average measurements of resident, fluvial and adfluvial westslope cutthroat trout redds in the Flathead drainage.

Creek	Stock	x length (range)	x width (range)	n	Source
Challenge	Resident	0.60 (0.50-0.65)	0.32 (0.25-0.40)	9	Shepard et al. 1982
Challenge	Fluvial	1.00 (0.70-1.40)	0.45 (0.30-0.60)	22	Shepard et al. 1982
Hungry Horse	Adfluvial	1.36 (1.00-1.60)	0.80 (0.55-1.10)	12	This study

Table 11. Mean cumulative percentages of material smaller than 6.35 and 1.70 mm and average predicted survival to emergence in westslope cutthroat trout spawning areas in the Hungry Horse Creek Drainage during 1986.

Spawning Area	n	x % X6.35 (range)	x % <1.70 (range)	x Predicted survival to emergence (range)
Hungry Horse Cr.				
Lower	12	28.1 (17.2-44.2)	10.8 (5.0-16.1)	30.8 (5.3-63.8)
Upper	12	30.6 (18.3-49.7)	10.2 (6.0-19.0)	26.6 (0.0-57.4)
Margaret Cr.	12	28.8 (21.1-34.4)	8.8 (4.6-11.8)	39.0 (23.1-60.4)
Tiger Cr.	12	25.7 (18.6-39.6)0	10.0 (4.9-22.7)	37.1 (0.2-63.3)

ranges observed were similar between the four spawning areas sampled, with lows of 5 percent or less and highs of approximately 60 percent (Table 1). In a laboratory study, Irving and Bjornn (1984) reported mean adjusted cutthroat survival from 95 percent, where no material smaller than 6.35 mm was present, down to less than 5 percent when more than 30 percent of the gravel was smaller than 6.35 mm.

In a natural stream channel, other factors such as mean dissolved oxygen content and apparent velocity of groundwater in redds also play important roles in embryo survival to emergence (Reiser and Bjornn 1979, Weaver and White 1985, Sowden and Power 1985).

It appeared that adfluvial cutthroat spawning in the Hungry Horse Creek drainage selected substrate with a higher percentage of fines than we did. Other factors such as water velocity, water depth and availability of cover influence redd selection by spawning cutthroat. Survival predictions for samples collected from the tailspill areas of natural redds averaged 28 percent while predicted survival from samples of undisturbed gravel surrounding redds averaged 36 percent (Table 12). Sac fry were observed in 9 of the 14 natural redds sampled (64 percent).

Population Estimates

Adfluvial cutthroat in Hungry Horse Creek spawn and rear primarily in stream sections with gradients less than six percent, whereas resident fish densities are usually highest in gradients of more than six percent. Using these criteria, reach two in Margaret, Tiger and Lost Mare creeks contained primarily resident cutthroat with the remaining stream reaches populated mostly by adfluvial juveniles (Table 13). Population estimates for westslope cutthroat trout juveniles were determined for eight reaches in the Hungry Horse drainage (Table 13).

The estimates ranged from 48 juveniles greater than 75 mm in total length per 100 meters of stream in Lost Mare Creek to I43 per 100 meters in Tiger Creek. Densities of juvenile cutthroat in Hungry Horse Creek were much higher than other streams in the Flathead system (Table 14). even though there appears to be a problem with incubation success. Although incubation success may be low, there may be adequate seeding to fill the available rearing habitat. However, additional seeding would increase recruitment of fry and yearling cutthroat to the reservoir, because fish would be forced to migrate downstream due to the intense competition for food and space.

Table 12. Comparison of mean cumulative percentages of material smaller than 6.35 and 1.70 mm and average predicted survival to emergence for samples collected from natural westslope cutthroat trout redds and samples from undisturbed gravel surrounding redds in the Hungry Horse Creek drainage during 1986.

Class	n	x % <6.35 mm (rsnge)	x % <1.70 mm (range)	x Predicted Survival (range)
Natural Redds	14	38.0 (18.3-49.7)	11.4 (6.0-18.0)	27.8 (0.0-57.4)
Undisturbed	34	27.6 (17.2-44.2)	9.9 (4.6-22.7)	36.0 (0.2-63.8)

Table 13. Estimated numbers (N) of westslope cutthroat trout juveniles. associated 95 percent confidence intervals and probability of capture (P) from electrofishing samples in the Hungry Horse drainage, 1986. The two catch estimator was used.

Stream	stream Order	Reach	Gradient Percent Slope	Date	Length of Section (m)	N for Fish >60 mm	95% CI	P	Number of fish per 100 m >60 mm	Number of fish per 100 m >75 mm
Hungry Horse	3	1	2.0	09/17/86	152	159	+25	0.60	105	97 (63)[a]
Hungry Horse	2	2	4.3	09/17/86	152	91	±21	0.59	60	45 (43)
Margaret	2	1	4.1	09/11/86	152	186	+7	0.82	122	84 (32)
Margaret	2	2	12.0	09/12/86	152	95	+7	0.79	63	45 (19)
Tiger	2	1	3.5	09/08/86	152	257	+18	0.71	169	143 (78)
Tiger	2	2	8.0	09/08/86	152	152	+13	0.72	100	70 (19)
Lost Mare	2	1	5.7	09/10/86	152	90	+5	0.81	59	48 (32)
Lost Mare	2	2	14.6	09/10/86	152	131	+22	0.61	86	65 (19)

[a] Numbers in parentheses are the mean estimates for juvenile cutthroat from other streams in North, Middle and South forks of the Flathead River with the identical stream order and similar gradients.

Table 14. Estimated number of cutthroat trout juveniles by stream order and gradient categories (for gradients less than six percent) in tributary reaches to the South, Middle and North forks of the Flathead River (from Zubik and Fraley 1987).

Stream Order	Gradients (%)	Number Reaches	Mean/ 100 m
2	1.5-1.5	1	22.7
2	2.2-2.3	4	56.9
2	2.6-3.8	7	77.6
2	3.9-5.9	32	31.6
3	0.7-1.0	2	22.3
3	1.1-1.4	2	38.9
3	1.7-2.2	8	62.9
3	2.6-4.0	20	25.4
3	4.1-5.9	20	43.4
4	0.3-0.6	8	5.2
4	1.1-1.3	5	24.0
4	1.7-4.8	13	13.5
5	0.6-0.8	3	14.3
TOTAL		125	

Westslope Cutthroat Trout Recruitment

Estimating the annual recruitment of westslope cutthroat trout to HHR was a difficult task. because of the number of tributary streams and the complex life cycles of the cutthroat. Although adfluvial juveniles live primarily in stream sections of less than six percent gradient, some resident juveniles are sympatric with them.

Adfluvial cutthroat from HHR have been documented spawning in many drainages to the reservoir and in the South Fork Flathead River upstream to Bunker Creek. Adfluvial cutthroat tagged in HHR have not been caught above Bunker Creek, nor have cutthroat tagged above Bunker Creek in the South Fork been caught downstream in HHR. Consequently, there is insufficient data to determine the magnitude of the spawning from HHR into the South Fork Flathead River above Bunker Creek and subsequent recruitment of juveniles. Because of these problems, we have estimated recruitment to HHR only from stream sections below Bunker Creek with gradients of less than six percent.

We estimated standing crops of juvenile cutthroat by using methodology developed by Zubik and Fraley (1986). This method categorizes the stream habitat by stream order and gradient and then utilizes the mean population estimates from sections with similar habitat characteristics in the Flathead drainage to estimate standing crops of juveniles (Table 14). Using these criteria, we estimated the standing crop of adfluvial juveniles >75 mm in length in HHR tributaries to be 43,125, and in tributaries to the South Fork from HHR to Bunker Creek to be 38,821 for a total of 81,946 fish (Appendix Gl).

The annual recruitment to the reservoir is the percent of the standing crop of juveniles which emigrates from the tributaries each year. Based on data from Young Creek, a tributary to Libby Reservoir, (Huston et al. 1984) and the current Hungry Horse study, it appears that approximately 25-30 percent of the adfluvial juveniles emigrate from the tributary streams each year. Applying the higher value to the standing crop figure, we calculated an annual recruitment of approximately 24,600 cutthroat juveniles to HHR. This figure is a minimum estimate because it does not include streams above Bunker Creek.

Westslope Cutthroat Movement

A total of 1,088 adults and 5,603 juveniles of westslope cutthroat trout have been tagged in HHR and its tributaries from 1983-1986 (Table 15). We tagged 299 adults in HHR and its tributaries during 1986. Movement information was obtained on 51 fish in 1986 caught by anglers and gill nets which indicated that 53 percent of these fish had moved more than one km (Table 16). The longest down-reservoir movement recorded from the 1986 tag

Table 15. The number of westslope cutthroat trout tagged in Hungry Horse Reservoir, the lover South Fork of the Flathead River from HHR to Meadow Creek (37 km), and the upper South Fork from Meadow Creek to Youngs Creek (106 km upstream from HHR).

	Location Tagged				
	Hungry Horse Reservoir			Flathead River	
	Emery area	Murray area	Sullivan area	Lover South Fork area	Upper South Fork area
			1983		
Juvenile	755	402	637	374	--
Adults	34	37	25	27	_-
			1984		
Juvenile	858	0	920	12	--
Adults	204	0	93	6	--
			1985		
Juvenile	1,413	0	242	0	712
Adults	256	0	69	36	319
			1986		
Juvenile	0	0	0	0	78
Adults	181	9	109	2	597
Totals					
Juveniles	3,026	402	1.789	386	790
Adults	675	46	296	71	916

Table 16. Movement of westslope cutthroat trout tagged in Hungry Horse Reservoir and recaptured by anglers and gill nets, 1983-86. Fish which moved less than one kilometer are given in the upstream movement column.

	Upstream Movement (km)						
	<1	10	11-20	21-30	31-40	41-50	51-60
				1983			
Juvenile	8	1	0	0	0	0	0
Adult	2	1	0	1	0	1	0
				1984			
Juvenile	3	6	0	0	0	0	0
Adult	13	1	0	0	0	0	0
				1985			
Juvenile	0	0	0	0	0	0	0
Adult	14	3	5	4	1	3	0
				1986			
Juvenile	0	0	0	0	0	0	0
Adult	24	2	10	2	4	1	0
				TOTAL			
Juvenile	11	7	0	0	0	0	0
Adult	53	7	15	7	5	5	0

		Downstream Movement (km)					
		10	11-20	21-30	31-40	41-50	51-60
				1983			
Juvenile	--	4	1	1	0	0	0
Adult	--	2	1	0	0	0	0
				1984			
Juvenile	--	7	0	1	0	0	0
Adult	--	2	2	1	0	1	0
				1985			
Juvenile	--	1	0	0	0	0	0
Adult	--	1	0	2	1	1	0
				1986			
Juvenile	--	0	0	0	0	0	0
Adult	--	0	2	2	2	2	0
				TOTAL			
Juvenile	--	14	2	2	0	0	0
Adult	--	6	5	5	3	4	0

returns was a cutthroat which was tagged near Elan Creek and recaptured 44 km downstream close to the Lid Creek campground. Another cutthroat tagged at Hungry Horse Creek was caught almost 43 km up-reservoir near Devils Corkscrew Creek (Appendix Hl).

Approximately 37 percent moved upstream with only 16 percent recaptured downstream from the tagging location. Cutthroat returns from previous years also showed a greater propensity for upstream movement. Cutthroat trout tagged in the Emery area appeared to travel more than cutthroat from the Sullivan area with 34 and 16 percent of the fish tagged in these areas, respectively, recaptured more than one km from the tagging location. These angler returns were corrected for differences in fishing pressure between the two areas.

The upstream movement of cutthroat was influenced by habitat preferences and spawning movements. The upper part of the reservoir has considerably more littoral zone than the Emery area, cooler water temperatures and more kilometers of spawning tributaries, especially if the South Fork Flathead River and its tributaries are included (Appendix Gl). Gill net and angler catches have indicated that cutthroat populations are highest in the Sullivan area where the preponderance of littoral habitat in the reservoir is located.

Cutthroat trout tagged in the upper South Fork of the Flathead River in 1985 and 1986 exhibited comparatively little movement (Table 17). Approximately 76 percent of the 71 fish recaptured moved less than one km. Ten fish were caught downstream from one to 35 km from tagging location, and seven fish were returned upstream of the tagging area with 37 km the maximum distance moved. Overall, only 10 of the cutthroat returned moved more than ten km. Thus, it appears that most cutthroat recaptured were resident fluvial fish which moved only short distances in the South Fork.

Creel census

A total of 599 anglers fishing HHR were contacted during the creel survey from May through October, 1986 (Table 18). Fishing pressure was highest in the Murray area with the Emery area a close second and Sullivan last. Cutthroat comprised 61 percent of the catch, followed by bull trout (31 percent) and mountain whitefish (8 percent). The mean catch rate for cutthroat of 0.19 fish per hour of effort was slightly higher than recorded in 1985 (0.17 fish per hour). The catch of cutthroat varied among the areas ranging from 0.14 fish per hour of effort in the Emery area to 0.22 fish per hour in the Sullivan area. The angler catch rate of bull trout in the Sullivan area of 0.26 fish per hour was much higher than recorded in the other two areas. Cutthroat varied in

Table 17. The movement of westslope cutthroat trout tagged in the South Fork of the Flathead River in the Bob Marshall Wilderness area and recaptured by anglers, 1985-86. Fish which moved less than one kilometer are given in the upstream movement column.

	Upstream Movement (km)					
	<1	1-10	11-20	21-30	31-40	41-50
			1985			
Juvenile	6	3	0	0	1	0
Adult	9	0	0	0	1	0
			1986			
Juvenile	7	0	0	0	0	0
Adult	32	0	1	1	0	0
			TOTAL			
Juvenile	13	3	0	0	1	0
Adult	41	0	1	1	1	0

	Downstream Movement (km)				
	1-10	11-20	21-30	31-40	41-50
		1985			
Juvenile	1	0	0	0	0
Adult	1	0	0	0	0
		1986			
Juvenile	0	0	0	0	0
Adult	2	3	2	1	0
		TOTAL			
Juvenile	1	0	0	0	0
Adult	3	3	2	1	0

Table 18. Summary of Contact Creel Census conducted on Hungry Horse Reservoir, 1986.

Month	Number Anglers	Hours Fished	Number and (%) of Catch			Catch per Man Hour of Effort		
			WCT	DV	MWF	WCT	DV	MWF
May	171	749.8	140 (53.0)	122 46.2	2 (0.8)	0.19	0.16	0.01
June	275	1012.0	209 (64.3)	80 (24.6)	36 (11.1)	0.21	0.08	0.04
July	70	192.5	28 (80.0)	3 (8.6)	4 (11.4)	0.15	0.02	0.02
Augus	37	104.5	19 (54.3)	5 (14.3)	11 (31.4)	0.18	0.05	0.11
September	36	120.5	17 (77.3)	4 (18.2)	1 (4.5)	0.14	0.03	0.01
October	10	35.0	8 (100)	0 (0)	0 (0)	0.23	0.00	0.00
Total	599	2214.3	421 (61.1)	214 (31.1)	54 (7.8)	0.19	0.10	0.02
				Emery Area				
Area Total	221	722.5	99 (83.2)	15 (12.6)	5 (4.2)	0.14	0.02	0.01
				Murray Area				
Area Total	259	1042.5	222 (64.0)	81 (23.3)	44 (12.7)	0.21	0.08	0.04
				Sullivan Area				
Area Total	119	449.3	100 (44.8)	118 (52.9)	5 (2.3)	0.22	0.26	0.01

length from 160-420 mm. with the median length of the catch 345 mm (Appendix 11). The median length of bull trout creeled was 430 mm and the largest fish caught was 665 mm in length (Appendix 12).

Fishing method was primarily from boats using lures or a combination of lures and natural bait (Table 19). Approximately 66 percent of the anglers fished primarily for cutthroat with only nine percent trying to catch bull trout.

The fishery in HHR appears to attract mostly local anglers. Our interviews indicated that 91 percent of the fishermen were from Flathead County, six percent from the rest of Montana and only three percent from out of state. These results are similar to those recorded in 1985 (May and Fraley 1986).

The 1985 fishing pressure estimate was used to estimate total harvest of cutthroat trout for both 1985 and 1986 because the 1986 estimate won't be completed until June 1987. The 1985 estimate was 6,071 man-days with a 95 percent confidence limits of +3,800 (Bob McFarland, pers. comm.). Based on a catch rate of 0.72 cutthroat per angler day in 1985, the total catch for that year was 4,425 fish. If the fishing pressure in1986 was similar to 1985, the catch of cutthroat in 1986 was approximately 4,200 fish. In comparison, an estimated 6,910 cutthroat trout were harvested from Flathead Lake in 1981 (Graham and Fredenberg 1983).

The total harvest of bull trout from HHR in 1985 and 1986 was predicted using the 1985 fish pressure estimate. The catch per angler of bull trout was 0.15 and 0.36 in1985 and 1986, respectively. The estimated catch for the two years was 887 and 2.168 bull trout as compared to 5,452 from Flathead Lake in 1981 (Graham and Fredenberg 1983).

MODEL DEVELOPMENT

Our modeling strategy entails the use of several component models corresponding specifically to the hypothesized mechanisms of the effects of dam operation upon the reservoirs biota. The component models, by virtue of their simplicity, are less likely to generate inappropriate predictions and are more accessible to assessment of reliability, than a complex full system model. The model will use particulate carbon to track energy flow through the trophic levels, identify limiting factors and include a sensitivity analysis. It will indicate the direction of change caused by reservoir operation in production of organisms in the various trophic levels.

Physical Framework Model

Evaluation of the consequences of the various reservoir management options requires a common physical framework within

Table 19. Fishing method, residency and species sought by anglers contacted during the creel survey conducted on Hungry Horse Reservoir. 1986.

Month	Percent Anglers Fishing With: Natural	Flies	Lures	Combination	Percent Anglers Fishing From: Shore	Boat	Percent Anglers Fishing For: WCT	DV	Any	Number and (%) of Anglers From: Flathead County	Western Montana	Eastern Montana	Non-Residents
5	15 (21)	1 (1)	43 (59)	14 (19)	31 (42)	42 (58)	46 (63)	5 (7)	22 (30)	68 (93)	3 (5)	1 (1)	1 (1)
6	28 (22)	2 (2)	55 (44)	41 (33)	66 (52)	60 (48)	82 (71)	2 (2)	31 (27)	115 (91)	2 (2)	3 (2)	6 (5)
7	3 (10)	1 (3)	18 (58)	9 (29)	7 (23)	24 (77)	15 (50)	1 (3)	14 (47)	30 (97)	1 (3)	0 (0)	0 (0)
8	1 (5)	1 (5)	13 (68)	4 (21)	6 (32)	13 (68)	12 (63)	0 (0)	7 (37)	18 (95)	0 (0)	1 (5)	0 (0)
9	0 (0)	0 (01	11 (65)	6 (35)	8 (47)	9 (53)	10 (63)	1 (6)	5 (31)	13 (76)	1 (6)	2 (12)	1 (6)
10	0 (0)	0 (0)	4 (80)	1 (20)	1 (20)	4 (80)	4 (80)	0 (0)	1 (20)	5 (100)	0 (0)	0 (0)	0 (0)
Total	47 (17)	5 (2)	144 (53)	75 (28)	119 (34)	152 (66)	169 (66)	9 (3)	80 (311	249 (91)	7 (3)	7 (3)	8 (3)

which the submodels can operate. This framework is a three-dimensional representation of the reservoir basin, coupled to a day-by-day representation of the inflow, turbidity, solar radiation and air temperature. The model has a provision for specifying the annual schedule of water withdrawals.

The effect of reservoir operation upon thermal regimes within the reservoir will be evaluated using the predictive thermal model. The model will enable us to hold environmental variables (volume of inflow, temperature of inflow, and solar radiation) constant, while determining impacts of operational variables (discharge volume, depth of discharge and timing of discharge) on the thermal regime in the reservoir. We can evaluate the effect of these predicted thermal regimes on primary productivity, secondary productivity and fish growth by incorporating them into the physical framework model.

Primary Production

The primary production submodel includes area, stratification and washout effects. The area component predicts the annual schedule of primary productivity for the entire lake by area. A generalized seasonal fish growth model will be used to estimate fish growth via a two-step average conversion efficiency from primary production through secondary to tertiary production. Particulate carbon will be used to track energy flow through the trophic levels.

The stratification component uses a physical framework to generate a description of profiles of temperature and light with passive distribution of nutrients. Diatom biomass is assigned to the mixed layer and primary production is calculated from light, temperature, and nutrients. The output is an annual schedule of primary productivity.

The "washout effect" part of the model computes net biomass loss to washout and incorporates this annual primary production model. The final output is a schedule of primary production as affected by washout loss.

Secondary Production

The benthos submodel uses a life history model of aquatic dipteran to obtain the rate of production of emergers by date. This rate is calibrated against the observed standing stock of emergers. The output will be a schedule of incremental dipteran production for the entire lake over the course of the year. If adequate sampling of the emerging forms is achieved, the results should be reliable and readily interpreted.

The generalized seasonal fish growth will be used to carry through secondary production to tertiary production. The estimate is refined by allocating the increased production to particular species on the basis of food habits data.

The zooplankton model will produce a schedule of zooplankton production by area and month as influenced by primary production, living space, and temperature. The generalized seasonal fish growth model will carry through zooplankton production to fish growth.

Fish Community

A growth model will produce a trajectory of differential growth for the salmonid stocks in the reservoir. Fish stocks will be allowed to grow in response to food availability and to place proportionate demands on food resources as indicated by food habits data. Treating the competition between the salmonids as resource-based scramble competition only should lead to reasonable predictions with respect to growth for a period of one growing season.

We will also use a population simulation model developed for adfluvial rainbow trout (Serchuk et al. 1980). This is an age-structured simulation model of the growth and population dynamics of a migratory rainbow trout population. It includes all principal life-history intervals and incorporates food-density and temperature relationships of salmonid growth efficiency. The core of the simulation involves individual fish growth rather than growth of the population. Factors directly affecting the growth processes of trout such as food availability, water temperature, and intraspecific competition have been incorporated. Population size, mean weight and biomass are estimated monthly in age, sex and location categories. A variety of environmental and biological parameters are utilized in the simulation which can be altered as a user option. The utility of this model will be dependent upon sufficient data to allow us to alter the parameters to represent local conditions.

Model Progress

The physical framework component of the model has been completed and the thermal component has been integrated into it. Work has begun on the primary production part of the model.

The database from 1983 through 1986 has been sent to Bozeman, reviewed by Dan Gustafson and is ready to be included in the various model components as they are developed.

RECOMMENDATIONS

Continue the study with the following modifications:

1. Evaluate incubation success of cutthroat trout eggs in Hungry Horse Creek to determine if the relatively high percent of fine sediment in the substrate is affecting egg survival.

2. Evaluate substrate compositions in Emery, Sullivan and Lover Twin Creeks, and to determine their suitability for incubation of salmonid eggs.

3. Use the cold branding technique to mark juveniles from Hungry Horse Creek to determine their survival in HHR.

4. Take water temperature profiles at approximately five mile intervals in HHR to provide data necessary for predicating water temperatures longitudinally in the reservoir.

5. Make population estimates in Hungry Horse Creek in spring and fall to determine mortality rates of juvenile cutthroat.

6. Conduct an evaluation/monitoring study for approximately ten years after this study is completed to provide data necessary for model validation. Ten years would enable us to examine how reservoir operation affects two life cycles of westslope cutthroat and bull trout.

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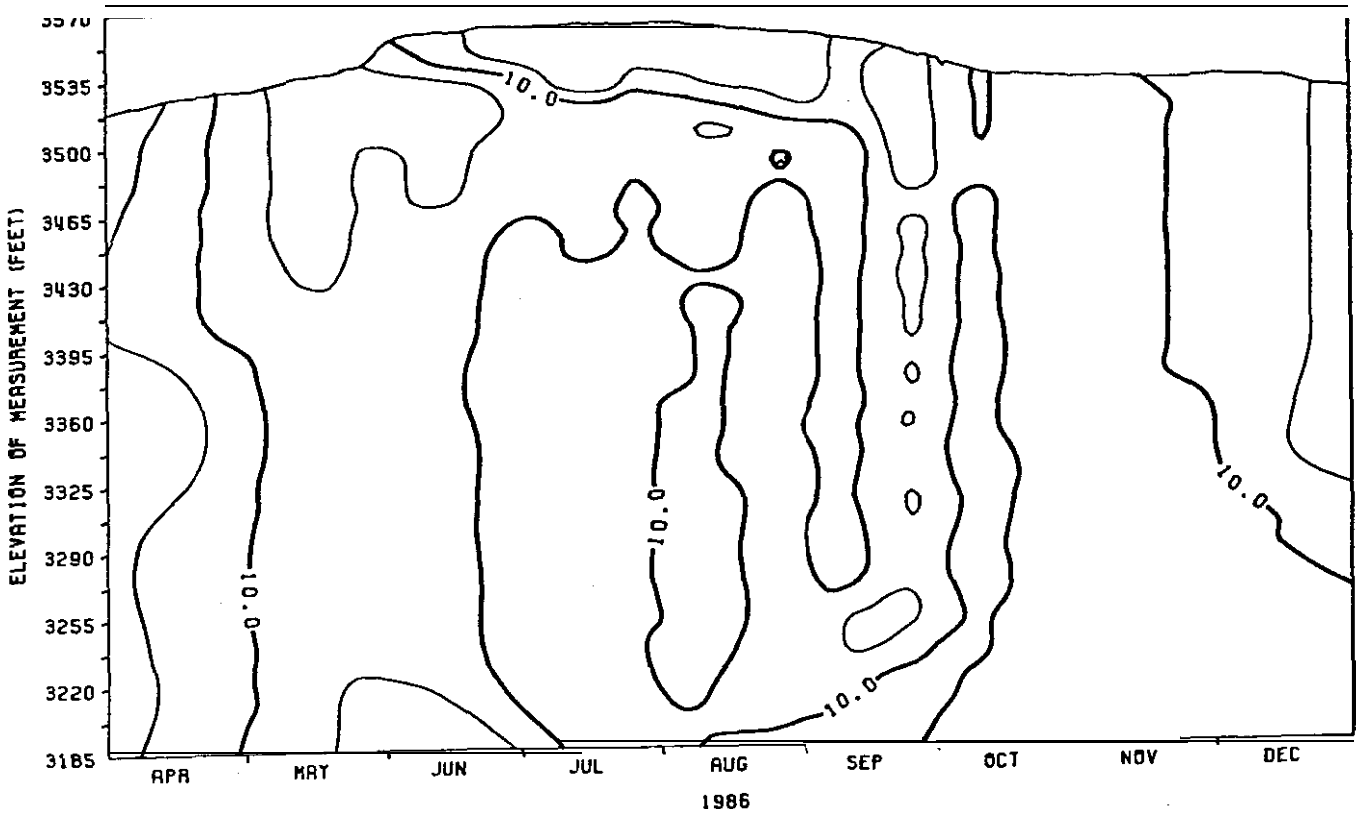
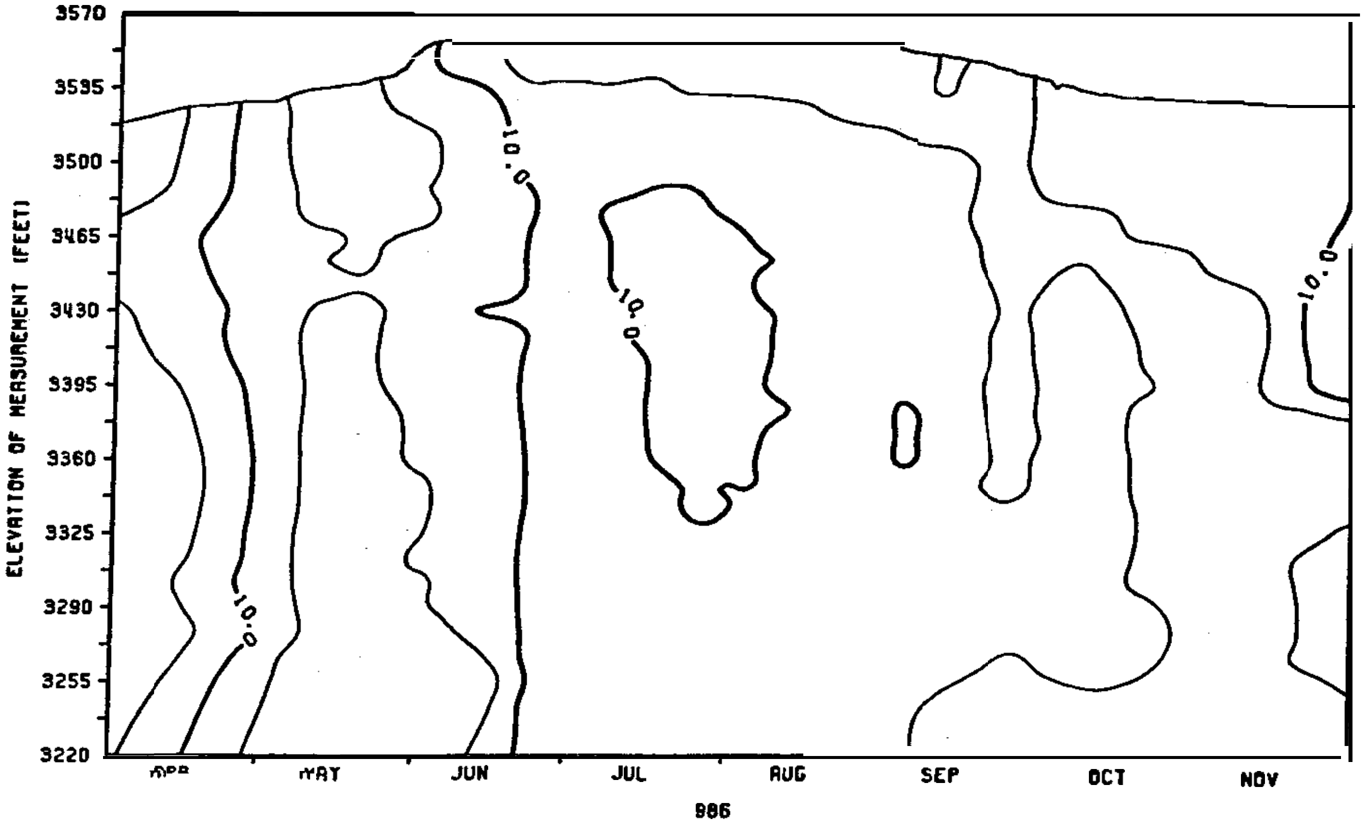
APPENDIX A

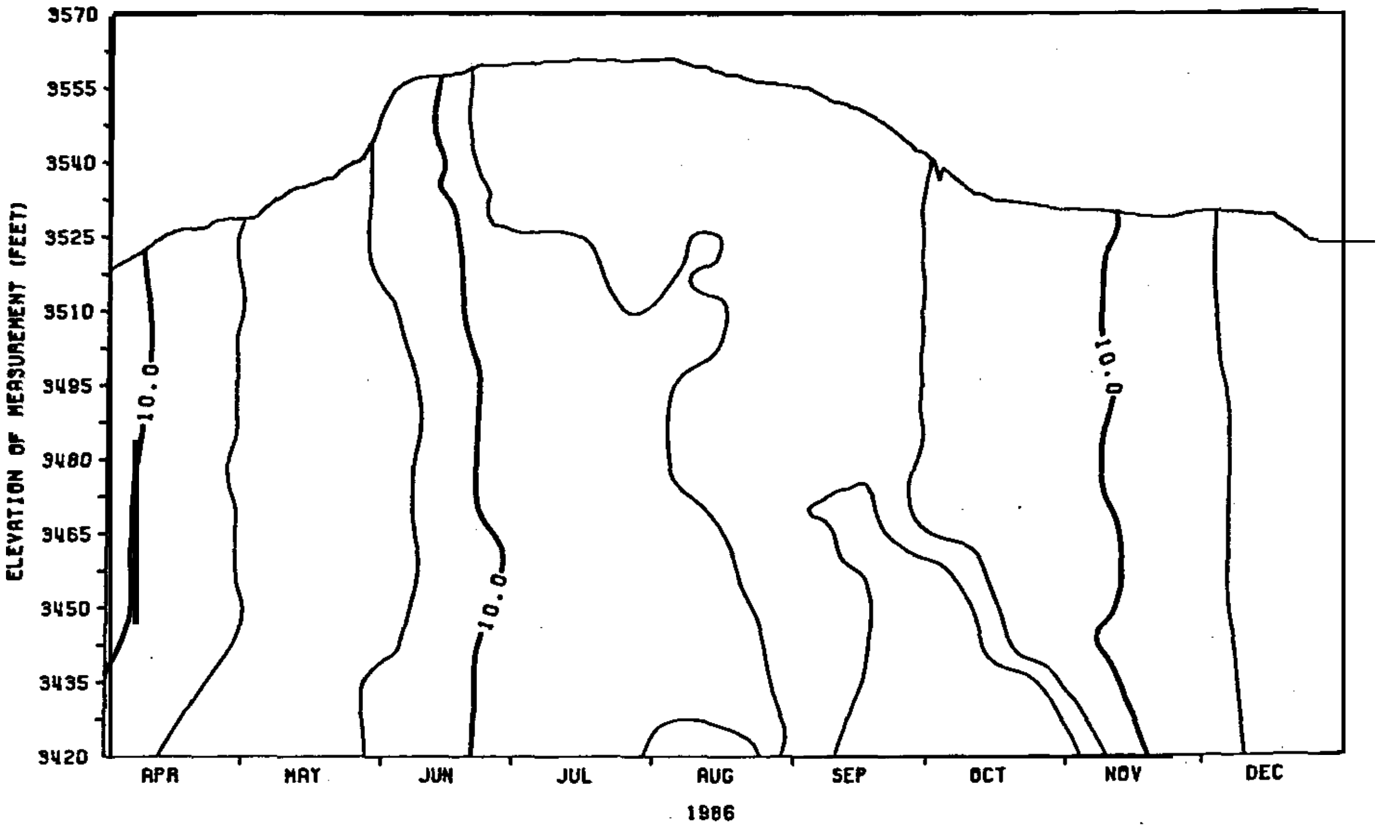
Isopleths of dissolved oxygen. pH, and conductivity, 1986.



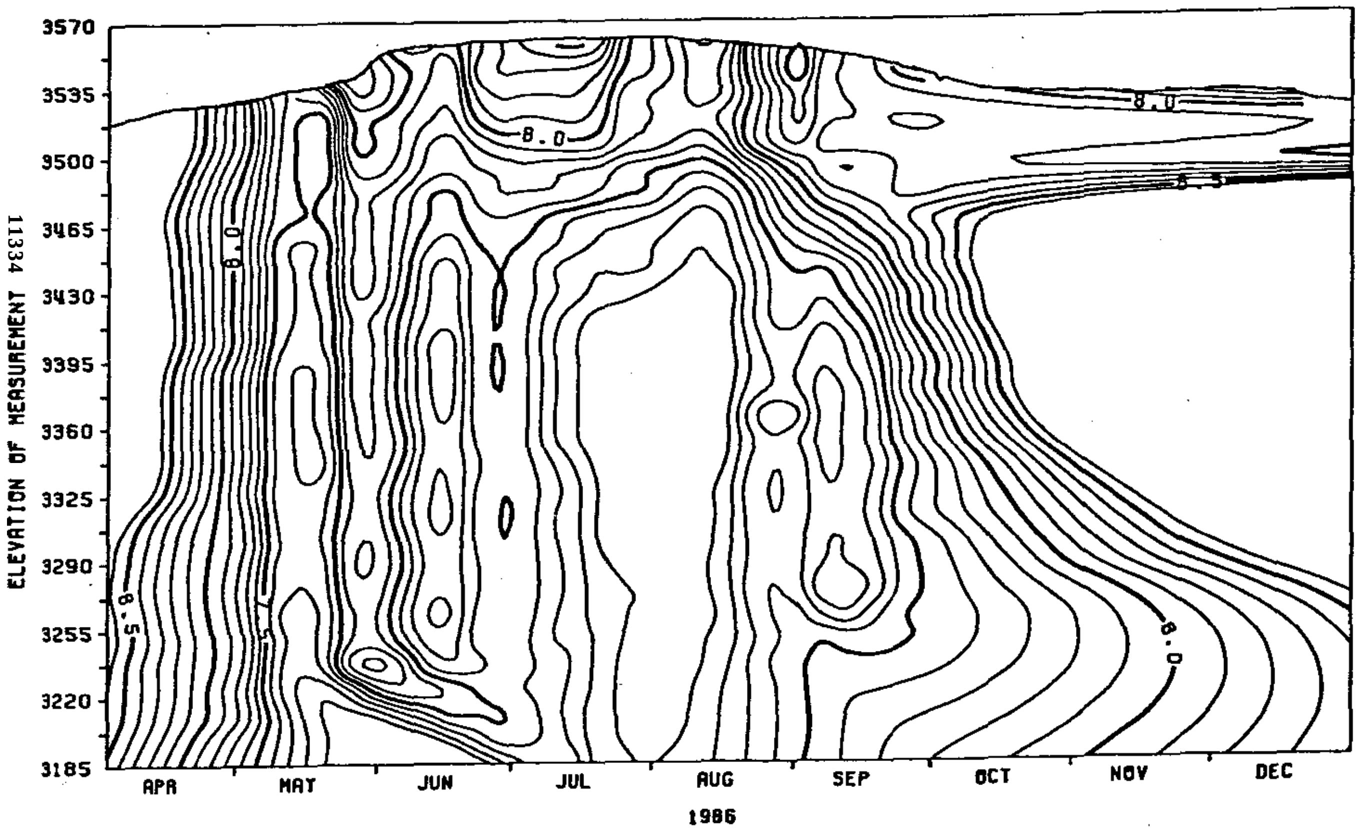
Appendix A1. Isopleths of dissolved oxygen $(mg \cdot l^{-1})$ from the Emery station, Hungry Horse Reservoir, 1986.



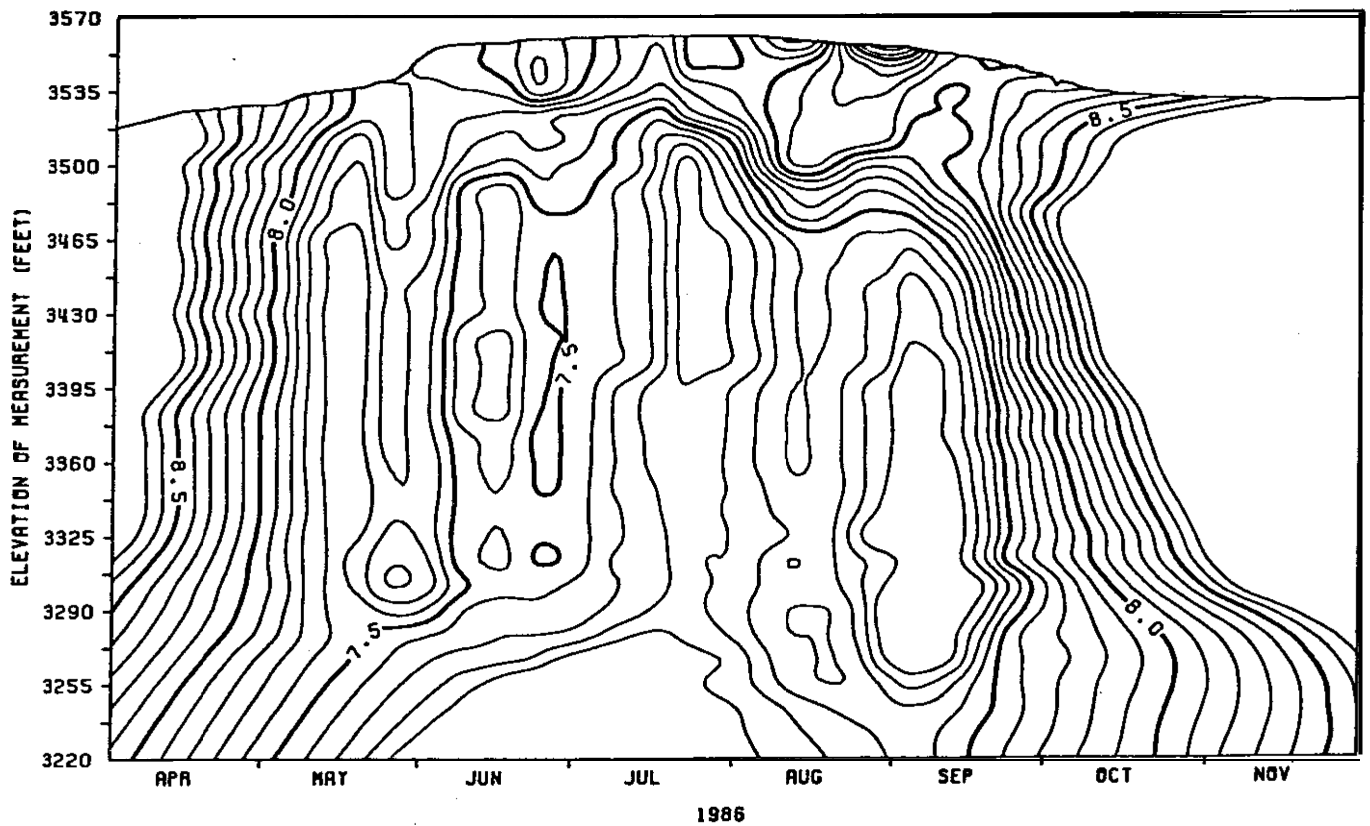
Appendix A2. Isopleths of dissolved oxygen ($mg \cdot l^{-1}$) from the Murray station, Hungry Horse Reservoir, 1986.



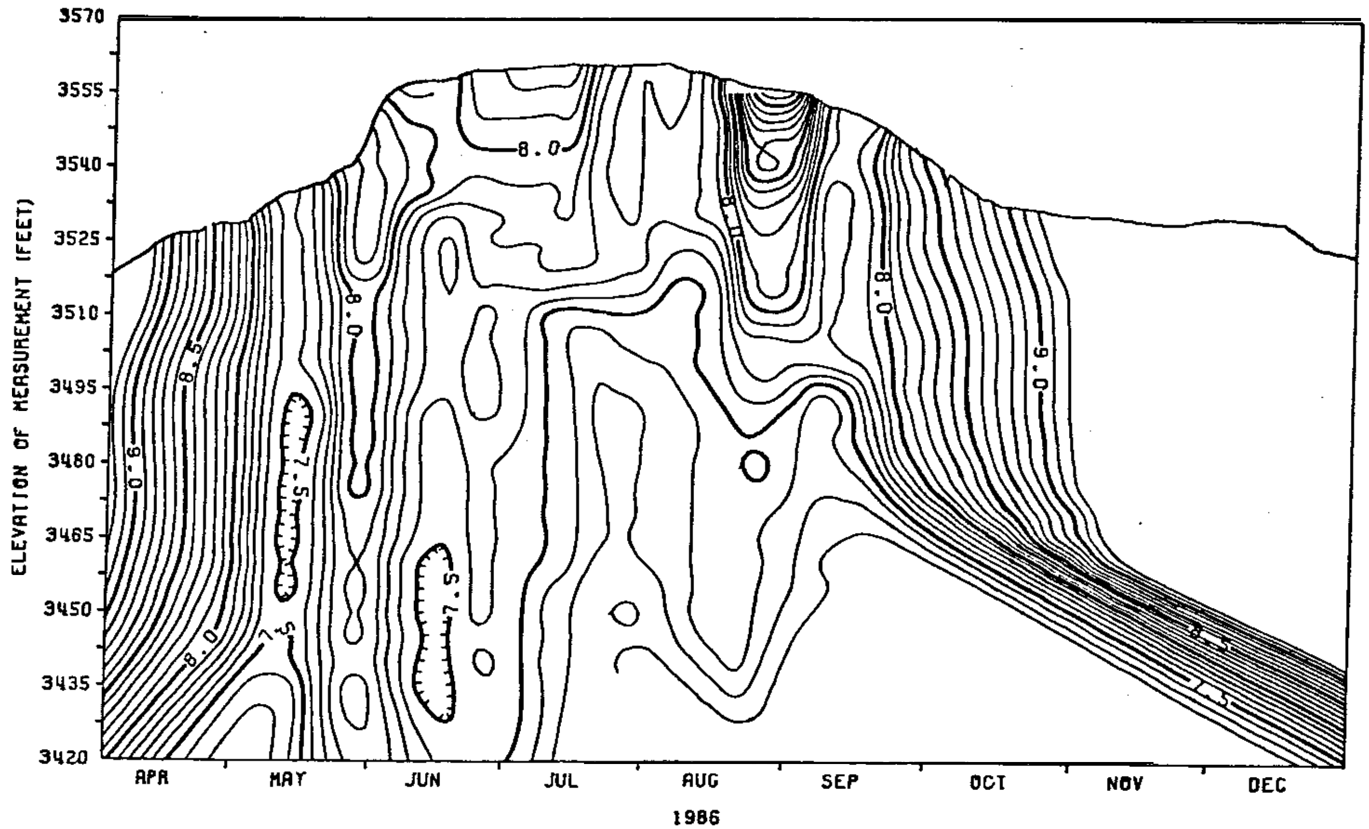
Appendix A3. Isopleths of dissolved oxygen ($mg \cdot l^{-1}$) from the Sullivan station, Hungry Horse Reservoir, 1986.



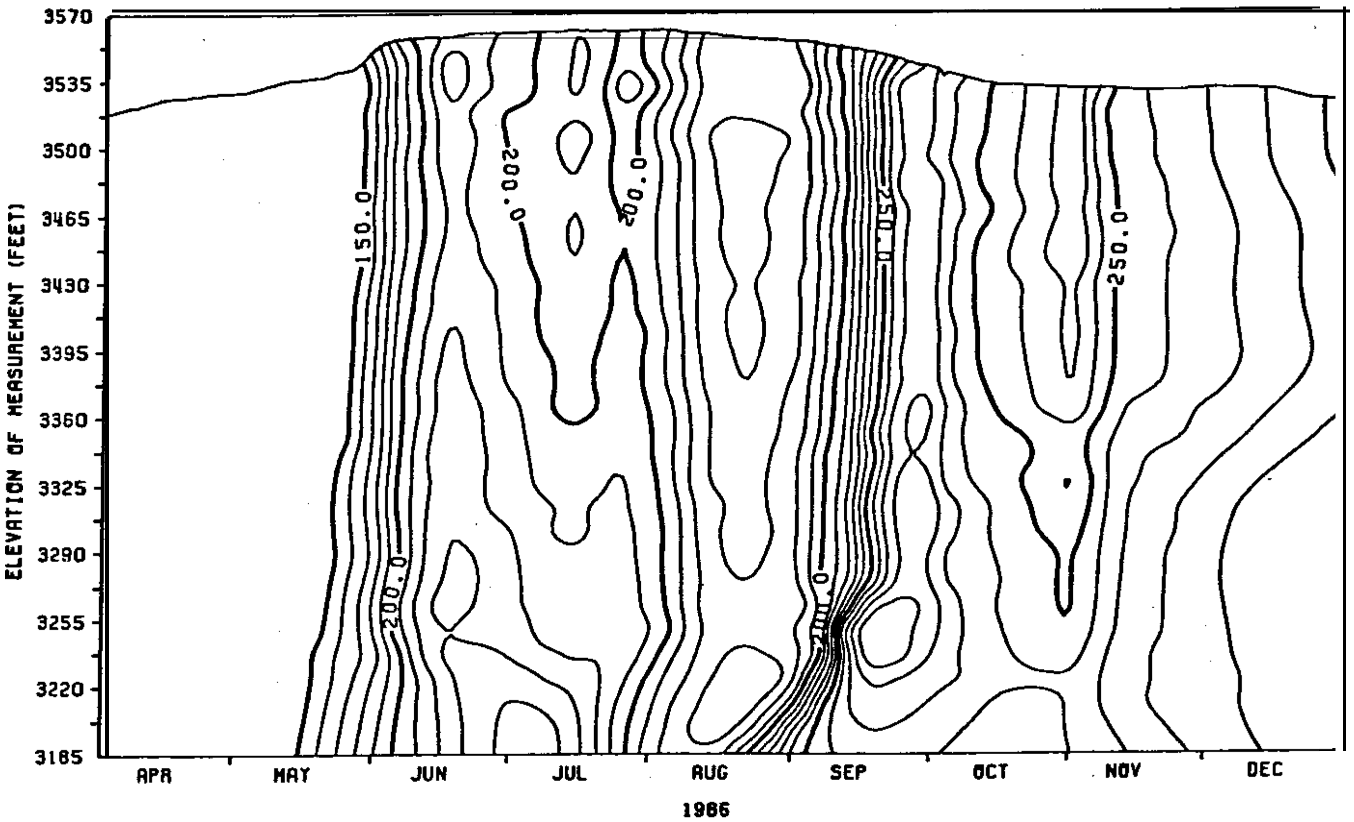
Appendix A4. Isopleths of pH standard units (0.1) from the Emery station, Hungry Horse Reservoir, 1986.



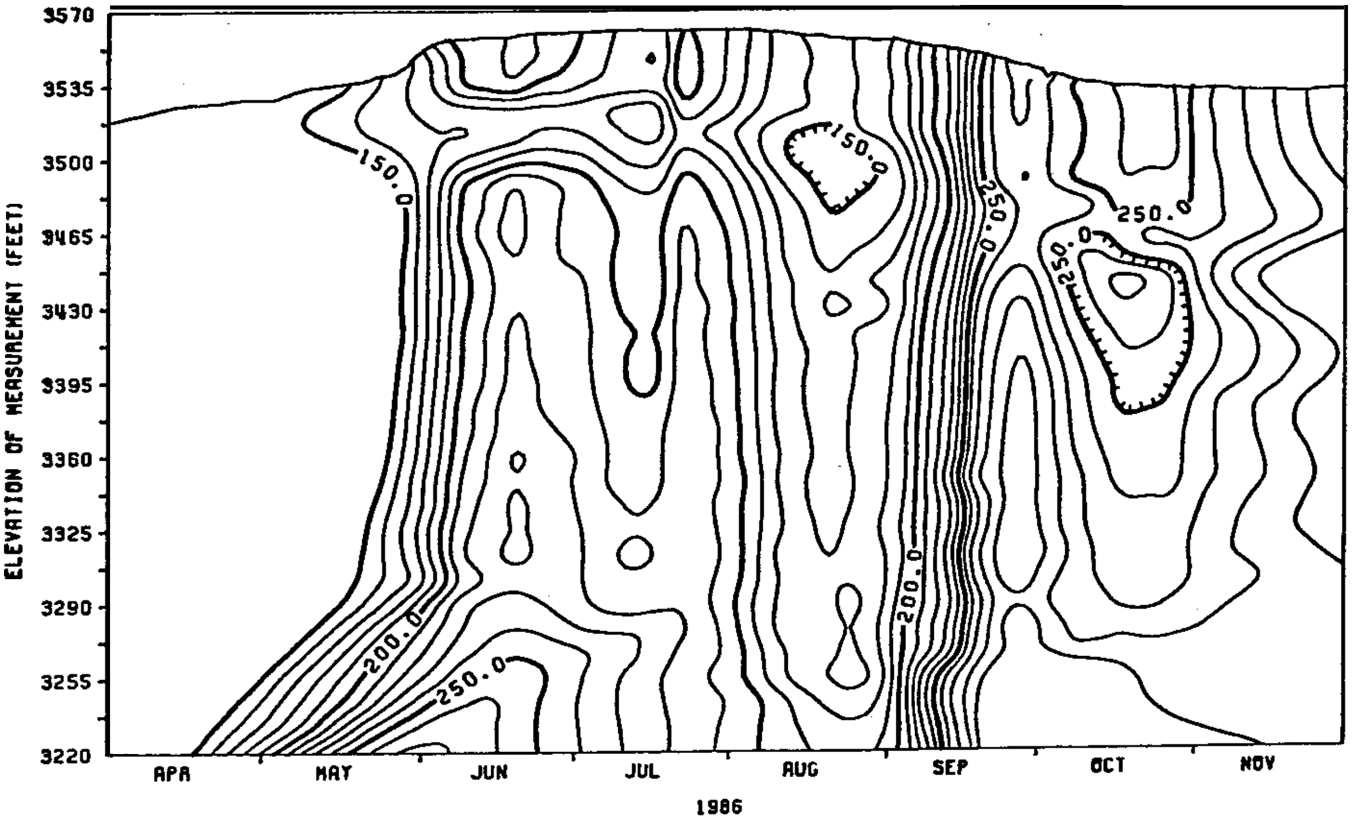
Appendix A5. Isopleths of pH standard units (0.1) the Hungry Horse Reservoir, 1986.



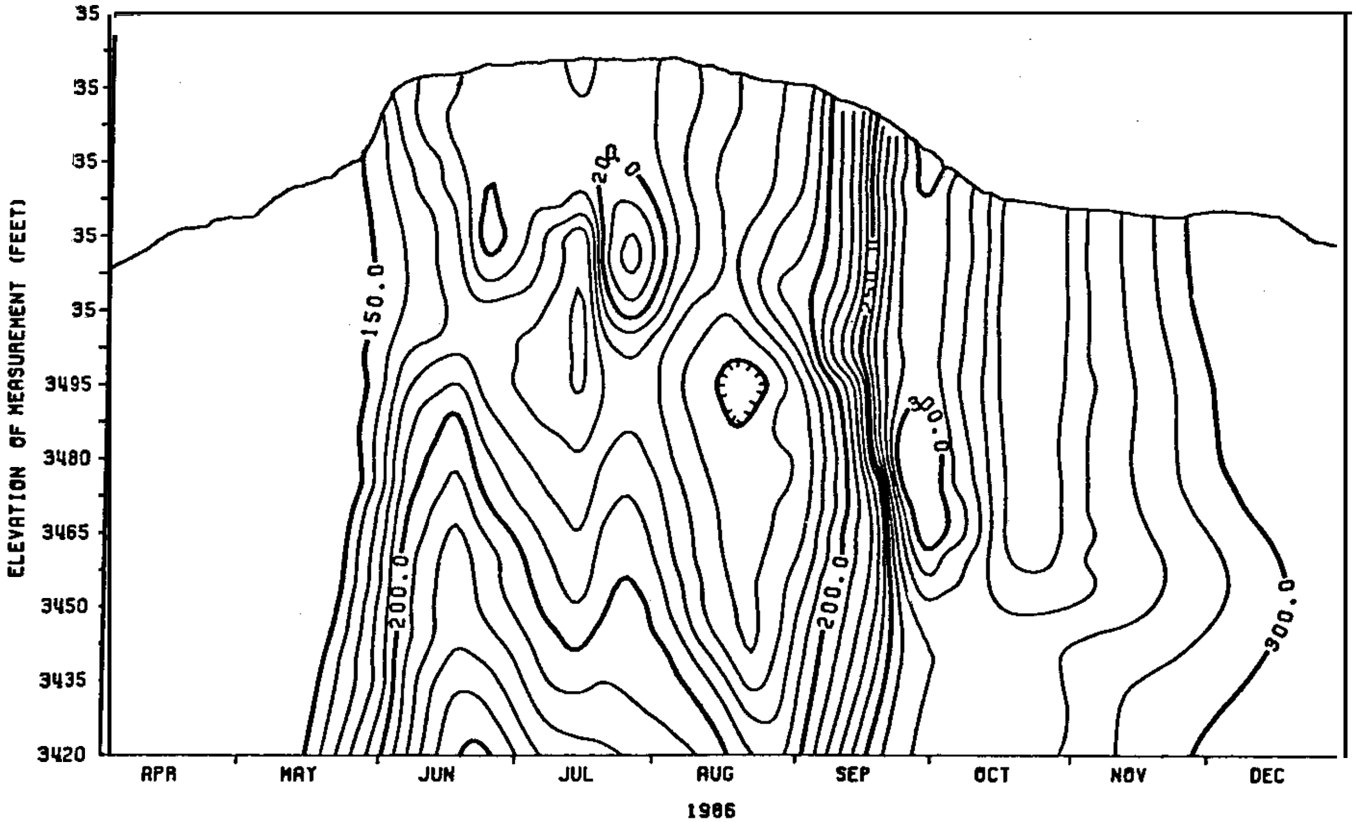
Appendix A6. Isopleths of pH standard units (0.1) from the Sullivan station, Hungry Horse Reservoir, 1986.



Appendix A7. Isopleths of specific conductance (10 mmhos) from the Emery station, Hungry Horse Reservoir, 1986.



Appendix A8. Isopleths of specific conductance (10 mmhos) from the Murray station, Hungry Horse Reservoir, 1986.



Appendix A9 Isopleths of specific conductance (10 mmhos) from the Sullivan station, Hungry Horse Reservoir, 1986.

APPENDIX B

Data summaries of zooplankton. benthos and surface insect collections, 1986.

Appendix B1. Mean zooplankton densities (#·M^{-3}) and weights (mg·M^{-3}) estimated from 30 m vertical tows during 1985 in the Emery Area, Hungry Horse Reservoir. Percents of total zooplankton are in parentheses.

Month	Number of Samples	Daphnia Pulex	Daphnia Non-pulex	Bosmina	Leptodora	Total Cladocerans	Diaptomus	Cyclops	Epischura	Total Copepods	Total Zooplankton
						Number					
May	6	23(<1)	52 (1)	99 (1)	0 (0)	174 (3)	3495(52)	3086(46)	1(<1)	6584(97)	6755
June	6	155 (2)	493 (6)	707 (9)	0 (0)	1355(17)	3318(42)	3185(40)	11(<1)	6514(83)	7869
July	6	626 (3)	2410(15)	4654(28)	0 (0)	7690(47)	3605(22)	5165(31)	5(<1)	8775(53)	16465
August	6	248 (3)	2682(34)	290 (4)	0 (0)	3220(41)	1438(18)	3128(40)	14(<1)	4580(59)	7800
September	5	418 (5)	2404(28)	327 (4)	0 (0)	3148(37)	1430(17)	4006(47)	5(<1)	5441(63)	8589
October	6	290 (4)	1250(18)	291 (4)	0 (0)	1831(26)	1326(19)	3845(55)	1(<1)	5172(74)	7003
November	3	140 (5)	389(14)	106 (4)	0 (0)	636(23)	621(23)	1489(54)	<1(<1)	2110(77)	2746
Year	38	278 (3)	1435(17)	1005(12)	0 (0)	2718(32)	2318(27)	3551(41)	7(<1)	5877(68)	8595
						Weight					
May	6	0.8(<1)	2.3 (1)	1.4(<1)	0 (0)	4.5 (2)	117.0(53)	100.5(45)	0.1(<1)	217.6(98)	221.1
June	6	13.5 (5)	15.4 (5)	6.0 (2)	0 (0)	34.9(12)	162.3(58)	82.8(29)	1.3(<1)	246.4(88)	281.3
July	6	60.4 (8)	217.0(28)	128.2(17)	0 (0)	405.6(53)	165.5(21)	197.7(26)	1.4(<1)	364.6(47)	770.2
August	6	25.0 (5)	326.7(69)	3.6 (1)	0 (0)	355.3(75)	35.7 (8)	76.5(16)	3.9 (1)	116.1(25)	471.4
September	5	45.8(11)	275.1(66)	4.0(<1)	0 (0)	324.9(78)	25.4 (6)	68.9(16)	1.7(<1)	94.3(22)	419.3
October	6	34.5(16)	67.4(31)	3.4(<1)	0 (0)	105.4(49)	27.0(13)	82.5(38)	<1.0(<1)	109.6(51)	215.0
November	3	16.3(19)	28.4(32)	1.6 (2)	0 (0)	46.3(52)	16.2(19)	25.1(29)	0.0 (0)	41.3(48)	87.6
Year	38	28.5 (8)	137.7(37)	23.1 (6)	0 (0)	189.4(51)	84.7(23)	96.3(26)	1.6(<1)	182.1(49)	371.6

Appendix B2. Weighted mean zooplankton densities ($\#\cdot M^{-3}$) and weights ($mg\cdot M^{-3}$) estimated from 30 m vertical tows during 1936 in Emery Area, Hungry Horse Reservoir.

Month	Number of Samples	Daphnia Pulex	Daphnia Non-pulex	Bosmina	Leptodora	Total Cladocerans	Diaptomus	Cyclops	Epischura	Total Copepods	Total Zooplankton
						Number					
April	—	—	—	—	—	—	—	—	—	—	—
May	9	188	647	89	0	925	2673	1683	<1	4356	5281
June	5	1173	4918	769	0	6860	7103	2276	50	9435	16290
July	6	849	3308	2379	0	6536	1978	4775	8	6760	13290
August	5	133	1452	4292	<1	5877	413	6572	31	7016	12890
September	5	154	2084	1563	<1	3801	1204	7318	13	8535	12330
October	6	307	1471	434	<1	2213	832	8489	4	9325	11530
November	5	266	631	147	0	1044	1185	4970	1	6156	7199
December	3	217	293	63	0	573	1388	3877	<1	5266	5839
Year	44	407	1836	1176	<1	3419	2151	4819	13	6982	10400
						Weight					
April	—	—	—	—	—	—	—	—	—	—	—
May	9	21.8	29.6	1.6	0	53.0	119.4	59.2	<0.1	178.7	231.7
June	5	161.8	242.2	11.8	0	415.7	202.9	73.0	2.1	278.1	693.8
July	6	99.8	180.0	25.9	0	305.8	68.5	105.1	2.0	175.6	481.3
August	5	23.8	122.0	47.6	0	193.4	13.1	141.5	3.5	158.1	351.5
September	5	28.0	251.0	15.0	0	294.0	59.7	143.6	2.8	206.1	500.1
October	6	52.1	189.4	5.2	0	246.7	31.0	144.7	1.4	177.0	423.8
November	5	41.2	43.7	2.5	0	87.4	31.7	100.5	0.3	132.4	219.7
December	3	35.5	38.0	1.1	0	74.7	39.5	80.5	0.2	120.3	195.0
Year	44	56.6	133.9	13.4	0	203.8	75.6	103.8	1.5	180.9	384.7

Appendix B3. Length-frequency distributions and mean lengths (mm) of Daphnia spp. and Daphnia pulex collected in 30 m vertical tows from Hungry Horse Reservoir, 1985. Mean length of Bosmina is also given.

		Length Groups												
		Daphnia species						Daphnia pulex						Bosmina
Month	Sample Size	0.00-0.49	0.50-0.99	1.00-1.49	1.50-1.99	2.00-2.49	Mean	0.00-0.49	0.50-0.99	1.00-1.49	1.50-1.99	2.00-2.49	Mean	Mean
						Emery Area								
May	6	0.0	42.9	50.0	7.1	0.0	1.03	0.0	40.0	60.0	0.0	0.0	0.71	0.43
June	6	0.0	87.0	13.0	0.0	0.0	0.76	0.0	43.3	53.3	3.4	0.0	1.09	0.35
July	6	0.0	45.0	42.5	12.5	0.0	1.10	0.0	33.6	55.5	10.9	0.0	1.11	0.49
August	6	0.0	35.6	38.2	23.6	2.6	1.21	0.0	25.9	50.6	23.5	0.0	1.20	0.39
September	5	0.0	45.4	29.6	25.0	0.0	1.13	0.0	26.0	48.8	19.2	6.0	1.22	0.39
October	6	0.0	57.5	22.5	17.5	2.5	0.91	0.0	29.0	42.0	27.0	2.0	1.22	0.38
November	3	0.0	50.0	45.0	5.0	0.0	1.03	0.0	22.0	50.0	24.0	4.0	1.23	0.41
Year	38	0.0	52.2	33.7	13.3	0.8	1.02	0.0	31.2	50.1	14.7	1.0	1.10	0.40
						Murray Area								
May	9	0.0	53.6	46.4	0.0	0.0	0.65	0.0	0.0	0.0	100.0	0.0	1.43	0.42
June	12	0.0	87.2	12.8	0.0	0.0	0.74	0.0	37.3	58.3	4.4	0.0	0.75	0.36
July	15	0.0	65.2	27.2	7.6	0.0	0.93	0.0	23.9	35.8	38.0	2.3	1.25	0.32
August	12	0.0	41.8	33.0	23.2	2.0	1.19	0.0	16.6	24.5	53.5	5.4	1.51	0.39
September	12	0.0	45.0	42.5	10.0	2.5	1.08	0.0	9.5	38.5	35.0	17.0	1.53	0.40
October	15	0.0	60.6	31.4	8.0	0.0	0.96	0.0	20.4	23.6	25.2	30.4	1.53	0.37
November	6	0.0	48.5	40.0	11.5	0.0	1.06	0.0	19.0	34.0	19.0	28.0	1.46	0.37
Year	81	0.0	57.3	30.9	8.6	0.7	0.95	0.0	17.2	28.3	29.0	11.5	1.23	0.37
						Sullivan Area								
May	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	1.29	0.44
June	6	0.0	97.0	3.0	0.0	0.0	0.63	0.0	44.0	44.0	12.0	0.0	1.09	0.37
July	7	0.0	50.7	46.4	2.9	0.0	0.97	0.0	31.0	40.9	28.1	0.0	1.25	0.37
August	6	2.5	27.5	55.0	12.5	2.5	1.13	0.0	19.1	20.3	40.3	20.3	1.58	0.34
September	6	0.0	41.5	40.0	18.5	0.0	1.14	0.0	5.0	42.0	29.0	25.0	1.60	0.35
October	6	0.0	70.0	27.5	2.5	0.0	0.94	0.0	27.0	31.0	36.0	6.00	1.32	0.35
November	2	0.0	0.0	0.0	0.0	0.0	0.00	0.0	0.0	0.0	0.0	0.0	0.00	0.00
Year	37	0.4	45.2	29.1	5.9	0.4	0.80	0.0	16.5	28.0	23.1	8.3	1.36	0.26
						All Areas Combined								
May	19	0.0	48.6	48.1	3.3	0.0	0.63	0.0	25.0	50.0	25.0	0.0	1.14	0.43
June	24	0.0	89.3	10.7	0.0	0.0	0.72	0.0	40.3	54.7	5.0	0.0	0.98	0.36
July	28	0.0	57.2	35.3	7.5	0.0	0.98	0.0	27.7	41.3	30.2	1.0	1.22	0.37
August	24	0.6	36.7	39.8	20.6	2.3	1.18	0.0	19.5	30.0	42.7	7.8	1.45	0.37
September	23	0.0	44.2	39.0	15.5	1.3	1.11	0.0	11.9	41.7	30.0	16.7	1.48	0.39
October	27	0.0	62.0	28.6	8.9	0.5	0.94	0.0	23.8	29.3	28.0	18.7	1.42	0.37
November	11	0.0	49.0	41.7	9.3	0.0	0.86	0.0	20.0	39.3	20.7	20.0	1.35	0.31
Year	156	0.1	56.5	33.0	9.7	0.7	0.93	0.0	23.6	38.7	27.8	9.5	1.23	0.35

Appendix B4. Zooplankton densities ($N \cdot M^{-3}$) estimated from Schindler Trap samples taken from Emery Area of Hungry Horse Reservoir 1985.

TAXON	June	July	October	November	Mean	Standard Deviation
One Meter						
Daphnia	667	2000	117	1083	967	794
Bosmina	0	1500	100	164	442	709
Diaptomus	4333	6600	600	1050	3146	2841
Cyclops	8667	4700	1217	1217	3950	3547
Epischura	0	0	0	0	0	0
Three Meters						
Daphnia	2333	3917	3483	1267	2750	1193
Bosmina	1000	12167	250	200	3404	5853
Diaptomus	5667	25833	2900	1733	9033	11320
Cyclops	16333	10583	4733	1550	8300	6533
Epischura	0	0	0	0	0	0
six Meters						
Daphnia	2083	7583	6250	1483	4350	3023
Bosmina	0	42350	500	183	10750	21060
Diaptomus	7917	23567	4500	1283	9317	9079
Cyclops	16250	17967	6500	1750	10610	7774
Epischura	0	0	0	0	0	0
Nine Meters						
Daphnia	3750	9867	7750	1167	5634	3911
Bosmina	417	26800	500	167	6971	13220
Diaptomus	4167	1467	4750	1117	5375	4362
Cyclops	13750	18133	8000	1900	10440	7048
Epischura	0	0	0	0	0	0
Twelve Meters						
Daphnia	417	8392	7750	817	4344	4315
Bosmina	417	19233	500	183	5083	9434
Diaptomus	4167	9317	3750	917	4538	3498
Cyclops	12917	19108	8250	1833	10520	7306
Epischura	0	0	0	0	0	0
Fifteen Meters						
Daphnia	467	6917	6250	900	3634	3422
Bosmina	267	11667	500	117	3138	5688
Diaptormus	2133	7167	4000	667	3492	2804
Cyclops	3000	20083	9500	1367	8487	8491
Epischura	0	0	0	0	0	0
Twenty Meters						
Daphnia	0	2333	7000	583	2479	3173
Bosmina	0	6800	1250	150	2050	3215
Diaptomus	2333	5800	4750	483	3341	2396
Cyclops	4333	8133	10750	917	6033	4310
Epischura	0	0	0	0	0	0
Twenty-Five Meters						
Daphnia	583	1600	2750	93	1466	954
Bosmina	150	5667	250	200	1567	2734
Diaptomus	533	3867	300	417	1279	1728
Cyclops	2583	4400	8000	1533	4129	2839
Epischura	0	0	0	0	0	0
Thirty Meters						
Daphnia	133	1150	7750	483	2379	3605
Bosmina	50	4050	1000	150	1312	1874
Diaptomus	1433	3350	5750	900	2858	2196
Cyclops	1983	4200	12250	283	4679	5296
Epischura	0	0	0	0	0	0

Appendix B4. Continued, Murray Area, 1985

TAXON	June	July	October	November	Mean	Standard Deviation
			One Meter			
Daphnia	1917		383	633	871	705
Bosmina	500	50	317	133	250	201
Diaptomus	18416	750	750	650	5141	8850
Cyclops	12833	1700	2117	1500	4538	5536
Epischura	0	0	0	17	4	8
			Three Meters			
Daphnia	2417	3033	6250	1800	3375	1982
Bosmina	1167	2383	500	200	1062	969
Diaptomus	19333	2933	4000	700	6741	8506
Cyclops	16417	5150	7000	817	7346	6579
Epischura	0	50	17	33	25	21
			Six Meters			
Daphnia	916	6500	7500	2750	4416	3103
Bosmina	1417	12500	500	367	3696	5868
Diaptomus	5167	9000	3750	2317	5059	2874
Cyclops	11250	12000	7000	1767	6004	4705
Epischura	0	0	17	0	4	8
			Nine Meters			
Daphnia	1250	12500	7250	2600	5900	5096
Bosmina	0	15417	500	417	4084	7559
Diaptomus	13250	6667	4250	1833	6500	4914
Cyclops	8917	13333	10500	1533	8571	5035
Epischura	0	0	0	0	0	0
			Twelve Meters			
Daphnia	17	7416	7333	3483	4562	3542
Bosmina	150	9375	333	283	2535	4560
Diaptomus	2267	6167	4000	1683	3529	2015
Cyclops	1383	8333	7667	1767	4788	3723
Epischura	0	0	0	0	0	0
			Fifteen Meters			
Diphnia	917	2333	5750	2417	2854	2049
Bosmina	750	3333	500	233	1204	1435
Diaptomus	8333	5667	2750	2083	4708	2874
Cyclops	8167	3333	9000	1867	5592	3522
Epischura	0	0	0	0	0	0
			Twenty Meters			
Daphnia	150	2667	3750	3000	2392	1562
Bosmina	233	1667	250	550	675	677
Diaptomus	1750	2667	3000	3067	2621	606
Cyclops	1800	5000	6000	2533	3833	1990
Epischura	0	17	0	0	4	8
			Twenty-Five Meters			
Daphnia	1000	1750	300	2883	1483	1105
Bosmina	233	2000	83	733	762	871
Diaptomus	1700	2750	300	2633	1846	1133
Cyclops	1667	3500	10250	1683	4275	4075
Epischura	0	0	0	0	0	0
			Thirty Meters			
Daphnia	383	2000	2750	2833	1992	1136
Bosmina	317	2250	250	433	812	961
Diaptomus	2867	1750	200	2500	1829	1181
Cyclops	2000	4000	4500	2267	3192	1244
Epischura	0	17	0	0	4	8

Appendix B4. Continued, Sullivan Area, 1985.

TAXON	May	June	July	October	November	Mean	Standard Deviation
One Meter							
Daphnia	0	383	1000	0	367	350	409
Bosmina	0	17	1000	0	50	213	440
Diaptomus	0	1567	8667	100	1583	2383	3595
Cyclops	0	3967	1500	633	1050	1430	1522
Epischura	0	0	650	0	0	130	290
Three Meters							
Daphnia	0	417	1250	517	2900	1017	1145
Bosmina	36	50	5000	0	533	1124	2178
Diaptomus	36	5850	6500	950	5333	3734	3005
Cyclops	391	2333	1250	3800	4633	2481	1752
Epischura	18	33	67	0	17	27	25
Six Meters							
Daphnia	0	267	5500	2717	3500	2397	2304
Bosmina	0	33	5750	33	2750	1713	2547
Diaptomus	36	5817	6250	1133	3500	3347	2758
Cyclops	89	1783	3250	5183	13250	4711	5129
Epischura	18	17	67	17	17	27	22
Nine Meters							
Daphnia	18	150	4000	4750	8500	3484	3541
Bosmina	0	33	8333	0	2250	2123	3604
Diaptomus	36	2867	4000	7500	2250	3331	2742
Cyclops	125	1517	3000	2250	15500	4478	6252
Epischura	0	0	50	0	17	13	22
Twelve Meters							
Daphnia	0	0	500	5250	7750	2700	3586
Bosmina	0	0	2500	250	1500	800	
Diaptomus	0	0	2250	9250	2500	2800	3797
Cyclops	302	0	1000	2250	9500	2610	3948
Epiachura	36	0	33	0	17	17	17
Fifteen Meters							
Daphnia	0	0	750	5500	9667	3183	4289
Bosmina	0	0	1500	250	1333	617	740
Diaptomus	0	0	1500	9500	4333	3067	4008
Cyclops	125	0	750	2250	16000	3825	6865
Epischura	36	0	0	0	33	14	19
Twenty Meters							
Daphnia	0	0	250	2500	1467	843	1108
Bosmina	0	0	967	100	717	357	454
Diaptomus	0	0	433	6000	1167	1520	2549
Cyclops	0	0	433	750	6450	1527	2770
Epischura	0	0	0	0	17	3	8
Twenty-Five Meters							
Daphnia	0	0	133	0	1433	313	629
Bosmina	0	0		0	833	213	361
Diaptomus	0	0	250	0	950	240	411
Cyclops	0	0	267	0	9100	1873	4041
Epischura	0	0	0	0	0	0	0
Thirty Meters							
Daphnia	0	0	167	0	0	33	75
Bosmina	0	0	733	0	0	147	328
Diaptomus	0	0	550	0	0	110	246
Cyclops	0	0	367	0	0	73	164
Epischura	0	0	0	0	0	0	0

Appendix B4. Continud, Areas Combined, 1985

TAXON	May	June	July	October	November	Mean	Standard Deviation
				One Meter			
Daphnia	0	989	1183	167	694	700	650
Bosmina	0	172	856	139	117	250	459
Diaptomus	0	8105	5339	483	1094	3467	5231
cyciops	0	8489	2633	1322	1256	3162	3697
Epischura	0	0	217	0	6	51	180
				Three Meters			
Daphnia	0	1722	2733	3417	1989	2276	1707
Bosmina	36	739	6517	250	311	1807	3407
Diaptomus	36	10280	11750	2617	2589	6290	7644
Cyclops	391	11690	5661	5178	2333	5768	5475
Epischura	18	11	39	6	17	18	22
				Six Meters			
Daphnia	0	1089	6528	5489	2578	3619	2734
Bosmina	0	483	20200	344	1100	5106	11740
Diaptomus	36	6300	12930	3128	2367	5711	5983
Cyclops	89	9761	11070	6228	5589	7541	5998
Epischura	18	6	22	11	6	12	19
				Nine Meters			
Daphnia	18	150	8789	6583	4089	4889	3981
Bosmina	0	33	16850	333	945	4218	8165
Diaptomus	36	2867	7378	5500	1733	4935	3906
Cyclops	125	1517	11480	6917	6311	7574	6234
Epischura	0	0	17	0	6	5	14
				Twelve Meters			
Daphnia	0	145	5436	6778	4017	3779	3588
Bosmina	0	189	10280	361	655	2652	5586
Diaptomus	0	2145	5911	5667	1700	3559	3072
Cyclops	302	4767	9480	6056	4367	5716	5833
Epischura	36	0	11	0	6	7	13
				Fifteen Meters			
Daphnia	0	461	3333	5833	4328	3221	3196
Bosmina	0	339	5500	417	561	1573	3167
Diaptomus	0	3489	4770	5417	2361	3703	3147
Cyclops	125	3722	8055	6917	6411	5803	6394
Epischura	36	0	0	0	11	5	13
				Twenty Meters			
Daphnia	0	50	1750	4417	1683	1823	2046
Bosmina	0	78	3145	533	472	976	1828
Diaptomus	0	1361	2967	4583	1572	2419	2080
Cyclops	0	2044	4522	5833	3300	3623	3460
Epischura	0	0	6	0	6	3	6
				Twenty-Five Meters			
Daphnia	0	528	1161	1017	1750	1028	1005
Bosmina		128	2633	111	589	799	1562
Diaptomus	i	744	2289	200	1333	1054	1275
Cyclops	0	1417	2722	6083	4105	3306	3606
Epischura	0	0	0	0	0	0	0
				Thirty Meters			
Daphnia	0	172	1106	3500	1105	1358	2188
Bosmina	0	122	2344	417	194	710	1184
Diaptomus	0	1433	1884	1903	1133	1485	1741
Cyclops	0	1328	2856	5583	850	2450	3406
Epischura	0	0	6	0	0	1	5

Appendix B5. Zooplankton densities ($N \cdot M^{-3}$) estimated from Schindler Trap samples taken from Emery Area of Hungry Horse Reservoir 1986.

TAXON	May	June	July	August	September	October	November	December	Year
					One Meter				
Daphnia	767	17	850	17	4500	2000	83	0	1029
Bosmina	67	0	383	150	2500	500	33	0	454
Diaptomus	6500	300	6450	466	4500	333	2000	0	2569
Cyclops	4500	100	767	300	5000	12500	7500	0	3833
Epischura	0	0	0	17	150	33	17	0	27
					Three Meters				
Daphnia	800	200	3000	1500	4000	5500	1500	0	2062
Bosmina	100	17	167	2000	2000	83	0	0	546
Diaptomus	8500	26500	16500	3500	5500	7000	1500	0	8625
Cyclops	4000	5000	1500	15000	7000	9500	8500	0	6312
Epischura	0	233	0	0	67	0	0	0	37
					Six Meters				
Daphnia	1017	6000	1983	2500	4000	5500	1500	0	2812
Bosmina	150	67	450	2500	1000	500	83	0	594
Diaptomus	9500	11000	5067	1500	3300	3500	2000	0	4483
Cyclops	8000	2000	850	12000	6000	9000	9000	0	5856
Epischura	0	133	33	117	17	17	0	0	40
					Nine Meters				
Daphnia	883	11000	7000	1500	3500	11000	1500	0	4548
Epischura	117	183	5500	500	3000	1000	333	0	1329
Diaptomus	14500	13500	7000	167	2500	2500	1000	0	5146
Cyclops	6500	4500	4000	8500	8500	20000	11000	0	7875
Epischura	0	83	0	0	17	0	33	0	17
					Twelve Meters				
Daphnia	383	10000	7000	4000	2500	5500	1500	0	3860
Bosmina	150	1500	2500	10000	1500	1000	500	0	2144
Diaptomus	11000	11500	5500	500	2500	3000	2000	0	4500
Cyclops	4500	9500	4500	11500	12000	19000	7500	0	8562
Epischura	0	0	0	100	50	0	0	0	19
					Fifteen Meters				
Daphnia	167	8000	12500	5500	1500	1000	1500	0	3771
Bosmina	83	1500	1500	15500	2500	500	500	0	2760
Diaptomus	4000	13000	4000	333	1000	500	2000	0	3104
Cyclops	2500	5000	3500	19000	10500	11000	10500	0	7750
Epischura	0	0	0	0	33	0	0	0	4
					Twenty Meters				
Daphnia	167	3000	8000	4500	1500	1000	1500	500	2521
Bosmina	17	1000	1000	6000	3500	1000	1000	83	1700
Diaptomus	1733	9000	5500	333	2000	1500	2000	2500	3071
Cyclops	1217	4500	1500	5000	5500	12500	8500	5000	5465
Epischura	0	0	0	0	17	0	0	17	4
					Twenty-Five Meters				
Daphnia	117	2500	6000	4000	2000	1500	1000	1000	2265
Bosmina	50	17	500	5500	4000	500	333	0	1362
Diaptomus	1817	9500	5500	500	2000	333	2000	4500	3269
Cyclops	1000	2000	2000	5000	6000	9500	10000	5500	5125
Epischura	0	33	0	167	0	0	0	0	25
					Thirty Meters				
Daphnia	133	1000	2000	1500	1500	1000	1000	1500	1204
Bosmina	17	167	333	5500	2000	0	83	0	1012
Diaptomus	1383	5000	4000	167	2000	1000	1000	9000	2944
Cyclops	783	1500	1500	5000	2000	6500	6000	6000	3660
Epischura	0	0	0	167	0	0	0	0	21

Appendix B5. Continued, Murray Area, 1986.

TAXON	April	May	June	July	August	September	October	November	December	Year
					One Meter					
Daphnia	117	200	50	1000	267	117	167	217	700	315
Bosmina	0	17	0	0	2200	17	0	67	33	259
Diaptomus	117	2367	433	42000	700	17	2000	983	2850	5719
Cyclops	550	1083	50	1500	3133	150	3000	1233	1017	1302
Epischura	0	0	0	0	133	0	117	0	0	28
					Three Meters					
Daphnia	83	667	167	3500	3100	3500	3500	1500	1000	1891
Bosmina	17	0	83	1000	4900	1000	0	0	83	787
Diaptomus	3533	8500	3833	38000	1233	3500	7000	4000	3000	8067
Cyclops	1683	5500	1067	2000	8433	4500	12500	5500	3000	4909
Epischura	0	0	217	33	33	0	17	0	0	33
					Six Meters					
Daphnia	467	817	833	3000	1883	3500	6500	1000	467	2052
Bosmina	17	50	300	3500	1183	2000	500	167	67	865
Diaptomus	4817	10500	8867	26000	117	2500	7000	1500	2117	7046
Cyclops	1750	6500	2867	4000	3083	6000	7000	3500	1700	4044
Epischura	0	0	600	117	33	0	33	0	50	93
					Nine Meters					
Daphnia	400	433	283	6000	3167	4500	4500	1500	767	2394
Bosmina	0	83	50	2500	1467	1500	333	167	17	680
Diaptomus	6000	15000	1683	15500	300	3500	4000	2500	2533	5668
Cyclops	1067	6500	850	5500	4067	4500	9500	5500	2117	4400
Epischura	0	0	183	50	0	33	0	0	0	30
					Twelve Meters					
Daphnia	500	150	150	4000	6000	3000	5500	1000	750	2339
Bosmina	50	100	50	183	7000	2000	500	333	33	1139
Diaptomus	6000	6500	1717	6500	1500	5000	4000	2000	2600	3980
Cyclops	1433	3500	383	3000	9500	6000	11500	5000	3017	4815
Epischura	0	0	100	0	33	67	0	0	0	22
					Fifteen Meters					
Daphnia	200	67	183	5500	3500	1000	2000	500	633	1509
Bosmina	17	67	17	83	10000	2000	500	500	33	1469
Diaptomus	2633	2100	1867	7500	1500	1500	2000	1500	1983	2509
Cyclops	1817	1100	383	3000	8500	5000	8500	7000	2267	4174
Epischura	0	0	17	0	50	17	0	0	17	11
					Twenty Meters					
Daphnia	83	33	100	1500	5000	1500	1500	1000	550	1252
Bosmina	17	0	17	333	8000	4000	167	167	67	1419
Diaptomus	1500	2833	1583	5000	1000	1500	1500	2000	2867	2198
Cyclops	683	917	317	2000	6000	4500	4000	5500	1783	2856
Epischura	0	0	0	0	17	50	0	0	0	7
					Twenty-Five Meters					
Daphnia	100	33	17	417	1233	1000	1500	317	467	565
Bosmina	33	0	17	250	4200	2000	500	50	0	783
Diaptomus	1350	2233	1517	4500	350	250	1500	883	1650	1581
Cyclops	350	617	317	583	3402	3000	6000	3000	1333	2067
Epischura	0	0	0	0	0	0	0	0	0	0
					Thirty Meters					
Daphnia	33	100	100	333	1600	500	1000	500	483	517
Bosmina	17	67	17	0	6033	1500	100	333	17	898
Diaptomus	1383	2083	1883	4500	600	1000	2000	2500	1450	1933
Cyclops	500	667	233	117	3367	3000	5500	4500	1400	2143
Epischura	0	0	0	0	50	0	33	0	0	9

Appendix B5. Continued, Sullivan Area, 1986.

TAXON	April	May	June	July	August	September	October	November	December	Year
					One Meter					
Daphnia	50	0	33	417	167	433	33	517	1500	350
Bosmina	17	0	0	33	4733	750	0	100	333	663
Diaptomus	5217	250	13500	4383	1783	583	233	1150	23500	5622
Cyclops	1300	167	1500	200	883	2483	350	1117	1500	1056
Epischura	0	0	600	33	0	17	17	0	0	74
					Three Meters					
Daphnia	100	17	183	1500	617	1433	2500	4000	3000	1483
Bosmina	17	0	0	500	1300	1533	167	500	100	457
Diaptomus	11333	50	4767	14000	650	466	4000	8000	34500	8641
Cyclops	4333	0	183	200	267	2167	4000	8500	1000	2294
Epischura	0	0	583	0	67	33	50	0	0	81
					Six Meters					
Daphnia	67	0	50	133	1083	1800	5000	3500	3500	1681
Bosmina	17	0	0	67	2117	1200	1000	500	250	572
Diaptomus	10000	417	2400	1267	717	1067	2000	5000	25500	5374
Cyclops	6000	267	33	33	500	2367	6500	9500	3500	3189
Epischura	0	0	66	0	233	33	17	0	0	39
					Nine Meters					
Daphnia	83	33	83	483	2767	1267	3000	4000	1000	1413
Bosmina	50	17	0	83	4333	733	167	500	333	691
Diaptomus	14000	283	1900	6000	667	400	1000	6500	13000	4861
Cyclops	3800	183	17	400	700	1933	6000	10500	4500	3115
Epischura	0	0	167	0	133	0	17	17	17	39
					Twelve Meters					
Daphnia	33	0	17	1067	1283	633	3000	5500	2500	1559
Bosmina	0	17	17	17	5883	2633	500	1000	83	1128
Diaptomus	2467	433	1417	1800	933	467	1500	8500	9500	3002
Cyclops	500	83	33	283	1033	2600	3500	15500	3500	3004
Epischura	0	0	17	17	67	0	50	0	0	17
					Fifteen Meters					
Daphnia	0	0	0	400	2000	2067	1500	2500	1000	1052
Bosmina	17	0	0	17	11000	3633	1000	0	0	1741
Diaptomus	2067	167	817	1783	667	667	500	4000	8000	2074
Cyclops	333	0	33	50	1167	2600	5000	12000	4000	2798
Epischura	0	0	50	0	17	0	0	0	0	7
					Twenty Meters					
Daphnia	0	0	50	300	2500	0	300	1500	1500	683
Bosmina	0	0	0	33	8000	0	83	333	0	939
Diaptomus	1200	183	1517	1783	917	0	767	2500	6500	1707
Cyclops	433	33	33	167	1083	0	1683	11500	2000	1881
Epischura	0	0	33	0	0	0	0	0	0	4
					Twenty-Five Meters					
Daphnia	17	0	50	233	2500	1367	333	500	1000	667
Bosmina	50	0	0	17	9500	2567	100	167	0	1378
Diaptomus	900	83	2967	1717	3000	667	550	1500	4000	1709
Cyclops	250	33	50	167	2500	1900	1433	7000	3000	1815
Epischura	0	0	17	0	133	0	17	0	0	19
					Thirty Meters					
Daphnia	0	0	33	300	1333	750	367	0	0	309
Bosmina	0	0	0	17	4300	2867	150	0	0	815
Diaptomus	0	0	1167	1367	933	333	500	0	0	478
Cyclops	0	0	17	50	1000	1133	200	0	0	267
Epischura	0	0	33	17	83	0	0	0	0	15

Appendix B6. The number ($N \cdot M^2$) and weight ($G \cdot M^2$) of aquatic macroinvertebrates in benthos samples from Emery, Murray and Sullivan areas of Hungry Horse Reservoir May through November, 1986.

Date	Number of Samples	Mean Depth(m)	Aquatic Dipteran: Larvae No.	Larvae Wt.	Pupae No.	Pupae Wt.	Total No.	Total Wt.	Oligochaeta No.	Oligochaeta Wt.	Other No.	Other Wt.
			Emery Area 1986									
May	3	8.7	50.2	0.038	0.0	0.000	50.2	0.038	0.0	0.000	0.0	0.0
	3	30.5	276.0	0.272	0.0	0.000	276.0	0.272	17.9	0.134	0.0	0.0
	2	43.2	172.0	0.887	0.0	0.000	172.0	0.887	43.0	0.081	0.0	0.0
July	3	4.0	465.9	0.140	0.0	0.000	465.9	0.140	681.0	0.170	0.0	0.0
	3	36.7	584.2	0.796	0.0	0.000	584.2	0.796	326.2	0.314	0.0	0.0
	3	39.2	663.1	0.555	0.0	0.000	663.1	0.555	0.0	0.000	0.0	0.0
August	3	4.0	7.2	0.001	0.0	0.000	7.2	0.001	10.8	0.012	0.0	0.0
	3	33.7	365.6	0.484	0.0	0.000	365.6	0.484	229.4	0.140	0.0	0.0
	2	90.0	145.1	0.922	0.0	0.000	145.1	0.922	365.6	0.397	0.0	0.0
September	1	4.0	43.0	0.047	0.0	0.000	43.0	0.047	0.0	0.000	0.0	0.0
	3	33.3	250.9	0.711	0.0	0.000	250.9	0.711	0.0	0.000	0.0	0.0
	3	90.0	35.9	0.186	0.0	0.000	35.9	0.186	57.3	0.088	0.0	0.0
October	3	9.0	365.6	0.084	0.0	0.000	365.6	0.084	57.4	0.022	0.0	0.0
	3	39.0	1086.0	1.413	0.0	0.000	1086.0	1.413	0.0	0.000	0.0	0.0
	3	72.0	60.9	0.088	0.0	0.000	60.9	0.088	347.7	0.103	0.0	0.0
November	3	11.0	329.7	0.339	0.0	0.000	329.7	0.339	0.0	0.000	0.0	0.0
	3	36.0	584.2	1.670	0.0	0.000	584.2	1.670	35.8	0.019	0.0	0.0
	3	67.3	290.3	0.396	0.0	0.000	290.3	0.396	14.3	0.007	0.0	0.0
Year	16	7.1	231.2	0.116	0.0	0.000	231.2	0.116	140.5	0.038	0.0	0.0
	18	34.9	524.5	0.891	0.0	0.000	524.5	0.891	101.6	0.101	0.0	0.0
	16	67.0	236.6	0.456	0.0	0.000	236.6	0.456	129.7	0.097	0.0	0.0

Appendix B6. Continued, Murray Area, 1986.

Date	Number of Samples	Mean Depth (m)	Aquatic Dipteran Larvae No.	Aquatic Dipteran Larvae Wt.	Aquatic Dipteran Pupae No.	Aquatic Dipteran Pupae Wt.	Aquatic Dipteran Total No.	Aquatic Dipteran Total Wt.	Oligochaeta No.	Oligochaeta Wt.	Other No.	Other Wt.
					Murray Area 1986							
May	2	8.2	59.2	0.055	0.0	0.000	59.2	0.055	0.0	0.000	0.0	0.0
	3	31.0	78.9	0.142	0.0	0.000	78.9	0.142	0.0	0.000	0.0	0.0
	2	93.0	69.9	0.264	0.0	0.000	69.9	0.264	5.4	0.004	0.0	0.0
July	3	3.0	86.0	0.039	7.2	0.001	93.2	0.040	10.7	0.013	0.0	0.0
	3	36.0	448.1	0.122	0.0	0.000	448.1	0.122	93.2	0.016	0.0	0.0
	3	97.0	770.6	0.400	0.0	0.000	770.6	0.400	254.5	0.144	0.0	0.0
August	3	3.0	68.1	0.039	0.0	0.000	68.1	0.039	21.5	0.028	0.0	0.0
	3	31.0	143.4	0.352	0.0	0.000	143.4	0.352	240.1	0.149	0.0	0.0
	2	68.0	414.0	1.065	0.0	0.000	414.0	1.065	284.9	0.162	0.0	0.0
September	1	6.0	139.8	0.051	0.0	0.000	139.8	0.051	0.0	0.000	0.0	0.0
	3	32.7	172.0	0.233	0.0	0.000	172.0	0.233	25.1	0.022	0.0	0.0
	3	76.0	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.0
October	3	9.0	258.1	0.199	0.0	0.000	258.1	0.199	0.0	0.000	0.0	0.0
	3	35.0	301.1	0.237	0.0	0.000	301.1	0.237	0.0	0.000	0.0	0.0
	3	88.0	89.6	0.086	0.0	0.000	89.6	0.086	60.9	0.011	0.0	0.0
November	3	11.0	132.6	0.091	0.0	0.000	132.6	0.091	0.0	0.000	0.0	0.0
	3	34.0	304.7	0.467	0.0	0.000	304.7	0.467	0.0	0.000	0.0	0.0
	3	95.0	50.2	0.079	0.0	0.000	50.2	0.079	315.4	0.137	0.0	0.0
Year	15	6.7	126.2	0.084	1.4	0.001	127.6	0.085	6.5	0.008	0.0	0.0
	18	33.3	241.3	0.259	0.0	0.000	241.3	0.259	59.7	0.030	0.0	0.0
	16	86.9	231.2	0.272	0.0	0.000	231.2	0.272	154.6	0.076	0.0	0.0

Appendix B6. Continued, Sullivan Area, 1986.

Date	Number of Samples	Mean Depth(m)	Aquatic Dipteran Larvae No.	Aquatic Dipteran Larvae Wt.	Aquatic Dipteran Pupae No.	Aquatic Dipteran Pupae Wt.	Aquatic Dipteran Total No.	Aquatic Dipteran Total Wt.	Oligochaeta No.	Oligochaeta Wt.	Other No.	Other Wt.
						Sullivan Area 1986						
May	2	8.0	10.8	0.024	0.0	0.000	10.8	0.0235	16.2	0.006	0.0	0.0
	3	36.0	218.6	0.267	0.0	0.000	218.6	0.267	0.0	0.000	0.0	0.0
July	3	3.0	39.5	0.038	0.0	0.000	39.5	0.038	7.2	0.016	0.0	0.0
	3	38.0	530.5	0.650	0.0	0.000	530.5	0.650	501.8	0.184	0.0	0.0
August	3	4.0	46.6	0.016	3.6	0.010	50.2	0.026	25.1	0.034	0.0	0.0
	3	39.0	494.6	3.174	0.0	0.000	494.6	3.174	659.5	0.479	0.0	0.0
September	3	5.7	121.9	0.034	0.0	0.000	121.9	0.034	3.6	0.015	0.0	0.0
	2	37.0	172.0	0.368	0.0	0.000	172.0	0.368	0.0	0.000	0.0	0.0
October	3	9.0	340.5	0.2803	0.0	0.000	340.5	0.2803	53.7	0.061	0.0	0.0
	3	38.0	336.9	0.760	0.0	0.000	336.9	0.760	394.3	0.254	0.0	0.0
November	3	11.3	64.5	0.096	0.0	0.000	64.5	0.096	17.9	0.015	0.0	0.0
	3	38.0	336.9	0.606	0.0	0.000	336.9	0.606	394.3	0.091	0.0	0.0
Year	17	6.8	109.4	0.085	0.6	0.002	110.1	0.087	20.9	0.026	0.0	0.0
	17	34.8	502.8	0.776	0.0	0.000	502.8	0.776	107.5	0.107	0.0	0.0

Appendix B6. Continued, Areas Combined, 1986.

Date	Number of Samples	Mean Depth (m)	Aquatic Dipteran: Larvae No.	Larvae Wt.	Pupae No.	Pupae Wt.	Total No.	Total Wt.	Oligochaeta No.	Oligochaeta Wt.	Other No.	Other Wt.
Areas Combined 1986												
May	7	8.4	41.5	0.038	0.0	0.000	41.5	0.038	4.6	0.002	0.0	0.0
	9	32.5	191.2	0.227	0.0	0.000	191.2	0.227	5.98	0.045	0.0	0.0
	4	68.1	121.0	0.575	0.0	0.000	121.0	0.575	24.2	0.043	0.0	0.0
July	9	3.3	197.1	0.073	2.4	0.001	199.5	0.0727	233.0	0.066	0.0	0.0
	9	36.9	520.9	0.522	0.0	0.000	520.9	0.522	307.1	0.171	0.0	0.0
	6	68.1	716.8	0.478	0.0	0.000	716.8	0.478	127.3	0.072	0.0	0.0
August	9	3.7	40.6	0.019	1.2	0.003	41.8	0.022	19.1	0.025	0.0	0.0
	9	34.6	334.5	0.1337	0.0	0.000	334.5	0.1337	376.3	0.256	0.0	0.0
	4	79.0	279.5	0.994	0.0	0.000	279.5	0.994	325.3	0.279	0.0	0.0
September	5	5.4	109.7	0.040	0.0	0.000	109.7	0.040	2.16	0.009	0.0	0.0
	8	34.0	201.6	0.446	0.0	0.000	201.6	0.446	9.41	0.008	0.0	0.0
	6	83.0	17.9	0.093	0.0	0.000	17.9	0.093	28.7	0.044	0.0	0.0
October	9	9.0	321.4	0.188	0.0	0.000	321.4	0.188	37.0	0.028	0.0	0.0
	9	37.3	574.7	0.803	0.0	0.000	574.7	0.803	131.4	0.085	0.0	0.0
	6	80.0	75.3	0.087	0.0	0.000	75.3	0.087	204.3	0.057	0.0	0.0
November	9	11.1	175.6	0.175	0.0	0.000	175.6	0.175	5.98	0.005	0.0	0.0
	9	36.0	408.6	0.914	0.0	0.000	408.6	0.914	143.4	0.037	0.0	0.0
	6	81.2	170.2	0.238	0.0	0.000	170.2	0.238	164.9	0.072	0.0	0.0
Year	48	6.9	155.2	0.095	0.7	0.001	155.9 (194.0)	0.096 (0.127)	56.2	0.024	0.0	0.0
	53	35.2	375.1	0.713	0.0	0.000	375.1 (273.7)	0.713 (0.844)	165.1	0.102	0.0	0.0
	32	76.9	233.9	0.364	0.0	0.000	233.9 (334.0)	0.364 (0.424)	142.1	0.086	0.0	0.0

Appendix B7. The mean number and weight (g) of surface insects captured per hectare from Hungry Horse Reservoir in the Emery, Murray and Sullivan areas May–November, 1986. Samples were taken nearshore (<100 m) and offshore (>100 m). Number of samples is given in parentheses.

		Areas															
		Emery				Murray				Sullivan				Areas Combined			
		Nearshore		Offshore		Nearshore		Offshore		Nearshore		Offshore		Nearshore		Offshore	
Month (N)	Insect Group	Number	Weight	Number	Weight	Number	Weight	Number	Weight	Number	Weight	Number	Weight	Number	Weight	Number	Weight
May (26)	Coleopterans	35.9	0.31	62.5	0.48	68.4	1.30	55.6	0.90	29.6	0.74	22.2	0.46	46.2	0.84	46.2	0.62
	Hemipterans	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00
	Homopterans	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00
	Hymenopterans	14.3	0.01	16.8	0.66	21.6	0.56	9.3	0.12	5.6	<0.01	5.6	0.04	14.1	0.22	10.3	0.26
	Other	0.0	0.00	4.1	0.01	1.7	0.02	1.9	0.02	0.0	0.00	0.0	0.00	0.6	0.01	1.9	0.01
	Total																
	Terrestrials	50.0	0.32	83.4	1.15	91.6	1.87	66.6	1.04	35.1	0.74	27.8	0.50	60.8	1.06	58.3	0.88
	Aquatic																
	Dipterans	216.7	0.49	133.4	0.35	190.1	0.46	127.8	0.33	172.4	0.50	129.4	0.61	191.2	0.48	130.1	0.43
	Other Aquatics	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	1.9	0.04	0.0	0.00	0.6	0.01	0.0	0.00
	Total Aquatics	216.7	0.49	133.4	0.35	190.1	0.46	127.8	0.33	174.2	0.54	129.4	0.61	19.8	0.05	130.1	0.43
	TOTAL INSECTS	266.7	0.81	216.6	1.50	281.6	2.33	194.6	1.37	209.2	1.28	157.2	1.11	252.5	1.56	188.4	1.32

		Areas															
		Emery				Murray				Sullivan				Areas Combined			
		Nearshore		Offshore		Nearshore		Offshore		Nearshore		Offshore		Nearshore		Offshore	
Month (N)	Insect Group	Number	Weight	Number	Weight	Number	Weight	Number	Weight	Number	Weight	Number	Weight	Number	Weight	Number	Weight
June (19)	Coleopterans	41.7	0.35	47.2	0.29	14.3	0.14	23.0	0.82	13.8	0.40	30.5	0.17	22.8	0.29	34.2	0.40
	Hemipterans	2.8	<0.01	36.2	0.42	4.9	0.01	3.4	0.08	14.0	0.12	2.8	0.06	7.1	0.04	14.8	0.19
	Homopterans	0.0	0.00	5.5	0.01	0.0	0.00	0.0	0.02	0.0	0.00	8.3	0.01	0.0	0.00	4.9	0.01
	Hymenopterans	2.8	0.03	11.2	0.07	4.9	0.11	6.8	0.00	0.0	0.00	2.8	0.02	2.7	0.05	6.9	0.04
	Other	5.7	0.06	14.0	0.04	0.0	0.00	3.4	0.24	8.3	0.02	11.2	0.03	4.4	0.02	9.9	0.09
	Total																
	Terrestrials	52.7	0.45	114.2	0.83	23.9	0.26	36.6	1.16	36.2	0.53	55.5	0.29	36.8	0.40	70.6	0.74
	Aquatic																
	Dipterans	258.7	0.39	841.8	0.67	307.1	0.68	220.0	0.44	1408.0	1.21	514.0	0.95	639.6	0.75	543.2	0.70
	Other Aquatics	0.0	0.00	2.8	0.01	0.0	0.00	3.4	<0.01	2.8	0.05	0.0	0.00	0.9	0.01	2.0	0.01
	Total Aquatics	258.7	0.39	844.7	0.68	307.1	0.68	223.4	0.44	1411.0	1.25	514.0	0.95	640.5	0.77	545.2	0.71
	TOTAL INSECTS	311.2	0.84	958.9	1.51	331.0	0.94	260.0	1.60	1447.0	1.78	569.5	1.24	677.3	1.17	615.6	1.44

Appendix B7. Continued, July and August, 1986.

Month (N)	Insect Group	Areas												Areas Combined			
		Emery				Murray				Sullivan							
		Nearshore		Offshore		Nearshore		Offshore		Nearshore		Offshore		Nearshore		Offshore	
		Number	Weight	Number	Weight	Number	Weight	Number	Weight	Number	Weight	Number	Weight	Number	Weight	Number	Weight
July (18)	Coleopterans	0.0	0.00	0.0	0.00	8.3	0.02	0.0	0.00	2.8	0.01	25.0	0.15	3.7	0.01	8.3	0.05
	Hemipterans	11.0	0.05	10.0	0.04	0.0	0.00	2.4	0.01	5.7	0.03	0.0	0.00	5.6	0.03	3.7	0.01
	Homopterans	1720.0	1.36	1893.0	0.74	322.2	0.11	183.3	0.11	397.2	0.18	944.5	0.53	812.9	0.55	912.1	0.42
	Hymenopterans	330.5	0.92	470.0	1.49	41.7	0.18	19.0	0.06	44.5	0.19	144.5	0.46	138.9	0.43	186.1	0.59
	Other	2.8	0.01	0.0	0.00	0.0	0.00	0.0	0.00	5.7	0.01	2.8	0.02	2.8	0.01	0.9	0.01
	Total Terrestrials	2064.0	2.35	2373.0	2.27	372.2	0.30	204.9	0.17	455.5	0.42	1117.0	1.16	963.9	1.02	1111.0	1.08
	Aquatic Dipterans	13.8	0.02	20.0	0.01	22.3	0.05	23.9	0.05	47.0	0.05	50.0	0.11	27.7	0.04	31.5	0.06
	Other Aquatics	41.7	0.08	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	13.9	0.03	0.0	0.00
	Total Aquatics	55.7	0.09	20.0	0.01	22.3	0.05	23.9	0.05	47.0	0.05	50.0	0.11	41.7	0.07	31.5	0.06
	TOTAL INSECTS	2120.0	2.44	2393.0	2.28	394.3	0.36	228.7	0.22	502.7	0.47	1167.0	1.27	1006.0	1.09	1143.0	1.14

Month (N)	Insect Group	Areas												Areas Combined			
		Emery				Murray				Sullivan							
		Nearshore		Offshore		Nearshore		Offshore		Nearshore		Offshore		Nearshore		Offshore	
		Number	Weight	Number	Weight	Number	Weight	Number	Weight	Number	Weight	Number	Weight	Number	Weight	Number	Weight
Aug. (18)	Coleopterans	11.3	0.24	3.4	0.02	8.3	0.12	7.1	0.06	0.0	0.00	0.0	0.00	6.6	0.12	3.9	0.03
	Hemipterans	0.0	0.00	6.8	0.04	0.0	0.00	2.4	0.01	2.8	0.01	0.0	0.00	0.9	<0.01	3.0	0.01
	Homopterans	11.2	0.03	3.4	0.04	2.8	0.01	359.6	0.12	2.8	<0.01	3.4	0.03	5.6	0.01	150.1	0.06
	Hymenopterans	744.5	1.38	926.6	1.14	172.2	0.82	152.3	0.14	39.2	0.28	13.4	0.08	318.6	0.83	339.2	0.42
	Other	0.0	0.00	3.4	0.01	0.0	0.00	2.4	<0.01	0.0	0.00	0.0	0.00	0.0	0.00	2.0	0.01
	Total Terrestrials	766.7	1.64	943.4	1.21	183.3	0.95	523.9	0.33	44.7	0.29	16.8	0.10	331.6	0.96	498.1	0.52
	Aquatic Dipterans	25.0	0.05	10.0	0.01	5.7	0.02	23.9	0.03	13.8	0.01	16.6	0.02	14.8	0.03	17.6	0.02
	Other Aquatics	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00
	Total Aquatics	25.0	0.05	10.0	0.01	5.7	0.02	23.9	0.03	13.8	0.01	16.6	0.02	14.8	0.03	17.6	0.02
	TOTAL INSECTS	791.5	1.69	953.4	1.22	188.7	0.97	547.7	0.35	58.7	0.30	33.2	0.12	346.3	0.99	515.7	0.54

Appendix B7. Continued, September and October, 1986.

		Areas															
		Emery				Murray				Sullivan				Areas Combined			
		Nearshore		Offshore		Nearshore		Offshore		Nearshore		Offshore		Nearshore		Offshore	
Month (N)	Insect Group	Number	Weight	Number	Weight	Number	Weight	Number	Weight	Number	Weight	Number	Weight	Number	Weight	Number	Weight
Sept. (16)	Coleopterans	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00
	Hemipterans	3.4	<0.01	0.0	0.00	3.4	<0.01	0.0	0.00	0.0	0.00	0.0	0.00	2.1	<0.01	0.0	0.00
	Homopterans	3.4	<0.01	0.0	0.00	0.0	0.00	16.8	0.01	5.7	<0.01	2.4	<0.01	3.2	0.01	7.2	<0.01
	Hymenopterans	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00
	Other	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	2.4	0.02	0.0	0.00	0.81	0.01
	Total Terrestrials	6.8	0.01	0.0	0.00	3.4	<0.01	16.8	0.01	5.6	0.00	4.8	0.02	5.3	0.01	8.0	0.01
	Aquatic Dipterans	20.0	0.04	0.0	0.00	40.2	0.03	10.5	0.01	30.5	0.06	33.4	0.07	30.2	0.04	15.1	0.03
	Other Aquatics	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	5.7	0.02	2.4	<0.01	2.1	0.01	0.8	<0.01
	Total Aquatics	20.0	0.04	0.0	0.00	40.2	0.03	10.5	0.01	36.2	0.08	35.7	0.07	32.4	0.05	15.9	0.03
	TOTAL INSECTS	26.6	0.05	0.0	0.00	43.4	0.03	27.1	0.02	41.7	0.09	40.6	0.09	37.5	0.06	23.9	0.04

		Areas															
		Emery				Murray				Sullivan				Areas Combined			
		Nearshore		Offshore		Nearshore		Offshore		Nearshore		Offshore		Nearshore		Offshore	
Month (N)	Insect Group	Number	Weight	Number	Weight	Number	Weight	Number	Weight	Number	Weight	Number	Weight	Number	Weight	Number	Weight
Oct. (18)	Coleopterans	61.9	0.64	20.0	0.34	0.0	0.00	4.7	0.06	0.0	0.00	0.0	0.00	24.1	0.23	7.8	0.12
	Hemipterans	49.9	0.12	10.0	0.14	0.0	0.00	2.4	<0.01	0.0	0.00	0.0	0.00	19.4	0.04	3.9	0.04
	Homopterans	157.1	0.07	30.0	0.04	8.3	0.01	2.4	0.02	0.0	0.00	0.0	0.00	63.9	0.03	9.8	0.02
	Hymenopterans	71.6	0.26	6.8	0.08	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	27.8	0.10	2.0	0.02
	Other	4.9	0.01	6.6	0.01	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	1.9	0.01	1.9	<0.01
	Total Terrestrials	345.3	1.11	73.4	0.61	8.3	0.01	9.6	0.08	0.0	0.00	0.0	0.00	137.1	0.43	25.5	0.21
	Aquatic Dipterans	188.0	0.07	46.8	0.06	8.5	0.02	190.6	0.06	0.0	0.00	10.2	0.01	75.9	0.03	95.2	0.05
	Other Aquatics	0.0	0.00	0.0	0.00	2.8	<0.01	0.0	0.00	3.4	0.01	0.0	0.00	1.9	<0.01	0.0	0.00
	Total Aquatics	188.0	0.07	46.8	0.06	11.3	0.02	190.6	0.06	3.4	0.01	10.2	0.01	77.8	0.04	95.2	0.05
	TOTAL INSECTS	533.4	1.17	120.2	0.67	19.7	0.02	200.0	0.15	3.4	0.01	10.2	0.01	214.9	0.47	120.7	0.26

Appendix B7. Continued, November and December, 1986.

Month (N)	Insect Group	Areas: Emery Nearshore Number	Weight	Emery Offshore Number	Weight	Murray Nearshore Number	Weight	Murray Offshore Number	Weight	Sullivan Nearshore Number	Weight	Sullivan Offshore Number	Weight	Areas Combined Nearshore Number	Weight	Areas Combined Offshore Number	Weight
Nov. (18)	Coleopterans	0.0	0.00	0.0	0.00	5.7	0.03	0.0	0.00	0.0	0.00	0.0	0.00	1.9	0.01	0.0	0.00
	Hemipterans	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00
	Homopterans	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	2.8	<0.01	0.0	0.00	0.9	<0.01
	Hymenopterans	0.0	0.00	0.0	0.00	0.0	0.00	2.4	0.01	0.0	0.00	0.0	0.00	0.0	0.00	0.9	<0.01
	Other	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00
	Total Terrestrials	0.0	0.00	0.0	0.00	5.7	0.03	2.4	0.01	0.0	0.00	2.8	<0.01	1.9	0.01	1.9	<0.01
	Aquatic Dipterans	5.5	0.01	6.6	<0.01	25.0	0.02	47.7	0.02	25.0	0.01	11.2	0.01	18.5	0.01	24.1	0.01
	Other Aquatics	0.0	0.00	0.0	0.00	0.0	0.00	2.4	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.9	0.00
	Total Aquatics	5.5	0.01	6.6	<0.01	25.0	0.02	50.1	0.02	25.0	0.01	11.2	0.01	18.5	0.01	25.1	0.01
	TOTAL INSECTS	5.5	0.01	6.6	<0.01	30.5	0.04	52.6	0.03	25.0	0.01	14.0	0.01	20.3	0.02	26.9	0.02

Month (N)	Insect Group	Areas: Emery Nearshore Number	Weight	Emery Offshore Number	Weight	Murray Nearshore Number	Weight	Murray Offshore Number	Weight	Sullivan Nearshore Number	Weight	Sullivan Offshore Number	Weight	Areas Combined Nearshore Number	Weight	Areas Combined Offshore Number	Weight
Dec. (9)	Coleopterans	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00
	Hemipterans	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00
	Homopterans	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00
	Hymenopterans	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00
	Other	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00
	Total Terrestrials	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00
	Aquatic Dipterans	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00
	Other Aquatics	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00
	Total Aquatics	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00
	TOTAL INSECTS	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00

Appendix B7. Continued, Annual Grand Mean, 1986.

Month (N)	Insect Group	Areas: Emery Nearshore Number	Emery Nearshore Weight	Emery Offshore Number	Emery Offshore Weight	Murray Nearshore Number	Murray Nearshore Weight	Murray Offshore Number	Murray Offshore Weight	Sullivan Nearshore Number	Sullivan Nearshore Weight	Sullivan Offshore Number	Sullivan Offshore Weight	Areas Combined Nearshore Number	Areas Combined Nearshore Weight	Areas Combined Offshore Number	Areas Combined Offshore Weight
Annual Grand Mean ( )	Coleopterans	21.8	0.22	20.9	0.17	18.8	0.31	13.2	0.25	7.8	0.20	11.3	0.13	16.1	0.24	14.9	0.18
	Hemipterans	9.8	0.03	8.1	0.08	1.0	0.01	1.3	0.01	2.9	0.02	0.4	0.01	4.5	0.02	3.1	0.03
	Homopterans	250.0	0.19	224.8	0.09	40.8	0.01	74.4	0.03	51.8	0.01	122.7	0.07	112.2	0.08	135.6	0.06
	Hymenopterans	153.7	0.34	167.9	0.46	31.3	0.25	25.2	0.05	11.7	0.06	21.3	0.07	64.5	0.22	66.8	0.18
	Other	1.8	0.01	3.9	0.01	0.3	0.01	1.0	0.03	1.8	0.01	2.2	0.01	1.2	0.01	2.3	0.02
	Total Terrestrials	437.0	0.80	425.7	0.81	92.2	0.58	115.1	0.37	75.9	0.31	157.8	0.29	198.5	0.56	222.5	0.47
														[778.5]	[1.48]	[920.6]	[1.19]
	Aquatic Dipterans	103.3	0.15	152.0	0.17	94.3	0.21	81.8	0.12	227.7	0.27	106.0	0.27	141.4	0.21	110.8	0.18
	Other Aquatics	5.4	0.01	0.4	<0.01	0.4	0.01	0.6	<0.01	1.8	0.02	0.4	<0.01	2.5	0.01	0.5	0.01
	Total Aquatics	108.7	0.16	152.4	0.17	94.7	0.22	82.4	0.12	229.4	0.29	106.4	0.27	143.8	0.22	111.3	0.18
														[511.7]	[0.69]	[427.9]	[0.54]
	TOTAL INSECTS	545.7	0.96	577.9	0.98	186.9	0.80	197.6	0.49	305.4	0.60	264.2	0.56	342.3	0.78	333.8	0.66
														[914.1]	[1.62]	[1007.0]	[1.31]

a/ Standard deviations are given in brackets.

APPENDIX C

Index of relative importance values for food items in the stomachs of westslope cutthroat. bull trout. mountain whitefish and northern squawfish, 1985.

Appendix Cl. Composition by number, weight, and frequency of occurance (percent) and calculated index of relative importance (IRI) for major food items in the stomachs of 19 juvenile westslope cutthroat collected May 1985

Item	Number	Percent	Weight(g)	Percent	Frequency	IRI
Daphnia	0	0.000	0.0000	0.000	0.000	0.000
COPepodS	0	0.000	0.0000	0.000	0.000	0.000
Epischura	0	0.000	0.0000	0.000	0.000	0.000
Leptodora	0	0.000	0.0000	0.000	0.000	0.000
Total Zooplankton	0	0.000	0.0000	0.000	0.000	0.000
Hymanoptera	149	7.237	1.7194	24.090	68.421	33.249
Coleoptera	70	3.400	0.6620	9.275	73.684	20.706
Hemiptera	5	0.243	0.0391	0.548	15.789	5.527
Hanoptera	2	0.097	0.0009	0.013	10.526	3.545
Other Terrestrial	22	1.068	0.1267	1.775	52.632	18.492
Total Terrestrial	240	12.045	2.5481	35.701	84.211	43.985
Diptera Larvae	1580	76.736	4.3710	61.241	78.947	72.308
Diptera Pupae	201	9.762	0.1215	1.702	36.842	16.102
Diptera Adult	26	1.263	0.0584	0.818	36.842	12.974
Total Diptera	1807	87.761	4.5509	63.761	94.737	82.086
Other Aguatics	4	0.194	0.0384	0.538	15.789	5.507
Total Aquatics	1811	07.955	4.5893	64.299	94.737	82.331
Westslope Cutthroat	0	0.000	0.0000	0.000	0.000	0.000
Bull Trout	0	0.000	0.0000	0.000	0.000	0.000
Mountain Whitefish	0	0.000	0.0000	0.000	0.000	0.000
Northern Squawfish	0	0.000	0.0000	0.000	0.000	0.000
Sucker	0	0.000	0.0000	0.000	0.000	0.000
Unidentified	0	0.000	0.0000	0.000	0.000	0.000
Total Fish	0	0.000	0.0000	0.000	0.000	0.000

Appendix C2. Composition by number weight, and frequency of occurance (percent) and calculated index of relative importance (IRI) for major food items in the stomachs of 33 adult westslope cutthroat collected May 1985

Item	Nmber	Percent	Weight(g)	Percent	Frequency	IHI
Daphnia	0	0.000	0.0000	0.000	0.000	0.000
copepods	0	0.000	0.0000	0.000	0.000	0.000
Epischura	0	0.000	0.0000	0.000	0.000	0.000
Leptodora	0	0.000	0.0000	0.000	0.000	0.000
Total Zooplankton	0	0.000	0.0000	0.000	0.000	0.000
Hymenoptera	698	15.654	14.9614	50.136	63.636	43.142
Coleoptera	141	3.162	3.7533	12.577	69.697	28.479
Hemiptera	7	0.157	0.1210	0.405	21.212	7.258
Homoptera	0	0.000	0.0000	0.000	0.000	0.000
Other Terrestrial	16	0.359	0.1877	0.629	36.364	12.450
Total Terrestrial	862	19.332	19.0234	63.748	84.848	55.976
Diptera Larvae	3427	76.856	10.6533	35.699	81.818	64.791
Diptera pupae	149	3.342	0.0631	0.211	42.424	15.326
Diptera **Adult**	11	0.247	0.0248	0.083	15.152	5.160
Total Diptera	3587	80.444	10.7412	35.994	87.879	68.106
Other Aquatics	10	0.224	0.0770	0.258	18.182	6.221
Total Aquatics	3597	80.668	10.8182	36.252	87.879	68.266
Westslope Cutthroat	0	0.000	0.0000	0.000	0.000	0.000
Bull Trout	0	0.000	0.0000	0.000	0.000	0.000
Mountain Whitefish	0	0.000	0.0000	0.000	0.000	0.000
Northern squawfish	0	0.000	0.0000	0.000	0.000	0.000
Sucker	0	0.000	0.0000	0.000	0.000	0.000
Unidentified	0	0.000	0.0000	0.000	0.000	0.000
Total Fish	0	0.000	0.0000	0.000	0.000	0.000

Appendix C3. Composition by number, weight, and frequency of occurance (percent) and calculated index of relative importance (IRI) for major food items in the stomachs of 52 westslope cutthroat collected May 1985

Item	Number	Percent	Weight (g)	Percent	Frequency	IRI
Daphnia	0	0.000	0.0000	0.000	0.000	0.000
copepods	0	0.000	0.0000	0.000	0.000	0.000
Epischura	0	0.000	0.0000	0.000	0.000	0.000
Leptodora	0	0.000	0.0000	0.000	0.000	0.000
Total Zooplankton	0	0.000	0.0000	0.000	0.000	0.000
Hymenoptera	847	12.995	16.6808	45.109	65.385	41.163
Coleoptera	211	3.237	4.4153	11.940	71.154	28.777
Hemiptera	12	0.184	0.1601	0.433	19.231	6.616
Homoptera	2	0.031	0.0009	0.002	3.846	1.293
Other Terrestrial	38	0.583	0.3144	0.850	42.308	14.580
Total Terrestrial	1110	17.030	21.5715	58.334	84.615	53.327
Diptera Larvae	5007	76.818	15.0243	40.629	80.769	66.072
Diptera Pupae	350	5.370	0.1846	0.499	40.385	15.418
Diptera Adult	37	0.568	0.0832	0.225	23.077	7.957
Total Diptera	5394	82.755	15.2921	41.353	90.385	71.498
Other Aquatics	14	0.215	0.1154	0.312	17.308	5.945
Total Aguatics	5408	82.970	15.4075	41.666	90.385	71.673
Westslope Cutthroat	0	0.000	0.0000	0.000	0.000	0.000
Bull Trout	0	0.000	0.0000	0.000	0.000	0.000
Mountain Whitefish	0	0.000	0.0000	0.000	0.000	0.000
Northern Squawfish	0	0.000	0.0000	0.000	0.000	0.000
Sucker	0	0.000	0.0000	0.000	0.000	0.000
Unidentified	0	0.000	0.0000	0.000	0.000	0.000
Total Fish	0	0.000	0.0000	0.000	0.000	0.000

Appendix C4. Composition by number, weight, and frequency of **occurance** (percent) and calculated index of relative importance (IRI) for major food items in the stomachs of 15 juvenile westslope cutthroat collected August 1985

Item	Number	Percent	Weight(g)	Percent	Frequency	IRI
Daphnia	119	3.659	0.0220	0.177	**20.000**	7.945
Copepods	0	0.000	0.0000	0.000	**0.000**	0.000
Epischura	25	0.769	0.0077	0.062	33.333	11.388
Leptodora	0	0.000	0.0000	0.000	0.000	0.000
Total Zooplankton	144	4.428	0.0297	0.239	40.000	14.889
Hymnoptera	2567	78.936	12.0064	96.462	93.333	89.577
Coleoptera	15	0.461	0.0611	0.491	40.000	13.651
Hemiptera	23	0.707	0.0561	0.451	40.000	13.719
Hanoptera	41	1.261	0.0379	0.304	60.000	20.522
Other Terrestrial		0.123	0.0314	0.252	6.667	2.347
Total Terrestrial	265:	81.488	12.1929	97.960	93.333	90.927
Diptera Larvae	66	2.030	0.0143	0.115	40.000	14.048
Diptera Pupae	24	0.738	0.0112	0.090	13.333	4.720
Diptera Adult	366	11.255	0.1923	1.545	66.667	26.489
Total Diptera	456	14.022	0.2178	1.750	80.000	31.924
Other Aquatics	2	0.062	0.0064	0.051	6.667	2.260
Total Aquatics	458	14.084	0.2242	1.801	80.000	31.962
Westslope **Cutthroat**	0	0.000	0.0000	0.000	0.000	0.000
Bull Trout	0	0.000	0.0000	0.000	0.000	0.000
Mountain Whitefish	0	0.000	0.0000	0.000	0.000	0.000
Northern squawfish	0	0.000	0.0000	0.000	0.000	0.000
Sucker	0	0.000	0.0000	0.000	0.000	0.000
Unidentified	0	0.000	0.0000	0.000	0.000	0.000
Total Fish	0	0.000	0.0000	0.000	0.000	0.000

Appendix C5. Composition by number, weight, end frequency of occurance (percent) and calculated index of relative importance (IRI) for major food items in the stomachs of 19 adult westslope cutthroat collected August 1985

Item	Number	Percent	Weight(g)	Percent	Frequency	IRI
Daphnia	16	0.240	0.0031	0.015	15.789	5.348
Copepods	1	0.015	0.0002	0.001	5.263	1.760
Epischura	1	0.015	0.0003	0.001	5.263	1.760
Leptodora	0	0.000	0.0000	0.000	0.000	0.000
Total Zooplankton	18	0.271	0.0036	0.018	15.789	5.359
Hymenoptera	6284	94.454	16.8133	83.372	68.421	82.082
Coleoptera	41	0.616	0.1172	0.581	42.105	14.434
Hemiptera	28	0.421	0.1408	0.698	21.053	7.391
Homoptera	98	1.473	0.1543	0.765	26.316	9.518
Other Terrestrial	40	0.601	1.8107	8.979	21.053	10.211
Total Terrestrial	6491	97.565	19.0363	94.396	68.421	86.794
Diptera Larvae	17	0.256	0.0130	0.064	15.789	5.370
Diptera Pupae	21	0.316	0.0116	0.058	31.579	10.651
Diptera Adult	105	1.578	1.0913	5.411	42.105	16.365
Total Diptera	143	2.149	1.1159	5.533	57.895	21.859
Other Aquatics	1	0.015	0.0034	0.017	5.263	1.765
Total Aquatics	144	2.164	1.1193	5.550	63.158	23.624
Westslope Cutthroat	0	0.000	0.0000	0.000	0.000	0.000
Bull Trout	0	0.000	0.0000	0.000	0.000	0.000
Mountain Whitefish	0	0.000	0.0000	0.000	0.000	0.000
Northern squawfish	0	0.000	0.0073	0.036	0.000	0.012
Sucker	0	0.000	0.0000	0.000	0.000	0.000
Unidentified	0	0.000	0.0000	0.000	0.000	0.000
Total Fish	0	0.000	0.0073	0.036	0.000	0.012

Appendix C6. Composition by number, weight, and frequency of occurance(percent) and calculated index of relative importance (IRI) for major food items in the stomachs of 34 westslope cutthroat collected August 1985

Item	Number	Percent	Weight(g)	Percent	Frequency	IRI
Daphnia	135	1.363	0.0251	0.077	17.647	6.362
copepods	1	0.010	0.0002	0.001	2.941	0.984
Epischura	26	0.262	0.0030	0.025	17.647	5.978
Leptodora	0	0.000	0.0000	0.000	0.000	0.000
Total Zooplankton	162	1.636	0.0333	0.102	26.471	9.403
Hymenoptera	8851	89.359	28.8197	99.368	79.412	35.713
Coleoptera	56	0.565	0.1783	0.547	41.176	14.096
Hemiptera	51	0.515	0.1969	0.604	29.412	10.177
Homoptera	139	1.403	0.1922	0.589	41.176	14.390
Other Terrestrial	44	0.444	1.8421	5.643	14.705	6.933
Total Terrestrial	9141	92.287	31.2292	95.756	79.412	89.152
Diptera Larvae	83	0.838	0.0273	0.084	26.471	9.131
Diptera Pupae	45	0.454	0.0228	0.070	23.529	8.013
Diptera Adult	471	4.755	1.2836	3.936	52.941	20.544
Total Diptera	599	6.047	1.3337	4.039	67.647	25.923
Other Aquatics	3	0.030	0.0098	0.030	5.882	1.981
Total Aquatics	602	6.078	1.3435	4.119	70.588	26.928
Westlope Cutthroat	0	0 000	0.0000	0.000	0.000	0.000
Bull Trout	0	0.000	0.0000	0.000	0.000	0.000
Mountain Whitefish	0	0.000	0.0000	0.000	0.000	0.000
Northern Squawfish	0	0.000	0.0073	0.022	0.000	0.007
Sucker	0	0.000	0.0000	0.000	0.000	0.000
Unidentified	0	0.000	0.0000	0.000	0.000	0.000
Total Fish	0	0.000	0.0073	0.022	0.000	0.007

Appendix C7. Composition by number, weight, and frequency of occurance (percent) and calculated index of relative importance (IRI) for major focd items in the stomachs of 24 jwenile westslope cutthroat collected November 1985

Item	Number	Percent	Weight(g)	Percent	Frequency	IRI
Daphnia	16649	96.634	4.5754	94.032	83.333	91.333
Copepods	0	0.000	0.0000	0.000	0.000	0.000
Epischura	384	2.229	0.1375	2.826	4.167	3.074
Leptodora	0	0.000	0.0000	0.000	0.000	0.000
Total Zooplankton	17033	98.862	4.7129	96.858	83.333	93.018
Hymenoptera	6	0.035	0.0942	1.936	20.833	7.601
Coleoptera	1	0.006	0.0001	0.002	4.167	1.392
Hemipera	0	0.000	0.0000	0.000	0.000	0.000
Homoptera	2	0.012	0.0008	0.016	8.333	2.787
Other Terrestrial	0	0.000	0.0000	0.000	0.000	0.000
Total Terrestrial	9	0.052	0.0951	1.954	25.000	9.002
Diptera Larvae	1	0.006	0.0001	0.002	4.167	1.392
Diptera Pupae	58	0.337	0.0116	0.238	16.667	5.747
Diptera Adult	118	0.685	0.0258	0.530	58.333	19.849
Total Diptera	177	1.027	0.0375	0.771	62.500	21.433
Other Aquatics	10	0.058	0.0203	0.417	25.000	8.492
Total Aquatics	187	1.085	0.0578	1.188	62.500	21.591
Westslope Cutthroat	0	0.000	0.0000	0.000	0.000	0.000
Bull Trout	0	0.000	0.0000	0.000	0.000	0.000
Mountain Whitefish	0	0.000	0.0000	0.000	0.000	0.000
Northern Squawfish	0	0.000	0.0000	0.000	0.000	0.000
Sucker	0	0.000	0.0000	0.000	0.000	0.000
Unidentified	0	0.000	0.0000	0.000	0.000	0.000
Total Fish	0	0.000	0.0000	0.000	0.000	0.000

Appendix C8. Composition by number, weight, and frequency of occurance (percent) and calculated index of relative importance (IRI) for major food items in the stomachs of 31 adult westslope cutthroat collected November 1985

Item	Number	Percent	Weight(g)	Percent	Frequency	IRI
Daphnia	20497	97.133	5.4096	96.686	90.323	94.714
Copepods	0	0.000	0.0000	0.000	0.000	0.000
Epischura	2	0.009	0.0008	0.014	6.452	2.158
Leptodora	0	0.000	0.0000	0.000	0.000	0.000
Total Zooplankton	20499	97.142	5.4104	96.701	90.323	94.722
Hymenoptera	4	0.019	0.0031	0.055	9.677	3.251
Coleoptera	3	0.014	0.0276	0.493	3.226	1.244
Hemiptera	1	0.005	0.0014	0.025	3.226	1.085
Homoptera	5	0.024	0.0035	0.063	12.903	4.330
Other Terrestrial	6	0.028	0.0303	0.542	9.677	3.416
Total Terrestrial	19	0.090	0.0659	1.178	25.806	9.025
Diptera Larvae	1	0.005	0.0002	0.004	3.226	1.078
Diptera Pupae	213	1.009	0.0412	0.736	32.258	11.335
Diptera Adult	360	1.706	0.0540	0.965	45.161	15.944
Total Diptera	574	2.720	0.0954	1.705	54.839	19.755
Other Aquatics	10	0.047	0.0233	0.416	16.129	5.531
Total Aquatics	584	2.768	0.1187	2.122	54.839	19.909
Westslope Cutthroat	0	0.000	0.0000	0.000	0.000	0.000
Hull Trout	0	0.000	0.0000	0.000	0.000	0.000
Mountain Whitefish	0	0.000	0.0000	0.000	0.000	0.000
Northern Squawfish	0	0.000	0.0000	0.000	0.000	0.000
Sucker	0	0.000	0.0000	0.000	0.000	0.000
Unidentified	0	0.000	0.0000	0.000	0.000	0.000
Total Fish	0	0.000	0.0000	0.000	0.000	0.000

Appendix C9. Con-position by number, weight, and frequency of occurance (percent) and calculated index of relative importance (IRI) for major food items in the stomachs of 55 westslope cutthroat collected November 1985

Item	Number	Percent	Weight(g)	Percent	Frequency	IRI
Daphnia	37146	96.909	9.9850	95.452	37.273	93.211
Copepods	0	0.000	0.0000	0.000	0.000	0.000
Epischura	386	1.007	0.1383	1.322	5.455	2.595
Leptodora	0	0.000	0.0000	0.000	0.000	0.000
Total Zooplankton	37532	97.916	10.1233	96.774	87.273	93.987
Hymenoptera	10	0.026	0.0973	0.930	14.545	5.167
Coleoptera	4	0.010	0.0277	0.265	3.636	1.304
Hemiptera	1	0.003	0.0014	0.013	1.818	0.611
Homoptera	7	0.018	0.0043	0.041	10.909	3.656
Other Terrestrial	6	0.016	0.0303	0.290	5.455	1.920
Total Terrestrial	28	0.073	0.1610	1.539	25.455	9.022
Diptera Larvae	2	0.005	0.0003	0.003	3.636	1.215
Diptera Pupae	271	0.707	0.0528	0.505	25.455	8.889
Diptera Adult	478	1.247	0.0798	0 763	50.909	17.640
Total Diptera	751	1.959	0.1329	1:270	58.182	20.471
Other Aquatics	20	0.052	0.0436	0.417	20.000	6.323
Total Aguatics	771	2.011	0.1765	1.687	58.182	20.627
Westslope Cutthroat	0	0.000	0.0000	0.000	0.000	0.000
Bull Trout	0	0.000	0.0000	0.000	0.000	0.000
Mountain Whitefish	0	0.000	0.0000	0.000	0.000	0.000
Northern Squawfish	0	0.000	0.0000	0.000	0.000	0.000
Sucker	0	0.000	0.0000	0.000	0.000	0.000
Unidentified	0	0.000	0.0000	0.000	0.000	0.000
Total Fish	0	0.000	0.0000	0.000	0.000	0.000

Appendix C10. Composition by number, weight, and frequency of occurance (percent) and calculated index of relative importance (IRI) for major food items in the stomachs of 58 jwenile westslope cutthroat collected seasonally 1985

Item	Number	Percent	Weight(g)	Percent	Frequency	IRI
Daphnia	16768	74.392	4.5974	18.803	39.655	44.284
Copepods	0	0.000	0.0000	0.000	0.000	0.000
Epischura	409	1.815	0.1452	0.594	10.345	4.251
Leptodora	0	0.000	0.0000	0.000	0.000	0.000
Total Zooplankton	17177	76.207	4.7426	19.397	44.828	46.810
Hymenoptera	2722	12.076	13.8200	56.524	55.172	41.257
Coleoptera	86	0.382	0.7232	2.958	36.207	13.182
Hemiptera	28	0.124	0.0952	0.389	15.517	5.344
Homoptera	45	0.200	0.0396	0.162	22.414	7.592
Other Terrestrial	26	0.115	0.1581	0.647	18.966	6.576
Total Terrestrial	2907	12.897	14.8361	60.679	62.069	45.215
Diptera Larvae	1647	7.307	4.3854	17.936	37.931	21.058
Diptera Pupae	283	1.256	0.1443	0.590	22.414	8.087
Diptera Adult	510	2.263	0.2765	1.131	53.448	18.947
Total Diptera	2440	10.825	4.8062	19.657	77.586	36.023
Other Aquatics	16	0.071	0.0651	0.266	17.241	5.360
Total Aquatics	2456	10.896	4.8713	19.924	77.586	36.135
Westslope Cutthroat	0	0.000	0.0000	0.000	0.000	0.000
Bull Trout	0	0.000	0.0000	0.000	0.000	0.000
Mountain Whitefish	0	0.000	0.0000	0.000	0.000	0.000
Northern Squawfish	0	0.000	0.0000	0.000	0.000	0.000
Sucker	0	0.000	0.0000	0.000	0.000	0.000
Unidentified	0	0.000	0.0000	0.000	0.000	0.000
Total Fish	0	0.000	0.0000	0.000	0.000	0.000

Appendix C11. Composition by number, weight, and frequency of occurance (percent) and calculated index of relative importance (IRI) for major food items in the stomachs of 83 adult westslope cutthroat collected seasonally 1985

Item	Number	Percent	Weight(g)	Percent	Frequency	IRI
Daphnia	20513	63.677	5.4127	9.735	37.349	36.920
Copepods	1	0.003	0.0002	0.000	1.205	0.403
Epischura	3	0.009	0.0011	0.002	3.614	1.209
Leptodora	0	0.000	0.0000	0.000	0.000	0.000
Total Zooplankton	20517	63.690	5.4140	9.737	37.349	36.925
Hymenoptera	6986	21.686	31.7778	57.151	44.578	41.139
Coleoptera	185	0.574	3.8981	7.011	38.554	15.380
Hemiptera	36	0.112	0.2632	0.473	14.458	5.014
Homoptera	103	0.320	0.1578	0.284	10.843	3.816
Other Terrestrial	62	0.192	2.0287	3.649	22.892	8.911
Total Terrestrial	7372	22.884	38.1256	6'3.567	59.036	50.163
Diptera Larvae	3445	10.694	10.6665	19.183	37.349	22.409
Diptera Pupae	383	1.189	0.1159	0.208	36.145	12.514
Diptera Adult	476	1.478	1.1701	2.104	32.530	12.037
Total Diptera	4304	13.361	11.9525	21.496	68.675	34.510
Cther Aquatics	21	0.065	0.1037	0.187	14.458	4.903
Total Aquatics	4325	13.426	12.0562	21.683	69.880	34.996
Westslope Cutthroat	0	0.000	0.0000	0.000	0.000	0.000
Bull Trout	0	0.000	0.0000	0.000	0.000	0.000
Mountain Whitefish	0	0.000	0.0000	0.000	0.000	0.000
Northern Squawfish	0	0.000	0.0073	0.013	0.000	0.004
Sucker	0	0.000	0.0000	0.000	0.000	0.000
Unidentified	0	0.000	0.0000	0.000	0.000	0.000
Total Fish	0	0.000	0.0073	0.013	0.000	0.004

Appendix C12. Composition by number, weight, and frequency of occurance (percent) and calculated index of relative importance (IRI) for major food items in the stomachs of 141 westslope cutthroat collected seasonally 1985

Item	Number	Percent	Weight(g)	Percent	Frequency	IRI
Daphnia	37281	68.088	10.0101	12.504	38.298	39.630
copepods	1	0.002	0.0002	0.000	0.709	0.237
Epischura	412	0.752	0.1463	0.183	6.353	2.439
Leptodora	0	0.000	0.0000	0.000	0.000	0.000
Total Zooplankton	37694	68.842	10.1566	12.687	40.426	40.652
Hymenoptera	9708	17.730	45.5978	56.959	48.936	41.209
Coleoptera	271	0.495	4.6213	5.773	37.589	14.619
Hemiptera	64	0.117	0.3584	0.448	14.894	5.153
Homoptera	148	0.270	0.1974	0.247	15.603	5.373
Other Terrestrial	88	0.161	2.1868	2.732	21.277	8.056
Total Terrestrial	10279	18.773	52.9617	66.158	60.284	48.405
Diptera Larvae	5092	9.300	15.0519	18.802	37.589	21.897
Diptera Pupae	666	1.216	0.2602	0.325	30.496	10.673
Diptera Adult	986	1.801	1.4466	1.807	41.135	14.914
Total Diptera	6744	12.317	16.7587	20.934	72.340	35.197
Other Aquatics	37	0.068	0.1688	0.211	15.603	5.294
Total Aquatics	6781	12.384	16.9275	21.145	73.050	35.526
Westslope Cutthroat	0	0.000	0.0000	0.000	0.000	0.000
Bull Trout	0	0.000	0.0000	0.000	0.000	0.000
Mountain Whitefish	0	0.000	0.0000	0.000	0.000	0.000
Northern Sqawfish	0	0.000	0.0073	0.009	0.000	0.003
Sucker	0	0.000	0.0000	0.000	0.000	0.000
Usidentified	0	0.000	0.0000	0.000	0.000	0.000
Total Fish	0	0.000	0.0073	0.009	0.000	0.003

Appendix Cl3. Composition by number, weight, and frequency of occurance (percent) and calculated index of relative importance (IRI) for major food items in the stomachs of 16 juveniie bull trout collected May 1985

Item	Number	Percent	Weight(g)	Percent	Frequency	IRI
Daphnia	1	0.224	0.0002	0.001	6.250	2.158
Copepods	45	10.067	0.0012	0.004	6.250	5.440
Epischura	0	0.000	0.0000	0.000	0.000	0.000
Leptodora	0	0.000	0.0000	0.000	0.000	0.000
Total Zooplankton	46	10.291	0.0014	0.004	6.250	5.515
Hymenoptera	0	0.000	0.0000	0.000	0.000	0.000
Coleoptera	0	0.000	0.0000	0.000	0.000	0.000
Hemiptera	0	0.000	0.0000	0.000	0.000	0.000
Homoptera	0	0.000	0.0000	0.000	0.000	0.000
Other Terrestrial	1	0.224	0.0066	0.020	6.250	2.165
Total Terrestrial	1	0.224	0.0066	0,020	6.250	2.165
Diptera Larvae	261	58.389	0.3261	1.010	75.000	44.800
Diptera Pupae	128	28.635	0.0627	0.194	50.000	26.277
Diptera Adult	1	0.224	0.0007	0.002	6.250	2.159
Total Diptera	390	87.248	0.3895	1.207	93.750	60.735
Other Aquatics	4	0.895	0.0473	0.147	25.000	8.680
Total Aquatics	394	88.143	0.4368	1.353	93.750	61.082
Westslope Cutthroat	1	0.224	27.3100	84.623	6.250	30.366
Hull Trout	0	0.000	0.0000	0.000	0.000	0.000
Mountain Whitefish	0	0.000	0.0000	0.000	0.000	0.000
Northern Squawfish	1	0.224	1.3928	4.316	6.250	3.596
Sucker	0	0.000	0.0000	0.000	0.000	0.000
Unidentified	4	0.895	3.1248	9.683	25.000	11.859
Total Fish	6	1.342	31.8276	98.622	31.250	43.738

Appendix C14. Composition by Number, weight, and frequency of occurance (percent) and calculated index of relative importance (IRI) for major food items in the stomachs of 26 adult bull trout collected May 1985

Item	Number	Percent	Weight(g)	Percent	Frequency	IRI
Daphnia	1	0.086	0.0002	0.000	3.846	1.311
Copepods	0	0.000	0.0000	0.000	0.000	0.000
Epischura	0	0.000	0.0000	0.000	0.000	0.000
Leptodora	0	0.000	0.0000	0.000	0.000	0.000
Total Zooplankton	1	0.086	0.0002	0.000	3.846	1.311
Hymenoptera	1	0.086	0.0011	0.001	3.846	1.311
Coleoptera	0	0.000	0.0000	0.000	0.000	0.000
Hemiptera	0	0.000	0.0000	0.000	0.000	0.000
Homoptera	1	0.086	0.0234	0.027	3.846	1.320
Other Terrestrial	0	0.000	0.0000	0.000	0.000	0.000
Total Terrestrial	2	0.172	0.0245	0.028	7.692	2.631
Diptera Larvae	1060	90.909	4.1811	4.778	57.692	51.126
Diptera Pupae	96	8.233	0.0802	0.092	46.154	18.160
Diptera Adult	0	0.000	0.0000	0.000	0.000	0.000
Total Diptera	1156	99.142	4.2613	4.869	69.231	57.747
Other Aquatics	3	0.257	0.0176	0.020	11.538	3.939
Total Aquatics	1159	99.400	4.2789	4.889	73.077	59.122
Westslope Cutthroat	1	0.086	49.4810	56.540	3.846	20.157
Bull Trout	0	0.000	0.0000	0.000	0.000	0.000
Mountain Whitefish	1	0.086	9.4356	10.782	3.846	4.905
Northern Squawfish	2	0.172	3.5453	4.051	7.692	3.972
Sucker	0	0.000	3.1186	3.564	0.000	1.188
Unidentified	0	0.000	17.6307	20.146	0.000	6.715
Total Fish	4	0.343	83.2112	95.082	15.385	36.937

Appendix C15. Composition by number weight, and frequency of occurance (percent) and calculated index of relative importance (IRI) for major food items in the stomachs of 42 bull trout collected May 1985

Item	Number	Percent	Weight(g)	Percent	Frequency	IRI
Daphnia	2	0.124	0.0004	0.000	4.762	1.629
Copepods	45	2.790	0.0012	0.001	2.381	1.724
Epischura	0	0.000	0.0000	0.000	0.000	0.000
Leptodora	0	0.000	0.0000	0.000	0.000	0.000
Total Zooplankton	47	2.914	0.0016	0.001	4.762	2.559
Hymenoptera	1	0.062	0.0011	0.001	2.381	0.815
Coleoptera	0	0.000	0.0000	0.000	0.000	0.000
Hemiptera	0	0.000	0.0000	0.000	0.000	0.000
Homoptera	1	0.062	0.0234	0.020	2.381	0.821
Other Terrestrial	1	0.062	0.0066	0.006	2.381	0.816
Total Terrestrial	3	0.186	0.0311	0.026	7.143	2.452
Diptera Larvae	1321	81.897	4.5072	3.763	64.286	49.982
Diptera Pupae	224	13.887	0.1429	0.119	47.619	20.542
Diptera Adult	1	0.062	0.0007	0.001	2.381	0.815
Total Diptera	1546	95.846	4.6508	3.883	78.571	59.433
Other Aquatics	7	0.434	0.0649	0.054	16.667	5.718
Total Aquatics	1553	96.280	4.7157	3.937	80.952	60.390
Westslope Cutthroat	2	0.124	76.7910	64.106	4.762	22.997
Bull Trout	0	0.000	0.0000	0.000	0.000	0.000
Mountain Whitefish	1	0.062	9.4356	7.877	2.381	3.440
Northern Squawfish	3	0.186	4.9381	4.122	7.143	3.817
Sucker	0	0.000	3.1186	2.603	0.000	0.868
Unidentified	4	0.248	20.7555	17.327	9.524	9.033
Total Fish	10	0.620	115.0388	96.036	21.429	39.362

Appendix C16 Composition by number, weight, and frequency of occurance (percent) and calculated index of relative importsnce (IRI) for major food items in the stomachs of 17 juvenile bull trout collected August 1985

Item	Number	Percent	Weight(g)	Percent	Frequency	IRI
Daphnia	0	0.000	0.0000	0.000	0.000	0.000
Copepods	0	0.000	0.0000	0.000	0.000	0.000
Epischura	0	0.000	0.0000	0.000	0.000	0.000
Leptodora	0	0.000	0.0000	0.000	0.000	0.000
Total Zooplankton	0	0.000	0.0000	0.000	0.000	0.000
Hymenoptera	0	0.000	0.0000	0.000	0.000	0.000
Coleoptera	0	0.000	0.0000	0.000	0.000	0.000
Hemiptera	0	0.000	0.0000	0.000	0.000	0.000
Homoptera	0	0.000	0.0000	0.000	0.000	0.000
Other Terrestrial	0	0.000	0.0000	0.000	0.000	0.000
Total Terrestrial	0	0.000	0.0000	0.000	0.000	0.000
Diptera Larvae	9	52.941	0.0024	0.008	11.765	21.571
Diptera Pupae	4	23.529	0.0044	0.014	17.647	13.730
Diptera Adult	0	0.000	0.0000	0.000	0.000	0.000
Total Diptera	13	76.471	0.0068	0.022	23.529	33.341
Other Aquatics	0	0.000	0.0000	0.000	0.000	0.000
Total Aquatics	13	76.471	0.0068	0.022	23.529	33.341
Westslope Cutthroat	0	0.000	0.0000	0.000	0.000	0.000
Bull Trout	0	0.000	0.0000	0.000	0.000	0.000
Mountain Whitefish	0	0.000	0.0000	0.000	0.000	0.000
Northern Squawfish	2	11.765	9.7005	30.914	11.765	18.148
Sucker	2	11.765	12.2494	39.037	11.765	20.856
Unidentified	0	0.000	9.4220	30.027	0.000	10.009
Total Fish	4	23.529	31.3719	99.978	23.529	49.012

Appendix C17. Composition by number, weight, and frequency of occurance (percent) and-calculated index of relative importance (IRI) for major food items in the stomachs of 29 adult bull trout collected August 1985

Item	Number	Percent	Weight (g)	Percent	Frequency	IRI
Daphnia	0	0.000	0.0000	0.000	0.000	0.000
Copepods	2	6.667	0.0001	0.000	3.448	3.372
Epischura	0	0.000	0.0000	0.000	0.000	0.000
Leptodora	0	0.000	0.0000	0.000	0.000	0.000
Total Zooplankton	2	6.667	0.0001	0.000	3.448	3.372
Hymenoptera	0	0.000	0.0000	0.000	0.000	0.000
Coleoptera	0	0.000	0.0000	0.000	0.000	0.000
Hemiptera	0	0.000	0.0000	0.000	0.000	0.000
Homoptera	0	0.000	0.0000	0.000	0.000	0.000
Other Terrestrial	0	0.000	0.0000	0.000	0.000	0.000
Total Terrestrial	0	0.000	0.0000	0.000	0.000	0.000
Diptera Larvae	1	3.333	0.0010	0.000	3.448	2.261
Diptera Pupae	6	20.000	0.0047	0.000	10.345	10.115
Diptera Adult	0	0.000	0.0000	0.000	0.000	0.000
Total Diptera	7	23.333	0.0057	0.001	13.793	12.376
Other Aquatics	0	0.000	0.0000	0.000	0.000	0.000
Total Aquatics	7	23.333	0.0057	0.001	13.793	12.376
Westslope Cutthroat	2	6.667	1.9526	0.205	3.448	3.440
Bull Trout	0	0.000	0.0000	0.000	0.000	0.000
Mountain Whitefish	2	6.667	167.8668	17.659	6.897	10.407
Northern Squawfish	10	33.333	178.7817	18.807	10.345	20.828
Sucker	7	23.333	512.2219	53.883	20.690	32.635
Unidentified	0	0.000	89.7905	9.445	0.000	3.148
Total Fish	21	70.000	950.6135	99.999	41.379	70.460

Appendix C18. Composition by Number weight, and frequency of occurance (percent) and calculated index of relative importsnce (IRI) for major FOOD items in the stomachs of 46 bull trout collected **August** 1985

Item	Number	Percent	Weight(g)	Percent	Frequency	IRI
Daphnia	0	0.000	0.0000	0.000	0.000	0.000
Copepods	2	4.255	0.0001	0.000	2.174	2.143
Epischura	0	0.000	0.0000	0.000	0.000	0.000
Leptodora	0	0.000	0.0000	0.000	0.000	0.000
Total Zooplankton	2	4.255	0.0001	0.000	2.174	2.143
Hymenoptera	0	0.000	0.0000	0.000	0.000	0.000
Coleoptera	0	0.000	0.0000	0.000	0.000	0.000
Hemiptera	0	0.000	0.0000	0.000	0.000	0.000
Homoptera	0	0.000	0.0000	0.000	0.000	0.000
Other Terrestrial	0	0.000	0.0000	0.000	0.000	0.000
Total Terrestrial	0	0.000	0.0000	0.000	0.000	0.000
Diptera Larvae	10	21.271	0.0034	0.000	6.522	9.266
Diptera Pupae	10	21.277	0.0091	0.001	13.043	11.440
Diptera Adult	0	0.000	0.0000	0.000	0.000	0.000
Total Diptera	20	42.553	0.0125	0.001	17.391	19.982
Other Aquatics	0	0.000	0.0000	0.000	0.000	0.000
Total Aquatics	20	42.553	0.0125	0.001	17.391	19.982
Westslope Cutthroat	2	4.255	1.9526	0.199	2.174	2.209
Bull Trout	0	0.000	0.0000	0.000	0.000	0.000
Mountain Whitefish	2	4.255	167.8668	17.094	4.348	8.566
Northern Squawfish	12	25.532	188.4822	19.194	10.870	18.532
Sucker	9	19.149	524.4713	53.409	17.391	29.983
Unidentified	0	0.000	99.2125	10.103	0.000	3.368
Total Fish	25	53.191	981.9854	99.999	34.783	62.658

Appendix C19. Composition by number, weight, and frequency of occurance (percent) and calculated index of relative importance (IRI) for major food items in the stomachs of 19 juvenile bull trout collected November 1985

Item	Number	Percent	Weight(g)	Percent	Frequency	IRI
Daphnia	521	98.117	0.1209	0.285	21.053	39.818
Copepods	0	0.000	0.0000	0.000	0.000	0.000
Epischura	0	0.000	0.0000	0.000	0.000	0.000
Leptodora	0	0.000	0.0000	0.000	0.000	0.000
Total Zooplankton	521	98.117	0.1209	0.285	21.053	39.818
Hymenoptera	0	0.000	0.0000	0.000	0.000	0.000
Coleoptera	0	0.000	0.0000	0.000	0.000	0.000
Hemiptera	0	0.000	0.0000	0.000	0.000	0.000
Homoptera	0	0.000	0.0000	0.000	0.000	0.000
Other Terrestrial	0	0.000	0.0000	0.000	0.000	0.000
Total Terrestrial	0	0.000	0.0000	0.000	0.000	0.000
Diptera Larvae	0	0.000	0.0000	0.000	0.000	0.000
Diptera Pupae	0	0.000	0.0000	0.000	0.000	0.000
Diptera Adult	1	0.188	0.0001	0.000	5.263	1.817
Total Diptera	1	0.188	0.0001	0.000	5.263	1.817
Other Aquatics	1	0.188	0.0001	0.000	5.263	1.817
Total Aquatics	2	0.377	0.0002	0.000	10.526	3.634
Westslope Cutthroat	0	0.000	0.0000	0.000	0.000	0.000
Bull Trout	0	0.000	0.0000	0.000	0.000	0.000
Mountain Whitefish	1	0.188	0.6053	1.428	5.263	2.293
Northern Squawfish	4	0.753	9.6446	22.759	21.053	14.855
Sucker	1	0.188	9.6102	22.678	5.263	9.377
Unidentified	2	0.377	22.3951	52.848	5.263	19.496
Total Fish	8	1.507	42.2552	99.714	36.842	46.021

Appendix C20. Composition by number, weight, and frequency of occurance (percent) and calculated index of relative importance (IRI) for major food items in the stomachs of 18 adult bull trout collected November 1985

Item	Number	Percent	Weight(g)	Percent	Frequency	IRI
Daphnia	0	0.000	0.0000	0.000	0.000	0.000
Copepods	0	0.000	0.0000	0.000	0.000	0.000
Epischura	0	0.000	0.0000	0.000	0.000	0.000
Leptodora	0	0.000	0.0000	0.000	0.000	0.000
Total Zooplankton	0	0.000	0.0000	0.000	0.000	0.000
Hymenoptera	0	0.000	0.0000	0.000	0.000	0.000
Coleoptera	0	0.000	0.0000	0.000	0.000	0.000
Hemiptera	0	0.000	0.0000	0.000	0.000	0.000
Homoptera	0	0.000	0.0000	0.000	0.000	0.000
Other Terrestrial	0	0.000	0.0000	0.000	0.000	0.000
Total Terrestrial	0	0.000	0.0000	0.000	0.000	0.000
Diptera Larvae	0	0.000	0.0000	0.000	0.000	0.000
Diptera Pupae	0	0.000	0.0000	0.000	0.000	0.000
Diptera Adult	0	0.000	0.0000	0.000	0.000	0.000
Total Diptera	0	0.000	0.0000	0.000	0.000	0.000
Other Aquatics	0	0.000	0.0000	0.000	0.000	0.000
Total Aquatics	0	0.000	0.0000	0.000	0.000	0.000
Westslope Cutthroat	0	0.000	0.0000	0.000	0.000	0.000
Bull Trout	0	0.000	0.0000	0.000	0.000	0.000
Mountain Whitefish	11	57.895	382.1400	54.433	16.667	42.998
Northern Squawfish	2	10.526	28.0780	4.000	11.111	8.546
Sucker	4	21.053	237.6300	33.849	22.222	25.708
Unidentified	2	10.526	54.1838	7.718	11.111	9.785
Total Fish	19	100.000	702.0318	100.000	61.111	87.037

Appendix C21. Composition by number, weight, and frequency of occurance (percent) and calculated index of relative importance (IRI) for major food items in the stomachs of 37 bull trout collected November 1985

Item	Number	Percent	Weight(g)	Percent	Frequency	IRI
Daphnia	521	94.127	0.1209	0.016	10.811	35.185
Copepods	0	0.000	0.0000	0.000	0.000	0.000
Epischura	0	0.000	0.0000	0.000	0.000	0.000
Leptodora	0	0.000	0.0000	0.000	0.000	0.000
Total Zooplankton	521	94.727	0.1209	0.016	10.811	35.185
Hymenoptera	0	0.000	0.0000	0.000	0.000	0.000
Coleoptera	0	0.000	0.0000	0.000	0.000	0.000
Hemiptera	0	0.000	0.0000	0.000	0.000	0.000
Homoptera	0	0.000	0.0000	0.000	0.000	0.000
Other Terrestrial	0	0.000	0.0000	0.000	0.000	0.000
Total Terrestrial	0	0.000	0.0000	0.000	0.000	0.000
Diptera Larvae	0	0.000	0.0000	0.000	0.000	0.000
Diptera Pupae	0	0.000	0.0000	0.000	0.000	0.000
Diptera Adult	1	0.182	0.0001	0.000	2.703	0.962
Total Diptera	1	0.182	0.0001	0.000	2.703	0.962
Other Aquatics	1	0.182	0.0001	0.000	2.703	0.962
Total Aquatics	2	0.364	0.0002	0.000	5.405	1.923
Westslopa Cutthroat	0	0.000	0.0000	0.000	0.000	0.000
Bull Trout	0	0.000	0.0000	0.000	0.000	0.000
Mountain Whitefish	12	2.182	382.7453	51.416	10.811	21.470
Northern Squawfish	6	1.091	37.7226	5.067	16.216	7.458
Sucker	5	0.909	247.2402	33.213	13.514	15.879
Unidentified	4	0.727	76.5789	10.287	8.108	6.374
Total Fish	27	4.909	744.2870	99.984	48.649	51.180

Appendix C22. Composition by number, weight, and frequency of occurance (percent) and calculated index of relative importance (IRI) for major food items in the stomachs of 52 juvenile bull trout collected seasonally 1985

Item	Number	Percent	Weight(g)	Percent	Frequency	IFS
Daphnia	522	52.462	0.1211	0.114	9.615	20.731
Copepods	45	4.523	0.0012	0.001	1.923	2.149
Epischura	0	0.000	0.0000	0.000	0.000	0.000
Leptodora	0	0.000	0.0000	0.000	0.000	0.000
Total Zooplankton	567	56.985	0.1223	0.115	9.615	22.239
Hymenoptera	0	0.000	0.0000	0.000	0.000	0.000
Coleoptera	0	0.000	0.0000	0.000	0.000	0.000
Hemiptera	0	0.000	0.0000	0.000	0.000	0.000
Homoptera	0	0.000	0.0000	0.000	0.000	0.000
Other Terrestrial	1	0.101	0.0066	0.006	1.923	0.677
Total Terrestrial	1	0.101	0.0066	0.006	1.923	0.677
Diptera Larvae	270	27.136	0.3285	0.310	26.923	18.123
Diptera Pupae	132	13.266	0.0671	0.063	21.154	11.494
Diptera Adult	2	0.201	0.0008	0.001	3.846	1.349
Total Diptera	404	40.603	0.3964	0.374	38.462.	26.479
Other Aquatics	5	0.503	0.0474	0.045	9.615	3.388
Total Aquatics	409	41.106	0.4438	0.419	40.385	27.303
Westslope Cutthroat	1	0.101	27.3100	25.757	1.923	9.260
Bull Trout	0	0.000	0.0000	0.000	0.000	0.000
Mountain Whitefish	1	0.101	0.6053	0.571	1.923	0.865
Northern Squawfish	7	0.704	20.7379	19.559	13.462	11.241
Sucker	3	0.302	21.8596	20.617	5.769	8.896
Unidentified	6	0.603	34.9419	32.956	9.615	14.391
Total Fish	18	1.809	105.4547	99.460	30.769	44.013

Appendix C23. Composition by number, weight, and frequency of occurance (percent) and calculated index of relative importance (IRI) for major food items in the stomachs of 73 adult bull **trout** collected seasonally 1985

Item	Number	Percent	Weight(g)	Percent	Frequency	IRI
Daphnia	1	0.082	0.0002	0.000	1.370	0.484
Copepods	2	0.165	0.0001	0.000	1.370	0.511
Epischura	0	0.000	0.0000	0.000	0.000	0.000
Leptodora	0	0.000	0.0000	0.000	0.000	0.000
Total Zooplankton	3	0.247	0.0003	0.000	2.740	0.996
Hymenoptera	1	0.082	0.0011	0.000	1.370	0.484
Coleoptera	0	0.000	0.0000	0.000	0.000	0.000
Hemiptera	0	0.000	0.0000	0.000	0.000	0.000
Homoptera	1	0.082	0.0234	0.001	1.370	0.485
Other Terrestrial	0	0.000	0.0000	0.000	0.000	0.000
Total Terrestrial	2	0.165	0.0245	0.001	2.740	0.969
Diptera Larvae	1061	87.325	4.1821	0.240	21.918	36.494
Diptera pupae	102	8.395	0.0849	0.005	20.548	9.649
Diptera Adult	0	0.000	0.0000	0.000	0.000	0.000
Total **Diptera**	**1163**	95.720	4.2670	0.245	30.137	42.034
Other Aquatics	3	0.247	0.0176	0.001	4.110	1.453
Total Aquatics	1166	95.967	4.2846	0.246	31.507	42.573
Westslope Cutthroat	3	0.247	51.4336	2.956	2.740	1.981
Bull Trout	0	0.000	0.0000	0.000	0.000	0.000
Mountain Whitefish	14	1.152	559.4424	32.149	8.219	13.840
NorthernSquawfish	14	1.152	210.4050	12.091	9.589	7.611
Sucker	11	0.905	752.9705	43.270	13.699	19.291
unidentified	2	0.165	161.6050	9.287	2.740	4.064
Total Fish	44	3.621	1735.8565	99.752	36.986	46.787

Appendix C24. Composition by number, weight, and frequency of occurance (percent) and calculated index of relative importance (IRI) for major food items in the stomachs of 125 bull trout collected seasonally 1985

Item	Number	Percent	Weight(g)	Percent	Frequency	IRI
Daphnia	523	23.665	0.1213	0.007	4.800	9.491
Copepods	47	2.127	0.0013	0.000	1.600	1.242
Epischura	0	0.000	0.0000	0.000	0.000	0.000
Leptodora	0	0.000	0.0000	0.000	0.000	0.000
Total Zooplankton	570	25.792	0.1226	0.007	5.600	10.466
Hymenoptera	1	0.045	0.0011	0.000	0.800	0.282
Coleoptera	0	0.000	0.0000	0.000	0.000	0.000
Hemiptera	0	0.000	0.0000	0.000	0.000	0.000
Homoptera	1	0.045	0.0234	0.001	0.800	0.282
Other Terrestrial	1	0.045	0.0066	0.000	0.800	0.282
Total Terrestrial	3	0.136	0.0311	0.002	2.400	0.846
Diptera Larvae	1331	60.226	4.5106	0.244	24.000	28.157
Diptera Pupae	234	10.588	0.1520	0.008	20.300	10.465
Diptera Adult	2	0.090	0.0008	0.000	1.600	0.564
Total Diptera	1567	70.905	4.6634	0.253	33.600	34.919
Other Aquatics	8	0.362	0.0650	0.004	6.400	2.255
Total Aquatics	1575	71.267	4.7284	0.256	35.200	35.574
Westslope Cutthroat	4	0.181	78.7436	4.265	2.400	2.282
Bull Trout	0	0.000	0.0000	0.000	0.000	0.000
Mountain Whitefish	15	0.679	560.0477	30.335	5.600	12.205
Northern Squawfish	21	0.950	231.1429	12.520	11.200	8.223
Sucker	14	0.633	774.8301	41.969	10.400	17.668
Unidentified	8	0.362	196.5469	10.646	5.600	5.536
Total Fish	62	2.805	1841.3112	99.736	34.400	45.647

Appendix C25. Composition by number, weight, and frequency of occurance (percent) and calculated index of relative importance (IRI) for major food items in the stomachs of 6 juvenile mountain whitefish collected May 1985

Item	number	Percent	Weight(g)	Percent	Frequency	IRI
Daphnia	7	6.604	0.0014	2.229	16.667	8.500
Copepods	0	0.000	0.0000	0.000	0.000	0.000
Epischura	0	0.000	0.0000	0.000	0.000	0.000
Leptodora	0	0.000	0.0000	0.000	0.000	0.000
Total Zooplankton	7	6.604	0.0014	2.229	16.667	8.500
Hymenoptera	0	0.000	0.0000	0.000	0.000	0.000
Coleoptera	0	0.000	0.0000	0.000	0.000	0.000
Hemiptera	0	0.000	0.0000	0.000	0.000	0.000
Homoptera	0	0.000	0.0000	0.000	0.000	0.000
Other Terrestrial	0	0.000	0.0000	0.000	0.000	0.000
Total Terrestrial	0	0.000	0.0000	0.000	0.000	0.000
Diptera Larvae	3	2.830	0.0002	0.318	33.333	12.161
Diptera Pupae	96	90.566	0.0612	97.452	66.667	84.895
Diptera Adult	0	0.000	0.0000	0.000	0.000	0.000
Total Diptera	99	93.396	0.0614	97.771	83.333	91.500
Other Aquatics	0	0.000	0.0000	0.000	0.000	0.000
Total Aquatics	99	93.396	0.0614	97.771	83.333	91.500
Westslope Cutthroat	0	0.000	0.0000	0.000	0.000	0.000
Bull Trout	0	0.000	0.0000	0.000	0.000	0.000
Mountain Whitefish	0	0.000	0.0000	0.000	0.000	0.000
Northern Squawfish	0	0.000	0.0000	0.000	0.000	0.000
Sucker	0	0.000	0.0000	0.000	0.000	0.000
Unidentified	0	0.000	0.0000	0.000	0.000	0.000
Total Fish	0	0.000	0.0000	0.000	0.000	0.000

Appendix C26. Composition by number, weight, and frequency of occurance (percent) and calculated index of relative importance (IRI) for major food items in the stomachs of 10 adult mountain whitefish collected May 1985

Item	Number	Percent	Weight(g)	Percent	Frequency	IRI
Daphnia	16	13.333	0.0032	5.634	40.000	19.656
Copepods	0	0.000	0.0000	0.000	0.000	0.000
Epischura	0	0.000	0.0000	0.000	0.000	0.000
Leptodora	0	0.000	0.0000	0.000	0.000	0.000
Total Zooplankton	16	13.333	0.0032	5.634	40.000	19.656
Hymenoptera	0	0.000	0.0000	0.000	0.000	0.000
Coleoptera	0	0.000	0.0000	0.000	0.000	0.000
Hemiptera	0	0.000	0.0000	0.000	0.000	0.000
Homoptera	0	0.000	0.0000	0.000	0.000	0.000
Other Terrestrial	13	10.833	0.0072	12.676	20.000	14.503
Total Terrestrial	13	10.833	0.0072	12.676	20.000	14.503
Diptera Larvae	27	22.500	0.0017	2.993	50.000	25.164
Diptera Pupae	63	52.500	0.0405	71.303	50.000	57.934
Diptera Adult	0	0.000	0.0000	0.000	0.000	0.000
Total Diptera	90	75.000	0.0422	74.296	70.000	73.099
Other Aquatics	1	0.833	0.0042	7.394	10.000	6.076
Total Aquatics	91	75.833	0.0464	81.690	70.000	75.841
Westslope Cutthroat	0	0.000	0.0000	0.000	0.000	0.000
Bull Trout	0	0.000	0.0000	0.000	0.000	0.000
Mountain Whitefish	0	0.000	0.0000	0.000	0.000	0.000
NorthernSguawfish	0	0.000	0.0000	0.000	0.000	0.000
Sucker	0	0.000	0.0000	0.000	0.000	0.000
Unidentified	0	0.000	0.0000	0.000	0.000	0.000
Total Fish	0	0.000	0.0000	0.000	0.000	0.000

Appendix C27. Composition by number, weight, and frequency of occurance (percent) and calculated index of relative importance (IRI) for major food item in the stomachs of 16 mountain whitefish collected May 1985

Item	Number	Percent	Weight(g)	Percent	Frequency	IRI
Daphnia	23	10.177	0.0046	3.846	31.250	15.091
Copepods	0	0.000	0.0000	0.000	0.000	0.000
Epischura	0	0.000	0.0000	0.000	0.000	0.000
Leptodora	0	0.000	0.0000	0.000	0.000	0.000
Total Zooplankton	23	10.177	0.0046	3.846	31.250	15.091
Hymanoptera	0	0.000	0.0000	0.000	0.000	0.000
Coleoptera . .	0	0.000	0.0000	0.000	0.000	0.000
Hemiptera	0	0.000	0.0000	0.000	0.000	0.000
Homoptera	0	0.000	0.0000	0.000	0.000	0.000
Other Terrestrial	13	5.752	0.0072	6.020	12.500	8.091
Total Terrestrial	13	5.752	0.0072	6.020	12.500	8.091
Diptera Larvae	30	13.274	0.0019	1.589	43.750	19.538
Diptera Pupae	159	70.354	0.1017	85.033	56.250	70.546
Diptera Adult	0	0.000	0.0000	0.000	0.000	0.000
Total Diptera	189	83.628	0.1036	86.622	75.000	81.750
Other Aquatics	1	0.442	0.0042	3.512	6.250	3.401
Total Aquatics	190	84.071	0.1078	90.134	75.000	83.068
Westslope Cutthroat	0	0.000	0.0000	0.000	0.000	0.000
Bull Trout	0	0.000	0.0000	0.000	0.000	0.000
Mountain Whitefish	0	0.000	0.0000	0.000	0.000	0.000
Northern Squawfish	0	0.000	0.0000	0.000	0.000	0.000
Sucker	0	0.000	0.0000	0.000	0.000	0.000
Unidentified	0	0.000	0.0000	0.000	0.000	0.000
Total Fish	0	0.000	0.0000	0.000	0.000	0.000

Appendix C28. Composition by number, weight, and frequency of occurance (percent) and calculated index of relative importance (IRI) for major food items in the stomachs of 6 juvenile mountain whitefish collected August 1985

Item	Number	Percent	Weight(g)	Percent	Frequency	IRI
Daphnia	2388	95.520	0.4953	98.724	100.000	98.081
Copepods	0	0.000	0.0000	0.000	0.000	0.000
Epischura	1	0.040	0.0004	0.080	16.667	5.595
Leptodora	0	0.000	0.0000	0.000	0.000	0.000
Total Zooplankton	2389	95.560	0.4957	98.804	100.000	98.121
Hymenoptera	1	0.040	0.0008	0.159	16.667	5.622
Coleoptera	0	0.000	0.0000	0.000	0.000	0.000
Hemiptera	0	0.000	0.0000	0.000	0.000	0.000
Homoptera	0	0.000	0.0000	0.000	0.000	0.000
Other Terrestrial	0	0.000	0.0000	0.000	0.000	0.000
Total Terrestrial	1	0.040	0.0008	0.159	16.667	5.622
Diptera Larvae	109	4.360	0.0051	1.017	33.333	12.903
Diptera Pupae	1	0.040	0.0001	0.020	16.667	5.576
Diptera Adult	0	0.000	0.0000	0.000	0.000	0.000
Total Diptera	110	4.400	0.0052	1.036	33.333	12.923
Other Aquatics	0	0.000	0.0000	0.000	0.000	0.000
Total Aquatics	110	4.400	0.0052	1.036	33.333	12.923
Westslope Cutthroat	0	0.000	0.0000	0.000	0.000	0.000
Bull Trout	0	0.000	0.0000	0.000	0.000	0.000
Mountain Whitefish	0	0.000	0.0000	0.000	0.000	0.000
Northern Squawfish	0	0.000	0.0000	0.000	0.000	0.000
Sucker	0	0.000	0.0000	0.000	0.000	0.000
Unidentified	0	0.000	0.0000	0.000	0.000	0.000
Total Fish	0	0.000	0.0000	0.000	0.000	0.000

Appendix C29. Composition by number, weight, and frequency of occurance (percent) and calculated index of relative importance (IRI) for major food items in the stomachs of 9 adult mountain whitefish collected August 1985

Item	Number	Percent	Weight(g)	Percent	Frequency	IRI
Daphnia	2531	99.724	0.5394	99.009	88.889	95.874
Copepods	1	0.039	0.0000	0.000	11.111	3.117
Epischura	0	0.000	0.0000	0.000	0.000	0.000
Leptodora	0	0.000	0.0000	0.000	0.000	0.000
Total Zooplankton	2532	99.764	0.5394	99.009	88.889	95.887
Hymenoptera	1	0.039	0.0020	0.367	11.111	3.839
Coleoptera	0	0.000	0.0000	0.000	0.000	0.000
Hemiptera	0	0.000	0.0000	0.000	0.000	0.000
Hanoptera	0	0.000	0.0000	0.000	0.000	0.000
Other Terrestrial	0	0.000	0.0000	0.000	0.000	0.000
Total Terrestrial	1	0.039	0.0020	0.367	11.111	3.839
Diptera Larvae	1	0.039	0.0003	0.055	11.111	3.735
Diptera Pupae	4	0.158	0.0031	0.569	33.333	11.353
Diptera Adult	0	0.000	0.0000	0.000	0.000	0.000
Total Diptera	5	0.197	0.0034	0.624	44.444	15.089
Other Aquatics	0	0.000	0.0000	0.000	0.000	0.000
Total Aquatics	5	0.197	0.0034	0.624	44.444	15.089
Weatslope Cutthroat	0	0.000	0.0000	0.000	0.000	0.000
Bull Trout	0	0.000	0.0000	0.000	0.000	0.000
Mountain Whitefish	0	0.000	0.0000	0.000	0.000	0.000
Northern Squawfish	0	0.000	0.0000	0.000	0.000	0.000
Sucker	0	0.000	0.0000	0.000	0.000	0.000
Unidentified	0	0.000	0.0000	0.000	0.000	0.000
Total Fish	0	0.000	0.0000	0.000	0.000	0.000

Appendix C30. Composition by number, weight, and frequency of occurance (percent) and calculated index of relative importance (IRI) for major food items in the stomachs of 15 mountain whitefish collected August 1935

Item	Number	Percent	Weight(g)	Percent	Frequency	IRI
Daphnia	4919	97.638	1.0347	98.872	93.333	96.615
Copepods	1	0.020	0.0000	0.000	6.667	2.229
Epischura	1	0.020	0.0004	0.038	6.667	2.242
Leptodora	0	0.000	0.0000	0.000	0.000	0.000
Total Zooplankton	4921	97.678	1.0351	98.911	93.333	96.641
Hymenoptera	2	0.040	0.0028	0.263	13.333	4.547
Coleoptera	0	0.000	0.0000	0.000	0.000	0.000
Hemiptera	0	0.000	0.0000	0.000	0.000	0.000
Hanoptera	0	0.000	0.0000	0.000	0.000	0.000
Other Terrestrial	0	0.000	0.0000	0.000	0.000	0.000
Total Terrestrial	2	0.040	0.0028	0.268	13.333	4.547
Diptera Larvae	110	2.183	0.0054	0.516	20.000	7.566
Diptera Pupae	5	0.099	0.0032	0.306	26.667	9.024
Diptera Adult	0	0.000	0.0000	0.000	0.000	0.000
Total Diptera	115	2.283	0.0086	0.822	40.000	14.368
Other Aquatics	0	0.000	0.0000	0.000	0.000	0.000
Total Aquatics	115	2.283	0.0086	0.822	40.000	14.368
Westslope Cutthroat	0	0.000	0.0000	0.000	0.000	0.000
Bull Trout	0	0.000	0.0000	0.000	0.000	0.000
Mountain Whitefish	0	0.000	0.0000	0.000	0.000	0.000
Northern Squawfish	0	0.000	0.0000	0.000	0.000	0.000
Sucker	0	0.000	0.0000	0.000	0.000	0.000
Unidentified	0	0.000	0.0000	0.000	0.000	0.000
Total Fish	0	0.000	0.0000	0.000	0.000	0.000

Appendix C31. Composition by number, weight, and frequency of occurance (percent) and calculated index of relative importance (IRI) for major food items in the stomachs of 5 juvenile mountain whitefish collected November 1985

Item	Number	Percent	Weight(g)	Percent	Frequency	IRI
Daphnia	4240	99.953	1.2095	98.735	80.000	92.896
Copepoda	0	0.000	0.0000	0.000	0.000	0.000
Epischura	0	0.000	0.0000	0.000	0.000	0.000
Leptodora	0	0.000	0.0000	0.000	0.000	0.000
Total Zooplankton	4240	99.953	1.2095	98.735	80.000	92.896
Hymenoptera	0	0.000	0.0000	0.000	0.000	0.000
Coleoptera	1	0.024	0.0143	1.167	20.000	7.064
Hemiptera	0	0.000	0.0000	0.000	0.000	0.000
Homoptera	0	0.000	0.0000	0.000	0.000	0.000
Other Terrestrial	0	0.000	0.0000	0.000	0.000	0.000
Total Terrestrial	1	0.024	0.0143	1.167	20.000	7.064
Diptera Larvae	0	0.000	0.0000	0.000	0.000	0.000
Diptera Pupae	1	0.024	0.0012	0.098	20.000	6.707
Diptera Adult	0	0.000	0.0000	0.000	0.000	0.000
Total Diptera	1	0.024	0.0012	0.098	20.000	6.707
Other Aquatics	0	0.000	0.0000	0.000	0.000	0.000
Total Aquatics	1	0.024	0.0012	0.098	20.000	6.707
Westslope Cutthroat	0	0.000	0.0000	0.000	0.000	0.000
Bull Trout	0	0.000	0.0000	0.000	0.000	0.000
Mountain Whitefish	0	0.000	0.0000	0.000	0.000	0.000
Northern Squawfish	0	0.000	0.0000	0.000	0.000	0.000
Sucker	0	0.000	0.0000	0.000	0.000	0.000
Unidentified	0	0.000	0.0000	0.000	0.000	0.000
Total Fish	0	0.000	0.0000	0.000	0.000	0.000

Appendix C32. Composition by number, weight, and frequency of occurance (percent) and calculated index of relative importance (IRI) for major food items in the stomachs of 8 adult mountain whitefish collected November 1985

Item	Number	Percent	Weight(g)	Percent	Frequency	IRI
Daphnia	9869	99.596	2.5356	99.603	100.000	99.733
Copepods	0	0.000	0.0000	0.000	0.000	0.000
Epischura	1	0.010	0.0004	0.016	12.500	4.175
Leptodora	0	0.000	0.0000	0.000	0.000	0.000
Total Zooplankton	9870	99.606	2.5360	99.619	100.000	99.742
Hymenoptera	0	0.000	0.0000	0.000	0.000	0.000
Coleoptera	0	0.000	0.0000	0.000	0.000	0.000
Hemiptera	0	0.000	0.0000	0.000	0.000	0.000
Homoptera	0	0.000	0.0000	0.000	0.000	0.000
Other Terrestrial	0	0.000	0.0000	0.000	0.000	0.000
Total Terrestrial	0	0.000	0.0000	0.000	0.000	0.000
Diptera Larvae	35	0.353	0.0070	0.275	12.500	4.376
Diptera Pupae	4	0.040	0.0027	0.106	25.000	8.382
Diptera Adult	0	0.000	0.0000	0.000	0.000	0.000
Total Diptera	39	0.394	0.0097	0.381	37.500	12.758
Other Aquatics	0	0.000	0.0000	0.000	0.000	0.000
Total Aquatics	39	0.394	0.0097	0.381	37.500	12.758
Westslope Cutthroat	0	0.000	0.0000	0.000	0.000	0.000
Bull Trout	0	0.000	0.0000	0.000	0.000	0.000
Mountain Whitefish	0	0.000	0.0000	0.000	0.000	0.000
Northern Squawfish	0	0.000	0.0000	0.000	0.000	0.000
Sucker	0	0.000	0.0000	0.000	0.000	0.000
Unidentified	0	0.000	0.0000	0.000	0.000	0.000
Total Fish	0	0.000	0.0000	0.000	0.000	0.000

Appendix C33 Composition by number, weight, and frequency of occurance (percent) and calculated index of relative importance (IRI) for major food items in the stanachs of 13 mountain whitefish collected November 1985

Item	Number	Percent	Weight(g)	Percent	Frequency	IRI
Daphnia	14109	99.703	3.7451	99.321	92.308	97.111
Copepods	0	0.000	0.0000	0.000	0.000	0.000
Epischura	1	0.007	0.0004	0.011	7.692	2.570
Leptodora	0	0.000	0.0000	0.000	0.000	0.000
Total Zooplankton	14110	99.710	3.7455	99.332	92.308	97.117
Hymenoptera	0	0.000	0.0000	0.000	0.000	0.000
Coleoptera	1	0.007	0.0143	0.379	7.692	2.693
Hemiptera	0	0.000	0.0000	0.000	0.000	0.000
Homoptera	0	0.000	0.0000	0.000	0.000	0.000
Other Terrestrial	0	0.000	0.0000	0.000	0.000	0.000
Total Terrestrial	1	0.007	0.0143	0.379	7.692	2.693
Diptera Larvae	35	0.247	0.0070	0.186	7.692	2.708
Diptera Pupae	5	0.035	0.0039	0.103	23.077	7.739
Diptera Adult	0	0.000	0.0000	0.000	0.000	0.000
Total Diptera	40	0.283	0.0109	0.289	30.769	10.447
Other Aquatics	0	0.000	0.0000	0.000	0.000	0.000
Total Aquatics	40	0.283	0.0109	0.289	30.769	10.447
Westslope Cutthroat	0	0.000	0.0000	0.000	0.000	0.000
Bull Trout	0	0.000	0.0000	0.000	0.000	0.000
Mountain Whitefish	0	0.000	0.0000	0.000	0.000	0.000
Northern Squawfish	0	0.000	0.0000	0.000	0.000	0.000
Sucker	0	0.000	0.0000	0.000	0.000	0.000
Unidentified	0	0.000	0.0000	0.000	0.000	0.000
Total Fish	0	0.000	0.0000	0.000	0.000	0.000

Appendix C34. Composition by number, weight, and frequency of cccurance (percent) and calculated index of relative importance (IRI) for major food items in the stomachs of 17 juvenile mountain whitefish collected seasonally 1985

Item	Number	Percent	Weight(g)	Percent	Frequency	IRI
Daphnia	6635	96.890	1.7062	95.345	64.706	85.647
Copepods	0	0.000	0.0000	0.000	0.000	0.000
Epischura	1	0.015	0.0004	0.022	5.882	1.973
Leptodora	0	0.000	0.0000	0.000	0.000	0.000
Total Zooplankton	6636	96.904	1.7066	95.367	64.706	85.659
Hymenoptera	1	0.015	0.0008	0.045	5.882	1.981
Coleoptera	1	0.015	0.0143	0.799	5.882	2.232
Hemiptera	0	0.000	0.0000	0.000	0.000	0.000
Homoptera	0	0.000	0.0000	0.000	0.000	0.000
Other Terrestrial	0	0.000	0.0000	0.000	0.000	0.000
Total Terrestrial	2	0.029	0.0151	0.844	11.765	4.213
Diptera Larvae	112	1.636	0.0053	0.296	23.529	8.487
Diptera Pupae	98	1.431	0.0625	3.493	35.294	13.406
Diptera Adult	0	0.000	0.0000	0.000	0.000	0.000
Total Diptera	210	3.067	0.0678	3.789	47.059	17.971
Other Aquatics	0	0.000	0.0000	0.000	0.000	0.000
Total Aquatics	210	3.067	0.0678	3.789	47.059	17.971
Westslope Cutthroat	0	0.000	0.0000	0.000	0.000	0.000
Bull Trout	0	0.000	0.0000	0.000	0.000	0.000
Mountain Whitefish	0	0.000	0.0000	0.000	0.000	0.000
Northern Squawfish	0	0.000	0.0000	0.000	0.000	0.000
Sucker	0	0.000	0.0000	0.000	0.000	0.000
Unidentified	0	0.000	0.0000	0.000	0.000	0.000
Total Fish	0	0.000	0.0000	0.000	0.000	0.000

Appendix C35. Composition by number, weight, and frequency of cccurance (percent) and calculated index of relative importance (IRI) for major food items in the stomachs of 27 adult mountain whitefish collected seasonally 1985

Item	Number	Percent	Weight(g)	Percent	Frequency	IRI
Daphnia	12416	98.798	3.0782	97.804	74.074	90.226
Copepods	1	0.008	0.0000	0.000	3.704	1.237
Epischura	1	0.008	0.0004	0.013	3.704	1.241
Leptodora	0	0.000	0.0000	0.000	0.000	0.000
Total Zooplankton	12418	98.814	3.0786	97.817	74.074	90.235
Hymenoptera	1	0.008	0.0020	0.064	3.704	1.258
Coleoptera	0	0.000	0.0000	0.000	0.000	0.000
Hemiptera	0	0.000	0.0000	0.000	0.000	0.000
Homoptera	0	0.000	0.0000	0.000	0.000	0.000
Other Terrestrial	13	0.103	0.0072	0.229	7.407	2.580
Total Terrestrial	14	0.111	0.0092	0.292	11.111	3.838
Diptera Larvae	63	0.501	0.0090	0.286	25.926	8.904
Diptera Pupae	71	0.565	0.0463	1.471	37.037	13.024
Diptera Adult	0	0.000	0.0000	0.000	0.000	0.000
Total Diptera	134	1.066	0.0553	1.757	51.852	18.225
Other Aquatics	1	0.008	0.0042	0.133	3.704	1.282
Total Aquatics	135	1.074	0.0595	1.891	51.852	18.272
Westslope Cutthroat	0	0.000	0.0000	0.000	0.000	0.000
Bull Trout	0	0.000	0.0000	0.000	0.000	0.000
Mountain Whitefish	0	0.000	0.0000	0.000	0.000	0.000
Northern Squawfish	0	0.000	0.0000	0.000	0.000	0.000
Sucker	0	0.000	0.0000	0.000	0.000	0.000
Unidentified	0	0.000	0.0000	0.000	0.000	0.000
Total Fish	0	0.000	0.0000	0.000	0.000	0.000

Appendix C36 Composition by number, weight, and frequency of occurance (percent) and calculated index of relative importance (IRI) for major food items in the stomachs of 44 mountain whitefish collected seasonally 1985

Item	Number	Percent	Weight(g)	Percent	Frequency	IRI
Daphnia	19051	98.125	4.7844	96.913	70.455	88.498
Copepods	1	0.005	0.0000	0.000	2.273	0.759
Epischura	2	0.010	0.0008	0.016	4.545	1.524
Leptodora	0	0.000	0.0000	0.000	0.000	0.000
Total Zooplankton	19054	98.141	4.7852	96.929	70.455	88.508
Hymenoptera	2	0.010	0.0028	0.057	4.545	1.537
Coleoptera	1	0.005	0.0143	0.290	2.273	0.856
Hemiptera	0	0.000	0.0000	0.000	0.000	0.000
Homoptera	0	0.000	0.0000	0.000	0.000	0.000
Other Terrestrial	13	0.067	0.0072	0.146	4.545	1.586
Total Terrestrial	16	0.082	0.0243	0.492	11.364	3.979
Diptera Larvae	175	0.901	0.0143	0.290	25.000	8.730
Diptera Pupae	169	0.870	0.1088	2.204	36.364	13.146
Diptera Adult	0	0.000	0.0000	0.000	0.000	0.000
Total Diptera	344	1.772	0.1231	2.494	50.000	18.088
Other Aquatics	1	0.005	0.0042	0.085	2.273	0.788
Total Aquatics	345	1.777	0.1273	2.579	50.000	18.119
Westslope Cutthroat	0	0.000	0.0000	0.000	0.000	0.000
Bull Trout	0	0.000	0.0000	0.000	0.000	0.000
Mountain Whitefish	0	0.000	0.0000	0.000	0.000	0.000
Northern Squawfish	0	0.000	0.0000	0.000	0.000	0.000
Sucker	0	0.000	0.0000	0.000	0.000	0.000
Unidentified	0	0.000	0.0000	0.000	0.000	0.000
Total Fish	0	0.000	0.0000	0.000	0.000	0.000

Appendix C37. Composition by number, weight, and frequency of occurance (percent) and calculated index of relative importance (IRI) for major food items in the stomachs of 4 juvenile northern squawfish collected May 1985

Item	Number	Percent	Weight(g)	Percent	Frequency	IRI
Daphnia	0	0.000	0.0000	0.000	0.000	0.000
Copepods	0	0.000	0.0000	0.000	0.000	0.000
Epischura	0	0.000	0.0000	0.000	0.000	0.000
Leptodora	0	0.000	0.0000	0.000	0.000	0.000
Total Zooplankton	0	0.000	0.0000	0.000	0.000	0.000
Hymenoptera	2	22.222	0.0423	2.329	25.000	16.517
Coleoptera	6	66.667	0.0595	3.276	75.000	48.314
Hemiptera	0	0.000	0.0000	0.000	0.000	0.000
Homoptera	0	0.000	0.0000	0.000	0.000	0.000
Other Terrestrial	0	0.000	0.0000	0.000	0.000	0.000
Total Terrestrial	8	88.889	0.1018	5.604	75.000	56.498
Diptera Larvae	0	0.000	0.0000	0.000	0.000	0.000
Diptera Pupae	0	0.000	0.0000	0.000	0.000	0.000
Diptera Adult	0	0.000	0.0000	0.000	0.000	0.000
Total Diptera	0	0.000	0.0000	0.000	0.000	0.000
Other Aquatics	0	0.000	0.0000	0.000	0.000	0.000
Total Aquatics	0	0.000	0.0000	0.000	0.000	0.000
Westslope Cutthroat	0	0.000	0.0000	0.000	0.000	0.000
Bull Trout	0	0.000	0.0000	0.000	0.000	0.000
Mountain Whitefish	0	0.000'	0.0000	0.000	0.000	0.000
Northern Squawfish	1	11.111	1.7146	94.396	25.000	43.502
Sucker	0	0.000	0.0000	0.000	0.000	0.000
unidentified	0	0.000	0.0000	0.000	0.000	0.000
Total Fish	1	11.111	1.7146	94.396	25.000	43.502

Appendix C38. Composition by number, weight, and frequency of occurance (percent) and calculated index of relative importance (IRI) for major food items in the stomachs of 17 adult northern squawfish collected May 1985

Item	Number	Percent	Weight (g)	Percent	Frequency	IRI
Daphnia	0	0.000	0.0000	0.000	0.000	0.000
Copepods	0	0.000	0.0000	0.000	0.000	0.000
Epischura	0	0.000	0.0000	0.000	0.000	0.000
Leptodora	0	0.000	0.0000	0.000	0.000	0.000
Total Zooplankton	0	0.000	0.0000	0.000	0.000	0.000
Hymenoptera	0	0.000	0.0000	0.000	0.000	0.000
Coleoptera	2	10.000	0.0022	0.001	5.882	5.295
Hemiptera	0	0.000	0.0000	0.000	0.000	0.000
Hanoptera	0	0.000	0.0000	0.000	0.000	0.000
Other Terrestrial	0	0.000	0.0000	0.000	0.000	0.000
Total Terrestrial	2	10.000	0.0022	0.001	5.882	5.295
Diptera Larvae	7	35.000	0.0051	0.003	11.765	15.589
Diptera Pupae	3	15.000	0.0026	0.001	11.765	8.922
Diptera Adult	0	0.000	0.0000	0.000	0.000	0.000
Total Diptera	10	50.000	0.0077	0.004	17.647	22.550
Other Aquatics	0	0.000	0.0000	0.000	0.000	0.000
Total Aquatics	10	50.000	0.0077	0.004	17.647	22.550
Westslope Cutthroat	1	5.000	41.5000	23.649	5.882	11.510
Bull Trout	4	20.000	79.0900	45.069	23.529	29.533
Maintain Whitefish	1	5.000	45.5881	25.978	5.882	12.287
NorthernSquawfish	0	0.000,	0.0000	0.000	0.000	0.000
Sucker	0	0.000	0.0000	0.000	0.000	0.000
Unidentified	2	10.000	9.2972	5.298	5.882	7.060
Total Fish	8	40.000	175.4753	99.994	41.176	60.390

Appendix C39. Composition by number, weight, and frequency of occurance (percent) and calculated index of relative importance (IRI) for major food items in the stomachs of 21 northern squawfish collected my 1985

Item	Number	Percent	Weight (g1	Percent	Frequency	IRI
Daphnia	0	0.000	0.0000	0.000	0.000	0.000
Copepods	0	0.000	0.0000	0.000	0.000	0.000
Epischura	0	0.000	0.0000	0.000	0.000	0.000
Leptodora	0	0.000	0.0000	0.000	0.000	0.000
Total zooplankton	0	0.000	0.0000	0.000	0.000	0.000
Hymenoptera	2	6.897	0.0423	0.024	4.762	3.894
Coleoptera	8	27.586	0.0617	0.035	19.048	15.556
Hemiptera	0	0.000	0.0000	0.000	0.000	0.000
Homhptera	0	0.000	0.0000	0.000	0.000	0.000
Other Terrestrial	0	0.000	0.0000	0.000	0.000	0.000
Total Terrestrial	10	34.483	0.1040	0.059	19.048	17.863
Diptera Larvae	7	24.138	0.0051	0.003	9.524	11.222
Diptera Pupae	3	10.345	0.0026	0.001	9.524	6.623
Diptera Adult	0	0.000	0.0000	0.000	0.000	0.000
Total Diptera	10	34.483	0.0077	0.004	14.286	16.258
Other Aguatics	0	0.000	0.0000	0.000	0.000	0.000
Total Aqutics	10	34.483	0.0077	0.004	14.286	16.258
Westslope Cutthroat	1	3.448	41.5000	23.406	4.762	10.539
Bull Trout	4	13.793	79.0900	44.608	19.048	25.816
Mountain whitefish	1	3.448	45.5881	25.712	4.762	11.307
Northern Aquawfish	1	3.448	1.7146	0.967	4.762	3.059
Sucker	0	0.000	0.0000	0.000	0.000	0.000
Unidentified	2	6.897	9.2972	5.244	4.762	5.634
Total Fish	9	31.034	177.1899	99.937	38.095	56.356

Appendix C40. Somposition by number, weight, and frequency of occurance (percent) and calculated index of relative importance (IRI) for major food items in the stomachs of 12 juvenile northern squawfish collected August 1985

Item	Number	Percent	Weight(g)	Percent	Frequency	IRI
Daphnia	923	85.701	0.1929	10.308	25.000	40.336
Copepods	0	0.000	0.0000	0.000	0.000	0.000
Epischura	0	0.000	0.0000	0.000	0.000	0.000
Leptodora	0	0.000	0.0000	0.000	0.000	0.000
Total Zooplankton	923	85.701	0.1929	10.308	25.000	40.336
Hymenoptera	154	14.299	0.9980	53.329	50.000	39.209
Coleoptera	0	0.000	0.0000	0.000	0.000	0.000
Hemiptera	0	0.000	0.0000	0.000	0.000	0.000
Homoptera	0	0.000	0.0000	0.000	0.000	0.000
Other Terrestrial	0	0.000	0.0000	0.000	0.000	0.000
Total Terrestrial	154	14.299	0.9980	53.329	50.000	39.209
Diptera Larvae	0	0.000	0.0000	0.000	0.000	0.000
Diptera Pupae	0	0.000	0.0000	0.000	0.000	0.000
Diptera Adult	0	0.000	0.0000	0.000	0.000	0.000
Total Diptera	0	0.000	0.0000	0.000	0.000	0.000
Other Aquatics	0	0.000	0.0000	0.000	0.000	0.000
Total Aquatics	0	0.000	0.0000	0.000	0.000	0.000
Westslope Cutthroat	0	0.000	0.0000	0.000	0.000	0.000
Bull Trout	0	0.000	0.0000	0.000	0.000	0.000
Mountain Whitefish	0	0.000	0.0000	0.000	0.000	0.000
Northern Sguawfish	0	0.000	0.0000	0.000	0.000	0.000
Sucker	0	0.000	0.0000	0.000	0.000	0.000
Unidentified	0	0.000	0.6805	36.363	0.000	12.121
Total Fish	0	0.000	0.6805	36.363	0.000	12.121

Appendix C41. Composition by number, weight, and frequency of cccurance (percent) and calculated index of relative importance (IRI) for major food items in the stomachs of 5 adult northern squawfish collected August 1985

Item	Number	Percent	Weight(g)	Percent	Frequency	IRI
Daphnia	0	0.000	0.0000	0.000	0.000	0.000
Copepods	0	0.000	0.0000	0.000	0.000	0.000
Epischura	0	0.000	0.0000	0.000	0.000	0.000
Leptodora	0	0.000	0.0000	0.000	0.000	0.000
Total Zooplankton	0	0.000	0.0000	0.000	0.000	0.000
Hymenoptera	84	100.000	0.4226	5.077	60.000	55.026
Coleogtera	0	0.000	0.0000	0.000	0.000	0.000
Hemiptera	0	0.000	0.0000	0.000	0.000	0.000
Homoptera	0	0.000	0.0000	0.000	0.000	0.000
Other Terrestrial	0	0.000	0.0000	0.000	0.000	0.000
Total Terrestrial	84	100.000	0.4226	5.077	60.000	55.026
Diptera Larvae	0	0.000	0.0000	0.000	0.000	0.000
Diptera Pupae	0	0.000	0.0000	0.000	0.000	0.000
Diptera Adult	0	0.000	0.0000	0.000	0.000	0.000
Total Diptera	0	0.000	0.0000	0.000	0.000	0.000
Other Aquatics	0	0.000	0.0000	0.000	0.000	0.000
Total Aquatics	0	0.000	0.0000	0.000	0.000	0.000
Westslope Cutthroat	0	0.000	0.0000	0.000	0.000	0.000
Bull Trout	0	0.000	0.0000	0.000	0.000	0.000
Mountain Whitefish	0	0.000	0.0000	0.000	0.000	0.000
Northern Squawfish	0	0.000	0.0000	0.000	0.000	0.000
Sucker	0	0.000	0.0000	0.000	0.000	0.000
Unidentified	0	0.000	7.9017	94.923	0.000	31.641
Total Fish	0	0.000	7.9017	94.923	0.000	31.641

Appendix C42. Composition by number, weight, and frequency of occurance (percent) and calculated index of relative importance (IRI) for major food items in the stomachs of 17 northern squawfish collected August 1985

Item	Number	Percent	Weight(g)	Percent	Frequency	IRI
Daphina	923	79.500	0.1929	1.892	17.647	33.013
Copepods	0	0.000	0.0000	0.000	0.000	0.000
Epischura	0	0.000	0.0000	0.000	0.000	0.000
Leptodora	0	0.000	0.0000	0.000	0.000	0.000
Total Zooplankton	923	79.500	0.1929	1.892	17.647	33.013
Hymenoptera	238	20.500	1.4206	13.933	52.941	29.125
Coleoptera	0	0.000	0.0000	0.000	0.000	0.000
Hemiptera	0	0.000	0.0000	0.000	0.000	0.000
Homoptera	0	0.000	0.0000	0.000	0.000	0.000
Other Terrestrial	0	0.000	0.0000	0.000	0.000	0.000
Total Terrestrial	238	20.500	1.4206	13.933	52.941	29.125
Diptera Larvae	0	0.000	0.0000	0.000	0.000	0.000
Diptera Pupae	0	0.000	0.0000	0.000	0.000	0.000
Diptera Adult	0	0.000	0.0000	0.000	0.000	0.000
Total Diptera	0	0.000	0.0000	0.000	0.000	0.000
Other Aquatics	0	0.000	0.0000	0.000	0.000	0.000
Total Aquatica	0	0.000	0.0000	0.000	0.000	0.000
Westslope Cutthroat	0	0.000	0.0000	0.000	0.000	0.000
Bull Trout	0	0.000	0.0000	0.000	0.000	0.000
Mountain Whitefish	0	0.000	0.0000	0.000	0.000	0.000
Northern Squawfish	0	0.000	0.0000	0.000	0.000	0.000
Sucker	0	0.000	0.0000	0.000	0.000	0.000
Unidentified	0	0.000	8.5822	84.175	0.000	28.058
Total Fish	0	0.000	8.5822	84.175	0.000	28.058

Appendix C43. Composition by number,, weight, and frequency of occurance (percent) and calculated index of relative importance (IRI) for major food items in the stomachs of 9 juvenile northern squawfish collected November 1985

Item	Number	Percent	Weight(g)	Percent	Frequency	IRI
Daphnia	6	100.000	0.0012	0.041	33.333	44.450
Copepods	0	0.000	0.0000	0.000	0.000	0.000
Epischura	0	0.000	0.0000	0.000	0.000	0.000
Leptodora	0	0.000	0.0000	0.000	0.000	0.000
Total Zooplankton	6	100.000	0.0012	0.041	33.333	44.458
Hymenoptera	0	0.000	0.0000	0.000	0.000	0.000
Coleoptera	0	0.000	0.0000	0.000	0.000	0.000
Hemiptera	0	0.000	0.0000	0.000	0.000	0.000
Homoptera	0	0.000	0.0000	0.000	0.000	0.000
Other Terrestrial	0	0.000	0.0000	0.000	0.000	0.000
Total Terrestrial	0	0.000	0.0000	0.000	0.000	0.000
Diptera Larvae	0	0.000	0.0000	0.000	0.000	0.000
Diptera Pupae	0	0.000	0.0000	0.000	0.000	0.000
Diptera Adult	0	0.000	0.0000	0.000	0.000	0.000
Total Diptera	0	0.000	0.0000	0.000	0.000	0.000
Other Aquatics	0	0.000	0.0000	0.000	0.000	0.000
Total Aquatics	0	0.000	0.0000	0.000	0.000	0.000
Westslope Cutthroat	0	0.000	0.0000	0.000	0.000	0.000
Bull Trout	0	0.000	0.0000	0.000	0.000	0.000
Mountain Whitefish	0	0.000	0.0000	0.000	0.000	0.000
Northern squawfish	0	0.000	0.0000	0.000	0.000	0.000
Sucker	0	0.000	0.0000	0.000	0.000	0.000
Unidentified	0	0.000	2.9049	99.959	0.000	33.320
Total Fish	0	0.000	2.9049	99.959	0.000	33.320

Appendix C44. Composition by number weight, and frequency of occurance (percent) and calculated index of relative importance (IRI) for major food items in the stomachs of 4 adult northern squawfish ccllected November 1985

Item	Number	Percent	Weight(g)	Percent	Frequency	IRI
Daphnia	0	0.000	0.0000	0.000	0.000	0.000
Copepods	0	0.000	0.0000	0.000	0.000	0.000
Epischura	0	0.000	0.0000	0.000	0.000	0.000
Leptodora	0	0.000	0.0000	0.000	0.000	0.000
Total Zooplankton	0	0.000	0.0000	0.000	0.000	0.000
Hymenoptera	0	0.000	0.0000	0.000	0.000	0.000
Coleoptera	0	0.000	0.0000	0.000	0.000	0.000
Hemiptera	0	0.000	0.0000	0.000	0.000	0.000
Homoptera	0	0.000	0.0000	0.000	0.000	0.000
Other Terrestrial	0	0.000	0.0000	0.000	0.000	0.000
Total Terrestrial	0	0.000	0.0000	0.000	0.000	0.000
Diptera Larvae	0	0.000	0.0000	0.000	0.000	0.000
Diptera Pupae	0	0.000	0.0000	0.000	0.000	0.000
Diptera Adult	0	0.000	0.0000	0.000	0.000	0.000
Total Diptera	0	0.000	0.0000	0.000	0.000	0.000
Other Aquatics	0	0.000	0.0000	0.000	0.000	0.000
Total Aquatics	0	0.000	0.0000	0.000	0.000	0.000
Westslope Cutthroat	0	0.000	0.0000	0.000	0.000	0.000
Bull Trout	0	0.000	0.0000	0.000	0.000	0.000
Mountain Whitefish	0	0.000	0.0918	3.654	0.000	1.218
Northern Squawfish	0	0.000	0.0000	0.000	0.000	0.000
Sucker	0	0.000	0.0000	0.000	0.000	0.000
Unidentified	0	0.000	2.4203	96.346	0.000	32.115
Total Fish	0	0.000	2.5121	100.000	0.000	33.333

Appendix C45. Compposition by number, weight, and frequency of occurance (percent) and calculated index of relative importance (IRI) for major food items in the stomachs of 13 northern squawfish collected November 1985

Item	Number	Percent	Weight (g)	percent	Frequency	IRI
Daphnia	6	100.000	0.0012	0.022	23.077	41.033
Copepods	0	0.000	0.0000	0.000	0.000	0.000
Epischura	0	0.000	0.0000	0.000	0.000	0.000
Leptodora	0	0.000	0.0000	0.000	0.000	0.000
Total Zooplankton	6	100.000	0.0012	0.022	23.077	41.033
Hymenoptera	0	0.000	0.0000	0.000	0.000	0.000
Coleoptera	0	0.000	0.0000	0.000	0.000	0.000
Hemiptera	0	0.000	0.0000	0.000	0.000	0.000
Homoptera	0	0.000	0.0000	0.000	0.000	0.000
Other Terrestrial	0	0.000	0.0000	0.000	0.000	0.000
Total Terrestrial	0	0.000	0.0000	0.000	0.000	0.000
Diptera Larvae	0	0.000	0.0000	0.000	0.000	0.000
Diptera Pupae	0	0.000	0.0000	0.000	0.000	0.000
Diptera Adult	0	0.000	0.0000	0.000	0.000	0.000
Total Diptera	0	0.000	0.0000	0.000	0.000	0.000
Other Aquatics	0	0.000	0.0000	0.000	0.000	0.000
Total Aquatics	0	0.000	0.0000	0.000	0.000	0.000
Westslope Cutthroat	0	0.000	0.0000	0.000	0.000	0.000
Bull Trout	0	0.000	0.0000	0.000	0.000	0.000
Mountain Whitefish	0	0.000	0.0918	1.694	0.000	0.565
Northern Squawfish	0	0.000	0.0000	0.000	0.000	0.000
Sucker	0	0.000	0.0000	0.000	0.000	0.000
Unidentified	0	0.000	5.3252	98.284	0.000	32.761
Total Fish	0	0.000	5.4170	99.978	0.000	33.326

Appendix C46. Composition by number, weight, and frequency of occurauce (percent) and calculated index of relative importance (IRI) for major food items in the stomachs of 25 juvenile northern squawfish collected seasonally 1985

Item	Number	Percent	Weight(g)	Percent	Frequency	IRI
Daphnia	929	85.073	0.1941	2.944	24.000	37.339
Copepods	0	0.000	0.0000	0.000	0.000	0.000
Epischura	0	0.000	0.0000	0.000	0.000	0.000
Leptodora	0	0.000	0.0000	0.000	0.000	0.000
Total Zooplankton	929	85.073	0.1941	2.944	24.000	37.339
Hymenoptera	156	14.286	1.0403	15.777	28.000	19.354
Coleoptera	6	0.549	0.0595	0.902	12.000	4.484
Hemiptera	0	0.000	0.0000	0.000	0.000	0.000
Homoptera	0	0.000	0.0000	0.000	0.000	0.000
Other Terrestrial	0	0.000	0.0000	0.000	0.000	0.000
Total Terrestrial	162	14.835	1.0998	16.679	36.000	22.505
Diptera Larvae	0	0.000	0.0000	0.000	0.000	0.000
Diptera Pupae	0	0.000	0.0000	0.000	0.000	0.000
Diptera Adult	0	0.000	0.0000	0.000	0.000	0.000
Total Diptera	0	0.000	0.0000	0.000	0.000	0.000
Other Aquatics	0	0.000	0.0000	0.000	0.000	0.000
Total Aguatics	0	0.000	0.0000	0.000	0.000	0.000
Westslope Cutthroat	0	0.000	0.0000	0.000	0.000	0.000
Bull Trout	0	0.000	0.0000	0.000	0.000	0.000
Mountain Whitefish	0	0.000	0.0000	0.000	0.000	0.000
Northern Squawfish	1	0.092	1.7146	26.003	4.000	10.031
Sucker	0	0.000	0.0000	0.000	0.000	0.000
Unidentified	0	0.000	3.5854	54.374	0.000	18.125
Total Fish	1	0.092	5.3000	80.377	4.000	28.156

Appendix C47. Composition by number, weight, and frequency of occurauce (percent) and calculated index of relative importance (IRI) for major food items in the stomachs of 26 adult northern squawfish collected seasonally 1985

Item	Number	Percent	Weight(g)	Percent	Frequency	IRI
Daphnia	0	0.000	0.0000	0.000	0.000	0.000
Copepods	0	0.000	0.0000	0.000	0.000	0.000
Epischura	0	0.000	0.0000	0.000	0.000	0.000
Leptodora	0	0.000	0.0000	0.000	0.000	0.000
Total Zooplankton	0	0.000	0.0000	0.000	0.000	0.000
Hymenoptera	84	80.769	0.4226	0.227	11.538	30.845
Coleoptera	2	1.923	0.0022	0.001	3.846	1.923
Hemiptera	0	0.000	0.0000	0.000	0.000	0.000
Homoptera	0	0.000	0.0000	0.000	0.000	0.000
Other Terrestrial	0	0.000	0.0000	0.000	0.000	0.000
Total Terrestrial	86	82.692	0.4248	0.228	15.385	32.768
Diptera Larvae	7	6.731	0.0051	0.003	7.692	4.809
Diptera Pupae	3	2.885	0.0026	0.001	7.692	3.526
Diptera Adult	0	0.000	0.0000	0.000	0.000	0.000
Total Diptera	10	9.615	0.0077	0.004	11.538	7.053
Other Aquatics	0	0.000	0.0000	0.000	0.000	0.000
Total Aquatics	10	9.615	0.0077	0.004	11.538	7.053
Westslope Cutthroat	1	0.962	41.5000	22.273	3.846	9.027
Bull Trout	4	3.846	79.0900	42.448	15.385	20.560
Mountain Whitefish	1	0.962	45.6799	24.517	3.846	9.775
Northern Squawfish	0	0.000	0.0000	0.000	0.000	0.000
Sucker	0	0.000	0.0000	0.000	0.000	0.000
Unidentified	2	1.923	19.6192	10.530	3.846	5.433
Total Fish	8	7.692	185.8891	99.768	26.923	44.794

Appendix C48. Composition by number, weight, and frequency of occurauce (percent) and calculated index of relative importance (IRI) for major food items in the stomachs of 51 northern squawfish collected seasonally 1985

Item	Number	Percent	Weight(g)	Percent	Frequency	IRI
Daphnia	929	77.676	0.1941	0.101	11.765	29.847
Copepods	0	0.000	0.0000	0.000	0.000	0.000
Epischura	0	0.000	0.0000	0.000	0.000	0.000
Leptodora	0	0.000	0.0000	0.000	0.000	0.000
Total Zooplaukton	929	77.676	0.1941	0.101	11.765	29.847
Hymeuoptera	240	20.067	1.4629	0.758	19.608	13.478
Coleoptera	8	0.669	0.0617	0.032	7.843	2.848
Hemiptera	0	0.000	0.0000	0.000	0.000	0.000
Homoptera	0	0.000	0.0000	0.000	0.000	0.000
Other Terrestrial	0	0.000	0.0000	0.000	0.000	0.000
Total Terrestrial	248	20.736	1.5246	0.790	25.490	15.672
Diptera Larvae	7	0.585	0.0051	0.003	3.922	1.503
Diptera Pupae	3	0.251	0.0026	0.001	3.922	1.391
Diptera Adult	0	0.000	0.0000	0.000	0.000	0.000
Total Diptera	10	0.836	0.0077	0.004	5.882	2.241
Other Aquatics	0	0.000	0.0000	0.000	0.000	0.000
Total Aquatics	10	0.836	0.0077	0.004	5.882	2.241
Westslope Cutthroat	1	0.084	41.5000	21.512	1.961	7.852
Bull Trout	4	0.334	79.0900	40.997	7.843	16.392
Mountain Whitefish	1	0.084	45.6799	23.679	1.961	8.574
Northern Squawfish	1	0.084	1.7146	0.889	1.961	0.978
Sucker	0	0.000	0.0000	0.000	0.000	0.000
Unidentified	2	0.167	23.2046	12.028	1.961	4.719
Total Fish	9	0.753	191.1891	99.105	15.686	38.515

APPENDIXD

Average catch in floating and sinking gill nets for fish species, 1983 to 1986.

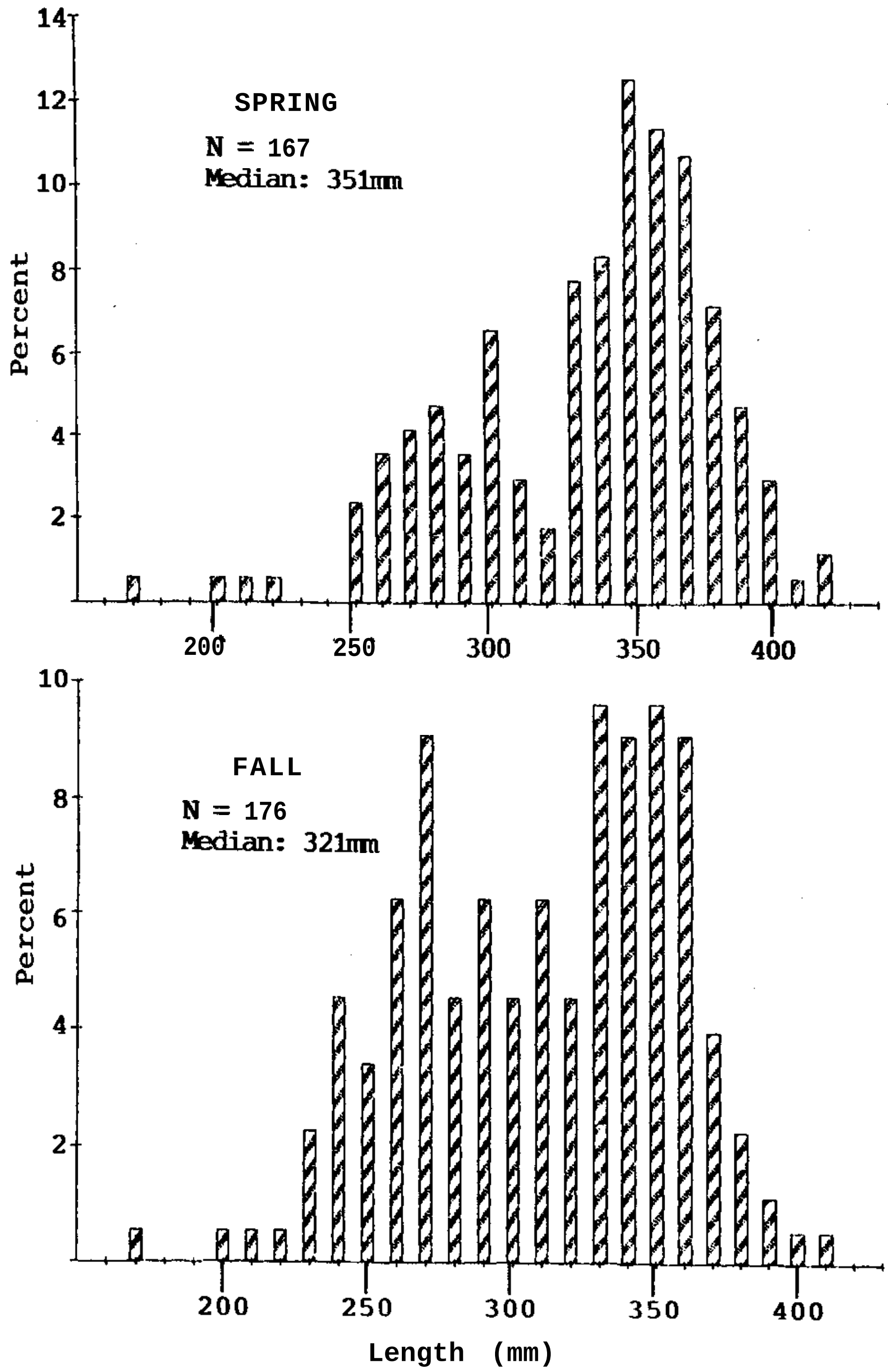
Appendix D1 Average catch in Floating and sinking nets for fish species from Hungry Horse Reservoir, 1983-86.

DATE	Number of[a] nets/area			Emery						Murray						Sullivan						Areas Combined					
	E	M	S	WCT	DV	MWF	NSQ	CSU	LNSU	WCT	DV	MWF	NSQ	CSU	LNSU	WCT	DV	MWF	NSQ	CSU	LNSU	WCT	DV	MWF	NSQ	CSU	LNSU
Floating Nets																											
07/26-28/83	14	14	14	1.2	0.1	0.1	2.9	0.0	0.0	0.7	0.1	0.0	1.7	0.0	0.0	1.4	0.1	0.0	0.6	0.1	0.0	1.1	0.1	0.0	1.7	0.1	0.0
08/23-25/83	14	14	14	0.2	0.1	0.0	2.7	0.0	0.0	0.2	0.1	0.0	1.9	0.1	0.1	0.9	0.0	0.0	1.5	0.1	0.1	0.4	0.1	0.0	2.0	0.1	0.0
09/27-29/83	14	14	14	2.0	0.2	1.7	4.4	0.0	0.0	3.0	0.3	1.9	3.3	0.3	0.0	3.5	0.1	0.3	1.1	0.0	0.0	2.8	0.2	1.3	2.9	0.1	0.1
11/01-03/83	14	14	14	2.6	0.2	0.5	0.1	0.0	0.0	1.2	0.1	0.4	0.0	0.0	0.0	3.3	0.1	0.9	0.1	0.1	0.0	2.4	0.2	0.6	0.1	0.0	0.0
11/29- 12/03/83	14	14	14	0.5	0.1	0.1	0.0	0.0	0.0	0.8	0.0	0.1	0.0	0.0	0.0	0.7	0.1	0.0	0.0	0.0	0.0	0.7	0.1	0.1	0.0	0.0	0.0
04/24-27/84	14	14	14	2.2	0.0	0.1	0.1	0.0	0.0	3.0	0.0	0.0	0.0	0.0	0.0	9.1	1.2	0.1	0.1	0.0	0.0	4.8	0.4	0.0	0.0	0.0	0.1
05/30-31/84	14	14	12	1.6	1.4	0.5	0.9	0.4	0.1	3.4	0.6	0.3	0.4	0.1	0.1	2.1	1.0	0.3	0.8	0.1	0.0	2.4	0.6	0.4	0.7	0.2	0.1
06/26-28/84	14	14	14	1.1	0.7	0.2	5.0	0.3	0.0	2.3	0.2	0.2	2.2	0.2	0.1	4.3	0.6	0.1	1.3	0.2	0.0	2.6	0.5	0.2	2.9	0.2	0.1
08/13-22/84	28	28	28	0.1	0.1	0.1	5.3	0.0	0.0	0.2	0.0	0.1	5.4	0.1	0.0	0.5	0.0	0.1	1.7	0.0	0.0	0.2	0.1	0.1	4.1	0.1	0.0
10/11-15/84	—	28	26	—	—	—	—	—	—	0.4	0.1	0.6	0.8	0.2	0.0	1.8	0.1	0.0	0.2	0.0	0.0	1.1	0.1	0.3	0.5	0.1	0.0
05/14-21/85	14	28	28	4.8	0.5	0.1	1.9	0.2	0.0	2.6	0.4	0.2	0.2	0.1	0.0	3.7	0.9	0.2	0.7	0.0	0.0	3.5	0.6	0.2	0.7	0.1	0.0
08/14-20/85 1011/06/85	28	26	14	0.7	0.4	0.1	1.7	0.1	0.0	1.2	0.1	0.3	0.0	0.1	0.0	1.1	0.1	0.2	1.6	0.0	0.0	1.3	0.2	0.4	0.1	0.1	0.0
05/15-22/86	28	28	28	2.4	0.3	0.2	0.2	0.1	0.0	1.7	0.4	0.1	0.3	0.1	0.1	1.7	0.4	0.1	0.2	0.0	0.1	1.9	0.3	0.1	0.2	0.1	0.1
08/12-20/86	28	28	28	0.1	0.0	0.1	8.0	0.1	0.1	0.3	0.1	0.2	1.9	0.1	0.0	0.5	0.0	0.1	0.1	0.1	0.0	0.3	0.1	0.1	3.4	0.1	0.1
11/01-07/86	28	28	28	1.9	0.4	0.8	0.1	0.0	0.0	1.2	0.3	0.6	0.1	0.0	0.0	2.8	0.6	1.0	0.2	0.0	0.0	1.9	0.4	0.8	0.1	0.0	0.0
Sinking Nets																											
07/26-28/83	2	2	2	0.0	1.0	1.0	13.5	3.5	18.5	0.0	4.0	1.5	7.5	4.0	7.5	0.0	2.0	2.0	3.0	4.0	10.0	0.0	2.3	1.5	7.0	3.8	12.0
08/23-25/83	3	3	3	0.3	1.3	2.0	8.7	3.3	11.3	0.0	0.3	1.3	10.3	6.3	6.0	0.0	0.7	0.7	6.0	5.7	6.0	0.1	0.8	1.3	8.3	4.1	7.8
09/27-29/83			3	0.0	4.7	15.0	14.7	4.7	0.3	1.0	3.3	38.0	5.3	1.3	0.0	2.3	3.7	22.0	3.3	0.3	0.0	1.1	3.9	25.0	7.8	2.1	0.1
11/01-03/83	3	3	3	0.3	1.1.9.3.2.0.7			0.1.0.0.0		1.3	1.3	7.7.0.1.3		0.0	0.0	0.3	2.0	16.7	3.7	0.7	0.0	0.3	1.7	15.9	0.8	0.9	0.1
11/29- 12/03/83	3	3																									
04/24-27/84	4	4	4	1.5	4.3	11.5	1.3	1.0	0.3	1.5	2.5	11.0	0.3	0.3	0.3	0.0	8.0	16.8	2.0	1.5	2.5	1.0	4.9	13.1	1.2	0.9	1.0
05/30-31/84	4	4	4	0.0	6.5	7.3	3.5	1.0	6.8	1.0	7.0	7.5	4.0	1.5	2.8	0.3	2.3	4.5	4.3	0.8	1.8	0.4	5.3	6.4	3.9	1.1	3.8
06/26-28/84	4	4	4	0.8	3.5	7.0	7.5	4.8	6.8	0.3	5.0	3.0	5.5	2.5	7.0	0.3	5.8	7.5	4.0	3.8	9.0	0.4	4.8	5.8	5.7	3.7	7.6
08/13-22/84	10	10	10	0.0	1.7	3.6	12.8	2.8	8.0	0.1	1.8	1.9	10.8	4.6	5.9	0.2	0.7	3.7	3.8	3.7	4.3	0.1	1.4	3.1	9.1	3.7	6.1
10/11-15/84	—	10	7	—	—	—	—	—	—	0.0	3.6	21.6	3.8	0.5	0.3	0.7	5.6	23.3	5.9	1.1	0.3	0.3	4.4	22.3	4.6	0.8	0.3
05/14-21/85	5	10	10	0.0	4.6	11.2	2.4	1.2	4.0	0.0	3.8	13.8	1.4	1.8	3.8	0.2	5.6	13.3	2.5	1.9	1.9	0.1	4.7	13.1	2.0	1.7	3.1
08/14-20/85	10	10	10	0.6	3.3	9.5	11.2	1.7	4.7	0.0	1.4	4.0	10.8	2.7	2.8	0.2	3.3	4.7	8.1	4.3	6.2	0.3	2.7	6.1	10.0	2.9	4.6
10/31- 11/06/85	10	10	5	0.0	3.9	6.8	2.8	1.0	0.4	0.1	2.2	4.3	2.3	1.0	0.1	0.6	4.2	11.8	1.2	1.2	0.4	0.2	3.8	6.8	2.3	1.0	0.3
05/15-22/86	10	10	10	0.3	4.1	16.2	1.1	1.4	2.9	0.0	4.5	11.0	2.2	2.9	3.6	0.5	8.7	9.8	2.6	1.2	4.3	0.3	5.8	12.3	2.0	1.8	3.6
08/12-20/86	10	10	10	0.0	3.4	5.3	7.0	1.3	7.4	0.8	1.4	2.1	10.3	4.2	4.0	0.2	1.9	2.8	5.7	4.8	5.5	0.3	2.2	3.4	7.7	3.4	5.6
11/01-07/86	10	10	10	0.4	5.1	10.3	1.7	1.6	0.2	0.6	2.6	6.5	2.2	1.0	0.0	0.2	6.6	21.5	2.4	1.1	0.1	0.4	4.8	12.8	2.1	1.2	0.1 (1.2)[b] PW

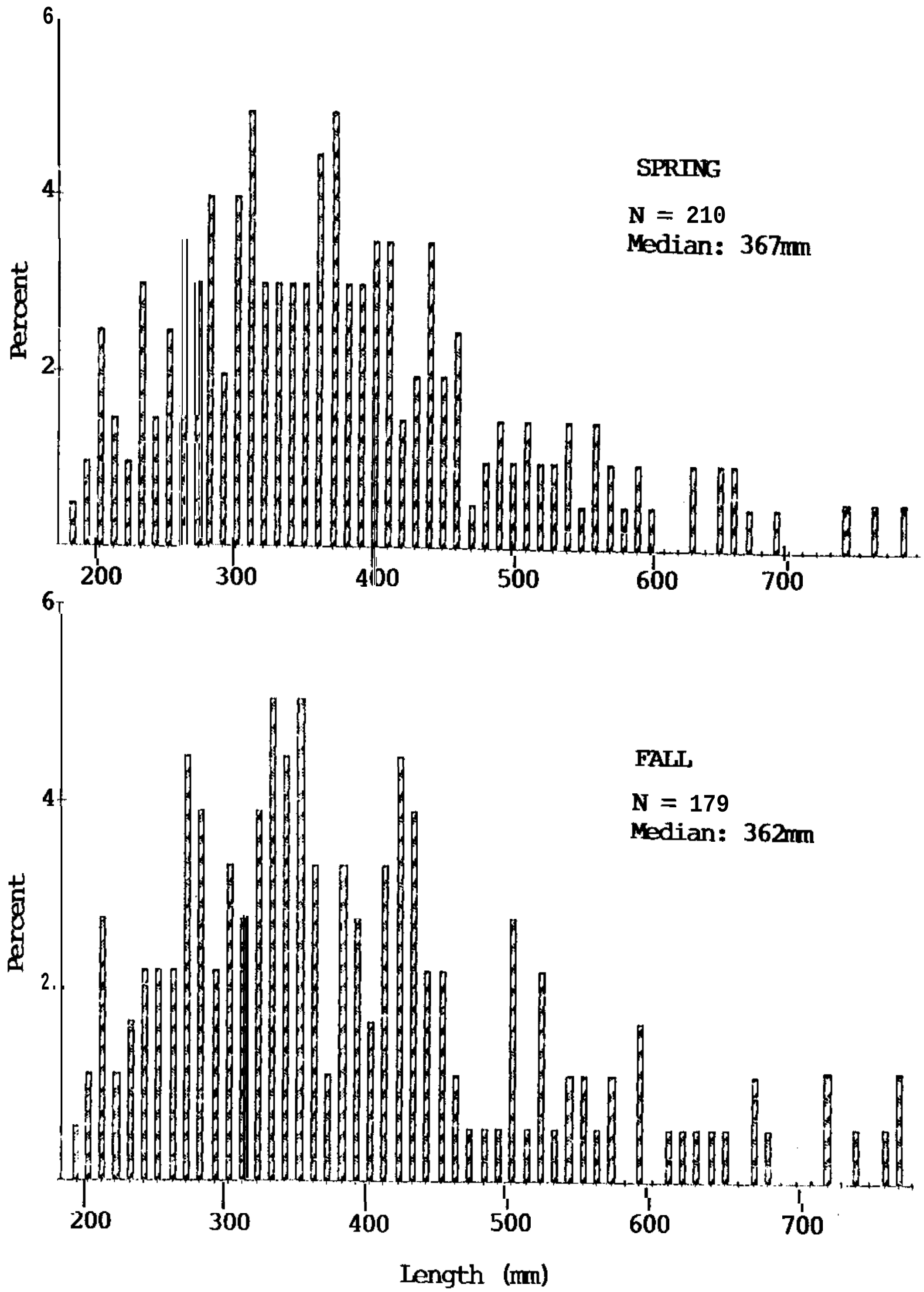
[a] E = Emery area M = Murray area, s = sullivan area, [b] Pygmy whitefish

APPENDIX E

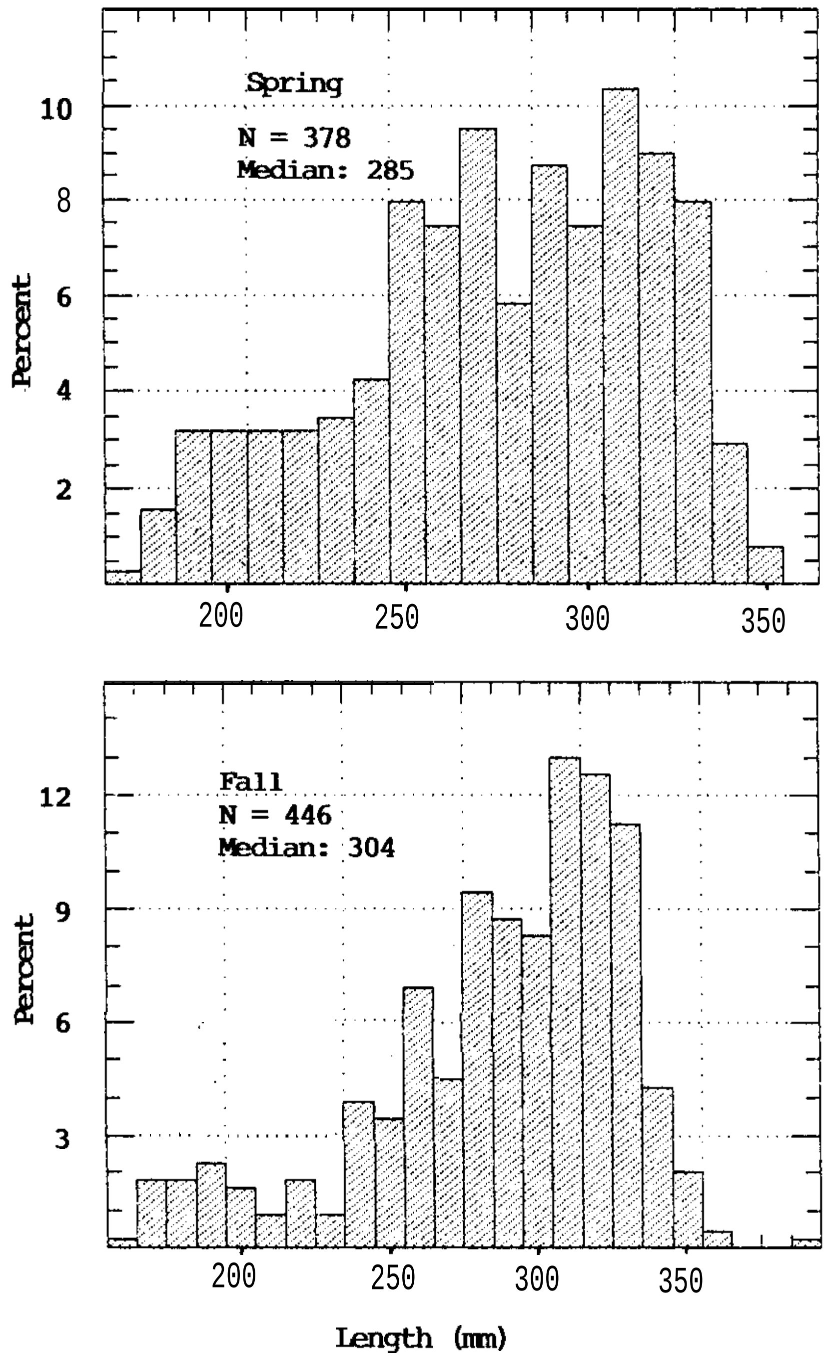
Length frequency diagrams for fish species captured in gill nets. 1986.



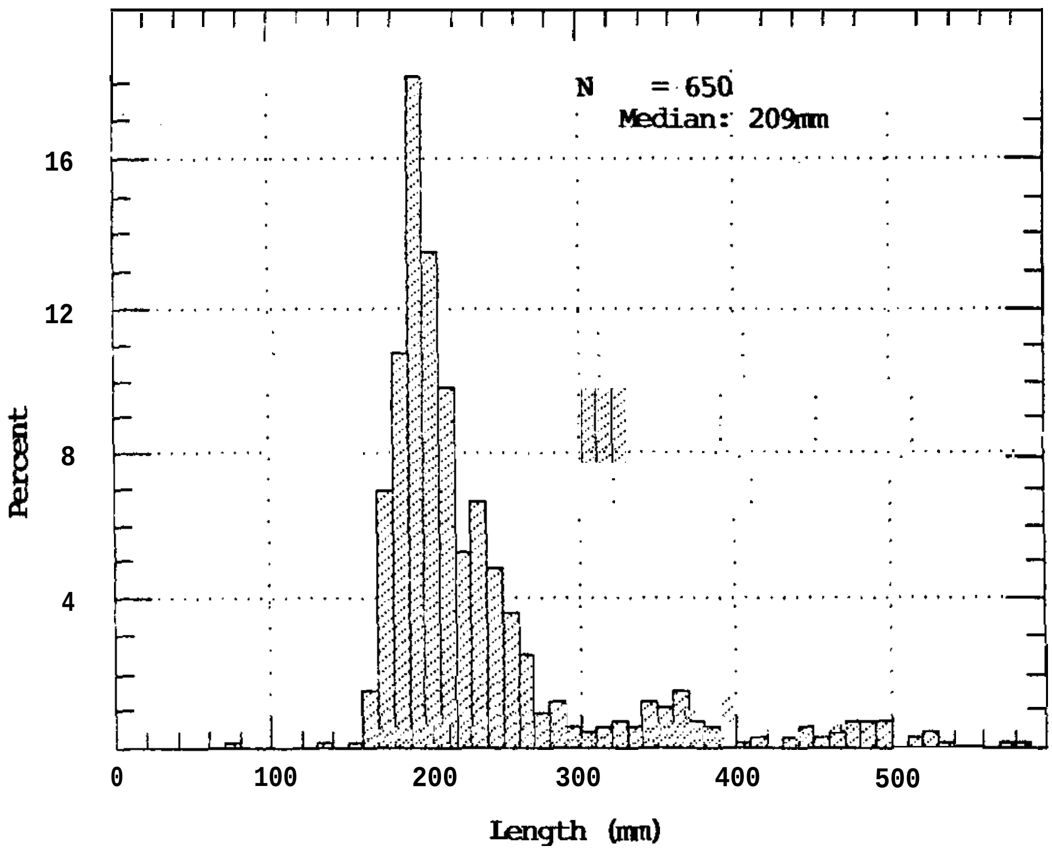
Appendix El . Length frequency diagrams for westslope cutthroat trout captured in floating and sinking gill nets in Hungry Horse Reservoir in the spring and fall, 1986



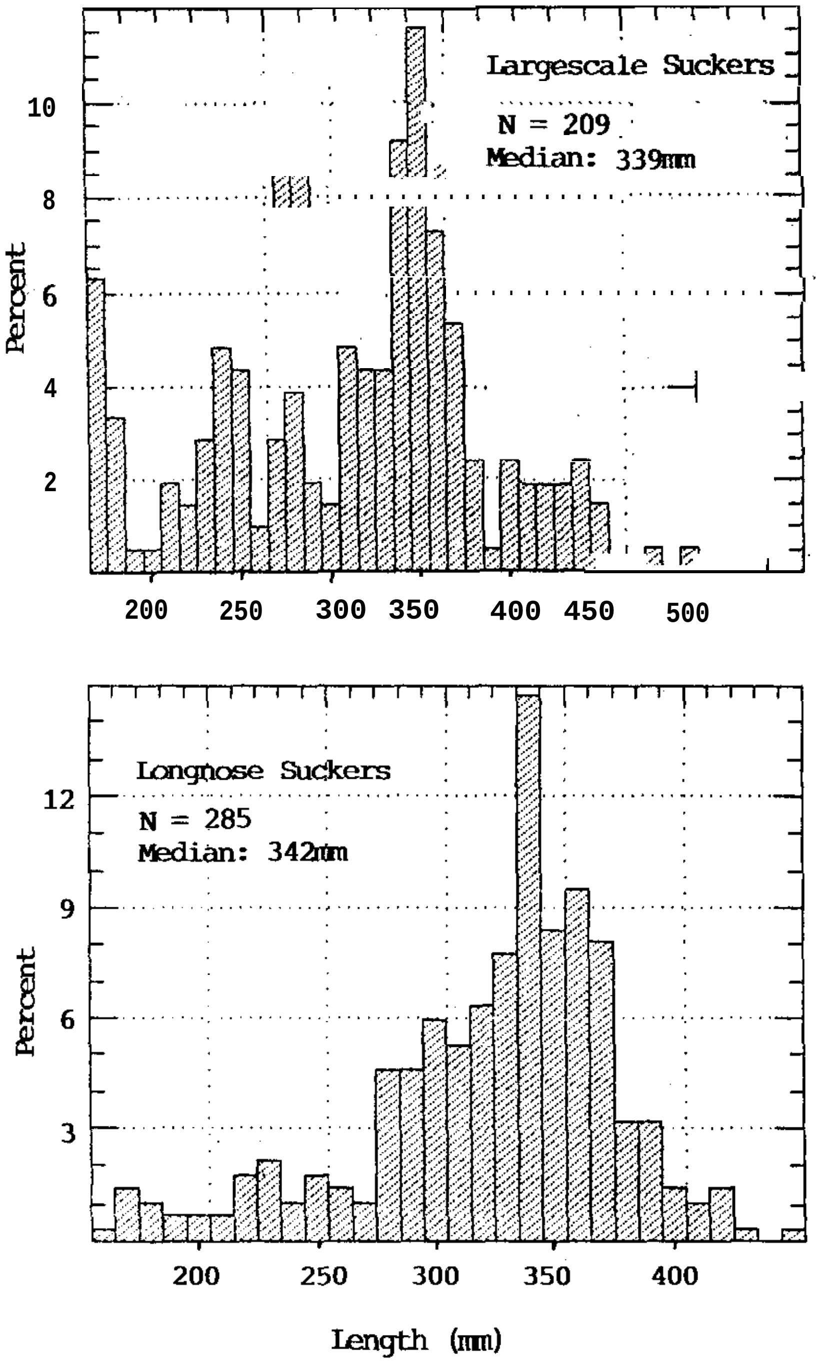
Appendix E2. Length frequency diagrams for bull trout captured in floating and sinking gill nets in Hungry Horse Reservoir in the spring and fall, 1986.



Appendix E3. Length frequeccy diagram for mountain whitefish **captured** in gill nets Set in Hungry Horse Reservior, **1986.**



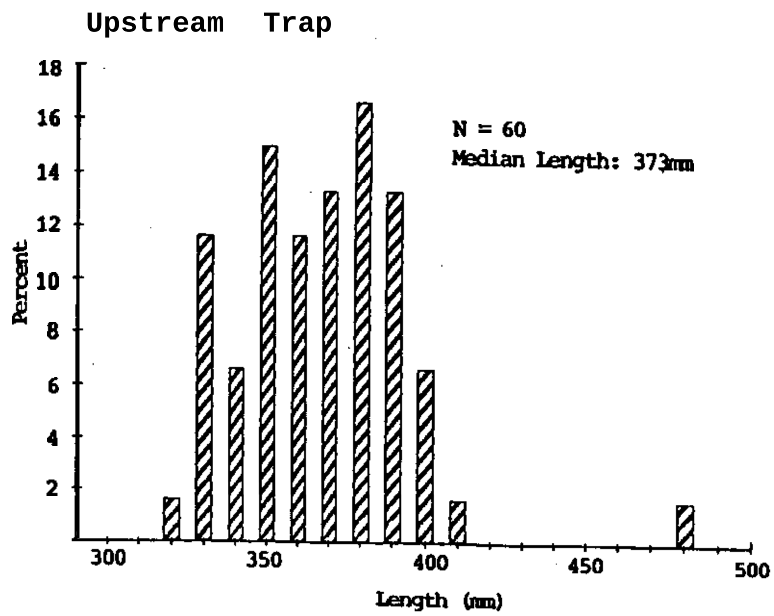
Appendix E4. Length frequency digram for northern squawfish captured in gill nets set in Hungry Horse Reservoir 1986.

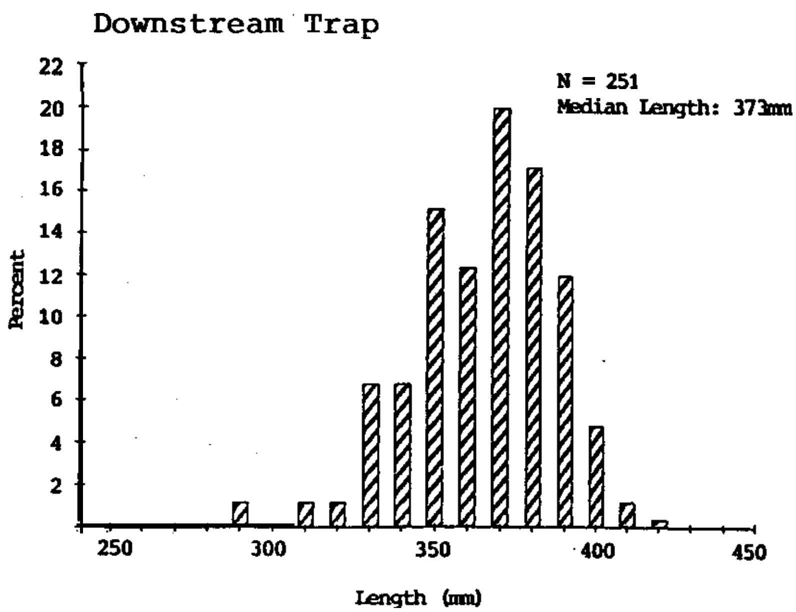


Appendix E5. Length frequency diagram for larqescale and longnose suckers captured in qillnets set in Hunqry Horse Reservoir.

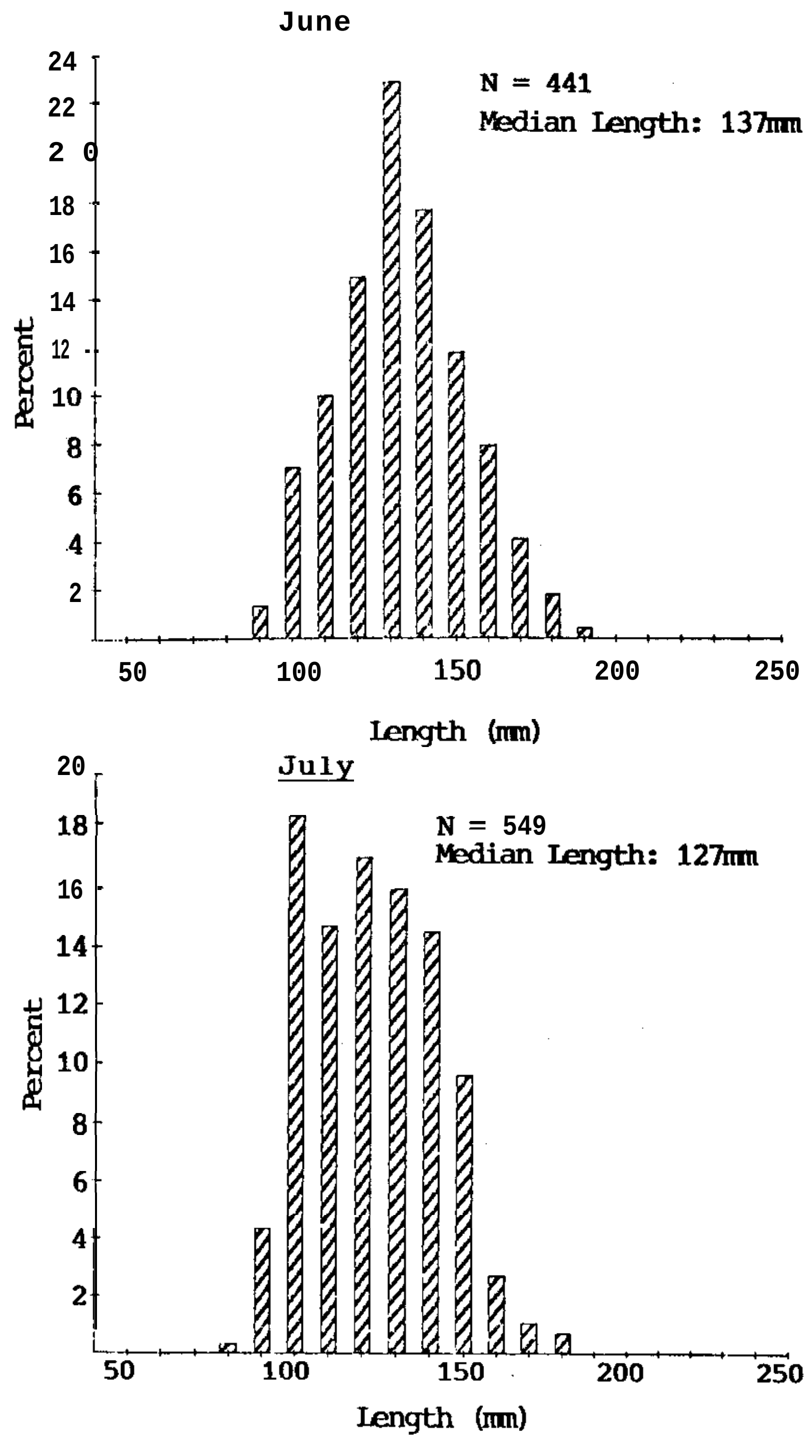
APPENDIX F

Length frequency diagrams for cutthroat trout caught in Hungry Horse Creek fish trap. 1986.





Appendix F1. Length frequency diagram of adult cutthroat trout caught in upstream and downstream traps in Hungry Horse Creek, 1986.



Appendix F2. Length frequency diagram of juvenile westslope cutthroat trout caught in down-stream trap in Hungry Horse Creek, June and July, 1986

APPENDIX G

Estimated number of cutthroat trout juveniles >75 mm in tributaries to Hungry Horse Reservoir and the South Fork of the Flathead giver upstream from the reservoir to Bunker Creek.

Appendix G1. Estimated number of cutthroat trout juveniles >75 mm in tributaries to Hungry Horse Reservoir and South Fork of the Flathead River upstream from the Reservoir to Bunker Creek.

Stream	Stream Order	Reach	Gradient Percent Slope	Length (meters)	Number WCT >75 mm
			Tributaries to Hungry Horse Reservoir		
Emery	3	1	2.0	10,000	6,290
Emery	2	1	5.8	261	82
Emery Loop	2	1	2.2	1,624	924
Emery Loop	2	1	5.9	1,501	474
Emery Loop	2	2	2.2	604	389
Strife	2	1	5.4	424	134
Hungry Horse	3	1	117	6,264	3,940
Hungry Horse	3	1	4.4	415	180
Hungry Horse	2	2	4.5	2,150	679
Margaret	2	1	4.1	2,700	853
Lost Mare	2	1	5.7	1,199	379
Tiger	2	1	3.5	2,882	2,231
Tent	3	1	3.2	717	182
Dudley	2	1	4.3	2,659	840
Riverside	3	1	5.9	1,237	537
McInernie	2	1	4.6	1,864	589
Logan	2	1	4.8	2,499	790
S.F. Logan	2	1	6.3	2,900	916
Baptiste	2	1	5.4	1,399	442
Peters	2	2	3.9	620	196
Boris	3	1	3.5	2,100	533
Boris	3	2	5.8	340	148
Lost Johnny	3	1	4.1	1,000	434
Wounded Buck	4	1	2.1	4,709	636
Wounded Buck	3	2	3.9	2,512	1,090
Quintonkon	3	1	3.3	5,200	1,321
Clark	2	1	3.9	2,500	790
Sullivan	4	1	1.2	10,800	2,592
Sullivan	3	2	2.2	8,346	5,250
Slide	2	1	5.5	2,100	664
Connor	3	1	3.3	4,800	1,219
Connor	2	1	5.5	4,721	1,492
Branch	3	1	5.3	1,542	669
Branch	2	2	3.6	2,261	1,745
Wheeler	3	1	2.8	1,700	432
Wheeler	3	2	2.6	8,300	2,108
Forest	2	1	6.7	2,200	955
				106,930	43,125

Appendix Gl. Continued

Stream	Stream Order	Reach	Gradient Percent Slope	Length (meters)	Number WCT >75 mm
Tributarie to South Fork Dowenstream from Bunked creek					
Soldier	2	1	6.4	6,539	2,066
Lower Twin	3	1	2.2	6,736	4,237
Twin	4	1	1.3	6.807	1,634
Tin	3	1	4.0	1,494	379
spotted Sear River	5	1	0.8	29,485	4,216
Spotted Bear River	4	2	2.0	3,503	473
Bent	2	1	4.0	1,542	487
Bent	2	2	4.8	3,849	1,216
Bent	2	3	2.9	2,083	1,616
Sergeant	3	1	4.4	4,704	2,042
Sergeant	2	1	4.4	1,353	428
Sergeant	2	2	4.0	686	217
Milk	2	1	5.0	245	77
Silvertip	3	1	4.8	1,814	787
Dean	4	1	4.8	3,893	526
Dean	3	2	3.0	3,206	814
Dean	2	3	2.3	5,749	4,086
Addition	4	1	4.2	2,639	356
Harrison	4	1	3.8	5,486	741
Harrison	3	2	5.9	1,897	823
Corporal	2	1	3.8	2,189	1,699
Bunker	5	1	0.6	8,170	1,168
Bunker	4	2	4.6	529	71
Gorge	4	1	2.1	5,656	764
Gorge	3	1	2.1	893	562
Gorge	3	2	1.3	7,357	2,862
Gorge	2	4	1.5	877	199
Stadium	4	1	3.4	4,433	598
Stadium	3	2	5.8	1,844	800
Cannon	3	1	5.0	6,630	2,877
				132,288	38,821

APPENDIX H

Tagging and return data for westslope cutthroat trout tagged in Hungry Horse Resevoir its tributaries and the South Fork of the Flathead giver, 1986.

Appendix H1. **Tagging and return information for westslope cutthroat trout tagged in tributaries to Hungry Horse Reservoir and the South Fork River from the reservoir to Bunker Creek, 1986.**

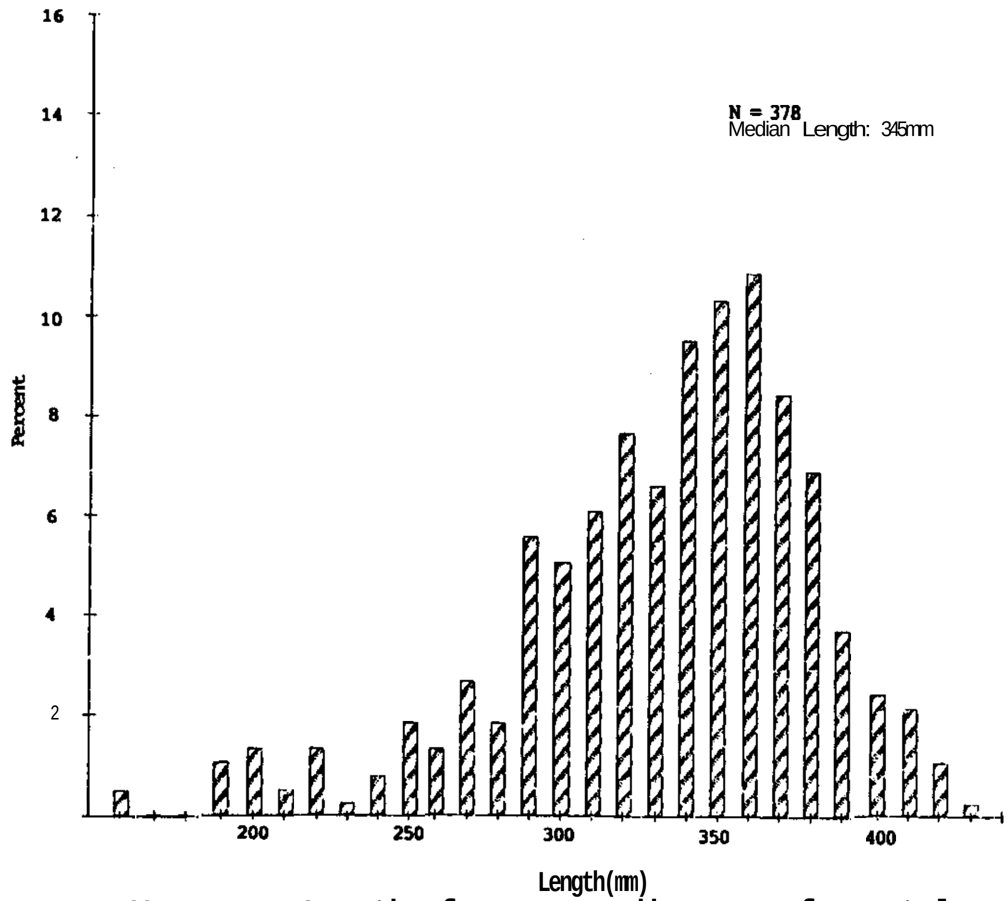
Tagging Data			Return Data				
Date	Location	Length (mm)	Date	Location	Length (mm)	Method of Recapture	Distance Moved (km)
07-02-84	Hungry Horse Cr.	321	05-01-86	Hungry Horse Bay	~381	Angler	-0.5
07-13-84	Hungry Horse Cr.	405	05-24-86	Hungry Horse Bay	422	Angler	-0.5
07-13-84	Hungry Horse Cr.	386	05-15-86	Hungry Horse Bay	~387	Angler	-0.5
07-23-84	Hungry Horse Cr.	373	05-15-86	Hungry Horse Bay	382	Gill Net	±1.0
07-24-84	Hungry Horse Cr.	420	05-15-86	Hungry Horse Bay	420	Gill Net	±1.0
06-24-85	Hungry Horse Cr.	397	05-17-86	Hungry Horse Cr.	~387	Angler	—
06-25-85	Hungry Horse Cr.	374	05-11-86	H.H.R. - Devil's Corkscrew	~370	Angler	+42.8
06-25-85	Hungry Horse Cr.	380	06-01-86	Clayton Cr.	~380	Angler	+18.0
06-25-85	Hungry Horse Cr.	357	05-24-86	H.H.R. - Lid Cr.	~366	Angler	+10.4
06-29-85	Hungry Horse Cr.	360	08-?-86	H.H.R. - Deep Cr.	—	Angler	+23.8
06-29-85	Hungry Horse Cr.	382	06-10-86	Tiger Cr.	~381	Angler	+0.5
07-01-85	Hungry Horse Cr.	395	07-21-86	—	~381	Angler	—
07-12-85	Hungry Horse Cr.	313	05-24-86	Hungry Horse Bay	~318	Angler	±0.5
07-13-85	Hungry Horse Cr.	389	05-23-86	Hungry Horse Bay	~390	Angler	±0.5
07-19-85	Hungry Horse Cr.	358	07-12-86	Hungry Horse Bay	~330	Angler	±0.5
06-12-86*	Hungry Horse Cr.	360	06-24-86	Hungry Horse Bay	~330	Angler	±0.5
06-12-86*	Hungry Horse Cr.	426	07-31-86	Hungry Horse Bay	~419	Angler	+5.5
06-15-86	Hungry Horse Cr.	383	10-07-86	H.H.R. - Lid Cr.	~381	Angler	+10.5
06-15-86	Hungry Horse Cr.	377	06-20-86	Hungry Horse Bay	~372	Angler	±0.5
06-15-86	Hungry Horse Cr.	354	06-23-86	Hungry Horse Bay	~330	Angler	±0.5
06-16-86	Hungry Horse Cr.	386	08-16-86	H.H.R. - Lid Cr.	~378	Angler	+10.5
06-16-86	Hungry Horse Cr.	392	07-06-86	H.H.R. - Anna Cr.	~387	Angler	+32.7
06-16-86	Hungry Horse Cr.	355	06-27-86	Hungry Horse Bay	~343	Angler	±0.5
06-18-86	Hungry Horse Cr.	358	06-21-86	Hungry Horse Bay	~311	Angler	±0.5
06-18-86	Hungry Horse Cr.	380	08-28-86	H.H.R. - Elk Island	~368	Angler	+20.4
06-18-86	Hungry Horse Cr.	380	06-25-86	H.H.R. - Wounded Buck Cr.	~368	Angler	+8.0
06-27-86	Hungry Horse Cr.	381	10-31-86	H.H.R. - Doris Cr.	380	Gill Net	+1.0
06-20-85*	Hungry Horse Cr.	412	09-23-86	H.H.R. - Lid Cr.	~381	Angler	+10.5
06-20-85*	Hungry Horse Cr.	372	07-21-86	H.H.R. - Lid Cr.	~372	Angler	+10.5
06-20-85*	Hungry Horse Cr.	365	05-26-86	Hungry Horse Bay	~367	Angler	±0.5
06-15-85	Hungry Horse Cr.	388	05-23-86	Hungry Horse Cr.	~387	Angler	—
06-15-85	Hungry Horse Cr.	342	05-26-86	H.H.R. - Clayton Cr.	~343	Angler	+18.0
06-15-85	Hungry Horse Cr.	347	05-25-86	H.H.R. - Clayton Cr.	—	Angler	+18.0
06-19-86	Hungry Horse Cr.	355	05-21-86	H.H.R. - Murray Area	~356	Angler	+18.8
04-24-86	H.H.R. - Elan Cr.	338	05-19-86	H.H.R. - Lid Cr.	~406	Angler	-43.9
04-24-86	H.H.R. - Peters Cr.	285	07-07-86	S.Fk. River - Harrison Cr.	~305	Angler	+35.1
04-24-86	H.H.R. - Peters Cr.	280	05-19-86	H.H.R. - Sullivan Area	280	Gill Net	0.0
04-26-86	H.H.R. - Peters Cr.	375	07-03-86	Sp.Br. River - Sergeant Cr.	~381	Angler	+33.8
04-29-86	H.H.R. - Peters Cr.	400	06-23-86	Sp.Br. River - 10 mi. upstream	—	Angler	+37.0
05-05-86	H.H.R. - Peters Cr.	375	05-19-86	H.H.R. - Sullivan Area	391	Gill Net	0.0
05-07-86	H.H.R. - Peters Cr.	376	05-19-86	H.H.R. - Sullivan Area	364	Gill Net	0.0
04-23-86	H.H.R. - Dry Park	326	11-07-86	H.H.R. - Murray Area	363	Gill Net	-36.4
06-05-86	H.H.R. - Sullivan Area	320	07-16-86	S.Fk. River	—	Angler	?
06-13-85*	S.Fk. River - Mouth Sp.Br. River	292	07-07-86	S.Fk. River - Harrison Cr.	356	Angler	+14.2
09-25-84	H.H.R. - Sullivan Area	335	10-14-86	H.H.R. - Emery Area	368	Angler	-42.8
09-15-84	H.H.R. - Sullivan Area	355	06-29-86	H.H.R. - Graves Bay	~381	Angler	-14.2
05-21-85	H.H.R. - Sullivan Area	405	05-25-86	H.H.R. - [illegible]arris Cr.	~400	Angler	-19.8
06-06-85*	S.Fk. River-(Mouth Sp.Br. River)	260	07-10-86	Sp.Br. River - Sergeant Cr.	~330	Angler	+12.9
05-29-85	H.H.R. - Sullivan Area	412	07-16-86	S.Fk. River	—	Angler	—
06-03-85	H.H.R. - Sullivan Area	327	10-07-86	H.H.R. - Lid Cr.	~381	Angler	-37.5
06-03-85	H.H.R. - Sullivan Area	364	06-17-86	H.H.R. - Elk Island	~356	Angler	-24.1
06-05-85*	S.Fk. River - 1 mi. ↓ Cedar Cr.	327	09-12-86	S.Fk. River - Gorge Hole	—	Angler	+6.9
07-18-84	Forest Cr.	258	08-16-86	H.H.R. - Riverside Cr.	~306	Angler	-26.4
06-11-86	H.H.R. - Dry Park Cr.	288	07-26-86	Sp.Br.River - 1/2 mi. upstream	~305	Angler	+20.0
06-11-86	H.H.R. - Dry Park Cr.	315	06-20-86	H.H.R. - Dry Park Cr.	~335	Angler	0.0
09-14-85*	S.Fk. River - Harrison Cr.	343	10-08-86	H.H.R. - Deadhorse Cr.	~330	Angler	-39.1
06-24-85	Emery Cr.	368	05-23-86	Emery Cr.	~381	Angler	—
07-11-85	Emery Cr.	410	06-07-86	Hungry Horse Bay	~410	Angler	±0.5

Appendix H2. Tagging and return information for westslope cutthroat trout tagged in the South Fork of the Flathead River in the Bob Marshall Wilderness area and recaptured by anglers, 1986.

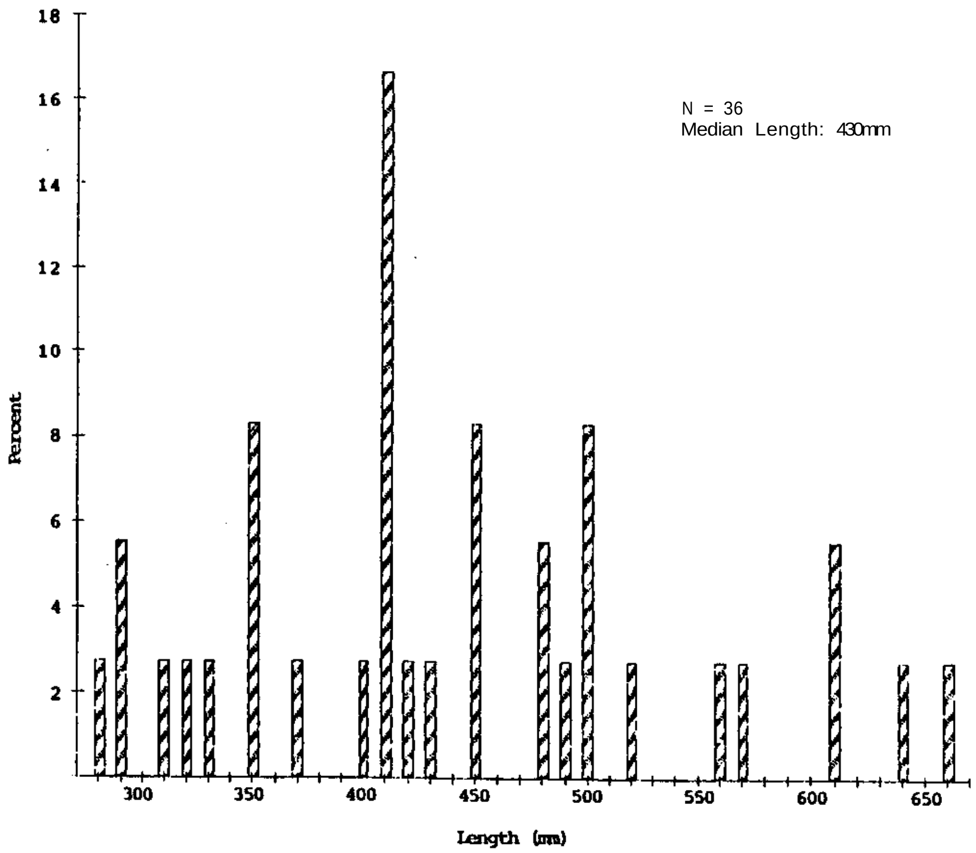
Tagging Data			Return Data		
Date	Location River Mile	Length (mm)	Date	Location River Mile	Distance Moved (km)
07-16-85	70.8	251	07- ?-86	?	—
07-16-85	70.8	323	08-29-86	70.8	0.0
08-05-85	70.8	350	07-29-86	70.8	0.0
07-18-85	72.3	290	07-29-86	88.0	+25.3
07-18-85	72.3	355	08-16-86	79.3	+11.3
08-05-85	74.2	258	07-07-86	64.4	-13.2
08-05-85	74.2	288	07-28-86	74.2	0.0
08-05-85	74.2	291	06-01-86	74.2	0.0
08-05-85	74.2	295	07-22-86	74.2	0.0
07-16-86	74.2	272	07-21-86	74.2	0.0
07-16-86	74.2	250	08-16-86	74.2	0.0
07-15-86	75.0	261	07-28-86	75.0	0.0
07-15-86	75.0	283	07-18-86	75.0	0.0
07-15-86	75.2	298	08-11-86	75.2	0.0
07-15-86	79.3	328	07-31-86	79.3	0.0
07-14-86	82.9	282	07-31-86	82.9	0.0
07-14-86	82.9	312	07-30-86	82.9	0.0
07-14-86	82.9	299	07-30-86	82.9	0.0
07-15-86	82.9	298	07-31-86	82.9	0.0
07-15-86	82.9	261	07-18-86	82.9	0.0
07-15-86	82.9	283	07-18-86	82.9	0.0
07-12-86	82.9	344	10-07-86	82.9	0.0
07-14-86	84.9	287	07-30-86	84.9	0.0
07-14-86	84.9	292	07-30-86	84.9	0.0
07-14-86	84.9	347	07-25-86	82.9	-3.0
07-15-86	84.9	383	07- ?-86	?	?
07-15-86	84.9	314	07- ?-86	?	?
07-14-86	87.5	251	07-23-86	87.5	0.0
07-17-85	88.0	335	06-29-86	88.0	0.0
07-17-85	88.0	290	07-14-86	88.0	0.0
07-19-85	88.0	315	07-14-86	88.0	0.0
07-19-85	88.0	255	07-14-86	88.0	0.0
07-13-86	88.0	263	07- ?-86	?	?
07-13-86	88.0	314	07- ?-86	?	?
07-14-86	88.0	274	07-23-86	88.0	0.0
07-14-86	88.0	262	?	?	?
07-14-86	88.0	265	07-21-86	88.0	0.0
07-14-86	88.0	290	07-22-86	88.0	0.0
07-13-86	92.5	335	07-28-86	92.5	0.0
07-12-86	95.4	312	09- ?-86	95.4	0.0
07-12-86	95.4	276	09- ?-86	95.4	0.0
07-10-86	99.0	355	09-18-86	82.9	-25.9
07-10-86	99.0	294	?	?	?
07-10-86	99.0	340	?	?	?
07-10-86	100.0	320	?	100.0	0.0
07-10-86	100.3	280	09-08-86	95.4	-7.9
07-11-86	100.3	250	?	?	?
07-18-85	104.6	305	07-12-86	104.6	0.0
07-19-85	104.6	250	07-13-86	88.6	-25.7
07-15-86	104.6	340	08-08-86	99.6	-8.0
07-15-86	104.6	350	07- ?-86	?	?
07-15-86	104.6	330	07- ?-86	?	?
07-15-86	104.6	300	07- ?-86	?	?
07-15-86	104.6	350	07- ?-86	?	?
07-15-86	104.6	270	07-28-86	104.6	0.0
07-15-86	104.6	288	10-08-86	104.6	0.0
07-16-86	105.0	285	08-12-86	84.9	-32.3

APPENDIX I

Length frequency diagrams of westslope cutthroat trout and bull trout caught by anglers from Hungry Horse Reservoir 1966.



Appendix I1. Length frequency diagram of westslope cutthroat trout caught by anglers from Hungry Horse Reservoir, 1986.



Appendix 12. **Length frequency diagrams of bull trout caught by anglers from Hungry Horse Reservoir, 1986.**