MONTANA DEPARTMENT OF FISH, WILDLIFE AND PARKS

FISHERIES DIVISION

JOB PROGRESS REPORT

State: Montana Project Number: F-46-R-2
Job Number: I-f

Project Title: Statewide Fisheries Investigations
Study Title: Survey and Inventory of Cold Water Streams
Job Title: Southwest Montana Major River Fisheries Investigation

Period Covered: July 1, 1988 through June 30, 1989

JOB OBJECTIVES

Madison River

1. Maintain a minimum flow ≥700 cfs at the Kirby gage below Quake Lake and ≥1100 cfs downstream from Ennis Dam.

Worked with the Montana Power Company using SCS snow survey information to insure stream flows at both gage sites remain at or above the 700 and 1100 cfs levels, respectively.

2. Maintain wild trout population ≥3000 age II and older trout/mile below Ennis Dam and determine effects of water temperatures on catch rates.

Spring wild trout population estimate was made in the Norris section to be compared with previous population estimates. Water temperature data was gathered using a thermograph. Data will be analyzed at a later date.

3. Maintain channel and streambanks in present or improved conditions.

Data included in this report.

4. Maintain aesthetic quality of upper Madison River fishing experience (State Project).

No work was done on this objective at this time as the Scenic Easement Committee was not reactivated.

5. Maintain densities of wild trout ≥13 inches at 1200/mile

between Quake Lake and McAtee Bridge (catch-and-release section).

Wild trout population estimates were made for the Pine Butte and Snoball sections for the fall, 1988 and spring 1989 period. Data included in this report.

6. Maintain densities of wild trout ≥13 inches at 1200/mile etween Varney Bridge and Ennis Lake with the opportunity of catching large size (≥18+ inches) brown trout.

A fall, 1988, wild trout population estimate was made on the Varney section of the river. Data to be analyzed at a later date.

7. Attempt to disperse angler use in the Quake Lake to Ennis Lake reach. Continue to provide spatial segregation for bank and boat anglers, where possible (State Project).

No work was done on this objective at this time, as special angling regulations were enacted in 1988 to divide the river between Ennis Lake and Quake Lake into areas of wade only fishing and areas which fishing from boat was allowed to disperse the two use types to minimize social interaction.

8. Will interview fishermen to determine barbed and barbless hook use; review and summarized hooking scar information form past shocking data; review and collect summer mortality data in 1989.

Data is collected and will be included in a future report.

Yellowstone River

1. Reduce magnitude of irrigation season dewatering in spring tributaries during cutthroat trout spawning and incubation periods.

Graduate student study was set up to determine cutthroat trout spawning and recruitment requirements in the various spawning tributaries.

2. Maintain channel and streambanks in present or improved condition. Data included in this report.

3. Maintain water quality and aesthetics of river.

A cooperative study with Yellowstone National Park was initiated to determine the location and causes of sediment input into the Yellowstone River during summer rain events.

4. Maintain a catch rate of 0.5 fish/hour with trout population densities ≥1000 fish greater than 9 inches/mile and 50 cutthroat trout over 12 inches/miles.

Four wild trout population sections were electrofished during 1987-88 period. Data is included in this report.

5. Increase cutthroat trout numbers in Yellowstone River.

A catch and release angling regulation was adopted for the Yellowstone River to reduce the annual mortality of cutthroat. Cutthroat trout eggs were placed in some of the spawning tributaries to determine if numbers in the river could be increased.

6. Provide increased opportunity to catch large trout in a reach of the Yellowstone River.

A special angling regulation was installed on the section of the river between the Emigrant Bridge and the Pine Creek Bridge (5 trout of which four can be below 13 inches and only one can exceed 22 inches) to provide more large trout.

7. Acquire a suitable fishing access site between Highway 89 and Springdale (State Project).

Attempted to purchase a parcel of land in this area, but failed. Have contacted the Montana Dept of Highways and obtained a site near the Highway 89 bridge.

Big Hole River

1. Insure, within hydrologic constraints, that flow do not fall below minimum of 300 cfs in reach 1, 200 cfs in reach 2 and 100 cfs in reach 3 of the Big Hole River.

Instream flows reservations filings are being prepared for filing in 1989-90.

2. Maintain channel and streambanks of the Big Hole River in present or improved state of stability.

Data included in this report.

3. Maintain instream sediment levels and flow regime at average current levels.

Reviewed those U.S.Forest Service timber sale and road plans which affected flows and water quality.

4. Maintain fluvial grayling populations at a minimum of 40 age II and older fish per mile upstream from Pintlar Creek.

Electrofished the Big Hole River between Wisdom and Wise River to define characteristics of Grayling spawning run and to determine the amount of Grayling habitat which presently exists. Work with the Grayling study committee to formulate a Grayling recovery plan. Attempted fall population estimates in Wisdom and McDowell study sections but ceased efforts due to extremely low flow conditions associated with the 1988-89 drought.

5. Maintain brown trout populations in lower river (Glen Access to mouth) at densities ≥1000 age II and older fish/mile with limited numbers of rainbow trout.

The Hogback study was electrofished during the spring of 1988 and 1989 with only the 1988 data will be presented in this report.

6. Maintain brown trout population in lower, mid-river (Divide to Glen Access) at densities ≥750 age II and older fish/mile and rainbow trout densities ≥1000 I and older fish/mile.

Spring and fall brown and rainbow trout population estimates were made in the Maiden Rock section to determine their densities with data included in this report.

7. Maintain rainbow trout populations in upper mid-river (Pintlar Creek to Divide) at densities ≥1300 age I and older fish/mile and brown trout densities at ≥200 age II and older fish/mile with limited numbers of fluvial grayling and brook trout.

Fall population estimates were made on the Jerry Creek study section in 1988 and 1989 with data to be included in this report.

8. Maintain native, fluvial grayling populations at a minimum of 40 age II and older/mile in upper river (Headwaters to Pintlar Creek) and densities of age II and older brook trout at ≥400 per mile.

Fall population estimates were attempted on the study section to determine numbers of fluvial grayling and brook trout with data to be included in a future report.

9. Maintain numbers of larger, brown trout (≥18 inches) at densities ≥100/mile and large rainbow trout (≥15") at densities ≥100/mile in special regulation section (Divide to Melrose).

Special angling regulations which allows only a 5 trout limit of which only one can exceed 22 inches and catch and release only

fishing for trout between 13 inches and 22 inches was evaluated

using spring and fall population estimates from the Maiden Rock study section.

Data is included in this report.

10. Collect information on fishing pressure, harvest, catch rates, angler attitudes and preferences to assist in responsible management.

No work was accomplished on this objective.

11. Provide increase user access to Big Hole River between the notch and Pennington Bridge (State Project).

Final plans for the development of the Notch Access has been approved with negotiations being made for an additional access site at Pennington Bridge.

12. Provide increased acreage of public land in Big Hole River Corridor.

Continued discussion with the BLM to locate additional public river frontage.

13. Keep Big Hole River management current with angler needs and expanding recreational demand.

The development of the Big Hole River management plan was continued.

14. Mitigate or eliminate deleterious effects of planned developments in the fishery of the Big Hole River including water quality and quantity and aesthetic values.

Was involved in various USFS and BLM planning processes.

Beaverhead River

1. Within hydrologic constraints, seek to obtain minimum non-irrigation season releases of 250 cfs from Clark Canyon Dam and maintain minimum flows of 150 cfs in the river downstream from Barretts. Maintain stable, spawning season flow releases.

Worked with the U.S. Bureau of Reclamation to insure the best possible flows from Clark Canyon Dam for sections of the river above and below Barretts Diversion.

2. Eliminate gas bubble trauma in Beaverhead River trout population.

Trout populations were sampled to determine number, species

and sizes having gas bubble trauma. Percent gas saturation was also measured. Data will be analyzed at a future date.

3. Insure that operation of proposed hydroelectric generator does not alter flow regimes or temperatures of discharges and utilize hydro generation to eliminate gas supersaturation problems.

Reviewed plans for proposed hydroelectric generator and made comments necessary to insure adequate protection to fisheries resource in river.

4. Maintain densities of $\geq$ 250 brown trout 18 inchesand larger/mile and $\geq$150 rainbow trout 18 inches and larger/mile above Henneberry. Maintain densities of $\geq$1000 age II and older brown trout and $\geq$600 age I and older rainbow trout per mile above Henneberry.

Spring and fall population estimates were made for the Hildreth and Pipe Organ sections of the river above Barretts Diversion for the spring and fall of 1989.

Data will be analyzed at a later date.

5. Collect population information for lower Beaverhead River (downstream from Barretts) to assist in management decisions (State Project).

Spring brown trout estimates were made for the Fish and Game, Low Flow, and Twin Bridges study sections. Data will be analyzed at a later date.

6. Maintain or increase numbers of rainbow trout in river upstream from Barretts.

Spring and fall rainbow population estimates were made for two sections of the river above Barretts Diversion with rainbow trout numbers being estimated. Data will be analyzed at a later date.

7. Collect information on fishing pressure, harvest, catch rates, angler preferences and attitudes to assist in managing for high quality angling experiences (1991).

Creel census and angler survey was initiated in spring 1989 with data to be included in a future report.

8. Increase angler use of Beaverhead River downstream from Barretts in an effort to decrease use of upper river (State Project).

No work done on this objective at this time.

9. Keep Beaverhead River management current with angler needs and expanding recreational demand.

No work on this objective at this time.

10. Maintain channel and streambanks in present or improved state of stability.

Data to be included in this report.

Gallatin River

1. Maintain channel and streambanks in present or improved stability.

Data to be included in this report.

2. Mitigate and reduce irrigation season dewatering in Gallatin River.

Actively promoted the irrigators to petition a ditch rider to be appointed by the water judge to insure water reaching all portions of the river.

3. Decrease magnitude of sediment and turbidity from Taylor Fork and Sage Creek.

Worked with the Gallatin Forest to promote better land use practices in these drainages.

4. Maintain wild trout populations of $\geq$2500 age II and older fish per mile upstream from Gallatin Gateway.

No work was done on this reach of river during study period due to insufficient time.

5. Determine potential of establishing large trout management area between mouth of canyon and Gallatin Gateway (State Project).

There was no work done on this objective.

Jefferson River

1. Insure, within hydrologic constraints, that flows do not drop below 550 cfs at the Three Forks gage.

Instream flow reservations filings are being prepared for filing in 1989.

2. Maintain channel and streambanks in present improved state of stability.

Data will be included in this report.

3. Increase numbers of rainbow trout to ≥200 age I and older/mile.

Special angler regulations were installed on the Jefferson River allowing only catch and release fishing for rainbow trout. The Hell's Canyon Creek rainbow trout spawning run was electrofished obtaining rainbow eggs to hatch and stock in a spring creek to imprint a possible new rainbow spawning run for the river.

4. Maintain densities of ≥450 age II and older brown trout/mile from mouth to Boulder River and ≥600 age II and older brown trout/mile between the Boulder river and the head of the river.

Brown trout population estimates were made on two sections of the river to determine the number of brown trout per mile. Data is included in this report.

5. Increase recreational use of Jefferson River (State Project).

No work done on this objective.

6. Acquire additional access sites at Kountz bridge and Waterloo bridge.

Both locations were initiated and the Kountz Bridge site was acquired.

7. Elevate public awareness of values of fishery (State Project).

No work was done on this objective.

Missouri River

1. Insure, within hydrologic constraints, that flows do not fall below 1500 cfs above Canyon Ferry Reservoir.

Instream flow reservations filings are being prepared for filing in 1989.

2. Maintain channel and streambanks of the Missouri River in present or improved state of stability.

Data will be included in this report.

3. Restore the fall run of rainbow trout out of Canyon Ferry Reservoir to 1978 levels and provide 12,000 hours of use with a harvest of ≥8000 rainbow trout.

The Missouri River below Toston was electrofished to determine the timing and quantity of fall spawning rainbow trout. Spot creel checks were also made to determine the success of angling these fall spawning rainbow trout. Data will be included in this report.

4. Increase reproduction of brown and rainbow trout (State Project).

Preliminary work was initiated.

PROCEDURES

Fish Populations in the Jefferson, Missouri and Yellowstone River were sampled with an 18-foot aluminum boat powered by a 90 horsepower outboard motor with a jet unit. The boat was equipped with a double boom system. A mobile positive electrode boat electrofishing system was used to electrofish the Beaverhead, Big Hole, Gallatin and Madison Rivers.

Population estimates of trout were made using the Peterson type mark and recapture system described by Vincent (1971).

Multiple mark and recapture runs were made where either sample size or efficiency was low. All movement studies were based on fish marked with individually numbered Floy FD-68B anchor tags.

Streambanks and channels were protected from poorly designed projects through FWP participation in administration of the Stream Protection Act and Natural Land and Streambank Protection Act of 1975 (SB 310). Water discharge permits issued by EPA and the Montana WQB will be reviewed and comments offered. A hand held current meter was used to make flow measurements.

FINDINGS

MADISON RIVER

Snoball Section

The Snoball study section on the Madison River (Figure 1) was first sampled in 1975 and 1976 when the angling limit was 10 fish or 10 pounds and one fish. In order to evaluate the impacts of angling the section was closed entirely to fishing for the 1977 through 1982 seasons (6 years) and then reopened to catch and release artificial lures only restrictions from 1983 to the present. The data collected from fall population estimates clearly show the improving trends in the fishery that have occurred over the 1975 to 1987 period.

Rainbow trout population expanded only slightly in total numbers under the closure (Figure 2), averaging 2,443 per mile in 1975-76 and 3,102 during 1977-82; a 27% increase. However, the age distribution of the population was changed dramatically with the

numbers of age 3 and older rainbow (generally 10 inches or longer) increasing from an average of 299 per mile in 1975-76 to 869 per mile in 1977-82; an increase of 191%. Changes in age 4 and older rainbow were even more impressive, increasing from 1975-76 levels averaging 52 per mile to 1977-82 levels averaging 520 per mile, a 10-fold increase.

As a consequence of the dramatic shift in rainbow to older age classes the biomass of rainbow trout climbed steadily averaging 741 pounds per mile in 1975-76 and 1,148 pounds per mile during the 1977-82 closure.

When the section was reopened to angling in 1983 under strict catch and release regulations the rainbow population showed only a slight decrease in total numbers (13% decrease), numbers of 3+ fish (23% decrease), and numbers of 4+ fish (6% decrease) despite intense angling pressure over the 1983-87 period (Figure 2). Total rainbow trout biomass also showed a slight decrease although estimates in 1985 and 1987 were incomplete, omitting the younger age classes. The data demonstrate conclusively that overharvest was limiting the population prior to 1977. Hooking mortality during the 1983-87 period may be responsible for the slight decline in the rainbow population although the changes are relatively minor. Annual mortality rates of large rainbow (age 4 and older) averaged 38% during the 6-year closure and 47% since then, suggesting an annual hooking mortality rate in the neighborhood of 9% per year.

Brown trout populations have responded to the regulation changes somewhat differently than rainbow. Total numbers of age one and older brown trout in the fall were 624 per mile under liberal regulations in 1976 and averaged 1,013 per mile in 1977-82 under a complete closure, a 62% increase (Figure 3). Since that time, under catch and release, brown trout unlike rainbow have continued to increase with average population levels (age one and older) of 1,280 per mile in 1983-87, up 105% over 1977 levels and 26% over 1977-82.

Populations of brown trout, as with rainbow, have expanded due largely to increases in the numbers of larger fish. The estimated numbers of age 3 and older brown trout averaged 91 per mile in 1975-76, 319 per mile under the 1977-82 angling closure (251% increase), and 429 per mile in 1983-87 (a 371% increase over 1975-76 levels and 34% increase over 1977-82).

As with rainbow, the brown trout biomass has increased substantially due to the greater numbers of older and larger fish. Total brown trout biomass averaged 270 pounds per mile in 1975-76, 981 pounds per mile in 1977-82 under the fishing closure, and 809 pounds per mile under the catch and release regulation in 1983-87.

The fact that brown trout numbers have continued to increase

after the river was reopened to angling under catch and release suggest that hooking mortality of released fish is less significant in brown trout populations than in rainbow. In fact, the annual mortality rates of age 3 and older brown trout average 35% under a total fishing closure and 33% under catch and release. This explains the increasing populations of larger brown trout.

In summary, the Snoball electrofishing results have clearly demonstrated the response of an overfished trout population to a total cessation of angling (1977-1982) and catch and release angling (1983 to present). Total trout numbers do not completely tell the story as improvements have been most significant in biomass and quality (i.e. number of larger fish).

The total trout biomass of the Snoball section averaged slightly over 1,000 pounds per mile in 1975-76, increased to an average of 1,795 pounds per mile in 1977-82 and has held steady under the catch and release regulation since 1983 (Figure 4).

The total population of trout over 13 inches averaged 216 per mile in 1975-76, 666 per mile in 1977-82 (a 208% increase), and 849 per mile in 1983-87 (Figure 5). This latter figure represents a 293% increase over 1975-76 levels and a 27% increase over 1977-82. The fact that the numbers of larger fish have actually increased since the angling closure was lifted and catch and release fishing began is due to increasing numbers of larger brown trout which appear to be relatively nonsusceptible to hooking mortality. Brown trout over 18 inches have now become common in the Snoball section, averaging an estimated 20 per mile since 1983 whereas they were virtually nonexistent (4 per mile estimated) prior to 1977. In general, brown trout in the Snoball section must be at least 5 years old in the fall to reach 18 inches. Catch and release fishing in combination with low hooking mortality rates have allowed some fish to achieve this size. Rainbow trout over 18 inches remain rare in the Snoball section, averaging less than one per mile in all estimates. Their growth potential is probably limited due to environmental conditions in the Madison River.

Monitoring should be discontinued on this section as the Pine Butte section immediately upstream provides a better index of long-term population trends.

Pine Butte Section

The Pine Butte study section of the Madison River (Figure 1) was first sampled in 1977 when the limit was 10 fish. Based on results from the Snoball section closure which found a dramatic decrease in mortality rates when angling was stopped in 1977, the Pine Butte section was changed to catch and release artificial lures only regulations in 1978 and has remained so since that time. Trout populations improved dramatically during the five years following

the imposition of catch and release regulations (Vincent, 1984). Since that time annual fall monitoring has demonstrated a stabilization of the fishery at a high level.

Rainbow trout population levels averaged 3,488 per mile in September 1984 through 1987 with an average biomass of 1,435 pounds per mile. Both values are higher than in the Snoball section immediately downstream, probably as a result of better fish habitat.

Estimated numbers of rainbow trout over 13 inches averaged 593 per mile in the 6 years following the advent of catch and release fishing (Vincent, 1984) and 707 per mile in 1984-87. Numbers of 13 inch and larger rainbow have stabilized in a broad range of 500-800 per mile following peaks in 1984 and 1985. Annual mortality rates are typically high for age 1 fish (70-80%), low for age 2 and 3 (0-40%), and then high again for fish age 4 and older (40-80%). Average annual mortality for age classes 1 through 5 and older was 78%, 28%, 14%, 47% and 85% respectively during 1984 through 1987. The catch and release regulations have shifted the high mortality rates from age classes 2 and 3 (due to harvest) out to age class 4 and older where natural mortality is more of a factor.

Brown trout populations in the Pine Butte section have stabilized in a very narrow range averaging 1,365 per mile age 1 or older fish during 1984-1987. Average biomass was 1,044 pounds per mile during the period. These figures are very comparable to but slightly higher than values in the Snoball section for a similar period.

Estimated numbers of brown trout over 13 inches averaged 413 per mile in 1978-83 and 496 per mile during 1984-87. Numbers of brown trout over 13 inches in the Pine Butte section have stabilized in a narrow range of 450-550 per mile since 1982 and do not show any recent fluctuations. Likewise, the estimated numbers of brown trout over 18 inches have consistently ranged from 17 to 34 per mile in recent years.

Annual brown trout mortality rates in the Pine Butte section during recent years follow the same pattern as rainbows with relatively high losses of age 1 fish (natural mortality) averaging 33% followed by low annual mortality of ages 2 and 3 (0-30%) and higher mortality in ages 4 and older (50%-80%).

Overall, the Pine Butte fishery stabilized within 5 years of the imposition of catch and release and now after 10 years of catch and release regulations shows very little annual variation in numbers, biomass, or mortality rates. The fall population estimates in this reach should be continued in order to monitor the fishery of the upper Madison.

YELLOWSTONE RIVER

Fish Population Estimates

Brown trout. Population estimates of large brown trout in the Ninth Street Bridge and Mill Creek Bridge sections of the Yellowstone River give a good indication of effectiveness of special regulation that went into effect on 1984 (Figure 6). The regulation on the Ninth Street Bridge section remained at 5 fish while the Mill Creek Bridge section has been under a 4 trout less than 13 inches and one over 22 inch slot limit and a restriction to artificial flies and lures only. Comparison of the populations of large brown trout between the two sections indicates that the numbers have shown increasing trends on both sections (Figures 7 and 8). The increases have been greater on the Ninth Street Bridge section where the 5-fish limit has remained in effect. The data indicates the special regulations have not increased the number of large brown trout.

Rainbow trout. Population estimates of large rainbow trout in the Ninth Street Bridge and Mill Creek Bridge sections of the Yellowstone River are used as a comparison to determine the effect of the special regulations. Rainbow trout are mobile in the Spring when population estimates are collected. This violates a basic assumption of the mark-recapture principle, introducing bias into the estimates. Since the situation is similar on both sections, a comparison is made of the calculated estimates, recognizing the bias. The population estimates on the two sections indicate the population has not increased since the special regulation took effect on the Mill Creek Bridge section while small increases have taken place on the Ninth Street Bridge section (Figures 9 and 10). A Fall population estimate on the Mill Creek Bridge section would be required to assess the effects of the special regulation.

Yellowstone cutthroat trout. During 1984, a catch and release regulation took effect on the upper 49 miles of the Yellowstone River in Montana. Within that section 16 miles were restricted to artificial flies and lures only. The lower section where the 5 fish limit remained in effect is represented by the Springdale and Ninth Street Bridge sections (Figures 11 and 12). The catch and release section where only artificial lures are used is represented by the Mill Creek Bridge section (Figure 13). The catch and release section where bait is permitted is represented by the Corwin Springs section (Figure 14). The data indicate the catch and release regulation has been successful both with and without bait.

Stream Flow

Streamflow during 1987 and 1988 on three of the important Yellowstone cutthroat trout spawning tributaries (Locke, Petersen and Mol Heron Creeks) indicate that during 1988 streamflow was lower than in 1987. The spawning migrations of Yellowstone cutthroat

trout into selected Yellowstone River tributaries are summarized in Tables 1-6.

Table 1. Vital statistics of Yellowstone cutthroat trout spawning in McDonald Spring Creek during 1987.

Date	Males	(Av.Ln.) inches	Females	(Av.Ln.) inches	Water Temp (max-min) F	Spawning Condition
5/13	0		0			
5/21	0		0			
5/27	1	(14.3)	0			
6/3	2	(12.4)	2	(14.2)	55-50	emitting eggs
6/11	2	(12.6)	0		56-46	
6/18	6	(13.3)	2	(14.3)	56-47	emitting eggs
6/22	2	(14.0)	1	(12.6)	56-47	emitting eggs
7/1	4	(12.9)	2	(14.0)	57-47	
7/8	1	(14.8)	0			
TOTAL*	17	(13.4)	7	(13.9)		

* for weekly summaries mean length is for all fish, for overall total mean length is for new fish only.

Table 2. Vital statistics of Yellowstone cutthroat trout spawning in Big Creek during 1987 and 1988.

Date	Males	(Av.Ln.) inches	Females	(Av.Ln.) inches	Water Temp (max-min) F	Spawning Condition
			1987			
5/13	0		1	(13.2)		not emitting eggs
5/21	0		0			
5/28	1	(14.0)	0		59-40	
6/4	2	(13.4)	2	(13.5)	54-36	not emitting eggs
6/10	8	(13.9)	3	(13.0)	60-45	not emitting eggs
6/16	1	(12.8)	1	(13.8)	67-48	emitting eggs
6/24			dry streambed_			
Total*	12	(13.7)	7	(13.3)		
			1988			
6/14	2	(14.9)	1	(15.5)		emitting eggs
6/20	3	(14.8)	13	(13.5)		emitting eggs
6/27	5	(13.2)	2	(13.5)		emitting eggs
7/7	0		0			
Total*	10	(14.0)	16	(13.6)		

* total for weekly summaries is for all fish, overall total is for new fish only.

Table 3. Vital statistics Yellowstone cutthroat trout spawning in Tom Miner Creek during 1987 and 1988.

Date	Males (Av.Ln.) inches	Females (Av.Ln.) inches	Spawning Condition
		1987	
5/13	0	0	
5/21	4 (13.7)	0	
5/28	6 (13.2)	3 (14.4)	not emitting eggs
6/4	10 (13.5)	4 (14.1)	emitting eggs
6/10	10 (13.5)	10 (14.3)	emitting eggs
6/16	15 (13.6)	11 (13.1)	emitting eggs
6/22	17 (13.6)	14 (13.6)	emitting eggs
7/1	12 (13.6)	7 (13.5)	emitting eggs
7/8	10 (13.2)	4 (13.3)	spent
7/15	1 (13.6)	0	
Total*	57 (13.6)	45 (13.3)	
		1988	
6/14	11 (13.8)	3 (13.5)	emitting eggs
6/20	biased by upstream barrier		emitting eggs
7/7	14 (13.7)	6 (14.0)	spent

Table 4. Vital statistics of spawning Yellowstone cutthroat trout in Peterson Creek during 1987.

Date	Males (Av.Ln.) inches	Females (Av.Ln.) inches	Water temp (max-min)F	Spawning Condition
5/12	1 (12.1)	0		
5/20	6 (13.5)	0		
5/27	9 (13.4)	3 (16.1)		emitting eggs
6/3	1 (15.2)	1 (14.9)		not emitting eggs
6/11	2 (12.7)	2 (14.3)	58-48	emitting eggs
6/18	4 (13.3)	1 (15.3)	64-48	emitting eggs
6/24	0	0	63-46	
7/20			65-46	
Total*	18 (13.4)	6 (15.7)		

* totals for weekly summaries are for all fish, overall total is for new fish only

Table 5. Vital Statistics of spawning Yellowstone cutthroat trout in Locke Creek during 1987.

Date	Males	(Av.Ln.) inches	Females	(Av.Ln.) inches	Water temp (max-min)F	Spawning Condition
5/12	3	(11.5)	4	(10.7)		not emitting eggs
5/20	3	(13.5)	0			
5/27	8	(12.1)	3	(13.6)		not emitting eggs
6/3	12	(12.4)	11	(13.3)	59-44	emitting eggs
6/11	4	(13.3)	4	(13.1)		emitting eggs
6/18	1	(14.6)	4	(13.8)		emitting eggs
6/24	1	(13.9)	1	(11.3)		emitting eggs
Total*	24	(12.5)	23	(12.8)		

*totals for weekly summaries are for all fish, overall total is new fish only

Table 6. Vital statistics of spawning Yellowstone cutthroat trout in Mol Heron Creek during 1987 and 1988.

Date	Males	(Av.Ln>) inches	Females	(Av.Ln.) inches	Water Temp (max-min)F	Spawning Condition
			1987			
5/21	0		0			
5/28	3	(13.3)	0		52-38	
6/4	7	(12.3)	0		54-39	
6/10	9	(14.0)	4	(12.8)	59-45	not emitting eggs
6/16	16	(13.7)	8	(13.2)	59-46	emitting eggs
6/22	9	(12.7)	4	(12.8)	57-46	emitting eggs
7/1	9	(13.2)	9	(13.2)	58-47	emitting eggs
7/8	4	(14.3)	3	(12.7)	60-48	emitting eggs
7/15	1	(14.5)	0		60-44	
Total*	51	(13.3)	33	(13.2)		
			1988			
6/9	4	(12.0)	0			
6/14	7	(14.4)	1	(12.4)		not emitting eggs
6/20	16	(13.6)	11	(12.9)		emitting eggs
6/27	14	(14.0)	11	(13.4)		emitting eggs
7/7	12	(14.0)	7	(13.8)		emitting eggs
Total*	36	(13.8)	26	(13.3)		

*weekly total is for all fish, overall total is for new fish only

BIG HOLE RIVER

Fish Population Estimates

Wisdom - McDowell Sections

The Wisdom and McDowell study sections were established to monitor and research arctic grayling populations in the upper Big Hole drainage. Population estimate work was conducted in these sections in 1986 but no estimates were collected in 1987 and 1988 due to extremely low streamflow. The 1986 population data will be presented with future data in a subsequent report due to previously discussed out-migration problems (Oswald 1986) and a need for a broader span of current data.

In addition to population estimate work, the arctic grayling research was expanded to include work on migration, winter habitat and spawning requirements. Since 1986, all captured grayling in excess of 7.0 inches in length have been implanted with numbered floy anchor tags. Subsequent tag return information has shown that the Big Hole grayling population requires a large expanse of river, migrating up to 60 river miles between spawning, summer and winter habitats. This data has been collected and will be presented in more detail in a subsequent report. Winter habitat has been located in three large pools downstream from the Wisdom vicinity. The age and length composition of grayling collected in these habitats has been analyzed as well as the migration of these tagged fish between habitats which has confirmed the importance of grayling migration between summer, winter and spawning habitats. These data will be presented in more detail in a subsequent report. All major components of the grayling spawning migration were analyzed in 1988 and 1989 by sampling large reaches of the Big Hole River between Jackson and Wise River, MT. Migration, length, age, and sex composition of the spawning run as well as descriptions of spawning habitat have been documented and summarized (Shepard and Oswald 1989). This data will be summarized in a subsequent report.

Jerry Creek Section

The Jerry Creek study section was instituted in 1986 to monitor wild rainbow and brown trout populations in a portion of the river dominated by rainbow trout and to provide fisheries management data for the reach in order to formulate a river management plan. The Jerry Creek section heads at the Jerry Creek bridge and continued downstream to a common use boat launch downstream from Dewey, MT for a distance of 4.73 miles in 1986 and 1987. In 1988, the section was shortened to 4.30 miles to end at the newly developed Dewey Fishing Access Site FWP. Because of the predominance of rainbow trout in the section, it is sampled in the fall (Sept.-Oct.). Gamefish collected in the study section include, rainbow trout, brown trout, mountain whitefish, arctic grayling, brook trout, cutthroat trout, and burbot. Non-game species occupying the section include white,

longnose, and mountain sucker, longnose dace and mottled sculpin.

During the 1986-87 sampling period, fishing regulations which applied to the Jerry Creek section included the standard bag limit of five brown , rainbow, or cutthroat trout, only one of which may exceed 18 inches in length (Limit A) and legal terminal gear included the use of bait. In 1988, a coalition of local sportsmen succeeded in including the reach of river under the special regulations that have applied to the Divide to Melrose reach since 1981. This special regulation, extended from Divide upstream to Dickie Bridge, allows the harvest of three trout under 13 inches and one in excess of 22 inches and restricts gear to the use of artificial lures and flies. Future trout population analysis for the Jerry Creek section will consequently include an evaluation of the special regulations.

Rainbow trout density and standing crop within the Jerry Creek section is presented in Figure 15. The section supports the highest average rainbow trout densities found in the Big Hole River. The large increase in population between 1986 and 1987 was due to superior recruitment of yearlings from 1986 which supplied the best summer flow regime of the 1985-88 period. The sudden drop in population between 1987 and 1988 was due to the extremely low summer flow regime of 1988. Standing crops of rainbow trout follow density trends within the section, however the 1987 density peak was much more marked than the biomass peak due to a predominance of age 1 fish in the population. This is further demonstrated in the analysis of the population by age class (Figure 16.) which depicts the superior recruitment of yearlings in 1987. This figure also depicts the affects of low 1988 streamflow on the population as the strong class of yearlings present in 1987 was rapidly reduced in 1988. The data suggest that age classes in both 1986 and 1988 were affected by low streamflows in 1985, 1987, and 1988. Size distributions of rainbow trout within the sample (Figure 17.) and within the population (Figure 18.) indicate the the rainbow trout population of the Jerry Creek section was dominated by fish under 13 inches in length however, numbers of 16 inch and larger fish exceeded those observed in the Maiden Rock section which has been under special regulation since 1981.

Brown trout densities and standing crops for the Jerry Creek section are presented in Figure 19. The apparent population increase between 1987 and 1988 is probably an artifact of sampling date and due to estimate inflation resulting from spawning movement. It is apparent that the section supports low densities of brown trout relative to downstream study sections and relative to the rainbow trout population within the section. The relationship between standing crop and density indicates a dominance of the population by large fish. This is further supported by length - frequency distribution within the sample (Figure 20.) and estimated densities of selected length groups within the population (Figure 21.) Distribution of brown trout density among age classes (Figure 22.) suggests that this is due, in part, to limited recruitment which probably results from an observed scarcity of brown trout mainstem

spawning habitat in the section. The scarcity of spawning habitat is due to the steep gradient and large substrate of the section. The predominance of large brown trout is also partially due to superior brown trout growth concomitant with low densities within the species.

Melrose and Maiden Rock Sections

Comparison of the Melrose and Maiden Rock sections have provided an evaluation of the special regulation "slot limit" since its initiation in 1981 (Oswald 1984, 1986). The Melrose section was not sampled in 1987 and 1988 due to a reorganization of work plan however sampling in the Maiden Rock section has been continuous since 1981. Both sections were sampled in spring and fall in all sample years.

Estimated numbers and standing crops of brown trout are presented in Figures 23 and 24 for the Melrose and Maiden Rock sections. Numbers and biomass of brown trout in the Melrose section were matched quite closely over the period indicative of an average weight of on pound per fish. Brown trout populations within the section have shown a tendency to increase over the sample period reaching observed maxima in 1985 and 1986 following a period of abundant streamflow in 1982-84. In contrast with the Melrose section, brown trout biomass in the Maiden Rock section exhibited a trend to exceed numbers indicative of a dominance of the population by larger fish. Exceptions to this trend included 1981, prior to the inception of special regulations, 1985 when exceptional recruitment similar to that observed in the Melrose section occurred, and 1988 when populations of large brown trout declined giving way to younger fish. The recruitment peak in 1985 in the Maiden Rock section did not carry over into 1986 as it did in the Melrose section indicating a continued dominance of the population by larger mature fish.

Estimated densities of 13 inch and larger brown trout have been compared for the two sections to determine the affect of the special regulations in increasing numbers of fish within the protected slot (Figure 25.). It is apparent from this graph that no significant increase in numbers of 13 inch and larger brown trout can be attributed to the special regulations. Comparison of densities of mature larger brown trout between the two sections (Figure 26.) indicates a substantial increase in the number of these 18 inch and larger brown trout due to special regulations. The numbers of 18 inch and larger brown trout in the Maiden Rock section increased more than five fold in the 1981-86 period while numbers of these large fish increased only slightly in the Melrose section. Some of the slight increase in the Melrose section may be attributable to out migration from the Maiden Rock section immediately upstream. The decline in the number of large brown trout in the Maiden Rock section in 1987 and 1988 is believed to be due to the dominance of the population by the older larger fish which suppressed recruitment and numbers of young fish. This can be seen in declines in numbers

of brown trout in the 1981-84 and 1985-87 period and is corroborated by recruitment data. As the dominant year classes aged and began to suffer from mortality, the population of 18 inch and larger fish began to decline in 1987 which opened more habitat for younger fish which increased in number. The 1989 data indicates an upward trend in the numbers of larger fish. This is further demonstrated in Figure 27, which depicts the percentage of the brown trout standing crop that is accounted for by 18 inch and larger fish and shows the domination of the brown trout production by this segment of the population. The growth, maturation, and decline of the 18 inch and larger segment of the brown trout population of the Maiden Rock section can be seen in Figure 28, which splits the density of these larger fish into inch groups. The data indicate a slower growth in the number of fully mature (19 and 20+ inch fish) until they attained maximum numbers after four to five years of regulation. These maximum numbers of large fish then underwent a rapid decline in 1987 and 1988 as mortality eroded the population. It is possible that the special regulation of the brown trout in the Maiden Rock section may result in cycles in which the 18 inch and larger fish dominate the population while inhibiting recruitment until mortality of old fish causes short term declines and an opportunity for younger fish to enter the population. It is also possible that the population is still adjusting to regulated harvest and will merely seek a level modified by recruitment and mortality rates and attain a relative degree of stability. It will be important to continue future monitoring to determine the mechanisms by which the population responds to the special regulation.

Estimated numbers and standing crops of rainbow trout are presented for the Maiden Rock and Melrose sections in Figures 29 and 30. Total numbers and biomass of rainbow trout have risen markedly in the Maiden Rock section since the inception of the special regulations while numbers in the Melrose section declined or fluctuated. Comparative densities of 13 inch and larger rainbow trout (Figure 31) have also shown marked increases in the Maiden Rock section while densities of these fish have increased slightly and fluctuated in the Melrose section. Fluctuations in the density of these fish under special regulations may be indicative of a cyclic process as was speculated upon for brown trout or may be a function of low streamflow in the 1985-88 period. Densities of 16 inch and larger rainbow trout in the Maiden Rock section increased rapidly to achieve a maximum in 1983 that was triple the observed density in 1981. This was followed by a decline and stabilization at approximately 50 per mile that has persisted since 1984. While populations of these larger rainbow trout have increased under the special regulation, a similar increase was noted in the Melrose section over the 1981-86 period. It is possible that out migration of some of these fish from the Maiden Rock section has contributed to this increase. It is also possible that the special regulation has had the opposite affect that it has had on brown trout and is most effective in increasing numbers of 13 inch and larger rainbow as well as overall rainbow trout density. Limited increases in the

16 inch and larger rainbow trout in the Maiden Rock section also may be a function of limited growth potential due to higher densities within the species (Figure 32). Some of the data suggest that this factor may be in operation and future analysis of this data will be presented in a subsequent report.

Hog Back Section

The Hog Back study section was established in the lower Big Hole River in 1987 in order to monitor brown trout populations and provide data necessary to formulate a river management plan. The section originates at the mouth of the Garrison diversion channel (T4S, R8W, NE Sec. 31) and continues downstream 4.52 miles to the Notch Bottom Fishing Access Site (MDFWP). Because the primary component of the fishery of the section is brown trout, the section is sampled in the spring. Gamefish occupying the section include brown trout, mountain whitefish, rainbow trout, burbot, and occasional arctic grayling. Nongame species occupying the section include white and longnose sucker, longnose dace, and mottled sculpin.

Density and standing crop of age 2 and older brown trout are reported in Figure 33. This figure demonstrates that the reach supports high densities of brown trout ranging between 1052 and 1885 per mile. While standing crop closely approximated density levels in 1987 and 1989, the two parameters were widely divergent in 1988. This was due to excellent recruitment of age 2 fish from 1986, the same observation made for rainbow trout in the Jerry Creek section in upper reaches of the river. This is demonstrated in greater detail in Figure 34 which presents estimated densities of age classes of brown trout. Age data from the spring sample of 1989 has not been included in this graph since it has not been analyzed. This figure also depicts poor recruitment into the population from 1985, as evidenced by the low density of age 2 brown trout in 1987. The length distribution of the 1988 sample (Figure 35) and the densities of selected length groups of brown trout (Figure 36) demonstrate the length composition of the brown trout population of the section. These distributions indicate that brown trout growth is somewhat limited in the section relative to other study sections upstream. This is probably due to chronic low summer streamflow within the reach coupled with high brown trout density. Numbers of 18 inch and larger brown trout (15 - 20 per mile are the lowest observed for any section supporting a viable brown trout population in the Big Hole River.

Estimated populations of rainbow trout in the Hog Back section (Figure 37) are low, ranging between 165 and 204 per mile. This represents a downward trend in rainbow trout density from highs observed in the Jerry Creek section downstream to minimum densities observed in the Hog Back section. It is believed that this is due to a change in habitat from high gradient rubble cobble substrate to a lower gradient cobble gravel substrate as well as a gradual

decline in tributary spawning habitat. The length distribution of the rainbow trout in the 1987 is shown in Figure 38 in order to depict the length composition of the sample. The rainbow trout population of the Hog Back section represents a relatively minor component of the fishery of the reach.

Sampling was conducted within the reach in the early 1970's. During this era, the Big Hole River still received annual plants of hatchery rainbow trout. It has been demonstrated that wild trout populations have responded favorably to the cessation of of these plants in in the Big Hole River in 1974 (Oswald, 1984). As was the case in the Melrose section, both brown and rainbow trout populations in the Hog Back Section have increased markedly over densities observed in the Reichle section in 1972 and 1973 Figures 39 and 40. Modern day wild populations of both species are approximately double those observed during the era of hatchery plants.

Discharge

Summer streamflows in the Big Hole River were somewhat below average in 1986 and markedly below average in 1987 and 1988 (Figure 41). This is representative of a drought condition which has persisted in southwest Montana since 1985 and has limited area streamflow. Flows in 1988 dropped to an instantaneous recorded minimum of 51 cfs, only 2 cfs above the record minimum of 49 cfs observed in 1931. Figure 41 demonstrates that August and September flows in 1987 and 1988 were well below the minimum recommended streamflow of 300 cfs for this reach of the Big Hole River. This drought regime streamflow in the Big Hole River is in sharp contrast to the abundant streamflows observed in the 1982-84 period.

The recent period of low streamflow has resulted in marked effects on populations of gamefish, particularly rainbow and brown trout, in the Big Hole River. Preliminary analysis of population data indicate that the affects of low streamflow have been manifest most severely in declines in survival of young rainbow trout between age 1 and age 2 and declines in recruitment of both brown and rainbow trout. This data is being analyzed and will be presented in a subsequent report.

Water Temperatures

Mean summer water temperatures in the Big Hole River were above average in 1987 and 1988 concomitant with low streamflow and warm climatic conditions (Figure 42). Maximum instantaneous water temperatures recorded over the period were 71.6 F in 1986, 72.5 F in 1987, and 74.3 F in 1988. For the July - August period, temperatures in excess of 70 F were recorded on three days in 1986, 10 days in 1987, and 21 days in 1988. Temperatures as high as 80 F were recorded in lower segments of the river near Twin Bridges and were associated with thermal stress kills of mountain whitefish and brown trout. High water temperatures coupled with low streamflow resulted in effects on the trout populations which will be analyzed

in detail in a subsequent report.

BEAVERHEAD RIVER

Fish Populations

Fish population data have been collected in 5 study sections on the Beaverhead River. Spring and fall population data has been collected in the Hildreth section to monitor the dynamics of populations of wild brown and rainbow trout in response to flow regimes from Clark Canyon Dam and competitive factors between the species. Data will be reported in a subsequent report.

Fish population data have been collected in spring and fall in the Pipe Organ study section to monitor population dynamics of brown and rainbow trout in lower reaches of the Clark Canyon Dam tailwater and to monitor the affect of year round angler harvest in a portion of the tailwater. Data will be reported in a subsequent report.

Fish population data have been collected in spring in the Fish and Game section to monitor populations in the reach of river downstream from the Clark Canyon Dam tailwater and to compare fish populations between two reaches of river with marked differences in flow regime. Data will be reported in a subsequent report.

Fish population data have been collected in spring in the Low Flow study section to monitor trout populations in the reach of river which is often managed as the low flow point in the Beaverhead River system. Data will be reported in a subsequent report.

Fish population data have been collected in spring in the Twin Bridges study section to describe the populations of the lowermost reach of river for development of a river management plan and to monitor populations in the reach of river with the highest degree of habitat degradation in the system. Data will be reported in a subsequent report.

Flows

Streamflow in the Beaverhead River was monitored at gauges at Grant, Barretts, Dillon, and Beaverhead Rock. Flow data and the response of fish populations to flow regime have been monitored. Data will be reported in a subsequent report.

Creel Census

A pressure, harvest, and angler preference survey is being conducted in the Beaverhead River tailwater reach (Clark Canyon Dam to Barretts Diversion). Data will be reported in a subsequent report.

MISSOURI RIVER

Fish Population Estimates

Rainbow trout. The Missouri River between Canyon Ferry Reservoir and Toston Dam supports both spring and fall runs of rainbow trout.The reservoir rainbow population (from which these runs originate) consists of planted, fall spawning variety of Arlee strain; planted wild spring spawning segment made of DeSmet strain (since 1983) and Eagle Lake strain (since 1987); and a small contribution of naturally produced wild fish. The presence of both spring and fall running rainbow strains in the reservoir has precluded accurate estimation of the resident rainbow population in this reach of river.

Fall Run - In 1978 and 1979, Fredenberg (1980) documented a substantial fall rainbow trout run and associated fishery. He showed the fall fishery concentrated between Townsend and Canyon Ferry Reservoir to peak between October 20 and November 17. Electrofishing at that time revealed large numbers of rainbow trout. In the years that followed, the magnitude of the run declined dramatically and the peak was delayed until mid-November (Rehwinkel, 1986). Marked rainbow trout from the reservoir, observed in the river, verified that the fall run was mainly comprised of Arlee strain rainbow trout. A closer review of historic stocking records confirmed that the Arlee rainbow plant was derived from two separate egg takes. The timing of these egg takes approximated the two different run modes. In an attempt to restore this run, the Arlee plant was again divided between the two different egg takes. This was done for three years. The results of this effort were not successful (Figure 43).

Spring Run - During certain years,a popular spring rainbow trout run fishery develops in the Townsend to Canyon Ferry section of the Missouri River. It does not occur every year and the factors controlling it are not understood. In 1988, this concentration developed and a creel census was initiated to document the angler success and the strain of the rainbow. The time period of the census was between March 24 and April 10. A total of 98 contacts were made during the seven days sampled which accounted for 292.5 angler hours. The documented catch was 70 rainbow trout for a combined catch rate of 0.24 rainbow trout per hour of angling. The expanded results analyzed by strata (weekdays and weekend days) indicated a total estimated pressure of 949.5 hours. The harvest was estimated to be 277 rainbow trout averaging 17.1 inches long.

The strain of rainbow could be determined since all plants in the reservoir are presently marked by color-coded "spray marks"(Lere, 1987). The sample inspected on the creel census was 67% Arlee and 33% Demet strain rainbow trout.

Flow Rates

Summer discharges of the Missouri River at Toston during 1986 were near long term averages, while flows during the summer of 1987 (especially early) and 1988 were below monthly means and recommended instream fishery levels(Table 7). Minimum discharges were 1870 cfs (August 12), 1090 cfs (May 15) and 788 cfs (August 6) for 1986 , 1987 and 1988, respectively.

JEFFERSON RIVER

Fish Population Estimates

Willow Creek - Three Forks Section

Brown trout. Annual brown trout population estimates were conducted in this section from 1979 through 1988. An estimate for

Table 7. Missouri River summer mean monthly discharges (cfs) for 1986, 1987 and 1988 (USGS, Toston).

MONTH	1986	1987	1988	MEAN
June	12770	3175	4511	11700
July	3764	2729	1243	4500
August	2250	2497	896	2460
September	4646	2680	1560	3430

1987 was not obtained due to low and erratic flow conditions. Previous work has indicated that spring numbers of age III and older brown trout vary between 248 and 452 per mile (Rehwinkel, 1980,1981,1982 1983,1986). The population estimates for 1986 and 1988 are shown in Tables 8 and 9, respectively.

Calculations of total annual mortality of adult brown trout have consistently indicated excessively high values (56.0 to 88.5 through 1985). With the lack of data for 1987, only the mortality rate from 1985 to 1986 can calculated for III+ to IV+ age brown trout. Again the rate of 71.0% appears to be very high. Considering the population is not declining severely, this might be an incorrect estimate of mortality. Reasons for such an error seem most likely to come from under estimating the age IV+ fish. These larger individuals are more likely inhabiting the deep water where sampling efficiency is very reduced.

Table 8. Brown trout population estimates for the Willow Creek -Three Forks section of the Jefferson River(7.0 miles),spring 1986 (80% confidence limits in parenthesis).

AGE	AV. LENGTH (inches)	NUMBER	BIOMASS (lbs)	NO/MILE
III	11.9	1855(162)	951.3	265
IV	14.9	478(55)	417.5	68
IV+		94(23)	113.8	13
TOTAL		2427	1482.6	346

As previously stated, brown trout estimates have been conducted in this section for approximately ten years. During this period, the irrigation season low flows have varied between 254 and 2680 cfs. There does not appear to be any clear relationship between numbers of age III brown trout and flow levels of the preceding 1, 2 or 3 years.

This information suggests that some other factor is exerting

Table 9. Brown trout population estimates for the Willow Creek -Three Forks section of the Jefferson River(7.0 miles), spring 1988 (80% confidence limits in parenthesis).

AGE	AV. LENGTH (inches)	NUMBER	BIOMASS (lbs)	NO/MILE
III	12.1	985(115)	984.6	141
IV	14.6	1044(111)	1044.0	149
IV+		501(74)	625.5	72
TOTAL		2530	2654.1	362

more influence over trout numbers than flows. Considering the silty nature of the stream substrate (especially the lower Jefferson River), successful reproduction is believed to be a likely explanation for these erratic population levels. Test planting of marked wild brown trout fingerlings for approximately five (5) years should clearly illustrate whether this system is recruitment limited.

Hell's Canyon Creek Section

Brown Trout - Annual brown trout population estimates were conducted in this section from 1983 through 1988 with the exception of 1987 (due to flow levels). Previous work has indicated that

spring numbers of age III and older brown trout vary between 253 and 503 per mile (Rehwinkel, 1986). The population estimates for 1986 and 1988 are presented in Tables 10 and 11, respectively.

Table 10. Brown trout population estimates for the Hell's Canyon Creek section of the Jefferson River(3.1 miles), spring 1986 (80% confidence limits in parenthesis).

AGE	AV. LENGTH (inches)	NUMBER	BIOMASS (lbs)	NO/MILE
III	12.3	666(102)	428.7	215
IV	14.8	255(42)	273.5	82
V+		258(47)	303.7	83
TOTAL		1179	1005.9	380

Annual mortality rates documented in 1984 and 1985 for III+ to IV+ age brown trout were low to moderate. Flow levels during those years were exceptionally high. The annual mortality rate between 1985 and 1986 for age III+ to IV+ brown trout increased to 67.1%. This rate of mortality is likely the result of deteriorated summer flow conditions.

Rainbow Trout - Catch and release angling regulations(no gear restrictions) on rainbow trout were initiated in 1986 for the entire Jefferson River and continue to be maintained. Population estimates (which must be conducted in the fall) have not yet been

Table 11. Brown trout population estimates for Hell's Canyon Creek section of the Jefferson River(3.1 miles), spring 1988 (80% confidence limits in parenthesis).

AGE	AV. LENGTH (inches)	NUMBER	BIOMASS (lbs)	NO/MILE
III	12.4	560(93)	559.9	181
IV	14.9	642(100)	641.7	207
IV+		350(71)	507.9	113
TOTAL		1552	1709.5	501

accomplished due to insufficient river flows. Rainbow numbers sampled in the spring (incidental to brown trout work) indicate the decline witnessed between 1984 and 1986 has been reversed. Sampling done in 1988 revealed numbers comparable to the high in 1984. Additionally, the hook scar rate on rainbow trout has increased to

a point higher than that for brown trout. This suggests anglers are cooperating with the established regulation which is resulting in increased rainbow survival.

Previous review of suitable rainbow trout spawning tributaries indicated Hell's Canyon Creek was probably the last one available. Since that time, a private landowner of a badly silted spring creek has agreed to cooperate with a stream fencing project. Wild rainbow resulting from egg-takes in Hell's Canyon Creek have been imprint planted into this spring creek (Willow Springs) as the stream improvement work continues. The intended result is to increase rainbow recruitment into the Jefferson River. This work is more completely reported under project 3311.

Flow Rates

Summer flows of the Jefferson River at Three Forks during 1986 were higher than the previous year but still slightly below normal. River discharges during 1987 were lower than 1986, while 1988 was near an all time record low. Mean monthly flows are presented in Table 12. Minimum discharges recorded for each year were 504 cfs (August 10, 1986), 364 cfs (August 12, 1987) and 44 cfs (August 19, 1988). Basically, 1988 marked the fourth consecutive year of ever increasingly more severe drought conditions.

Table 12. Jefferson River summer mean monthly discharges (cfs) for 1986, 1987 and 1988 (USGS, Three Forks).

MONTH	1986	1987	1988	MEAN
June	5031	1427	1778	5500
July	1488	959	352	2100
August	757	609	59.1	690
September	1854	768	303	1000

Stream Protection Projects

There are six Soil Conservation District associated with the seven major rivers in this report. The following are the SCD's and the number of stream project proposals inspected during the project period: Beaverhead 15, Broadwater 4, Gallatin 35, Jefferson Valley 4, Madison 4, and Park 30.

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Prepared by: E.R. Vincent, Chris Clancy, Wade Fredenberg, Richard Oswald, and Bruce Rehwinkel.

Date: August 29, 1989.

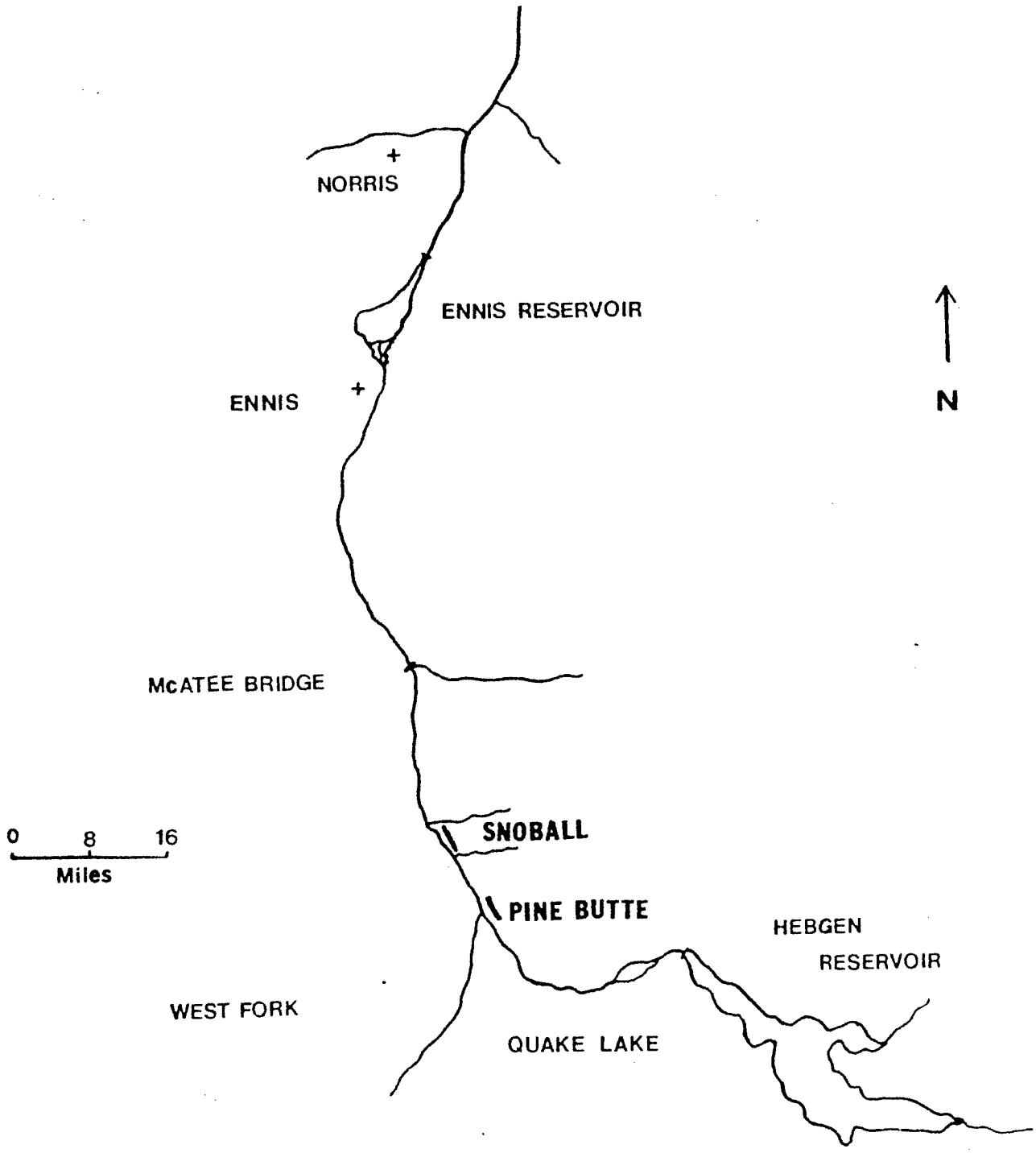


Figure 1 Map of the Madison River showing study sections.

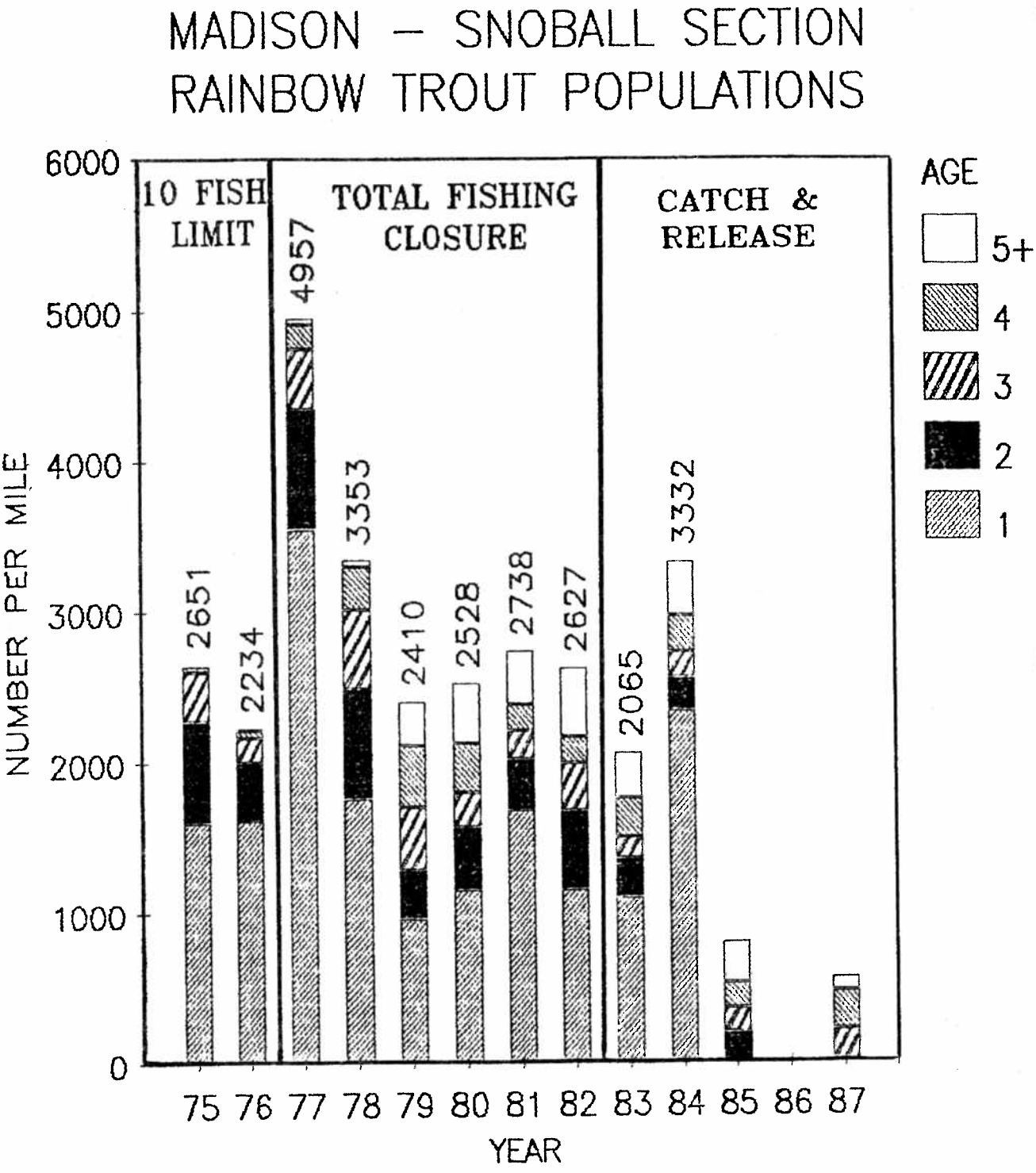


Figure 2 . Estimated September rainbow trout population (number per mile) in the Snoball section of the Madison River during 1975 through 1987. No estimate available for 1986; 1985 and 1987 estimates omit young age classes. Numbers above bars indicate totals (Age 1 and older).

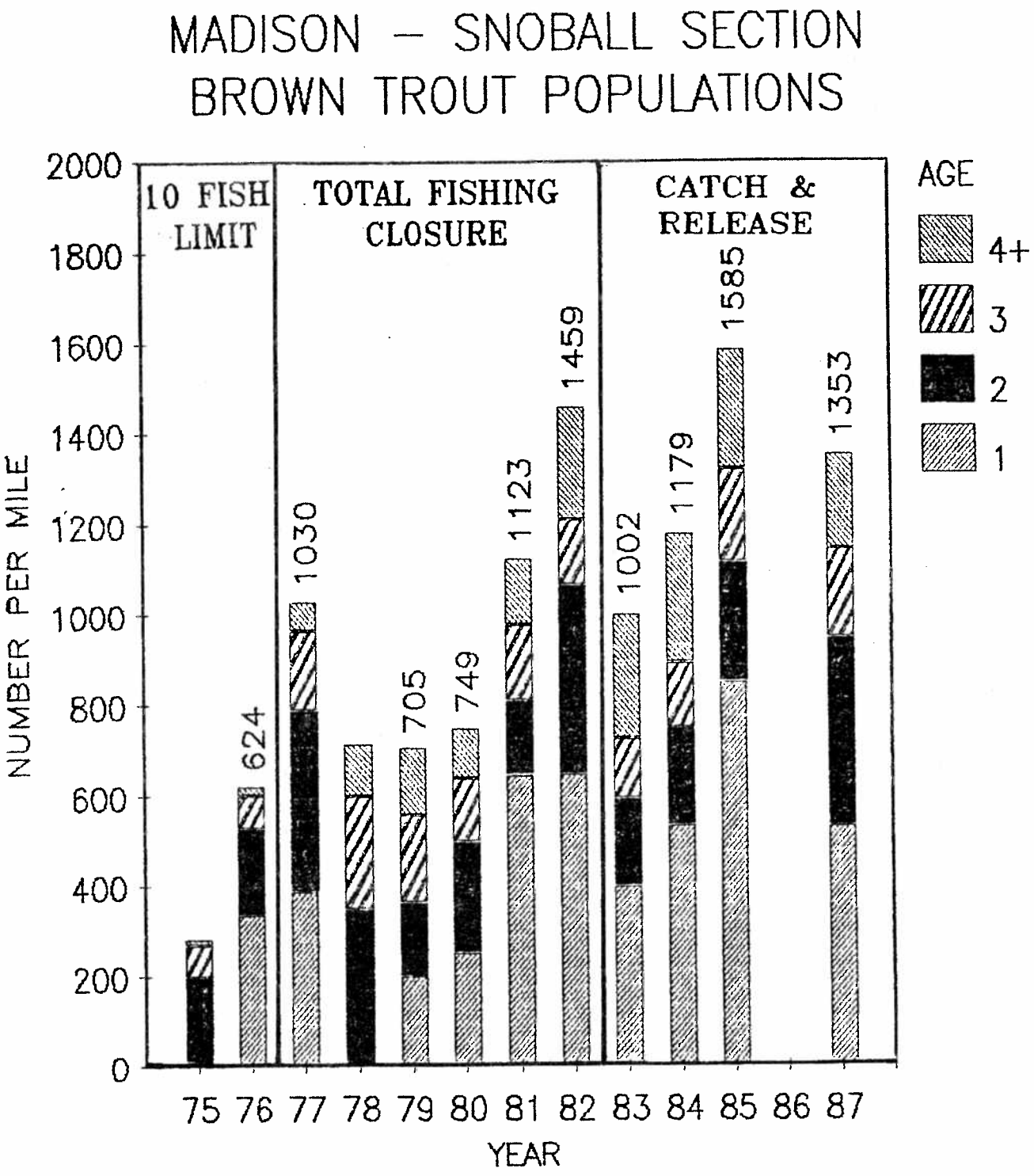


Figure 3. Estimated September brown trout population (number per mile) in the Snoball section of the Madison River during 1975 through 1987. No estimate available for 1986; 1975 and 1978 estimates omit younger age classes. Numbers above bars indicate totals (Age 1 and older).

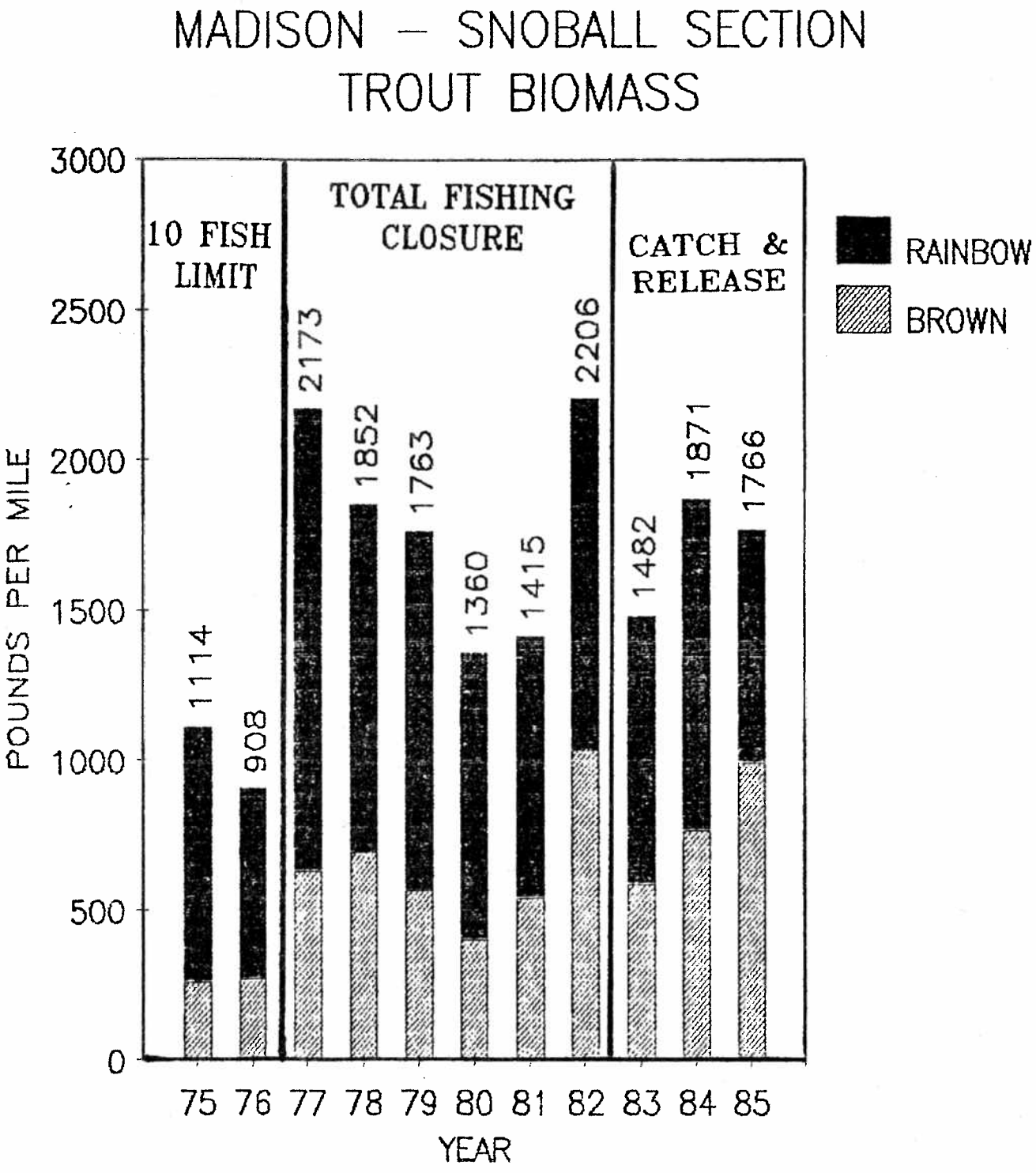


Figure 4 . Estimated September trout biomass (pounds per mile) in the Snoball section of the Madison River during 1975 through 1985. Total estimates for 1986 and 1987 were not available. Numbers above bars indicate totals.

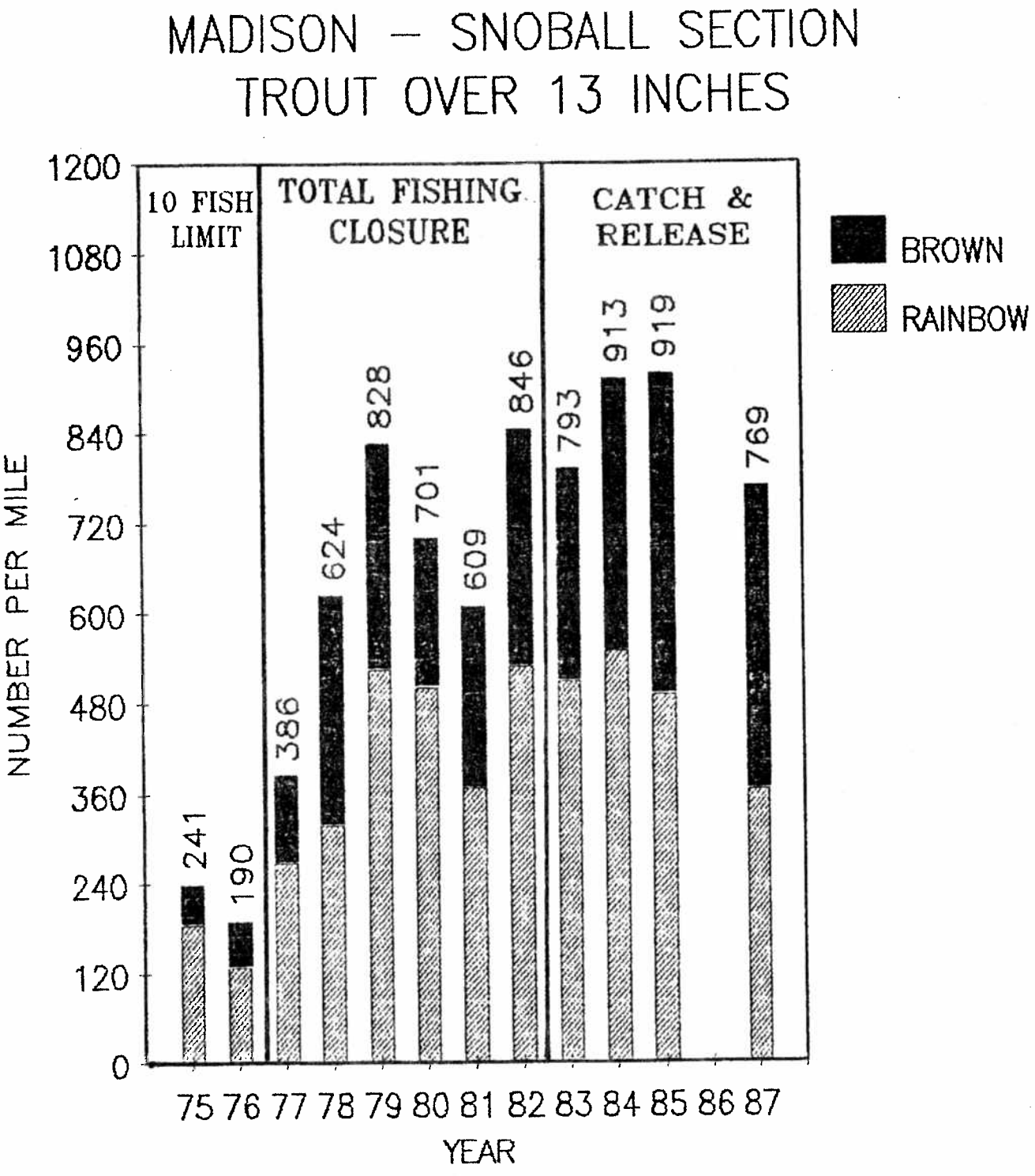


Figure 5. Estimated September populations (trout per mile) of fish over 13 inches in the Snoball section of the Madison River during 1975 through 1987. No estimate available for 1986. Numbers above bars indicate total for both species.

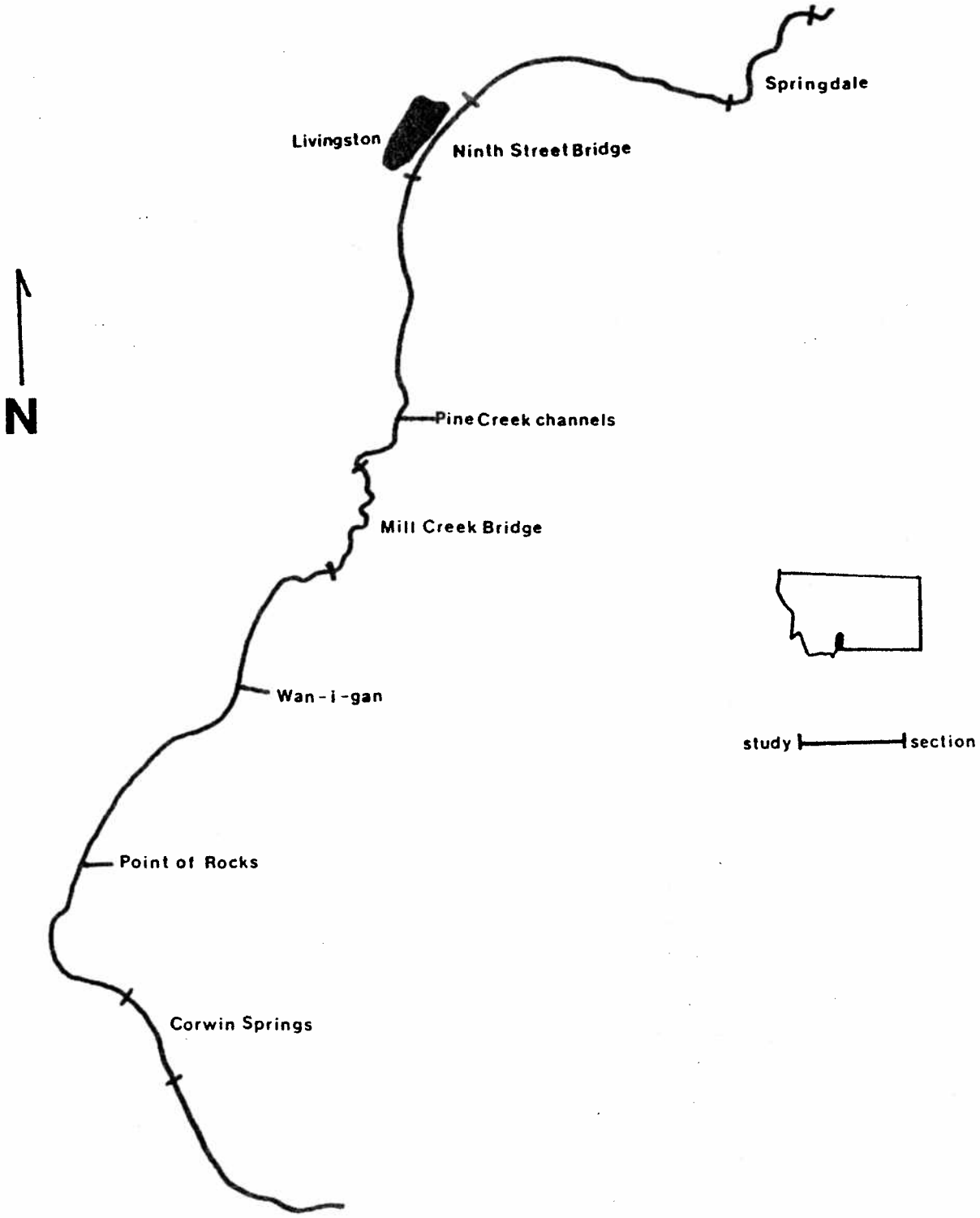


Figure 6. Map of the Upper Yellowstone River.

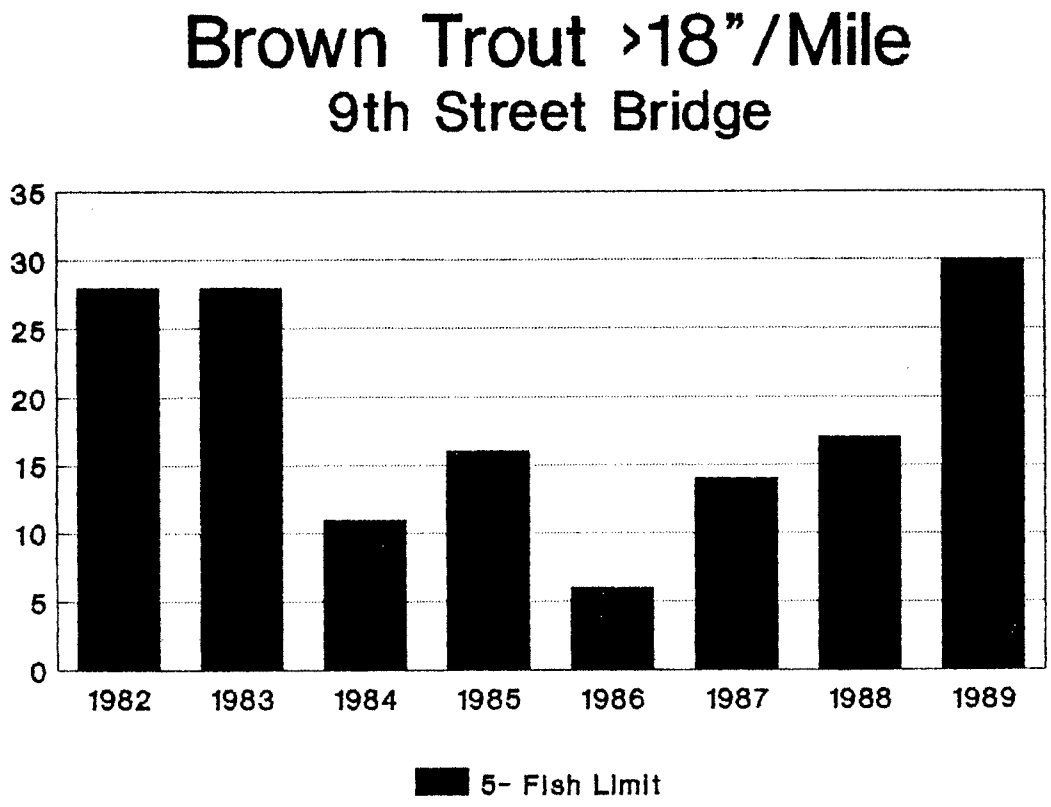


Figure 7. Comparison of 18 inch and larger brown trout in the 9th Street Bridge section of the Yellowstone River for the 1982-89 period.

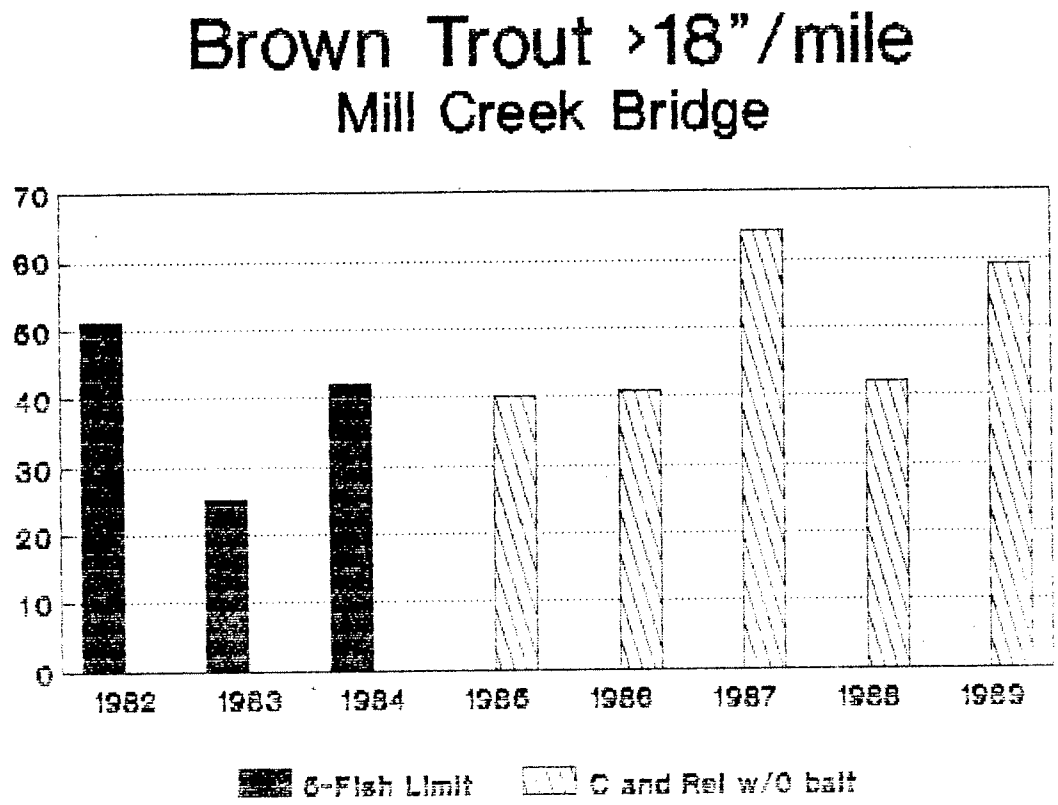


Figure 8. Comparison of 18 inch and larger brown trout in the Mill Creek section of the Yellowstone River for the 1982-89 period.

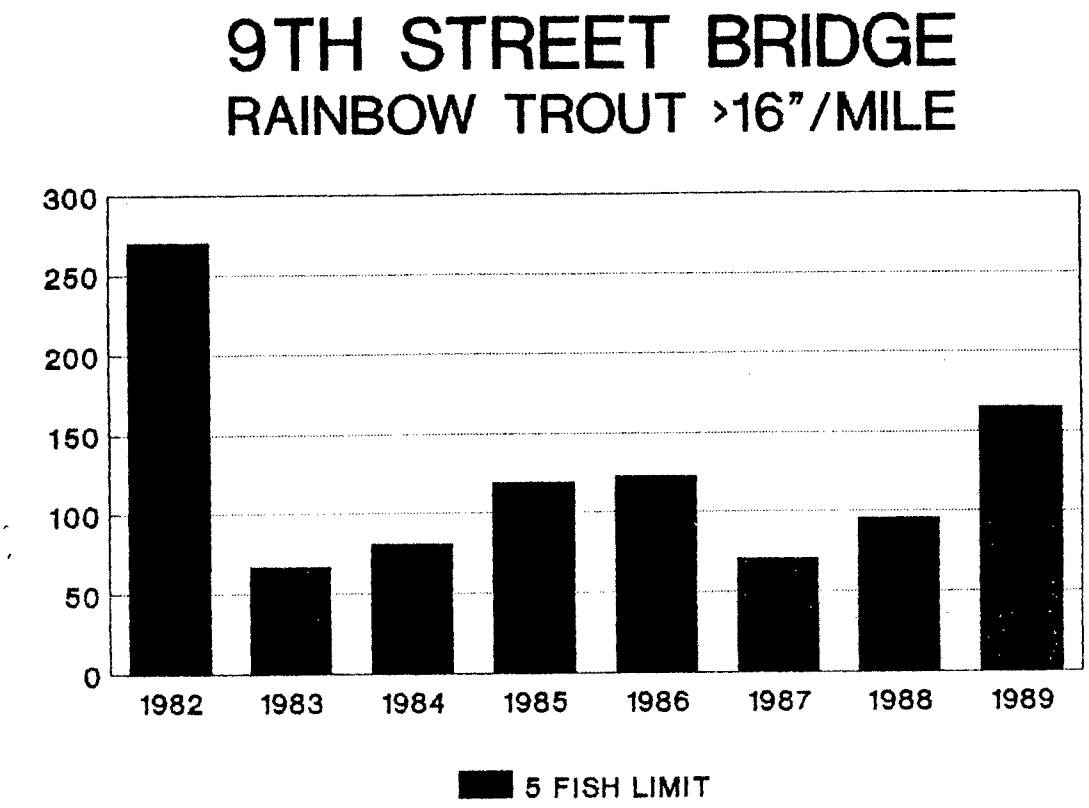


Figure 9. Comparison of the number of 16 inch and larger rainbow trout for the 9th Street Bridge section for the 1982-89 period.

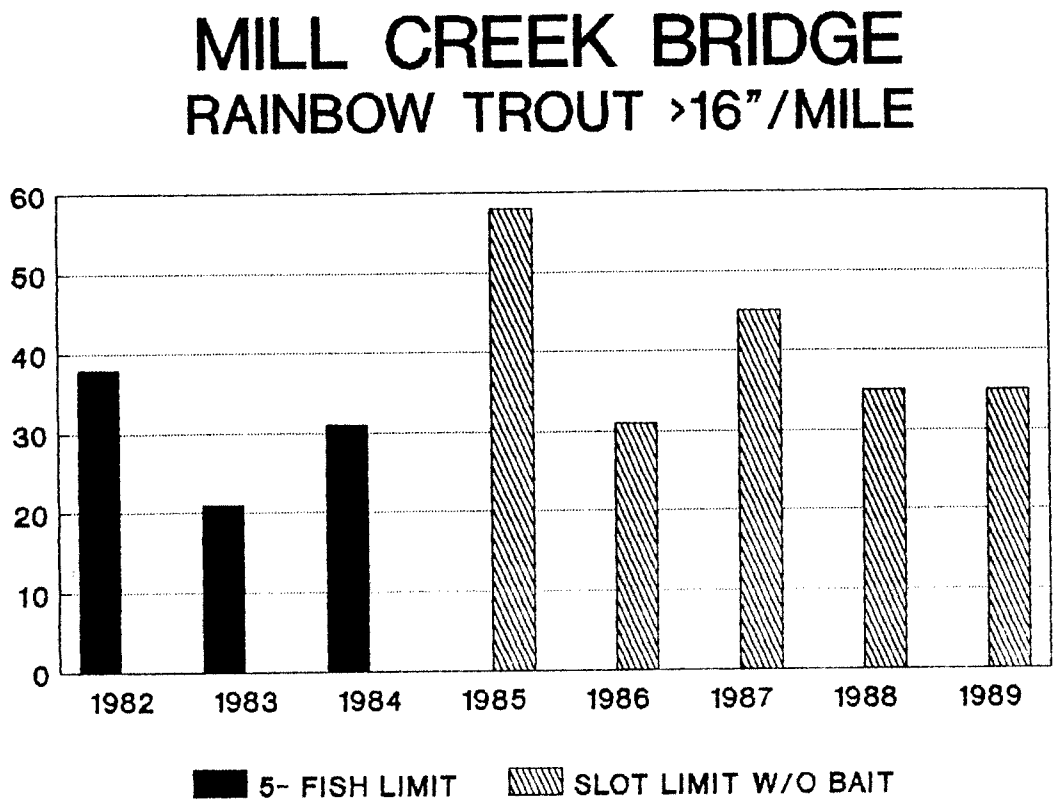


Figure 10. Comparison of the number of 16 inch and larger rainbow trout for the Mill Creek section of the Yellowstone River for the 1982-89 period.

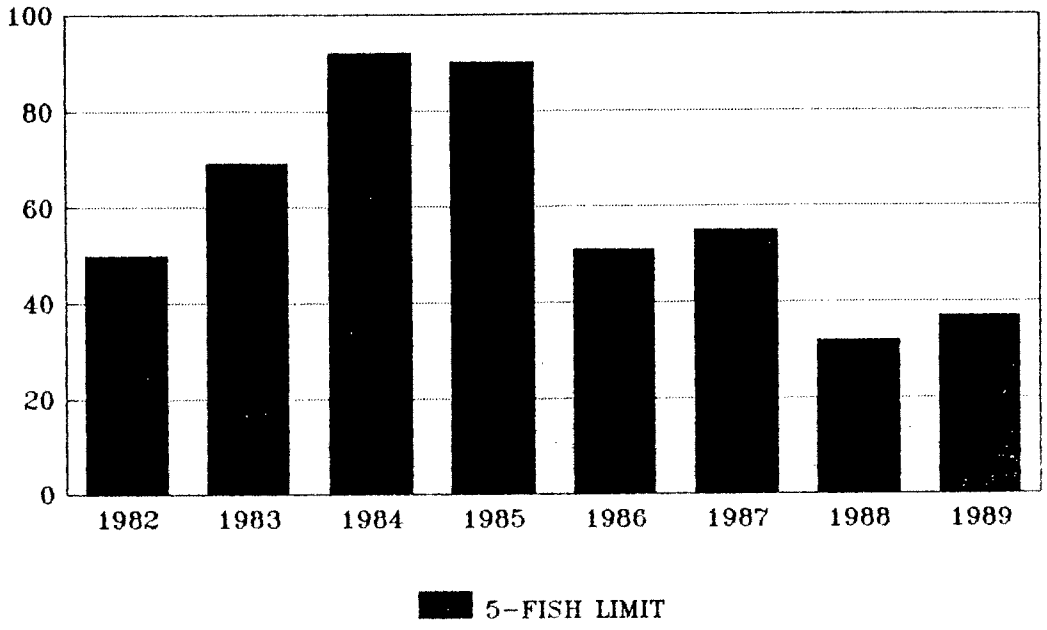


Figure 11. Comparison of the number of cutthroat trout 12 inches and larger for the Springdale section of the Yellowstone River for the 1982-89 period.

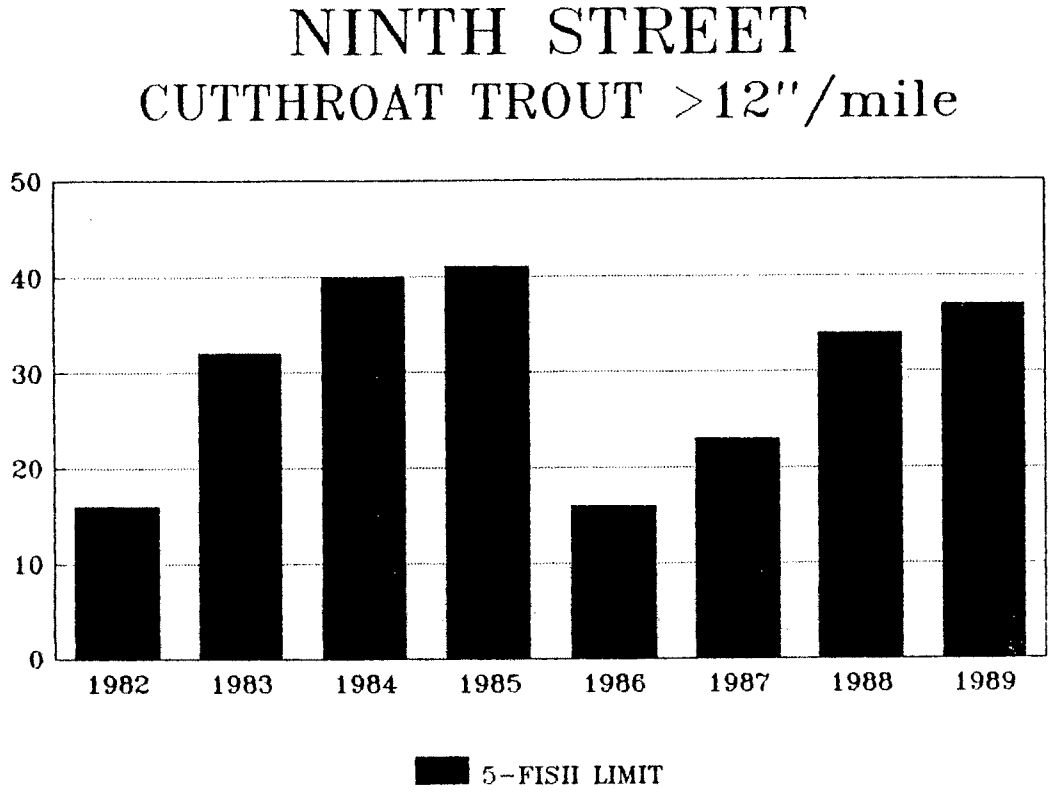


Figure 12. Comparison of the number of 12 inch and larger cutthroat trout for the 9th Street Bridge section of the Yellowstone River for the 1982-89 period.

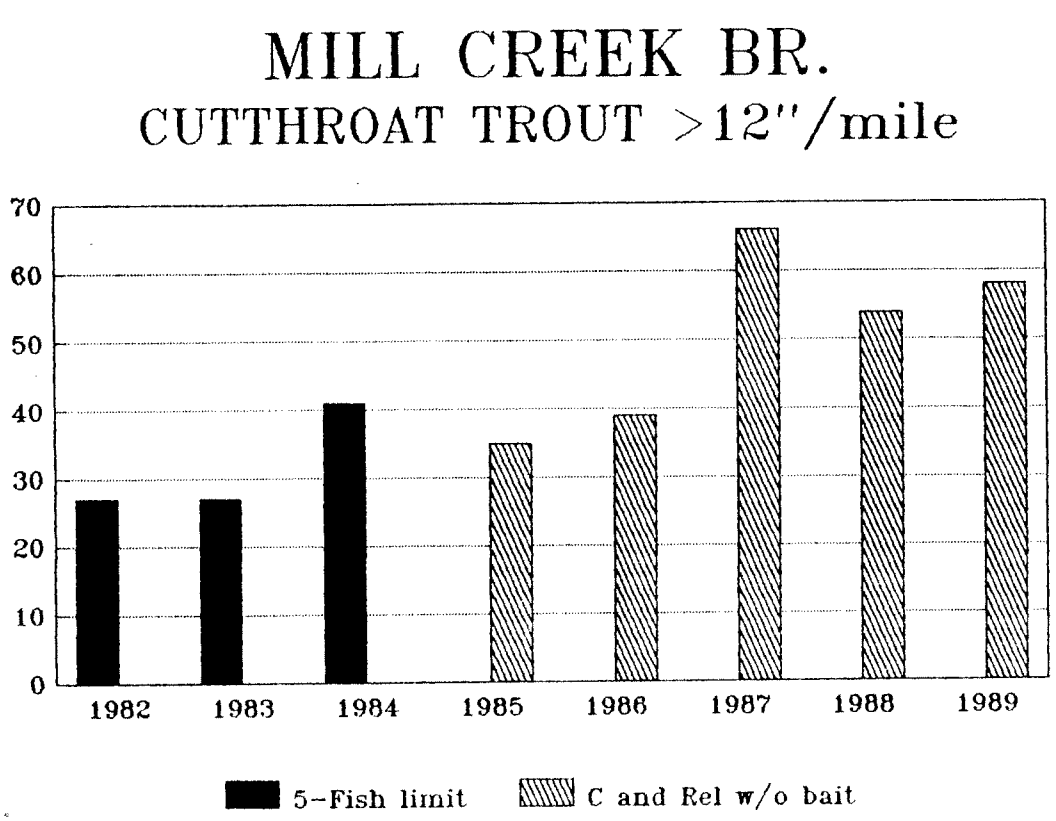


Figure 13. Comparison of the number of 12 inch and larger cutthroat trout in the Mill Creek section of the Yellowstone River for the period of 1982-89 period.

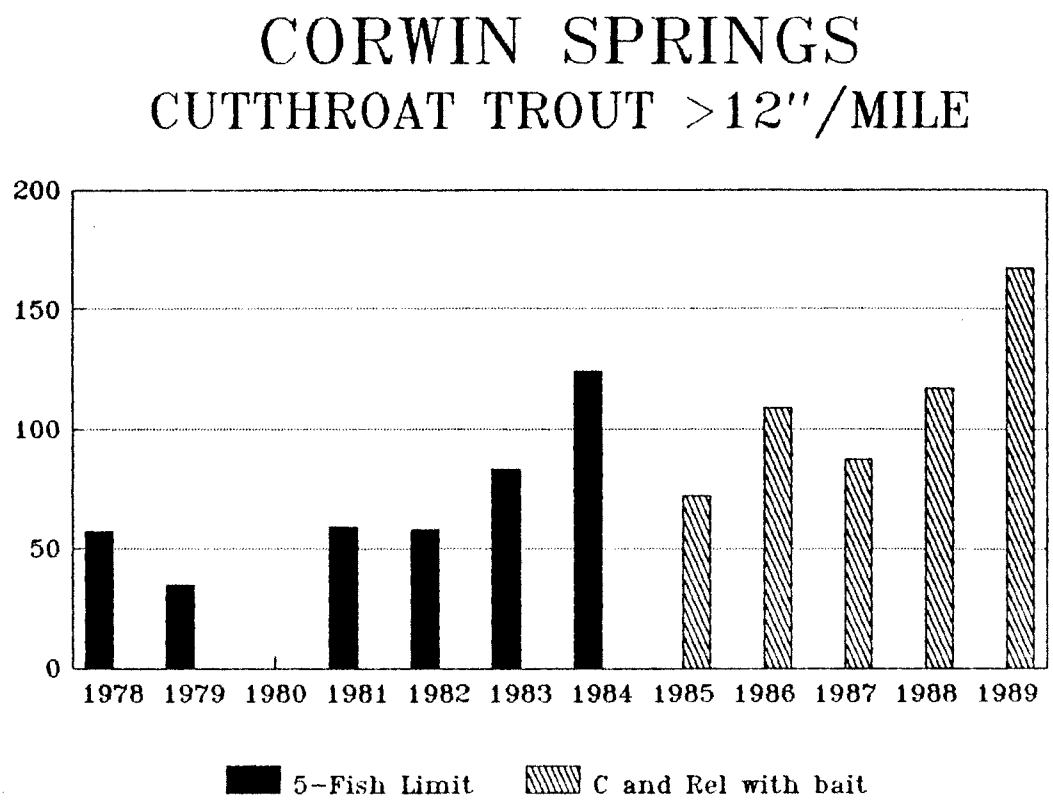


Figure 14. Comparison of 12 inch and larger cutthroat trout in the Corwin Springs section of the Yellowstone River for the 1978-89 period.

Figure 15 . Estimated numbers and standing crop (lbs.) per mile of rainbow trout from fall samples collected in the Jerry Creek study section (4.3 mi.) of the Big Hole River 1986 - 1988.

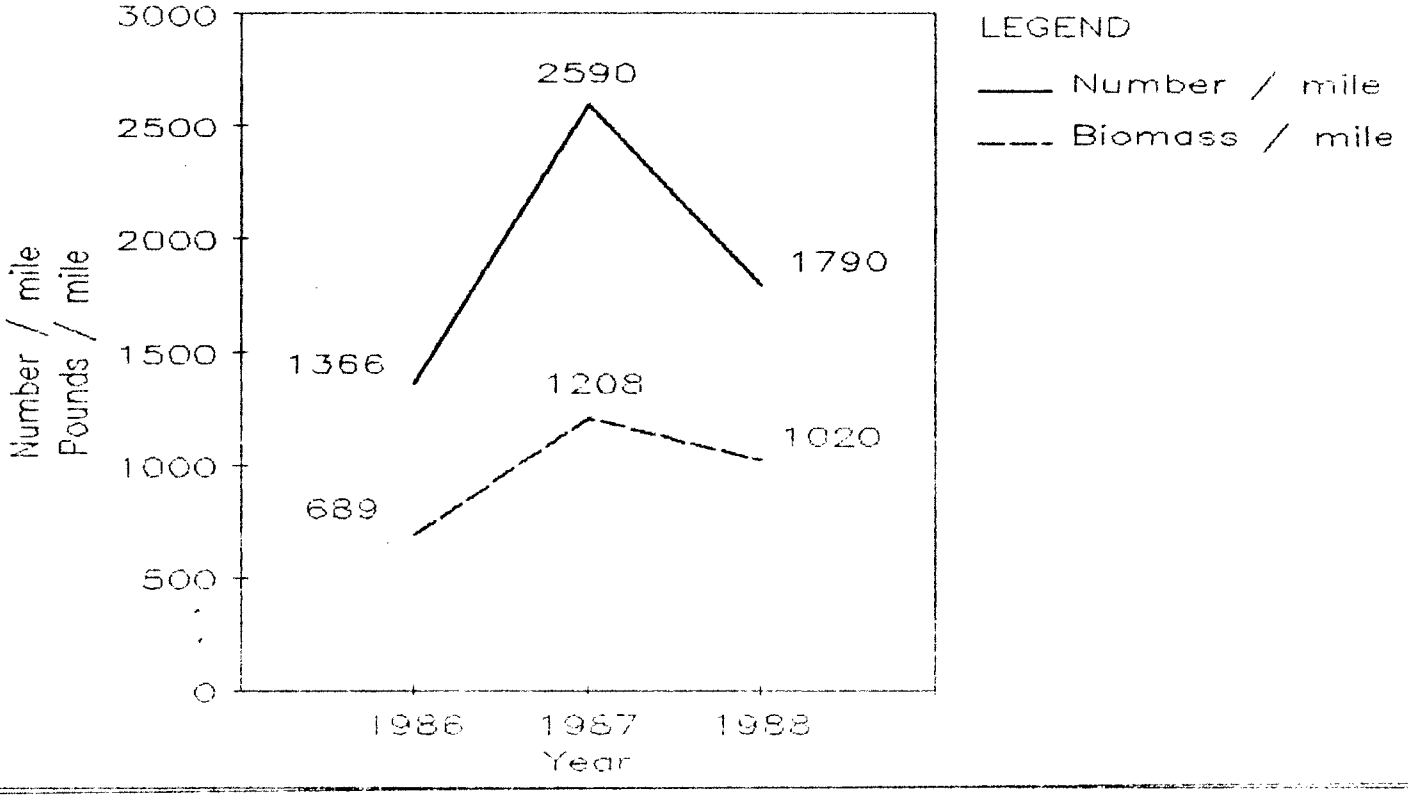


Figure 19 Estimated numbers and standing crop (lbs.) per mile of brown trout from fall samples collected in the Jerry Creek study section (4.3 mi.) of the Big Hole River 1986 - 1988.

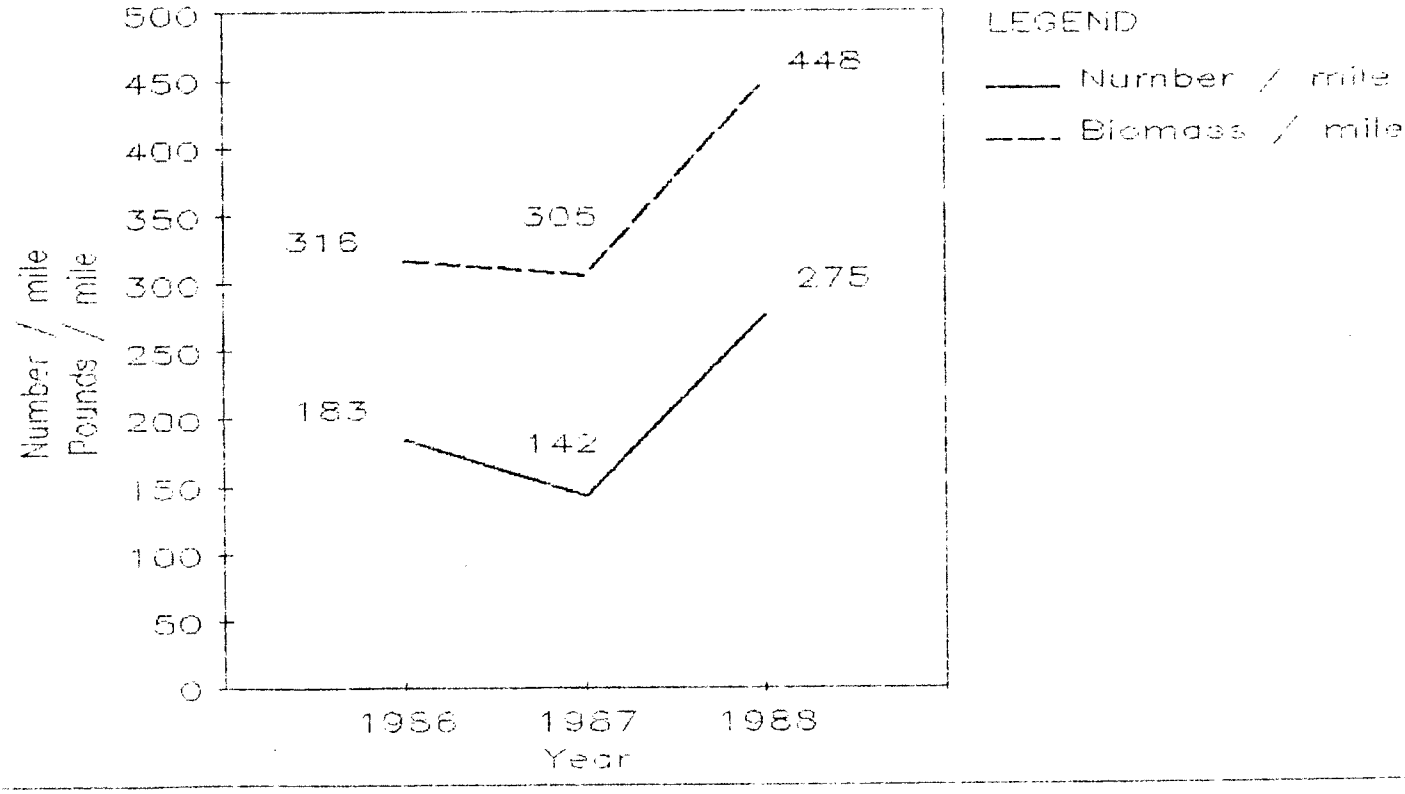


Figure 17. Length - frequency of rainbow trout collected in the fall sample of 1987 from the Jerry Creek Section of the Big Hole River.

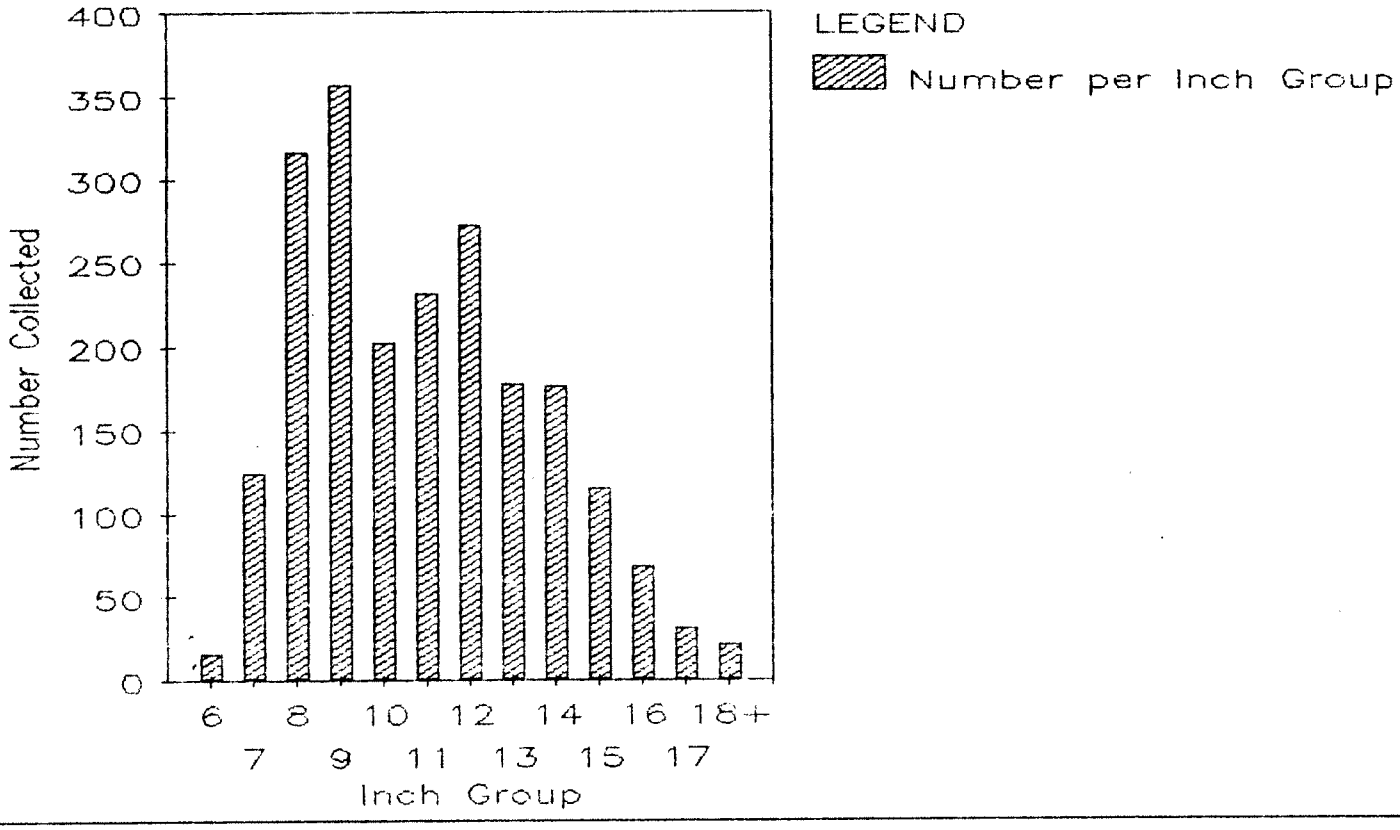


Figure 20 . Length - frequency of brown trout collected in the fall sample of 1987 from the Jerry Creek study section of the Big Hole River.

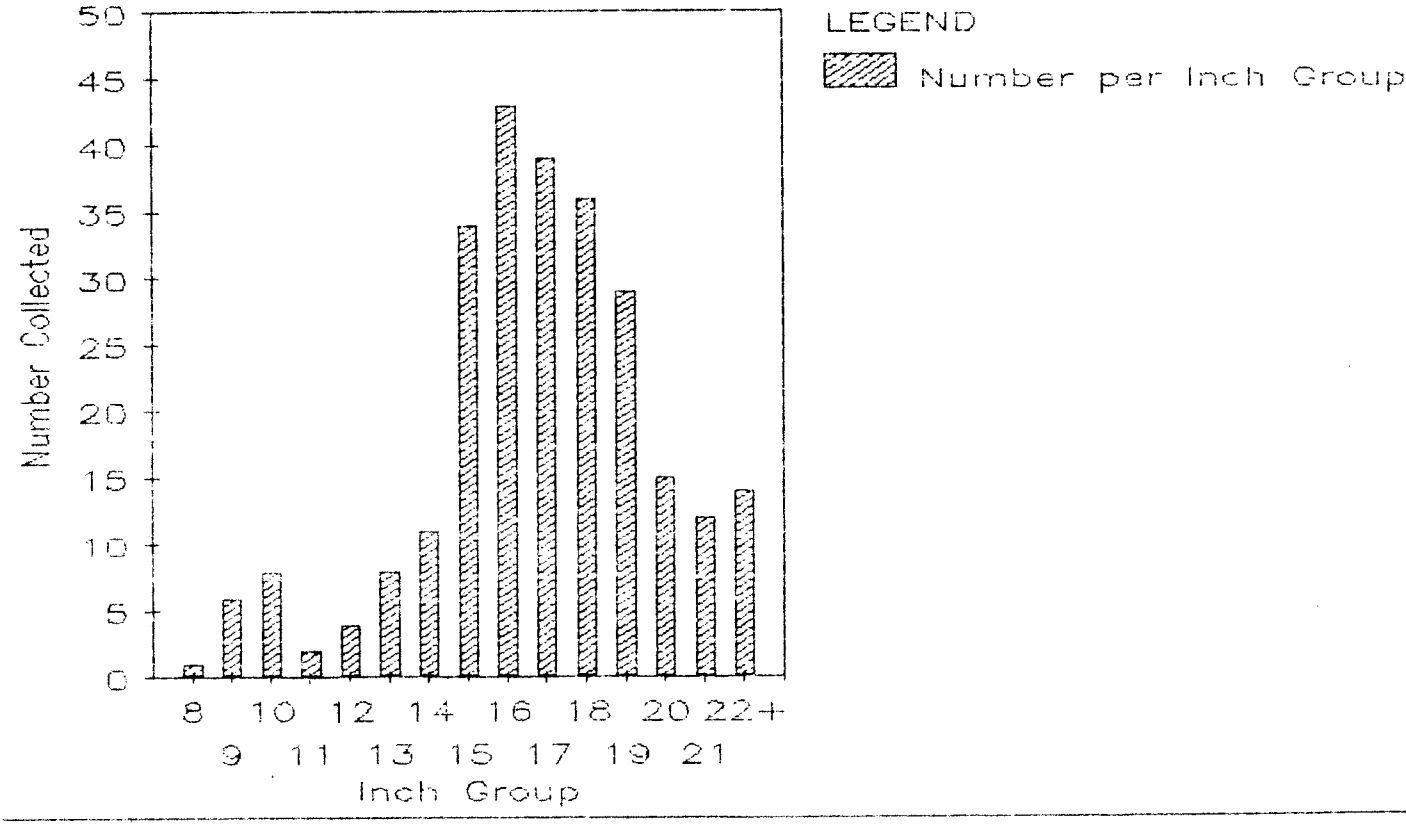
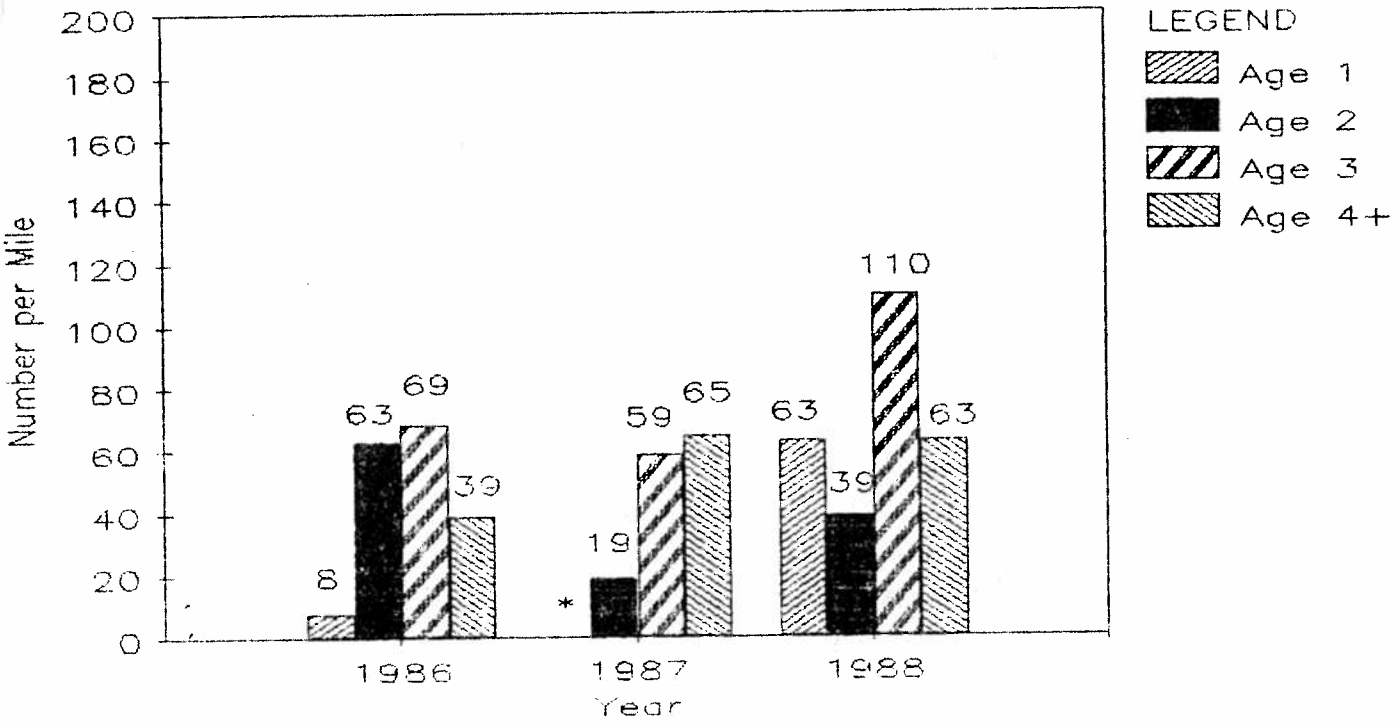
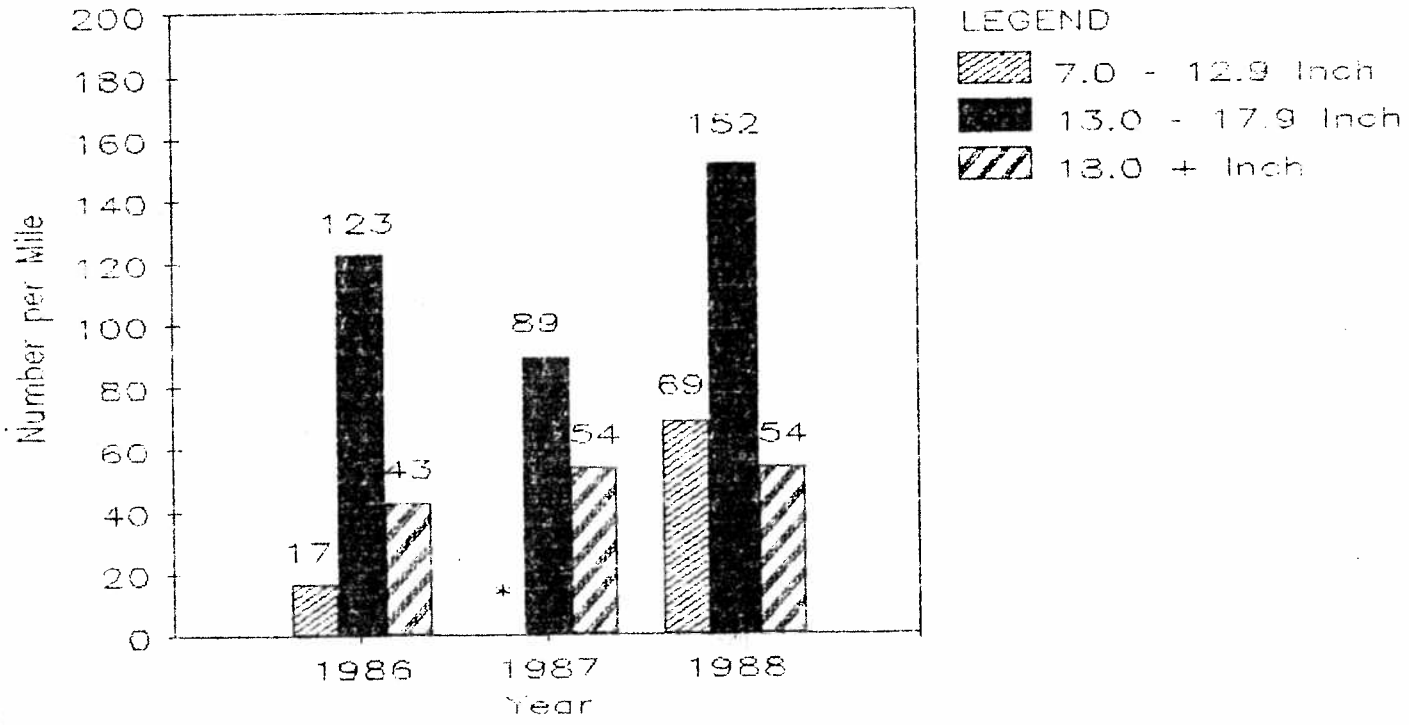


Figure 18. Estimated fall brown trout populations (number per mile) by age class from samples collected in the Jerry Creek study section (4.3 mi.) of the Big Hole River 1986 - 1988.



* No estimate due to small sample size

Figure 21 Estimated fall brown trout populations (number per mile) by length group from samples collected in the Jerry Creek study section (4.3 mi.) of the Big Hole River 1986 - 1988.



* No estimate due to small sample size

Figure 16. Estimated fall rainbow trout populations (number per mile) by age class from samples collected in the Jerry Creek study section (4.3 mi.) of the Big Hole River 1986 - 1988.

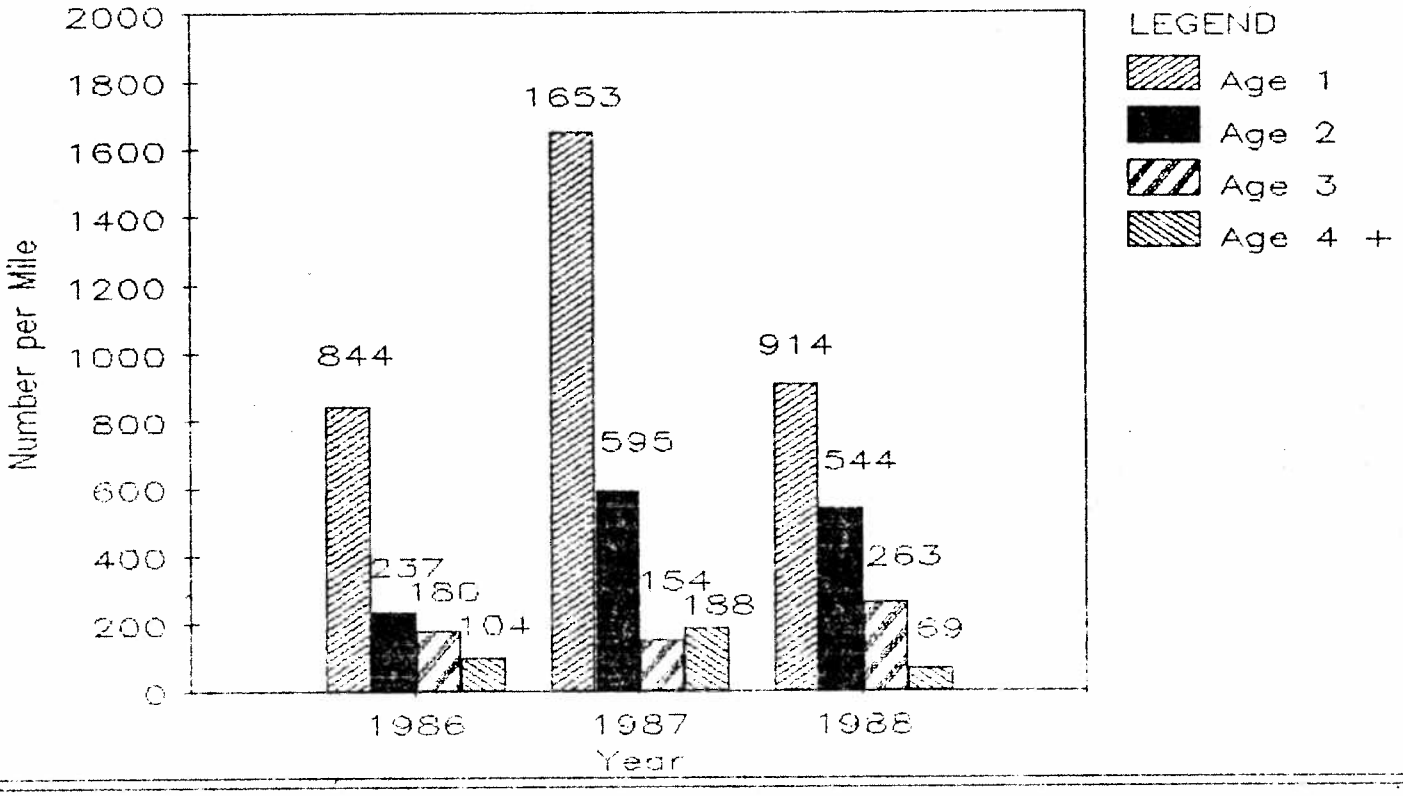


Figure 22. Estimated fall rainbow trout populations (number per mile) by length group from samples collected in the Jerry Creek study section (4.3 mi.) of the Big Hole River 1986 - 1988.

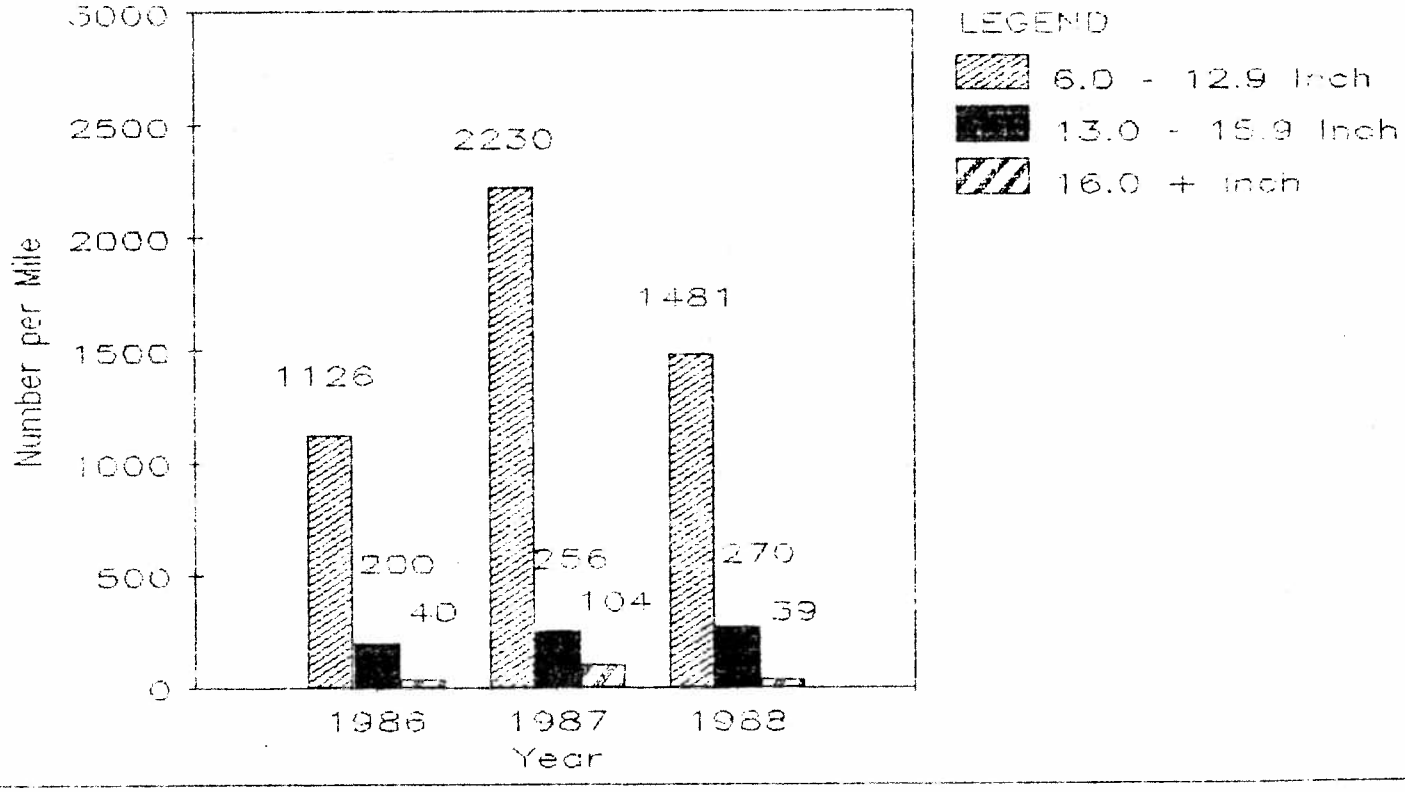
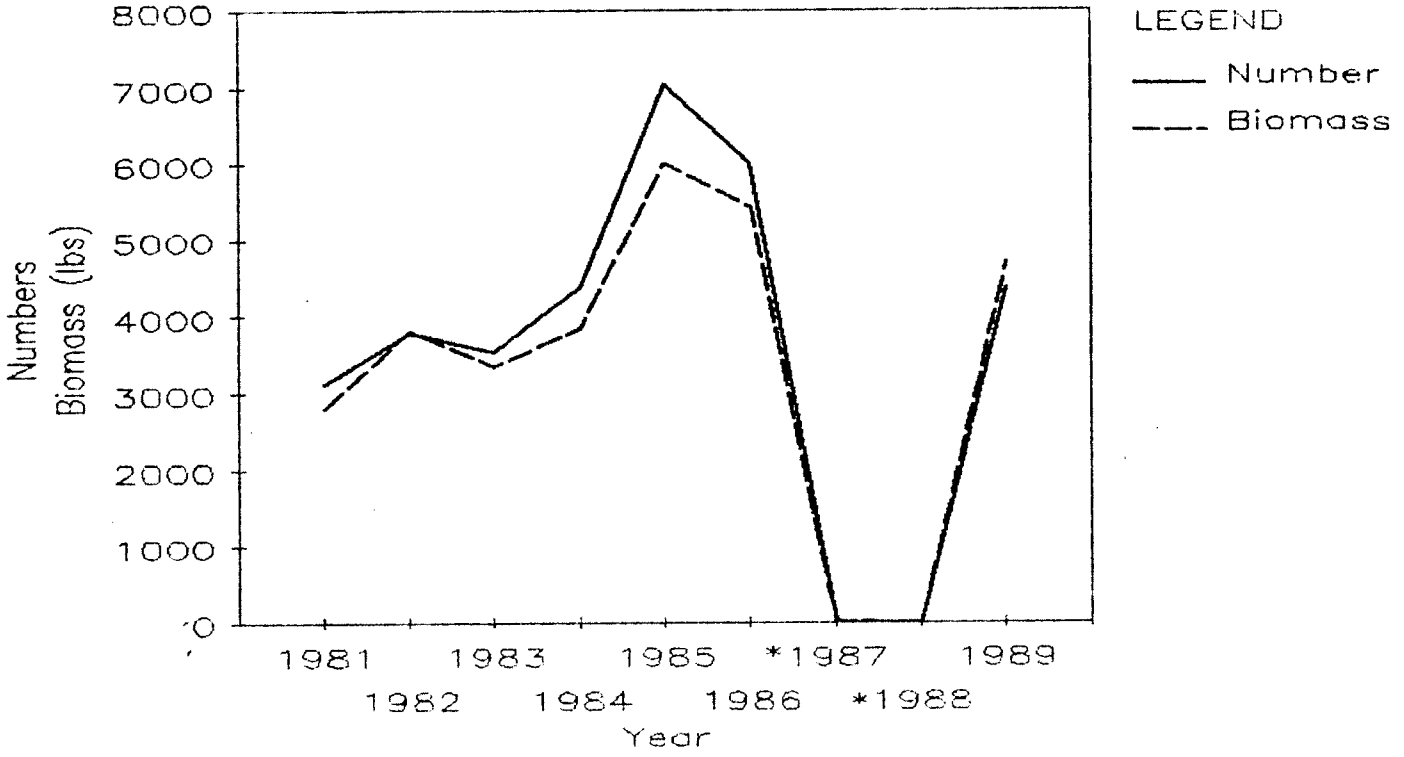


Figure 23. Estimated numbers and standing crop (lbs.) of brown trout from spring samples collected in the Melrose study section (5.00 mi.) of the Big Hole River 1981 - 1989.



* No sampling conducted in 1987 and 1988.

Figure 24. Estimated numbers and standing crop (lbs.) of brown trout from spring samples collected in the Maiden Rock study section (4.42 mi.) of the Big Hole River 1981 - 1989.

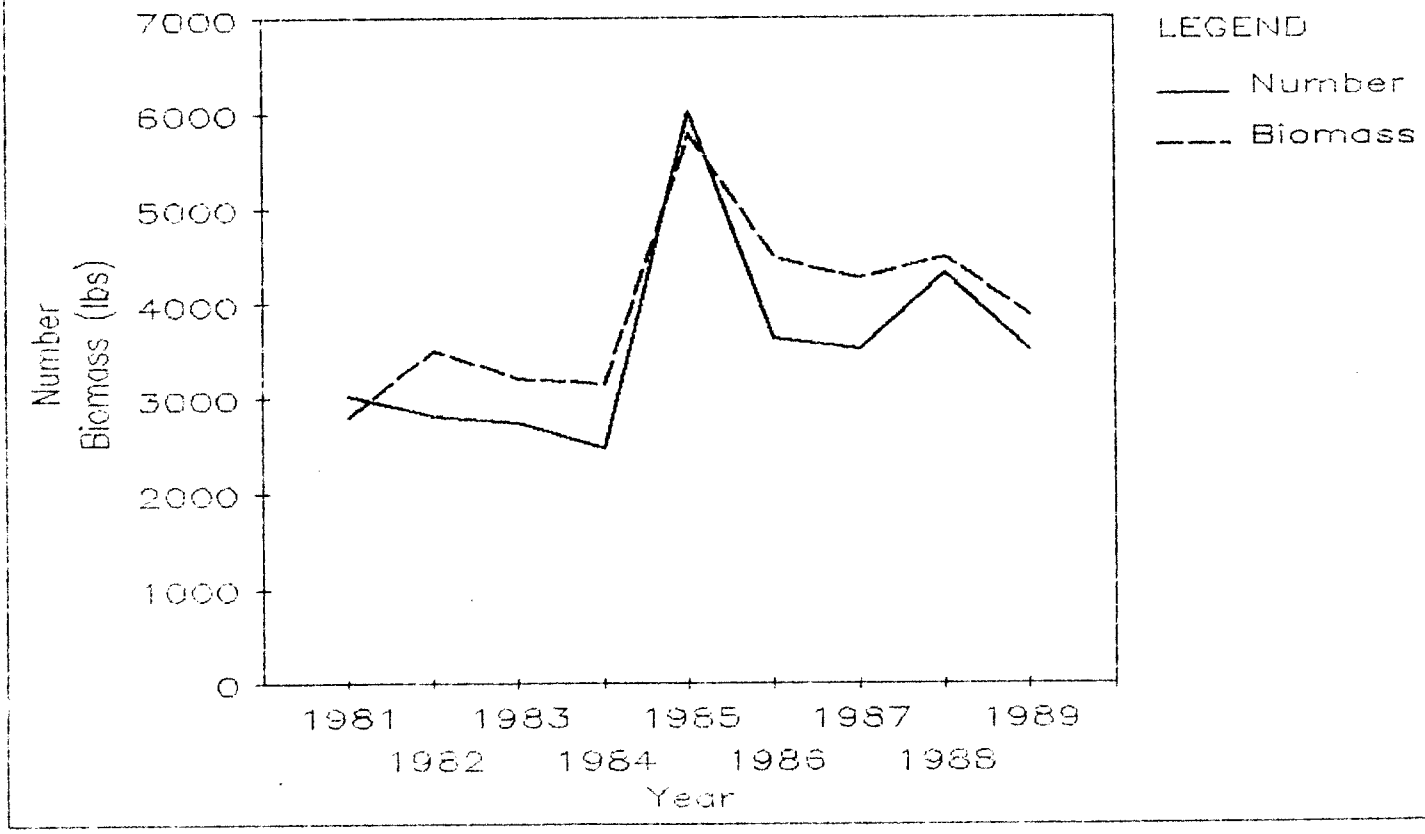
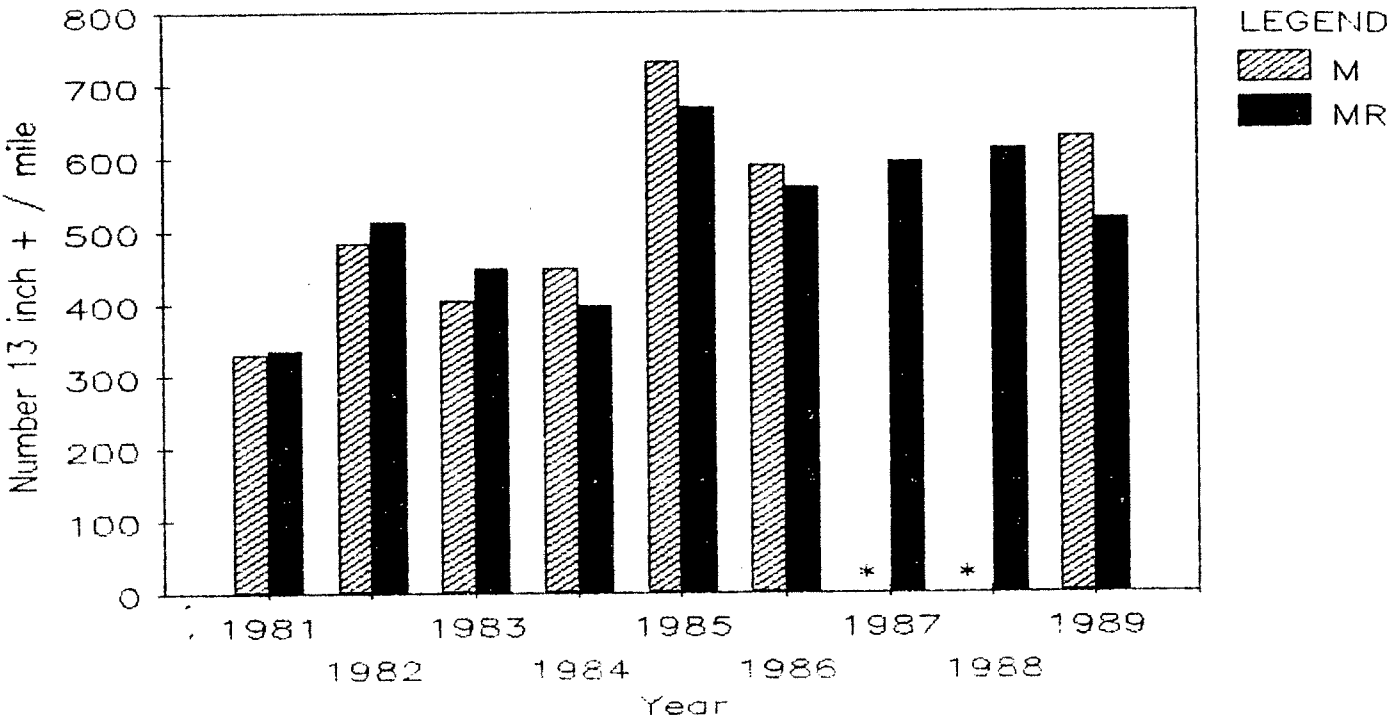
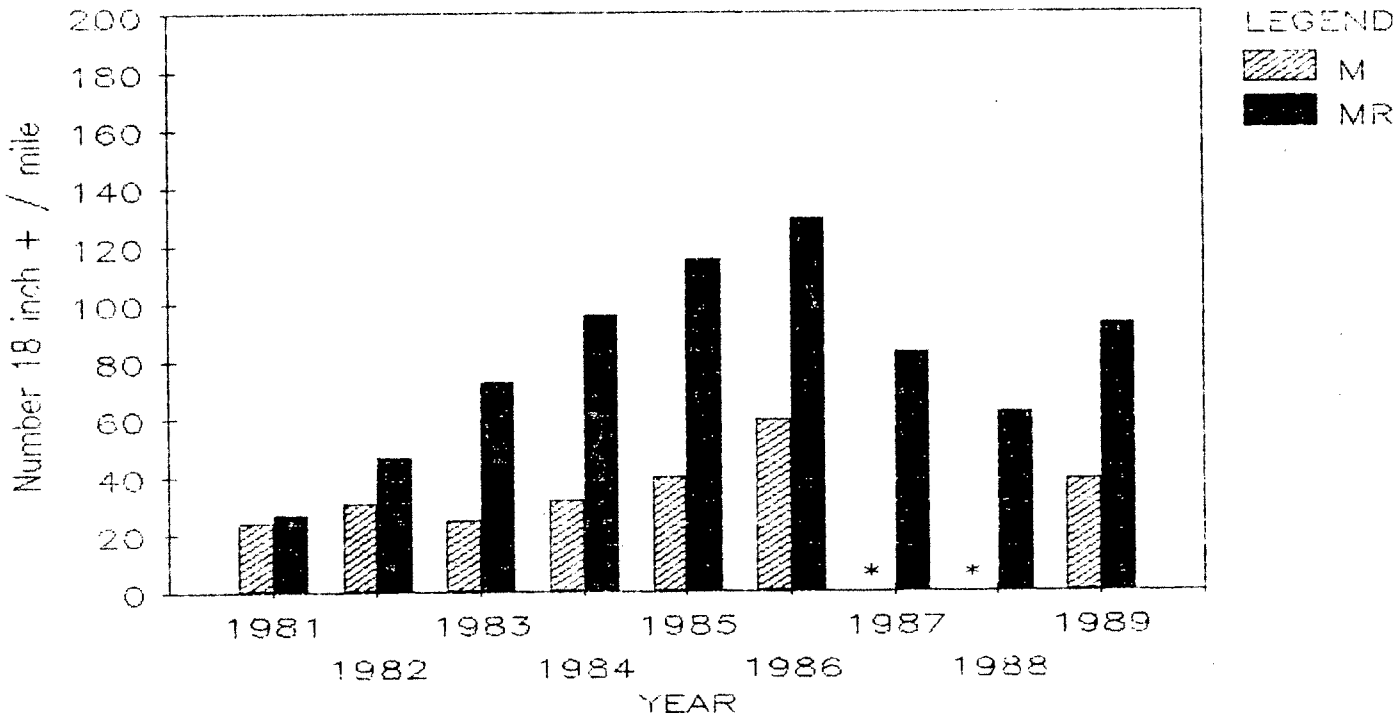


Figure 25 . Estimated numbers per mile of 13 inch and larger brown trout from spring samples collected in the Melrose (5.00 mi.) and Maiden Rock (4.42 mi.) study sections of the Big Hole River 1981 - 1989.



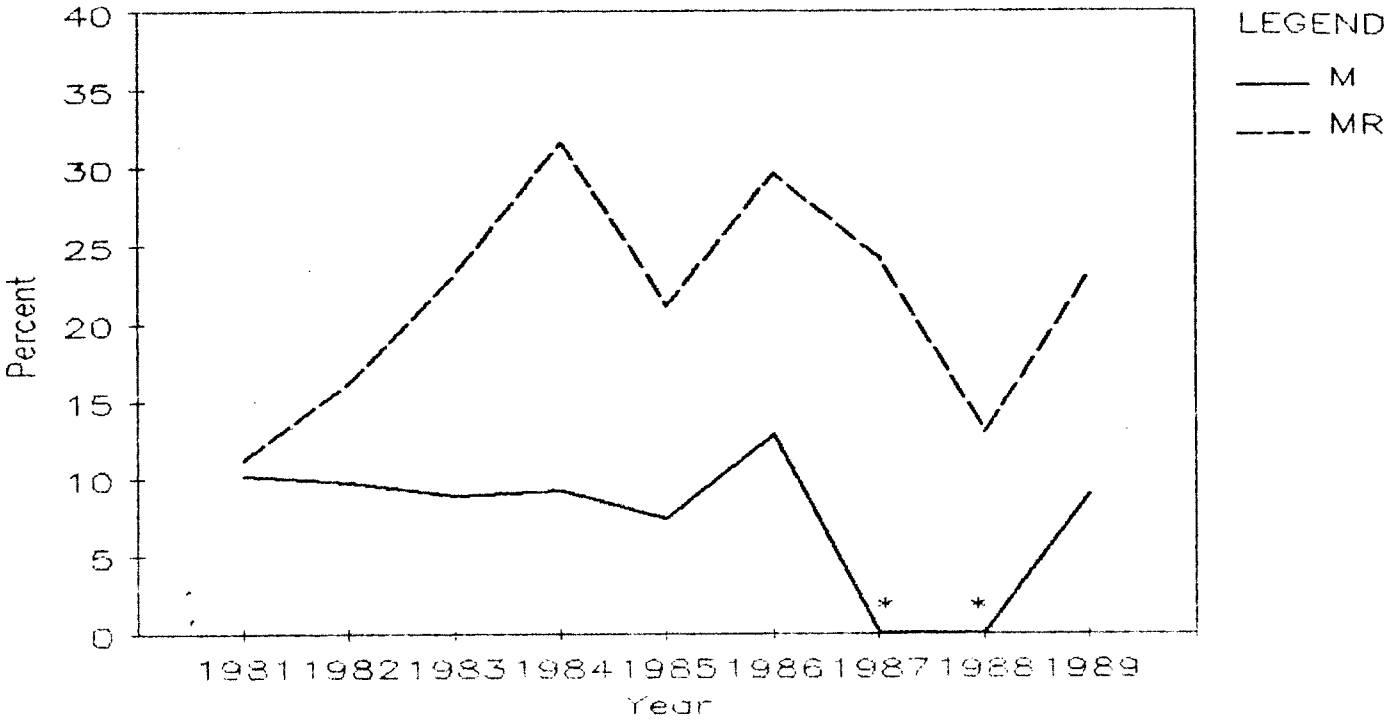
* No sampling conducted 1987 and 1988

Figure 26 . Estimated numbers per mile of 18 inch and larger brown trout from spring samples collected in the Melrose (5.00 mi.) and Maiden Rock (4.42 mi.) study sections of the Big Hole River 1981 - 1989.



* No sampling conducted in 1987 and 1988

Figure 27 . Estimated biomass of 18 inch and larger brown trout as a percent of the total brown trout standing crop from spring samples collected in the Melrose and Maiden Rock study sections of the Big Hole River 1981 - 1989.



* No sampling conducted in 1987 and 1988

Figure 28 . A comparison of estimated numbers per mile, by selected length group, for 18 inch and larger brown trout from spring samples collected in the Maiden Rock study section of the Big Hole River 1981 - 1989.

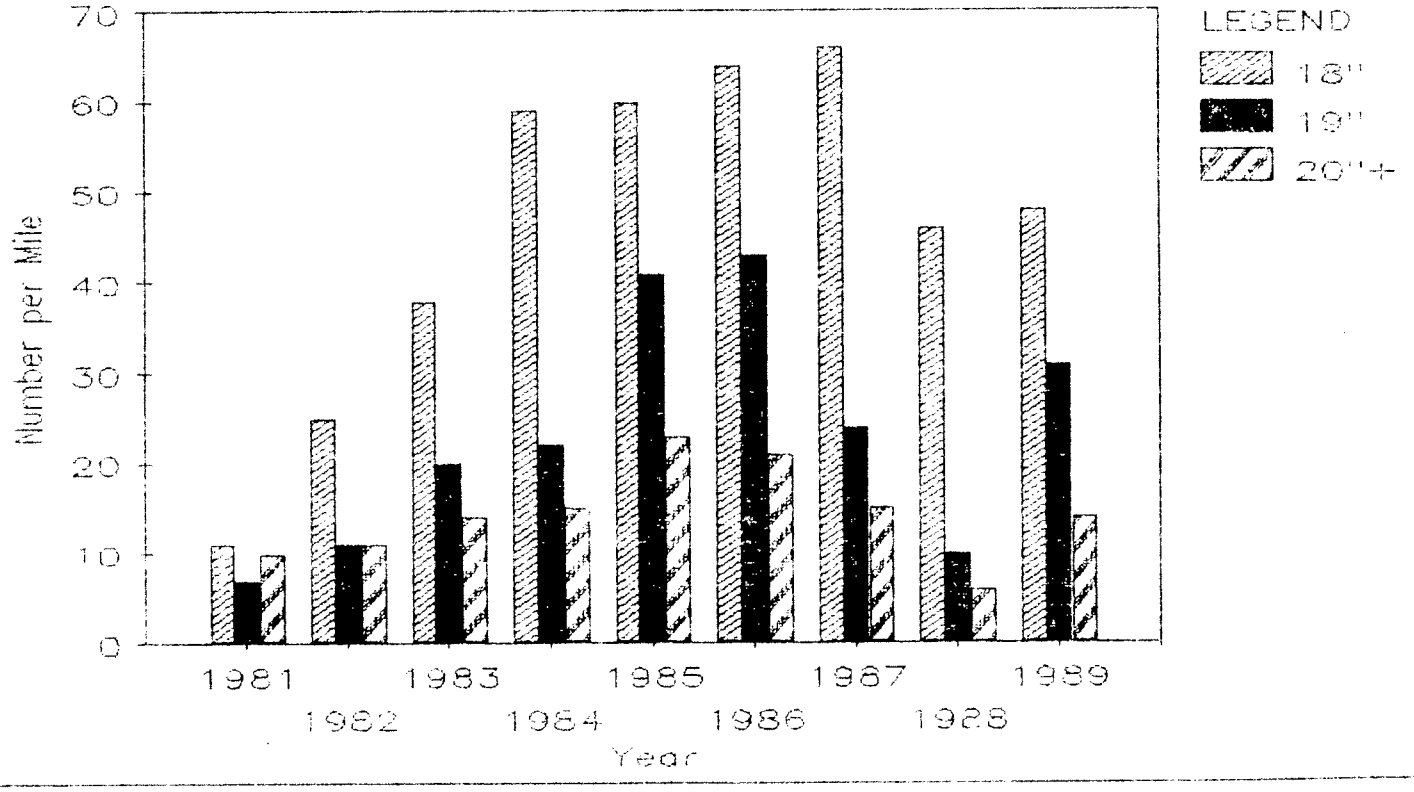


Figure 29 . Estimated numbers and standing crop (lbs.) of rainbow trout from fall samples collected in the Melrose study section (5.00 mi.) of the Big Hole River 1981 - 1986.

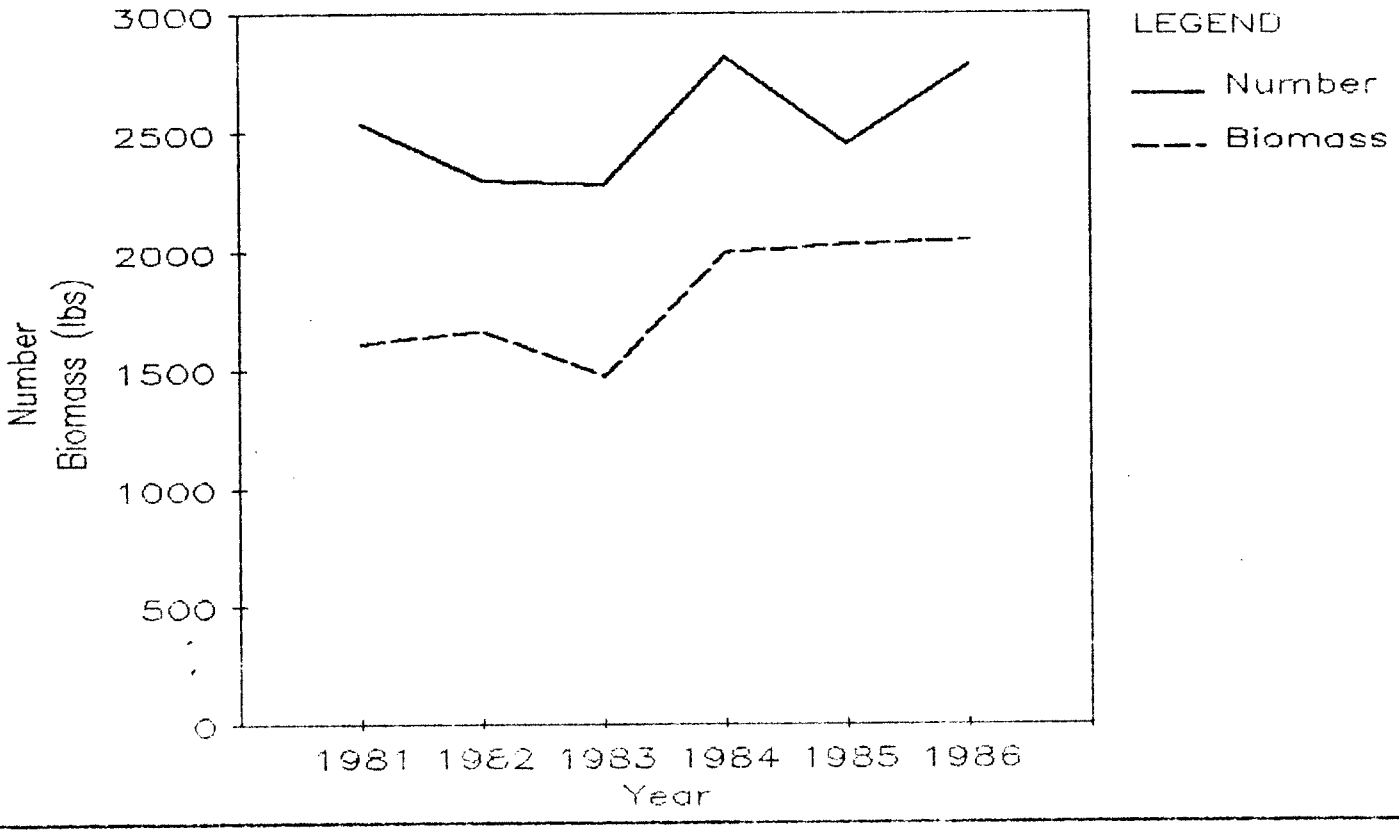


Figure 30 . Estimated numbers and standing crop (lbs.) of rainbow trout from fall samples collected in the Maiden Rock study section (4.42 mi.) of the Big Hole River 1981 - 1988.

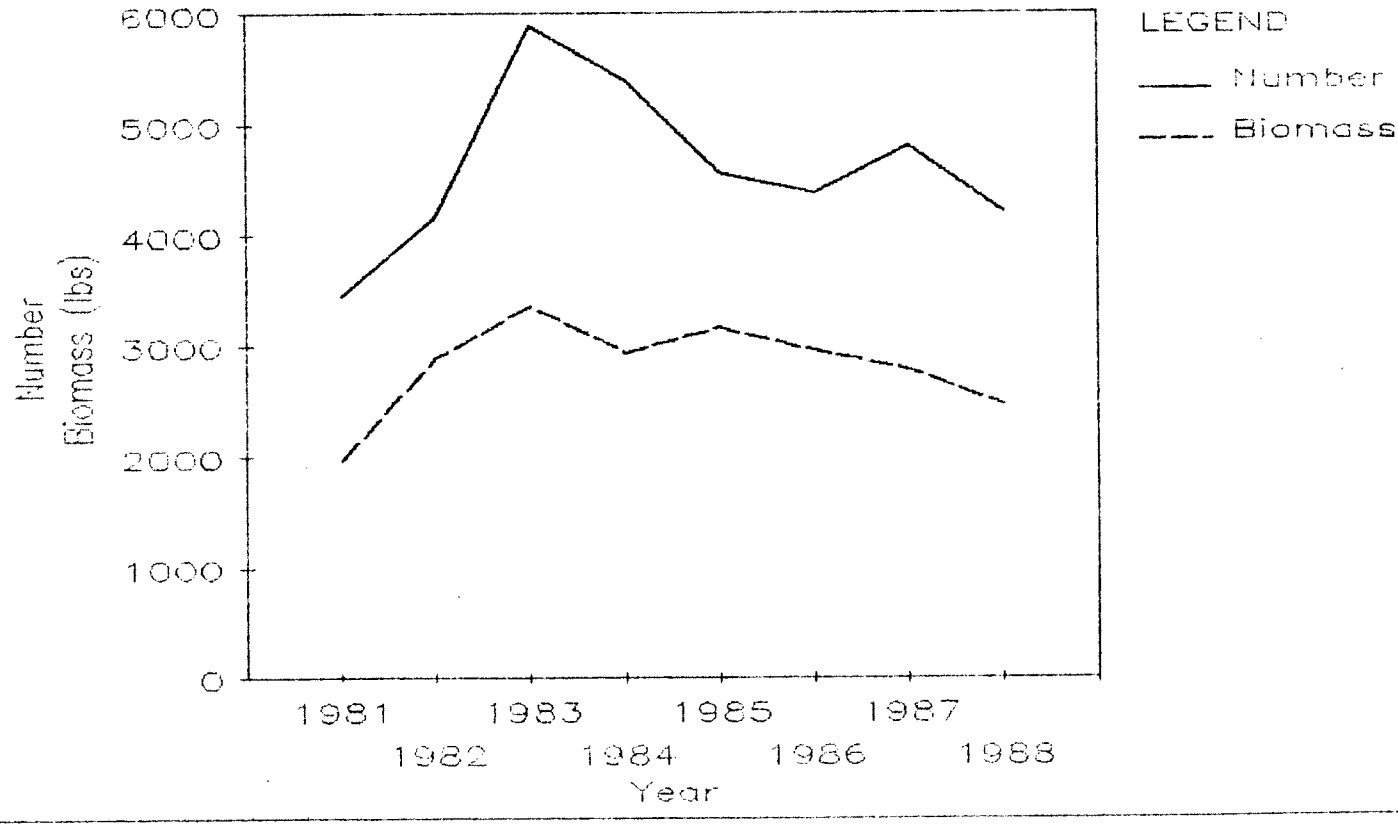
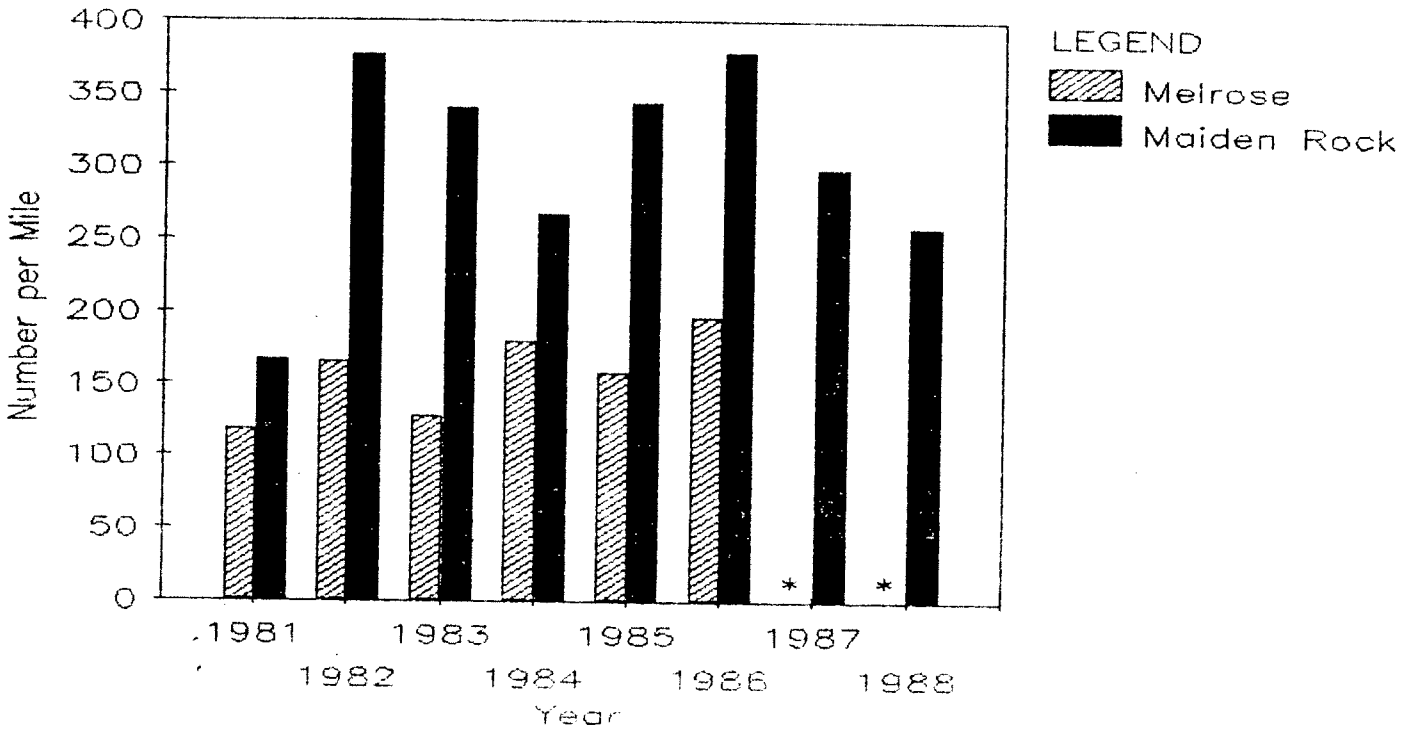
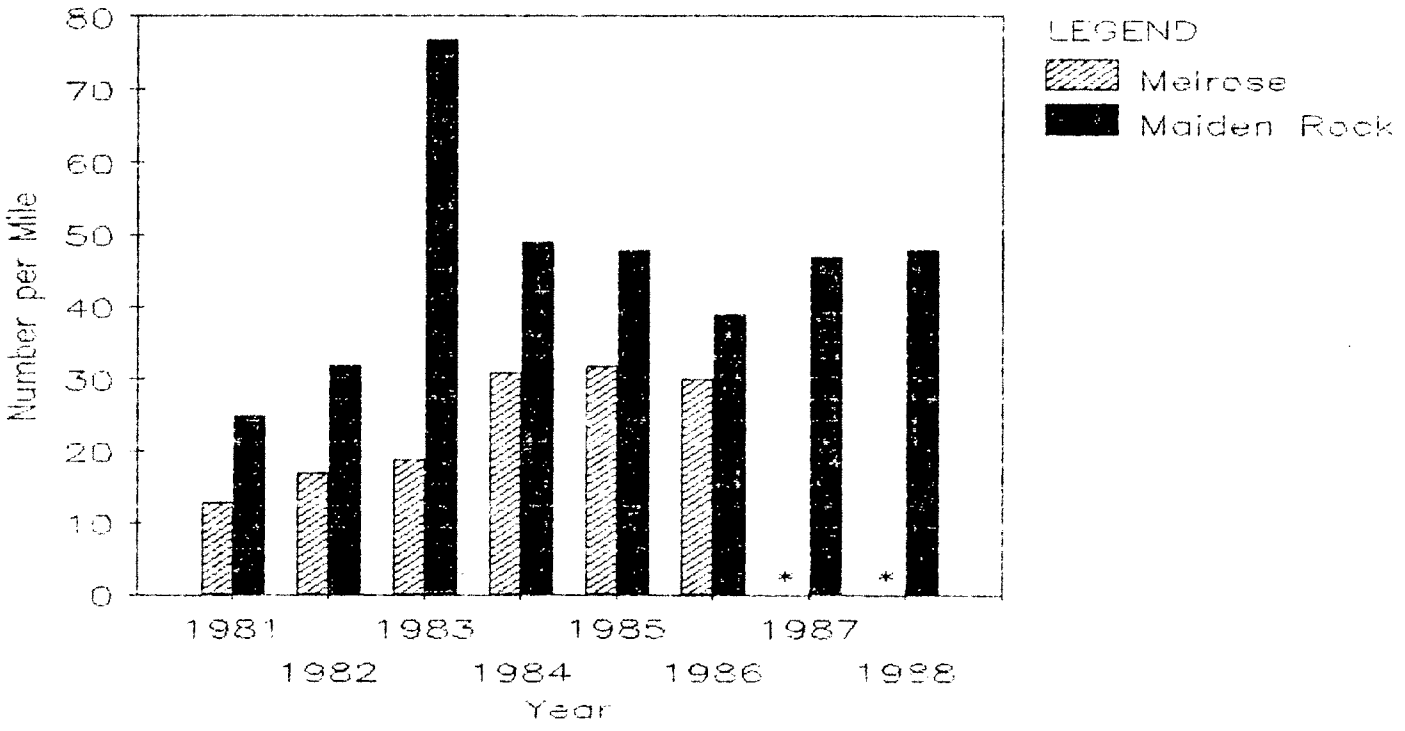


Figure 31. Estimated numbers per mile of 13 inch and larger rainbow trout from fall samples collected in the Melrose (5.00 mi.) and Maiden Rock (4.42 mi.) study sections of the Big Hole River 1981 - 1988.



* No sampling conducted in 1987 and 1988

Figure 32. Estimated numbers per mile of 16 inch and larger rainbow trout from fall samples collected in the Melrose (5.00 mi.) and Maiden Rock (4.42 mi.) study sections of the Big Hole River 1981 - 1988.



* No sampling conducted in 1987 and 1988

Figure 33 Estimated numbers and standing crop (lbs.) per mile of brown trout from spring samples collected in the Hog Back study section (4.52 mi.) of the Big Hole River 1987 - 1989.

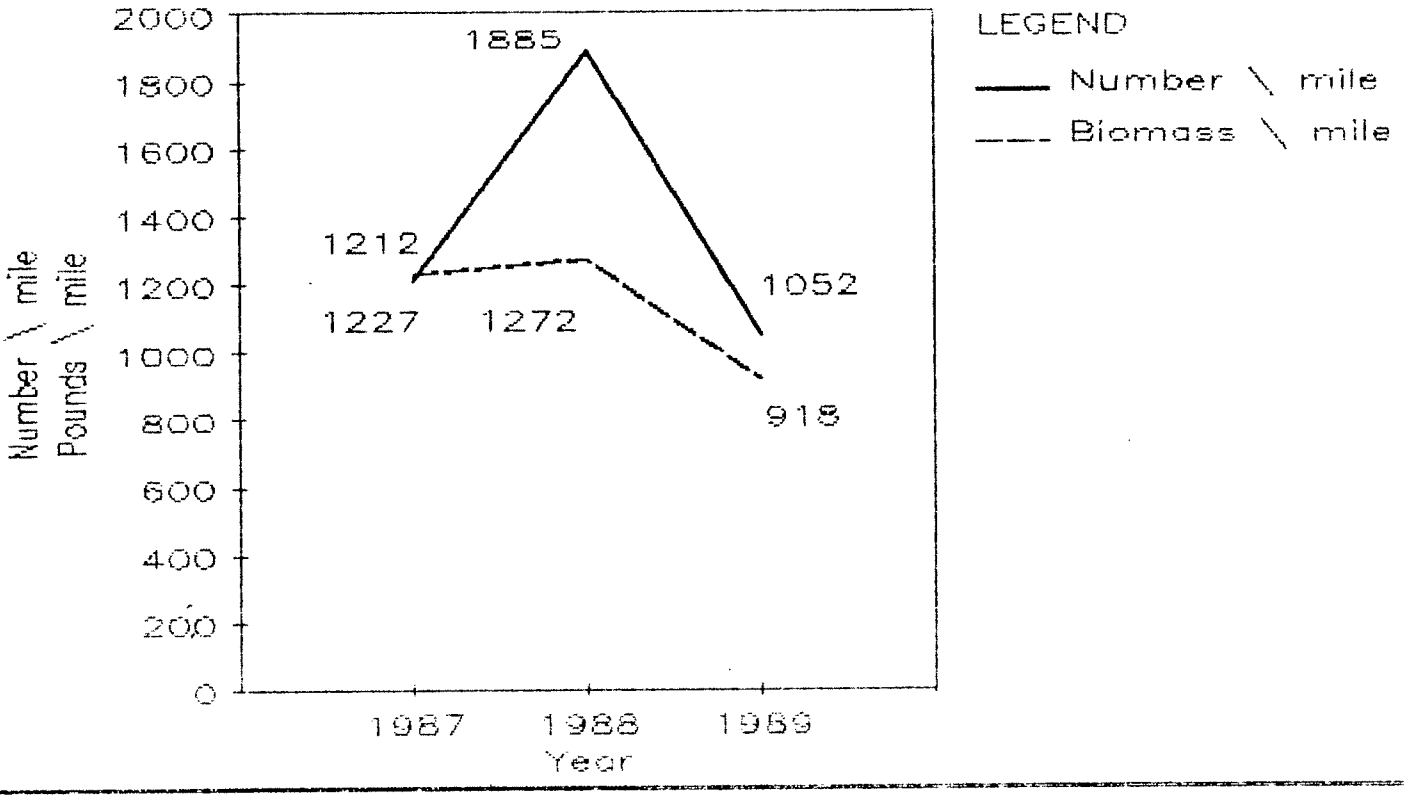


Figure 35. Length - frequency of brown trout collected in the spring sample of 1988 from the Hog Back study section of the Big Hole River.

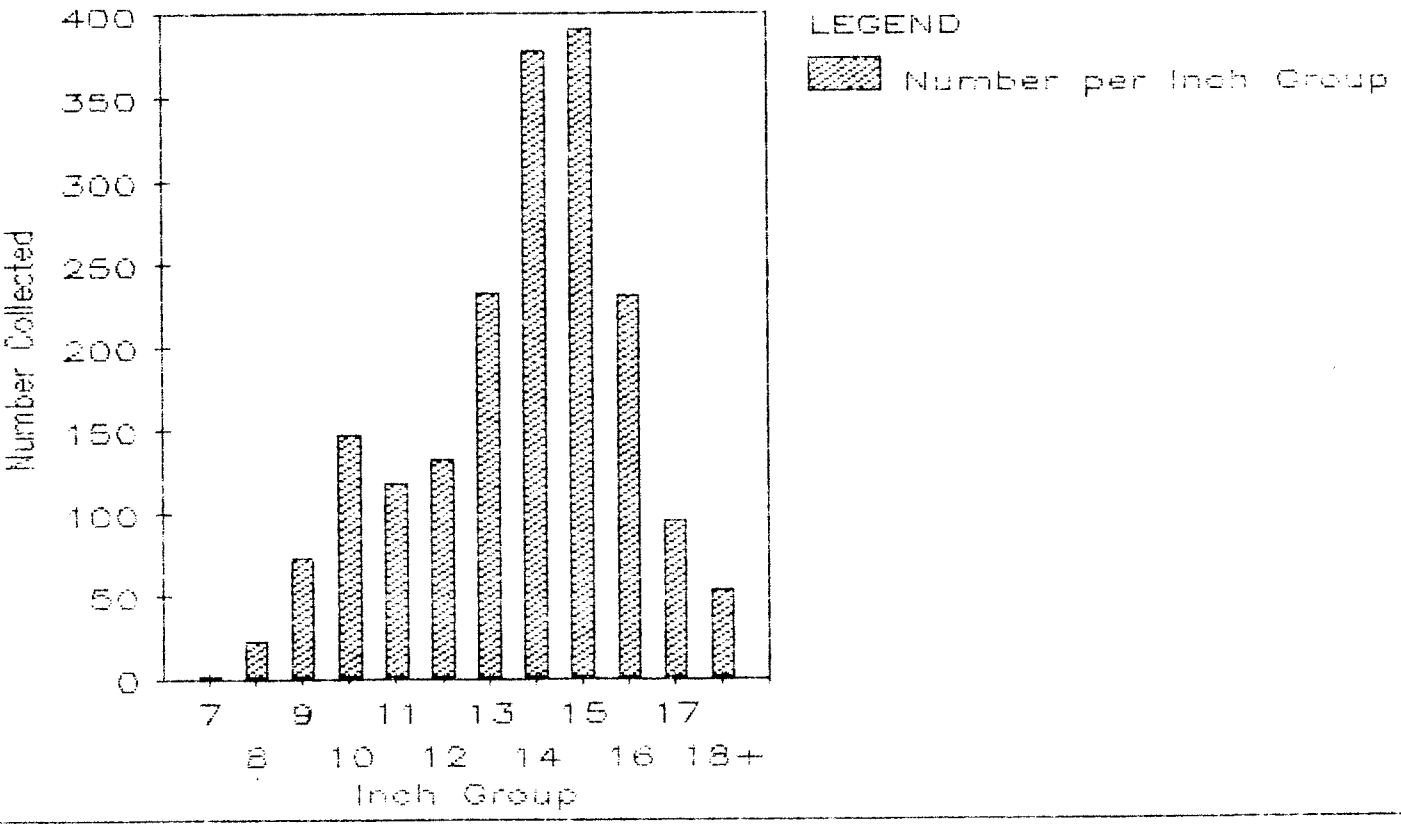


Figure 34 . Estimated spring brown trout populations (number per mile) by age class from samples collected in the Hog Back study section (4.52 mi.) of the Big Hole River 1987 - 1988.

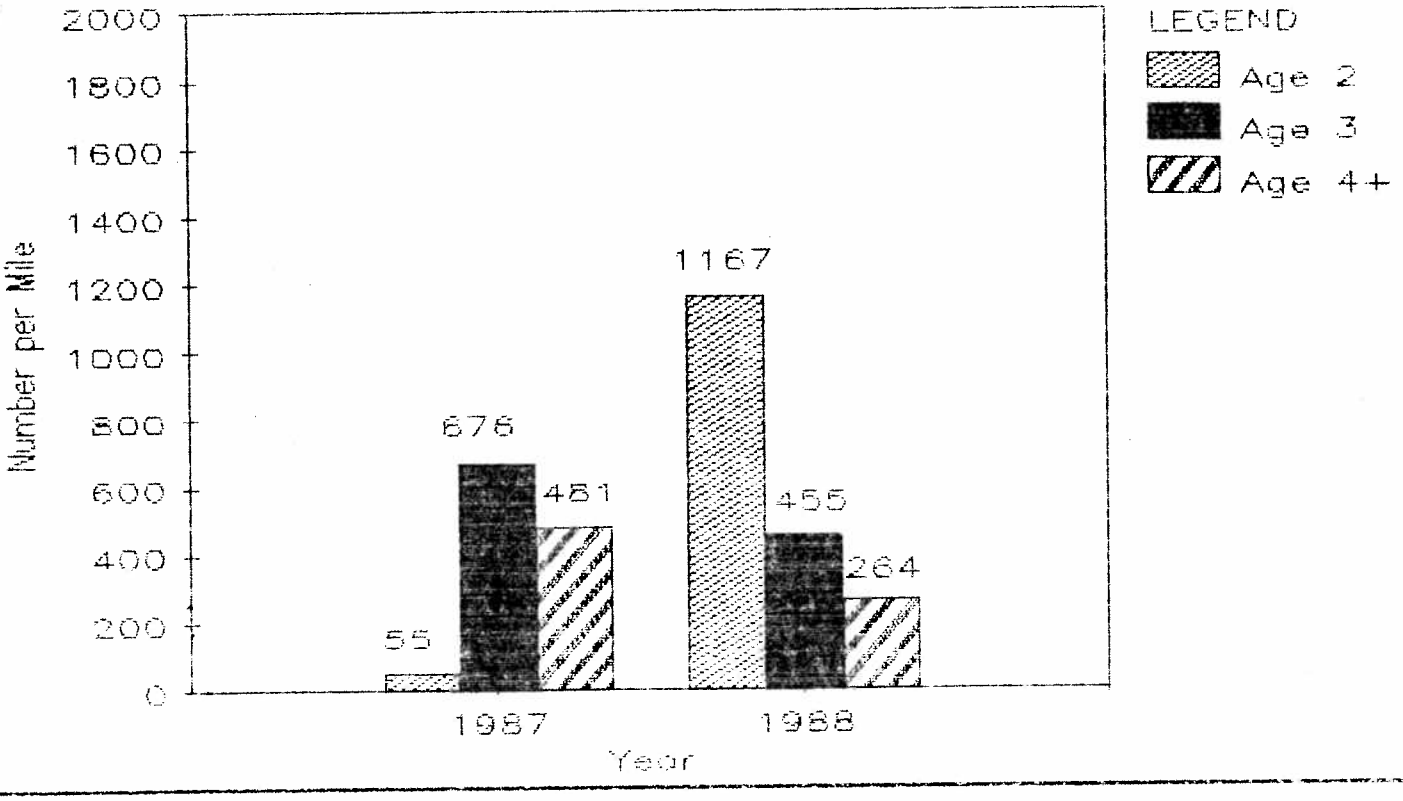


Figure 36 . Estimated spring brown trout populations (number per mile) by length group from samples collected in the Hog Back study section (4.52 mi.) of the Big Hole River 1987 - 1989.

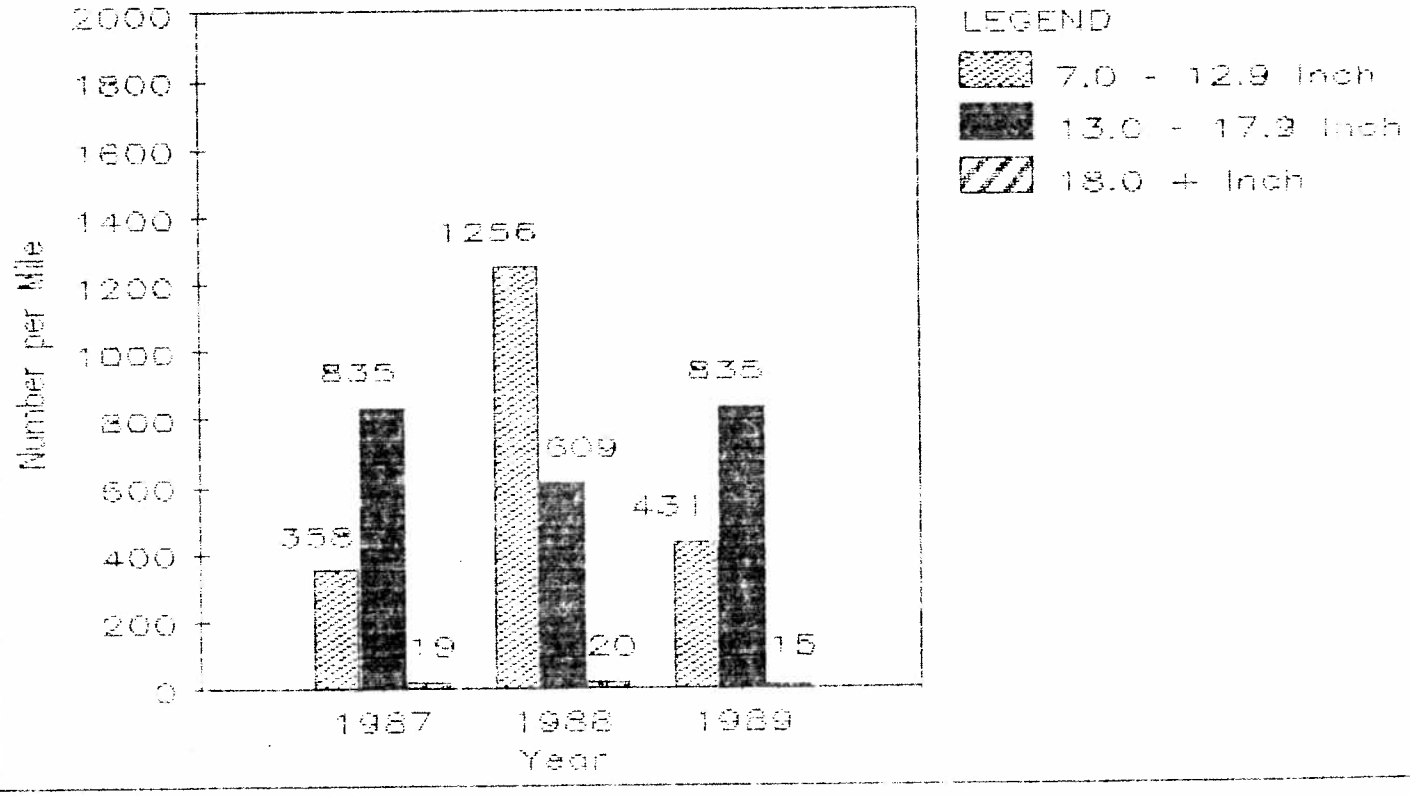


Figure 37. Estimated numbers and standing crop (lbs.) per mile of rainbow trout from spring samples collected in the Hog Back study section (4.52 mi.) of the Big Hole River 1987 - 1989.

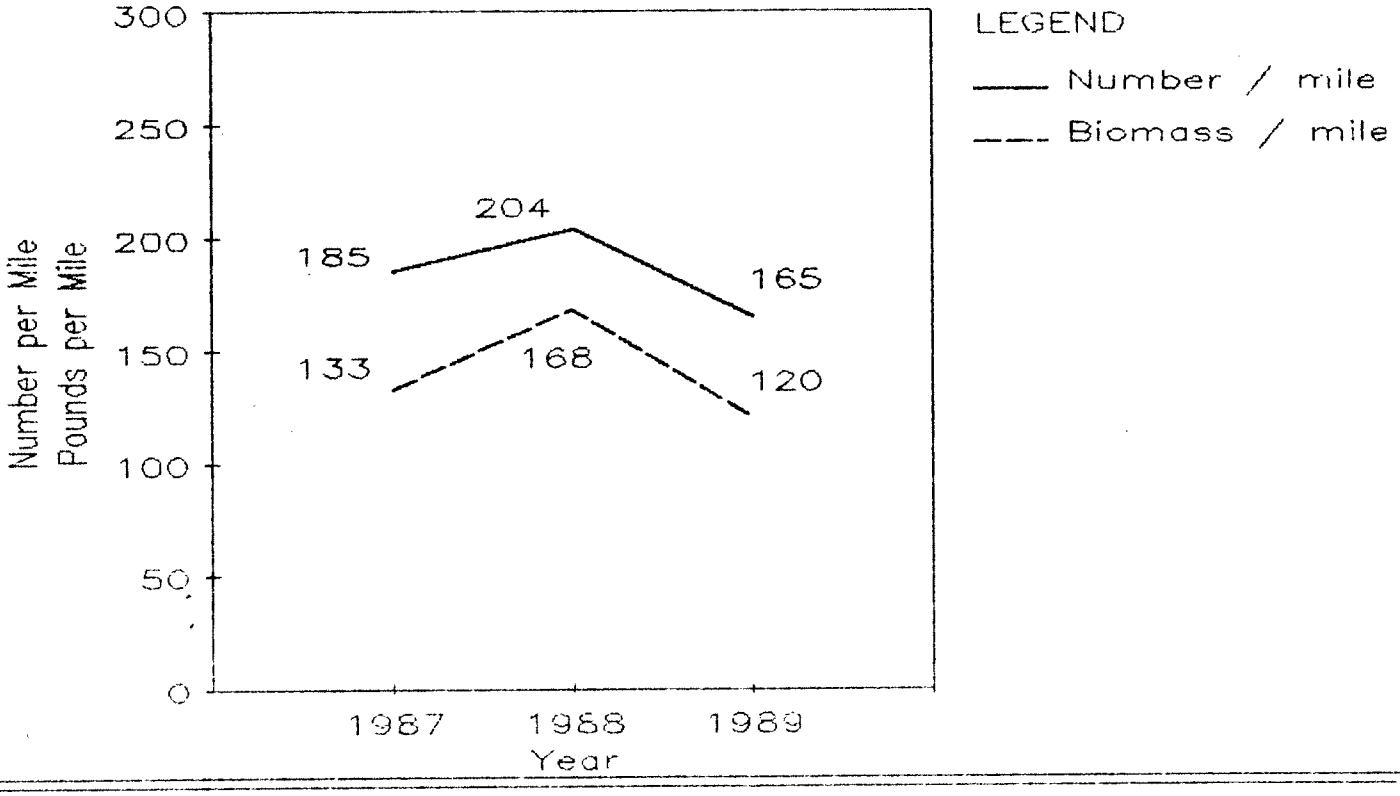


Figure 38. Length - frequency of rainbow trout collected in the spring sample of 1987 from the Hog Back study section of the Big Hole River.

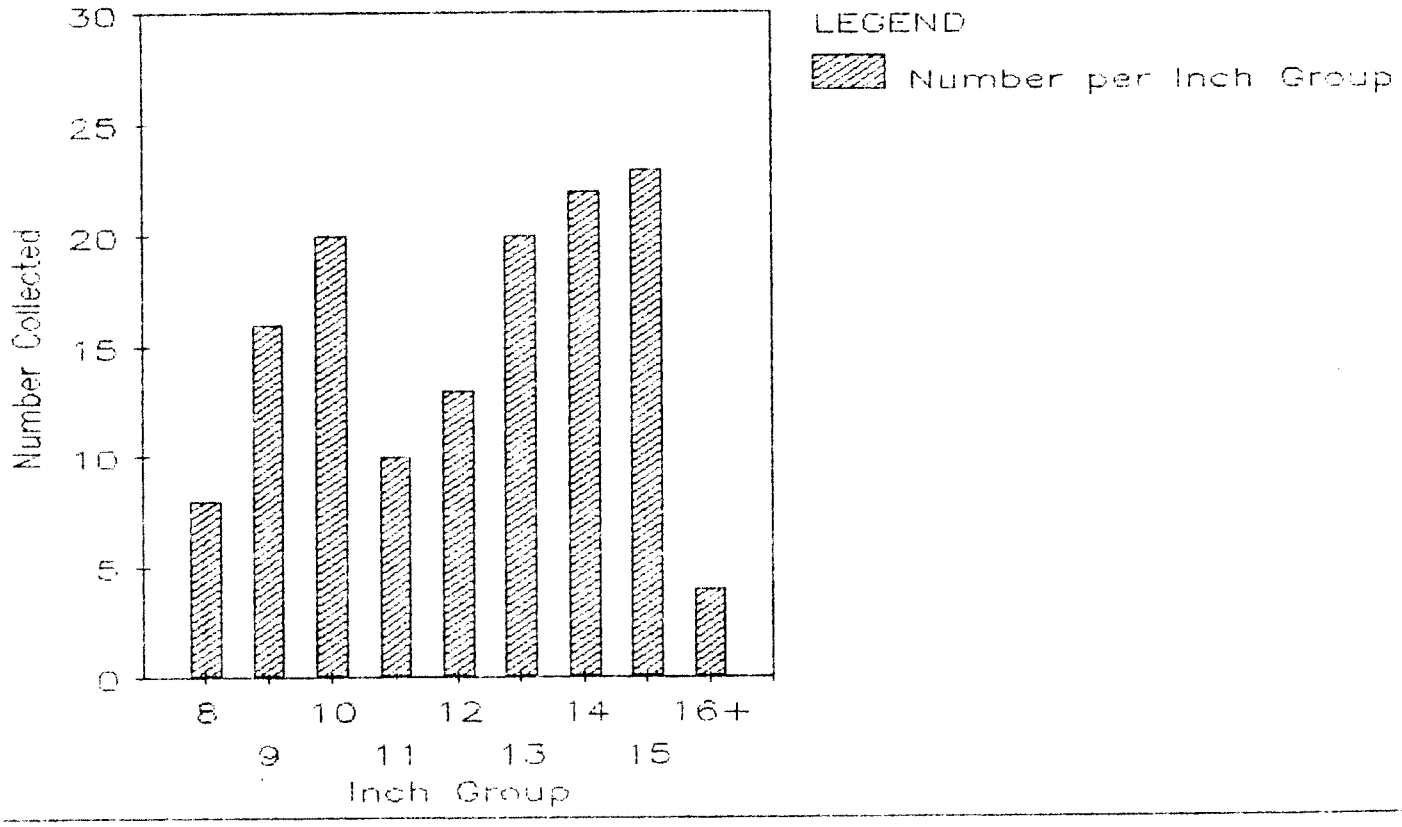


Figure 39. Estimated numbers per mile of brown trout from spring samples collected in the Reichle study section (4.5 mi.) and the Hog Back study section (4.52 mi.) of the Big Hole River 1972 - 1973 and 1987 - 1989.

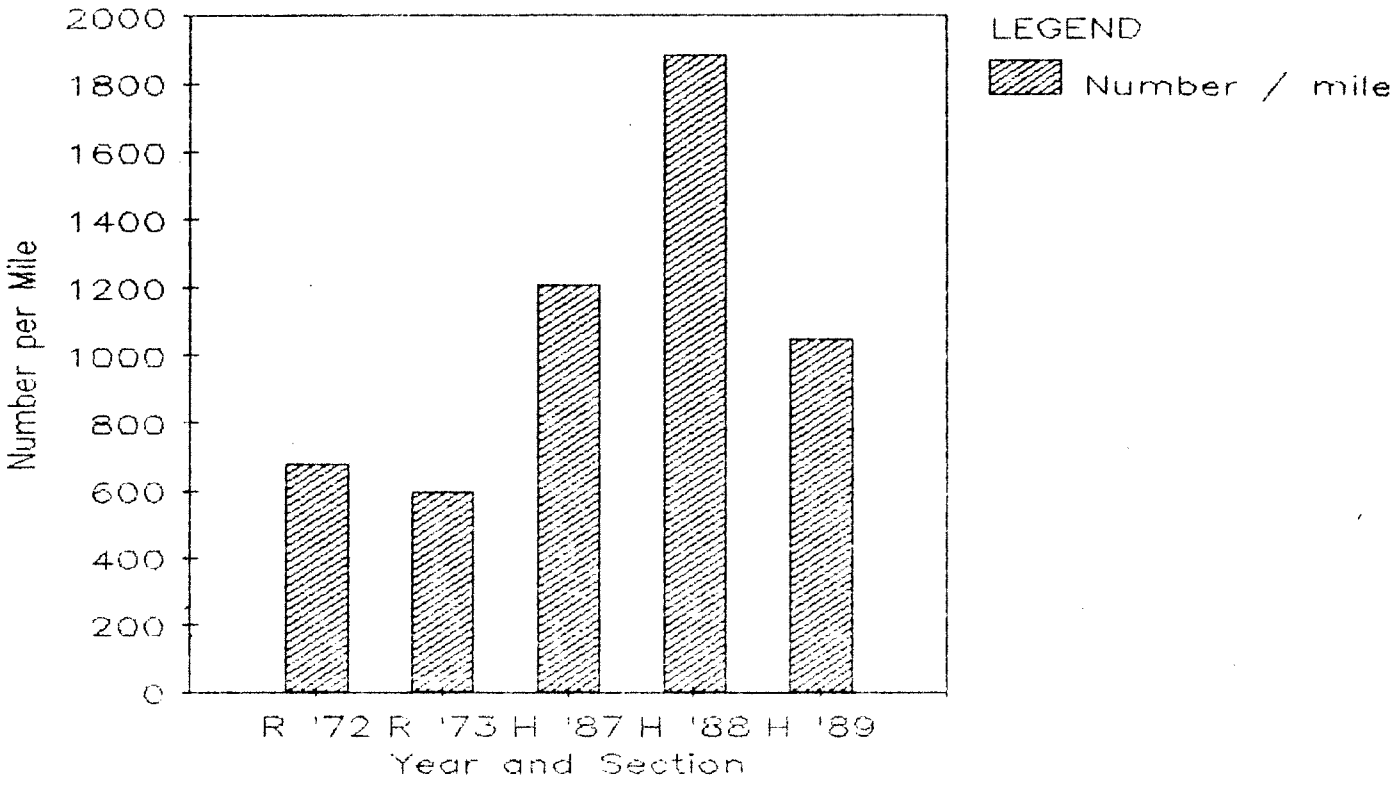


Figure 40. Estimated numbers per mile of rainbow trout from spring samples collected in the Reichle study section (4.5 mi.) and the Hog Back study section (4.52 mi.) of the Big Hole River 1972 - 1973 and 1987 - 1989.

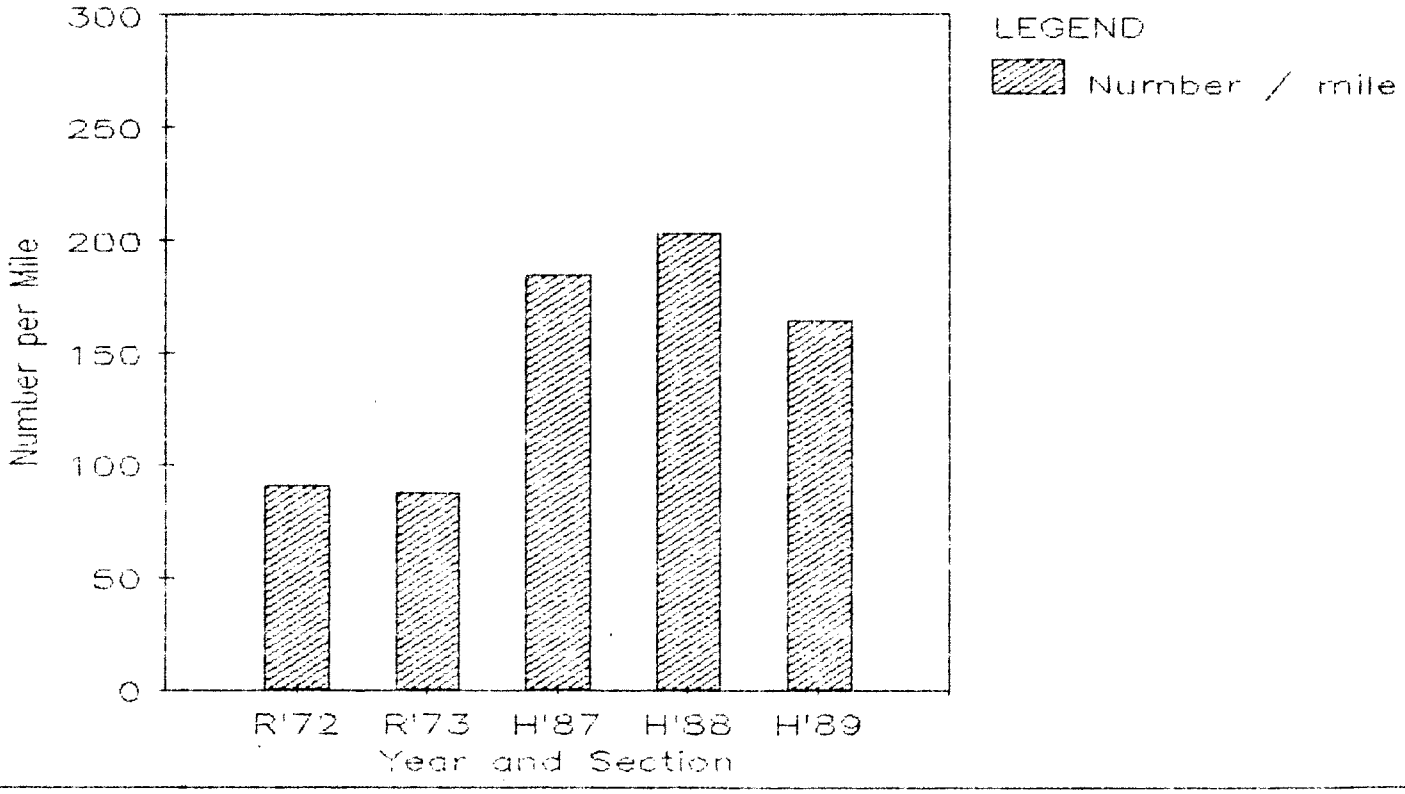


Figure 41. Mean daily discharge (cfs) recorded at the USGS gage station on the Big Hole River near Melrose, MT for the August - September period 1986 - 1988.

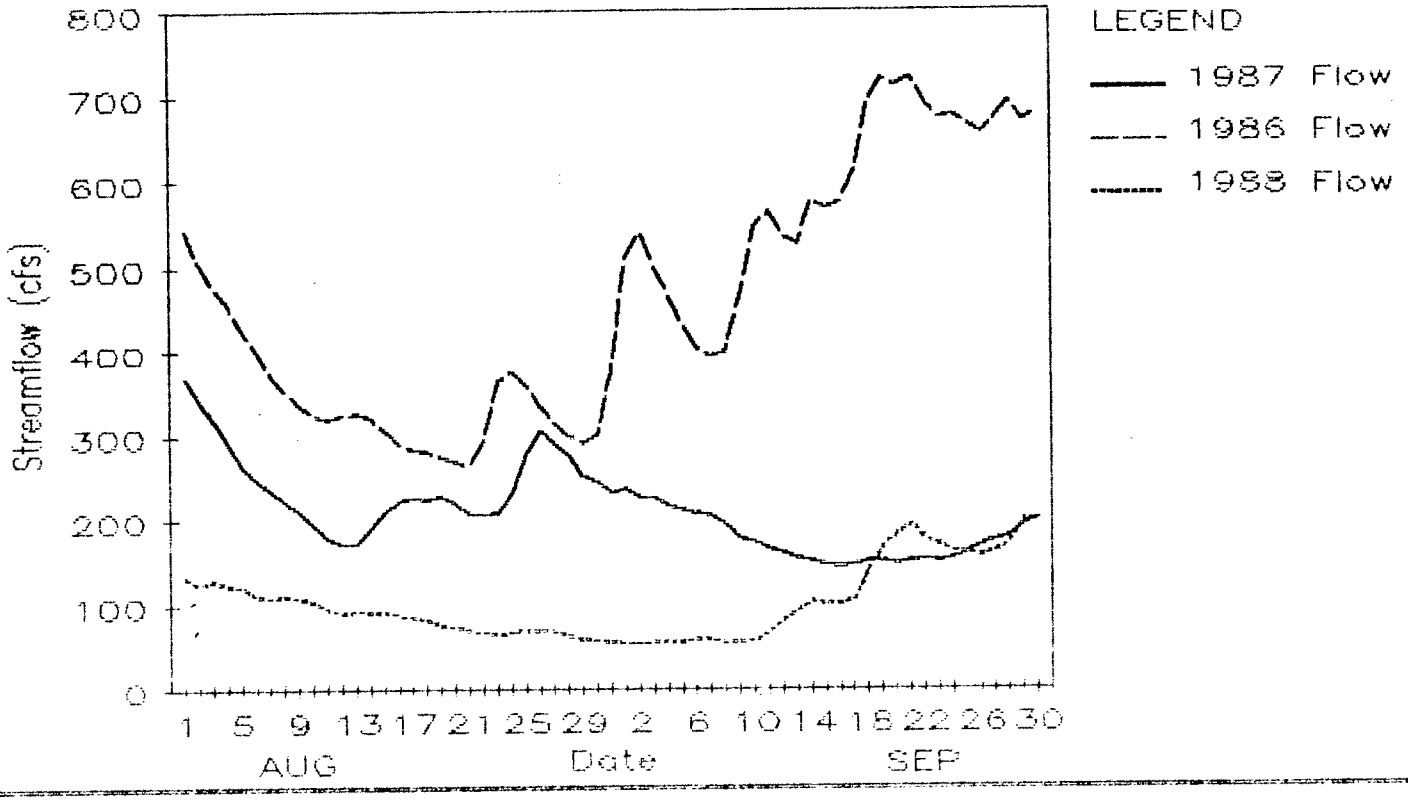


Figure 42. Five - day average mean daily water temperature (F) recorded at the USGS gage near Melrose, MT. summer 1986 - 1988.