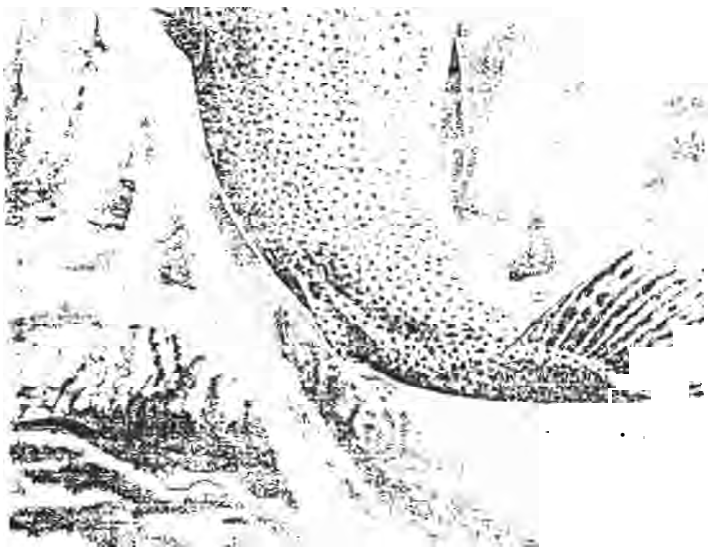
PAUL C. MARSH

# PRE-IMPOUNDMENT STUDY of the FLAMING GORGE RESERVOIR

reproduction as abstract
& pre impoundment fish





WYOMING GAME and FISH COMMISSION

Fisheries Technical Report 9

# PRE-IMPOUNDMENT STUDY OF THE FLAMING GORGE RESERVOIR

by

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WYOMING GAME AND FISH COMMISSION

Fisheries Technical Report Number 9

Cheyenne, Wyoming

June, 1960

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A Contribution of Federal Aid to Fish Restoration
Dingell-Johnson Project F-25-R-1

Cheyenne, Wyoming
June, 1960

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## ABSTRACT

The Flaming Gorge Reservoir is scheduled for completion in 1962. Impounded waters will back up the Green River to within four miles of the town of Green River, Wyoming. An estimated 300,000 people will utilize the reservoir annually for recreational purposes.

Gill net sets, electrofishing, and toxicant applications indicate that the game fish populations, within the confines of the reservoir, are negligible. Trash fish populations are very high with suckers, bonytails, squawfish, and carp representing the majority of fishes present. The removal of trash fish populations is feasible under certain conditions.

Reservoir contours and physical data indicate that two types of habitat will exist. The main body of the reservoir and canyon area will contain habitat suitable for salmonid species, and the numerous arms and bay areas will furnish habitat for warm water species.

Initial game fish populations will be stocked with the thought of maximum reproductive potential in mind. Potential spawning grounds exist for salmonid species in the Green River proper above the reservoir and in the tributaries of Henry's Fork and Carter Creek.

Experimental eyed and green kokanee egg plants in the Green River proper and Henry's Fork indicate that prolonged low water temperatures existing during the incubation period of this species will virtually eliminate any natural reproduction from late running fish.

Chemical, physical and biological studies indicate that the lower section of the Green River above the town of Green River is capable of producing a better game fishery than it is at the present time.

The advent of the Seedskadee project, approximately sixty river miles upstream from the backwaters of the Flaming Gorge Reservoir, will change the chemical and physical characteristics of the Green River between the two projects. Of these changes the alteration of stream flows, increased water temperatures, and increased turbidities may have a detrimental effect upon the natural spawning potential of the Green River proper.

## INTRODUCTION

In the fall of 1962 the Ashley Dam of the Flaming Gorge Project will be completed. This dam will impound waters of the Green River which enclose approximately 14,300 square miles of drainage area. Ashley Dam is being constructed on the Green River proper in Northeastern Utah. This dam, 495 feet high, will impound approximately 3,930,000 acre feet of water and form a reservoir some 43,000 surface acres in size when full.

The upper Green River has long been regarded as one of the finest fishing streams in the State of Wyoming. Unfortunately, this situation does not prevail thoughout the entire length of the stream. The lower section of the Green River courses through 100 miles of the Green River, Bridger and Wasatch formations. These formations are composed of gravel, sandstone and shale, and are overlain with sandy soils which are highly erosive. Consequently, the lower section of tha river suffers annually from silt laden run-off waters in the spring. The rainfall in this area varies from 13 inches in the headwaters to 8 inches along the lower section. Fluctuation varies from a high of approximately 12,000 cfs during spring run-off to a low of about 350 cfs in the late fall. The lower section is also subject to high temperatures during the summer and fall which approach the tolerance limit of trout. The yearly temperature range is from freezing point to about 78° F. in July.

Attempts to establish game fish populations in the lower section of the Green River have met with little success. Shifting beds of silt and sand cover large expanses of the river's bed, limiting development of fish food organisms. Habitat areas for salmonid species are practically non-existent. Large populations of bonytail, suckers, squawfish and carp represent the majority of fish present.

Advent of the Seedskadee project will further limit development of game fish from the backwaters of the Flaming Gorge Reservoir to the Fontenelle Dam of the Seedskadee project. Present plans call for diversion and storage of surplus spring flows in the Green River to irrigate 59,620 acres of presently undeveloped lands. Anticipated effects of this project range from increased turbidities, increased dissolved solids to increased water temperatures and complete dewatering of the river bed for some ten miles below Fontenelle Dam in the fall of the year.

This study entitled "Pre-Impoundment Study of the Flaming Gorge Reservoir" was initiated as a part of an inter-state cooperative fisheries management program with the State of Utah. An attempt was made to evaluate the present status of the Green River and anticipated changes in habitat, from a sport fisheries standpoint, resulting from the previously mentioned installations. Financing for this study was obtained, in part, from Dingell-Johnson funds. The project number assigned to the study was F-25-R-1, and the period of time covered during the study was from July 1, 1958 to April 30, 1960.

## OBJECTIVES

(1) To determine the species composition in the Green River proper and in the tributaries within the study area.

(2) To determine the water chemistry of the river and changes that occur throughout the year.

(3) To determine the types and volume of plankton development, aquatic invertebrates and algal growth existing in the Green River proper.

(4) To determine if resident populations of sport fish can be established and maintained in the section of stream above the proposed impoundment area and the best species suited.

(5) Mapping the impoundment area on contour maps to determine areas of rough fish spawning, recreational development.

(6) To determine the spawning potential of sport fish, both natural and artificial, in the Green River proper and in the impoundment area.

(7) To determine the species of sport fish best suited to conditions which will exist in the impoundment area.

## METHODS OF PROCEDURE

In determining the fish composition, a number of collecting methods were used: Experimental gill nets 150 feet long with mesh sizes ranging from 1 x 1 inches to 2 1/4 x 2 1/4 inches, modified wide mouth fyke nets with 50 foot wings, and an emulsified rotenone fish toxicant were used. In addition to the above, three shockers, a 115 volt 60 amp. AC, a 230 voLt 10.9 amp. DC, and a 115 volt 1.3 amp. AC were used as water and bottom conditions dictated.

Travel on the river to points where fish collections were made was very difficult during periods of low water flow, and many of the areas were inaccessible to vehicle. Construction and use of an air-boat facilitated collections and exploration in these areas. This craft was made from a 16 foot Aero-craft aluminum boat fitted with a 65 horsepower Continental aircraft engine and protective screens. Guiding was accomplished by two aluminum fins 2' x 3 1/2' mounted at the rear of the craft. A pressure fuel system was constructed from a 15 gallon gasoline tank with a car tire pump to provide pressure. Photos of this craft have been included in the text.

In determining the water chemistry, flora and fauna existing in the river seven sampling stations were established; Station Number One being located at the upper end of the study area, in the vicinity of LaBarge, Wyoming and Station Number Seven at the Wyoming-Utah State line well within the impounded area.

Periodic trips were made to the selected station sites and samples were taken as follows: Aquatic invertebrate samples were taken by using the Surber Square Foot Sampler; zooplankton samples were taken with the Wisconsin Plankton Sampler; ten liters were concentrated to form the zooplankton samples; algal samples were taken at random within the study area; and phytoplankton was collected by scraping material from the bottom of the stream and by use of a modified diatometer. This diatometer was constructed to accept microscope slides as a sub-surface collecting strata.

All flora and fauna samples collected were preserved with 10% formalin for future identification.

Marginal and streamside vegetation and aquatic plants were pressed and mounted. The majority of plant identification was made by Dr. Seville Flowers of the Department of Botany at the University of Utah.

All water chemistry obtained at the sampling stations was conducted according to standard methods. Dissolved oxygen, pH, MO and phth alkalinity, phosphates and nitrites were run on the samples as soon as possible. Other analyses were run as soon as convenient. Additional water chemistry data and turbidities was obtained from a "Trona" processing plant operated by the Intermountain Chemical Company. This plant operates a pumping station, for processing water, approximately three miles below station three of this report.

Coliform counts were made by diluting samples when necessary and making a plate count after incubation. The media used was violet red bile agar.

Turbidities were taken with a Jackson turbidometer.

Determination of the spawning potential and resident status of sport fish was made by analyses of fish composition data and by conducting hatching experiments within the study area. Hatching experiments were conducted to determine the viability of brown trout, rainbow trout and kokanee salmon in the Green River proper.

Mapping was accomplished by use of U.S.G.S. contour maps, information from the Bureau of Reclamation and assistance from the Engineering Division of the Wyoming Game and Fish Department.

All water flow data was secured from the U.S.G.S. office in Casper, Wyoming, and from "Surface Water Supply of the United States", a publication of the U.S.G.S.

## STATION LOCATIONS

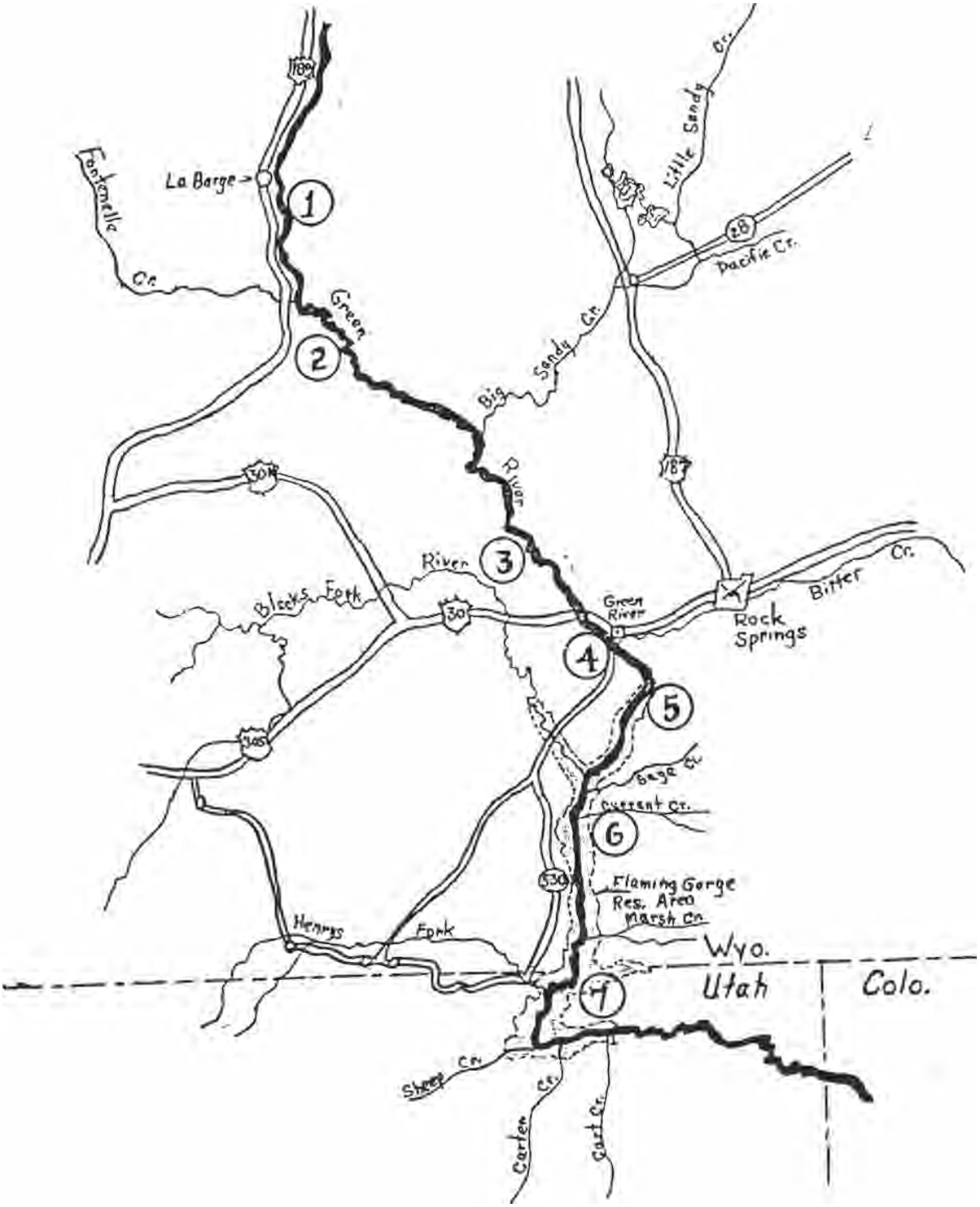
The following is a listing of the sampling sites established on the Green River within the study area of this project. The name of the nearest well known landmark or object has been assigned to these stations to help In establishing definite location.

(1) Names Hill
(2) Little Colorado Bridge
(3) Big Island Bridge
(4) Toll Gate Rock
(5) Kinkaid Ranch
(6) Holmes Ferry
(7) Government Bridge; Linwood, Utah

The map on the following page shows distribution of these stations.

Of the seven sampling stations established during this study, only Stations No. 2, No. 3 and No. 4 will be available for future comparisons. The backwaters of Fontenelle Reservoir, of the Seedskadee project, will very likely inundate Station No. 1, and Stations No. 5, No. 6 and No. 7 will be inundated by the Flaming Gorge Reservoir.

Location of Sampling S□#□ □



## FINDINGS
## Biological, Physical and Chemical

### Station No. 1 - Names Hill

This station is located at the site of a public picnic ground approximately 1/2 of a mile downstream from Names Hill Cafe, T26N; R11W; S32.

Station No. 1
Looking Downstream

Streamside vegetation furnishing shade to a portion of the river is the narrowleaf cottonwood, Populus angustifolia; sandbar willow, Salix exigua; red osier dogwood, Cornus stolonifera; and sumach, Rhus trilobata. The wild rose, Rosa nutkana, was very prevalent in the area but was restricted to some 30 yards from the stream bank.

Predominant grasses in the area were: western bluestem, Agropyron smithii; squirreltail barley, Hardeum ubatum; and Kentucky bluegrass, Poa pratensis.

Other plants in the immediate vicinity of the stream were: goosegrass, Potentilla anserina; and sloughgrass, Beckmannia sycigachne. The spike rush, Eleocharis palustris, was found growing along the stream bank and out into the water at depths of 6 inches.

The only aquatic plant present at the sampling site was the common pondweed, Potamogeton pectinatus. Some true moss sp. was found in the riffle area.

Attached algae was Cladophora sp. At no time did this algae form large fronds; growth was restricted to strands approximately 1 to 2 inches in length.

Filamentous algae taken during the summer months was Spirogyra sp.

The sampling site was a small riffle on the west side of the river. The site was opposite the north end of an island which split the river into two channels. The bottom consisted of rock from 1 to 5 inches in diameter. A light covering of silt was present during the spring and early summer, but was usually gone by July.

Diatom growth at this station was not heavy. Collections made with the diatometer showed a predominance of Nitzschia followed by Tabellaria and Cymbella. Gomphonema, Navicula and Cocconeis were also present, but in much reduced numbers.

Zooplankton populations averaged 2.7 organisms per liter. The organisms were copepods and rotifers.

The bottom fauna at this station was not too varied. Representatives from 8 orders were taken and are listed in Table V, page 29. The Ephemeroptera represented the majority of organisms in both numbers and bulk in most of the samples. Samples could have easily been biased at this station. The scattered areas where mosses and attached algae were present contained a considerably larger number of organisms. A square foot sample taken in one of these areas would have given the impression that the fauna populations were heavier than they actually were.

Water chemistry data fr all stations is presented in Table No. VI, on page 30.

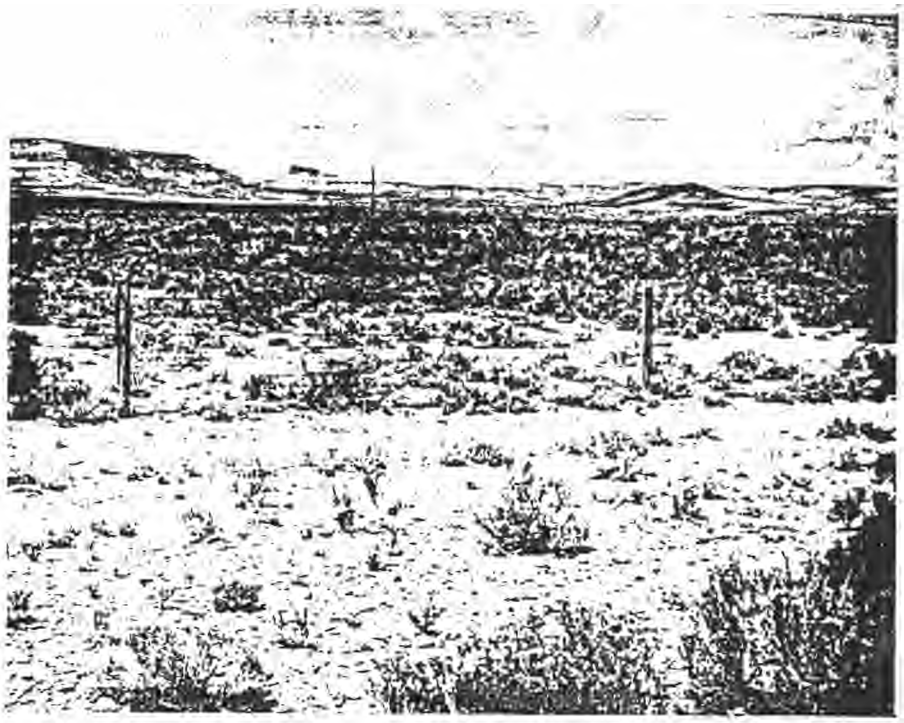
Coliform counts were quite low at this station. Of the three plate counts made in November, 1958, only three colonies developed, one per each plate.

The area between Stations No. 1 and No. 2 is composed of a sandy loam which is highly erosive. Run-off is high and precipitation in the area often causes the Green River to become murky for some distance downstream.

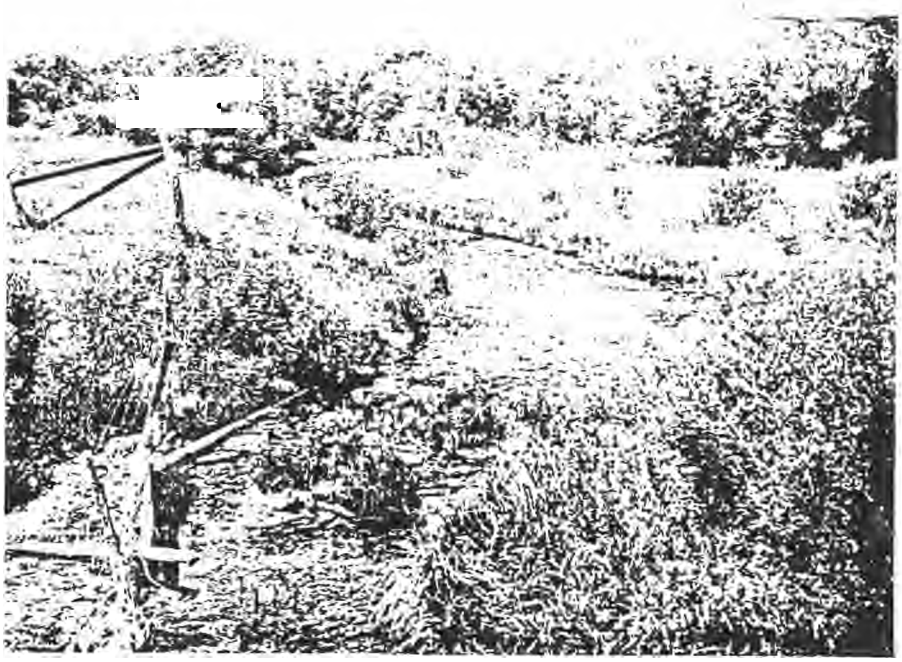
The dominant plants in this area are: greasewood, Sarcobatus vermiculatus; rabbitbrush, Chrysothamnus nauseosus; silver sage, Artemisia frigidia; Aromatic sage, Artemisia dracunculoides; and the saltgrass, Distichlis stricta.

Dominant streamside vegetation in this section is the andbar willow. Scattered clumps of narrowleaf cottonwood are found throughout the area.

Three streams enter the Green River between Stations No. 1 and No. 2, they are: Muddy Creek, Fontenelle Creek and Sheep Creek. Muddy Creek and Sheep Creek are intermittant and contribute little besides silt and dissolved solids during spring run-off. Fontenelle Creek has a sustained flow although irrigation withdrawals greatly reduce the volume of water in the lower reaches. The majority of water flow in the late summer is a result of return seepage. Stream temperatures range from 33 F. in the winter to the high 70's in late summer and early fall.



**Typical Area Between Stations No. 1 & No. 2**



Late Summer Flows, Fontenelle Creek

A large community of flora develops in the lower section of Fontenelle Creek during the summer. In areas of little gradient, this aquatic development covers the entire stream bed. Plants collected in the vicinity of the Highway 189 Bridge crossing were: Water buttercup, Batrachium trachyphyllum; marestail, Hippuris vulgaris; bur-reed, Sparganium angustifolium; water smartweed, Polygonum amphibium; marsh paintbrush, Castilleja exilis; and the Missouri iris, Iris missouriensis.

Algal growths were heavy throughout the area wherever riffles occurred. Dominant algae was the filamentous Microspora sp., and Ulothrix sp. Large gelantinous masses of Anabaena sp. were also present in the riffle areas. The Scenedemus dimorphis was present in small numbers. The diatom growths were quite heavy, Cocconeis, Navicula, Gomphonema and Cymbella were the dominant forms.

One chemical check was run on Fontenelle Creek. The most interesting item resulting from this check was the amount of total dissolved solids. Concentrations of dissolved solids were more than double that of the Green River at Station No. 2 located below the mouth of Fontenelle Creek.

TABLE I

Water Chemistry - Fontenelle Creek - 8/3/1959

| | |
|---|---|
| DO ppm. | 8.1 |
| Temperature °F. | 74 |
| pH | 8.4 |
| MO as ppm CO3 | 130.0 |
| phth as ppm $CO_3$ | 5.0 |
| Total dissolve solids ppm. | 464.0 |
| Phosphate ppm. | .13 |
| Chloride ppm. | 16.5 |
| Calcium | 48.0 |

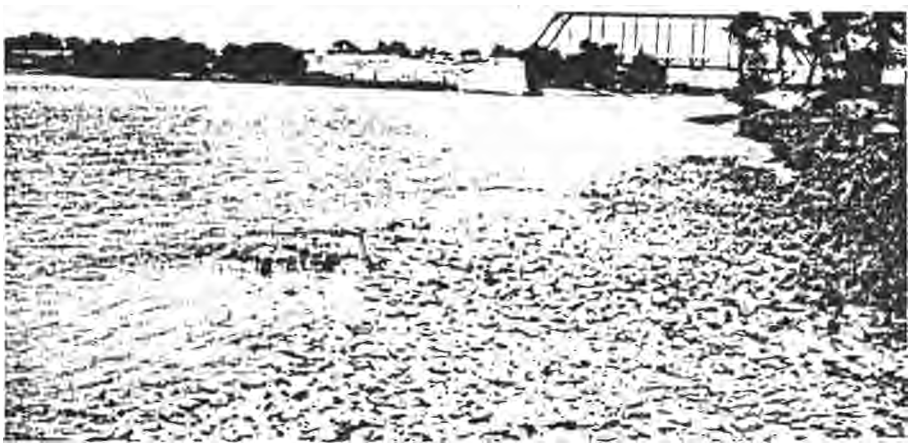
Station No. 2 - Little Colorado Bridge

This station is located approximately 650 feet downstream from the Little Colorado Bridge, T23N; R11W; S18.

Vegetation on the surrounding river bottom is predominately sagebrush, Artemisia sp., and greasewood, Sarcobatus vermiculatus. The smaller grasses and plants are: saltgrass, Distichilis stricta; the three nerved goldenrod, Solidago trinervata; and whitetop, Lepidium draba.

Streamside vegetation at this station is dominated by the sandbar willow, Salix exigua. Occasional stands of the narrowleaf cottonwood, Populus angustifolia are present. Grasses along the stream bank were the saltgrass, Distichlis stricta, and Kentucky bluegrass, Poa pratensis, and along the water's edge, arrowgrass, Triglochin maritima; goosegrass, Potentilla anserina; and the spike rush, Eleocharis palustris. The only aquatic plant at this station was the common pondweed, Potamogeton pectinatus. This plant was not very prevalent, however.

The only algae present was Cladophorasp. Stream vegetation, on the whole, was very sparce in this section.



Station No. 2
Looking Upstream at the Little Colorado Bridge

The actual sampling site was on a large riffle, an extension of the rocky area in the foreground of the Station No. 2 photo. The bottom was composed of rock from 3 to 6 inches in diameter. Deposits of silt were noticeably heavier than at Station No. 1. This deposit remained on the gravel most of the year.

Diatoms collected at this station with the diatometer showed a predominance of Fragilaria sp., and Cymbella sp. The Gomphonema sp., and Navicula increased over the amount present at Station No. 1. Occasional Cocconeis placentula, Diatomella sp., and Gyrosigma sp. were found.

Zooplankton concentrations dropped in numbers at this station as compared to Station No. 1. The average number of organisms was 0.9 per liter. The organisms found were almost exclusively rotifers, with an occasional copepod found.

Bottom fauna was also smaller in numbers than in Station No. 1. The bulk of the organisms taken were Ephemeroptera and Diptera. The Diptera count being somewhat higher at this station.

The only apparent change in water chemistry, as noted in Table VI, page 30, was a general increase in the total dissolved solids over the amount present at Station No. 1.

Coliform counts were also quite low at this station; of the three plate counts made in November, 1958, two colonies were counted in one of the plates, the other two showed no development.

The area from Station No. 2 to No. 3 is very similar to that between Stations No. 1 and No. 2. Sagebrush is the dominant plant on lands overlooking the river, and greasewood, sagebrush and rabbitbrush dominate the area adjacent to the river bed. The soil is highly alkaline and subject to erosion during

spring thaws. There are a number of washes which enter the Green River in this area. These washes contribute large amounts of eroded soil to the river during spring run-off periods.

The area between Stations No. 2 and No. 3 lies within the proposed Seedskadee project, and the lands adjacent to the river bed have also been designated as a waterfowl development area by the Fish and Wildlife Service (see Seedskadee project map, page 65).

The only stream entering the Green River between Stations No. 2 and No. 3 is the Big Sandy River. The Big Sandy River contributes little as a fisheries habitat. The bottom,from the mouth to approximately 12 miles upstream, is a shifting bed of silt and sand. Aquatic flora, and fauna, is very sparce in this section. Spawning riffles are nonexistant.

Analyses of the chemical content indicates that it is a very poor river for development of any type of a fishery, and that the section of river from the Eden Valley project downstream is serving as a drainage system for a part of that area. The following is a list of the chemical and physical analysis run on water from the Big Sandy River in May, 1959.

TABLE II

Water Chemistry - Big Sandy Creek - May, 1959

| | |
|---|---|
| Temperature | 46° F. |
| pH | 8.1 |
| Total Dissolved Solids ppm. | 3,240.0 |
| MO Alkalinity as ppm. CO3 | 119.0 |
| phth Alkalinity as ppm. $CO_3$ | 0.0 |
| Ca. ppm. | 196.9 |
| Mg. ppm. | 99.4 |
| Chlorides ppm. | 60.5 |
| Sulphate ppm. | 10.5 |
| Turbidity (ppm. - 1,200) cm. | 2.1 |

Mouth of the Big Sandy River
(Delta Formed is at Upper Right of Standing Figure)

Turbidities are very high in the Big Sandy during the spring and early summer. Sufficient silt is carried in the river to form a large delta at its mouth; this delta remains year around. Light, or moderate, amounts of precipitation on the Big Sandy Drainage frequently cause the Green River to become quite turbid as far down as Big Island Bridge. Big Island Bridge is approximately nine river miles below the mouth of the Big Sandy.

Station No. 3 - Big Island Bridge

This station is located approximately 150 feet above Big Island Bridge, T21N; R109W; S35.

Dominant vegetation on the surrounding lands in this section is: greasewood, Sarcobatus vermiculatus; sagebrush, Artemisia sp.; and rabbitbrush, Chrysothamnus nauseosus. The soil is quite alkaline, and all low areas have a characteristic white alkaline deposit. The dominant grass is saltgrass, Distichlis stricta.

Streamside vegetation in this area is dominated by the sandbar willow, Salix exigua; some buffalo berry, Lepargyrea sp. was found. Daisey fleabane, Erigeron divergens; goosegrass, Potentialla anserina; broad-leaved arrowhead, Sagittaria latifolia; and spike rush, Eleocharis palustris, was also found along the streamside. The only aquatic found was the common pondweed, Potamogeton pectinatus.

Station No. 3
Looking Downstream Toward the Big Island

Algae taken at this station was predominately Cladophora sp.; large amounts of this algae is found floating through this section of the river during the late summer.

The sampling site was approximately 300 feet above the Big Island Bridge on the west side of the river. The bottom consisted of rock from 1 to 4 inches in diameter. A light layer of silt is present at this station during most of the year.

Development of diatom populations was heavier at this station than any of the stations previously described. Tabellaria and Gomphonema were present in large amounts on the sampling slides from the diatometer. Cymbella and Cocconeis were present in smaller numbers, and an occasional Navicula was found.

Zooplankton populations were also higher at this station. The average number of organisms being 7.2 per liter. The organisms found in the plankton samples were primarily rotifers and ostracods.

The bottom fauna was not noticeably higher than at the other stations. Representatives from all of the orders listed on Table V, Bottom Fauna, page 29, were taken except Annelida and Odanata.

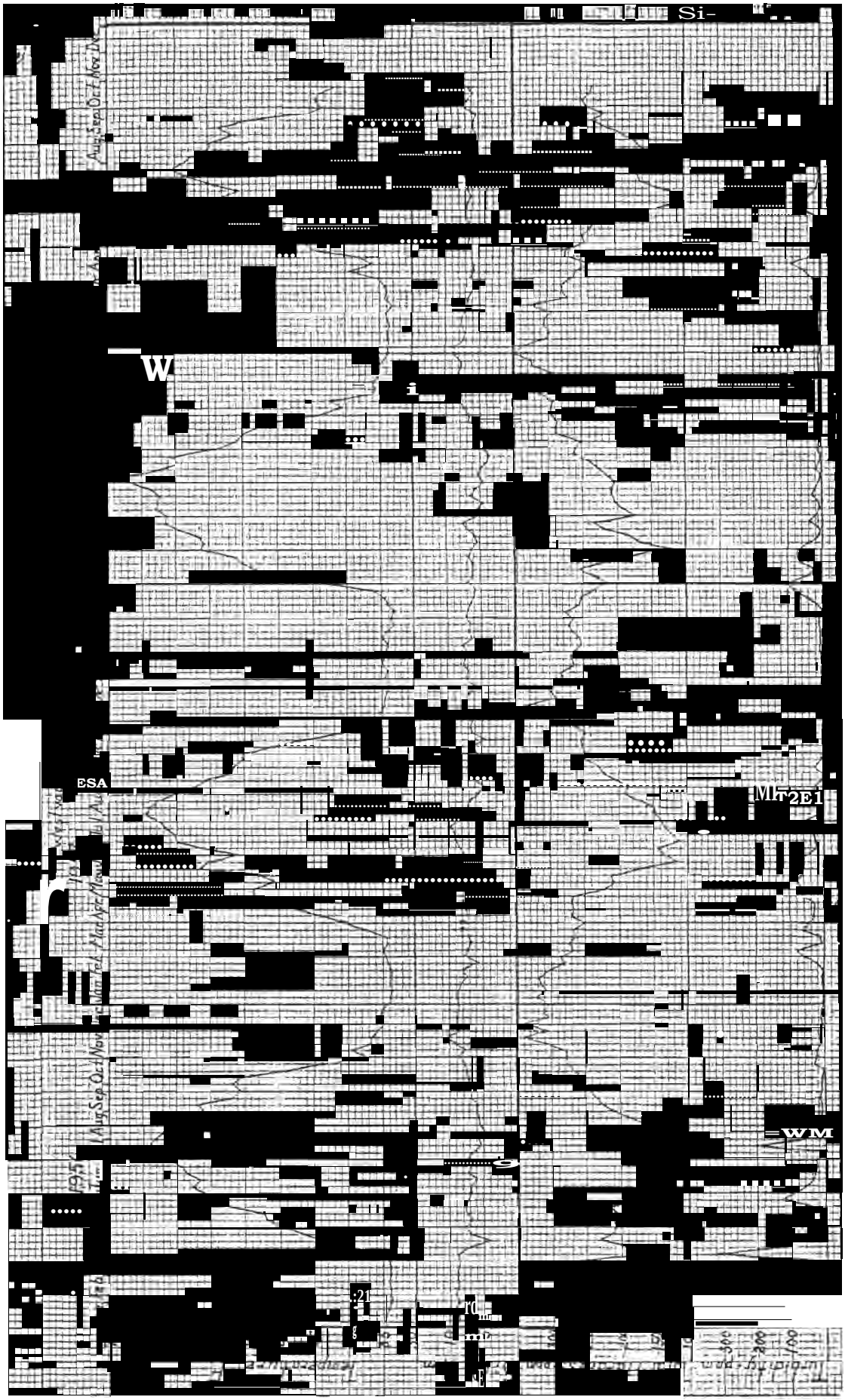
The change in chemical composition of the water was not great. An increase in total solids gives the only indication, in those analysis run, of a change in quality.

Coliform counts were slightly higher than the previous station. Of the three plate counts made in November, 1958, two of the plates developed two colonies each, and the third plate developed one colony during incubation.

The area between Stations No. 3 and No. 4 is not as open as previously described areas. The river, for much of the distance, is confined in a valley from 1/2 to 1 1/2 miles wide. Many bluff areas are present along the east side of the river where no vegetation growth is possible. The river alternates between shallow riffle areas of gravel and long deep holes. No tributaries enter the river between Stations No. 3 and No. 4.

The surrounding hillside vegetation in this area is sagebrush, Artemisia frigida. Bottom lands are covered with greasewood, Sarccbatus vermiculatus; scattered stands of narrowleaf cottonwood are present along the river. Predominate streamside vegetation is the sandbar willow, Salix Exigua.

The physical and chemical data present in Graph I on the following page was taken from the records of a sodium carbonate plant operated by the Intermountain Chemical Company. This plant, located approximately 20 miles east of Green River, Wyoming, utilizes one million gallons of water per day in its operation. The water is pumped from the Green River to a stand tank which has approximately one million gallon capacity. Water for plant use is fed into the powerhouse from this tank, and samples for chemical analysis are taken between the tank and the powerhouse. Temperature data varies somewhat from river temperatures because of the time spent in the tank. Turbidities and $SiO_2$ would also be slightly conservative.


Si-
W
ESA
Mr2E1
=WM

Temperature, hardness and turbidity readings were taken a number of times each day. Water temperatures were taken at 2:00 a.m., 6:00 a.m., 12:00 noon, 2:00 p.m., 6:00 p.m., and 10:00 p.m. Hardness analysis were made three times daily; 8:00 a.m., 12:00 noon, and 4:00 p.m. Turbidity readings were made at 12:00 noon, 8:00 a.m., and 4:00 p.m. Weekly averages of these daily readings are presented in the table.

Station No. 4 - Toll Gate Rock

This station is located at the site of a camp ground just off highway 30, T18N; R107W; S16.

Streamside vegetation on the east bank consists of a single line of narrowleaf cottonwood trees extending approximately 1/4 mile along the stream. Grasses in the area are primarily saltgrass, Distichlis stricta. A few wild rose, Rosa nutkana, were present below the sampling site.

Station No. 4
(Looking Downstream Toward Toll Gate Rock)

The sampling site was directly across from an island on the east side of the river. There is no riffle at this sampling site; samples were taken just off the stream bank.

The only aquatic plant at this station was the common pondweed, Potamogeton pectinatus, and this plant was present in small amounts only.

Algae found at this station was Cladophora sp. Just after the initial run-off, or low land run-off, this algae was very noticeable on the stream bottom. The large later run-off from the high country seems to depress growths or further development of this algae.

The bottom type at this station was gravel from 1 to 3 inches in diameter. The stream bed, towards the center, was a mixture of gravel and flat sheets of sandstone. The sandstone was apparently bedrock. A layer of silt was found at this station during all sampling periods.

Diatom growth appeared to be less at this station than those stations previously described. Diatoms found were predominately Tabellaria, Navicula, Cymbella and Cocconeis placentula. Occasional Gyrosigma were found.

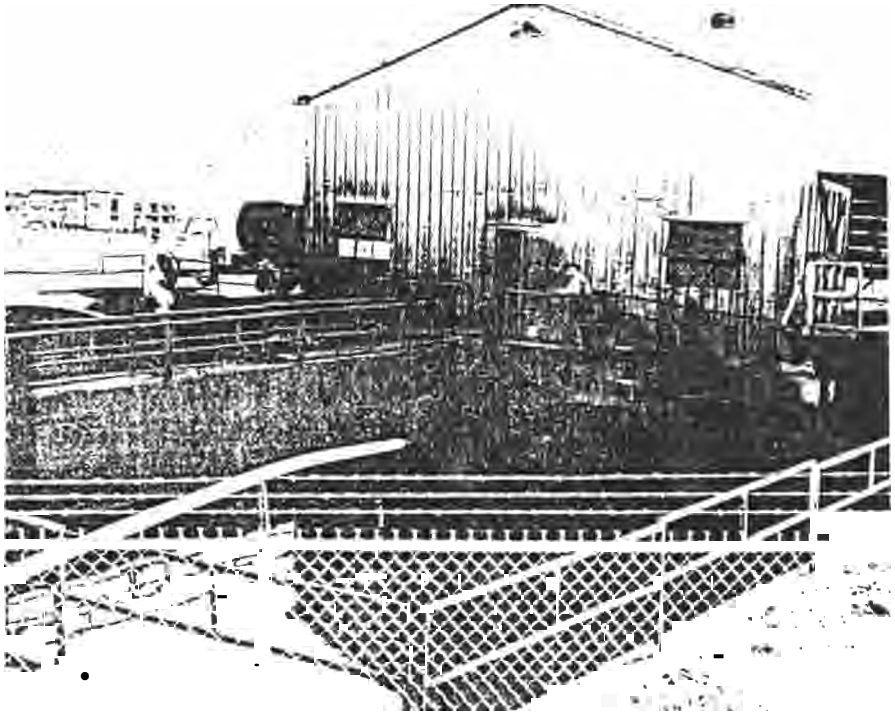
Zooplankton populations averaged .35 organisms per liter at this station. This is a reduction from concentrations at other stations.

Bottom fauna was essentially the same as Station No. 3 except for an increase in the number of Annelida.

Coliform counts increased noticeably at this station. This increase is due, undoubtedly, to housing along the river bank above and below the Highway 30 Bridge. Of two plate counts taken in November, 1958, one plate developed 15 colonies per cc., and the other 12 colonies per cc. This concentration is below the recommended counts for game fish waters.

The area between Stations No. 4 and No. 5 encloses the town of Green River. These stations, approximately 7 miles apart, were established in an attempt to determine the amount of pollution entering at Green River and Bitter Creek. The town of Green River, with a population of approximately 4,500, has no sewage disposal system at the present time. Raw sewage is dumped directly into the river. Tentative plans call for the construction of a sewage lagoon southeast of the town. Unfortunately, the site selected for this lagoon was within the "take line" of the Bureau of Reclamation's survey of lands to be withdrawn for the Flaming Gorge Reservoir. Steps are being taken to have this land released for sewage lagoon construction.

During past years, large amounts of oils were released into the river by the U. P. Railroad at Green River. Installation of an oil separation plant has greatly reduced this source of pollution. The plant processes from three to four thousand gallons of waste water per day. The waste oil is pumped into a tank truck for disposal, and the water is returned to the stream. Spills from this plant are rare but do occur. Occasionally effluent from the roundhouse is in volumes that cannot be handled by the scavenging pumps. During these periods, the effluent escapes through an overflow line into the river. The photo on the following page was taken of this separation plant. The sumps in the foreground contain effluent from the roundhouse. The truck, upper left, is used to haul spearated oil from the plant.



U.P. Railroad Separation Plant
Green River City, Wyoming

Outfall of Oil Separation Plant After Escape
Of Oil Laden Water From the U. P. Railyard

The only tributary entering the Green River between Stations No. 4 and No. 5 is Bitter Creek. Bitter Creek itself is intermittant; it rises rapidly with the first spring thaws and maintains a flow until late June or early July. The stream contributes a heavy silt load during this period. The flow after July is maintained 100% by the outfall of the Rock Springs sewage disposal plant. This disposal plant contributes approximately 900,000 gpd. to Bitter Creek at the point of outfall. The population served by this disposal system is estimated at 13,000 and the BOD reproduction is estimated by plant operator at 85 to 907.. With this BOD reduction, the effluent entering Bitter Creek at the point of outfall would be the equivalent of a town with a population of 1,300 to 1,950 with no disposal system. There are no facilities for chlorination of the outfall, and there are indications that the final settling basin does not have adequate retention time to allow the effluent to stabilize. Consequently, although the BCD reduction at this plant is excellent, the coliform count is high and some undesirable compounds are present in the effluent.

The following table is an analysis run on the effluent from the Rock Springs Sewage Disposal Plant in 1957.

TABLE III

Rock Springs Sewage Disposal Plant

| Analysis | Concentrations |
|---|---|
| Turbidity | 9.6 cm (260 ppm.) |
| pH | 7.5 |
| Chlorides | 97.5 ppm. |
| Phosphates | 11.2 ppm. |
| Ammonia Nitrogen | 9.6 ppm. |
| Ammonia | 11.7 ppm. |
| Nitrate Nitrogen | 40.0 ppm. |
| Nitrite Nitrogen | .186 ppm. |
| Coliform organisms | 245,000 per ml. |

Two coliform plate counts were made at the mouth of Bitter Creek in November, 1959. One plate developed 132 colonies per cc., and the other 134 colonies per cc. These counts are above the concentrations recommended by the California Water Quality Criteria for fresh water fish.

Bitter Creek, from a fisheries standpoint, is a sterile stream. The concentrations of compounds in the water during the majority of the year have eliminated all bottom fauna. The only algae present is found at the mouth of the stream. The bottom of the stream is hardpan and shifting silt and sand. River flow data collected at the town of Green River is presented in Graph No. II for the years 1956 through 1959.

Station No. 5 - Kinkaid Ranch

This station is located approximately 5 miles below the town of Green River, T17N; R106W; S8.

Vegetation on the surrounding hillsides is predominately sagebrush. Streamside vegetation is dominated by sandbar willow, with scattered stands of cottonwood trees present in the immediate vicinity of the stream.

Attached algae found in this area was Cladophora sp.; some filamentous, Spiragyra, was taken during early summer months.

The sampling site was a shallow area of the stream. The bottom type was gravel from 1 to 3 inches across. This gravel was **interspersed with silt which formed a very compact bottom.**

Station No. 5
Looking Upstream

Diatom growth at this station was much reduced as compared to previous stations. Dominant forms were Cocconeis, Tabellaria and Gomphonema. Navicula and Gyrosigma were present in reduced numbers.

Zooplankton populations averaged 1.6 organisms per liter. The organisms found were rotifers and ostracods.

Bottom fauna at this station was restricted to Diptera, Ephemeroptera, Annelida and Gastrapods. This assemblage is characteristic of water receiving organic wastes. The bottom fauna samples collected in this area are listed on Table V, page 29.

Coliform counts at this station were high. Of two plate counts made in November, 1958, one plate developed 115 colonies per cc., and the other 134 per cc.

The river between Stations No. 5 and No. 6 is quite slow and turbid. Large areas of the stream bed are covered with shifting beds of silt and sand. The river has cut into the surrounding hills in many places, creating steep or precipitous banks composed of sandstone, clay, and a highly erosive sandy loam.

Cover through this area is light. Sagebrush dominates the hillside vegetation, and sagebrush and greasewood grow together on the bottom lands.

The sandbar willow is dominate along the stream banks. Some groves of cottonwood trees are found, but they are not as prevalent through this area. Occasional salt cedars are found along the river bank.

Typical Landscape Between Stations No. 5 and No. 6

Tributary streams entering the Green River between Stations No. 5 and No. 6 are: Sage Creek, Currant Creek and the Black's Fork River. Sage and Currant Creeks are the smaller of the three, entering on the east side of the Green River. Both streams contribute large amounts of silt to the Green River during spring run-off. Diversions, for purposes of irrigation, often drastically reduce, or eliminate, water flows in the vicinity of the mouths of these streams during summer months. The beds of these streams, near their mouths, is a combination of shifting silt and hardpan. Currant Creek does support trout populations in its headwaters, but none were found in the vicinity of its mouth.

The Black's Fork River varies in flow rate from 3,000 cfs during run-off to 0 cfs in the late summer. The majority of the water is diverted for irrigation above Lyman, Wyoming. The bottom of the Black's Fork River, from

the mouth upstream approximately 70 river miles, is a shifting bed of silt and sand. Bottom fauna populations are very small, and except for filamentous algae floating through the area from above, there is practically no algal growth.

A water sample, taken in May of 1959, gave the following results.

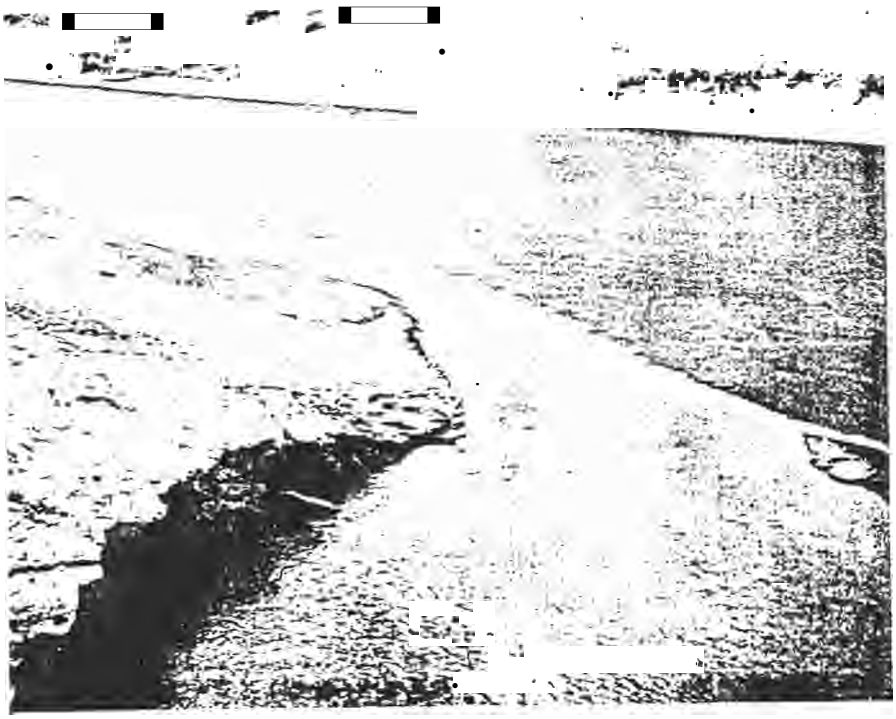
TABLE IV

Black's Fork River - 5/17/1

| | |
|---|---|
| Total Dissolved Solids | 576 ppm. |
| pH | 8.6 ppm. |
| MO Alkalinity as ppm. CO3 | 102 |
| phth as ppm. CO3 | 4.0 |
| Calcium | 3.4 ppm. |
| Magnesium | 19.4 ppm. |
| Chlorides | 38.0 ppm. |
| Sulphate | ppm. |
| Turbidity | cm. (460 ppm.) |
| Temperature - F. | 57 |

**The photos below were taken at the mouth** of Sage Creek **in October, 1959.**

**Mouth of Sage Creek**



**Silt Load Carried** Into the Green River-by Sage Creek

Station No. 6 - Holmes Ferry

This station is located at the site of the old Holmes Ferry River crossing, T15N; R108W; S27.

The vegetation in the vicinity of this station is a continuation of sagebrush and greasewood, similar to the area between Stations No. 5 and No. 5. Streamside vegetation is scant in the area; greasewood extends to the river's edge along much of the area.

Small amounts of Cladophora sp. was found in the sampling area. A covering of silt was present during all sampling periods.

The sampling site was located on the west side of the river just below the ferry crossing. The bottom in this area was composed of gravel from 1 to 4 inches across. This gravel was bedded in silt and formed a very firm bottom.

Diatom population was heavier at this station than at Station No. 5. Fragilaria was very apparent; Tabellaria, Gomphonema, and Cymbella were present in much reduced numbers.

Zooplankton populations were slightly higher than at Station No. 5. Rotifers were the only organisms found, with an average count of .95 organisms per liter.

Bottom fauna was primarily Diptera and Ephemeroptera. The number of organisms per square foot averaged less than at any other station (see Table V, page 29).

The section between Stations No. 6 and No. 7 is a continuation of highly erosive steep hills bordering the river. Sagebrush and greasewood are the dominant forms of vegetation on the hillsides, and often extend to the river's edge. Sandbar willow is present along the river's edge, but in decreasing amounts. The river becomes increasingly more turbid through this section, having a bed of shifting sand. At the Wyoming-Utah State line, the terrain levels out for some distance on both sides of the river. This area will be the widest part of the Flaming Gorge Reservoir, approximately 5 miles during full stages. No tributary streams enter the Green River through this section.

Station No. 7 - Linwood Bridge

This station is located approximately 300 feet below the Government Bridge crossing the Green River 4 miles east of Linwood, Utah, T3N; R21E; S28.

Very little streamside vegetation is present at this station. The river banks are either 2 to 6 feet high or slope steeply into the river. Grease-wood, sagebrush and sandbar willow are found along the river's edge in the immediate vicinity of the sampling site.

The sampling site is located on the east side of the river along the bank. At this location the river current had swept the sand off, leaving an area of gravel. This gravel is from 1 to 5 inches in diameter, and is interspersed with sand and clay, forming a firm bottom.

Diatom growth is very light at this station; Tabellaria, Fragilaria, and Navicula were found in small amounts.

Zooplankton populations were also light, with an average of .42 organisms per liter recorded.

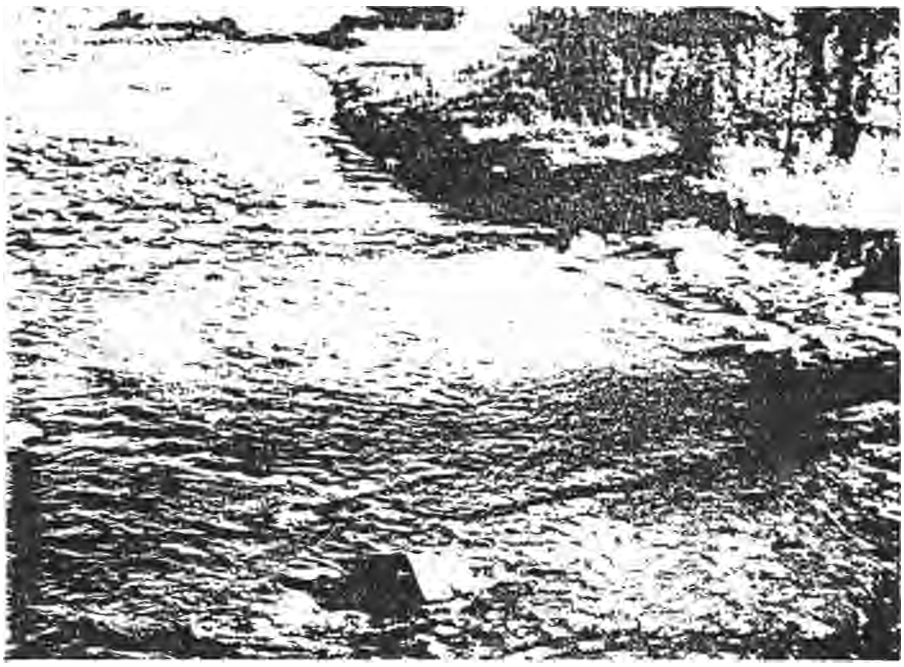
Bottom fauna populations were composed primarily of Diptera and Ephemeroptera.

Station No. 7
Looking Upstream Toward Linwood Bridge

Approximately 1 1/2 miles below Station No. 7 the Green River enters Flaming Gorge Canyon, and from this cleft in the mountain side, it is confined by steep canyon areas which extend below Ashley damsite. The cover in this section changes drastically from that found in and above Station No. 7. Cedar and pine trees dominate the hillside areas, and in many places, extend to the river's edge. Some valleys enter through the canyon area. These valleys are sagcbrush covered, and the sagebrush extends to the river's edge.

Four tributaries worthy of note enter the Green River between Station No. 7 and Ashley damsite. These tributaries are: Henry's Fork, Sheep Creek, Carter Creek and Cart Creek.

Henry's Fork enters the Green River approximately 1/2 mile below Station No. 7. Discharge rates of this stream range from 500 cfs during spring run-off to 0.4 cfs in October. Much of the flow is diverted, during summer months, for irrigation purposes. The stream gradient at the mouth of Henry's Fork is very slight, and large beds of silt and sand have been deposited. This silt and sand gives away to gravel and hardpan about three miles upstream from the mouth. Above this point, gravel, boulders and sand comprise the stream bed. An arm of the Flaming Gorge Reservoir will extend approximately 5 miles up Henry's Fork.



Henry's Fork
Approximately 8 miles from the mouth - 7/1959

Populations of native and brook trout are present in the headwaters of Henry's Fork, but no game fish exist in the lower section at the present time.

Sheep Creek enters the Green River at the upper end of Hideout Forest Camp through a very narrow canyon. The bottom of the stream, at the mouth, is sand and gravel. Trout populations exist a short distance above the mouth of this stream. Brown trout were shocked approximately 1 mile above the mouth, and rainbow are stocked by the Utah Fish and Game Department in the upper sections. The stream sustains a flow during the entire year, and is quite clear except during run-off periods. No discharge rates are available for this stream.

Carter Creek enters the Green River approximately 2 miles below Hideout Forest Camp. Gradient of this stream, in the vicinity of the mouth, is steep. The bottom type is composed of rubble, sand and gravel. A series of old beaver dams serve to slow the rate of water flow in the lower sections of the stream. Carter Creek maintains a flow during all months of the year, and trout populations are present. Rainbow trout populations are maintained by the Utah Fish and Game Department in the upper sections. These populations have migrated downstream and are present in the vicinity of the mouth. Evidence of natural reproduction was found in rainbow x native crosses taken at the mouth of the stream in October, 1959.

Little is known at this time of the status of Cart Creek. From cursory surveys it appears to maintain flow during all months of the year. Gradient is precipitous in the lower section; much of this percipitous area will be eliminated by the reservoir water level. No flow data is available on rates of discharge of this stream.

TABLE V

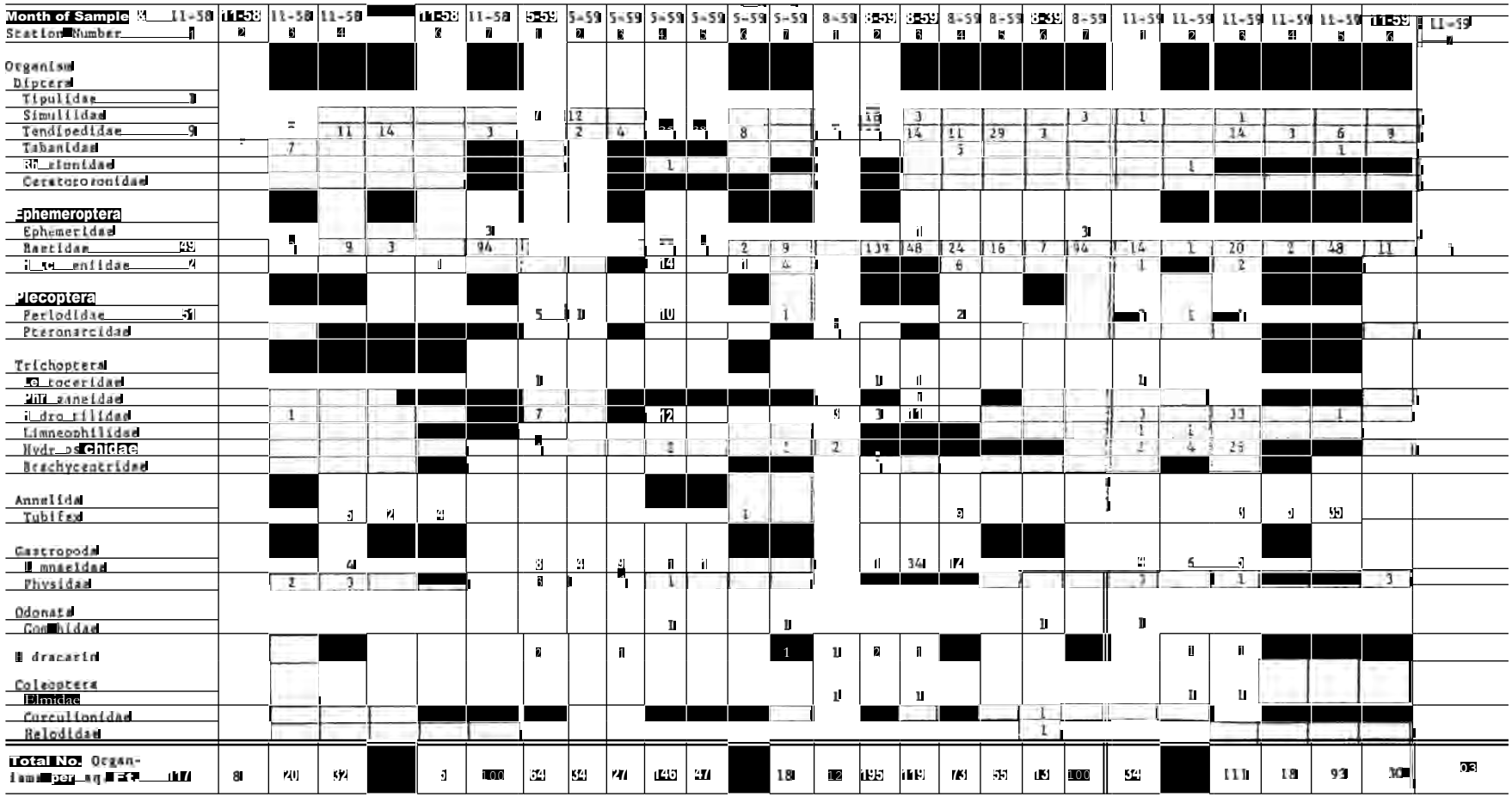


TABLE VI
Water Chemistry - Green River

| DATE | November - 1958 | | | | | | | April - 1959 | | | | | | | August - 1959 | | | | | | | October - 1959 | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Station Number | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Analysis Total Dissolved Solids | 246 | 352 | 496 | 458 | 520 | 636 | 738 | 292 | 302 | 483 | 510 | 452 | 482 | 458 | 186 | 194 | 290 | 462 | 457 | 332 | 292 | 236 | 424 | 256 | 28 | 418 | 472 | 470 |
| Dissolved Oxygen | 10.5 | 10.6 | 10.4 | 11.4 | 11.3 | 12.4 | 12.5 | 13.1 | 13.8 | 12.9 | 11.7 | 12.6 | 12.0 | 11.7 | 6.7 | 7.2 | 6.2 | 6.4 | 6.6 | 7.3 | 7.0 | 13.9 | 14.4 | 13.9 | 14.1 | 16.7 | 13.5 | 12.9 |
| pH | 7.2 | 7.4 | 7.8 | 7.4 | 7.8 | 8.0 | 8.2 | 7.2 | 7.4 | 7.8 | 7.4 | 7.8 | 8.0 | 8.2 | 8.6 | 8.5 | 8.4 | 7.6 | 7.8 | 7.6 | 8.0 | 8.2 | 8.2 | 8.2 | 8.2 | 8.6 | 8.6 | 8.5 |
| Alkalinity as ppm CO3 MO | 86 | 91 | 86 | 88 | 89 | 114 | 120 | 86.0 | 91.0 | 86.0 | 88.0 | 89.0 | 114 | 120 | 60 | 62 | 68 | 69 | 64 | 61 | 66 | 146 | 144 | 152 | 160 | 154 | 168 | 136 |
| phth | 0.0 | 0.0 | 3.0 | 3.0 | 5.0 | 8.2 | 4.8 | 3.0 | 3.0 | 2.5 | 6.0 | 13.0 | 5.0 | 5.0 | 1.5 | 1.0 | 0 | 5.0 | 3.0 | 1.0 | 0.5 | 2.0 | 0.0 | 0.0 | 0.0 | 8.0 | 8.4 | 7.2 |
| Calcium ppm. | 59.2 | 62.4 | 67.2 | 72.0 | 73.6 | 75.2 | 89.6 | 52.8 | 121.6 | 75.8 | 65.6 | 82.0 | 76.0 | 74.0 | 35.2 | 32.0 | 33.6 | 48.0 | 52.0 | 33.6 | 30.4 | 48 | 48 | 60.8 | 49.6 | 54.4 | 38.4 | 36.8 |
| Magnesium ppm | 9.7 | 11.3 | 14.4 | 15.0 | 16.0 | 18.5 | 20.0 | 7.8 | 7.8 | 8.0 | 10.9 | 9.1 | 10.3 | 10.0 | 3.1 | 3.1 | 3.5 | 3.5 | 7.3 | 5.4 | 5.0 | 13.5 | 13.5 | 25.2 | 19.4 | 25.2 | 27.1 | 24.2 |
| Phosphates ppm | | | | | | | | .046 | .078 | .078 | .126 | .140 | .116 | .170 | 1.4 | 1.4 | 1.6 | .05 | 1.1 | 1.0 | 1.3 | 2.4 | 2.1 | 2.4 | 1.9 | 1.57 | 1.5 | 1.5 |
| Chlorides ppm | 1.25 | 2.0 | 2.25 | 2.5 | 3.0 | 4.5 | 4.75 | 5.0 | 6.0 | 9.0 | 9.0 | 7.5 | 21.0 | 15.0 | 2.5 | 3.0 | 5.5 | 13.0 | 9.0 | 9.3 | 10.0 | 3.0 | 4.5 | 5.0 | 7.5 | 10.0 | 10.5 | 16.0 |
| Sulfates ppm | 3.8 | 5.2 | 11.9 | 14.8 | 15.7 | 19.5 | 23.2 | 2.3 | 1.4 | 14.3 | 16.6 | 9.1 | 21.0 | 38.0 | | | | | | | | | | | | | | |
| Nitrites ppm | | | | | | | | .01 | .008 | .011 | .009 | .01 | .011 | .01 | 0 | 0 | tr. | 0 | tr. | 0 | 0 | | | | | | | |
| Turbidities cm. | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 12.2 | 15.3 | 4.2 | 2.3 | 2.7 | 2.2 | 2.2 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| Temperature ° F. | 35 | 35 | 34 | 33 | 33 | 33 | 33 | 54° | 54° | 56° | 58 | 58° | 57° | 60° | 72° | 76° | 68° | 72° | 70° | 73° | 70 | 36 | 36° | 38° | 38° | 36° | 36' | 36' |

Mouth of Sheep Creek
July, 1958

Mouth of Carter Creek
October, 1959

## OBSERVATIONS ON FISH POPULATIONS

The following is a list of the fish taken in the Green River proper and its tributaries and the type of gear used successfully in their capture. An attempt has been made to list these fish in apparent abundance. This listing is only approximate, however. Some of the tributaries, such as Sheep Creek, showed a heavy concentration of sculpin in the lower section. Fontenelle Creek, on the other hand, showed a very heavy or dominating concentration of rainbow in its upper section.

TABLE VII

| SPECIES | Location Taken | Experimental Gill Net | Fyke Net | Shocker, Paddle Electrode | Shocker, Electric Seine | Hoxicant |
|---|---|---|---|---|---|---|
| Bigmouth Sucker - Catostomus latipinnis discobolus | R,T | X | X | X | X | X |
| Bonytail - Gila robusta robusta | R,T | X | X | X | X | |
| Bluehead Sucker - Pantosteus delphinus | R,T | | | X | X | |
| Sculpin - Cottus bairdi | | | | | | |
| Whitefish - Coregonus williamsoni williamsoni | R,T | X | | X | X | |
| Utah Silversides Minnow - Gila balteatus hydrophlox | T | | | X | X | X |
| Green River Spring Dace - Rhinichthys osculus yarrowi | R,T | | | X | X | X |
| Brown Trout - Salmo trutta faro | R,T | X | | X | X | |
| Rainbow Trout - Salmo gairdneri irideus | R,T | X | | X | | |
| Colorado River Squawfish - Ptychocheilus lucius | R | X | | | | |
| Carp - Cyprinus carpio | R | X | | | X | |
| Channel Catfish - Ictalurus punctatus | R | X | | | | |
| Yellow Perch - Perca flavescens | T | | | X | | |
| Hybrid Trout - Salmo clarkii lewisi x Salmo gairdneri irideus | T | | | | | X |
| Fathead Minnow - Pimephales promelas promelas | R | | | | | |
| Humpback Sucker - Xyrauchen texanus | R | | | | | |
| Black Bullhead - Ictalurus melas | T | | | | | |
| Brook Trout - Salvelinus fontinalis | T | | | | | |

Green River Proper (R)
Tributaries (T)

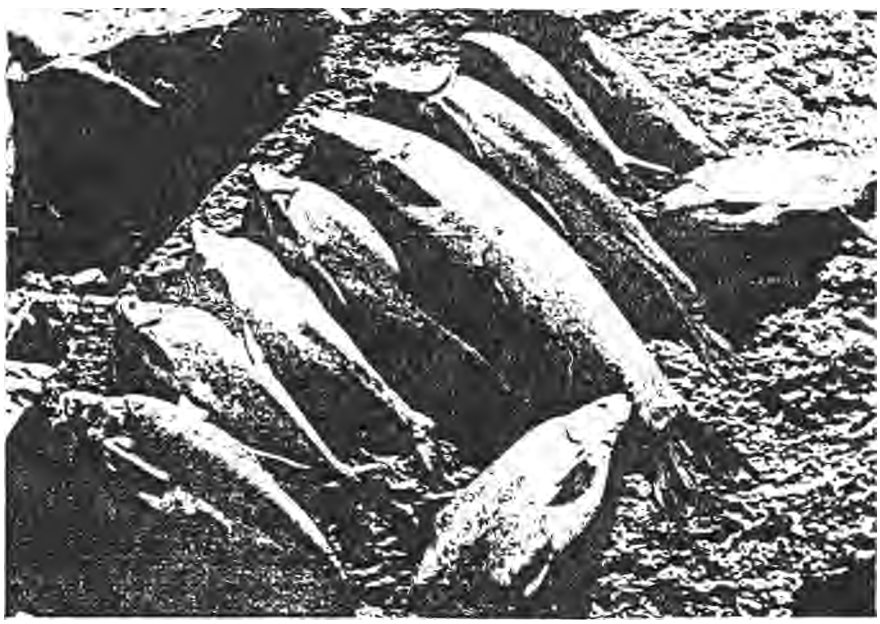
The last four species were not taken by the Wyoming Game and Fish personnel. They were reported to have been taken by Utah Fish and Game working in the study area, and consequently would be included in the species composition.

Bigmouth Sucker - Catostomus latipinnis discobolus)

This sucker is probably the most uniformly distributed large sucker in the study area. It was taken by every fish collecting method used during the study, and practically every gill net set or shocking operation produced a number of specimens. It accounted for 48.57. of the number of fish taken in the gill net sets and 51.47. of the total weight of these fish. The largest specimen taken was 20 1/4 inches long and weighed 2 7/8 pounds.

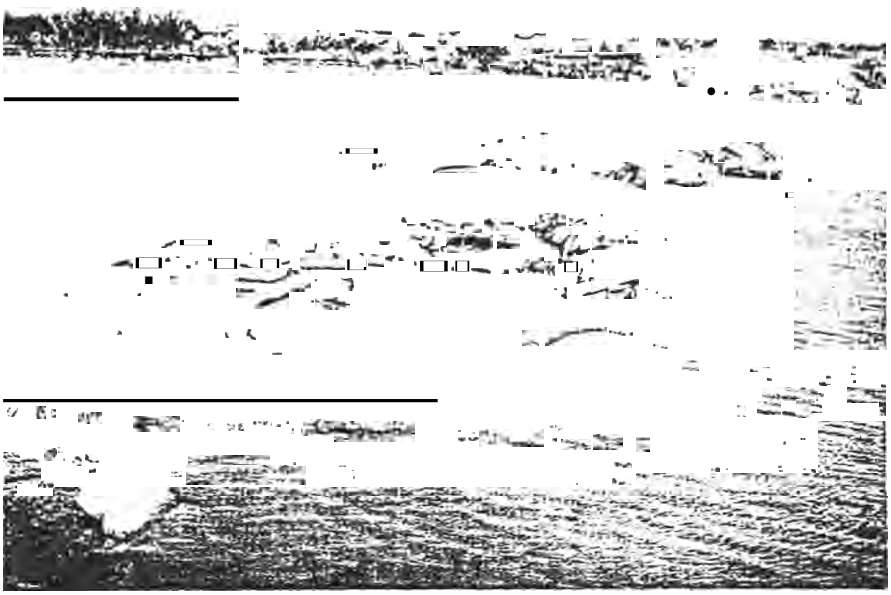
Bonytail - (Gila robusta robusta)

The bonytail is distributed throughout the study area. Concentrations are confined, for the most part, to the Green River proper. These fish seem to prefer the moderate to slow stream flows, and sand-silt bottom conditions existing in the lower section of the river from Big Island downstream. There appears to be a change in the physical characteristics of this fish in the extreme lower section of the study area, from Flaming Gorge downstream. Many of the fish taken in this section of the Green River had a very pronounced humpback. In one gill net set made in this area, the incidence of humpback ran over 667. of the total bonytails taken. In the photograph below the bottom five fish are bonytails displaying this charactristic. These fish have been considered as possibly a sub-species by some writers. However, **no attempt will be made** to do so **in this report**.



**Humpback Bonytail -** Green River
(Bottom Five Fish)

The Black's Fork River is the only tributary where heavy concentrations of bonytail were found over two miles from its mouth. The Black's Fork River was also the only tributary where fingerling bonytail were taken. During shocking operations in the latter part of May, 1959, at the Highway 30 crossing, approximately 35 river miles from the mouth, specimens from two to five inches were very common. This would indicate that the bonytail is reproducing successfully in the Black's Fork River. It is doubtful that fingerling would move that distance upstream from the Green River. Specimens of bonytail were also taken above the Paravincini Diversion, approximately 42 river miles from the mouth by use of the electric seine during late October, 1959.



Paravincini Diversion, Black's Fork River

Bonytails were not taken in the upper section of Fontenelle Creek, Big Sandy Creek, Sage Creek or Sheep Creek; however, they are so universally distributed there is a possibility that they are in these areas, but were not taken. The largest bonytail taken in the gill net sets was 19 1/4 inches long and weighed 2.0 pounds.

Bluehead Sucker - (Pantosteus delphinus)

This sucker seems to be more concentrated in the upper section of the Green River. The majority of these fish were taken between Station No.1, below LaBarge, and a point about five miles below the mouth of the Big Sandy River.

Bluehead suckers were also taken at the mouth, and upper section of Fontenelle Creek, the Black's Fork River and in Henry's Fork River at the Highway 530 bridge crossing. All specimens were taken by electro-fishing gear.

Sculpin (Cottus bairdi)

This fish is very common throughout the entire drainage. It is found in practically every part of the study area having a gravel or rubble bottom. All tributaries to the Green River, except Sage Creek, produced specimens of this fish.

Rocky Mountain Whitefish - (Coregonus williamsoni williamsoni)

The whitefish is found primarily from the vicinity of Big Island upstream. It seems to prefer the rubble bottom and clearer waters in this area although one specimen was taken just below the Flaming Gorge Canyon. This fish, and the brown trout, provide the majority of game fish taken by fishermen within the study area. The only tributary in the study area in which whitefish were found was Fontenelle Creek. During shocking operations at the mouth of Sheep Creek, one fish seen momentarily was thought to be a whitefish, but unfortunately it passed beyond the electrical field and recovered before it could be captured. The whitefish taken in gill nets during this study ranged in size from 6.8 inches to 12.3 inches, and the average size was 8.6 inches.

Utah Silversides Minnow - Gila baleatus hydrophlox)

This fish was found in moderate to heavy concentrations in tributary streams of the Green River. It was found throughout the length of the Big Sandy River from Highway 187 downstream, in the Black's Fork River upstream as far as the Highway 30 bridge crossing, and in Henry's Fork six miles above Highway 530 bridge crossing. Although no specimens were taken in the Green River proper during this study, it is felt that this species is present in the Green River, at least in the vicinity of the mouths of the above mentioned tributaries. Simon, 1946, reports that silversides spawn near the Little Colorado Bridge in late June and early July. The Little Colorado Bridge is located on the Green River proper, and is the site of Station No. 2 of this study.

**Brown Trout - (Saimo** trutta fario)

The brown is the predominate species of trout in the Green River from LaBarge downstream. A check on past planting discloses that 90.77. of all fish planted in the Green River below LaBarge since 1939 have been brown trout. Specimens were collected as far downstream as the Big Island Bridge, Station No. 3 of this report. Evidence that brown trout do exist in the Green River below the town of **Green River** has been found. The use of toxicant at the mouth of Sage Creek produced a brown trout approximately 3 inches long. This fish was thought to be the result of natural reproduction in the river, since the last plant made in the river was in 1954 and some 60 miles upstream

from the mouth of Sage Creek. The only other tributary where brown were taken was Sheep Creek in Utah. This fish at this location are a result of stocking by the Utah Fish and Game Commission.

Rainbow Trout - (Salmo gairdneri irideus)

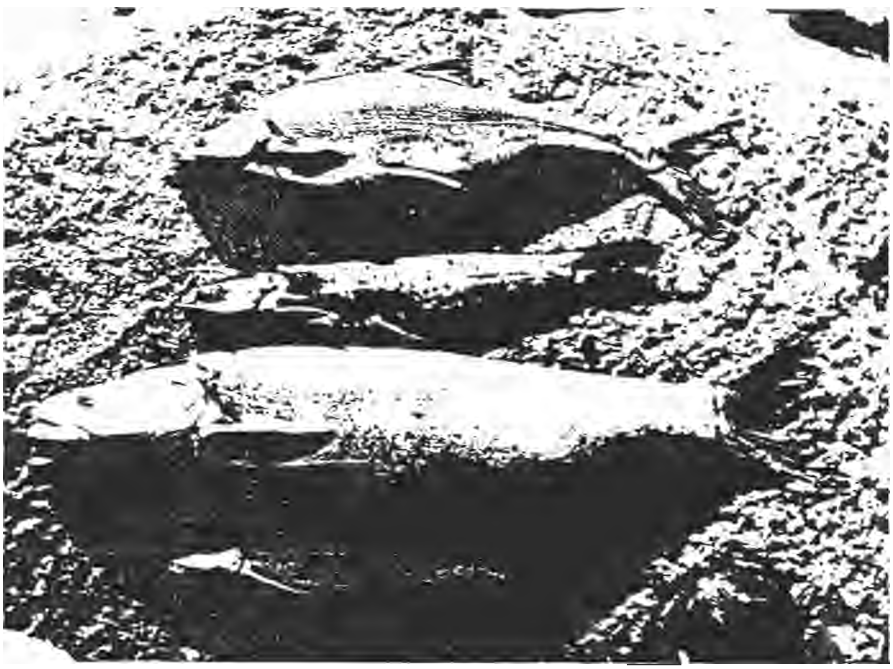
The rainbow is a fish of the uppermost end of the study area and above. Only one specimen was taken in a gill net. This catch was made approximately five miles above the Little Colorado Bridge, Station No. 2 of this report. A number of rainbow were taken with a shocker in the upper end of Fontenelle Creek. These fish, 4 to 6 inches in length, were the result of Game and Fish Department stocking policy which specifies rainbow in this section of the stream. Rainbow are also planted in the upper sections of Sheep Creek and Carter Creek in Utah by the Utah Fish and Game Commission.

Squawfish - (Ptychocheilus lucius)

The squawfish is confined in the Green River below the town of Green River. Information from gill nets indicates that its upstream penetration ends in the vicinity of the Kinkaid Ranch, approximately five miles below town. Eight of these fish were taken during gill netting operations. The largest specimen measured 24 inches long and weighed 3 pounds 8 ounces. These fish were not taken in any of the tributaries checked.

Information from a fisheries survey party in 1938 indicates that squawfish were above the town of Green River at that time.

The largest fish in the photo below is a squawfish taken in a gill net set below the Flaming Gorge Canyon.



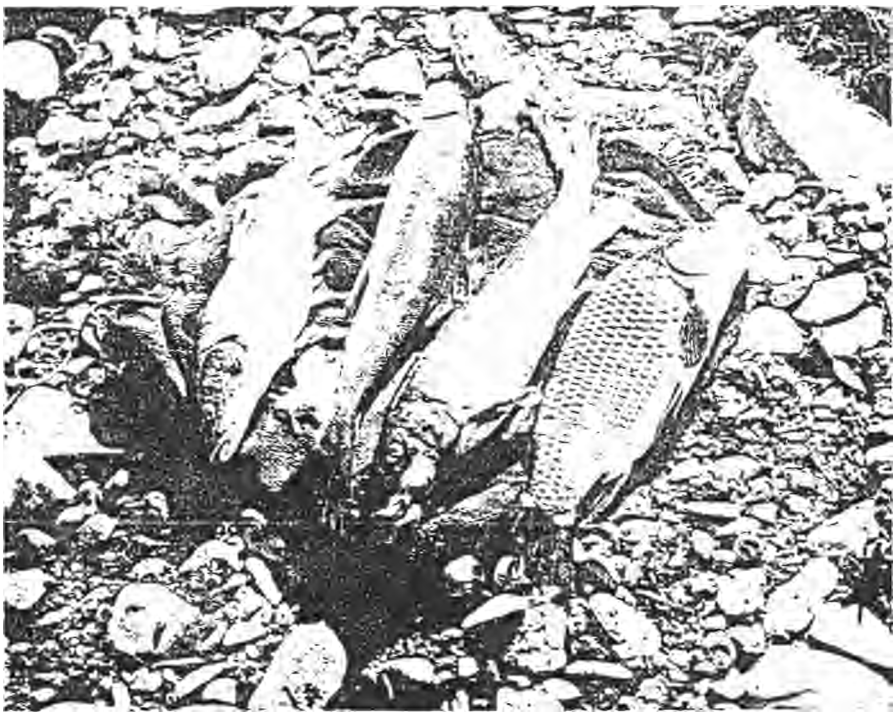
Borytail, Channel Catfish, Squawfish,
and Big Mouth Sucker

Carp -(Cyprinus carpio)

Carp were taken by gill net and electric seine in the Green River in the vicinity of the mouth of the Big Sandy River. These fish are apparently widely distributed and reproducing in the upper Green River drainage. Fisheries personnel at Pinedale have taken immature carp in the New Fork River, and have had reports of mature carp being caught in the New Fork below the town of Pinedale.

In 1938 fisheries personnel of the Wyoming Game and Fish Department working in the vicinity of the town of Green River stated that carp were present in the area. There were numerous reports of carp being seen in the immediate vicinity of the town of Green River during this study; however, gill net sets failed to produce any. Carp were recovered by personnel of the Utah Fish and Game at Hideout Forest Camp in Utah.

The photo below is a part of the catch from a gill net set at the mouth of the Big Sandy River. They are from left to right: bonytail, two big mouth suckersand a carp.



Channel Catfish - (Ictalurus punctatus)

Channel catfish populations are restricted to the lower section of the Green River. All specimens taken were in the area below the Flaming Gorge Canyon. The fish were nct exceptionally large, the largest of the two taken was 12.3 inches long and weighed 8 ounces.

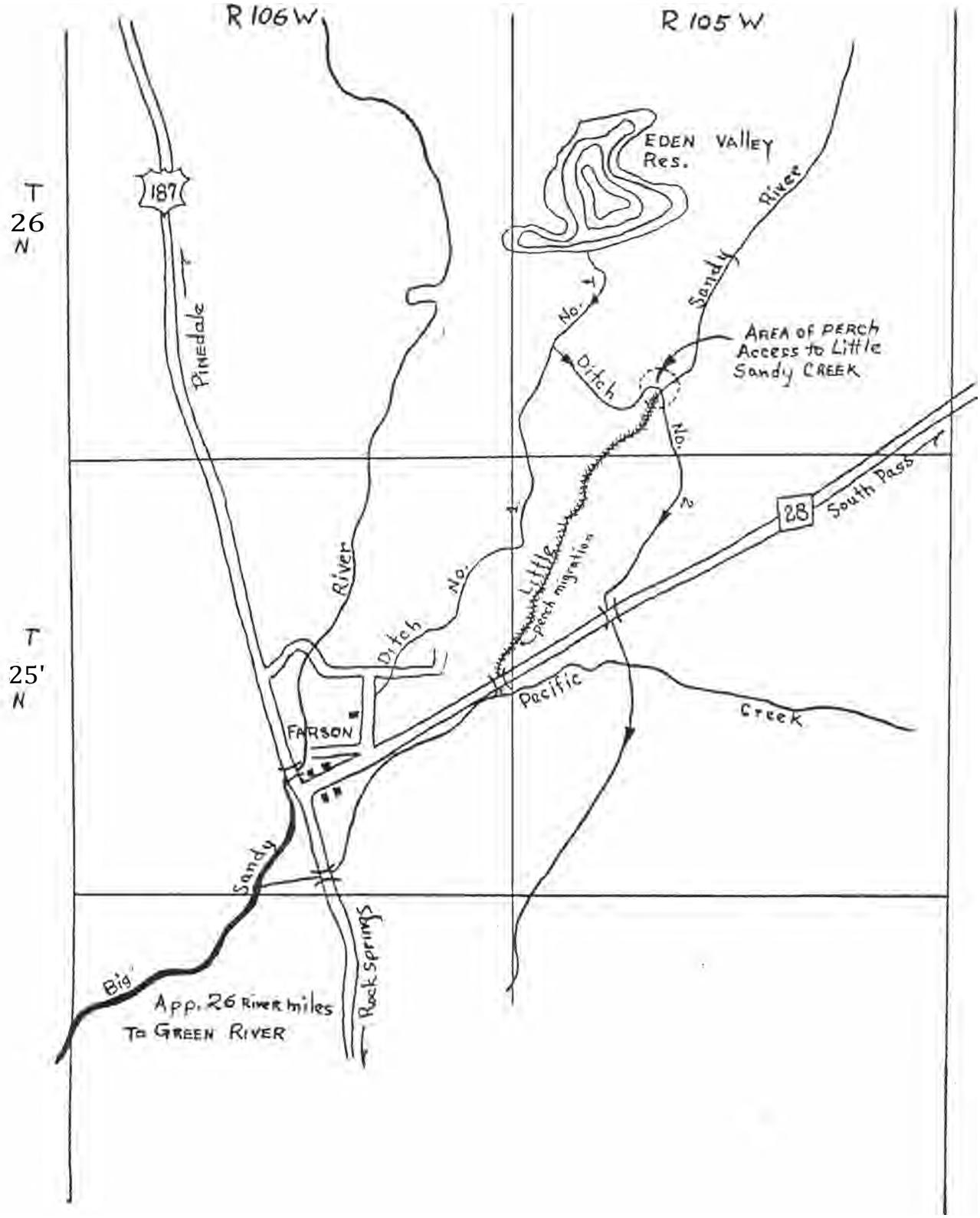
There were numerous reports of catfish being taken below the town of Green River twelve to fifteen years ago. It is the concensus of the townspeople that extensive pollution by the U. P. Railroad and towns of Green River and Rock Springs during the last ten to fifteen years has been the cause of a decline in catfish populations.

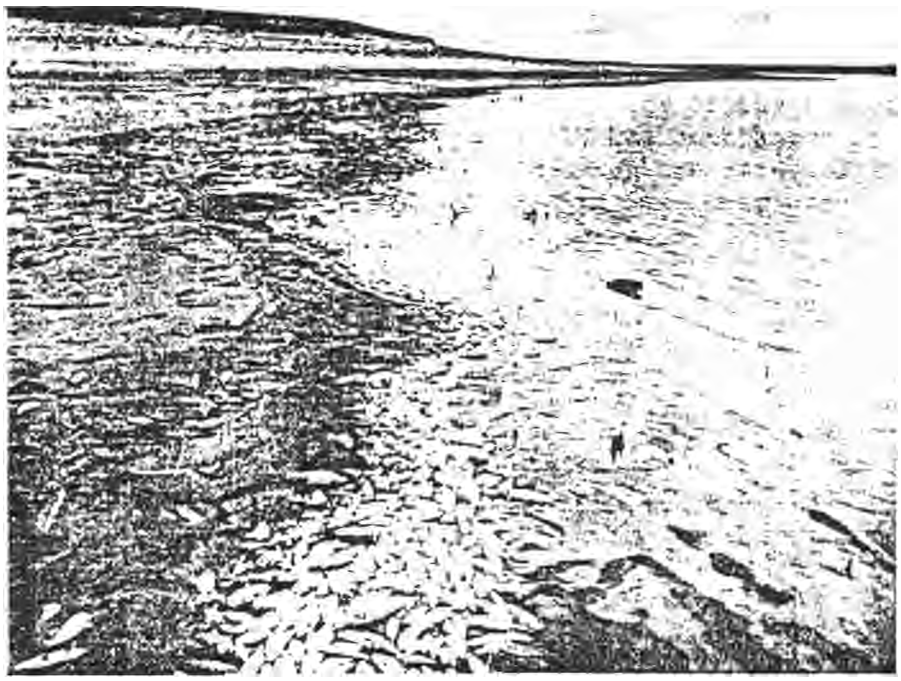
Stocking of catfish by the Wyoming Game and Fish Department has been rather limited. One plant of 4,000 two-inch fish was made at the town of Green River on November 3, 1939, and one plant of 4,425 two to three-inch fish was made 5 miles above the town of Green River on November 3, 1955. A fisherman living in the vicinity of the second plant stated that he and his *son* had caught a number of catfish in the spring of 1957. These fish, from a description of the physical characteristics, were undoubtedly channel catfish. An attempt to take catfish in this area with gill nets in 1958 and 1959 was unsuccessful.

Yellow Perch - (Perca flavescens)

Originally perch had been stocked in the Eden Valley Reservoir, but were found in the Little Sandy River as far downstream as the bridge crossing on Highway 28. This movement was accomplished through withdrawals of water from the Eden Valley Reservoir for irrigation purposes. The perch probably gained access to the Little Sandy River through a discharge gate in ditch number 2 at the site of a siphon going under the Little Sandy (see diagram on following page). It was felt by Game and Fish personnel assigned to the project that immediate steps should be taken to prevent further downstream migration of these fish. The rate of downstream migration would place them in the Green River proper and present an additional species to contend with in future fisheries development in the Flaming Gorge Reservoir. In May, 1959, toxicant was applied to the Little Sandy River from the coffer dam, site of siphon crossing on ditch number 2, to the mouth of Pacific Creek. In September, 1959, toxicant was applied to Eden Valley Reservoir to eliminate the source of the perch. The delay in toxicant application, May to September, was to allow evaporation and seepage to reduce the reservoir to minimum storage capacity before treatment.

Diagram
Perch distribution in tLe Little Sandy drainage





Part of Perch Kill Obtained
In Eden Valley Reservoir

Hybrid Trout - (Salmo gairdneri irideus x Salmo clarkii)

In September, 1959, pronox fish was used to sample the fish populations at the mouth of Carter Creek. Species recovered were sculpins, dace and trout. The trout coloration was that of a rainbow x native cross. The scale count was also that of hybridized fish. By use of scales and otoliths the age of these fish was established at two years. Inquiries into the stocking policy set by the Utah Fish and Game revealed that two plants of native fry had been made. One plant of 30,672 fry in 1946 and one plant of 52,992 fry in 1955 were made. The remainder of fish planted have been rainbow, except for one brook plant in 1948. It is believed that the hybrids taken in September, 1959, are a result of the 1955 native plant crossing with rainbow present in the stream. This evidence of natural reproduction should place Carter Creek high on the list of tributary streams capable of producing an annual spawning run, and subsequent returns to the reservoir proper

Fathead Minnow - (Pimephales promelas promelas)

This minnow taken by the Utah Fish and Game is not indigenous to the Green River system. Since it was found only in one location, approximately ten miles upstream from the Wyoming-Utah State Line, it is probably a recent introduction in this area.

Humpback Sucker - (Xyrauchen texanus)

This fish was taken in Utah in the vicinity of the Hideout Forest Camp by personnel of the Utah Fish and Game. It has been known to exist in the Green River system, but occurrences in Wyoming are rare. It is conceivable that the humpback could move into Wyoming in reservoir waters backed up by the Flaming Gorge Dam, since it was taken upstream from the damsite proper.

## LOCATION OF NET SETS AND SHOCKING SITES

The following map and accompanying legend give the locations where gill net sets, toxicant applications, and shocking operations were conducted in determining the species composition in the lower Green River system. Comparison of map symbols and locations will indicate species taken in a particular area.

SPECIES COMPOSITION LEGEND

| Map Symbol | Location | Species Taken |
|---|---|---|
| (A) | Two miles below Names Hill Cafe | 1,2,5,8 |
| (B) | Mouth of Fontenelle Creek | |
| (C) | Upper Fontenelle Creek | 3,4,5,7,9 |
| (D) | One-Fourth mile above Little Colorado Bridge | 1,3,5,8 |
| (E) | One mile below the Pat Hawley Ranch | 1,2,5,11 |
| (F) | Mouth of Big Sandy River | 1,2,5,11 |
| (G) | One-Half mile above mouth on Big Sandy River | 1,2 |
| (H) | Big Sandy crossing east of Farson, Wyoming | 4,6,7 |
| (I) | Highway 187 crossing at Farson, Wyoming | 1,4,6,7 |
| (J) | Little Sandy River above Highway 28 | 1,6,7,13 |
| (K) | Little Sandy River below mouth of Pacific Cr. | 1 |
| (L) | Below mouth of Big Sandy on Green River | 1,3,4,5 |
| (M) | One-Fourth mile below Big Island Bridge | 1,2,8 |
| (N) | Two miles above highway 30 bridge | 1,2,4 |
| (O) | Above highway 30 bridge | 1,2,4 |
| (P) | Mouth of Bitter Creek | 1 |
| (Q) | Three miles below town of Green River | 1,2,10 |
| (R) | Black's Fork River Highway 530 Bridge crossing | 1,2,3,6 |
| (S) | Black's Fork River Highway 30 Bridge crossing | 2,3,6 |
| (T). | Black's Fork River above Paravicini Diversion | 1,2 |
| (U) | Mouth of Sage Creek | 1,8 |
| (V) | Holmes Ferry Site | 1,2 |
| (W) | Four miles upstream from Wyoming-Utah Line | 1,2 |
| (X) | Henry's Fork below Highway 530 Crossing | 1,2,3,6,7 |
| (Y) | Henry's Fork five miles above Highway 530 | 1,3,6,7 |
| (Z) | Flaming Gorge to Horseshoe Canyon | 1,2,5,10,12 |
| (A-1) | Sheep Creek at mouth and one-half mile above | 1,4,6,7,8 |
| (A-2) | Carter Creek Mouth | 4,7,9,14,15 |
| (A-3) | Hideout Forest Camp | 1,2,10,11,12,17 |

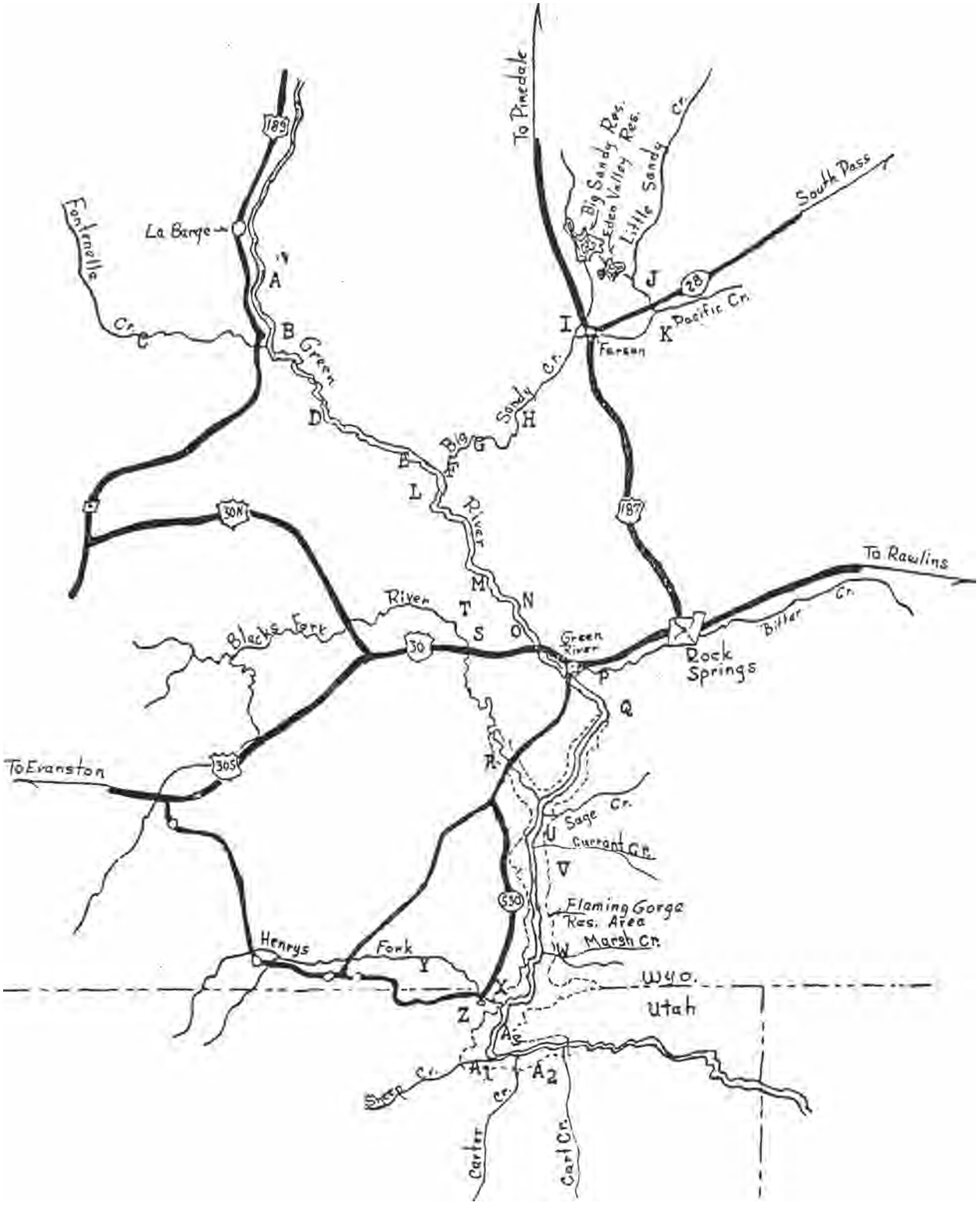
Species

(1) Bigmouth Sucker
(2) Bonytail
(3) Bluehead Sucker
(4) Sculpin
(5) Whitefish
(6) Utah Silversides Minnow
(7) Green River Spring Dace
(8) Brown Trout
(9) Rainbow Trout
(10) Squawfish
(11) Carp —
(12) Channel Catfish
(13) Yellow Perch
(14) Hybrid Trout
(15) Native
(16) Fathead Minnow
(17) Humpback Sucker

Diagram II

Species Composition Map

Location of net sets and shocking sites.



The following is a list of past fish plants made in the Green River within the confines of the study area. These plants were taken from the Wyoming Game and Fish Department, Fish Division, files.

Table VIII

| Date | Species | No. | Weight | Length | Location |
|---|---|---|---|---|---|
| 11/3/39 | Channel Catfish | 4,000 | ? | 2" | Green River, Wyoming |
| 8/18/41 | Brown Trout | 15,846 | #32 | 1" | ? |
| 8/5/42 | Brown Trout | 24,846 | #35 | VP | Highway 30 Crossing |
| 8/11/42 | Brown Trout | 21,117 | #30 | W | Green River, Wyoming |
| 8/6/43 | Brown Trout | 16,800 | #35 | W | 5 Miles above Green River, Wyoming |
| 9/10/45 | B. Bullhead | 5,000 | ? | 3-10" | 1 Mile South Green River, Wyoming |
| 9/21/45 | Brook Trout | 4,800 | ? | 1½-2" | Green River, Wyoming |
| 7/14/46 | Rainbow Trout | 528 | #210 | 10" | Green River, Wyoming |
| 8/11/47 | Rainbow Trout | 2,100 | #150 | 5½" | Highway 30 crossing |
| 6/24/48 | Brown Trout | 38,400 | #50 | 2" | Green River, Wyoming & upstream 8 miles |
| 7/13/48 | Brown Trout | 36,000 | #75 | 2" | Green River up to Lombard Ferry |
| 7/14/48 | Brown trout | 10,080 | #21 | 1 3/4" | Fontenelle Creek to County Line |
| 7/14/48 | Brown Trout | 9,600 | #20 | 2" | County Line To Dodge Suspension Bridge |
| 11/12/52 | Brown Trout | 6,020 | #70 | 3" | Below LaBarge |
| 11/19/52 | Brown Trout | 2,200 | #25 | 3" | 20 miles below LaBarge |
| 5/10/54 | Brown Trout | 1,945 | #143 | 6" | Below Little Colo. Bridge |
| 7/15/54 | Brown Trout | 18,000 | #60 | 1½" | 3 miles below Sweetwater County Line |
| 7/27/54 | Brown Trout | 1,950 | #350 | 8" | Vicinity of Big Island Bridge |
| 11/3/55 | Channel Catfish | 4,425 | #29.5 | 2-3" | 5 miles above Highway 30 |

Breakdown of fish planted by species within the study area during the last twenty years.

| Species | Total | % Of Total |
|---|---|---|
| Brown Trout | 202,596 | 90.7 |
| Channel Catfish | 8,425 | 3.8 |
| Black Bullhead | 5,000 | 2.2 |
| E. Brook Trout | 4,800 | 2.1 |
| Rainbow Trout | 2,628 | 1.2 |
| Total | 223,449 | 100.0 |

Above fish planted by Wyoming Game and Fish only.

## SPAWNING POTENTIAL
(Game Fish)

### Experimental Spawning Beds

In any consideration of game species to be stocked in the Flaming Gorge Reservoir, high priority must beassigned to its reproductive potential. Maintaining adequate populations of game fish in a reservoir of this size, in excess of 42,000 surface acres, by annual stocking would place a serious drain upon existing state hatchery facilities.

In March, 1957, representatives of the Utah Fish and Game Department and the Wyoming Game and Fish Department met to discuss basic fishery management problems for the Flaming Gorge Reservoir. One of the agreements emerging from this meeting was that the initial stocking policy be restricted to salmonid species, preferably rainbow and kokanee. It was felt that since these species have migratory tendencies during spawning, the Green River proper and tributary streams within the impounded area could be utilized as natural spawning sites. At the time of this meeting little was known of the reproductive potential in the lower sectiсn of the Green River proper. The following egg experiments were conducted to determine this potential.

Inital egg plants were restricted to eyed eggs only. If these were successful it was planned to use eyed eggs, kckanee in this instance, to establish spawning runs. Brown trout eyed eggs were also used to provide a comparison of hatching success. The decision to use brown trout eggs was based on the fact that it was also a fall spawning fish, and availability of the eggs at the time this segment of the project was initiated.

On December 19, 1958, 2,800 eyed brown trout eggs were planted in the Green River immediately above Big Island Bridge, Station No. 3 of this report. The eggs were hauled from the State Fish Hatchery at Daniel, Wyoming. A 10 gallon cream can was used to transport the eggs to the planting site. Water temperatures were, 46' F. at the hatchery, 55 F. on arrival at the planting site, and the stream temperature was 45' F. The can containing the eggs was set in the stream for tempering, approximately 40 minutes. After tempering, the eggs were divided into three lots. Two of the lots contained 1,000 eggs and one contained 800 eggs. Quart jars were used to hold the eggs until they were planted.

The artificial spawning redd was constructed by digging a trench perpendicular to the stream flow. This trench was approximately 18 inches wide, 7 inches deep and 4 feet long. Water depth, from surface to the stream bed, was 12 inches. Planting procedure consisted of placing a plywood box 16 x 16 x 25 inches into the artificially constructed redd. This box eliminated the effect of stream current on the buoyance of the eggs.

Planting baskets, made of triple warp mesh cloth, 8½ x 3½ x 12 inches, were filled approximately 2/3 with gravel and set in the trench, inside the planting box. Eggs were transferred to the baskets by holding a hand over the quart jar and inverting it under water. The hand was then withdrawn and the

eggs allowed to flow from the jar. An attempt was made to distribute the eggs over the entire area of the basket. The remaining 1/3 of the basket was then filled with gravel and the lid wired down.

Additional gravel was placed around and on top of the basket to bring the redd up to the level of the original stream bed. The planting box was then pulled straight up leaving the egg basket buried in the stream bed. This process was repeated on each of the egg baskets.

Egg Tempering

Preparation of Redd

Counting of Eggs

Egg Basket and Gravel

Planting Box in Position

Dates for removal of these baskets were staggered in order to determine the effect of silt, if the eggs died and at what stage of development they did die. Removal date was calculated by estimating the hatching date, then dividing the time and number of baskets equally. At the time of removal, the baskets were placed in a tub with sufficient water to cover the basket and taken into the laboratory for enumeration.

The following information was accumulated on the brown trout eggs from the time of stripping to the time the last basket was removed. Unfortunately, one of the baskets containing 1,000 eggs was not recovered. It was believed to have been dislodged by ice during breakup and swept downstream. The last basket would have been removed on March 8th.

Eggs Taken - - - - - - - - - - - - - - - - - - - November 11
Size - - - - - - - - - - - - - - - - - - - - - - 225/ oz.
Amt. of incubation completed at the time eggs were taken from hatchery - - - - - - - - - 70%
Planting basket size 8½ x 3½ x 12 inches, triple warp mesh cloth 7/10 x 1/10 inches.
Planting box - - - - - - - - - - - - - 16 x 16 x 25 inches.

Brown Trout Eyed Egg Experiment - TABLE IX

| | Basket No. 1 | Basket No. 2 |
|---|---|---|
| Date Planted | December 15, 1958 | December 15, 1958 |
| Date Removed | January 15, 1959 | February 11, 1959 |
| Days in River | 31 | 59 |
| Number Eggs in Basket | 800 | 1,000 |
| Number Eggs Recovered | 541 (67.5%) | 954 (95.4%) |
| Number Eges Alive | 538 | 876 |
| % Survival of Eggs Recovered | 99.4% | 91.8% |
| % Of Eggs Lost and Dead | 32.5% | 12.4% |

Losses in the number of eggs is attributed, to a large extent, to the techniques of placing the planting box in the redd, and distribution of the eggs in the planting baskets. Undercurrents created by not seating the planting box firmly on the stream bed swept many of the eggs up and out of the baskets.

On January 19, 1959, 1,500 eyed kokanee eggs were picked up from the Daniel Hatchery. These eggs were hauled, tempered, and planted by the same procedure used in making the previous brown trout plants. These eggs were also planted in the Green River at Big Island Bridge. Water depth over the redd at the time of the plant was 14 inches. Water temperature of the stream, at the time of the planting, was 34° F.

Original plans had been made to use kokanee eggs spawned at Fremont Lake, in Wyoming, so a close check could be maintained on eyeing, and incubation period. However, spawning concentrations did not materialize as anticipated and eggs from the State of Montana were used. The date these eggs were taken and the time spent incubating, before planting, was not known. It is estimated that 80 to 907. of the incubation time had been completed. The time these eggs remained in the stream was considerably less than those of the brown trout because of the advanced stage of development.

The following information was accumulated on this plant of kokanee eggs.

Eggs Taken - - - - - - - - - - - - - - - - - -
Size - - - - - - - - - - - - - - - - - - - - - 260/ oz.
Amt. of incubation completed at time of plant - Est. 80 to 907.
Planting Basket Size - - - - - - - - - - - - - 8 x 31/2 x 12 inches
Planting Box - - - - - - - - - - - - - - - - - 16 x 16 x 25 inches

Kokanee Salmon Eyed Egg Experiment - TABLE X

| | Basket No. 1 | Basket No. 2 |
|---|---|---|
| Date Planted | January 19, 1959 | January 19, 1959 |
| Date Removed | March 6, 1959 | March 14, 1959 |
| Days in River | 46 | 53 |
| Number Eggs in Basket | 1,000 | 500 |
| Number Eggs Recovered | 511 | 436 |
| Number Eggs Alive | 219 | 182 |
| % Survival of Eggs Recovered | 42.87. | 41.7% |
| % Eggs Lost and Dead | 48.97. | 12.8% |

The percentage of eggs lost and dead is larger in the kokanee eggs than in the brown trout eggs. This loss is explained in part by two conditions:

(1) The advanced stage of development in the kokanee eggs when they were planted.

Hatching had taken place in the kokanee eggs between the time they were planted and recovered. In Basket No. 1, 5.9% of the recovery was alevin. In Basket No. 2, 15.87. of the recovery was alevin. It is felt that while buried in the redd, a number of eggs hatched and the alevin escaped through the basket mesh. In transporting the baskets into town for enumeration, it was noted that a number of alevin had passed through the basket mesh into the tub of water in which the basket was being transported.

(2) Rust from the wire mesh used in construction of the baskets. During enumeration, it was noted that a large number of eggs had adhered to the sides of the baskets. These eggs, when removed,

had large rust spots on them. In Basket No. 1, 41.97. of the dead eggs showed rust spots, and 9.27. of the dead eggs in Basket No. 2 exhibited this condition. This large amount of dead eggs had served for the development of fungus which enveloped many surrounding eggs.

Following the above experiments, inquiries were made to other states concerning the effect of low temperatures on the viability of kokanee eggs. A copy of a letter sent to the Colorado Game and Fish Department by Mr. Roger Burrows, Chief of the Salmon-Cultural Laboratory in Entiat, Washington, was received. Mr. Burrows stated that experiments conducted with sockeye (Oncorhynchus nerka) eggs indicated that below 42.5° F. losses were abnormally high. At 35° F. the mortality was in excess of 807.. Also, the work indicated that low temperatures caused mortality only during early stages of development. Once the eggs had passed the 128 celled stage of development, they could stand temperatures of 35° F. with impunity.

Information from the State of Montana stated that eggs were held in temperatures from 46° F. in November to about 38° F. in January with a good percentage of survival and hatching. The days at which the eggs were incubated before being subjected to low temperatures, if any, were not given.

It was decided from the results of inquiries that additional experiments should be conducted with green eggs to determine eyeing and hatching success.

During this segment additional groups of eggs were planted. Pine Creek, at the inlet of Fremont Lake, was used to determine hatching success to be expected from fingerling plants made there to establish spawning runs, and 40 Rod Creek adjacent to the Daniel Hatchery was used to compare eyeing and hatching success in waters having temperatures above 43° F. Eggs were also placed in the Daniel Hatchery incubator as a control.

The planting procedure used was the same as that described for previous plants using eyed kokanee and brown trout eggs in 1958 and 1959. The baskets were painted with a rust retarding hatchery trough paint.

The steps followed, from stripping of the eggs to planting in the selected sites, have been listed below:

December 2, 1960

(1) Eggs stripped at Granby Reservoir in Colorado, packed in quart jars and placed in panniers. Sawdust was used as insulation. Time at completion of this operation was 11:30 a.m.

(2) Eggs picked up by Wyoming Game and Fish Department airplane at 1:30 p.m.

(3) Eggs delivered at Pinedale, Wyoming at 4:00 p.m., temperature on arrival was 39° F.

(4) Eggs were hauled to the Daniel Hatchery, approximately 14 miles, tempered to hatchery water and measured into 18 quart jars. Three ounces of eggs were placed in each jar. This procedure was taken to expedite planting

on the following day. The jars were then sealed and iced to hold them overnight. Time at completion of this operation was 5:30 p.m.

December 3, 1960

(5) The first plant of five baskets, three ounces per basket, was made in 40 Rod Creek adjacent to the Daniel Hatchery. The eggs were tempered from 32 plus degrees F. (overnight icing temperature) to 42° F. (40 Rod Creek temperature) before planting. Tempering time was approximately 40 minutes. Time at completion of this plant was 9:30 a.m.

(6) Of the remaining thirteen jars, ton were packed in cases, in sawdust, for transporting to other sites. Three jars were placed in hatchery water to temper before placing them in the incubator.

(7) The second plant of five baskets, three ounces per basket, was made in Pine Creek at the inlet of Fremont Lake. Egg temperature was 32 plus degrees F. and Pine Creek temperature was 33° F. Approximately 5 inches of ice covered Pine Creek at the time of the plant. The baskets were placed in approximately 18 inches of water. Time at completion of this plant was 12:00 noon.

(8) The third plant of 5 baskets, three ounces per basket, was made at the Big Island Bridge in the Green River. The planting site was the same location where eyed kokanee and brown trout eggs were planted in 1958 - and 1959. The river temperature was 32° F., and the egg temperature was 39° F. Tempering time was approximately 45 minutes. The eggs were planted in about 15 inches of water. Time at completion of this plant was 6:00 p.m.

(9) The remaining three jars of eggs were removed from hatchery tempering water and placed in the incubator about 4:30 p.m. The total time elapse from stripping to planting of all eggs was 30½ hours. On March 15th and 16th the first were removed from Pine Creek and the Green River. The remainder of the baskets were removed from the Green River at Big Island Bridge and 40 Rod Creek on April 26, 1960, and from Pine Creek on May 5, 1960. Table No. XI, page 55, shows a tabulation of these egg plants. The results of these green egg kokanee plants were similar to the results of the Salmon-Cultural Laboratory at Entiat, Washington, previously mentioned in paragraph 2, page 50, of this report. The eggs planted in 40 Rod Creek, which maintains a water temperature of 42° F., eyed and hatched at a very high percentage. Those eggs planted in Pine Creek and the Green River at water temperatures approaching 32° F. suffered 100% mortality.

(10) To obtain additional information on planting green eggs, experiments were conducted in the spring of 1960 after the termination of this project. Green rainbow trout eggs obtained from Lake DeSmet fish were planted on April 26, in the same manner as described for the kokanee egg planting experiments. Eggs were planted in the Henry's Fork, The Green River below U. S. Highway 30, the Green River just above the Big Island Bridge and at the Daniel Hatchery as a control. The

investigations were terminated on June 30, 1960 with a 50% to 60% hatch in the experimental groups and an 83% hatch in the control group at the Daniel Hatchery.

The photos below were taken at the site of the Pine Creek plant.

Removing Ice Cover on Pine Creek
in Preparation for Egg Plant

Placing Egg Baskets in the
Artificial Redd

Snow Vehicle Used to Cross Fremont Lake to Planting Site at Mouth of Pine Creek

Ice Removal Over Egg Baskets

Removing Slush and Ice Chips

Egg Basket Removal

## SPAWNING POTENTIAL
(Non-Game Fish)

The fish present in the Green River from LaBarge to the Flaming Gorge damsite are predominately rough fish. Trout populations are present in lesser numbers, and are confined to the section of the Green River from LaBarge to the Big Island Bridge. These trout populations are a direct result of the Wyoming *Game* and Fish Department planting policy. Channel catfish populations are present in the Green River from the Wyoming-Utah State line downstream through the damsite area. These catfish populations are thought to be largely the result of the Utah Fish and Game planting policy for that section of the river.

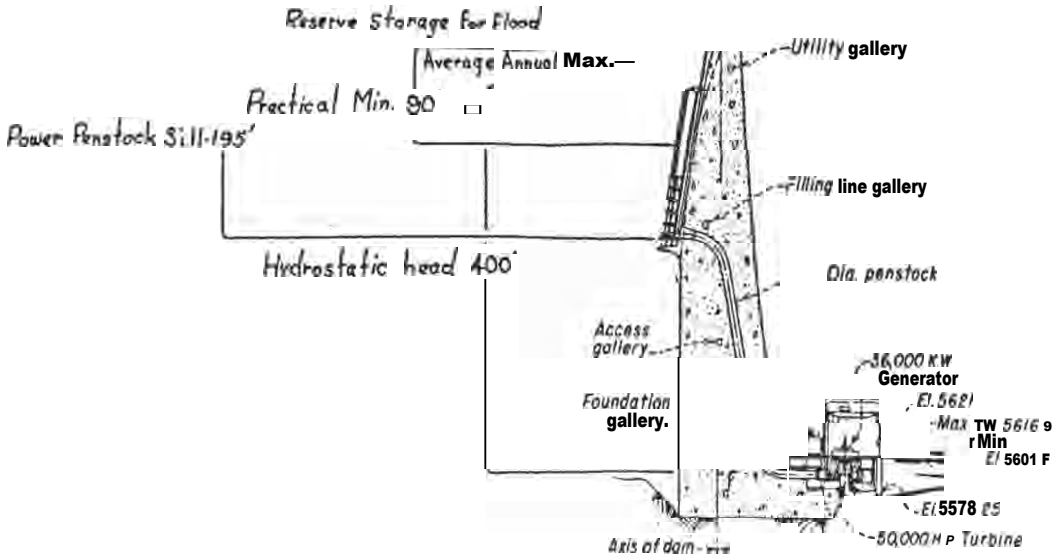
The bonytail, squawfish, carp and sucker represent the larger species of coarse fish which will compete for space and food in the Flaming Gorge Reservoir. Spawning conditions will be excellent for rough fish in the reservoir. Numerous streams will flow into the reservoir to provide spawning areas for suckers. The Green River proper, between the Flaming Gorge proper and the Fontenelle Dam, will also provide adequate spawning area for suckers, squawfish and bonytail.

Anticipated reservoir operation will provide optimum conditions for carp spawning. In the management of other reservoirs in the State, Platte River reservoirs in particular, it has been possible to affect some control of carp populations by lowering, or transferring, water during the carp spawning season. This manipulation of water levels can, and does, strand much of the egg production of the carp on dry land. The procedure followed on the Platte River Reservoir system will be impossible on the Flaming Gorge Reservoir. Under anticipated reservoir operation, the Flaming Gorge will begin filling during the latter part of April or early May. The filling period will extend into the latter part of July, and the reservoir will remain relatively stable until the following January. This filling period coincides with run-off data, Graph 1, page 15. Carp spawning in the reservoir in June and July will be assured an abundance of shallow water areas and stable, or rising, water elevations until the spawn has hatched.

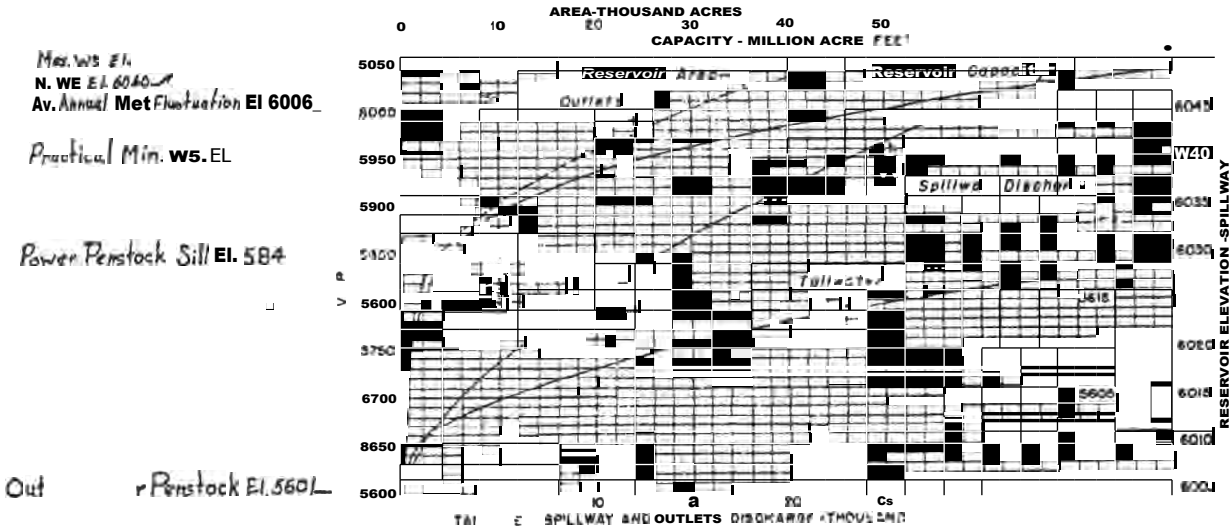
## RESERVOIR FLUCTUATION

The Flaming Gorge Reservoir is designed to operate as a water storage and hydro-electric unit rather than an irrigation project. On this basis, it is reasonable to assume that water releases will be regulated to take full advantage of power producing installations. It has been stated, by Bureau of Reclamation officials, that the hydro-electric units were designed to operate most effectively under a 400 foot hydrostatic head. There is approximately 34 feet of storage above this 400 foot mark.

The average annual maximum fluctuation has been given as 34 feet; however, the practical minimum has been given as 90 feet, see diagram on page 58. Consequently, during any year or period of years, the reservoir could fluctuate as much as 90 feet to meet power commitments. The maps, pages 62 and 63,




**SECTION THRU POWER PLANT**
*IAT PLANE OF CENTERS)*




**TAILWATER, AREA, CAPACITY, AND DISCHARGE CURVES**

Diagrams taken from USBR Plate 59/ - - /42

## PUBLIC ACCESS

Tentative plans have been made by the Wyoming and Utah Game and Fish Departments and governmental agencies concerned with recreational development for construction of seven access areas on the reservoir proper. Four of these sites; Dutch John, Cedar Springs, Sheep Creek and Antelope Flats, are located in Utah. The other three; Lucerne Valley, Holmes Ferry and Marsh Creek, are in Wyoming. It should be noted that Antelope Flats, Lucerne Valley and Sheep Creek sites will be some distance from water at elevation 5,950, which could make these situations unusable for boat launching during portions of the season. The approximate location for these sites have been noted on the practical minimum fluctuation maps, pages 62 and 63. Exact locations are: Holmes Ferry, T15N; R108W; S32, and Marsh Creek, T14N; R108W; S35, 36.

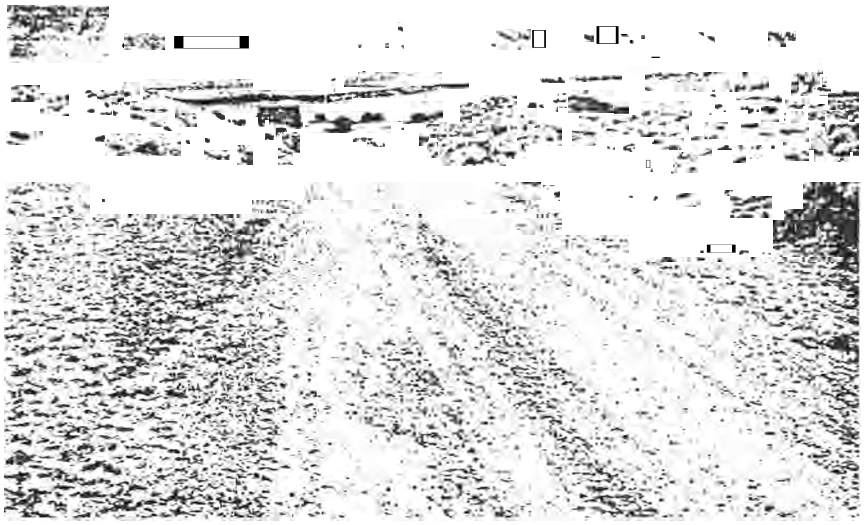


Photo taken at Holmes Ferry Site looking East

As a result of work done on this project and previous investigations, the access sites at Holmes Ferry and Marsh Creek have already been recommended for development by the Wyoming Game and Fish Department. On April 30, 1959, a report was [illegible] to the Secretary of the Interior by the Wyoming Game and Fish Department entitled, "A Report on the Fish and Wildlife Resources and the Future Development of these Resources for the Flaming Gorge Reservoir." A request was made that this report be entered under Section 8, Public Law 485 - 84th Congress, entitled, An Act "To Authorize the Secretary of the Interior to Construct, Operate, and Maintain the Colorado River Storage Project and Participating Projects, and for other Purposes", and Public Law 85 - 624, 85th Congress, Fish and Wildlife Coordination Act. It was also requested that this report be made a part of any report submitted by the Bureau of Reclamation to Congress in order that an appropriate share of the cost of the Flaming Gorge Project be allocated to fish and wildlife purposes.

A section of this report dealing with access requested that funds be made available for development of the Holmes Ferry and Marsh Creek sites.

The following is a breakdown of anticipated expenditures requested in this report.

TABLE XII

Anticipated Fisherman Access Expenditures

| | |
|---|---|
| 20 Acres of Land (Minimum of 10 acres per site) | $ 200.00 |
| Fencing and Cattle Guards (Both Sites) | 1,500.00 |
| Sanitary Facilities (4 units) | 600.00 |
| Garbage Pit Installation (4 units) | 300.00 |
| Two Concrete Launching Ramps 650 feet long by 16 feet wide on 147. grade, @ $20.00 per lineal foot graded and installed | 30,000.00 |
| TOTAL COSTS | $32,600.00 |

DIAGRAM IV
Average Annual Maximum Discharge

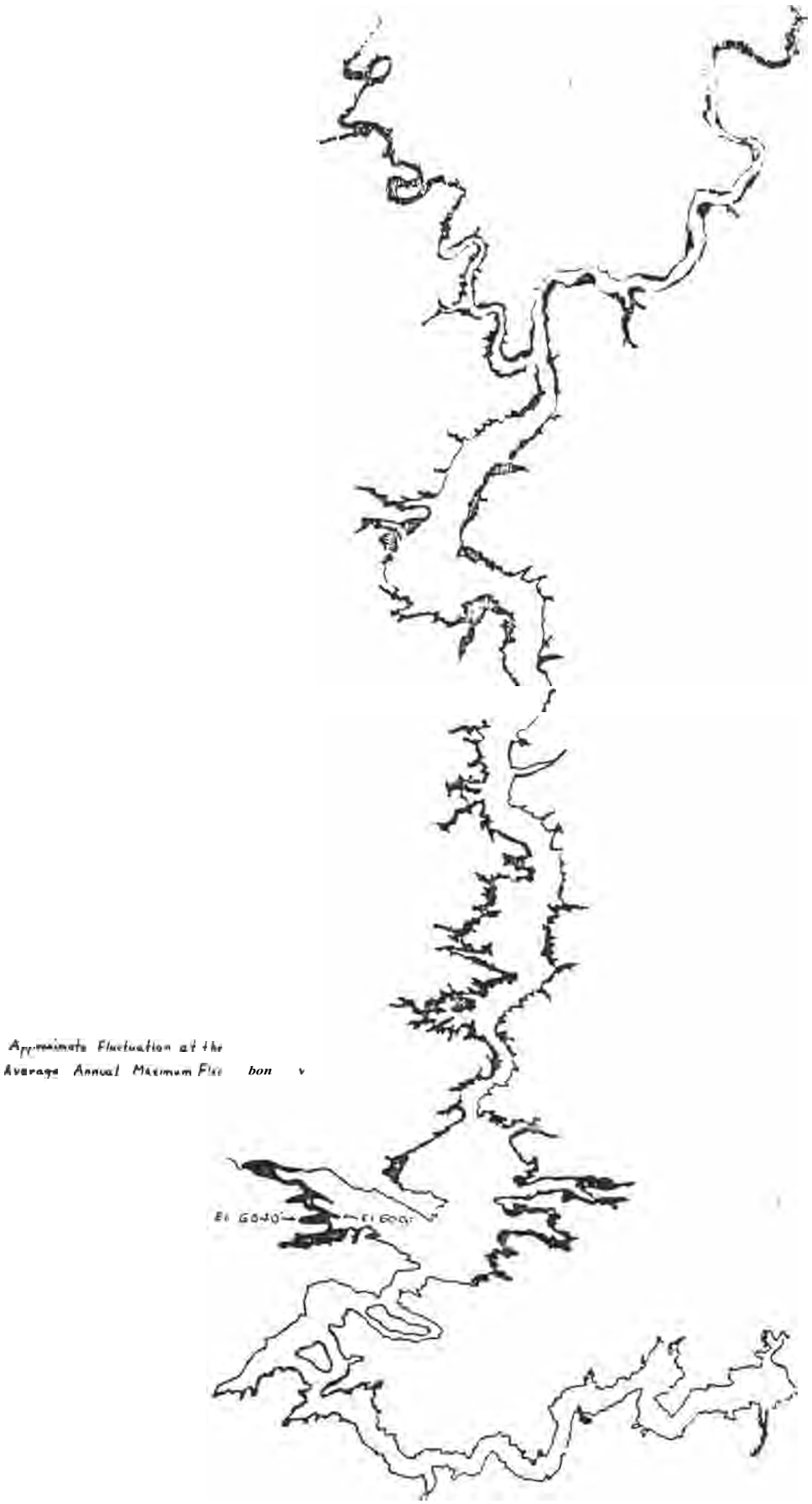
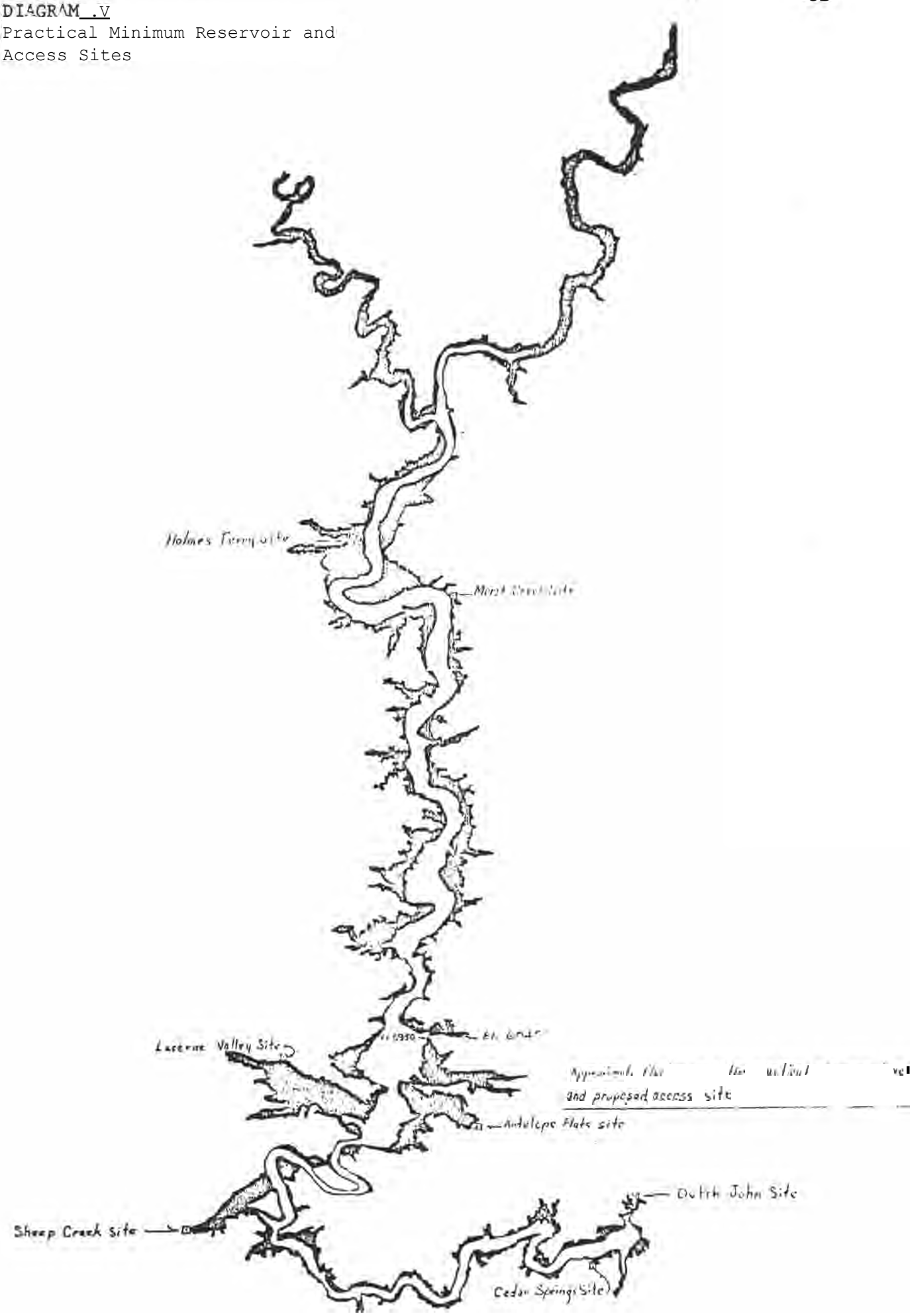


DIAGRAM_.V
Practical Minimum Reservoir and
Access Sites




and proposed access site

## SEEDSKADEE PROJECT

Survey and construction plans are being formulated for the Seedskadee Project. Present plans call for construction of Fontenelle Dam, an earthen structure to be built approximately one-half mile above Station No. 2 of this report. This dam, when completed, will back waters to form Fontenelle Reservoir. There will be 7,000 surface acres in this reservoir at full stage and it will extend some 16 miles up the Green River to the vicinity of Station No. 1 of this report.

The proposed Fontenelle Reservoir will divert direct flows of the Green River, store surplus spring flows and supplement late season flows to provide irrigation water for 59,620 acres of land in the project area. From information on hand at this time, the reservoir will have a total capacity of 285,000 acre feet, and of this storage, 85,000 acre feet or approximately 30% will be used annually for irrigation. Of the remaining water, 5,000 acre feet will be used for fish and wildlife and 195,000 acre feet will be stored in the reservoir as dead storage below the canal system elevations.

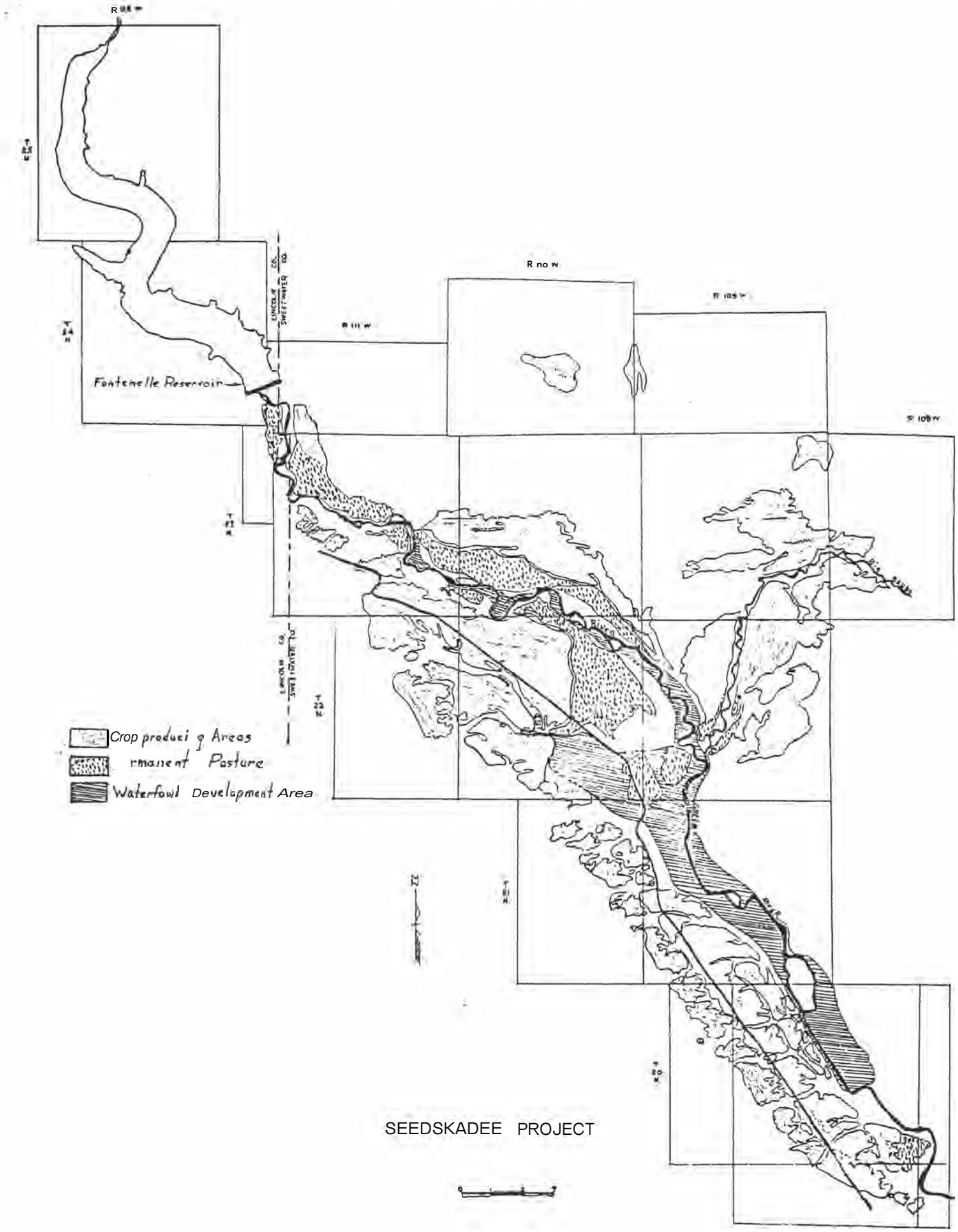
The map, following page, shows the areas to be developed and the waterfowl area to be developed in conjunction with the irrigation project. The waterfowl area was proposed and will be developed by the U. S. Fish and Wildlife Service.

For purposes of classification the U.S.D.A. has divided lands to be developed in this area into four groups; A, B, C, and D. Lands classified into the A, B, and part of C groups are those which lend themselves to crop cultivation.. These crops will be limited for the most part to hay and grains. The majority of crops grown will be utilized in the area on diary farms and for the production of sheep and beef. Lands in the remainder of the C group and all of the D group are recommended for the production of permanent pasture because of shallow, uneven soil depths, high alkaline content of the soil, soil textures, etc.

Extensive drainage installations have been recommended for a large part of the project by the U.S.D.A. The purpose of these drains are to transport irrigation waste and seepage waters away from areas where high water tables are likely to develop. It is anticipated that these waters will be very saline and if allowed to seep back as ground water they would cause the soils on lower cropland benches to become highly alkaline.

DIAGRAM VI.

Seedskadee Project



## DISCUSSION

The Green River will undergo major changes in the next ten years. These changes will affect the entire section of the river within the confines of the study area. Under present conditions, excellent trout habitat exists from the town of LaBarge to the Big Island Bridge. Bottom fauna present in this section of the river ranges from moderate to good. The limiting factor appears to be the relative absence of algal and aquatic plant growth which offer sources of food and attachment. Silt conditions are high during spring run-off, periods of April, May and part of June. The water velocity, however, is sufficient to prevent an accumulation of silt in the riffle, food producing, areas. Silt carrying waters are normally gone by the latter part of June. After this time, silt is introduced only during extensive rainfall.

Chemical analyses, of tests conducted, give no indication that the stream is suffering from a lack or overabundance of any specific chemical or compound. Total dissolved solids show an expected rise at each successive downstream station. This concentration increase is due to the terrain through which the river flows. High salt content of surrounding countryside combined with soils of high drainage texture allow salts to leech from the soil quite readily.

This section of the river contains a limited brown trout population. The population of trout is very good considering the small numbers that have been planted, an average of 6.4 fish per surface acre of stream per year over a twenty-year period.

The majority of this area will either be inundated by the Fontenelle Reservoir of the Seedskadee Project, or have normal stream conditions drastically changed through water manipulations connected with the irrigation phase of the Seedskadee Project. Plans for future management of this area should be based upon anticipated conditions likely to exist after the Seekskadee Project is completed.

The section of the river from the Big Island Bridge to the Wyoming-Utah State Line is one of increasing turbidities. This accumulation of silt is caused by tributaries, and intermittant streams which discharge tons of silt during spring run-off. Stream gradieat is less through this section, allowing large shifting beds of sand and silt to rove slowly through the area. An increase in water temperatures in this area, peaking at 79° F. at Green River, makes this a borderline river for salmonids. Development of aquatic communities is largely restricted to those organisms which are either highly mobile, such as the Ephemeroptera or those such as the Diptera which have few appendages for attachment. Algal growth and aquatic plant development is very light in the area.

Organic pollution contributed by the town of Green River and Rock Springs is not in sufficient quantities to create septic conditions, but coliform organisms are greatly increased and are beyond limits desirable for game fish waters.

Industrial pollution by the U. P. Railroad has been greatly reduced during the last ten years. .Occasional, accidental, spills of oils into the river indicate that adequate safety devices are lacking in the disposal system.

A number of tributaries enter the Green River throughout the study area. These tributaries were investigated during the study in an attempt to evaluate them as potential spawning streams and for possible establishment of sport fish populations. Of the tributaries investigated, Fontenelle Creek in the upper section of the study area, must be eliminated from any consideration given the Flaming Gorge Reservoir. The mouth of Fontenelle Creek lies above the proposed Fontenelle Dam. The Big Sandy River offers nothing from the standpoint of a spawning tributary. The bottom of this stream is composed of very fine sand and silt and excessive silt conditions exist during the majority of the year. These conditions also render the lower section of the Big Sandy River unfavorable for game fish populations. Bitter Creek flow is maintained the greater part of the year by outfall from the Rock Springs Sewage Disposal Plant. Consequently, it can be considered for all practical purposes as a sterile stream. Sage and Currant Creeks contain poor bottom conditions for spawning purposes. Production of food in the lower sections of these streams is also very light. It is doubtful that game fish populations in the reservoir will utilize these streams to any extent. Henry's Fork, located approximately one-fourth of a mile below the Government Bridge on the Green River, has a sand and silt bottom extending some three miles upstream from the mouth. The high water level of the reservoir will extend approximately five miles up Henry's Fork, thus inundating this sandy area. No game species are found in the lower section of Henry's Fork at the present time, but bottom conditions of gravel and sand in the vicinity of McKinnon could furnish limited spawning area to spawning migrants from the reservoir. Sheep Creek supports a trout population at present and will probably continue to do so after the reservoir is completed. The upper section of Sheep Creek contains rainbow and would probably furnish limited spawning area to spring run species. Water flow is zreatly reduced during the fall; spawning area available would be very limited during this period. Carter Creek supports trout populations to its mouth. Recovery of rainbow x native crosses in 1959 indicate that natural reproduction is taking place in the stream. This stream offers the greatest potential of stream tributary to the Green River for natural spawning grounds or development of egg taking operations.

## PAST STOCKING

The Green River from LaBarge to the town of Green River has been known to contain a limited trout population for some time. However, fishing pressure in this section in past years has never demanded that an intensive management program be developed to improve the quality of fishing. Consequently, past hatchery production and other management methods have been diverted for the most part to more heavily utilized areas in the drainage.

The first record of stocking in the study area was November 3, 1939. Since that time, approximately twenty years, there has been 223,449 fish planted. At first glance, this would appear to be a substantial number; however, in analyzing the calculations, it can be seen that the stocking policy has not been very intensive in the section of river within the confines of this study.

**TABLE XIII**

**A Summary of Past Stocking, Green River**

| | |
|---|---|
| **Number of Fish Planted** | **223,449** |
| **Number of miles of stream enclosed within the planting sites** | **87** |
| **Estimated surface acres of stream within the planting sites, based on stream width of 150 to 180 feet** | **1,740** |
| **Average number of fish planted per year, per surface acre of stream during the last twenty years** | **6.4** |

## PLANTING POLICY

During the initial meeting between the Utah Fish and Game and the Wyoming Game and Fish, a number of species were considered for the Flaming Gorge Reservoir. It was decided that the initial stocking policy be restricted to salmonid species, preferably rainbow and kokanee. Stocking rates of rainbow were tentatively set as follows: Minimum - Utah 2,000,000; Wyoming 2,000,000 two-inch fish over a two-year period, and if one inch fish are used the numbers will be doubled. Numbers of kokanee planted will be left to the discretion of the individual states. Following the initial plants, channel catfish, walleye pike, and largemouth bass would be considered. The following discussions are confined to these species and the brown trout.

### Rainbow Trout - (Salmo gairdnerii irideus)

In considering a rainbow trout stocking policy for the reservoir the first year of impoundment, the following factors should be considered:

(1) A rough fish removal program if carried out will place predation and competition for food and space at a minimum. Every advantage should be taken of a situation like this, since it will never occur in the reservoir again.

(2) Water temperatures rise rapidly in the Green River when the ice goes off. Plankton populations should increase early in the reservoir because of this temperature rise.

(3) Reservoir depth should be sufficient at the time the ice goes off in the spring of 1963 to provide cool water areas during summer months.

(4) At least 6,000 surface acres, minimum pool level, is assured the first year of impoundment, 1963. In all probability this acreage will be greater by August. Therefore, stocking rate at a rate of 200 fish per surface acre, based on 6,000 surface acre minimum pool level, should not be excessive. Stocking at this rate would require 600,000 fish from both Wyoming and Utah the first year of impoundment.

### Kokanee Salmon - (Oncorhynchus nerka)

Experiments conducted with eyed and green kokanee salmon eggs gave results similar to those obtained at the Salmon Cultural Station at Entiat, Washington.

Brown Trout - (Salmo trutta fario)

The hatching experiments with eyed brown trout eggs gave evidence of the ability of eyed eggs to withstand low water temperatures and conditions of silting; survival rate was 91.87. at the time of recovery.

Although the consensus of the original meeting between Utah and Wyoming was not in favor of stocking brown trout, the relative merits of this species should be considered before a definite planting policy is established.

The brown trout is the dominant salmonid, in the Green River, from the Daniel Bridge downstream. Evidence that it exists and spawns below the town of Green River was found at the mouth of Sage Creek in 1959. A fingerling brown trout 3 inches long was taken during a check of the species present in this stream. The last, nearest, plant of brown trout was made at Big Island Bridge in 1954. Big Island Bridge is approximately 60 miles above the mouth of Sage Creek.

From the standpoint of natural reproductivity, the brown trout would be well adapted to spawning conditions existing in conjunction with the Flaming Gorge Reservoir. The brown trout would utilize the Green River proper and tributaries with a greater degree of spawning success than any of the other salmonid species. Resident populations of brown trout would be more likely to develop in the area between the backwaters of the Flaming Gorge Reservoir and the Fontenelle Dam, thus reducing the number of species needed to utilize and manage the entire unit.

Walleye Pike - (Stizostedien vitreum vitreum)

In discussions of walleye pike with other fisheries workers, states of Nebraksa, Montana, the Dakotas and provinces of Alberta and Saskatcehwan, one factor invaribly emerges; the inability of fishermen to harvest walleye populations during summer months. During the late fall and early spring fishing seasons, pike are readily taken but catches fall off sharply during the summer. The majority of fishing pressure on the Flaming Gorge Reservoir is anticipated during the months of June, July and August. This pressure is expected to be quite high, estimated initially at 90,000 fisherman days. If walleye pike populations were established in the reservoir, they would be competing with other game fish populations and at the same time furnish little to peak fishing pressures. During periods of drawdown in the winter and early spring, these walleye populations would be forced into the main body of the reservoir normally occupied by rainbow populations. In these instances, predation of young rainbow is likely to be quite high.

Largemouth Bass - (Huro salmonides)

From initial findings a number of factors appear to be in favor of largemouth bass. (1) During full stages the reservoir will offer large areas of shallow water, 0 to 30 feet in depth. These areas lie in the vicinity of the Wyoming-Utah State Line, the mouth of the Black's Fork River, and in the backwaters of the reservoir. (2) Bass spawn from May into July when water

temperatures are in the range of 60 to 68° F. Temperature data, from the Intermountain Chemical Company, and maximum-minimum temperatures recorded at Green River indicate that water temperatures approaching 60° F. can be expected about the last week in May and last until the end of August or early September. (3) Projected reservoir operation calls for the reservoir to be filling, or nearly full, by July so the danger of sudden drops in the reservoir water level, which could harm spawn, is at a minimum. (4) Anticipated rough fish populations will be utilizing the same area as bass so adequate food in the form of rough fish should be available for young bass. Feeding habits of bass indicate that they become inactive in water temperatures below 50° F. The growing season estimated from available water temperature data will be between five and six months long. The heat budget of the reservoir could possibly extend this growing season. Therefore, bass would be available to peak fishing pressures, have a relatively long growing season, yet be inactive during the winter and early spring drawdown periods while in close contact with rainbow populations in the main body of the reservoir. Predation on rainbow would be less in this case with bass populations than with pike populations.

Channel Catfish - (Ictalurus punctatus)

Following construction of the Seedskadee project the Green River below the project may not contain suitable habitat for salmonid species. Silt lying on the river bed, total dissolved solids and water temperatures are expected to increase. River flows will be reduced and confined to a series of long pools connected by a series of shallow areas. Organic matter coming from the project will increase. Bureau officials anticipate that the stream bed, for some ten miles below the project, will be de-watered during the fall of most years. These conditions would appear to favor stocking of channel catfish. Channel catfish have been present in the Green River in the vicinity of the town of Green River in past years. A report of catfish taken above the Green River in 1957 from a plant made in 1955 indicates that populations could be established in the river proper.

## ACCESS

The prime contract on Ashley Dam of the Flaming Gorge Project calls for impounding to begin on September 1, 1962. Except for a 400 cfs. release to maintain fish populations below the dam, no water releases are anticipated during the remainder cf the year. Bureau officials at Dutch John, Utah estimate that by the spring of 1963 the water level will have raised to the 5,866 elevation mark. This elevation will provide approximately 5,000 surface acres of water in the reservoir at the time ice cover goes off in April or May. The majority of this water will be confined in the canyon area immediately above the damsite. Water depth at the damsite at this stage of filling will be approximately 265 feet. The surface of the water will be even with the Green River Bridge crossing at Linwood, Utah. No water releases are anticipated until the reservoir is at or above the minimum pool level. The minimum pool elevation is 5,871 feet. At this elevation there will be approximately 6,000 surface acres of water in the reservoir. The minimum pool elevation should be reached quite rapidly as spring run-off will come shortly after ice cover

is gone. If water and power committments prevent the reservoir level from rising above the 5,871 elevation in 1963, the spring run-off in 1964 should raise it to the full elevation mark, 6,040 feet.

Assuming that the projected plan of reservoir operation is followed, or a plan similar to it, and that the practical minimum level or a level close to it is reached during drawdown, three of the proposed access sites may be unavailable for boat launching purposes from the disappearance of ice cover until sufficient water is accumulated to raise the water level to these facilities. These sites are: Lucerne Valley, Antelope Flats and Sheep Creek. Consequently, early spring fishermen, residents in most cases, will be forced to rely upon the remaining sites. Of the four remaining sites, Holmes Ferry and Marsh Creek offer easiest accessibility because of their graidents.

## SEED SKADEE PROJECT

Development of the Seedskadee will present a definite limitation to the fisheries potential in the Green River from the backwaters of the Flaming Gorge Reservoir to the Fontenelle Dam. The effect of the Seedskadee Project on the Green River will be:

(1) Inundation of approximately 16 miles of the Green River proper. This section produces very little in the way of sport fishing at the present time, but is potentially an excellent site for eventual development of a good trout fishery.

(2) Alteration of normal stream flow rates. - Storage of run-off water and diversion of the Green River onto irrigated lands will change normal flow rates below Fontenelle Dam. There are indications that the river bed will be completely de-watered during the latter part of the irrigating season for the months of August and September. This condition will exist from the damsite downstream to a point where waste and seepage waters are returned through drainage installation in sufficient quantities to create a stream flow.

(3) Increased water temperatures. - Diversion of large volumes of the Green River onto irrigated fields will expose it to warm air temperatures and the sun. Return of this water through proposed drainage facilities will cause a temperature rise in water in the river channel.

Temperatures taken at the town of Green River in 1958 showed a peak temperature of $79^{o}$ F. during the month of July under normal flow conditions. This temperature if prolonged or increased for any length of time would very likely eliminate any trout populations in this section of the river.

(4) increased total dissolved solids. - The drainage installations recommended for the Seedskadee Project are to carry irrigation waste and seepage water back into the river. Under this drainage system, salts that might have been deposited in lower sections of the land will be carried directly into the river channel. These salt concentrations are expected to be quite high initially. Reduction in concentrations will depend on irrigation practices. Heavy applications

of water will result in deeper penetration, thus greater and prolonged leeching of alkaline materials from the soil will result.

(5) Increased turbidities. - The Green River carries a heavy silt load during spring run-off, but is normally quite clear by July. Under anticipated operations the Seedskadee Project will contribute silt from irrigation waste waters until the latter part of September.

The Big Sandy River contributes a large part of the silt carried in the Green River during the summer months. A combination of silt carrying waters from the Big Sandy, anticipated silt load in irrigation water from the Seedskadee Project, plus a reduction of river flows and the associated diluting effect in the Green River below Fontenelle Dam may contribute materially to the elimination of game fish habitat from the mouth of the Big Sandy River downstream.

## RECOMMENDATIONS

It is recommended that the trash fish populations in the Green River above the Flaming Gorge impoundment area be depressed to the greatest possible extent. This would necessarily be accomplished by a complete chemical treatment program cooperatively initiated by the states of Wyoming and Utah. It is also recommended in view of the fact that carp populations have been found by the fisheries management crew in the Green River proper as far upstream as the mouth of the New Fork River, in the New Fork River as far as the mouth of the East Fork River, in all the sloughs and tributaries included in these drainage sections, that the chemical treatment be extended to include these areas. Also, this treatment should be extended up the Green River beyond the mouth of the New Fork River to the mouth of Horse Creek. Omitting these upper sections would only result in an accelerated re-infestation of trash fish in the treated areas.

The following chart is an itemized cost of treating the section of the Green River proper as described above and the tributaries entering the Green River throughout the proposed area of treatment. This estimation was prepared by Fred W. Jackson, District Fisheries Biologist.

The estimates of toxicant quantities is based on the average water flows during the latter part of September and early October. Present plans call for impoundage to begin in September, 1962. Toxicant applied in the fall of 1962 would allow time for dissipation before stocking in the spring of 1963. Timing of toxicant application and dam closure will have to coincide as any delay would result in a pool being formed which would make the cost of treatment prohibitive.

In the event that the dam is not completed until the spring of 1963, the estimates may be revised to fit spring flows by multiplying the gallons of rotenone and cost by a factor of four.

Table XIV

GREEN RIVER TOXICANT ESTIMATES BASED ON STATIONS AT TEN-MILE INTERVALS

| Name of Stream | Stream Section | Miles of Stream | Probable CPS for Sept-Oct | Number of Sta. | Drip-Barrels Per Station | Total Drip-Barrels | Total Gals. of Rotenone for all Sta. for 5 ppm. | Est. Cost of Rotenone at $7.15 per gal. |
|---|---|---|---|---|---|---|---|---|
| Green River | Horse Cr. to New Fk. R. | 47 | 400 | 5 | 4 | 20 | 1,616 (A) | $11,554.40 |
| Green River | New Fk. to Seedskadee | 70 | 750 | 7 | 4 | 28 | 4,242 (A) | 30,330.30 |
| Green River | Seedskadee to Green R. | 80 | 800 | 8 | 4 | 32 | 5,170 (A) | 36,965.50 |
| Green River | Green R. to Linwood, Utah | 70 | 900 | 7 | 4 | 28 | 5,089 (A) | 36,386.35 |
| New Fk. River | Boulder Cr. to East Fk. R. | 5 | 200 | 1 | 3 | 3 | 162 (A) | 1,158.30 |
| New Fk. River | East Fk. R. to Mouth | 21 | 250 | 2 | 3 | 6 | 404 (A) | 2,888.60 |
| East Fk. River | Lower Mile | 1 | 50 | 1 | 1 | 1 | 21 (B) | 150.15 |
| Horse Creek | Lower Mile | 1 | 30 | 1 | 1 | 1 | 12 (B) | 85.80 |
| Cottonwood Cr. | Lower Mile | 1 | 60 | 1 | 2 | 2 | 24 (B) | 171.60 |
| Muddy Creek | Lower Mile | 1 | 30 | 1 | 1 | 1 | 12 (B) | 85.80 |
| No. Piney Creek | Lower Mile | 1 | 60 | 1 | 2 | 2 | 24 (B) | 171.60 |
| Mid. Piney Creek | Lower Mile | 1 | 30 | 1 | 1 | 1 | 12 (B) | 85.80 |
| So. Piney Creek | Lower Mile | 1 | 80 | 1 | 2 | 2 | 32 (B) | 228.80 |
| LaBarge Creek | Lower Mile | 1 | 60 | 1 | 2 | 2 | 24 (B) | 171.60 |
| Fontenelle Creek | Lower Mile | 1 | 60 | 1 | 2 | 2 | 24 (B) | 171.60 |
| Big Sandy Creek | Little Sandy to Mouth | 40 | 30 | 4 | 1 | 4 | 98 (A) | 700.70 |
| Black's Fork | Granger to Mouth | 70 | 100 | 7 | 2 | 14 | 567 (A) | 4,054.05 |
| Henry's Fork | Burnt Fk. Bridge to Mouth | | 40 | 4 | 1 | 4 | 130 (A) | 929.50 |
| TOTAL | | 452 | | 54 | | 153 | 17,663 (322 55-gal. drums.) | $126,290.45 |

NOTE: For estimate for toxicant costs for period May 1 through May 15 multiply by a factor of 4.

(A) 6 hour station
(B) 3 hour station

It is recommended that after rotenone dissipation, rainbow be stocked in the Flaming Gorge Reservoir following the disappearance of ice cover in the spring of 1963. It is further recommended that the fish be two to four inches in size and stocking rates be set at 200 fish per surface acre, based on the 6,000 surface *acre* minimum pool level. Stocking at this rate will require 600,000 fish from the State of Wyoming and 600,000 fish from the State of Utah. All fish stocking should be made far enough into the canyon area to keep the effects of silt, carried in the Green River during spring run-off, at a minimum. It is also recommended that the majority of these fish be planted from a boat to insure proper distribution.

Under adverse stream and apparent borderline eyeing conditions, it is recommended that kokanee salmon be removed from the list of game fish species being considered for the Flaming Gorge Reservoir.

It is recommended that walleye pike not be stocked in the Flaming Gorge Reservoir until all other species being considered have been given trial and proven unsuitable.

It is recommended that following initial plantings of rainbow trout and the establishment of fluctuation patterns in the reservoir, a study be initiated to determine the feasibility of establishing largemouth bass. These studies should include the approximate water level at the time spawning temperatures (60 to 68° F.) are reached, the location, and amount of suitable spawning area present, and habitat areas existing during full reservoir conditions.

It is recommended that following impoundment of the Fontenelle Reservoir of the Seedskadee Project, channel catfish be stocked in the section of the Green River between the two reservoirs and in the backwaters of the Flaming Gorge Reservoir. It is also recommended that no fish be planted in the Green River proper below the town of Green River until an adequate disposal system is installed.

It is recommended, if coliform counts in the Green River below the mouth of Bitter Creek are not reduced to acceptable numbers by the installation of the sewage lagoon system at the Town of Green River, Rock Springs should then be requested to increase the efficiency of their disposal plant to further reduce these counts to acceptable health standards.

# APPENDIX

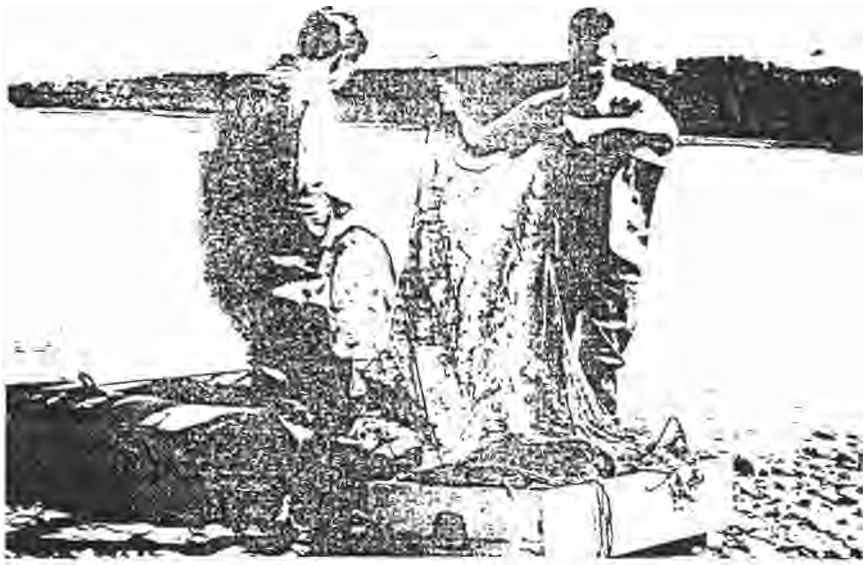
Fish Collecting Gear and Methods

## FISH COLLECTING GEAR

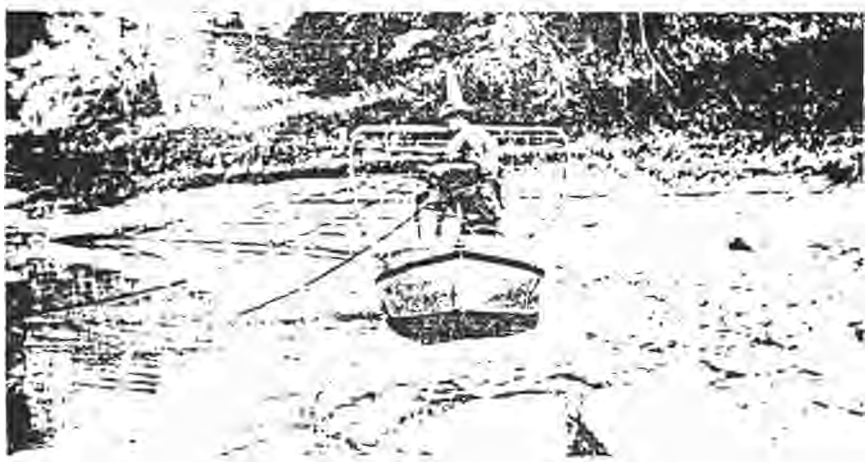
### Experimental Gill Nets:

The experimental gill net was the most widely used piece of equipment for fish collecting purposes. This was due primarily to manpower shortages which made it impossible to operate the shockers effectively.

Gill nets were most effective immediately after ice cover had gone from the river and in the early summer. [illegible] water conditions in June and July brought large amounts of beaver c[illegible]s and trash into the gill netting area, fouling many of the net sets. [illegible] amounts of floating algae had a similar effect in the late summer. Algae, at times, formed almost a solid wall on the nets sweeping them into shore on the downstream side.



Gill Netting at Mouth of the Big Sandy River



Gill Netting in the Flaming Gorge Canyon

Shockers:

Water velocity on many occasions made electro-fishing very difficult with the DC shocker. The DC was often "drawndown" to a point where much of its effectiveness was lost, and it would not hold fish long enough to capture them. In these situations the 115 volt 60 amp. shocker in combination with the electric seine was used very effectively.

The following photos show the electric seine being assembled and stream conditions under which it was used.

Assembling the Electric Seine

Shocking Deep Water Area with Electric Seine

ACKNOWLEDGEMENTS

Gratitude is expressed to Dr. Seville Flowers of the University of Utah for the time which he spent identifying plant specimens collected during this study.

I am also indebted to Mr. E. L. Heinschel of the Intermountain Chemical Company for making additional chemical and physical data available for this report.

Thanks also go to the personnel of the Pinedale Fisheries Management Unit and Mr. Ralph Garbutt, Superintendent of the Daniel Hatchery, for assistance in field collections.

A note of appreciation is also extended to Mr. Fred M. Eiserman, Supervisor of Fisheries Management, Wyoming Game and Fish Department, for the time he spent in editing and the numerous suggestions which he made during the course of this project.

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