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Ecological Studies of the Flora and Fauna of Flaming Gorge Reservoir Basin, Utah and Wyoming

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The University of Utah Anthropological Papers are a medium for reporting to interested scholars and to the people of Utah research in anthropology and allied sciences bearing upon the peoples and cultures of the Great Basin and the West. They include, first, specialized and technical record reports on Great Basin archeology, ethnology, linguistics, and physical anthropology, and second, more general articles on anthropological discoveries, problems and interpretations bearing upon the western regions, from the High Plains to the Pacific Coast, insofar as they are relevant to human and cultural relations in the Great Basin and surrounding areas.

For the duration of the archeological salvage project for the upper Colorado River Basin which the University has undertaken by contract agreement with the National Park Service, reports relating to that research program are being published as series within a series, bearing numbers in the general sequence of the papers as well as their own identifying numbers.

The Upper Colorado and Glen Canyon subseries will represent a wider range of the sciences and humanities than the parent series itself. The project provides for studies of the natural history of the Glen Canyon area and its inhabitants so that the relationships of the prehistoric cultures and their settings will be understood in depth. As contact with Western peoples and cultures has had a varying effect upon the native Americans and the land, some papers will be concerned with the Colorado in the more recent past.

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UNIVERSITY OF UTAH
DIVISION OF BIOLOGICAL SCIENCES

ECOLOGICAL STUDIES
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of the
FLORA AND FAUNA OF FLAMING GORGE RESERVOIR BASIN,
UTAH AND WYOMING

Articles by

Seville Flowers, Heber H. Hall, Gerald T. Groves; Don M. Rees
and Beng C. Ho; George F. Edmunds and Guy G. Musser; Jean Musser;
Joann Sessions and Arden R. Gaufin; Arden R. Gaufin, Gerald R.
Smith and Phil Dotson; John M. Legler; Clayton M. White and
William H. Behle; and Stephen D. Durrant and Nowlan K. Dean.

ANGUS M. WOODBURY, Biological Editor

Number 48 (Upper Colorado Series Number 3) November, 1960

ANTHROPOLOGICAL PAPERS

Department of Anthropology

ACKNOWLEDGEMENT

The courtesy of the Division of Biological Sciences, University of Utah, in releasing this paper for publication in the Anthropological Series, instead of the Divisional Biology Series is acknowledged with appreciation.

FOREWORD

Following approval by Congress of the program for development of the Upper Colorado River Basin (Federal Public Law 485, 84th Congress, 1956), a series of investigations was initiated in the anticipated reservoir basins. Biological investigations in Glen Canyon were reported in University of Utah Anthropological Papers, Nos. 31 (1958), 36 and 40 (1959). The present publication deals with studies conducted in the Flaming Gorge Reservoir Basin on Green River located in northeastern Utah and southwestern Wyoming.

The Glen Canyon studies of 1957 and 1958 were conducted by the University of Utah under contract agreement with the U. S. National Park Service and the U. S. Bureau of Reclamation, under which the University Department of Anthropology conducted archeological salvage operations and the Division of Biological Sciences participated in biological investigations.

The Flaming Gorge studies of 1959 conducted by the Division of Biological Sciences were undertaken primarily for the Bureau of Reclamation to make a survey of the vegetation that will be inundated by the reservoir. Through assistance from the University Research Fund and the cooperation of the Utah State Department of Fish and Game, the studies of the expedition were extended to include a survey of both aquatic and terrestrial fauna.

Through the courtesy of Dr. Jesse D. Jennings, head of the University Department of Anthropology, results of the Flaming Gorge studies will be published in the same series with those from Glen Canyon. The survey of vegetation for the Bureau of Reclamation is published in University of Utah Anthropological Papers, No. 45. The present number contains by-products of the expeditions and deals with ecological studies of the flora and fauna. The field data upon which these papers are based comes mainly from two expeditions down Green River in 1959, but the various authors have not hesitated to draw upon their respective backgrounds in the general region.

In anticipation of this work, Drs. Angus M. Woodbury, Stephen D. Durrant and Seville Flowers flew over the reservoir area in a commercial plane from Vernal, Utah to Green River, Wyoming and back on August 27, 1958. To supplement this perspective, Drs. Woodbury and Durrant reconnoitered the reservoir site by automobile from Green River, Wyoming to Dutch John, Manila, and Green Lakes, Utah, September 23 and 24, 1958.

To make detailed plans for field work, a boating trip was made June 9-11, 1959 from a point near Green River, Wyoming, river mile 383.1 left, downstream to Hideout Forest Camp, Utah, mile 306.8 right. The personnel of this trip included Don M. Rees, head of Division of Biological Sciences; Angus M. Woodbury, Principal Investigator; Stephen D. Durrant, field



Fig. 1. A scene in the canyons of Flaming Gorge Reservoir Basin showing part of the crew preparing to move. Photo by Phil Dotson.

director of Expedition; Seville Flowers, field chief of the vegetation survey; Arden R. Gaufin, Limnologist; and Bruce Lium, boatman. On this trip, detailed plans for a summer expedition were finalized.

The summer expedition, organized and equipped during May and June, reached Green River, Wyoming June 29 and spent the intervening time until August 2 surveying the reservoir basin (Fig. 1). The crew consisted of 16 scientists and two boatmen, as follows: Dr. Stephen D. Durrant, field director of the expedition; Dr. Seville Flowers, field chief of vegetation crew; Harvey H. Brady, Antone Brooks, Richard Dawson, Orland Ned Eddins, Gerald Groves, Heber H. Hall, Gideon Herrmann, Guy G. Musser, Gary L. Ranck, and Clayton M. White, members of the vegetation survey crew; Nowlan K. Dean, Beng C. Ho, and Gerald R. Smith, faunal study team; Phil Dotson, representing the Utah State Department of Fish and Game; and two brothers Dean Allan and David Allan, representing the Hatch River Expeditions.

Since the survey of vegetation was the primary objective of the expedition, the vegetation party set the pace and the faunal crews adapted their operations to fit. There was, however, a good "esprit de corps" manifest and much cooperation was evident between members and between crews. Exchange of observations between them was a common practice.

The field data thus accumulated was studied during the winter and the results are reported in this publication. Crew members that had secondary interests in addition to their main responsible tasks were encouraged to gather such data as became available to them and much of such information is incorporated in the articles published here.

Both expeditions progressed downstream from the upper end of the anticipated reservoir to the dam site. Points along the way were recorded in terms of river miles (abbreviated as R.M.) above Greenriver, Utah as given on the USGS Plan and Profile maps of Green River (sheets H, I, and J). The reservoir with its upper limit at R.M. 378, about eight miles below the city of Green River, Wyoming, extends downstream about 56 miles to the Wyoming-Utah state line (R.M. 322) and 32 miles in Utah to the dam site (R.M. 290) near the new town of Dutch John, Utah. Green River is joined by Blacks Fork at R.M. 356.6R, by Henrys Fork at 318.4R, by Sheep Creek at 309.2R, and smaller tributaries at many other places. A river mileage table is given in University of Utah Anthropological Paper No. 45, p. 118.

Angus M. Woodbury

STUDIES OF THE
FLORA AND FAUNA OF FLAMING GORGE

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VEGETATION

of

FLAMING GORGE RESERVOIR BASIN

SEVILLE FLOWERS

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Fig. 1. A view of terrace and hillside vegetation at the junction of Blacks Fork (right) and Green River, mile 356; shadscale, hop sage, and little sage-brush in foreground; greasewood on terrace across river. Photo by Gerald Groves.



Fig. 2. View of Green River showing scanty fringe of vegetation below the high water level. Photo by Phil Dotson.

INTRODUCTION

During the summer of 1959 two expeditions were made by boat down the Green River from Green River City, Wyoming to the site of the Flaming Gorge Dam, Utah. The purpose of these expeditions was to make a survey of the vegetation of the regions bordering the Green River and its tributaries, specifically the areas which will eventually be inundated by the Flaming Gorge reservoir. A three-day reconnaissance trip was made by boat early in June to get a general idea of the physical conditions, to make plans for a larger expedition, and to make a preliminary study of the vegetation. Results of the main survey are reported elsewhere (UUAP 45). The purpose of the present paper is to present a general ecological account of the vegetation. During the two trips, specimens of plants were collected and notes on plant communities, ecological factors and general floristics were recorded. Special attention was given to the topography, geology, soil, soil moisture and climate as the principal ecological influences determining the distribution and composition of the various plant communities encountered. Since the studies were made in two topographically different regions the present account is more or less two-fold in nature.

TOPOGRAPHY

The area under consideration extends southward from the Kincaid Ranch, located nine miles below Green River city, Wyoming, southward downstream, 88 river miles to Flaming Gorge Dam site near the new town of Dutch John, Utah. The elevation at the upper end of the reservoir is 6,040 feet and at the Dam site it is 5,605 feet, which represents a 435 feet fall in the river. The total area includes two distinct topographic regions, a northern desert region and a southern mountainous region.

NORTHERN DESERT REGION

The general aspect of the larger northern region presents a desolate treeless desert of rolling hills (Fig. 1) of drab or grayish color, cut by numerous dry gullies and gulches and a few wide shallow valleys where low shrubs and much exposed bare soil are continuous as far as the eye can see. The major contrast is the deeper valley of the Green River which bisects the area from north to south in a tortuous course. It is flanked on each side either by rolling hills arising gently from the river or by abrupt discontinuous cliffs and promontories cut in the horizontal beds of sandstone and shale. The cliffs vary from low ledges to cliffs about 300 feet high while a few buttes arise above the general level of the uplands and stand out as landmarks in the otherwise rolling country.

The Green River varies, in this region, from about 30 feet to more than 300 feet in width according to the local topography. It is joined by Blacks Fork Creek from the northwest about 30 miles below the city of Green River, Wyoming; Henrys Fork Creek enters from the west, below the Wyoming-Utah boundary. The

main permanent streams entering from the east are Bitter Creek, which enters at the city of Green River, and Carrant, Upper and Middle Marsh Creeks at the midpoint of the area, but all are small brooks.

SOUTHERN MOUNTAINOUS REGION

The second topographic region to the south, as one progresses downstream, is first encountered in the form of hogback ridges called The Glades which extend in a more or less east-west direction in the vicinity of the Utah-Wyoming state boundary. These are bounded on the south by Lucerne Valley, through which Henrys Fork Creek flows from the west, and Spring Creek Valley (also called Chokecherry Draw) from the east. The southern boundaries of these valleys are Bear Mountains and the short Dutch John Mountains which arise abruptly from about 5,700 feet to elevations between 7,000 and 8,000 feet. These mountains are a part of the Uinta Range and form a sort of northern tongue branching off and extending parallel with the main range. The Green River cuts through them by way of the tortuous Flaming Gorge, Horseshoe Bend, and Kingfisher canyons. The latter swings eastward and is joined by Sheep Creek Canyon entering from the west, at which point Red Canyon (including Hideout Canyon) begins and continues eastward beyond the dam site to Browns Hole, Colorado. These canyons are profoundly deep with high bounding cliffs and extremely steep, rough and rocky slopes. A discontinuous fringe of bright green trees and shrubs borders the river alternating with vertical cliffs and ledges reaching the water edge while darker green shrubs and coniferous trees stand out against the red, gray and drab rocks of the uplands. Compared with the monotonous gray desert to the north, this is a region of savage beauty.

GEOLOGY

From the region north of Green River city, Wyoming southward to the Wyoming-Utah state boundary the rocks are composed almost entirely of more or less horizontal bedded Tertiary strata, especially those to the west of the river and north of the city. Ten to 15 miles east of the river, these rocks are gently arched upward around the Baxter Basin anticlinal dome across which erosion has removed them completely, exposing the underlying Cretaceous rocks. The latter dome is roughly oval in shape with the long axis extending in a north-south direction east of the town of Rock Springs, entirely within the drainage basin of Bitter Creek, which drains into Green River at Green River city.

Only the Tertiary rocks along the course of the main river form the setting of the current study. The youngest of this series, lying next above the Cretaceous rocks, are alternating layers of soft yellowish, brown and white sandstones and drab, gray and carbonaceous shales of the Wasatch formation. These are overlaid by the Green River formation composed of a narrow exposure of the Tipton shales with intercalated beds of sandstone and oolitic limestone with some concretionary beds, the Cathedral Bluffs red beds, the Laney shale member and the Tower sandstones of Powell through which the main channel of the Green River is cut. Most of these rocks are more or less horizontal with local shallow dips. Many of these beds carry soluble salts which impart a mildly saline quality to the soils of the region.

The Uinta anticline extends in an east-west direction in Utah while the northern limb extends along the Utah-Wyoming boundary where the Tertiary rocks are arched upward with a northward dip and give way to exposures of Cretaceous beds of Mesa Verde sandstones and Mancos shale which dip northward at angles ranging from 20° to 50°. In turn these beds are followed by exposures of Jurassic, Triassic and Carboniferous rocks in the Flaming Gorge area and include several strata, the most conspicuous of which are the Navajo sandstone of the Jurassic (Flaming Gorge proper), and Weber quartzite (actually a white sandstone) and the Park City formation of thick-bedded limestone with thinner beds of shale and chert of the Carboniferous in the regions of Horseshoe and Kingfisher canyons. These rocks are on the downward thrust of a large fault which cuts them off in an irregular east-west direction while the upward thrust abruptly exposes the massive reddish Precambrian sandstones through which Red Canyon is cut.

CLIMATE

Rainfall and temperature data have been recorded for many years at stations lying mainly to the north of the present area while the station at Manila, Utah is the only one within it. These data, however, are reflected eloquently by the vegetation and show an annual average precipitation of about eight inches and an average temperature of about 49° Fahrenheit in the northern desert areas. The mountainous southern section shows about 12 inches average precipitation at elevations of about 6,000 feet. The latter figures are estimated from data recorded at stations somewhat removed from the immediate areas. At higher elevations in the mountains the rainfall is greater and the average temperatures lower.

The following table gives the annual average precipitation and temperature at certain stations in the general region.

Table 1. Climatological Data for the Green River — Flaming Gorge Region

<u>Location</u>	<u>County</u>	<u>Elevation</u>	<u>Average precipitation in inches</u>	<u>Average temperature degrees F.</u>
Wyoming:				
Evanston	Uintah	6,860	13.16	39.4
Kemmerer	Lincoln	6,954	8.72	37.9
Green River	Sweetwater	6,083	7.68	43.8
Rock Springs	Sweetwater	6,271		
Utah:				
Manila	Daggett	6,225	10.36	42.8
Hole-in-Rock	Summit	8,300	15.79*	- -
Trout Creek	Uintah	9,200	11.78**	- -

* from fragmentary data

** data from June to October only

VEGETATION OF THE NORTHERN DESERT REGION

Physiographically the vegetation may be divided into three general types, depending upon the amount of available groundwater, and are designated as follows: 1. River bank or streamside communities, 2. Terrace communities and 3. Hillside communities.

River bank communities occupy the area immediately adjacent to the streams including the zone of fluctuation between high and low water levels and that portion of the higher ground where the subsoil is kept wet by percolating water during most of the summer season. Also included in this category, as a subdivision, are the hydrophytic communities in and around seepage areas, springs, oxbow ponds and low swampy situations. Terrace communities are those adjacent to the river banks where the surface soil is usually dry but the subsoil is kept moist by capillary water from the river or by precipitation water percolating from the uplands above. The hillside communities are dependent entirely upon precipitation water as the subsoil is comparatively dry.

RIVER BANK COMMUNITIES

Along the greatest extent of the river and its tributaries, the river bank vegetation occupies a relatively narrow zone ranging from a few feet to as much as 10 or 15 feet wide but in a few places where the valley broadens, low-lying bars and islands ranging upwards to 150 yards wide and as much as five miles long may be occupied by fairly dense growths of river bank types of plants. At the other extreme, the vegetation may form only a scanty fringe (Fig. 2) or be entirely lacking where steep rocky slopes or cliffs extend to the water edge.

According to the size and general aspect there are two communities occupying the river banks, either low herbaceous forms or shrubs and small trees.

Herbaceous communities

Perhaps as much as three-fourths of the linear extent of the river bank is occupied by herbaceous plants in communities varying in general aspect from extremely scanty growths to local concentrations of plants where the density may reach as much as 80 to 90 per cent. Muddy banks predominate along most of the river course with limited local areas showing varying amounts of shingle, some of them culminating in extremely rocky deposits. On the whole, these substrata harbour about the same species of plants with local variations in composition and density.

There are three dominant species of herbaceous plants. The Baltic rush, Juncus balticus Willd. (Fig. 3), is an erect rush with slender dark green leafless stems and spreading by underground stems, or rhizomes, which send up aerial shoots either in straight rows or in dense clumps. The stems, which range from cylindrical to somewhat flattened, are more or less twisted and range from one to three feet in height. The flowers are borne in what appears to be a lateral subterminal panicle, but actually the clusters are terminal with a cylindrical

bract extending vertically and continuous with the stem. Each flower has three sepals and three petals of greenish-brown color, three stamens and a three-celled ovary maturing as a brown capsule.

The spike rush, Eleocharis palustris (L.) Roem. & Schult., also has erect, strict, leafless, nearly cylindrical stems spreading by rhizomes, but it is more slender and of a brighter green color than the baltic rush. In the present region it is much smaller, ranging from about six inches to about 18 inches tall. The flowers are grass-like and brown chaffy at maturity, densely clustered together in small terminal spikes.

The silverweed, Potentilla anserina L., is a low prostrate plant spreading by stolons and bearing compound pinnate leaves densely covered with silvery-white appressed hairs, especially on the underside. The flowers are about one inch across, bright yellow, resembling a buttercup, and are borne on short stalks close to the ground. It is a member of the rose family.

Since much of the herbaceous flora lies between the high and low water levels, the vegetation is scanty along the greatest extent of the banks with local dense stands here and there. Often there are long stretches of barren shingle or mud and these stands of rushes may occur in thin scattered clumps, scarcely adding more than a tinge of green to the dark brown mud. In local areas where these three plants are better established, they form a dense dark green stand of slender erect stems, six to 18 inches tall. Likewise the silverweed may occur as scattered individuals but in a few places it may form a dense mat by the spreading stolons, the leaves closely appressed to the wet soil.

Some of the less frequent plants may form local dense stands as in the instances of the reed, Phragmites communis Trin.; the saltgrass, Distichlis stricta (Torr.) Rydb.; dropseed muhly, Muhlenbergia aspirifolia (Nees & Mey.) Parodi; the saltwort, Glaux maritima L.; and the Kansas horsetail, Equisetum kansanum Schaffn.

Less common but sometimes conspicuous are the following:

<u>Equisetum arvense</u> L.	Meadow horsetail
<u>Triglochin maritima</u> L.	Arrow grass
<u>Scirpus americanus</u> Pers.	American rush
<u>Scirpus paludosus</u> A. Nels.	Marsh rush
<u>Rumex mexicanus</u> Meisn.	Mexican dock
<u>Polygonum amphibium</u> L.	Water smartweed
<u>Ranunculus cymbalaria</u> Pursh.	Trailing buttercup
<u>Radicula lyrata</u> (Nutt.) Greene	Yellow watercress
<u>Glycyrrhiza lepidota</u> Nutt.	Wild licorice
<u>Apocynum cannabinum</u> L.	Indian hemp
<u>Solidago trinervata</u> Greene	Goldenrod
<u>Aster brachyactis</u> Blake	Marsh aster
<u>Gnaphalium palustre</u> Nutt.	Cudweed
<u>Cirsium scariosum</u> Nutt.	Meadow thistle
<u>Leontodon taraxacum</u> L.	Common dandelion



Fig. 3. Baltic rush bordering Currant Creek. Photo by Phil Dotson.

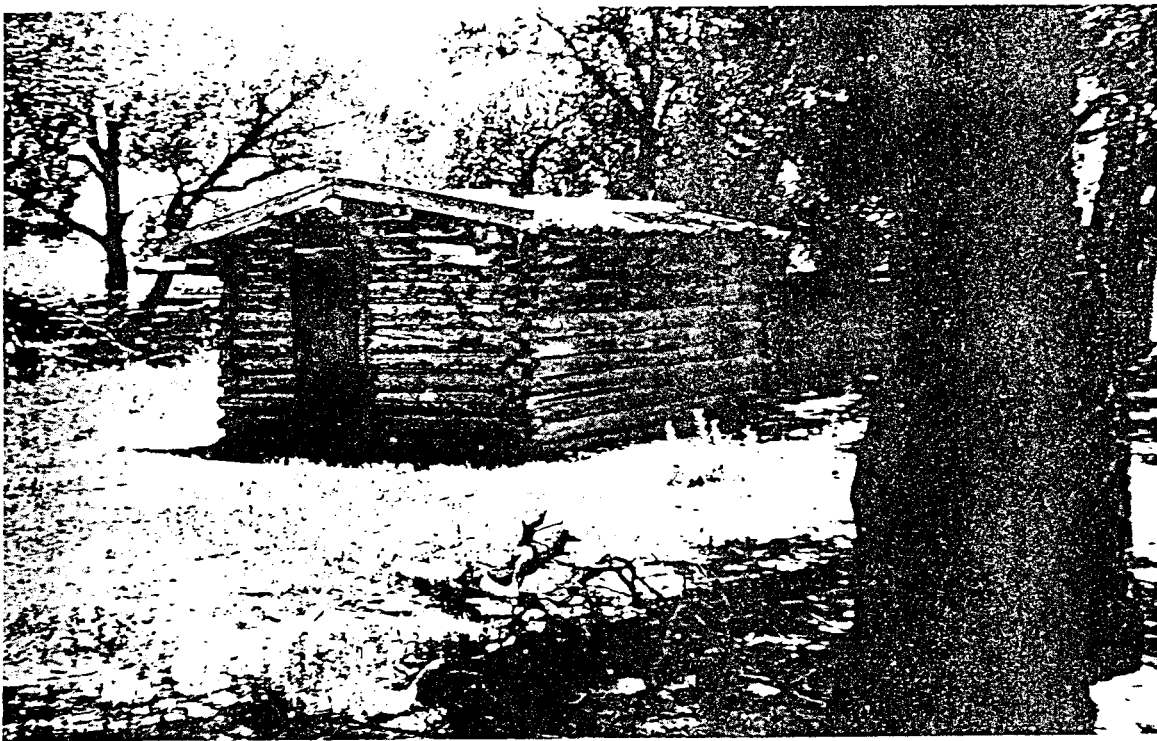


Fig. 4. A log cabin among trees of streamside and terrace trees.
Photo by Phil Dotson.

The horsetail, rushes, wild licorice and Indian hemp tend to form local colonies but the other species are more generally scattered. The Mexican dock, goldenrod and meadow thistle are widely scattered but stand out conspicuously on bare mud banks or among smaller plants because of their taller shoots.

A scattered stand of the rare Equisetum glabella (Nutt.) Walp. was found on a bare bank near the foot of high cliffs.

Near the Utah-Wyoming state boundary the cocklebur, Xanthium italicum Mor.; sneezeweed, Helenium montanum Nutt.; Canada thistle, Cirsium arvense (L.) Scop. become locally abundant.

Here and there young growths of the sandbar willow, Salix exigua Nutt. and the narrowleaf cottonwood, Populus angustifolia James, are beginning to invade the herbaceous communities, sometimes as new colonies and sometimes as extensions from adjacent shrub-tree communities.

In the vicinity of the Holmes and Brinegar ranches are areas where oxbow ponds occur. The vegetation in these is included with the river bank communities since it shows much of the same flora discussed above but with some notable variations. In some of these places submerged aquatic plants occur as follows:

<u>Potamogeton pectinatus</u> L.	Pondweed
<u>Potamogeton americanus</u> S. & C.	American pondweed
<u>Ruppia maritima</u> L.	Widgeongrass

Emergent species include:

<u>Scirpus validus</u> Vahl.	Bulrush
<u>Scirpus paludosus</u> A. Nels.	Marsh rush
<u>Eleocharis palustris</u> (L.) R. & S.	Spikerush
<u>Polygonum amphibium</u> L.	Water smartweed
<u>Polygonum lapathifolium</u> L.	Smartweed
<u>Sagittaria cuneata</u> Sheld.	Arrowhead
<u>Alisma geyeri</u> Torr.	Water plantain

Plants of the muddy borders include arrowgrass, Triglochin maritima L.; annual inkweed, Suaeda depressa (Pursh) Wats.; allocarya, Allocarya nitens Greene; and cudweed, Gnaphalium palustre Nutt. These plants are more or less scattered with much bare mud exposed although small dense stands occur here and there. The zones of vegetation beyond the mud vary according to the topography. There are narrow meadow-like grass communities which give way sharply to dry ground. Here the salt grass and Nuttall alkali grass, Puccinellia airoides (Nutt.) Walt & Coult., may occur separately or in mixed communities with a few scattered plants of annual atriplex, Atriplex hastata L., and silver atriplex, Atriplex argentea Nutt. In other places there may be dense stands of spike rush forming a zone reaching as much as 60 feet wide or a zone of dropseed muhly of even greater extent.

Communities of Shrubs and Small Trees

Shrubs and small trees (Fig. 4) occur mainly on low bluffs, steep river banks, on some low-lying islands and broad bars. In a few instances they have become established on low flood plains. The sandbar willow is the most frequent species with the narrowleaf cottonwood, yellow willow and wild rose occurring less frequently. More spotty in distribution are the river birch, dogwood, golden currant, silver buffaloberry and service berry which occur mainly on steep narrow banks at the bases of cliffs or higher up where occasional seepage springs and a little more shade favors their growth. Somewhat more general in its distribution is Chrysothamnus linifolius which requires more moisture than other species of the genus. The tamarix or salt cedar, Tamarix pentandra, is sparse in this region and occurs at the mouth of Blacks Fork and at a few points farther downstream.

While the shrubs and small trees lend a dominant aspect to these communities, many of the herbs discussed above form a lower layer beneath them or an outer fringe along the river edge. Frequently the shrubs and trees give way to herbaceous communities and like the latter they are discontinuous and interrupted by cliffs and ledges. On steep slopes where there is a narrow fringe of shrubs and trees, a number of plants of the dry terraces or hillsides extend downward and form a sharp ecotone with the river bank species. Local stands of the tall reed are conspicuous among the shrubs while here and there the Indian hemp, forms patches. Likewise little patches of grassy meadow of salt grass and dropseed muhly interrupt the continuity of the shrubs and trees, sometimes forming a narrow fringe along the water edge. In the latter situations there are scattered occasional plants of the Kansas horsetail, annual atriplex, Mexican dock, mint, marsh paintbrush, Fremont aster and the tall Nuttall sunflower. The community in general has the following botanical composition:

Dominant: Salix exigua Nutt. Sandbar willow

Frequent: Populus angustifolia James Narrowleaf cottonwood
Salix lutea Nutt. Yellow willow
Rosa ultramontana (S. Wats.) Heller . . . Wild rose

Occasional: Betula fontinalis Sarg. River birch
Ribes aureum Pursh. Golden currant
Amelanchier alnifolia Nutt. Service berry
Elaeagnus argentea Pursh. Silver buffaloberry
Cornus stolonifera Michx. Red osier dogwood
Tamarix pentandra Pall. Tamarix
Chrysothamnus linifolius Greene Rabbitbrush

Herbs in the grassy situations:

<u>Equisetum kansanum</u> Schaffn.	Kansas horsetail
<u>Rumex mexicanus</u> Meis.	Mexican dock
<u>Atriplex hastata</u> L.	Annual atriplex
<u>Mentha penardi</u> (Briq.) Rydb.	Mint
<u>Castilleja exilis</u> A. Nels.	Marsh paintbrush
<u>Aster fremonti</u> (T. & G.) Gray	Fremont aster
<u>Helianthus nuttallii</u> T. & G.	Nuttall sunflower

SIDE STREAMS

Blacks Fork shows much the same type of river bank vegetation with a few minor variations. The lower part, extending for about a mile above the junction with Green River, has rather wide flood plains alternating from side to side which narrow higher up in the valley. The species of herbaceous plants predominate but with much less variety while the sandbar willow occurs in patches here and there in the broader parts, becoming quite dense in narrow upper areas. The tamarix occurs here but nowhere is it abundant.

Currant Creek, North Marsh Creek and Middle Marsh Creek are small brooks entering Green River from the east. They harbour an extremely limited vegetation of river bank types and, with the exception of two or three infrequent plants not encountered along the main Green River channel, the dominant species are among the commonest ones mentioned above.

Henrys Fork Creek enters Green River from the west through Lucerne Valley above the entrance to Flaming Gorge and marks the southern limit of the desert region. The lower portion of Lucerne Valley is rather wide and rises on the northern side to low rolling hills while the south side rises quite suddenly to the mountains forming the northern flank of the Uinta range. Westward for a distance of about six miles the valley narrows to about 50 yards in width, the last three quarters of a mile being bounded by bluffs and cliffs about 150 feet high. The stream is of fair size and varies in width from about five to 15 feet according to the topography. The moist banks are mostly narrow with a few low flood plains and isolated oxbow ponds.

For most of the distance along this tributary stream, the river bank vegetation is much the same as that along the Green River but more limited in extent. However, several swamp communities show the strongest contrast in hydrophytic vegetation of the desert, both in general aspect and variety of plants. At the eastern extremity of Lucerne Valley, a short distance from Green River, there are some small swamps occupying low depressions in old river terraces. About six miles westward, just above the hamlet of Linwood, there is a larger, though somewhat discontinuous, swamp community about a half mile in extent maintained by a series of seeps and springs arising from the bedding planes of horizontal rocks along the base of a high bluff on the south side. Here abundant water from the springs creates a muddy seepage area with numerous rivulets anastomosing around little hummocks bearing tussocks of grass and other water-loving herbs while a mixed vegetation of swamp, meadow and river bank plants occupy slightly higher ground interspersed with small clumps of

willows, birch and wild rose bushes. Here grasses, sedges and rushes dominate the muddy areas while algae and mosses form a lower layer beneath. The botanical composition is as follows:

Submerged algae:

Spirogyra porticalis (Muell.) Cleve
Spirogyra spp. (two other sterile species)
Zygnema sp.
Vaucheria sessilis (Vauch) DC.

Mosses:

Drepanocladus aduncus (Hedw.) Warnst. submerged and emergent
Cratoneuron filicinum (Hedw.) Roth
Bryum cuspidatum (Schimp.) Schimp.
Amblystegium compactum (C. Mull.) Aust.

Dominant herbs:

Agrostis alba Redtop
Agrostis palustris Huds. Redtop
Poa pratensis L. Kentucky bluegrass
Hordeum jubatum L. Squirrel tail barley
Eleocharis palustris (L.) Roem. & Shultz. Spikerush
Eleocharis acicularis (L.) Roem. & Schultz. Small spikerush
Carex sp.
Beckmannia syzigachne (Steud.) Fernald Sloughgrass
Glyceria grandis S. Wats. American mannagrass
Polygonum lapathifolium L. Smartweed
Cicuta occidentalis Greene Water hemlock
Lycopus americana Michx. Bugleweed
Veronica americana Schwein American speedwell

A few restricted clumps of the cattail, Typha domingensis Pers., occur here and there in the zone of emergent plants.

An irregular zone of wet or damp soil, a few feet to as much as 50 feet wide, borders the swamps and it harbors a grassy meadow spotted with small thickets of willow, birch and rose bushes. The botanical composition is as follows:

Dominant meadow plants:

Agrostis alba L. Red Top
Poa pratensis L. Kentucky bluegrass
Puccinellia airoides (Nutt.) Wats. & Coult. Nuttall alkaligrass
Muhlenbergia aspirifolia (Nees. & Mey.) Parodi. Dropseed muhly
Distichlis stricta (Torr.) Rydb. Saltgrass

Less frequent are the following:

Equisetum kansanum Schaffn. Kansas horsetail
Agropyron smithii Rydb. Western bluestem
Iris missouriensis Nutt. Missouri iris

Less frequent (continued)

<u>Chenopodium hybridum</u> L.	Chenopodium
<u>Chenopodium album</u> L.	Lambsquarters
<u>Atriplex hastata</u> L.	Annual atriplex
<u>Trifolium pratense</u> L.	Red clover
<u>Epilobium adenocaulon</u> Hausskn.	Marsh willow herb
<u>Glaux maritima</u> L.	Saltwort
<u>Mentha perardi</u> (Briq.) Rydb.	Mint
<u>Stachys scopulorum</u> Greene	Western betony
<u>Castilleja exilis</u> A. Nels.	Marsh paintbrush
<u>Mimulus guttatus</u> DC.	Monkeyflower
<u>Plantago major</u> L.	Common plantain
<u>Plantago eriopoda</u> Torr.	Plantain
<u>Bidens cernua</u> L.	Beggar's tick
<u>Helenium montanum</u> Nutt.	Snееzweed
<u>Erigeron canadense</u> L.	Canada fleabane
<u>Cirsium lanceolatum</u> L.	Bull thistle
<u>Cirsium scariosum</u> Nutt.	Downy thistle
<u>Cirsium arvense</u> (L.) Scop.	Canada thistle
<u>Centaurea picris</u> Pall.	Centaurea
<u>Sonchus asper</u> (L.) Hill	Sow thistle
<u>Tragopogon porrifolius</u> L.	Salsify
<u>Leontodon taraxacum</u> L.	Dandelion
<u>Hieracium</u> sp.	Hawkweed

Frequent and occasional herbs:

<u>Glyceria grandis</u> S. Wats.	American mannagrass
<u>Sisyrinchium halophilum</u> Greene	Blue-eyed grass
<u>Polygonum lapathifolium</u> L.	Smartweed
<u>Rumex persicarioides</u> L.	Marsh dock
<u>Ranunculus sceleratus</u> L.	Cursed crowfoot or celeryleaf buttercup
<u>Radicula nasturtium-aquaticum</u> Britton & Rendle.	Watercress
<u>Roripa lyrata</u> (Nutt.) Rydb.	Cress
<u>Epilobium adenocaulon</u> Hausskn.	Marsh willow herb
<u>Hippuris vulgaris</u> L.	Mare's-tail
<u>Castilleja exilis</u> A. Nels.	Marsh paintbrush
<u>Veronica anagallis-aquatica</u> L.	Water speedwell
<u>Veronica americana</u> Schwein.	American speedwell
<u>Mimulus guttatus</u> DC.	Monkeyflower

On slightly higher ground are the following dominant trees:

<u>Salix exigua</u> Nutt.	Sandbar willow
<u>Salix lutea</u> Nutt.	Yellow willow
<u>Populus angustifolia</u> James	Narrowleaf cottonwood
<u>Betula fontinalis</u> Sarg.	River birch
<u>Alnus tenuifolia</u> Nutt.	Alder

Frequent shrubs and herbs:

<u>Equisetum arvense</u> L.	Meadow horsetail
<u>Equisetum kansanum</u> Schaffn.	Kansas horsetail
<u>Urtica breweri</u> S. Wats.	Stinging nettle
<u>Rosa woodsii</u> Lindl.	Wildrose

Frequent shrubs and herbs (continued)

<u>Ribes aureum</u> Pursh.	Golden currant
<u>Trifolium pratense</u> L.	Red clover
<u>Lonicera involucrata</u> Banks	Twinberry honeysuckle
<u>Helianthus nuttallii</u> Torr. & Gray	Nuttall sunflower

Beyond the muddy seepage areas the water drains into old river channels creating small swamps surrounded by small grass-sedge meadows with little thickets of willow, birch and rose bushes here and there forming a variegated pattern. There is only a small amount of open water harboring the following submerged aquatic plants:

<u>Potamogeton pectinatus</u> L.	Pondweed
<u>Ruppia maritima</u> L.	Widgeongrass
<u>Batrachium trachophyllum</u> (Chaix) Bossch.	Water buttercup

Emergent species include the following:

<u>Triglochin maritima</u> L.	Arrowgrass
<u>Eleocharis palustris</u> (L.) Roem. & Schultz.	Spikerush
<u>Scirpus validus</u> Vahl.	Bulrush
<u>Scirpus paludosus</u> A. Nels.	Marsh rush
<u>Carex</u> sp.	Sedge

TERRACE COMMUNITIES

Locally the terraces are called bottoms on official maps of the upper Green River region and many of them have specific names. These areas vary in height from about two to four feet above the high water level of spring floods and as much as six or seven feet later in the season. They range from a few feet wide, at the upper and lower extremities where they taper out, to as much as 200 or 300 yards wide at the widest points. In length, they range from short strips about 10 yards long to as much as five miles long and are interrupted, usually on the cutting banks, by steep bluffs, low rocky ledges or by cliffs. Several islands in the river are disjunct terraces.

The ground is more or less level but sometimes slightly undulated and occasionally with depressions extending parallel with the river having been small lagoons created in the past by old levies while some are more or less sinuous oxbows of former river channels. The soils are generally clay-loams or sandy clay with a few local sandy areas. Along the outer limits conjunctive with the rising hillsides are zones of gravelly character, sometimes with boulders, especially in the outwashes at the mouths of ravines. The surface soil is dry with a damp subsoil ranging from about two to five feet below the surface according to the height of the terrace or to irregularities of the local topography. Nearly everywhere the soils are mildly alkaline and harbour many salt-loving plants.

Four general types of vegetation occupy the terraces according to the local topography and to human influences. The most conspicuous are the tree communities of narrowleaf cottonwood with mixtures of various smaller trees and shrubs; second, and more extensive, are shrub communities of greasewood, big sagebrush and rabbitbrush; and third, more local, are grassy meadow communities. These three types are the natural primary plant successions of the terraces. The fourth is a secondary successional type of weedy herbs and grasses which invaded the areas after the removal of the original native vegetation. These are either remnants of abandoned farmlands or partly denuded areas overgrazed. These four types of vegetations merge more or less along the zones of contact and occasionally form mixed communities.

Cottonwood Communities

Groves of the narrowleaf cottonwood on the larger terraces form the most conspicuous community because of their size and the somewhat mesophytic conditions which they help to maintain. There are two general aspects, (1) the trees may be more or less evenly spaced or in small clumps with irregular spaces occupied either by an intermediate layer of shrubs and smaller trees or by a lower layer of grasses and herbs. On the other hand, (2) the trees may be in larger clumps dispersed in a more or less continuous grassy meadow in savannah-like fashion. In either instance the intermediate layer of smaller trees may extend beyond the taller cottonwoods for considerable distance.

The narrowleaf cottonwood is a medium-sized tree ranging upwards to about 60 feet tall with conspicuous greenish-white branches and young trunks while in older trees the lower part of the trunk develops a gray, deeply furrowed bark. A skirt of copious shoots and suckers often forms around the bases. In larger groves where considerable shade and moisture is present the yellow willow, birch, wild rose, squawbush, golden currant and occasionally dogwood forms an intermediate layer. Outstanding and often conspicuous are dense vines of virgin bower which clamber up the trunks of the cottonwood and sprawl over the smaller trees and shrubs. The Canadian ryegrass is also conspicuous in some places by its size, habit and color. It grows in dense bunches three to four feet tall which are scattered here and there among the other plants.

The composition of the lower grass-herb layer varies widely according to the locality and the local interference of human agencies.

The general composition of the cottonwood communities is as follows:

Dominant:

Populus angustifolia James Narrowleaf cottonwood

Subdominant (and locally dominant):

Betula fontinalis Sarg. River birch

Rhus trilobata Nutt. Squawbush

Rosa ultramontana (S. Wats.) Heller Wild rose

Frequent shrubs and smaller trees:

<u>Salix lutea</u> Nutt.	Yellow willow
<u>Ribes aureum</u> Pursh.	Golden currant
<u>Cornus stolonifera</u> Michx.	Red osier dogwood
<u>Chrysothamnus viscidiflorus</u> (Hook) Nutt.	Varnishleaf rabbitbrush
<u>Chrysothamnus viscidiflorus</u> var. <u>tortifolius</u> (A. Gray) Greene.	Varnishleaf rabbitbrush
<u>Chrysothamnus nauseosus</u> (Pall.) Britton	Big rabbitbrush
<u>Artemisia tridentata</u> Nutt.	Big sagebrush

Vine: Clematis ligusticifolia Nutt. Virgin bower

Dominant grass: Distichlis stricta (Torr.) Rydb. . Saltgrass

Frequent or locally dominant:

<u>Sporobolus airoides</u> Torr.	Alkali sacaton
<u>Muhlenbergia aspirifolia</u> (N. & M.) Parodi	Dropseed muhly
<u>Agropyron smithii</u> Rydb.	Western bluestem
<u>Agropyron repens</u> (L.) Beauv.	Quackgrass
<u>Elymus canadensis</u> L.	Canada wild rye

Frequent herbs:

<u>Polygonum aviculare</u> L.	Knotweed
<u>Chenopodium album</u> L.	Lambsquarters
<u>Chenopodium fremonti</u> S. Wats.	Fremont chenopodium
<u>Chenopodium leptophyllum</u> Nutt.	Narrowleaf chenopodium
<u>Monolepis nuttalliana</u> (Schultz) Greene	Monolepis
<u>Bassia hyssopifolia</u> (Pall.) Kuntze	Bassia
<u>Salsola kali</u> var. <u>tenuifolia</u> Tausch.	Russian thistle
<u>Descurainia pinnata</u> (Walt.) Britt.	Tansy mustard
<u>Malcolmia africana</u> (L.) R. Br.	Malcolmia
<u>Cleome lutea</u> Hook.	Yellow beeweed
<u>Cleome serrulata</u> Pursh.	Rocky mountain beeflower
<u>Glycyrrhiza lepidota</u> Nutt.	Wild licorice

Occasional herbs:

<u>Smilacina stellata</u> (L.) Desf.	False Solomon seal
<u>Urtica breweri</u> S. Wats.	Stinging nettle
<u>Comandra pallida</u> A. DC.	False toadflax
<u>Atriplex hastata</u> L.	Annual atriplex
<u>Atriplex rosea</u> L.	Rose atriplex
<u>Atriplex argentea</u> Nutt.	Silver atriplex
<u>Berberis repens</u> Lindl.	Oregon grape
<u>Schoenocrambe linifolia</u> (Nutt.) Greene	Plains mustard
<u>Thelypodium integrifolium</u> Torr.	Thelypodium
<u>Lepidium draba</u> L.	White top mustard
<u>Lepidium montanum</u> Nutt.	Mountain peppergrass
<u>Lepidium virginicum</u> L.	Virginia peppergrass
<u>Lepidium perfoliatum</u> L.	Common peppergrass
<u>Thlaspi arvense</u> L.	Penny cress
<u>Sisymbrium altissimum</u> L.	Tumbling mustard

Occasional herbs (continued)

<u>Brassica nigra</u> (L.) Koch.	Black mustard
<u>Camelina microcarpa</u> Andr.	Gold of pleasure
<u>Lupinus</u> sp.	Lupine
<u>Medicago lupulina</u> L.	Black medick
<u>Melilotus officinalis</u> (L.) Lam. & DC.	Yellow sweet clover
<u>Astragalus mortoni</u> Nutt.	Tall locoweed
<u>Vicia linearis</u> (Nutt.) Greene	Narrowleaf vetch
<u>Sphaeralcea coccinea</u> (Pursh) Rydb.	Scarlet globe mallow
<u>Sida hederacea</u> (Dougl.) Torr.	Alkali mallow
<u>Mentzelia pumila</u> (Nutt.) T. & G.	Dwarf mentzelia
<u>Chylismia scapoidea</u> (Nutt.) Small	Chylismia
<u>Asclepias speciosa</u> Torr.	Milkweed
<u>Cressa truxellensis</u> H. B. K.	Cressa
<u>Convolvulus arvensis</u> L.	Bindweed
<u>Phlox longifolia</u> Nutt.	Wild sweet William
<u>Gilia aggregata</u> (Pursh) Spring	Scarlet gilia
<u>Cynoglossum officinale</u> L.	Hounds tongue
<u>Lappula occidentalis</u> (S. Wats.) Greene	Western stickseed
<u>Cryptantha</u> sp.	Cryptantha
<u>Heliotropium xerophilum</u> Cockerell	Heliotrope
<u>Nicotiana attenuata</u> Torr.	Wild tobacco
<u>Marrubium vulgare</u> L.	Hoarhound
<u>Solanum triflorum</u> Nutt.	Nightshade
<u>Physalis neomexicana</u> Rydb.	Annual groundcherry
<u>Adenostegia ramosa</u> (Nutt.) Greene	Hairy adenostegia
<u>Thalesia fasciculata</u> (Nutt.) Britton	Cancer-root
<u>Gutierrezia sarothrae</u> (Pursh) Brit. & Rusby	Snakeweed
<u>Aster fremontii</u> (T. & G.) Gray	Fremont aster
<u>Iva axillaris</u> Pursh	Poverty weed, marsh elder
<u>Aplopappus lanceolatus</u> (Hook) T. & G.	Tall aplopappus
<u>Hieracium gracile</u> Hook	Slender hawkweed

The centers of several ranches are located in or near cottonwood groves where human activities and overgrazing have reduced much of the lower layers of native plants, thus exposing considerable bare ground. Secondary successional weedy species have usually replaced the native species, especially the grasses. Single species of weeds tend to form dense colonies in these places, for example, the tansy mustard, Descurainia pinnata, forms dense colonies under the trees, becoming more scattered beyond them. Chenopodium album and C. fremontii have the same habit and frequently grow together under trees. Bassia hyssopifolia forms dense colonies along the sides of buildings, along fences and roadsides. The white top mustard, Lepidium draba, grows in dense colonies here and there, either in depressions or in places where the soil has been disturbed.

Shrub communities

The shrub communities are the most extensive type of vegetation on the terraces of the desert region and they are dominated by greasewood, big sagebrush, and rabbitbrush.

The greasewood is an erect dark green shrub mostly two to four feet tall but sometimes becoming six or seven feet in local stands. The main stems are usually straight, with wide irregular furrows and gray bark at the base, the branches more or less horizontal with erect spiny twigs bearing linear fleshy leaves about one inch long. The wood is green. The shrub is typically a ground-water feeder with a deep taproot usually reaching at least to the capillary water zone. As such, it is a ground-water indicator. Besides growing on the terraces it also extends high up in ravines and gullies where precipitation water drains underground.

The big sagebrush is a silver-gray shrub of more erect-spreading habit of growth, mostly one to two feet tall but becoming five to seven feet tall in local stands. The main trunks become thick with gray shreddy bark extending high up on the somewhat abruptly narrowing branches and twigs. The leaves are wedge-shaped with three teeth at the truncated apex and are covered with white appressed hairs. It is essentially a surface-water feeder with a widely spreading root system but, in deep soils, the roots may reach great depths. It thrives best in loose loamy or sandy-loam soil where it is known to become as high as 15 feet.

The rabbitbrushes are of three principal species and one or two varieties. Chrysothamnus viscidiflorus and its variety tortifolius have numerous slender erect straight main stems with slender green erect-spreading branches bearing linear to linear-lanceolate green, somewhat varnished, leaves about two to three inches long. In the variety the leaves are more or less spirally twisted. C. stenophyllus, often treated as a smaller variety of the former, has a similar habit but is somewhat more spreading and grows in drier places; hence it is usually much smaller, ranging from one to two feet tall. The leaves are smaller and shorter, either flat or twisted but less resinous. On the terraces with more moisture, it becomes almost as tall as C. viscidiflorus and the leaves are larger.

C. nauseosus has a similar habit of growth but the younger stems and leaves are covered with a dense white tomentum of compact interwoven white hairs giving the plant a decided whitish appearance. C. linifolius also has a similar habit of growth but the young stems are greenish-white and the leaves are broader, narrowly lanceolate, bright green without a marked resinous quality. It has also been treated as a variety of C. viscidiflorus. It grows in moister soils and is not uncommon around the margins of springs and seeps. All of the rabbitbrushes, except C. stenophyllus, are indicators of ground water.

Greasewood Communities

The greasewood forms the most extensive plant community of the terraces (Fig. 1) and covers a wider area than all other communities of this zone combined. It not only occupies the terraces proper but extends high up in the wider valleys and forms a narrow zone in the narrower less steep ravines. The general aspect presents a continuous community of the dark green shrubs two to three feet tall, more or less evenly spaced with considerable bare ground

between the plants the density varying from about 30 to 60 percent, although local dense stands may reach as high as 90 percent. Associated species vary in number of kinds and populations. In dense greasewood stands there are few associated plants and few in numbers while in some open places the same condition may exist due mainly to the tramping of cattle and sheep. In many open stands there is a good variety of grasses, herbs and associated shrubs. As would be expected, big sagebrush and the rabbitbrushes frequently make up a mixed shrub community with the greasewood, the proportions of each varying.

The general composition of the greasewood community is as follows:

Dominant: Sarcobatus vermiculatus (Hook.) Torr. . . Greasewood

Frequent, sometimes subdominant:

<u>Atriplex confertifolia</u> (Torr. & Frem.) Wats.	. Shadscale
<u>Atriplex nuttallii</u> S. Wats.	. . . . . Nuttall saltbush
<u>Chrysothamnus viscidiflorus</u> (Hook.) Nutt.	. . . Varnishleaf rabbitbrush
<u>Chrysothamnus nauseosus</u> (Pall.) Brit.	. . . Big rabbitbrush
<u>Artemisia tridentata</u> Nutt.	. . . . . Big sagebrush
<u>Artemisia spinescens</u> DC. Eaton	. . . . . Bud sagebrush

Frequent to occasional:

<u>Hilaria jamesii</u> (Torr.) Benth.	. . . . . Galleta grass
<u>Aristida longiseta</u> Steud.	. . . . . Purple three-awn grass
<u>Sporobolus airoides</u> Torr.	. . . . . Alkali sacaton
<u>Distichlis stricta</u> (Torr.) Rydb.	. . . . . Saltgrass
<u>Poa sandbergii</u> Vasey	. . . . . Sandberg bluegrass
<u>Poa confusa</u> Rydb.	. . . . . Bluegrass
<u>Festuca elatior</u> L.	. . . . . Meadow fescue
<u>Bromus tectorum</u> L.	. . . . . Downy chess
<u>Agropyron smithii</u> Rydb.	. . . . . Western bluestem
<u>Agropyron repens</u> (L.) Beauv.	. . . . . Quackgrass
<u>Agropyron trachycaulum</u> (Link) Malte	. . . . . Slender wheatgrass
<u>Hordeum gussonianum</u> Parl.	. . . . . Mediterranean barley
<u>Elymus canadensis</u> L.	. . . . . Canada wild rye
<u>Sitanion hystrix</u> (Nutt.) J. G. Smith	. . . . . Squirrel tail
<u>Allium cernuum</u> Roth.	. . . . . Wild onion
<u>Calochortus nuttallii</u> T. & G.	. . . . . Sego
<u>Comandra pallida</u> A. DC.	. . . . . False toadflax
<u>Eriogonum cernuum</u> Nutt.	. . . . . Slender eriogonum
<u>Eriogonum ovalifolium</u> Nutt.	. . . . . Silver plant
<u>Monolepis nuttalliana</u> (Schultz) Greene	. . . . . Monolepis
<u>Chenopodium leptophyllum</u> Nutt.	. . . . . Narrowleaf chenopodium
<u>Chenopodium album</u> L.	. . . . . Lambsquarters
<u>Chenopodium fremontii</u> S. Wats.	. . . . . Fremont chenopodium
<u>Atriplex hastata</u> L.	. . . . . Annual atriplex
<u>Atriplex argentea</u> Nutt.	. . . . . Silver atriplex
<u>Atriplex saccaria</u> S. Wats.	. . . . . Annual atriplex
<u>Eurotia lanata</u> (Pursh) Moq.	. . . . . Winterfat
<u>Kochia vestita</u> (S. Wats.) Rydb.	. . . . . Gray molly
<u>Suaeda torreyana</u> S. Wats	. . . . . Torrey inkweed

Frequent to occasional (continued)

<u>Salsola kali</u> var. <u>tenuifolia</u> Tausch.	Russian thistle
<u>Bassia hyssopifolia</u> (Pall.) Kuntze	Bassia
<u>Amaranthus graecizans</u> L.	Tumbleweed redroot, pigweed
<u>Amaranthus blitoides</u> S. Wats	Prostrate redroot
<u>Argemone hispida</u> A. Gray	Prickly poppy
<u>Schoenocrambe linifolia</u> (Nutt.) Greene	Plains mustard
<u>Thelypodium integrifolium</u> (Nutt.) Endl.	Plain-leaf thelypodium
<u>Thelypodium sagittatum</u> (Nutt.) Endl.	Saggitate thelypodium
<u>Lepidium perfoliatum</u> L.	Common peppergrass
<u>Lepidium virginicum</u> L.	Virginia peppergrass
<u>Sisymbrium altissimum</u> L.	Tumbling mustard
<u>Camelina microcarpa</u> Andrez.	Gold of pleasure
<u>Descurainia pinnata</u> (Walt.) Britt.	Tansey mustard
<u>Erysimum repandum</u> L.	Bitter cress
<u>Malcolmia africana</u> (Willd.) R. Br.	Malcolmia
<u>Cleome lutea</u> Hook	Yellow beeweed
<u>Lupinus pusillus</u> Pursh.	Little lupine
<u>Lupinus</u> sp.	Lupine
<u>Astragalus</u> sp.	Locoweed
<u>Linum lewisii</u> Pursh.	Blue flax
<u>Euphorbia robusta</u> Engelm.	Tall spurge
<u>Euphorbia glyptosperma</u> (Engelm.) Small.	Little spurge
<u>Sphaeralcea coccinea</u> (Pursh) Rydb.	Scarlet globe mallow
<u>Mentzelia pumila</u> (Nutt.) T. & G.	Dwarf mentzelia
<u>Opuntia hystricina</u> Engelm. & Bigl.	Yellow prickly pear
<u>Oenothera caespitosa</u> Nutt.	Evening primrose
<u>Chylismia scapoidea</u> (Nutt.) Small	Chylismia
<u>Cymopterus</u> sp.	Cymopterus
<u>Asclepias capricornu</u> Woodson	Spider milkweed
<u>Convolvulus arvensis</u> L.	Bindweed
<u>Phlox longifolia</u> Nutt.	Wild sweet William
<u>Gilia aggregata</u> (Pursh) Spreng.	Scarlet gilia
<u>Gilia inconspicua</u> (J. E. Smith) Dougl.	Dwarf gilia
<u>Phacelia crenulata</u> Torr.	Purple phacelia
<u>Cynoglossum officinale</u> L.	Hounds-tongue
<u>Lappula occidentalis</u> (S. Wats.) Greene	Western stickseed
<u>Cryptantha flavoculata</u> (A. Nels.) Payson	Cryptantha
<u>Cryptantha</u> sp.	Cryptantha
<u>Verbena bracteosa</u> Michx.	Prostrate verbena
<u>Solanum triflorum</u> Nutt.	Prostrate nightshade
<u>Marrubium vulgare</u> L.	Hoarhound
<u>Castilleja chromosa</u> A. Nels.	Paintbrush
<u>Adenostegia ramosa</u> (Nutt.) Greene	Slender adenostegia
<u>Thalesia fasciculata</u> (Nutt.) Britt.	Cancer-root
<u>Grindelia squarrosa</u> (Pursh) Dunal.	Gumweed
<u>Gutierrezia microcephala</u> (DC.) A. Gray	Snakeweed, matchweed
<u>Gutierrezia sarothrae</u> (Pursh) Brit. & Rusby	Snakeweed
<u>Aster occidentalis</u> (Nutt.) T. & G.	Western aster
<u>Aster leucelene</u> Blake	Dwarf aster
<u>Aster leucanthemifolius</u> Greene	Desert aster

Frequent to occasional (continued)

<u>Erigeron divergens</u> T. & G.	Fleabane
<u>Iva axillaris</u> Pursh	Marsh elder, poverty weed
<u>Franseria acanthicarpa</u> (Hook.) Coville	Bur sage
<u>Helianthus annuus</u> L.	Sunflower
<u>Helianthus petiolaris</u> Nutt.	Sunflower
<u>Chaenactis stevioides</u> Hook. & Arn.	Annual chaenactis
<u>Tetradymia spinosa</u> Hook & Arn.	Spiny horsebush
<u>Senecio uintahensis</u> (A. Nels.) Greenm.	Uintah senecio
<u>Arctium minus</u> (Hill) Bernh.	Burdock
<u>Centaurea picris</u> Pall.	Centaurea
<u>Cirsium scariosum</u> Nutt.	Downy thistle
<u>Cirsium</u> sp.	Thistle
<u>Malacothrix sonchoides</u> (Nutt.) T. & G.	Malacothrix
<u>Lactuca scariola</u> L.	Prickly lettuce
<u>Lygodesmia juncea</u> L.	Desert pink
<u>Agoseris glauca</u> (Pursh) D. Dietr.	False dandelion

Big sagebrush communities

The big sagebrush (Fig. 5) occurs mainly on some of the higher terraces where it is sometimes unusually tall and almost the exclusive plant. Particularly fine examples of this vegetation (Fig. 6) occur on high bars below Blacks Fork, at Badger Bottom, and in Lucerne Valley. The general aspect presents a bushy appearance of silvery-gray shrubs, mostly two to four feet tall, usually more or less evenly spaced, the density ranging from about 30 percent to as much as 90 percent in local dense stands. Usually there is considerable bare ground between the bushes, this augmented by cattle trails, with about the same grass and herbaceous underlayer as that listed from the greasewood community. Some minor contrasts in different communities are manifested by the presence of other shrubs or small trees. For example, the wild rose, golden currant, squaw bush and buffaloberry occasionally form clumps of dark green foliage amid the silvery-gray of the sagebrush. It is not uncommon to find the various species of rabbitbrush growing with the sage, especially along the borders of a sage community.

Rabbitbrush communities

The rabbitbrush has less tendency to form constant or large communities than the other dominant shrubs of the region. While it is a frequent and conspicuous member of communities dominated by trees and other shrubs, it forms pure stands of limited extent, usually on the outer fringe of thickets, on some moderately high terraces (Fig. 7) and in some ravines. The numerous erect straight stems, and brighter green color of the leaves lends contrast to the darker green or silvery-gray of the surrounding vegetation. Later in the season the leaves often become somewhat yellowish green and in late summer and fall the bushes are topped with dense clusters of golden-yellow flowers. The associated plants are among those listed for the greasewood community. Some notable situations where the rabbitbrush is conspicuously associated with other plants



Fig. 5. Big sagebrush dominates the landscape.
Photo by Gerald Groves.



Fig. 6. Especially large specimens of the big
sagebrush at lower end of Badger Bottom,
mile 327.8. Photo by Gerald Groves.

include: (1) open stands of the narrowleaf cottonwood amid a dense growth of tall rabbitbrush and (2) meadows of dense growths of saltgrass spotted with clumps of rabbitbrush.

Meadow communities

Limited areas occupied by grassy meadows with scattered herbs are frequent on the terraces either as distinct units or extension of the herb-grass lower layer under the tree communities. Saltgrass is the commonest species and it may grow in very dense sods of 100 percent density and as much as 12 inches tall. In some situations it grows with the dropseed muhly in varying proportions. Associated herbs are the usual common ones including lambsquarters, annual atriplex, Fremont chenopodium, bassia, dandelion, plantain, hawkweed and several other species in fewer numbers. Some grassy communities also harbour scattered shrubs or even a few small trees such as clumps of dogwood, yellow willow or birch.

Weedy herb and grass community

Abandoned farm land and strongly overgrazed areas on the terraces have been invaded by common weeds, sometimes so densely as to have a meadow-like appearance from a distance. Bassia is generally the dominant plant although the poverty weed sometimes is most abundant, both species commonly growing together. Other weedy species in fewer numbers include three species of Atriplex, A. hastata, A. saccaria, and A. rosea; lambsquarters; tansey mustard and a number of others. Thinly scattered growths of saltgrass commonly occur among the weeds and are apparently a regeneration from old rhizomes of former vegetation.

HILLSIDE AND UPLAND PLAINS COMMUNITIES

For the most part the vegetation of the hillsides and uplands is quite uniform throughout most of the region with local variations in shallow ravines, gullies, steep rocky slopes and among cliffs. The rolling hills present a more or less continuous low grayish shrub community one to two feet tall. On the upland plains the plants are usually widely spaced with considerable clay-loam or gravelly surface exposed. The density ranges from about 10 to 30 percent with local patches on some gentle north-facing slopes and in shallow ravines reaching as much as 60 percent.

On the whole the communities are composed of essentially the same species of plants with local variations in the populations of certain ones. Over most of the hillsides and uplands the dominant plants are shadscale, big sagebrush and little sagebrush. More locally, and in various combinations, the hop sage, gray molly, winterfat, bud sagebrush and little rabbitbrush assume a dominant role. All of these plants are dependent on precipitation water of which the annual average amount throughout the region is only about eight to 10 inches. The soil is very dry during most of the season and subsoil moisture is remote except in some ravines where subsoil drainage is reflected by the presence of greasewood and some of the taller species of rabbitbrush.

In contrast with the big sagebrush, the little sagebrush is a lower, more densely branched shrub, rarely exceeding 16 inches tall, with numerous slender, erect herbaceous branches bearing smaller leaves of darker and duller gray color, at times almost lead-colored. It grows in drier and often more rocky soils than the big sagebrush; where it is the dominant plant it imparts a darker shade to the community as a whole, from which it is sometimes called black sagebrush.

The shadscale is a round-topped, silvery-gray shrub, one to two feet tall with spiny branches bearing broadly ovate leaves covered with grayish-white scurfy scales. It reflects the mild saline quality of the soils which it inhabits and is very widely distributed throughout the western part of the United States.

The hop sage is a round-topped, intricately branched spiny shrub one to two feet tall with thick fleshy green obovate to spatulate leaves one to two inches long which become somewhat whitish scurfy with age. It is adapted to mildly saline soil.

The gray molly is a low gray shrub, six to 12 inches tall with slender spreading to erect branches bearing erect linear leaves, one to one and a half inches long, and covered with villous white hairs.

Winterfat is a small shrub of pale gray color producing several tall slender flowering stalks 16 to 30 inches tall which bear numerous fruits covered with copious long silky white hairs giving the plant a decidedly white appearance late in the season. The leaves are linear to narrowly lanceolate, three quarters to one and a half inches long, with the margins revolute and the surface covered with dense white stellate hairs. It is widely distributed throughout the western states and is highly palatable to sheep and cattle for which reason it is often much reduced in numbers.

Unlike most other species of the genus, little rabbitbrush is adapted to drier soils and it is often abundant on upland plains and gentle slopes. It is somewhat weedy in nature and usually indicates overgrazing where it is abundant.

Other conspicuous shrubs include bud sagebrush, the Nelson and Nuttall saltbushes, prickly pear cactus, and three species of horsebrush. The most abundant grass is galleta, while Indian ricegrass, needle-and-thread grass and the ubiquitous downy chess are less frequent. The herbs are numerous in kinds but mostly widely scattered, some of them forming local concentrated colonies.

The general composition of the hillside and upland plains communities is as follows:

Dominant shrubs:

<u>Atriplex confertifolia</u> A. Wats.	Shadscale
<u>Artemisia tridentata</u> Nutt.	Big sagebrush
<u>Artemisia nova</u> A. Nels.	Little sagebrush

Frequent shrubs, sometimes dominant or subdominant:

<u>Grayia spinosa</u> (Hook.) Moq.	Hop sage
<u>Kochia vestita</u> (S. Wats.) Rydb.	Gray molly
<u>Eurotia lanata</u> (Pursh) Moq.	Winterfat
<u>Opuntia hystricina</u> Engelm. & Bigl.	Prickly pear cactus
<u>Chrysothamnus stenophyllus</u> (A. Gray) Greene	Little rabbitbrush

Other frequent shrubs:

<u>Atriplex cuneata</u> A. Nels.	Nelson saltbush
<u>Atriplex nuttallii</u> S. Wats.	Nuttall saltbush
<u>Artemisia spinescens</u> D. C. Eaton	Bud sagebrush
<u>Artemisia frigida</u> Willd.	Silver sagebrush
<u>Tetradymia spinosa</u> Hook. & Arn.	Spiny horsebrush
<u>Tetradymia nuttallii</u> T. & G.	Nuttall horsebrush
<u>Tetradymia canescens</u> DC.	Horsebrush

Locally dominant shrubs in bottoms of ravines and drainage ways:

<u>Sarcobatus vermiculatus</u> (Hook.) Torr.	Greasewood
<u>Suaeda torreyana</u> S. Wats.	Torrey inkweed
<u>Chrysothamnus viscidiflorus</u> (Hook.) Nutt.	Varnishleaf rabbitbrush
<u>Chrysothamnus nauseosus</u> (Pall.) Britt.	Big rabbitbrush
<u>Chrysothamnus graveolens</u> (Nutt.) Greene	Rabbitbrush

Dominant grasses:

<u>Hilaria jamesii</u> (Torr.) Benth.	Galleta
<u>Stipa comata</u> Trin. & Rupr.	Needle and thread grass
<u>Oryzopsis hymenoides</u> (Roem. & Schult.) Riker	Indian ricegrass

Frequent herbs and grasses:

<u>Bromus tectorum</u> L.	Downy chess
<u>Sitanion hystrix</u> (Nutt.) J. G. Smith	Squirrel tail grass
<u>Aristida longiseta</u> Steud.	Purple three-awn grass
<u>Poa confusa</u> Rydb.	Desert bluegrass
<u>Poa sandbergii</u> Vasey	Sandberg bluegrass
<u>Agropyron trachycaulum</u> (Link.) Malte	Slender wheatgrass
<u>Allium textile</u> Nels. & McBride	Wild onion
<u>Calochortus nuttallii</u> T. & G.	Sego
<u>Comandra pallida</u> A. DC.	Pale comandra, false toadflax
<u>Eriogonum cernuum</u> Nutt.	Nodding eriogonum
<u>Eriogonum ovalifolium</u> Nutt.	Silver plant
<u>Eriogonum umbellatum</u> Torr.	Sulphur flower
<u>Chenopodium leptophyllum</u> Nutt.	Narrowleaf chenopodium
<u>Atriplex saccaria</u> S. Wats.	Annual atriplex
<u>Suaeda torreyana</u> S. Wats.	Torrey inkweed
<u>Salsola kali</u> var. <u>tenuifolia</u> Tausch.	Russian thistle
<u>Abronia elliptica</u> A. Nels.	Sandverbena
<u>Arenaria uintahensis</u> A. Nels.	Uintah sandwort

Frequent herbs and grasses (continued)

<u>Delphinium</u> <u>nanus</u> DC.	Larkspur
<u>Argemone</u> <u>hispida</u> A. Gray	Prickly poppy
<u>Stanleya</u> <u>pinnata</u> (Pursh) Britt.	Prince's plume
<u>Schoenocrambe</u> <u>linifolia</u> (Nutt.) Greene	Plains mustard
<u>Caulanthus</u> <u>crassicaulis</u> (Torr.) S. Wats.	Swollen stalk mustard
<u>Lepidium</u> <u>montanum</u> Nutt.	Mountain peppergrass
<u>Physaria</u> <u>didymocarpa</u> (Hook.) A. Gray	Bladderpod
<u>Camelina</u> <u>microcarpa</u> Andrz.	Gold of pleasure
<u>Descurainia</u> <u>pinnata</u> (Walt.) Britt.	Tansey mustard
<u>Arabis</u> <u>holboellii</u> Hornem.	Western rockcress
<u>Arabis</u> <u>exilis</u> A. Nels.	Nelson rockcress
<u>Erysimum</u> <u>repandum</u> L.	Bittercress
<u>Erysimum</u> <u>asperum</u> DC.	Western wallflower
<u>Alyssum</u> <u>alyssoides</u> L.	Alyssum
<u>Cleome</u> <u>lutea</u> Hook.	Yellow beeweed
<u>Lupinus</u> <u>pusillus</u> Pursh.	Dwarf lupine
<u>Astragalus</u> <u>diversifolius</u> A. Gray	Narrowleaf locoweed
<u>Astragalus</u> <u>purshii</u> Dougl.	Pursh locoweed
<u>Astragalus</u> <u>three</u> sp. undetermined	Loco
<u>Linum</u> <u>lewisii</u> Pursh.	Blue flax
<u>Sphaeralcea</u> <u>coccinia</u> (Pursh) Rydb.	Scarlet globemallow
<u>Mentzelia</u> <u>pumila</u> (Nutt.) T. & G.	Dwarf mentzelia
<u>Pediocactus</u> <u>simpsonii</u> (Engelm.) Brit. & Rose	Little barrel cactus
<u>Oenothera</u> <u>marginata</u> Nutt.	Evening primrose
<u>Sphaerostigma</u> <u>contortum</u> (Dougl.) Walp.	Twistedpod sphaerostigma
<u>Chylismia</u> <u>scapoidea</u> (Nutt.) Small.	Chylismia
<u>Cymopterus</u> <u>lpidosus</u> Jones	Cymopterus
<u>Phlox</u> <u>hoodii</u> Rich.	Tufted phlox
<u>Phlox</u> <u>longifolia</u> Nutt.	Wild sweet William
<u>Gilia</u> <u>leptomeria</u> A. Gray	Slender gilia
<u>Gilia</u> <u>inconspicua</u> (Smith) Dougl.	Dwarf gilia
<u>Gilia</u> <u>aggregata</u> (Pursh) Spreng.	Scarlet gilia
<u>Phacelia</u> <u>crenata</u> Torr.	Purple phacelia
<u>Lappula</u> <u>occidentalis</u> (S. Wats.) Greene	Western stickseed
<u>Cryptantha</u> <u>affinis</u> (Gray) Greene	Silverclub
<u>Cryptantha</u> <u>flavoculata</u> (A. Nels.) Payson	Cateye
<u>Pentstemon</u> sp.	Pentstemon
<u>Castilleja</u> <u>chromosa</u> A. Nels.	Paintbrush
<u>Gutierrezia</u> <u>microcephala</u> A. Gray	Snakeweed, matchweed
<u>Aplopappus</u> <u>amerioides</u> (Nutt.) A. Gray	Aplopappus
<u>Aplopappus</u> <u>acaulis</u> (Nutt.) A. Gray	Aplopappus
<u>Townsendia</u> <u>excapa</u> (Rich.) Porter	Townsendia
<u>Townsendia</u> <u>watsoni</u> A. Gray	Townsendia
<u>Aster</u> <u>leucelene</u> Blake	Dwarf aster
<u>Aster</u> <u>leucanthemifolius</u> Greene	Desert aster
<u>Erigeron</u> <u>divergens</u> T. & G.	Fleabane
<u>Franseria</u> <u>acanthicarpa</u> (Hook.) Coville	False ragweed
<u>Hymenopappus</u> <u>filifolius</u> Hook.	Hymenopappus
<u>Chaenactis</u> <u>steviodes</u> Hook. & Arn.	Annual chaenactis
<u>Senecio</u> <u>uintahensis</u> A. Nels.	Uintah senecio
<u>Malacothrix</u> <u>sonchoides</u> (Nutt.) T. & G.	Malacothrix
<u>Lygodesmia</u> <u>grandiflora</u> T. & G.	Desert pink
<u>Lygodesmia</u> <u>junceae</u> Don.	Lygodesmia

Narrow rocky ravines, especially those with steep walls among cliffs, where drainage water lasts longer because of the extra shade they get from the cliffs, provide contrasts in habitat conditions and harbor a few shrubs and other plants not commonly found elsewhere on the hillsides. In such places the squawbush, four-wing saltbush, Atriplex canescens (Pursh.) Nutt., and some of the taller rabbitbrushes extend upwards from the terraces while a few plants common in mountainous areas find here a minimum of conditions permitting their growth. The latter include depauperate shrubs of rock spiraea, Holodiscus dumosus (Nutt.) Heller; chokecherry, Prunus melanocarpa A. Nels.; broadleaf mountain mahogany, Cercocarpus montanus Raf.; and the snowberry, Symphoricarpos albus (L.) Blake. Herbs characteristic of this type of habitat include Eriogonum chrysocephalum A. Gray, Arabis formosa Greene and Leptodactylon pungens (Torr.) Nutt. which occur principally among rocks or lodged in crevices. Species of the surrounding hills show a more vigorous growth in these places as in the instance of taller shrubs, and optimum growth of herbs like the purple phacelia, Chylismia scapoidea, peppergrass, paintbrush, annual chaenactis, Malacothrix sonchoides, Aplopappus amerioides, Artemisia ludoviciana and its varieties, and A. frigida Willd.

On the north sides of Lucerne and Currant Creek valleys, where higher hog-back ridges cut across the Green River valley at right angles, the variety of plants is greater than in other parts of the desert area since many of the plants occur on the south side of these valleys on outlying extensions from the Uinta Range. In this general region Utah juniper stands out conspicuously as the only tree entering the desert plains and hillsides.

VEGETATION OF THE SOUTHERN MOUNTAINOUS REGION

The Green River enters Flaming Gorge very suddenly and the topography changes from the lower rolling hills to high mountains with deep canyons where the climate is more humid and the soils change from saline clay loams to salt-free sand and sandy loams, derived from predominantly sandstone rocks although limestone and shale produce rocky loams higher in the gorge. Strongly contrasting slope exposures and deep ravines provide watersheds where winter snows insure a longer and steadier supply of ground water during late spring and summer. Several side canyons carry sizable perennial streams and a number of springs.

The most notable change in aspect of the vegetation between the two regions is from a salt desert shrub to essentially conifer forests with a more lush growth of streamside plants (Fig. 8). It is a notable feature that most of the plants of the northern desert region persist in the bottoms of the deep canyons but there most of them assume a minor role in the various communities, especially the salt bushes and herbs.

RIVER BANK COMMUNITIES

In the canyons of the Green River, the banks are of several sorts including high vertical cliffs, vertical soil banks up to 15 feet high, narrow banks of variable pitch to wide banks ranging up to as much as 60 yards wide at their



Fig. 7. Rabbitbrush seldom dominates a large community as it does here. Photo by Gerald Groves.



Fig. 8. Shown here is the "canyon effect" which brings conifers from the mountains into much lower altitudes; also shown is rocky river bank with scanty vegetation. Photo by Gerald Groves.

widest points. For about half the distance through these canyons the deposits of the banks are usually muddy in character being composed of silt carried down from above by the river while in the lower part of Red Canyon sand predominates variably mixed with silt. Where some steep rock slopes extend to the water edge masses of fallen rocks line the banks. In these canyons the river is quite sinuous and the current is swifter so that there are only a few straight stretches where the deposits have formed bars of any extent and there are only a few low lying islands maintained by rocks in midstream.

Although most of the species found on the river banks of the desert region occur in this region also, they are usually dispersed in a somewhat different manner and often among different dominant plants. The diversity of situation precludes a classification of river bank communities except in a very general way. The distribution of specific plants is irregular and discontinuous, small communities of one group of plants giving way at short intervals to different groups. Throughout the entire course of the river the spike rush, baltic rush and sandbar willow range from scanty growths to small concentrated patches and frequently as very narrow fringes.

On the steep rocky banks of Horseshoe and Kingfisher canyons, river birch, boxelder and narrowleaf cottonwood form a discontinuous narrow fringe with the wild rose, sandbar willow, yellow willow and dogwood here and there. The boxelder stands out conspicuously as it usually exceeds the other trees in height while its abundant bright green foliage contrasts strongly with the duller green of the associated plants. Here and there erect cylindrical dark green stems of the tall horsetail form bristling colonies on the wet soil. Along these banks a few terrace species such as squawbush, big sagebrush and several rabbitbrushes crowd in just back of the riverbank species while the Utah juniper, pinon pine, Douglas fir, ponderosa pine (Fig. 9) and numerous other hillside species merge with and sometimes grow among the riverbank species. In contrast, a few alluvial flats and slopes occur along the cutting side of the river where vertical soil banks as high as 15 feet have little or no vegetation along the water edge while big sagebrush or Utah juniper extend to the brink of the bluffs. Elsewhere the soil slopes descend gradually toward the river forming broader banks harbouring dense clumps of wild rose or small thickets of yellow willow, sandbar willow and the alder. In some places there is a rich growth of grasses, rushes, sedges and water-loving herbs between the trees.

In Red Canyon the same sort of river bank communities are found but they are more patchy. Here are more small sandy bars supporting mainly herbaceous plants in open stands with much bare soil exposed. Along these banks the beach grass, Spartina gracilis, makes its appearance together with three species of horsetail, curly dock, Mexican dock, silverweed and willow herb. Other small bars are diverse in plants; for example, a dense stand of the giant ryegrass about 150 yards long and up to 50 yards wide was practically the only species covering the soil completely while the Canadian reedgrass occurs as a dominant plant at a few points, and here and there small bars may harbour thickets of dogwood, willow, or birch.



Fig. 9. A scene in the canyons showing pigmy conifers of juniper and pinyon pine and larger coniferous forests extending from river edge to canyon top. Photo by Phil Dotson.



Fig. 10. A typical scene of a side canyon draining from the Uinta Mountains. Photo by Phil Dotson.

The generalized composition of the river banks is as follows:

Dominant (sometimes subdominant):

<u>Populus angustifolia</u> James	Narrowleaf cottonwood
<u>Salix exigua</u> Nutt.	Sandbar willow
<u>Salix lutea</u> Nutt.	Yellow willow
<u>Betula fontinalis</u> Sarg.	River birch
<u>Alnus tenuifolia</u> Nutt.	Alder
<u>Cornus stolonifera</u> Michx.	Red osier dogwood
<u>Rosa woodsii</u> Lindb.	Wild rose
<u>Acer interius</u> Britt.	Boxelder

Locally dominant, general throughout the canyon:

<u>Equisetum arvense</u> L.	Meadow horsetail
<u>Equisetum kansanum</u> Schaffn.	Kansas horsetail
<u>Equisetum prealtum</u> Raf.	Tall horsetail
<u>Eleocharis palustris</u> (L.) Roem & Schult.	Spike rush
<u>Juncus balticus</u> Willd.	Baltic rush
<u>Agrostis alba</u> L.	Red top
<u>Calamagrostis canadensis</u> (Michx.) Beauv.	Bluejoint, Canada reedgrass
<u>Spartina gracilis</u> Trin.	Beachgrass, cordgrass

Frequent:

<u>Polypogon monspeliensis</u> (L.) Desf.	Beard grass
<u>Hordeum jubatum</u> L.	Squirrel-tail barley
<u>Carex aurea</u> Nutt.	Golden sedge
<u>Carex stipata</u> Muhl.	Sedge
<u>Carex nebraskensis</u> Dewey	Nebraska sedge
<u>Juncus bufonius</u> L.	Toad rush
<u>Juncus longistylis</u> Torr.	Long-style rush
<u>Juncus brunescens</u> Rydb.	Brown rush
<u>Juncus orthophyllus</u> Coville	Straightleaf rush
<u>Juncoides parviflorum</u> (Ehrh.) Coville	Small-flowered woodrush
<u>Epilobium adenocaulon</u> Haussk.	Willowherb
<u>Rumex crispus</u> L.	Curly dock
<u>Rumex persicarioides</u> L.	Golden dock
<u>Rumex mexicanus</u> Meisn.	Mexican dock

Occasional:

<u>Scirpus americanus</u> Pers.	American rush
<u>Urtica breweri</u> S. Wats.	Stinging nettle
<u>Ranunculus cymbalaria</u> Pursh.	Trailing buttercup
<u>Radicula lyrata</u> (Nutt.) Green	Cress
<u>Potentilla anserina</u> L.	Silverweed
<u>Mentha penardi</u> (Brig.) Rydb.	Mint
<u>Solidago trinervata</u> Greene	Goldenrod
<u>Cirsium arvense</u> (L.) Scop.	Canada thistle
<u>Leontodon taraxacum</u> L.	Dandelion



Fig. 11. Rich growth of herbs along South Skull Creek.
Photo by Phil Dotson.



Fig. 12. Juniper and pinyon (pigmy conifers) on south facing slopes and ponderosa pines along river edges in the canyon. Photo by Gerald Groves.

SIDE CANYONS

Several side canyons carrying streams of clear water (Fig. 10) join the Green River mainly from the south and west. The valleys are V shaped, with a few wide areas formed by alluvial fans from side ravines and flats formed by the sedimentation of old beaver ponds.

Sheep Creek arises high in the Uinta Mountains and enters the Green River from the west at the western end of Red Canyon. The stream averages about 10 feet wide with a fairly swift current and is characteristic of many mountain brooks in its sinuous course, rocky bed and variable banks. Over most of the distance river birch, willows, boxelder, river hawthorn and narrowleaf cottonwood dominate the general aspect with intervening areas where wild rose, golden currant, alder, dogwood and sandbar willow are the principal smaller trees. At some points the stream has cut through alluvial fans and higher level ground, forming high bluffs on the cutting side and small flood plains on the depositing side. On the latter side small herbaceous communities of grasses, sedges and rushes have a fresh lushness especially in some broader meadow-like situations rising gradually to drier ground. Here is a wider variety of hydrophytic and mesophytic herbs and shrubs including a number of brightly colored flowers dotting the meadows and copses. Species such as the yellow monkey flower, buckbean and cinquefoils contrast with the reds of the marsh paintbrush, red clover, Rocky Mountain bee plant and Canada thistle.

Carter Creek enters Red Canyon from the south about seven miles below Sheep Creek Canyon. It is a rather short steep canyon with a wider stream bed strewn with larger rocks round which the swift water dashes. The banks are also bordered with large rocks, here and there with niche-like sandy areas between them. Here again there is little distinction between the dominant plants of the river banks and terraces; only among the lower layers is there a contrast between the hydrophyte and mesophyte as the mountain sides rise abruptly. At the mouth of the canyon there are tall narrowleaf cottonwoods with a few boxelders, blue spruce and Douglas fir ranging outward from the river banks across a small terrace. Whip lash willow, yellow willow, river birch and alders form a lower layer bordering the stream. The canyon bottom in general is filled with a dense growth of alder in which a few tall cottonwoods, spruce and fir are scattered while the willows, dogwood, wild rose, hawthorn, twinberry, black and fetid currants grow closer to the stream bank and are almost obscured by the denser alders. Here and there between the trees are small grassy areas in which mesophytes and zerophytes mingle. Several species are downward extensions from their more normal altitudinal range above 6,000 feet elevation. These include the lovely white pearly everlasting, blue bell, red baneberry, northern bedstraw, thimble berry, strawberry, mountain dogbane, black and fetid currants.

Smaller steep side canyons carrying small brooks enter from the south. These are Hideout Canyon, Allen Creek, Eagle Creek, Trail Creek, South Skull Creek (Fig. 11), and Cart Creek. The vegetation along these brooks is of the same general character as in the larger side canyons, with local variations.

In contrast, North Skull Creek, entering from the drier north side of Red Canyon, has a very small brook which fails to reach the Green River, the water disappearing in the gravelly soil about a quarter of a mile from the mouth. Along the brook is a rather poor growth of narrowleaf cottonwood with widely

spaced clumps of birches and a few scattered willows and wild rose. In the mouth of the canyon several acres of rabbitbrush represent terrace types with a grove of boxelder near the river.

The general composition of the river bank communities is as follows:

Dominant trees:

<u>Populus angustifolia</u> James	Narrowleaf cottonwood
<u>Salix exigua</u> Nutt.	Sandbar willow
<u>Salix lutea</u> Nutt.	Yellow willow
<u>Salix caudata</u> (Nutt.) Heller	Whiplash willow
<u>Betula fontinalis</u> Sarg.	River birch
<u>Alnus tenuifolia</u> Nutt.	Alder
<u>Acer interior</u> Britt.	Boxelder

Subdominant or frequent trees and shrubs:

<u>Salix geyeriana</u> Andress.	Geyer willow
<u>Salix bebbiana</u> Sarg.	Beb or beaked willow
<u>Ribes aureum</u> Pursh.	Golden currant
<u>Ribes petiolare</u> Dougl.	Fetid currant
<u>Ribes inerme</u> Rydb.	Black or wine gooseberry
<u>Rosa woodsii</u> Lindb.	Wild rose
<u>Amelanchier alnifolia</u> Nutt.	Service berry
<u>Crataegus rivularis</u> Nutt.	River hawthorn
<u>Prunus melanocarpa</u> (A. Nels.) Rydb.	Chokecherry
<u>Cornus stolonifera</u> Michx.	Red osier dogwood
<u>Lonicera involucrata</u> Banks.	Twinberry

Frequent grasses and herbs, locally dominant:

<u>Agrostis palustris</u> Huds.	Marsh bentgrass
<u>Calamagrostis canadensis</u> (Michx.) Beauv.	Canadian reedgrass
<u>Phleum pratense</u> L.	Timothy
<u>Distichlis stricta</u> (Torr.) Rydb.	Saltgrass
<u>Poa pratensis</u> L.	Kentucky bluegrass
<u>Poa palustris</u> L.	Swamp bluegrass
<u>Glyceria striata</u> (Lam.) Hitchc.	Fowl mannagrass
<u>Glyceria grandis</u> S. Wats.	American mannagrass
<u>Festuca elatior</u> L.	Meadow fescue
<u>Hordeum jubatum</u> L.	Squirrel tail barley
<u>Elymus condensatus</u> Presl.	Giant ryegrass
<u>Scirpus americanus</u> Pers.	American rush
<u>Eleocharis palustris</u> (L.) Roem. & Schult.	Spikerush
<u>Eleocharis acicularis</u> (L.) Roem. & Schult.	Needle rush
<u>Carex nebraskensis</u> Dewey	Nebraska sedge
<u>Carex aurea</u> Nutt.	Golden sedge
<u>Carex rostrata</u> Stokes	Beaked sedge
<u>Carex aquatilis</u> Wahl.	Aquatic sedge
<u>Carex stipata</u> Muhl.	Stipitate sedge
<u>Juncus balticus</u> L.	Baltic rush
<u>Juncus bufonius</u> L.	Toad rush
<u>Juncus longistylis</u> Torr.	Long-style rush
<u>Juncus orthophyllus</u> Coville	Straightleaf rush

Frequent grasses and herbs, locally dominant (continued)

<u>Juncus tweedii</u> Rydb.	Tweedy rush
<u>Juncus brunnescens</u> Rydb.	Brown rush
<u>Juncoides parviflorum</u> (Ehrh.) Coville	Juncoides
<u>Urtica breweri</u> S. Wats.	Stinging nettle
<u>Rumex crispus</u> L.	Curly dock
<u>Rumex mexicanus</u> Meisn.	Mexican dock
<u>Smilacina stellata</u> (L.) Desf.	Star-flowered false Solomon seal
<u>Habenaria borealis</u> Cham.	Rein orchis
<u>Stellaria jamesiana</u> Torr.	Chickweed
<u>Ranunculus cymbalaria</u> Pursh.	Trailing buttercup
<u>Radicula nasturtium-aquaticum</u> Britt. & Rend.	Watercress
<u>Roripa lyrata</u> (Nutt.) Greene	Yellow cress
<u>Potentilla anserina</u> L.	Silverweed
<u>Potentilla filipes</u> Rydb.	Cinquefoil
<u>Potentilla biennis</u> Greene	Cinquefoil
<u>Potentilla milligrana</u> Engelm.	Cinquefoil
<u>Geum macrophyllum</u> Willd.	Avens
<u>Thermopsis montana</u> Nutt.	Buck-beans
<u>Trifolium repens</u> L.	White clover
<u>Trifolium pratense</u> L.	Red clover
<u>Melilotus alba</u> L.	White sweet clover
<u>Melilotus officinalis</u> (L.) Lam.	Yellow sweet clover
<u>Astragalus mertonii</u> Nutt.	Tall locoweed
<u>Glycyrrhiza lepidota</u> Nutt.	Wild licorice
<u>Sphaeralcea rivularis</u> (Dougl.) Torr.	River hollyhock
<u>Viola canadensis</u> L.	Canada white violet
<u>Epilobium adenocaulon</u> Haussk.	Willow herb
<u>Circaea pacifica</u> Aschers. & Magn.	Enchanters-nightshade
<u>Hippuris vulgaris</u> L.	Marestail
<u>Conium maculatum</u> L.	Poison hemlock
<u>Cicuta occidentalis</u> Greene	Water hemlock
<u>Angelica pinnata</u> S. Wats.	Angelica
<u>Angelica dilatata</u> A. Nels.	Angelica
<u>Glaux maritima</u> L.	Saltwort
<u>Apocynum cannabinum</u> L.	Dogbane, Indian hemp
<u>Asclepias speciosa</u> Torr.	Milkweed
<u>Mertensia brevistyla</u> S. Wats.	Mertensia
<u>Mertensia foliosa</u> A. Nels.	Mertensia
<u>Mentha penardi</u> (Briq.) Rydb.	Mint
<u>Prunella vulgaris</u> L.	Self-heal
<u>Mimulus guttatus</u> DC.	Yellow monkeyflower
<u>Mimulus moschatus</u> Dougl.	Small monkeyflower
<u>Limosella aquatica</u> L.	Mudwort
<u>Veronica americana</u> Schwein.	American speedwell
<u>Veronica anagallis-aquatica</u> L.	Speedwell
<u>Castilleja exilis</u> A. Nels.	Marsh paintbrush
<u>Plantago major</u> L.	Common plantain
<u>Galium triflorum</u> Michx.	Bedstraw
<u>Galium boreale</u> L.	Northern bedstraw
<u>Sambucus caerulea</u> Raf.	Blue elderberry
<u>Sambucus microbotrys</u> Rydb.	Red elderberry



Fig. 13. Steep banks with Douglas Fir close to river. Photo by Gerald Groves.



Fig. 14. Coniferous forests on north facing slopes in the canyon. Photo by Gerald Groves.

Frequent grasses and herbs, locally dominant (continued)

<u>Solidago canadensis</u> L.	Canadian goldenrod
<u>Chrysothamnus linifolius</u> Greene	Rabbitbrush
<u>Erigeron canadensis</u> L.	Canadian fleabane
<u>Gnaphalium palustre</u> Nutt.	Cudweed
<u>Helianthus nuttallii</u> T. & G.	Nuttall sunflower
<u>Bidens cernua</u> L.	Beggar-ticks
<u>Helenium montanum</u> Nutt.	Snееzweed
<u>Cirsium arvense</u> (L.) Scop.	Canada thistle
<u>Leontodon taraxacum</u> L.	Dandelion

TERRACE COMMUNITIES

Only a few river-formed terraces occur along Green River in this region. Most of the areas occupied by terrace types of vegetation occur as a narrow strip along steep slopes and on some alluvial fans at the mouths of side ravines. While narrowleaf cottonwood, river birch, willows, dogwood and wild rose were typical of terraces in the desert region, here they are river bank types extending upward or outward to the drier areas with no sharp line of demarcation. On the other hand terrace types like squawbush, golden currant, and rabbitbrush crowd closely down to the river bank plants on steep slopes or form limited communities on some alluvial slopes. The big sagebrush, being both a terrace and hillside plant, is more or less ubiquitous on the lower mountain slopes. The boxelder and river hawthorn are more typical types but they occur in the canyon bottoms in general.

Since the region is essentially non-saline, the saltgrass, greasewood and saltbushes are scarce and occur only sparingly here and there or in local stands along the lower parts of some alluvial slopes. The general flora of the ill-defined terrace areas in these canyons is so merged with river banks and hillside communities as to have little or no individuality and is omitted. For example, groves of yellow pine grow on some terraces while the Utah juniper descends at frequent intervals to the zones of capillary water.

MOUNTAINSIDE COMMUNITIES

The general aspect of the vegetation of the mountainsides is mainly two-fold. The south facing sides of the canyons show more or less scattered Utah juniper and pinyon pine spotting the rocky slopes and clinging to ledges among the cliffs (Fig. 12) often extending nearly to the river banks and here and there forming dense clumps. On the north facing slopes tall Douglas fir (Fig. 13) and blue spruce form dense forests (Fig. 14) sometimes extending to the river banks and often obscuring much of the rocky terrain while at lower elevations the ponderosa pine becomes conspicuous on both sides of the river. In Red Canyon, the dark green of the trees stands out in contrast with the red sandstones. On some ridges, where the trees are less dense or lacking, shrubs predominate including broadleaf mountain mahogany, snowberry, wax currant and bitterbrush. In steep rocky ravines, chokecherry, service berry and mountain red maple are conspicuous at lower levels while at higher levels the aspen becomes predominant, sometimes spreading to the hillsides.

In local favorable habitats, principally in ravines, the Douglas fir and blue spruce occur among the Utah juniper and pinyon pine on the south-facing slopes and conversely the latter trees occur on some north-facing slopes, especially where the bottom of the main canyon and side ravines are wide and exposed to more direct sunlight. Here they extend upward on the slopes for considerable distance merging with the taller conifers and the shrubs. Many shrubs and herbs are common to both sides of the canyons although they are more robust and denser on the north-facing slopes. Local variations in composition and density are numerous. In this respect the yellow pine is outstanding. It forms small groves on the river banks and open woods along a few level areas parallel with the river. Its large trunks with light tan-colored scaly bark and its densely clustered long needle-like leaves on stout irregular horizontal branches make a strong contrast with the surrounding plants.

Juniper-pinyon pine community

This community is most distinctive. The juniper and pinyon pine dominate the aspect while the shrubs and herbs are mostly scattered with considerable exposed soil and rocks between them. In addition, the mountain red juniper is a conspicuous member although in much fewer numbers. Conspicuous shrubs include the jointfir, bitterbrush, and broadleaf mountain mahogany. The general composition is as follows:

Dominant trees:

<u>Juniperus osteosperma</u> (Torr.) Little	Utah juniper
<u>Pinus edulis</u> Engelm.	Pinyon pine

Occasional tree:

<u>Juniperus scopulorum</u> Sarg.	Mountain red juniper
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Frequent shrubs:

<u>Ephedra viridis</u> Coville	Green jointfir
<u>Purshia tridentata</u> (Pursh) DC.	Bitterbrush
<u>Cercocarpus montanus</u> Raf.	Broadleaf mountain mahogany
<u>Holodiscus dumosus</u> Heller	Rock spiraea
<u>Artemisia tridentata</u> Nutt.	Big sagebrush

Douglas fir-blue spruce community

The tall conifers dominate the more protected slopes forming a watershed where winter snow remains longer and where the undergrowth is taller and denser. The general composition is as follows:

Dominant trees:

<u>Pseudotsuga menziesii</u> (Mirb.) Franco	Douglas fir
<u>Picea pungens</u> Engelm.	Blue spruce

Frequent trees:

<u>Pinus ponderosa</u> Dougl.	Ponderosa pine, at lower elevations
<u>Pinus contorta</u> Dougl.	Lodgepole pine, at high elevations
<u>Juniperus scopulorum</u> Sarg.	Mountain red juniper

Frequent shrubs:

<u>Cercocarpus montanus</u> Raf.	Broadleaf mountain mahogany
<u>Holodiscus dumosus</u> Heller	Rock spiraea
<u>Purshia tridentata</u> (Pursh) DC.	Bitterbrush
<u>Prunus melanocarpa</u> (A. Nels.) Rydb.	Chokecherry
<u>Amelanchier alnifolia</u> Nutt.	Service berry
<u>Symphoricarpos vaccinioides</u> Rydb.	Snowberry

The composition of the less frequent shrubs and herbs is much the same in both communities. A generalized list includes the following:

Shrubs:

<u>Berberis repens</u> Lindb.	Oregon grape
<u>Ribes cereum</u> Dougl.	Wax currant
<u>Philadelphus occidentalis</u> A. Nels.	Western mock orange
<u>Symphoricarpos albus</u> (L.) Blake	White snowberry, at low elevations

The zone forming a junction between the river banks and the uplands is often of a mixed composition where some of the river bank types and certain species which do not occur elsewhere merge with the upland shrubs or trees. Here squawbush, river hawthorn, boxelder, wild rose, chokecherry, service berry and the white snowberry form variably mixed communities sometimes with local stands of the big sagebrush and rabbitbrush while the virgin bower sprawls over the larger plants or climbs upward along the bases of cliffs. Intervening between clumps of trees and shrubs are local grassy spots and some open areas where much bare soil is exposed. Here a wide variety of herbs stand out conspicuously while upward on the hills the same species persist in greatly reduced numbers so that the general composition consists of the same species but in varying frequency and numbers. The general overall composition is as follows:

Frequent shrubs:

<u>Gutierrezia microcephala</u> (DC.) A. Gray	Snakeweed
<u>Artemisia dracunculoides</u> Pursh.	Aromatic sagebrush
<u>Artemisia frigida</u> Willd.	Silver or mt. sagebrush
<u>Chrysothamnus nauseosus</u> (Pall.) Britt.	Big rabbitbrush
<u>Chrysothamnus viscidiflorus</u> (Hook.) Nutt.	Varnished rabbitbrush
<u>Chrysothamnus graveolens</u> (Nutt.) Greene	Tall rabbitbrush

Frequent herbs:

<u>Sporobolus cryptandrus</u> (Torr.) A. Gray	Sand dropseed
<u>Aristida longiseta</u> Steud.	Purple three-awn grass
<u>Stipa comata</u> Trin. & Rupr.	Needle and thread grass
<u>Poa secunda</u> Presl.	Sandberg bluegrass
<u>Poa ampla</u> Merr.	Big bluegrass

Frequent herbs (continued)

<u>Bromus tectorum</u> L.	Downy chess
<u>Agropyron spicatum</u> (Pursh) Scrib. & Smith	Bunch wheatgrass
<u>Agropyron trachycaulum</u> (Link) Malte	Slender wheatgrass
<u>Agropyron smithii</u> Rydb.	Western bluestem wheatgrass
<u>Hordeum jubatum</u> L.	Foxtail barley
<u>Elymus condensatus</u> Presl.	Giant wild rye
<u>Sitanion hystrix</u> (Nutt.) J. G. Smith	Squirreltail
<u>Calochortus nuttallii</u> T. & G.	Sego
<u>Allium acuminatum</u> Hook.	Wild onion
<u>Eriogonum cernuum</u> Nutt.	Nodding eriogonum
<u>Eriogonum racemosum</u> Nutt.	Wild buckwheat
<u>Eriogonum chrysocephalum</u> A. Gray	Golden eriogonum
<u>Eriogonum microthecum</u> Nutt.	Eriogonum
<u>Eriogonum elatum</u> Dougl.	Tall eriogonum
<u>Eriogonum corymbosum</u> Benth.	Shrubby eriogonum
<u>Eriogonum ovalifolium</u> Nutt.	Silver plant
<u>Chenopodium leptophyllum</u> Nutt.	Narrowleaf chenopodium
<u>Chenopodium album</u> L.	Lambsquarters
<u>Atriplex rosea</u> L.	Rose atriplex
<u>Amaranthus blitoides</u> S. Wats.	Pigweed
<u>Abronia elliptica</u> A. Nels.	Sandverbena
<u>Arenaria uintahensis</u> A. Nels.	Sandwort
<u>Delphinium menziesii</u> DC.	Larkspur
<u>Stanleya pinnata</u> (Pursh) Britt.	Prince plume
<u>Schoenocrambe linifolia</u> (Nutt.) Greene	Plains mustard
<u>Thelypodium integrifolium</u> (Nutt.) Endl.	Thelypodium
<u>Lepidium montanum</u> Nutt.	Mountain peppergrass
<u>Lepidium virginicum</u> L.	Peppergrass
<u>Physaria didymocarpa</u> (Hook.) A. Gray	Bladderpod
<u>Camelina microcarpa</u> Andrz.	Gold of pleasure
<u>Descurainia pinnata</u> (Walt.) Britt.	Tansy mustard
<u>Arabis glabra</u> (L.) Benth.	Tower mustard
<u>Arabis holboellii</u> Hornem.	Rockcress
<u>Erysimum asperum</u> DC.	Western wallflower
<u>Cleome lutea</u> Hook.	Yellow beeweed
<u>Cleome serrulata</u> Pursh.	Rocky mountain beeweed
<u>Polanisia trachycarpa</u> T. & G.	Clammyweed
<u>Sedum stenopetalum</u> Pursh.	Stonecrop
<u>Lupinus arentinus</u> Rydb.	Silver lupine
<u>Lupinus pusillus</u> Pursh.	Dwarf lupine
<u>Astragalus diversifolius</u> A. Gray	Narrowleaf locoweed
<u>Astragalus</u> spp.	(3-4 species undetermined)
<u>Glycyrrhiza lepidota</u> Nutt.	Wild licorice
<u>Erodium cicutarium</u> (L.) L'Her	Filaree
<u>Euphorbia glyptosperma</u> Engelm.	Little spurge
<u>Euphorbia albomarginata</u> (T. & G.) Small	Spurge
<u>Sphaeralcea coccinea</u> (Pursh) Rydb.	Scarlet globe mallow
<u>Mentzelia pumila</u> (Nutt.) T. & G.	Dwarf mentzelia
<u>Pediocactus simpsonii</u> (Engelm.) Brit. & Rose	Simpson cactus
<u>Opuntia hystricina</u> Engelm. & Biglow	Yellow pricklypear

Frequent herbs (continued)

<u>Ceanothus rhodanthus</u> Schum.	Red pricklypear
<u>Ceanothus marginatus</u> Nutt.	Evening primrose
<u>Ceanothus pallida</u> (Lindl.) Britton	Pale evening primrose
<u>Chylisma scapoidea</u> (Nutt.) Small	Chylisma
<u>Aulospermum jonesii</u> Coult. & Rose	Indian parsnip
<u>Cogswellia macdougalii</u> (Coult. & Rose) Jones	Cogswellia
<u>Asclepias carpricornu</u> Woodson	Spider milkweed
<u>Phlox longifolia</u> Nutt.	Wild sweet William
<u>Gilia aggregata</u> (Pursh) Spreng	Scarlet gilia
<u>Gilia leptomeria</u> A. Gray	Gilia
<u>Phacelia corrugata</u> A. Nels.	Purple phacelia
<u>Cynoglossum officinale</u> L.	Hounds tongue
<u>Lappula occidentalis</u> (S. Wats.) Greene	Western stickseed
<u>Cryptantha flavoculata</u> (A. Nels.) Payson	Cateye
<u>Cryptantha affinis</u> (A. Gray) Greene	Cryptantha
<u>Verbena bracteosa</u> Michx.	Prostrate verbena
<u>Pentstemon</u> spp.	(2 species undetermined)
<u>Castilleja chromosa</u> A. Nels.	Paintbrush
<u>Castilleja linariaefolia</u> Benth.	Paintbrush
<u>Adenostegia ramosa</u> (Nutt.) Greene	Slender adenostegia
<u>Thalesia uniflora</u> (L.) Britton	Cancer-root
<u>Plantago purshii</u> Roem. & Schult.	Desert plantain
<u>Coleosanthus grandiflorus</u> (Hook.) Kuntze	Brickellia
<u>Grindelia squarrosa</u> (Pursh) Dunal.	Gumweed
<u>Chrysopsis villosa</u> (Pursh) Nutt.	Hairy chrysopsis, golden aster
<u>Solidago trinervata</u> Greene	Goldenrod
<u>Solidago petradoria</u> Blake	Rock goldenrod
<u>Aplopappus amerioides</u> (Nutt.) A. Bray	Aplopappus
<u>Aster leucelene</u> Blake	Dwarf aster
<u>Aster eatonii</u> (Gray) Howell	Eaton aster
<u>Erigeron divergens</u> T. & G.	Daisy fleabane
<u>Townsendia exscapa</u> (Richards) Porter	Townsendia
<u>Antennaria</u> spp.	(2 species undetermined)
<u>Iva axillaris</u> Pursh.	Poverty weed
<u>Franseria acanthicarpa</u> (Hook.) Coville	Bur sage
<u>Viguiera multiflora</u> (Nutt.) Blake	Goldenray
<u>Helianthus annuus</u> L.	Sunflower
<u>Chaenactis douglasii</u> (Hook.) H. & A.	Chaenactis
<u>Chaenactis stevioides</u> H. & A.	Annual chaenactis
<u>Gaillardia gracilis</u> A. Nels.	Gaillardia
<u>Achillea lanulosa</u> Nutt.	Yarrow
<u>Artemisia ludoviciana</u> Nutt.	Herbaceous sagebrush
<u>Artemisia gnaphalodes</u> Nutt.	Herbaceous sagebrush
<u>Senecio uintahensis</u> (A. Nels.) Greenm.	Uinta senecio
<u>Senecio cymbalarioides</u> Nutt.	Senecio
<u>Senecio integerrimus</u> Nutt.	Senecio
<u>Cirsium undulatum</u> (Nutt.) Spreng.	Thistle
<u>Hymenoxys acaulis arizonica</u> (Greene) Blake	Hymenoxys
<u>Ptiloria</u> sp.	Undetermined
<u>Lactuca pulchella</u> (Pursh) DC.	Blue lettuce

Frequent herbs (continued)

<u>Lygodesmia grandiflora</u> (Nutt.) T. & G.	Desert pink
<u>Lygodesmia juncea</u> (Pursh) D. Don.	Slender lygodesmia
<u>Agoseris glauca</u> (Pursh) D. Dietr.	False dandelion
<u>Crepis acuminata</u> Nutt.	Hawks-beard

In some of the deeper more shady side canyons the intermediate zone is somewhat more mesophytic and harbors a number of grasses, herbs and low shrubs which dominate these local areas. These include:

Shady side canyon vegetation:

<u>Stipa columbiana</u> Macoun.	Needle and thread grass
<u>Stipa lettermannii</u> Vasy	Lettermann stipa
<u>Phleum pratense</u> L.	Timothy
<u>Bromus carinatus</u> H. & A.	California brome
<u>Poa pratensis</u> L.	Kentucky bluegrass
<u>Fragaria bracteata</u> Heller	Strawberry
<u>Rubus parviflorus</u> Nutt.	Thimbleberry
<u>Rubus melanolasius</u> Focke	Western red raspberry
<u>Potentilla filipes</u> Rydb.	Cinquefoil
<u>Berberis repens</u> Lindl.	Oregon grape
<u>Rhus radicans</u> var. <u>rydbergii</u> Small	Poison ivy
<u>Galium boreale</u> L.	Northern bedstraw
<u>Apocynum androsaemifolium</u> L.	Dogbane
<u>Campanula uniflora</u> L.	Bluebell
<u>Anaphalis margaritacea subalpina</u> A. Gray	Pearly everlasting
<u>Antennaria microphylla</u> Rydb.	Everlasting
<u>Lactuca pulchella</u> L.	Blue lettuce

Of special interest are some plants of limited occurrence and distribution. In rocky ravines and crevices or under rocks on hillside are species adapted to these habitats. Here the brittle fern is frequent, its delicate leaves becoming shrivelled in late summer while the more xerophytic lip fern merely curls its leaves up in scaly scrolls until moisture returns. Three species of the little clubmoss are frequent in crevices and under rocks on dry slopes. A number of herbs and shrubs are peculiar to these places and, although some of them are of general distribution on the hillsides, they reach their best growth here and are usually dominant in the narrower rocky ravines. Included here are the following:

Rocky ravine vegetation:

Shrubs:

<u>Ephedra viridis</u> Coville	Ephedra
<u>Holodiscus dumosus</u> Heller	Rock spiraea
<u>Cercocarpus intricatus</u> S. Wats.	Dwarf mountain mahogany
<u>Philadelphus occidentalis</u> A. Nels.	Western mock orange
<u>Ribes cereum</u> Dougl.	Wax currant
<u>Forsellesia spinescens</u> A. Gray	Forsellesia
<u>Aplopappus watsoni</u> A. Gray	Watson aplopappus
<u>Laphamia stansburii</u> A. Gray	Laphamia

Herbs:

Heuchera parviflora utahensis (Rydb.) Garrett . Alum-root
Cogswellia grayi Coult. & Rose Grays cogswellia
Cynomarathrum nuttallii (A. Gray) Coult. & Rose. Nuttall dog-parsley
Leptodactylon watsoni (A. Gray) Rydb. Spiny phlox

Ferns and clubmosses:

Selaginella watsoni Underw. Watsons little clubmoss
Selaginella densa Rydb. Little clubmoss
Selaginella mutica D. C. Eaton Little clubmoss
Cystopteris fragilis (L.) Bernh. Brittle fern
Cheilanthes feei Moore Lipfern

THE MOSS FLORA

The moss flora of the Green River region is fairly rich in the southern mountainous region but unusually sparse in the northern desert region, even where moisture would ordinarily invite at least a scanty growth. Wide search on the terraces and hillsides of the latter area yielded very few specimens of Pterygoneurum ovatum (Hedw.) Dixon and Tortula ruralis (Hedw.) Smith, zerophytes which should normally be frequent or locally abundant on dry soil. Almost equally scarce are the rock mosses Grimmia anodon Bry. Eur. and G. alpestris Nees, which were encountered only a few times. Only in shaded places in some of the deeper rocky ravines or among cliffs were a few colonies of Encalypta vulgaris var. mutica Brid. and mats of Hypnum vaucheri Lesq. found. Wet banks of the Green River and its side brooks showed only the slightest growth of Didymodon tophaceus (Brid.) Jur. and Bryum sp. both in markedly juvenile and sterile state.

The freshwater springs and swampy areas in Henrys Fork near Linwood, Utah showed the only conspicuous growth of mosses in the northern areas although few in species. Submerged in shallow water of the marshy outflow of springs and wet meadows are Drepanocladus aduncus (Hedw.) Warnst., and Cratoneuron filicinum (Hedw.) Roth. On wet logs and rotten wood Amblystegium compactum (C. Mull.) Austin is frequent.

The diversity of habitats provided in the mountainous region reflect an equally diverse moss flora. Banks of brooks flowing in shaded ravines yield a variety of mosses peculiar to these places. Frequent or locally abundant are the following:

Liverworts:

Pellia neesiana (Gottsche) Limpr.
Lophozia porphyroleuca (Nees) Schiffn.
Jungermannia pumila var. rivularis With.

Mosses:

Bryoerythrophyllum recurvirostrum (Hedw.) Chen.
Tortula mucronifolia Schwaegr.
Didymodon tophaceus (Brid.) Jr.

Mosses (continued)

Barbula vinealis Brid.
Funaria hygrometrica Hedw.
Philonotis fontana var. tomentella (Mol.) Dixon
Leptobryum pyriforme (Hedw.) Schimp.
Pohlia wahlenbergii (Lindb.) Andrews
Bryum weigelii Spreng.
Bryum gemmiparum DeNot.
Bryum cuspidatum (Bry. Eur.) Schimp.
Bryum pallescens Schleich.
Mnium serratum Brid.
Brachythecium rivulare Bry. Eur.
Amblystegium juratzkanum Schimp.
Amblystegium varium (Hedw.) Lindb.
Amblystegium compactum (C. Mull.) Austin
Cratoneuron filicinum (Hedw.) Roth
Drepanocladus uncinatus (Hedw.) Warnst.
Hypnum lindbergii Mitt.

In rocky ravines, usually under overhanging cliffs and large rocks where the soil tends to remain damp, the large Timmia bavarica Hessel., Tortula norvegica (Web. & Mohr.) Wahlenb., Brachythecium collinum (Schleich.) Bry. Eur., Brachythecium idahense R. & C. and occasionally Brachythecium suberythrorrhizon R. & C. are characteristic species. On dry soil, usually in open places where there has been some disturbance, such as around camp grounds, burned over areas or infrequently used trails, the common Ceratodon purpureus (Hedw.) Brid. is found. On dry hillsides, often under rocks or roots of trees, Bryum caespitium Hedw., Tortula mucronifolia Schwaegr., Encalypta vulgaris var. mutica Brid., and Brachythecium collinum (Schleich.) Bry. Eur. are typical species of these habitats. On more open dry sandy ground, often quite exposed, a curious form of Dicranum strictum Schleich. is out of its usual habitat on the trunks of large trees in shady woods. It is fairly abundant in Red Canyon both on open soil and among rocks but prior to the present observations it was known in Utah only from a single small collection made in the Wasatch Mountains. Pottia heimi Furrn., Tortula ruralis (Hedw.) Smith, Bryum argenteum Hedw. are other common species on soil of hillsides.

Among ledges and especially in rocky ravines where it is shady part of the day a variety of rock and crevice mosses are especially characteristic and usually abundant. Here Grimmia calyptrata Hook. is the most conspicuous member of this genus and it occurs also on rocks of open hillsides. Less frequent are Grimmia anodon Bry. Eur., and Grimmia plagiopodia Hedw. All of these species form very compact cushions with a convex surface hoary with fine white hairs on the apices of the leaves. Other characteristic rock mosses are Orthotrichum hallii Sull. & Lesq., Orthotrichum macounii Aust., and Orthotrichum anomalum Hedw. all of which form compact tufts of darker green and coarser texture than the Grimmias. Rich growths of Tortula papillosissima (Coppey) Broth., as much as 18 inches across and three inches deep are one of the most conspicuous features of the moss flora of the region while Tortula ruralis (Hedw.) Smith is less robust but equally abundant. Both species extend to the hillsides and are

perhaps the commonest species in Red Canyon. In similar places Hypnum vaucheri Lesq. and Hypnum revolutum (Mitt.) Lindb. are two outstanding mat-forming species common on shaded rocks and occasionally on soil. The former is especially common in the deeper canyons of the Green River and Colorado River basin while the latter is widely distributed in nearly all mountainous regions of the western states.

Orthotrichum affine Brid. is peculiar to the bark of trees and it is the only one of this sort that was encountered. It is fairly common on the trunks of larger narrowleaf cottonwoods and boxelders.

Dry bleached logs harbor mosses peculiar to this sort of substratum and representatives were encountered in Dicranoweisia crispula (Hedw.) Lindb. Lescurea incurvata var. tenuiretis (Culm.) Lawt. and Pseudoleskeella tectorum A. Br.

INTRODUCTION

This is an annotated list of plants found on the University of Utah Expedition through the Flaming Gorge Reservoir Basin, June 9 to 11 and June 30 to August 1, 1959. This list includes both known plants observed and plants collected as specimens. The principal collections were made along the route of the expedition on Green River from the upper end of the reservoir at river mile 378, about eight miles below the city of Green River, Wyoming, thence downstream 56 miles to the Utah state line (river mile 322) and another 32 miles to the dam site near the new settlement of Dutch John, Utah (river mile 290), a total distance of 88 miles. Additional collections were made on the tributaries, Blacks Fork in Wyoming and Sheep Creek in Utah, but observations of known plants were made by field parties covering the entire basin.

The specimens collected are only representative and not complete samples of the diversified ecological plant communities surveyed and encountered along the 110 miles of river and tributaries traversed by the expedition as described in the preceding article by Seville Flowers. Exigencies of field work did not always permit the preservation of specimens when encountered. Also some plants at the time of the expedition in midsummer were not at proper stages of development to make suitable specimens. Many of the spring annuals had passed the stage of suitability, and fall blooming plants had not reached that stage.

In total, 298 specimens were collected. Of these, six are still undetermined, 15 have been determined to genus, 277 have been determined to species but 31 of these are duplicates, leaving a total of 246 known species included in the list of specimens. To this list has been added known plants of the area identified by Dr. Flowers, for which no specimens were obtained, totaling 557 different species, eight blue-green algae, three yellow-green algae, 11 green algae, 16 diatoms, one stonewort, 60 true mosses, and 149 additional vascular plants known to occur in the area of the reservoir which will be inundated.

In preparing this list, the plant families have been arranged taxonomically according to Kearney and Peebles (1951) but the genera and species have been placed in alphabetical order. The annotations consist primarily of specific location, date, altitude, and general ecological habitat. Duplicates are indicated by additional locations. No attempt has been made to indicate relative abundance but a general idea of the quantitative relations of dominant plants may be obtained from the report on the survey of vegetation made by the expedition (Woodbury, Durrant and Flowers, 1960) and the frequency of occurrence in specific habitats from the preceding article by Dr. Flowers.

The authors appreciate assistance both from other members of the field crews and from herbarium workers. The initials in parentheses following the species annotations indicate the person responsible for identification of the plant in the field or determination of the specimen in the laboratory as follows:

SF = Seville Flowers, HHH = Heber H. Hall

ALGAE (class) Algae

Myxophyceae (family). Blue-green algae

Coelosphaerium naegelianum Unger.

Hog Spring, Sweetwater Co., Wyoming (SF).

Oscillatoria amoena (Ktz.) Gomont

Wet rocks, Eagle Creek, Daggett Co., Utah (SF).

Anabaena sp.

On wet muddy banks, Eagle Creek, Daggett Co., Utah (SF).

Nodularia harveyana (Thwaites) Thuret

On wet rocks splashed by brook, Eagle Creek, Daggett Co., Utah (SF).

Nodularia amorica Thuret

On wet rocks splashed by brook, Daggett Co., Utah (SF).

Nostoc verrucosum (L.) Vauch.

On rocks in brook, Currant Creek, Sweetwater Co., Wyoming (SF).

Calothrix parietina (Naegeli) Thuret

On wet rocks, Hog Spring, Sweetwater Co., Wyoming (SF).

Rivularia sp.

On wet rocks, Hog Spring, Sweetwater Co., Wyoming (SF).

Chrysophyceae (family) Yellow-green algae

Tribonema bombycina Hazen

Hog Spring, Wyuta Spring, Sweetwater Co., Wyoming, Sheep Creek, Eagle Creek, Daggett Co., Utah (SF).

Vaucheria sessilis (Vauch.) DC.

Hog Spring, Sweetwater Co., Wyoming (SF).

Vaucheria sp.

Frequent in Green River and its tributaries, Sweetwater Co., Wyoming and Daggett Co., Utah (SF).

Bacillarieae (family) Diatoms

Diatoma hiemale mesodon (Ehren.) Grun.

Tabellaria flocculosa (Roth) Ktz.

Fragilaria spp.

Bacillarieae (family) continued
Synedra ulna (Nitzsch.) Ehren.

Ceratoneis acus (Ehrn.) Ktz.

Cocconeis placentula Ehren.

Achnanthes sp.

Navicula spp.

Stauroneis spp.

Amphipleura sp.

Gyrosigma sp.

Gomphonema spp.

Cymbella spp.

Amorpha ovalis Ktz.

Rhopalodia gibba (Ehrn.) O. Müll.

Surirella elegans Ehrn.

Frequent and locally abundant according to the season in the Green River and especially in its tributaries, Sweetwater Co., Wyoming and Daggett Co., Utah (SF).

Chlorophyceae (family) Green algae

Ulothrix variabilis Ktz.

Gorge Creek, Daggett Co., Utah (SF).

Ulothrix zonata (Web. & Morh) Ktz.

Gorge Creek, Daggett Co., Utah (SF).

Ulothrix tenuissima Ktz.

Gorge Creek, Daggett Co., Utah (SF).

Chaetophora elegans (Roth) Ag.

On rocks in brook and seepage, Clay Basin, Daggett Co., Utah (SF).

Monostroma quaternarium (Ktz.) Desmaz.

On rocks in brook, Eagle Creek, Daggett Co., Utah (SF).

Cladophora glomerata (L.) Ktz.

Frequent in the Green River and its tributaries, Sweetwater Co., Wyoming and Daggett Co., Utah (SF).

Chlorophyceae (family) continued

Cladophora kuetzingiana Grun.

On rocks in brook, Currant Creek, Sweetwater Co., Wyoming (SF).

Spirogyra porticalis (Mull.) Cleve

In springs and swamps, near Linwood, Daggett Co., Utah (SF).

Spirogyra spp.

Frequent in clear water of springs and still pools along brooks, tributary to the Green River, Sweetwater Co., Wyoming and Daggett Co., Utah (SF).

Closterium acerosum (Schrank) Ehrb.

In brook, Eagle Creek, Daggett Co., Utah (SF).

Zygnema insigne (Hass.) Ktz.

Swamps and slow brooks, 5800-6000, near Linwood, and in Sheep Creek, Daggett Co., Utah (SF).

Charaphyceae (family) Stone worts

Chara spp.

Occasional in ponds and slow water along the Green River, Sweetwater Co., Wyoming and Daggett Co., Utah (SF).

Rhodophyceae (family) Red algae

Lemanea fucina Bory.

On rocks in swift stream, Carter Creek, Daggett Co., Utah (SF).

BRYOPHYTA (Phylum) Mosses

HEPATICAЕ (Class) Liverworts

Marchantiaceae (family)

Conocephalum conicum (L.) Dumort.

On damp rocks and soil, Carter Creek, Daggett Co., Utah, 5,800 ft. (SF).

Preissia quadrata (Scop.) Nees.

On damp soil, brook bank, Carter Creek, 5,800 ft., Daggett Co., Utah (SF).

Marchantia polymorpha L.

On wet soil and rocks, brook bank, Carter Creek, Daggett Co., Utah, 5,800 ft. (SF).

Metzgeriaceae (family)

Pellia neesiana (Gottsche) Primpr.

On damp soil banks, Carter Creek, Daggett Co., Utah, 5,800 ft. (SF).

Riccardia pinguis (L.) S. F. Gray

On wet soil, North Skull Creek, Daggett Co., Utah, 5,880 ft. (SF).

Jungermanniaceae (family)

Jungermannia pumila rivularis With.

On damp soil banks, Carter Creek, Daggett Co., Utah, 5,800 ft. (SF).

Lophozia porphyroleuca (Nees) Schiffn.

On damp soil banks, Carter Creek, Daggett Co., Utah, 5,800 ft. (SF).

MUSCI (Class) True mosses

Ditrichaceae (family)

Ceratodon purpureus (Hedw.) Brid.

On dry soil, Hideout and Red canyons, Daggett Co., Utah, 5,850 ft. (SF).

Distichium capillaceum (Hedw.) Bry.Eur.

On wet rocks and rotten wood, by brook, Allen Creek, Daggett Co., Utah, 5,830 ft. (SF).

Dicranaceae (family)

Dicranoweisia crispula (Hedw.) Lindb.

On dry rocks and bleached logs, Red Canyon, Daggett Co., Utah, 5,830 ft. (SF).

Dicranum strictum Schleich.

On dry sandy soil among rocks, Red Canyon, Daggett Co., Utah, 5,830 ft. (SF).

Encalyptaceae (family)

Encalypta vulgaris mutica Brid.

On shaded soil, crevices of rocks, Hideout and Red canyons, Daggett Co., Utah, 5,880 ft. (SF).

Pottiaceae (family)

Barbula vinealis Brid.

On wet rocks by brook, North Skull Creek, Daggett Co., Utah, 5,860 ft. (SF).

Pottiaceae (family) continued

Bryoberythrophyllum recurvirostrum (Hedw.) Chen.

On wet rocks, Allen Creek, Daggett Co., Utah, 5,840 ft. (SF).

Desmatodon cernuus (Hueben.) Bry. Eur.

On damp soil, Hideout Canyon, Daggett Co., Utah, 5,840 ft. (SF).

Desmatodon obtusifolius (Schwaegr.) Jur.

On damp soil and rocks, Hideout Canyon, Daggett Co., Utah, 5,800 ft. (SF).

Didymodon tophaceus (Brid.) Jur.

Wet banks, Green River, Sweetwater Co., Wyoming and North Skull Creek, Daggett Co., Utah, 5,820-6,000 ft. (SF).

Pottia heimii (Hedw.) F  rn  r.

On damp soil, crevices, Allen Creek, Daggett Co., Utah, 5,850 ft. (SF).

Pterygoneurum ovatum (Hedw.) Dixon

On dry soil, terraces of Green River, Sweetwater Co., Wyoming, 5,800 ft. (SF).

Tortula mucronifolia Schwaegr.

On damp soil, brook banks, Hideout Canyon, Daggett Co., 5,880 ft. (SF).

Tortula norvegica (Web. & Mohr.) Wahlenb.

On dry soil, shaded rocks and crevices, Hideout Canyon, Daggett Co., 5,850 ft. (SF).

Tortula papillosissima (Coppey) Broth.

On dry soil and among rocks, common in Hideout and Red canyons, 5,800-6,000 ft. Daggett Co., Utah, (SF).

Tortula ruralis (Hedw.) Smith

On dry soil and among rocks, terraces and ravines, common throughout the Green River region, Sweetwater Co., Wyoming and Daggett Co., Utah, 5,700-6,000 ft. (SF).

Grimmiaceae (family)

Grimmia alpestris Nees

On dry rocks, Hideout Canyon, Daggett Co., Utah, 5,900 ft. (SF).

Grimmia anodon Bry. Eur.

On dry rocks, hillsides and canyon bottoms, 5,750-6,300 ft., Sweetwater Co., Wyoming and Daggett Co., Utah, (SF).

Grimmia calyptrata Hook.

Common on dry rocks, Hideout and Red canyons, Daggett Co., Utah, 5,700-6,000 ft. (SF).

Grimmiaceae (family) continued

Grimmia dupreti Theriot

On dry rocks, Hideout Canyon, Daggett Co., Utah, 5,900 ft. (SF).

Grimmia plagiopodia Hedw.

On dry rock, Hideout Canyon, Daggett Co., Utah, 5,900 ft. (SF).

Funariaceae (family)

Funaria hygrometrica Hedw.

On wet and dry soil, Hideout Canyon, Daggett Co., Utah, 5,800 ft. (SF).

Orthotrichaceae (family)

Orthotrichum affine Brid.

On trunks of boxelder trees, Hideout Canyon, Daggett Co., Utah,
5,800 ft. (SF).

Orthotrichum anomalum Hedw.

Hideout Canyon, Daggett Co., Utah, 5,800 ft. (SF).

Orthotrichum cupulatum (Hoffm.) Brid.

On dry rocks and crevices, Hideout Canyon, Daggett Co., Utah, 5,900
ft. (SF).

Orthotrichum hallii Sull. & Lesq.

On dry rocks and in crevices, Hideout Canyon, Daggett Co., Utah, 5,800
ft. (SF).

Orthotrichum macouni Aust.

On dry rocks and crevices, Hideout Canyon, Daggett Co., Utah, 5,850
ft. (SF).

Orthotrichum strangulatum Schwaegr.

On dry rocks and crevices, Hideout Canyon, Daggett Co., Utah, 5,850
ft. (SF).

Orthotrichum texanum Sull.

On dry rocks and crevices, Hideout Canyon, Daggett Co., Utah, 5,880
ft. (SF).

Timmiaceae (family)

Timmia bavarica Hessel.

On damp soil under rock, shade, Red Canyon, Daggett Co., Utah, 5,840
ft. (SF).

Fartramiaceae (family)

Philonotis fontana (Hedw.) Brid.

On wet soil, brook banks, Carter and Allen Creeks, Daggett Co., Utah, 5,850 ft. (SF).

Philonotis fontana tomentella (Mol.) Dixon

On wet soil, brook banks, Carter Creek, Daggett Co., Utah, 5,820 ft. (SF).

Bryaceae (family)

Leptobryum pyriforme (Hedw.) Schimp.

On damp or wet soil, rocks and rotten wood by brook, Allen and Carter creeks, Daggett Co., Utah, 5,800 ft. (SF).

Pohlia wahlenbergii (Web. & Mohr) Andrews

On wet soil, brook bank, Carter Creek, Daggett Co., Utah, 5,800 ft. (SF).

Bryum argenteum Hedw.

On dry soil, Hideout Canyon, Daggett Co., Utah, 5,840 ft. (SF).

Bryum caespitium Hedw.

On dry soil, Hideout Canyon, Daggett Co., Utah, 5,840 ft. (SF).

Bryum cuspidatum (Bry. Eur.) Schimp.

On wet soil and rocks, by brook, Carter and Allen creeks, Daggett Co., Utah, 5,860 ft. (SF).

Bryum gemmiparum DeNot.

On wet rocks, North Skull Creek, Daggett Co., Utah, 5,820 ft. (SF).

Bryum pallescens Schleich.

On wet soil and rocks, Carter Creek, Daggett Co., Utah, 5,840 ft. (SF).

Bryum pseudotriquetrum (Hedw.) Schwaegr.

On wet soil and rocks, by brook, Eagle Creek, Daggett Co., Utah, 5,860 ft. (SF).

Bryum weigellii Spreng.

On damp soil, by brook, Allen Creek, Daggett Co., Utah, 5,860 ft. (SF).

Mnium affine Bland.

On wet soil by brook, Eagle Creek, Daggett Co., Utah, 5,860 ft. (SF).

Mnium serratum Brid.

On wet soil by brook, Carter Creek, Daggett Co., Utah, 5,840 ft. (SF).

Hypnaceae (family)

Brachythecium collinum (Schleich.) Bry. Eur.

On dry shaded soil, Hideout Canyon, Daggett Co., Utah, 5,890 ft. (SF).

Brachythecium idahense Ren. & Card.

On dry shaded soil, Hideout Canyon, Daggett Co., Utah, 5,880 ft. (SF).

Brachythecium suberythrorrhizon Ren. & Card

On damp soil under tree roots, shade, Hideout Canyon, Daggett Co., Utah (SF).

Brachythecium rivulare B. & S.

In water or on wet soil, near Linwood, and Allen Creek, Daggett Co., Utah, 5,840-6,000 ft. (SF).

Amblystegium compactum (C. Mull.) Austin

On wet rocks and wood, swampy area near Linwood, on brook banks, Hideout Canyon, Daggett Co., Utah, 5,880-6,000 ft. (SF).

Amblystegium irriguum spinifolium Wils.

On wet rocks, Currant Creek, Sweetwater Co., Wyoming, 6,120 ft. (SF).

Amblystegium juratskanum Schimp.

On wet soil and rotten wood in brook, Hideout Canyon, Daggett Co., Utah, 5,860 ft. (SF).

Amblystegium kochii Bry. Eur.

On damp or wet soil and rotten wood, by brook, Allen Creek, Daggett Co., Utah, 5,860 ft. (SF).

Amblystegium varium (Hedw.) Lindb.

On damp rotten wood, near Linwood, Daggett Co., Utah, 6,000 ft. (SF).

Cratoneuron filicinum (Hedw.) Roth

Submerged and on wet soil, swamp near Linwood, by brook, Hideout Canyon, Daggett Co., Utah, 5,860-6,000 ft. (SF).

Drepanocladus aduncus (Hedw.) Warnst.

Submerged in swampy area, near Linwood, Daggett Co., Utah, 6,000 ft. (SF).

Drepanocladus uncinatus (Hedw.) Warnst.

Submerged in swampy area, near Linwood, Daggett Co., Utah, 6,000 ft. (SF).

Hypnum lindbergii Mitt.

On wet soil and humus, Allen Creek, 5,860 feet, Daggett Co., Utah (SF).

Hypnum revolutum (Mitt.) Lindb.

On dry rocks and soil, Red Canyon, Daggett Co., Utah, 5,880 ft. (SF).

Hypnaceae (family) continued

Hypnum vaucheri Lesq.

On dry rocks, Red Canyon, Daggett Co., Utah, Sweetwater Co., Wyoming,
5,620-6,000 (SF).

Leskeaceae (family)

Lescurea incurvata tenuiretis (Culm.) Lawton

On dry rocks in shade, Red Canyon, Daggett Co., Utah, 5,860 ft. (SF).

Pseudoleskeella tectorum A. Br.

On dry rocks and decorticated tree trunks, Red Canyon, Daggett Co.,
Utah, 5,840 ft. (SF).

PTERIDOPHYTA (Phylum) Ferns and allies

Selaginellaceae (family) Selaginellas

Selaginella mutica D.C. Eaton Little clubmoss

Hideout Forest Camp, Daggett County, Utah, dry rocks, July 25, 1959,
5,900 ft. (HHH).

Selaginella densa Rydb. Little clubmoss

Red Canyon, Daggett Co., Utah, among dry rocks, 5,600-7,000 ft. (SF)..

Selaginella watsoni Underw. Little clubmoss

Red Canyon and Sheep Creek, Daggett Co., in dry crevices and among
dry rocks, 5,560-8,000 ft. (SF).

Equisetaceae (family) Horsetails

Equisetum arvense L. Meadow horsetail

Carter Creek, Daggett Co., Utah, creek bank frequent, July 27, 1959,
5,550 ft. (HHH).

Equisetum prealtum Raf. Tall horsetail

Common throughout the canyons of the Green River from Flaming Gorge
to the Damsite, in Sheep Creek and other side tributaries, on wet or
damp soil of stream banks and around springs, 5,600-6,000 ft. (SF).

Equisetum kansanum Schaffn. Kansas horsetail

Common throughout the course from the Green River, including its
tributaries, from the Kincaid Ranch to the Flaming Gorge Damsite, on
stream bank and in meadows (SF).

Equisetum hiemale var. californicum Milde . . . California horsetail

Trail Creek, Daggett Co., Utah, stream side abundant, July 31, 1959,
5,650 ft. (SF).

Polypodiaceae (family) Ferns

Cheilanthes feei Moore Slender lip fern

Flaming Gorge, Green River, Daggett Co., Wyoming, crevices of dry sandstone cliff, shade, July 11, 1959, 7,000 ft. (HHH).

Cystopteris fragilis (L.) Bernh. Brittlefern

Hideout Canyon, Daggett Co., Utah, damp soil under rocks, July 25, 1959, 5,900 ft. (HHH).

SPERMATOPHYTA (Phylum) Seed plants

GYMNOSPERMAE (Class) Cone-bearing plants

Pinaceae (family) Pines

Pinus edulis Engelm. Doubleleaf pinyon pine

Hideout Canyon, Daggett Co., Utah, dry side hill, July 25, 1959, 5,900 ft. (HHH).

Pinus contorta Dougl. Lodgepole pine

Pinus ponderosa Lawson Ponderosa pine

Dutch John Bridge, Daggett Co., Utah, abundant stream side canyon bottom, July 31, 1959, 5,700 ft. (HHH).

Picea pungens Engelm. Blue spruce

Sheep Creek, Hideout and Eagle Creek canyons, Daggett Co., in canyon bottoms and mountains sides, 5,600-8,000 ft. (SF).

Pseudotsuga menziesii (Mirb.) Franco Douglas fir

Cupressaceae (family) Cypress and junipers

Juniperus osteosperma (Torr.) Little Utah juniper

Hideout Canyon, Daggett Co., Utah, dry hill side, July 25, 1959, 5,900 ft. (HHH).

Juniperus scopulorum Sarg. Mountain red juniper

Horseshoe Bend, Daggett Co., Utah, steep river bank, July 24, 1959, 5,810 ft. (HHH).

Ephedraceae (family) Jointfirs

Ephedra viridis Coville Green jointfir

Horseshoe Bend, Daggett Co., Utah, steep side hill, July 24, 1959, 5,830 ft. (HHH). Flaming Gorge, Hideout Forest Camp, Daggett Co., July 11, 1959, 6,000 ft., dry hills (SF).

ANGIOSPERMAE (Class) Flowering plants

MONOCOTYLEDONES (Subclass) Monocots

Typhaceae (family) Cattails

Typha domingensis L. Narrow-leafed cattail

Hideout Camp, Daggett Co., Utah, moist soil, July 27, 1959, 5,900 ft.
(HHH).

Potamogetonaceae (family) Pondweeds

Potamogeton americanus Schlecht. & Cham. American pondweed

Near Holms Ranch, Sweetwater Co., Wyoming, submerged with floating
leaves in ox-bow ponds, 5,930 ft. (SF).

Potamogeton pectinatus L. Pondweed

Frequent in ponds and side streams of the Green River, Sweetwater Co.,
Wyoming and Daggett Co., Utah (SF).

Ruppia maritima L. Ditchgrass, widgeongrass

Occasional in slow side streams and in ponds, Sweetwater Co., Wyo. (SF).

Juncaginaceae (family) Arrow grass

Triglochin maritima L. Arrow grass

Lucerne Valley, Daggett Co., Utah, wet meadow, July 22, 1959, 5,900
ft. (HHH).

Alismaceae (family) Water-plantains

Alisma geyeri Torr. Water-plantain

Near Holms Ranch, Sweetwater Co., Wyoming, emergent in ox-bow ponds,
5,930 ft. (SF).

Sagittaria cuneata Sheld Arumleaf arrowhead

Near Holms Ranch, Sweetwater Co., Wyoming, emergent in ox-bow ponds,
5,930 ft. (SF).

Gramineae (family) Grasses

Agropyron desertorum (Fisch.) Schult. Desert wheatgrass

Dutch Johns Bridge, Daggett Co., Utah, dry side hill abundant, August
1, 1959, 5,700 ft. (HHH).

Agropyron repens (L.) Beauv. Quackgrass

Frequent around Farms, Brinegar Ranch, Sweetwater Co., Wyoming; near
Linwood, Daggett Co., Utah, 5600-6000 ft. (SF).

Gramineae (family) continued

Agropyron smithii Rydb. Western bluestem

South Skull Creek, Daggett Co., Utah, abundant, July 30, 1959, 5,900 ft. Williams Ranch, Lucerne Valley, Daggett Co., Utah, abundant in meadow, July 22, 1959, 5,900 ft. (HHH).

Agropyron spicatum (Pursh) Scribn. & Smith Bunch wheatgrass

Carter Creek, Daggett Co., Utah, dry hill side, July 28, 1959, 5,800 ft. South Skull Creek, Daggett Co., Utah, dry hill side, July 30, 1959, 5,700 ft. (HHH).

Agropyron trachycaulum (Limb) Malte Slender wheatgrass

Hideout Forest Camp, Daggett Co., Utah, dry hill side, July 26, 1959, 5,900 ft. (HHH).

Agrostis alba L. Redtop

Frequent around farms, Brinegar and Holms ranches, Sweetwater Co., Wyoming; near Linwood and Sheep Creek, Daggett Co., Utah, 5,600-6,000 ft. (SF); Lucerne Valley, Daggett Co., Utah, wet meadow abundant, July 22, 1959, 5,900 ft. (HHH).

Agrostis palustris Huds. Redtop

Hideout Forest Camp, Daggett Co., Utah, streamside abundant, July 26, 1959, 5,800 ft. (HHH).

Aristida longiseta Steud. Purple three-awn grass

Hideout Flat, Daggett Co., Utah, abundant, dry soil, July 29, 1959, 5,900 ft. (HHH).

Beckmannia syzigachne (Steud.) Fernald Slough grass

Wyuta Spring, Sweetwater Co., Wyoming, 5,870 ft. in wet soil. (SF).

Bouteloua gracilis (H.B.K.) Lag. Graceful grama grass

Campbell Springs Hideout Flat, Daggett Co., Utah, very rare, July 28, 1959, 6,000 ft. (HHH).

Bromus carinatus H. & A. California brome

Sheep Creek, Daggett Co., Utah, canyon bottom, 5,600-6,500 ft. (SF).

Bromus marginatus Nees. Cheat grass

Carter Creek, Daggett Co., Utah, canyon bottom, 5,740 ft. (SF).

Calamagrostis canadensis L. Canadian reed-grass

Sheep Creek, Allen Creek, Daggett Co., Utah, on wet soil, 5,680-5,700 ft. (SF).

Calamagrostis inexpansa A. Gray Bog reed-grass

Kingfisher Canyon, Lower Sheep Creek, Daggett Co., Utah, on wet soil, 5,700 ft. (SF).

Dactylis glomerata L. Orchard grass

Near Linwood, Daggett Co., Utah, waysides and around farms, 5,800 ft. (SF).

Gramineae (family) continued

Distichlis stricta (Torr.) Rydb. Saltgrass
Kincaid Ranch, Sweetwater Co., Wyoming abundant stream and swamp area,
July 3, 1959, 5,700 ft. (HHH).

Elymus condensatus Pursh. Giant ryegrass
Horseshoe Bend, Daggett Co., Utah, steep side hill, July 24, 1959,
5,830 ft. (HHH).

Elymus canadensis L. Canadian wild rye
Frequent on terraces of the Green River (SF).

Festuca elatior L. Meadow fescue
Lucerne Valley, Daggett Co., Utah, wet meadow, July 22, 1959, 5,900
ft. (HHH).

Glyceria grandis S. Wats. American mannagrass
Linwood, Daggett Co., Utah in ditches and wet meadows, 5,600 ft. (SF).

Glyceria striata (Lam.) Hitchc. Fowl mannagrass
Hideout Forest Camp, Daggett Co., Utah, July 26, 1959, 5,800 ft.,
stream side abundant (HHH).

Hilaria jamesii (Torr.) Benth. Galleta grass
Common on desert plains and hillsides, Sweetwater Co., Wyoming and
Daggett Co., Utah, 5,600-7,000 ft. (SF).

Hordeum gussonianum Parl. Mediterranean barley
Around farms and overgrazed areas in damp saline soil, Sweetwater Co.,
Wyoming, 5,590 ft. (SF).

Hordeum jubatum L. var. caespitosum (Scrib.) Hitchc. Foxtail barley
Kincaid Ranch, Logan Ranch, Wyoming, abundant river bank, June 30,
1959, 6,050 ft. (HHH).

Muhlenbergia aspirifolia (Nees. & Mey.) Parodi Dropseed muhly
Wyuta Spring, Sweetwater Co., Wyoming, valley terrace, abundant, July
23, 1959, 5,870 ft. (HHH).

Oryzopsis hymenoides (Roem. & Schult.) Ricker Indian ricegrass
Frequent on terraces and hillsides along the Green River, Sweetwater
Co., Wyoming and Daggett Co., Utah, 5,550-6,000 ft. (SF).

Phalaris arundinacea L. Reed canary-grass
Hideout Forest Camp, Daggett Co., Utah, abundant in patches on river-
bank, July 26, 1959, 5,550 ft. (SF).

Phleum pratense L. Timothy
Williams Ranch, Lucerne Valley, Daggett Co., Utah, wet meadow abundant
July 22, 1959, 5,900 ft. (HHH).

Phragmites communis Trin. Reed cane
North Skull Creek, Daggett Co., Utah, abundant wet soil, July 30, 1959,
5,900 ft. (HHH).

Gramineae (family) continued

Poa ampla Merr. Big bluegrass

Poa confusa Rydb. Desert bluegrass

Poa palustris L. Swamp bluegrass

Poa pratensis L. Kentucky bluegrass

Occasional around Linwood and side canyons of the Green River, Daggett Co., Utah, 5,500-6,000 ft. (SF).

Poa secunda Presl. Sandberg bluegrass

Polypogon monspeliensis (L.) Desf. Beard grass

Near Holms and Brinegar ranches and occasional along the Green River, in moist saline soil, 5,550-6,000 ft. (SF).

Puccinellia airoides (Nutt.) Wats. & Coult. Nuttall alkaligrass

Frequent along the Green River, in damp saline soil, 5,600-5,800 ft. (SF).

Spartina gracilis Trin. Slender cord grass

Hideout Canyon, Daggett Co., on sandy soil of river banks, 5,550 ft. (SF).

Sitanion hystrix J. G. Smith Squirrel-tail grass

On terraces and hillsides along the Green River, Sweetwater Co., Wyoming and Daggett Co., Utah, on dry soil, 5,540-6,000 ft. (SF).

Sporobolus airoides Torr. Alkali sacaton

Wyuta Spring, Lucerne Valley, Sweetwater Co., Wyoming, wet meadow abundant, July 24, 1959, 6,750 ft. (HHH).

Sporobolus cryptandrus (Torr.) Gray Sand dropseed

Hideout Canyon, Daggett Co., Utah, dry side hill, juniper assoc. July 25, 1959, 5,900 ft.; Carter Creek, Daggett Co., Utah, frequent, July 29, 1959. (HHH).

Stipa comata Trin. & Rupr. Needle and thread grass

Frequent along the Green River on plains and hillsides, Sweetwater Co., Wyoming and Daggett Co., Utah, 5,300-6,700 ft. (SF).

Stipa columbiana Macoun. Needle and thread grass

Mouth of Carter Creek, Daggett Co., Utah, wet soil, July 28, 1959, 5,550 ft. (HHH).

Stipa lettermannii Vasey Letterman stipa

Mouth of Carter Creek, Daggett Co., Utah, wet soil, July 25, 1959, 5,550 ft. (HHH).

Cyperaceae (family) Sedges

Carex acutatis Wahl. Water sedge

Frequent on wet soil, Sheep Creek, Red Canyon and side tributaries,
5,500-6,000 ft. (SF).

Carex aurea Nutt. Golden sedge

Frequent on wet soil, Sheep Creek, Red Canyon and side tributaries,
5,500-6,000 ft. (SF).

Carex nebraskensis Dewey Nebraska sedge

South Skull Creek, Daggett Co., Utah, streamside moist soil, July 30,
1959, 5,900 ft. (HHH).

Carex rostrata Stokes Beaked sedge

Frequent on wet soil, Sheep Creek, Red Canyon and side tributaries,
5,500-6,000 ft. (SF).

Carex stipata Muhl. Stipitate sedge

Sheep Creek, Daggett Co., on wet soil, 5,560 ft. (SF).

Carex sp. Sedge

Eagle Creek, Daggett Co., Utah, moist soil streamside, abundant, July 30,
1959, 5,750 ft. (SF); Wyuta Springs, Sweetwater Co., Wyoming, July 24,
1959, 6,750 ft., wet meadow (HHH).

Cyperus sp. Cyperus

Carter Creek, Daggett Co., Utah, dry soil, Jly 29, 1959, 5550 ft. (HHH) (SF).

Eleocharis acicularis (L.) Roem. & Schult. Small spikerush

Frequent to common on river bank, Sweetwater Co., Wyoming and Daggett,
Co., Utah, 5,500-6,040 ft. (SF).

Eleocharis montana (H.B.K.) R. & S. Montana spike-rush

Ashley Falls, Daggett Co., Utah, common near stream, wet soil, August 1,
1959, 5,800 ft. (SF).

Eleocharis palustris (L.) Roem. & Schult. Spike rush

Wyuta Springs, Sweetwater Co., Wyoming found in swamp wet soil, July 14,
1959, 6,550 ft. (SF).

Scirpus americanus Pers. American bulrush

Frequent along the Green River, Sweetwater Co., Wyoming and Daggett
Co., Utah, emergent and on wet soil, 5,500-6,000 ft. (SF).

Scirpus paludosus A. Nels. Marsh bulrush

Linwood, Daggett Co., Utah, emergent in ponds and swamps, 5,700 ft. (SF).
Wyuta Spring, Sweetwater Co., Wyoming, abundant wet meadow, July 23,
1959, 6,000 ft. (HHH).

Scirpus validus Vahl. Mat bulrush

Brinegar Ranch, Sweetwater Co., Wyoming, emergent ditch bank, July 17,
1959, 5,860 ft. (HHH).

Juncaceae (family) Rushes

Juncus balticus Willd. Baltic rush, wire grass
Abundant on river banks along the Green River, 5,500-6,040 feet,
Sweetwater Co., Wyoming and Daggett Co., Utah (SF).

Juncus brunnescens Rydb. Brown rush
Sheep Creek, Daggett Co., Utah, on wet soil, 5,580 ft. (SF).

Juncus bufonius L. Toad rush
Hideout Canyon, Sheep Creek, Daggett Co., Utah, on wet soil, 5,550-
5,600 ft. (SF).

Juncus longistylis Torr. Long-style rush
Sheep Creek, Daggett Co., on wet soil, 5,600 ft. (SF).

Juncus orthophyllus Coville Straightleaf rush
Sheep Creek, Daggett Co., Utah on wet soil, 5,600 ft. (SF).

Juncus tweedyi Rydb. Tweedy rush
Sheep Creek, Daggett Co., Utah on wet soil, 5,600 ft. (SF).

Juncoides parviflorum (Ehrh.) Coville Small-flowered woodrush
Sheep Creek, Allen Creek, Daggett Co., Utah, 5,680 ft. (SF).

Liliaceae (family) Lilies and allies

Allium acuminatum Roth. Wild onion
Red Canyon and Sheep Creek on dry soil, 5,580-6,000 ft. Daggett Co.,
Utah (SF).

Allium acuminatum Hook. Wild onion
Canyons of the Green River, Daggett Co., Utah, frequent on dry soil,
5,500-6,500 ft. (SF).

Allium bisceptrum Wats. Wild onion
Green River, Utah State line, Sweetwater Co., Wyoming, dry gravelly
hills, June 11, 1959, 6,200 ft. (HHH).

Allium cernuum Roth. Wild onion
Frequent on terraces and hillsides along the Green River, Sweetwater Co.,
Wyoming and Daggett Co., Utah, 5,600-7,000 ft. (SF).

Allium textile Nels. & McBride Wild onion
Occasional on terraces and hillsides, Sweetwater Co., Wyoming, 5,900-
6,500 ft. (SF).

Calochortus nuttallii T. & G. Sego
Frequent on dry plains and hillsides along the Green River, Sweetwater
Co., Wyoming and Daggett Co., Utah (SF).

Liliaceae (family) continued

Asparagus officinalis L. Asparagus
Hideout Forest Camp, Daggett Co., Utah, July 26, 1959, 5,800 ft. (HHH).

Smilacina stellata (L.) Desf. False Solomon seal
Frequent on terraces along the Green River and its tributaries, Sweet-water Co., Wyoming and Daggett Co., Utah on damp soil, usually in shade, 5,500-6,000 ft. (SF).

Iridaceae (family) Iris

Iris missouriensis Nutt. Missouri iris
Entrance Flaming Gorge, Daggett Co., Utah, moist soil, July 20, 1959, 5,850 ft. (HHH).

Sisyrinchium halophilum Greene Blue-eyed grass
Near Linwood, Daggett Co., Utah in wet meadows, 5,900 ft. (SF).

Orchidaceae (family) Orchids

Habenaria hyperborea (L.) R. Tall leafy green orchis
Hideout Forest Camp, Daggett Co., Utah, July 25, 1959, 5,800 ft. (HHH);
Sheep Creek, Daggett Co., Utah, July 27, 1959, 5,800 ft. (SF).

DICOTYLEDONES (Subclass) Dicots

Salicaceae (family) Willows and cottonwoods

Populus angustifolia James Narrowleaf cottonwood
Hideout Forest Camp, Daggett Co., Utah, abundant along streamside, July 26, 1959, 5,800 ft. (HHH); observed many other places along the river.

Salix bebbiana Sarg. Bebb or beaked willow
Carter Creek, Allen Creek and Sheep Creek, Daggett Co., Utah, canyon bottoms, 5,550-7,000 ft. (SF).

Salix caudata (Nutt.) Heller Whiplash willow
Sheep Creek, Daggett Co., Utah, river bank abundant, July 25, 1959, 5,900 ft. (HHH).

Salix exigua Nutt. Sandbar willow
Hideout Forest Camp, Daggett Co., Utah, abundant along river bank, July 25, 1959, 5,800 ft. (HHH).

Salix geyeriana Anderss Geyer willow
Carter Creek, Sheep Creek, Daggett Co., Utah, along streams, 5,550-6,000 ft. (SF).

Salicaceae (family) continued

- Salix lutea Nutt. var. watsoni (Bebb.) Jepson Yellow willow
Wyuta Springs, Sweetwater Co., Wyoming, along seepage in valley floor,
July 23, 1959, 6,550 ft. (SF).

Betulaceae (family) Birches

- Alnus tenuifolia Nutt. Alder
Sheep Creek, Daggett Co., stream bank, abundant, July 25, 1959,
6,000 ft. (HHH).

- Betula fontinalis Sarg. River birch
South Kincaid Ranch, Sweetwater Co., Wyoming, RM. 372, first encountered
on river - rare, riverbank, July 3, 1959, 5,980 ft; (HHH); Red Canyon
and tributaries, Daggett Co., Utah (SF).

Urticaceae (family) Nettles

- Urtica breweri Wats. Stinging nettle
Trail Creek, Daggett Co., Utah, damp soil abundant, July 31, 1959, 5,650
ft. (SF).

Santalaceae (family) Sandalwood

- Comandra pallida A. DC. False toadflax
Occasional along the Green River, Sweetwater Co., Wyoming and Daggett
Co., Utah, on terraces and in ravines, 5,500-6,000 ft. (SF).

Polygonaceae (family) Buckwheat

- Eriogonum alatum Torr. Winged eriogonum
Hideout Forest Camp, Daggett Co., Utah, July 26, 1959, 5,800 ft., dry
hillside, (HHH).

- Eriogonum campanulatum Nutt. Narrowleaf eriogonum
Kincaid Ranch, Sweetwater Co., Wyoming, dry hillside, July 2, 1959,
6,300 ft. (HHH).

- Eriogonum cernuum (Nutt.) Slender eriogonum
Hideout Forest Camp, Daggett Co., Utah, sage flat, July 26, 1959,
5,800 ft. (SF).

- Eriogonum chrysocephalum A. Gray Golden eriogonum
Rocks on dry hillsides near Kincaid Ranch, Sweetwater Co., Wyoming, July 2,
1959, 6,300 ft. (SF).

polygonaceae (family) continued

Eriogonum corumbosum Benth. Shrubby eriogonum

Red Canyon, Daggett Co., Utah, frequent on dry hillsides, 5,600 ft. (SF).

Eriogonum effusum Nutt. var. divergens Effuse eriogonum

Hideout Forest Camp, Daggett Co., Utah, dry hillside, July 25, 1959,
5,900 ft. (HHH).

Eriogonum microthecum Nutt. Slender eriogonum

Hideout Forest Camp, Daggett Co., Utah, dry flat, dry soil, July 29, 1959,
5,200 ft.; Buckboard Ranch, Sweetwater Co., Wyoming, July 15, 1959, 6,000
ft. (SF).

Eriogonum nudicaule ssp. tristichum (Small) Stoker Nakedstem eriogonum

River mile 350 on the Green River, Sweetwater Co., Wyoming, common dry
hillside, July 13, 1959, 5,800 ft. (HHH).

Eriogonum ovalifolium Nutt. Silver plant

Kincaid Ranch, Sweetwater Co., Wyoming, open sage flat, rare, July 3,
1959, 6,100 ft. (SF).

Eriogonum racemosum Nutt. Wild buckwheat

Dry hillsides near Linwood, Daggett Co., Utah (SF).

Eriogonum umbellatum Torr. Sulphur flower

Hideout Forest Camp, Daggett Co., Utah, roadside, July 28, 1959, 5,800
ft. (HHH).

Polygonum amphibium L. Water smartweed

Occasional along the Green River, Sweetwater Co., Wyoming and Daggett Co.,
Utah emergent in ponds and on wet soil of river banks, 5,500-6,600 ft. (SF).

Polygonum aviculare L. Pink knotweed

Occasional, Brinegar Ranch, Sweetwater Co., Wyoming, Linwood, Daggett Co., Utah,
on dry soil, roadsides and waste places, 5,500-6,000 ft. (SF).

Polygonum erectum L. Erect knotweed

Williams Ranch, Daggett Co., Utah, dry bench, July 22, 1959, 6,000 ft. (SF).

Polygonum lapathifolium L. Smartweed

Near Brinegar's and Holms ranches, Sweetwater Co., Wyoming, Linwood, Daggett
Co., Utah, emergent or in wet soil, 5,900-6,000 ft. (SF).

Rumex crispus L. Curly dock

Wet soil, river banks, Hideout Canyon, Daggett Co., Utah, 5,800 ft. (SF).

Rumex mexicanus Meisn. Mexican dock

Brinegar Ranch, Sweetwater Co., Wyoming, ditch bank, July 17, 1959, 5,860
ft.; Kincaid Ranch, Sweetwater Co., Wyoming, dry hillside, rare, July 2,
1959, 6,100 ft. (HHH).

Polygonaceae (family) continued

Rumex persicarioides L. Golden dock

Hideout Forest Camp, Daggett Co., Utah, moist soil, July 27, 1959, 5,800 ft.,
North Skull Creek, Daggett Co., Utah, rare streamside, July 30, 1959, 5,700
ft. (HHH); Linwood, Sheep Creek and in Red Canyon, Daggett Co., Utah,
emergent in freshwater swamps and on wet soil of stream banks, 5,500-6,000
ft. (SF).

Chenopodiaceae (family) Goosefoots

Atriplex argentea Nutt. Silver atriplex

Common throughout Green River area. (SF).

Atriplex canescens (Pursh.) Nutt. Four-winged saltbush

Hideout Flat, Daggett County, Utah, abundant, July 28, 1959, 5,900 ft. (HHH).

Atriplex confertifolia Wats. Shadscale

Abundant on dry plains on hillsides throughout the region, Sweetwater and
Daggett Co. (SF).

Atriplex hastata L. Fat-hen atriplex

Lucerne Valley, Daggett Co., Utah, wet meadow, July 22, 1959, 5,700 ft. (SF).

Atriplex nuttallii cuneata (Nelson) H. & C. Cuneate saltbush

Kincaid Ranch, Sweetwater Co., Wyoming, dry side hill above ranch, abundant
in patches, 6,100 ft. (HHH).

Atriplex nuttallii (Nuttallii) Wats. Nuttall saltbush

Kincaid Ranch, open side hill, abundant, June 30, 1959, 6,050 ft. (HHH).

Atriplex rosea L. Rose atriplex

Frequent around farms, 5,500-6,000, Sweetwater Co., and Daggett Co. (SF).

Atriplex patula var. hastata (L.) Gray Spear orache

Kincaid Ranch, Sweetwater Co., Wyoming, sage and greasewood community,
abundant, June 30, 1959, 6,050 ft. (SF).

Atriplex saccaria S. Wats Annual atriplex

Occasional on terraces of Green River, 5,950 ft., Sweetwater Co., Wyoming,
(SF).

Atriplex wolfei Wats. Wolfe saltbush

Lucerne Valley, Sweetwater Co., Wyoming, dry slopes, July 20, 1959, 5,870
ft. (HHH).

Bassia hyssopifolia (Pall.) Kuntze Bassia

Common on terraces throughout the Green River Basin. (SF).

Blitum capitatum L. Blite

Hideout Forest Camp, Daggett Co., Utah, abundant, July 24, 1959, 5,800 ft.
(HHH).

Chenopodiaceae (family) continued

Chenopodium album L. White goosefoot, lambsquarters
Common terraces throughout the Green River basin (SF). Below Kincaid Ranch,
Sweetwater Co., Wyoming, dry hills, July 3, 1959, 6,000 ft. (HHH).

Chenopodium hybridum (L.) Mapleleaf goosefoot
Brinegar Ranch, ditch bank, Sweetwater Co., Wyoming, July 17, 1959, 5,860
ft. (HHH).

Chenopodium fremonti S. Wats. Fremont chenopodium
Brinegar Ranch, Sweetwater Co., Wyoming, July 17, 1959, 5,860 ft. (SF).

Chenopodium leptophyllum Nutt. Narrowleaf chenopodium
Holms Ranch, Sweetwater Co., Wyoming, dry side hill, abundant, July 22,
1959, 6,000 ft. (HHH), common throughout the region. Above Kincaid Ranch,
Sweetwater Co., Wyoming, July 1, 1959, 6,100 ft. disturbed soil (SF).

Grayia spinosa (Hook) Moq. Hop sage
Locally abundant on dry hillside, 5,800-6,500 ft., Sweetwater Co., Wyoming,
and Daggett Co., Utah, (SF).

Eurotia lanata (Pursh) Moq. Winterfat
Wyuta Spring, Sweetwater Co., Wyoming, dry sagebrush terrace, July 23,
1959, 5,870 ft. (HHH). Horseshoe Bend, Daggett Co., Utah, steep side
hill, July 24, 1959, 5,830 ft. (HHH).

Kochia americana var. vestita Wats. Gray molly
Along Green River, near Utah State line, Sweetwater Co., Wyoming, dry hill-
side abundant in areas, June 10, 1959, 6,200 ft.; Kincaid Ranch, June 30,
1959, 6,050 ft. (HHH).

Monolepis nuttalliana (Schult) Green Nuttall monolepis
Along Green River near Utah State Line, Sweetwater Co., Wyoming, dry hill
side, gravelly soil, June 10, 1959, 6,200 ft. (HHH) (SF).

Salicornia rubra A. Nels. Red samphire
Mouth of Henrys Fork, on damp saline soil, 6,200 ft. (SF).

Salsola kali tenuifolia Tausch. Russian thistle
Common weed throughout the region, 5,500 - 6,500 feet, Sweetwater Co.,
Wyoming and Daggett Co., Utah, (SF).

Sarcobatus vermiculatus (Hook.) Torr. Greasewood
Lucerne Valley, Daggett Co., Utah, very abundant river terrace, July 29,
1959, 6,800 ft. (HHH).

Suaeda depressa (Pers.) Wats. Annual inkweed
Lucerne Valley, in low saline flats, 5,800 ft, Daggett Co., Utah (SF).

Suaeda torreyana Wats. Torrey inkweed
Kincaid Ranch, Sweetwater Co., Wyoming, sage and greasewood community,
abundant, June 30, 1959, 6,050 ft, (HHH) (SF).

Amaranthaceae (family) Amaranths

Amaranthus graecizans L. Pigweed or tumbleweed redroot
Hideout Forest Camp, Daggett Co., Utah, waste open roadside, July 26,
1959, 5,900 ft. (HHH).

Amaranthus blitoides S. Wats. Prostrate redroot
Around Linwood, Daggett Co., Utah, 5,600 ft. (SF).

Nyctaginaceae (family) Four o'clocks

Allionia linearis Pursh. Narrowleaf umbrellawort
Hideout Forest Camp, Daggett Co., Utah, dry hillside, July 28, 1959,
5,800 ft. (HHH).

Abronia elliptica A. Nels. Sandverbena
Williams Ranch Lucerne Valley, Daggett Co., Utah, dry hillside rare,
July 22, 1959, 5,900 ft. (HHH). Green River near Utah State line,
Sweetwater Co., Wyoming, dry gravelly hills, June 10, 1959, 6,200
ft. (SF).

Caryophyllaceae (family) Pinks

Arenaria fendleri Gray Fendler sandwort
Hideout Forest Camp, Daggett Co., Utah, dry hillside, July 26, 1959,
5,800 ft. (HHH).

Arenaria nuttallii Pax. Nuttall sandwort
Kincaid Ranch, Sweetwater Co., Wyoming, river bank, dry sand soil,
July 2, 1959, 6,100 ft. (HHH).

Arenaria uintahensis A. Nels. Uinta sandwort
North of Little Fire Hole Canyon, Sweetwater Co., Wyoming, dry side hill,
rare, July 3, 1959, 6,300 ft. (HHH). Along Green River, near Utah State
line, Sweetwater Co., Wyoming, dry side hills, June 10, 1959, 6,200
ft. (SF).

Stellaria jamesiana Torr. Chickweed
Hideout Forest Camp, Daggett Co., Utah, on damp soil in shade, 5,870 ft.
(SF).

Ranunculaceae (family) Buttercups and allies

Actaea arguta Nutt. Baneberry
South Skull Creek, Daggett Co., Utah, stream bank, July 30, 1959, 5,900
ft. (HHH).

Ranunculaceae (family) continued

Batrachium trichophyllum (Chaiz.) Bosch. Water buttercup
Mouth of Sheep Creek, Daggett Co., Utah, abundant, submerged, July 27,
1959, 5,900 ft. (SF).

Clematis ligusticifolia Nutt. Western virginbower
Lucerne Valley, Sweetwater Co., Wyoming, moist river bank, July 21,
1959, 5,870 ft. (HHH).

Delphinium menziesii DC. Menzies larkspur
Holms Ranch, Sweetwater Co., Wyoming, river bank abundant, July 22,
1959, 5,900 ft. (HHH).

Ranunculus cymbalaria Pursh. Trailing buttercup
Blacks Fork, confluence of Green River, Sweetwater Co., Wyoming,
abundant streamside, July 11, 1959, 6,000 ft. (HHH).

Ranunculus sceleratus L. Celeryleaf buttercup
Hideout Forest Camp, Daggett Co., Utah, riverbank, July 25, 1959,
5,800 ft.; Wyuta Springs, Sweetwater Co., Wyoming, July 13, 1959,
5,650 ft. (SF).

Berberidaceae (family) Barberry

Berberis repens Lindl. Hollygrape or Oregon grape
Hideout Forest Camp, Daggett Co., Utah, abundant canyon streamside,
July 29, 1959, 5,820 ft. (HHH). Skull Creek, Daggett Co., Utah,
July 30, 1959, 5,700 ft. (HHH).

Papaveraceae (family) Poppies

Argemone hispida A. Gray Prickly poppy
Occasional on dry terraces and hillsides, 6,000-6,400 ft., Sweetwater
Co., Wyoming (SF).

Cruciferae (family) Mustards

Alyssum alyssoides L. Yellow alyssum
On terraces and roadsides, Hideout Canyon, Daggett Co., Utah, 5,800
ft. (SF).

Arabis exilis A. Nels. Nelson rockcress
Dry hillsides, Daggett Co., Utah, 5,500-7,000 ft. (SF).

Arabis formosa Greene
Occasional on dry hillsides, Hideout Canyon, Daggett Co., Utah, (SF).

Arabis glabra (L.) Bernh. Tower mustard
Trail Creek, Daggett Co., Utah, on dry gravelly flat, 5,650 ft. (SF).

Cruciferae (family) continued

- Arabis holboellii Hornem. Western rockcress
Occasional, dry hillside, Hideout Canyon, Daggett Co., Utah, 5,860 ft. (SF).
- Brassica nigra (L.) Koch. Black mustard
Common around farms, 6,000-6,300 ft. Sweetwater Co., Wyoming (SF).
- Camelina microcarpa Andrz. Gold of pleasure
Hideout Forest Camp, Daggett Co., Utah, river bank, July 25, 1959, 5,800 ft. (HHH).
- Caulanthus crassicaulis (Torr.) S. Wats. Swollen stalk mustard
Occasional on dry terraces and hillsides, Sweetwater Co., Wyoming and Daggett Co., Utah, 6,000-6,500 ft. (SF).
- Descurainia pinnata (Walt.) Britton Tansey mustard
Common on terraces throughout the Green River Basin, Sweetwater Co., Wyoming and Daggett Co., Utah (SF).
- Erysimum asperum DC. Western wallflower
Frequent on dry terraces and hillsides, Sweetwater Co., Wyoming and Daggett Co., Utah, 5,500-6,500 ft. (SF).
- Erysimum repandum L. Bitter cress
Occasional on terraces and dry hillsides, Sweetwater Co., Wyoming and Lucerne Valley, Daggett Co., Utah (SF).
- Lepidium draba L. White-top mustard
Common on terraces throughout the Green River region (SF).
- Lepidium medium Greene Peppergrass
Along Green River near Utah State line, Sweetwater Co., Wyoming, dry gravelly hills, June 10, 1959, 6,200 ft. (HHH) (SF).
- Lepidium montanum Nutt. Montane peppergrass
Green River near Utah State line, Sweetwater Co., Wyoming, dry gravelly hills, June 10, 1959, 6,200 ft. (HHH) (SF)?
- Lepidium perfoliatum L. Common peppergrass
Occasional on terraces along the Green River (SF).
- Lepidium virginicum L. Virginia peppergrass
Hideout Canyon, Daggett Co., Utah (SF).
- Malcomia africana (L.) R.Br. Malcomia
On dry soil around farms, Sweetwater Co., Wyoming and Daggett Co., Utah, 6,000-6,500 ft. (SF).
- Physaria didymocarpa (Hook.) A. Gray Bladderpod
On dry hillsides, Hideout Canyon, Daggett Co., Utah, 5,500-6,000 ft. (SF).

Cruciferae (family) continued

Radicula lyrata (Nutt.) Greene Yellow watercress
North of Kincaid Ranch, Sweetwater Co., Wyoming, dry hillside, July 2,
1959, 6,100 ft. (SF).

Rorippa nasturtium-aquaticum Britton & Rendle Watercress
Hideout Forest Camp, Daggett Co., Utah, wet soil, July 29, 1959, 5,820
ft. (HHH); Freshwater brooks near Linwood, Daggett Co., Utah, 6,000
ft. (SF).

Rorippa sinuata (Nutt.) Greene Yellow-cress
Confluence of Green and Blacks Fork, Sweetwater Co., Wyoming, sage
and shadscale assoc., rare, July 9, 1959, 5,900 ft.; Lucerne Valley,
Sweetwater Co., Wyoming, moist soil terrace, July 21, 1959, 5,870
ft. (HHH).

Schoenocrambe linifolia (Nutt.) Greene Plains mustard

Sisymbrium altissimum L. Tumbling mustard
Occasional on terraces of the Green River (SF).

Sisymbrium linifolium Nutt.
Hideout Canyon, Daggett Co., Utah, Uinta Mountains, dry hills, June 11,
1959, 6,000 ft. Along Green River, near Utah State line, Sweetwater Co.,
Wyoming, dry gravelly hills, June 10, 1959, 6,200 ft. (HHH) (SF).

Stanelya pinnata (Pursh.) Britton Prince's plume
Kincaid Ranch, Sweetwater Co., Wyoming, frequent open field, July 2,
1959, 6,300 ft. (HHH).

Thelypodium sagittatum (Nutt.) Endl. Saggitate thelypodium
Occasional on terraces and lower hillsides. (SF).

Thelypodium integrifolium (Nutt.) Endl. Thelypodium
Linwood, Daggett Co., dry soil, roadsides (SF).

Thlaspi arvense L. Pennycress
Occasional on damp soil, 5,700 ft., Sweetwater Co., Wyoming (SF).

Capparidaceae (family) Capers

Cleome lutea Hook. Yellow beeweed
Holms Ranch, Sweetwater Co., Wyoming, riverbank, rare, July 22, 1959,
5,900 ft. (HHH).

Cleome serrulata Pursh. Rocky Mountain beeflower
Big Bend, Green River, Sweetwater Co., Wyoming, terrace abundant, July 15,
1959, 6,000 ft. Lucerne Valley, Sweetwater Co., Wyoming, moist river
bank, July 29, 1959, 5,780 ft. Lucerne Valley, Sweetwater Co., Wyoming,
damp terrace open field and road banks, July 21, 1959, 5,870 ft. (HHH).

Capparidaceae (family) continued

- Polanisia trachysperma Torr. & Gray Clammy weed
Hideout Canyon, Daggett Co., Utah, dry gravel hill, July 25, 1959,
5,900 ft. (HHH).

Crassulaceae (family) Stonecrops

- Sedum stenopetalum Pursh. Stonecrop
Hideout Forest Camp, Daggett Co., Utah, Uinta Mountains, dry hillside,
June 11, 1959, 6,000 ft. (SF).

Saxifragaceae (family) Alumroots

- Heuchera parviflora utahensis (Rydb.) Garrett Utah alumroot
In crevices of shaded rocks, Hideout Canyon, Daggett Co., Utah, 5,850
ft. (SF).

Hydrangeaceae (family) Hydrangeas

- Philadelphus occidentalis A. Nels. Philadelphus or mock-orange
Hideout Canyon, Daggett Co., Utah, hillsides, abundant, July 25, 1959,
5,900 ft. (HHH).

Grossulariaceae (family) Gooseberries and currants

- Ribes aureum Pursh. Golden currant
Frequent along the Green River and Henrys Fork, on terraces, Sweetwater
Co., Wyoming and Daggett Co., Utah, 5,800-6,000 ft. (SF).

- Ribes cereum Dougl. Wax currant
Blacks Fork, Sweetwater Co., Wyoming, rare, streamside, July 11, 1959,
6,000 ft. Hideout Forest Camp, Daggett Co., Wyoming, July 29, 1959,
5,280 ft. damp soil, (HHH).

- Ribes inerme Rydb. Black or wine gooseberry
Trail Creek, Daggett Co., Utah, damp soil, July 29, 1959, 5,650 ft. (HHH).

- Ribes petiolare Dougl. Fetid currant
Damp soil in canyon bottoms, Carter Creek, Daggett Co., Utah, 5,700
ft. (SF).

Rosaceae (family) Roses and allies

- Amelanchier alnifolia Nutt. Service berry
Sheep Creek, Daggett Co., Utah, streamside, rare, July 27, 1959, 5,900
ft. (HHH).

Rosaceae (family) continued

- Cercocarpus montanus Raf. Broadleaf mountain mahogany
Campbell Spring Hideout Canyon, Daggett Co., Utah, abundant, July 28,
1959, 6,000 ft. Entrance to Flaming Gorge, Daggett Co., Utah, dry
hillside, numerous, July 24, 1959, 5,820 ft. (HHH).
- Cercocarpus intricatus S. Wats. Dwarf mountain mahogany
Dry hillside, 6,000-6,500 ft. Sweetwater Co., Wyoming, and Daggett Co.,
Utah (SF).
- Crataegus rivularis Nutt. River hawthorn
Hideout Forest Camp, Daggett Co., Utah, riverbank rare, July 28, 1959,
5,900 ft. (HHH).
- Fragaria bracteata Heller Strawberry
On damp soil in shade, 5,640 ft., Carter Creek, Daggett Co., Utah (SF).
- Geum macrophyllum Willd. Avens
Trail Creek, Daggett Co., Utah, streamside abundant, July 31, 1959,
5,650 ft. (SF).
- Holodiscus dumosus (Nutt.) Heller Rock spiraea
Sheep Creek, Daggett Co., Utah, abundant hillside dry, July 27, 1959,
5,900 ft. Kincaid Ranch, Sweetwater Co., Wyoming, July 1, 1959, 6,400
ft. (HHH).
- Petrophytum caespitosum (Nutt.) Rydb. Rock plant
In crevices of dry rocks, Hideout Canyon, Daggett Co., Utah, 5,800
ft. (SF).
- Potentilla anserina Rydb. Silver weed
Kincaid Ranch, Sweetwater County, Wyoming, river bank, abundant, June
30, 1959, 6,000 ft. (SF). Wyuta Spring, Sweetwater Co., Wyoming, moist
river bank, July 23, 1959, 5,870 ft. (HHH).
- Potentilla biennis Greene Cinquefoil
Hideout Forest Camp, Daggett Co., Utah, riverbank, frequent, July 25,
1959, 5,800 ft. (HHH).
- Potentilla filipes Rydb. Cinquefoil
On dry soil in open woods, Hideout and Sheep Creek Canyons, 5,800-6,000
ft. (SF).
- Potentilla micropetala Rydb. Cinquefoil
On dry soil, canyon bottoms, Sheep Creek, Daggett Co., Utah, 5,900
ft. (SF).
- Prunus melanocarpa A. Nels. Chokecherry
Hideout Forest Camp, Daggett Co., Utah, riverbank abundant, July 24,
1959, 5,800 ft, and streamside abundant, July 27, 1959, 5,900 ft,
South Skull Creek, Daggett Co., Utah, July 30, 1959, 5,780 ft, abundant
streamside (HHH).

Rosaceae (family) continued

Purshia tridentata (Pursh) DC. Bitterbrush

Hideout Forest Camp, Daggett Co., Utah, dry hillside, July 25, 1959,
5,800 ft. (HHH).

Rosa ultramontana (Watts.) Heller Wild rose

Hideout Forest Camp, Daggett Co., Utah, abundant along canyon streams,
July 29, 1959, 5,820 ft. (HHH). River banks and terraces, Sweetwater
Co., Wyoming (SF).

Rosa woodsii Lind. Wild rose

Along streams, Sheep Creek, Daggett Co., Utah, 5,860 ft. (SF).

Rubus melanolasius Focke Western red raspberry

Hideout Forest Camp, Daggett Co., Utah, abundant along canyon streams
moist soil, July 29, 1959, 5,900 ft. (HHH).

Rubus parviflorus Nutt. Thimbleberry

On damp soil, usually in shade, Carter Creek, Daggett Co., Utah, 5,560
ft. (SF).

Leguminosae (family) Peas and allies

Astragalus amphioxys Gray Locoweed

Blacks Fork Canyon, Sweetwater Co., Wyoming, rare in open flats, July 11,
1959, 6,500 ft. (HHH).

Astragalus cyaneus Gray Locoweed

Holms Ranch, Sweetwater Co., Wyoming, hillside, rare, July 22, 1959,
6,100 ft. (HHH).

Astragalus diversifolius A. Gray Narrowleaf locoweed

Hideout Canyon, Daggett Co., Utah, dry hillside, July 29, 1959, 5,800
ft (HHH).

Astragalus mortoni Nutt. Tall locoweed

On damp soil, grassy places in open places among narrowleaf cottonwoods,
along terraces of the Green River, Kincaid Ranch, Sweetwater Co., Wyoming,
6,027 ft. (SF).

Astragalus purshii Dougl. Pursh locoweed

Dry plains, 6,400 ft. Sweetwater Co., Wyoming, (SF).

Astragalus sp. Locoweed

North Skull Creek, Daggett Co., Utah, abundant dry sandy side hills, July
31, 1959, 6,000 ft. Near Williams Ranch, Dagget Co., Utah, near stream in
field, July 22, 1959, 5,800 ft. Hideout Forest Camp, Daggett Co., Utah,
dry soil, rare, July 27, 1959, 6,000 ft. Kincaid Ranch, Sweetwater Co.,
Wyoming, rare dry side hill, July 2, 1959, 6,100 ft. (HHH).

Leguminosae (family) continued

Astragalus sp. (continued)

Along the Green River, near Utah State line, Sweetwater Co., Wyoming, dry gravelly hills, June 10, 1959, 6,200 ft. Near Buckboard Ranch, Sweetwater Co., Wyoming, July 15, 1959, 6,000 ft. (SF).

Glycyrrhiza lepidota (Nutt.) Pursh. Wild licorice

Mouth of Little Fire Hole Canyon, Sweetwater Co., Wyoming, very abundant along riverbank, July 3, 1959, 6,000 ft. Flaming Gorge, Daggett Co., Utah, July 26, 1959, 6,000 ft., abundant near stream terrace (HHH).

Lupinus pusillus Pursh. Little lupine

Blacks Fork, Sweetwater Co., Wyoming, abundant on sand hills, July 11, 1959, 6,500 ft. Along Green River near Utah State line, Sweetwater Co., Wyoming, dry gravelly hills, June 10, 1959, 6,200 ft. (HHH).

Lupinus argenteus Pursh. Silver lupine

Blacks Fork above Bridge, Sweetwater Co., Wyoming, dry sandy soil, July 11, 1959, 6,500 ft. (SF).

Medicago lupulina L. Black Medick

On dry soil, Lucerne Valley, Daggett Co., Utah, 6,000 ft. (SF).

Medicago sativa L. Alfalfa

Lucerne Valley and Sheep Creek, Daggett Co., Utah, 5,800-6,000 ft. (SF).

Melilotus alba L. White sweet clover

Frequent around farms 5,800-6,000 ft. Sweetwater Co., Wyoming and Daggett Co., Utah (SF).

Melilotus officinalis (L.) Lam. Yellow sweet clover

Hideout Forest Camp, Daggett Co., Utah, abundant streamside, July 26, 1959, 5,800 ft. (HHH).

Thermopsis montana Nutt. Buck-beans

On dry soil, Sheep Creek, Daggett Co., Utah, 5,860 ft. (SF).

Trifolium repens L. White clover

On damp soil, along brooks and on meadows, 5,850-6,000 ft., Sweetwater Co., Wyoming and Daggett Co., Utah (SF).

Trifolium pratense L. Red clover

Sheep Creek, Daggett Co., Utah, abundant, July 27, 1959, 5,900 ft. (SF).

Vicia linearis (Nutt.) Greene Narrowleaf vetch

On damp soil, usually in shade among trees, occasional on terraces, Sweetwater Co., Wyoming, Sheep Creek, Daggett Co., Utah, 5,600-6,000 ft. (SF).

Geraniaceae (family) Geraniums

Erodium cicutarium (L.) L'Her Filaree

On dry soil, roadsides, Lucerne Valley, Daggett Co., Utah, 6,000 ft. (SF).

Geranium fremontii Torr. Fremont geranium

Trail Creek, Daggett Co., Utah, dry soil, July 31, 1959, 5,650 ft. (HHH).

Linaceae (family) Flaxes

Linum lewisii Pursh. Blue flax

Holms Ranch, Sweetwater Co., Wyoming, rare, open flat sage, July 22, 1959, 5,900 ft. Kincaid Ranch, Sweetwater Co., Wyoming, rare, shale hillside, July 2, 1959, 6,000 ft. (HHH).

Zygophyllaceae (family) Caltrops

Tribulus terrestris L. Land caltrop

Holms Ranch, Sweetwater Co., Wyoming, riverbank open area, abundant, July 22, 1959, 5,900 ft. Wyuta Spring, Sweetwater Co., Wyoming, dry farm land, July 23, 1959, 6,200 ft. (HHH).

Euphorbiaceae (family) Spurges

Euphorbia albomarginata T. & G. Spurge

Hideout Forest Camp, Daggett Co., Utah, dry roadside, abundant, July 28, 1959, 5,700 ft. (SF).

Euphorbia glyptosperma Engelm. Little spurge

Hideout Forest Camp, Daggett Co., Utah, dry waste areas, July 26, 1959, 5,800 ft. (HHH).

Euphorbia robusta (Engelm.) Small Tall spurge

Kincaid Ranch, Sweetwater Co., Wyoming, open sage flat, July 2, 1959, 6,050 ft. Blacks Fork, Sweetwater Co., Wyoming, abundant dry hillside, July 11, 1959, 6,500 ft. (HHH).

Anacardiaceae (family) Cashews

Rhus trilobata Nutt. Squawbush

Hideout Forest Camp, Daggett Co., Utah, abundant, July 25, 1959, 5,800 ft. (HHH).

Rhus rydbergii Small. Poison sumac, poison ivy

Canyon bottoms, Carter Creek, Daggett Co., Utah, 5,600 ft. (SF).

Celastraceae (family) Bittersweets

Forsellesia spinescens (A. Gray) Forsellesia
Hideout Forest Camp, Daggett Co., Utah, rocky hillside, July 26, 1959,
5,800 ft. (HHH).

Aceraceae (family) Maples

Acer glabrum Torr. Mountain red maple
Hideout Forest Camp, Daggett Co., Utah, canyon streamside, July 25,
1959, 5,800 ft. (HHH).

Acer interius Britt. Boxelder
Horseshoe Bend, Daggett Co., Utah, steep river bank, July 24, 1959,
5,810 ft. (HHH).

Malvaceae (family) Mallows

Sphaeralcea coccinea (Greene) Rydb. Scarlet globe mallow
Williams Ranch, Lucerne Valley, Daggett Co., Utah, dry hillside,
July 22, 1959, 5,900 ft. (HHH).

Sphaeralcea rivularis (Dougl.) Torr. River hollyhock
Sheep Creek, Daggett Co., Utah, damp soil, 5,900 ft. (SF).

Sida hederacea (Dougl.) Torr. Alkali mallow
On dry saline soil, Lucerne Valley, Daggett Co., Utah, 5,900 ft. (SF).

Tamaricaceae (family) Tamarix

Tamarix pentandra Pall. Tamarix or salt cedar
Blacks Fork Canyon, Sweetwater Co., Wyoming, rare small immature plants,
July 11, 1959, 6,000 ft. (HHH).

Violaceae (family) Violets

Viola canadensis L. Canadian white violet
Wet or damp soil, Carter Creek, 5,700 ft, Daggett Co., Utah (SF).

Cactaceae (family) Cactuses

Opuntia hystricina Engelm. & Bigel. Yellow prickly pear
Kincaid Ranch, Sweetwater Co., Wyoming, dry side hills in sage com-
munity, July 1, 1959, 6,200 ft. (HHH).

Cactaceae (family) continued

Opuntia rhodantha Schum. Red prickly pear
Kincaid Ranch, Sweetwater Co., Wyoming, dry side hills in sage community,
July 1, 1959, 6,200 ft. (SF).

Pediocactus simpsonii (Engelm) Britt. & Rose. Little barrel cactus
Dry hillsides along the Greene River, 6,600 ft. (SF).

Loasaceae (family) Loasas

Mentzelia albicaulis Dougl. Blazing star
Kincaid Ranch, Sweetwater Co., Wyoming, abundant gravel soil, July 2,
1959, 6,200 ft. (SF).

Mentzelia pumila (Nutt.) Torr. & Gray Dwarf mentzelia
Near Utah State line on the Green River, Sweetwater Co., Wyoming,
gravelly hill, dry soil, June 10, 1959, 6,200 ft. (HHH).

Elaeagnaceae (family) Oleasters

Elaeagnus argentea Pursh. Silver buffaloberry

Elaeagnus commutata Bernh. Silverberry
Blacks Fork, Sweetwater Co., Wyoming, stands along riverbank, July 11,
1959, 6,000 ft. Sage Creek Draw, Sweetwater Co., Wyoming, riverbank
sparse, July 8, 1959, 5,900 ft. (HHH).

Onagraceae (family) Evening-primroses

Boisduvallia glabella (Nutt.) Wolf. Boisduvallia
Kincaid Ranch, Sweetwater Co., Wyoming, abundant open flat, July 2, 1959,
6,000 ft. (SF). Sheep Creek, Daggett Co., Utah, dry side hill and open
field abundant, July 27, 1959, 5,900 ft. (HHH).

Circaea pacifica Aschers. & Magn. Enchanters nightshade
Damp shady soil, Eagle and Carter creeks, Daggett Co., Utah, 5,760 ft. (SF).

Chylismia scapoidea (Nutt.) Small. Chylismia
Common at the bases of cliff and in dry ravines, Sweetwater Co., Wyoming,
5,900-6,000 ft. (SF).

Epilobium adenocaulon Hausskn. Marsh willowherb
Hideout Forest Camp, Daggett Co., Utah, wet soil, July 27, 1959, 5,800
ft. (HHH). Trail Creek, Daggett Co., Utah, wet soil, July 31, 1959,
5,650 ft. (SF).

Onagraceae (family) continued

Gayophytum ramossimum Torr. & Gray Gayophytum

Hideout Canyon, Daggett Co., Utah, dry side hill, July 25, 1959, 5,900 ft. (HHH).

Oenothera brachycarpa Gray Evening primrose

Hideout Canyon, Daggett Co., Utah, dry side hill, rare, July 25, 1959, 6,200 ft. (HHH).

Oenothera caespitosa Nutt. Evening primrose

Wet soil, near Linwood, Daggett Co., Utah, 6,000 ft. (SF).

Oenothera clavaeformis Torr. & Hook. Evening primrose

Green River near Utah State line, Sweetwater Co., Wyoming, dry side hills, June 10, 1959, 6,200 ft. (HHH).

Oenothera marginata Nutt. Evening primrose

On dry soil, Hideout Canyon, Daggett Co., Utah, 5,800 ft. (SF).

Oenothera pallida Lindl. Pale evening primrose

Along Green River near Utah State line, Sweetwater Co., Wyoming, June 10, 1959, 6,200 ft. (HHH). Kincaid Ranch, Sweetwater Co., Wyoming, July 2, 1959, sandy soil, river bank, rare, 6,050 ft. (SF). Holms Ranch, Sweetwater Co., Wyoming, dry side hills, July 22, 1959, 6,000 ft. Hideout Forest Camp, Daggett Co., Utah, dry hill side, July 26, 1959, 5,900 ft. (HHH).

Oenothera strigosa Rydb. Yellow evening primrose

Trail Creek, Daggett Co., Utah, dry soil abundant, July 31, 1959, 5,600 ft. (SF).

Sphaerostigma contortum (Dougl.) Walp. Twistedpod sphaerostigma

Dry hillsides, common along the Green River (SF).

Haloragidaceae (family) Water-milfoils

Hippuris vulgaris L. Joint-weed, mare's tail

Up stream from Linwood, Daggett Co., Utah, emergent in swamp, July 22, 1959, 5,900 ft. (HHH).

SF).

Umbelliferae (family) Parsley and allies

Angelica dilatata A. Nels. Angelica

Damp soil, brook bank, Allen Creek, Carter Creek, Daggett Co., Utah, 5,600 ft. (SF).

Angelica pinnata S. Wats. Angelica

Damp soil, brook banks, Carter Creek, Daggett Co., Utah, 5,650 ft. (SF).

Umbelliferae (family) continued

Aulospermum jonesii Coult. & Rose Indian parsnip
On dry soil, canyon bottoms, Hideout Canyon, Daggett Co., Utah, 5,800
ft. (SF).

Cicuta occidentalis Green Water hemlock
Brinegar Ranch, Sweetwater Co., Wyoming, July 17, 1959, 5,860 ft. (SF).

Cogswellia grayi Coult. & Rose Gray cogswellia
Dry rocky soil, ravines, Sweetwater Co., Wyoming, 6,000 ft. (SF).

Cogswellia macdougalii (Coult. & Rose) Jones Cogswellia
Dry terraces, Kincaid Ranch, Sweetwater Co., Wyoming, 6,040 ft.; on
dry soil, terraces, near Buckboard Ranch, Sweetwater Co., Wyoming,
5,983 ft. (SF).

Conium maculatum L. Poison hemlock
Damp soil around farms, Sheep Creek, Daggett Co., Utah, 5,700 ft. (SF).

Cymopterus lapidosus Jones Cymopterus
Dry terraces and hillsides, Kincaid Ranch, Sweetwater Co., Wyoming,
6,040 ft. (SF).

Cynomarathrum nuttallii (A. Gray) Coult. & Rose . . . Nuttall dog-parsley
Dry rocky hillside, Hideout Canyon, Daggett Co., Utah, 5,800 ft. (SF).

Lomatium grayi C. & R. Lomatium
Hideout Forest Camp, Daggett Co., Utah, dry hillside, June 11, 1959,
6,000 ft. (HHH).

Lomatium scabrum (C. & R.) Math. Lomatium
Kincaid Ranch, Sweetwater Co., Wyoming, rare in small draws, July 3,
1959, 6,700 ft. (HHH).

Lomatium sp. Lomatium
Near Utah State line along Green River, Sweetwater Co., Wyoming, dry
gravelly hills, June 11, 1959, 6,200 ft. (HHH).

Cornaceae (family) Dogwoods

Cornus stolonifera Michx. Red osier dogwood
Frequent on terraces and stream banks of the Green River, Henrys Fork
and side canyons in the Uinta Mountains, 5,600-6,000 ft. (SF).

Primulaceae (family) Primroses

Glaux maritima L. Saltwort
Frequent on wet or damp soil of the banks of the Green River, Sweetwater
Co., Wyoming and Daggett Co., Utah, 5,600-6,200 ft. (SF).

Apocynaceae (family) Dogbanes

Apocynum cannabinum L. Indian hemp

Frequent on damp or wet soil on river banks and terraces of the Green River and its tributaries, 5,600-6,200 ft. (SF).

Apocynum androsaemifolium L. Dogbane

On damp or dry soil, canyon bottoms, Daggett Co., Utah, 5,700-6,000 ft. (SF).

Asclepiadaceae (family) Milkweeds

Asclepias capricornu Woodson Spider milkweed

North Skull Creek, Daggett Co., Utah, dry side hill, rare, July 30, 1959, 6,000 ft. (SF).

Asclepias cryptoceras Wats. Milkweed

Hideout Forest Camp, Daggett Co., Utah, dry rocky hillside, July 26, 1959, 6,300 ft. (HHH).

Asclepias speciosa Torr. Milkweed

Common throughout the Green River Basin (SF).

Convolvulaceae (family) Morning-glories

Convolvulus arvensis L. Bindweed

On dry soil, around farms and along roadsides, Henrys Fork, Daggett Co., Utah, 6,000 ft. (SF).

Cressa truxillensis H. B. K. Cressa

Low saline flats, mouth of Henrys Fork, 5,840 ft., Daggett Co., Utah, (SF).

Polemoniaceae (family) Phloxes

Gilia aggregata (Pursh.) Spreng. Scarlet gilia

Mouth of Sheep Creek, Daggett Co., Utah, dry side hill, abundant, July 25, 1959, 6,000 ft. (HHH).

Gilia inconspicua (Dougl.) Sweet. Dwarf gilia

Buckboard Ranch, Sweetwater Co., Wyoming, July 15, 1959, 6,000 ft. (HHH). Near Utah State line, Sweetwater Co., Wyoming, along the Green River, June 10, 1959, 6,200 ft., dry gravelly hills (SF).

Gilia leptomeria Gray Slender gilia

Green River near Utah State line, Sweetwater Co., Wyoming, dry hill side gravelly, June 10, 1959, 6,200 ft. (HHH) (SF). Kincaid Ranch, Sweetwater Co., Wyoming, rare in small isolated crevices, July 2, 1959, 6,000 ft. (HHH).

Polemoniaceae (family) continued

Gilia nuda (Eastw. & Rydb.) Gilia

Green River near Utah State line, Sweetwater Co., Wyoming, dry gravelly hill, June 10, 1959, 6,200 ft. (HHH) (SF).

Leptodactylon pungens (Torr.) Nutt. ex. Rydb. Pungent phlox

Blacks Fork, Sweetwater Co., Wyoming, abundant dry side hill. (HHH).

Hideout Canyon, Daggett Co., Utah, 6,800 ft. (SF).

Leptodactylon watsoni Underw. Spiny phlox

Dry rocky ravines, 6,200 ft, Sweetwater Co., Wyoming (SF).

Phlox canescens Torr. & Gray Tufted phlox

Sweetwater Co., Wyoming, along Green River near Utah State line, dry gravelly hills, June 10, 1959, 6,200 ft. (SF).

Phlox hoodii Rich. Tufted phlox

On dry soil, Hideout Canyon, 8,840 ft., Daggett Co., Utah (SF).

Phlox longifolia Nutt. Wild sweet William

On dry soil, Henrys Fork, near Linwood, Daggett Co., Utah, 6,000 ft. (SF).

Hydrophyllaceae (family) Waterleaves

Phacelia crenulata Torr. Purple phacelia

Green River near Utah State line, Sweetwater Co., Wyoming, dry gravelly hills, June 10, 1959, 6,200 ft. (HHH).

Boraginaceae (family) Borages

Allocarya nitens Greene Allocarya

Common throughout the Green River region (SF).

Coldenia nuttallii Hook. Coldenia

Near Buckboard Ranch, Sweetwater Co., Wyoming, July 15, 1959, 6,000 ft. (HHH).

Cryptantha affinis (Gray) Greene Silverclub

On dry soil, terraces, Sweetwater Co., Wyoming, 5,900 ft. (SF).

Cryptantha fendleri (A. Gray) Greene Cryptantha

Holms Ranch, Sweetwater Co., Wyoming, dry side hill, July 22, 1959, 6,000 ft. (SF). Near Buckboard Ranch, Sweetwater Co., Wyoming, July 15, 1959, 6,000 ft. (HHH).

Cryptantha flava (A. Nels.) Payson Yellow cryptantha

Along Green River near Utah State line, Sweetwater Co., Wyoming, dry gravelly hills, June 10, 1959, 6,200 ft. (HHH).

Boraginaceae (family) continued

Cryptantha flavoculata (Nels.) Payson Cateye

Blacks Fork, Sweetwater Co., Wyoming, abundant hill side dry soil, July 11, 1959, 6,500 ft. Kincaid Ranch, Sweetwater Co., Utah, July 2, 1959, 6,300 ft. rare on hill side (HHH).

Cynoglossum officinale L. Hounds tongue

Occasional on terraces and around farms, Sweetwater Co., Wyoming and Daggett Co., Utah, 5,600-6,000 ft. (SF).

Heliotropium xerophilum Cockerell Desert heliotrope

Dry saline soil, north of Henrys Fork, Daggett Co., Utah, 5,840 ft. (SF).

Lappula occidentalis (S. Wats.) Green Western stickseed

Frequent on dry soil, terraces and hillsides, Sweetwater Co., Wyoming and Daggett Co., Utah, 5,600-6,200 ft. (SF).

Mertensia brevistyla S. Wats. Bluebell

Dry shaded hillsides, Carter Creek, 5,840 ft. (SF).

Mertensia foliosa A. Nels. Bluebell

Damp soil along brooks, Eagle Creek, Daggett Co., Utah, 5,900 ft. (SF).

Verbenaceae (family) Verbenas

Verbena bracteosa Michx. Prostrate verbena

On dry soil, terraces and roadsides, Daggett Co., Utah, 5,800-6,200 ft. (SF).

Solanaceae (family) Potatoes and relatives

Hyoscyamus niger L. Hensbane

Entrance to Flaming Gorge, Sweetwater Co., Wyoming, dry slope, July 20, 1959, 5,980 ft. (HHH).

Nicotiana attenuata Torr. Wild tobacco

Sheep Creek, Daggett Co., Utah, meadow wet, July 25, 1959, 6,000 ft. (HHH).

Physalis longifolia Nutt. Ground cherry

On dry soil around farms, Linwood, Daggett Co., Utah, 6,000 ft. (SF).

Physalis neomexicana Rydb. Annual ground cherry

Dry soil around farms, 6,000 ft., Sweetwater Co., and Daggett Co. (SF).

Solanum nigrum L. Nightshade

On damp soil in meadows and around farms, Linwood, Daggett Co., Utah, 6,000 ft. (SF).

Solanaceae (family) continued

- Solanum triflorum Nutt. Nightshade
Linwood, Daggett Co., Utah, dry soil, July 22, 1959, 5,900 ft. (HHH).

Labiatae (family) Mints

- Lycopus americanus Muhl. Bugleweed
On wet soil, ditch banks and edges of swamps, Sweetwater Co., Wyoming,
and Daggett Co., Utah, 5,800-6,000 ft. (SF).

- Marrubium vulgare L. Horehound
On dry soil, roadsides and around farms, Sweetwater Co., Wyoming, and
Daggett Co., Utah, 5,800-6,200 ft. (SF).

- Mentha penardi (Briq.) Rydb. Mint
Frequent on stream banks and around swamps, Sweetwater Co., Wyoming
and Daggett Co., Utah, 5,600-6,200 ft. (SF).

- Prunella vulgaris L. Self-heal
On damp soil around springs and on brook banks, Daggett Co., Utah (SF).

- Stachys scopulorum Greene Western betony
On damp soil, meadows and brook banks, Lucerne Valley, Daggett Co.,
Utah, 5,900 ft. (SF).

Scrophulariaceae (family) Figworts

- Adenostegia kingii (Wats.) Adenostegia
Kincaid Ranch, Sweetwater Co., Wyoming, rare, open sage flat, June 30,
1959, 6,050 ft. (SF).

- Adenostegia ramosa (Nutt.) Greene Slender adenostegia
Damp saline soil, terraces, near Holms Ranch, Sweetwater Co., Wyoming,
5,920 ft. (SF).

- Castilleja exilis A. Nels. Marsh paintbrush
Lucerne Valley, Sweetwater Co., Wyoming, dry slope, July 20, 1959,
5,870 ft. (HHH).

- Castilleja chromosa A. Nels. Paintbrush
Kincaid Ranch, Sweetwater Co., Wyoming, June 30, 1959, sage community,
rare, 6,050 ft. (SF).

- Castilleja linariaefolia Benth. Paintbrush
Hideout Canyon, Daggett Co., Utah, sage community, frequent, July 22,
1959, 5,900 ft. (HHH).

- Cordylanthus ramosus (Nutt.) Greene Cordylanthus
Lucerne Valley, Wyuta Spring, Sweetwater Co., Wyoming, dry sage brush
community, July 23, 1959, 5,890 ft. (SF).

Scrophulariaceae (family) continued

Limosella aquatica L. Mudweed

Wyuta Spring, Sweetwater Co., Wyoming, wet soil, 5,800 ft., July 13, 1958 (SF).

Mimulus guttatus DC. Yellow monkeyflower

Trail Creek, Daggett Co., Utah, streamside, July 31, 1959, 5,650 ft. (SF).

Mimulus moschatus Dougl. Little monkeyflower

Eagle Creek, on wet soil, 5,680 ft., Daggett Co., Utah (SF).

Pentstemon comarrhenus A. Gray Pentstemon

Near Utah State line, along Green River, Sweetwater Co., Wyoming, dry gravelly hills, July 10, 1959, 6,200 ft. (SF).

Pentstemon comatus Pennell Pentstemon

South of Manila, Daggett Co., Utah, dry side hill, June 11, 1959, 6,250 ft. (HHH).

Veronica anagallis-aquatica L. Water speedwell

Trail Creek, Daggett Co., Utah, wet soil, July 31, 1959, 5,650 ft. (SF).

Veronica americana (Raf.) Schwein. American speedwell

Hideout Forest Camp, Daggett Co., Utah, wet soil, July 27, 1959, 5,800 ft. (HHH).

Orobanchaceae (family) Broomrapes

Orobanche multiflora Nutt. Cancer-root

Lucerne Valley, Sweetwater Co., Wyoming, sagebrush terrace, scarce, July 21, 1959, 5,870 ft. (HHH).

Thalesia fasciculata (L.) Britton Cancer-root

On dry soil among sagebrush, occasional on terraces, Sweetwater Co., Wyoming, 5,800 ft. (SF).

Thalesia uniflora (L.) Britt. Cancer-root

On dry soil, terrace, Sweetwater Co., Wyoming, 5,960 ft. (SF).

Plantaginaceae (family) Plantains

Plantago eriopoda Torr. Plantain

Frequent on damp soil, terraces along the Green River, Sweetwater Co., Wyoming and Daggett Co., Utah, 5,800-6,000 ft. (SF).

Plantago major L. Common plantain

On damp soil around swamps and on brook banks, Lucerne Valley and Sheep Creek, Daggett Co., Utah, 6,000 ft. (SF).

Plantaginaceae (family) continued

- Plantago purshii Roem. & Schult. Desert plantain
On dry terraces and hillsides, Hideout Canyon, Daggett Co., Utah,
5,800 ft. (SF).

Rubiaceae (family) Madders

- Galium boreale L. Northern bedstraw
Carter Creek, Daggett Co., Utah, dry soil, July 29, 1959, 5,550 ft.
(HHH).

- Galium triflorum Michx. Bedstraw
On dry soil, Sheep Creek, Daggett Co., Utah, 5,900 ft. (SF).

Caprifoliaceae (family) Honeysuckles

- Lonicera involucrata Banks Twinberry honeysuckle
Brook banks, near Linwood and in Sheep Creek, Daggett Co., Utah,
5,850-6,000 ft. (SF).

- Sambucus coerulea Raf. Blue elderberry
On dry hillsides and canyon bottoms, Hideout Canyon, Daggett Co., Utah,
5,850 ft. (SF).

- Sambucus microbotrys Rydb. Red elderberry
On dry soil, canyon bottoms, Hideout Canyon, Daggett Co., Utah, 5,700-
6,000 ft. (SF).

- Symphoricarpos albus (L.) Blake White snowberry
Canyon bottoms and hillsides, Hideout Canyon, Daggett Co., Utah, 5,700-
6,000 ft. (SF).

- Symphoricarpos vaccinioides Rydb. Snowberry
Canyon bottoms and dry hillsides, Hideout and Red Canyons, Daggett Co.,
Utah, 5,600-6,000 ft. (SF).

Campanulaceae (family) Bellflower

- Campanula uniflora L. Bluebell
Carter Creek, Daggett Co., Utah, dry soil, July 28, 1959, 5,550 ft. (HHH).

Compositae (family) Composite flowers

- Achillea lanulosa Nutt. Yarrow
Dry soil, Hideout Canyon, Daggett Co., 5,800 ft. (SF).

Compositae (family) continued

Agoseris arizonica Greene False dandelion
Williams Ranch Lucerne Valley, Daggett Co., Utah, wet meadow abundant,
July 22, 1959, 5,900 ft. (SF).

Agoseris glauca (Pursh.) D. Dietr. False dandelion
Sheep Creek, Daggett Co., Utah, abundant streamside, July 27, 1959,
5,800 ft. (HHH). Lucerne Valley, Sweetwater Co., Wyoming, dry slopes,
July 20, 1959, 5,870 ft. Sheep Creek, Daggett Co., Utah, meadow, July
27, 1959, 5,800 ft., abundant (SF).

Anaphalis subalpina (A. Gray) Rydb. Pearly everlasting
On dry soil, Carter Creek, Daggett Co., Utah, 5,550 ft. (SF).

Antennaria microphylla Rydb. Everlasting
Hideout Forest Camp, Daggett Co., Utah, Uinta Mountains, Flaming Gorge,
dry hills, June 11, 1959, 6,000 ft. (HHH).

Aplopappus acaulis (Nutt.) A. Gray Aplopappus
Hillside, above Kincaid Ranch, 6,100 ft., Sweetwater Co., Wyoming, (SF).

Aplopappus armerioides (Nutt.) A. Gray Aplopappus
On dry rocky soil, hillsides, Hideout Canyon, Daggett Co., Utah, 5,860
ft. (SF).

Aplopappus lanceolatus (Hook.) T. & G. Tall aplopappus
On dry soil, terraces, Sweetwater Co., Wyoming, 5,800 ft. (SF).

Aplopappus watsoni A. Gray Watson aplopappus
Rocky crevice, Hideout Canyon, Daggett Co., 5,900 ft. (SF).

Aplopappus nuttallii (Torr. & Gray) Nuttalls aplopappus
Hideout Forest Camp, Daggett Co., Utah, abundant dry hillside, July 26,
1959, 5,800 ft. (HHH). Green River near Utah State line, Sweetwater Co.,
Wyoming, dry gravelly, hills, June 10, 1959, 6,200 ft. (HHH) (SF).
Kincaid Ranch, Sweetwater Co., Wyoming, rare side hill, July 3, 1959,
6,300 ft. (HHH).

Arctium minus (Hill) Bernh. Burdock
Dry soil, near Linwood, Daggett Co., Utah, 6,000 ft. (SF).

Artemisia dracunculoides Pursh. Aromatic sagebrush
Hideout Forest Camp, Daggett Co., Utah, dry side hill, July 26, 1959,
5,900 ft. (HHH). South Skull Creek, Daggett Co., Utah, dry sage flat,
abundant, July 30, 1959, 5,600 ft. (SF).

Artemisia frigida Willd. Silver sagebrush
Lucerne Valley, Daggett Co., Utah, dry hillside, July 21, 1959, 5,880 ft.
Along Green River, near Utah State Line, Sweetwater Co., Wyoming, dry
hills, gravelly soil, June 10, 1959, 6,200 ft. Kingfisher Canyon, Daggett
Co., Utah, July 24, 1959, 5,800 ft. (HHH).

Compositae (family) continued

- Artemisia gnaphalodes Nutt. Herbaceous sagebrush
Frequent on terraces and ravines, Sweetwater Co., Wyoming and Daggett Co., Utah, 5,600-6,000 ft. (SF).
- Artemisia ludoviciana Nutt. Herbaceous sagebrush
Lucerne Valley, Daggett Co., Utah, abundant dry meadow, July 22, 1959, 5,900 ft. (HHH). South Skull Creek, Daggett Co., Utah, dry soil abundant, July 30, 1959, 5,700 ft. (SF).
- Artemisia nova A. Nels. Little sagebrush
Wyuta Spring Lucerne Valley, Sweetwater Co., Wyoming, dry sagebrush terrace, July 23, 1959, 5,870 ft. (HHH).
- Artemisia spinescens D.C. Eaton Bud sagebrush
Green River along near Utah State line, Sweetwater Co., Wyoming, June 10, 1959, 6,200 ft. (HHH).
- Artemisia tridentata Nutt. Big sagebrush
Lucerne Valley, Daggett Co., Utah, dry terrace abundant, mature stands, July 23, 1959, 5,870 ft. (HHH).
- Aster adscendens Lindl. Aster
Hideout Canyon, Daggett Co., Utah, dry hillside, July 29, 1959, 5,800 ft. (SF).
- Aster brachyactis Blake Marsh aster
- Aster eatoni A. Gray Eaton aster
Dry soil, Hideout Canyon, Daggett Co., Utah, 5,800 ft. (SF).
- Aster fremontii A. Gray Fremont aster
Lucerne Valley, Daggett Co., Utah, dry meadow abundant, July 22, 1959, 5,900 ft. (HHH).
- Aster leucanthemifolius Greene Desert aster
Dry plains (SF).
- Aster leucelene Blake Dwarf aster
Along Green River near Utah State line, Sweetwater Co., Wyoming, dry gravelly hills, June 10, 1959, 6,200 ft. Kincaid Ranch, Sweetwater Co., Wyoming, rare on dry sandy hillside, July 2, 1959, 6,200 ft. (HHH).
- Aster occidentalis (Nutt.) T. & G. Western aster
Common along the Green River area (SF).
- Bidens cernua L. Beggar-tick
On damp or wet soil, brook banks and around swamps, Linwood, Daggett Co., Utah, 6,000 ft. (SF).

Compositae (family) continued

Centaurea picrus Pall. *Centaurea*

Wyuta Spring Lucerne Valley, Sweetwater Co., Wyoming, terrace near river, July 24, 1959, 5,870 ft. (HHH).

Chaenactis douglasii (Hook.) Hook. & Arn. *Chaenactis*

Blacks Fork, river mile 14, Sweetwater Co., Wyoming, abundant dry sand hill, July 11, 1959, 6,500 ft. Hideout Forest Camp, Daggett Co., Utah, July 25, 1959, 5,900 ft., dry hillside (HHH).

Chaenactis stevioides Hook. & Arn. Annual *chaenactis*

Common on terraces and hillsides throughout three region, Sweetwater Co., Wyoming and Daggett Co., Utah, 5,600-6,900 ft. (SF).

Chrysopsis villosa (Pursh.) Nutt. Golden aster

Flaming Gorge, Green River, Daggett Co., Utah, June 11, 1959, 6,100 ft. (HHH).

Chrysothamnus graveolens (Nutt.) Greene Rabbitbrush

On dry rocky soil, ravines, Sweetwater Co., Wyoming, 5,800 ft. (SF).

Chrysothamnus linifolius Greene Rabbitbrush

On damp soil, terraces along the Green River, Sweetwater Co., Wyoming 5,900-6,000 ft. (SF).

Chrysothamnus nauseosus (Pall.) Britton Big rabbitbrush

Hideout Canyon, Daggett Co., Utah, dry sandy soil, hillside, July 25, 1959, 5,900 ft. Blacks Fork, Sweetwater Co., Wyoming, July 11, 1959, 6,100 ft. very abundant on hills in upper reaches (HHH).

Chrysothamnus viscidiflorus var. stenophyllus (Gray) H.M. Hall . Varnishleaf

Big Bend on Green River, Sweetwater Co., Wyoming, abundant to 40% cover, July 15, 1959, 6,000 ft. Lucerne Valley, Sweetwater Co., Wyoming, dry terrace abundant, July 23, 1959, 5,870 ft. (HHH).

Chrysothamnus viscidiflorus (Hook) Nutt. var. tortuifolia . . Varnishleaf

Entrance to Flaming Gorge, Daggett Co., Utah, dry open flat, July 24, 1959, 5,800 ft. (HHH).

Cirsium arvense (L.) Scop. Canada thistle

Big Bend of Green River, Sweetwater Co., Wyoming, abundant on river bank, July 15, 1959, 6,000 ft. (HHH).

Cirsium lanceolatum (L.) Hill Bull thistle

Along brook banks, Trail Creek, Daggett Co., Utah, 5,650 ft. (SF).

Cirsium scariosum Nutt. Meadow thistle or downy thistle

Common on terraces along the Green River, Sweetwater Co., and Daggett Co., Utah, 5,800-6,000 ft. (SF).

Compositae (family) continued

Cirsium undulatum (Nutt.) Spreng. Thistle

On dry soil, hillsides, Hideout Canyon, Daggett Co., Utah, 5,800-6,000 ft. (SF).

Coleosanthus grandiflorus (Hook.) Kuntze Brickellia

Among dry rocks, canyon bottoms, Hideout Canyon, Daggett Co., Utah 5,800 ft. (SF).

Crepis acuminata Nutt. Hawksbeard

Green River near Utah State Line, Sweetwater Co., Wyoming, dry gravelly hills, June 10, 1959, 6,200 ft. (HHH).

Erigeron canadense L. Canadian fleabane

Frequent on damp soil, terraces, Sweetwater Co., Wyoming and Daggett, Co., Utah, 5,800-6,000 ft. (SF).

Erigeron divergens Torr. & Gray Fleabane

Hideout Forest Camp, Daggett Co., Utah, dry side hill, July 25, 1959, 5,900 ft. Holms Ranch, Sweetwater Co., Wyoming, very rare open flat, July 22, 1959, 6,200 ft. (HHH).

Erigeron sp. Fleabane

Kincaid Ranch, Sweetwater Co., Wyoming, abundant open river bank, July 2, 1959, 6,050 ft. (HHH).

Franseria acanthicarpa (Hook.) Coville Bur-sage

Frequent on terraces, Sweetwater Co., Wyoming and Daggett Co., Utah, 5,600-6,000 ft. (SF).

Gaillardia gracilis A. Nels. Gaillardia

Hideout Canyon, Daggett Co., Utah, dry soil on hillside, July 26, 1959, 5,800 ft. (SF).

Gnaphalium palustre Nutt. Cudweed

On river banks along the Green River, Sweetwater Co., Wyoming, 5,900-6,200 ft. (SF).

Grindelia squarrosa (Pursh) Dunal. Gumweed

Lucerne Valley, Daggett Co., Utah, dry meadow abundant, July 22, 1959, 5,900 ft. (HHH).

Gutierrezia microcephala (DC) A. Gray Snakeweed, matchweed

On dry soil, ravines and canyon bottoms, Sweetwater Co., Wyoming and Daggett Co., Utah, 5,600-6,200 ft. (SF).

Gutierrezia sarothrae (Pursh) Britt. & Rusby . . . Snakeweed, matchweed

On dry soil, terraces along the Green River, Sweetwater Co., Wyoming and Daggett Co., Utah, 5,800-6,000 ft. (SF).

Compositae (family) continued

Helianthus annuus L. Common sunflower

Dry soil, ravines and around farms, Sweetwater Co., Wyoming and Daggett Co., Utah, 5,700-6,000 ft. (SF).

Helianthus nuttallii Torr. & Gray. Greer Nuttall sunflower

Brinegar Ranch, Sweetwater Co., Wyoming, July 17, 1959, 5,860 ft. (SF).

Helianthus petiolaris Nutt. Sunflower

Common throughout the Green River region (SF).

Helenium montanum Nutt. Montane sneezeweed

Lucerne Valley, Sweetwater Co., Wyoming, moist terrace, July 21, 1959, 5,870 ft. (HHH).

Hieracium gracile Hook. Hawkweed

Blacks Fork, Sweetwater Co., Wyoming, wet populus, willow assoc. July 17, 1959, 5,980 ft. (HHH) (SF). Lucerne Valley, Sweetwater Co., Wyoming, dry side hills, July 20, 1959, 5,870 ft. (HHH).

Hymenopappus filifolius Hook. Hymenopappus

Dry hillsides, 6,400 ft., Sweetwater Co., Wyoming, (SF).

Hymenoxys acaulis (Pursh) K. F. Parker Hymenoxys

Hideout Forest Camp, Daggett Co., Utah, dry hillside, June 11, 1959, 6,000 ft. (HHH).

Iva axillaris Pursh, Woodruff Poverty weed, marsh elder

Wyuta Spring, Sweetwater Co., Wyoming, moist river terrace, July 23, 1959, 5,870 ft. Williams Ranch, Daggett Co., Utah, abundant dry soil hills and fields, July 22, 1959, 5,890 ft. (HHH).

Lactuca pulchella (Pursh) Riddell Blue lettuce

Hideout Forest Camp, Daggett Co., Utah, river bank, July 25, 1959, 5,800 ft. Hideout Forest Camp, Daggett Co., Utah, moist soil, July 25, 1959, 5,800 ft. (HHH).

Lactuca scariola L. Prickly lettuce

Dry soil, around farms and along roadsides, Linwood, Daggett Co., Utah, 6,000 ft. (SF).

Laphamia stansburii Gray Laphamia

Campbell Spring Hideout Canyon, Daggett Co., Utah, July 29, 1959, 6,000 ft. (HHH).

Leontodon taraxacum L. Common dandelion

Hideout Forest Camp, Daggett Co., Utah, moist soil, rare, July 27, 1959, 5,600 ft. (HHH).

Lygodesmia grandiflora (Nutt.) Torr. Desert pink

Hideout Canyon, Daggett Co., Utah, rare, July 25, 1959, 6,000 ft. Dutch Johns Bridge, Daggett Co., Utah, rare, Aug. 1, 1959, 5,700 ft. (HHH).

Compositae (family) continued

Lygodesmia juncea (Pursh.) Don. Desert pink

Blacks Fork, Sweetwater, Wyoming, very abundant, dry sand soil, July 11, 1959, 6,500 ft. (SF).

Malacothrix sonchoides (Nutt.) Torr. & Gray Malacothrix

Holms Ranch, Sweetwater Co., Wyoming, dry side hill, rare, July 22, 1959, 6,000 ft. (HHH). Hideout Forest Camp, Daggett Co., Uinta Mountains, Utah, dry hills (SF). Green River, near Utah State line, Sweetwater Co., Wyoming, dry hills, June 10, 1959, 6,200 ft. (HHH).

Ptiloria exigua (Nutt.) Greene Ptiloria

Hideout Forest Camp, Daggett Co., Utah, rare, dry soil, July 20, 1959, 5,800 ft. (SF). Carter Creek, Daggett Co., Utah, dry hillside, July 28, 1959, 5,552 ft. (HHH).

Ptiloria parryia (A. Gray) Coville Parry ptiloria

On dry hillsides, Kincaid Ranch, Sweetwater Co., Wyoming, 6,400 ft. (HHH).

Rudbeckia occidentalis Nutt. Niggerhead

Dry soil, Carter Creek, Daggett Co., Utah, 5,600 ft. (SF).

Senecio cymbalarioides Nutt. Senecio

Dry soil, canyon bottoms and hillsides, Hideout and Red canyons, Daggett Co., Utah, 5,600-5,900 ft. (SF).

Senecio integerrimus Nutt. Senecio

Dry soil and hillsides, Hideout and Red canyons, Daggett Co., Utah, 5,600-6,900 ft. (SF).

Senecio uintahensis A. Nels. Uinta senecio

Flaming Gorge entrance, Daggett Co., Utah, June 11, 1959, 6,100 ft. (HHH) (SF).

Solidago canadensis L. Canadian goldenrod

Common in Red Canyon, Daggett Co., Utah (SF).

Solidago missouriensis Nutt. Goldenrod

Lucerne Valley, Sweetwater Co., Wyoming, moist terrace, July 21, 1959, 5,870 ft. (HHH).

Solidago petradoria Blake Rock goldenrod

Hideout Forest Camp, Daggett Co., Utah, dry hill, June 11, 1959, 6,000 ft. (SF). Hideout Forest Camp, Daggett Co., Utah, dry side hill abundant, July 26, 1959, 5,800 ft. (HHH). Hideout Forest Camp, Daggett Co., Utah, dry side hill abundant, July 25, 1959, 5,800 ft. (HHH).

Solidago trinervata Greene Goldenrod

Frequent on river banks, Sweetwater Co., Wyoming and Daggett Co., Utah, 5,600-6,000 ft. (SF).

Compositae (family) continued

Sonchus asper (L.) All. Sowthistle

Lucerne Valley, Daggett Co., Utah, wet meadow, frequent, July 22, 1959,
5,800 ft. (HHH).

Sonchus oleraceus L. Sowthistle

Brinegar Ranch, Sweetwater Co., Wyoming, ditch bank, open fields, July
17, 1959, 5,860 ft. (HHH).

Stephanomeria parryi Gray Stephanomeria

Kincaid Ranch, Sweetwater Co., Wyoming, dry hillside, rare, July 2,
1959, 6,400 ft. (HHH). Middle Firehole Canyon, Sweetwater Co., Wyoming,
dry soil, July 4, 1959, 6,200 ft. (SF).

Tetradymia canescens DC. Horsebrush

Mouth of middle Firehole Canyon, Sweetwater Co., Wyoming, July 5, 1959,
6,500 ft. (HHH). Green River near Utah State line, Sweetwater Co.,
Wyoming, June 10, 1959, 6,200 ft. (HHH) (SF). Near Buckboard Ranch,
Sweetwater Co., Wyoming, July 15, 1959, (HHH).

Tetradymia nuttallii Torr. & Gray Nuttall horsebrush

Blacks Fork, Sweetwater Co., Wyoming, rare in this section, dry side
hill, July 6, 1959, 5,980 ft. (HHH).

Tetradymia spinosa Hook. & Arn. Spiny horsebrush

On dry soil, terraces and hillsides, Sweetwater Co., Wyoming, 5,800-
6,500 ft. (SF).

Tragopogon dubius Scop. Goats beard

Hideout Forest Camp, Daggett Co., Utah, riverbank, July 25, 1959,
5,800 ft. (HHH).

Tragopogon parvifolius L. Salsify

Dry soil, near Linwood, Daggett Co., Utah, 6,000 ft. (SF).

Townsendia exscapa (Richards) Porter Townsendia

Along Green River near Utah State line, Sweetwater Co., Wyoming,
dry gravelly hills, June 10, 1959, 6,200 ft. (HHH) (SF).

Townsendia incana Nutt. Townsendia

Hideout Forest Camp, Daggett Co., Utah, dry hillside, July 26, 1959,
5,800 ft. (HHH).

Townsendia watsoni A. Gray Watson townsendia

On dry hillsides, Sweetwater Co., Wyoming, 6,300 ft. (SF).

Viguiera multiflora (Nutt.) Blake Goldenray

Trail Creek, Daggett Co., Utah, wet soil, stream bank, July 31,
1959, 5,600 ft. Eagle Creek, Daggett Co., Utah, moist soil abundant
stream side, July 30, 1959, 5,750 ft. (HHH).

Compositae (family) continued

Xanthium italicum Mor. Cocklebur

Wyuta Spring, Sweetwater Co., Wyoming, moist river terrace, July 23,
1959, 5,870 ft. (HHH).

Xanthium pennsylvanicum Wallr. Cocklebur

Lucerne Valley, Sweetwater Co., Wyoming, moist terrace, July 21, 1959,
5,870 ft. (HHH).

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ARTHROPODS FOUND
in
FLAMING GORGE RESERVOIR BASIN, 1959

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ARTHROPODS OF FLAMING GORGE RESERVOIR BASIN

INTRODUCTION

During the progress of the Flaming Gorge expeditions conducted by the Division of Biological Sciences, 1959, (see Foreword), many members of the crews collected specimens of arthropods, but the chief responsibility for preserving and caring for the specimens on the main expedition rested upon Beng C. Ho, a graduate student from Singapore, who, upon returning to the University, undertook the principal task of preparing the specimens for study and determination, under the direction of Don M. Rees.

The specimens were sorted into taxonomic groups and those that could not readily be identified were referred to specialists. George F. Edmunds and Guy G. Musser studied the mayflies, Jean S. Musser the dragonflies, Joan Sessions and Arden R. Gaufin the stoneflies, Lewis T. Nielsen the mosquitoes, Dale D. Parker the fleas, Ted Davis the hymenopterans (except ants), Albert W. Grundmann the ants, and D. Elmer Johnson the ticks. The mayflies, dragonflies, and the stoneflies have been given special treatment. In the general list which follows, the majority have been determined to species but in a few cases, identification is limited to genus or family. Those not included in the lists are still unidentified.

In the lists, R. M. is used as an abbreviation of river mile, which signifies the distance above Greenriver, Utah as given on the USGS Plan and Profile maps of Green River, sheets H, I, and J. The Flaming Gorge Reservoir Basin extends from R. M. 290 upstream to 378. Since the expedition came downstream, the records are usually recorded in that order. A.M.W.

GENERAL LISTS

INSECTS (class) Insects

EPHEMEROPTERA (order) Mayflies

See annotated list by George F. Edmunds and Guy G. Musser, p. 111

ODONATA (order) Dragonflies and damselflies

See annotated list by Jean S. Musser, p. 125

PLECOPTERA (order) Stoneflies

See annotated list by Joann Sessions and Arden R. Gaufin, p. 133

ORTHOPTERA (order) Grasshoppers, crickets and allies
Identification by Beng C. Ho

Locustidae (family)
Grasshoppers

Dissosteira carolina
Taken at R.M. 378, 372, 366,
358, 356 (9 mi. up Blacks
Fork), 356 (3 mi. up Blacks
Fork), 339, 324, 323, 319
(Lucerne Valley), 309 (Sheep
Creek), 307 (Hideout Forest
Camp), 290 (Cart Creek), 306.

Melanoplus femur-rubrum (DeGeer). .
Red-legged grasshopper
Taken at R. M. 366, 356, 339, 309
(Sheep Creek), 298 and 294.

Melanoplus bivitattus (Say)
Two-striped locust
Taken at R.M. 372 (Middle Fire-
hole Canyon), 362, 356 (3 mi.
up Blacks Fork), 339, 320.

Tettigoniidae (family)
Katydid and allies

Anabrus simplex (Haldeman)
Mormon cricket
Taken at R.M. 307 (Hideout Forest
Camp).

Gryllidae (family)
Crickets and tree crickets

Nemobius fasciatus (DeGeer)
Taken at R. M. 350 (Buckboard
Hotel) and 323.

Stenopelmatidae (family)
Sand crickets and allies

Stenopelmatus fasciatus (Thomas)
Taken at R.M. 356 (Blacks Fork),
350 (Buckboard Hotel), and 307
(Hideout Forest Camp).

ANOPLURA (order) True lice
Identification by Richard Elzinga

Hoplopleuridae (family)

Hoplopleura hesperomydis (Osborn)
Found on pocket mouse (Perognathus fasciatus) at R.M. 356,
opposite mouth of Black Fork,
July 13; deer mouse at R. M. 350
(Buckboard), July 14 and 4 deer
mice, July 15; deer mouse at R.M.
339, 5900 ft., July 17; deer mouse
at R.M. 306.8, (Hideout Forest
Camp) 5900 ft., July 26; deer
mouse at R.M. 299 (near Skull Creek),
July 31; pinyon mouse at R.M. 291
(1 mi. above dam site), Aug. 1.

Neohaematopinus inornatus
Found on bushy-tailed wood rat
at R. M. 350 (Buckboard), July
16.

Polyplax auricularis K. and F.
Found on: deer mouse at R.M. 378,
July 8; deer mouse at R.M. 350
(Buckboard) July 14; deer mouse
at R. M. 323, 5850 ft., July 23;
2 deer mice at R. M. 306.8 (Hide-
out Spring), 5850 ft., July 28.

HOMOPTERA (order) Cicadas, aphids, and allies
Identification by Beng C. Ho

Membracidae (family)
Tree hoppers
Ceresa bubalus (Fab.)
Taken at R.M. 309 (Sheep Creek),
298 and 294.

Aphididae (family) Aphids
Taken at R.M. 323, 307, (Hideout
Forest Camp), and 294.

Cicadidae (family) Cicadas
Cicada sp.
Taken at R. M. 378

Cercopidae (family) Spittle bugs
Philaenus sp.
Taken at R.M. 378, 372, 366 and 294.

Genus sp.
Taken at R.M. 366, 356 (8 mi. up
Blacks Fork), 339, 319 (Lucerne Valley).

COLEOPTERA (order) Beetles
Identification by B. C. Ho

Cicindelidae (Family) . Tiger beetles
Cicindela limbalis Klug
Taken at R.M. 378, 309 (Sheep
Creek), and 294.

Cicindela repanda Dej.
Taken at R.M. 378, 309 (Mouth
of Sheep Creek), 304 (Eagle
Creek), and 294.

Omus californicus
Taken at R.M. 307 (Hideout
Forest Camp) and 306.

Carabidae (family) . Ground beetles
Chlaenius sericeus Forst.
Taken at R.M. 376, 372 and 356 (3
mi. up Blacks Fork).

Tenebrionidae (family)
Megasattus erosus (Horn)
Taken at R.M. 366, 309 (Sheep
Creek), 308 (Hideout Flat),
and 307 (Hideout Forest Camp).

Coccinellidae (family) . Lady beetles
Chilocorus stigma Say
Taken at R.M. 323, and 319
(Lucerne Valley).

Coccinella transversoguttata Fald.
Taken at R.M. 373, 366, 358, 332,
323, 320, 319 (Lucerne Valley),
309 (Sheep Creek), 307 (Hideout
Forest Camp), and 298.

Coccinellidae (family continued)
Hippodamia convergens Guer.
Taken at R.M. 378, 373, 366, 356
(3 mi. up Blacks Fork), 346, 339,
323, 309 (Sheep Creek), 319
(Lucerne Valley), 307 (Hideout
Forest Camp), 298 and 294.

Scarabeidae (family) . Lamellicorn beetles
Phyllophaga fervida Fab.
Taken at R.M. 356, 338 (Brinegar
Ranch), 323, 307 (Hideout Forest
Camp).

Cerambycidae (family)
Longhorn woodborers
Batyleoma suturale (Say)
Taken at R.M. 309 (Sheep Creek).

Batyleoma sp.
Taken at R.M. 373 (Bull Bottom),
358, and 308 (Hideout Flat).

Prionus californicus (Mots)
Taken at R.M. 366, 364, 356 (Blacks
Fork), 350 (Buckboard Hotel), 339,
338 (Brinegar Ranch), 323, 307
(Hideout Forest Camp).

Tetraopes femoratus Lec.
Taken at R.M. 378 and 376.

LEPIDOPTERA (order) Butterflies and moths
Identification by B. C. Ho

Nymphalidae (family)
Four-footed butterflies
Aglaia antiopa (L.)
Mourning cloak
Taken at R.M. 309 (Hideout
Forest Camp).

Papilionidae (family)
Swallowtails
Papilio rutulus Lucus
Taken at R.M. 307 (Hideout
Forest Camp)

Pieridae (family)
Sulfur and white butterflies
Pieris protodice Bdv. and Lec. . . .
S. cabbage butterfly
Taken at R.M. 366 and 319
(Lucerne Valley).

Vanessa carye
Taken at R.M. 323, 319 (Lucerne
Valley), 309 (Sheep Creek), and
307 (Hideout Forest Camp).

Zerene eurydice
Taken at R.M. 319 (Lucerne Valley),
and 309 (Sheep Creek).

DIPTERA (order) Two-winged flies

Culicidae (family) Mosquitoes
Identification by Lewis T. Nielsen
Aedes dorsalis (Meigen)
Taken at R.M. 378, 373, 372, 366,
356 (Blacks Fork), 339, 326, 323,
and 319.

Aedes campestris Dyar & Knab
Taken at R.M. 378, 356, (Blacks
Fork), 343, 339 and 323.

Aedes melanimon Dyar
Taken at R.M. 366, 362, 356, 350,
344, 343, 339 and 323.

Aedes nigromaculis (Ludlow)
Taken at R.M. 339.

Aedes spencerii (Theobald)
Taken at R.M. 378, 376, 373, 372,
369, 366, 364, 356, (Blacks Fork),
350, 343, 339, and 310.

Aedes vexans (Meigen)
Taken at R.M. 362, 350, 339, and
310.

Identification by B. C. Ho

Tipulidae (family) . . . Crane flies
Nephrotoma erythrophrys
Taken at R.M. 309 (Sheep Creek).
Nephrotoma ferrupinea
Taken at R.M. 373, 366, 362, 353,
350 (Buckboard Hotel), 346 and 339.
Tipula sp.
Taken at R.M. 323.

Tabanidae (Family) . . . Horseflies
Chrysops carbonaria Walker
Taken at R.M. 323.

Chrysops discalis Will.
Taken at R.M. 358 and 323.

Chrysops fulvaster (O. S.)
Taken at R.M. 323.

Tabanus aegrotus (O. S.)
Taken at R.M. 323.

Tabanus punctifer (O. S.)
Taken at R.M. 307, (Hideout Forest Camp)

DIPTERA (order) continued
Identification by B. C. Ho

Asilidae (family) . . Assassin flies

Asilus sp.

Taken at R.M. 372, 350 (Buckboard Hotel), 323, and 298.

Cyrtopogon sp.

Taken at R.M. 378 and 323.

Dasyllis sp.

Taken at R.M. 307 (Hideout Forest Camp).

Hybomitra rhombica (O.S.)

Taken at R.M. 307 (Hideout Forest Camp).

Hybomitra tetrica (Marten)

Taken at R.M. 378, 324 and 323.

Mallophora sp.

Taken at R.M. 309 (Sheep Creek), and 307 (Hideout Forest Camp).

Promachus sp.

Taken at R.M. 378, 373, 372, 366, 347, 339, 356 (3 mi. up Blacks Fork).

Dolichopodidae (family) . Longhead flies

Dolichopus sp.

Taken at R.M. 378, 323 and 294.

Peckia sp.

Taken at R.M. 366, and 309 (Sheep Creek).

Syrphidae (family) . . Flower flies

Baccha sp.

Taken at R.M. 366 and 353.

Syritta sp.

Taken at R.M. 323.

Otitidae (family) . Picturewing flies

Eurycephala sp.

Taken at R.M. 378, 373, 366, 362, 339, and 323.

Calliphoridae (family)

Calliphora sp.

Taken at R.M. 366, 350 (Buckboard Hotel), 323, 309 (Sheep Creek), and 307 (Hideout Forest Camp).

Lucilia illustris (Meig.)

Taken at R.M. 378, 366, 350 (Buckboard Hotel), 339, 323, and 307 (Hideout Forest Camp).

Sarcophagidae (family) . Flesh flies

Neobellier sp.

Taken at R.M. 378, 372, 366, 323 and 306.

Ravinia sp.

Taken at R.M. 307 (Hideout Forest Camp).

Sarcophaga bullata Parker

Taken at R.M. 350 (Buckboard Hotel), 324, and 323.

Sarcophagula sp.

Taken at R.M. 372, 366, 339, 323, 307 (Hideout Flat), and 298.

Tachinidae (family) . Tachina flies

Fabriciella spinosa Toth.

Taken at R.M. 366, 356 (Blacks Fork), 347, 309 (Hideout Forest Camp), and 298.

Muscidae (family) . . Muscid flies

Drymeia sp.

Taken at R.M. 378.

Hylemyia cilicrura (Pond)

Taken at R. M. 378, 373 and 323.

Hylemyia sp.

Taken at R. M. 378.

SIPHONAPTERA (order) Fleas

Identification by Dale D. Parker

Ceratophyllidae (family)

Monopsyllus sp. (eumolpi?)

Found on least chipmunks at R. M.
321R, 1 ♀, July 23.

Monopsyllus w. wagneri (Baker)

Found on deer at R. M. 378R,
(Kincaid Ranch), 1 ♂, 8 ♀,
July 1; at R. M. 378, 4 ♂,
6 ♀, July 2; at R. M. 360,
(Sage Creek), 6 ♀, July 8; at
R. M. 356R, (Blacks Fork) 1 ♀,
July 9; at R. M. 350R, (Buck-
board) 1 ♀, July 14, and 1 ♂
and 1 ♀, July 15. Found on
Northern grasshopper mouse at
R. M. 360RM (Sage Creek) 2 ♂
and 1 ♀, July 8. Found on
Long-tailed meadow mouse at
R. M. 378R, (Kincaid Ranch)
9 ♂, July 1; and 2 ♀, July 2,
2 ♀, July 8.

Opisocrostitis labis Jordan and
Rothschild

Found on White-tailed prairie
dog at R. M. 360, (Sage Creek),
1 ♂ and 1 ♀, July 10.

Orchopeas sp.

Found on deer mouse at R. M. 350,
(Buckboard) 1 ♀, July 15.

Orchopeas ?

Found on deer mouse at R. M. 339,
(Brinegar Ranch), 1 ♀, July 15.

Orchopeas sexdentatus (Rothschild)

Found on sparrow hawk, at R. M.
352L (Holms Ranch), 1 ♀, July 13.
Found on deer mouse at R. M. 350R
(Buckboard), 1 ♀, July 16.

Hystriehopsyllidae (family)

Callistopsyllus terinus

Found on deer mouse at R. M.
360R (Sage Creek), 1 ♀, July 8,
at R. M. 356 (Blacks Fork, 1 ♂,
July 11. Found on Long-tailed
meadow mouse at R. M. 378R,
(Kincaid Ranch), 1 ♀, July 1.

Callistopsyllus sp.

Found on Northern grasshopper
at R. M. 360R (Sage Creek), 1 ♂,
July 8.

Catallagia decepiens Rothschild

Found on deer mouse at R. M.
291, 1 ♂, Aug. 1.

Pulicidae (family)

Cediopsylla i. inaequalis (Baker)

Found on Audubon cottontail at
R. M. 372 (Firehole), 9 ♂, and
16 ♀, July 4; at R. M. 356,
(Blacks Fork), 5 ♂ and 13 ♀,
July 12; at R. M. 327.7 (Badger
Bottom), 4 ♂ and 10 ♀, July 19.
Found on deer mouse at R. M.
291, 6 ♂ and 13 ♀, Aug. 1.

HYMENOPTERA (order) Bees, wasps, ants, and allies
Identification by Ted Davis

- Tenthredinidae (Family) . . Sawflies
Taken at R. M. 378 (Kincaid Ranch),
378, 372, 366, and 339.
- Siricidae (family) . . Horntails
Taken at R. M. 305 (Carter Creek).
- Ichneumonidae (family) . Ichneumon flies
Taken at R. M. 378, 373, 366, 356
(Blacks Fork), 346, 339, 323, 308
(Hideout Flat), 298, and 294.
- Ophioninae (subfamily)
Taken at R. M. 323 and 306.
- Braconidae (family) . . Braconids
Taken at R. M. 378, 373, 362
and 294.
- Cynipidae (family) . . Gallwasps
Taken at R. M. 378, 329 and 356
(8 mi. up Blacks Fork).
- Chalcidoidea (Superfamily) .Chalcid flies
Torymidae (family) . . Seed chalcids
Taken at R. M. 378 and 362.
- Chalcididae (family) . . Chalcid flies
Taken at R. M. 366, and 356
(8 mi. up Blacks Fork).
- Eurytomidae (family) . . Straw worms
Taken at R. M. 372.
- Encyrtidae (family) .Encyrtid parasites
Taken at R. M. 373.
- Formicidae (family) . . Ants
Taken at R. M. 378, 358, 356
(3 mi. up Blacks Fork), and
323.
- Chrysididae (family) . . Cuckoo wasps
Taken at R. M. 378, 373, 362, 329,
and 309 (Sheep Creek).
- Nyssonidae (family) . Policeman flies
Taken at R. M. 378, 372, 366, 356
(3 mi. up Blacks Fork), 339, 332,
323 and 298.
- Larridae (family) . Burrowing wasps
Tachysphex sp.
Taken at R. M. 366.
- Philanthidae (family) . Bee-killer wasps
Taken at R. M. 346.
- Pemphredonidae (family) . Aphid wasps
Taken at R. M. 378 and 339.
- Trypoxylidae (family) . Spider wasps
Trypoxylon sp.
Taken at R. M. 378 and 339.
- Sphecidae (family) . . Digger wasps
Spheg sp.
Taken at R. M. 309 (Sheep Creek),
308 (Hideout Flat), and 307
(Hideout Forest Camp).
- Sceliphron sp.
Taken at R. M. 332 and 323.
- Ammophila sp.
Taken at R. M. 378, 366, 339, 323,
309 (Sheep Creek) and 307 (Hide-
out Forest Camp).
- Sphecinae (family)
Taken at R. M. 378, 339, 323,
307 (Hideout Forest Camp), and
306.
- Crabronidae (family) . Squarehead wasps
Taken at R. M. 356 (8 mi. up Blacks
Fork), 378, and 309 (Sheep Creek).
- Dimorphidae (family) . Varicolored wasps
Taken at R. M. 378 and 323.
- Alyssonidae (family)
Taken at R. M. 373 and 353.

HYMENOPTERA (order) continued

Mutillidae (family) . . Velvet ants
Taken at R.M. 308 (Hideout Flat),
307 (Hideout Forest Camp) and 307.

Tiphiidae (family) . .Tiphiid wasps
Taken at R. M. 378.

Eumenidae (family) . Mud daubers
Taken at R. M. 378 (Kincaid Ranch)
378, 373, 366, 356 (3 mi. up
Blacks Fork), 346, 339, 323 and
307 (Hideout Forest Camp).

Psammocharidae (family) .Spider wasps
Taken at R.M. 378, 366, 356 (3 mi.
up Blacks Fork) 8 mi. up Blacks
Fork), and 309 (Sheep Creek).

Vespididae (family) . . Paper wasps
Taken at R. M. 378, 373, 366,
356 (3 mi. up Blacks Fork), 347,
323, 319 (Lucerne Valley), 316
(Horseshoe Canyon), 309 (Sheep
Creek), 308 (Hideout Flat), 306
and 294.

Colletidae (family) . Plumed bees
Colletes sp.
Taken at R. M. 356 (3 mi. up
Blacks Fork) and 319 (Lucerne
Valley).

Halictidae (family) . Sweat bees
Halictus sp.
Taken at R. M. 378.

Agapostemon sp.
Taken at R. M. 356 (3 mi. up
Blacks Fork), 346, and 332.

Lasioglossum sp.
Taken at R. M. 378, 366, 347,
and 319 (Lucerne Valley).

Andrenidae (family) . Andrenid bees
Perdita sp.
Taken at R. M. 307 (Hideout Forest
Camp).

Anthophoridae (family) . Anthophorid bees
Diadasia sp.
Taken at R.M. 373, 347, 332 and 306.

Anthophora sp.
Taken at R. M. 378, 373, 369, 347,
and 323.

Hemisia sp.
Taken at R. M. 332.

Tetralonia sp.
Taken at R. M. 366 and 332.

Nomada sp.
Taken at R. M. 306.

Nomadopsis sp.
Taken at R. M. 356 (3 mi. up
Blacks Fork).

Megachilidae (family) . Leaf-cutting bees
Megachile sp.
Taken at R. M. 356 (8 mi. up
Blacks Fork), and 332.

Coelioxys sp.
Taken at R. M. 339.

Hesperapis sp.
Taken at R. M. 346

Heriades sp.
Taken at R. M. 378.

Apidae (family) . . Honey bees
Apis sp.
Taken at R. M. 319 (Lucerne
Valley), 309 (Sheep Creek, 307
(Hideout Forest Camp), and 298.

Bombus sp.
Taken at R. M. 320, 309 (Sheep
Creek), 307 (Hideout Forest Camp),
and 306.

HYMENOPTERA (order) continued

Formicidae (family) . . . Ants

Specimens and identification by Albert W. Grundmann

Myrmicinae (subfamily)

Myrmica lobicornis fracticornis Emery
Carter Creek

Myrmica brevispinosa Wheeler
Hideout Springs

Myrmica brevispinosa discontinua
Wheeler
Hideout

Myrmica brevinodis Emery
Hideout

Myrmica scabrinodis mexicana Wheeler
Hideout

Pogonomyrmex occidentalis Cresson
Hideout

Pheidole pilifera artemesia Emery
Hideout

Pheidole pilifera coloradensis Emery
Hideout

Monomorium minimum Buckley
Hideout

Solenopsis molesta validiuscula Emery
Hideout

Leptothorax canadensis Provancher
Green Lakes

Dolichoderinae (subfamily)

Dorymyrmex pyramicus Roger
Hideout Springs

Tapinoma sessile Say
Hideout Springs

Formicinae (subfamily)

Campanotus vicinus Mayr
Hideout

Formicinae (subfamily) continued

Campanotus herculeanus (Linne^s)
Hideout

Campanotus pennsylvanicus modoc Wheeler
Green Lakes

Lasius americanus Emery
Carter Creek, Hideout

Lasius niger neoniger Emery
Carter Creek, Green Lakes

Lasius flavus microps Wheeler
Carter Creek

Lasius umbratus aphidicola (Walsh)
Carter Creek

Formica fusca Linne^s
Hideout, Carter Creek, Green Lakes

Formica neorufibarbis Emery
Hideout

Formica neoclara Emery
Hideout

Formica altipetens Wheeler
Hideout

Formica obscuripes Forel
Hideout, Carter Creek

Formica puberula Emery
Hideout

Formica perpilosa Wheeler
Hideout

Formica neogagates Emery
Hideout

Formica neogagates lasioides Emery
Hideout

ARACHNIDA (class) Arachnids

ACARINA (order) Mites and ticks

TICKS

Identification by D. E. Johnson

Argasidae (family)

Ornithodoros aquilae Cooley & Kohls
Found on: Golden eagle at R. M.
356.6R, (9 mi. up Blacks Fork);
and Eastern sparrow hawk at R. M.
351L, July 13.

Ornithodoros parperi Cooley
Found on: deer mouse at R.M. 378,
July 2, and R.M. 360, July 8;
White-tailed prairie dog at R.M.
360 (near Sage Creek), July 10.

Ixodidae (family)

Dermacentor andersoni Stiles
Found on: Golden-mantled ground
squirrel at R.M. 377 (Kincaid Ranch),
July 1; Least chipmunk at R.M. 356,
July 11; Ord kangaroo rat at R.M.
307.5 (Hideout Flat), July 28-29;
Deer mouse at R.M. 378, July 1, 378R
(Kincaid Ranch), July 2; R.M. 339
(Brinegar Ranch), July 17; 356L
(opp. Blacks Fork), July 9; 350R
(Buckboard), July 14; 322.5 ($\frac{1}{2}$ mi.
N.Wy-Utah), July 22; 307.5 (Hideout
Forest Camp), July 26; 306.8 (Hide-
out Spring), July 29; 291 (above dam
site), Aug. 1; Bushtailed wood rat
at R.M. 350R (Buckboard), July 15;
Montane meadow mouse at R.M. 378,
July 1 and R.M. 306.8R (Hideout
Forest Camp), July 26; Audubon
cottontail at R.M. 356, July 12;
humans at R.M. 378R (Kincaid Ranch),
June 30; 373R, July 4; 360 (Sage
Creek), July 7; 330, July 19 and
306.8R (Hideout Forest Camp),
July 29.

Ixodidae family (continued)

Haemaphysalis leporis-palustris
(Packard)
Found on: Rock wren at R.M. 354,
(below Blacks Fork), July 9;
black-tailed jackrabbit at R. M.
378 (Kincaid Ranch), July 3;
Nuttall cottontail at R.M. 378
(Kincaid Ranch), July 3; at 372R
(opp. Firehole), July 3; and at
356.6R (Blacks Fork), July 9.

Ixodes sp.

Found on: Bairds sandpiper at
R.M. 321 (near swamp), July 23.

Ixodes sp. near angustus Neuman
Found on: deer mouse at R. M.
378 July 1; at R. M. 339 (Brine-
gar Ranch), July 19, at R. M.
323, July 23; at R. M. 309,
(Sheep Creek), July 27; at
R. M. 307.5, July 19 and 29;
at R. M. 291 (above dam site)
Aug. 1; Pinyon mouse at R. M.
291 (1 mi. above dam site)
Aug. 1.

ACARINA (order) continued

MITES

Identification by Richard Elzinga

Haemogamasidae (family)

Ischyropoda armatus Keegan

Found on: deer mouse at R. M.
360, July 8; grasshopper mouse
at R. M. 360, July 8.

Trombiculidae (family) . . .
chiggers

Whartonia perplexa

Found on deer mouse at R. M.
378 (Kincaid Ranch), July
2.

Laelaptidae (family)

Haemolaelaps glasgowi (Ewing)

Found on: grasshopper mouse
at R. M. 360, July 8; deer
mouse at R. M. 306.8 (Hideout
Springs), 5,850 ft., July 28.

Eubrachylaelaps circularis (Ewing)

Found on deer mouse at R. M. 350
(Buckboard), July 15.

THE MAYFLY FAUNA OF GREEN RIVER
IN THE FLAMING GORGE RESERVOIR BASIN
WYOMING AND UTAH

George F. Edmunds

Guy G. Musser

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THE MAYFLY FAUNA OF GREEN RIVER*

INTRODUCTION

The construction of Flaming Gorge dam on the Green River in extreme north-eastern Utah will inundate large areas of lotic water and change the habitat to standing water. Several tributary streams will also be inundated on their lower portions but their fauna, which is largely montane, will be maintained in their exposed upper reaches. The mayfly fauna of the Green River proper is one that is so unique and diverse that its loss by inundation is very regrettable.

The construction of a dam in the gorge will affect the fauna profoundly in two ways. The long, narrow deep lake will be unsuitable for most of the present river fauna. Below the dam, the river will be much cooler than at present as the cold water is released from the bottom of the thermally stratified lake. This will unquestionably materially alter the fauna for a number of miles downstream. It is probable that all of the most interesting and rare elements of the mayfly fauna of the river will become extinct in this section of the river.

The first recorded mayfly collections from the Green River, where it cuts a gorge through the east end of the Uinta Mountains in Utah, were made by O. A. Peterson in 1908 at "Camp Douglas", the campsite of the dinosaur quarry then being worked by personnel of Carnegie Museum. Adults of Traverella albertana and Anepeorus rusticus were reported as collected; no additional specimens of the latter genus have been collected there or at any other locality in the western United States.

In this report, the river mile given (abbreviated R. M.) indicates the distance in miles above Greenriver, Utah as given on USGS Plan and Profile Maps of Green River, sheets H, I, and J. The senior author first collected mayflies at Hideout Forest Camp (R. M. 306.5) and a tributary, Carter Creek, at Carter Creek Forest Camp in early August, 1947. The mayfly fauna at Hideout Canyon was so interesting that a second trip was made early in September for the specific purpose of rearing adults from the nymphs to establish the identity of some of the latter. The senior author made subsequent trips with various parties to Hideout Canyon and nearby tributaries in September, 1948, 1950, 1952, 1954, and June 1960. Collections of mayflies were made below the dam site area at Split Mountain in Dinosaur National Monument in May, 1950 and May, 1959.

During June and July, 1959, an expedition of the University of Utah sampled and surveyed the plant and animal life of the Green River, the lower reaches of its tributaries, and the land along the lower gorge from R. M. 378

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near Green River, Wyoming to the Flaming Gorge dam site at R. M. 291 near Dutch John, Utah. The aquatic insects were sampled principally by the junior author and the terrestrial insects (including some mayfly adults) by Beng C. Ho. The authors made a few additional collections from R. M. 323 to 307 in June, 1960. Only the most important of the records from this trip are reported here.

In the following species accounts all records for which no collector is listed are from collections made by the junior author. All date records for which no year is given were made in 1959 by the University of Utah Expedition. The citation BCH refers to collection by Beng C. Ho and the senior author's collections are indicated by GFE.

The area sampled flows through Sweetwater County, Wyoming (R. M. 387 to 322), Daggett County, Utah (R. M. 322 to 291). Samples which were collected in Uintah County, Utah at Split Mountain and Jensen are also included. Of the tributary streams from which mayflies are herein recorded, Sage Creek enters the Green River at R. M. 360, Blacks Fork enters at R. M. 356, and Upper Marsh Creek at R. M. 337, all in Wyoming. In Utah, Henrys Fork enters at R. M. 316, Sheep Creek at R. M. 309.5, Carter Creek at R. M. 305, and Eagle Creek at R. M. 303. Blacks Fork and Henrys Fork are large warm streams with many of the same faunal elements as the Green River, while Sheep, Carter, and Eagle Creeks are trout streams. Sage Creek and Upper Marsh Creek are small tributaries with a limited baetis mayfly fauna.

ANNOTATIONS

Siphonuridae (family)

Genus et species novum

This remarkable mayfly represents a new genus allied to Acanthametropus. The nymph is a sand dweller with carnivorous-type mouthparts. It is known only from a half specimen collected in 1951 and a well grown nymph collected in 1959. The adult is unknown. The genus and species is being named and described in a separate paper in manuscript.

The nymph was found in a habitat consisting of coarse to fine sand, heavily laden with fine clay, and relatively free from debris and algae. In the majority of streams throughout Utah, this type of habitat is relatively sterile, supporting only small populations of chironomid larvae. It is of interest to note that this habitat on the Green River also contains many nymphs of the dragonfly, Gomphus intricatus, and chironomid larvae. It is probable that the dragonfly and mayfly nymphs are predaceous upon the smaller chironomids and upon each other in the small nymphal stages. Though exhaustive sampling was carried out in this type of habitat, and other similar habitats in the river, the acquisition of only one nymph during several weeks of collecting attests to the relative paucity of this mayfly species.

Record - Wyoming, Sweetwater County: R. M. 350, 1 nymph, July 16.
Utah, Daggett County: R.M. 306.5, 1 nymph (part), Sept. 9, 1951 (GFE).

Siphonurus occidentalis Eaton

The adults of this species oviposit in rapids of streams. The young nymphs migrate or else the eggs are washed into side pools during high water. It is uncertain whether the nymphs originate only from tributary streams or also from the Green River. The omnivorous nymphs are often abundant in side pools and occasionally on the edges of streams if they are relatively free from predation. The species is widespread in western North America.

Records - Wyoming, Sweetwater County: R. M. 353, side pool, 1 nymph, July 13; R. M. 343, side channel, 1 nymph, July 16, R. M. 362, side pool, 2 nymphs, July 7; R. M. 387, 1 subimago female, July 29. Utah, Daggett County: Carter Creek at Carter Creek Forest Camp, side pools, several nymphs, August 7, 1949 (GFE).

Ameletus sp.

Record - Utah, Daggett County: R. M. 303, Eagle Creek, 2 nymphs, July 28.

Isonychia sicca campestris McDunnough

The nymphs are filter feeders, straining the food from the current with the legs and mouthparts. They are fairly common among rocks in the Green River and some larger tributaries. The species is an invader from the plains, being fairly common in the Platte Drainage to the east.

Records - Wyoming, Sweetwater County: R. M. 378, 6 nymphs, June 30; R. M. 373, 3 nymphs, July 4; R. M. 372, 4 nymphs, July 3; R. M. 360, 4 nymphs, July 8; Blacks Fork, 1 mi. upstream from mouth, R. M. 356, 20 nymphs, July 9-12; R. M. 350, 8 nymphs, July 16; R. M. 337, 10 nymphs, July 17; R. M. 332, adults, July 20 (BCH); R. M. 323, 10 nymphs, July 20, adults, July 19 (BCH). Utah, Daggett County: R. M. 306.5, 2 nymphs, July 24, 2 nymphs, July 26, several nymphs, Sept. 11, 1952 (GFE), several subimagos, Sept. 11, 1950 (GFE).

Oligoneuriidae (family)

Lachlania powelli Edmunds

This species was described from adults and nymphs collected at Hideout Springs Forest Camp, R. M. 306.5. The slow moving nymphs cling to rocks and sticks where they filter food from the current. During gill-netting operations for fish in slow moving, deeper stretches of the river, all the twigs, brush, etc. entangled in the gill net was literally covered with nymphs. These samples were obtained at an estimated depth of 15 ft. Although extensive collecting for mayflies north of the gorge was carried out, the species was not encountered in the river until R. M. 323, approximately 6 mi. from the actual gorge. In subsequent collections within the gorge area, it was one of the most common organisms of the aquatic insect fauna. The species also occurs in Glen Canyon of the Colorado River in Utah.

Records - Wyoming, Sweetwater County: R. M. 323, 15 nymphs, July 20. Utah, Daggett County: R. M. 318-306.5, 60 nymphs, July 24; R. M. 306.5, 1 female adult and numerous nymphs, Aug. 9, 1947 (GFE), numerous adults and nymphs, Sept. 3-4, 1947 (GFE), several adults and nymphs, September 5, 1948 (GFE), several

Lachlania powelli (continued)

nymphs, Sept. 11, 1950 (GFE), several nymphs, Sept. 9, 1952 (GFE), several adults and nymphs, Sept. 18, 1952 (GFE); R. M. 301.5, 35 nymphs, July 26; R. M. 299, 12 nymphs, July 30, 1959.

Heptageniidae (family)

Heptagenia elegantula Eaton

The nymphs of this species are abundant on rocks in rapids of the Green and Colorado rivers and the warmer tributary streams. It is widespread in the west.

Records - Wyoming, Sweetwater County: R. M. 387, 63 imagos, 8 nymphs, June 29; R. M. 378, 1 subimago, 12 nymphs, June 30, July 2; R. M. 377, 1 male imago, July 1; R. M. 372, 10 nymphs, July 3; R. M. 373, 7 nymphs, July 4; R. M. 366, 10 nymphs, July 6, adults, July 5 (BCH); R. M. 360, 2 nymphs, July 8; R. M. 350, 4 nymphs, July 16; R. M. 356, 12 nymphs, July 12; R. M. 356, Blacks Fork, 1 mi. from mouth, 6 nymphs, July 10; R. M. 356, several adults, July 11 (BCH); Blacks Fork, 20 mi. upstream from mouth, 2 nymphs, July 11; R. M. 339, 1 imago, 1 subimago, 2 nymphs, July 17-18; R. M. 323, 2 nymphs, July 20; R. M. 322, adults, July 24, 1959 (BCH). Utah, Daggett County: R. M. 318-306.5, 1 nymph, July 24; R. M. 316, Henrys Fork, 4 nymphs, July 23, 1959; R. M. 309.5, Sheep Creek, 5 nymphs, July 27, and several nymphs, Sept. 6, 1948 (GFE); R. M. 306.5, many nymphs and adults, Sept. 3, 1947 (GFE), many nymphs, Aug. 9, 1947 (GFE); many nymphs, Sept. 5, 1948 (GFE); many adults and nymphs, Sept. 11, 1950 (GFE); many adults, Sept. 9, 1954 (GFE); many nymphs, Sept. 18, 1954 (GFE); R. M. 301.5, 6 nymphs, July 26, 1959.

Heptagenia sp.

The one nymph collected does not belong to the known species of the area (H. simplicioides, H. criddlei, H. solitaria, H. elegantula). It must represent an undescribed species or one not reported for this area. In Traver's (1935) key, the nymph runs to couplet 8 which terminates in H. simplicioides and H. rosea (as rubroventris). It does not conform with either of these species.

Records - Wyoming, Sweetwater County: R. M. 358, 1 nymph, July 8, 1959.

Cinygmula spp.

Several species of this genus are common in the cool tributary streams flowing from the Uinta Mountains. They do not occur in the Green River except when accidentally washed into the stream. Members of this genus are very common and widespread in cooler streams of the area.

Records - Utah, Daggett County: R. M. 305, mouth of Carter Creek, 4 nymphs, July 28; R. M. 303, mouth of Eagle Creek, 51 nymphs, July 28, 1959.

Rhithrogena undulata Banks

The nymphs are found uncommonly along the Green River on rocks in the current. This species is widespread in the west.

Rhithrogena undulata (continued)

Records - Wyoming, Sweetwater County: R. M. 378, adults, July 1 (BCH); R. M. 339, adults, July 17 (BCH); R. M. 323, adults, July 22 (BCH). Utah, Daggett County: R. M. 306.5, several adults, Sept. 11, 1950 (GFE), several nymphs, Sept. 9, 1952 (GFE), several adults, Sept. 18, 1954 (GFE).

Epeorus longimanus Eaton

This species is abundant in the cooler tributary streams from the Uinta Mountains. The nymphs do not occur in the Green River, except when accidentally washed in from tributaries. The species is widespread and abundant in the west.

Records - Utah, Daggett County: R. M. 306.5, 1 adult, Aug. 9, 1947 (GFE); R. M. 305, mouth of Carter Creek, 3 nymphs, July 28; R. M. 305, Carter Creek at Carter Creek Forest Camp, numerous adults and nymphs, Aug. 6, 1947 (GFE). Uintah County: R. M. 262, Browns Park, several nymphs Aug. 11, 1949 (Collector not indicated).

Epeorus albertae McDunnough

This species is found uncommonly in warmer tributary streams in the Uinta Mountains. Water temperatures in lower Carter Creek are probably barely warm enough for this species. In warmer streams or sections of streams, it is normally an ecological replacement for E. longimanus which is very abundant at Carter Creek Forest Camp, where E. albertae has not been reported. They both occur at the mouth of Carter Creek, but E. albertae may be more abundant, although the small sample (3 E. longimanus, 13 E. albertae) is not adequate to make a conclusion. The species is widespread and common in the west.

Records - Utah, Daggett County: R. M. 305, 13 nymphs, July 28.

Pseudiron sp.

No adult specimens of this genus have been reared from the nymph, so the association of nymphal and adult stages is speculative. A single female subimago collected at Hideout Forest Camp (R. M. 306.5) was assigned to this genus, and three nymphs from Wyoming (R. M. 323) agree with this female in having double reddish bands on the femora. No other records of Pseudiron are known from the western fauna. Similar nymphs have been assigned tentatively to this genus by Burks (1953) and Spieth (1938). The nymphs were found on silted sand and have mouthparts suggesting carnivorous habits. They were collected by means of a seine net. A large area of apparently suitable habitat was investigated, but only three specimens were found. Extensive collecting in other areas of suitable habitat on the river produced no specimens of the species. Intensive collecting of the same area in June, 1960 yielded no additional specimens.

Records - Wyoming, Sweetwater County: R. M. 323, 3 nymphs, July 21, 1959. Utah, Daggett County: R. M. 306.5, 1 subimago female, Sept. 3, 1947 (GFE).

Anepeorus rusticus McDunnough

The nymph tentatively assigned to this genus is a sand-dwelling form with carnivorous-type mouthparts. No nymphs of this type have been collected from the Green River and the only record of the adults is the one cited below. This is the only record of the genus for the western fauna.

Records - Utah, Uintah County: "Camp Douglas", (west bank of the Green River, near south boundary of Dinosaur National Monument), several adults, July 13, 1911, (O. A. Peterson, Carnegie Museum).

Ametropodidae (family)

Ametropus albrighti Traver

The nymphs are found on the surface of sand bars where they are washed by a moderate current. Unique fleshy seta-covered pads on the forecoxae of the nymphs are used to anchor the nymph on the shifting sand bottom, and the short forelegs are held in front of the face. The comb-like foreclaws of the nymph are used to preen the antennae, face, and mouthparts. The elongate claws of the middle and hind legs aid in anchoring the nymph on the shifting substrate. The nymphs are excellent swimmers; for this purpose, they drop the legs back along the ventral surfaces of the body. The freshly caught nymphs have a silt line mark on them suggesting that they bury themselves all except the dorsal surface and the gills. The elevated frontal position of the eyes might be an adaptation for life in this partially buried position.

Records - Wyoming, Sweetwater County: R. M. 373, 1 young nymph, July 4, 1959; R. M. 323, 1 large nymph, June 4, 1960 (GFE and GGM). Utah, Daggett County: R. M. 307, 2 large nymphs, July 5, 1960 (GGM and GFE); R. M. 306.7, 1 young nymph, Sept. 9, 1952 (GFE), 3 broken nymphs from stomach of channel catfish, Sept. 3, 1947 (GFE).

Baetidae (family)

Callibaetis doddsi Traver

The adults recorded below are tentatively assigned to this poorly known species. The species was described from Colorado.

Records - Utah, Daggett County: lower Sheep Creek, R. M. 307.4, Sept. 6, 1948 (GFE).

Callibaetis fuscus Dodds

This pond-inhabiting form is probably common in lakes, ponds, and pools and in beaver dams of tributary streams. The species is common and abundant in the Rocky Mountain region.

Records - Utah, Daggett County: Manila, August 10, 1946, (F. C. Harmston); Green Lakes Resort, August 9, 1947 (GFE).

Callibaetis nigritus Banks

This species is usually abundant in ponds in valleys.

Callibaetis nigritus (continued)

Records - Wyoming, Sweetwater County: R. M. 356, Blacks Fork, 2 dead female imagos on surface, July 10; R. M. 333, Middle Marsh Creek Spring, 6 female imagos, July 19; R. M. 323, ponds near river, 2 female imagos, July 21, 1959.

Callibaetis spp.

Nymphs and adults which were not identifiable to species were commonly collected along the Green River.

Records - Wyoming, Sweetwater County: R. M. 353, side pools, 70 nymphs, July 13; R. M. 333, side pool, 15 nymphs, July 19; R. M. 322.3, side pool, 55 nymphs, July 21. Utah, Daggett County: R. M. 321, 20 nymphs, July 22; R. M. 319, 5 nymphs, July 23; R. M. 309.4, July 27; R. M. 307.4, 1.5 mi. up Sheep Creek, 15 nymphs, July 29; R. M. 306.7, 25 nymphs, July 24, 1959.

Baetis tricaudatus Dodds

This species is probably common in the cool tributary streams. The adults are known to emerge all months of the year.

Record - Utah, Daggett County: R. M. 303, Eagle Creek, 8 nymphs, July 28, 1959.

Baetis intermedius Dodds

This common species probably occurs in all cool tributary streams.

Record - Utah, Daggett County: R. M. 303, Eagle Creek, July 28, 1959.

Baetis bicaudatus Dodds

This species is probably common in most cool tributary streams. It is abundant and widespread in the mountain west.

Records - Utah, Daggett County: Carter Creek at Carter Creek Forest Camp, numerous nymphs, August 6, 1947 (GFE); R. M. 303, Eagle Creek, 10 nymphs, July 28, 1959.

Baetis insignificans McDunnough

Records - Wyoming, Sweetwater County: R. M. 356, Blacks Fork, 16 mi. above mouth, adults, July 11 (BCH). Utah, Daggett County: R. M. 306.5, several adults and nymphs, Sept. 11, 1952 (GFE).

Baetis sp.

The nymph of an apparently undescribed species having peculiar flattened claws with a truncate comb-like distal margin was collected at Hideout Springs Forest Camp. Adults of what is probably this species were also collected at the same time and place. Similar nymphs have been collected from the Colorado and Virgin rivers in Utah, from west-central California, and from Brazil.

Records - Wyoming, Sweetwater County: R. M. 339, 2 nymphs, July 17. Utah, Daggett County: R. M. 306.5, several nymphs and adults, Sept. 11, 1952 (GFE); R. M. 229, 1 nymph, July 30, 1959.

Baetis spp.

At least three additional unidentified species of Baetis nymphs are represented in the collections. One form was found only in Upper Marsh and Sage creeks, and a second type in Sheep and Carter creeks. A third type was found only in the Green River.

Records - Wyoming, Sweetwater County: R. M. 366, 1 nymph, July 12; R. M. 356, 1 nymph, July 6; R. M. 360, Sage Creek, 60 nymphs, July 9; R. M. 337, Upper Marsh Creek, 25 nymphs, July 17. Utah, Daggett County: R. M. 309.4, Sheep Creek, 3 nymphs, July 27; R. M. 305, Carter Creek, 7 nymphs, July 28, 1959.

Caenidae (family)

Brachycercus sp.

This species is known from a very few nymphs in Green River. These represent the only record of the genus in the western United States. If the Green River specimens belong to a described species, it is most likely that they are Brachycercus prudens McDunnough which is known from the Saskatchewan River at Saskatoon. The mayflies Heptagenia elegantula, Traverella albertana and Anepeorus rusticus occur both in the Green River in Utah and the Saskatchewan at Saskatoon.

Records - Wyoming, Sweetwater County: R. M. 378, 2 nymphs, June 30, 1959. Utah, Daggett County: R. M. 306.5, 2 nymphs, Sept. 5, 1945 (GFE).

Tricorythidae (family)

Tricorythodes minutus Traver

This common species is widespread. The nymphs are found on rocks and vegetation in Green River and warmer tributaries. Daily, particularly during the first two weeks in July, 1959, large flights of newly emerged adults swarmed along the edge of the river. The flight began about 7:00 o'clock A. M., reached a maximum density approximately an hour later, and gradually declined until noon, when only a few stragglers remained. The numbers in the swarm gradually decreased during the course of the expedition until, on the first of August, few emerging adults were observed. Large swarms have also been observed in September, so it is possible that there are two fairly distinct broods per year.

Records - Wyoming, Sweetwater County: R. M. 387, 11 nymphs, June 29; R. M. 378, 12 nymphs, over 500 adults, June 30; R. M. 373, 12 nymphs, 20 adults, July 4; R. M. 372, 6 nymphs, 75 adults, July 3; R. M. 366, 50 nymphs, July 6; R. M. 362, 40 nymphs, July 7; R. M. 358, 5 nymphs, July 8; R. M. 356, 79 nymphs, several adults, July 9-12 (ECH); R. M. 356, Blacks Fork, 6 nymphs, July 10; R. M. 343, side channel, 12 nymphs, July 16; R. M. 339, 3 nymphs, July 17. Utah, Daggett County: R. M. 319, Henrys Fork, 3 nymphs, July 23; R. M. 309.5, 27 nymphs, July 27; R. M. 309.5 Sheep Creek, 27 nymphs, July 27; R. M. 306.5, many adults and nymphs, Sept. 11, 1950 (GFE); R. M. 301.5, 5 nymphs, July 24, 1959.

Tricorythodes sp.

Several nymphs with depressed abdomens and flattened femora with a dense row of marginal setae are tentatively placed in this genus. In some features these nymphs resemble those of the genus Leptohyphes, but they lack the scale-like setae and developing hind wing pads characteristic of this genus.

Records - Utah, Daggett County; R. M. 306.5, several nymphs, Sept. 11, 1950 (GFE).

Ephemerellidae (family)

Ephemerella inermis Eaton

Numerous nymphs and adults are herein assigned to this species. It and the closely related E. infrequens McDunnough may be members of a complex of sibling species in the western mayfly fauna, or they may be two highly variable species which may hybridize in some localities. Collections from Green River suggest that this population has a single annual brood emerging in June and July. The Great Basin populations assigned to this species appears to have multiple broods emerging throughout the summer. This suggests that the Great Basin and Green River populations tentatively considered as E. inermis represent separate species, but a more certain answer can be given only after a careful study of the inermis-infrequens complex.

Records - Wyoming, Sweetwater County: R. M. 387, 33 nymphs, 25 subimagos, June 29; R. M. 378, 23 nymphs, 8 subimagos, June 30; R. M. 373, 25 nymphs, several imagos (BCH), July 4; R. M. 372, 26 imagos, July 3; R. M. 366, 15 nymphs, 1 subimago, July 4, imagos, July 5 (BCH); R. M. 362, imagos, July 7 (BCH); R. M. 356, 3 nymphs, July 9, 2 nymphs, July 12; R. M. 352, imagos, July 13 (BCH); R. M. 350, 1 nymph, July 16; R. M. 339, imagos, July 17 (BCH); R. M. 323, imagos, July 22, 1959 (BCH). Utah, Daggett County: R. M. 307, numerous nymphs, June 5, 1960 (GFE and GGM). Uintah County: Split Mountain, many nymphs, May 27, 1950 and May 23, 1959 (GFE and GGM).

Ephemerella tibialis McDunnough

This species is probably widespread in the cool montane tributaries in the Uinta Mountains.

Records - Utah, Daggett County: R. M. 305, Carter Creek, near mouth, 25 nymphs, July 25; Carter Creek at Carter Creek Forest Camp, several nymphs, August 6, 1947 (GFE); R. M. 303, Eagle Creek, 27 nymphs, July 28, 1959.

Ephemerella grandis Eaton

This common species probably occurs in the lower reaches of several cool tributary streams.

Records - Utah, Daggett County, Carter Creek at Carter Creek Forest Camp, several nymphs, August 6, 1947 (GFE).

Leptophlebiidae (family)

Leptophlebia gravastella Eaton

In addition to the records cited below, this species has also been collected from the tributary Uinta River at Fort Duchesne, Utah. The adults emerge mostly in May and June. It is probable that they had been present early in the year all along the collected sections of Green River and the warmer tributaries.

Records - Wyoming, Sweetwater County: R. M. 387, 1 nymph, June 29; R. M. 372, 1 nymph, July 3; R. M. 356, Blacks Fork, 3 nymphs, July 10, 1959. Utah, Daggett County: R. M. 318-306.5, 1 nymph, July 24; Uintah County, R. M. 199.5, Split Mountain, numerous nymphs, May 27, 1950 (GFE); R. M. 182, Jensen, several subimagos, June 13, 1947 (F. C. Harmston).

Paraleptophlebia pallipes Hagen

Record - Utah, Daggett County: R. M. 303, Eagle Creek, 1 nymph, July 28, 1959.

Choroterpes albiannulata McDunnough

Nymphs of this genus have been collected at several points along Green River and in tributary Henrys Fork and Duchesne River. The rarity of this genus from the June and July, 1959 expedition collections probably can be attributed to late seasonal development of this species.

Records - Wyoming, Sweetwater County: R. M. 350, 1 young nymph, July 16. Utah, Daggett County: R. M. 306.5, Hideout Forest Camp, 2 adults, Sept. 11, 1950 (GFE), 2 adults, Sept. 18, 1954 (GFE).

Traverella albertana McDunnough

This is a characteristic species of Green and Colorado rivers and their larger tributaries wherever well-aerated water flows over rocky bottoms. In the gorge, nymphs of this species were most abundant in heavy concentrations of algae on the rocks of the river bottoms. The nymphs appear to be filter feeders.

Records - Wyoming, Sweetwater County: R. M. 339, 25 nymphs, July 17. Utah, Daggett County: R. M. 323, 10 nymphs, July 20; R. M. 306.5, numerous nymphs, Aug. 9, 1947 (GFE), numerous imagos and nymphs, Sept. 3, 1947 (GFE), numerous imagos and nymphs, Sept. 5, 1948 (GFE), numerous nymphs, Sept. 11, 1950 (GFE), numerous nymphs, Sept. 9, 1952 (GFE); R. M. 299, 90 nymphs, July 11; R. M. 182, Jensen, several adults, Sept. 8, 1911 (A. O. Peterson, Carnegie Museum).

Ephemeridae (family)

Hexagenia limbata Serville

The nymphs of this species burrow in silt and silty clay, usually in a less compacted material than Ephoron album. Series of adults are necessary for a subspecific assignment of the population, but the collections from adjacent areas represent intergrades between H. l. limbata and H. l. venusta, with the predomance of characters of the former.

Hexagenia limbata (continued)

Records - Wyoming, Sweetwater County: R. M. 372, 1 nymph, July 3; R. M. 356, Blacks Fork at mouth, 1 nymphal skin, 1 male imago, July 10-11; Blacks Fork, 1 mi. above mouth, 8 nymphs, July 10; R. M. 350, 2 nymphs, July 11; R. M. 339, 1 nymphal skin, July 17, 1959.

Ephemera simulans Walker

The nymphs burrow in sand and silty sand. This species also occurs in the tributary Uinta River at Fort Duchesne, Utah.

Records - Wyoming, Sweetwater County: R. M. 387, 2 nymphs, June 29; R. M. 378, 6 nymphs and 2 adults, June 30; R. M. 372, 7 nymphs, July 3; R. M. 366, 1 subimago, July 6; R. M. 360, 2 nymphs, July 8; R. M. 356, 1 nymph, July 12, 1959.

Polymitarcidae (family)

Ephoron album Say

The nymphs of this species burrow in semi-compact sand-clay bottoms and cut banks. The adults have only a brief crepuscular-nocturnal life of about one to one and one-half hours. They are often attracted to lights in great numbers. An account of the biology of this species has been given by Edmunds, Nielsen, and Larsen (1956, Wasmann Jour. Biol., 14(1): 145-153, 2 figs.)

Records - Wyoming, Sweetwater County: R. M. 358, numerous nymphs, July 8; R. M. 356, 1 nymph, July 19, 4 nymphs, July 12; R. M. 339, 90 nymphs, July 12; R. M. 306.5, many adults and nymphs, Sept. 3, 1947 (GFE), many adults and nymphs, Sept. 5, 1948 (GFE), many adults and nymphs, Sept. 7 and 9, 1952 (GFE), many adults and nymphs, Sept. 18, 1954 (GFE).

SUMMARY

Of the species of Ephemeroptera known to occur in the Flaming Gorge area of Green River, a new species of Pseudiron and a new genus and species in the family Siphonuridae are known only from this area. The records of Brachycercus sp. and Anepeorus rusticus McDunnough are the only known collections of these genera in the western United States. The only known Utah records of Isonychia sicca campestris, Ametropus albrighti, Choroterpes albiannulata and the peculiar, flattened Tricorythodes sp. are from the Flaming Gorge area. Lachlania powelli and Ametropus albrighti are known only from limited areas in the Colorado River drainage. The other species in Flaming Gorge are generally widespread.

The mayfly fauna of this river constitutes one of the most unusual and interesting ones known to exist in any part of the world. It is unfortunate that a more thorough year-long study of the fauna cannot be undertaken before it is lost.

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DRAGONFLIES (ODONATA: ANISOPTERA) FROM GREEN RIVER

IN THE FLAMING GORGE RESERVOIR BASIN

WYOMING AND UTAH

R. Jean Musser

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DRAGONFLIES FROM GREEN RIVER

INTRODUCTION

The completion of the Flaming Gorge Dam in northeastern Utah will radically change the various habitat areas for aquatic insects as the backed up water forms a lake, inundating the original river and the lower reaches of tributaries. This reservoir will cover the river habitat of Gomphus intricatus and Ophiogomphus severus and the ponds and lower tributaries where the other dragonflies reported herein were collected. With the exception of G. intricatus, which will have its known habitat in Utah inundated, other species of dragonflies will probably continue to exist in the adjacent ponds and streams. It is not probable that the fluctuating reservoir will serve as an important site for dragonflies.

This paper reports the dragonflies collected by Guy G. Musser of the University of Utah, June and July, 1959. The collections are of special interest because of the lack of previous collecting in the area. During the expedition, a variety of habitats were sampled, ranging from the river proper, to tributaries, seeps, ponds and sloughs.

ANNOTATIONS

Gomphidae (family)

Ophiogomphus severus Hagen

This species is one of the most common of the aquatic insects collected along the river, and was one of two species of dragonflies collected in the river proper. The nymphs were collected in rocky riffle areas along the river bank, and in the deeper portions of the river where suitable habitats were present. The species is widespread in this type of habitat throughout the west.

Gomphus intricatus Hagen

This species was collected infrequently along the course of the river. The preferred habitat is apparently from coarse to fine grained sand bottoms, relatively free of larger debris and algae. The nymphs conceal themselves by burrowing in the sand. It apparently occupies this habitat exclusive of Ophiogomphus, as no specimens of the latter were found in association with it. Prior to this report, the only specimen known from Utah was a nymph collected from the Colorado River in Glen Canyon (G. Musser, 1959). The species, according to Walker (1958), is found in warm rivers in open country.

Aeshnidae (family)

Aeshna interrupta nevadensis Walker

Only one adult and one nymph of this species were taken. The nymph was found in the same habitat area as A. palmata.

Aeshna palmata Hagen

This species was abundant in quiet streams, ponds and pools along the tributaries of the river and especially so in clear pools at Sheep Creek. Usually the nymphs of the species are difficult to identify, but identification was confirmed by rearing a female through to the adult stage.

Libellulidae (family)

Libellulinae (subfamily)

Libellula pulchella Drury

Adults of this beautifully colored species were found flying above a swampy area of Currant Creek. The only nymph was collected at Sheep Creek in association with L. quadrimaculata. This species covers a wide range throughout North America.

Libellula quadrimaculata Linnaeus

Nymphs of this most commonly collected species of the family Libellulidae were collected in fairly warm tributaries of the river and from springs filled with ooze. One adult female, after being placed in a plastic envelope, deposited eggs. This species is widespread and common throughout the west.

Sympetrum corruptum (Hagen)

This wide ranging species was taken at ponds and swampy areas adjacent to the river in Wyoming. The various instars from Green River seem to differ from the description by Needham (1903) by having lateral spines on the 8th segment more than half as long as those on segment 9, and the hind femora extending to the base of segment 8. Further investigation of these differences is necessary to interpret their significance.

Sympetrum danae Sulzer

The nymphs were found only in ponds at Sheep Creek, but the adults were collected over a 17 mile span. This small black and yellow species is found in western and northeastern North America.

Sympetrum occidentale Bartenev, s. l.

Three adults collected within a 16 mile range all show distinct black markings on the pleural sutures, indicative of this species. One male and one female have the distinct banding of dark yellow at the nodus area on both wings, typical of S. o. fasciatum Walker. The remaining female has less distinct banding on the wings and the black markings on the pleural sutures are less definite than in the other two. Walker (1951) states that S. o. fasciatum was found to intergrade with other subspecies in Rio Grande County, southwestern Colorado and Luis Valley, Monte Vista. The three specimens collected thus far in Green River show similar intergradation. Further collecting will be necessary to determine its significance.

Sympetrum madidum Hagen

One adult of this species was collected in the vicinity of several ponds in Wyoming, 1 mile from the Utah-Wyoming border. It is known from many western states (Needham and Westfall, 1955), but has not been collected from Utah. Further collecting most probably will add this species to the Utah list.

Sympetrum pallipes Hagen

Only nymphs of this western species were collected.

Sympetrum rubicundulum Say

Adults were taken in Wyoming and Utah. This species is found throughout western North America in fresh water ponds, but intensive collecting in its typical habitat yielded no nymphs.

Sympetrum sp.

An adult Sympetrum was collected, but was so badly crushed that identification to species was impossible. Thirty-one nymphs including one cast skin could not be determined to species by the available keys. Further collecting and rearing of the nymphs is planned to determine the identity of the species.

DRAGONFLIES FROM GREEN RIVER

LIST OF COLLECTIONS

Gomphidae (family)

Gomphus intricatus Hagen

Adults 2, nymphs 22

Localities:

Wyoming, Sweetwater Co., R. M. 356R, July 12.

Wyoming, Sweetwater Co., R. M. 350R, July 16.

Wyoming, Sweetwater Co., R. M. 343, side channel, July 16.

Utah, Daggett Co., R. M. 306.5R, July 26.

Ophiogomphus severus Hagen

Adults 34, nymphs 254

Localities:

Wyoming, Sweetwater Co., R.M. 387L, June 29.

Wyoming, Sweetwater Co., R.M. 378R, July 1.

Wyoming, Sweetwater Co., R.M. 377.4L, July 1.

Wyoming, Sweetwater Co., R.M. 373R, July 3.

Wyoming, Sweetwater Co., R.M. 367L, July 7

Wyoming, Sweetwater Co., R.M. 366R, July 8.

Wyoming, Sweetwater Co., R.M. 360L, Sage Creek, July 8.

Wyoming, Sweetwater Co., R.M. 358L, July 8

Adults		Nymphs
♂	♀	c s
0	0	4
0	0	12
0	0	1
0	1+	3 + 2
	1 cs	
0	0	22
1	1	31 + 1
0	0	1 + 1
1	0	22 + 1
0	0	3
0	0	4
0	0	4
0	0	6

(R = right side, L = left side, c s = cast skin)

Ophiogomphus severus (continued)

	Adults		Nymphs
	♂	♀	c s
Wyoming, Sweetwater Co., R.M. 356R, Blacks Fork, 1 mi. up, July 10.	1	5	39 + 1
Wyoming, Sweetwater Co., R.M. 356R, Blacks Fork, 25 mi. up, July 11.	1 + 1 cs	0	7
Wyoming, Sweetwater Co., R.M. 350R, July 16.	0	0	7
Wyoming, Sweetwater Co., R.M. 343L, July 16.	0	0	8
Wyoming, Sweetwater Co., R.M. 339L, July 17.	0	0	3
Wyoming, Sweetwater Co., R.M. 323R, July 20.	1	3	4
Utah, Daggett Co., R.M. 319R, Henrys Fork, July 23.	0	0	11
Utah, Daggett Co., R.M. 318-306.5, July 24.	0	0	5
Utah, Daggett Co., R.M. 309.4R, Sheep Creek July 29.	0	2	30
Utah, Daggett Co., R.M. 309.4, Sheep Creek, 1 mi. up, July 29.	2	1	4
Utah, Daggett Co., R.M. 308.7R, Mouth of Hideout Canyon, July 29.	4	2	0
Utah, Daggett Co., R.M. 306.5, Carter Creek, July 26.	0	0	13
Utah, Daggett Co., R.M. 299L, July 30.	6	2	0
Adults with no tags	6	2	

Aeshnidae (family)

Aeshna interrupta Walker

Adults 1, nymphs 1

Localities:

Utah, Daggett Co., R.M. 309.4R, Sheep Creek, July 29.	0	0	1
Utah, Daggett Co., R.M. 306.5R, Hideout Springs, July 26.	1	0	0

Aeshna palmata Hagen

Adults 11, nymphs 74 + 46 too young to identify with certainty to species.

Localities:

Wyoming, Sweetwater Co., R.M. 356, Blacks Fork, 1 mi. up, July 10.	0	0	5 + 3
Utah, Daggett Co., R.M. 309.4R, Sheep Creek 1.5 mi. up, July 29	3	0	64 + 2 46 too young
Utah, Daggett Co., R.M. 306.5R, Hideout Forest Camp, July 28.	3	3	0
Utah, Daggett Co., R.M. 306.5R, Carter Creek, July 28.	1	0	0
Utah, Daggett Co., R.M. 303R, mouth of Eagle Creek, July 30.	0	1	0

Libellulidae (family)

Libellula quadrimaculata Linnaeus

Adults 15, nymphs 59

Localities:

Wyoming, Sweetwater Co., R.M. 323R, Springs,
July 20.

Utah, Daggett Co., R.M. 309.4R, Sheep Creek,
1.5 mi. up, July 29.

Utah, Daggett Co., R.M. 306.5R, Hideout
Springs, July 26.

Libellula pulchella Drury

Adults 2, nymphs 1

Localities:

Wyoming, Sweetwater Co., R.M. 353L, Currant
Creek Swamp, July 13.

Utah, Daggett Co., R.M. 309.4R, Sheep Creek,
1.5 mi. up, July 29.

Sympetrum corruptum Hagen

Adults 9, nymphs 34

Localities:

Wyoming, Sweetwater Co., R.M. 375, small
ponds, July 2.

Wyoming, Sweetwater Co., R.M. 356R, Blacks
Fork, 1 mi. up, July 10.

Wyoming, Sweetwater Co., R.M. 353L, Currant
Creek, swamp, July 13.

Wyoming, Sweetwater Co., R.M. 322.3R, ponds
near river, July 21.

Sympetrum danae Sulzer

Adults 5, nymphs 2

Localities:

Wyoming, Sweetwater Co., R.M. 323R, Springs,
July 20.

Utah, Daggett Co., R.M. 309.4R, Sheep Creek,
1.5 mi. up, July 29.

Utah, Daggett Co., R.M. 306.5L, Hideout
Springs, July 13.

Sympetrum occidentale Bartenev, s.l.

Adults 3, nymphs description unknown

Localities:

Utah, Daggett Co., R.M. 323R, July 20.

Utah, Daggett Co., R.M. 309.4R, Sheep

Creek, 1.5 mi. up, July 29.

Utah, Daggett Co., R.M. 321, slough at bridge,
July 22

Sympetrum madidum Hagen

Adults 1, nymphs 0

Localities:

Wyoming, Sweetwater Co., R.M. 323R, July 22.

	Adults		Nymphs
	♂	♀	c s
<u>Libellula quadrimaculata</u> Linnaeus			
Adults 15, nymphs 59			
Localities:			
Wyoming, Sweetwater Co., R.M. 323R, Springs, July 20.	3	1	3
Utah, Daggett Co., R.M. 309.4R, Sheep Creek, 1.5 mi. up, July 29.	0	4	59
Utah, Daggett Co., R.M. 306.5R, Hideout Springs, July 26.	4	3	0
<u>Libellula pulchella</u> Drury			
Adults 2, nymphs 1			
Localities:			
Wyoming, Sweetwater Co., R.M. 353L, Currant Creek Swamp, July 13.	2	0	0
Utah, Daggett Co., R.M. 309.4R, Sheep Creek, 1.5 mi. up, July 29.	0	0	1
<u>Sympetrum corruptum</u> Hagen			
Adults 9, nymphs 34			
Localities:			
Wyoming, Sweetwater Co., R.M. 375, small ponds, July 2.	1	2	0
Wyoming, Sweetwater Co., R.M. 356R, Blacks Fork, 1 mi. up, July 10.	1	1	0
Wyoming, Sweetwater Co., R.M. 353L, Currant Creek, swamp, July 13.	2	1	34
Wyoming, Sweetwater Co., R.M. 322.3R, ponds near river, July 21.	1	0	0
<u>Sympetrum danae</u> Sulzer			
Adults 5, nymphs 2			
Localities:			
Wyoming, Sweetwater Co., R.M. 323R, Springs, July 20.	2	1	0
Utah, Daggett Co., R.M. 309.4R, Sheep Creek, 1.5 mi. up, July 29.	1	0	2
Utah, Daggett Co., R.M. 306.5L, Hideout Springs, July 13.	1	0	0
<u>Sympetrum occidentale</u> Bartenev, s.l.			
Adults 3, nymphs description unknown			
Localities:			
Utah, Daggett Co., R.M. 323R, July 20.	1	1	1
Utah, Daggett Co., R.M. 309.4R, Sheep Creek, 1.5 mi. up, July 29.	0	1	1
Utah, Daggett Co., R.M. 321, slough at bridge, July 22			29
<u>Sympetrum madidum</u> Hagen			
Adults 1, nymphs 0			
Localities:			
Wyoming, Sweetwater Co., R.M. 323R, July 22.	1	0	0

Sympetrum pallipes Hagen

Adults 0, nymphs 4

Localities:

Wyoming, Sweetwater Co., R.M. 339L, South
river channel, July 17.

Sympetrum rubicundulum Say

Adults 3, nymphs 0

Localities:

Wyoming, Sweetwater Co., R.M. 356, 1 mi.
up Blacks Fork, July 10.

Wyoming, Sweetwater Co., R.M. 309.4R,
Sheep Creek, July 27.

Utah, Daggett Co., R.M. 319R, near mouth
of Henrys Fork, July 22.

Sympetrum sp.

Adults 1 (probably S. rubicundulum)

Localities:

Wyoming, Sweetwater Co., R.M. 353L, Currant
Creek, swamp, July 14.

Adults		Nymphs
♂	♀	c s
0	0	4
0	1	0
1	0	0
0	1	0
0	1	0

SUMMARY

Twelve species of dragonflies were collected during the investigation of aquatic insects in the Flaming Gorge area of Green River. Of these 12 species, only two were collected in Green River proper; others were collected only in tributaries or ponds. Of the 276 nymphs collected in the river, 254 were Ophiogomphus severus; the balance were Gomphus intricatus. The latter was represented in the collections by nymphs and adults; the only other record of this species in Utah was of one nymph from the Colorado River in south-eastern Utah.

Three adult specimens of Sympetrum occidentale s.l. were taken from river mile 323 and 309.4. These specimens seem referable to Sympetrum occidentale fasciatum, but show definite evidence of intergradation with S. occidentale occidentale. 32 nymphs were determined as Sympetrum occidentale s.l. by rearing similar nymphs from Utah County, Utah the summer of 1960. The nymphs cannot be keyed to S. occidentale californicum Walker (Smith & Pritchard 1956) because the dorsal spine on segment 7 is much shorter than the segment which bears it. Thus, further work may reveal definitive differences among the nymphs of the three subspecies.

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STONEFLIES (PLECOPTERA) FROM GREEN RIVER
IN THE FLAMING GORGE RESERVOIR BASIN,
WYOMING AND UTAH

Joann Sessions
Arden R. Gaufin

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STONEFLIES OF GREEN RIVER

INTRODUCTION

The following annotated checklist reports the stoneflies collected from the Flaming Gorge reservoir basin by Guy G. Musser, Gerald R. Smith, and Arden R. Gaufin of the University of Utah in June and July of 1959.

The area of the river sampled extended from Sweetwater County, Wyoming into Daggett County, Utah, presenting a wide variety of habitats for aquatic insects. Although the river itself is warm and turbid, several of its tributaries, Sheep Creek, Carter Creek, Eagle Creek are cold, clear trout streams. Blacks Fork and Henrys Fork are warm water tributaries displaying much the same type of habitat as the river proper. Stoneflies collected from the river and from the above mentioned tributaries were always found in the swiftly moving portions of the stream. Adults were collected from log piles in or near the stream and from the undersides of bridges and abutments.

The locations given in this report refer to the distance in river miles (abbreviated as R. M.) above Greenriver, Utah as indicated on USGS Plan and Profile Maps of Green River, sheets H, I, and J.

ANNOTATIONS

Pteronarcidae (family)

Pteronarcys californica Newport

Nymphs of this species were collected exclusively from Sheep Creek, a tributary of Green River. Three sizes of nymphs were distinguishable, representing the various stages in the three year life cycle of the species. This species is abundant throughout the western states.

Record:— Utah, Daggett County: Sheep Creek, R.M. 309.4, 43 nymphs, July 27.

Pteronarcella badia (Hagen)

Nymphal specimens were collected upon only one occasion from Sheep Creek. Both this species and the former one are vegetarians and are generally found in those sections of the stream where vegetable debris tends to accumulate. This species is common in the Rocky Mountains.

Record - Utah, Daggett County: Sheep Creek, R.M. 309.4, 9 nymphs, June 11.

Perlodidae (family)

Arcynopteryx parallela (Frison)

This species was comparatively rare in collections, a single nymph being collected from each of three tributaries, Sheep Creek, Carter Creek, and Henrys Fork. It is an extremely common species in Utah and on the Pacific Coast.

Arcynopteryx parallela (continued)

Record - Utah, Daggett County: Carter Creek, R. M. 305, 1 nymph, July 18; Sheep Creek, R. M. 309.5, 1 nymph, July 27; Henrys Fork, R. M. 319, 1 nymph, July 22.

Arcynopteryx signata (Hagen)

This species was also encountered infrequently, 2 nymphs being collected upon a single occasion from Eagle Creek. It is common throughout the Rocky Mountains.

Record - Utah, Daggett County: Eagle Creek, R. M. 303, 2 nymphs, July 28.

Isoperla mormona Banks

This species was identified only in the adult stage since the nymph is indistinguishable in appearance from that of I. longiseta. No specimens were encountered in the tributary streams; all were collected from the river. It is abundant throughout the western states.

Record - Wyoming, Sweetwater County: R. M. 339, 1 female and 1 male, July 18; R. M. 372, 1 female and 3 males, July 3; R. M. 373, 6 females and 10 males, June 29; R. M. 378, 3 females and 1 male, June 30; R. M. 387, 1 male, June 29.

Isoperla longiseta Banks

Adults of this species were more abundant than those of I. mormona but the distribution of the 2 species was very similar. Nymphal identification was not possible. It is of rare occurrence in the western states.

Record - Wyoming, Sweetwater County: R. M. 329, 2 females and 7 males, June 11; R. M. 339, 9 females and 14 males, July 18; R. M. 377.4, 1 female and 1 male, July 1; R. M. 378, 1 female and 1 male, June 30; R. M. 387, 1 female and 2 males, June 29.

Isoperla ebria (Hagen)

A single adult was obtained from Green River. Nymphs were abundant in the river and were also collected from Hideout Springs, a small tributary stream. It is of common occurrence in the Rocky Mountains and along the Pacific Coast.

Record - Wyoming, Sweetwater County: R. M. 329, 22 nymphs, June 11; R. M. 333, 5 nymphs, June 10; R. M. 341, 5 nymphs, June 10; R. M. 377.6, 1 female, June 9. Utah, Daggett County: Hideout Springs, R. M. 306.5, 6 nymphs, June 11; R. M. 318, 1 nymph, June 11.

Isoperla patricia Frison

This was one of the most numerous of the stoneflies collected from the area. Although only 2 adults were taken from the river, a large number of nymphs were encountered in both the river and in tributary streams. It is an abundant species throughout the west and midwest.

Record - Wyoming, Sweetwater County: R. M. 329, 13 nymphs, 1 female and 2 males, June 11; R. M. 333, 1 nymph, June 10; R. M. 341, 9 nymphs, June 10; Currant Creek, R. M. 353, 1 nymph, July 13; R. M. 377.6, 1 female, June 9. Utah, Daggett County: Hideout Springs, R. M. 306.5, 2 nymphs, June 11, Sheep Creek, R. M. 309.4, 54 nymphs, June 11.

Isoperla spp.

A large number of nymphs of the genus Isoperla were collected from the river and its tributaries. Presumably these nymphs were either I. longisetæ or I. mormona or both, but positive identification was impossible.

Record - Wyoming, Sweetwater County: R. M. 329, 2 nymphs, June 11; R. M. 333, 3 nymphs, June 10; R. M. 341, 3 nymphs, June 10; R. M. 350, 1 nymph, July 16; R. M. 358, 2 nymphs, June 29; R. M. 366, 20 nymphs, July 6; R. M. 372, 30 nymphs, June 30; R. M. 387, 8 nymphs, June 29. Utah, Daggett County; Hideout Springs, R. M. 306.5, 4 nymphs, June 11; Sheep Creek, R. M. 309.4, 5 nymphs.

Isogenus frontalis colubrinus Hagen

A single adult specimen was collected from Green River. This particular subspecies is abundant in western Alaska, Canada, and northwestern United States.

Record - Wyoming, Sweetwater County: R. M. 387, 1 female, June 29.

Perlidae (family)

Acroneuria theodora Needham and Claassen

Two nymphs were collected from Green River and a cast skin was taken from a tributary stream. This species has not been recorded from Utah but is common in Wyoming and along the Pacific Coast.

Record - Wyoming, Sweetwater County: R. M. 350, 1 nymph, July 15; R. M. 356, Blacks Fork, 1 cast skin, July 10; R. M. 378, 1 nymph, June 30.

Acroneuria pacifica Banks

This species was collected only in tributaries, large numbers of nymphs being taken from Carter and Eagle creeks. It is of very common occurrence throughout the western United States.

Record - Utah, Daggett County: Carter Creek, R. M. 305, 28 nymphs, July 28; Eagle Creek, R. M. 303, 33 nymphs, July 28.

Claassenia sabulosa (Banks)

An exuvium was taken from Carter Creek and a nymph and an adult were collected from separate locations on the Green River. This species is common in the Cordilleran and Rocky Mountain ranges.

Record - Wyoming, Sweetwater County: R. M. 373, 1 nymph, July 4; R. M. 387, 1 female, June 29. Utah, Daggett County: Carter Creek, R. M. 305, 1 exuvium, July 28.

Perlesta placida Hagen

This species was represented by a single nymph in the collection. It is generally regarded as being an eastern and midwestern species.

Record - Wyoming, Sweetwater County: R. M. 378, 1 nymph, June 30.

Chloroperlidae (family)

Alloperla spp.

Nymphs of the genus Alloperla were not identifiable past the generic level. Although the genus is widely distributed throughout North America, the nymphs are practically indistinguishable from one another and no satisfactory keys for their identification have been constructed.

Record - Utah, Daggett County: Eagle Creek, R. M. 303, 3 nymphs, July 30; R. M. 305, 1 nymph, July 29.

SUMMARY

A total of 14 species of stoneflies belonging to eight genera and four families was collected from Green River and its tributaries during the 1959 ecological study of the area. Since a great many species of stoneflies emerge during the fall and winter months and are seldom encountered in the nymphal stage during the summer, it is probable that with intensive collecting during the other seasons, numerous records could be added to those already obtained from the area.

Pteronarcys californica, Pteronarcella badia, Arcynopteryx signata, and Acroneuria pacifica were apparently confined to the relatively cold, clear waters of the tributary streams of the Green River. Other species were found to exist either in the warm water tributaries or in the river itself while Arcynopteryx parallela, Isoperla patricia, I. ebria and Claassenia sabulosa were encountered in both types of habitats.

Inundation of the Flaming Gorge area will doubtlessly destroy the stonefly fauna of the river by converting the running water habitat into one of standing water. Those species present in the tributaries should not be markedly affected, however, for only the mouths of these streams will be altered.

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AQUATIC SURVEY OF GREEN RIVER AND TRIBUTARIES

within the

FLAMING GORGE RESERVOIR BASIN

Arden R. Gaufin

Gerald R. Smith

Phil Dotson

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INTRODUCTION

During the University summer expedition of 1959 (see Foreword) three advanced students, Gerald R. Smith, Guy G. Musser and Phil Dotson, the latter representing the Utah State Department of Fish and Game, conducted an aquatic survey of the Green River and adjacent sections of some of its tributaries in the Flaming Gorge Reservoir Basin. This survey included samplings for physical and chemical data, and collection of specimens of fishes, insects and algae taken at selected locations.

The collection sites were selected to represent as many types of habitat conditions as was deemed practical under conditions of the expedition. Samples were taken in 47 different locations; 36 in the main current of the river and 11 in tributaries or side canyons.

The physical data obtained usually included information about the site selected: location, date, time, habitat type (current, riffle, pool, back-water, pond, river, tributary), bottom type (rocks, gravel, sand, or mud), width, depth, velocity, turbidity, and temperature (air and water). The chemical data usually included measurements of pH, dissolved oxygen, carbon dioxide, carbonates and bicarbonates. These data and notes on the biota were recorded on standard forms at the collection site. In order to measure the daily variation in these factors, three special sampling projects on Green River and one on Blacks Fork were conducted in which water samples were collected and analysed, usually at four hour intervals, over a period of 24 hours, Table 1. These were conducted at selected sites and were in addition to the routine analyses.

METHODS AND PROCEDURES

Transportation of the crew down the river was accomplished by means of a 16 foot aluminum barge provided by the Utah State Department of Fish and Game, as a part of the overall expedition. It carried part of the supplies and equipment, as well as the personnel, during the expedition.

Mr. Smith acted as crew leader and assumed primary responsibility for the equipment and records and usually collected the physical-chemical data. The collection and preservation of the specimens was handled primarily by Musser and Smith, but all three cooperated in all phases of the operation. The over-all control of travel down the river was determined by the progress of the expedition. Within this limitation, samples were taken as time permitted.

The equipment and reagents used in chemical analysis of the water, in addition to some of the other equipment necessary for the survey, were made available by the Department of Zoology, University of Utah.

24-HOUR RUNS

Table 1. Showing physical data collected on 24-hour runs. Temperature in °F; turbidity by Hellige and colorimetric methods; alkalinity given in burette readings.

Location	Date	Time	Temperature		Turbidity		pH	PPM				Alkalinity		
			Air °F.	Water °F.				D	O ₂	CO ₂	-CO ₃	-HCO ₃	Phen.	Total
GREEN RIVER July														
Mile 378 above Kin- caid Ranch	2	0700	56	60	12	10	8.2	7.0	0	4.0	109	.2	11.3	
		1000	75	64			8.2	7.2	0	6.0	112	.3	11.8	
		1300	80	64			8.2	7.3	0	10.0	104	.5	11.4	
		1600	80	66			8.2	7.2	0	10.0	107	.5	11.7	
		1900	68	64			8.2	7.0	0	10.0	105	.5	11.5	
		2200	60	62			8.0	6.4	0	12.0	100	.6	11.2	
	3	0100	59	62			8.0	6.8	0	6.0	109	.3	11.5	
		0400	50	61			8.0	6.7	0	8.0	107	.4	11.5	
Mile 356	12	0800	80	66	3	4	8.4	7.5	0	24.0	125	1.2	14.9	
		1200	88	72			8.5	7.7	0	22.0	138	1.1	16.0	
		1600	87	73			8.5	7.6	0	24.0	123	1.2	14.7	
		2000	62	72			8.4	7.1	0	28.0	116	1.4	14.4	
		2400	58	68			8.0	6.2	0	30.0	119	1.5	14.9	
	13	0400	48	66	8.4	6.5	0	44.0	109	2.2	15.3			
	Mile 323 3 miles above Linwood Bridge	21	1200	90	73	6	7	8.4	6.7	0	14.0	123	.7	13.7
			1600	80	73			8.4	6.9	0	22.0	110	1.1	13.2
2000			68	72	8.4			6.6	0	30.0	120	1.5	15.0	
2400			55	69	8.5			6.8	0	28.0	113	1.4	14.1	
22		0400	48	65	8.4			6.9	0	24.0	111	1.2	13.4	
		0800	68	69	8.3			6.9	0	20.0	113	1.0	13.3	
TRIBUTARIES														
1 mi. up Blacks Fork mile 356	12	0730	77	63			8.4	7.1	0	42.0	216	2.1	25.8	
		1600	86	74			8.4	7.0	0	42.0	237	2.1	27.9	
	13	0600	51	64			8.4	5.9	0	48.0	212	2.4	26.0	

PHYSICAL DATA

The physical data at each station were obtained as follows:

Location: The exact location of each collecting site was obtained from the United States Geological Survey Maps of the canyon area.

Average width and depth: Measurements of average width and depth were obtained by careful estimate, taking into consideration the extremely variable conditions.

Velocity: Measurements of velocity were made by timing a float from the upper to the lower end of 100 feet of unobstructed stream. The average of three consistent measurements was accepted for the record and was recorded in feet per second.

Color and turbidity: Notes on water color were made from observation in the field. Water samples were brought into the laboratory at the University of Utah and turbidity measured with a Hellige Turbidimeter. Results are expressed as parts per million of silicon, Fig. 1.

Temperature: Temperature measurements were made with field-type thermometers and recorded to the nearest degree Fahrenheit. Air temperatures were measured in the shade usually at standing height above the water.

CHEMICAL DATA

All water samples were collected below the surface in a 250 cc. sample bottle and analyses were made at the collection sites using a portable chemical analysis field kit, Fig. 2.

pH. Hydrogen ion concentration was measured with a Rascher and Bechtold colorimetric pH kit using cresol red and bromthymol blue as indicators.

Oxygen. The sodium azide modification of the Winkler method as outlined in the "Standard Methods of Water Analysis" (1955) was used to determine the dissolved oxygen concentration. Results are expressed in parts per million (p.p.m.).

Carbon Dioxide. The amount of free carbon dioxide recorded as parts per million (p.p.m.) was obtained by titrating 100 cc. samples of water with N/44 Sodium Hydroxide using phenolphthalein as an indicator.

Alkalinity. Alkalinity was measured by titrating a 100 cc. sample of water against N/50 sulfuric acid using phenolphthalein as an indicator. After this reading, methyl orange was added to the same sample and again titrated with the same acid. These measurements were converted and expressed as p.p.m. of carbonate and bicarbonate, respectively, by means of a formula given by Welch, 1948:215.

Date
1959 Location
July

TURBIDITY SAMPLES FROM GREEN RIVER

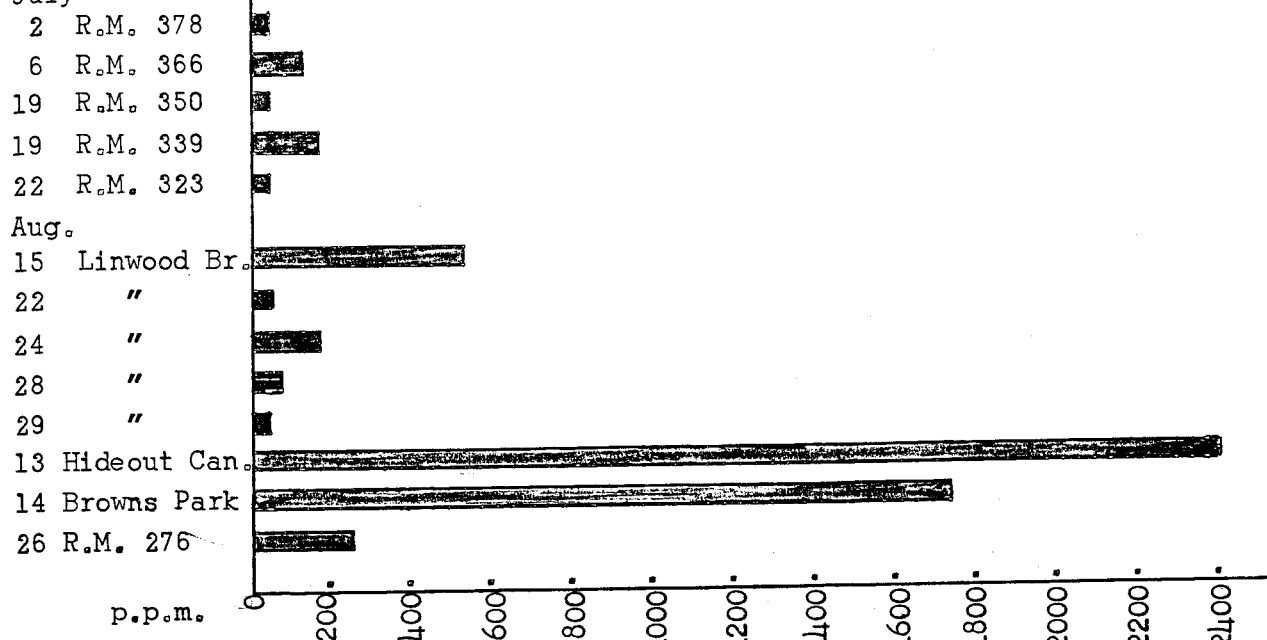


Fig. 1. Graph showing the turbidity found in Green River at different places and different dates. The extremes in turbidity are due to floods.

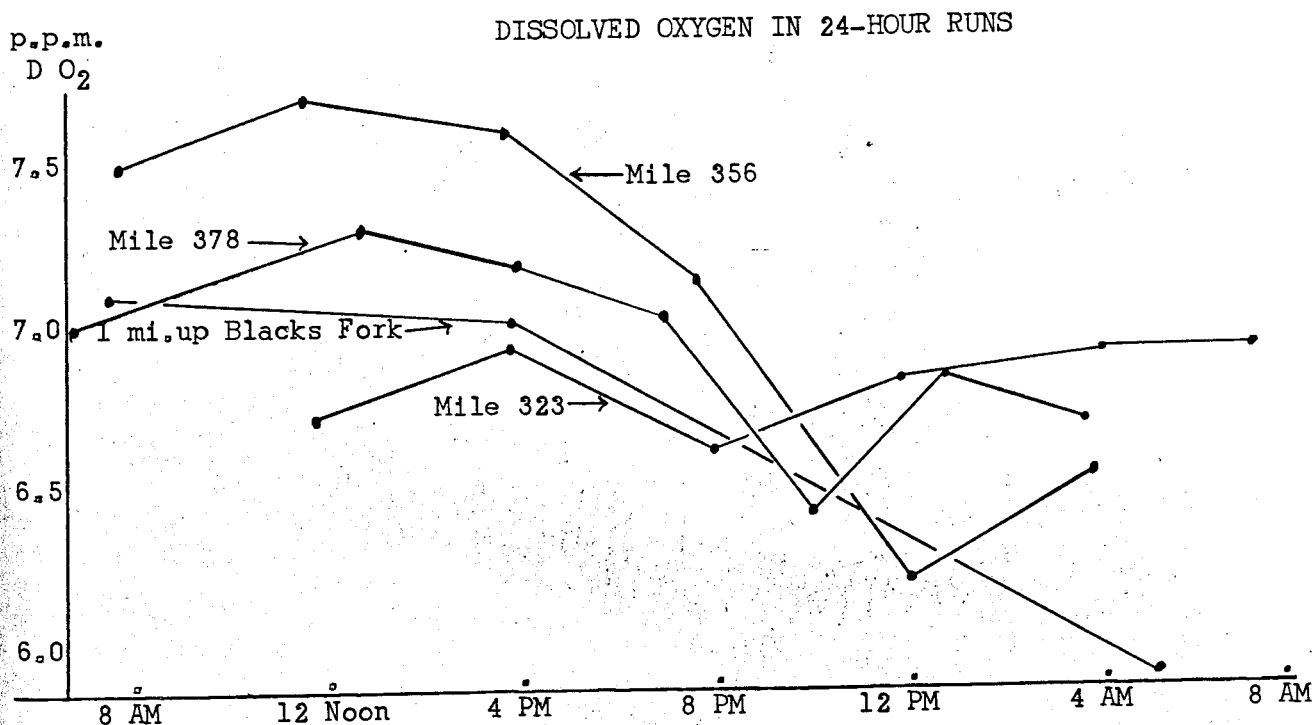


Fig. 3. Graph showing the amount of dissolved oxygen found during 24-hour periods at three points in Green River and one point in a tributary.

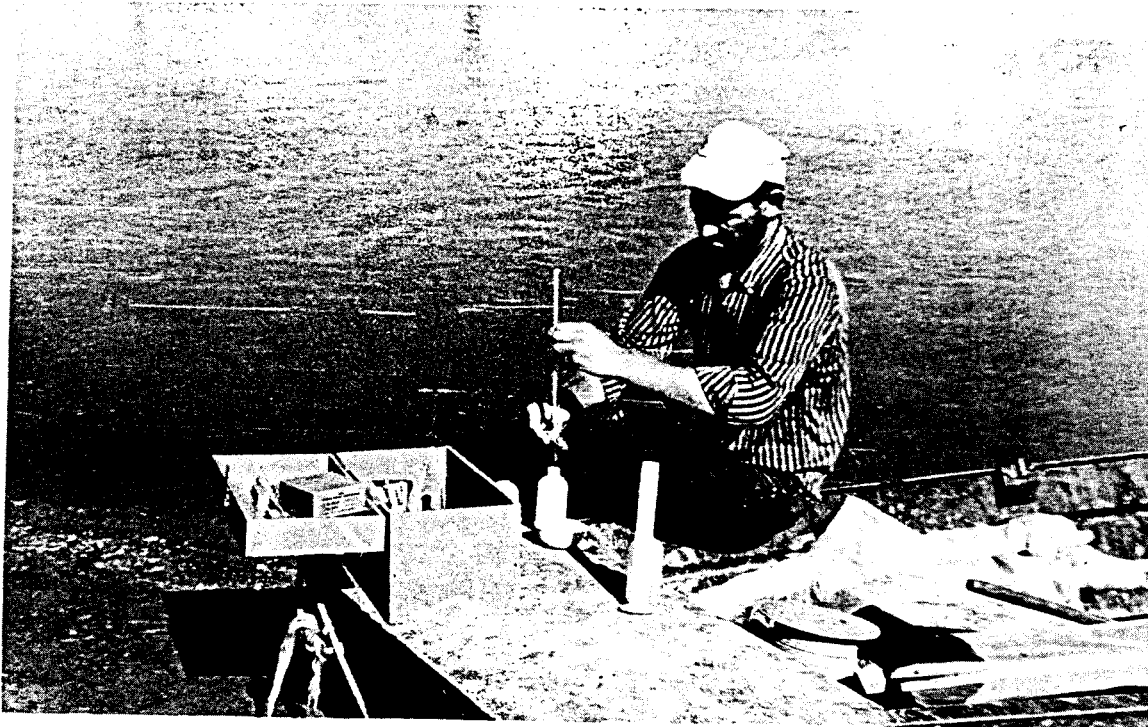


Fig. 2. A portable chemical analysis kit carried in the boat.
Photo by Phil Dotson.

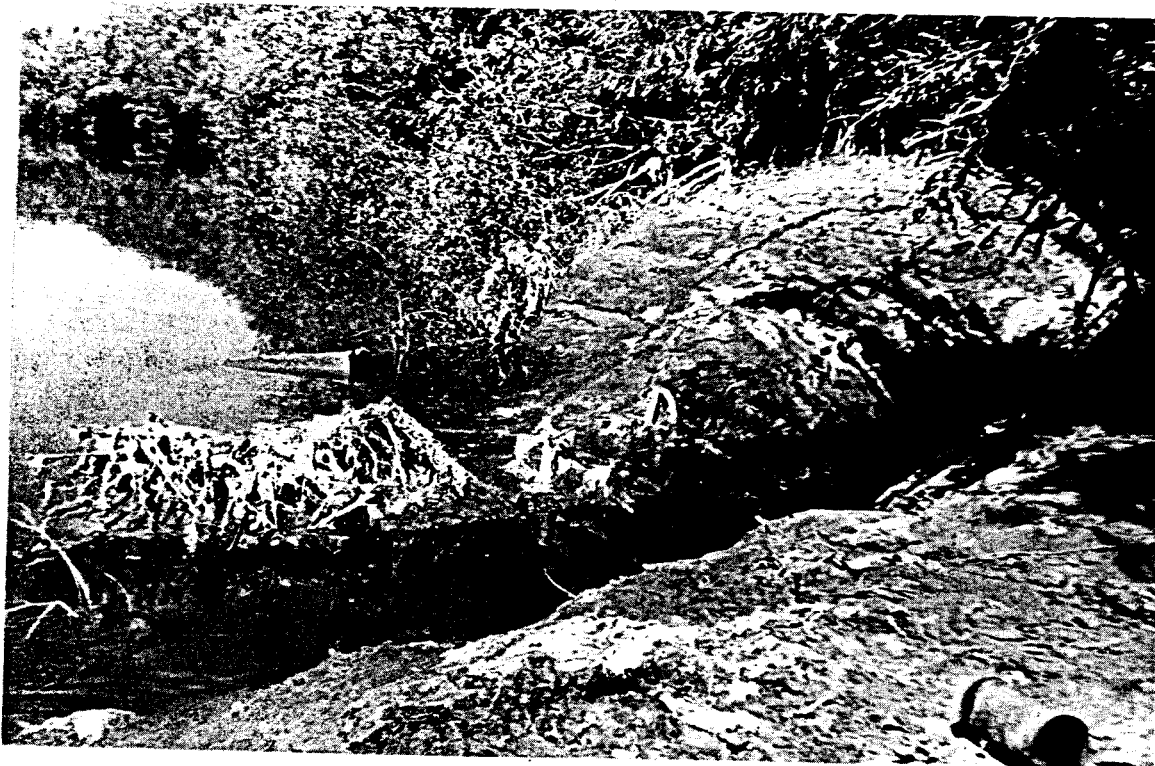


Fig. 4. Sewage from the city of Green River, Wyoming entering
Green River, July 17, 1959. Photo by Phil Dotson.

LIMNOLOGICAL CHARACTERISTICS

Analysis of the chemical-physical characteristics of the river and its tributaries reveal conditions conducive to high productivity, Table 2. Except for one sample taken at Green River, Wyoming, oxygen concentrations approached saturation levels at all times during the day but showed some decline at night when photosynthetic activity is at a minimum, Fig. 3. The oxygen depletion encountered at Green River was undoubtedly due to organic pollution of the river by that city, Fig. 4. Oil wastes released into the stream by the Union Pacific Railroad at that point also degrade the stream quality by coating the bottom and surface with an oil slick for several miles below the point of discharge.

The temperature of the water in the river ranged from 60° F. to 79° F. and in general was several degrees higher than in the tributaries. Tributaries such as Blacks Fork and Sage Creek displayed temperatures similar to those in the main channel but tributaries such as Carter Creek and Sheep Creek were colder, being more suitable for cold water fishes such as trout.

The pH of the river ranged from 7.5 in the polluted section below Green River to 8.4 throughout most of the length. Most of the tributaries were equally alkaline except Carter Creek, which is comparatively lacking in carbonates due to its granitic drainage basin.

There was little or no free carbon dioxide in the river except at Green River, Wyoming and in Carter Creek. The 4 p.p.m. in the former location can be attributed to decay of organic wastes while the 1 p.p.m. in Carter Creek can be attributed to its source. Considerable calcium bicarbonate is present in the river in the area studied ranging from 100 to 386 p.p.m. Several samples analysed constituted distinctly "hard" water but such hardness is indicative of increased productivity through the additional "half bound" CO₂ which is available for plant use. By contrast, several of the tributaries were relatively "soft" with a calcium bicarbonate content as low as 29 p.p.m., Fig. 5.

BIOLOGICAL DETERMINATIONS

FISHES

The survey crew had the following equipment at its disposal for fish collection: prima-cord, (Figs. 6 and 7), a 20 foot seine (Fig. 8), 10 foot seine, fike or hoop net, gill net (Fig. 9), purse seine, dip net, angling gear (Fig. 10), and rotenone; the latter suffocates fish by coagulating mucous on the gills. Use of the seines in the shallower areas of the river proved quite successful in collection of minnows and flannelmouth suckers, but the use of prima-cord in slow pool areas of the river was the most effective means of collecting these forms. Angling with flies was used for collecting trout in the tributaries. Collection of other fish in the tributaries was found to be considerably easier with the common handscreen (see insect section) employed as an entrapment device. Rotenone was successfully used when the dilution factor was such that it was rendered harmless upon reaching the river.

AQUATIC SURVEY DATA COLLECTED

Table 2. Giving physical-chemical characteristics of sampled area

River mile	Location	Date	Time	Shore cover	Bank erosion	Bottom type	Max. width
SWEETWATER COUNTY, WYOMING							
386.5	Green River	June 29-30	--	Willows, etc.	Stable	Silt-sand-rubble	
386	Bridge	July 17	9:30	Dense willow	Not marked	Silt-rubble	
378R	Green R., Wyo.						
378R	Above Kincaid Ranch	1-2	7:00	Willows, etc.	Stable	Silt-sand-rubble	30
376.8	End of island	1	--	--	--	Rubble-mud	
376.5	End of island	2-3	--	--	--	Rubble-mud	
373R	Side channel	4	9:00	Willows, etc.	Moderate	Sand-silt-rubble	3
366	Opposite Big Chimney Rock	6	10:45	Willow & meadow	Stable	Rubble-sand	30
358	Side pool	8	3:00	--	Moderate	Sand-silt	30
360	Sage Creek	8	10:30	--	Eroding	Clay-sand	2
356	Just above Blacks Fork	10-11-12	--	Sagebrush rabbitbrush	Moderate	Rubble, some sand	35
356	1 mi. up Blacks Fork	10	4:00	24-hr. run	Severe sandy banks	Sand-silt-rubble	7
353	Currant Creek	13	1:00	--	--	Mud	
350	Buckboard Ranch	15	5:30	--	Moderate	Rubble, some silt	
339	Brinegar Ranch	19	7:30	--	Steeply eroded bank	Rubble	
333	Spring, mouth Middle Marsh Cr.	20	11:30	Sagebrush shadscale	--	Completely covered algae	5.
323	Hogs Back Spring	20	3:00	--	--	--	
323	Hogs Back Spring	20	24 hr.	Rubble	Moderate	Silt over rubble	
DAGGETT COUNTY, UTAH							
309.5	Sheep Creek	26	10:00	Willow chokecherry	Slight	Mud over rubble	1
306	Hideout Forest Camp	29	6:30	Conifers	--	Silt over rubble	
305	Carter Creek	30	9:45	Dense willow	Stable	Rubble with boulders	3
303R	Eagle Creek	30	10:10	Dense Willow, cottonwood	Slight	Rubble with silt	
229R	Skull Creek	30	11:45	Dense veg.	--	Rubble	
299	Below Skull Creek	31	7:30	--	--	--	
294R	Trail Creek	31	10:20	--	--	--	

Max. width feet	Ave. width feet	Max. depth feet	Ave. depth feet	Turbidity	Color	Velocity ft./sec.	Temperature		pH	D O ₂	CO ₂	CO ₃	HCO ₃
							Air°	H ₂ O					
--	--	--	--	--	--	--	--	--	--	--	--	--	--
6°	5°	1°	.8°	--	--	5.0	84	79	7.5	0	4	0	268
300°	--	8°	3.5°	24 hr. run	--	4.7	58	60	8.2	7	0	4	109
--	--	--	--	--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--	--	--	--	--
30°	25°	4°	--	--	--	--	60	62	8.2	7	0	12	114
300°	--	3.5°	2.5°	9	Green brown	3.5	82	66	8.3	6.3	0	12	125
300°	--	4°	2°	--	--	--	80	66	8.4	7.2	--	38	100
20°	2°	.5°	.2°	Clear	--	1	74	74	--	13.4	0	56	326
350°	300°	4.5°	1.8°	12	--	1.5	--	--	--	(24 hour run)			--
75°	45°	4°	1.5°	4	yes	1.5	86	74	8.4	7.0	0	42	237
--	--	2°	.5°	--	--	--	88	70	8.4	13.1	0	36	351
--	--	3.5°	1.5°	15	--	--	76	74	8.4	7.5	0	24	116
--	--	--	--	--	--	--	67	69	8.4	7.0	0	20	120
5.8°	4°	1°	.8°	--	--	0	85	49	7.4	5.6	0	8	386
--	--	24 hour run		--	--	--	89	50	8.5	4.5	0	34	29
--	--	--	--	323	--	--	--	--	--	24 hour run		--	--
15°	13°	4°	1.2°	--	Reddish brown	8	82	63	8.2	8.2	0	28	146
--	--	15°	4.5°	--	Green	--	80	71	8.4	7.0	0	18	111
35°	20°	4°	1°	--	--	--	82	60	8.0	8.9	1	0	29
8°	4°	2°	.7°	Little	--	Rapid	82	58	8.2	7.2	0	8	74
7°	5°	2°	.5°	--	--	4	80	58	8.4	8.4	0	0	90
--	--	--	--	--	--	--	72	68	8.4	7.3	0	12	123
--	--	--	--	--	--	--	75	59	8.6	8.5	0	52	140

BICARBONATES IN RIVER AND TRIBUTARIES

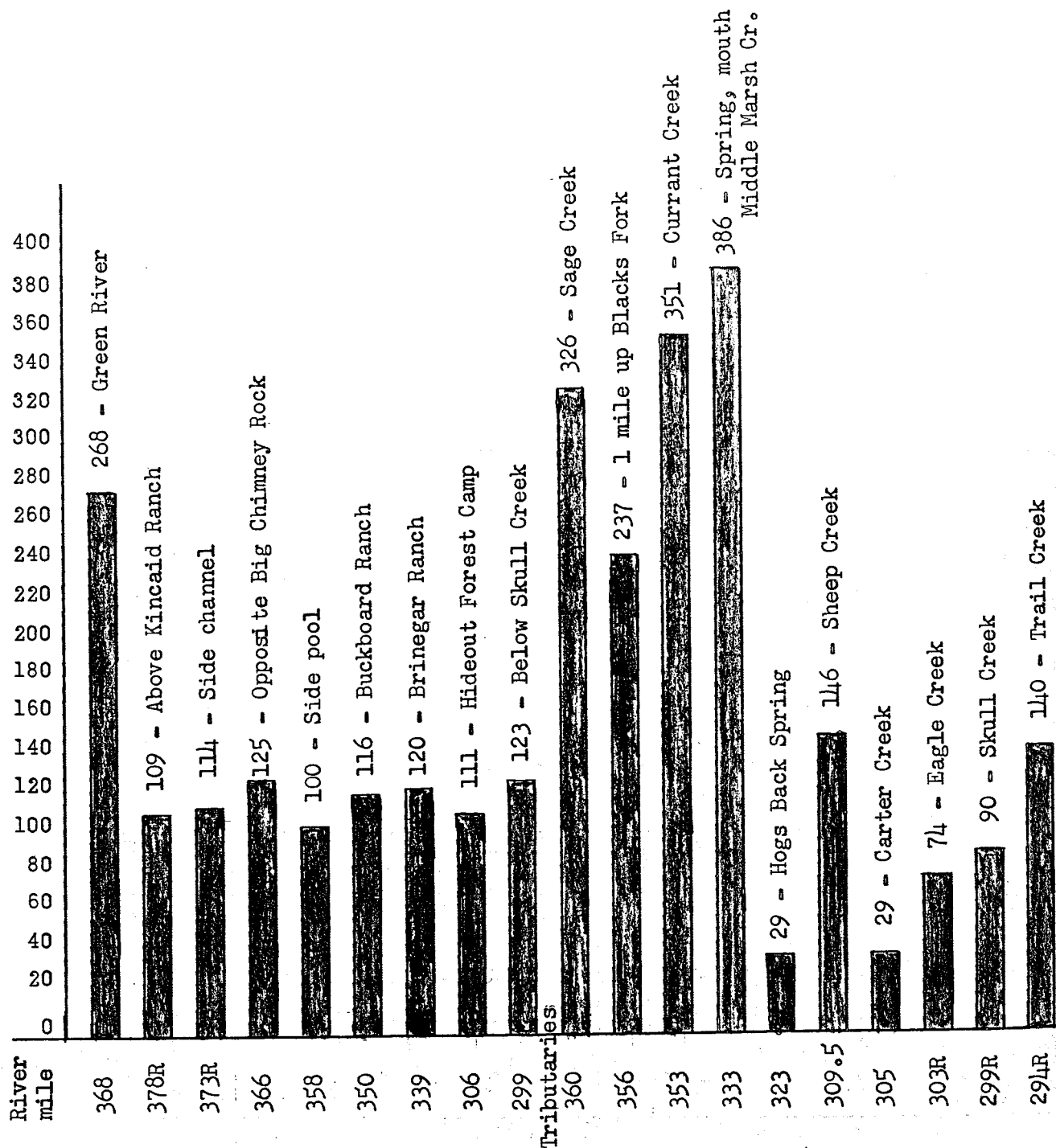


Fig. 5. A bar graph showing the amount of bicarbonates present in Green River and certain tributaries to Flaming Gorge.

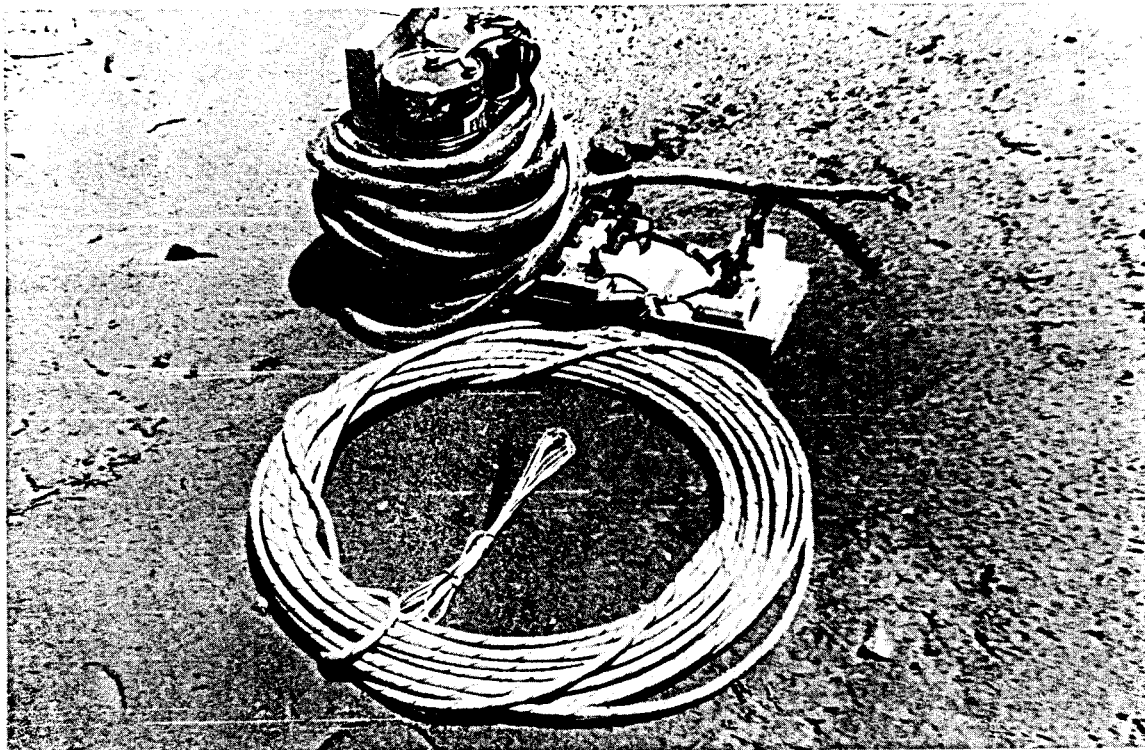


Fig. 6. A roll of primacord and electrical equipment used to initiate explosion. Photo by Phil Dotson.

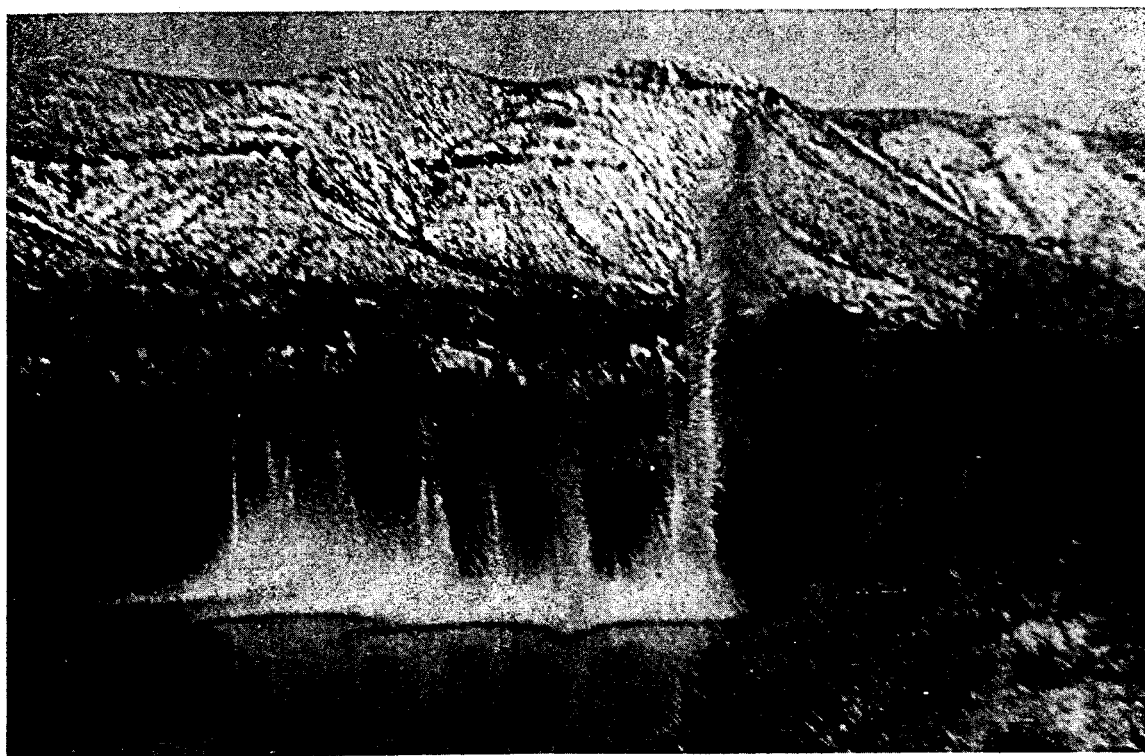


Fig. 7. A primacord explosion used for the collection of fish specimens for scientific study. Photo by Phil Dotson.



Fig. 8. A seine used in shallow water of the river, often used below primacord explosions. Photo by Phil Dotson.



Fig. 9. A gill net illustrating the catch of fish by this method. Photo by Phil Dotson.

Fish were transported to the boat or camp after collection and preserved in 10% formaldehyde, each collection being kept separate in an individual plastic bag and stored until the end of the trip. Identification of fish in the laboratory was made by Gerald R. Smith with verification and/or identification by Dr. Robert R. Miller, Museum of Vertebrate Zoology, University of Michigan.

INSECTS

The primary method of collecting insects was dislodgement and entrapment with a handscreen constructed of two wooden handles, 3 ft. by 1 in., holding a 2½ ft. by 2 ft. piece of standard fine mesh door screen. This apparatus was used in a scraping, scooping action to collect insects from pools and ponds. Insect collecting in moving waters with rocky bottoms was accomplished by hand picking the rocks or by kicking and scraping the bottom material and catching the disturbed insects with the hand screen.

Insects were carefully preserved in 70% alcohol in shell vials which were then sealed in small jars for maximum protection.

ALGAE

Algae samples consisting of filamentous green and blue-green algae and diatoms were preserved in 1:22 parts of lacto-phenol in water and stored in corked glass vials. Identifications made by Seville Flowers are reported in the list of plants, page 51.

RESULTS

During the aquatic survey, studies were made at 47 stations, some of which were subdivided into more than one study or sampling area. Of these stations, 36 were located in or along the banks of the Green River, while 11 were in tributaries or side canyons. At most of these places, data on physical characteristics of the sites and chemical characteristics of the water were obtained. From these sampling areas, 4,831 specimens of fishes representing 15 species were collected. The fishes are listed in Table 3.

Data concerning the physical and chemical characteristics of the sites and the specimens of fishes collected at each site are given in the Aquatic Survey Tabulation, Table 2. The fishes encountered on the expedition are discussed in the annotated check list in Appendix A.

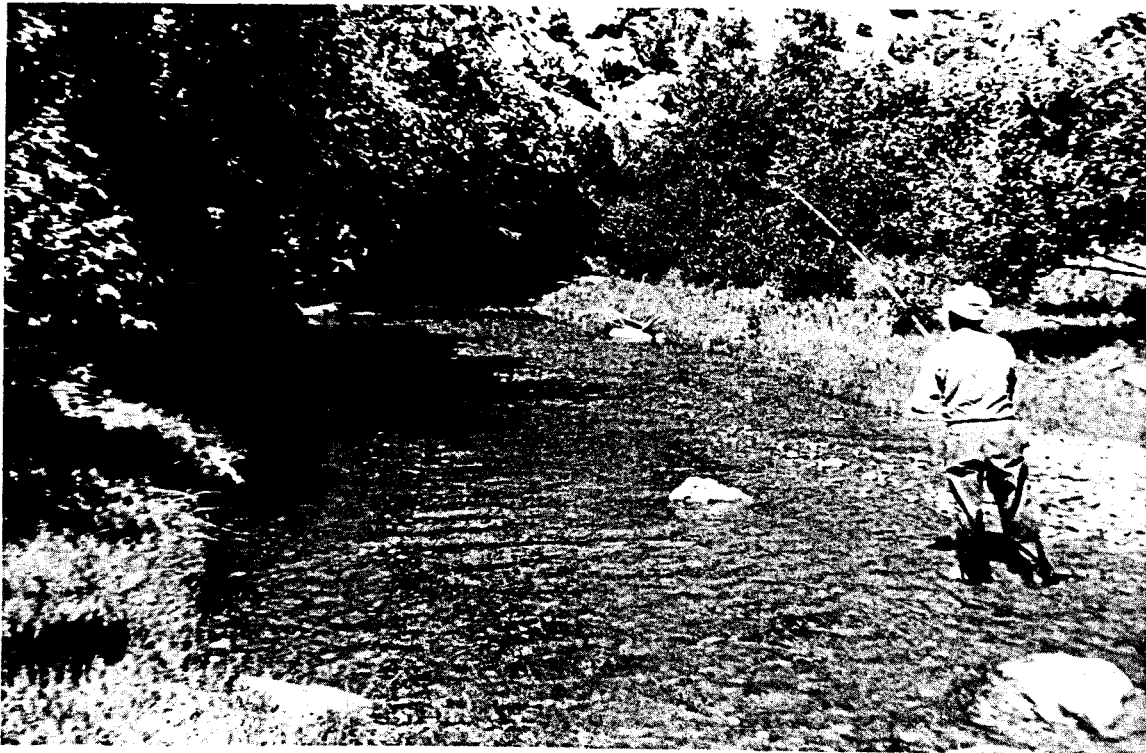


Fig. 10. Angling gear in use in a tributary. Photo by Gerald Groves.

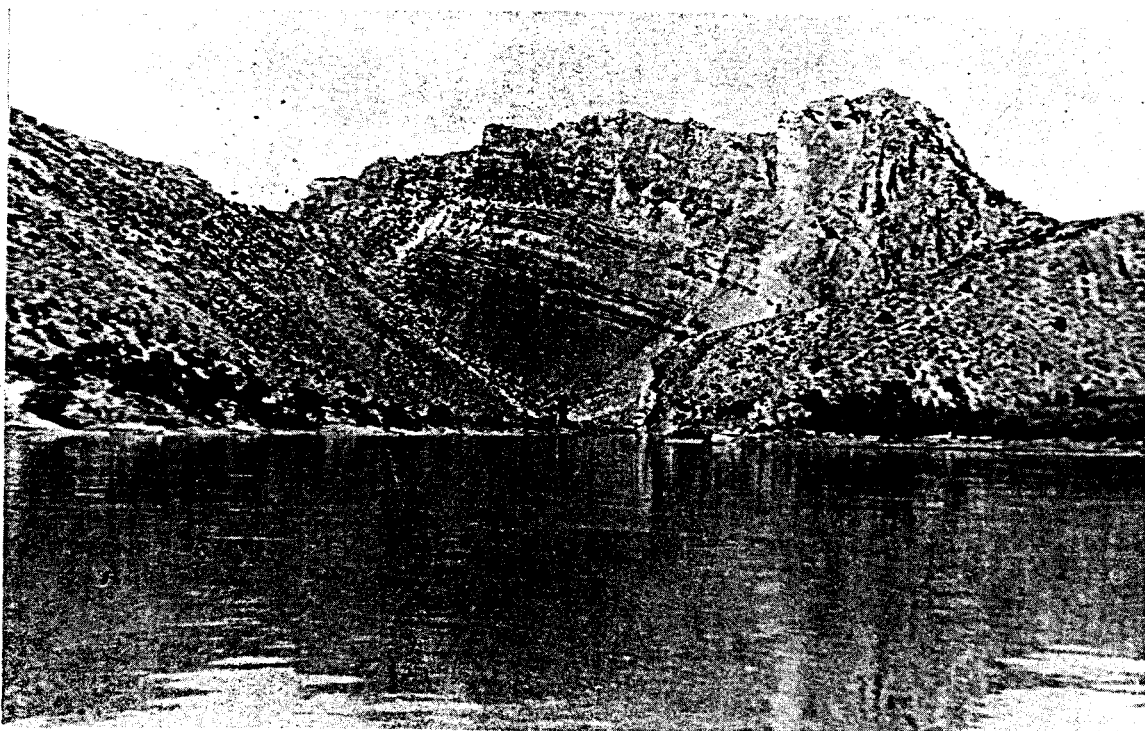


Fig. 11. A view of the primary river channel just above the entrance to Flaming Gorge. Photo by Phil Dotson.

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HABITAT TYPES

Within the area to be inundated by the impoundment are many varied habitat types. Because of the large number of collecting sites a discussion of the general habitat types encountered will be given rather than a description of each site.

PRIMARY RIVER CHANNEL ABOVE THE FLAMING GORGE

This includes only the main river channel of the Green River above the Flaming Gorge (Fig. 11) exclusive of the littoral areas. The river here presents a rather slow, steady flow, the channel being between 200 and 300 ft. in width and rarely exceeding about six ft. in depth. At the time at which samples were taken and measurements made, the river was several feet below the high water mark and local testimony indicated that the low water mark was at least one foot lower. During the summer, the drop in the water level is persistent. At the station above Blacks Fork, the water level receded about seven inches in three days. Many depth samplings were made but deep waters were seldom encountered. Depths near eight feet were measured near the Kincaid Ranch and at the mouth of Blacks Fork but in most cases the maximum depth was found to be between four and six feet, and in many places the river could be waded with little difficulty. Measurements of velocity within this habitat ranged from 1.5 to 4.7 feet per second. Slower velocities were encountered in pool-like areas. These were limited to a few instances of slower waters at bends in the river and behind obstructions such as large boulders.

The bottom material in this habitat type consisted primarily of rocks six to 10 inches or smaller in diameter. Accumulation of silt and sand was common in areas of slower velocity. The dominant fishes in this habitat were the flannelmouth sucker and the bonytail which were readily collected by gill-netting and by prima-cord. This habitat type gives way to the following type with the entrance of the river into the Flaming Gorge.

MAIN CHANNEL OF THE GREEN RIVER IN THE CANYON

This represents a continuation of the above type with some changes due to the canyon conditions. In contrast to the previous type in which the river winds its way more or less steadily over a rather homogeneous substratum the river within the canyon encounters obstructions of various sorts resulting in a marked increase in the variability of the habitat with regards to velocity. The river here is narrower and deeper and the current often alternates between stretches of slow water blocked up behind barriers of harder bed-rock and areas of faster water, or rapids, as the water cascades over these barriers.

Our collections indicate that several species of fishes are more common in this canyon area. A striking example of this type of distribution is offered by the humpback chub, which was not collected by us above the Flaming Gorge. However, the first specimen was taken within a few miles of the entrance into this area. The squawfish, humpback sucker, and catfish were also taken only within the canyon area.

The most important site sampled by this expedition was the large pool below the Hideout Forest Camp and above Carter Creek. Located at a slight bend in the river, this extensive pool area proved to be a most productive site, easily sampled with the gill net and with prima-cord. The pool is about 25 by 70 yards and is formed at the outside band of the river by a diversion of a small portion of the water to the right while the main river continues to the left. This diverted water turns slowly in a wide circle, eventually rejoining the main channel at the upper end of the pool. The center of the pool was sounded with some difficulty and judged to be over 15 feet deep. The bottom appeared to be covered with fine silt and organic matter. Ten species of fish were collected here. The only fish which was common in the upper river but absent from this area was the redbreasted shiner.

LITTORAL HABITAT AREA

This habitat type graded into the main channel generally throughout the length of the river within this study area. It is defined as the area of slower water from the shore line out to the channel at a depth of about one foot. Above the Flaming Gorge this habitat was dominated by the redbreasted shiners and dace, with sculpins and young flannelmouth and bluehead suckers also appearing commonly. This habitat was somewhat reduced within the canyons by the more precipitous banks characteristic of that area.

ISLAND CHANNELS

This distinctive habitat type appeared commonly above the canyon area. It consisted of channels between two and 30 feet wide and from several inches to four feet in depth, separated from the main river by islands. Channels of this type up to a mile in length were found. The type of habitat presented was dependent upon the size of the channel. Small channels constituted the usual situation and approached the littoral habitat in characteristics of bottom type and fish fauna, but the larger channels were more like the main river in their characteristics. This type of habitat seemed to serve as a refugium for immature fishes.

TRIBUTARIES ABOVE FLAMING GORGE

Tributaries to the Green River in the upper section of the study area were very distinct from those within the canyons. With the exception of Blacks Fork, Henrys Fork, and possibly Currant Creek, they were intermittent and supported no permanent fish fauna. Blacks Fork was sampled intensively at several sites along the 22.5 miles between its confluence with the Green River and the upper end of the proposed reservoir. It is a sizable stream with a large drainage area and at the time of the investigation, had an average width of about 45 feet and an average depth of about one foot. The maximum width was about 75 feet and the maximum recorded depth four feet. Our observations indicate that this stream is very much like the Green River on a smaller scale and our fish collections reflect this similarity.

Henrys Fork is closer to its mountain source and field observations indicated that it is intermediate between the tributaries characteristic of the upper section and the canyon tributaries. In contrast to the upstream tributaries it presented much riffle and pool type of habitat with extensive rubble bottom. Fish populations encountered were similar to those in Blacks Fork but there was an apparent reduction in the numbers of chubs.

Currant Creek was the only other tributary above the gorge to show a well developed fish fauna. Two situations were sampled there, one of which was a muddy backwater at the mouth of the creek, separated from the Green River. Redside shiners and young flannelmouth suckers were dominant in this situation with fathead minnows and bluehead suckers being of secondary importance.

A portion of Currant Creek had been diverted, creating an artificial marsh above the natural stream channel. A short, rapidly running creek had formed, draining this marsh into the backwater pools mentioned above. This unique habitat supported primarily dace, although mountain suckers, redside shiners and fathead minnows were also present. This habitat was also notable because of its high dissolved oxygen and bicarbonate concentrations. Those characteristics are attributable to the profuse algae growth in the marsh source of this water.

CANYON TRIBUTARIES

Sheep Creek was the first of the canyon tributaries encountered. This stream is also intermediate between the two classes of tributaries treated here but was more typical of the lower streams than was Henrys Fork. At the time of sampling it had an estimated flow of about eight cubic feet per second and was heavily laden with reddish silt.

Rothone was used to sample the lower 1/2 mile of the stream. Redside shiners (230 specimens) and dace (203) were the dominant fishes. Flannelmouth suckers (14), bluehead suckers (1), brown trout (1) and sculpins (2) were also present. (See Table 3).

The remaining canyon tributaries (Fig. 12) are very similar in their characteristics and are discussed in the section on the trouts. One of the characteristics which should be mentioned is the unusual softness of the waters of these streams. Carter Creek is the most extreme example, showing a bicarbonate reading of only 29 parts per million when sampled. (This may be compared to the reading of 386 p.p.m. in the spring near the mouth of Middle Marsh Creek). The softness of the waters of Carter Creek and the other canyon streams may be attributable to the insoluble nature of much of the bedrock in their drainage basin. Their headwaters are in the adjacent Uinta Mountains and the water flows in general over the Uinta Mountain Quartzite. The presence and dominance of trout in these streams is probably due largely to the lower temperature provided. (See Table 2). The only other fishes encountered in these streams were the dace, whitefish and sculpins.



Fig. 12. A clear cold stream in South Skull Creek from the north slope of Uinta Mountains. Photo by Phil Dotson.

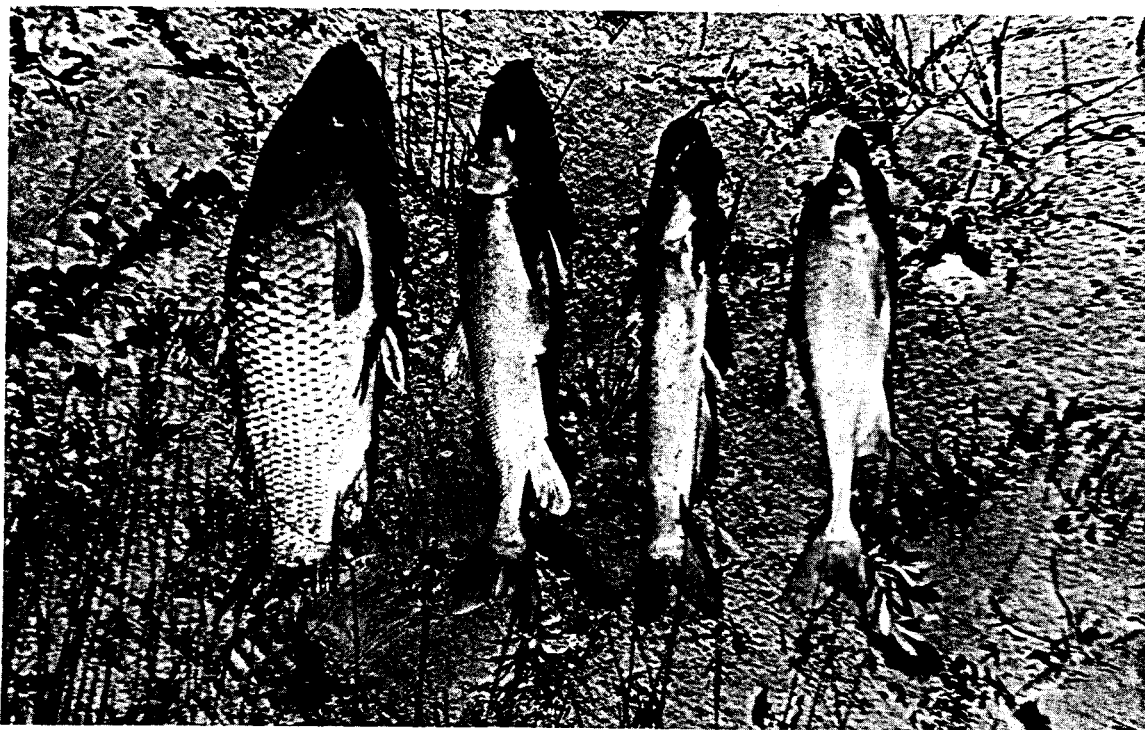


Fig. 13. View of fish from left: a. carp, b. flannelmouth sucker, c. channel catfish, and d. humpback chub. Photo by Phil Dotson.

SPRINGS

Several small springs were found and sampled during the course of the investigation and the results of this work are given in Table 2. No fishes were collected in any of the springs or their waters.

CHECK LIST OF FISHES

Salmonidae (family) Salmon and trout

Salmo trutta Linnaeus Brown trout
Salmo clarki Richardson Cutthroat trout
Salmo gairdneri Richardson Rainbow trout
Prosopium williamsoni (Girard) Mountain whitefish

Catostomidae (family) Suckers

Catostomis latipinnis Baird and Girard Flannelmouth sucker,
 Fig.13b, Fig.14, lower row.
Xyrauchen texanus (Abbott) Humpback sucker, Fig.15.
Pantosteus delphinus (Cope) Bluehead sucker

Cyprinidae (family) Carp, dace, and minnows

Cyprinus carpio Linnaeus Carp, Fig. 13a.
Gila robusta Baird and Girard Bonytail chub,
 Fig. 14, upper row.
Gila cypha Miller Humpback chub, Fig. 13d.
Richardsonius balteatus (Richardson) Redside shiner
Rhinichthys osculus (Girard) Speckled dace
Ptychocheilus lucius Girard Colorado squawfish
Pimephales promelas Rafinesque Fathead minnow

Cottidae (family) Sculpins

Cottus bardii punctulatus (Gill) Colorado mottled sculpin

Ictaluridae (family) North American catfishes

Ictalurus melas (Rafinesque) Black bullhead
Ictalurus punctatus (Rafinesque) Channel catfish,
 Fig. 13c.

FISHES COLLECTED

Table 3. Showing fish collected at different sampling stations.

River	mile	Side	Stream	Location	Habitat	Bottom	Collecting method	SALMONIDS			
								Salmo	trutta	Salmo clarki x S. gairdneri	Prosopium williamsi
387			GR	Green River	Riffle	Rubble	HS				
378			GR	Above Kincaid R.	Riffle	Rubble	PS				2
377.4			GR								
376.8	L		GR	Isl. Channel	Channel	Silt-gravel	S				2
376.5	L-A		GR	Isl. Channel	Channel	Silt-gravel	P				1
376.5	L-B		GR	Main Channel	Channel	Silt-rubble	GN				
376.5	L-C		GR	Main Channel	Channel	Silt-rubble	GN				
372	R-A		GR	Isl. Channel	Channel	Silt-gravel	PS				2
372	R-B		GR	Isl. Channel	Channel	Silt-gravel	S				11
366	L-A		GR	Isl. Channel	Channel	Silt-gravel	P				
366	L-B		GR	Isl. Channel	Channel	Silt-gravel	S				
367	L		GR	Isl. Channel	Channel	Silt-gravel	S				
365			GR	Deep pool	Pool	Silt	P				
360			Trib.	Sage Creek	--	--	HS				
358			GR	Deep pool	Pool	--	P				
356			GR	Above Blacks Fk.	Channel	Rubble	GN				
356			GR	Above Blacks Fk.	Channel	Rubble	S				
356			Trib.	1 mi. up Blacks Fk.	Riffle	Rubble	S				
356			Trib.	20 mi. up Blacks Fk.	Riffle	Rubble	S				
356			Trib.	20 mi. up Blacks Fk.	Backwater	Silt	S				
356			Trib.	20 mi. up Blacks Fk.	Channel	Rubble	S				
353	L		Trib.	Currant Creek	Riffle	Rubble	HS				
353	L		Trib.	Currant Creek	Backwater	Silt	S				
350			GR	Main Channel	Channel	Rubble	S				
339			GR	Main Channel	Channel	Rubble	P				
339			GR	Isolated Channel	Backwater	Silt	HS				
326.5	R		GR	Isl. Channel	Channel	Silt	P				
326	L		GR	Pool	Pool		P				
324-A			GR	Main Channel	Semi-pool		P				
324-B			GR	Main Channel	Semi-pool		GN				
324-C			GR	Main Channel	Semi-pool		GN				
320			GR	Hogsback Spring	Channel	Rubble-silt	S				
320			Trib.	Henrys Fork	Riffle-pool	Sand-rubble	S				
318			GR	Entrance of F.G.	Pool		P				
310			Trib.	Sheep Cr. 1/2 mi.	Riffle-pool	Rubble-sand	R+S	2			
306-A			GR	Below Hideout Camp	Channel	Sand-silt	A				
306-B			GR	Below Hideout Camp	Pool		GN				
306-C			GR	Below Hideout Camp	Pool		GN				
306-D			GR	Below Hideout Camp	Pool		P				
306-E			GR	Below Hideout Camp	Pool		GN				
306-318			GR	Flaming Gorge	Channel		GN				
305	R		Trib.	Carter Creek	Riffle-pool	Rubble	A			206	
303	R		Trib.	Eagle Creek	Riffle-pool	Rubble	A			25	
303	R		Trib.	Eagle Creek	Riffle-pool	Rubble	R	4		18	
299	L		GR	Channel	Channel	Rubble-silt	P				
294	R		Trib.	Trail Creek	Riffle	Rubble	R	1		6	
299	R		Trib.	Skull Creek	Riffle	Rubble	R	5		21	1
TOTAL								12		276	19
FREQUENCY OF OCCURRENCE								4		5	6

Sampling methods: HS = Handscreen,
 GN = Gill net, P = Prima-cord,
 S = Seine, R = Rotenone, A = Angling

BUCKERS	Catastomus latipinnis	Xyrauchen texanus	Pantosteus delphinus	CYPRINIDS	Cyprinus Carpio	Ptychocheilus lucius	Gila robusta	Gila cypha	Rhinichthys osculus	Pimephales promelas	Richardsonius balteatus	CATFISH	Ictalurus punctatus	SCULPINS	Cottus b. punctulatus	TOTAL	Freq. of occurrence
(outside study area)									4 (not incl.)				in total)	3		--	--
15			4						18		6				1	46	6
1			13				6		14		6				2	42	6
24			25				1		29		101					182	6
59			15				18		64		47					204	6
4							3									7	2
3							3									6	2
13			5						6		18					44	5
53			61				3		192	1	195					516	7
13							3		4		2					22	4
60							9		36		72					177	4
36							15		169	21	971					1212	5
5																5	1
6																6	1
31							15								1	47	3
1			1				5									7	3
x			x				x		x		x					5	5
42							8		10		5					65	4
35			16				98		48		51					248	5
37			43				83		10		91				1	265	6
8			4				4		6		5					27	5
			1						31	2	2					36	4
105			18	1			2		1	19	256				4	406	8
15			4				x		20		6				1	47	6
8							14		2							24	3
				30												30	1
7																7	1
3							7									10	2
5							3									8	2
4			2				35									41	3
10			2				11		17		9				10	23	3
18			2				2		37		8				1	58	6
62			2				3									113	6
6							1									7	2
14			1						203		230				3	454	6
												8				8	1
2			2				7		5						1	17	5
1			5		1		4		4				1			16	6
3	1						7		1	11			1			24	6
3			2			2	15		3							25	5
4			3				3		2							12	4
																206	1
																25	1
															19	41	3
1				1									1			3	3
															6	13	3
									7						17	51	5
718	1	232		33	2	390	15	936	43	2082	11	67	4837				
38	1	23		4	1	31	5	23	4	20	4	13					182

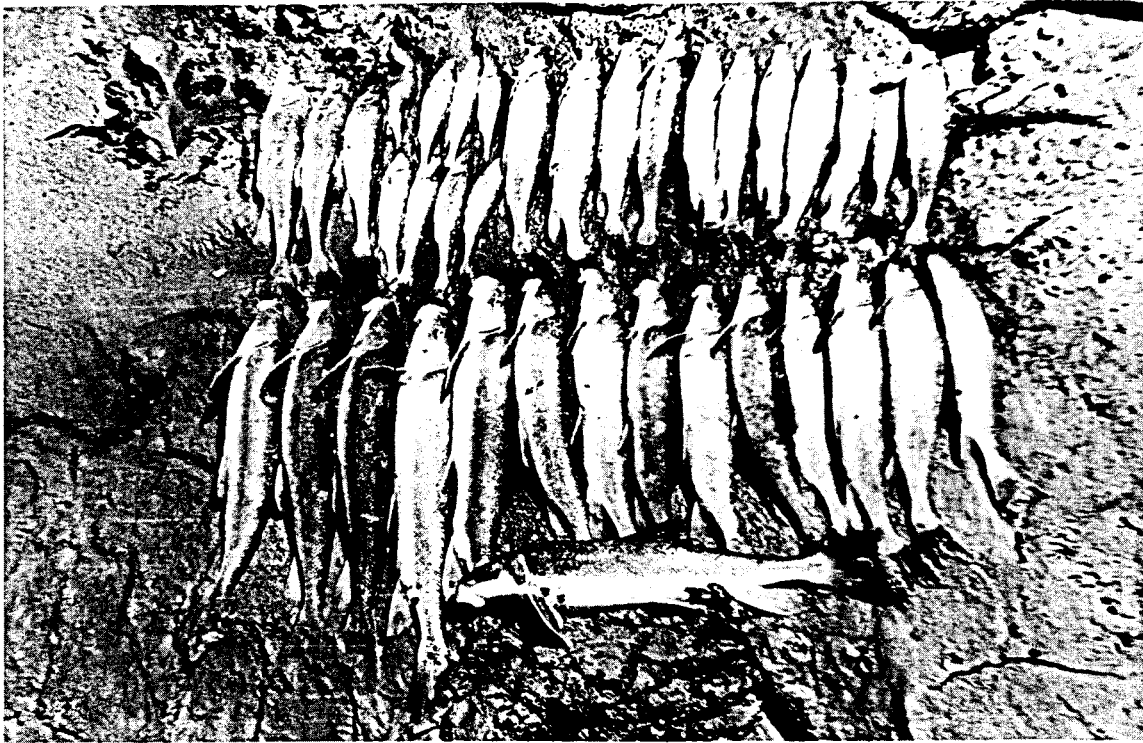


Fig. 14. A series of bonytail chubs (upper row) and of flannelmouth sucker (bottom row) from Green River.
Photo by Phil Dotson.



Fig. 15. A large humpback sucker from Green River.
Photo by Gerald Groves.

APPENDIX A

ANNOTATED LIST OF FISHES

of the

FLAMING GORGE RESERVOIR BASIN, 1959

Gerald R. Smith

Salmonidae (family) Trouts and whitefishes

Salmoninae (subfamily) Trouts

Salmo trutta Linnaeus Brown trout

This introduced species was encountered within the study area in four tributary streams, all within the Flaming Gorge canyons. Our collections would seem to indicate that they are limited in their local distribution to the lower ends of cooler more permanent creeks. They are more tolerant of siltations than the other trouts encountered as was shown by their presence in Sheep Creek where other trouts were not collected. At that time, Sheep Creek was heavily silted, appearing reddish brown and non-transparent. This species seems fairly well established here in the absence of the other trouts. A specimen 192 mm in standard length was collected by hook and line by Gary L. Ranck of the survey crew and a specimen about 17 inches (428 mm) long, weighing about 1½ pounds was shown to members of the crew in Manila, and said to have been collected in Sheep Creek. All other specimens seen were of small size and were collected with rotenone.

Salmo clarki Richardson Cutthroat trout

Salmo gairdneri Richardson Rainbow trout

Because of the fact that specimens of these species which were collected on this expedition show extensive hybridization, making complete separation largely impossible, the two species will be discussed together. The cutthroat trout of the Upper Colorado system, Salmo clarki pleuriticus is the only trout native to the study area. This trout is partially distinguishable from the Yellowstone cutthroat, S. c. lewisi, by having smaller scales and a very brassy-orange appearance. Pure specimens of the two species present are ordinarily distinguishable on the basis of scale counts, color patterns, head and body shape, and presence or absence of basibranchial teeth. Specimens which matched the description of S. c. pleuriticus perfectly were collected in some of the more isolated tributaries of the Flaming Gorge, but each trout population examined showed some degree of hybridization with the introduced rainbow trout, S. g. irideus.

To what extent the populations were influenced by characters of the Yellowstone cutthroat is not known, as there appeared to be no means of differentiating characters of this subspecies from characters shown by the Colorado cutthroat and rainbow trout hybrids. However, it is possible that Yellowstone cutthroat trouts have had access to these waters through introduction and have interbred with the other trouts present.

Trout populations were encountered in four clear, cold, permanent tributaries within the Flaming Gorge. These streams all possessed characteristics common to good trout streams, showing, at the time samples were taken, temperatures of 60° F. or less, dissolved oxygen of 7.2 to 8.9 parts per million, pH of 8.0 to 8.6, and clear, cascading waters with ample food supply. The richness of these streams was indicated by the collection by angling of 46 trout, taken in 3½ hours from Carter Creek by two fishermen from the expedition.

Salmo gairdneri (continued)

Carter Creek was the largest and richest of the streams and was also the most accessible, most heavily fished, and contained the greatest percentage of rainbow trout characters in the trout population. Eagle Creek, 1/2 mile downstream, showed little indication of fishing pressure and contained trout of larger average size than those of Carter Creek. Eagle Creek also produced some of the most typical specimens of the Colorado cutthroat. While several of these fish appeared well within the range of the subspecies S. c. pleuriticus on the basis of scale counts, body shape, cutthroat mark, basibranchial teeth and size and distribution of spots, it seems unwise to designate them as "pure" specimens because of the extensive occurrence of rainbow trout characters in the population.

The introgression of characters would seem to indicate a high degree of fertility between these two species under the artificial conditions which have brought them together in this environment. Although these trouts appear well adapted and recreationally desirable, the original value of the native trout to the study of evolution has been destroyed, offering another example of the undesirability of promiscuous transfers of fishes from one drainage to another.

Corregoninae (subfamily) Whitefishes

Prosopium williamsoni Girard Mountain whitefish

This fish, native to this drainage, apparently has a rather sporadic distribution in the study area. Two specimens were obtained in the main channel of the Green River at Kincaid Ranch but all other specimens were collected in small island channels or tributaries, always in association with a silt-gravel or rubble bottom. The largest specimen collected was 135 mm in total length.

Catostomidae (family) Suckers

Catostomus latipinnis Baird and Girard Flannelmouth sucker

This fish was encountered in numbers exceeded only by the speckled dace and the silver-side minnow. It was the most common fish from the standpoint of frequency of occurrence, appearing in 37 of the 46 collections. It is also the largest of the common fishes in the study area. Many specimens were collected which were over 400 mm long, the largest reaching 556 mm. By virtue of its abundance and size, the flannelmouth sucker must be considered the most important fish in the study area at this time. It was encountered in all habitats except the swift canyon streams. Juveniles were especially common in the small island channels where they may avoid the swift current and predators. Adults were found most commonly in slower, deeper waters where they move along the bottom using their large fleshy lips to feed on organic matter.

Xyrauchen texanus (Abbott) Humpback sucker

This species, endemic to the Colorado River system, is common in the lower part but comparatively rare in the upper section of Green River. The species is noted for the possession of a sharp nuchal hump which

Xyrauchen texanus (continued)

is said to have some significance as an adaptation to the deep swift waters in which it lives. A single adult specimen 488 mm in length (Fig. 14) was collected by means of a prima-cord blast in the large pool in the Green River below Hideout Forest Camp. Six specimens representing hybrids between this species and Catostomus latipinnis were collected at presumably this location by William F. Sigler and party in 1950 and reported by Carl L. Hubbs and Robert Rush Miller in 1953. An additional specimen representing this hybrid combination was collected from the Green River near the Utah-Colorado line by Phil A. Dotson of the Utah State Fish and Game Department later than the expedition being reported here. This species is apparently becoming increasingly rare in the upper Colorado system (Hubbs and Miller, 1953).

Pantosteus delphinus (Cope) Bluehead sucker

This native species is common in the Green River and the slower tributaries, being notably absent from the colder, faster streams supporting trout. Specimens ranged from fry size up to 411 mm in length and are represented in 23 of the 46 collections. The larger specimens were collected in the deeper section of the river and smaller specimens were especially numerous in the tributaries and island channels. Small specimens were also commonly taken in seine hauls from the littoral habitat of the river.

Cyprinidae (family) Minnows

Cyprinus carpio Linnaeus Carp

This species has been very widely introduced and its occurrence in the Green River is not unexpected. Our collection includes individual specimens from Currant Creek and from two locations in the Green River in Flaming Gorge. Thirty small specimens were collected by Mr. Musser in an isolated channel near river mile 339.

Ptychocheilus lucius Girard Colorado squawfish

This species, endemic to the Colorado River system, is the largest of North American minnows and is said to reach a length up to five feet. Two specimens, a female and a male, measuring 544 and 400 mm in total length, were taken by gill net from the large pool in the Green River below Hideout Forest Camp. Local testimony indicated that this fish, also called the white salmon, was once abundant in the upper Green River. It is apparently uncommon at the present time.

Gila robusta Baird and Girard Bonytail

Gila cypha Miller Humpback chub

Three different forms representing the genus Gila were collected by this expedition including two subspecies of Gila robusta, G. r. robusta and G. r. elegans, and a third type, Gila cypha Miller. These three types of fishes very likely represent three diverging lines of evolution but

Gila cypha (continued)

the taxonomic treatment is a problem needing further study. Adult specimens are largely separable by fin ray counts and body shape. G. r. robusta usually has 9 dorsal rays, 9 anal rays, a relatively deep caudal peduncle and no development of a dorsal hump or elevation. G. r. elegans, which is considered to be better adapted to swifter waters, usually has 10 or 11 dorsal rays, 10 or 11 anal rays, an extremely slender caudal peduncle and an arched elevation of the posterior part of the skull and the nuchal area. Gila cypha is distinguished in the adult stage by the presence of an abrupt nuchal hump. It usually has 9 dorsal rays, 10 anal rays, and an intermediate caudal peduncle. Young specimens are difficult to identify because of the lack of development of the characteristic shapes of the nuchal area and caudal peduncle and the overlap in fin ray counts for the three types.

G. r. robusta is the most common of the three forms in our collections and is one of the dominant fishes of the river and larger tributaries from the standpoint of size and numbers. It occurs in reduced numbers in Henrys Fork. G. r. elegans was collected only in the main channel of the Green River and in the deep pool near Hideout Canyon. G. cypha was found only in the Green River within the canyons. It is interesting to note that no Gila was collected in the colder, swifter tributaries which supported trout.

Rhinichthys osculus (Girard) Speckled Dace

The speckled dace was the most abundant of the native fishes. This small fish has an apparent wide ecological tolerance being one of the two fishes found in all of the primary types of fish habitats sampled. It was encountered in island channels, along the shallow margins of the Green River and in most of the tributaries. A tuberculate male and several ripe females were collected in Sheep Creek on July 27.

Pimephales promelas Rafinesque Fathead minnow

This species is not native to the Colorado River system but has been extending its distribution rapidly since its first occurrence in the drainage several years ago. Specimens taken from two island channels and from Cur-rant Creek are believed to be the first record of its occurrence in the Green River drainage.

Richardonius balteatus (Richardson) Redside shiner

Simon (1951) reported that this species was first collected in the Green River in 1938 (3 specimens), and that many specimens were collected in 1942. In 1959 it was the most common species in our collections, being especially common in the island channels and larger tributaries. No specimens were collected below Sheep Creek. This is probably due in part to the increased scarcity of the slow, shallow habitat that this fish seemingly prefers, although it is probable that fishes of this species nevertheless occur in suitable habitat in the canyons.

Ictaluridae (family) Catfishes

Ictaluris punctatus (Rafinesque) Channel catfish

There have been repeated introductions of this species into the Green River of Wyoming and Utah. However, our collecting failed to produce any specimens until we reached the canyon area where it was collected from two locations in the Green River.

Ictalurus melas (Rafinesque) Black bullhead

Although no specimens of this catfish were collected in the study area by the expedition, several specimens were later taken from the Green River just below the study area by Mr. Phil Dotson and Mr. Rod Stone of the Utah State Department of Fish and Game. It is possible that this species occurs in limited numbers within the study area.

Cottidae (family) Sculpins

Cottus bairdi punctulatus (Gill) Colorado mottled sculpin

This small fish was found most abundantly in the cold streams that supported trout. It was not common in any other situation and yet it showed apparently the broadest ecological tolerance of any of the species collected. In addition to its presence in the cold trout stream it was collected in the main channel of the Green River, in island channels, and in most of the tributaries. One specimen was collected with a gill net at the bottom of the large pool below Hideout Forest Camp.

APPENDIX B

NOTES ON DISEASES, PARASITES, FOOD, AND CONDITION

of

GREEN RIVER FISHES, 1959

Phil Dotson

Fisheries Biologist

Utah State Fish and Game Department

DISEASES

Fish diseases and parasites are a natural phenomenon occurring in nature. They are not readily detected due to the fact that many of the parasites are extremely small and difficult to see without the aid of a microscope. The diseased fish, as they weaken, become easy prey to piscivorous fish and other animals. Other diseased fish slowly settle to the stream bottom where they go undetected and decompose.

The Green River is no exception to this general rule. The flannelmouth sucker, Catostomus latipinnis, and bluehead mountainsucker, Pantosteus delphinus, seemed to be more susceptible to diseases and parasites than other species collected from the river in midsummer, 1959. This could easily be a density dependent factor or could be caused by domestic and industrial pollution which enters the river at the city of Green River, Wyoming. The fish collections began approximately seven miles below the town, and in this vicinity, the diseased fish were more prevalent than farther downstream. The external parasites were extensively scattered throughout the river and tributaries.

Open sores of red bleeding lesions were readily observed on these two species of suckers. This disease had the symptoms of a bacterial ulcer. The fish had dark spots (Fig. 16) in the premature stages, on their bodies, heads, or both, but upon closer examination of the specimens, the spots were decomposed flesh. Some of the fish had both, the dark colored spots and open lesions. The lesions were much darker than the surrounding epidermis. At the base of the epithelial tissue there was a red discoloration that is supposedly caused by congestion of blood vessels in the dermis. The fins, especially the caudal, were also infected and some of the membranous tissue destroyed. The ulcer develops from the surface inward and does not usually extend into the muscle tissue. The disease was not detected in other species of fish collected.

PARASITES

Leeches (Hirudinea) were commonly seen attached to the caudal and dorsal fins of suckers, chubs, trout and whitefish. An internal parasite, a post-plerocercoid larva, Ligula intestinalis (Linnaeus), was found protruding from the anus of a bluehead mountainsucker after it had been placed in a preservative formaldehyde solution. This parasite was fantastically large in comparison to its host. Meyer (1954) states that infected fish are often distinguishable because of their greatly distended bellies, which, in some cases, are so crowded with worms that the body wall bursts with handling. Plehn (1924) reports that the weight of plerocercoids may equal that of the host fish.



Fig. 16. A fish showing lesion from bacterial ulcer. Photo by Phil Dotson.

FOOD

BONYTAIL CHUB

The analysis of food found in stomachs taken from Gila robusta (Table 4), reveals that this species is omnivorous in its feeding habits. It appears to feed on almost any type of food or parts available. Three of the seventeen stomachs examined were entirely empty. Two of the larger stomachs contained one small minnow each. One of these minnows was identified as speckled dace, Rhinichthys osculus. However, the presence of these minnows does not necessarily indicate that this species is carnivorous, but it is highly probable that it includes fish in its diet upon reaching maturity. The animal material in the stomachs consisted primarily of terrestrial insects. The insects included ants, mayflies, beetles and true flies. Ants were the most numerous of the terrestrial insects, constituting 58.7 percent of the items. The study also showed that this fish consumes a large quantity of plant matter, mostly in the form of woody fragments, but the nutritional value of these fragments is highly questionable. In the Flaming Gorge vicinity, following a heavy rain which washed debris into the river, several bonytail chubs were observed feeding at the surface in a bay area which contained a floating mass of woody fragments.

Table 4. Showing analysis of food taken from the stomachs of 17 bonytail chubs from Green River during August, 1959. Fish total lengths in inches; maximum, 16.1; minimum 6.8; average, 9.0. Volume of food, 16.6 cubic centimeters; number of animals, 225. This study is based on percentages of occurrence, number and volume.

Animal	Percent		
	Occurrence	Items	Vol. cc.
Animal	54.2	87.9	44.3
Undetermined	4.2	.4	2.2
Determined	50.0	87.5	42.1
Fish	8.3	.7	7.5
Undetermined	4.1	.3	3.1
determined	4.2	.4	4.4
<u>Rhinichthys osculus</u>	4.2	.4	4.4
Insects	41.7	86.8	34.6
Undetermined	20.9	21.1	16.8
Determined	20.8	65.7	17.8
Hymenoptera	9.6	58.7	14.2
Diptera	6.4	5.8	2.7
Ephemeroptera	1.6	.4	.4
Coleoptera	3.2	.8	.5
Plant	16.7	12.1	23.7
Undetermined	12.5	- -	21.5
Determined	4.2	12.1	2.2
Seeds	4.2	12.1	2.2
Undetermined Organic material	29.1	- -	32.0

CONDITION OF FISHES

The condition of fishes was determined on this expedition by use of a standard condition factor (K) obtained from the formula $K = \frac{W \times 10^5}{L^3}$, in which L = standard length in millimeters and W = weight in grams. Results are given in the following Table 5. In all fishes studied, the condition factor indicated relatively normal growth except in the cutthroat trout, where variable growth was indicated. Most of the specimens were subnormal but two of them were above normal.

Table 5. Showing condition factor "K" for specimens taken from Green River during midsummer, 1959.

<u>Standard length mm</u>	<u>Weight gms.</u>	<u>K factor</u>	<u>Standard length mm</u>	<u>Weight gms.</u>	<u>K factor</u>
Brown trout: two from Carter Creek taken during August, 1959.			Cutthroat trout: 10 from Carter Creek taken during August, 1959.		
175	75	1.39	80	80	.93
176	75	1.37	143	30	1.02
Whitefish: five from Carter Creek taken during August, 1959.			147	25	.79
169	75	1.55	150	50	1.48
177	95	1.71	158	50	1.27
183	85	1.39	160	50	1.22
188	95	1.43	166	50	1.09
200	120	1.50	168	50	1.05
Humpback sucker: one from Green River taken during July, 1959.			168	115	2.42
419	1000	1.36	169	100	2.07
Carp: two from Green River taken during July, 1959.			Rainbow trout: 10 from Carter Creek taken during August, 1959.		
334	1025	2.75	132	50	1.74
443	2000	2.30	135	35	1.42
Colorado squawfish: from Green River taken during July, 1959.			139	50	1.86
340	535	1.36	163	75	1.73
465	1250	1.25	173	85	1.64
			183	75	1.22
			199	115	1.46
			253	215	1.33
			280	275	1.25
			309	350	1.19

Standard length mm	Weight gms.	K factor	Standard length mm	Weight gms.	K factor
Flannemouth suckers: 45 from Green River taken during July and August, 1959.			Bonytail chubs: 44 from Green River taken during July and August, 1959.		

86	16	2.51
176	74	1.36
185	80	1.26
186	90	1.40
218	175	1.69
220	132	1.25
224	160	1.42
238	175	1.30
242	195	1.38
248	215	1.41
250	240	1.54
255	255	1.55
256	240	1.43
258	255	1.48
263	255	1.40
271	295	1.48
275	315	1.51
281	300	1.35
288	295	1.23
295	395	1.54
304	415	1.48
305	440	1.55
305	430	1.51
307	450	1.55
312	445	1.46
313	418	1.36
330	505	1.57
332	530	1.45
354	620	1.40
362	540	1.14
362	675	1.42
365	870	1.79
371	730	1.43
374	750	1.43
376	275	.52
382	630	1.13
382	815	1.46
382	825	1.48
385	825	1.44
390	795	1.34
390	945	1.59
394	815	1.33
400	835	1.30
405	1001	1.51
481	1610	1.45

128	25	1.19
133	50	2.12
138	25	.95
141	50	1.78
142	45	1.57
150	55	1.63
151	55	1.60
151	56	1.63
152	40	1.14
152	55	1.56
152	65	1.85
158	70	1.77
160	35	.85
162	60	1.41
163	80	1.83
164	65	1.47
165	52	1.16
165	59	1.31
168	90	1.90
171	70	1.40
173	80	1.54
177	80	1.44
178	65	1.15
185	75	1.18
185	80	1.26
187	75	1.15
188	80	1.20
204	135	1.59
209	105	1.15
250	200	1.28
251	245	1.55
265	285	1.53
269	235	1.21
271	240	1.20
273	255	1.25
283	335	1.48
288	420	1.76
293	315	1.25
297	330	1.26
308	350	1.20
336	470	1.24
344	515	1.26
348	480	1.14
360	555	1.19

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AMPHIBIANS AND REPTILES OF FLAMING GORGE

by

JOHN M. LEGLER

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INTRODUCTION

In the summer of 1959, from June 28 to August 2, a group of 16 biologists from the Division of Biological Sciences, University of Utah, made an expedition along an 88 mile stretch of the Green River in extreme southwestern Wyoming and adjacent northeastern Utah. The purpose of the expedition was to investigate the flora and fauna of an area that will eventually be inundated by a reservoir formed by a dam on the Green River near Dutch John, Utah. The upper limit of the proposed reservoir will be approximately eight miles below Green River, Wyoming.

Investigation of the flora of the mentioned region was undertaken for the U. S. Bureau of Reclamation. Faunal studies were undertaken with the assistance of the University of Utah Research Fund. The project was under the direction of Angus M. Woodbury; field work was supervised by Stephen D. Durrant.

This paper deals with the 236 amphibians and reptiles collected in the course of the expedition. The specimens are now in the collection of the University of Utah, Museum of Zoology (UU). Nolan K. Dean was in charge of collecting and preserving herpetological specimens, but many other members of the expedition assisted him with this task. Collecting was done chiefly by hand. Many of the localities given below are expressed in miles, by river (hereinafter, river miles -- abbreviated R. M.); upstream from Green River, Emery County, Utah; all of these localities are, however, in Sweetwater County, Wyoming, or Daggett County, Utah. River miles are given on the Plan and Profile Maps, Green River, U. S. Geological Survey, sheets H, I, and J.

ANNOTATIONS

AMPHIBIA (class) Amphibians

Ambystoma tigrinum spp. Tiger salamander

One hundred and twenty-nine larval salamanders (UU 3527) were seined from a stagnant backwater pool of the Green River $1\frac{1}{2}$ mi. north of the Utah-Wyoming state line in Sweetwater County, Wyoming, on July 21. The pool was approximately 900 ft. long and 30 ft. wide. Spirogyra was abundant in the pool.

Ground color of the larvae (in preservative) is gray to dirty cream. The gills are noticeably darkened and there are many dark flecks and irregular spots on the dorsum. Snout-vent length of the specimens varies from 42 to 90 mm. and total length from 77 to 155. The greatest width of the head in the largest specimen is 34 mm.

Allocation of the series to subspecies is impossible, inasmuch as no adults are present. It is probable, however, that the specimens represent a population of the Utah tiger salamander, A. t. utahense Lowe 1955, of which the type locality is Lapoint, Uintah County, Utah. Lowe (1955:247) included extreme southwestern Wyoming in the geographic range of this subspecies.

Scaphiopus hammondi intermontanus Cope 1883 Great Basin spadefoot
Five partly metamorphosed young (UU 3529) (having tails 8 to 22 mm. long)
were taken at the same time and place as the salamanders mentioned above.
An adult (UU 3530) was taken in an irrigation ditch at Manila, Daggett
County, Utah, July 14.

Rana pipiens brachycephala Cope 1889 Western leopard frog
Eleven specimens were obtained as follows: Sweetwater Co., Wyoming --
R. M. 366, 5980 ft., July 6, UU 3516; Blacks Fork, 14 mi. above confluence
with Green River, 6000 ft., July 12, UU 3517-8; R. M. 323, 5878 ft., July
20, UU 3519-21; 1½ mi. N. Utah-Wyoming state line, 5850 ft., July 22,
UU 3522-23. Daggett Co., Utah -- Sheep Creek, R. M. 309, 5850 ft., July
25, UU 3524; and Henrys Fork, below Linwood, July 23, UU 3525-6.

REPTILIA (class) Reptiles

Phrynosoma douglassi brevirostre (Girard) 1858 . . Eastern short-horned lizard
Five specimens were collected at the following localities in Sweetwater
County, Wyoming: 9 mi. S. Green River, 6025 ft., June 30, UU 3450; 11 mi.
S. Green River, 6025 ft., July 2, UU 3449; R. M. 360, 5600 ft., July 7,
UU 3451; and R. M. 349, 5400 ft., July 15, UU 3452-3.

The specimens are assigned to this subspecies on the basis of the
following combination of characters: length of temporal spines less than
greatest basal diameter; dorsal dark markings bordered only posteriorly
by pale color; frontal area slightly concave. In all specimens the head
is wider in the temporal region than at the angles of the jaw, and the
specimens more nearly resemble the subspecies ornatum in this character.
Coloration of the UU specimens (in alcohol) is as follows: dorsal ground
color pale bluish gray to tannish gray in adult females; dark dorsal mark-
ings slate gray to brownish black, bordered posteriorly by cream; head tan-
nish gray above; venter cream, having scattered specks of melanin. The
young differ from adults in having bluer dorsal ground color, the top of
the head more tannish and distinctly paler than rest of dorsum, a powder
blue stripe from nape to base of tail, and little or no melanin on venter.

Reeve (1952:916) allocated all specimens of P. douglassi from south-
western Wyoming (Sweetwater and Uintah counties) to this subspecies; his
map (Fig. 10, p. 933) shows three localities in northeastern Utah (probably
Duchesne and Uintah counties) but these specimens are not mentioned in the
text. In Utah, Reeve further allocated specimens from Carbon, Emery and
San Pete counties (op.cit:926) as P. d. hernandesi and specimens from Cache,
Salt Lake and Utah counties (op.cit:932) as P. d. ornatum. The differences
between these three subspecies are, as presently defined, subtle. Further
critical study of these populations will be necessary to determine the
geographical and morphological extent of intergradations between them. The
UU specimens possibly represent a population that is intermediate between
brevirostre and ornatum.

The two largest females (UU 3452-3, snout-vent length 72 mm.) con-
tained 15 and 13 embryos (all of approximately the same stage of develop-
ment), respectively, and the smallest mature female (UU 3449, snout-vent
length 54 mm.) contained four embryos. Considering these data, it is

Phrynosoma douglassi brevirostre (continued)

worthy of note that the fourth female had a snout-vent length of 49 mm. and was immature (as revealed by examination of ovaries), suggesting that possibly breeding first occurs when a snout-vent length of approximately 50 to 55 mm. is attained. Smith (1946:303) stated that number of young was five to six per brood but mentioned (op.cit:305-308) records of eight to 30 young per brood in other subspecies of P. douglassi.

Urosaurus ornatus wrighti (Schmidt) 1921 Northern tree lizard

Three specimens are at hand from Sweetwater County, Wyoming. A single female (UU 3513), taken at R. M. 372, 6900 ft., on July 4, contains five recently ovulated eggs. Two mature males (UU 3514-5) were obtained at Blacks Fork, 10 mi. above confluence with Green River, 6100 ft., July 12. The specimens, taken at the northern edge of the range of U. ornatus, correspond closely to the description of U. o. wrighti given by Smith (1946:274-275).

Sceloporus graciosus graciosus Baird & Girard 1852 . Great Basin sagebrush lizard

Thirty-three specimens were obtained at the following localities: Sweetwater Co., Wyoming -- R. M. 372, 6000 ft., July 4, UU 3480-6; R. M. 360, July 6-7, UU 3487-9; Blacks Fork, 10-14 mi. above confluence with Green River, 6100 ft., July 12, UU 3490-1; 1½ mi. N. Utah-Wyoming state line, 5850 ft., July 22, UU 3492-8. Daggett Co., Utah -- Sheep Creek, near confluence with Green River, 5850 ft., July 25, UU 3499-3502; Lucerne Valley, 5800 ft., July 23, UU 3503; and Hideout Forest Camp, 5900 ft., July 26-27, UU 3504-12. Most of the specimens are typical in all important respects of the subspecies graciosus. The nine specimens from Hideout Forest Camp differ in color from the remainder of the series as follows: dorsal ground color dark brown, dorsal markings faintly indicated in larger mature specimens of both sexes; belly patches (in perservative) metallic grey (females) to dark blackish blue, bright blue (as in specimens from the other localities mentioned) only in smaller males; belly patches of largest males confluent at level of adpressed elbows or separated by two to two and one-half paler scale-rows, the intervening paler rows dirty gray, not contrasting sharply with belly patches; throats of largest males with continuous deep blue area from tip of chin to level of ears (not distinctly mottled). No explanation for these melanistic tendencies can be offered at present.

Sceloporus undulatus elongatus Stejneger 1890 . . Northern plateau lizard

A total of 26 specimens of this subspecies was collected at the following localities: Sweetwater Co., Wyoming -- R. M. 372, 6200 ft., July 4, UU 3454-5; R. M. 366, 7000 ft., July 6, UU 3456-7; R. M. 356, 5930 ft., July 9, 3458-9; Blacks Fork, 10-14 mi. above confluence with Green River, July 11-12, UU 3460-9; 1½ mi. N. Utah-Wyoming state line, 5850 ft., July 22-23, UU 3470-2, 3474-5. Daggett Co., Utah -- Lucerne Valley, 5800 ft., July 23, UU 3473; Hideout Forest Camp, 5900 ft., July 27, UU 3476-9. The series consists of 15 females and 11 males. Average snout-vent length of 14 mature females is 64 mm. (range, 55-74) and that of eight mature males is 55 mm. (range, 46-64). Counts of dorsal scales range from 50 to 56 (average, 53). Colors of nearly all specimens are badly faded as a result of preservation in strong formalin. In all specimens the blue throat

Sceloporus undulatus elongatus (continued)

patches are at least narrowly separated. The belly patches of mature males tend to have an overall dark blue coloration whereas those of mature females have a wide, dark blue border on their medial sides and are otherwise paler than in males. A striking characteristic of the series is the tendency, in adults, toward uniformity of dorsal coloration, especially in females. Dorsal markings are generally obscure in individuals of small to medium size, and are completely wanting in the larger individuals of both sexes. Large, mature females are especially pallid dorsally, the ground color ranging from tan to yellowish or bluish gray. In this respect the specimens herein reported differ from specimens of this species obtained farther south in eastern Utah. A tendency toward uniform dorsal coloration was noted also in a series of this species (now in University of Kansas, Museum of Natural History) that I collected 3 mi. E. and 4 mi. S. of Collbran, Mesa Co., Colorado in June, 1954, at an altitude of 6800 ft. Perhaps the unicolored condition is associated only with populations at higher altitudes. This subspecies is generally considered to have distinct, dark dorsal markings.

Only one (UU 3457) of the 14 mature females contained oviducal eggs. The remaining females had only small ovarian follicles and no oviducal eggs, indicating that oviposition is ordinarily completed in June.

Coluber constrictor mormon Baird & Girard 1852 . . Western yellow-bellied racer

A single female of this subspecies (UU 3531) was obtained at Hideout Forest Camp, Daggett County, Utah, 5850 ft., on July 28. Dorsal ground color of the specimen is nearly uniform bluish brown; the venter is chiefly greenish yellow except for the chin, throat and subcaudal surface, which are bluish white. Pertinent characters of scalation for the specimen are as follows: ventrals 174, subcaudals 78, scale-rows 17-17-15, supralabials 8/8, the fourth and fifth entering orbit on each side, infralabials 9/8, maxillary teeth 14.

Pituophis catenifer deserticola Stejneger 1893 . . Great Basin gopher snake

Four specimens of this subspecies are at hand from the following localities in Sweetwater Co., Wyoming: 9 mi. S. Green River, 6025 ft., UU 3532-3; R. M. 372, 6000 ft., July 4, UU 3534; and R. M. 366, 5980 ft., July 5, UU 3535. The specimens are distinguishable from other subspecies of P. catenifer on the basis of the following combination of characters: maximum number of scale-rows of midbody 28 (1 specimen) to 29 (3 specimens); dark dorsal blotches on body 61-74, on tail 16-24; anterior 5 to 10 blotches black to blackish brown; other dorsal blotches paler brown except on posterior most part of body and on tail where they are again black; rostral wider than high, nearly flush with adjacent head scales, its anterior edge conforming to blunt anterior curve of snout when viewed from above; supralabial sutures posterior to level of eye not darkened; length of tail as a percentage of total length, .140 in one female, .153-.165 in three males.

The nearest subspecies in a geographic sense is P. c. sayi, known to occur just east of the Rocky Mountains; Burt & Hoyle (1934:209) recorded specimen of sayi from 3 mi. NW Diversion Dam (presumably Wind River Diversion Dam), Fremont Co., Wyoming. Klauber (1947:30) listed specimens of P. c. deserticola from 30 mi. E. Point of Rocks, Sweetwater Co., Wyoming and suggested (op.cit:35) that the subspecies possibly intergraded with

Pituophis catenifer deserticola (continued)

sayi farther eastward along Bitter Creek. As yet no such intergradation has been demonstrated, at least in southwestern Wyoming.

The female specimen (UU 3534) contained five oviducal eggs.

Thamnophis elegans vagrans (Baird & Girard) 1853 . . . Wandering garter snake

The collection includes 12 specimens of this subspecies from the following localities: Sweetwater Co., Wyoming -- 9 mi. S. Green River, 6025 ft. July 2, UU 3536; R. M. 360, 5800 ft., July 7, UU 3537-8; R. M. 328, 5850 ft., July 20, UU 3539. Daggett Co., Utah -- Hideout Forest Camp, R. M. 306.5, 5850 ft., July 25-29, UU 3540-3; R. M. 291, 5850 ft., July 23, UU 3544-6; Eagle Creek near confluence with Green River, 5840 ft., UU 3547. The two largest females in the series, collected on July 7, had complements of 16 and 13 embryos, respectively.

Crotalus viridis concolor Woodbury 1929 Yellow rattlesnake

Six specimens were collected at the following localities in Sweetwater Co., Wyoming -- 9 mi. S. Green River, 6025 ft., July 3, UU 3553; R. M. 366, 7000 ft., July 6, UU 3548; mouth of Blacks Fork, R. M. 356, 6000 ft., July 9, UU 3549, UU 3550; Blacks Fork, 20 mi. upstream from mouth, July 11, UU 3551-2. The subspecies is readily distinguishable by virtue of its generally faded and pallid dorsal coloration and relatively small adult size (total length of five adults, 505 to 665 mm.). Dorsal ground color of adults ranges from pale buff to smoke gray. Markings on head and dorsum are more distinct in smaller than in larger specimens. Where discernible, the dorsal blotches are elliptical or nearly circular and range in total number from 40 to 43, four to seven of these being bandlike and on the tail. Dorsal markings are distinctly darker than general ground color and have a ragged border of dark brown in smaller adults. In this small series it is evident that dorsal markings are obliterated gradually with age, fading first to approximately the same color as the dorsum and then losing their dark borders. In the oldest individuals, the only dark dorsal marks are the remaining fragments of the blotch-borders.

Data on scalation for the six specimens are as follows: ventrals 169-173, subcaudals 18-24, rows of scales at midbody 23-25. Of the three females collected, the largest (600 mm.) contained five embryos, the next largest (520 mm.) three embryos, and the smallest (505 mm.) no embryos.

The occurrence of this subspecies in southwestern Wyoming is generally accepted but few definite locality records from that region have been published heretofore. Klauber (1930:113) listed a specimen (USNM 48680) from 4 mi. N. Linwood, Daggett Co., Utah in Sweetwater Co., Wyoming.

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BIRDS OF FLAMING GORGE RESERVOIR BASIN

by

Clayton M. White and William H. Behle

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INTRODUCTION

A dam in Red Canyon being constructed by the U. S. Reclamation Service, when finished, will back water up the Green River 28 miles in Utah and an additional 60 miles in Wyoming. A floral and faunal survey of this basin made by the University of Utah prior to filling made possible collection of data on which this report is based.

Prior to the University of Utah's summer expedition of 1959 along the Flaming Gorge portion of the Green River in southwestern Wyoming and northeastern Utah, there were virtually no records from the canyon area itself although much work had been done on the birds of this general area (see Knight, 1902; Twomey, 1942; Behle and Ghiselin, 1959; and Hayward and Killpack, 1959). This paper summarizes the few records from the literature bearing on the immediate vicinity of the potential reservoir as well as the data gathered during 1959. On a reconnaissance trip from June 9 to June 11, A. M. Woodbury made special notes of birds. On the river trip from June 30 to August 1, Clayton M. White served as the ornithologist, although other members of the expedition contributed occasional records, especially Phil Dotson, Heber Hall, Guy Musser and Gerald Smith.

At present 155 kinds of birds are known from the reservoir site. Of these, 29 are water or shore birds and 126 are land birds. On the basis of seasonal status, the present indications are that 56 are permanent residents, 78 are summer residents, 11 are transients, seven are winter visitants and three are casual. Of the water-shore bird contingent, the most common forms are the great blue heron, the common merganser and the spotted sandpiper. Of the land birds, the nighthawk, the violet-green swallow, the yellow-breasted chat, and Brewer's blackbird were by far the most common at the time of the expedition.

AVIAN HABITATS

Several ecological situations or habitats with distinctive bird occupants were found. They are as follows:

OPEN WATER

The river itself is the primary source of open water but there are also some fairly large tributaries, such as Blacks Fork and Henrys Fork. The most distinctive bird of open water is the common merganser.

MARSH

Virtually the only places that marsh areas occurred were in the tributaries, with Henrys Fork furnishing the greatest number. The vegetation of these small

marsh areas consisted principally of patches of common wideleaf cattails, Typha domingensis L; bulrushes, Scirpus; sedge, Carex; and spike-rush, Eleocharis. Some of the marsh areas appeared to be intermittent, filling up only during periods of high water or during the spring rainfall. Brewer's blackbird is the most common bird of the marsh areas.

STREAMSIDE VEGETATION

The river banks and numerous islands were for the most part covered with the dominant streamside vegetation in the nature of a very dense, luxurious thicket. The shrub types are the sandbar willow, Salix exigua (Rydb.) Schu.; snowberry, Symphoricarpos alba (L.) Blake; wild rose, Rosa ultramontana (S.Wats.) Heller; squawbush, Rhus trilobata Nutt.; and the river birch, Betula fontinalis, Sarg. Much of the shrub-type vegetation was covered with a very thick growth of the vine-like clematis, Clematis ligusticifolia Nutt., thus making an ideal habitat for some of the small passerine birds.

Numerous groves of trees were also part of the streamside vegetation, the principal species being cottonwood, Populus angustifolia James and the boxelder, Acer interius Britt. Underlying the trees and shrubs was a conspicuous covering of grasses and herbs such as salt grass, Distichlis stricta (Torr.) Tydb.; squirrel tail, Hordeum jubatum J. G. Smith; Baltic rush, Juncus balticus Willd.; and the wild licorice, Glycyrrhiza lepidota Nutt. The streamside vegetation in many places constituted just a fringe, lining the river, but in other places it ran back from the river as far as 600 yards where it often mixed with the terrace vegetation. This streamside vegetation association attracts the greatest number of land birds. The magpie, yellow-breasted chat, and the mountain bluebird are distinctive of this habitat.

TERRACE VEGETATION

The terraces are for the most part old flood plains of the river. Most often the terraces are rather broad and wide and rise slowly to the hillsides. In the gorge itself, however, the terraces are often absent with the streamside vegetation progressing along a steep incline directly into the hillside vegetation. The terraces, for the most part, are rather dry and desert-like in character and as a consequence a good representation of desert-type birds are found there. The shrubs on the terraces vary from one to five feet in height. The principal vegetation types are the greasewood, Sarcobatus vermiculatus (Hook) Torr., the big sagebrush, Artemisia tridentata Nutt.; and rabbitbrush, Chrysothamnus spp. More often than not the areas between the shrubs support various grasses and herbs. In various places, due to overgrazing and other man-made causes, there are large areas of annual weeds. The surface of the soil is dry and often xerophytic types, such as the cacti, Opuntia, are also found. In places the terrace vegetation extends up onto the lower hillsides. The most distinctive birds of the terrace vegetation are the Brewer's blackbird, lark sparrow and sage thrasher.

HILLSIDE VEGETATION

In the open country above the mouth of Flaming Gorge Canyon, the big sagebrush dominates the landscape over the upland valleys, benches and foothills but in lower altitudes and south-facing slopes, it often yields to desert shrubs such as shadscale, Atriplex confertifolia (T. and F.) S. Wats.; winterfat, Eurotia lanata (Pursh.) Moq.; hop sage, Grayia spinosa (Hook) Moq., and many others.

Below the mouth of Flaming Gorge, the hillsides in the canyons are mostly dominated by the pigmy conifers of juniper and pinyon pine except on north-facing protected slopes in deep canyons where larger coniferous forest trees usually take possession. Most of these forests have an intermixture of big sagebrush or mountain brush in suitable openings in the forest cover.

The pigmy conifers consist mainly of Utah juniper, Juniperus osteosperma (Torr.) Little, and double-leaf pinyon pine, Pinus edulis Engelm. The larger conifers consist mainly of the ponderosa pine, Pinus ponderosa Lawson var. scopulorum Engelm., with occasional patches of Douglas fir, Pseudotsuga menziesii (Mirb.) Franco, and other minor components. These forests in the canyons are closely associated with those of the Uinta Mountains through which the canyons pass, and the avian fauna doubtless shares the same influence. The Clark's nutcracker is a common example.

CLIFFS AND TALUS SLOPES

In some places the hillsides are steep and rugged with cliffs and talus deposits that are free of vegetation. Such birds as rock wrens are attracted to this environment.

FARMLAND

A number of the farms found in the reservoir area are deserted and rundown with nothing but annual weeds such as the Russian thistle, Salsola kali L. Others are well kept and covered with desirable grasses and cultivated plants such as fescue, Festuca elatior L.; blue stem, Agropyron smithii Rydb.; timothy, Phleum pratense L.; clover, Trifolium pratense L.; and alfalfa, Medicago sativa L. Typical birds are the house sparrow and barn swallow.

ANNOTATED LIST
of the
BIRDS OF FLAMING GORGE

AVES (class) Birds

Ciconiiformes (order) Herons, storks, ibises and allies

Ardeidae (family) Herons and bitterns

Ardea herodias treganzai Court Great blue heron
Woodbury (field notes) reports seeing herons many times June 9 to 11, 1959, between river mile 369.7 and 325.3 as follows: single birds on June 10, at miles 369.7, 352, 351, 348, 347.5, 339, 336 and two at mile 333, while on June 11, three birds were seen at mile 332 and one each at mile 331 and 325.3. On July 7, one was seen at river mile 360. On July 15, four nests were found in cottonwood trees, one of which still contained two young birds that were nearly ready to fly. One bird was seen on July 22, 1959, up Henrys Fork one mile below Linwood, Utah. On July 23, nine birds were seen feeding together along the river at river mile 321. The species is a common summer resident.

Nycticorax nycticorax hoactli (Gmelin) Black-crowned night heron
One was seen on July 22, 1959, on Henrys Fork, two miles upstream from Green River at mile 317. Summer resident.

Botaurus lentiginosus (Rackett) American bittern
One was observed to fly from a marshy area along Henrys Fork, three miles upstream from Green River at river mile 317 on July 22, 1959. Summer resident.

Anseriformes (order) Screamers, swans, geese, ducks

Anatidae (family) Swans, geese and ducks

Branta canadensis (Linnaeus) Canada goose
Woodbury saw five at river mile 356.4 on June 9, 1959. White saw several at river mile 354 on July 12, eight at river mile 339 on July 16, and 11 at river mile 323 on July 22. The latter were flying up the river at dusk. The next day, at the same place, 11 were seen flying down river, possibly the same birds. Summer resident.

Anas platyrhynchos platyrhynchos Linnaeus Mallard
Woodbury saw one at Kincaid Ranch, river mile 377, on June 9, 1959. He also reported two at river mile 369.7 and 362.5 on June 10, two at river miles 351.5 and 339 on June 10, and three at river mile 312

Anas platyrhynchos platyrhynchos (continued)

on June 11. White saw one at mile 378 on July 2 and at mile 366 on July 5. On July 11 a female with five young was seen at mile 356. The next day, three downy young were seen at the same place and one was caught, possibly being one of the young of the day before. Eight adults were flushed from Currant Creek at river mile 352.5 on July 13. Permanent resident.

Anas acuta Linnaeus Pintail

Woodbury saw a female with nine young at river mile 351 on June 10, 1959. White saw a female with four young in a pond near the river at mile 320 on July 23. One was seen flying at river mile 357 on July 8. Six were flushed at Currant Creek (Holms Ranch) mile 356, on July 13. Summer resident.

Anas carolinensis Gmelin Green-winged teal

One was seen by Woodbury at river mile 362.5 and two at mile 354 on June 10, 1959. White saw four birds at Currant Creek (Holms Ranch), mile 352 on July 13. Summer resident.

Mareca americana (Gmelin) American widgeon

Reported as occurring on Green River by Knight (1902:32). Transient.

Spatula clypeata (Linnaeus) Shoveler

Reported by Knight (1902:33) for this region in Wyoming. Summer resident.

Aythya americana (Eyton) Redhead

Reported as being common by Knight (1902:34). Summer resident.

Aythya collaris (Donovan) Ring-necked duck

One specimen taken at Green River reported by Knight (1902:35). Transient.

Bucephala albeola (Linnaeus) Buffle-head

One was noted by Woodbury above the Kincaid Ranch at mile 383 on June 9, 1959. Guy Musser and Gerald Smith saw a male at the bridge at river mile 319.6 on July 23. Transient.

Oxyura jamaicensis rubida (Wilson) Ruddy duck

Two were seen by Woodbury at river mile 383 on June 9, 1959. Summer resident.

Lophodytes cucullatus (Linnaeus) Hooded merganser

Reported on the Green River by Knight (1902:31). Transient.

Mergus merganser americanus Cassin Common merganser

These birds were seen frequently in small flocks of from three to six as they traveled up and down the river. They usually uttered a continuous quacking. White saw five at river mile 359 on July 7, 1959, and single birds at mile 356 on July 8, and mile 350 on July 13. A female with two large young was seen in Kingfisher Canyon, mile 309, on July 24. Summer resident and transient.

Falconiformes (order) Vultures, hawks and falcons

Cathartidae (family) American vultures

Cathartes aura teter Friedmann Turkey vulture

Woodbury saw one flying over some cliffs at mile 363 on June 10, 1959, and two at mile 316 on June 11. White saw this species at mile 378 on July 1, at mile 356 on July 12, and at mile 328 on July 19. On July 23, White entered the gorge with Mr. and Mrs. Cliff Bosley of the Wyoming State Game and Fish Department in an air boat. The noise scared 17 vultures from one cliff in Horseshoe Canyon, mile 316, and six more from another cliff at mile 315. Common summer resident.

Accipitridae (family) Hawks and harriers

Accipiter gentilis atricapillus (Wilson) Goshawk

Reported from the Green Lakes by Twomey (1942:376). Permanent resident.

Accipiter striatus velox (Wilson) Sharp shinned hawk

White saw it only once when an adult male was observed at Allens Creek, river mile 294, on July 31, 1959. Two old nests were found that day, one being about 20 feet above the ground in a small yellow pine, the other in a small boxelder. Permanent resident.

Accipiter cooperii (Bonaparte) Cooper's hawk

White saw this hawk in Horseshoe Canyon, river mile 316 on July 23, 1959, and at Hideout Forest Camp, mile 306 on July 24, 1959. Several old nests were found in cottonwood trees above the camp and in one there was a tail feather from an adult bird. On July 30, 1959, an immature was seen flying across the river at Skull Creek, mile 299, and a nest of the year was found in a yellow pine. All the young had gone, but one was seen about 300 feet from the nest in a ponderosa pine. Permanent resident.

Buteo jamaicensis calurus (Cassin) Red-tailed hawk

This hawk was less numerous than one might expect, possibly because of the low mammal density in the area. It was most numerous around farmlands and pairs were found nesting in the cliffs near every one of the ranches visited. Of the several nests, White found three containing young. In two cases, the adult birds were of two color phases, the light or normal and the melanistic. Woodbury saw one on July 10, 1959, at river mile 349 and at river mile 338. On July 24, 1959, at river mile 313, a bird was seen chasing away a golden eagle. Another was seen at mile 307 on July 25. Permanent resident.

Buteo swainsoni Bonaparte Swainson's hawk

Woodbury saw a pair at river mile 354 on June 10, 1959. Phil Dotson and Gerald Smith saw one up Henrys Fork near the town of Linwood, Utah, on July 22, 1959. White saw one near the confluence of Henrys Fork and the Green River, mile 317 on July 23. Summer resident.



Fig. 1. A young golden eagle learning to fly was captured on Blacks Fork and kept several days with the expedition. Photo by Phil Dotson.

Fig. 2. A young prairie falcon captured and kept with the expedition. Photo by Gerald Groves.



Fig. 3. Two young prairie falcons captured at mile 352 were kept with the expedition. Photo by Phil Dotson.

Aquila chrysaetos canadensis (Linnaeus) Golden eagle

This was rather common along the river and abandoned nests were seen on nearly every suitable cliff. Woodbury saw a nest with two young at river mile 329.6 on June 11, 1959. Members of the survey caught an immature male nine miles up Blacks Fork, which, after three attempts at flying along the talus slopes, finally alighted in the river. Ned Eddins and Richard Dawson found a young bird which had recently left the nest at mile 354 on July 11. Permanent resident.

Circus cyaneus hudsonius (Linnaeus) Marsh hawk

This hawk was only seen on a few occasions probably because of the lack of marshy areas suitable for nesting. Woodbury saw one at river mile 349 on June 10, 1959. White saw an adult male at river mile 328 on July 19, and found a nest of four young near the confluence of Henrys Fork and Green River at mile 317 on July 22. One was seen at mile 348 on July 15. Permanent resident.

Pandionidae (family) Ospreys

Pandion haliaetus carolinensis (Gmelin) Osprey

The first one was seen by Gerald Smith at river mile 323 on July 20, 1959, and one was seen regularly near that campsite for the next three days. Smith and Musser saw one take a fish from the river on July 22, 1959. White and Cliff Bosley, while in Horseshoe Canyon on July 23, 1959, found a nest located on the top of a needle-like rock at mile 315. The following day White found another nest at mile 313.5 and found that both that nest and the one previously found each contained two young. Summer resident.

Falconidae (family) Caracaras and falcons

Falco mexicanus Schlegel Prairie falcon

This was probably the most common raptor along the river. Eight eyries, with young, were found and on one occasion, an adult was seen carrying prey to the eyrie. Woodbury reported seeing a prairie falcon at river mile 344.5 on July 10, 1959. Permanent resident.

Falco columbarius columbarius Linnaeus Pigeon hawk

Knight (1902:74) reports specimens taken from Green River. Permanent resident.

Falco columbarius richardsonii Ridgway Pigeon hawk

Knight (1902:75) reports that specimens were taken from Green River. Rare transient.

Falco sparverius sparverius Linnaeus Sparrow hawk

This species was common on the river. Woodbury saw one at river mile 354 and another at mile 332 on June 10, 1959. White saw a male on July 4, 1959, at mile 371. It tried several times to seize a young violet-green swallow at a nest. Despite much harassing from the numerous adult

Falco sparverius sparverius (continued)

swallows, he finally succeeded in reaching into one of the nests, capturing a young bird and making off with it. Smith, Musser, and Dotson caught two young birds (male and female) near the Holms Ranch, mile 352, on July 13. Permanent resident.

Galliformes (order) Gallinaceous birds

Tetraonidae (family) Grouse and ptarmigans

Dendragapus obscurus (Say) Blue grouse

Phil Dotson and Gerald Smith saw one up Eagle Creek one and one-half miles from the Green River, mile 302, on July 28, 1959. Permanent resident.

Bonasa umbellus umbelloides (Douglas) Ruffed grouse

Seen at Green Lake by Twomey (1942:385). Permanent resident.

Centrocercus urophasianus (Bonaparte) Sage grouse

Three birds were seen by White up Blacks Fork near Highway 530 on July 9, 1959, about 15 at river mile 347.5 on July 15, and about 20 at river mile 320 on July 23, 1959. Ned Eddins reported about 30 on Dead Man's Island, mile 331, on July 19. Permanent resident.

Phasianidae (family) Partridge, pheasants and quails

Phasianus colchicus Linnaeus Ring-necked pheasant

One was heard crowing a mile below Linwood, Utah, on July 22, 1959. Permanent resident.

Alectoris graeca (Meisner) Chukar

One specimen: one mile from confluence of Sheep Creek and Green River, river mile 309.3, Daggett County, Utah, 5,880 feet, July 27, 1959. This partridge was seen in fairly large numbers in the general area of Sheep Creek and Red Bench where one was collected from a flock of about 25. They were heard at mile 318 on July 24, 1959, and at various points along the river between mile 318 and 306 on July 24. A flock of 15 was seen at mile 308 on July 29. Permanent resident.

Gruiformes (order) Cranes, rails and allies

Rallidae (family) Rails, gallinules and coots

Fulica americana americana Gmelin Coot

Woodbury saw one at river mile 345 on June 10, 1959. Summer resident.

Charadriiformes (order) Shorebirds, gulls and allies

Charadriidae (family) Plovers, turnstones and surf-birds

Charadrius vociferus vociferus Linnaeus Killdeer

Smith saw a killdeer with young at Chicken Draw Springs, river mile 367, on July 7, 1959. Others were seen up Blacks Fork on July 11, 12 and 13. A pair with three young, was seen at mile 378 on July 15. Five birds were seen on a marshy area at the confluences of Henrys Fork and the Green River, mile 317 on July 22. Permanent resident.

Scolopacidae (family) Woodcock, snipe and sandpipers

Capella gallinago delicata (Ord) Wilson's snipe

White saw one in Henrys Fork, two miles below Linwood, Utah, on July 22, 1959. One was seen at river mile 349 on July 16, 1959. Summer resident.

Actitis macularia (Linnaeus) Spotted sandpiper

Two specimens: river mile 356, Green River, Sweetwater County, Wyoming, 5,970 feet, July 13, 1959 and river mile 320, Green River, Daggett County, Utah, 5,900 feet, July 23, 1959. This was the most common shore bird, being seen every few miles. A pair of adults and four downy young were seen 11 miles up Blacks Fork on July 12, 1959. Their characteristic calls were heard nearly anytime from dawn to dusk at almost any point on the river. Summer resident.

Tringa solitaria cinnamomea (Brewster) Solitary sandpiper

White saw one at the edge of Currant Creek, river mile 352 on July 13, 1959. Transient.

Catoptrophorus semipalmatus inornatus (Brewster) . . . Western willet

One specimen: river mile 323 Green River, Sweetwater County, Wyoming, 5,900 feet, July 23, 1959. Summer resident.

Erolia bairdii (Coues) Baird's sandpiper

White saw three on a pond about three quarters of a mile from the river at mile 321.5 on July 22, 1959. Transient.

Erolia minutilla (Vieillot) Least sandpiper

Small flocks were seen at Green Lake by Twomey (1942:393). Transient.

Ereunetes pusillus (Linnaeus) Semipalmated sandpiper

Seen during migration at Green Lake by Twomey (1942:395). Transient.

Ereunetes mauri Cabanis Western sandpiper

One specimen: River mile 320, Green River, Daggett County, Utah, 5,900 feet, July 22, 1959. A flock of five was feeding in a pond at the edge of the river when the one was collected. Transient.

Recurvirostridae (family) Avocets and stilts

Recurvirostra americana Gmelin Avocet

One was seen at the Wyoming-Utah border, river mile 322, on July 24, 1959. Summer resident.

Himantopus mexicanus (Muller) Black-necked stilt.

Guy Musser saw one at river mile 321 on July 23, 1959. Summer resident.

Laridae (family) Gulls and terns

Larus californicus Lawrence California gull

White saw this bird on three occasions, once at dusk at river mile 356 on July 10, 1959, again at mile 350 on July 14, and at mile 328 on July 19, 1959. Casual.

Larus pipixcan Wagler Franklin's gull

A pair was seen at dusk going up stream at river mile 328 on July 19, 1959. Casual.

Columbiformes (order) Sand-grouse, pigeons, doves

Columbidae (family) Pigeons and doves

Columba livia Gmelin Rock dove or domestic pigeon

White saw several in rocks and cliffs by a spring at river mile 323 on July 21, 1959; others were seen up Henrys Fork and near Linwood, Utah, on July 22, 23, 1959. Permanent resident.

Zenaidura macroura marginella (Woodhouse) Mourning dove

They were very common along the river, and in some places occurred in large concentrations. A flock of about 75 was seen feeding in an acre plot of poverty weed (Iva axillaris) and goosefoot (Chenopodium album) at river mile 335 on July 17, 1959. A flock of about 50 was seen feeding in big sagebrush at mile 339 on July 18. Summer resident.

Strigiformes (order) Owls

Strigidae (family) Typical owls

Otus asio (Linnaeus) Screech owl

Heber H. Hall saw one at river mile 368 on July 5, 1959. The following day White frightened one from a flicker hole in a cottonwood tree at mile 366. Permanent resident.

Bubo virginianus (Gmelin) Great horned owl

This owl was occasionally seen but many nesting and roosting sites were found, as well as many pellets, indicating that it is common. Woodbury saw one at river mile 352.5 on June 10, 1959. A nest with one young, which flew when disturbed, was found at mile 332 on June 10. White found two young, hardly able to fly, up Blacks Fork, 11 miles from the Green River at mile 356 on July 11, 1959. On July 15, two young birds were seen in cliffs at mile 347. Permanent resident.

Asio otus wilsonianus (Lesson) Long-eared owl

Two specimens: river mile 366. Green River, Sweetwater County, Wyoming, 5,980 feet, July 5, 1959. One was seen at Kincaid Ranch, river mile 377, on June 30. A nest with three young was located about 25 feet up a cottonwood, at river mile 366 on July 4. Permanent resident.

Caprimulgiformes (order) Goatsucker and allies

Caprimulgidae (family) Goatsuckers

Phalaenoptilus nuttallii nuttallii (Audubon) Poor-will

One specimen: River mile 376, Green River, Sweetwater County, Wyoming, 5,980 feet, July 5, 1959. On various occasions, the calls of this species could be heard in the distance and White saw three at river mile 376 on July 5, as they dashed through camp, presumably in pursuit of insects. One was collected. Summer resident.

Chordeiles minor howelli Oberholser Nighthawk

Four specimens: River mile 378, Sweetwater County, Wyoming, 6,025 feet, July 2, 1959; river mile 378, Sweetwater County, Wyoming, 6,025 feet, July 3, 1959; river mile 350, Sweetwater County, Wyoming, 5,910 feet, July 15, 1959. Nighthawks were seen nearly every night during the river trip. Large numbers were also seen during daylight hours feeding on the hordes of mayflies. Summer resident.

Apodiformes (order) Swifts and hummingbirds

Apodidae (family) Swifts

Aeronautes saxatalis saxatalis (Woodhouse) White-throated swift

Swifts were seen wherever the cliffs were high and rough. White found them nesting up Blacks Fork 10 miles from the Green River on July 11, 1959. Summer resident.

Trochilidae (family) Hummingbirds

Archilochus alexandri (Bourcier and Mulsant) Black-chinned hummingbird

White saw one, a male, at Hideout Forest Camp, mile 305, on July 27, 1959. Summer resident.

Selasphorus platycercus platycercus (Swainson) Broad-tailed hummingbird

White found them at river mile 323 on July 20, 1959. They were feeding on drops of liquid on the leaves of cottonwood. Upon examination, the liquid proved to be that produced by aphids. They were also seen at mile 306 on July 27, and at Carter Creek, mile 303, on July 28. Summer resident.

Coraciiformes (order) Kingfisher and allies

Alcedinidae (family) Kingfisher

Megaceryle alcyon caurina (Grinnell) Belted kingfisher

White saw a pair in Kingfisher Canyon, river mile 308, on July 24, 1959, one at mile 300 on July 30, and one at Trail Creek, mile 294, on July 31. Summer resident.

Piciformes (order) Woodpecker and allies

Picidae (family) Woodpeckers

Colaptes cafer collaris Vigors Red-shafted flicker

One specimen: River mile 305, Green River, Sweetwater County, Wyoming, 5,910 feet, July 14, 1959. They were seen or heard at all of the campsites and were most often found where there were cottonwoods. Permanent resident.

Sphyrapicus varius nuchalis Baird Yellow-bellied sapsucker

Several specimens were collected by Twomey (1942:407) at Green Lake. Summer resident.

Sphyrapicus thyroideus nataliae (Malherbe) Williamson's sapsucker

Twomey (1942:408) collected this sapsucker at Green Lake. This high altitude forest bird was not seen in the low canyons. Summer resident.

Dendrocopos villosus monticola (Anthony) Hairy woodpecker

Richard Dawson reported seeing this bird twice, once at river mile 308 on July 26, 1959 and again at Hideout Forest Camp, mile 306, on July 27. White saw one fly across the river and into a yellow pine (Pinus ponderosa) at mile 303 on June 30. Twomey (1942:408) took specimens at Green Lake. Permanent resident.

Dendrocopos pubescens leucurus (Hartlaub) Downy woodpecker

White saw one near Kincaid Ranch, river mile 378, on June 30, 1959 and one feeding in the cottonwoods at mile 372 on July 3. Twomey (1942:409) reported collecting specimens from Green Lake. Summer resident.

Passeriformes (order) Perching birds

Tyrannidae (family) Tyrant flycatchers

Tyrannus tyrannus (Linnaeus) Eastern kingbird

One specimen: Henrys Fork two miles from confluence of Green River and Henrys Fork, 5,890 feet, Daggett County, Utah, July 23, 1959. White saw several in Henrys Fork on July 22 and 23, 1959. Woodbury also reported seeing a kingbird lacking a yellow breast, and thus presumably of this species, at river mile 361.5 on June 10, 1959. Summer resident.

Tyrannus verticalis Say Western kingbird

One was seen at Linwood, Utah, on July 23, 1959. Summer resident.

Myiarchus cinerascens cinerascens (Lawrence) Ash-throated flycatcher

One was seen at Kincaid Ranch, mile 378, on June 30, 1959. Summer resident.

Sayornis saya saya (Bonaparte) Say's phoebe
One specimen: River mile 373, Green River, Sweetwater County, Wyoming,
6,070 feet, July 4, 1959. Phoebes were rather common, being seen every
few miles and in many cases they were found nesting in the cliffs or
feeding young which had recently left the nest. Summer resident.

Empidonax traillii (Audubon) Traill's flycatcher
White saw a pair feeding in big sagebrush adjacent to willows and cotton-
woods near the river at mile 378, on July 1, 1959. Summer resident.

Empidonax hammondi (Xantus) Hammond's flycatcher
One was collected by Twomey (1902:412) at Green Lake. Summer resident.

Empidonax wrightii Baird Gray flycatcher
One specimen: River mile 366, Green River, Sweetwater County, Wyoming
5,980 feet, July 5, 1959. It was feeding in a cottonwood when collected.
Summer resident.

Contopus sordidulus veliei Coues Western wood peewee
White saw one at river mile 351 on July 13, 1959. Summer resident.

Alaudidae (family) Larks

Eremophila alpestris leucolaema Coues Horned lark
Two specimens: One adult and one immature, Blacks Fork, 14 miles from
confluence of Blacks Fork and Green River, Sweetwater County, Wyoming,
5,980 feet, July 11, 1959. They were seen most frequently on the ter-
races some distance from the river. Many were seen near Blacks Fork on
July 11, and a large number were seen near mile 350 on July 15, 1959.
Permanent resident.

Hirundinidae (family) Swallows

Tachycineta thalassina lepidus Mearns Violet-green swallow
Two specimens: River mile 378, Green River, Sweetwater County, Wyoming,
6,025 feet, July 3, 1959. They were common and were seen every few
miles the entire length of the trip from mile 378 to 291, from June 30
to August 1, 1959. Summer resident.

Iridoprocne bicolor (Vieillot) Tree swallow
Woodbury reported some at river mile 315 on June 11, 1959. White
saw some also at the same place on July 24, 1959. Summer resident.

Riparia riparia riparia (Linnaeus) Bank swallow
White saw some near Currant Creek at river mile 343 on July 13, 1959.
Summer resident.

Stelgidopteryx ruficollis serripennis (Audubon) Rough-winged swallow
White saw five up Blacks Fork four miles from its confluence with the
Green River at river mile 356 on July 8, 1959. Summer resident.

Hirundo rustica erythogaster Boddaert Barn swallow
White saw several up Henrys Fork around Linwood, Utah; July 22, 1959.
Summer resident.

Petrochelidon pyrrhonota pyrrhonota (Vieillot) Cliff swallow
Two specimens: River mile 352, Green River, Sweetwater County, Wyoming,
5,960 feet, July 13, 1959. Woodbury saw a nesting colony at river mile
358.5 and also at river mile 329.6 and mile 325 on June 11. White saw
a few at mile 357 on June 7, and a very large concentration feeding at
the mouth of Currant Creek, mile 352.5 on July 13, where the two were
taken. Summer resident.

Corvidae (family) Jays, magpies and crows

Perisoreus canadensis capitalis Ridgway Gray jay
Three of these jays were seen by Twomey (1942:417) at Green Lake in the
yellow pine forest. Permanent resident.

Cyanocitta stelleri annectens (Baird) Steller's jay
White saw one lone bird in a ponderosa pine in Red Canyon, river mile
303, on July 30, 1959. Permanent resident.

Aphelocoma coerulescens (Bosc) Scrub jay
White noted several at Red Bench just north of Sheep Creek at river mile
310 on July 27, 1959. Permanent resident.

Pica pica hudsonia (Sabine) Magpie
One specimen: A juvenile, river mile 378, Green River, Sweetwater
County, Wyoming, 6,025 feet, July 1, 1959. Magpies were common and
were seen the entire length of the trip, river mile 378 to 291 from
June 30 to August 1, 1959. Many nests and young were found. The
nests were usually placed in cottonwood trees. Permanent resident.

Corvus corax sinuatus Wagler Raven
A pair was seen one mile above the mouth of Blacks Fork at river mile
357 on July 9, 1959. Permanent resident.

Gymnorhinus cyanocephala Wied Pinyon jay
One was seen at river mile 322 on July 23, 1959, and again at mile 309
on July 25. Permanent resident.

Nucifraga columbiana (Wilson) Clark's nutcracker
One specimen: River mile 307, near Hideout Forest Camp, Green River,
Daggett County, Utah, 5,850 feet, July 27, 1959. They were seen mainly
around the Carter Creek area, river mile 303, and thence down to the
Ashley Falls area at mile 282. White saw them every day from July 24,
1959, mile 307 to August 1, 1959, mile 291. Permanent resident.

Paridae (family) Chickadees, titmice, verdins and bushtits

Parus atricapillus garrinus Behle Black-capped chickadee
One specimen: River mile 366, Green River, Sweetwater County, Wyoming,
5,980 feet, July 5, 1959. White first heard a chickadee at Kincaid Ranch,
river mile 378 on June 30, 1959. Later one was seen at mile 372 on July
3. A pair with five young was seen at mile 366, on July 5, where one
adult was collected. Permanent resident.

Parus gambeli gambeli Ridgway Mountain chickadee
Twomey (1942:422) took specimens at Green Lake. Permanent resident.

Parus inornatus ridgwayi Richmond Plain titmouse
Two specimens: Hideout Forest Camp on the Green River, river mile 306.
Daggett County, Utah, 5,900 feet, July 26, 1959. White saw five birds
in the junipers above Hideout Forest Camp, river mile 306 on July 26,
1959, and some were seen near Sheep Creek at mile 310 on July 27.
Permanent resident.

Psaltiriparus minimus plumbeus (Baird) Bushtit
White recorded a flock of about twenty at the Hideout Forest Camp,
river mile 306, on July 24, 1959, and another flock at mile 304 on
July 29. Permanent resident.

Sittidae (family) Nuthatches

Sitta carolinensis nelsoni Mearns White-breasted nuthatch
Several were collected at Green Lake by Twomey (1942:422). Permanent
resident.

Sitta canadensis Linnaeus Red-breasted nuthatch
One specimen was collected at Green Lake by Twomey (1942:424). Per-
manent resident.

Sitta pygmaea melanotis Van Rossem Pygmy nuthatch
Three specimens were collected at Green Lake, while feeding in yellow
pine, by Twomey (1942:424). Permanent resident.

Certhiidae (family) Creepers

Certhia familiaris montana Ridgway Brown creeper
Twomey (1942:424) collected several of these at Green Lake. Permanent
resident.

Cinclidae (family) Dippers

Cinclus mexicanus unicolor Bonaparte Dipper or water ouzel
A pair was seen at Skull Creek, river mile 299 on July 30, 1959.
Permanent resident.

Troglodytidae (family) Wrens

Troglodytes aedon parkmanii Audubon House wren

A pair was seen by White, feeding in a squawbush at river mile 305 on July 24, 1959. Summer resident.

Thryomanes bewickii eremophilus Oberholser Bewick's wren

White found a nest of four young in a woodpecker hole about 30 feet up a cottonwood tree, at river mile 378 on July 1, 1959, and some adults at mile 366 on July 5. Permanent resident.

Telmatodytes palustris plesius (Oberholser) Long-billed marsh wren

Three were seen in a marshy area four miles up Henrys Fork on July 22, 1959. Permanent resident.

Catherpes mexicanus conspersus Ridgway Canyon wren

This wren was seen only three times, at river mile 297 and mile 290 on July 21 and at mile 291 on August 1. Permanent resident.

Salpinctes obsoletus obsoletus (Say) Rock wren

Three specimens (one adult, two immatures): River mile 365, Green River, 5,980 feet, Sweetwater County, Wyoming, July 10 and 12, 1959. Rock wrens were seen throughout the trip from river mile 378 to river mile 291 between June 29 and August 1, 1959. Summer resident.

Mimidae (family) Mocking birds and thrashers

Mimus polyglottos leucopterus (Vigors) Western mockingbird

Durrant saw three harassing a prairie falcon at Buckboard Ranch, river mile 350, 5,910 feet, on July 14, 1959. Two specimens (one adult and one immature) taken at same place July 15, Summer resident.

Oreoscoptes montanus (Townsend) Sage thrasher

Three specimens (two adults and one immature): River mile 320 Green River, Daggett County, Utah, 5,900 feet, July 22, 1959. They were rather common throughout the trip and especially numerous up Blacks Fork. Summer resident.

Turdidae (family) Thrushes, bluebirds and solitaires

Turdus migratorius propinquus Ridgway Robin

Seen throughout the Flaming Gorge, being most numerous around cottonwoods. Summer resident.

Sialia mexicana Swainson Western bluebird

Three of these birds, two adults and one immature, were seen at river mile 347 on July 15, 1959. Permanent resident.

Sialia currucoides (Bechstein) Mountain bluebird

Two specimens: River mile 323, Green River, Sweetwater County, Wyoming, 5,900 feet July 19, 1959. Bluebirds were most frequently seen in family groups and even though the immatures were seemingly old enough to feed themselves, the parents were still feeding them. Woodbury reported a pair at river mile 377 on June 9, 1959. White saw a family of seven at mile 366 on July 5, while on July 16 two different groups, one of six and one of five, were seen at mile 339. Another group of five was seen on July 19, at mile 323. They were usually seen in association with cottonwood trees. Summer resident.

Myadestes townsendi townsendi (Audubon) Townsend's solitaire

Several specimens were collected by Twomey (1942:432) at Green Lake. Summer resident.

Sylviidae (family) Old world warblers, gnatcatchers and kinglets

Polioptila caerulea amoenissima Grinnell Blue-gray gnatcatcher

Two specimens (one adult and one juvenile): River mile 371, Green River, Sweetwater County, Wyoming, 6,020 feet, July 4, 1959. A family group of five was seen at river mile 368 on July 3, 1959, and the following day a family was seen at mile 371. Summer resident.

Regulus calendula cineraceus Grinnell Ruby-crowned kinglet

These were reported by Knight (1902:156) as being seen at Henrys Fork, Twomey (1942:433) found them at Green Lake. Permanent resident.

Motacillidae (family) Wagtails and pipits

Anthus spinoletta alticola Todd Water pipit

Some specimens were collected by Twomey (1942:434) at Green Lake and Knight (1902:149) reported them from Henrys Fork. Summer resident.

Laniidae (family) Shrikes

Lanius excubitor Linnaeus Northern shrike

These were reported at Green River by Knight (1902:141). Winter visitant.

Lanius ludovicianus Linnaeus Loggerhead shrike

One specimen: River mile 321, Green River, 5,900 feet, Daggett County, Utah, July 22, 1959. Shrikes were seen by White at mile 370 on July 3, 1959, and mile 357 on July 8. An adult and three young were seen at mile 352 on July 13. Twomey (1942:435) and Miller (1931) indicate that the Flaming Gorge area lies within the transitional zone between excubitorides and gambeli. Summer resident.

Sturnidae (family) Starlings

Sturnus vulgaris vulgaris Linnaeus Starling

One lone bird was seen at river mile 376 on July 7, 1959, and five at river mile 345 on July 15, 1959. Two flocks of about eight birds each were seen at dusk flying toward the Brinegar Ranch, mile 339, on July 16. Permanent resident.

Vireonidae (family) Vireos

Vireo solitarius plumbeus Coues Solitary vireo

White saw one feeding in sand bar willows (Salix exigua) at river mile 366 on July 5, 1959. Summer resident.

Vireo gilvus swainsonii Baird Warbling vireo

A pair feeding three young was seen by White at the Hideout Forest Camp, river mile 306, on July 26, 1959. Summer resident.

Vermivora celata celata (Say) Orange-crowned warbler

Twomey (1942:438) assigned two specimens taken at Green Lake to this race. Transient.

Vermivora celata orestera Oberholser Orange-crowned warbler

Specimens from this resident race were also taken by Twomey (1942:438) at Green Lake. Summer resident.

Vermivora virginiae (Baird) Virginia's warbler

Several, most of which appeared to be immature, were seen at Hideout Creek, river mile 306, on July 6, 1959. Summer resident.

Dendroica petechia morcomi Coale Yellow warbler

One specimen: river mile 378, Green River, Sweetwater County, Wyoming, 6,025 feet, July 1, 1959. Yellow warblers were very common along the Green River wherever there were cottonwoods, sandbar willows or some other type of streamside vegetation. Summer resident.

Dendroica auduboni memorabilis Oberholser Audubon warbler

Several specimens were taken at Green Lake by Twomey (1942:442). Summer resident.

Dendroica nigrescens (Townsend) Black-throated gray warbler

One specimen: River mile 372, Green River, Sweetwater County, Wyoming, 6,075 feet, July 4, 1959. This warbler was seen on three occasions, once at river mile 372 on July 4, 1959, at mile 366 on July 5, feeding in a cottonwood, and at mile 310 on July 27, feeding in a juniper. Summer resident.

Geothlypis trichas occidentalis Brewster Yellow-throat

Two specimens (one adult and one immature): River mile 371, Green River Sweetwater County, Wyoming, 6,075 feet, July 4, 1959. Yellow-throats were also found commonly along the river bank of the Green river usually where there were sandbar willows. Summer resident.

Icteria virens auricollis (Deppe) Yellow-breasted chat
Two specimens: River mile 378, Green River, Sweetwater County, Wyoming,
6,025 feet, June 30 and July 1, 1959. They were seen or heard virtually
every day of the trip from river mile 378 to river mile 291. They fre-
quented the dense streamside vegetation. Summer resident.

Wilsonia pusilla pileolata (Pallas) Wilson warbler
Knight (1902:149) records them as being taken at Henrys Fork and Twomey
(1942:448) reports that specimens were taken at Green Lake. Summer
resident.

Ploceidae (family) Weaver finches

Passer domesticus domesticus (Linnaeus) House sparrow
The species was seen only three times: at the Kincaid Ranch, river mile
377 on June 30, 1959, at the Brinegar Ranch, mile 337 on July 18, and up
Henrys Fork around Linwood, Utah, on July 23. Permanent resident.

Icteridae (family) Meadowlarks, blackbirds and allies

Sturnella neglecta Audubon Meadowlark
They were seen numerous times along the Green River on an average of
one every four or five miles. Permanent resident.

Xanthocephalus xanthocephalus (Bonaparte) Yellow-headed blackbird
They were seen only twice, once above the Brinegar Ranch, at river mile
341 on July 15, 1959 and up Henrys Fork one mile below Linwood, Utah, on
July 23. Summer resident.

Agelaius phoeniceus fortis Ridgway Redwinged blackbird.
Two were seen below the Kincaid Ranch at river mile 376 on July 2, 1959,
five were seen above the Brinegar Ranch at mile 341 on July 16, and
several were noted up Henrys Fork and near its mouth at mile 320 on
July 20, 22, and 23. Permanent resident.

Icterus bullockii (Swainson) Bullock's oriole
One specimen: River mile 378, Green River, near Kincaid Ranch, Sweet-
water County, Wyoming, 6,025 feet, July 2, 1959. A pair was noted at the
Kincaid Ranch at river mile 378 on July 2, 1959, and again at the Brinegar
Ranch, mile 339, on July 16. Summer resident.

Euphagus cyanocephalus (Wagler) Brewer's blackbird
One specimen: River mile 360, Green River, Sweetwater County, Wyoming,
5,970 feet, July 7, 1959. This species was ubiquitous, being found
literally everywhere in the Flaming Gorge area. Permanent resident.

Molothrus ater artemisiae Grinnell Cowbird
Two were seen, one at the Kincaid Ranch, river mile 377, on July 22, 1959,
and the other about one and one-half miles above Linwood, Utah, on July
23. Permanent resident.

Thraupidae (family) Tanagers

Piranga ludoviciana (Wilson) Western tanager

White saw this species flying from a Douglas Fir about three miles up Sheep Creek, July 25, 1959. Summer resident.

Fringillidae (family) Grosbeaks, finches, sparrows and buntings

Pheucticus melanocephalus melanocephalus (Swainson) . . Black-headed grosbeak

Twomey (1942:457) collected some at Green Lake. Summer resident.

Passerina cyanea (Linnaeus) Indigo bunting

One specimen: River mile 372, Green River, Sweetwater County, Wyoming, 6,050 feet, July 4, 1959. This species was seen by White at one and one-half miles above the Hideout Forest Camp at mile 307.5 on the morning of July 30. Guy Musser reported one at mile 307 on July 29. Casual.

Passerina amoena (Say) Lazuli bunting

One specimen: River mile 373, Green River, Sweetwater County, Wyoming, 6,025 feet, July 4, 1959. Buntings were seen the entire length of the trip. They were especially numerous up Sheep Creek. Summer resident.

Hesperiphona vespertina brooksi Grinnell Evening grosbeak

Three specimens were taken at Green Lake by Twomey (1942:459) who assigned them to the race montana. However, the A.O.U. checklist, fifth ed. 1957, lists this area within the range of brooksi. Winter visitant.

Carpodacus cassinii Baird Cassin's finch

A male was seen feeding a brood of young birds in Kingfisher Canyon, river mile 312, on July 24, 1959. Summer resident.

Carpodacus mexicanus frontalis (Say) House finch

This species was abundant, being seen every two or three days the entire length of the trip. Permanent resident.

Acanthis flammea (Linnaeus) Common redpoll

This species was reported by Knight (1902:122) from Wyoming. Winter visitant.

Spinus pinus pinus (Wilson) Pine siskin

One specimen: Sheep Creek, four miles from the Green River, 5,900 feet, July 27, 1959. This was one of a pair seen feeding young in a native alder. Permanent resident.

Spinus tristis pallidus Mearns Pale goldfinch

A flock of about twenty was seen feeding on thistle near Henrys Fork at river mile 319.5 on July 20, 1959. Permanent resident.

Loxia curvirostra benti Griscom Red crossbill
Twomey (1942:464) collected the species at Green Lake. Summer resident.

Loxia curvirostra grinnelli Griscom Red crossbill
Two specimens were taken in Hideout Canyon by Selander (1953:159) and also reported by Behle and Ghiselin (1958:18). Summer resident.

Chlorura chlorura (Audubon) Green-tailed towhee
White saw one at Red Bench above Sheep Creek at river mile 310 on July 27, 1959. Twomey (1942:466) took specimens at Green Lake. Summer resident.

Pipilo erythrophthalmus montanus Swarth Rufous-sided towhee
One specimen (immature): Hideout Forest Camp, river mile 306, Green River, Daggett County, Utah, 5,850 feet, July 25, 1959. A pair was seen at Hideout Forest Camp, river mile 306, on July 25, 1959, when a young bird was caught in a mammal trap. White saw another one at river mile 310 on July 27, 1959. Behle and Ghiselin (1958:19) reported them at Hideout Canyon. Permanent resident.

Poocetes gramineus confinis Baird Vesper sparrow
Woodbury found a nest under a small sagebrush. It contained three eggs and one pebble which looked much like an egg, having similar markings. At river mile 332 on June 10, 1959, White found the species numerous up Blacks Fork on July 11, 1959, and also at Brinegar Ranch, mile 339, on July 16. Summer resident.

Chondestes grammacus strigatus Swainson Lark sparrow
One specimen: River mile 370, Green River, Sweetwater County, Wyoming, 6,025 feet, July 4, 1959. They were numerous, being seen every few days during the trip. Summer resident.

Amphispiza belli nevadensis (Ridgway) Sage sparrow
One specimen: River mile 371, Green River, Sweetwater County, Wyoming, 6,000 feet, July 4, 1959. This species was fairly common, being seen every few miles along the Green River. The specimen collected had been incubating a nest of three eggs which was located under a hop sage. Summer resident.

Junco hyemalis (Linnaeus) Slate-colored junco
They were reported by Knight (1902:132) as occurring along the Green River in Wyoming. Winter visitant.

Junco oreganus mearnsi Ridgway Oregon junco
Several specimens were collected at Green Lake by Twomey (1942:471). Winter visitant.

Junco caniceps caniceps (Woodhouse) Gray-headed junco
Twomey (1942:471) found this species nesting at Green Lake. Summer resident.

Spizella arborea ochracea Brewster Tree sparrow
Knight (1902:130) reports them from Henrys Fork area. Winter visitant.

- Spizella passerina arizonae Coues Chipping sparrow
One specimen: Skull Creek, river mile 299, Green River, 5,800 feet, Daggett County, Utah, July 31, 1959. This species was seen on two occasions, once at river mile 372 on July 4, 1959, and again in Red Canyon at Skull Creek, mile 299 on July 31. Summer resident.
- Spizella breweri breweri Cassin Brewer's sparrow
Two specimens (one adult and one juvenile): Kincaid Ranch, river mile 378, Green River, 6,025 feet, Sweetwater County, Wyoming, June 30, July 1, 1959. This species was common and was found the entire length of the trip from river mile 378 to river mile 291 from July 30 to August 1, 1959. Summer resident.
- Zonotrichia leucophrys oriantha Oberholser White-crowned sparrow
One was seen at the Kincaid Ranch, river mile 378 on July 1, 1959. Permanent resident.
- Melospiza lincolni alticola (Miller and McCabe) Lincoln sparrow
Knight (1902:134) reported specimens taken from Henrys Fork and Twomey (1942:475) collected them at Green Lake. Winter visitant.
- Melospiza melodia montana Henshaw Song sparrow
They were seen on numerous occasions. A pair was found on an island, at river mile 340, on July 16, 1959 feeding three young. Permanent resident.

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MAMMALS OF FLAMING GORGE RESERVOIR BASIN

by

Stephen D. Durrant and Nowlan K. Dean

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INTRODUCTION

The junior author, a member of the expedition through the Flaming Gorge Reservoir Site from June 28 to August 2, 1959 under the auspices of the University of Utah Flaming Gorge Project, was in charge of the vertebrate collection. His main duties consisted of collecting and preserving mammalian specimens under the direct supervision of Dr. Stephen D. Durrant, Field Director. In addition to the above mentioned duties, he obtained some data of ecological significance. Several members of the expedition aided him at odd times but Gary L. Ranck helped daily in the setting out of traps and preparation of specimens. The major part of the collection of mammals was obtained by Museum Special snap traps; some were obtained by shooting and some few skeletal remains were "pick ups".

The primary purpose of the expedition was the study of the vegetation of the basin of the Flaming Gorge Reservoir; all other activities were secondary to this main objective. Unlike the expedition through Glen Canyon in 1958, where the activities were not conducive to the collecting of mammals, the expedition through Flaming Gorge was adequate for this purpose. In Glen Canyon 25 camps were established in 40 days, requiring almost daily movement; in Flaming Gorge, but 12 camps were established in 35 days. With the exception of three camps which were each of one night duration, the remainder were usually three to four days. This provided sufficient time to trap the mammals in each of the several habitats in the vicinity and to prepare the specimens. The animals were skinned and, with some few exceptions, both skin and skull were preserved. Trapping was carried out on both sides of the river, so that in general specimens were available to evaluate the characteristics of the mammalian fauna from each side. No detailed ecological data were taken because of the nature of the expedition. Such as were obtained are largely notations upon types of soil and plant cover. With the exception of 12 bats, 8 rabbits, 2 coyotes, 1 skunk and 3 bobcats, the remainder of the specimens were rodents.

Two methods were used in trapping rodents, quadrats and lines of traps. Because of the nature of the terrain, both quadrat and lines could be used in most areas of the reservoir basin. In rough terrain, such as ledges, steep hillsides, narrow canyons and among large boulders, only lines of traps were used. All quadrats contained 100 traps spaced 10 paces apart in 10 rows of 10 traps each. The majority of the trap lines contained 100 traps, but there was some variation; the greatest number used was 400 while as few as 20 were used in some lines. All traps were baited with moistened rolled oats.

The specific operations in collecting rodents are noted in Table 1, while the kinds and numbers are reported by locality of capture and date in Table 2. Although it was possible to trap for two to three nights at most campsites, no attempt was made to carry out repeated trapping at any area. Owing to the diversity of the terrain and the lack of time, it was deemed more advisable to sample the populations of mammals in each of the several types of habitats. The same type of bait and traps were used at all times, and undoubtedly the

bait did not appeal equally to all kinds of rodents, and some are unquestionably more trap-shy than others. It is understood, therefore, that the results do not furnish accurate data on comparative sizes of the populations.

Unlike Glen Canyon of the Colorado River where the reservoir site is narrow, confined generally between high walls and ledges and with quite similar habitats throughout, the reservoir site of the Flaming Gorge Project on the Green River contains two drastically different areas consisting of remarkably different types of habitats. In the upper 60 miles, including Blacks Fork, the reservoir site is in a relatively shallow, wide river basin of the high plains of southern Wyoming. The remaining 28 miles, however, is contained within the deep narrow confines of Flaming Gorge, Horseshoe, Kingfisher, Hide-out and Red canyons in the northeastern section of the Uinta Mountains in extreme northeastern Utah.

As concerns rodents, the fauna of the upper basin is considerably different from that of the lower basin. For example, pocket mice, Perognathus parvus and P. fasciatus, Richardson's ground squirrel, Citellus richardsoni, and white-tailed prairie dogs, Cynomys leucurus are restricted to the upper basin, while the cliff chipmunk, Eutamias dorsalis, and the Pinon mouse, Peromyscus truei, were found only in the lower basin. Others, such as the montane vole, Microtus montanus, the long-tailed vole, Microtus longicaudus, and the bushy-tailed woodrat, Neotoma cinerea, were found in suitable habitats in both basins. The ubiquitous deer mouse, Peromyscus maniculatus, was present throughout both basins in nearly all types of habitats.

Trapping was spotty and with the exception of five traplines, the catch was far below that normally expected. Four sets of 100 traps each (three quadrats and one line) produced no animals, and seven sets of 100 traps produced but eight animals collectively. A total of 4,550 trap nights produced only 235 animals or a ratio of success of only 4.09 per cent. Reference to Tables 1 and 2 will give this detail and also indicate that while the actual number of rodents was low, the number of species was considerable. Although the ratio of success in trapping was generally low everywhere, it was 23 per cent higher in the lower section of the reservoir with its deep canyons, than in the upper section characterized by wide shallow basins. Rodents were neither abundant nor does the number caught give an accurate data relative to the sizes of the populations. The variation in numbers probably indicates a relationship between the home ranges of the animals and the distribution of the traps within the several habitats. Many animals have well defined habitats and if the traps are placed there, they are likely to be caught if the trap is within the home range. Perhaps the home ranges are smaller within the canyon area than in the basin area. Type of soil appeared to have a direct bearing upon the presence of rodents. Trap lines in areas of heavy clay soils had the lowest yield of mammals. Gravelly soils were little better, but sandy soils and loam produced the highest catches. The totals in Table 2 will inform the reader that deer mice occur throughout the area and furnished 67 per cent of the total catch. Beyond this the data are too meager to warrant any interpretation other than some generalization.

RODENTS COLLECTED IN FLAMING GORGE RESERVOIR BASIN, 1959

Table 1. Showing collection data on rodents taken and the number of skins and skulls kept as scientific specimens. All quadrats contained 100 traps set 10 paces apart in quadrangular fashion.

Date	Quad.	Line	Other	Totals	Location	Habitat
July	yld.	trp.yld.	yield	yld.svd.	map unit mile	Soil Vegetation
1		220	11	1	12 10	1 2a-2d 378 Sagebrush, rabbitbrush, saltbush
2		200	13	2	15 7	1 1a 378 Sagebrush, squawbush, cotton-wood, rabbitbrush, saltbush
3		30	1		1 1	2 2a 372 Cottonw., salt grass, sagebr.
4		100	1		1 1	2 2e 372 Greasewood, sagebr., cottonw.
5		200	2		2 2	2 3d 366 Sagebrush, greasewood
6		100	1		1 1	2 2n 366 Cottonw, squawbush, salt grass
7	4	20	2		6 6	2 3h-2n 366 Sagebr., cottonw., salt grass, greasewood
8	4	110	14	1	19 13	5 2a-2f 360 sand Greasew., sagebr., saltbush
9	1			1	2 2	5 3e 356 grvl. Saltbush, hop sage, sagebr., greasewood
10	1			2	3 3	5 2b 356 Saltbush, greasew., sagebr.
11	4	100		2	6 6	5 1g-2a 356 Greasew., sagebr., salt grass
12		100	6		6 4	5 3a-2a 356 cliff Greasew., sagebr., saltbush
13	4				4 4	5 2b-3b 356 grvl. Saltbush, sagebr., greasew.
14	13	20	2		15 6	7 2c 350 sd.cl. Greasew., saltbush, squawbush, rabbitbr., salt grass, cottonw.
15		230	26	2	28 12	7 1b-2d 352 Greasew., sagebr., wild-rye
16		20	6		6 3	7 2c 350 cliff Greasew., rabbitbr., salt grass, cottonwood
17	3				3 3	9 2b 339 clay Greasew., sagebr., cord grass
18	1				1 1	9 3c 339 grvl. Hop sage, horsebrush, grass
19		100	5		5 4	9 2b 339 Greasew., sagebr., saltbush
20	2				2 2	11 2a 328 Sagebr., salt grass, squawbush
21	0				0 0	11 3h 323 sd, cl. Rabbitbr., sagebr., drop-seed
22		200	5	1	6 5	11 1g-3h 323 rocky Grass, sagebrush
23	5			1	6 6	11 3h 323 Sagebr., greasew., rabbitbrush
24	0				0 0	11 3h 323 clay Sagebr., greasew., rabbitbrush
25	0	100	0		0 0	13 2d 306.5 Sagebr., squawbush, cheat grass
26		400	8		8 8	13 2d-3h 306.5 Juniper, sagebr., cheat grass
27	8	100	8	1	17 11	13 2b 309.5 Sagebr., clematis, matchweed
28		200	2		2 2	13 2d-3h 306.5 Sagebr., juniper, clematis
29		100	10		10 10	13 2f 307.5 sd. Greasew., cheat grass, cactus
30	1	100	12	1	14 10	13 2f 307.5 sd. Greasew., cheat grass, cactus
31		100	11		11 6	16 1a-3b 299 cliff Juniper, pine, mixed grasses
Aug. 1		100	23		23 20	18 3a 291 Juniper, sagebr., mahogany
Totals						
	51	2950	169	15	235	169

Trapping success: Line 5.72%; quadrat 3.56%; average 4.09%

Trp. = trap; yld. = yield; svd. = saved, the number made into scientific specimens.

This report upon mammals (account of species) is restricted to the data obtained by the expedition of 1959 through the reservoir basin of the Flaming Gorge Project of Green River. An appended list gives supplemental data obtained from other sources. This study is principally based upon the collection of 235 mammals of which 169 were prepared as scientific specimens, either skins and skulls, or skulls only. In addition, data from signs such as tracks, scats, workings or actual observations of the animals are included. All specimens are in the collections of the Department of Zoology and Entomology, University of Utah. The appended list, an annotated checklist after Hall and Kelson (1959), is provided for animals known to or supposed to occur in the area, but for which evidence was not obtained by the expedition. For additional information on mammals from the general region, the reader is referred to Durrant (1952), Svihla (1931) and Hall and Kelson (1959). For references to the plant communities associated with the habitats of the several kinds of mammals, see Woodbury, Durrant and Flowers (1960). The main map of reference to the exact locality of capture based on river miles above Greenriver, Utah is "Plan and Profile Maps of Green River from Greenriver, Utah to Green River, Wyoming", sheets H, I, J, inclusive, United States Geological Survey, 1924. The letters L and R following the river mile indicate left and right banks of the river, respectively, looking downstream. For detailed descriptions of the majority of mammals from the area, the reader is referred to Durrant (1952) and Hall and Kelson (1959).

From the data at hand, based upon the materials obtained by the expedition and from Hall and Kelson (1959), the mammalian fauna of the reservoir site, and environs of Flaming Gorge consists of animals belonging to six orders, 19 families, 53 genera, 80 species and 86 subspecies. It is understood that this list, although large, is not complete. Some kinds here referred to as occurring in the region may be found not to occur there and additional study may well reveal the presence of some kinds not now known to occur in this region. The taxonomic arrangement here employed from family to genus is after Simpson (1945). The arrangement of species and subspecies is after Hall and Kelson (1959). Vernacular names are after Hall et al. (1957).

ACCOUNT OF SPECIES

CHIROPTERA (order) Bats

Vespertilionides (family) Vespertilionid bats

Bats were not common in the area. A few were observed every evening as they flew over the river and above and around the trees and shrubs along the banks. This was in direct contrast to the situation in Glen Canyon, where they were probably the most abundant kind of mammal (Durrant and Dean, 1959). The presence of a large stream of water and somewhat similar shoreline vegetation in both areas indicated that the great discrepancy in numbers of bats between the two areas must be accounted for by some other means. We are of the opinion that this is because of the marked differences in physiography between the two areas. Unlike Glen Canyon, with its innumerable ledges and cliffs that furnished tremendous

RODENTS COLLECTED IN FLAMING GORGE RESERVOIR EXPEDITION 1959

Table 2. Listing of rodents taken by capture date.

	July	1	2	3	4	5	6	7	8	9	10	11	12
SCIURIDAE													
<u>Cynomys leucurus</u>													
White tailed prairie dog											2		
<u>Citellus richardsoni</u>													
Richardson's ground squirrel													
<u>Citellus lateralis</u>													
Golden-mantled ground squirrel		3		1									
<u>Eutamias minimus</u>													
Least chipmunk												4	
<u>Eutamias dorsalis</u>													
Cliff chipmunk													
GEOMYIDAE													
<u>Thomomys talpoides</u>													
Northern pocket gopher									1				
HETEROMYIDAE													
<u>Perognathus fasciatus</u>													
Olive-backed pocket mouse											1		
<u>Perognathus parvus</u>													
Great basin pocket mouse								2	1				
<u>Dipodomys ordii</u>													
Ord's kangaroo rat									1				
CASTORIDAE													
<u>Castor canadensis</u>													
Beaver			2										
CRICETIDAE													
<u>Reithrodontomys megalotis</u>													
Western harvest mouse													
<u>Peromyscus maniculatus</u>													
Deer mouse		7	9		1	2		1	9	1		2	6
<u>Peromyscus truei</u>													
Pinon mouse													
<u>Onychomys leucogaster</u>													
Northern grasshopper mouse								1	5				
<u>Neotoma cinerea</u>													
Bushy-tailed wood rat						1	2			1			
<u>Ondatra zibethicus</u>													
Muskrat									1				
<u>Microtus montanus</u>													
Montane vole		1	1										
<u>Microtus longicaudus</u>													
Long-tailed vole		1	2						1				
MURIDAE													
<u>Mus musculus</u>													
House mouse			1										
ERETHIZONTIDAE													
<u>Erethizon dorsatum</u>													
Porcupine													
TOTALS		12	15	1	1	2	1	6	19	2	3	6	6

RODENTS COLLECTED IN FLAMING GORGE RESERVOIR EXPEDITION 1959

August																			TOTALS	
13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	1	
2 3								1												2
								1												5
4																				5
												2 1								9
																				3
3																				4
																				3
2																				3
																4 3				8
																				2
								1 2												3
2 13 15 5				3 1 5 2				3 3				5 16 2				5 10 10 20				158
																1 1 3				5
1																				7
1 1																				6
																				1
1								1				1								5
																				4
																				1
																1				1
4 15 28				6 3 1 5 2				0 6 6 0				0 8 17				2 10 14 11 23				235

Vespertilionidae (family) continued

numbers of roosting sites in its caves and crevices, Flaming Gorge was actually depauperate in these features. Attempts were made nearly every evening to obtain specimens by shooting. Only 12 specimens representing four genera and five species were obtained.

Myotis volans interior Miller 1914 Long-legged myotis

The single specimen obtained was taken as it flew around cottonwood trees at Buckboard Ranch, river mile 350R. Only one other kind, Eptesicus fuscus, was observed at this locality. This area is a wide river basin in which a former ranch with abandoned buildings was located in a large grove of cottonwood trees along the right bank of the river. The abandoned farmlands had grown back to greasewood and annuals in the heavier clay soils and to shadscale in the drier, more sandy areas. Such ledges as exist are low, of soft soils, and modulated in relief.

Myotis subulatus subulatus (Say) 1823 Small-footed myotis

Only a single specimen was obtained. It was shot at dusk as it flew around a large grove of cottonwood trees at Brinegar Ranch at river mile 339L. It was also taken along with big brown bats. This specimen is from the southwestern section of the range of this subspecies and shows some intermediate characteristics in color between this subspecies and M. s. melanorhinus, the subspecies to the south and west. The assignment here is made largely on the basis of geographic distribution. We are of the opinion that additional specimens from this region may prove to be members of an intergrading population between these two subspecies. This area has some ledges with crevices and some abandoned buildings which would furnish adequate retreats for these more or less solitary bats.

Pipistrellus hesperus hesperus (H. Allen) 1864 Western pipistrelle

According to the marginal records of this subspecies, Hall and Kelson (1959), the entire area comprising the reservoir of the Flaming Gorge is north of the known limits of occurrence of these bats. The nearest known area of occurrence is 10 miles southwest of Ouray, Uintah County, Utah (Kruttsch and Heppenstall, 1955:127). Only one specimen was obtained by the expedition and it was from Skull Canyon, mile 299, Daggett County, Utah which extends the limits of occurrence of this subspecies 40 miles to the north. In Glen Canyon this was the commonest bat and we observed thousands of them there in 1958. This is a southern species that attains its northernmost limits in the intermountain region in this area.

Eptesicus fuscus pallidus Young 1908 Big brown bat

This is the commonest bat in the Flaming Gorge area, but is not abundant. This was the only kind of bat found to occur in both the upper and lower sections of the reservoir site. In the upper section, with its wide open valleys, specimens were obtained while flying around cottonwood trees in areas containing abandoned buildings and low ledges. In the lower section, in the narrow precipitous canyons, they were shot while flying around a dense grove of boxelder trees.

Available specimens are two from Buckboard Ranch, mile 350R, two from Brinegar Ranch, mile 339L, and four from Skull Creek, mile 299.

Antrozous pallidus pallidus (LeConte) 1856 Pallid bat

One specimen was obtained by Clayton White who shot the animal as it flew from its perch under the bridge across Blacks Fork on Wyoming Highway 530. This is the first record of this bat from Wyoming. It is a northward extension of range of this species of nearly 100 miles. Previously the northernmost known locality was six miles north of Jensen, Uintah County, Utah, Krutzsch and Heppenstall (1955:127).

Comparisons of the skin and skull with specimens in the collections of the University of Utah show this specimen to be referable to this subspecies.

LAGOMORPHA (order) Hares, rabbits and pikas

Leporidae (family) Hares and rabbits

Lepus townsendii townsendii Backman 1839 White-tailed jack rabbit

No specimen of this hare was taken. Animals were observed on two different occasions. One was observed along the road leading from Buckboard Ranch, river mile 350R to Wyoming Highway 530. Several others were seen late at night in the headlights of an automobile on the road between the mouth of Blacks Fork at Green River, mile 356 and Wyoming Highway 530. Both of these areas are beyond the limits of the site for the reservoir, but the nature of the terrain is such that without doubt they also inhabit the area of the impending reservoir.

Sylvilagus audubonii baileyi (Merriam) 1897 Desert cottontail

Desert cottontails were common in the upper basin of the reservoir site, and were observed throughout the basin from the upper reaches downstream to the entrance to Flaming Gorge but were not found within the narrow precipitous canyons in the lower part of the basin. They were abundant along the river, in the draws and gullies that drain from the hillsides, on the hillsides and back from the river on the higher plains. They were uncommon on the flats along the river where the soil was clay and supported large stands of greasewood. Areas containing soils of mixed clay and sand, and sand supporting sage brush, shadscale and rabbitbrush had large populations. This supports previous observation that members of this species are inhabitants of open plains or other relatively open country. Available specimens are: three from near Logan Ranch (Kincaid Ranch), mile 377R; two from mile 372R, 1 from mile 328R, one from mile 323R. All localities are in Sweetwater County, Wyoming.

RODENTIA (order) Rodents

Sciuridae (family) Squirrels

This family is represented in the area by animals belonging to four genera, six species and six subspecies. They were nowhere abundant, only 24 specimens and one sight record were obtained.

Marmota flaviventris nosophora A. H. Howell, 1914 . . Yellow-bellied marmot
One animal was observed by Dean Allan at the bridge in Sheep Creek Canyon, Daggett County, Utah. The entire area of the reservoir is beyond the previously known limits of occurrence of this species. According to Hall and Kelson (1959:324, 326) no animals are known from the upper basin of the reservoir. They guessed that the lower canyons of the reservoir were within the range of this subspecies, but had no specimens. This sight record substantiates their ideas and places the lower canyons within the range of this subspecies. Svihla (1931:260) reported two specimens from Carter Creek and four from Beaver Creek, which are in the drainage of the lower section of the reservoir. Moreover, she reported them as abundant in rock slides in the sagebrush parks of the spruce-fir and alpine belts.

Cynomys leucurus Merriam 1890 White-tailed prairie dog
We found only one area in the upper basin that contained prairie dogs. Two specimens were obtained from near the mouth of Sage Creek, mile 360L. The "dog towns" were on well drained hillsides and were easily discernible by the mounds and sparse vegetation. They were absent from adjoining areas of dense vegetation. The soils of the "dog towns" were sandy-clay with mixtures of small stones, which supported rather open stands of shadscale, sagebrush and mixed grasses. Svihla (1931:260) reported them to be common in the sagebrush belt in the lower part of the upper basin. She obtained eight specimens from Manila, Utah and three from Linwood, Utah. We observed no animals in this area where 28 years before they were common. Svihla (loc.cit.) stated that already at that early date they were being heavily poisoned. This activity has been continued because of their damage to agricultural lands and undoubtedly accounts for their absence from the area at present.

Citellus richardsoni elegans (Kennicott) 1863 . . Richardson's ground squirrel
We observed these squirrels in the upper basin of the reservoir. They were generally uncommon, but occurred in abundance at the mouth of Currant Creek on the left side of the river. Five specimens were obtained from this locality at mile 352. They were trapped in rather grassy areas that had formerly been under cultivation and now contained some greasewood and sagebrush. We consider the fact that we found these animals only on the left side of the river to be coincidental because they are reported from localities to the west.

Citellus lateralis lateralis (Say), 1823 . . Golden mantled ground squirrel
We found these squirrels only in the upper basin of the reservoir site. Our specimens were taken from the extreme upper end of the basin and also from the extreme lower end of the upper basin. Judging from the terrain and ecological situations, we are convinced that they occur throughout the area in favorable situations. Although we did not observe these animals in the lower basin, they are known to occur there. Svihla (1931:260) reported obtaining 32 specimens from Sheep Creek and one from Carter Creek, both creeks being within drainage of the lower basin.

Only one of our specimens was obtained from areas that had not been under cultivation. Three were obtained from near buildings on a relatively unused ranch and another was taken from an area adjacent to cultivated lands.

Citellus lateralis lateralis (continued)

Critical study of these specimens indicates that all except one have the dark median dorsal stripes expressed in varying degrees. While they are definitely referable to this subspecies, this tendency to a dorsal stripe, best developed in the specimen from Henrys Fork, makes them intergrades with the subspecies C. l. castanurus whose range lies to the south and west. No doubt, there is some gene exchange in this region. None of our specimens show any characters assigned to C. l. wortmani, which occurs immediately to the eastward.

Available specimens are: three from nine miles south of Green River, 6,050 feet, mile 378R, Sweetwater County, Wyoming; one from mile 372R; one from Henrys Fork, five miles above confluence with Green River, mile 318.4R, 5,840 feet, Daggett County, Utah.

Eutamias minimus minimus (Bachman) 1839 Least chipmunk

Least chipmunks are known to occur throughout the area of the reservoir site. We were able, however, to collect specimens from only the upper basin. They occurred along the streamside in areas of mixed vegetation, but in which sagebrush predominated. They were also noted in rocky areas.

The animals from this region are not far removed from the type locality, but the entire area is one of intergradation between this subspecies and the subspecies E. m. consobrinus which occurs to the south and west. As one goes from north to south in the basin there is a gradual increase in character of the latter subspecies; without doubt, a considerable exchange of genes between populations of the two subspecies is occurring in this region.

Available specimens are: two from Blacks Fork, 19 miles above confluence of Green River, 5,950 feet; two from mile 356L; four from Currant Creek, mile 352L, 5,920 feet; one from near Wyoming line on Green River, mile 322R, Daggett County, Utah.

Eutamias dorsalis utahensis Merriam 1897 Cliff chipmunk

Cliff chipmunks were the only kind we obtained in the lower basin of the reservoir site, and we were convinced that they did not occur in the upper basin. Svihla (1931:261), however, reported one specimen from Wyoming from one mile north of Lipwood, Utah. This locality is in the extreme lower end of the upper basin and marks the northernmost record of occurrence of this species in the eastern segment of its range. Insofar as we are aware, this is the only record of this mammal from Wyoming. As their name implies, these chipmunks are practically restricted to ledges and cliffs in areas of pinyon, juniper, and sagebrush.

Available specimens are: one from Sheep Creek, five miles above confluence with Green River; one from Hideout Spring, mile 306R, one from Hideout Forest Camp, mile 306.5R all from Daggett County, Utah.

Geomyidae (family) Pocket gophers

Thomomys talpoides ocius Merriam, 1901 Northern pocket gopher

Notwithstanding that considerable careful search was made, pocket gophers were obtained from only two localities from one general area on the left

Thomomys talpoides occlusus (continued)

bank of the river. These localities are in the upper basin of the reservoir site, and the animals were quite localized there in small populations. Considerable farming is still being carried out in the middle and lower reaches of the upper basin, much of it on irrigated land. Usually, these areas of farmland are extremely favorable to pocket gophers, and they may be expected to occur in abundance; none, however, was found. The localities of capture were from areas of yellow willow and sedges along a streamside and along the river proper. The soil here was quite loamy in contrast to that of the remainder of the region where it varies from pure heavy clay through sandy clay to stony and rocky soil.

Four specimens were obtained of which two were immature. At first glance they closely resemble this subspecies in size and general coloration. The underparts are uniformly slightly darker than in topotypes. Cranially, they show some similarities to topotypes but they also exhibit several, uniform, markedly distinct characters. In the development of the supra-occipital into a widened shelf rather than a ridge, in the shape of the interparietal and in the extension of the interparietal into the supra-occipital they closely resemble topotypes of this subspecies. In other comparisons with topotypes they differ in: skull larger in all measurements and markedly more robust; tympanic bullae less inflated; rostrum longer and heavier; nasals more expanded distally; upper incisors longer, wider and markedly less recurved; zygomatic arches wider, longer and heavier; occipital condyles much wider and more massive; interpterygoid space much wider owing to flaring of the pterygoid hamulae.

Not only are these characters distinctive of animals from these populations, but they are also remarkably uniform in the specimens examined. This not only bespeaks considerable homozygosity of these characters within this population, but gives a good insight into the rapidity of fixation of characters in small populations in which little gene exchange is occurring with outside populations. Insofar as we are able to discern, these populations are practically isolated, and this is further reflected in the relative uniformity of the aforementioned characters. There is little doubt but that these animals contain many genes characteristic of this subspecies but there must also be present genes of other stocks, in addition to some of their own proper mutations.

Because of the paucity of specimens, since the localities of capture are within the geographic range ascribed to this subspecies, (Hall and Kelson, (1959:438) and because some characters show relationships, we are tentatively assigning these animals to this subspecies. The problems of distribution and taxonomy of members of this species from southern Wyoming and northeastern Utah are exceedingly complex and merit considerable additional investigation. For example, within a radius of 50 miles distant from the localities of capture of our specimens are found the ranges of the subspecies T. t. bridgeri, T. t. uinta, T. t. pygmaeus, T. t. rarus, and T. t. clusius. In light of our findings as to the extreme modifications, resulting from rapid gene fixation in small, isolated populations, it is entirely possible that restudy of this complex of subspecies will help to unravel the inter-relationships between diagnostic characters and extremes of variation exhibited within other populations.

Available specimens are: one from mile 360, 5,719 feet; and three from Currant Creek, mile 352L, 3,920 feet.

Heteromyidae (family) Heteromyids

This family is represented within the area by animals belonging to two species of the genus Perognathus and one of the genus Dipodomys. Both species of pocket mice were found in the upper basin only, while kangaroo rats were obtained from both the upper and lower basin.

Perognathus fasciatus callistus Osgood, 1900 . .Olive-backed pocket mouse

Three specimens were obtained from the upper reaches of the reservoir site and all from the left side of the river. This is in keeping with the known distribution (Hall and Kelson, 1959:475) of this species, as these authors record no marginal records from the right side of the Green River. They were taken from gravel-sand soil covered with sagebrush and shadscale. We are unable to account for their apparent absence from the bottom 50 mile area of the upper basin. Although sought for assiduously, no specimens were obtained below the mouth of Blacks Fork.

Specimens are: three from opposite the mouth of Blacks Fork, mile 356L, 5,930 feet.

Perognathus parvus clarus Goldman, 1917 . . . Great Basin pocket mouse

We likewise obtained only three specimens of this species. Unlike the situation for the olive-backed pocket mice, these were restricted to the right side of the river. The habitats are approximately the same on both sides, judging from the plant cover and soil type. Nevertheless, these two species are separated by the river. This is further substantiated by the known geographic range (Hall and Kelson, 1959:488). These authors have no marginal records beyond the right side of the river. It is rather perplexing to understand how this river, which freezes solidly in winter and practically dries up in summer, can function as such a complete barrier to the extension of ranges by members of these two species.

No specimen of this pocket mouse was found below the mouth of Blacks Fork. Svihla (1931:262) stated that she obtained two specimens from two miles north of Linwood, Utah in the sagebrush-type habitat. From this, we judge that members of this species occur sparingly throughout the upper basin on the right side of the river. As concerns the upper basin proper, this wide gap between the areas of occurrence may indicate that this is not a continuous distribution but that these animals exist only in small numbers in localized, semi-isolated areas.

Available specimens are: two from mile 366R; one from mile 360R.

Dipodomys ordii priscus Hoffmeister, 1942 Ord kangaroo rat

Unlike members of the genus Perognathus, in which different species were restricted to one side of the river or the other, kangaroo rats of this subspecies were obtained from both sides of the river. Although we sought for them in all regions of apparent adequate habitat, chiefly characterized by sandy, loose soil, few specimens were obtained. We collected for 24 days in the upper basin and obtained but a single specimen from the right bank of the river. In this area, they are doubtlessly restricted to small localized populations and because our activities were chiefly concerned with that area within the reservoir site, perhaps we did not trap in the most propitious localities. Svihla (1931:262) obtained no

Dipodomys ordii priscus (continued)

specimens but did report tracts and burrows in the sandy soil sagebrush area north of Linwood, Utah. There is an interesting correlation in our findings with reference to both pocket mice and kangaroo rats. In the upper basin we obtained all our heteromyid rodents from the same general area. Likewise, Svihla (loc.cit.) found heteromyid rodents only in the area north of Linwood, Utah. The status of these animals in the intervening 40 miles between the localities reported by us and her remains unknown, but judging from the type of terrain and soil, we are convinced that additional work will prove them to exist in this intervening area.

Durrant (1952:259) reported a single specimen from the left side of the river at Hideout. This locality is within the narrow canyon area of the lower basin of the reservoir site. We camped here for several days and obtained seven specimens from this locality. Furthermore, this is the only locality within the lower basin from which specimens were obtained.

All specimens of kangaroo rats from this area are referable to this subspecies and are from localities not distantly removed from the type locality which lies east of the river. The single specimen we obtained from west of the river shows some remarkable differences. It differs from specimens from the east bank in: nasals more widely flared distally; interpterygoid space wider; basioccipital wider, with concave sides as opposed to roughly triangular shape; tympanic bullae more expanded posteriorly; color generally lighter; arietiform markings much paler.

It is well known that these animals are markedly restricted by large, permanent streams. Additional material from west of the river in southern Wyoming and northern Utah may prove that this area is inhabited by animals belonging to an unnamed subspecies.

Available specimens are: one from river mile 360R; seven from Hideout Flat, 5,850 feet, mile 306.5R.

Castoridae (family) Beaver

Castor canadensis missouriensis Bailey, 1919 Beaver

Beavers were abundant throughout the upper basin. Throughout the 60 river miles of this area, we were never out of sight of the animals or evidence of their activities. In floating down the river, we constantly saw animals swimming, diving, hauling out on the banks or entering the water. At times it was possible to float the boats close to them, following which they made their characteristic splashes and dives. Every sand bar and mud bar bore numerous tracks, while backwaters contained floating cut twigs and stems from their feeding. Every willow copse and cottonwood stand showed evidence of their cutting activities. It is difficult to estimate the number of animals present, but they appeared to be more abundant even than in Glen Canyon, where we counted 10 active burrows per mile. Burrows were common, but not so easily observed as in Glen Canyon. This is attributable, however, to the differences in the type of banks between the two regions, and also to the fact that in the upper basin of the Green River there was almost a complete lack of sheer cliffs at the edge of the water. In Glen Canyon the burrows were largely

Castor canadensis missouriensis (continued)

restricted to the areas of the permanent terraces, while here they were more evenly distributed along the river.

Beaver dams were not observed in the river itself, but good dams were found in Currant Creek, one of the tributaries. Houses were not observed anywhere. In this respect they are similar behavioristically to the animals which inhabit Glen Canyon. It is undoubtedly true that this lack of dams and houses results from the nature of the river itself. It is characterized by periods of both extremely high water and near-drought conditions. We embarked on approximately 7,500 second feet of water and five weeks later disembarked on between 500 and 600 second feet. These extreme fluctuations would prove disastrous to both dams and houses.

Although beavers were abundant in the upper basin of the reservoir site, they were not common in the lower basin. Here the walls are steep, and rocky and the canyon is narrow. In this area, the extreme fluctuations of the river would exert a much more drastic effect upon the beavers than they would in the upper basin. The riparian vegetation, so essential for their food, is much more restricted in amount and certainly in vertical distribution. This, coupled with recurring flooding of the banks suitable for den sites, would greatly reduce the area available for occupancy. Tracks were present along the stream, but were relatively few in numbers. Many streams that flow into the river in the region of the lower basin are known to contain sizable populations of beavers in their headwaters and middle reaches. The lower reaches are steep and the streams cascade rapidly to the river. No beavers were noted in this section of these streams. One exception was Sheep Creek, which has a good flow and a moderate gradient. Here, dams were observed in the lower reaches of the stream.

Specimens were not prepared so taxonomic studies are not possible at this time. Hall and Kelson (1959:549) refer animals from this area to this subspecies, but it should be noted that the range of three subspecies come into contact with each other in this region. According to their distribution map, the upper basin is within the range of C. c. missouriensis while the lower basin is in the range of C. c. duchesnei. Immediately to the east, they indicate the range of C. c. concisor. We have two skulls from river mile 278, nine miles south of Green River city, Wyoming. They have some differences of their own. Owing to the lack of adequate series of comparative material, we are referring animals from this region to this subspecies, solely on the basis of geographical occurrence.

Cricetidae (family) Cricetids

We obtained animals belonging to this family from the reservoir site that are representative of seven genera, eight species and eight subspecies.

Reithrodontomys megalotis megalotis (Baird) 1858 . . . Western harvest mouse

We obtained three specimens from the upper basin. This is the first known occurrence of animals of this genus in southwestern Wyoming. This is an eastward extension of range of this subspecies of approximately 100 miles. Also, the closest known areas of occurrence to the southward are 100 miles distant.

Our specimens were all obtained on sandy clay soil covered with sagebrush, shadscale and rabbitbrush from the extreme lower part of the upper basin. Judging from the terrain and plant cover of the remainder of the upper basin, we are convinced that additional collecting will disclose the presence of these mice in more northern localities.

Available specimens are: one from mile 323.5R and two from mile 323R; the latter locality is one mile north of the Utah-Wyoming state line.

Peromyscus maniculatus nebrascensis (Coues) 1877 . . . Deer mouse

The majority of the specimens obtained by the expedition belong to this subspecies. Animals were obtained throughout both the upper and lower basins of the reservoir site from both sides of the river. Moreover, they were present in all types of habitats. Study of Table 1 gives some interesting correlations between the number of animals caught and the type of soil and vegetational cover. While some exceptions exist, it is noticeable that the poorest catches were usually made on clay or gravelly soil. Conversely, the largest catches were usually made on areas of sandy-clay soil. The plant cover in all localities, with some exceptions, usually consisted of varying compositions of greasewood, sagebrush, shadscale and rabbitbrush which contained some mixed grasses. The plant cover did not appear to be as restrictive with reference to their presence as did the type of soil.

Durrant (1952:308) lacked specimens from the left bank (northern side) of the river in the region of the lower basin. He did, however, include both banks of the river in this area within the range of the subspecies P. m. rufinus. The remainder of the area in this part of Utah, he assigned to the range of P. m. osgoodi which is now known to be a synonym of P. m. nebrascensis (Jones, 1958:110). Ninety-seven animals were prepared as scientific specimens. In the upper basin 28 were from the right side of the river and 18 from the left side, while in the lower basin 34 were from the right side and 17 from the left side. Our study of the specimens from both sides of the river in the upper basin discloses no significant differences between the animals from either side, and we consider all of them to be referable to this subspecies. Within the lower basin, however, this same condition does not pertain. Our comparisons of size and color of animals from this region reveals little difference in animals from either side of the river. Those from the right side are on the average slightly darker, more rufescent. Cranially, there is also considerable similarity but there exist some rather constant differences between the series of animals from each side of the river, particularly in the width of the maxillary processes of the zygomatic arches. We, therefore, refer all animals from the left side of the river within the lower basin to this subspecies, and those from the right side to the subspecies P. m. rufinus.

Peromyscus maniculatus nebrascensis (continued)

These conclusions differ not only from those held previously by Durrant (loc. cit.), but also differ in detail from those of Kelson (1951:85) and Hall and Kelson (1959:622), who referred animals from the right side of the river to P. m. osgoodi (P. m. nebrascensis). We realize that these animals from the right side are intergrades, but more closely resemble deer mice of this latter subspecies. We seriously doubt that any gene exchange occurs between the populations from the opposite sides of the river in this region. The Green River here is large, moderately swift and deeply entrenched, which would practically preclude the possibilities of these mice to cross from one side to the other. A few miles upstream, however, the mice can easily cross over at certain times of the year and thus gene exchange takes place. Once these exchanges occur they would extend their impact gradually throughout the entire population of both sides.

Available specimens are: nine from nine miles south of Green River, mile 378R; three from mile 372L; one from mile 366R; three from mile 360L; nine from mouth of Blacks Fork, mile 356R; six from Buckboard Hotel (Ranch), mile 350R; eight from mile 339L; two from mile 328R; five from one mile north Utah-Wyoming line, mile 323R; 12 from Hideout Flat, mile 297L; five from Skull Canyon, nine miles above dam site, mile 299 R.

Peromyscus maniculatus rufinus (Merriam) 1890 Deer mouse

Restricted to the right side of the river within the lower basin from the mouth of Sheep Creek downstream to the dam site. For comments, see account of P. m. nebrascensis.

Available specimens are: 10 from Sheep Creek, near confluence with Green River; seven from Hideout Forest Camp; 17 from one mile above Ashley (Flaming Gorge) Damsite.

Peromyscus truei truei (Shufeldt), 1885 Pinon mouse

We obtained three specimens from the right side of the river and two from the left side, all within the confines of the lower basin. Hoffmeister (1951:38) reported four specimens from four miles northeast of Linwood, Utah. This locality is in southern Wyoming and within the lower reaches of the upper basin of the reservoir site, and is the only known area of occurrence of this species in Wyoming.

Comparisons of these five specimens with series of this subspecies from extreme southeastern Utah, show these northern animals to have some differences. They have wider, more distally inflated nasals, heavier rostrum, more inflated auditory bullae; and are less rufescent in color, particularly along the sides and flanks. There is no apparent difference in the animals from either side of the river. These specimens are from the northernmost area of occurrence of this species within the Middle Rocky Mountain Province. It is well known that, along the periphery of the range, many small populations become isolated or semi-isolated from animals of the main range. Because of the small size of the populations and lack of gene exchange, characters become rapidly set in the genetic patterns. The differences demonstrated in these specimens may be examples and additional material from this area may prove these animals to merit separation and naming.

Available specimens are: one from Hideout Flat; one from Skull Canyon, mile 298.8L; three from mile 291.5R.

Onychomys leucogaster arcticeps Rhoads, 1898 . . . Northern grasshopper mouse

We obtained seven specimens from three localities in the upper 28 miles of the upper basin. Six were from the right side of the river and one from the left side. They were taken on sandy-clay soil having a plant cover of sagebrush, shadscale and greasewood. Six were taken in association with pocket mice. Six of our specimens are immature, so detailed taxonomic studies are not possible. On the basis of distribution (Hall and Kelson, 1959:664), we are assigning our specimens to this subspecies. This area might well prove to be really significant in the taxonomy of this species because animals from only 20 to 30 miles to the west are assigned to another subspecies, O. l. brevicaudus.

We found no animals in the lower basin where the flora is characteristically different. Hall and Kelson (Loc. cit.), however, assign all this area to the range of this subspecies although they had no specimens upon which to base this assignment.

Available specimens are: one from mile 366R; five from mile 360R; and one from Currant Creek, mile 352L.

Neotoma cinerea cinnamomea Allen, 1895 Bushy-tailed wood rat

This is the only species of woodrat known to occur in the entire basin of the reservoir. All of our specimens are from the upper basin and belong to this subspecies. Specimens are not available from the left side of the river in the lower basin, but animals from the right bank are known to belong to the subspecies N. c. orolestes (see checklist), to which Svihla (1931:263) assigned seven animals from north of Linwood, Utah. This assignment, however, is not in keeping with our findings of animals in the upper basin, and we suspect they belong to the subspecies N. c. cinnamomea. Furthermore, this agrees with the area of occurrence as set forth by Hall and Kelson (1959:702).

Although all of our specimens were obtained from the upper 28 miles of the upper basin, we are certain that these animals occur throughout the area in suitable environments. Our specimens were obtained near ledges and in abandoned buildings.

Available specimens are: three from mile 366R; one from Blacks Fork, five miles above its mouth; two from Buckboard Ranch, mile 350R.

Ondatra zibethicus osoyoosensis (Lord), 1863 Muskrat

We obtained one specimen from river mile 360R and the senior author saw another at river mile 337R. Svihla (1931:264) reported them as common along Henrys Fork and Sheep Creek. Their tracks were noticed nearly every day on the wet sand and mud banks, and feeding stations were observed in several localities. They undoubtedly occur throughout the entire basin of the reservoir.

Microtus montanus nanus (Merriam), 1891 Montane vole

Our collecting revealed that these voles were present in both the open country and the canyons. Specimens were few but were taken from both sides of the river. Although they were not abundant, we did obtain two from the extreme upper end, one from the central part and one from the lower reaches of the upper basin. This indicates that they were present in favorable habitats throughout this region. One was taken in the mountainous gorge of the lower basin.

Microtus montanus nanus (continued)

Four were taken in dense grass adjacent to the river and one in dense grass by a spring about one-half mile distant from the river. The populations were low as indicated by the number caught but also from the lack of runways through the grass in what appeared to be ideal habitat.

Available specimens are: two from nine miles south of Green River, Wyoming, river mile 378R; one from Currant Creek, mile 352L; one from $1\frac{1}{2}$ miles north of Utah-Wyoming line, mile 323R; and one from Hideout Forest Camp, mile 306R.

Microtus longicaudus mordax (Merriam) 1891 Long-tailed vole

It was indeed surprising to obtain specimens only from the open country and not from the canyons. Previously, at this latitude, our experience had been that long-tailed voles occurred only in the mountains and the immediately adjacent areas. Three specimens were taken in the same habitats as montane voles and one was taken in a somewhat drier habitat farther downstream.

Available specimens are: three from nine miles south of Green River, Wyoming, mile 378R; one from mile 360R.

Muridae (family) Murids

Mus musculus domesticus Ratty, 1772 House mouse

One specimen was obtained from around the buildings at the Kincaid Ranch, nine miles south of the city of Green River, Wyoming, where these mice are also known to occur.

Erethizontidae (family) New world porcupines

Erethizon dorsatum epixanthum Brandt, 1835 Porcupine

Our only specimen is a skull from one-half mile above the mouth of Skull Creek, Daggett County, Utah. Svihla (1931:264) reported two from Sheep Creek and gnawed pine trees at Hideout. We observed some tracks and gnawings in this region also. All records of occurrence are from the lower basin of the reservoir site. Although we did not record them from the upper basin, we suspect that some few animals will be found to inhabit this area in the region containing the denser stands of trees.

CARNIVOR (order) Carnivores

Canidae (family) Wolves, coyotes, dogs and foxes

Canis latrans lestes Merriam, 1897 Coyote

Coyotes occur throughout the entire area. We obtained two skulls only from the upper basin and observed one animal there. Their tracks were observed from time to time in the soft mud and sand banks of the river. This area is heavily grazed by sheep, mainly in winter, spring and early summer, and also by cattle throughout the entire year; hence they are

Canis latrans lestes (continued)

subject to predator control, otherwise there might be a heavy population, since the habitat is suitable and the area was previously known to harbor a large population of coyotes. We obtained no evidence of their occurrence within the lower basin; Svihla (1931:259) reported them from several areas adjacent to the reservoir site and from Hideout on the Green River.

Our specimens are: one from Blacks Fork, four miles above the mouth, mile 356R and one from Currant Creek, mile 352L.

Mustelidae (family) Mustelids

Mustela frenata nevadensis Hall, 1936 Long-tailed weasel

No specimens were obtained and no animals were observed. Tracks were seen sparingly along the banks of the river in the wet mud and sand. They undoubtedly occur throughout the area.

Mustela vison erergumenos (Bangs) 1896 Mink

Our only knowledge of the occurrence of mink was the observation of tracks along the banks in the mud and sand. These were not common. Mr. Clifford Bosley of the Wyoming Department of Fish and Game informed us that mink occurred sparingly throughout the upper basin of the reservoir site. Svihla (1931:259) reported two animals from Sheep Creek, which is within the lower basin.

Taxidea taxus taxus (Schreber), 1778 Badger

Badger workings were present throughout both basins of the reservoir site. They were not numerous. This may be explained by the paucity of ground squirrels, pocket gophers, and kangaroo rats. The workings were observed in all types of habitats in the river bottoms and side hills. Svihla (1931:259) reported a skull from Hideout on the Green River. The extremely low populations of all rodents found by our expedition may account for the low numbers of predators observed. This was in contrast to the situation observed the year before in Glen Canyon. Here, rodent populations were high and badger workings were numerous.

Mephitis mephitis hudsonica Richardson, 1829 Striped skunks

Tracks were observed frequently along the banks of the river in the soft sand and mud. We obtained one skull only from one mile north of the Utah-Wyoming line, river mile 323. Our experience indicates that these animals are present throughout the upper basin. Generally, striped skunks occur in valleys or along low streamside areas in the foothills while the rocky, more mountainous areas harbor spotted skunks. Svihla (1931:259) reported one from Sheep Creek within the lower basin.

The ranges of two subspecies M. m. hudsonica and M. m. major come into contact in the region of the lower basin. Specimens are not available, to resolve this problem, but we strongly suspect that future investigation will show that the two ranges will be separated by the Uinta Mountains, the former on the north and the latter on the south.

Spilogale putorius gacilis Merriam, 1890 Western spotted skunk
A skunk emitted musk one evening at the Hideout Forest Camp in the lower basin. It was in an area of ledges that is typical habitat for spotted skunks but not for striped skunks. This caused us to consider that the animal belonged to this subspecies. Furthermore, Svihla (1931:259) reported specimens from Sheep Creek which is in the same general area.

Felidae (family) Cats and allies

Lynx rufus pallescens Merriam, 1899 Bobcat
Bobcats occur throughout both basins in areas of ledges. We obtained three skulls only, from $1\frac{1}{2}$ miles north of the Utah-Wyoming line, river mile 323R. Svihla (1931:260) reported a specimen from just north of Linwood, Utah.

ARTIODACTYLA (order) . . . Even toed ungulates

Cervidae (family) Cervids

Cervus canadensis nelsoni Bailey, 1935 Wapiti
These animals are known to range throughout the lower basin. We obtained one shed antler from this region. Every year there is a limited hunt on this herd to maintain it at a size in keeping with its forage.

Odocoileus hemionus hemionus (Rafinesque) 1817 Mule deer
These are common animals throughout the basin of the reservoir. In floating down the river through the upper basin, we saw them several times every day. Every island, every mud bank and every sidehill bore evidence of their presence in tracks and droppings. They were observed wading and swimming across the river and climbing the barren hillsides. They were observed in the lower basin, but were markedly less numerous than in the upper basin. Because of the isolation of the region, some poaching takes place. One animal was poached by two men in a boat between Blacks Fork and Buckboard Ranch. We found the puck the next day. Mule deer will be greatly affected by the reservoir (see account at end of this paper).

Odocoileus virginianus dacotensis Goldman & Kellogg, 1940 . . White-tailed deer
We observed several animals of this species in the thickets along the river banks in the uppermost reaches of the upper basin. Mr. Clifford Bosley of the Wyoming Department of Fish and Game informed us that they had been introduced into this area several years previously.

Alces alces shirasi Nelson, 1914 Moose
Moose probably occur rarely in the drainages of the lower basin, but we found no evidence of this. Mr. Bosley of the aforementioned department stated that a dead moose had been found in the upper basin several years ago on the ice on Green River, six miles north of the Utah-Wyoming line.



Fig. 1. Mule deer disturbed on Green River.
Photo by Phil Dotson.

Antilocapridae (family) Pronghorn

Antilocapra americana americana (Ord), 1815 Pronghorn

Pronghorns were observed daily in the upper basin, where they frequent the benchlands and high plains adjacent to the river. They were always observed in open areas save a few that came to the river to drink. The herds were not large and many pairs and individual animals were seen. They do not inhabit the lower basin.

REMARKS ON DISTRIBUTION

The Flaming Gorge Reservoir site on the Green River and the Glen Canyon reservoir site on the Colorado River are both within the same river system, being separated by a distance of approximately 400 river miles. Both sites are on large rivers although the Green River is somewhat smaller than the Colorado River. Beyond this the similarity generally disappears. The Glen Canyon site is mostly contained within a deep gorge and is confined by high, sheer, cliffs and ledges. The lower basin of the Flaming Gorge site is somewhat similar, being in narrow, deep canyons, but not bordered by sheer, barren cliffs and ledges. The upper basin is wide and shallow for the most part, and the reservoir will be characterized by wide shallow bays.

Glen Canyon is one of the most spectacular areas on earth in which to study the effects of physiography upon the distribution of mammals. Here the river and its gorge isolate four species and 23 subspecies on the western side from eight distinct species and 22 subspecies on the eastern side. This is drastically different from the effects of the river and its canyon at the Flaming Gorge site. Judging from the available specimens and reports from the literature, the river acts as a complete barrier to only one kind of mammal; pocket mice. The right side is populated by animals belonging to the species Perognathus parvus while the left side has members of Perognathus fasciatus. This must result from the restrictive ability of the water itself upon these mammals because they occur in close proximity to the edge of the water and the soil and plants are the same on both sides. Still another fact makes this situation even more puzzling because even in the upper basin, where there is definite evidence of island shifting, there is no evidence of these animals occurring on the opposite side of the river. We are convinced that this is the only case in the upper basin in which animals are restricted to one side of the river. As mentioned above, there are many examples of the river shifting its course in this open area causing island shifting and thus enabling animals to attain either side. With the exception noted above, certain kinds of mammals which occur in the upper basin and are as yet unknown from the lower basin, occur on both sides of the river and belong to the same subspecies.

The lower basin with its deep, narrow canyon and faster moving stream acts in a somewhat different manner. This entire basin is in mountainous country but the topography on either side quickly changes into different types, providing different ecological situations. The terrain back from the gorge on the right bank continues to increase in elevation to the south to ultimately attain the summit of the Uinta Mountains, while that on the left bank decreases in

altitude toward the north and opens up into the lower high plains country of the upper basin. In this area the river and the gorge limit the range of some subspecies to one side or the other. In addition it prevents the mountain forms from crossing the river after following down the canyon slopes. Certain subspecies, such as Peromyscus maniculatus nebrascensis and Neotoma cinerea cinnamomea that are common on both sides of the river in the upper basin are limited to the left side of the river in the lower basin, while the corresponding subspecies P. m. rufinus and N. c. orolestes occur on the right side. Specimens are not yet available to completely evaluate the total effects of the river upon the distribution of mammals. Undoubtedly it will be found to be quite restrictive, especially in the lower basin. As understood at present, with the exception of those kinds already mentioned, we consider both sides of the river in the upper basin, the right side downstream to Sheep Creek, and the total left side of the lower basin to be inhabited by animals belonging to the same subspecies. Here, the river and gorge do not prevent transfer of genes between populations on opposite sides. The right side of the lower basin downstream from the vicinity of Sheep Creek, however, is populated by members of other subspecies. In this region, we consider that the river and the gorge are good barriers inhibiting gene exchange between the populations from opposite sides.

EFFECTS OF THE RESERVOIR UPON MAMMALS

When the ecological components of an area are drastically modified and in some cases even totally destroyed, all members of the communities undergo severe changes. The construction of the Flaming Gorge Dam and its subsequent reservoir will cause such modifications. At present, the area that will be inundated consists of two quite different sections that will contain two rather distinct lakes. As previously mentioned, the upper lake will be generally wide and shallow expanding into large shallow bays and side arms.

The lower lake will be deep and narrow, being contained within a narrow canyon. For the most part the side arms of this lake will be rather short and narrow, occupying the lower reaches of precipitous side canyons. In essence, the drastic differences will be those of replacing a moving stream, with its lush phreatophyte riparian vegetation and its terraces, with a lake that will totally inundate all valley features and establish its shorelines against the desert ledges, cliffs and hillsides.

All habitats that exist at present, from the streamside up to several hundred feet above the bottom, will be lost or changed. It is important to emphasize that this band of phreatophyte vegetation on each bank of the river is possibly the single most important area in the food chain of the mammals which inhabit this area. As noted in Glen Canyon, here, also, the dry, desert areas in many localities are adjacent to the water and the so-called mesophytic area is markedly reduced or absent.

Our present concepts of the impact of the reservoir upon the present mammalian inhabitants is that the animals will undergo drastic changes. The large deer herd presently found in both basins will practically disappear because of the changed habitat and consequent lack of food. This is particularly evident in the upper basin where deer abound in the dense copses on the shores and islands

of the river. Some, will remain in the side canyons on the desert sidehills and washes but their numbers will be small in comparison to those at present.

Another problem that is as yet unanswerable is the effects of this new lake upon the migration of the deer between their summer and winter ranges. Deer swim well and enter water readily, and they can swim this lake in certain areas. At this latitude, however, these lakes will freeze over and the impact of ice upon the migrations might really be severe. The animals may cross on the ice, they may break through, they may take off and encounter shore ice and be unable to haul out on the distant shore. These tragedies could really decimate a herd. Also, in the lower basin the area remaining between the rim of the canyon and the shoreline of the lake is much reduced in area and is precipitous in many places.

Antelope will be unaffected because they are principally inhabitants of the high plains. Beaver are doomed because all available food, now found on the river banks, will be lost. Some may move upstream or downstream, or up side canyons that contain water. These areas, however, are all stocked to the carrying capacity for beavers. Microtines, such as muskrats and meadow mice, will practically disappear because of the destruction of their habitats.

In the lower basin, the only area containing kangaroo rats will be inundated. Those kinds that live in ledges, such as wood rats and canyon mice, will have their areas reduced and hence deplete their populations. Moreover, the area between high and low water stages of the lake has been cleared and burned and will remain practically sterile because of the fluctuations in the level of the lake.

In summary, it can be stated that the mammalian fauna will be practically wiped out of the reservoir basin. They cannot remain where they are now located. If they move, they will either enter unsuitable new habitat or find suitable habitat already occupied. They would soon perish in either case.

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SUPPLEMENTAL CHECK LIST OF MAMMALS

Stephen D. Durrant

The following check list of mammals is a supplement to the list found by the University Flaming Gorge expedition of 1959. It contains those known or supposed to occur within the impending reservoir basin for which no evidence was obtained by the expedition. The list is based largely upon reports in Hall and Kelson (1959) and pertinent original papers of other authors.

The basin of the impending reservoir, as described by Woodbury, Durrant, and Flowers (1960) consists of two distinct physiographic units. In the upper 60 miles of the basin, Green River flows through an open country of valleys, benches and rolling foothills, in which broad shallow bays will occur. In the lower 28 miles, the river flows through a series of deep rugged canyons as it enters the lower slopes of the Uinta Mountains, where it is deflected eastward about 35 miles before breaking through the mountain chair. These deep canyons that shut out a good deal of sunlight produce a "canyon effect" (Woodbury, 1933) that brings downward from the mountains some of the mountain vegetation and associated animals. References are cited in the preceding article.

INSECTIVORA (order) Insectivores

Soricidae (family) Long-tailed shrews

Sorex cinereus cinereus Kerr, 1792 Masked shrew

Hall and Kelson (1959:26) include the upper basin of the reservoir within the range of this species, and exclude the lower basin. This resulted from the lack of specimens. Since these shrews are known to favor moist areas in this general region, and because the river is common to both basins, we are of the opinion that if they occur here at all, they will be found in both basins.

Sorex vagrans obscurus Merriam, 1891 Vagrant shrew

This is the commonest of the smaller shrews from the intermountain region. Hall and Kelson (1959:30) include both basins within the range of this subspecies. We were surprised at our inability to obtain specimens, but there are many specimens known from localities not distantly removed.

Sorex merriami merriami Dobson, 1890 Merriam shrew

Hall and Kelson (1959:47) include the reservoir basin within the range of this subspecies. Because these animals are known mostly from open, arid regions, they may be found to occur sparingly within the upper basin.

Sorex nanus Merriam, 1895 Dwarf shrew

This one of the rarest mammals in North America, known only from a few specimens from widely separated localities in Wyoming, South Dakota, Utah, Colorado, Arizona and New Mexico. Hall and Kelson (1959:35) plotted these localities on their map and found the Flaming Gorge Reservoir within its circumscribed range.

Sorex palustris navigator (Baird) 1858 Water shrew
 Svihla (1931:258) reported a specimen from Beaver Creek, a tributary of
 Carter Creek, and a sight record from Sheep Creek, both of which empty
 into the reservoir basin. Durrant (1952:37) recorded one specimen from
 Carter Creek. They probably occur within both basins.

CHIROPTERA (order) Bats

Vespertilionidae (family) Vespertilionid bats

Myotis lucifugus carissima Thomas, 1904 Little brown myotis
 Insofar as I am aware, there are no records of these bats from our area.
 Hall and Kelson (1959:162) on the basis of marginal records include this
 entire region within their range. Specimens are known from elsewhere in
 Wyoming and Utah to the north and south and should be found here.

Myotis evotis evotis (H. Allen) 1864 Long-eared myotis
 Miller and Allen (1928:116-118) reported two specimens from Wyoming and
 because they had others from the surrounding states they (page 112) include
 the reservoir basin within their range.

Myotis thysanodes thysanodes Miller, 1897 Fringed myotis
 It is doubted that these bats inhabit this area, because first, the ter-
 rain differs from their known habitat and second, the known areas of occur-
 rence are far removed. The closest records to the south in Utah are
 roughly 100 miles distant beyond two mountain ranges (Kruttsch and
 Heppenstall, 1955:126). Since there are reports of animals, they are
 doubtfully included in the list because of Hall and Kelson's data, (1959:
 170).

Lasiorycteris noctivagans (LeConte) 1831 Silver-haired bat
 The range of this bat includes practically all of the United States
 and southern Canada. We obtained no specimens and know of none from
 the area of the reservoir site. They may, however, occur sparingly
 there.

Lasiurus cinereus cinereus (Palisot deBeauvois) 1796 Hoary bat
 The remarks under the preceding species apply equally well in the case
 of the hoary bat.

Euderma maculatum (J. A. Allen) 1891 Spotted bat
 Hall and Kelson (1959:197) include the reservoir site within the range
 of this species. This is perhaps the rarest of North American bats and
 the few specimens known have all been taken somewhat accidentally. It
 is possible that spotted bats may occur in the reservoir basin.

Plecotus townsendii pallescens (Miller) 1897 Townsend big-eared bat
 Specimens of these bats are known from northern and northeastern Wyoming,
 southeastern Idaho, north central and northeastern Utah and northwestern
 Colorado, which practically surrounds the area of the reservoir site. These
 bats will undoubtedly be found to occur there.

LAGOMORPHA (order) Rabbits

Ochotonidae (family) Pikas

Ochotona princeps uinta Hollister 1912 Pika

No pikas are known to occur in the reservoir basin, but they are included here because Svihla (1931:264) lists specimens from Granite Park on the headwaters of Carter Creek, about 14 miles upstream from the reservoir basin. Their habitat is restricted to rock slides usually at high elevations and there is little likelihood that they may occur in the rocky talus in the Green River canyons at lower elevations.

Leporidae (family) Rabbits and hares

Sylvilagus nuttallii grangeri (J. A. Allen) 1895 . . . Nuttall cottontail

The expedition found the desert cottontail (Sylvilagus audubonii) to be abundant in the upper basin of the reservoir site, but found no cottontails in the lower basin. Svihla (1931:265) reported Nuttall's cottontails from along the streamsides and adjacent areas in the sagebrush belt. She specifically reported observing "several" in Sheep Creek, the lower part of which is within the lower basin. They undoubtedly occur throughout the lower basin in favorable habitat. Ordinarily the desert cottontail occupies an ecological range slightly lower in elevation or farther south in latitude than the Nuttall but here in this reservoir basin where mountain vegetation has been brought to lower elevations by the "canyon effect", it is probable that the dip in vegetation is accompanied by a similar dip in the range of the Nuttall cottontail into the canyons of Green River in the lower part of the reservoir basin.

Lepus americanus hairdii Hayden, 1869 Snowshoe rabbit

Hall and Kelson (1959:274) include both the upper and lower basins of the reservoir site within the range of this species. It is certain that they do not occur in the upper basin, because they are, at this latitude, restricted to the fir-spruce habitat, none of which exists in the upper basin. Svihla (1931:264) reported specimens from upper Carter Creek and Granite Park, only 14 miles removed from the lower basin. It is almost certain that they will follow the conifers downward into the Green River canyons, at least in winter.

RODENTIA (order) Rodents

Sciuridae (family) Squirrels and relatives

Eutamias minimus consobrinus (J.A.Allen) 1890 Least chipmunk

All specimens of this species obtained by the expedition were from the open country of the upper basin. They were referred to E. m. minimus, although possessing some characters of this subspecies (see account of E. m. minimus in preceding article). Svihla (1931:261) reported four specimens from Sheep Creek which possessed characters of both but were referable to this subspecies. From the results of our studies and data

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Eutamias minimus consobrinus (continued)

from the literature, it may now be understood that animals from the right side of the river in the lower basin are patently referable to E. m. consobrinus while those from the left side of the river, while still intermediate, are referable to E. m. minimus. Within the deep canyons of the lower basin, the river undoubtedly prevents gene exchange between the populations on either side. Farther upstream the barrier is not so restrictive and may account for the great area of intergradation.

Eutamias umbrinus umbrinus (J. A. Allen) 1890 Uinta chipmunk

These chipmunks are mostly montane mammals, but do descend at times into the higher foothills. No specimens were obtained although we had expected to do so in the area of the lower basin, which is mountainous. White (1953:572) reported specimens from nine miles south of Robertson, Wyoming and Howell (1929:95) reported them from Lonetree, Wyoming. Svihla (1931:261) reported them from Sheep Creek and several other localities in Utah not far removed from the area of the lower basin. We are certain that these animals occur in the lower basin, because suitable habitat exists there and they are known from localities adjacent to the area.

Citellus tridecemlineatus parvus (J.A.Allen) 1895 . Thirteen-lined ground squirrel

Howell (1938:119) lists specimens from the open country along Green River in the upper basin and Durrant (1952:117) lists them from Diamond Mountain south of the lower basin. Judging from the ecological conditions of the terrain, it is not believed that they occur in the deep canyons but may occur elsewhere within the reservoir basin.

Tamiasciurus hudsonicus fremonti (Audubon and Backman) 1853 . . Red squirrel

Durrant and Hansen (1954:94) report red squirrels from several localities that are not far removed from the canyons of the lower section of the reservoir basin. We think that they may follow the large conifers down the slopes into these canyons but doubt if they cross Green River to the left side.

Glaucomys sabrinus lucifugus Hall, 1934 Northern flying squirrel

Svihla (1931:261) and Durrant (1952:153) report specimens from several localities not far removed from the area of the lower basin of the reservoir. While generally speaking, flying squirrels are restricted to high mountain areas, yet they have been known to range widely and may follow the large conifers down into the canyons of the Green River but may not cross it.

omyidae (family) Pocket gophers

Thomomys talpoides pygmaeus Merriam, 1901 Northern pocket gopher

We obtained no specimens of pocket gophers from the lower basin. In the collections of the University of Utah, there are three specimens of this subspecies from Hickerson Park, north Fork of Sheep Creek, 8,500 feet elevation. Svihla (1931:261) was the first to report this subspecies from Utah. Her specimens were taken along the streams at high elevations. She

Thomomys talpoides pygmaeus (continued)

did, however, list nine specimens from Sheep Creek, which according to her map (p. 257) is from a locality not far from the limits of the Sheep Creek arm of the reservoir.

Thomomys talpoides ravanus Durrant, 1946 Northern pocket gopher

The type locality of this subspecies is only 15 miles south of the lower basin. Both the type locality and the lower basin are in the Uinta Mountains. We believe that additional study will reveal the northern limits of the range of this subspecies to be the right side of the river of the lower basin. This is an extremely interesting distribution with the large bluish animals of T. t. ravanus inhabiting the terrain immediately adjacent to that of the markedly small, brownish animals of T. t. pygmaeus. No intergrades are known and here both kinds are behaving like full species and the ranges are allopatric. It might be also of interest to point out that the range of yet another subspecies, T. t. uinta, is immediately to the west. A close scrutiny of the pocket gophers of the reservoir site and environs is merited when it is realized that the ranges of four subspecies come into contact in this region. Moreover, not far to the west, at Fort Bridger, Wyoming, is the range of yet another subspecies, T. t. bridgeri. All of these subspecies are remarkably distinct from each other, bespeaking considerable genetic differences. In addition, within each subspecies there is demonstrated marked homozygosity by the great uniformity of the characters.

Cricetidae (family) Cricetids

Peromyscus crinitus doulti Goin, 1944 Canyon mouse

We obtained no specimens of this species from the reservoir basin. Goin (1944:191) recorded specimens from one mile north of Linwood, Utah, which is within the lower reaches of the upper basin. Svihla (1931:262) also reported three from north of Linwood, Utah and seven from Sheep Creek, which is within the confines of the lower basin. The localities north of Linwood, Utah, are the northeastern known limits of occurrence of this species and the only records from Wyoming.

These mice are inhabitants of ledges and talus slopes, of which many exist in the lower basin. Our inability to obtain specimens was surprising, but Svihla (loc. cit.) noted that she obtained no specimens in 1929 where she had taken them in 1928.

Peromyscus boylii utahensis Durrant, 1946 Brush mouse

No specimens were obtained of this species. Svihla (1931:263) reported two specimens from Hideout Canyon on the Green River within the confines of the lower basin. However, these specimens could not be located in the Museum of Zoology, University of Michigan, where they were supposed to have been deposited. Recent studies indicate that this location is outside their expected range. We took pinon mice but no brush mice at that place. Since both of these mice are large and have large ears, we wonder if this was not a case of misidentification.

Neotoma cinerea

Svihla (1931:263) recorded specimens from the lower basin of N. c. cinerea. The left side of the range of N. c. cinerea reaches the canyon. It appears that there is a change in the distribution of N. c. cinerea upstream.

Clethrionomys

No specimens of Clethrionomys were known from the reservoir basin. Svihla (1931:263) recorded specimens from the lower basin. It follows that the range of Clethrionomys is in the lower basin.

Phenacomys

We know of no specimens of Phenacomys from the reservoir basin. Svihla (1931:263) recorded specimens from the lower basin. It follows that the range of Phenacomys is in the lower basin.

Lagurus

Hall and Goin (1931:263) recorded specimens from the lower basin. It follows that the range of Lagurus is in the lower basin.

Zapus princeps

Specimens of Zapus princeps were obtained from the lower basin. It follows that the range of Zapus princeps is in the lower basin.

Canis lupus

Without doubt, the range of Canis lupus extends from the lower basin to the upper basin.

Neotoma cinerea orolestes Merriam, 1894 Bushy-tailed wood rat
Svihla (1931:263) and Durrant (1952:350) reported specimens from several localities in Daggett County, Utah, not distantly removed from the Green River canyons. Evidence of their occurrence was found by the expedition in the ledges and cliffs in this area but no specimens were taken. The specimens reported by Durrant (loc. cit.) are darker in color and differ cranially from bushy-tailed wood rats from the upper basin (see account of N. c. cinnamomea). Animals from the upper basin and those from the left side of the river in the lower canyons are patently referable to N. c. cinnamomea. Animals from the right side of the river in the upper reaches of the lower basin are intergrades while those farther down in the canyons on the right side are referable to N. c. orolestes. Thus, it appears that the river and its gorge are good barriers to gene exchange between the animals from opposite sides, but is less effective upstream.

Clethrionomys gapperi uintaensis Doult. 1941 . . . Northern red-backed mouse
No specimen of this species was obtained by the expedition and, insofar as we know, no specimen is known from the area of the reservoir site. Svihla (1931:263) reported a specimen from the upper headwaters of Carter Creek. These are high mountain forms in the spruce-fir belt but may follow the coniferous forests downward into the reservoir basin.

Phenacomys intermedius intermedius Merriam, 1889 Heather vole
We know of no specimen of this species from the reservoir site, but Hall and Kelson (1959:719) include the lower part of the upper basin and the entire lower basin within its range. Habitats favorable to heather voles do not exist in the open country of the upper basin. If these voles occur in the reservoir basin, it would be in the mountain vegetation of the lower canyons.

Lagurus curtatus levidensis (Goldman) 1941 Sagebrush vole
Hall and Kelson (1959:752) include the entire reservoir site within the range ascribed to this subspecies. We know of no specimen from this area. The closest known area of occurrence is Blacks Fork in the high Uinta Mountains. They may occur accidentally within the reservoir site.

Zapus princeps utahensis Hall, 1934 Western jumping mouse
Specimens are known from the high country south and east of the area of the lower part of the reservoir basin and they may be found to occur sparingly in this area. (See Hall and Kelson, 1959:775).

CARNIVORA (order) Carnivores

Canidae (family) Foxes, coyotes and wolves

Canis lupus youngi Goldman, 1937 Gray wolf
Without doubt the entire area of the reservoir basin was formerly within the range of this subspecies. Goldman (1944:463) reported specimens from areas not far removed from the reservoir site. At present, gray

Canis lupus youngi (continued)
 wolves are thought to be extinct in this region, but some few may yet be found to occur in remote areas.

Vulpes fulva macroura Baird, 1852 Red fox
 Hall and Kelson (1959:856) include the lower basin of the reservoir site within the range of this subspecies. No specimens are known, but they may occur sparingly in this area.

Vulpes velox hebes Merriam, 1902 Swift fox
 Hall and Kelson (1959:859) include the upper basin and the extreme eastern part of the lower basin within the range of this subspecies. We know of no specimens from this general area.

Urocyon cinereoargenteus scottii Mearns, 1891 Gray fox
 Hall and Kelson (1959:862) include the eastern end of the lower basin of the reservoir site within the range of this subspecies. We know of no gray foxes from there, but some may occur in the drier regions. Generally, this is a southern subspecies that attains its northernmost limits of occurrence in northeastern Utah and northern Colorado.

Ursidae (family) Bears

Ursus americanus cinnamomum Audubon and Bachman, 1854 Black bear
 Hall and Kelson (1959:866) include the reservoir site in the range of this species. Although specimens are unavailable, tracks have been recorded from areas close to the site (Svihla 1931:259). Black bears are not common but do occur in the general area and certainly some are present from time to time in the area of the reservoir site, especially the lower basin.

Mustelidae (family) Weasels and allies

Martes americana origenes (Rhoads), 1902 Marten
 The lower basin of the reservoir site is within the range of this subspecies. We know of no animal taken from the reservoir site, but Durrant (1952:424) reported them from the near vicinity. Undoubtedly, they occur in small numbers throughout this area.

Martes pennanti columbiana Goldman, 1935 Fisher
 Durrant (1952:425) reported tracks of this mammal from Trial Lake in the western part of the Uinta Mountains. Because the lower part of the reservoir basin is in the eastern part of these mountains, it is not improbable that fishers may rarely visit this area.

Mustela erminea muricus (Bangs), 1899 Ermine
 Hall and Kelson (1959:905) show the range of this subspecies to include the reservoir site. We know of no specimens actually from this area, but because they are known to occur widely throughout western United States, we are confident that they occur within the reservoir area.

Gulo luscus
 Wolverine
 Powell
 up the lake
 records of
 this area

Lutra canadensis
 Durrant
 reportedly
 The river
 and the area
 from here
 river.

Ursidae (family)

Felis concolor
 Specimens
 deer occur
 that this
 deer are
 canyons of
 ing in site
 in Red Canyon
 Ashley National
 Svihla (1931)
 the site.

Lynx canadensis
 At this lake
 elevation
 attain the
 the mountain
 14520 was
 ber 13, 1952
 locality

Ursidae (family)

Bison bison
 Hall and
 the range

Ovis canadensis
 Hall and
 the range
 the Uinta
 in these
 formerly
 There is
 Canyon.
 may occur

Gulo luscus luscus (Linnaeus), 1758 Wolverine

Wolverines are extremely rare throughout the southern Rocky Mountain area. Powell (1875:19) reported wolverines from Red Canyon. This canyon makes up the largest part of the lower basin of the reservoir site. No other records are available but it is possible that an animal may wander into this area.

Lutra canadensis nexa Goldman, 1935 River otter

Durrant (1952:436) reported seeing strips of otter skin from an animal reportedly taken in the Green River south of the area of the reservoir site. The river throughout the lower basin contains a large population of fish and the area appears to be good for river otters. We know of no animals from here, but suspect that at times some few animals may frequent the river.

Procyonidae (family) Cats

Felis concolor hippolestes Merriam, 1897 Mountain lion

Specimens of mountain lions are unknown from the reservoir area. Since deer occur in nearly all parts of the reservoir basin, it is suspected that this principal predator of deer will occur in almost any part where deer are concentrated. They are especially likely to occur in the lower canyons during the deer migrations of winter when they may be concentrating in side canyons or on canyon slopes. Powell (1875:19) reported animals in Red Canyon. Barnes (1927:67) estimated that 25 animals occurred on the Ashley National Forest, which contains the lower basin of the reservoir site. Svihla (1931:260) reported one from Dowds Hole a few miles to the north of the site.

Lynx canadensis canadensis Kerr, 1792 Lynx

At this latitude, the lynx would not normally be expected to occur at elevations as low as those found at the reservoir site. These animals attain their southern distributional limits in the Canadian Life Zone of the mountains of Utah and Colorado. A single specimen, male, U. U. number 14520 was obtained in the sagebrush lowlands, 6000 feet elevation on December 13, 1957 at Tom Cook's Ranch, one mile northeast of Manila, Utah. This locality is within an arm of the reservoir that will be formed by Henry's Fork.

Bovidae (family) Bovids

Bison bison bison (Linnaeus), 1758 Bison

Hall and Kelson (1959:1025) include the area of the reservoir site within the range of these animals. None is known from there at present.

Ovis canadensis canadensis Shaw, 1804 Mountain sheep

Hall and Kelson (1959:1031) include the area of the reservoir site within the range of these animals. Durrant (1952:468) reported 25 animals from the Uinta Mountains and Barnes (1927:177) stated that 400 animals occurred in these mountains. There is little doubt that the area of the reservoir formerly contained mountain sheep. None is known to occur there at present. There is a herd of these animals downstream on the Green River in Ladore Canyon. Although not expected, it is entirely possible that some animals may occasionally visit the area of Red Canyon in the lower basin.

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