Dodge, D. P. and H. R. MacCrimmon, 1970. Vital statistics of a population of Great Lakes rainbow trout (Salmo gairdneri) characterized by an extended spawning season. Jour. Fish. Res. Bd. Can. 27(3): 613-618.

Bothwell's Crk. Trib. L. Huron, Ontario
spawning

run A Oct. 29 - Feb. 15 N = 640 ~~Feb. 20 - Apr. 30~~

run B Feb. 16 - May 3 N = 610 Feb. 20 - Apr. 30

A = 75% repeat spawners 74% run 5-7 yrs.
~~more~~ longer lake life

B = 52% repeat spawners 79% run 3-5 yrs. ~~its~~
shorter lake life

	Model	♂	♀
size:	A	51-55 cm.	71-75 cm.
	B	61-65	66-70

- two runs not overlap -

The extended spawning season in Bothwell's Creek, characterized by two separately migrating populations, is evidence of the plasticity of the rainbow to adapt migration and spawning patterns to local environmental conditions.

Averett, Eaprings, Kaspo, Osmera

Whether basis of winter - spring spawning ~~pattern~~ groups is genotypic or phenotypic not resolved.

Mac Cammon Marshall & Gots 1970
World Dist. Brown Fat, S. c. : further observat.
J. F. R. B. C. 27(4): 811-818.
Dept. Zool. Univ Guelph, Guelph, Ont.

- Lavy bee -
- Berg 48
- Tibet
- Tehran -
- if considered
S. isabellina as
ssp. S. tatta
- introduced much
more widely than
Dsungk-Kul.

Tibet
Acta Zool. Sinica
1963, 14: 529-536.

Berg 48 · Izd. Akad. Nauk. 159-172

· Rainbow x Brown hybrid
Prog. Fish. Cult. 1970 32(1):8

Eagle Mtn. Trout Farm, Georgia.
"Rainbros" from rainbow ♂ and brown ♀
~~400~~ 398 eggs ~~fertilized~~ hatched Feb. 17, 1968 - same as pure parental crosses. - 398 hatched of 400 eggs fertilized. 48 jumped out & lost. - March 29, 1969 - 350 left. $\bar{x}$ 9.3 in., 6.6 oz. (range 7.5 - 11.0 inches, & 3.4 oz. - 9.5 oz.) 70% were 9-10 in. -

pure brown trout hatched at same time were 4-5 in. and 1.0 oz. on March 29, 1969.

pure rainbow averaged 7.1 in. & 3 oz.

L. McConaughy. Rainbow Trout

Van Velson, R.C. 1969. Migration dynamics of in rainbow trout. M.S. thesis. C.S.U. Dept. Fish. Wildl. Biol., 97 pp.

fig. 3 silvery ♀ - w/ very few spots (Royal Silver)
fig 4 - spent ♀ silvery-white w/ steel-blue back - few spots (royal silver) + ripe ♂ w/ red opercle, reddish area along ~~mid~~ mid body & greenish-brown back & heavier spotting.

9 Mile Crk. - spawning run mainly age II+ fish

			growth
1965	74% II+	age groups	I. 12-18.1 in.
1966	60% II+		II 14-26 in.
1967	58% II+		III 16.4-26.5 in.

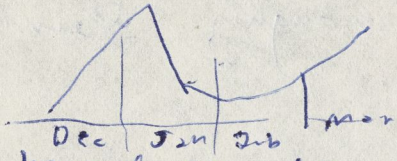
repeat spawners.

73% first
25% II
2% III

- young in stream become smolt-like before migrating to lake. (as in Finger Lks. N.Y.)
(after one summer in stream - born - Feb-Mar.
migrate following spring - age I
- some spend 2 summers.

- Since 1963 all ~~catchables~~ hatchery marked -
1963-1967 23,268 marked trout 3-8 in. stocked ~~N. Fork~~ in 9 Mi. Crk.
- 14 recovered - only 1 (17.6 in.) had gone to lake)

Spawning max. Dec.-Jan



* - In March an increase in spawning activities - indicates there is also a limited spring run of rainbow from L. M. C.

(Coop Fish Unit : Mont. St. Univ. Bozeman Mt.)

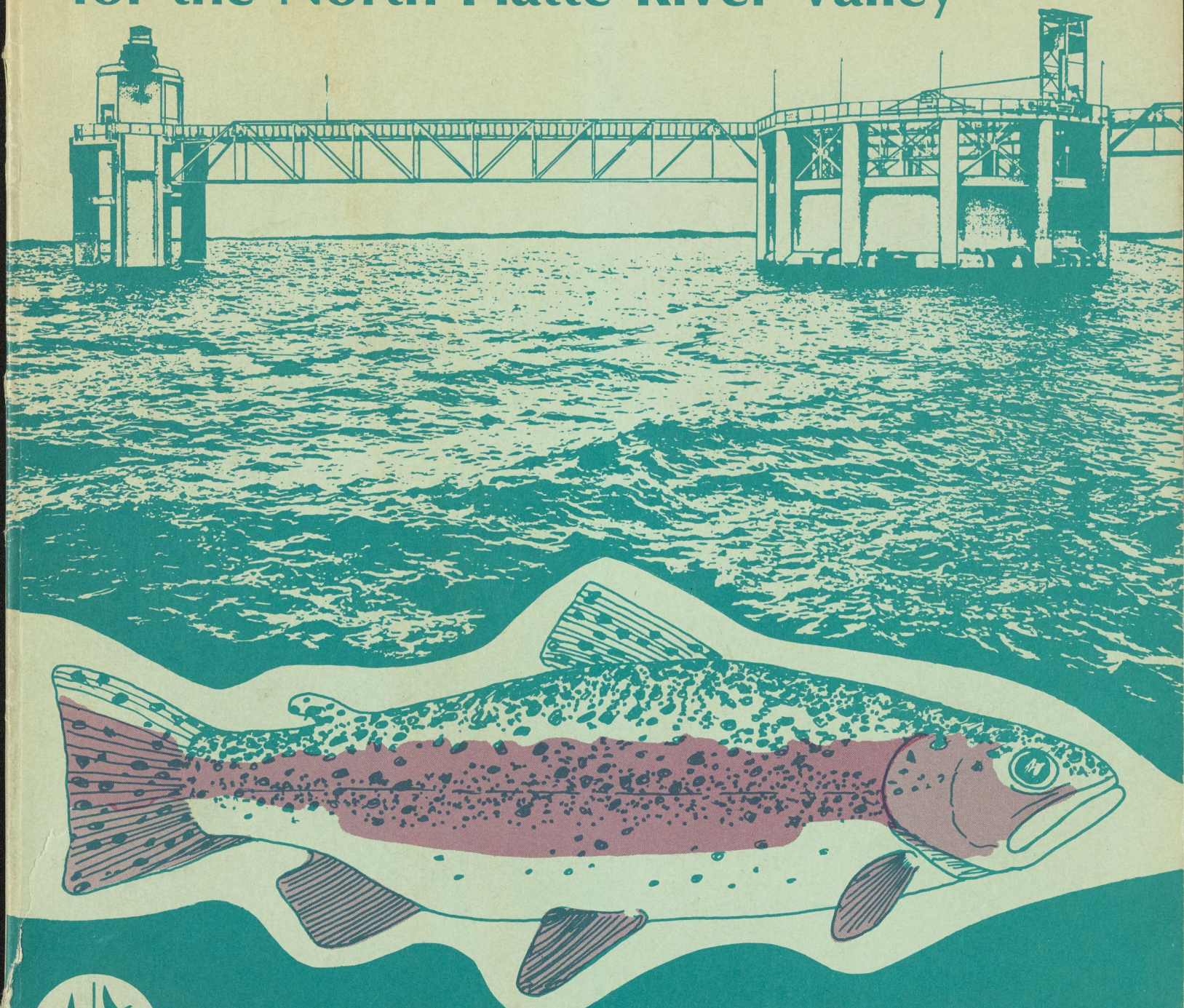
Gould, W. R. 1966. Cutthroat trout (*Salmo clarkii* Richardson) × golden trout (*Salmo aguabonita* Jordan) hybrids. Copeia (3): 599-600.

1964 - cutt ♂ × golden ♀ - hatching est. >90%
high mortality in advanced fry stage (no controls)
7 specimens survived - raised to 3.3 - 6.3 in. killed:
246 - 323 days - yellow-green pectoral fins
orange pelvics w/ white borders. D & A white tips
yellow-green cutt mark
D 11-12 A 10-11 P 14-16 V 9-10
4 of 7 w/ basibranchial teeth.

Diffenbach, W. H. ibid. Taxonomy of the cutthroat trout (*Salmo clarkii* Richardson) of the South Platte drainage, Colorado. ibid: 414-24.

THE McCONAUGHY RAINBOW

...Life History and a Management Plan for the North Platte River Valley



Nebraska Technical Series No. 2
Nebraska Game and Parks Commission

THE McCONAUGHY RAINBOW

...Life History and a Management Plan for the North Platte River Valley

by Rodney C. Van Velson

Editor: Elizabeth Huff
Layout and Design: Steve O'Hare

Nebraska Technical Series No. 2
Nebraska Game and Parks Commission
P.O. Box 30370
Lincoln, Nebraska 68503
1978

A contribution of Federal Aid in Sport Fish Restoration
Project F-4-R Nebraska

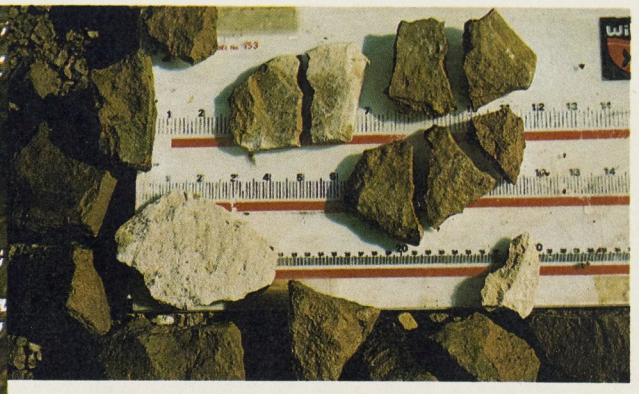
ACKNOWLEDGEMENTS

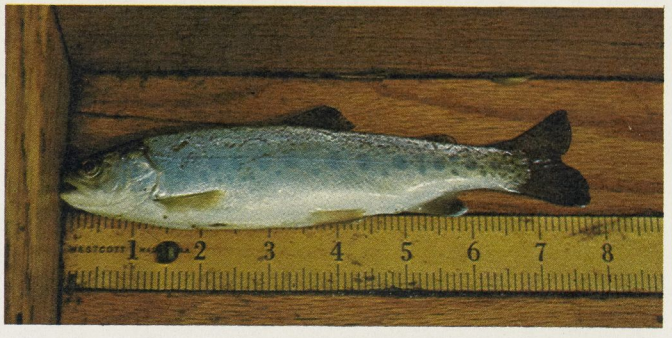
Sincere appreciation and thanks are extended to all the Game and Parks Commission fishery biologists who unselfishly gave their time and efforts to the rainbow trout investigations in the North Platte River drainage.

The author is deeply indebted to Mr. Robert E. Thomas, Chief of Fisheries, Nebraska Game and Parks Commission, for his sincere interest, guidance, knowledge and encouragement during the study.

A special thanks to Jack L. Peterson, district fishery supervisor, who always made himself available during the study.

The dedication, patience and sincere interest shown by Fran Reed, District I secretary, during the preparation and typing of the manuscript was deeply appreciated.



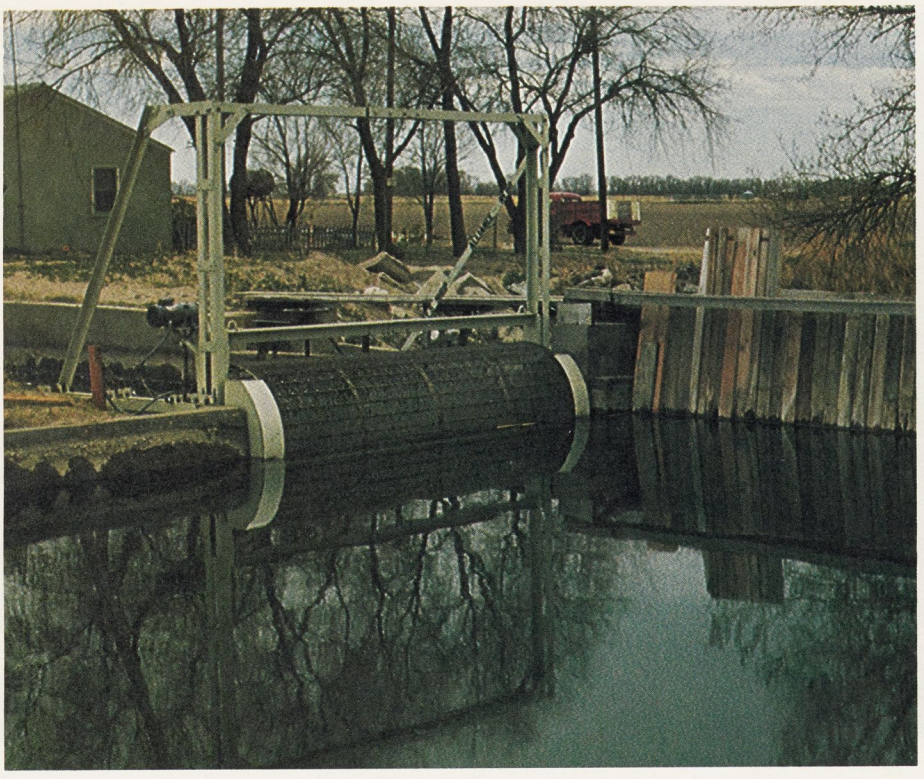


McConaughy rainbow begin life in the gravel riffles of tributary streams in the North Platte Valley above Lake McConaughy in western Nebraska. Smolts migrate downstream to the reservoir after a year in the stream. Then, after two or three years in the reservoir, the 4 to 6-pound adult spawners migrate back upstream to spawn in the tributary of their origin, thus completing the life cycle.

These color plates depict important aspects of the life history and management of this species in Nebraska's upper North Platte River Valley. Mature spawning rainbow (upper left) migrates to a typical valley stream. The spawning gravel (upper right) is primarily hard clay fragments, broken off from the substrate. The one-year-old smolt (above) would be ready for its journey to Lake McConaughy.

At left, before and after photos of Nine Mile Creek graphically depict the results of management on what has become the best spawning stream in the valley. In 1969 (upper) Nine Mile was typical of most unmanaged North Platte River tributaries. Note bank erosion and scarcity of vegetation due to livestock. In 1974 (lower), after the state had purchased the land, eroding banks were backsloped, stabilized with rock, and revegetated. Natural vegetation flourished with the elimination of livestock. These management practices substantially improved the capability of this section of Nine Mile to produce rainbow trout.

Exclusion of livestock by fencing has proven to be the most important management practice for improving trout production in the valley. Also important are the stabilization of eroding banks and installation of structures to prevent migrating trout from entering irrigation canals.



Rotary screen (above) prevents migrating trout from entering irrigation canal. At right, winter stream fisherman goes after typical spawning-run McConaughy rainbow.

The end product of management—a quality fishery for rainbow trout in Lake McConaughy.

TABLE OF CONTENTS

TABLE OF CONTENTS—Continued

INTRODUCTION

McConaughy Reservoir and the North Platte River drainage upstream to the Nebraska-Wyoming state line represent a major part of the coldwater habitat in Nebraska, 87%, according to the 1972 Nebraska Fish and Wildlife Plan (Figure 1). The plan also showed the upper North Platte River drainage contains 159 miles of coldwater stream habitat and 192 miles of mixed cold and warm water stream habitat, 29 percent of the total mileage in the state. Together, these 351 miles account for 80 percent of the coldwater stream acreage in Nebraska.

McConaughy Reservoir and the North Platte River drainage rainbow trout fishing attracts anglers from throughout Nebraska and adjoining states. McConaughy meets the requirements of a "two-story" reservoir as described by Kirkland and Bowling (1966). Beside the rainbow trout fishery, McConaughy provides excellent warmwater fishing for walleye, white bass, catfish, smallmouth and striped bass. The ecology and fishery management of the reservoir was described by McCarraher, Madsen and Thomas (1971).

The self-sustaining rainbow trout population there is recognized as unique in the Great Plains region. The species propagates in tributary streams of the North Platte River, located approximately 60 to 100 miles above the reservoir. These spawning streams are vital to the rainbow population in the drainage and in the reservoir, since they provide the necessary spawning habitat to sustain natural reproduction.

Fishing for migratory rainbow trout in the North Platte River drainage began with the creation of Lake McConaughy in 1945, primarily in the Scottsbluff area streams, with most pressure coming from local anglers in the late 1940's. As the word spread this unique winter stream fishery attracted more and more fishermen from a wider area. Stream fishing pressure increased steadily into the early 1960's.

In the early years of impoundment rainbow fishing at McConaughy was done mainly from the bank during the early spring. Like the rainbow stream fishery, pressure was low and very localized during the early years of impoundment. Anglers didn't discover trolling was very productive until the early 1960's. Angling pressure on the reservoir increased drastically with the rise in popularity of trolling. The increased pressure on both the stream and lake rainbows plus a concern about stream and lake habitat, prompted the Game and Parks Commission to initiate rainbow trout investigations in the North Platte River drainage during the mid-1960's.

The study concentrated on collection of life history information and total utilization of the coldwater stream habitat through a specialized stocking program. Information from the results of this study are presented in the following management plan for Lake McConaughy and the upper North Platte River drainage. The management goal for this drainage is to produce the maximum number of rainbows over one pound for a quality lake and stream fishery.

History

Construction of Kingsley Dam, which created McConaughy Reservoir, radically changed rainbow trout management in the upper North Platte River drainage. The closing of the gates in Kingsley Dam during 1945 and the filling of McConaughy Reservoir created a new coldwater environment that ultimately changed rainbow trout management policies in the tributary streams of the North Platte River. Prior to

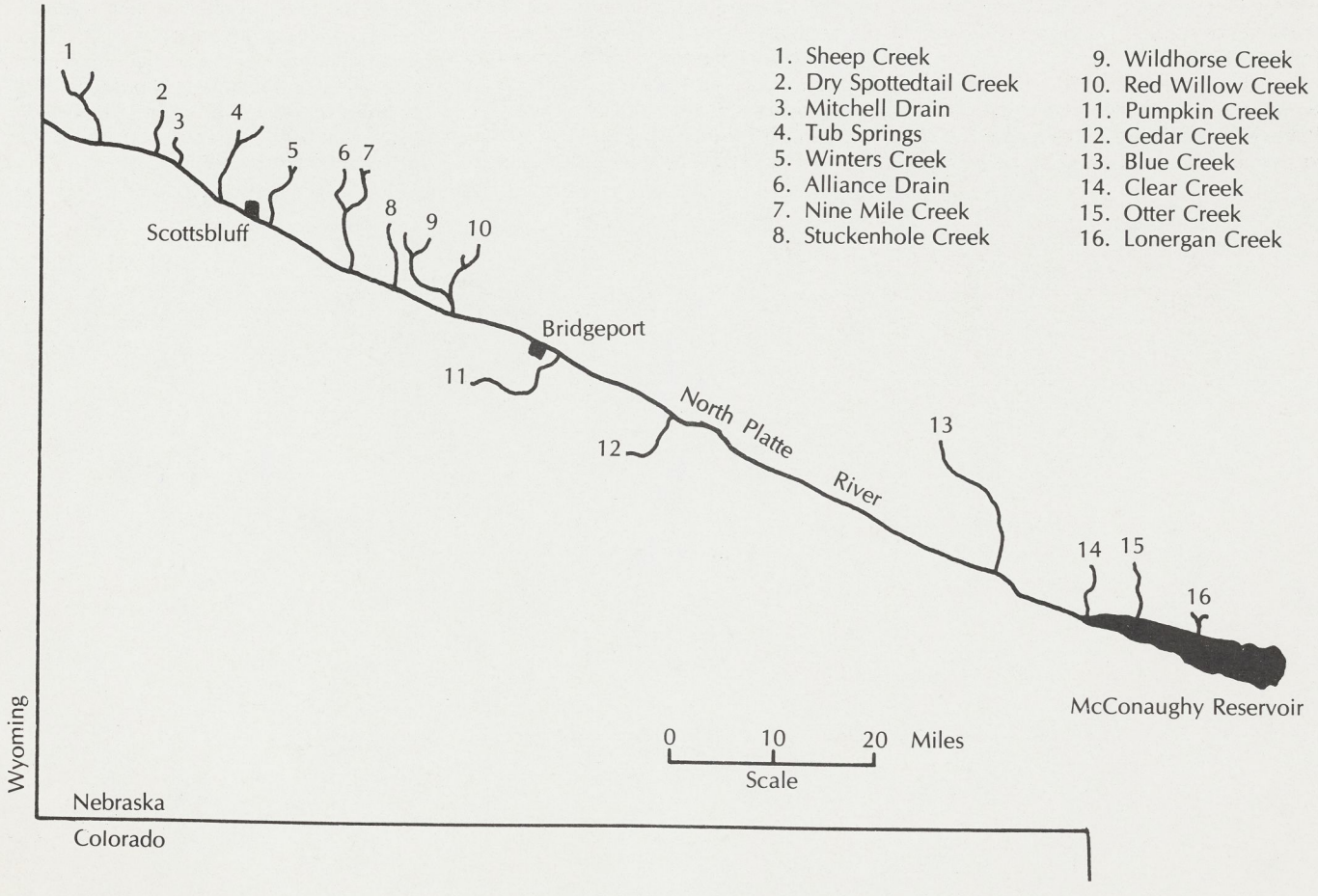


Figure 1. McConaughy Reservoir and Coldwater Streams in the Upper North Platte River drainage, Nebraska.

that time, North Platte Valley streams probably contained only resident rainbow populations. After 1945 stream rainbow populations were influenced by reservoir rainbow populations.

Three philosophies have been pursued during the history of trout management in the upper North Platte River drainage. The 1911-1945 period involved stocking hatchery origin rainbow in most of the North Platte Valley streams. The migratory population of large rainbow as we know it today was probably nonexistent in the drainage. Any migration would probably have been confined to local movement between streams.

From 1946-67 stocking of hatchery origin rainbow continued in the North Platte Valley streams. Migratory reservoir rainbow populations, however, established themselves during this period and survived in the same stream habitat as the stocked rainbow. Stream inventories and surveys conducted during this period were used to classify streams according to the amount of trout natural reproduction present. Beginning in 1968 all stocking of hatchery origin rainbow was terminated. A fingerling stocking program utilizing the wild McConaughy rainbow as brood stock was initiated for the North Platte Valley streams that did not support rainbow trout natural reproduction.

In 1911 hatchery origin rainbow trout were introduced into the upper North Platte River drainage in Nebraska. It is not known if rainbow existed in the tributary streams before these introductions. What natural reproduction resulted from these introductions is another unknown, but undoubtedly it occurred. Until 1945, fingerling and catchable rainbow trout were stocked annually in most of the tributary streams of the North Platte River. These same streams later became spawning areas for the Lake McConaughy rainbow. It is doubtful if distinct rainbow trout spawning migrations occurred before 1945, although this is pure speculation.

After 1945, rainbow populations in many of the tributary streams were influenced by large rainbows which had spent part of their life in McConaughy Reservoir. The first spawning runs from Lake McConaughy were probably rainbows that had been stocked in the tributary streams. This is a reasonable assumption, since McConaughy was not stocked with rainbows until 1947 and they would not have matured until 1949. Nonetheless, anglers reported catching large rainbow in several of the tributary streams from 1946 to 1949.

The unusually large size of these fish would tend to indicate that they migrated from the newly-created reservoir. These first large rainbow spawners had to originate either from spawning stream natural reproduction or from rainbows stocked in the tributary streams. One of the earliest and best documented rainbow trout runs occurred in Otter Creek, a small stream emptying directly into McConaughy. During March 1948, the McConaughy spawning runs at Otter Creek provided eggs for Nebraska's Rock Creek Hatchery and the Crawford National Fish Hatchery.

Hatchery rainbow trout were also stocked annually from 1945 to 1967 in the tributary streams which also served as spawning streams for the McConaughy rainbow. Hatchery rainbows were also stocked directly in Lake McConaughy periodically from 1947 to 1970.

Rainbow trout investigations in the early 1960's concluded these stockings were not increasing the spawning runs from McConaughy Reservoir (Van Velson 1969). Consequently, stocking hatchery origin rainbow was terminated on the spawning streams in 1967 and in the reservoir in 1970.

Since 1967 only fingerling trout hatched from McConaughy rainbow eggs have been stocked in the tributary streams of the North Platte River. Future management plans for McConaughy Reservoir and the upper North Platte River drainage calls for (1) stocking McConaughy rainbows in streams lacking natural reproduction potential; and, (2) aquatic habitat manipulation.

Whether it came about from mass hatchery stockings or rainbow introductions somewhere upstream, or from a combination of the two, a self-sustaining rainbow trout population has established itself by taking advantage of the available environment. This population is superior to the rainbow hatchery product and can sustain itself if man does not degrade the coldwater stream and lake environments.

METHODS AND PROCEDURES

Rainbow trout investigations were conducted in the upper North Platte River drainage in Nebraska from Kingsley Dam (which impounds McConaughy Reservoir) upstream to the Nebraska-Wyoming state line, a distance of approximately 140 miles. Water temperature information and rainbow trout populations were sampled in most coldwater tributary streams emptying into McConaughy or the North Platte River.

Field data collections were made between 1963 and 1975. Fyke nets, electrofishing, and the electrical weir were used to sample rainbow populations throughout the drainage. Rainbow trout exceeding 12 inches total length were classified as adults. Individuals under 12 inches were recorded as juveniles.

Adult rainbow trout were sampled in the spawning streams and the reservoir. The 1963-1966 rainbow trout runs from McConaughy were monitored by electrofishing the spawning streams. The 1967-1974 spawning runs were sampled at the Lewellen electrical weir and fish trap located in the North Platte River immediately above the reservoir, which made it possible to separate the fall and spring spawning populations for the first time. Operation and description of the electrical weir and fish trap were reported by Madsen (1973). Age and growth data were collected at the Lewellen trap. Sexual maturity was classified according to gonad condition. Rainbow trout were recorded as sexually mature when the sex products were visible after gentle pressure was applied along the underside of the body. Age determinations were made by two independent scale interpretations, which were used to determine migration patterns and to classify the life history categories. Designations for life history categories were modified from Shapovalvo and Taft (1954) and Hartman (1959).

Juvenile rainbow trout were captured throughout the drainage. Those ranging from four to eight inches were fin-clipped to ascertain migration patterns and to verity age determinations. Marked rainbow trout were recaptured in the reservoir, at the Lewellen trap, and in the streams when they returned to spawn.

Author checks rainbow captured at the electric weir on the North Platte River, west of Lake McConaughy

LIFE HISTORY OF THE McCONAUGHY RAINBOW

Time of Spawning Migrations

Two spawning runs of rainbow trout migrate from McConaughy Reservoir. Information collected at the Lewellen trap indicated the largest run occurs in the fall (Appendix Table A), beginning slowly in September. The earliest catch of rainbow at the Lewellen trap was on September 11. Over the years, anglers have also reported rainbow catches during September in the spawning streams. The rainbow catch at the Lewellen trap generally increased steadily through October and into early November. Table 1 lists the week producing the most fall run rainbows captured during the 1967-1974 trapping period.

Spawning stream anglers usually report the best fishing during the 30-day period from October 21 through November 19. The catch rate of fall run rainbow at the Lewellen trap usually declined steadily in late November each year until trapping operations ceased because of adverse weather conditions.

Spring run rainbow were captured immediately after the Lewellen trap was put into operation each year. Adverse weather conditions usually delayed trapping operations until March. Since anglers were already catching spring run rainbows in the spawning streams by the time the trap was put in operation, these trout probably leave the lake during late February. However, the peak spawning migration probably doesn't occur until ice cover leaves the reservoir and the Lewellen trap was usually in operation by that time. Table 2 shows the largest weekly catch of spring run rainbow monitored at the Lewellen trap. The spring run was usually over by the middle of April each year.

Table 1. Week of the largest fall run rainbow catch at the Lewellen trap 1967-1974.

Year	Week	Number
1967	October 15-21	50
1968	October 20-26	150
1969	October 19-25	177
1970	October 25-31	58
1971	October 17-23	311
1972	October 15-21	218
1973	October 21-27	191
1974	Sept. 29-Oct. 5	167

Most fall and spring run rainbow were captured during the hours of darkness. Weather appeared to directly affect the daily catch rate of rainbow trout. The largest numbers of rainbow were trapped during mild fall and spring weather. Sudden adverse weather conditions temporarily reduced the number of rainbow migrating from the lake, while a sharp rise in the barometer usually triggered an increased catch of rainbow at the Lewellen trap.

Table 2. Largest weekly catch of spring run rainbow trout at the Lewellen trap 1968-1975.

Year	Week	Number
1968	March 10-16	14
1969	April 6-12	138
1970	March 22-28	27
1971	March 14-20	83
1972	March 5-11	45
1973	March 18-24	193
1974	March 10-16	47
1975	March 19-25	206

Life History Data

Fifteen life history categories were represented in the rainbow trout spawning runs from McConaughy Reservoir (Table 3). Maiden spawners, which had spent one growing season in the stream and two growing seasons in the lake (1/2), made up 63 percent of the spawning run. Second-year spawners which spent one growing season in the stream and two growing seasons in the lake (1/2.1S) accounted for 12

Table 3. Life history categories represented in the 1965-1974 rainbow trout spawning runs from McConaughy Reservoir.

	Life History Categories*															
Year	1/1	1/2	1/3	2/1	2/2	2/3	1/1.1S	1/2.1S	1/3.1S	2/1.1S	2/2.1S	1/1.2S	1/2.2S	2/1.2S	2/2.2S	Total
1965	4	119	4	1	14	—	33	16	—	9	1	6	—	—	—	207
1966	18	73	5	—	4	—	19	29	1	1	—	4	—	—	—	154
1967	32	68	4	2	6	—	2	7	—	1	—	2	—	—	—	124
F-1968	16	499	17	—	31	—	16	73	—	—	—	—	—	—	—	652
S-1969	1	145	6	—	4	—	3	31	—	—	1	—	2	—	—	193
F-1969	12	322	13	7	15	1	17	119	—	1	7	2	2	—	—	518
S-1970	—	22	—	—	2	—	1	1	—	—	—	—	—	—	—	26
F-1970	23	127	—	1	17	—	25	17	—	3	4	3	—	—	1	221
S-1971	2	56	2	—	13	—	6	23	—	—	7	—	1	—	2	112
F-1971	18	410	—	5	62	—	57	17	—	8	2	6	—	—	—	585
S-1972	2	60	3	—	6	—	5	9	—	—	—	—	—	1	—	86
F-1972	13	360	34	5	31	—	44	68	4	—	4	12	4	—	—	579
S-1973	—	154	21	2	10	2	3	31	—	2	6	7	—	—	—	238
F-1973	67	248	43	8	21	—	3	111	15	—	—	30	9	—	—	555
S-1974	—	17	10	—	1	1	—	18	—	—	1	3	1	—	—	52
F-1974	60	422	20	12	13	—	53	31	—	6	—	3	—	—	—	620
Total:	268	3102	182	43	250	4	287	601	20	31	33	78	19	1	3	4922
% Composition	5.45	63.02	3.70	.87	5.08	.08	5.83	12.21	.41	.63	.67	1.58	.39	.02	.06	
% Spawner Classification	Maiden 78						2nd Year 20					3rd Year 2				

*The number of years of stream life are to the left of/. The sum of the numbers to the right of the / are the years spent in the reservoir. The number and the letter S to the right of the period indicates the number of previously completed spawning runs not including the present one.

percent of the run.

The 1965-74 spawning runs contained 78 percent maiden, 20 percent second-year, and 2 percent third-year spawners. The fall and spring run life histories which could be distinguished from each other by utilizing the Lewellen trap are shown in Appendix Tables B and C. Life histories representing the spawning runs monitored in the North Platte Valley streams are shown in Appendix Table D. Fall and spring spawners could not be distinguished from each other so the runs were combined.

Of the young produced from the 1965-1974 spawning runs 93 percent were 1-year-old smolts and 7 percent were 2-year-old smolts before migrating downstream to the reservoir (Table 4). The spawning runs during the 1965-1974 period were comprised of 69.7 percent 3-year-olds, 23.2 percent 4-year-olds, 5.4 percent 2-year-olds, 1.6 percent 5-year-olds and .1 percent 6-year-olds. Rainbow trout scale analysis indicated 14 percent of the fish had spent one growing season, 82 percent spent two growing seasons and 4 percent had spent three growing seasons in the reservoir before maturation and entering their first spawning migration.

Rainbows sampled during the 1967-1974 spawning runs averaged 20.6 inches long and 3.9 pounds. Spring spawning trout were larger than those in the fall. Spring run fish averaged 21.3 inches and 4.4 pounds, compared to 20.4 inches and 3.8 pounds recorded for the fall spawning runs (Appendix Tables E and F).

The sex ratio averaged 1.9 females per male for the 1967-1974 spawning runs monitored at the Lewellen trap. Spring spawning runs (Appendix Table G) showed 2.5 females per male, while the fall average (Appendix Table H) was 1.8 females per male. The fact that some males mature a few months sooner than females may explain the sex ratio difference between spring and fall runs.

A higher proportion of males mature at two years of age than females. This causes a large difference in the sex ratio among the various life history categories (Appendix Table I) and can influence the sex ratio of the entire spawning runs. Examination of two life history categories shows the influence of the earlier maturing males. For instance the 1/1 category (2-year-old fish) had a sex ratio of .6 females per male (Table 5). The predominate category (1/2), composed of three-year-old fish, had a sex ratio of 2.0 females per male (Table 5). A strong year-class of rainbow, which would show up first in the 1/1 category, could influence the sex ratio of the entire spawning run.

Year-Class Strength

The most reliable information available on rainbow trout year-class strength is based on the abundance of two-year-old fish in the spawning runs. Some estimates of year-class strength are available when a year-class is followed throughout its appearances in the spawning runs.

Table 6 shows the age composition of each spawning run during the 1965-1974 period by following the diagonal lines. This table also makes it possible to follow a particular year class through the various spawning runs (by using the dotted lines) from 2 years until 5 or 6 years of age, when they disappear from the population. For example, the 1969 year-class makes its first appearance as a 2-year-old in the 1970 spawning run. By following the diagonal line upward and to the right it is evident that 3-year-old fish representing the 1968 year-class made up 69.2 percent of the 1970 spawning population. The 4-year-old fish from the 1967 year-class represented 18.2 percent of the spawning population, while the 5-year-old fish from the 1966 year-class accounted for 1.8 percent of the 1970 spawning population. The 1965 year class (6-year-old fish) comprised only .4 percent of the 1970 spawning run.

Information on 2-year-old and 3-year-old fish, transferred from Table 6 to Table 7, indicated that in 1966, 1969, and 1972 the strong year-class of 2-year-old fish made up the strongest year classes the following year.

The information from Tables 6 and 7 indicate strong year-classes of 3-year-old

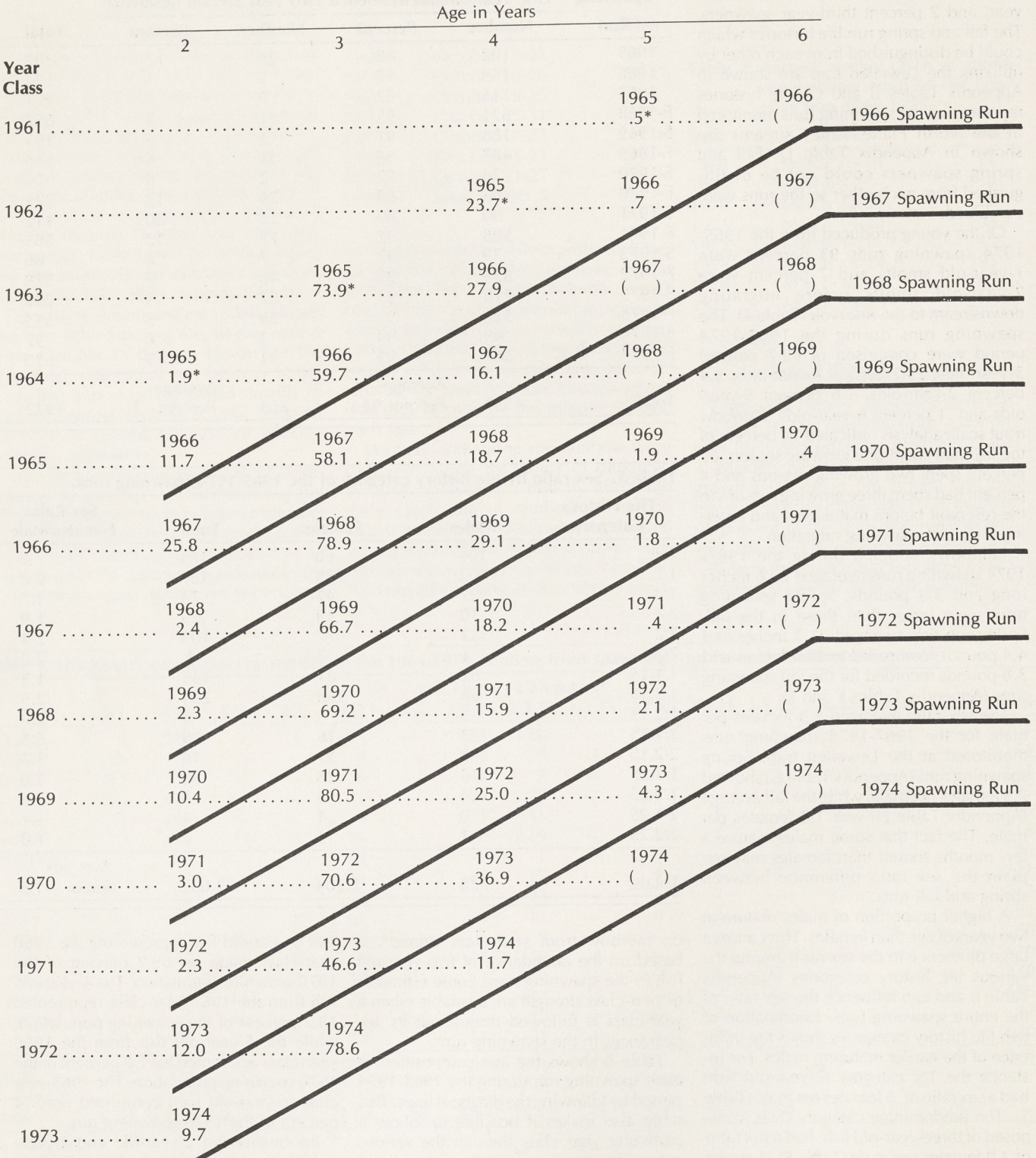
Table 4. Stream residency of the 1965-1974 rainbow trout spawning runs.

Spawning Run	One Year Stream Residence Number	Percent	Two Year Stream Residence Number	Percent	Total
1965	182	88	25	12	207
1966	149	97	5	3	154
1967	115	93	9	7	124
F-1968	621	95	31	5	652
S-1969	188	97	5	3	193
F-1969	487	94	31	6	518
S-1970	24	92	2	8	26
F-1970	195	88	26	12	221
S-1971	90	80	22	20	112
F-1971	508	87	77	13	585
S-1972	79	92	7	8	86
F-1972	539	93	40	7	579
S-1973	216	91	22	9	238
F-1973	526	95	29	5	555
S-1974	49	94	3	6	52
F-1974	589	95	31	5	620
Totals:	4557	Average Percent 93	365	Average Percent 7	4922

Table 5. Sex ratio by life history category of the 1965-1974 spawning runs.

Life History Category	Males	Females	Total	Sex Ratio Females/Male
1/1	104	60	164	.6
1/2	402	785	1,187	2.0
1/3	27	47	74	1.7
2/1	10	19	29	1.9
2/2	32	77	109	2.4
2/3	1	2	3	2.0
1/1.1S	62	81	143	1.3
1/2.1S	66	168	234	2.5
1/3.1S	3	6	9	2.0
2/1.1S	3	16	19	5.3
2/2.1S	3	11	14	3.7
1/1.2S	10	26	36	2.6
1/2.2S	4	4	8	1.0
2/1.2S	0	1	1	—
2/2.2S	1	1	2	1.0
Totals:	728	1,304	2,032	Ave. Sex Ratio 1.8

Table 6. Lake McConaughy rainbow trout age distribution per year class and spawning run for the 1961-1974 period.



*Percentage of the spawning run.

fish can be predicted by knowing the percentage of 2-year-old fish in the spawning runs. As a general rule, a strong year-class is present if 2-year-old fish comprise over 10 percent of a spawning run. The same holds true, if 3-year-old fish represent over 70 percent of the spawning run.

Table 7. Year-class strength of 2-year-old rainbow trout representing the 1964-1972 year classes.

Year Class	Percentage of 2-year-old fish in the spawning runs	Percentage of 3-year-old fish the following spawning run
1964	1.9	59.7
1965	11.7*	58.1
1966	25.8*	78.9*
1967	2.4	66.7
1968	2.3	69.2
1969	10.4*	80.5*
1970	3.0	70.6*
1971	2.3	4.6
1972	12.0*	78.6*

*Four strongest year classes

Deformity

Adult rainbow trout with some type of deformity comprised 4.6 percent of the rainbows captured at the Lewellen trap during the 1967-1975 spawning runs (Table 8). Deformities observed in each spawning run and separated by sex are shown in Appendix Tables J and K.

Two kinds of deformity were observed at the Lewellen trap: One involved rainbow with curvature of the vertebral column either of the lordiosis or scoliosis type. This deformity was most common in the dorsal fin area. The scoliosis type was identified by a large lump along the side. In extreme cases, the lordosis type of deformity caused the rainbow to take on a boomerang shape. X-rays made of rainbows exhibiting scoliosis and lordosis deformities indicated the vertebral columns were out of line in either the lateral or dorsal position but otherwise appeared nearly normal.

The second variety deformity usually occurred in the caudal peduncle region. X-rays of rainbows with this type of deformity indicated the vertebrae in the deformed area appeared smashed or jammed together. No external lumps or any sign of scoliosis or lordosis were noticed on this type of deformity. These individuals merely appeared to be "stubby" because of the shorter than normal caudal peduncle area.

Both types of deformities were either congenital or caused during the first year of life. Available evidence seemed to indicate something happened early in life, and the deformity became more severe and visibly evident as the fish matured. The fact that very few deformed rainbow under 10 inches have been observed supports this theory.

Table 8. Deformity observed among rainbow trout collected at the Lewellen trap during the 1967-1975 period.

Spawning Run	Normal	Deformed	Total	Percent Deformity
Fall Run	3,955	197	4,152	4.7
Spring Run	989	43	1,032	4.2
Totals:	4,944	240	5,184	4.6

Table 9. Anchor worm data collected from fall run rainbow trout populations, Lewellen trap, 1967-1974.

Spawning Run	Sample Size	Anchor Worms or Scars					
		0		−5		+5	
		Number	Percent	Number	Percent	Number	Percent
Fall 1974	618	35	5.6	276	44.7	307	49.7
Fall 1973	506	39	7.7	190	37.6	277	54.7
Fall 1972	577	145	25.2	377	65.3	55	9.5
Fall 1971	578	219	37.9	312	54.0	47	8.1
Fall 1970	211	76	36.0	96	45.5	39	18.5
Fall 1969	565	433	76.6	119	21.1	13	2.3
Fall 1968				No anchor worm data recorded			
Fall 1967				No anchor worm data recorded			
Totals:	3055	947		1370		738	
Average Percent:			31.0		44.8		24.2

Exposure to electricity at the Lewellen trap during the smolt stage or during the juvenile stream sampling program would be the only obvious mechanical injury that might cause deformities. An experiment was conducted to see if the electrical field at the Lewellen trap was causing skeletal damage. Hatchery rainbow (8-10 inches in length) were exposed to the electrical field of the Lewellen trap. The exposed rainbow were X-rayed but no indications of skeletal damage could be observed. However, it is possible that the electrical field caused nerve or muscular damage that would not appear on the X-rays. As long as the percentage of deformities remains low, it might be a natural occurrence. If deformities approach 8 to 10 percent, they should no longer be considered natural, and investigations should be made to determine the cause.

Parasites

The most common external parasite observed on adult rainbow trout in the North Platte River was the anchor worm (*Lernaea* sp.). Anchor worms were observed annually on adult rainbow spawners throughout the rainbow trout investigations. Usually anchor worm infestations were heaviest during the late summer and fall. Consequently anchor worms were present in the largest numbers on fall run rainbow. Spring run rainbows had very few anchor worms.

Anchor worms were observed in various stages of development. The first sign of anchor worm infestation was a small red inflamed area. Upon close observation a very small thread-sized anchor worm could be seen protruding from the inflamed area. Later in the fall the anchor worms were fully developed with egg sacks present. After the anchor worms had dropped from the rainbow, large red inflamed areas remained and were recorded as scars.

Anchor worm data are presented in two different forms because no distinction was made between anchor worms and scars left by anchor worms during the 1967-1971 period (Tables 9 and 10). After 1971 a distinction was made between anchor worms and scars, consequently the actual counts of both were recorded for each adult examined in the spawning runs (Table 11 and 12). The information contained in Tables 9 and 10 indicate a trend towards heavier anchor worm infestations between the 1969 and 1974 spawning runs. In 1969, 77 percent of the adult rainbow examined at the Lewellen trap were free of anchor worm infestations. However, in 1974 only 6 percent were not infected (Table 9).

During several spawning runs, anchor worm investigations were recorded either

as worms or scars and actual counts were made (Table 11 and 12). If a worm was visible in the inflamed area, it was counted and recorded as a worm, otherwise, it was recorded as a scar. Worms and scars were recorded for each adult fish examined in the spawning runs.

An occasional fish louse was observed on the adult rainbow examined at the Lewellen trap, but the occurrence was rare. No other external parasites were noted.

Disease

Investigations were made on the McConaughy rainbow trout population from 1970 through 1976 (Table 13), primarily to determine the disease status of this wild population.

The first examination for diseases was made in 1970, when small rainbow fry were sent to the U.S. Fish and Wildlife Service Disease Laboratory in Genoa, Wisconsin. Tests conducted there showed no evidence of disease. The high mortality of fry that year was apparently a combination of never learning to feed and a possible poor grade of feed, plus the fact these fish are from a "wild" population.

Adult spawners were held for egg collections beginning in 1966. However, the first disease problems did not develop until the spring of 1971. That spring, rainbows held at Winter Creek Hatchery suffered heavy mortality the first 10 days. Externally, the fish developed large patches of fungus around the dorsal area and the fish appeared to lose equilibrium. An internal examination revealed a very extended air bladder filled with small amounts of mucus. Eggs from the 1971 spring run suffered a very high mortality in the pre-eyed stage, but disease diagnosis was not conducted.

The 1971 fall run of adult rainbow trout, held at the Winter Creek Hatchery and at the Rock Creek Hatchery, showed the same symptoms observed in the spring. This time, however, adult rainbow trout were sent to the U.S. Fish and Wildlife Service Disease Laboratory in Genoa, Wisconsin, which identified cultures of *Aeromonas liquefaciens*. The lab identified the same disease in 1972 fall-run rainbows.

In 1973, adult McConaughy rainbow were again sent to the Genoa lab. These fish were tested for infectious pancreatis necrosis (IPN), infectious hematopoietic necrosis (IHN), viral hemmorrhagic septicemia (VHS), furunculosis, and kidney disease. None of these diseases were found.

McConaughy rainbow trout spawners were taken to the U.S. Fish and Wildlife Service Fish Disease Control Center in Fort Morgan, Colorado, during 1975 and 1976. Routine investigations revealed no diseases.

Aeromonas liquefaciens is the only disease identified in the wild McConaughy rainbow trout populations, and it has appeared only periodically when rainbow spawners are held prior to artificial egg collections.

Table 10. Anchor worm data collected from spring run rainbow trout populations, Lewellen trap, 1971-1974.

Spawning Run	Sample Size	Anchor Worms or Scars					
		0		−5		+5	
		Number	Percent	Number	Percent	Number	Percent
Spring 1974	52	10	19.2	19	36.6	23	44.2
Spring 1973	247	231	93.5	13	5.3	3	1.2
Spring 1972	87	79	90.8	5	5.8	3	3.4
Spring 1971	116	108	93.1	8	6.9	0	0.0
Totals:	502	428		45		29	
Average Percent:			85.2		9.0		5.8

Table 11. Anchor worms and scars present on fall run rainbow trout collected in the Lewellen trap, 1971-1974.

		Spawning Run					
		Fall 1974	Fall 1973	Fall 1972	Fall 1971	Total	Percent of Total
	Sample Size	618	506	577	578	2279	
ANCHOR WORMS	0	217	39	327	219	802	35.2
	1	131	28	140	135	434	19.0
	2	104	67	71	102	344	15.1
	3	67	49	18	52	186	8.2
	4	38	46	10	23	117	5.1
	5	25	53	2	17	97	4.3
	6-10	34	120	5	17	176	7.7
	11-15	1	54	2	9	66	2.9
	16-20	1	20	0	1	22	1.0
	21-25	0	9	0	1	10	.4
	26-30	0	2	0	0	2	.1
	31+	0	19	2	2	23	1.0
ANCHOR WORM SCARS	0	50	—*	216	—*	266	22.3
	1	81	—	187	—	268	22.4
	2	110	—	96	—	206	17.2
	3	100	—	32	—	132	11.0
	4	82	—	18	—	100	8.4
	5	43	—	7	—	50	4.2
	6-10	128	—	13	—	141	11.8
	11-15	11	—	1	—	12	1.0
	16-20	4	—	4	—	8	.7
	21-25	3	—	1	—	4	.3
	26-30	—	—	—	—	—	0.0
	31+	6	—	2	—	8	.7

*No scars recorded.

Pesticide Analysis

Adult McConaughy rainbow trout and eggs from this wild population were tested for various pesticides during the 1968-1970 period. Results appear in Table 14.

Tag Return and Fin Clipping Data

Tag Return Data

Angler harvest and migration data was collected by tagging adult rainbow trout at two sites, the Lewellen trap (1967-1972) and in the North Platte Valley spawning streams (1962-1970). All spawners were marked with metal monel jaw tags. Angler harvest data from both sites are shown in Table 15.

Voluntary tag returns by anglers from each tagging site were separated into two

Table 12. Anchor worms and scars present on spring run rainbow trout collected in the Lewellen trap, 1972-1974.

		Spawning Run				
		Spring 1974	Spring 1973	Spring 1972	Total	Percent of Total
	Sample Size	52	247	87	386	
ANCHOR WORMS	0	39	247	83	369	95.6
	1	4	0	4	8	2.0
	2	4	0	0	4	1.0
	3	3	0	0	3	.8
	4	1	0	0	1	.3
	5	1	0	0	1	.3
	6-10	0	0	0	0	0.0
	11-15	0	0	0	0	0.0
	16-20	0	0	0	0	0.0
	21-25	0	0	0	0	0.0
	26-30	0	0	0	0	0.0
	31+	0	0	0	0	0.0
ANCHOR WORM SCARS	0	13	231	81	325	84.2
	1	4	6	1	11	2.9
	2	8	6	1	15	3.9
	3	1	0	1	2	.5
	4	3	1	0	4	1.0
	5	3	1	2	6	1.6
	6-10	11	2	1	14	3.6
	11-15	4	0	0	4	1.0
	16-20	3	0	0	3	.8
	21-25	0	0	0	0	0.0
	26-30	0	0	0	0	0.0
	31+	2	0	0	2	.5

Table 13. Lake McConaughy (Spring and Fall Run) rainbow trout disease investigations, 1970-1976.

Year	Size	Laboratory	Type of Test	Disease Reported
1970	Fry	Genoa, Wis.	Routine	None
1971	Adult	Genoa, Wis.	Routine	*Aeromonas liquefaciens*
1972	Adult	Geona, Wis.	Routine	*Aeromonas liquefaciens*
1973	Adult	Geona, Wis.	Routine including IPN, IHN, VHS, Furuculosis, Kidney Disease	None
1975	Adult	Fort Morgan	Routine	None
1976	Adult	Fort Morgan	Routine	None

Table 14. Lake McConaughy rainbow trout pesticide analysis.

			p.p.m. Pesticide (Wet Basis)						
Date	Description of Sample	Percent Fat	DDE	DDD	DDT	Dieldrin	BHC	Est. PCB	p.p.m. Mercury
1/ Nov. 1970	3 Adult Rainbow Trout (Composite Sample)	11.3	.140	.050	.028	.020	.010	.083	.11
2/ Oct. 1969	3 Adult Rainbow Trout (Composite Sample)	9.88			.459* 4.650**				
2/ Oct. 1969	Adult Rainbow Trout	10.79	160	340	.571* 5.290**				
2/ Jan. 1968	Rainbow Trout Eggs					.076			

*Whole Fish.
**Fat.
1/ Tests conducted by WARF Institute, Inc., Madison, Wisconsin.
2/ Tests conducted by Game and Parks Commission, Lincoln, Nebraska.

Table 15. Vountary angler tag return data from Lewellen trap and North Platte Valley tagging efforts.

Tagging Site	Total Number Tagged	Number of Voluntary Tag Returns	Angler Harvest or Tag Returns (Percent)
North Platte Valley Streams 1962-1968	1,010	182	18.0
Lewellen Trap 1967-1972	1,046	203	19.4

Table 16. McConaughy rainbow trout data obtained from fall and spring run spawners tagged at the Lewellen trap during 1967-1972, returned by anglers in the North Platte River drainage during 1967-1976.

Spawning Run	Number Tagged	Returned by Stream Fishery		Returned by Lake Fishery		Returned by Others*		Total Number Returned	Total Percent Returned
		Number	Percent	Number	Percent	Number	Percent		
Fall 1967	96	14	14.6	5	5.2	—	—	19	19.8
Fall 1968	104	23	22.1	5	4.8	—	—	28	26.9
Fall 1969	142	17	12.0	11	7.7	—	—	28	19.7
Fall 1970	118	22	18.6	3	2.5	—	—	25	21.2
Fall 1971	219	36	16.4	4	1.8	—	—	40	18.2
Fall 1972	185	19	10.3	2	1.1	1	.5	22	11.9
	864	131		30		1		162	18.8
Spring 1968	13	1	7.7	1	7.7	—	—	2	15.4
Spring 1969	90	9	10.0	11	12.2	1	1.1	21	23.3
Spring 1970	18	—	—	7	38.9	—	—	7	38.9
Spring 1971	43	5	11.6	3	7.0	—	—	8	18.6
Spring 1972	18	1	5.6	2	1.1	—	—	3	16.7
	182	16		24		1		41	22.5
Totals:	1046	147	14.1	54	5.2	2	.1	203	19.4

Average voluntary return (Spring and Fall) = 203/1046 = 19.4%

*Lake Ogallala or irrigation canal and North Platte River below the Keystone diversion.

Table 17. McConaughy rainbow trout tagging data. Fall and spring run spawners tagged in the North Platte Valley spawning streams and returned by anglers in the North Platte River drainage during the 1962-1970 period.

Spawning Run	Total Number Tagged	Returned by Stream Fishery		Returned by Lake Fishery		Total Number Returned	Total Percent Returned
		Number	Percent	Number	Percent		
1962-63	106	11	10.4	4	3.8	15	14.2
1963-64	120	25	20.8	4	3.3	29	24.1
1964-65	239	33	13.8	10	4.2	43	18.0
1965-66	267	15	5.6	16	6.0	31	11.6
1966-67	147	28	19.0	12	8.2	40	27.2
1967-68	131	20	15.2	4	3.1	24	18.3
Totals:	1,010	132	13.1	50	4.9	182	18.0

Table 18. Tag returns from Lewellen trap and North Platte Valley tagging efforts, representing the lake and stream fishery.

Tagging Site	Number Tagged	Number Returned	Number And Percentage Of Tag Returns Stream Fishery		Lake Fishery	
			Number	Percent	Number	Percent
North Platte Valley Streams	1,010	182	132	72.5	50	27.5
Lewellen Trap	1,046	203	147	72.4	54	26.6

Table 19. Destination of McConaughy fall and spring run rainbow trout spawners tagged at the Lewellen trap (1967-1972) and recovered in tributary streams of the North Platte River.

Streams Where Tagged Fish Were Caught by Anglers	Number	Percent
Nine Mile Creek	57	42.3
Red Willow Creek	33	24.5
Tub Springs	20	14.8
Pumpkin Creek	16	11.9
Winters Creek	5	3.7
Wildhorse Creek	1	.7
Sheep Creek	1	.7
Silvernail Drain	1	.7
Browns Canal	1	.7
Totals:	135*	100.0

*12 additional tags were reported, 6 from the North Platte River and 6 from unknown streams.

Table 20. Rainbow trout tagged at the Lewellen trap and recaptured in a later spawning run.

Spawning Run	Number
Fall run rainbow trout recaptured in a fall run approximately 10-12 months later	17
Fall run rainbow trout recaptured in a spring run approximately 15-17 months later	1
Spring run rainbow trout recaptured in a spring run approximately 10-12 months later	2
Spring run rainbow trout recaptured in a fall run approximately 5-7 months later	1
Total:	21

categories: (1) tags returned by stream anglers and (2) tags returned by lake anglers (Tables 16 and 17).

A similar proportion of tag returns from the lake fishery and the stream fishery was reported from each tagging site (Table 18). There was not a statistically significant difference ($P<.01$) between spawners tagged at the Lewellen trap and spawners tagged in the North Platte Valley streams. The annual return of tags representing the lake and stream fishery for both tagging sites are shown in Appendix Table L.

The spawning stream destination of McConaughy spring and fall run rainbows can be obtained through examination of tagged rainbow (Table 19). Of the streams located above the reservoir, Nine Mile Creek, Red Willow Creek, and Tub Springs accounted for over 80 percent of the tags returned.

Use of the Lewellen trap as a sampling tool allowed complete separation of fall run and spring run spawners for the first time. The only evidence to substantiate the theory of two separate and distinct spawning populations comes from recaptures of tagged rainbow trout spawners (Table 20). The total number of tagged rainbow trout recaptured is low because of the high turnover rate in the spawning population. The spawning populations are comprised of 78% maiden, 20% second year and 2% third year spawners (Table 3). Consequently only 21 tag returns from second and third year spawners were available. Of this number, 19 (90 percent) migrated from the reservoir during the same (fall or spring) spawning run as they were originally tagged in. Only 2 (10 percent) of the tagged rainbow were classified as strays and returned in a different spawning run. If this small sample size of tagged rainbow trout is representative of the entire population, the theory of two distinct spawning runs is apparently true.

The capability of the McConaughy rainbow trout to return and spawn for a second time in a stream where they had spawned previously can be measured by examining the return of tagged trout to the spawning streams one year after being tagged. High mortality among first-year spawners severely reduced the number of tagged trout returning to spawn for a second or third time. Of the 1,010 adult rainbow trout spawners tagged in the spawning streams during 1962-1968, only 24 were recaptured in a second spawning run. Of these, 21 or 88 percent had returned to the stream where they had spawned and been tagged the year before. The remaining 12 percent went to other streams and were classified as strays. If these tag returns are indicative, then approximately 12 percent of the rainbows stray to a different stream to spawn the second time.

Fin-Clipping Data

Since 1963 every hatchery origin or domestic rainbow trout stocked in the North Platte River drainage above Kingsley Dam has been fin clipped. Information collected from these marked hatchery origin trout from 1963 through 1965 was reported by Van Velson (1969). Data in this report cover the period from 1966 through 1975. The survival and return of all fin-clipped rainbow trout was evaluated at the Lewellen trap.

Three different groups of rainbow trout were marked from 1966 through 1973: (1) hatchery origin or domestic rainbow trout, (2) McConaughy rainbow trout natural reproduction, and (3) stocked McConaughy rainbow trout progeny.

Lengths and weights of all fin-clipped trout captured at the Lewellen trap from 1967 through 1975 are shown in Appendix Table M. Rainbow trout fin-clipping records for the North Platte River drainage during 1965-1973 are shown in Appendix Table N, while Appendix Tables O, P, and Q indicate the spawning runs in which each group of fin-clipped fish was recovered. The survival and return data for each group of marked rainbow trout are shown in Tables 21, 22, and 23.

Several assumptions must be made about the fin-clipped rainbow trout in the North Platte River drainage. First, the Lewellen trap was merely a sampling tool, and efficiency was probably below 5 percent during most of the sampling periods. However, there was no evidence that it was biased for or against the capture of marked rainbow trout. Secondly, it must be assumed, since there is no evidence to dispute it, that marked and unmarked trout had similar migration patterns in the North Platte River drainage.

There were 14,535 marked hatchery origin rainbow trout stocked in the North Platte Valley spawning streams during 1966 and 1967(Table 21). Data collected from these marked fish indicated it was necessary to stock 1817 hatchery trout to sample one marked adult in the Lewellen trap (1:1817).

Natural reproduction of McConaughy rainbow trout in the North Platte Valley spawning streams were fin clipped annually from 1965 through 1970, usually between November and March each year when they were about four to eight inches long. Although most marking was done in Nine Mile Creek, rainbows were fin-clipped throughout the spawning streams in the North Platte Valley. Totally, 8,614 rainbow trout originating from natural reproduction were marked in the North Platte River drainage (Table 22). The ratio was 1 marked adult spawner recaptured at the Lewellen trap for every 57 juvenile natural reproduction rainbow marked in the spawning streams (1:57). Obviously, marked rainbow trout natural reproduction returned in larger proportions than the marked hatchery origin rainbow trout.

A similar marking program was conducted for the McConaughy rainbow progeny stocked in the upper North Platte River drainage. These fish were hatched from wild eggs artificially stripped from fall and spring run spawners. The rainbows were raised to approximately 500 fish per pound in the Rock Creek Hatchery, then

Table 21. Survival and return of hatchery origin rainbow trout in the North Platte River drainage, 1966-1975.

Date	Fin Clip	Source	Stocking Location	Number Marked	Number Re-captured at Lewellen Trap	Percent Recaptured
May 1966	Left Pectoral	Hatchery	Nine Mile Creek	2,050	3	.146
May 1966	Right Pelvic	Hatchery	North Platte Valley Streams	2,185	1	.046
Feb.-Sept. 1967	Dorsal	Hatchery	North Platte Valley Streams	10,300	4	.039
				14,535	8	.055
			ratio of marked juveniles to recaptured adult rainbow 1:1817			
Nov. 1967	Anal	Hatchery	Lake McConaughy	5,021	2	.040
June 1970	Dorsal	Hatchery	Wildhorse Dam	3,011	10	.332
Oct. 1970	Right Pectoral	Hatchery	Lake McConaughy	12,000	4	.033
				20,032	16	.086
			ratio of marked juveniles to recaptured adult rainbow 1:1252			

Table 22. Survival and return of McConaughy rainbow trout natural reproduction in the North Platte River drainage, 1966-1975.

Date	Fin Clip	Source	Stocking Location	Number Marked	Number Re-captured at Lewellen Trap	Percent Recaptured
Nov. 1965-March 1966 1965 Year Class	Left Pelvic	Natural Reproduction	Nine Mile Creek	599	5	.835
Nov. 1966-March 1967 1966 Year Class	Right Pectoral & Anal Right Pelvic	Natural Reproduction	North Platte Valley Streams	3,598	51	1.417
Nov. 1967-March 1968 1967 Year Class	Adipose	Natural Reproduction	Nine Mile Creek	1,320	42	3.182
Nov. 1968-March 1969 1968 Year Class	Right Pelvic	Natural Reproduction	Nine Mile Creek	1,320	28	2.121
Nov. 1969-March 1970 1969 Year Class	Left Pectoral	Natural Reproduction	North Platte Valley Streams	1,209	15	1.241
Nov. 1970-March 1971 1970 Year Class	Left Pelvic	Natural Reproduction	North Platte Valley Streams	568	9	1.585
Totals:				8,614	150	1.741
			ratio of marked juveniles to recaptured adult rainbow 1:57			

Table 23. Survival and return of McConaughy rainbow progeny stocked in the North Platte River drainage, 1970-1975.

Date	Fin Clip	Source	Stocking Location	Number Marked	Number Re-captured at Lewellen Trap	Percent Recaptured
Nov. 1970-March 1971 1970 Year Class	Left Pelvic	McConaughy RB Progeny	North Platte Valley Streams	370	6	1.622
Nov. 1971-March 1972 1971 Year Class	Right Pelvic	McConaughy RB Progeny	North Platte Valley Streams	475	2	.421
Nov. 1972-March 1973 1972 Year Class	Left Pectoral	McConaughy RB Progeny	Alliance Drain	5,756	15	.261
				6,601	23	.348
			ratio of marked juveniles to recaptured adult rainbow 1:287			
Nov. 1971-March 1972 1971 Year Class	Anal	McConaughy RB Progeny	Clear Creek	585	2	.342
Nov. 1972-March 1973 1972 Year Class	Right Pectoral	McConaughy RB Progeny	Clear Creek	230	1	.435
				815	3	.368
			ratio of marked juveniles to recaptured adult rainbow 1:272			

stocked in the North Platte River drainage. They were fin clipped at sizes ranging from two to eight inches. Results are shown in Table 23. There would have been even more marked rainbow trout from the 1972 year-class had the Lewellen trap been operated during the 1975 fall run and 1976 spring run.

The ratio was 1 marked adult spawner recaptured at the Lewellen trap for every 287 marked McConaughy rainbow stocked in the North Platte river drainage (1:287). This return (1:287) is lower than the return of McConaughy rainbow trout natural reproduction (1:57) but it is much higher than hatchery origin rainbows (1:1817). The McConaughy rainbow progeny, stocked in the North Platte Valley streams, return in much greater proportions than hatchery origin rainbow stocked in the same North Platte Valley streams.

Adults sampled in the Lewellen trap that were marked in the upper end of Clear Creek were not figured in the return of stocked McConaughy rainbow progeny. These fish represented strays, since Clear Creek enters the North Platte River 2.2 miles below the Lewellen trap. There is no evidence of straying among rainbow trout marked in Otter Creek. There were 7,222 naturally produced rainbow trout (5 to 7 inches long) fin-clipped in Otter Creek, but no marked Otter Creek rainbow trout were ever captured at the Lewellen trap.

Life Cycle

The McConaughy rainbow begins its life in the gravel riffle areas of ground water streams in the upper North Platte Valley. The female fans a depression in the shallow gravel areas of the stream. She then deposits the eggs, which are quickly fertilized by male rainbows. The female covers the eggs with four to eight inches of gravel and abandons the nest. Spawning nests or redds, visible because of the disturbed gravel, can be seen throughout the winter in the spawning streams.

Two distinct rainbow trout spawning runs enter the North Platte Valley trout streams. Fall-run spawners start entering the spawning streams during September and continue into late November. The fall run contains the largest numbers. The spring run in March and April is smaller but individual fish are slightly larger. The fall run spawning peaks in December, the most active spawning month. March is the most active spawning month for the spring run.

The quality, type, and amount of spawning gravel varies considerably throughout the drainage. Heavy silt loads present in the spawning streams during the irrigation season undoubtedly affect the quality of the spawning gravel. The silt causes compaction of the spawning gravel, which in turn reduces the flow of water through the spawning gravel. Fortunately, the silt loads are lowest during the spawning period. The heaviest silt loads observed in the spawning streams during the winter months occur only when large concentrations of waterfowl use these streams during prolonged cold periods.

The stream bottom substrate, where rainbows spawn, varies between a hard compressed clay in the upper end of the drainage to that at Otter Creek which has gravel similar to large rock gravel found on some sand bars in the North Platte River. The spawning substrate in part of Nine Mile Creek consists of Brule clay which has broken off as the stream eroded through this formation. This clay has persisted because it is much more resistant to erosion than the other soils in the watershed. The size of the stream bottom substrate used for spawning varies between one and four inches in diameter. The amount of spawning gravel varies considerably from very small areas of less than 10 feet in diameter to areas such as Nine Mile Creek where there are stretches of continuous spawning gravel nearly one-half mile long. Rainbow trout spawning is probably confined to the tributary streams of the North Platte River, at least it has never been documented in the main channels of the North Platte River.

Most of the North Platte Valley streams have eroded into the water-bearing gravel or clay. The groundwater, which is the main water source, enters the streams in these rocky or gravel areas that also are utilized by spawning rainbow trout. This flow of water into the stream insures an adequate water supply over the eggs buried in the gravel and is one of the major factors which allows rainbow to reproduce in the North Platte Valley streams.

The water temperature in the prime spawning areas of the North Platte Valley streams ranges between 40 and 50 degrees Fahrenheit during the winter period. At these water temperatures it takes approximately 8 to 10 weeks for rainbow eggs to hatch and the fry to develop to a point where they emerge from the gravel and start feeding. Rainbow fry can usually be observed in the shallow, quiet, slow moving areas of the spawning streams during the first part of February. In streams like Nine Mile that have both fall and spring run spawners rainbow fry can usually be observed during February, March, and April. Within two to three weeks after emerging from the gravel the fry have developed enough so most of their time is spent in the faster water where they are not easily observed. Periodic surveys from February through April usually gives some indication of rainbow trout spawning success.

The small trout continues to grow and develop during the summer, fall and winter in the North Platte Valley streams. By early spring, approximately one year after being hatched, juvenile rainbows have reached about 7 to 10 inches. Most of them are then ready for the long journey out of the spawning streams and down the North Platte River into Lake McConaughy. Approximately 93 percent of the rainbow move to the lake at the end of the first year, while the remaining 7 percent stay in the spawning streams two years before the first migration to the reservoir. The juvenile rainbows that spend two years in the spawning streams probably represent the late spring spawning rainbows and the small and slower growing fall run rainbows. Virtually the entire rainbow population in the North Platte Valley streams migrates to Lake McConaughy.

Appearance of the juvenile rainbow changes drastically just prior to the downstream migration. At this smolt stage, the parr marks (dark oval markings on the side characteristic of fingerling rainbow) disappear, while the sides of the trout turn from light gray to a bright silvery white. The tips of the tail and, to a lesser extent, the tip of the dorsal fin turn nearly black and the entire body becomes more streamlined. The 7 to 10-inch rainbows with their black tails can be easily observed by quietly walking the spawning streams in late February, March, and April, just prior to the downstream migration.

The smolts enter McConaughy during March, April, and May. Upon entering the reservoir, the rainbow feed almost entirely upon Cladocerans. During May of some years small trout can be observed on the surface of the reservoir in the Sports Service Bay area, directly south of Kingsley Dam.

Recently there has been concern about the loss of rainbow smolts through the "morning glory" or surface outlet of the reservoir. This appears to be a valid concern, because of the strong downstream migration instinct of the smolt population during the early spring. Officials of the Central Nebraska Public Power and Irrigation District stationed at Kingsley Dam

have cooperated and have agreed to attempt to manipulate the water level without using the morning glory or surface outlet until July 1. Keeping the surface outlet gate closed from April through June is possibly one of the best reservoir management recommendations for the rainbow trout population.

The growth rate of rainbow trout approaches an inch per month during the first few months in the reservoir. By July when the recently hatched gizzard shad become available as forage the rainbow are about 12 to 13 inches in length. At this size, rainbow switch from a plankton diet to one of small fish, mainly the gizzard shad. At the end of the first summer or growing season in McConaughy, rainbows have grown to an average of 15 inches. A small percentage of the two-year-old rainbows will mature at this size and migrate upstream to spawn. However, most McConaughy rainbows become sexually mature a year later, when three years of age.

When the trout leave the reservoir, journey up the North Platte River, and enter the spawning streams to spawn, their life cycle is nearly completed. They usually return to the same streams where they hatched three years before. By maturity the rainbow have moved the 100-mile length of the North Platte River twice, been exposed to high water temperatures, flooding, irrigation return waters, and predation by man, animals, birds and other fish in the streams, river, and reservoir. The rainbow that have survived can perpetuate the species providing the proper spawning habitat is available.

Rainbow trout were originally spring spawners. In the case of the McConaughy rainbow, however, a more successful fall run has become established because the stream environment in the North Platte River drainage gives it an advantage over a spring run. Fall spawners gain an advantage because the young have from February until May to grow enough to survive the critical conditions that exist during the summer months. Also, during this period rainbow become acclimated to warming water temperatures. In contrast, the spring run rainbow barely emerge from the gravel when the streams begin to show the effects of the critical summer season. These factors help explain why the fall run produces the bulk of the rainbow trout production in the North Platte Valley drainage.

In any self-sustaining rainbow trout population the most competitive and successful individuals survive to carry on the population. Genetics has indeed played an important role in the present self-sustaining rainbow population that survives in the North Platte River drainage. This is the single most important concept that should influence future management of this population.

THE STREAM ENVIRONMENT

Observations and data collections were made from all streams in the North Platte River drainage that had rainbow trout potential. It was concluded approximately 30.4 miles of streams will support at least some rainbow trout natural reproduction. An additional 29.6 miles do not support natural reproduction but can be used as nursery streams for stocked rainbow trout. These 60 miles of trout streams were classified as natural reproduction or nursery streams based upon water temperature, grazing practices, irrigation diversions, flooding, irrigation return waters, dewatering practices, migration barriers, and spawning habitat observations.

The riparian habitat surrounding the North Platte Valley streams ranges from intensively farmed cropland in the upper end of the drainage to the sandhills grasslands in the lower end of the drainage near McConaughy Reservoir.

The North Platte Valley streams located from Bridgeport to the Nebraska-Wyoming state line generally start in grasslands with high water tables or groundwater areas. Where the streams originate as small groundwater seeps, there is little if any influence from irrigation return water or waste water releases from canals. Flooding is generally not as severe in these headwater areas of the North Platte Valley streams. The streams gradually increase in size, as they flow toward the North Platte River.

Irrigation canals cross the middle or lower reaches of most of the streams. These canals influence the volume of water in the North Platte Valley streams. Waste water release from canals and irrigation return water from fields directly increase stream flows. Indirectly, stream flows are increased by water seepage from the canals, which recharges the groundwater. An increase in streamflow above the groundwater base flow is evident when the irrigation canals are filled in May each year and continues until they are drained in September. Streamflows then decrease slowly until a low point is reached the following March or April. The cycle repeats itself when the irrigation canals are filled again. Most of the streams located below irrigation canals in this area of the North Platte Valley show some variation of this typical streamflow pattern.

Irrigation projects and heavy streambank grazing in the upper North Platte drainage has the greatest impact on trout production in the North Platte Valley streams. Such grazing is very heavy along most of the trout streams from the Bridgeport area to the Nebraska-Wyoming line.

Stream bank grazing is usually not as heavy along the trout streams flowing out of the sandhills in the lower end of the drainage as in the Scottsbluff area. The flow in these streams (Otter, Clear, and Lonergan creeks) is relatively stable, and they are not influenced by irrigation projects like those in the upper North Platte Valley.

Streams with the steepest gradient (Nine Mile, Red Willow, and Otter Creeks) are the most productive for rainbow trout. The prime spawning areas of Nine Mile Creek have a gradient of 30.6 feet per mile. Spawning success is poor in the lower end of Nine Mile Creek where the gradient is 14.3 feet per mile. Low gradient streams generally will not support natural reproduction, because of silt or sand bottoms, and appear to have lower aquatic insect populations than high gradient streams.

Generally speaking, the irrigation diversions in the North Platte Valley only divert water during the irrigation season from May through September. During this time, the streams carry the heaviest silt loads from irrigation return water, waste water releases from canals, and floods caused by periodic heavy rainfalls. Most of the streams clear up after the irrigation season, and the turbidity is at its lowest level during the winter spawning period.

Natural Reproduction Streams

North Platte Valley streams that support natural reproduction are presented in their order of importance for rainbow trout production. Some have both natural reproduction and nursery area potential for McConaughy rainbow trout fingerlings. Actual fisheries management of each stream and acquisition recommendations are presented in the management plan section.

Nine Mile Creek

Located in Scotts Bluff County, Nine Mile Creek is the major spawning stream for the McConaughy rainbow trout population. This stream originates as two small groundwater streams in Sec. 34, Twp. 23N, Rge. 53W. After these streams join in Sec. 3, Twp. 22N, Rge. 53W, the creek flows in a southerly direction picking up groundwater throughout its length until it flows approximately 130 cfs before joining the North Platte River in Sec. 25, Twp. 21N, Rge. 53W. Small unnamed drains flow into Nine Mile Creek in Sec. 11, 23, 33, Twp. 22N, Rge. 53W. Additional drains enter Nine Mile Creek at these locations: the Alliance drain in Sec. 28, Twp. 21N, Rge. 53W, the Moffat drain in Sec. 33, Twp. 21N, Rge. 53W, and the Minatare drain in Sec. 10, Twp. 21N, Rge. 53W. The Alliance drain has trout production potential, while the others offer only very limited natural reproduction and nursery area possibilities.

Water Temperature: Water temperature data from the prime spawning areas of Nine Mile Creek indicate summer maximum water temperatures rarely reach 75°F, while winter temperatures seldom drop below 40°F. Maximum water temperatures in the 75-80°F range exist only rarely in the lower two miles of stream.

Barriers and Diversions: There are no permanent irrigation diversion structures or barriers in Nine Mile Creek to hinder rainbow trout migrations. There is a small diversion structure in Sec. 10, Twp. 21N, Rge. 53W. This structure was built in a side channel and does not extend into the main channel. It is seldom used, and under present operating conditions, no rainbow migration problems should be encountered at this structure.

Limiting Factors: Rainbow trout production in Nine Mile Creek is affected by flooding, irrigation return water, and periodic waste water releases from the canals that cross the stream. Heavy livestock grazing limits the rainbow trout carrying capacity in some areas. Nine Mile Creek receives moderate to heavy siltation from irrigation return water.

Rechanneling or ditching has taken place in Sec. 33, Twp. 22N, Rge. 53W, and Sec. 4, 9, 10, 14, 23, 26, Twp. 21N, Rge. 53W on the lower end. Nine Mile Creek is not dewatered, at any point, throughout its length.

Fish kills, resulting from feedlot runoffs, occurred during 1972-1974. Feedlot runoff control facilities and proper maintenance are essential or cattle feeding operations pose a threat to the aquatic environment of Nine Mile Creek.

Rainbow Trout Population: Nine Mile Creek is the most important McConaughy rainbow trout spawning stream. The fall run contributes most to the rainbow trout production, although there is also a spring spawning population. Good to excellent spawning gravel can be found in Sec. 2, 3, 11, 14, 22, 27, 28 and 33, Twp. 22N, Rge. 53W, and most of the rainbow trout spawners are found in these areas. Spawning gravel is poor to fair in Sec. 4, 9, 10, Twp. 21N, Rge. 53W, consequently fewer spawners are present. From Sec. 10, Twp. 21N, Rge. 53W downstream to the North Platte River, spawning gravel is almost nonexistent.

Although the fall and spring runs overlap, the trout do not necessarily use the same spawning areas. For example, through Sec. 4 and 9, Twp. 21N, Rge. 53W the spawning habitat is marginal and is not utilized during the fall run in November and December. However, the spring run uses this stretch during March and April.

Spawning rainbow trout can be observed in Nine Mile Creek from mid-

November through April. December is the peak spawning period of the fall run, while the most active spawning period of the spring run occurs during March.

Investigations during 1964-1966 indicated 72 percent of the rainbow trout examined in Nine Mile Creek during January and February had already spawned. Therefore, any protection of the fall run must be implemented during October to December. This reasoning prompted the closure of the prime spawning areas in Nine Mile Creek from October 1 through December 31. Fishing pressure is heavy on Nine Mile when the entire stream is open to fishermen after January 1.

Red Willow Creek

Red Willow Creek in Morrill County is second only to Nine Mile in importance as a McConaughy rainbow spawning stream.

Trout habitat in Red Willow Creek begins at the Tri-State Canal in Sec. 3, Twp. 21N, Rge. 51W. The creek flows in a southerly direction and empties into the North Platte River in Sec. 17, Twp. 20N, Rge. 51W. Major tributaries enter Red Willow Creek in Sec. 15, 16, 29, 32, Twp. 21N, Rge. 51W, but none of them have rainbow trout potential. Wildhorse Creek, which has rainbow potential, empties into Red Willow Creek in Sec. 12, Twp. 20N, Rge. 52W

Water Temperature: Daily water temperatures range from 60° to 75°F during the summer in the prime rainbow trout spawning habitat (Sec. 29 and 32, Twp. 21N, Rge. 51W) of Red Willow Creek. High water temperatures (above 75°F) occur only in the lower end of Red Willow Creek near the North Platte River.

Barriers and Diversions: One irrigation structure, in Sec. 1, Twp. 20N, Rge. 52W diverts water from Red Willow Creek. This structure was a barrier to upstream trout migrations, until it was modified in 1965 by district fishery personnel. Since that time, rainbow trout have been able to move over this structure to spawn successfully in the upper end of Red Willow Creek. Another problem developed with this irrigation diversion for yearling rainbow smolts on their downstream migration. When water was diverted early in the spring, rainbow losses down the irrigation canal were high. This particular irrigation district consistently diverted water earlier in the year than any other districts in the North Platte Valley. To eliminate the problem, a rotary screen was designed and installed in the diversion structure in 1975. This screen has prevented the loss of rainbow smolts in this particular irrigation canal.

Limiting Factors: The single factor most detrimental to trout production in Red Willow Creek is the large amount of water periodically released from the Tri-State Canal during the irrigation season. Frequent extreme fluctuations of water levels (sometimes daily) affect the entire length of Red Willow Creek. These frequent releases result in scouring of the stream bed and excessive stream bank erosion.

Rainbow trout potential is further limited by the large amount of silt entering Red Willow Creek from tributaries or drains in the watershed. The lower end of Red Willow Creek in Sec. 1 and 12, Twp. 20N, Rge. 52W has been ditched and very few meanders exist. When boards that dam the water at the irrigation diversion are pulled at the close of the irrigation season, approximately three feet of silt flush through the lower end of Red Willow Creek into the North Platte River.

Heavy grazing and frequent flooding also influence trout production in Red Willow Creek.

Several small fish kills have been reported. From the limited evidence available, kills were apparently caused by people using illegal methods to catch fish. Some type of chemical is suspected.

Rainbow Trout Populations: Fall and spring runs of McConaughy rainbow trout spawn successfully in Red Willow Creek. Unlike Nine Mile Creek, Red Willow Creek spawning concentrations are heaviest during January through March. The best spawning gravel and the most rainbow trout spawning occur in Sec. 29, Twp. 21N, Rge. 51W. Fishing pressure on Red Willow Creek is heavy during the winter, when McConaughy rainbow spawners are present in the stream.

Several stockings with McConaughy rainbow fingerlings were tried in areas of Red Willow Creek, where poor spawning conditions existed, and in small tributary streams. Survival was poor, compared to stocking attempts in other streams in the North Platte River drainage. Consequently nursery stream stocking is not recommended for the Red Willow Creek drainage.

Spawning gravel at the upper end of Red Willow Creek (Sec. 10 and 15, Twp. 21N, Rge. 51W) is used more by resident brown trout populations than by McConaughy rainbows. This area also experiences the most extreme water level fluctuations. Apparently brown trout are better adapted to this area of the stream than the McConaughy rainbow. Brown trout spawning occurs in this area during November and early December.

Otter Creek

Otter Creek in Keith County originates in the sandhills approximately 4½ miles north of McConaughy Reservoir. The creek starts in a high water table area along the east edge of Sec. 18, Twp. 16N, Rge. 40W. Otter Creek increases in size as it flows southward through Sec. 17, 18, 19, 20, 29, 30, 32, Twp. 16N, Rge. 40W. A spring, located in the NW ¼ of Sec. 20, Twp. 16N, Rge. 40W, is the largest water source entering Otter Creek. The rest of the creek is fed by small groundwater seep areas located mainly in the upper one mile of the stream. Otter Creek flows directly into McConaughy in Sec. 5, Twp. 15N, Rge. 40W.

Water Temperature: Water temperatures remain below 75°F during the summer months almost the entire length of Otter Creek, and thus probably does not figure as a limiting factor in Otter Creek.

Barriers and Diversions: There are no active irrigation diversions along Otter Creek. A partial barrier exists where a culvert flows under Nebraska 92 near the reservoir. Adult rainbows are delayed at this culvert for short periods depending on the water level of the reservoir. Some years, when water levels are low during the fall and winter, a three to five-foot jump into a culvert presents a problem. During high lake levels no barrier exists. A dredging project at the creek delta has eliminated a migration barrier which existed several years ago. However, extra low water levels may again cause problems in Otter Creek Bay for migrating rainbow trout.

Limiting Factors: The upper two miles of Otter Creek has been leased by the Game and Parks Commission, and the area has responded well after grazing was ended. At present, the spawning habitat there is excellent.

The lower three miles of Otter Creek are grazed and are not reaching potential for rainbow trout production, which could be increased by removing grazing. The lower end of Otter Creek is further limited by the quantity and quality of the spawning gravel. Total trout production will not approach the levels achieved in the upper two miles because of poorer quality spawning gravel, the shifting sand bottom, and a lower stream gradient.

Rainbow Trout Populations: The rainbow trout population in Otter Creek has experienced drastic changes in the last 35 years. After filling of McConaughy in 1941, movement of rainbows from the reservoir into Otter Creek began in the late 40's. Previously, periodic stream stocking of rainbows plus an unknown amount of natural reproduction probably resulted in a resident stream fishery. The large adults from McConaughy Reservoir had an impact on the trout population in Otter Creek during the late 40's and early 50's. The runs diminished in the 1950's and nearly disappeared. Poor spawning habitat has to be considered as one of the major reasons for the decline.

In the late 1960's efforts were initiated to re-establish rainbow trout spawning runs in

Otter Creek. At that time, the upper two miles of Otter Creek were heavily grazed. The sandy stream banks were trampled and generally void of vegetation. Hard rains in the upper end of the watershed would wash sand from the surrounding hills into the stream. This sand periodically covered the spawning gravel, which severely inhibited natural reproduction. Between 1969 and 1973, land in the upper watershed was leased and stream banks were fenced to prevent cattle access. Within the first year vegetation returned. The stream bottom stabilized and the amount of sand drifting downstream decreased. Rainbow trout natural reproduction was verified during 1970 and 1971.

Periodic stream sampling during 1966-1967 indicated a small resident brown trout population, but very few rainbows. Efforts were made to establish a run of Lake McConaughy rainbow. First, eyed eggs then fingerlings hatched from McConaughy rainbow eggs were stocked, starting in 1967. By 1971, when the first group of stocked McConaughy rainbow matured and returned to spawn, the quality of the spawning habitat was improved to a point where natural reproduction was successful. Since 1971 rainbows have not been stocked in Otter Creek.

Annual stream surveys were used to estimate the number of rainbow smolts produced in Otter Creek that migrated into McConaughy Reservoir each spring (Table 24).

Table 24. Annual rainbow trout production in Otter Creek, 1968-1976.

Year Class	Year of Migration Into McConaughy Reservoir	Number of Rainbow Smolts Produced in Otter Creek
1968	Spring 1969	1,347
1969	Spring 1970	3,751
1970	Spring 1971	6,087
1971	Spring 1972	8,872
1972	Spring 1973	6,357
1973	Spring 1974	4,130
1974	Spring 1975	20,419
1975	Spring 1976	13,137
1976	Spring 1977	9,753

Rainbow trout that moved into the reservoir from 1975 through 1977 reflect the added production resulting from the final fencing project, which gave complete protection to the upper watershed.

Under the present conditions the brown trout population has declined probably because they could not compete with the rainbow under what has to be considered ideal rainbow trout habitat. Rough fish populations of suckers, chubs, and dace in the fenced area also decreased. The fenced area in the upper end of Otter Creek illustrates how a game fish population, in this instance rainbow trout, will displace undesirable species if the proper habitat is available.

The best spawning habitat in Otter Creek occurs in Sec. 17 and 18, Twp. 16N, Rge. 40W. Rainbow trout spawning also takes place in the less desirable habitat located in Sec. 19, 20, 29, 30, Twp. 16N, Rge. 40W.

Rainbow fingerlings stocked in Otter Creek were hatched from fall run eggs. However, poor growth rates and other problems caused stocking dates to vary between March and June during the years rainbow were stocked. Since growth rates affect maturation a pure fall run was unlikely. Apparently both fall and spring spawners utilize Otter Creek, because rainbow have been observed spawning in Otter Creek from late November into early April. Spawning peaks are similar to the other streams in the North Platte Valley, with late December and early March usually the peak periods. One year, however, spawning activity was heaviest during February.

Fishing pressure on the upper two miles is light. The land owner controls access and restricts anglers. This policy is probably best, since the stream in the prime spawning area is shallow and large holes are rare. Heavy bank traffic and fishing would interrupt spawning in the upper reaches of Otter Creek. Angling pressure on the lower end of Otter Creek is moderate to heavy when rainbow are moving upstream.

Tub Springs

Tub Springs in Scotts Bluff County ranks among the top five McConaughy rainbow trout streams in the North Platte River drainage. The main branch of Tub Springs begins in Sec. 15, Twp. 23N, Rge. 55W. It merges with a large tributary, Hiersche Drain, in Sec. 23, Twp. 23N, Rge. 55W. Hiersche drain begins immediately below the dam creating Big Lake Alice in Sec. 7, Twp. 23N, Rge. 54W. As it flows southwest, Tub Springs picks up another tributary, the Sunflower Drain, in Sec. 33, Twp. 23N, Rge. 55W. It flows into the North Platte River in Sec. 8, Twp. 22N, Rge. 55W.

Water Temperature: Water Temperature is not a limiting factor for rainbow trout from the headwaters of Hiersche Drain down to the irrigation diversion above Tri-State Canal, since it is below 75°F during the summer. From that point to the mouth of Sunflower Drain, dewatering results in water temperatures too warm for rainbow trout. From Sunflower Drain to the Platte River, the water temperature is marginal for rainbow trout during the summer months.

Barriers and Diversions: An irrigation diversion, located in Sec. 27, Twp. 23N, Rge. 55W, shunts almost the entire flow of Tub Springs into the Tri-State Canal during the irrigation season.

A partial barrier hinders trout migrations in Sec. 33, Twp. 23N, Rge. 55W. The cement drop structure is not a complete barrier, but it slows the upstream movement of adult rainbows for a short period during the fall and winter migration period. This obstacle contributes to illegal harvest of the spawners, since some persons have used unlawful methods to attempt to take the trout delayed at the base of the structure.

Limiting Factors: Rainbow trout production in Tub Springs is affected by flooding, irrigation return water, and overgrazing. The upper end of the main branch of Tub Springs carries a very heavy silt load during the irrigation season.

Approximately 2.4 miles of Tub Springs in Sec. 27, 33, 34, Twp. 23N, Rge. 55W are severely dewatered (over 85% of the streamflow) during the irrigation season. High water temperatures from dewatering virtually eliminates rainbow trout production in these 2.4 miles of Tub Springs.

There are approximately 1.4 miles of rechanneled or ditched areas located in Sec. 15, 23, 33, Twp. 23N, Rge. 55W. and Sec. 5, Twp. 22N, Rge. 55W.

Rainbow Trout Populations: Both fall and spring run rainbow trout migrate and successfully reproduce in Tub Springs. The migration and major spawning periods closely parallel Nine Mile Creek.

Tub Springs' best spawning gravel can be rated as only fair to good in quality and is located in Sec. 27 and 22, Twp. 23N, Rge. 55W. That part of the stream temporarily dewatered during the irrigation season has fair quality spawning gravel. Although natural reproduction takes place there during the winter when the water level is normal, it is eliminated by high water temperatures during low summer stream flows.

Approximately four miles of the Hiersche Drain and one mile of the Sunflower Drain in the Tub Springs drainage have rainbow trout nursery stream potential. McConaughy rainbow fingerlings have been stocked in this drainage since 1974.

Tub Springs receives light to moderate fishing pressure.

Wildhorse Creek

Rainbow trout habitat in Wildhorse Creek in Morrill County begins in two separate branches, approximately six miles north of Bayard. Coldwater habitat in the west branch of Wildhorse Creek begins in Sec. 27, Twp. 22N, Rge. 52W. The west branch flows south approximately five miles and joins the east branch in the lower end of Sec. 22, Twp. 21N, Rge. 52W. Coldwater habitat in the east branch begins in Sec. 35, Twp. 22N, Rge. 52W. It also flows southerly until it joins the west branch.

Flood control dams are located on both

branches of Wildhorse Creek. One on the west branch in Sec. 3, Twp. 21N, Rge. 52W is capable of creating a 60-acre coldwater reservoir, but the lake is dry because of differences in recreational attitudes among the various organizations involved with the flood-control project. The east branch has two flood control dams, neither of which create permanent lakes. One dam is located in Sec. 14, Twp. 21N, Rge. 52W in the area designated as rainbow trout habitat. The other dam is located in the dry drainage above the flowing stream in Sec. 13 and 14, Twp. 22N, Rge. 52W. Wildhorse Creek flows into Red Willow Creek in Sec. 12, Twp. 20N, Rge. 52W.

Water Temperature: Upstream from Bayard, the water temperature is seldom a problem, since it stays below 75°F during the summer. The lower end of Wildhorse Creek nears the critical range (water temperatures over 75°F) for rainbow trout. However, if Dam 14A on the west branch is filled a low level outlet would be most desirable. Otherwise the water temperature will exceed 75°F one mile below U.S. 26 in Sec. 10, Twp. 21N, Rge. 52W during hot summer days.

Barriers and Diversions: The flood-control dams form almost a complete barrier to McConaughy rainbow trout migrations. An irrigation diversion on the east branch in Sec. 11, Twp. 21N, Rge. 52W above the flood-control structure diverts most of the streamflow during the summer.

Limiting Factors: Heavy stream bank grazing, heavy silt loads, and occasional flooding limit the trout production in Wildhorse Creek. Ditching and rechanneling have taken place from Bayard downstream to the junction with Red Willow Creek, a total of 4.6 miles.

Rainbow Trout Populations: McConaughy rainbow trout spawners ascend Wildhorse Creek only up to the flood-control dams located on each branch. Spawning gravel for natural reproduction ranges from poor to fair in Sec. 10, 15, 22, 23, Twp. 21N, Rge. 52W. The best spawning gravel available in Wildhorse Creek is found in Sec. 10, Twp. 21N, Rge. 52W. Little, if any, natural reproduction occurs below Bayard.

Although both fall and spring rainbow spawners move into Wildhorse Creek, the spawning population is probably very small. Fishing pressure is light.

The Wildhorse Creek drainage has approximately 1.4 acres of coldwater nursery stream habitat, located in Sec. 34, Twp. 22N, Rge. 54W, on the west branch above the flood control dam, that is stocked annually with McConaughy Rainbow finglerlings.

From the Tri-State Canal to the irrigation diversion approximately 2.6 miles downstream in Sec. 11, Twp. 21N, Rge. 52W, coldwater habitat on the east branch endures heavy silt loads and severe water fluctuation. Water temperatures are only marginal for rainbow trout. Consequently, this area is managed for a resident brown trout fishery.

Winters Creek

Permanent flowing water in Winters Creek, Scotts Bluff County, begins as two branches in Sec. 34, Twp. 23N, Rge. 54W. The branches join in the lower end of that section to flow southerly until emptying into the North Platte River in Sec. 31, Twp. 22N, Rge. 54W. The only major tributary is Dunham Andrews Drain, which enters Winters Creek in Sec. 8, Twp. 22N, Rge. 54W. The heavy silt load and high water temperatures mean the drain has little trout production potential.

Winter Creek flows through an intensively farmed area and presently would rank much lower than Nine Mile as a rainbow trout stream. Under different circumstances, however, Winters Creek could become a major trout stream.

Water Temperature: Water temperatures in Winters Creek generally stay below 75°F except possibly in the extreme lower end. Water temperatures in Sec. 34, Twp. 23N, Rge. 54W, and Sec. 3, 4, 8, 9, 17, Twp. 22N, Rge. 54W remain well below 75°F and are suitable for rainbow trout.

Barriers and Diversions: There are three water diversions along Winters Creek. The first is upstream from the North Platte River in Sec. 31, Twp. 21N, Rge. 54W. It diverts water from October through February period, when the sugar beet factories are operating, but it does not block all the rainbow migrating up Winters Creek. Rainbows, can move over that diversion, but they are stopped at the next structure in Sec. 19, Twp. 22N, Rge. 54W.

The second diversion also operates October through February to provide water for the Scottsbluff sugar beet factory and completely blocks migrating rainbows during this period. When water is no longer needed, usually the latter part of February, trout can move through the structure if all the dam boards are removed. Although also used to divert water during the irrigation season, the structure usually does not severely dewater the lower end of the stream, either during irrigation season or sugar beet processing.

The third Winters Creeks diversion is a small structure in Sec. 8, Twp. 22N, Rge. 54W that diverts water periodically during the irrigation season. It has no effect on rainbow migrations during the rest of the year.

Limiting Factors: Most of Winters Creek is heavily grazed. Fast, heavy rains can cause severe flooding in the watershed, and Winters Creek usually carries a moderate to heavy silt load during the summer growing season. There are no severely dewatered areas in Winters Creek, but a feedlot near the headwaters in Sec. 34, Twp. 23N, Rge. 54W poses pollution threat if not correctly operated. Approximately 3.2 miles on the lower end of Winters Creek in Sec. 18, 19, 30, 31, Twp. 22N, Rge. 54W has either been rechanneled or ditched.

Rainbow Trout Populations: Winters Creek is far from being a major rainbow trout stream in the North Platte Valley. Each year, a few fall-run rainbows can be observed below the major irrigation diversion barrier in Sec. 19, Twp. 22N, Rge. 54W. This diversion allows only the spring spawning population to utilize the available spawning gravel. The best spawning gravel can be classed as only fair to good and is limited to that portion of Winters Creek that flows through Sec. 8, 9, and the upper end of Sec. 17, Twp. 22N, Rge. 54W.

Approximately 4.3 miles have potential as a nursery stream. About 1.8 miles in Sec. 34, Twp. 23N, Rge. 54W have been stocked annually since 1968 with McConaughy rainbows and survival has been good. Fishing pressure is light to moderate in Winters Creek.

Dry Spottedtail Creek

Permanent flowing water in the upper end of Dry Spottedtail Creek begins in Sec. 16, Twp. 24N, Rge. 56W. The creek flows south for approximately nine miles, then empties into the North Platte River in Sec. 28, Twp. 23N, Rge. 56W.

Water Temperature: Water temperatures are good in the upper five miles of Dry Spottedtail Creek, rarely exceeding 72°F. However, they become marginal (over 75°F) in the lower reaches and where the stream is dewatered.

Barriers and Diversions: Three irrigation diversions are located in Dry Spottedtail Creek. The first is approximately two miles upstream from the North Platte River in Sec. 20, Twp. 23N, Rge. 56W and diverts water for irrigation during the summer and for the operation of the Mitchell sugar beet factory from October through February. Rainbows migrating upstream are completely stopped at this structure when water is being diverted.

Active only during the irrigation season, the second is in Sec. 16, Twp. 23N, Rge. 56W approximately one-half mile above the first diversion, and ordinarily does not severely dewater the stream. Although the upstream migration usually is not blocked by this structure, very few fish can reach it between October and February because of the diversion immediately downstream.

The third diversion is located in Sec. 4, Twp. 23N, Rge. 56W. Active only during the irrigation season, it does not create a barrier to fall and winter rainbow migra-

tions. However, it severely dewaters the stream when water is diverted.

It is doubtful that any smolts migrating downstream are lost at these diversions under the present operating procedures.

Limiting Factors: The pasture land surrounding the stream is moderately to heavily grazed. Siltation is light in the upper end but changes from moderate to heavy in the lower reaches. Severe dewatering of the stream occurs for approximately 1.5 miles in Sec. 4 and 9, Twp. 21N, Rge. 56W.

The lower 2.8 miles of Dry Spottedtail Creek in Sec. 16, 21, 28, Twp. 23N, Rge. 56W have been rechanneled or ditched. Irrigation return water from fields and canals influence the streamflow in the lower seven miles of Dry Spottedtail Creek. The tributary that enters Dry Spottedtail Creek in Sec. 9, Twp. 23N, Rge. 56W carries a heavy load of silt during the irrigation season and the water temperature frequently exceeds 75°F. This tributary has no rainbow trout nursery potential.

Rainbow Trout Populations: Dry Spottedtail Creek supports only limited natural reproduction of McConaughy rainbow trout. Its value under the present conditions lies in its nursery stream potential.

The diversion nearest the North Platte River blocks all fall run spawners from the upper reaches of the stream. Only late winter or spring rainbow migrations can move over this structure.

The best spawning gravel is found in the upper reaches of Dry Spottedtail Creek in Sec. 16, 21, 28, 33, Twp. 24N, Rge. 56W, but even it is only poor to fair in quality. Spring-run McConaughy rainbow have been stocked annually since 1973 in the upper end of Dry Spottedtail Creek to take advantage of the growth potential available in this stream. These successful plants offer a method of producing rainbow trout smolts for the drainage. The rainbow trout population in Dry Spottedtail Creek depends on this stocking program.

Fishing pressure is light for rainbow trout in this stream. Fishing consists of 8-10 inch brown trout in the upper end and rainbow spawners in the lower end from February to April. There is a small resident brown trout population in most sections of the stream.

Sheep Creek

Permanent flowing water in Sheep Creek begins in Sec. 36, Twp. 25N, Rge. 58W and flows in a southeasterly direction for approximately 14 miles to empty into the North Platte River in Sec. 20, Twp. 23N, Rge. 57W. One major tributary, Dry Sheep Creek, Starts in Sec. 19, Twp. 24N, Rge. 57W and flows approximately three miles south before joining Sheep Creek in Sec. 8, Twp. 23N, Rge. 57W.

Water Temperature: Water temperatures during the summer are adequate near the headwaters but become slowly marginal as the creek approaches the North Platte River. Water temperatures approach 75°F during hot summer days near the forks of Sheep Creek in Sec. 8, Twp. 23N, Rge. 57W. Only very marginal water temperatures exist below the forks.

Barriers and Diversions: One irrigation diversion located in Sec. 8, Twp. 23N, Rge. 57W diverts water into the Tri-State Canal. Active only during the irrigation season, it is not a barrier during the fall and winter. However, a cement drop structure on the north side of the Tri-State Canal creates an obstacle that hinders the upstream movement of rainbow during fall and winter migration. Little concern exists to alter this structure, however, since Sheep Creek has very limited spawning habitat.

Limiting factors: Streambanks along Sheep Creek are heavily grazed. Since it flows through more pasture land than most other North Platte Valley streams, Sheep Creek does not get the heavy silt loads or amount of irrigation return water typical of other streams in the area.

Sheep Creek is severely dewatered for about 2.8 miles from the irrigation diversion to the North Platte River. Water temperature there approaches 80°F during hot summer days. Spawning gravel is scarce and of poor quality throughout Sheep Creek. A shifting sand or silt bottom is common the full length of the stream.

Rainbow Trout Populations: Sheep Creek has very poor rainbow trout natural reproduction. Because of poor recruitment, the stream receives only a few spawners and many are probably strays produced in other streams in the drainage. Rainbow trout nursery sites are limited in the main branch of Sheep Creek. A little nursery stream potential exists in the upper end of Dry Sheep Creek, but generally speaking the stream habitat is very poor. The outlook is rather bleak for natural rainbow reproduction or for rainbow nursery areas in the Sheep Creek drainage.

Sheep Creek has been managed as a catchable put-and-take brown trout fishery in the past. Fishing pressure is light to moderate, depending on the stocking schedules. Using Sheep Creek for this purpose offers the North Platte Valley angler a change of pace from the typical fall and winter adult rainbow fishery. Put-and-take fishing appeals to many spring and summer trout stream anglers, and it appears to be the best fishery management plan for Sheep Creek.

Nursery Streams

Five additional streams support little, if any, natural reproduction, but most of them have potential as nursery streams for McConaughy rainbow trout fingerlings.

Pumpkin Creek

Pumpkin Creek originates near the Banner-Scotts Bluff county line, southwest of Gering. The creek flows eastward nearly 60 miles before emptying into the North Platte River in Sec. 12, Twp. 19N, Rge. 50W. Only the lower end of Pumpkin Creek is utilized by or has potential for a McConaughy rainbow population. This portion begins at the small irrigation storage reservoir in Sec. 23, Twp. 19N, Rge. 50W, flows approximately 2.2 miles through Sec. 12, 13, 14, Twp. 19N, Rge. 50W, then enters the North Platte River.

Water Temperature: Water temperatures at the U.S. 385 bridge will reach 85°F on hot summer days when the stream is dewatered.

Barriers and Diversions: A dam, impounding a small irrigation reservoir in Sec. 23, Twp. 19N, Rge. 50W, creates a permament year-around barrier to upstream migration of rainbow trout in Pumpkin Creek. Consequently, diversions, located throughout the drainage above this dam, have little importance, since migratory trout never reach them.

Limiting Factors: Severe dewatering below the irrigation dam is the biggest limiting factor in Pumpkin Creek. Some years during the irrigation season, Pumpkin Creek is periodically dry at the U.S. 385 bridge. Water temperatures are too high during the summer for rainbow survival, even when water is present in this section of the stream. Heavy grazing and light silt loads are found on the lower end of Pumpkin Creek.

Rainbow Trout Populations: The status of the rainbow population in Pumpkin Creek is very confusing. Pumpkin Creek supports a late winter and spring run of rainbows that attracts a surprisingly large number of anglers considering the overall rainbow trout habitat available. Fishing pressure for rainbow spawners is light to moderate during these migrations. Interestingly anglers reported enough tagged trout from this stream to rank Pumpkin Creek fourth in the tag returns behind Nine Mile, Red Willow Creek, and Tub Springs in the upper North Platte River drainage.

However, successful rainbow trout natural reproduction and survival to the smolt stage is very rare in Pumpkin Creek. Consequently the rainbow trout spawning runs do not represent a return of rainbow to the "home stream". The runs are comprised of stray fish hatched in other streams. Their "homing" instinct apparently isn't strong enough, and they enter the first large stream available. Pumpkin Creek is the first large stream above the reservoir that enters from the south side of the North Platte River. Blue Creek and Cedar Creek are the only two streams that

enter the river below Pumpkin Creek.

The lower end of Pumpkin Creek has a shifting sand bottom and virtually no gravel large enough to be used for spawning. There is no nursery stream potential for McConaughy rainbow in the Pumpkin Creek drainage.

Lonergan Creek

Keith County's Lonergan Creek originates as two small spring-fed branches in Sec. 8, Twp. 15N, Rge. 39W. It flows only about one mile before emptying into McConaughy Reservoir. A small spring fed pond is located in the headwaters of the east branch.

Water Temperature: The maximum summer water temperature recorded on the lower end of Lonergan Creek is 72°F.

Barriers and Diversions: There are no diversions in Lonergan Creek, but the culvert through the highway may cause some upstream migration problems. Some years a sand delta builds up on the lower end of the Lonergan Creek. This should be watched closely to make sure upstream or downstream migrating rainbow don't become stranded.

Limiting Factors: The entire creek above the old county road is usually heavily grazed except for the area immediately surrounding the small pond on the east branch. The creek periodically carries heavy loads of sand that cover the stream bottom.

None of Lonergan Creek is dewatered, rechanneled, or affected by irrigation return water.

Rainbow Trout Populations: Electrofishing in March 1971 in Lonergan Creek produced white suckers, creek chubs, and longnose dace. No evidence of brown or rainbow trout was found. Later that month the entire length of Lonergan Creek was renovated with rotenone. Fall-run McConaughy rainbow fingerlings have been stocked in the spring in Lonergan Creek annually since April 1971. This was the beginning of the present rainbow trout management there.

Lonergan Creek contains 1.31 acres of flowing water. Each year the total trout production was estimated from a sampling station that included 66 percent or .86 acres of the stream aquatic habitat. Survival of stocked McConaughy rainbow fingerlings was evaluated during the late fall and winter. Table 25 shows the fish stocked and the entire rainbow population in Lonergan Creek during 1971-1974.

The high standing crop of rainbow in Lonergan Creek the year after the 1971 stocking can be attributed to: (1) stocking in a newly renovated stream that contains no other fish species; and, (2) good stream habitat during the summer growing season.

As the rough fish populations (creek chubs and longnose dace) reappeared, the standing crop of rainbow declined. Also, heavy summer grazing was resumed in the headwaters of Lonergan Creek. These two factors are the most logical explanation for the leveling out of the standing crop of rainbow at a production of approximately 80 pounds per acre.

It appears there is little need to stock over 2,000 to 3,000 rainbow annually in Lonergan Creek. Total trout production has leveled out and stocking 9,000-10,000 will yield about the same as stocking 2,000 to 3,000 rainbows there.

Besides electro-fishing, several observations were made of the rainbow populations by walking the length of Lonergan Creek. A dramatic decline in rainbow numbers was noted each year starting in February and continuing into March. These rainbow were smolting and migrating into the reservoir. Few rainbow were left in the stream by April when it was restocked with fingerlings. Electro-fishing data indicated only a very small population of rainbow remained in Lonergan Creek after one year. Very few adult rainbow, which had migrated back from the reservoir, were observed in Lonergan Creek.

Lonergan Creek contains only marginal spawning gravel, and natural reproduction has never been verified. The shifting sand bottom would prevent any natural reproduction. A possibility exists for natural reproduction of trout, if the Lonergan Creek watershed was fenced and grazing removed.

Until there is a drastic change in the aquatic habitat, Lonergan Creek should be managed as a rainbow trout nursery stream.

Fishing pressure on Lonergan Creek is almost nonexistent at the present time.

Stuckenhole Creek or Bayard Drain

The locally accepted name of the stream is Stuckenhole Creek and will be used in this report. However, it is listed as Bayard Drain on USGS topographic maps.

Stuckenhole Creek (Morrill County) originates in a high groundwater or wetlands area located immediately below the Tri-State Canal in Sec. 29, Twp. 22N, Rge. 52W. The creek gradually increases in size as it flows approximately 10 miles southeast and enters the North Platte River in Sec. 4, Twp. 20N, Rge. 52W. A small drain with no rainbow potential enters Stuckenhole Creek in Sec. 8, Twp. 21N, Rge. 52W.

Water Temperature: Water temperatures in the sections of Stuckenhole Creek managed for rainbow trout remain below 75°F during hot summer days.

Barriers and Diversions: The first irrigation diversion on Stuckenhole Creek is located about a quarter mile upstream from the North Platte River in Sec. 4, Twp. 20N, Rge. 52W. This diversion is active only during the irrigation season and would not be a barrier during fall and winter upstream migrations. This structure, however, diverts water very early in the year, particularly during a dry spring. Late March or early April water diversions are very possible. If this happens rainbow smolts will be lost, as with the early water diversions from Red Willow Creek. The possibility of a loss of rainbow smolts at this diversion has existed only since 1975, when downstream smolt migrations began because of upstream plants of McConaughy rainbow fingerlings.

A culvert under Nine Mile canal in Sec. 28, Twp. 21, Rge. 52W serves only to slightly slow upstream migrating rainbow. An irrigation diversion located in Sec. 8, Twp. 21N, Rge. 52W removes water only during the irrigation season. Several cement drop structures are located in Sec. 8 and 17, Twp. 21N, Rge. 52W, but won't hinder fish movements during migration periods.

Limiting Factors: Although grazing occurs on stream banks of Stuckenhole Creek, it isn't as heavy or frequent as the rest of the North Platte Valley strams. This is because the upper two-thirds of the stream resembles an irrigation lateral that cuts through intensively farmed land. Farming takes place right up to the stream banks, which are less than ten feet wide in many places. Stuckenhole carries a moderate to heavy load of silt during the irrigation

Table 25. Lonergan Creek McConaughy rainbow trout stocking and survival data for the 1971-1974 period.

Year	Number Stocked	Acres Stocked	Percent Survival	Population Estimate	Size Fish/Lb.	Sampling Month	Standing Crop Lbs./Acre
1971	16,319	1.31	13.5	2,207	9.9	Nov.	170
1972	16,000	1.31	3.6	553	9.5	Jan.	44
1973	9,020	1.31	7.6	687	6.8	Jan.	77
1974	3,050	1.31	14.8	593	5.7	Nov.	79

season.

The creek is severely dewatered for approximately two miles below the irrigation diversion in Sec. 8, Twp. 21N, Rge. 52W. It appears that almost the entire length of Stuckenhole Creek has been ditched or rechanneled at sometime in the past. Periodically, maybe once in five years, the stream in Sec. 32, Twp. 22N, Rge. 52W is ditched by the Farmer's Irrigation District.

Rainbow Trout Populations: Some 10 to 15 years ago, large rainbow could be observed jumping into the culvert under Nine Mile canal during the fall and winter migrations. Whether these adults originated from stocked rainbow or natural reproduction is unknown. However, very few adults can now be found or observed in this same area of the creek.

Rainbow potential of Stuckenhole Creek can best be realized through a nursery stream stocking policy. Approximately 2.6 acres of water have been stocked with McConaughy rainbow fingerlings since 1974.

Rainbow smolts produced in Stuckenhole will have no problem with any of the irrigation structures, except possibly the one located on the extreme lower end. The possible loss of smolts at this structure should be evaluated.

Fishing pressure on Stuckenhole is very light at the present time. Spawning gravel is very limited, and the quality is poor.

Mitchell Drain

The Mitchell Drain in Scotts Bluff County originates in a wetlands or marsh area right below the Tri-state Canal in Sec. 10, Twp. 23N, Rge. 56W. This creek flows southeast for approximately five miles to empty into the North Platte River in Sec. 35, Twp. 23N, Rge. 56W. Some confusion arises as to the name of this small stream. Many people refer to it as Spottedtail Creek. Spottedtail Creek, however, flows year-around directly into the Tri-State Canal just above where the Mitchell Drain originates. Spottedtail flows down the canal approximately 2.8 miles and, when not being used for irrigation, flows directly south to the North Platte River. Spottedtail Creek actually flows through a siphon under the Mitchell Drain in Sec. 35, Twp. 23N, Rge. 56W.

Water Temperature: Water temperature in Mitchell Drain will reach 75°F on hot days, as it flows through Sec. 15, Twp. 23N, Rge. 56W approximately one mile below the Tri-State Canal. Farther downstream where the railroad crosses the Mitchell Drain in Sec. 26, Twp. 23N, Rge. 56W, the water temperature barely reaches 70°F during the summer. Groundwater and small springs increase the flow until the water is actually cooler further downstream. This is not typical of North Platte Valley streams.

Barriers and Diversions: There are no barriers or diversions on Mitchell Drain.

Limiting Factors: Only the upper 25 percent of the Mitchell Drain does not have heavy stream bank grazing. Very little irrigation return water enters the stream, so the silt load during the summer months is low. The bottom is sand or silt.

The stream passes near the northeast corner of the city of Mitchell. At least one pipe of untreated domestic sewer effluent from a housing development and possibly others from residences along the creek flow into Mitchell Drain.

Rainbow Trout Populations: Stream sampling showed brown trout were rare and only one adult rainbow spawner was examined. Fall-run McConaughy fingerlings have been stocked in the Mitchell Drain since 1974. The initial 1974 stocking showed a very poor growth rate, so only the best areas of the stream were stocked during 1975 and 1976 at a much reduced rate.

Two small areas are stocked annually at the present time. The first encompasses the portion of the stream that parallels Nebraska 29 along the west edge of Sec. 15, Twp. 23N, Rge. 56W. The second runs from the U.S. 26 bridge and approximately one-fourth mile downstream where the creek parallels the county road between Sec. 26 and 27, Twp. 23N, Rge. 56W. The area between these two stocking sites should not be stocked unless the domestic sewage problem is corrected.

Even poor quality spawning gravel is almost nonexistent in Mitchell Drain, consequently little if any natural rainbow trout reproduction can be expected. Fishing pressure is very light on this stream.

Mitchell Drain should be managed as a McConaughy rainbow nursery area.

Clear Creek

Headwaters of Clear Creek are located in Sec. 16, Twp. 16N, Rge. 41W, near the west edge of Keith County. It flows south approximately six miles before emptying into the upper end of McConaughy Reservoir in Sec. 5, Twp. 15N, Rge. 41W.

Water Temperature: During the summer water temperature in Clear Creek will remain below 72°F one mile below the headwaters at the lower end of Sec. 16, Twp. 16N, Rge. 41W. By the time Clear Creek flows through Sec. 21, Twp. 16N, Rge. 41W, water temperatures approach 80°F during hot days. Summer water temperatures alone limit the rainbow trout habitat in Clear Creek to the portion that flows through Sec. 16 and 21, Twp. 16N, Rge. 41W.

Barriers and Diversions: Two irrigation diversions, located in Sec. 29 and 32, Twp. 16N, Rge. 41W, completely dewater the lower end of Clear Creek during the irrigation season. These diversions are not barriers during the rest of the year, but they might affect downstream migration of smolts if they are ever activated during March and April.

The lower end of Clear Creek was rechanneled so smolts wouldn't be stranded in the shallow water at the delta of the creek before reaching the North Platte River. This area should be watched so it doesn't become a barrier to downstream smolt migrations again.

Limiting Factors: Warm water temperatures limit rainbow trout habitat to the upper two miles of stream. Below that, water is too warm to support trout. Rainbow trout could not survive even if the lower two miles were not dewatered by the irrigation diversions.

Grazing is usually heavy on the upper end of Clear Creek, and sand washing into the stream from the surrounding hills causes an unstable stream bed. Irrigation return water is not a problem in Clear Creek. No areas above the irrigation diversions have been ditched or rechanneled.

Rainbow Trout Populations: Electrofishing during June 1971 found white suckers, creek chubs, stonerollers, and longnose dace in that portion of Clear Creek that flows through Sec. 16 and 21, Twp. 16N, Rge. 41W. No game fish, including brown or rainbow trout, were sampled. Based on this survey, the entire length of Clear Creek was renovated with rotenone. Management since 1971 calls for annual stocking with McConaughy rainbow fingerlings.

The rainbow trout population has been estimated during the 1971-1974 period. Each fall and winter electro-fishing was conducted to determine the survival of stocked McConaughy rainbow trout fingerlings. Survey results are shown in Table 26.

Clear Creek was stocked with spring-run McConaughy rainbow each June from 1971 through 1973. In 1974 stocking was changed to fall-run McConaughy rainbow fingerlings in April or May. This policy is currently in effect. Before when spring-run rainbow were stocked in mid-June they had to make water temperature adjustment from 57-59°F hatchery water to 72-80°F stream water. A change to stocking fall run rainbow in late April allows the rainbow to acclimate slowly to warming water temperature in May and June.

The earlier stocking date also insures a larger smolt for downstream migration to the reservoir. These two factors, plus leaving the upper one mile of stream ungrazed during 1974, help explain the increase in size and the survival of fall-run over spring-run stockings (Table 26).

Adult rainbows have not been observed spawning or returning to Clear Creek. However, stream sampling and observations have

verified the movement of rainbow smolts from the upper reaches of Clear Creek. Smolt migrations through the lower end of Clear Creek have also been verified.

At present, only the portion of Clear Creek that flows through Sec. 16, Twp. 16N, Rge. 41W is stocked and managed as a rainbow trout nursery stream. The part that flows through Sec. 21, Twp. 16N, Rge. 41W is presently being used for an experimental fingerling brown trout stocking project.

Spawning gravel exists only in the upper end of Clear Creek, and it will not support natural reproduction under the present land management practices. Fishing pressure on Clear Creek is almost nonexistent.

Alliance Drain

The Alliance Drain, Scotts Bluff County, originates from a spring at the base of Lake Minatare in Sec. 5, Twp. 22N, Rge. 53W. This stream flows in a southerly direction for approximately six miles and enters Nine Mile Creek in Sec. 28, Twp. 22N, Rge. 53W.

Water Temperature: Summer temperatures in the upper end of the Alliance Drain above the irrigation diversion range from 60°-70°F. Summer water temperatures below the irrigation diversion (located in Sec. 20, Twp. 22N, Rge. 53W) range between 75°F and 80°F, so rainbow populations are reduced in this section downstream to Nine Mile Creek.

Barriers and Diversions: The diversion located in Sec. 20, Twp. 22N, Rge. 53W completely dewaters the Alliance Drain during the irrigation season. This structure is a permanent barrier to upstream migration of rainbow trout. However, it does not affect downstream migration of smolts during March and April.

Limiting Factors: Rainbow habitat is limited to the upper 3.6 miles of stream. The lower 2.4 miles are too warm for trout during the summer months. Approximately one mile of the Alliance Drain has been ditched or rechanneled. The Alliance Drain carries a light to moderate load of silt during the summer irrigation period. Grazing is moderate to heavy throughout its watershed.

Rainbow Trout Populations: Alliance Drain was managed as a rainbow trout nursery stream during 1972-1974 and has the best nursery stream potential in the North Platte River drainage. It consistently had the highest survival rate and standing crop of any stream stocked with McConaughy rainbows.

Electro-fishing during the winter of 1971 revealed a resident rainbow trout population. This is the only self-sustaining nonmigrating rainbow trout population in the North Platte Valley. This population also inhabits a short section below the irrigation diversion and appears to survive in an environment consisting of warm-water temperatures and very marginal spawning requirements. At best, the spawning gravel appears to be only poor to fair in quality, yet this population has survived without stocking since the early 1940's.

Investigations were initiated to determine if the resident rainbow population is better adapted to the coldwater habitat in Nebraska. Therefore, the Alliance Drain was discontinued as a rainbow trout nursery stream. Emphasis now is placed on collecting eggs from the resident rainbow population for stocking in various streams throughout the state to see if they perform better than the hatchery strains of rainbow trout presently being used. If the Alliance Drain rainbow do not prove superior to the hatchery rainbow, then it is recommended the Alliance Drain again be used as a rainbow trout nursery stream.

Fishing pressure on the Alliance Drain appeared light five years ago but has gradually increased since that time.

Cedar Creek

Cedar Creek, Morrill County, originates in the edge of the hills approximately five miles southeast of Broadwater and flows northeasterly before entering the North Platte River.

Irrigation diversions and pumps cause severe dewatering nearly the entire length of the creek during the irrigation season. The gradient, except for the extreme upper end is quite flat. Occasionally a few large rainbow are caught near the lower end, but these are thought to be strays hatched and reared in some of the other North Platte Valley streams.

Cedar Creek has very little rainbow trout nursery potential under the present summer dewatered stream conditions.

Blue Creek

The headwaters of Blue Creek are located near Crescent Lake in westcentral Garden County. The creek flows southeasterly to empty into the North Platte River near Lewellen. The middle area of the creek is severely dewatered by irrigation diversions. Some of these diversions would be permanent barriers to fish migrations.

It has only marginal trout potential. Spawning gravel is very limited throughout the Blue Creek drainage. The upper end is presently managed as a brown trout fishery. Because of irrigation practices, Blue Creek does not appear to have potential as a rainbow trout nursery stream.

Table 26. Clear Creek McConaughy rainbow trout stocking and survival data for the 1971-1974 period.

Year	McConaughy Rainbow Progeny	Number Stocked	Acres Stocked	Population Estimate	Percent Survival	Size Fish/Lb.	Sampling Month	Standing Crop Lbs./Acre
1971	Spring	8,965	1.1	2,001	22.3	29.0	Feb.	63
1972	Spring	13,200	1.1	924	7.0	16.2	Feb.	52
1973	Spring	7,620	1.1	1,555	20.4	25.9	Feb.	55
1974	Fall	6,429	1.1	3,454	53.7	10.6	Dec.	296

season.

The creek is severely dewatered for approximately two miles below the irrigation diversion in Sec. 8, Twp. 21N, Rge. 52W. It appears that almost the entire length of Stuckenhole Creek has been ditched or rechanneled at sometime in the past. Periodically, maybe once in five years, the stream in Sec. 32, Twp. 22N, Rge. 52W is ditched by the Farmer's Irrigation District.

Rainbow Trout Populations: Some 10 to 15 years ago, large rainbow could be observed jumping into the culvert under Nine Mile canal during the fall and winter migrations. Whether these adults originated from stocked rainbow or natural reproduction is unknown. However, very few adults can now be found or observed in this same area of the creek.

Rainbow potential of Stuckenhole Creek can best be realized through a nursery stream stocking policy. Approximately 2.6 acres of water have been stocked with McConaughy rainbow fingerlings since 1974.

Rainbow smolts produced in Stuckenhole will have no problem with any of the irrigation structures, except possibly the one located on the extreme lower end. The possible loss of smolts at this structure should be evaluated.

Fishing pressure on Stuckenhole is very light at the present time. Spawning gravel is very limited, and the quality is poor.

Mitchell Drain

The Mitchell Drain in Scotts Bluff County originates in a wetlands or marsh area right below the Tri-state Canal in Sec. 10, Twp. 23N, Rge. 56W. This creek flows southeast for approximately five miles to empty into the North Platte River in Sec. 35, Twp. 23N, Rge. 56W. Some confusion arises as to the name of this small stream. Many people refer to it as Spottedtail Creek. Spottedtail Creek, however, flows year-around directly into the Tri-State Canal just above where the Mitchell Drain originates. Spottedtail flows down the canal approximately 2.8 miles and, when not being used for irrigation, flows directly south to the North Platte River. Spottedtail Creek actually flows through a siphon under the Mitchell Drain in Sec. 35, Twp. 23N, Rge. 56W.

Water Temperature: Water temperature in Mitchell Drain will reach 75°F on hot days, as it flows through Sec. 15, Twp. 23N, Rge. 56W approximately one mile below the Tri-State Canal. Farther downstream where the railroad crosses the Mitchell Drain in Sec. 26, Twp. 23N, Rge. 56W, the water temperature barely reaches 70°F during the summer. Groundwater and small springs increase the flow until the water is actually cooler further downstream. This is not typical of North Platte Valley streams.

Barriers and Diversions: There are no barriers or diversions on Mitchell Drain.

Limiting Factors: Only the upper 25 percent of the Mitchell Drain does not have heavy stream bank grazing. Very little irrigation return water enters the stream, so the silt load during the summer months is low. The bottom is sand or silt.

The stream passes near the northeast corner of the city of Mitchell. At least one pipe of untreated domestic sewer effluent from a housing development and possibly others from residences along the creek flow into Mitchell Drain.

Rainbow Trout Populations: Stream sampling showed brown trout were rare and only one adult rainbow spawner was examined. Fall-run McConaughy fingerlings have been stocked in the Mitchell Drain since 1974. The initial 1974 stocking showed a very poor growth rate, so only the best areas of the stream were stocked during 1975 and 1976 at a much reduced rate.

Two small areas are stocked annually at the present time. The first encompasses the portion of the stream that parallels Nebraska 29 along the west edge of Sec. 15, Twp. 23N, Rge. 56W. The second runs from the U.S. 26 bridge and approximately one-fourth mile downstream where the creek parallels the county road between Sec. 26 and 27, Twp. 23N, Rge. 56W. The area between these two stocking sites should not be stocked unless the domestic sewage problem is corrected.

Even poor quality spawning gravel is almost nonexistent in Mitchell Drain, consequently little if any natural rainbow trout reproduction can be expected. Fishing pressure is very light on this stream.

Mitchell Drain should be managed as a McConaughy rainbow nursery area.

Clear Creek

Headwaters of Clear Creek are located in Sec. 16, Twp. 16N, Rge. 41W, near the west edge of Keith County. It flows south approximately six miles before emptying into the upper end of McConaughy Reservoir in Sec. 5, Twp. 15N, Rge. 41W.

Water Temperature: During the summer water temperature in Clear Creek will remain below 72°F one mile below the headwaters at the lower end of Sec. 16, Twp. 16N, Rge. 41W. By the time Clear Creek flows through Sec. 21, Twp. 16N, Rge. 41W, water temperatures approach 80°F during hot days. Summer water temperatures alone limit the rainbow trout habitat in Clear Creek to the portion that flows through Sec. 16 and 21, Twp. 16N, Rge. 41W.

Barriers and Diversions: Two irrigation diversions, located in Sec. 29 and 32, Twp. 16N, Rge. 41W, completely dewater the lower end of Clear Creek during the irrigation season. These diversions are not barriers during the rest of the year, but they might affect downstream migration of smolts if they are ever activated during March and April.

The lower end of Clear Creek was rechanneled so smolts wouldn't be stranded in the shallow water at the delta of the creek before reaching the North Platte River. This area should be watched so it doesn't become a barrier to downstream smolt migrations again.

Limiting Factors: Warm water temperatures limit rainbow trout habitat to the upper two miles of stream. Below that, water is too warm to support trout. Rainbow trout could not survive even if the lower two miles were not dewatered by the irrigation diversions.

Grazing is usually heavy on the upper end of Clear Creek, and sand washing into the stream from the surrounding hills causes an unstable stream bed. Irrigation return water is not a problem in Clear Creek. No areas above the irrigation diversions have been ditched or rechanneled.

Rainbow Trout Populations: Electrofishing during June 1971 found white suckers, creek chubs, stonerollers, and longnose dace in that portion of Clear Creek that flows through Sec. 16 and 21, Twp. 16N, Rge. 41W. No game fish, including brown or rainbow trout, were sampled. Based on this survey, the entire length of Clear Creek was renovated with rotenone. Management since 1971 calls for annual stocking with McConaughy rainbow fingerlings.

The rainbow trout population has been estimated during the 1971-1974 period. Each fall and winter electro-fishing was conducted to determine the survival of stocked McConaughy rainbow trout fingerlings. Survey results are shown in Table 26.

Clear Creek was stocked with spring-run McConaughy rainbow each June from 1971 through 1973. In 1974 stocking was changed to fall-run McConaughy rainbow fingerlings in April or May. This policy is currently in effect. Before when spring-run rainbow were stocked in mid-June they had to make water temperature adjustment from 57-59°F hatchery water to 72-80°F stream water. A change to stocking fall run rainbow in late April allows the rainbow to acclimate slowly to warming water temperature in May and June.

The earlier stocking date also insures a larger smolt for downstream migration to the reservoir. These two factors, plus leaving the upper one mile of stream ungrazed during 1974, help explain the increase in size and the survival of fall-run over spring-run stockings (Table 26).

Adult rainbows have not been observed spawning or returning to Clear Creek. However, stream sampling and observations have

verified the movement of rainbow smolts from the upper reaches of Clear Creek. Smolt migrations through the lower end of Clear Creek have also been verified.

At present, only the portion of Clear Creek that flows through Sec. 16, Twp. 16N, Rge. 41W is stocked and managed as a rainbow trout nursery stream. The part that flows through Sec. 21, Twp. 16N, Rge. 41W is presently being used for an experimental fingerling brown trout stocking project.

Spawning gravel exists only in the upper end of Clear Creek, and it will not support natural reproduction under the present land management practices. Fishing pressure on Clear Creek is almost nonexistent.

Alliance Drain

The Alliance Drain, Scotts Bluff County, originates from a spring at the base of Lake Minatare in Sec. 5, Twp. 22N, Rge. 53W. This stream flows in a southerly direction for approximately six miles and enters Nine Mile Creek in Sec. 28, Twp. 22N, Rge. 53W.

Water Temperature: Summer temperatures in the upper end of the Alliance Drain above the irrigation diversion range from 60°-70°F. Summer water temperatures below the irrigation diversion (located in Sec. 20, Twp. 22N, Rge. 53W) range between 75°F and 80°F, so rainbow populations are reduced in this section downstream to Nine Mile Creek.

Barriers and Diversions: The diversion located in Sec. 20, Twp. 22N, Rge. 53W completely dewaters the Alliance Drain during the irrigation season. This structure is a permanent barrier to upstream migration of rainbow trout. However, it does not affect downstream migration of smolts during March and April.

Limiting Factors: Rainbow habitat is limited to the upper 3.6 miles of stream. The lower 2.4 miles are too warm for trout during the summer months. Approximately one mile of the Alliance Drain has been ditched or rechanneled. The Alliance Drain carries a light to moderate load of silt during the summer irrigation period. Grazing is moderate to heavy throughout its watershed.

Rainbow Trout Populations: Alliance Drain was managed as a rainbow trout nursery stream during 1972-1974 and has the best nursery stream potential in the North Platte River drainage. It consistently had the highest survival rate and standing crop of any stream stocked with McConaughy rainbows.

Electro-fishing during the winter of 1971 revealed a resident rainbow trout population. This is the only self-sustaining nonmigrating rainbow trout population in the North Platte Valley. This population also inhabits a short section below the irrigation diversion and appears to survive in an environment consisting of warm-water temperatures and very marginal spawning requirements. At best, the spawning gravel appears to be only poor to fair in quality, yet this population has survived without stocking since the early 1940's.

Investigations were initiated to determine if the resident rainbow population is better adapted to the coldwater habitat in Nebraska. Therefore, the Alliance Drain was discontinued as a rainbow trout nursery stream. Emphasis now is placed on collecting eggs from the resident rainbow population for stocking in various streams throughout the state to see if they perform better than the hatchery strains of rainbow trout presently being used. If the Alliance Drain rainbow do not prove superior to the hatchery rainbow, then it is recommended the Alliance Drain again be used as a rainbow trout nursery stream.

Fishing pressure on the Alliance Drain appeared light five years ago but has gradually increased since that time.

Cedar Creek

Cedar Creek, Morrill County, originates in the edge of the hills approximately five miles southeast of Broadwater and flows northeasterly before entering the North Platte River.

Irrigation diversions and pumps cause severe dewatering nearly the entire length of the creek during the irrigation season. The gradient, except for the extreme upper end is quite flat. Occasionally a few large rainbow are caught near the lower end, but these are thought to be strays hatched and reared in some of the other North Platte Valley streams.

Cedar Creek has very little rainbow trout nursery potential under the present summer dewatered stream conditions.

Blue Creek

The headwaters of Blue Creek are located near Crescent Lake in westcentral Garden County. The creek flows southeasterly to empty into the North Platte River near Lewellen. The middle area of the creek is severely dewatered by irrigation diversions. Some of these diversions would be permanent barriers to fish migrations.

It has only marginal trout potential. Spawning gravel is very limited throughout the Blue Creek drainage. The upper end is presently managed as a brown trout fishery. Because of irrigation practices, Blue Creek does not appear to have potential as a rainbow trout nursery stream.

Table 26. Clear Creek McConaughy rainbow trout stocking and survival data for the 1971-1974 period.

Year	McConaughy Rainbow Progeny	Number Stocked	Acres Stocked	Population Estimate	Percent Survival	Size Fish/Lb.	Sampling Month	Standing Crop Lbs./Acre
1971	Spring	8,965	1.1	2,001	22.3	29.0	Feb.	63
1972	Spring	13,200	1.1	924	7.0	16.2	Feb.	52
1973	Spring	7,620	1.1	1,555	20.4	25.9	Feb.	55
1974	Fall	6,429	1.1	3,454	53.7	10.6	Dec.	296

THE LAKE ENVIRONMENT

Data Collection from McConaughy Reservoir

Water quality data collected from 1969-1975 was used to describe the rainbow trout habitat in McConaughy Reservoir during the critical summer months. Rainbow trout habitat has been defined as water 70°F or colder, yet containing 3.0 ppm or more of dissolved oxygen (Wilkens, Kirkland and Hulsey, 1968), Four sampling stations were used: Station 1, ½ mile from the dam; Station 2, 6½ miles; Station 3, 11½ miles, and Station 4, 16½ miles up the lake from the dam. Data was collected at these stations periodically from June through October. Oxygen content and water temperatures were measured either with an oxygen and temperature probe or a Kemmerer water sampler. When the water sampler was used oxygen determinations were made with a Hach kit.

Annual Cycle

Summer oxygen and temperature data plus observations made throughout the year were used to describe the annual cycle conditions in Lake McConaughy. Ice completely melts near the dam sometime in early March, usually about two to three weeks after the melt on the upper end of the reservoir. From ice breakup until early June, the water warms slowly and the oxygen content from the surface to the bottom of the lake remains nearly the same. The first hot days of early summer warm the surface water faster than that in the middle or the bottom of the lake. This trend continues unless strong winds again mix the lake from top to bottom. If strong spring and summer winds persist, the entire lake will be warmer before stratification begins.

Air temperature and spring winds determine the water temperature of the hypolimnion during the summer stratification period. As summer progresses, however, the surface warms considerably faster than the lower depths and a thermocline forms in the reservoir. The thermocline prevents the surface water from mixing with the water near the lake bottom. When this happens, oxygen is not replenished in water below the thermocline. Consequently, the oxygen is slowly used up by decaying organic materials. Early in the summer the water below the thermocline contains sufficient oxygen and is cool enough for trout.

By mid-August, sometimes sooner, not enough oxygen is available in the water below the thermocline to support fish. While the oxygen is slowly leaving the water below the thermocline, the waters between the thermocline and the surface are warmed and mixed by winds. When the critical period is reached sometime in August, the trout are theoretically sandwiched in an area between the warm surface water (not preferred trout habitat) and the cool water devoid of oxygen. This area is usually located near the thermocline. Some years this trout water or coldwater habitat (water 70°F and cooler but containing at least 3.0 ppm oxygen) is very small, sometimes only three feet in depth. Fortunately this condition lasts only one or two weeks.

The wind plays an important role in the oxygen and temperature cycle in McConaughy Reservoir and helps increase the trout water in late August or early September. Cool days and nights lower the surface water temperature, and the wind circulates this water down to the thermocline. Under these conditions the reservoir again contains coldwater habitat above the thermocline in a very short time.

Cool September weather and winds help cool the reservoir. As they do, the thermocline sinks towards the bottom of the reservoir. By early October, the thermocline is located very deep in the lake and surface waters have cooled to about the same temperature as the water below the thermocline near the bottom of the lake. When this happens, the density of the surface waters and bottom waters are nearly equal and the entire lake begins to mix. This period is called the fall turnover. The lake continues to cool and is mixed by winds until freezeup in December or January. The upper end of the reservoir freezes three to four weeks before ice-up near the dam.

Rainbow Trout Habitat

The volume of coldwater habitat for each of the six summer periods was calculated from the data collected at the sampling stations (Appendix Table R). Data collections were not made during the summer of 1971. The coldwater habitat present in McConaughy during the critical summer periods of 1969 through 1975 is shown in Table 27. When the volume of trout habitat is smallest, it takes on a pie-shaped appearance. Then, the vertical depth of the trout water is largest near the dam. The band of trout water decreases in size until it nearly disappears in the vicinity of Station 2 approximately 6½ miles up lake from the dam. The minimum amount of trout habitat in McConaughy during 1969-1975 is shown in Figures 2-7. Because of the shape of the trout water a plainmeter was used to calculate the volume of the trout water. Average summer surface water tempera-

Table 27. Warm weather, water elevation, and trout habitat in McConaughy Reservoir, 1969-1975.

Year	Total Number of Days Over 90° F, May, June, July	Minimum Amount of Trout Habitat (Acre Feet)	Water Elevation August 1
1969	22	47,660	3,265
1970	33	141,197	3,264
1972	19	260,954	3,259
1973	25	11,418	3,265
1974	39	12,243	3,252
1975	38	171,476	3,256

Table 28. Average surface water temperatures at the four summer sampling stations on McConaughy Reservoir, 1969-1975.

Station	Month	Year and Average Water Surface Temperature						
		1969	1970	1971	1972	1973	1974	1975
1	June	—	65.0	NO DATA COLLECTED THIS YEAR	—	—	69.0	62.5
	July	76.0	77.0		67.5	71.3	74.5	71.5
	August	75.0	76.5		70.0	73.8	71.3	75.0
2	June	—	62.5		—	—	72.0	63.5
	July	75.0	74.4		68.0	73.0	72.0	73.0
	August	78.0	74.7		72.0	74.0	71.7	75.0
3	June	—	57.0		—	—	75.0	66.0
	July	74.0	74.0		68.0	74.3	75.0	74.5
	August	—	74.7		73.0	75.5	73.0	73.0
4	June	—	—		—	—	—	65.0
	July	—	—		—	—	77.0	73.7
	August	—	—		—	—	72.0	71.5

tures in McConaughy from 1969 through 1975 are shown in Table 28.

Coldwater habitat in McConaughy Reservoir varied considerably during the six-year study period (Table 27). Parameters, such as water level, air temperature, and surface water temperature, were assumed to have a strong relationship to the coldwater habitat present during the critical periods. However, examination of the data presented in Tables 27 and 28 did not indicate the strong relationship expected. Coldwater habitat during 1970 and 1973 illustrates this point. In 1970 there were 33 days when the air temperature exceeded 90°F. Water levels were within one foot of the highest recorded during the study, and surface water temperatures during July were the highest recorded during the study. That year there were 141,197 acre-feet of trout habitat during the critical August period. Compare this to 1973 when there were only 25 days when the air temperature exceeded 90°F, and the surface water temperatures recorded during July were nearly six degrees cooler. The water level was nearly the same as 1970. However, during 1973 there were only 11,418 acre-feet of coldwater habitat in McConaughy Reservoir during the critical August period. Only the 1972 and 1974 data show a relationship between air temperature over 90°F and the amount of trout habitat available during the critical period.

Although the parameters measured have some influence on the volume of coldwater habitat in McConaughy Reservoir, there must be other parameters that were not investigated that influence the rainbow trout habitat during the critical summer period. These parameters must be identified and measured before predictions of coldwater habitat in the future can be made. Some parameters not measured but needing investigation are (1) wind velocity and duration, (2) the biological oxygen demand in the hypolimnion, and (3) more sophisticated air and cloud cover data.

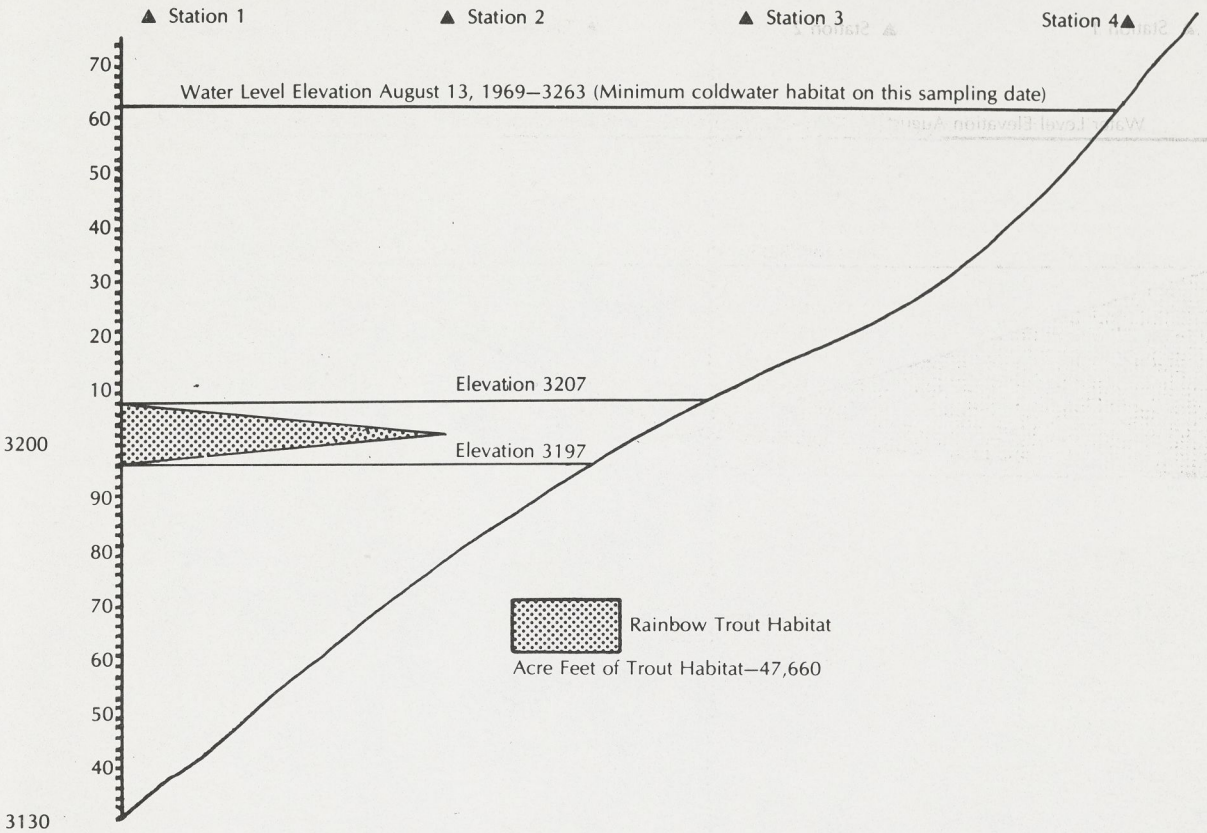


Figure 2. Rainbow trout habitat in McConaughy Reservoir, summer 1969.

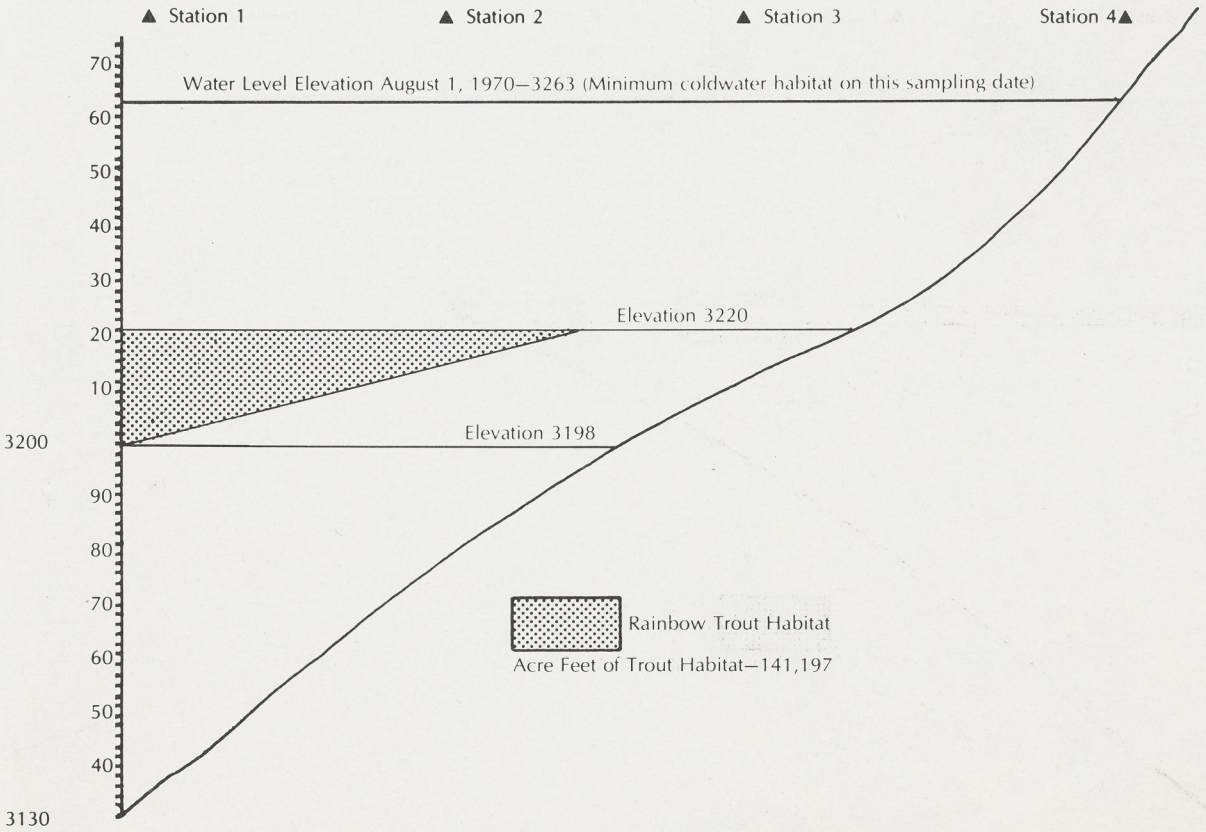


Figure 3. Rainbow trout habitat in McConaughy Reservoir, summer 1970

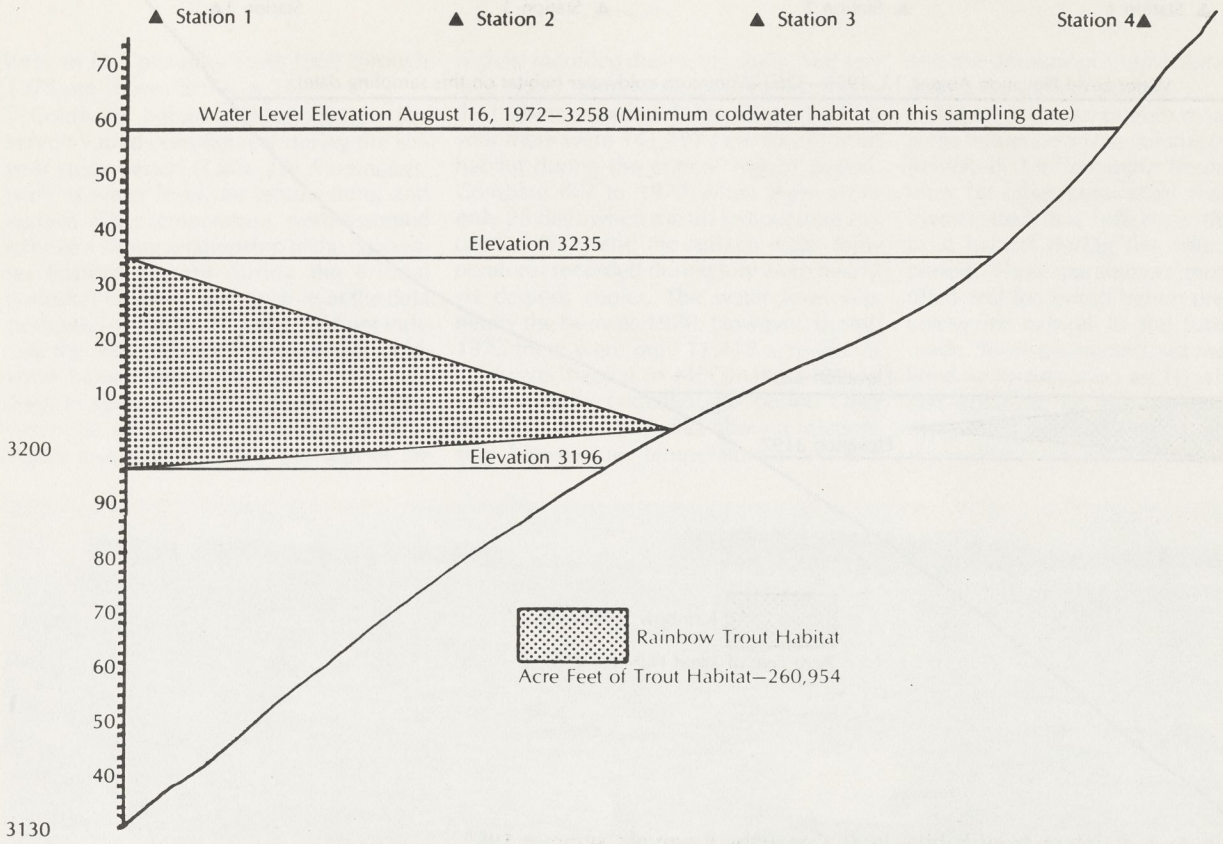


Figure 4. Rainbow trout habitat in McConaughy Reservoir, summer 1972.

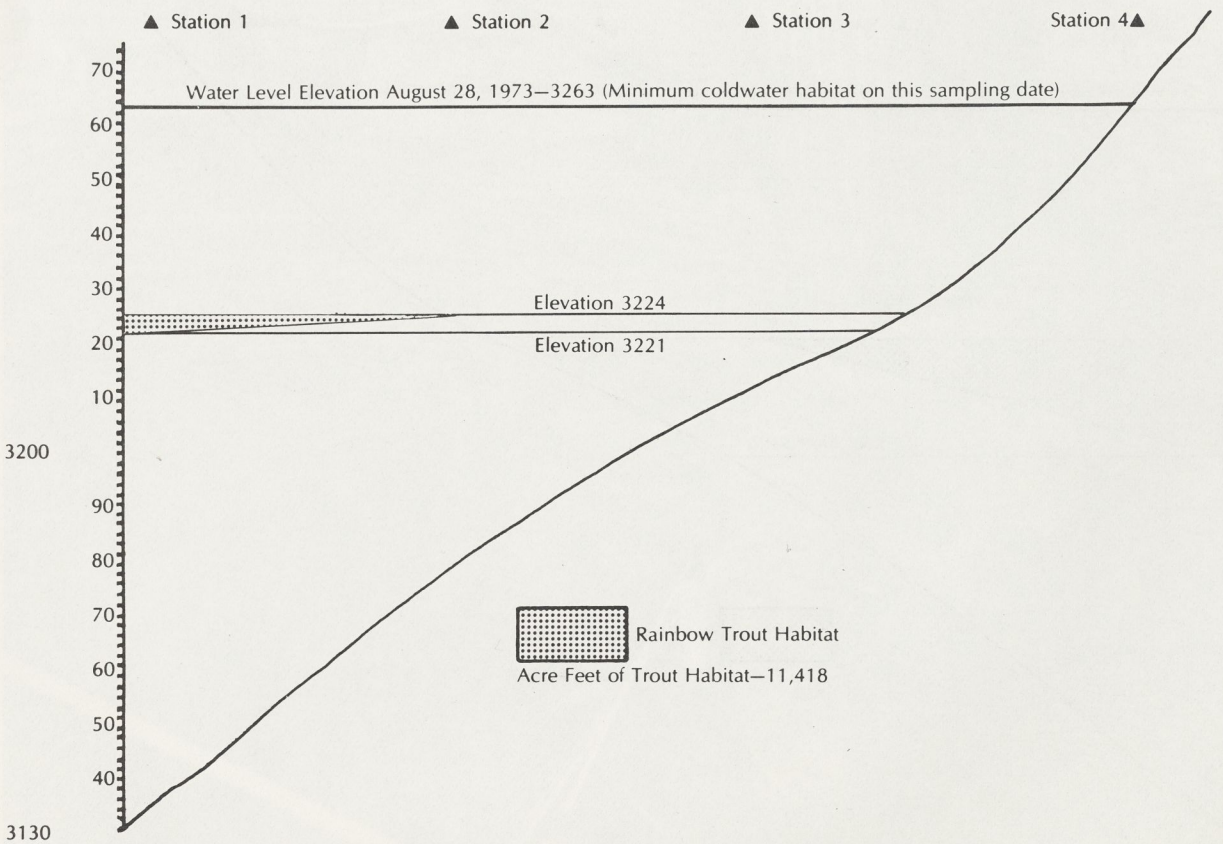


Figure 5. Rainbow trout habitat in McConaughy Reservoir, summer 1973.

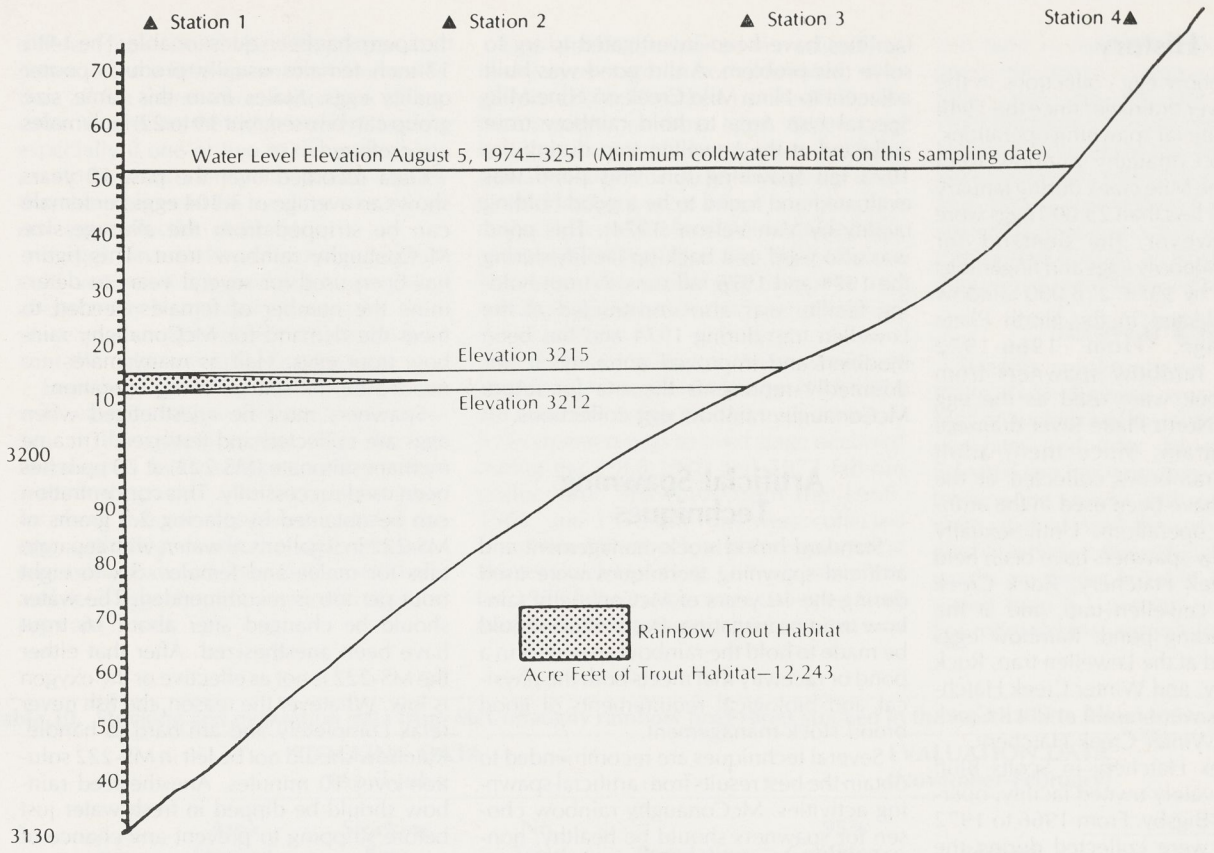


Figure 6. Rainbow trout habitat in McConaughy Reservoir, summer 1974.

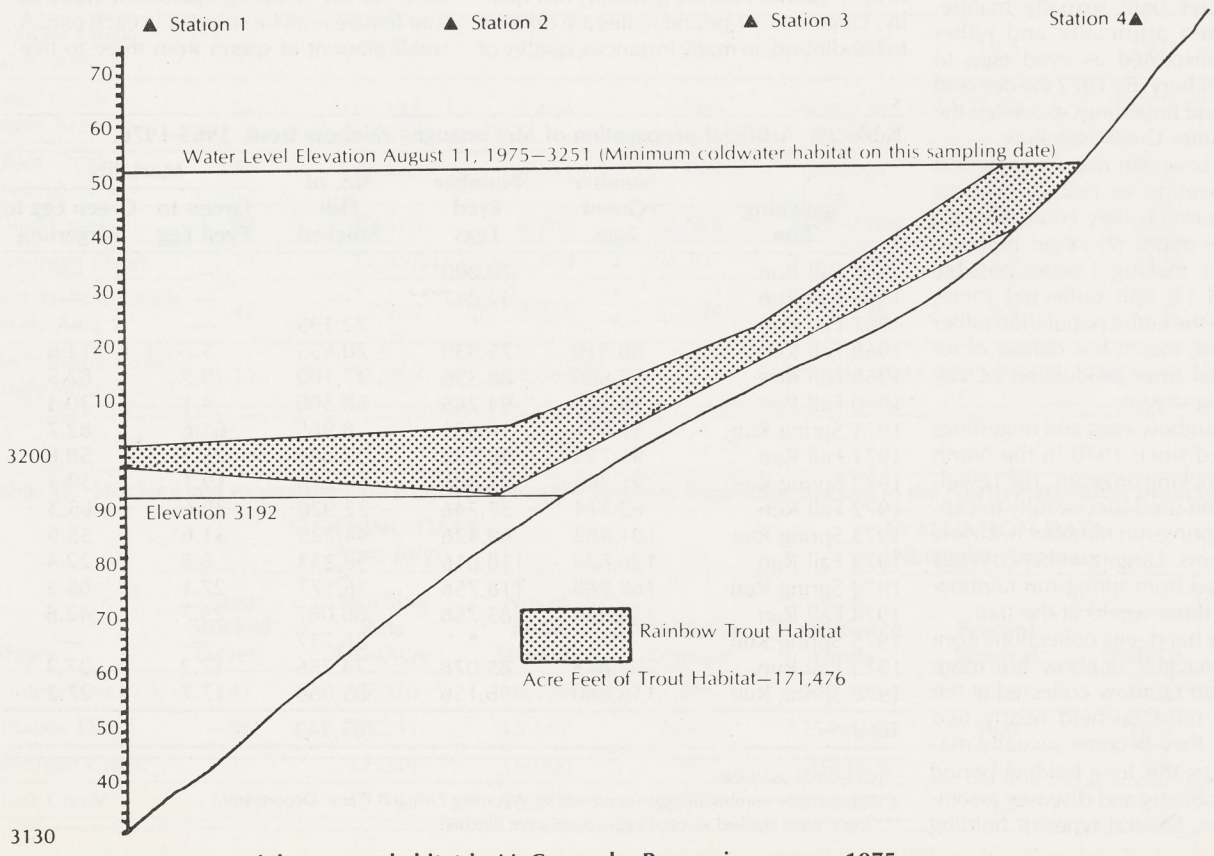


Figure 7. Rainbow trout habitat in McConaughy Reservoir, summer 1975.

ARTIFICIAL PROPAGATION

History

The first rainbow egg collections in the North Platte River drainage, since the 1948 Otter Creek artificial spawning operations, came from McConaughy rainbow trout captured in Nine Mile creek during January 1966. That year less than 25,000 eggs were stripped. However, the demand for McConaughy rainbow eggs and fingerlings increased until by 1974, 278,000 rainbow eggs were collected in the North Platte River drainage. From 1966-1972 McConaughy rainbow spawners from Nine Mile Creek were used as the egg source for the North Platte River drainage stocking program. Since then, adult McConaughy rainbows collected at the Lewellen trap have been used in the artificial spawning operations. Until sexually mature, rainbow spawners have been held at Winter Creek Hatchery, Rock Creek Hatchery, the Lewellen trap, and at the Nine Mile holding pond. Rainbow eggs have been eyed at the Lewellen trap, Rock Creek Hatchery, and Winter Creek Hatchery. Fingerlings were raised at Rock Creek Hatchery and Winter Creek Hatchery.

Winter Creek Hatchery in Scotts Bluff County is a privately owned facility, operated by Rupert Bigsby. From 1966 to 1972 rainbow trout were collected during the winter months in Nine Mile creek or at the Lewellen trap and transported to Winter Creek Hatchery, where they were held in cement raceways until sexually mature. Eggs were taken artificially and either hatched or transported as eyed eggs to Rock Creek Hatchery. By 1972 the demand for eyed eggs and fingerlings exceeded the capacity of Winter Creek Hatchery.

In 1972 the Lewellen trap was selected as the best location to collect rainbow spawners because (1) they could be captured with less effort, (2) larger numbers could be taken, making a better possible selection, and (3) fish collected there, which are from the entire population rather than one stream, meant less danger of reducing the total trout production of any single spawning stream.

Spring-run rainbow eggs and fingerlings have been used since 1970 in the North Platte Valley stocking program. The Lewellen trap has been used successfully to capture and hold spring-run rainbow, with few holding problems. Large numbers of eggs can be collected from spring-run rainbow held less than three weeks at the trap.

On the other hand, egg collections from fall-run McConaughy rainbow are more difficult. Fall-run rainbow collected at the Lewellen trap must be held nearly two months before they become sexually mature. Some years this long holding period has caused problems and diseases associated with stress. Several types of holding facilities have been investigated to try to solve this problem. A dirt pond was built adjacent to Nine Mile Creek on Nine Mile Special Use Area to hold rainbow trout collected at the Lewellen trap during the 1973 fall spawning run. This pond was evaluated and found to be a good holding facility by Van Velson (1974). This pond was also used as a back-up facility during the 1974 and 1975 fall runs. A trout holding facility was also constructed at the Lewellen trap during 1974 and has been modified and improved annually. It undoubtedly represents the site for future McConaughy rainbow egg collections.

Artificial Spawning Techniques

Standard brood stock management and artificial spawning techniques were used during the 10 years of McConaughy rainbow trout propagation. Every effort should be made to hold the rainbow spawners in a pond or raceway that meets both the physical and biological requirements of good brood stock management.

Several techniques are recommended to obtain the best results from artificial spawning activities. McConaughy rainbow chosen for spawners should be healthy, nondeformed fish, 19-22 inches long, which generally means they are three years old. Eggs collected from females over 24 inches (6 to 10-pound size) are generally low quality. Large 6 to 10-pound males are difficult to handle and, in many instances, quality of the sperm has been questionable. The 14 to 17-inch females usually produce poorer quality eggs. Males from this same size group can be used, but 19 to 22-inch males are preferred.

Data recorded over the past 10 years shows an average of 3,304 eggs per female can be stripped from the average-size McConaughy rainbow trout. This figure has been used for several years to determine the number of females needed to meet the demand for McConaughy rainbow trout eggs. Half as many males are needed for the spawn-taking operation.

Spawners must be anesthetized when eggs are collected and fertilized. Tricaine methanesulfonate (MS-222) at 70 ppm has been used successfully. This concentration can be obtained by placing 2.3 grams of MS-222 in 9 gallons of water, with separate tubs for males and females. Six to eight trout per tub is recommended. The water should be changed after about 16 trout have been anesthesized. After that either the MS-222 is not as effective or the oxygen is low. Whatever the reason, the fish never relax completely and are hard to handle. Rainbow should not be left in MS-222 solution over 10 minutes. Anesthesized rainbow should be dipped in fresh water just before stripping to prevent any chance of MS-222 interfering with egg fertilization.

Plastic pans approximately 10 inches in diameter and 3 inches deep work satisfactorily for the stripping operation. Three to four females can be stripped in each pan. A small amount of sperm from three to five

Table 29. Artificial propagation of McConaughy rainbow trout, 1965-1976.

Spawning Run	Number Green Eggs	Number Eyed Eggs	No. of Fish Stocked	Mortality	
				Green to Eyed Egg	Green Egg to Fingerling
1965 Fall Run	*	20,000**	—	—	—
1966 Fall Run	*	42,047***	—	—	—
1967 Fall Run	*	*	22,195	—	—
1968 Fall Run	80,519	75,930	70,655	5.7	12.6
1969 Fall Run	97,660	88,396	17,100	9.5	82.5
1970 Fall Run	98,347	94,285	68,590	4.1	30.3
1971 Spring Run	51,801	19,901	8,965	61.6	82.7
1971 Fall Run	91,759	68,532	37,845	25.3	58.8
1972 Spring Run	91,286	73,888	55,210	19.1	39.5
1972 Fall Run	62,514	37,746	22,920	39.6	63.3
1973 Spring Run	101,482	69,426	44,725	31.6	55.9
1973 Fall Run	126,624	118,016	98,233	6.8	22.4
1974 Spring Run	162,888	118,756	56,177	27.1	65.5
1974 Fall Run	115,464	85,756	66,087	25.7	42.8
1975 Spring Run	*	*	36,717	—	—
1975 Fall Run	102,845	85,078	74,756	17.2	27.3
1976 Spring Run	116,880	96,156	85,068	17.7	27.2
Total:			765,243		

*No records available.
**Approximate number of eggs transferred to Wyoming Fish and Game Department.
***These were stocked as eyed eggs—none were hatched.

different males should be used per pan. It is better to use a little sperm from five males than all the sperm from one or two males, since it increases the chance of fertilization especially if one or two of the males happen to have inferior sperm. It also insures that the males can be used for more than one egg collection operation.

If eggs have to be collected outside in cold weather, it is a good practice to place about an inch of water in one pan, then place another pan inside it. This helps prevent the cold from affecting the eggs.

Eggs should be stripped into a pan rinsed with water and still wet. Water is not necessary in the spawning pan. After the last female has been stripped, put enough water in the pan to cover the eggs. Set aside for about five minutes before washing the eggs with clean water the same temperature as the spawners were held in. All shells and dead eggs should be removed after the eggs are rinsed.

Eggs can be transported immediately or in the eyed stage. In both instances, two-gallon coolers worked successfully for McConaughy rainbow eggs. Green eggs have been successfully transported in these containers from the Scottsbluff area to Rock Creek Hatchery, over a four-hour journey. Green eggs should be water hardened to a point where they are not sticky before transport. The entire egg stripping and handling operation should be shaded from direct sunlight.

Records of artificial propagation of McConaughy rainbow trout for 1965-1976 are shown in Table 29. The lowest mortality from green eggs to eyed stage occurred during the 1968-1970 and 1973 fall-run collections. Spawners from the 1968, 1969, and 1970 fall runs were collected from Nine Mile Creek, and the eggs eyed at Winter Creek Hatchery. Sixty-six percent of the 1973 fall-run eggs were collected from rainbow trout captured at the Lewellen trap and held in the Nine Mile SUA holding pond. The rest of the eggs came from Nine Mile Creek spawners. All eggs from the 1973 fall run were eyed at the Rock Creek Hatchery. Except for the 1968 fall run the lowest mortality from green eggs to fingerlings also occurred from the 1973 fall run spawning operation when green eggs were transported directly to Rock Creek where they were eyed and raised to stocking size.

Survival Rates

Streams representative of the North Platte River drainage were stocked with McConaughy rainbow fingerlings at various rates and sizes during 1971-1974. Selected streams were then sampled to determine the growth and survival. Streams were stocked April through July and sampled November through February. Survey results are shown in Table 30-33. Survival varied from 6.1 percent to 54.1 percent. For more details, consult Job Progress Re-

Table 30. Stocking and evaluation data from McConaughy rainbow fingerlings stocked in the North Platte River drainage during 1971.

	STOCKING DATA (April-July)			EVALUATION DATA (November-February)				
							Size	
Stream	Area Stocked (acres)	Stocking Rate Fish/Acre	No. Trout Stocked	Population Estimate	95% Confidence Limits	Percent Survival	Fish/Lb.	Average Length (inches)
Winters Creek Study Area 1	.24	12,590	3,149	443	363-571	14.1	20.3	5.1
Winters Creek Study Area 2	.17	7,974	1,362	266	211-339	19.5	19.0	5.0
Otter Creek Study Area 1	.44	17,133	7,484	1,080	900-1296	14.4	17.8	5.2
Otter Creek Study Area 2	.37	16,362	6,134	576	500-731	9.4	19.6	5.1
Clear Creek	.84	10,673	8,965	2,668	2480-2884	29.8	29.0	4.5
Lonergan Creek	1.31	12,457	16,319	2,207	1977-2360	13.5	9.9	6.2
Red Willow Creek Study Area 1	.42	7,962	3,356	204	158-296	6.1	25.0	4.5
Red Willow Creek Study Area 2	1.11	15,885	17,565	SURVIVAL WAS TOO POOR TO CALCULATE				

Table 31. Stocking and evaluation data from McConaughy rainbow fingerlings stocked in the North Platte River drainage during 1972.

	STOCKING DATA (April-July)			EVALUATION DATA (November-February)				
							Size	
Stream	Area Stocked (acres)	Stocking Rate Fish/Acre	No. of Trout Stocked	Population Estimate	95% Confidence Limits	Percent Survival	Fish/Lb.	Average Length (inches)
Winters Creek	.41	15,020	6,158	1,086	970-1234	17.6	14.2	5.5
Alliance Drain	.86	18,241	15,687	5,643	5254-6094	36.0	16.9	5.4
Lonergan Creek	1.31	12,214	16,000	553	486-665	3.6	9.5	6.5
Clear Creek	3.64	15,168	55,210	2,230	1933-2713	4.0	19.7	5.1

ports F-4-R, No.s. 17-20. Annual survival rates for all streams evaluated during 1971-1974 are shown in Table 34.

Based on the 1971-1974 stream-sampling program, there is an obvious difference in the productivity of the North Platte Valley streams. Alliance Drain is the most productive stream stocked in the North Platte River drainage. Stocked with 18,000 fingerlings per surface acre of water, it produced a 36 percent survival rate. The standing crop of rainbow in this stream averaged 589 pounds per acre. Standing crops of trout in the rest of the stocked streams are shown in Table 35.

A standing crop of approximately 100 pounds of trout per acre can be expected in most of the streams now stocked with McConaughy rainbow fingerlings. The most reliable estimate of the rainbow trout standing crop in a natural reproduction stream was made on a 2,070 foot section of Nine Mile Creek on the Nine Mile Special Use Area. For five years (1970-1975) the average standing crop of McConaughy rainbow (less than 9.0 inches) was 155 pounds per acre in this section of stream.

Fingerlings stocked at 400 fish per pound had the best survival, consequently this is the recommended stocking size. Fall-run rainbow fingerlings should be stocked from April 15 to May 31, with the first week in May preferred. If possible, spring-run fingerlings should be stocked by June 15.

The number of rainbow smolts produced by the fingerling stocking program can be calculated from Table 34. Survival from the first two years (1971 and 1972) can be discounted, since better procedures of stream selection, stocking rates, and stocking size were used during 1973 and 1974. Average survival of 1973 and 1974 fingerling plants was 28 percent. Using this survival rate, the annual recruitment of smolts for McConaughy Reservoir was calculated (Table 36). These rainbow smolts plus those resulting from natural reproduction comprise the annual recruitment of rainbow trout for McConaughy Reservoir from the North Platte Valley streams.

To spread out the egg-handling and fry-feeding operations at Rock Creek Hatchery and to insure fish reach 400 per pound size by mid-April, every effort should be made to obtain an early egg source of fall-run rainbows. Fall-spawning operations should strive to collect the first lot of fall run eggs by December 15, which may involve collecting fall-run rainbow from spawning streams for the first egg take.

The coldwater fisheries management of each stream must be handled on an individual basis. Stocking and survival rates vary not only by stream but also some years within each stream. Current knowledge of stream conditions, such as productivity, water use patterns, and stream bank grazing, must be used and updated frequently. These factors affect the stocking rate and standing crop of the North Platte Valley streams.

Table 32. Stocking and evaluation data from McConaughy rainbow fingerlings stocked in the North Platte River drainage during 1973.

	STOCKING DATA (May-June)			EVALUATION DATA (December-February)				
							Size	
Stream	Area Stocked (acres)	Stocking Rate Fish/Acre	No. of Trout Stocked	Population Estimate	95% Confidence Limits	Percent Survival	Fish/Lb.	Average Length (inches)
Lonergan Creek	1.31	6,885	9,020	687	579-849	7.6	6.8	7.1
Alliance Drain	.86	16,165	13,900	7,097	6251-8206	51.1	8.7	6.0
Clear Creek	3.64	6,927	25,215	2,621	2065-3567	10.4	26.7	4.7
Winters Creek	1.34	9,000	12,060	3,636	3130-4261	30.1	18.5	5.1

Table 33. Stocking and evaluation data from McConaughy rainbow fingerlings stocked in the North Platte River drainage during 1974.

	STOCKING DATA (May-June)			EVALUATION DATA (December-February)				
							Size	
Stream	Area Stocked (acres)	Stocking Rate Fish/Acre	No. of Trout Stocked	Population Estimate	95% Confidence Limits	Percent Survival	Fish/Lb.	Average Length (inches)
Alliance Drain	.86	9,983	8,585	4,644	4145-5275	54.1	12.5	5.9
Clear Creek	1.54	5,844	9,000	4,815	4271-5636	53.5	10.6	6.2
Lonergan Creek	1.31	3,049	3,995	593	561-641	14.8	5.7	7.2
Mitchell Drain	3.10	8,284	25,680	7,109	6458-7915	27.7	37.7	4.1
Winters Creek	1.18	7,627	9,000	1,580	1422-1821	17.6	12.6	6.0

Table 34. Survival rates of McConaughy rainbow trout fingerlings stocked in the North Platte River drainage, 1971-1974.

Year	Number Stocked	Survival to Approx. 7 Inches	Percent Survival
1971	46,769	7,444	15.9
1972	93,055	9,512	10.2
1973	60,195	14,041	23.3
1974	56,260	18,741	33.3
Totals:	256,279	49,738	

Table 35. Standing crop (pounds per acre) of trout in streams stocked with McConaughy rainbow trout fingerlings.

Stream	Year	Average Length	Standing Crop Lbs/Acre	Av. Standing Crop Per Stream
Lonergan Creek	1971	6.2	170	
Lonergan Creek	1972	6.5	44	93
Lonergan Creek	1973	7.1	77	
Lonergan Creek	1974	7.2	79	
Clear Creek	1971	4.5	109	
Clear Creek	1972	5.1	31	116
Clear Creek	1973	4.7	27	
Clear Creek	1974	6.2	296	
Winters Creek	1971	5.1	91	
Winters Creek	1971	5.0	82	
Winters Creek	1972	5.5	187	123
Winters Creek	1973	5.1	147	
Winters Creek	1974	6.0	106	
Alliance Drain	1972	5.4	388	
Alliance Drain	1973	6.0	948	589
Alliance Drain	1974	5.9	432	
Otter Creek	1971	5.2	138	109
Otter Creek	1971	5.1	79	
Red Willow	1971	4.5	19	19
Mitchell Drain	1974	4.1	61	61

Table 36. Annual smolt recruitment to McConaughy Reservoir (1969-1977) from the fingerling McConaughy rainbow stocking program.

Year Stocked	Number of Fingerlings Stocked	Smolt Recruitment for McConaughy Reservoir* (from fingerling stocking program only)	
		Year	Number
1968	22,195	1969	6,215
1969	70,655	1970	19,783
1970	17,100	1971	4,788
1971	77,555	1972	21,715
1972	93,055	1973	26,055
1973	67,645	1974	18,941
1974	154,410	1975	43,235
1975	102,804	1976	28,785
1976	159,824	1977	44,751
Totals:	765,243		214,268

*Smolt recruitment calculated using 28 percent survival rate of stocked fingerlings.

MANAGEMENT PLAN

Acquisition proposals and environmental considerations will be suggested for aquatic management of the North Platte Valley coldwater streams, along with annual activities to assist with the individual management of each stream.

Acquisition Recommendations

This section is based on an October 1974 report entitled "The North Platte Valley Trout-Wildlife Habitat Program". The importance of a stream habitat program to the total environment in the North Platte Valley is reviewed along with an implementation proposal.

Spawning gravel is a most valuable natural resource with an estimated capital value in the mid-1960's from $345,160/acre in Battle Creek, California, to $3,200,000/acre for the Fraser River. Both of these streams provide gravel for salmon spawning.

The cost of constructing artificial spawning channels for rainbow trout and kokanee was $41,000/acre above Kootenay Lake in British Columbia. Estimated costs for other such artificial channels run from $120,000 to $470,000/acre. These are all mid-1960's values and have undoubtedly increased. And yet, little has been done to protect or enhance this valuable natural resource in Nebraska. Other valuable trout habitat in the form of nursery streams also remains unprotected.

Under the present land purchase system, it appears difficult to bring trout streams or adjacent small buffer strips of land under public ownership. When land that contains a stream is for sale, it usually includes high-priced cropland. Budgeting and land exchange policies are complex, making it difficult to negotiate a transaction in a reasonable amount of time. Unless the present land purchasing procedures change drastically, some type of leasing program is needed to give the trout streams adequate protection. The proposed long-range program should remain sensitive to the attitudes and needs of both the landowners in the North Platte Valley and the sportsmen of Nebraska. It can also serve as a priority guide for purchase, as streams become available.

The North Platte Valley contains fertile topsoil which produces excellent vegetative growth in the form of crops, grass, or weeds in a single growing season. If not grazed, this heavy growth stabilizes stream banks and also makes excellent upland game habitat. Thus, both wildlife cover and a better aquatic habitat with a correspondingly higher production of rainbow trout is provided.

Rainbow trout investigations concluded that 30.4 miles of North Platte Valley streams produce, through natural spawning, most of the rainbow trout for the McConaughy Reservoir system. In addition to these familiar trout streams, there are another 29.6 miles of small streams or drains located throughout the North Platte Valley, especially in Scotts Bluff County, that are utilized as trout rearing or nursery streams. Both can receive protection under the proposed habitat program with additional trout in the fisherman's creel as the result.

Stream fencing to exclude livestock is the single most important conservation practice and will yield the greatest benefit to trout production in the North Platte River drainage. Livestock grazing along most of the North Platte Valley streams has caused excessive stream bank erosion. When this happens, the streams become wide and shallow, and water velocity is reduced. Streams in the North Platte River drainage don't have the steep gradient usually associated with typical trout streams. So, every effort must be made to keep the banks constricted to maintain maximum velocities. Good stream velocities keep the gravel bottoms free of silt and sand to insure natural reproduction of rainbow trout and good aquatic insect populations. Aquatic insects are the primary source of food for trout. Three major benefits result from fencing to exclude livestock: (1) enhancement and protection of rainbow trout spawning habitat, (2) better aquatic fish-food production, and (3) increased wildlife habitat and wildlife production. A fourth benefit to be considered is public access for fishing and possibly hunting.

Rainbow trout spawning areas

A habitat program would enhance and preserve the 30.4 miles of rainbow trout spawning streams. The rainbow fishery in McConaughy Reservoir plus the quality rainbow trout stream fishing during the fall and winter in the upper North Platte River drainage can be traced to the hatching success and the production of rainbow trout in these 30 miles of trout streams, and they must receive top priority under the trout-wildlife habitat program.

Fish food production

Clean gravel and aquatic vegetation are excellent substrates for aquatic insects. However, in those streams where livestock graze the banks, the gravel is usually partially or completely covered by sand and silt. Moving sand is the least productive substrate for aquatic insects. In addition, livestock use usually precludes the development of aquatic vegetation. To obtain maximum trout production in both nursery streams and natural reproduction streams, an abundant supply of aquatic insects is necessary, since insects are the trout's primary food source. Maximum insect populations are possible only where livestock use of the stream is restricted.

Terrestrial wildlife production

Although designed for rainbow trout, terrestrial wildlife species, especially upland game, would benefit from the proposed habitat program. Land fenced under the program would provide permanent cover for wildlife where it is now nearly nonexistent.

At present, lands surrounding the streams are farmed and livestock are grazed along the stream banks, throughout the North Platte Valley and especially Scotts Bluff County. No permanent cover exists under such land-use practices. If the unfarmed land could be managed for wildlife, then long narrow strips of land protecting the rainbow trout environment and providing wildlife cover would lace the North Platte Valley. Examples of wildlife cover produced as a result of fencing are evident on the Nine Mile Special Use Area and on the leased area fenced on Otter Creek.

Public access

Public ownership along the North Platte Valley trout streams is restricted to a 1.4-mile section of Nine Mile Creek, owned by the Game and Parks Commission. The rest of the streams in the drainage are privately owned. North Platte Valley landowners, in general, have been very cooperative in allowing fishermen access to trout streams. However, problems associated with human population increase, and changes in land ownership could create an access problem in the future. Over the past several years, small tracts of land along some of the streams have been sold, and cabins have been built with some of this land being closed to public access. At present, no known fishing rights have been leased along the streams. However, this practice is certainly a coming reality. Future public access to these streams is in jeopardy unless a lease and/or purchase program is initiated quickly.

Stream Types

Two types of streams can produce trout in the North Platte River Valley. One can sustain natural reproduction, while the "nursery" type cannot. Nursery streams can be stocked with 1 to 2-inch rainbow trout annually. The following spring, these fish migrate to Lake McConaughy as 7 to 9-inch smolts.

Only three of the benefits (fish-food production, public access, and terrestrial wildlife production) apply to the nursery stream program. A program and a priority list is presented for both types of streams.

Rainbow trout natural reproduction streams

Table 37 gives priorities for North Platte Valley streams which support most of the present trout natural reproduction for the McConaughy system.

Rainbow trout production will be increased the most (about 60 percent) by leasing Priority 1 sections of stream. Trout production in Priority 2 and 3 stream sections can be increased by 40 percent and 20 percent respectively. Priorities were drawn on the basis of the quality of the spawning gravel, angler utilization, and areas that would benefit most from fencing. Poor spawning gravel, polluted, and dewatered areas were included. A priority was given to each section of land the streams cross. The entire section was classified according to the major stream priority within each section.

Fisherman access to natural reproduction streams was another important consideration in setting priorities. If a landowner is not interested in fencing but is willing to consider public access, every effort should be made to acquire that right. This should be kept in mind when monetary values are determined.

Nursery streams

Nursery streams do not have sufficient gravel for natural reproduction. However, they do contain coldwater habitat that will support rainbow trout once past the critical in-gravel stage. The nursery streams are usually less than eight feet wide and are located in the upper end of the drainages where flooding and irrigation return water are less frequent than the lower areas.

Many of the nursery streams have been stocked with Lake McConaughy rainbow progeny and have proven to be excellent production areas. McConaughy fingerlings grow to smolt size in about a year there, then migrate to McConaughy. When the smolts migrate in the early spring, they leave the streams practically barren of fish. These streams are then restocked with rainbow fingerlings later that spring. This is an ideal situation, because the newly stocked rainbow have little competition from other fishes. The nursery streams have become very important Lake McConaughy rainbow trout production areas. It is recommended that approximately 168,000 McConaughy rainbow fingerlings be stocked annually to produce about 47,000 smolts for the McConaughy system.

The nursery streams have not reached their potential rainbow trout production because of over-grazing and poor land practices. If these streams are protected, the nursery areas could then reach maximum production. The most important nursery streams were given priorities (Table 38), based on potential rainbow trout production and maximum benefits from fencing. Trout production can be increased by about 60 percent, 40 percent and 20 percent for Priority 1, 2 and 3 nursery streams respectively.

Fish-food production and terrestrial wildlife production are the two most important benefits which can be obtained from the nursery stream program. Next in importance is public access. Nursery streams offer little in the way of fishing, because about the time the stocked rainbow become catchable size, they migrate to the reservoir. Fishing potential is further limited by the small size of the nursery streams. However, public access would be valuable for activities like hunting, trapping, and hiking. This point should be remembered when the monetary values are set. There is no spawning area benefit in the nursery stream program, since spawning gravel is either nonexistent or very poor.

If it becomes necessary to set priorities among natural reproduction and nursery streams then the information in Table 39 should be used.

Table 37. Acquisition or leasing priority for North Platte Valley trout streams that support rainbow trout natural reproduction.

Stream	Length (miles)	Priority	Legal Description
Nine Mile Creek	1.7	1	S22, T22N, R53W
Nine Mile Creek	1.4	1	S28, T22N, R53W
Nine Mile Creek	.5	1	S23, T22N, R53W
Nine Mile Creek	1.0	2	S14, T22N, R53W
Nine Mile Creek	1.1	2	S33, T22N, R53W
Nine Mile Creek	1.9	3	S4, T21N, R53W
Nine Mile Creek	.7	3	S3, T22N, R53W
Tub Springs	.2	1	S22, T23N, R55W
Tub Springs	.6	1	S27, T23N, R55W
Red Willow Creek	2.0	1	S29, T21N, R51W
Red Willow Creek	1.2	1	S32, T21N, R51W
Red Willow Creek	1.3	2	S10, T21N, R51W
Red Willow Creek	.6	2	S15, T21N, R51W
Red Willow Creek	1.0	2	S16, T21N, R51W
Red Willow Creek	2.4	3	S21, T21N, R51W
Red Willow Creek	.2	3	S28,T21N, R51W
Red Willow Creek	.2	3	S20, T21N, R51W
Otter Creek	1.5	2	S29, T14N, R40W
Otter Creek	1.5	3	S32, T14N, R40W
West Wildhorse Creek	.2	3	S3, T21N, R52W
West Wildhorse Creek	1.1	3	S10, T21N, R52W
West Wildhorse Creek	1.0	3	S15, T21N, R52W
West Wildhorse Creek	1.8	3	S22, T21N, R52W
West Wildhorse Creek	1.1	3	S27, T21N, R52W
West Wildhorse Creek	.7	3	S23, T21N, R52W
West Wildhorse Creek	.2	3	S14, T21N, R52W
Winters Creek*	1.1	1	S9, T22N, R54W
Winters Creek*	.9	1	S8, T22N, R54W
Winters Creek*	1.0	1	S17, T22N, R54W
Winters Creek*	.3	3	S4, T22N, R54W
Total:	30.4		

*These areas will support only limited reproduction until the proposed fish ladder is installed. Priorities are based on the ladder in place.

Implementation of the Habitat Program

Monetary values are needed for the four trout-wildlife benefits of the program. The values placed on (1) stream fencing, (2) public access, and (3) terrestrial wildlife production can be used for both the nursery and natural reproduction stream programs. A fourth value is needed for the spawning habitat present in streams listed as rainbow trout natural reproduction streams. Natural reproduction streams contain sufficient gravel for trout reproduction and are more valuable than the nursery streams which have very little if any spawning gravel. The monetary values assigned to these four benefits will serve as the basis for landowner payments.

The guidelines for setting up the program include:

(1) Landowners along the trout streams

Table 38. Acquisition or leasing priority for North Platte Valley nursery streams.

Stream	Length (miles)	Priority	Legal Description
Alliance Drain	1.0	1	S5, T22N, R43W
Alliance Drain	.2	1	S8, T22N, R53W
Alliance Drain	1.1	2	S7, T22N, R53W
Winters Creek	1.7	1	S34, T23N, R54W
Winters Creek	.9	2	S3, T22N, R54W
Hiersche Drain	.8	1	S7, T23N, R54W
Hiersche Drain	.5	1	S12, T23N, R55W
Hiersche Drain	1.2	1	S13, T23N, R55W
Hiersche Drain	.6	1	S24, T23N, R55W
Hiersche Drain	1.0	1	S23, T23N, R55W
Sunflower Drain	1.0	2	S32, T23N, R55W
Mitchell Drain	.2	1	S10, T23N, R56W
Mitchell Drain	1.2	1	S15, T23N, R56W
Mitchell Drain	1.2	1	S22, T23N, R56W
Mitchell Drain	.5	2	S27, T23N, R56W
Mitchell Drain	.6	1	S26, T23N, R56W
Mitchell Drain	1.0	2	S35, T23N, R56W
Clear Creek	.5	2	S16, T14N, R41W
Clear Creek	1.0	2	S21, T14N, R41W
Lonergan Creek	1.0	1	S8, T15N, R39W
Dry Spottedtail Creek	.7	1	S16, T24N, R56W
Dry Spottedtail Creek	1.3	1	S21, T24N, R56W
Dry Spottedtail Creek	1.4	1	S28, T24N, R56W
Dry Spottedtail Creek	1.7	1	S33, T24N, R56W
Dry Spottedtail Creek	.5	1	S4, T24N, R56W
Dry Sheep Creek	1.2	2	S30, T24N, R57W
Dry Sheep Creek	1.2	2	S31, T24N, R57W
Bayard Drain	.4	3	S29, T22N, R52W
Bayard Drain	1.0	3	S32, T22N, R52W
Bayard Drain	1.2	3	S5, T21N, R52W
Bayard Drain	.4	3	S8, T21N, R52W
West Wildhorse Creek	.4	1	S27, T22N, R52W
West Wildhorse Creek	1.0	1	S34, T22N, R52W
Total:	29.6		

should be contacted and their views on public access, length of lease, and payment estimates incorporated into the program. This would insure a better chance of the program being accepted by landowners.

(2) A monetary value should be placed on each of the four benefit areas.

(3) The priority list of the streams in the North Platte Valley should be used to obtain the most benefits for the money spent.

Once this program has been set up, the landowner should be given several options to follow. For instance, if a landowner disapproved of the public access option, he could still enroll in the program but with a smaller payment. Such a program would be more acceptable than one which is implemented with strict guidelines.

To illustrate how the wildlife habitat program might work: When a landowner indicates an interest in the habitat program, the stream would be classified according to the priority list as either a nursery stream or a rainbow trout natural reproduction stream. The landowner could then choose the options or benefits which fit his needs and the payment set accordingly.

For example, suppose a landowner along Nine Mile Creek decided to place one mile of stream under the habitat program and decided to go with all four options or benefits, with monetary value of the four benefits as follows:

1.	Spawning areas	$4.00 per acre/year
2.	Fish-food	2.00 per acre/year
3.	Public access	3.00 per acre/year
4.	Wildlife production	1.00 per acre/year
	Total Benefits	$10.00

In this situation, the landowner would receive an annual payment of $10 per acre/year. If the stream is 25 feet wide and 50 feet are needed on each side of the stream, the landowner would be paid $152 per year for 15.2 acres of land.

Financing the program

It is recommended the proposed stream habitat program be financed by funds derived under the Habitat Bill LB 861. If this is not possible, a special trout stamp would offer another source of revenue.

A trout habitat stamp would probably be acceptable to anglers, if a sound public relations program was carried out before the trout stamp law was passed and if revenues generated by the trout stamp were handled along these general guidelines:

1. The trout habitat stamp would be required to fish for trout in Lake McConaughy and any stream in the North Platte River drainage.
2. Money from the stamp would be spent only in the drainage where it was collected.
3. Trout stamp revenue would be spent directly on trout habitat improvement. No trout stamp monies would be used for administrative costs.

Problems involving a trout stamp law would no doubt arise. For instance, how would the trout stamp be enforced on Lake McConaughy? How much money would a trout stamp generate? How many law enforcement problems would it cause? These questions and no doubt others will be encountered. However, the trout stamp does offer a new source of money, and its merits should be thoroughly investigated.

Environmental Recommendations

There are several environmental recommendations regarding rainbow trout migrations in the North Platte River drainage and stream improvement procedures.

Fish Passage

Road and bridge construction, culvert installation, irrigation structures and drop structures have impeded rainbow trout migrations in the North Platte Valley streams. Guidelines and recommendations can help eliminate present barriers and prevent future interference with rainbow trout migrations.

Recommendations for fish passage through culverts and over barriers were taken from literature by Gebhards and Fisher (1972) and Evans and Johnson (1974). Several conditions are recommended to insure unobstructed migrations of rainbow trout.

Resting area below obstacle

A pool of quiet water should be located immediately below any instream obstacle.

Table 39. Sequence of priorities for use in purchasing or leasing North Platte Valley trout streams.

Stream Type	Priorities from Tables 37 & 38	Sequence of Priorities
Natural reproduction streams	Priority 1	1
Natural reproduction streams	Priority 2	2
Nursery streams	Priority 1	3
Natural reproduction streams	Priority 3	4
Nursery streams	Priority 2	5
Nursery streams	Priority 3	6

This pool provides a resting area and a "good start" for the fish to bypass the obstacle. A take-off pool below any natural or man-made obstacle across the stream should be 1½ to 2 times deeper than the barrier is high.

Minimum jumps

Any structure which creates a vertical drop over one foot should be avoided if possible. If this is not possible, several guidelines concerning vertical drops or waterfalls should be followed. A six-foot vertical drop should be considered a barrier to the upstream migration of rainbow trout. All vertical drops over one foot should be investigated to make sure the water velocities and the water depth both in the pools below and over the structure are within the recommended guidelines.

Water depths.

A minimum water depth of eight inches is necessary to insure unimpeded rainbow trout migrations.

Water velocities

Maximum water velocities caused by any stream alteration should not exceed four feet per second. This is very important when culverts and other in-stream structures are planned.

General guidelines

Culverts placed in streams should always be located slightly below the stream grade. Those less than 100 feet long should not produce a stream velocity that exceeds 4 feet per second. The water velocity in culverts over 100 feet long should not exceed 2 feet per second.

Several precautions are advised for bridge and road construction. Construction activity should be limited to May through September. No construction should take place from October through April, when rainbow trout migrations are under way. Every effort should be made during construction to keep debris and siltation at a minimum level. If a cement apron is necessary in an area immediately below a bridge, it should be placed below the stream grade. Water should be at least eight inches deep in culverts during rainbow trout migrations (October through April). If the width of the bridge and stream bed does not allow an eight-inch water depth, a small area of the apron should be notched so an eight-inch depth is available.

It is strongly recommended that regulations be implemented and/or a memorandum of understanding be worked out with all organizations which alter the physical structure of any stream in the North Platte River drainage. Road construction by county or state departments can be handled through the present environmental impact statements. However, private irrigation districts do not fill out environmental impact statements when stream channel alterations are made. A memorandum of understanding is needed with these organizations, so they are aware of the stream conditions necessary to have unobstructed rainbow trout migrations.

Stream Improvement

Stream improvement activities have been conducted in several streams in the North Platte River drainage to help eliminate bank erosion and provide better trout habitat. Several recommendations are made based upon these activities.

The single most important stream improvement in the North Platte River drainage is bank fencing. In many instances, fencing will stabilize bank erosion and stream bank vegetation will encroach on the stream. When this happens, the stream narrows and the current increases. Such changes create habitat diversity between pool and riffle areas, thereby making the stream more attractive to rainbow trout. The amount of land fenced on each side of the stream depends upon the topography of the land. An adequate buffer strip should be maintained to protect the stream environment. Fencing too close to the stream will only cause excessive fence maintenance.

Fencing alone will not stabilize very steep eroding banks. In addition to fencing these areas, it is necessary to stabilize the bank with artificial structures. Since most North Platte Valley streams are fairly accessible, scrap concrete can be used. Broken concrete should be laid from the stream bed to approximately two feet above the summer water level. Although floods occasionally raise the stream five to seven feet, it is not necessary to place rock to the high water mark. The two-foot level usually is adequate during the summer months. Preferably vegetation above this level will control erosion caused by the periodical floods, and the stream will retain its natural look appearance.

Two or three layers of concrete are usually placed in the stream. This insures the stream current cannot erode the bank behind the concrete. Reed canary grass should be planted on the moist banks where the concrete is placed. Seed can be sprinkled on top of the dirt and raked lightly. The grass provides excellent stream bank protection within a year. In many instances, this vegetation will eventually cover most of the concrete riprap. It is essential to keep livestock off banks that are stabilized. If the eroded stream banks are tall and vertical, it may be necessary to back-slope them with a dragline before the concrete is put into place.

These stabilization procedures were used satisfactorily on Nine Mile Special Use Area. This type of bank stabilization maintains the natural appearance of the stream.

McConaughy Reservoir Recommendations

Every effort should be made to make the Central Nebraska Public Power and Irrigation District aware of the potential loss of rainbow trout smolts which might occur if the upper gates are used to release water during March through June. If possible, the water level in Lake McConaughy should be regulated by the low level outlet during that period, since rainbow smolts are migrating into the reservoir.

McConaughy becomes marginal for rainbow trout almost annually during July and August. Lower water levels in any reservoir usually mean overall warmer water temperatures during the summer months. Prolonged drouth conditions could drastically lower the volume of the water in McConaughy, which would tend to decrease the amount of rainbow trout habitat. The importance of high water levels for rainbow trout survival in Lake McConaughy cannot be overemphasized.

During low water years, the mouth of the North Platte River at McConaughy should be checked to make sure the trout can migrate across the delta and into the river. Although not a problem in the past, it could possibly present one.

A sand delta usually builds up at the point where Otter Creek enters McConaughy Reservoir and can be a barrier to migrating trout when the water is shallow. A sand pumping operation during the summer of 1974 alleviated this problem. However, recent low reservoir water levels have caused another sand delta to form below the area that was pumped. When pumping is not possible a corncrib fence is an economical way to deal with the shallow water barrier at the mouth of Otter Creek. Two sections of corncribbing, placed 10 to 15 feet apart completely across the shallow water, will concentrate the flow of the creek. The channel formed between the fence sections permits trout to migrate over the delta.

Stream Management Recommendations

Nursery streams recommended for stocking are marked on U.S. Geological Survey Maps on file in the Game and Parks Commission's District I Office. The top 10 North Platte Valley streams were ranked according to their importance to rainbow trout both for natural reproduction and nursery potential (Table 40). Pumpkin Creek was not ranked because it has neither natural reproduction nor nursery stream potential.

Table 40. Importance of the top ten North Platte Valley trout streams based upon rainbow trout populations.

Rank	Stream
1	Nine Mile Creek
2	Red Willow Creek
3	Otter Creek
4	Tub Springs
5	Dry Spottedtail Creek
6	Winters Creek
7	Stuckenhole Creek
8	Clear Creek
9	Wildhorse Creek
10	Lonergan Creek

Specific stream management recommendations, based on the rainbow trout investigations in the North Platte River drainage, are presented in addition to the routine management activities that should be conducted, such as population surveys, pollution detection, and encouragement of good stream management by landowners and others. These recommendations include:

(1) The same sections of Nine Mile Creek should continue to be closed to fishing October 1 through December 31. This regulation has been accepted by anglers and allows protection during the major spawning period.

(2) A specific program should be developed within the framework of the Habitat Plan LB 861 for leasing and acquisition of live streams in the North Platte River drainage.

(3) The dip net regulation in effect on the North Platte River drainage trout streams should be continued. Most anglers in the drainage apparently favor this regulation, and there has been little adverse reaction.

(4) Minimum stream flows should be established for the streams in the North Platte River drainage.

(5) Larger fines and stiffer penalties are needed for violators who illegally take or attempt to take trout in the North Platte River drainage.

Specific recommendations are proposed for management of individual streams within the drainage.

Nine Mile Creek

General: The annual fish population survey should be continued on the 2,070 foot section of Nine Mile Creek on the Nine Mile Special Use Area just above Tri-State Canal. Usually conducted in December, it indicates the general success of rainbow trout spawning.

Rainbow Trout Migrations: No specific recommendations.

Nursery Stream Stocking: None

Red Willow Creek

General: Every effort should be made to reduce the amount of waste water entering Red Willow Creek from the Tri-State Canal.

Rainbow Trout Migrations: No specific recommendations.

Nursery Stream Stocking: None.

Otter Creek

General: The lease on the upper end of Otter Creek should be renewed when it expires, including approximately the same amount of land. The annual rainbow trout production survey should be continued at the two permanent sampling stations in Otter Creek.

Rainbow Trout Migrations: Modifications should be made on the vertical drop in Otter Creek caused by the culvert under Highway 92, so established fish passage guidelines for successful migration of rainbow trout can be met.

Nursery Stream Stocking: None.

Tub Springs

General: No specific recommendations.

Rainbow Trout Migrations: No specific recommendations.

Nursery Stream Stocking: There are 6.0 acres of water in 5.3 miles of coldwater nursery stream habitat in the Tub Springs drainage, which should be stocked with 23,840 fall-run rainbows at 400 fish per pound. Recommended stocking rate is 4,000 fish per acre.

Wildhorse Creek

General: If Wildhorse Reservoir on the west branch is filled with water, a low level outlet should be installed to provide cooler water to sustain the downstream trout fishery. If a low level outlet and a filled reservoir are not possible, the total fishery in the Wildhorse Creek drainage would benefit the most from the creation of a lake. In this case, it is better to have a reservoir with no low level outlet rather than not fill the reservoir.

Rainbow Trout Migrations: No specific recommendations.

Nursery Stream Stocking: There are 1.4 acres of water in 1.3 miles of coldwater nursery stream habitat in the Wildhorse Creek drainage. The coldwater nursery habitat should be stocked with 7,000 fall-run rainbows at 400 fish per pound. The recommended stocking rate is 5,000 fish per acre.

The coldwater habitat in the east branch of Wildhorse Creek is located between the Tri-State Canal and the irrigation diversion structure in Sec. 11, Twp. 21N, Rge. 52W. This section of the stream should be stocked annually with fingerling brown trout.

Winters Creek

General: No specific recommendations.

Rainbow Trout Migrations: A fish ladder should be built on Winters Creek at the irrigation diversion located in Sec. 19, Twp. 22N, Rge. 54W, provided the fishery benefits can justify construction. A feasibility study for this proposed fish ladder should also investigate the irrigation structure located downstream in Sec. 31, Twp. 21, Rge. 54W. It, too, may need to be altered to meet specifications for successful upstream migration of rainbow trout.

Nursery Stream Stocking: Until a fish ladder is installed in Winters Creek, it should be used as a nursery stream, stocked annually with McConaughy rainbow fingerlings.

Two nursery areas are recommended for stocking in the Winters Creek drainage. The upper area, containing 2.35 acres of water in 1.8 miles, should be stocked with 11,750 fall-run rainbows at 400 fish per pound. Recommended stocking rate is 5,000 fish per acre. The lower nursery area contains 6.45 acres of water in 2.5 miles and should be stocked with 25,800 fall-run rainbows at 400 fish per pound. Stocking rate is 4,000 fish per acre.

Dry Spottedtail Creek

General: No specific recommendations.

Rainbow Trout Migrations: Boards in the irrigation diversion located in Sec. 16, Twp. 23N, Rge. 56W should be manipulated so rainbow trout can migrate over this structure.

Nursery Stream Stocking: There are 11.97 acres of water in 8.0 miles of coldwater nursery stream habitat in the Spottedtail Creek drainage. It should be stocked with 59,850 spring-run rainbows at 400 fish per pound. Recommended stocking rate is 5,000 fish per acre.

Sheep Creek

General: Sheep Creek should be managed as a catchable put-and-take brown trout fishery.

Rainbow Trout Migrations: No specific recommendations.

Nursery Stream Stocking: None.

Pumpkin Creek

No recommendations are made for the Pumpkin Creek drainage.

Lonergan Creek

General: No specific recommendations.

Rainbow Trout Migrations: No specific recommendations.

Nursery Stream Stocking: The 1.31 acres of water in 1.0 miles of coldwater nursery stream habitat in the Lonergan Creek drainage should be stocked with 3,275 fall-run rainbows at 400 fish per pound. Recommended stocking rate is 2,500 fish per acre.

Stuckenhole Creek

General: No specific recommendations.

Rainbow Trout Migrations: An investigation is recommended to determine if smolts migrating to McConaughy Reservoir are lost at the Stuckenhole Creek irrigation diversion, located approximately one-fourth mile upstream from the North Platte River in Sec. 4, Twp. 20N, Rge. 52W. If a fish loss can be identified, some type of screen should be installed.

A permanent sampling station should be established in Stuckenhole Creek immediately below Nine Mile Canal in Sec. 28, Twp. 21, Rge. 52W. This should be sampled annually in November or December for the next three years to determine the survival of stocked McConaughy rainbows.

Nursery Stream Stocking: There are 3.37 acres of water in 2.6 miles of coldwater nursery stream habitat in the Stuckenhole Creek drainage. This coldwater nursery habitat should be stocked with 14,380 fall-run rainbows at 400 fish per pound.

Mitchell Drain

General: A permanent sampling station should be established in the Mitchell Drain where it flows along Highway 29 north of Mitchell. This station should be sampled for the next three years to determine the status of the rainbow trout fingerlings stocked in that section of the Mitchell Drain.

Rainbow Trout Migrations: No specific recommendations.

Nursery Stream Stocking: There are 1.14 acres of water in 1.0 mile of coldwater nursery stream habitat in the Mitchell Drain, which should be stocked with 3,420 fall-run rainbows at 400 fish per pound. Recommended stocking rate is 3,000 fish per acre.

Clear Creek

General: The portion of Clear Creek that flows through Sec. 21, Twp. 16N, Rge. 41W is stocked annually with fingerling brown trout. If their survival is poor and the browns do not produce a stream fishery, that section should be stocked with McConaughy rainbow fingerlings at a rate of 2,000 fish per acre.

Rainbow Trout Migrations: The lower end of Clear Creek should be channeled to permit rainbow trout to migrate from the North Platte River to the upper end of the creek. The area involved is located on Clear Creek Refuge in Sec. 5, Twp. 15N, R41W.

Nursery Stream Stocking: There are 1.54 acres of water in 1.7 miles of coldwater nursery stream habitat in the Clear Creek drainage which should be stocked with 6,160 fall-run rainbow at 400 fish per pound. Recommended stocking rate for this section is 4,000 fish per acre.

Alliance Drain

General: This stream should be used as a brood stock area for the Alliance Drain strain of rainbow trout. If this particular rainbow population cannot be adapted to the statewide coldwater program, the upper end of the Alliance Drain should be stocked annually with McConaughy rainbow fingerlings.

Rainbow Trout Migrations: No specific recommendations.

Nursery Stream Stocking: If McConaughy rainbows are used in this drainage the .9 acre of water in 1.2 miles of coldwater nursery stream habitat should be stocked with 9,000 fall-run rainbow at 400 fish per pound. The recommended stocking rate is 10,000 fish per acre.

Cedar Creek

No specific recommendations are made for this drainage.

Blue Creek

No specific recommendations are made for this drainage.

Stocking Schedule:

Table 41 outlines the annual McConaughy rainbow stocking schedule for the North Platte River drainage. Stocking arrangements should be made with the District fishery supervisor.

Annual Work Schedule

Other recommendations scheduled on a yearly basis for the North Platte Valley trout streams include:

January

1. Artificially spawn fall-run rainbow trout.

February

1. Verify natural reproduction of fall-run rainbow trout in the natural reproduction streams.
2. Check water diversion structure on Winters Creek to make certain all the boards are pulled by Great Western Sugar Company. If all the boards are not pulled, spring-run rainbow cannot ascend Winters Creek.
3. After the Great Western Sugar Factory at Mitchell has completed diverting water from Dry Spottedtail Creek manipulate the flow over the irrigation diversion located in Sec. 16, Twp. 23N, Rge. 56W. Proper placement of these boards will allow spring-run rainbow to move up Dry Spottedtail Creek.

March

1. Prepare the Red Willow fish screen for operation and put it into place when water is diverted into the Alliance Drain Irrigation Canal.
2. Make sure rainbow smolts can migrate through the lower end of Clear Creek and enter the North Platte River.
3. Check for fish loss from Stuckenhole Creek via the irrigation diversion located in Sec. 4, Twp. 20N, Rge. 52W. If a fish screen is installed, make sure it is ready for operation.
4. Collect and artificially spawn spring-run rainbow at the Lewellen trap.

April-May

1. Stock fall-run rainbow trout fingerlings in Tub Springs, Wildhorse Creek, Winters Creek, Lonergan Creek, Clear Creek, Stuckenhole Creek, Mitchell Drain, and Alliance Drain.
2. Stock catchable brown trout in Sheep Creek.
3. Stock fingerling brown trout in Clear Creek and the east branch of Wildhorse Creek.

June

1. Stock spring-run fingerlings in Dry Spottedtail Creek.

July-August

1. Set thermographs in trout streams where water temperatures may approach the critical range due to recent changes in water-use patterns.

Table 41. Stocking schedule for McConaughy rainbow trout in the North Platte River drainage.

Stream	Miles Stocked	Surface Acres (Water)	Stocking Rate Fish/Acre	Spawning Run		Number Stocked
Tub Springs •	5.3	5.96	4,000	Fall Run		23,840
W. Wildhorse Creek	1.3	1.4	5,000	Fall Run		7,000
Winters Creek						
Area 1	1.8	2.35	5,000	Fall Run	11,750	
Area 2	2.5	6.45	4,000	Fall Run	25,800	37,550
Lonergan Creek	1.0	1.31	2,500	Fall Run		3,275
Clear Creek	1.7	1.54	4,000	Fall Run		6,160
Mitchell Drain	1.0	1.14	3,000	Fall Run		3,420
Stuckenhole Creek						
Area 1	2.1	2.47	4,000	Fall Run	9,880	
Area 2	.5	.9	5,000	Fall Run	4,500	14,380
Alliance Drain	1.2	.9	10,000	Fall Run		9,000*
			Total Fall Run:			104,625
Dry Spottedtail Creek	8.0	11.97	5,000	Spring Run		59,850
			Grand Total (Fall and Spring Run):			164,475

*Do not stock this creek if the Alliance Drain rainbow program is active.

September

1. Check streams and water diversion structures in the North Platte River drainage to make sure water conditions still permit rainbow trout migrations.
2. Post the closed fishing areas on Nine Mile Creek in Sections 11, 22, 23, 27, 28, 33, 34, Twp. 22N, Rge. 53W which are closed annually October 1 through December 31.

October-November

1. Operate Lewellen trap to obtain fall-run spawners for egg collections.
2. Sample permanent stations in Otter Creek, Nine Mile Creek, Stuckenhole Drain and the Mitchell Drain.
3. Check the lower end of Otter Creek to make sure stream conditions will permit the upstream migration of rainbow trout.

December

1. Artificially spawn fall-run rainbow trout.
2. Evaluate fingerling brown trout stockings in the North Platte River drainage.

Water-use and land-use patterns can quickly change in the North Platte River drainage. The fishery manager should keep informed of the changes in the aquatic environment and alter the management of the North Platte Valley streams accordingly.

A summary of major rainbow trout management recommendations for the North Platte River drainage include:

North Platte Valley Streams

1. An active stream purchase and leasing program designed specifically for the North Platte River drainage should be initiated immediately.
2. Either special regulations should be implemented and/or a memorandum of understanding should be made with all organizations which alter the physical structure of any stream in the North Platte River drainage. This would be for all organizations that do not file environmental impact statements.
3. Fish passage guidelines should be used when construction activities are planned which affect the aquatic resources in the North Platte River drainage.
4. Stream improvement activities should include first, streambank fencing and then if needed bank stabilization utilizing the techniques used on the Nine Mile Special Use Area.
5. Annual fish production surveys should be continued in Otter Creek and Nine Mile Creek.
6. Minimum stream flows should be established for the streams in the North Platte River drainage.
7. The dip net regulation now in effect in the trout streams of the North Platte River drainage should be continued.
8. The stream closure regulation affecting the spawning areas in Nine Mile Creek should be continued.
9. Larger fines and stiffer penalties are recommended for persons illegally taking or attempting to take trout in the North Platte River drainage.
10. The vertical drop in Otter Creek caused by the culvert under Highway 92 should be modified so the guidelines for fish passage are met.
11. A new lease on the upper end of Otter Creek should be negotiated when the present lease expires.
12. Only McConaughy strain rainbow trout should be stocked in the North Platte River drainage.

Artificial Propagation

1. Unless special studies are initiated the Lewellen trap should be operated only long enough during the fall and spring rainbow spawning runs to collect the number of spawners needed to meet the egg demand.
2. Fall run spawners should be used exclusively as the egg source for the North Platte River drainage stocking program with the exception of the streams listed in the management plan.
3. Every effort should be made to obtain the first lot of fall run eggs by December 15.
4. All McConaughy rainbow eggs

should be treated for disease before being placed in Rock Creek Hatchery.

5. Annual disease investigations should be conducted on McConaughy rainbow spawners to insure a disease free egg supply.

McConaughy Reservoir

1. The low level outlet in McConaughy Reservoir should be used to release water during the March through June period.
2. The oxygen and temperature data collected under the U.S. Department of Interior, office of Water Research and Technology Grant Number 14-34-001-6227, "Modeling the effects of eutrophication on trout habitat in Lake McConaughy, a two story reservoir," should be used to compute the annual volume of trout water in McConaughy Reservoir during the critical summer period.
3. All parameters which affect the volume of trout water in McConaughy Reservoir should be identified and measured.
4. The important relationship between high water levels and trout habitat in McConaughy Reservoir should be emphasized in present and future water development projects utilizing water from the North Platte River drainage.

LITERATURE CITED

EVANS, W. A., and F. B. JOHNSTON. 1974. Fish migration and fish passage: A practical guide to solving fish passage problems. U.S. Forest Service, Region 5. 43 p.

GEBHARDS, S., and J. FISHER. 1972. Fish passage and culvert installation. Mimeo. Rep. Idaho Fish and Game Department. 12 p.

HARTMAN, W. L. 1959. Biology and vital statistics of rainbow trout in the Finger Lake Region, New York. N. Y. Fish and Game J. 6: 121-177.

KIRKLAND, L., and M. BOWLING. 1966. Preliminary observations on the establishment of a reservoir trout fishery. Proc. 20th Annu. Conf., Southeast Ass. Game Fish Comm. 569 p.

MADSEN, M. L. 1973. An experimental electric barrier and trap for removing non-game fish from a reservoir tributary. Mimeo. Rep. Nebr. Game Parks Comm. 33 p.

MC CARRAHER, D. B., M. L. MADSEN, and R. E. THOMAS. 1971. Ecology and fishery management of McConaughy Reservoir, p. 299-311. In Gordon E. Hall (ed.) Reservoir fisheries and liminology. Amer. Fish. Soc. Spec. Pub. No. 8, Washington.

SHAPOVALOV, L., and A. C. TAFT. 1954. The life histories of steelhead rainbow trout *(Salmo gairdneri,* Richardson) and silver salmon *(Oncorhynchus kisutch)* with special reference to Waddell Creek, California, and recommendations regarding their management. Calif. Dept. Fish Game. Fish Bull. 98: 375 p.

VAN VELSON, R. C. 1969. Migration dynamics in rainbow trout. M.S. Thesis. Colo. St. Univ. 97 p.

VAN VELSON, R. C. 1974. Rainbow trout holding and spawning facility proposal for Nine Mile SUA. Mimeo. Rep. Nebr. Game Parks Comm. 7 p.

WILKINS, P., L. KIRKLAND, A. HULSEY. 1968. The management of trout fisheries in reservoirs having a self-sustaining warmwater fishery. Reservoir Fishing Resources Symposium, Athens, Georgia.

REFERENCES

The following reports, publications and technical papers, cover the various investigations of the rainbow trout population in the North Platte River drainage from 1966-1976.

DAVIDSON, C. 1968, The closed mile, Nebraskaland. Vol. 46. No. 3 P. 44-45, 50-51.

MORRIS, J. W. 1976. Lake McConaughy water sampling and analysis. Unpublished job progress report. Project F-4-R-21. Nebr. Game Parks Comm. p. 29-32.

OATES, D. W. 1975. Lake McConaughy water sampling and analysis. Unpublished job progress report. Project F-4-R-20. Nebr. Game Parks Comm. p. 49-50.

PETERSON, J. L. 1976. Creel census on two major trout streams in the North Platte Valley. Mimeo. Rep. Nebr. Game Parks Comm. 14 p.

SCHOENECKER, W. E. 1967. Physical-chemical changes recorded in Nine Mile Creek, Scotts Bluff County due to irrigation return water. Mimeo. Rep. Nebr. Game Parks Comm. 3 p.

STUCKY, N. P. 1971. Investigation of the eutrophication process of Lake McConaughy, western Nebraska. Unpublished job progress report. Project F-4-R-17. Nebr. Game Parks Comm. p. 86-89.

VAN VELSON, R. C. 1966. Rainbow trout study—Upper North Platte River drainage, 1965-1966 migratory movement. Mimeo. Rep. Nebr. Game Parks Comm. 19 p.

VAN VELSON, R. C. 1966. 1966 Fisheries division annual report. Mimeo. Rep. Nebr. Game Parks Comm. p. 37-39.

VAN VELSON, R. C. and W. E. SCHOENECKER. 1966. Results of a post card creel census for Scotts Bluff and Morrill counties. Mimeo. Rep. Nebr. Game Parks Comm. 9 p.

VAN VELSON, R. C. 1967. An experiment with instream incubators in two western Nebraska streams. Mimeo. Rep. Nebr. Game Parks Comm. 12 p.

VAN VELSON, R. C. 1967. Rainbow trout study—Upper North Platte River drainage, 1966-1967 migratory movement. Mimeo. Rep. Nebr. Game Parks Comm. 25 p.

VAN VELSON, R. C. 1967. Fisheries division annual report. Mimeo. Rep. Nebr. Game Parks Comm. p. 109-113.

VAN VELSON, R. C. 1968. Fisheries division annual report. Mimeo. Rep. Nebr. Game Parks Comm. p. 134-136.

VAN VELSON, R. C. 1969. Migration dynamics in rainbow trout. M.S. Thesis. Colo. St. Univ. 97 p.

VAN VELSON, R. C. 1969. Fisheries division annual report. Mimeo. Rep. Nebr. Game Parks Comm. p. 131-134.

VAN VELSON, R. C. 1970. Deformity observed among adult rainbow trout from the upper North Platte River drainage. Mimeo. Rep. Nebr. Game Parks Comm. 11 p.

VAN VELSON, R. C. 1970. A measurement of trout habitat present in Lake McConaughy during the summer of 1969. Mimeo. Rep. Nebr. Game Parks Comm. 11 p.

VAN VELSON, R. C. 1970. The spring run rainbow trout of the North Platte River drainage. Mimeo. Rep. Nebr. Game Parks Comm. 3 p.

VAN VELSON, R. C. 1970. Stocking of Lake McConaughy rainbow trout fry. Mimeo. Rep. Nebr. Game Parks Comm. 3 p.

VAN VELSON, R. C. 1970. A summary of rainbow trout spawntaking activities, Winter Creek Hatchery, December 1969-April 1970. Mimeo. Rep. Nebr. Game Parks Comm. 3 p.

VAN VELSON, R. C. 1970. The age composition of the 1968-1970 spawning runs of Lake McConaughy rainbow trout. Mimeo. Rep. Nebr. Game Parks Comm. 9 p.

VAN VELSON, R. C. 1970. A future rainbow trout stocking plan for Lake McConaughy and the North Platte River drainage. Mimeo. Rep. Nebr. Game Parks Comm. 7 p.

VAN VELSON, R. C. 1970. Fisheries division annual report. Mimeo. Rep. Nebr. Game Parks Comm. p. 116-119.

VAN VELSON, R. C. 1971. The trout habitat available in Lake McConaughy during the summer of 1970. Mimeo. Rep. Nebr. Game Parks Comm. 9 p.

VAN VELSON, R. C. 1971. A summary of Lake McConaughy rainbow trout spawntaking activities, Winter Creek Hatchery, December 1970-July 1971. Mimeo. Rep. Nebr. Game Parks Comm. 5 p.

VAN VELSON, R. C. 1971. Coldwater fisheries management plan for the upper North Platte River drainage. Unpublished job progress report. Project F-4-R-17. Nebr. Game Parks Comm. p. 90-102.

VAN VELSON, R. C. 1972. Fence for trout. Nebraskaland. Vol. 50. No. 7. 1972. p. 46-47, 63-64.

VAN VELSON, R. C. 1973. Coldwater fisheries management plan for the upper North Platte River drainage. Unpublished job progress report. Project F-4-R-18. Nebr. Game Parks Comm. p. 50-67.

VAN VELSON, R. C. 1974. Coldwater fisheries management plan for the upper North Platte River drainage. Unpublished job progress report. Project F-4-R-19. Nebr. Game Parks Comm. p. 23-40.

VAN VELSON, R. C. 1974. Self-sustaining rainbow trout *(Salmo gairdneri)* population in McConaughy Reservoir, Nebr. Trans. Amer. Fish. Soc. 103: 59-64.

VAN VELSON, R. C. 1974. Rainbow trout holding and spawning facility proposal for Nine Mile SUA. Mimeo. Rep. Nebr. Game Parks Comm. 7 p.

VAN VELSON, R. C. 1974. The North Platte Valley trout-wildlife habitat program. Mimeo. Rep. Nebr. Game Parks Comm. 9 p.

VAN VELSON, R. C. 1974. Lake McConaughy rainbow trout habitat investigations. Mimeo. Rep. Nebr. Game Parks Comm. Research Re-briefs, 3 p.

VAN VELSON, R. C. 1975. Coldwater fisheries management plan for the upper North Platte River drainage. Unpublished job progress report. Project F-4-R-20. Nebr. Game Parks Comm. p 26-42.

VAN VELSON, R. C. 1976. The rainbow trout in the North Platte Valley. Nebr. Game Parks Comm. Special publication. 14 p.

VAN VELSON, R. C. 1976. Coldwater fisheries management plan for the upper North Platte River drainage. Unpublished job progress report. Project F-4-R-21. Nebr. Game Parks Comm. p. 23-28.

VAN VELSON, R. C. 1977. Stream fencing—the salvation of Otter Creek. American Society of Agricultural Engineers Annual Meeting. Raleigh, North Carolina.

VAN VELSON, R. C. 1975. Rainbow trout management in the North Platte River Drainage. 24th Annual Workshop, Great Plains Fisheries Workers Assocation. Scottsbluff, Nebraska.

VAN VELSON, R. C. 1972. Genetic adaption of rainbow trout in the North Platte River Drainage. American Fisheries Society Annual Meeting. Hot Springs, Ark.

VAN VELSON, R. C. 1971. The Plains steelhead of western Nebraska. 33rd Midwest Fish and Wildlife Conference. Omaha, Nebraska.

VAN VELSON, R. C. 1970. Trout management in western Nebraska. Nebraska Chapter of Wildlife Society. Chadron, Nebraska.

VAN VELSON, R. C. 1970. Migration dynamics of rainbow trout. Nebraska Chapter of the American Fisheries Society. Hastings, Nebraska.

VAN VELSON, R. C. 1969. A self-sustaining rainbow trout population in a fluctuating Nebraska reservoir. Western Division Meeting American Fisheries Society. Jackson, Wyoming.

VAN VELSON, R. C. 1968. An experiment with instream incubators in two western Nebraska streams. Colorado-Wyoming Chapter American Fisheries Society. Fort Collins, Colorado.

APPENDIX

Table A.

Total catch of fall and spring run rainbow at the Lewellen trap during the 1967-1975 period.

Spawning Run	Total Catch
1976 Fall Run	200
1968 Fall Run	665
1969 Fall Run	635
1970 Fall Run	282
1971 Fall Run	1,054
1972 Fall Run	761
1973 Fall Run	705
1974 Fall Run	898
Total:	5,200

Spawning Run	Total Catch
1968 Spring Run	23
1969 Spring Run	243
1970 Spring Run	46
1971 Spring Run	184
1972 Spring Run	133*
1973 Spring Run	300
1974 Spring Run	115
1975 Spring Run	455
Total:	1,499

*March records only. April records were lost in a fire.

Table B.

Life history categories in the 1968-1974 fall spawning runs of rainbow trout monitored at the Lewellen trap.

Life History Category	Fall Run Rainbow Trout							Totals	Percent Composition	Spawner Classification (percent)
	1968	1969	1970	1971	1972	1973	1974			
1/1	16	12	23	18	13	67	60	209	5.6	
1/2	499	322	127	410	360	248	422	2388	64.0	
1/3	17	13	—	—	34	43	20	127	3.4	Maiden 79%
2/1	—	7	1	5	5	8	12	38	1.0	
2/2	31	15	17	62	31	21	13	190	5.1	
2/3	—	1	—	—	—	—	—	1	.1	
1/1.1S	16	17	25	57	44	3	53	215	5.8	
1/2.1S	73	119	17	17	68	111	31	436	11.7	
1/3.1S	—	—	—	—	4	15	—	19	.5	2nd Year 19%
2/1.1S	—	1	3	8	—	—	6	18	.4	
2/2.1S	—	7	4	2	4	—	—	17	.4	
1/1.2S	—	2	3	6	12	30	3	56	1.5	
1/2.2S	—	2	—	—	4	9	—	15	.4	3rd Year 2%
2/1.2S	—	—	—	—	—	—	—	—	—	
2/2.2S	—	—	1	—	—	—	—	1	.1	
Totals:	652	518	221	585	579	555	620	3730		

Table C.

Life history categories in the 1969-1974 spring spawning runs of rainbow trout monitored at the Lewellen trap.

Life History Category	Spring Run Rainbow Trout						Totals	Percent Composition	Spawner Classification (percent)
	1969	1970	1971	1972	1973	1974			
1/1	1	—	2	2	—	—	5	.7	
1/2	145	22	56	60	154	17	454	64.2	
1/3	6	—	2	3	21	10	42	5.9	Maiden 77%
2/1	—	—	—	—	2	—	2	.3	
2/2	4	2	13	6	10	1	36	5.1	
2/3	—	—	—	—	2	1	3	.4	
1/1.1S	3	1	6	5	3	—	18	2.6	
1/2.1S	31	1	23	9	31	18	113	16.0	
1/3.1S	—	—	—	—	—	—	—	—	2nd Year 21%
2/1.1S	—	—	—	—	2	—	2	.3	
2/2.1S	1	—	7	—	6	1	15	2.1	
1/1.2S	—	—	—	—	7	3	10	1.4	
1/2.2S	2	—	1	—	—	1	4	.6	3rd Year
2/1.2S	—	—	—	1	—	—	1	.1	2%
2/2.2S	—	—	2	—	—	—	2	.3	
Totals:	193	26	112	86	238	52	707		

Table D.

Life history categories in the 1965-1967 spawning runs of rainbow trout monitored in the North Platte Valley streams, Fall and Spring spawners could not be distinguished from each other so the runs were combined.

Life History Categories	Year			Totals	Percent Composition	Spawner Classification (percent)
	1965	1966	1967			
1/1	4	18	32	54	11.1	
1/2	119	73	68	260	53.6	
1/3	4	5	4	13	2.7	Maiden 73%
2/1	1	—	2	3	.6	
2/2	14	4	6	24	5.0	
2/3	—	—	—	—	—	
1/1.1S	33	19	2	54	11.1	
1/2.1S	16	29	7	52	10.7	2nd Year 25%
1/3.1S	—	1	—	1	.2	
2/1.1S	9	1	1	11	2.3	
2/2.1S	1	—	—	1	.2	
1/1.2S	6	4	2	12	2.5	
1/2.2S	—	—	—	—	—	3rd Year 2%
2/1.2S	—	—	—	—	—	
2/2.2S	—	—	—	—	—	
Totals:	207	154	124	485		

Table E.

Lengths and weights of fall run rainbow trout monitored at the Lewellen trap 1967-1974.

Spawning Run	Average Length of Males	Sample Size	Average Length of Females	Sample Size	Average Length of Males + Females	Sample Size	Average Weight of Males	Sample Size	Average Weight of Females	Sample Size	Average Weight of Males + Females	Sample Size
Fall 1974	20.0	241	19.7	379	19.8	620	3.6	241	3.4	379	3.5	620
Fall 1973	20.8	197	20.9	358	20.9	555	4.3	197	4.3	358	4.3	555
Fall 1972	22.6	209	20.7	370	21.4	579	4.7	191	4.0	349	4.2	540
Fall 1971	19.7	224	19.0	362	19.3	586	3.3	187	2.9	286	3.1	473
Fall 1970	20.4	82	20.1	133	20.2	215	3.7	60	3.5	97	3.6	157
Fall 1969	21.5	151	21.2	359	21.3	510	4.3	85	4.2	147	4.2	232
Fall 1968	20.8	207	20.5	442	20.6	649	4.9	8	4.5	10	4.7	18
Fall 1967	17.6	36	17.4	63	17.5	99	2.5	36	2.4	62	2.4	98
Totals:		1347		2466		3813		1005		1688		2693

Average Length (Females + Males) = 20.4 inches
Average Length (Females) = 20.2 inches
Average Length (Males) = 20.7 inches

Average Weight (Females + Males) = 3.8 lbs.
Average Weight (Males) = 3.9 lbs.
Average Weight (Females) = 3.7 lbs.

Table F.

Lengths and weights of spring run rainbow trout monitored at the Lewellen trap 1968-1975.

Spawning Run	Average Length of Males	Sample Size	Average Length of Females	Sample Size	Average Length of Males + Females	Sample Size	Average Weight of Males	Sample Size	Average Weight of Females	Sample Size	Average Weight of Males + Females	Sample Size
Spring 1975	21.0	54	21.1	202	21.0	256	3.9	54	4.2	202	4.2	256
Spring 1974	23.9	15	22.3	37	22.8	52	5.9	15	5.1	37	5.3	52
Spring 1973	22.4	99	21.3	146	21.8	245	5.0	98	4.4	146	4.7	244
Spring 1972	20.5	23	20.0	63	20.1	86	4.0	23	3.8	63	3.8	86
Spring 1971	20.3	24	21.3	89	21.0	113	3.6	24	4.4	89	4.3	113
Spring 1970	22.7	6	21.3	20	21.6	26	5.1	6	4.3	19	4.5	25
Spring 1969	21.8	61	21.6	132	21.7	193	—	—	—	—	—	—
Spring 1968	16.4	5	20.7	9	19.2	14	2.1	5	4.2	9	3.5	14
Totals:		287		698		985		225		565		790

Average Length (Females + Males) = 21.3 inches
Average Length (Females) = 21.2 inches
Average Length (Males) = 21.7 inches

Average Weight (Females + Males) = 4.4 lbs.
Average Weight (Females) = 4.3 lbs.
Average Weight (Males) = 4.9 lbs.

Table G.

Sex ratio of spring rainbow trout spawning runs monitored at the Lewellen trap, 1968-1975.

Spring Spawning Run	Sex Ratio	Males			Females		
		Normal	Deformed	Total	Normal	Deformed	Total
1975	3.8	54	0	54	202	4	206
1974	2.7	15	0	15	37	4	41
1973	1.5	99	2	101	146	6	152
1972	2.8	23	1	24	63	4	67
1971	3.9	24	2	26	91	10	101
1970	3.8	6	0	6	20	3	23
1969	2.1	62	3	65	133	4	137
1968	1.8	5	0	5	9	0	9
Totals:		288	8	296	701	35	736

Average Sex Ratio—736/296 = 2.5 Females/Male.

Table H.

Sex ratio of fall rainbow trout spawning runs monitored at the Lewellen trap, 1967-1974.

Fall Spawning Run	Sex Ratio	Males			Females		
		Normal	Deformed	Total	Normal	Deformed	Total
1974	1.5	241	17	258	379	14	393
1973	1.8	197	22	219	358	28	386
1972	1.8	221	14	235	409	16	425
1971	1.6	258	7	265	417	18	435
1970	1.8	82	3	85	133	9	142
1969	2.2	151	21	172	359	24	383
1968	2.2	207	0	207	444	3	447
1967	1.8	36	0	36	63	1	64
Totals:		1393	84	1477	2562	113	2675

Average Sex Ratio—2675/1477 = 1.8 Females/Male.

Table I.
Sex Ratio Of The Life History Categories Represented In The 1965-1974 Rainbow Trout Spawning Runs From McConaughy Reservoir

1965 (Fall and Spring Runs Combined)
Life History Categories

Sex	1/1	1/2	1/3	2/1	2/2	2/3	1/1.1S	1/2.1S	1/3.1S	2/1.1S	2/2.1S	1/1.2S	1/2.2S	2/1.2S	2/2.2S	Total
Male	3	19	1	1	1	—	6	7	—	1	—	1	—	—	—	40
Female	1	99	3	—	13	—	27	9	—	8	1	5	—	—	—	166
Total:	4	118	4	1	14	—	33	16	—	9	1	6	—	—	—	206
Sex Ratio*	.3	5.2	3.0	—	13.0	—	4.5	1.3	—	8.0	—	5.0	—	—	—	
1966 (Fall and Spring Runs Combined)																
Male	11	14	1	—	—	—	18	6	—	1	—	1	—	—	—	52
Female	6	58	4	—	4	—	1	23	1	—	—	3	—	—	—	100
Total:	17	72	5	—	4	—	19	29	1	1	—	4	—	—	—	152
Sex Ratio*	.5	4.1	4.0	—	—	—	.1	3.8	—	—	—	3.0	—	—	—	
1967 (Fall and Spring Runs Combined)																
Male	25	16	2	—	1	—	—	1	—	—	—	—	—	—	—	45
Female	5	52	2	2	5	—	2	6	—	1	—	2	—	—	—	77
Total:	30	68	4	2	6	—	2	7	—	1	—	2	—	—	—	122
Sex Ratio*	.2	3.3	1.0	—	5.0	—	—	6.0	—	—	—	—	—	—	—	
1968 Fall Run																
Male	4	39	2	—	2	—	2	10	—	—	—	—	—	—	—	59
Female	—	46	2	—	4	—	—	5	—	—	—	—	—	—	—	57
Total:	4	85	4	—	6	—	2	15	—	—	—	—	—	—	—	116
Sex Ratio*	—	1.2	1.0	—	2.0	—	—	,5	—	—	—	—	—	—	—	
1969 Fall Run																
Male	5	46	4	3	4	1	6	6	—	—	1	1	1	—	—	78
Female	4	52	4	4	3	0	1	29	—	1	1	1	—	—	—	100
Total:	9	98	8	7	7	1	7	35	—	1	2	2	1	—	—	178
Sex Ratio*	.8	1.1	1.0	1.3	.8	—	.2	4.8	—	—	1.0	1.0	—	—	—	
1970 Fall Run																
Male	11	29	—	2	3	—	6	4	—	—	1	1	—	—	1	58
Female	5	35	—	—	6	—	8	7	—	2	1	1	—	—	—	65
Total:	16	64	—	2	9	—	14	11	—	2	2	2	—	—	1	123
Sex Ratio*	.5	1.2	—	—	2.0	—	1.3	1.8	—	—	1.0	1.0	—	—	—	
1971 Fall Run																
Male	3	72	—	—	13	—	11	3	—	1	—	1	—	—	—	104
Female	7	89	—	2	10	—	12	4	—	2	1	2	—	—	—	129
Total:	10	161	—	2	23	—	23	7	—	3	1	3	—	—	—	233
Sex Ratio*	2.3	1.2	—	—	.8	—	1.1	1.3	—	2.0	—	2.0	—	—	—	
1972 Fall Run																
Male	4	44	5	1	2	—	5	10	2	—	—	2	1	—	—	76
Female	3	80	8	2	8	—	12	12	1	—	1	2	1	—	—	130
Total:	7	124	13	3	10	—	17	22	3	—	1	4	2	—	—	206
Sex Ratio*	.8	1.8	1.6	2.0	4.0	—	2.4	1.2	.5	—	—	1.0	1.0	—	—	

*Female/Male

Table I. (Continued)

1973 Fall Run
Life History Category

Sex	1/1	1/2	1/3	2/1	2/2	2/3	1/1.1S	1/2.1S	1/3.1S	2/1.1S	2/2.1S	1/1.2S	1/2.2S	2/1.2S	2/2.2S	Total
Male	21	31	3	1	2	—	—	8	1	—	—	2	1	—	—	70
Female	17	37	9	4	4	—	2	21	4	—	—	6	2	—	—	106
Total:	38	68	12	5	6	—	2	29	5	—	—	8	3	—	—	176
Sex Ratio*	.8	1.2	3.0	4.0	2.0	—	—	2.6	4.0	—	—	3.0	2.0	—	—	

1974 Fall Run

Male	14	31	2	2	1	—	5	1	—	—	—	—	—	—	—	56
Female	10	42	1	3	1	—	7	3	—	1	—	1	—	—	—	69
Total:	24	73	3	5	2	—	12	4	—	1	—	1	—	—	—	125
Sex Ratio*	.7	1.4	.5	1.5	1.0	—	1.4	3.0	—	—	—	—	—	—	—	

1969 Spring Run

Sex	1/1	1/2	1/3	2/1	2/2	2/3	1/1.1S	1/2.1S	1/3.1S	2/1.1S	2/2.1S	1/1.2S	1/2.2S	2/1.2S	2/2.2S	Total
Male	1	20	2	—	—	—	2	4	—	—	1	—	—	—	—	30
Female	—	44	—	—	2	—	—	8	—	—	—	—	1	—	—	55
Total:	1	64	2	—	2	—	2	12	—	—	1	—	1	—	—	85
Sex Ratio*	—	2.2	—	—	—	—	—	2.0	—	—	—	—	—	—	—	

1970 Spring Run

Male	—	4	—	—	—	—	—	—	—	—	—	—	—	—	—	4
Female	—	13	—	—	2	—	1	1	—	—	—	—	—	—	—	17
Total:	—	17	—	—	2	—	1	1	—	—	—	—	—	—	—	21
Sex Ratio*	—	3.3	—	—	—	—	—	—	—	—	—	—	—	—	—	

1971 Spring Run

Male	—	4	—	—	—	—	—	—	—	—	—	—	—	—	—	4
Female	2	24	1	—	8	—	3	11	—	—	3	—	—	—	1	53
Total:	2	28	1	—	8	—	3	11	—	—	3	—	—	—	1	57
Sex Ratio*	—	6.0	—	—	—	—	—	—	—	—	—	—	—	—	—	

1972 Spring Run

Male	2	7	1	—	1	—	—	3	—	—	—	—	—	—	—	14
Female	—	42	1	—	3	—	4	4	—	—	—	—	—	1	—	55
Total:	2	49	2	—	4	—	4	7	—	—	—	—	—	1	—	69
Sex Ratio*	—	6.0	1.0	—	3.0	—	—	1.3	—	—	—	—	—	—	—	

1973 Spring Run

Male	—	23	—	—	2	—	1	1	—	—	—	—	—	—	—	27
Female	—	60	8	2	3	1	1	10	—	1	2	2	—	—	—	90
Total:	—	83	8	2	5	1	2	11	—	1	2	2	—	—	—	117
Sex Ratio	—	2.6	—	—	1.5	—	1.0	10.0	—	—	—	—	—	—	—	

1974 Spring Run

Male	—	3	4	—	—	—	—	2	—	—	—	1	1	—	—	11
Female	—	12	4	—	1	1	—	15	—	—	1	1	—	—	—	35
Total:	—	15	8	—	1	1	—	17	—	—	1	2	1	—	—	46
Sex Ratio	—	4.0	1.0	—	—	—	—	7.5	—	—	—	1.0	—	—	—	

*Female/Male

Table J.

Deformity observed among fall run rainbow trout collected at the Lewellen trap, 1967-1974.

	MALES				FEMALES				TOTALS		
Fall Run	Deformed	Normal	Total	Percent Deformed	Deformed	Normal	Total	Percent Deformed	Deformed	Normal	Percent Deformed
1974	17	241	258	6.6	14	379	393	3.6	31	651	4.8
1973	22	197	219	10.0	28	358	386	7.3	50	605	12.1
1972	14	221	235	6.0	16	409	425	3.8	30	660	4.5
1971	7	258	265	2.6	18	417	435	4.4	25	700	3.6
1970	3	82	85	3.5	9	133	142	6.3	12	227	5.3
1969	21	151	172	12.2	24	359	383	6.3	45	555	8.1
1968	0	207	207	0.0	3	444	447	.7	3	654	.5
1967	0	36	36	0.0	1	63	64	1.6	1	100	1.0
TOTALS:	84	1,393	1,477	5.7	113	2,562	2,675	4.2	197	4,152	4.7

Table K.

Deformity observed among spring run rainbow trout collected at the Lewellen trap, 1968-1975.

	MALES				FEMALES				TOTALS		
Spring Run	Deformed	Normal	Total	Percent Deformed	Deformed	Normal	Total	Percent Deformed	Deformed	Normal	Percent Deformed
1975	0	54	54	0.0	4	202	206	1.9	4	260	1.5
1974	0	15	15	0.0	4	37	41	9.8	4	56	7.1
1973	2	99	101	2.0	6	146	152	3.9	8	253	3.1
1972	1	23	24	4.2	4	63	67	6.0	5	91	5.4
1971	10	91	101	9.9	2	24	26	7.7	12	127	9.4
1970	0	6	6	0.0	3	20	23	13.0	3	29	10.3
1969	3	62	65	4.6	4	133	137	2.9	7	202	3.5
1968	0	5	5	0.0	0	9	9	0.0	0	14	0.0
Totals:	16	355	371	4.3	27	634	661	4.1	43	1,032	4.2

Table L.

Annual tag returns from Lewellen trap and North Platte Valley tagging efforts, representing the lake and stream fishery.

Lewellen Trap

Spawning Run	Total No. Tag Returns	Returned by Stream Fishery		Returned by Lake Fishery		Returned by Others	
		Number	Percent	Number	Percent	Number	Percent
Fall 1967	19	14	73.7	5	26.3	—	—
Fall 1968	28	23	82.1	5	17.9	—	—
Fall 1969	28	17	60.7	11	39.3	—	—
Fall 1970	25	22	88.0	3	12.0	—	—
Fall 1971	40	36	90.0	4	10.0	—	—
Fall 1972	22	19	86.4	2	9.1	1	4.5
Totals:	162	131	80.9 (Ave.)	30	18.5 (Ave.)	1	.6 (Ave.)
Spring 1968	2	1	50.0	1	50.0	—	—
Spring 1969	21	9	42.8	11	52.4	1	4.8
Spring 1970	7	—	—	7	100.0	—	—
Spring 1971	8	5	62.5	3	37.5	—	—
Spring 1972	3	1	33.3	2	66.7	—	—
Totals:	41	16	39.0 (Ave.)	24	58.5 (Ave.)	1	2.5 (Ave.)
Grand Total Fall & Spring:	203	147	72.4 (Ave.)	54	26.6 (Ave.)	2	1.0 (Ave.)

North Platte Valley Streams

Spawning Run	Total No. Tag Returns	Returned by Stream Fishery		Returned by Lake Fishery	
		Number	Percent	Number	Percent
1962-63	15	11	73.3	4	26.7
1963-64	29	25	86.2	4	13.8
1964-65	43	33	76.7	10	23.3
1965-66	31	15	48.4	16	51.6
1966-67	40	28	70.0	12	30.0
1967-68	24	20	83.3	4	16.7
Totals:	182	132	72.5 (Ave.)	50	27.5 (Ave.)

Table M.

Marked McConaughy Rainbow Trout Captured At The Lewellen Trap, 1967-1975

Fin clipped McConaughy rainbow trout captured at the Lewellen trap, fall 1967.

Fin Clip	Length	Weight	Sex
Right Pectoral	14.0	1.2	F
Right Pectoral	16.8	1.6	M
Right Pectoral	12.6	.9	F
Right Pectoral	15.0	1.5	F
Left Pelvic	16.2	2.0	F
Left Pelvic	19.3	2.6	F

Fin Clip	Total Number	Deformed*	Normal
R. Pectoral	4	0	4
L. Pelvic	2	0	2

Fin Clip	Average Length	Sample Size	Average Weight	Sample Size
R. Pectoral	14.6	4	1.3	4
L. Pelvic	17.8	2	2.3	2

Fin clipped McConaughy rainbow trout captured at the Lewellen trap, spring 1968.

Fin Clip	Length	Weight	Sex
Left Pelvic	19.2	3.3	F
Dorsal	17.6	2.5	M

Fin Clip	Total Number	Deformed*	Normal
L. Pelvic	1	0	1
Dorsal	1	0	1

Fin Clip	Average Length	Sample Size	Average Weight	Sample Size
L. Pelvic	19.2	1	3.3	1
Dorsal	17.6	1	2.5	1

*Deformed trout were not used in computing average length and average weight.

Table M. (Continued)

Fin clipped McConaughy rainbow trout captured at the Lewellen trap, fall 1968.

Fin Clip	Length	Weight	Sex
Right Pectoral	23.2	6.3	M
Right Pectoral	21.0	4.9	F
Right Pectoral	19.6	—	F
Right Pectoral	17.9	—	F
Right Pectoral	22.8	—	M
Right Pectoral	21.5	—	M
Right Pectoral	21.2	—	F
Right Pectoral	20.9	—	F
Right Pectoral	20.7	—	F
Right Pectoral	21.2	—	F
Right Pectoral	17.5	—	F
Right Pectoral	16.0	—	F
Right Pectoral	21.6	—	M
Right Pectoral	20.8	—	F
Right Pectoral	19.9	—	F
Right Pectoral	18.6	—	F
Right Pectoral	18.9	—	F
Right Pectoral	18.5	—	F
Right Pectoral	20.0	—	F
Right Pectoral	19.7	—	F
Right Pectoral	21.3	—	F
Right Pectoral	20.9	—	M
Right Pectoral	19.0	—	F
Right Pectoral	21.2	—	F
Right Pectoral	17.6	—	F
Right Pectoral	20.9	—	F
Right Pectoral	17.7	—	M
Right Pectoral	17.8	—	F
Right Pectoral	18.4	—	F
Right Pectoral	21.0	—	F
Right Pectoral	19.5	—	F
Right Pectoral	18.5	—	M
Left Pectoral	19.5	—	F
Left Pectoral	20.9	—	F
Left Pelvic	20.4	—	F
Left Pelvic	21.8	—	M
Right Pelvic	18.9	—	M
Anal R. Pelvic	19.0	—	F

Fin Clip	Total Number	Deformed*	Normal
R. Pectoral	33	1	32
L. Pectoral	2	0	2
R. Pelvic	1	1	1
L. Pelvic	2	0	2
Anal R. Pel.	1	0	1

Fin Clip	Average Length	Sample Size	Average Weight	Sample Size
R. Pectoral	19.9	32	5.6	2
L. Pectoral	20.2	2	—	—
R. Pelvic	18.9	1	—	—
L. Pelvic	21.1	2	—	—
Anal R. Pel.	19.0	1	—	—

*Deformed trout were not used in computing length and average weight.

Table M. (Continued)

Fin clipped McConaughy rainbow trout captured at the Lewellen trap, spring 1969.

Fin Clip	Length	Weight	Sex
Dorsal	21.4	—	F
Dorsal	23.0	—	M
Dorsal	22.9	—	F
Right Pectoral	19.8	—	F
Right Pectoral	19.8	—	F
Right Pectoral	20.9	—	F
Right Pectoral	20.5	—	M
Anal	21.5	—	M
Anal	18.4	—	M
Left Pectoral	20.9	—	F

Fin Clip	Total Number	Deformed*	Normal
Dorsal	3	0	3
R. Pectoral	5	1	4
Anal	2	0	2
L. Pectoral	1	1	0

Fin Clip	Average Length	Sample Size	Average Weight	Sample Size
Dorsal	22.4	3	—	—
R. Pectoral	20.3	5	—	—
Anal	20.0	2	—	—
L. Pectoral	20.9	1	—	—

*Deformed trout were not used in computing average length and average weight.

Table M. (Continued)
Fin clipped McConaughy rainbow trout captured at the Lewellen trap, fall 1969.

Fin Clip	Length	Weight	Sex
Adipose	17.0	2.6	M
Adipose	21.5	5.6	F
Adipose	21.0	4.2	F
Adipose	18.8	3.7	F
Adipose	20.6	4.5	F
Adipose	18.5	3.2	F
Adipose	22.8	4.7	F
Adipose	19.2	3.2	M
Adipose	18.5	2.9	F
Adipose	22.6	5.2	F
Adipose	20.7	—	F
Adipose	19.8	3.9	F
Adipose	14.7	1.3	F
Adipose	16.6	2.3	F
Adipose	19.6	3.8	F
Adipose	20.0	3.6	F
Adipose	20.4	3.7	F
Adipose	18.6	3.4	—
Right Pectoral	21.5	4.1	F
Right Pectoral	19.5	3.7	F
Right Pectoral	21.3	4.5	F
Right Pectoral	20.7	—	F
Right Pectoral	21.8	4.5	F
Right Pectoral	22.6	4.4	M
Right Pectoral	22.6	5.2	F
Right Pectoral	23.2	5.7	F
Right Pelvic	13.8	—	—
Right Pelvic	13.1	—	—
Right Pelvic	16.5	2.1	M
Right Pelvic	20.7	—	F
Right Pelvic	17.0	2.3	F
Right Pelvic	13.8	.9	—

Fin Clip	Total Number	Deformed*	Normal
Adipose	38	20	18
R. Pectoral	8	0	8
R. Pelvic	6	0	6

Fin Clip	Average Length	Sample Size	Average Weight	Sample Size
Adipose	19.5	18	3.6	16
R. Pectoral	21.6	8	—	—
R. Pelvic	15.8	6	—	—

*Deformed trout were not used in computing average length and average weight.

Table M. (Continued)

Fin clipped McConaughy rainbow trout captured at the Lewellen trap, spring 1970.

Fin Clip	Length	Weight	Sex
NONE			

Fin Clip	Total Number	Deformed*	Normal
Adipose	1	1	0

Fin Clip	Average Length	Sample Size	Average Weight	Sample Size
Adipose	—	—	—	—

Fin clipped McConaughy rainbow trout captured at the Lewellen trap, fall 1970.

Fin Clip	Length	Weight	Sex
Right Pelvic	17.5	—	F
Right Pelvic	19.0	2.9	F
Right Pelvic	21.5	4.0	M
Right Pelvic	18.7	2.6	F
Right Pelvic	17.8	2.0	F
Right Pelvic	19.3	2.3	F
Right Pelvic	16.3	—	F
Right Pelvic	20.6	3.2	F
Right Pelvic	19.3	—	M
Right Pelvic	19.7	—	M
Right Pelvic	18.4	—	M
Right Pelvic	21.5	—	F
Right Pelvic	20.5	—	M
Right Pelvic	21.9	4.6	F

Fin Clip	Total Number	Deformed*	Normal
R. Pelvic	16	2	14
Adipose	2	2	0

Fin Clip	Average Length	Sample Size	Average Weight	Sample Size
R. Pelvic	19.4	14	3.1	7
Adipose	—	—	—	—

*Deformed trout were not used in computing average length and average weight.

Table M. (Continued)

Fin clipped McConaughy rainbow trout captured at the Lewellen trap, spring 1971.

Fin Clip	Length	Weight	Sex
Right Pelvic	20.5	4.4	F
Right Pelvic	18.5	2.6	M
Dorsal	16.6	2.0	F
Dorsal	15.8	1.7	F
Dorsal	17.1	2.2	F
Dorsal	18.2	2.7	M
Dorsal	17.2	2.2	M
Dorsal	18.5	2.7	M
Left Pectoral	14.5	1.5	M

Fin Clip	Total Number	Deformed*	Normal
R. Pelvic	3	1	2
Dorsal	6	0	6
R. Pectoral	2	2	0
L. Pectoral	1	0	1

Fin Clip	Average Length	Sample Size	Average Weight	Sample Size
R. Pelvic	19.5	2	3.5	2
Dorsal	17.2	6	2.3	6
R. Pectoral	—	—	—	—
L. Pectoral	14.5	1	1.5	1

*Deformed trout were not used in computing length and average weight.

Table M. (Continued)

Fin clipped McConaughy rainbow trout captured at the Lewellen trap, fall 1971.

Fin Clip	Length	Weight	Sex
Dorsal	21.5	—	F
Right Pelvic	19.4	3.1	F
Right Pelvic	21.0	—	F
Right Pelvic	21.6	—	F
Right Pictoral	18.8	2.8	M
Left Pelvic	20.1	3.8	F
Adipose	18.9	—	F
Left Pectoral	19.3	3.1	M
Left Pectoral	17.2	2.3	F
Left Pectoral	18.2	—	—
Left Pectoral	20.8	3.7	M
Left Pectoral	18.6	—	F
Left Pectoral	18.0	2.8	F

Fin Clip	Total Number	Deformed*	Normal
L. Pectoral	10	4	6
Dorsal	1	0	1
R. Pelvic	3	0	3
R. Pectoral	2	1	1
L. Pelvic	1	0	1
Adipose	1	0	1

Fin Clip	Average Length	Sample Size	Average Weight	Sample Size
L. Pectoral	18.7	6	3.0	4
Dorsal	21.5	1	—	—
R. Pelvic	20.7	3	3.1	1
R. Pectoral	18.8	1	2.8	1
L. Pelvic	20.1	1	3.8	1
Adipose	18.9	1	—	—

Fin clipped McConaughy rainbow trout captured at the Lewellen trap, spring 1972.

Fin Clip	Length	Weight	Sex
Left Pectoral	20.5	4.5	F
Dorsal	20.0	3.9	M
Dorsal	20.8	4.6	F

Fin Clip	Total Number	Deformed*	Normal
L. Pectoral	1	0	1
Dorsal	3	1	2

Fin Clip	Average Length	Sample Size	Average Weight	Sample Size
L. Pectoral	20.5	1	4.5	1
Dorsal	20.4	2	4.3	2

*Deformed trout were not used in computing average length and average weight.

Table M. (Continued)

Fin clipped McConaughy rainbow trout captured at the Lewellen trap, fall 1972.

Fin Clip	Length	Weight	Sex
Left Pelvic	19.6	3.0	M
Left Pelvic	19.7	3.5	F
Left Pelvic	23.0	4.9	M
Left Pectoral	16.5	2.1	M

Fin Clip	Total Number	Deformed*	Normal
L. Pelvic	4	1	3
L. Pectoral	1	0	1

Fin Clip	Average Length	Sample Size	Average Weight	Sample Size
L. Pelvic	20.8	3	3.8	3
L. Pectoral	16.5	1	2.1	1

Fin clipped McConaughy rainbow trout captured at the Lewellen trap, spring 1973.

Fin Clip	Length	Weight	Sex
Right Pelvic	20.8	3.5	F
Left Pelvic	16.7	2.0	F
Left Pectoral	21.0	4.7	F

Fin Clip	Total Number	Deformed*	Normal
R. Pelvic	1	0	1
L. Pelvic	1	0	1
L. Pectoral	1	0	1

Fin Clip	Average Length	Sample Size	Average Weight	Sample Size
R. Pelvic	20.8	1	3.5	1
L. Pelvic	16.7	1	2.0	1
L. Pectoral	21.0	1	4.7	1

*Deformed trout were not used in computing average length and average weight.

Table M. (Continued)

Fin clipped McConaughy rainbow trout captured at the Lewellen trap, fall 1973.

Fin Clip	Length	Weight	Sex
Left Pelvic	20.5	4.6	M
Left Pelvic	21.9	4.8	M
Left Pelvic	21.2	4.7	F
Left Pelvic	19.0	3.2	F

Fin Clip	Total Number	Deformed*	Normal
L. Pelvic	6	2	4
L. Pectoral	1	1	0

Fin Clip	Average Length	Sample Size	Average Weight	Sample Size
L. Pelvic	20.7	4	4.3	4
L. Pectoral	—	—	—	—

*Deformed trout were not used in computing average length and average weight.

Fin clipped McConaughy rainbow trout captured at the Lewellen trap, spring 1974.

Fin Clip	Length	Weight	Sex
Left Pelvic	25.3	7.1	M

Fin Clip	Total Number	Deformed*	Normal
L. Pelvic	1	0	1

Fin Clip	Average Length	Sample Size	Average Weight	Sample Size
L. Pelvic	25.3	1	7.1	1

*Deformed trout were not used in computing length and average weight.

Table M. (Continued)

Fin clipped McConaughy rainbow trout captured at the Lewellen trap, fall 1974.

Fin Clip	Length	Weight	Sex
Left Pectoral	16.8	1.9	F
Left Pectoral	16.6	2.0	F
Left Pectoral	20.7	3.7	M
Left Pectoral	17.0	2.1	M
Left Pectoral	20.4	3.7	M
Left Pectoral	18.9	2.6	F
Left Pectoral	20.6	3.4	F
Left Pectoral	19.8	3.2	F
Left Pectoral	19.3	2.8	M
Left Pectoral	19.5	3.3	F
Anal	23.2	4.7	F
Anal	22.7	5.1	F
Left Pelvic	22.1	4.3	F
Right Pelvic	20.9	2.7	F
Right Pectoral	21.1	3.9	M

Fin Clip	Total Number	Deformed*	Normal
Left Pec.	10	0	10
Anal	2	0	2
L. Pelvic	1	0	1
R. Pelvic	1	0	1
R. Pectoral	1	0	1

Fin Clip	Average Length	Sample Size	Average Weight	Sample Size
Left Pec.	19.0	10	2.9	10
Anal	23.0	2	4.9	2
L. Pelvic	22.1	1	4.3	1
R. Pelvic	20.9	1	2.7	1
R. Pectoral	21.1	1	3.9	1

Fin clipped McConaughy rainbow trout captured at the Lewellen trap, spring 1975.

Fin Clip	Length	Weight	Sex
Left Pectoral	20.1	3.5	M
Left Pectoral	22.3	3.0	M
Left Pectoral	19.5	2.6	F
Left Pectoral	20.4	4.2	F
Left Pectoral	19.4	3.3	F
Left Pelvic	25.0	6.6	F

Fin Clip	Total Number	Deformed*	Normal
L. Pectoral	5	0	5
L. Pelvic	1	0	1

Fin Clip	Average Length	Sample Size	Average Weight	Sample Size
L. Pectoral	20.3	5	3.3	5
L. Pelvic	25.0	1	6.6	1

*Deformed trout were not used in computing length and average weight.

Table N.

Rainbow trout fin clipping records in the North Platte River drainage, 1966-1973.

Date	Number	Source	Mark	Location
Jan. and March 1966	599	Natural Reproduction	Left Pelvic	Nine Mile Creek
May 1966	2,050	Hatchery Origin	Left Pectoral	Nine Mile Creek
May 1966	2,185	Hatchery Origin	Right Pelvic	Red Willow Creek
Aug. 1966-May 1967	3,598	Natural Reproduction	Right Pectoral	North Platte Valley Streams
Feb.-Sept. 1967	10,300	Hatchery Origin	Dorsal	North Platte Valley Streams
Nov. 1967	5,021	Hatchery Origin	Anal	Lake McConaughy
Nov. 1967-April 1968	1,320	Natural Reproduction	Adipose	Nine Mile Creek
Nov. 1968-March 1969	1,320	Natural Reproduction	Right Pelvic	Nine Mile Creek
March 1969	3,011	Hatchery Origin	Dorsal	Wildhorse Lake
Oct. 1969-March 1970	1,209	Natural Reproduction	Left Pectoral	North Platte Valley Streams
Oct. 1970	12,000	Hatchery Origin	Right Pectoral	Lake McConaughy
Nov. 1970-March 1971	938	Natural Reproduction and McConaughy RB	Left Pelvic	North Platte Valley Streams
Nov. 1971-March 1972	585	McConaughy Rainbow	Anal	Clear Creek
Nov. 1971-March 1972	475	McConaughy Rainbow	Right Pelvic	North Platte Valley Streams
Nov. 1972-March 1973	5,756	McConaughy Rainbow	Left Pectoral	Alliance Drain
Nov. 1972-March 1973	230	McConaughy Rainbow	Right Pectoral	Clear Creek

Table O.

Recapture dates of marked hatchery origin rainbow trout stocked in the North Platte River drainage and collected at the Lewellen trap.

Fin Clip: Left Pectoral
Marking Date: May 1966
Number Marked: 2,050

Spawning Run Recaptured	Number
Fall 1968	2
Spring 1969	1
Total:	3

Fin Clip: Right Pelvic
Marking Date: May 1966
Number Marked: 2,180

Spawning Run Recaptured	Number
Fall 1968	1
Total:	1

Fin Clip: Dorsal
Marking Date: February 1967
Number Marked: 10,300

Spawning Run Recaptured	Number
Spring 1968	1
Spring 1969	3
Total:	4

Fin Clip: Anal
Marking Date: November 1967
Number Marked: 5,021

Spawning Run Recaptured	Number
Spring 1969	2
Total:	2

Fin Clip: Dorsal
Marking Date: June 1970
Number Marked: 1,500

Spawning Run Recaptured	Number
Spring 1971	6
Fall 1971	1
Spring 1972	3
Total:	10

Fin Clip: Right Pectoral
Marking Date: October 1970
Number Marked: 12,000

Spawning Run Recaptured	Number
Spring 1971	2
Fall 1971	2
Total:	4

Table P.

Recapture dates of McConaughy rainbow trout natural reproduction marked in the North Platte Valley spawning streams and collected at the Lewellen trap.

Fin Clip: Left Pelvic
Marking Date: Nov. 1965-March 1966
Number Marked: 599

Spawning Run Recaptured	Number
Fall 1967	2
Spring 1968	1
Fall 1968	2
Total:	5

Fin Clip: Right Pectoral
Marking Date: Nov. 1966-March 1967
Number Marked: 3,500

Spawning Run Recaptured	Number
Fall 1967	4
Fall 1968	33
Spring 1969	5
Fall 1969	8
Total:	50

Fin Clip: Anal-Right Pelvic
Marking Date: Nov. 1966-March 1967
Number Marked: 97

Spawning Run Recaptured	Number
Fall 1968	1
Total:	1

Fin Clip: Adipose
Marking Date: Nov. 1967-March 1968
Number Marked: 1,320

Spawning Run Recaptured	Number
Fall 1969	38
Spring 1970	1
Fall 1970	2
Fall 1971	1
Total:	42

Fin Clip: Right Pelvic
Marking Date: Nov. 1968-March 1969
Number Marked: 1,320

Spawning Run Recaptured	Number
Fall 1969	6
Fall 1970	16
Spring 1971	3
Fall 1971	3
Total:	28

Fin Clip: Left Pectoral
Marking Date: Nov. 1969-March 1970
Number Marked: 1,209

Spawning Run Recaptured	Number
Spring 1971	1
Fall 1971	10
Spring 1972	1
Fall 1972	1
Spring 1973	1
Fall 1973	1
Total:	15

Fin Clip: Left Pelvic
Marking Date: Nov. 1970-March 1971
Number Marked: 938

Spawning Run Recaptured	Number
Fall 1971	1
Fall 1972	4
Spring 1973	1
Fall 1973	6
Spring 1974	1
Fall 1974	1
Spring 1975	1
Total:	15

Table Q.

Recapture dates of marked McConaughy rainbow progeny stocked in the North Platte River drainage and collected at the Lewellen trap.

Fin Clip: Right Pelvic
Marking Date: Nov. 1971-March 1972
Number Marked: 475

Spawning Run Recaptured	Number
Spring 1973	1
Fall 1974	1
Total:	2

Fin Clip: Left Pectoral
Marking Date: May 1972
Number Marked: 5,756

Spawning Run Recaptured	Number
Fall 1974	10
Spring 1975	5
Total:	15

Fin Clip: Anal
Marking Date: February 1972
Number Marked: 585

Spawning Run Recaptured	Number
Fall 1974	2
Total:	2

Fin Clip: Right Pectoral
Marking Date: February 1973
Number Marked: 230

Spawning Run Recaptured	Number
Fall 1974	1
Total:	1

Table R.
Summer McConaughy Reservoir Oxygen and Temperature Data, 1969-1975.

McConaughy Reservoir temperature and oxygen data, Station 1, July-October, 1969.

Depth (Meters)	July 29		August 13		September 9		October 7											
	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F
Surface	7.5	76	9.0	75	9.5	71	10.5	62										
1	—	—	—	—	—	—	—	—										
2	—	—	—	—	—	—	—	—										
3	—	—	—	—	—	—	—	—										
4	—	—	—	—	—	—	—	—										
5	—	75	8.8	74	9.1	70	—	—										
6	—	—	—	—	—	—	—	—										
7	—	—	—	—	—	—	—	—										
8	—	—	—	—	—	—	—	—										
9	—	—	—	—	—	—	—	—										
10	5.0	68	8.8	73	8.9	70	—	—										
11	—	—	—	—	—	—	—	—										
12	—	—	—	—	—	—	—	—										
13	—	—	—	—	8.5	70	—	—										
14	—	—	—	—	2.3	67	—	—										
15	5.1	67	7.1	72	1.9	67	—	—										
16	—	—	—	—	—	—	—	—										
17	—	—	—	—	—	—	—	—										
18	—	—	—	—	1.2	65	—	—										
19	—	—	—	—	—	—	—	—										
20	3.0	65	2.9	64	1.3	64	—	—										
21	—	—	—	—	—	—	—	—										
22	—	—	—	—	—	—	—	—										
23	—	—	—	—	—	—	—	—										
24	—	—	—	—	—	—	—	—										
25	2.1	65	1.5	60	1.3	61	10.4	62										
26	—	—	—	—	—	—	—	—										
27	—	—	—	—	—	—	—	—										
28	—	—	—	—	—	—	—	—										
29	—	—	—	—	—	—	—	—										
30	2.1	61	—	—	.6	60	4.5	60										
31	—	—	—	—	—	—	—	—										
32	—	—	—	—	—	—	.5	57										
33	—	—	—	—	—	—	—	—										
34	—	—	—	—	—	—	—	—										
35	.7	60	.3	60	.8	59	—	—										
36	—	—	—	—	—	—	—	57										
37	—	—	—	—	—	—	—	—										
38	—	—	—	—	—	—	—	—										
39	—	—	—	—	—	—	—	—										
40	.2	60	.5	59	—	—	—	—										
41	—	—	—	—	—	—	—	—										
42	—	—	—	—	—	—	—	—										
43	—	—	—	—	—	—	—	—										
44	—	—	—	—	—	—	—	—										
45	—	—	.8	59	—	—	—	—										
46	0.0	60	—	—	—	—	—	—										
47	—	—	—	—	—	—	—	—										
48	—	—	—	—	—	—	—	—										
49	—	—	—	—	—	—	—	—										
50	—	—	.4	59	—	—	—	—										

Table R. (Continued)

McConaughy Reservoir temperature and oxygen data, Station 2, July-September, 1969.

	July 18		July 29		August 12		September 8											
Depth (Meters)	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F
Surface	7.8	73	7.6	77	8.0	78	8.4	71										
1	—	—	—	—	—	—	—	—										
2	—	—	—	—	—	—	—	—										
3	—	—	—	—	—	—	—	—										
4	—	—	—	—	—	—	—	—										
5	7.8	73	7.0	74	8.0	76	8.3	71										
6	—	—	—	—	—	—	—	—										
7	—	—	—	—	—	—	—	—										
8	—	—	—	—	—	—	—	—										
9	—	—	—	—	—	—	—	—										
10	7.1	67	6.6	74	7.6	75	8.0	71										
11	—	—	—	—	—	—	—	—										
12	—	—	—	—	—	—	—	—										
13	—	—	—	—	—	—	—	—										
14	—	—	—	—	—	—	—	—										
15	5.6	64	4.6	65	7.6	74	4.4	70										
16	—	—	—	—	2.5	69	—	—										
17	—	—	—	—	1.7	66	2.5	67										
18	—	—	—	—	—	—	—	—										
19	—	—	—	—	—	—	—	—										
20	4.3	60	1.7	62	.8	62	1.0	66										
21	—	—	—	—	—	—	—	—										
22	—	—	—	—	—	—	.8	63										
23	—	—	—	—	—	—	—	—										
24	—	—	—	—	—	—	—	—										
25	—	—	.7	61	—	68	—	—										
26	—	—	—	—	—	—	—	—										
27	—	—	.1	61	—	—	—	—										
28	—	—	—	—	—	—	—	—										
29	2.9	57	—	—	—	—	—	—										

Table R. (Continued)

McConaughy Reservoir temperature and oxygen data, Station 3, July-September, 1969.

	July 30		September 9															
Depth (Meters)	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F
Surface	8.3	74	8.7	72														
1	—	—	—	—														
2	—	—	—	—														
3	—	—	—	—														
4	—	—	—	—														
5	7.4	74	—	—														
6	—	—	—	—														
7	—	—	—	—														
8	—	—	—	—														
9	—	—	—	—														
10	7.4	74	7.3	70														
11	—	—	—	—														
12	—	—	—	—														
13	—	—	—	—														
14	—	—	—	—														
15	3.8	69	—	—														
16	—	—	—	—														
17	—	—	6.8	70														
18	1.9	64	—	—														
19	—	—	—	—														
20	1.5	62	—	—														

Table R. (Continued)

McConaughy Reservoir temperature and oxygen data, Station 1, June-September 1970.

Depth (Meters)	June 4		June 26		July 8		July 17		July 31		August 8		August 25		September 8			
	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F
Surface	9.1	62	9.4	68	7.8	75	8.6	80	8.9	76	8.8	78	8.1	75	—	70		
1	—	62	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
5	—	60	9.3	66	—	71	—	73	—	—	—	75	—	71	8.2	69		
6	—	—	—	—	—	—	—	—	—	—	—	—	—	—				
7	—	—	—	—	—	—	—	—	—	—	—	—	—	—				
8	—	—	—	—	—	—	—	—	—	—	—	—	—	—				
9	—	—	—	—	—	—	—	—	—	—	—	—	—	—				
10	9.2	56	9.9	65	—	67	8.8	70	8.6	76	—	—	8.6	70				
11	—	—	—	—	—	—	—	—	—	—	—	—	—	—				
12	—	—	—	59	—	—	—	65	—	—	—	73	—	70				
13	—	—	—	—	—	—	—	—	6.2	69	—	69	—	—				
14	—	—	—	—	—	—	—	63	—	—	—	64	—	68				
15	—	54	8.8	59	6.3	67	—	—	4.1	63	—	64	—	66				
16	—	—	—	—	—	—	—	—	—	—	—	64	—	64				
17	—	—	—	—	—	—	5.6	61	—	—	—	—	—	—				
18	—	—	—	—	—	—	—	—	—	—	—	58	—	60				
19	—	—	—	—	—	—	—	—	—	—	—	—	—	—				
20	9.0	50	8.6	55	5.8	56	—	—	4.4	60	—	56	3.0	57				
21	—	—	—	—	—	—	—	—	—	—	—	—	—	—				
22	—	—	—	—	—	—	—	—	—	—	—	—	—	—				
23	—	—	—	—	—	—	—	—	—	—	—	—	—	—				
24	—	—	—	—	—	—	—	—	—	—	—	—	—	—				
25	—	49	9.4	52	—	—	—	—	—	—	—	53	2.9	55				
26	—	—	—	—	—	—	—	—	—	—	—	—	—	—				
27	—	—	—	—	—	—	—	—	—	—	—	—	—	—				
28	—	—	—	—	—	—	—	—	—	—	—	—	—	—				
29	—	—	—	—	—	—	—	—	—	—	—	—	—	—				
30	—	48	10.2	50	—	—	—	—	3.6	59	—	—	—	53				
31	—	—	—	—	—	—	—	—	—	—	—	—	—	—				
32	—	—	—	—	—	—	—	—	—	—	—	—	—	—				
33	—	—	—	—	—	—	—	—	—	—	—	—	—	—				
34	—	—	—	—	—	—	—	—	—	—	—	—	—	—				
35	—	48	—	—	—	—	—	—	—	—	—	—	—	52				
36	—	—	—	—	—	—	—	—	—	—	—	—	—	—				
37	—	—	—	—	—	—	—	—	—	—	—	—	—	—				
38	—	—	—	—	—	—	—	—	—	—	—	—	—	—				
39	—	—	—	—	—	—	—	—	3.4	59	—	—	—	—				
40	6.8	50	—	—	4.7	55	4.5	55	—	—	—	—	—	—				

No Data Collected Below This Depth—Too Windy

Table R. (Continued)

McConaughy Reservoir temperature and oxygen data, Station 2, June-August, 1970.

Depth (Meters)	June 4		June 23		July 8		July 11		July 17		July 24		July 31		August 8		August 25		August 31	
	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F
Surface	8.9	61	8.4	64	—	74	9.0	78	8.8	75	7.8	69	—	76	9.3	78	7.4	73	8.4	73
1	—	61	—	64	—	—	—	—	—	74	—	69	—	—	—	78	—	73	—	73
2	—	61	—	64	—	—	—	—	—	—	—	—	—	—	—	78	—	73	—	73
3	—	61	—	—	—	—	—	—	—	74	—	69	—	—	—	77	—	73	—	73
4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	77	—	73	—	—
5	—	61	8.2	64	—	—	8.9	78	—	73	7.5	69	—	—	—	77	—	73	8.8	73
6	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	73	—	—
7	—	—	—	—	—	—	—	—	—	—	—	69	—	—	—	76	—	73	—	73
8	—	—	—	—	—	—	—	—	—	73	—	—	—	—	—	—	—	72	—	—
9	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	76	—	72	—	—
10	—	60	8.0	63	—	—	8.9	74	8.8	71	6.9	69	8.2	75	6.8	75	6.2	72	8.4	73
11	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	74	—	72	—	—
12	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	72	—	72	—	—
13	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	71	—	72	—	73
14	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	69	—	70	—	73
15	—	56	7.6	62	—	—	6.6	70	6.7	66	7.9	69	4.6	66	—	68	6.2	68	5.6	70
16	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	66	—	66	—	68
17	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	63	—	61	—	63
18	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	61	—	59	—	58
19	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	60	—	56	—	57
20	8.4	52	6.2	60	—	—	7.4	65	5.7	59	7.5	66	—	—	1.6	59	7.3	56	8.1	56
21	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	57	—	55	—	55
22	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	56	5.2	55	—	54
23	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	56	—	55	—	—
24	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	55	—	55	—	54
25	—	50	—	—	—	—	5.8	59	—	—	—	—	—	—	—	54	.6	55	8.9	53
26	—	—	—	—	—	—	—	—	—	—	3.0	54	—	—	1.0	53	—	—	—	—
27	—	—	—	—	4.4	56	5.2	59	4.6	56	—	—	2.4	57	—	—	—	—	—	—
28	—	—	6.1	52	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
29	8.1	49	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Table R. (Continued)

McConaughy Reservoir temperature and oxygen data, Station 3, June-August, 1970.

Depth (Meters)	June 4		June 23		July 8		July 17		August 18		August 25		August 31					
	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F
Surface	9.6	57	8.2	—	9.2	74	8.8	74	8.4	75	8.2	76	8.5	73				
1	—	57	—	—	—	—	—	—	—	—	—	75	—	73				
2	—	57	—	—	—	73	—	—	—	—	—	75	—	73				
3	—	—	—	—	—	73	—	—	—	74	—	74	—	72				
4	—	—	—	—	—	—	—	—	—	—	—	74	—	—				
5	—	57	8.3	—	—	72	—	—	—	—	—	74	—	72				
6	—	—	—	—	—	—	—	—	—	74	—	74	—	—				
7	—	—	—	—	—	72	—	—	—	—	—	74	—	—				
8	—	—	—	—	—	70	—	—	—	—	—	74	—	72				
9	—	—	—	—	—	68	—	—	7.7	72	—	73	—	—				
10	—	57	—	—	6.9	66	8.2	73	—	—	—	73	—	72				
11	—	—	—	—	—	64	—	—	—	—	—	73	—	—				
12	8.8	56	—	—	—	62	—	—	—	—	—	73	—	72				
13	—	—	—	—	—	—	—	—	—	—	—	73	—	72				
14	—	—	—	—	—	60	—	—	—	—	—	72	—	71				
15	—	—	7.2	—	—	—	—	—	—	—	3.8	71	—	—				
16	—	—	—	—	—	—	5.9	62	—	—	—	—	4.5	71				
17	—	—	—	—	4.2	59	—	—	—	—	—	—	—	—				

Table R. (Continued)

McConaughy Reservoir temperature and oxygen data, Station 1, July-September, 1972.

Depth (Meters)	July 5		July 19		August 3		August 10		August 16		August 25		September 25					
	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F
Surface	8.5	66	—	69	—	68	10.0	72	—	72	—	70	—	68				
1	—	—	—	—	—	68	—	—	—	—	—	—	—	—				
2	8.5	66	—	—	—	68	—	70	—	—	—	—	—	—				
3	—	—	—	—	—	68	—	—	—	72	—	—	—	—				
4	8.5	66	—	—	—	68	—	—	—	—	—	—	—	—				
5	—	—	—	—	—	68	—	—	9.0	72	—	—	—	67				
6	8.5	66	—	—	—	68	—	—	—	72	—	—	—	—				
7	—	—	—	—	—	68	—	—	—	71	—	—	—	—				
8	8.5	66	—	—	—	68	—	—	—	70	—	—	—	—				
9	—	—	—	—	—	66	—	—	—	—	—	—	—	—				
10	8.5	66	—	—	—	66	—	—	—	70	—	70	—	67				
11	—	—	—	—	—	66	—	—	—	—	—	—	—	—				
12	8.5	66	—	—	—	66	—	—	—	—	—	—	—	—				
13	—	—	—	—	—	64	—	—	—	—	—	—	—	—				
14	8.5	66	—	—	—	64	—	—	—	—	—	—	—	—				
15	—	—	—	—	—	64	—	—	—	68	—	70	—	67				
16	5.5	63	—	—	—	63	—	—	—	—	—	70	—	—				
17	—	—	—	—	—	63	4.0	67	—	—	5.0	69	—	—				
18	4.5	62	—	—	—	62	3.0	66	4.0	68	—	—	—	—				
19	4.5	58	—	—	—	62	2.0	66	3.0	67	—	—	—	—				
20	4.5	58	—	—	—	62	2.0	66	2.0	66	—	68	9.0	66				
21	4.5	57	—	—	—	—	—	—	—	64	—	—	—	—				
22	4.0	55	—	—	—	—	—	—	—	62	—	68	7.0	66				
23	—	—	—	—	—	—	—	—	—	—	4.0	64	2.0	64				
24	4.0	55	—	—	—	—	—	—	—	—	T*	61	0.0	62				
25	4.0	54	3.0	58	—	—	—	—	0.0	60	—	60	—	60				
26	4.0	54	—	—	—	—	—	—	—	—	—	58	—	—				
27	3.0	52	—	—	—	—	—	—	—	—	—	—	—	—				
28	3.0	52	—	—	—	—	—	—	—	—	—	—	—	—				
29	3.0	52	—	—	—	—	—	—	—	—	—	—	—	—				
30	3.0	52	2.0	59	—	—	—	—	—	56	—	56	—	58				
31	3.0	51	—	—	—	—	—	—	—	—	—	—	—	—				

*Trace — less than 1 ppm oxygen.

Table R. (Continued)

McConaughy Reservoir temperature and oxygen data, Station 2, July-September 1972.

Depth (Meters)	July 5		August 10		August 16		August 25		September 15									
	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F
Surface	8.5	68	—	72	—	72	—	72	—	68								
1	—	—	—	—	—	—	—	—	—	—								
2	—	—	—	71	—	—	—	72	—	—								
3	—	—	—	71	—	—	—	—	—	—								
4	—	—	—	—	—	—	—	—	—	—								
5	8.5	66	—	71	8.0	72	—	71	9.0	68								
6	—	—	—	—	—	—	—	—	—	—								
7	—	—	—	—	—	72	—	71	—	—								
8	—	—	—	71	—	—	—	70	—	—								
9	—	—	—	70	—	—	—	70	—	—								
10	8.5	65	—	70	—	71	—	70	—	—								
11	7.5	63	—	—	—	—	—	—	—	—								
12	7.0	60	—	70	—	—	—	—	—	—								
13	5.0	58	—	—	—	71	—	—	—	—								
14	5.0	57	—	—	—	70	—	—	—	—								
15	5.0	55	—	—	—	70	8.0	70	—	—								
16	—	—	—	—	5.0	70	7.0	70	—	—								
17	—	—	—	—	4.0	70	2.0	67	—	—								
18	—	—	3.0	67	2.0	66	1.0	65	—	—								
19	—	—	—	—	—	64	—	—	—	—								
20	4.0	56	1.0	62	1.0	64	1.0	64	—	68								
21	—	—	—	—	—	—	—	—	—	67								
22	—	—	—	—	—	—	—	60	3.0	66								
23	—	—	—	—	1.0	59	—	—	—	—								
24	—	—	—	—	—	—	—	—	—	—								
25	3.0	57	—	57	—	—	—	—	—	—								
26	—	—	—	—	—	—	—	—	—	—								
27	3.0	52	—	—	—	—	—	—	—	—								
28	1.0	52	—	—	—	—	—	—	—	—								
29	.5	54	—	—	—	—	—	—	—	—								
30	.5	54	—	—	—	—	—	—	—	—								

Table R. (Continued)

McConaughy Reservoir temperature and oxygen data, Station 3, July-September, 1972.

Depth (Meters)	July 5		August 10		August 16		August 25		September 15									
	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F
Surface	8.0	68	—	72	—	73	—	74	9.0	68								
1	—	—	—	—	—	—	—	73	—	—								
2	8.0	66	—	—	—	—	—	72	—	—								
3	—	—	—	—	—	—	—	72	—	—								
4	8.0	66	—	—	—	—	—	71	—	—								
5	—	—	—	72	—	—	—	71	—	—								
6	8.0	66	—	—	—	73	—	71	—	—								
7	—	—	—	—	—	—	—	—	—	—								
8	8.0	65	—	—	—	—	—	71	—	—								
9	—	—	—	71	—	—	—	70	—	—								
10	8.0	65	—	70	—	72	—	70	—	—								
11	—	—	—	—	—	—	—	—	—	—								
12	5.0	65	—	—	—	72	—	—	—	—								
13	—	—	—	—	—	—	—	—	—	—								
14	5.0	65	—	—	—	—	—	—	9.0	68								
15	—	—	—	70	5.0	72	8.0	70	—	—								
16	5.0	65	3.0	70	—	—	—	—	—	—								
17	—	—	—	—	—	—	—	—	—	—								
18	3.5	61	—	—	—	—	—	—	—	—								
19	2.5	59	—	—	—	—	—	—	—	—								
20	2.0	59	—	—	—	—	—	—	—	—								

Table R. (Continued)

McConaughy Reservoir temperature and oxygen data, Station 1, July-September 1973.

Depth (Meters)	July 5		July 17		July 30		August 7		August 14		August 20		August 28		September 6		September 20	
	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F
Surface	—	72	10.0	72	8.0	70	10.0	73	8.0	74	9.0	74	9.0	74	8.0	72	7.0	65
1	—	72	—	—	—	70	—	—	—	—	—	—	—	—	—	—	—	—
2	7.0	72	10.0	72	8.0	70	10.0	73	8.0	73	10.0	74	9.0	74	8.0	71	7.0	65
3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
4	—	71	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
5	—	70	—	72	—	—	—	—	—	—	—	—	—	73	—	71	—	—
6	—	70	—	—	—	—	—	—	—	—	—	74	—	—	—	—	—	—
7	—	66	—	71	—	—	—	—	—	—	—	—	—	—	—	—	—	—
8	—	65	—	70	—	—	—	—	—	—	—	—	—	—	—	—	—	—
9	—	—	—	70	—	—	—	—	—	—	7.0	73	—	—	—	—	—	—
10	—	64	—	68	—	70	—	72	—	—	—	72	—	72	—	71	—	65
11	—	—	—	65	—	—	—	—	—	72	—	—	—	72	—	—	—	—
12	—	—	—	64	—	—	—	—	—	—	—	71	4.0	70	—	—	—	—
13	—	—	—	—	—	—	—	72	—	71	—	—	2.0	70	8.0	71	—	—
14	—	—	—	—	—	—	—	70	4.0	70	—	71	2.0	69	—	71	—	—
15	—	—	—	64	—	69	—	69	4.0	69	4.0	70	1.0	69	8.0	70	—	65
16	—	62	—	—	—	—	—	68	2.0	69	3.0	70	—	—	—	—	—	—
17	—	—	—	—	—	—	3.0	66	—	—	2.0	69	—	—	—	70	—	—
18	—	—	—	—	—	—	2.0	65	2.0	67	—	68	—	67	—	—	—	—
19	—	—	—	—	—	—	—	—	—	—	—	67	—	—	—	—	—	—
20	—	62	6.0	63	—	68	2.0	64	—	66	—	66	—	66	5.0	70	—	65
21	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1.0	—	—	—
22	—	—	—	—	—	68	—	—	—	—	—	—	—	—	.5	67	—	—
23	—	—	—	—	—	68	—	—	—	—	—	—	—	—	—	—	—	—
24	—	64	—	—	3.0	65	—	—	—	—	—	—	—	—	—	—	—	—
25	—	—	—	—	3.0	62	2.0	62	1.0	64	.5	64	—	64	—	65	—	64
26	—	62	—	—	2.0	62	—	—	—	—	—	—	—	—	—	—	—	—
27	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	5.0	63
28	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
29	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
30	6.0	62	3.0	62	1.0	61	—	61	—	62	—	62	—	63	—	63	4.0	62

Table R. (Continued)

McConaughy Reservoir temperature and oxygen data, Station 2, July-September, 1973.

Depth (Meters)	July 5		July 17		July 30		August 7		August 14		August 20		August 28		September 6		September 20	
	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F
Surface	—	74	10.0	74	8.0	71	10.0	72	9.0	74	10.0	75	8.0	75	9.0	71	7.0	65
1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2	6.0	74	10.0	72	8.0	71	9.0	72	8.0	74	10.0	75	9.0	74	8.0	71	8.0	65
3	—	—	—	71	—	—	—	—	—	—	—	—	—	—	—	—	—	—
4	—	74	—	70	—	—	—	—	—	—	—	—	—	—	—	—	—	—
5	—	—	—	70	—	71	—	—	—	—	—	—	—	74	—	—	—	—
6	—	72	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
7	—	71	—	70	—	71	—	—	—	—	—	—	—	—	—	—	—	—
8	—	70	—	69	—	70	—	—	—	—	—	—	—	—	—	—	—	—
9	—	69	—	69	—	—	—	—	—	—	—	—	—	—	—	—	—	—
10	—	68	—	69	—	70	—	72	—	73	—	73	—	74	—	71	—	65
11	—	67	—	—	—	—	—	71	—	—	—	—	—	—	—	—	—	—
12	—	66	—	—	—	—	—	70	5.0	71	—	—	—	—	—	—	—	—
13	—	—	—	—	—	—	—	70	—	71	—	—	—	73	—	71	—	—
14	—	—	—	69	—	—	—	70	4.0	70	—	—	—	—	—	70	—	—
15	—	—	—	69	—	68	—	70	—	69	6.0	72	7.0	72	—	70	—	65
16	—	—	—	66	—	67	—	69	—	—	3.0	70	7.0	72	—	—	—	—
17	—	—	—	64	—	66	—	—	3.0	68	2.0	69	3.0	71	—	—	—	—
18	—	—	—	64	4.0	66	—	67	2.0	68	—	68	2.0	70	—	—	—	—
19	—	—	—	—	—	64	—	—	—	—	—	68	—	—	—	—	—	—
20	—	62	5.0	63	—	63	3.0	66	2.0	68	1.0	68	—	68	5.0	70	—	65
21	—	—	—	—	3.0	62	—	—	—	—	—	—	—	—	5.0	70	—	—
22	—	—	—	—	2.0	62	3.0	65	—	67	—	66	—	—	2.0	69	—	—
23	—	—	—	—	2.0	62	3.0	65	—	—	—	—	—	65	2.0	68	—	65
24	—	—	—	—	—	—	2.0	65	—	—	—	—	—	—	—	68	—	64
25	—	62	4.0	62	2.0	61	—	64	1.0	67	.5	65	—	64	—	65	—	62
26	—	—	—	—	—	—	—	63	—	—	—	65	—	—	—	—	—	—
27	5.0	62	—	—	—	—	—	—	—	—	—	—	—	—	—	—	8.0	61

Table R. (Continued)

McConaughy Reservoir temperature and oxygen data, Station 3, July-September 1973.

Depth (Meters)	July 5		July 17		July 30		August 7		August 14		August 20		August 28		September 6		September 20	
	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F
Surface	—	75	10.0	75	10.0	73	11.0	75	7.0	74	10.0	76	11.0	77	9.0	71	8.0	65
1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2	7.0	75	11.0	74	10.0	73	10.0	74	7.0	74	10.0	76	11.0	76	9.0	71	8.0	65
3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
5	—	75	—	—	—	—	—	73	—	—	—	—	—	—	—	71	—	65
6	—	—	—	—	—	72	—	—	—	—	—	—	—	75	—	—	—	—
7	—	—	—	—	—	72	—	71	—	—	—	—	—	—	—	71	—	—
8	—	—	—	—	—	70	—	71	—	—	—	—	—	—	—	70	—	—
9	—	—	—	—	—	—	—	70	—	—	—	—	—	—	—	—	—	—
10	—	74	—	72	—	70	—	69	—	73	—	74	—	75	—	70	—	65
11	—	73	—	—	—	69	—	—	—	73	—	—	—	75	—	69	—	—
12	—	68	—	72	—	67	—	—	3.0	71	—	73	—	74	—	69	—	—
13	—	68	—	72	—	67	—	—	2.0	70	5.0	72	—	74	—	67	—	65
14	—	—	3.0	70	3.0	65	3.0	68	—	69	2.0	70	—	74	6.0	67	—	64
15	—	—	—	68	3.0	64	2.0	67	1.0	69	1.0	70	6.0	74	—	—	6.0	61
16	5.0	66	—	—	—	—	—	—	—	68	—	—	—	—	—	—	—	—

Table R. (Continued)

McConaughy Reservoir temperature and oxygen data, Station 1, June-October, 1974.

	June 20		July 2		July 23		August 5		August 12		August 19		September 9		September 19		October 17	
Depth (Meters)	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F
Surface	9.0	69	11.0	75	8.0	74	8.0	72	7.0	71	7.0	71	8.0	68	9.0	64	8.0	57
1	—	69	—	74	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2	8.0	69	9.0	72	5.0	74	8.0	72	7.0	71	7.0	71	8.0	68	10.0	64	—	—
3	—	—	—	71	—	—	—	—	—	—	—	—	—	—	—	—	—	—
4	—	—	—	71	—	—	—	—	—	—	—	—	—	—	—	—	—	—
5	—	68	—	71	—	74	—	72	—	71	—	71	—	—	—	—	—	—
6	—	65	—	70	—	—	—	—	—	—	—	—	—	—	—	—	—	—
7	—	—	—	70	—	—	—	—	—	71	—	—	—	—	—	—	—	—
8	—	64	—	—	—	—	—	72	—	70	—	71	—	—	—	—	8.0	57
9	—	—	—	—	—	—	—	—	—	—	—	70	—	—	—	—	—	—
10	—	62	—	70	—	73	—	71	—	70	—	70	—	—	—	—	—	—
11	—	—	—	69	—	—	5.0	70	—	—	—	—	—	—	—	—	—	—
12	—	—	—	68	6.0	72	2.0	68	—	70	5.0	70	8.0	67	—	—	—	—
13	—	61	—	67	—	70	1.0	68	—	—	—	—	—	—	—	—	—	—
14	—	—	—	—	—	69	—	68	6.0	70	—	—	—	—	—	—	—	—
15	—	—	8.0	66	—	68	—	—	—	—	—	—	—	—	7.0	64	—	—
16	—	—	—	64	3.0	68	1.0	67	—	—	—	—	—	—	—	—	8.0	57
17	—	—	—	63	3.0	66	—	—	—	69	—	—	—	—	—	—	—	—
18	—	—	—	62	2.0	65	—	—	4.0	68	—	—	—	—	—	—	—	—
19	—	—	—	—	—	—	—	—	1.0	66	—	—	—	—	—	—	—	—
20	—	—	—	—	—	64	—	65	—	—	5.0	70	—	—	—	—	—	—
21	—	—	—	61	—	—	—	—	T*	65	2.0	69	—	—	—	—	—	—
22	—	—	—	—	—	—	—	—	—	—	T*	68	—	—	—	—	—	—
23	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
24	—	—	—	—	T*	62	—	—	—	—	—	66	6.0	66	—	—	8.0	57
25	—	—	—	—	—	—	—	62	—	—	—	—	—	—	—	—	—	—
26	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
27	—	59	—	—	—	—	—	—	—	—	—	—	—	66	—	—	—	—
28	—	—	—	—	—	—	—	—	—	—	—	—	6.0	66	—	—	—	—
29	—	—	—	—	—	—	—	—	—	—	—	—	6.0	66	—	—	—	—
30	—	—	4.0	61	—	—	—	—	0.0	61	—	62	0.0	63	6.0	63	—	—
31	—	—	—	—	—	—	—	—	—	—	—	—	—	—	4.0	62	—	—
32	—	—	—	—	—	—	0.0	60	—	—	—	—	—	—	0.0	60	—	—
33	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.0	59	—	—
34	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
35	—	—	—	—	T*	60	—	—	—	—	0.0	61	—	—	0.0	59	—	—
36	—	—	—	—	—	—	—	—	—	—	—	—	0.0	60	—	—	—	—
37	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
38	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
39	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
40	5.0	59	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
41	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
42	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
43	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
44	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.0	58	—	—
45	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
46	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
47	4.0	58	3.0	60	—	—	—	—	—	—	—	—	—	—	—	—	—	—
48	—	—	—	—	—	—	0.0	60	—	—	—	—	—	—	—	—	—	—

*Trace — less than 1 p.p.m. oxygen.

Table R. (Continued)

McConaughy Reservoir temperature and oxygen data, Station 2, June-September, 1974.

Depth (Meters)	June 20		July 3		July 23		August 5		August 12		August 20		September 9		September 20			
	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F
Surface	10.0	72	9.0	70	8.0	74	8.0	72	8.0	71	8.0	72	9.0	68	8.0	64		
1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
2	10.0	72	8.0	70	6.0	74	8.0	72	8.0	71	8.0	72	9.0	69	8.0	64		
3	—	70	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
4	—	70	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
5	—	69	—	70	—	—	—	—	—	71	—	—	—	68	—	—		
6	—	65	—	—	—	74	—	—	—	—	—	72	—	—	—	—		
7	—	64	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
8	—	—	—	—	—	—	—	—	—	71	—	—	—	—	—	—		
9	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
10	—	—	—	—	—	73	8.0	72	—	—	—	—	—	—	—	—		
11	—	—	—	70	—	—	—	—	—	—	—	—	—	—	—	—		
12	—	—	7.0	67	5.0	72	—	—	—	71	6.0	71	8.0	68	8.0	64		
13	—	64	—	62	4.0	70	7.0	72	—	—	—	—	—	—	—	—		
14	—	—	—	61	3.0	69	—	—	—	—	—	—	—	—	—	—		
15	—	—	—	—	2.0	69	—	—	—	71	7.0	71	—	67	—	—		
16	—	—	—	—	2.0	69	—	72	—	70	—	—	—	—	—	—		
17	—	60	—	61	—	—	—	—	—	70	—	71	—	—	—	—		
18	—	—	—	—	—	67	7.0	72	—	—	—	71	—	—	—	—		
19	—	—	—	—	—	—	2.0	69	6.0	70	4.0	70	—	—	—	—		
20	—	59	—	—	T*	66	0.0	65	2.0	68	3.0	69	—	—	—	—		
21	—	—	—	—	—	—	—	—	—	—	1.0	68	—	—	—	—		
22	—	—	—	—	—	—	—	—	—	—	—	—	—	—	6.0	63		
23	—	—	—	—	T	64	—	—	—	67	0.0	67	6.0	66	—	—		
24	—	—	4.0	60	—	—	—	—	—	—	—	—	—	—	—	—		
25	6.0	60	—	—	—	—	—	—	—	—	—	—	—	—	—	—		

Table R. (Continued)

McConaughy Reservoir temperature and oxygen data, Station 3, June-October, 1974.

Depth (Meters)	June 19		July 3		July 22		August 5		August 12		August 20		September 9		September 20		October 16	
	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F
Surface	12.0	75	8.0	72	8.0	78	8.0	73	7.0	71	9.0	75	10.0	71	8.0	63	9.0	56
1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2	12.0	74	8.0	72	7.0	77	8.0	73	7.0	71	9.0	74	10.0	71	8.0	63	—	—
3	—	71	—	—	—	—	—	—	—	—	—	—	—	70	—	—	—	—
4	—	69	—	72	—	—	—	72	—	—	—	—	—	70	—	—	—	—
5	—	64	—	—	—	77	—	—	—	—	—	—	—	—	—	—	10.0	56
6	—	—	—	71	7.0	77	8.0	72	—	—	8.0	74	9.0	70	8.0	63	—	—
7	—	—	7.0	70	—	—	—	—	—	—	—	—	—	—	—	—	—	—
8	—	—	—	69	—	76	—	—	—	—	—	—	—	—	—	—	—	—
9	—	—	—	67	—	73	—	—	—	71	—	—	—	—	—	—	—	—
10	—	60	—	67	4.0	72	—	—	—	70	—	—	—	—	—	—	—	—
11	—	—	—	—	—	—	5.0	72	4.0	70	8.0	74	—	—	8.0	63	9.0	56
12	—	—	—	65	2.0	71	—	—	—	—	—	—	—	—	—	—	—	—
13	—	—	—	64	1.0	70	—	—	—	—	—	—	9.0	70	—	—	—	—
14	7.0	62	5.0	62	—	—	—	—	—	—	—	—	—	—	—	—	—	—

*Trace—less than 1 ppm oxygen.

Table R. (Continued)

McConaughy Reservoir temperature and oxygen data, Station 4, June-October, 1974.

Depth (Meters)	July 3		July 22		August 5		August 12		August 20		September 9		September 20		October 16			
	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F
Surface	8.0	74	12.0	80	8.0	71	9.0	72	10.0	73	10.0	73	—	56	10.0	56		
1	—	—	—	—	7.0	71	9.0	72	8.0	73	—	73	9.0	56	—	—		
2	8.0	73	9.0	79	—	—	—	—	—	—	—	—	—	—	—	—		
3	—	—	7.0	78	—	—	—	—	—	—	—	—	—	—	—	—		
4	6.0	72	—	—	—	—	—	—	—	—	—	—	—	—	—	—		

Table R. (Continued)

McConaughy Reservoir temperature and oxygen data, Station 1, June-September, 1975.

Depth (Meters)	June 16		June 30		July 14		July 28		August 11		August 25		September 8		September 9			
	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F
Surface	9.0	60	7.0	65	8.0	70	8.0	73	8.5	73	8.5	77	7.5	70	9.0	63		
1	—	—	—	—	—	—	8.0	73	8.5	73	8.5	77	7.5	70	9.0	63		
2	—	—	—	—	7.5	72	8.0	73	8.5	73	8.5	75	7.5	70	9.0	63		
3	8.8	60	—	—	—	72	8.0	73	8.0	73	8.5	75	7.5	70	9.0	63		
4	—	—	—	—	—	72	8.0	73	8.0	72	8.5	75	7.5	70	9.0	63		
5	—	—	—	63	7.0	68	8.0	73	8.0	72	8.5	75	7.5	70	9.0	63		
6	8.8	60	—	—	—	—	8.0	73	8.0	72	8.0	75	7.5	70	9.0	63		
7	—	—	—	—	—	—	8.0	73	8.0	72	8.0	75	7.5	70	9.0	63		
8	—	—	—	—	—	—	8.0	73	8.0	72	8.0	75	7.5	70	9.0	63		
9	9.0	59	—	—	—	—	7.5	73	8.0	72	8.0	75	7.5	70	9.0	63		
10	—	—	—	62	7.0	64	7.5	72	7.5	72	7.5	74	7.5	70	9.0	63		
11	—	—	—	—	—	—	6.5	72	7.5	72	7.5	74	7.5	70	9.0	63		
12	—	—	—	—	—	—	6.0	72	7.5	71	8.0	74	7.5	70	9.0	63		
13	—	—	—	—	—	—	5.0	69	7.0	70	7.5	74	7.5	70	9.0	63		
14	—	—	—	—	—	—	4.0	68	7.0	70	6.5	72	7.5	70	9.0	63		
15	—	—	—	—	7.0	63	4.0	63	7.0	70	3.5	68	7.5	70	9.0	63		
16	8.0	57	8.0	60	—	—	4.0	61	1.5	65	1.0	65	7.5	70	9.0	63		
17	—	—	—	—	—	—	4.5	61	1.5	64	1.0	63	3.0	70	9.0	63		
18	—	—	—	—	—	—	4.5	61	1.5	63	0.0	62	2.5	70	9.0	63		
19	—	—	—	—	—	—	4.5	60	1.5	63	0.0	61	1.0	69	9.0	63		
20	8.5	56	—	—	6.5	62	4.5	60	1.5	61	0.0	60	0.0	68	9.0	63		
21	—	—	—	—	—	—	4.5	59	1.5	61	0.0	59	0.0	67	9.0	63		
22	—	—	—	—	5.5	61	4.5	59	2.0	61	0.0	59	0.0	66	9.0	63		
23	—	—	—	—	—	—	3.0	58	2.0	59	0.0	57	0.0	66	9.0	63		
24	—	—	—	—	—	—	2.5	57	1.5	59	0.0	57	0.0	66	9.0	63		
25	—	—	4.8	60	5.5	60	2.0	57	1.0	57	0.0	57	0.0	65	9.0	63		
26	—	—	—	—	—	—	1.5	57	.5	57	0.0	57	0.0	65	9.0	63		
27	—	—	—	—	5.5	60	1.0	57	0.0	55	0.0	57	0.0	61	9.0	63		
28	—	—	—	—	4.0	60	.5	56	0.0	55	0.0	57	0.0	61	9.0	63		
29	—	—	—	—	3.5	60	.5	55	0.0	55	0.0	57	0.0	60	8.5	63		
30	—	—	—	—	3.5	60	.5	55	0.0	55	0.0	57	0.0	59	7.0	63		
31	—	—	—	—	—	—	T*	55	0.0	55	0.0	57	0.0	—	7.0	62		
32	—	—	—	—	—	—	T	55	0.0	55	0.0	57	0.0	—	6.0	61		
33	—	—	4.0	58	—	—	T	55	0.0	55	0.0	57	0.0	—	3.0	61		
34	—	—	—	—	—	—	T	55	0.0	55	0.0	57	0.0	—	2.0	60		
35	7.5	55	—	—	—	—	T	55	0.0	55	0.0	57	0.0	—	2.0	60		

*Trace—less than 1 p.p.m. oxygen.

Table R. (Continued)

McConaughy Reservoir temperature and oxygen data, Station 1, June-September, 1975.

Depth (Meters)	June 16		June 30		July 14		July 28		August 11		August 25		September 8		September 29			
	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F
36	—	—	—	—	—	—	T*	55	0.0	55	0.0	57	0.0	—	2.0	59		
37	—	—	—	—	—	—	T	55	0.0	55	0.0	57	0.0	—	1.0	58		
38	—	—	—	—	—	—	T	55	0.0	55	0.0	57	0.0	—	1.0	58		
39	—	—	—	—	1.0	58	—	—	0.0	55	0.0	57	0.0	—	0.0	57		
40	7.8	54	2.0	—	—	—	—	—	0.0	55	0.0	57	0.0	—	0.0	57		
41	—	—	—	—	—	—	—	—	0.0	55	0.0	57	0.0	—	0.0	57		
42	—	—	—	—	—	—	—	—	0.0	55	0.0	57	0.0	—	0.0	56		
43	—	—	—	—	—	—	—	—	0.0	55	0.0	57	0.0	—	0.0	56		
44	—	—	—	—	—	—	—	—	0.0	55	0.0	57	0.0	57	0.0	56		
45	—	—	—	—	—	—	—	—	0.0	55	0.0	57	—	—	—	—		
46	—	—	—	—	—	—	—	—	0.0	55	0.0	57	—	—	—	—		
47	—	—	—	—	—	—	—	—	0.0	55	—	—	—	—	—	—		
48	—	—	—	—	1.0	56	—	—	0.0	55	—	—	—	—	—	—		
49	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
50	—	—	1.0	56	—	—	—	—	—	—	—	—	—	—	—	—		

Table R. (Continued)

McConaughy Reservoir temperature and oxygen data, Station 2, June-September, 1975.

Depth (Meters)	June 16		June 30		July 14		July 28		August 11		August 25		September 8		September 29			
	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F
Surface	9.5	62	9.0	65	8.0	72	8.5	74	9.0	77	8.0	73	8.5	70	9.5	63		
1	—	—	—	—	—	—	8.5	74	9.0	74	8.0	73	8.5	70	9.5	63		
2	—	—	9.0	65	8.0	71	8.5	73	9.0	73	8.0	73	8.5	70	9.5	63		
3	—	—	—	—	—	—	8.5	73	9.0	73	7.5	73	8.5	70	9.5	63		
4	—	—	—	—	—	—	8.0	73	9.0	72	7.5	73	8.5	70	9.5	63		
5	—	—	—	—	8.0	70	8.0	73	8.5	72	7.5	73	8.5	70	9.5	63		
6	8.8	61	—	—	—	—	8.0	73	7.5	72	7.5	73	8.5	70	9.5	63		
7	—	—	—	—	—	—	8.0	73	7.5	70	7.5	73	8.5	70	9.5	63		
8	—	—	—	—	—	—	7.5	72	7.5	70	7.0	73	8.0	70	9.5	63		
9	8.9	61	—	—	—	—	7.5	72	7.0	70	6.0	72	8.0	70	9.5	63		
10	—	—	9.0	64	7.5	70	7.0	72	7.0	70	5.5	72	8.0	70	9.5	63		
11	—	—	—	—	—	—	5.0	72	6.5	70	5.5	72	8.0	70	9.5	63		
12	—	—	—	—	—	—	4.0	68	6.5	69	5.5	71	8.0	70	9.5	63		
13	—	—	—	—	—	—	4.0	66	6.0	69	5.5	71	8.0	70	9.5	63		
14	—	—	—	—	—	—	4.0	65	5.5	68	5.0	70	8.0	70	9.0	63		
15	—	—	9.0	62	5.0	65	4.0	65	5.0	68	5.0	70	8.0	70	9.0	63		
16	8.6	60	—	—	—	—	4.0	63	3.0	66	5.0	70	8.0	70	9.0	63		
17	—	—	—	—	5.0	63	4.5	63	2.0	65	5.0	70	8.0	70	9.0	63		
18	—	—	—	—	4.5	63	4.5	62	1.0	63	1.5	70	8.0	70	9.0	63		
19	—	—	—	—	—	—	4.0	61	.5	61	.5	68	8.0	70	9.0	63		
20	8.0	58	8.0	62	4.0	59	4.0	61	.5	59	0.0	66	7.5	70	9.0	63		
21	—	—	—	—	4.0	59	3.0	59	.5	59	0.0	65	7.5	70	9.0	63		
22	—	—	—	—	3.5	57	2.0	59	0.0	57	0.0	65	7.0	70	—	—		
23	—	—	—	—	3.0	55	2.0	59	0.0	56	—	—	—	—	—	—		
24	—	—	—	—	2.5	55	—	—	—	—	—	—	—	—	—	—		
25	7.0	55	—	—	2.5	55	—	—	—	—	—	—	—	—	—	—		
26	—	—	—	—	2.5	55	—	—	—	—	—	—	—	—	—	—		
27	—	—	5.0	60	—	—	—	—	—	—	—	—	—	—	—	—		

*Trace—less than 1 ppm oxygen.

Table R. (Continued)

McConaughy Reservoir temperature and oxygen data, Station 3, June-September, 1975.

Depth (Meters)	June 16		June 30		July 14		July 28		August 11		August 25		September 8		September 29			
	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F
Surface	9.3	62	9.0	70	8.0	73	9.5	76	7.0	74	6.5	72	9.0	70	10.5	63		
1	—	—	—	—	—	—	9.5	76	7.0	74	6.5	72	9.0	70	10.5	61		
2	—	—	8.0	70	8.0	73	9.5	76	7.0	74	6.5	72	9.0	70	10.0	61		
3	9.1	61	—	—	—	—	9.5	76	7.0	74	6.0	72	9.0	70	9.5	61		
4	—	—	—	—	8.0	72	9.5	76	7.0	74	5.5	72	9.0	70	9.5	61		
5	—	—	—	—	—	—	7.0	75	7.0	74	4.5	72	9.0	70	9.5	61		
6	8.2	60	—	—	8.0	72	7.0	73	7.0	74	4.0	71	8.5	70	9.5	61		
7	—	—	—	—	—	—	7.0	73	7.0	74	4.0	71	8.5	70	9.5	61		
8	—	—	—	—	8.0	72	6.0	73	7.0	74	4.0	70	8.5	70	9.5	61		
9	8.6	59	—	—	—	—	6.5	73	7.0	74	2.5	70	8.5	70	9.0	61		
10	—	—	8.0	69	7.5	72	6.5	73	7.0	74	2.5	70	8.0	70	9.0	59		
11	—	—	—	—	—	—	5.0	72	6.5	74	2.0	70	—	—	—	—		
12	—	—	—	—	7.0	72	5.0	72	6.5	74	.5	70	—	—	—	—		
13	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
14	—	—	—	—	5.0	70	—	—	—	—	—	—	—	—	—	—		
15	6.5	56	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
16	—	—	8.0	68	—	—	—	—	—	—	—	—	—	—	—	—		

Table R. (Continued)

McConaughy Reservoir temperature and oxygen data, Station 4, June-September, 1975.

Depth (Meters)	June 16		June 30		July 14		July 28		August 11		August 25		September 8		September 28			
	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F	O_2 ppm	Temp. F
Surface	11.8	65	9.0	71	7.0	73	7.5	77	6.5	73	5.5	70	9.0	66	10.0	57		
1	—	—	—	—	6.5	72	7.5	77	6.5	73	5.0	70	8.5	66	10.0	57		
2	9.4	61	9.0	71	6.5	72	7.5	77	6.0	73	—	—	—	—	—	—		
3	—	—	—	—	7.0	72	7.0	77	—	—	—	—	—	—	—	—		
4	—	—	—	—	6.0	72	—	—	—	—	—	—	—	—	—	—		
5	9.0	61	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
6	—	—	6.0	71	—	—	—	—	—	—	—	—	—	—	—	—		

OFFICE MEMO

TO:

Date

FROM:

SUBJECT:

REMARKS:

Allegiance Drain
① — Scottish/Icon
② — "Nab," wild rainbow steel
③ — Return to fisheries?
④ — stripped bass?