United States Department of the Interior

OFFICE OF THE SECRETARY
WASHINGTON, D.C. 20240

May 16, 1975

Dr. Robert J. Behnke
Department of Zoology
Colorado State University
Fort Collins, Colorado 80523

Dear Bob:

I am taking the liberty of sending your address to Ernest Schweibert who is very interested in contacting you about some subspecies of trout that are way beyond my expertise. While fishing in North Carolina with him recently we discussed a new book he is doing on the trout and I recommended that the two of you get together.

I regret that you are no longer with the Fish and Wildlife Service but I am delighted that you are continuing your excellent work at Colorado State University. Ernest Schweibert is considered the top trout angler in the United States and so it is a rare privilege to get the two "Mr. Trouts" together.

With warmest best wishes,

Sincerely,

Nathaniel P. Reed
Assistant Secretary for
Fish and Wildlife and Parks

Chuck Fothergill's Outdoor Sportsman
14913 Hwy 82
Carbondale Colo. 81623

Schweibert – McCloud/Ronn rk.
Roaring Fk. Ranch

Robert Behnke
Colo State University
Fort Collins, Colo.
80521

BLM

Utah Colo

Yampa-White

Humpback chub

bony tail

(2) Humpback (2)

(1) - hybrid

- bluehead sucker -

Colo

Dive Wildlife

USFS

Baker Co

- Sea Lion

- Nitrogen

NPS

Colo. R.

- Spec. Rep. - stoley fish

in sept in a water volume low water -

identification

- shelves - supplies -

salary - (student)

(work-study)

- general -

- special projects

- R. & E. 81

Chuck Fothergill's Outdoor Sportsman
14913 Hwy 82
Carbondale, Colo. 81623

Robert Behnke
CSU
Fort Collins, Colo.

Dear Bob -

In the way of introduction - I am the manager of a branch store of Chuck Fothergill's Outdoor Sportsman of Aspen, Colo. The Branch Store is located at The Ranch at Roaring Fork near Carbondale, Colo.

The Ranch is a condominium development - literature enclosed to save alot of words. Chuck and myself are more or less supervising the Fish Management here. As for philosophy - fishing on the Ranch is all Fly Fishing only, and over half of the water is restricted to Fly Rods and Catch and Release.

Ernest Schweibert spent the past few days fishing here and advised that we write you for the following reason.

He thinks the possibility exists that a rather pure strain of McCloud/Kern Rainbos are here on the Ranch. These fish, because of the situation of the water have been fairly well isolated from other fish in the Ranch waters, from recent introductions of stockers, from fish in the Roaring Fork River, and have had some (not a lot) spawning area available. There are many fish of 4 to 6 pounds.

Ernie felt that it should be ascertained if these fish are as he thinks. If so - they might be of value to the World of Trout. We would appreciate any thoughts you might have regarding this.

Most sincerely --

Charlie Loughridge

cc - Ernest Schweibert
- Jay Kee Jacobson
- Chuck Fothergill

4 September 1975

Mr. Charles Loughridge
Chuck Fotergills' Outdoor Sportsman
14913 Highway 82
Carbondale, Colorado 81623

Dear Mr. Loughridge:

In response to your query on the strain of wild trout you have on the Roaring Fork Ranch, I will first tell you that the situation is likely to be complex and a mixture of various non-native races of rainbow trout with a trace of the native cutthroat trout. This would be my assessment, without actual examination of specimens.

The only native trout in your area and in the whole upper Colorado River basin is the Colorado River cutthroat trout, Salmo clarki pleuriticus, now virtually extinct as pure populations.

Rainbow trout were first brought into Colorado in 1880 and the earliest propagation of rainbow trout was from fish taken in the McCloud River, California. The McCloud River originally had two species of native trout, the anadromous rainbow or steelhead trout, Salmo gairdneri, and a non-migratory trout found in the upper tributaries which I have called the redband trout. The redband trout is most closely related to the California golden trout (S. aguabonita aguabonita of South Fork of Kern River and S. a. gilberti of the main Kern River). Both of these trout - the steelhead and the redband were mixed together to form the original hatchery rainbow trout. However, because of the size and availability of the steelhead in the McCloud River at the time, the overwhelming majority of the hereditary background of the original hatchery rainbow was of the steelhead-rainbow variety. All hatchery stocks of rainbow trout I have examined or have data on are typical of the coastal rainbow trout in their taxonomic characters and in their chromosome number (60). Thus, from the very beginning, a pure strain of McCloud River trout was never propagated.

For the last 80-90 years, stocking of rainbow trout has caused massive hybridization with the native cutthroat trout and all degrees of hybrid populations can be found. In many rivers with self-reproducing populations, the present wild trout is actually a mixture of the introduced rainbow (of various strains and the native cutthroat - the hybrids are full fertile. You might possibly observe this hybrid influence in the

Roaring Fork "rainbows" by fish with larger, rounder spots, tints of yellow and orange and a trace of a cutthroat mark.

The Colorado River cutthroat trout is one of the most beautiful of all trouts but its fate has been sealed by environmental degradation and hybridization. I have been active in projects to restore the original cutthroat trout to some of its former habitat by finding existing populations in need of habitat protection and to make transplants into new waters. The Wyoming Game and Fish Department is to be commended on their program to restore native trout and I hope other states will follow their example. I believe our subspecies of native cutthroat trout can be managed for sport fisherels and not as museum curiosities. They take a fly more readily than any other trout and are unwary to the point of being caught and released several times - they are the ideal catch-and-release fish.

I will see if I have some of my reports and literature on the subjects discussed above to send with this letter. I will have a copy sent to Mr. Schwiebert because eventually it will be through public education influencing anglers opinions and values that trout management policies of public agencies will be re-directed in a more realistic course emphasizing quality rather than quantity, - or as I have used the analogy in one of my reports - the psychological factors that influence the preference to savor a fine wine rather than large amounts of a poor vintage. I think this analogy is realistic - many fishery programs are suffering from what can be characterized as a "catchable hangover".

Sincerely yours,

Robert J. Behnke

Robert J. Behnke
Associate Professor

aa

Encl:

UNITED STATES
DEPARTMENT OF THE INTERIOR
OFFICE OF THE ASSISTANT SECRETARY
WASHINGTON, D.C. 20240

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INT 418

1975

Reed - introduce ms & Schaeffer

Dr. Robert J. Behnke
Department of Zoology
Colorado State University
Fort Collins, Colorado 80523


VIA AIR MAIL

state of utah

DIVISION OF WILDLIFE RESOURCES

JOHN E. PHELPS
Director

1596 West North Temple / Salt Lake City, Utah 84116 / 801-328-5081

Reply To
CENTRAL REGIONAL OFFICE
176 East Center Street, Provo, Utah 84601 / (801) 373-4774

August 12, 1975

Dr. Robert Behnke
Colorado Cooperative Fishery Unit
Colorado State University
Fort Collings, Colorado 80521

Dear Sir:

It is our information that you did some work on cutthroat trout that were taken from the Deep Creek Mountain Range in Utah last year. These fish were taken by the B.L.M. and identified by you as a pure strain of cutthroat. The B.L.M. is much interested in designating this range of mountains as primitive. They have requested that our Division make an assessment of the fish in the area and do some irradication of rainbow and rainbow-cutthroat hybrids in the lower reaches of the streams that also have pure cutthroat. We are interested in working cooperatively with the B.L.M. in this endeavor.

I wonder if you would be willing to examine cutthroat that we have taken from other streams in the Deep Creek Mountain Range to determine their purity. If we decide to undertake an irradication project in the area, it would be very helpful to know which cutthroat have hybridizes and which are pure. It now seems possible that there are some pure cutts in many of the streams as well as hybrids. In each stream we have investigated so far, it appears that there is a clear dividing line between pure and hybrid strains. If you would be able to examine fish for use, we could ship some at your earliest convenience and others as we are able to collect them.

We appreciate very much the help you have given in the past, and look forward to working with you in the future.

Sincerely,

Charles W. Thompson

Charles W. Thompson
Fisheries Manager
Central Region

CWT:mkh

state of utah

DIVISION OF WILDLIFE RESOURCES
1596 West North Temple / Salt Lake City, Utah 84116

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SUPPORT YOUR
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We hold these Truths...
UNITED STATES 10c

Dr. Robert Behnke
Colorado Cooperative Fishery Unit
Colorado State University
Fort Collings, Colorado 80521

DENVER AUDUBON SOCIETY

August 20, 1975

Dear Bob,

I'm sending the remaining photocopies: introduction, Arizona native trout, Gila trout, Lahontan cutthroat, and Paiute trout.

Several other things

① The library has only received Vol 20, no 1 of Sport Fisheries Abstracts. I was unable to find the reference to the Montana PR-DJ paper comparing grazed & ungrazed areas. Could you look it up and send the reference to me so that I can begin to run it down?

② Other papers which the Library does not have and which I could use if you have them and can spare them long enough for me to photocopy:

Burns, JE 1970 The importance of streamside vegetation to trout and salmon in B.C. B.C. Fish & Wildl. Br., Fish. Tech. Circ. 1: 12p.

Platts, W.S. 1974. Geomorphic & aquatic conditions influencing salmonids and stream classification. USFS, SEAM publ., Billings, MT (mimeo) 199p.
(I'm also writing for this one but don't know how long it may take).

Wesche, TA 1973. Parametric determination of minimum stream-flow for trout. Water Res. Res. Inst., Univ. Wyo., Laramie. 102p.

I may postpone my trip to Utah until the week after Labor Day, don't know yet for sure. If that proves to be the case, I may try to get up to Ft Collins next week.

Thanks for your help with the above.

Regards,
Mark

UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE
HUMBOLDT NATIONAL FOREST
BAKER, NEVADA 89311

March 17, 1975

Dr. Robert Behnke
Bureau of Sport Fisheries and Wildlife
Colorado Cooperative Fishery Unit
Colorado State University
Fort Collins, Colorado 80521

Dear Sir:

Recently the U. S. Army Historical Research Collection in Pennsylvania sent me a copy of a request you made concerning the heliograph on Wheeler Peak. I had sent them a similiar request about the heliograph. Since then I have discovered from a different source the history of the heliograph, and I felt you might be interested if you have not already discovered the answer.

The station was a part of a system operated by The U.S. Coast and Geodetic Survey, to determine by means of triangulation, the 39th parallel. It was also used briefly by other parties in the great effort to map the west.

I don't believe that the personnel involved with this station would have had much to do with transplanting the cutthroat trout as they wre only in the area for very short periods of time. Further research may prove this wrong, however.

We would appreciate any new information you may have on this trout, as we have recently completed a diorama exhibit using two freeze-dried specimens, and are bound to be asked many questions.

I will watch for any mention of the fish as I continue my research on the areas history, and let you know what I discover, if anything.

Sincerely

Katherine Kaiser

Ms. Katherine Kaiser
V.I.S. Technician

U. S. DEPARTMENT OF AGRICULTURE

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Heliograph Mt. Wheeler.

Dr. Robert Behnke
Bureau of Sport Fisheries and Wildlife
Colorado Cooperative Fishery Unit
Colorado State University
Fort Collins, Colorado 80521

CALIFORNIA ACADEMY OF SCIENCES

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THE SCIENCE MUSEUM

THE ALEXANDER F. MORRISON PLANETARIUM

THE STEINHART AQUARIUM

April 4, 1975

Dr. Robert Behnke
Department of Fishery and Wildlife Biology
Colorado State University
Fort Collins, Colorado 80523

Dear Bob:

We have some information regarding your letter of 20 February.

Enclosed is a copy of the pertinent section out of the catalog for SU4769, along with a map and a page out of a geographic dictionary which Lillian Dempster located. Mt. Carlton is now Mt. Spokane. Perhaps someone in Idaho can tell you exactly where Snake Creek is located, but it is near Mt. Spokane.

Hope this helps.

Sincerely yours,

Bill

William N. Eschmeyer

WNE/mab

1	Catostomus teres	Boyer R., Arion
2	Etheostoma caprodes	Des Moines R., Estherville, Iowa
3	Notropis topeka	Boyer R., Arion
4	Trachinocephalus myops	Jamaica.
5.	Labrichthys rubiginosa	
6	Salmo irideus	Waddell Cr., Calif
7	~~Capoeta~~ Leiognathus nuchalis	Japan.
8	Salmo gairdneri irideus	
9	Sphaeroides marmoratus	Jamaica.
4760	Lektocottus armatus	Waddell Cr., Calif.
1	Diodon hystrix	Jamaica.
2	Rhyncus coriaceus	"
3	Trichiurus japonicus	Japan.
4	Latilus argentatus	"
5	Bodianus fulvus ruber	Jamaica
6	Polydactylus virginicus	"
7	Petrometopon cruentatus	"
T 8	Mylloidichthys ~~Upeneus~~ martinicus	"
→ 9	Salmo mykiss	Sw. Fk Cr., near Mt. Carleton, Idaho
		"

Spieden Bluff. A headland at the west end of Spieden Island, in west central San Juan County. (6)

Spieden Channel. A channel between Spieden and San Juan islands, in northwestern San Juan County. (6)

Spieden Island. An island about 3 miles long, southwest of Stuart Island, and north of San Juan Island, in west central San Juan County; maximum elevation, about 410 feet. (6)

Spiketon. See Morristown.

Spire Mountain. A mountain near the head of Howard Creek, northeast of Index, in southeastern Snohomish County; elevation, 6,065 feet. (72)

Spire Point. A peak on the Cascade summit, near the Skagit-Snohomish boundary line; elevation, 8,220 feet. (52)

Spirit. A post office on Deep Creek, about 10 miles southeast of Northport, in northeastern Stevens County. (1)

Spirit Lake. A lake 3 miles long, at the head of Toutle River, north of Mount Saint Helens, in northwestern Skamania County; elevation, 3,199 feet. (15)

Split Rock. A small rock island near the shore, about 7 miles north of the mouth of Quinault River, in northwestern Grays Harbor County. (5)

Spokane. This city is the county seat of Spokane County, and is located in the central part, on Spokane River. The altitude is 1,910 feet. It has an area of about 39 square miles. The city is well served by several trunk line railroads and a number of branch lines and interurbans. There are 215 factories, including sash and door, shingle and box factories, metal working plants, brick, clay and cement works, meat packing plants, candy, cracker and biscuit factories, flouring mills, and railroad shops. It is a natural center for a lumbering, mining and agricultural region. The population in 1910 was 104,402. According to the estimates of the Census Bureau the population on July 1, 1916, was 150,323. (1)

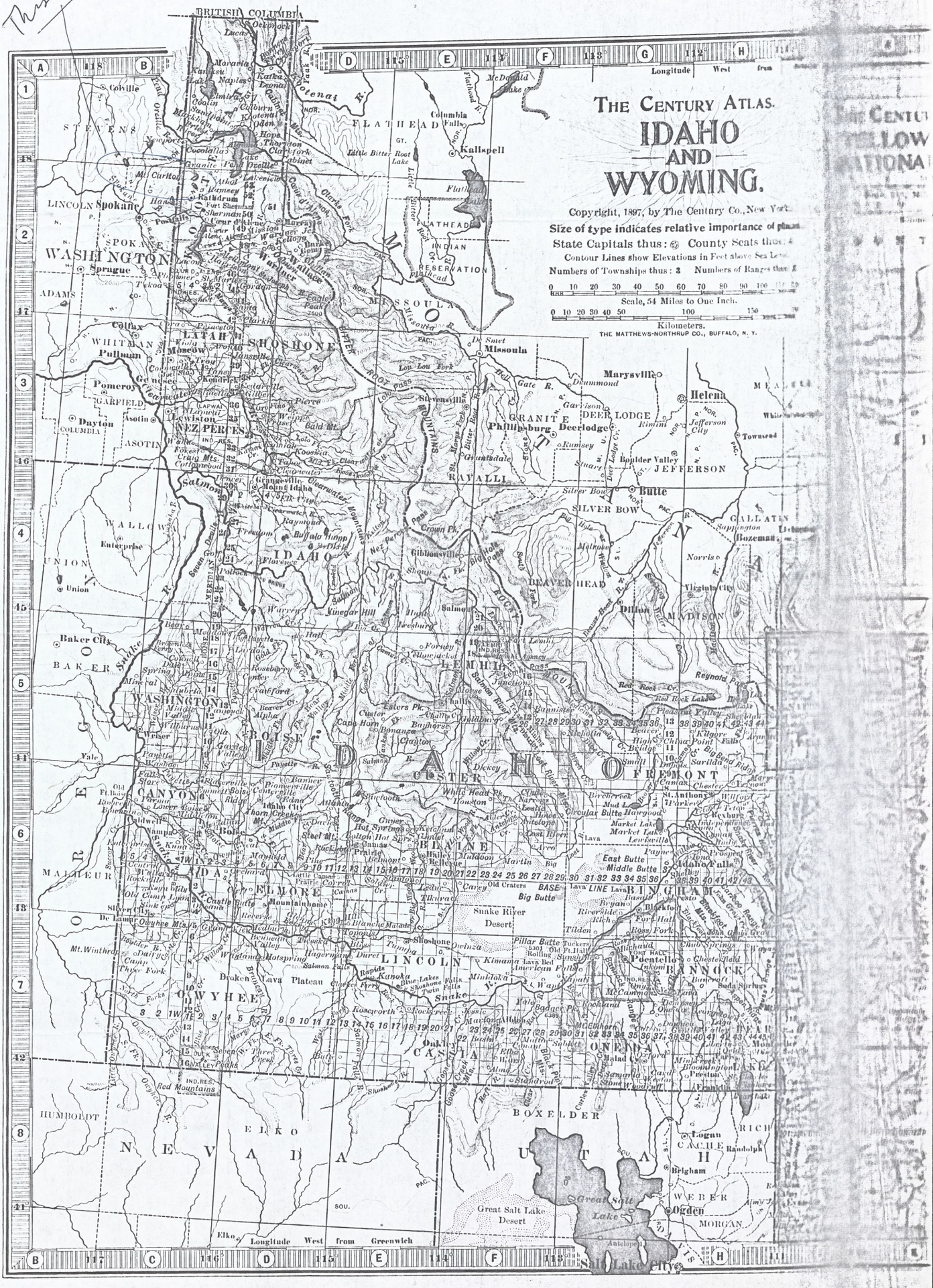
Spokane Bridge. A station on the C. M. & St. P. Ry., 18 miles east of Spokane, in east central Spokane County; elevation, 2,114 feet. (4)

Spokane County. This county is located in east central Washington, adjacent to Idaho. It contains 1,756 square miles. The topography of the county is generally rolling, with mountains along the eastern line. The mean annual temperature is 48° F., and the mean annual range is 42° F. The precipitation per year averages 17 inches. Spokane is an Indian word meaning "chief of the sun." Spokane County has the second largest population of the state. The Census Bureau estimated that it was 190,870 on July 1, 1916. Manufacturing and diversified agriculture are the leading occupations of the people. Apple growing and dairying constitute two of the important industries. Spokane is the largest city and the county seat. Some of the other important towns are Cheney, Medical Lake, Deer Park, Rockford, Spangle, Fairfield, Latah, and Waverly. (1)

Spokane, Fort. A village near the mouth of Spokane River, in north central Lincoln County; elevation, 1,673 feet. (4)

Spokane Indian Reservation. A large reservation, with a total area of 147,422 acres, located in southwestern Stevens County, near the confluence of Columbia and Spokane rivers. (1)

Spokane, Mount. A mountain northeast of Spokane, in northeastern Spokane County, near the state line; elevation, 5,208 feet. (Formerly Carlton.) (75)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AND
WYOMING.
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Size of type indicates relative importance of places.
State Capitals thus: ⊛ County Seats thus:
Contour Lines show Elevations in Feet above Sea Level.
Numbers of Townships thus: 3 Numbers of Ranges thus: 2
Scale, 54 Miles to One Inch.
Kilometers.
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Salt Lake City
Great Salt Lake
Great Salt Lake Desert
Snake River Desert
Yellowstone National Park

William N. Eschmeyer
CALIFORNIA ACADEMY OF SCIENCES
GOLDEN GATE PARK SAN FRANCISCO
94118

Westslope cutts
— Snake Ark
« Mt. Cordilleran
= Mt. Spokane

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Dr. Robert Behnke
Department of Fishery and Wildlife Biology
Colorado State University
Fort Collins, Colorado 80523

MONTANA TELEVISION NETWORK
A Division of Garryowen Corporation

Norma Ashby, Producer/Today in Montana

Oct. 7, 1976

Dr. Robert Behnke
Dept. of Fish & Wildlife Biology
Colorado State University
Fort Collins, Colo. 80523

Dear Dr. Behnke,

I understand you have written a thesis on the cutthroat trout. At the moment I am involved in a campaign to name the Black-Spotted Cutthroat trout the State Fish of Montana and am interested to know if any material you cover in your thesis could be helpful in adding to the knowledge people have of the this particular species.

Actually the Montana Grayling is in contention too but so far the Black Spotted Cutthroat is far ahead in the balloting. I'm enclosing some information for you on our campaign.

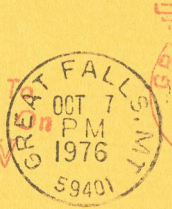
I will appreciate any information you can give me. Thank you in advance for your consideration of my request.

Sincerely yours,

Norma Ashby
Producer
"Today in Montana"

Enclosures

MONTANA TELEVISION NETWORK
Box 1331, Great Falls, Montana 59403



Dr. Robert Behnke
Dept. of Fish & Wildlife Biology
Colorado State University
Fort Collins, Colo. 80523

427 Zoology

OFFICE MEMO

TO:

FROM:

SUBJECT:

REMARKS:

Date

① Reiser & Wesche
Water Res Series #64
1977

② Platts
Geomophic & Aquatic Cond
Influencing Salmonids &
Stream Classification 1974

③ Production & Angler Harvest of
Wild Brook Trout in Lawrence
Creek, Wisc. 1966 R. Hunt

④ Symposium on Stream Channel
Modification Harrisburg Pa
1975

Taken by
Lynn Hartmann

⑤ Trout Vol 17 # 1 1976

Dr Behnke

Sorry I missed you. Could you please look at the Following samples

1. Columbine Cr, Colorado R. drainage, RMNP
2. Nanita lake, " " " , RMNP
3. Dream lake, S. Platte " " , RMNP

Columbine Cr. This population exists in a hanging basin, and by location could should be Colorado River. Unfortunately, the samples are in Terrible shape

Dream lake. This lake used to be stocked, with no fish found in 1978. In the 80's we were told that fish were there, with fish easily caught in 1987 that look like greenbacks. Your opion would be Interesting

Nanita lake. This is an excellent pop. of cutthroats. I'm calling them Colorado Rivers, but would like your opion.

3S
Tr. Ft Thy Lake
10,610 Pk.

We'll pay you for your time. Please send an invoice to me.

Thanks
Bruce Rosenlund

Department of Fishery and Wildlife Biology

Colorado State University
Fort Collins, Colorado
80523

17 January 1977

Ms. Johanna Reinhart
Environment Canada
Scientific and Information Branch
116 Lisgar Street
Ottawa, Canada KIA OH3

Dear Johanna:

I am familiar with Mr. Reinitz' work because I was in communication with him in 1973 when he was working on his MS thesis on westslope (should it be hyphenated?) cutthroat trout at the University of Montana and I had a graduate student at CSU working on the same fish using morphological characters. Despite our communications, Reinitz' thesis contained some outrageously naive conclusions. I note from the present manuscript that he has gone to considerable lengths to quantify the data this time, but he still can't control the urge to make unwarranted implications regarding practical application.

As mentioned in my critique, the manuscript should be sent to Dr. Fred Allendorf, Dept. Zoology, Univ. Montana, Missoula 59801, to review biochemical nomenclature and for his comments on the protein PGI in regards to species specificity. The literature is listed under references, much of it not cited in the text.

I usually enjoy the opportunity to review most manuscripts dealing with salmonid fishes, and I still have a debt of gratitude for the publications you sent to me in Iran, thus the review of an extra two or three papers each year would be accepted gladly.

Sincerely,

Robert J. Behnke

RJB:pcb

Environment Canada | Environnement Canada
Fisheries and Marine Service | Service des pêches et des sciences de la mer
Your file Votre dossier
Our file Notre dossier J4674-1
Scientific Information and Publications Branch | Direction de l'information et des publications scientifiques
Ottawa K1A 0H3

COMMENTS OF REFEREE / COMMENTAIRES DE L'ARBITRE

A guide is given on the reverse / *Voir guide au verso*

AUTHOR(S)/AUTEUR(S): Gary L. Reinitz

TITLE/TITRE: Electrophoretic distinction of rainbow trout (Salmo gairdneri), west-slope cutthroat trout (Salmo clarki), and their hybrids

---

This manuscript merits ☐ does not merit ☐ publication.
It should be assessed after rewriting ☑ after further research ☐

Le texte mérite ☐ ne mérite pas ☐ d'être publié.
Il faudrait l'évaluer après une nouvelle rédaction ☐ de plus amples recherches ☐

In view of the actual data and its limitations the paper should be revised omitting implications to practical fisheres management such as ..."might clarify several questions facing fisheries management biologists" (p. 12) "...."biochemical screening of hatchery brood stocks could identify hybrid individuals" ...."screening of wild populations"...."application in the preservation of several species of fish currently classified as endangered" (p. 13).

What the paper actually reveals is that one protein pattern (PGI) consistently differed between all six samples of westslope cutthroat trout and 15 specimens of rainbow trout. Does this difference represent a species specific difference between Salmo clarki and S. gairdneri? Can it characterize westslope cutthroat from other subspecies of cutthroat trout? What is the origin of the 15 rainbow trout used in the experiment? How representative are they of the species Salmo gairdneri?

Even if all these questions could be answered with authority the fact remains that PGI, although useful for distinguishing rainbow trout from westslope cutthroat trout and for the recognition of F1 hybrids, a complete novice could learn to do the same by field observation of phenotypes in a few minutes.

If not already done, the data should be reviewed by Dr. Fred Allendorf, University of Montana, particularly for his comments on the species specificity of PGI, and Dr. Allendorf's comments added to the revised manuscript.

Of greater significance concerning the limitations of utilizing biochemical techniques to identify pure populations of westslope cutthroat trout is the fact that most of the doubtful populations (where hybridization may have occurred but is not obvious) involves hybridization with other subspecies of cutthroat trout. Is there any evidence that all westslope cutthroat trout have a unique protein allowing recognition from all other cutthroat trout?

The protagonist of the paper is the westslope cutthroat trout, but there is not a word explaining anything about the trout under discussion. How is it classified? What is its native distribution? What has happened to it? Why is it of interest?

The introductory statement that ..."Species identification by the use of morphological criteria has proven unsatisfactory in areas where species hybridize", is misleading. For about 40 years, taxonomists have developed various hybrid indices using morphological

---

Please type comments on this or a separate sheet, and return the original and one copy.

Do not hesitate to write on the manuscript itself, but please use only a lead pencil.

Prière de dactylographier les commentaires sur la présente feuille ou sur une page distincte et de retourner l'original ainsi qu'une copie.

Ne pas hésiter à écrire sur le manuscrit même, mais utiliser un crayon au plomb seulement.

Scientific Editing:
(613) 996-1630 or 996-1656
Production: 996-2372

characters and the literature includes hundreds of papers attesting to the efficacy of these characters. A competent taxonomist using morphological criteria could more authoritatively evaluate the degree of hybridization between westslope cutthroat trout and rainbow trout and between westslope cutthroat and other subspecies of cutthroat than is possible with biochemical techniques with the present state of knowledge.

The statement in the introduction, that westslope cutthroat trout and rainbow trout are two morphologically similar species, attributed to Schreck and Behnke, 1971, is in error. Westslope cutthroat trout were not mentioned in the article cited.

The localities of the five wild populations of westslope cutthroat trout used in the study should be given.

Journal of the Fisheries Research Board of Canada
Journal de l'office des recherches sur les pêcheries du Canada

Environment Canada
Fisheries and Marine Service

Environnement Canada
Service des pêches et des sciences de la mer

Your file Votre dossier
Our file Notre dossier J4674

Office of the Editor Bureau du Rédacteur
116 Lisgar, Ottawa K1A 0H3

February 24, 1977

Dr. Robert J. Behnke,
Dept. of Fishery & Wildlife Biology,
Colorado State University,
Fort Collins, Colorado 80523

Dear Bob:

Subject: J4674 -- Reinitz

Many thanks for your review of the manuscript. You and a second referee (Dr. Allendorf) had numerous criticisms of the work, leaving me feeling uneasy about encouraging the author to revise the paper. I left the door open, suggesting that Mr. Reinitz condense his presentation to a Note focusing on the PGI-3 locus, and requesting that he overcome or refute the referees' major objections. I hope this is not a futile exercise in trying to make a silk purse from a sow's ear.

Your kind offer to review papers for the Journal has not gone unnoticed, and we will gladly send you papers from time to time, depending on whether or not we think they will interest you.

I hope our paths will cross again at some AFS meeting, for I'd like to be regaled with tales from Iran.

With kind regards.

Sincerely,

Johanna

Johanna M. Reinhart,
Assistant Editor.

Environment Canada
Environnement Canada

AIR MAIL

Dr. Robert J. Behnke,
Dept. of Fishery & Wildlife Biology,
Colorado State University,
Fort Collins, Colorado 80523

01-2100 (12/74)

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June 13, 1977

Dr. Robert J. Behnke
Department of Biological Sciences
Colorado State University
Fort Collins, Colorado 80521

Dear Dr. Behnke:

Several weeks ago, while compiling information on Tiger Trout; I came upon a transcription of your phone conservation to Salmon Unlimited about the poor choice of introducing Golden Rainbows into Lake Michigan. Further into the copy you mentioned Caspian Sea Salmo Trutta.

When I read of the possibility of obtaining these fish for Lake Michigan at that time, I was amazed that it wasn't followed through. Thus the reason for my writing you.

As you probibly know, Salmon Unlimited is the largest organization of its kind promoting the preservation and upgrading of the Great Lakes; in particular Lake Michigan.

Being on the Board of Directors of Salmon Unlimited as well as being involved with the Great Lakes Sport Fishing Council, not to mention my deep love and respect for Salmo Trutta, I have been selected to research the possibility of aquiring Caspian Sea Brown Trout for Lake Michigan.

As per your phone conservation with Carol Schmidt a couple of years ago, you appeared willing to help obtain these fish for the Great Lakes. The main question of course is, would you still consider this?

Also, we need as much information as possible to study and distribute among the conservation departments bordering our lake.

- continued -

There are five main questions which crop up at all discussions on Caspian Sea Brown Trout.

1. What would be the cost of such an attempt to plant them here?
2. Why would they be good for the Great Lakes?
3. Do they grow larger that Great Lakes Salmo Trutta?
4. What would be the impact of introducing Caspian Sea Browns on the Salmo Trutta already present?
5. Would they survive?

Giving seminars on Salmo Trutta for several years now, I have been attempting to obtain color photos or better still slides of brown trout from around the world and have failed. Is there such a collection in existence if so, could I purchase copies?

When you reply, would you please let me know what your office phone number is as well as the best time to call you.

Thank you for your kind attention. I hope to hear from you as soon as possible.

Respectfully yours,

Jim Kurth, Director
Salmon Unlimited
4325 North Hamlin Avenue
Chicago, Illinois 60618
312-478-8866

JDK:jhk

BOAT - "BROWN TROUTER"

A NONPROFIT CORPORATION

JIM KURTH
AWARDS CHAIRMAN
4325 N. HAMLIN AVE.
CHICAGO, ILL. 60618

312/478-8866

BOAT - "BROWN TROUTER"

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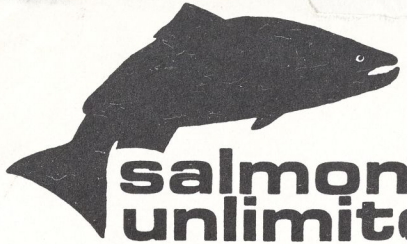
312/478-8866



4608 NORTH ELSTON AVENUE
CHICAGO, ILLINOIS 60630

wants to stock in Caspian trout in Ont. like

Dr. Robert J. Behnke
Department of Biological Sciences
Colorado State University
Fort Collins, Colorado 80521

HB

March 19, 1977

Mr. Robert J. Behnke
Fort Collins

Dear Bob:

Thanks for your letter and accompanying material received yesterday. To answer your question: yes, even to a rank layman such as I your "Special Regulations" paper is completely comprehensible.

The West Denver Chapter of T.U. looks forward to having you as its guest speaker at its Wednesday, April 6 at 7:30 pm meeting. This will be held at the Disabled American Veterans Club, 4901 Marshall, Arvada. Directions: W from I-25 on I-70; turn off at "Harlan St." exit which is, I believe, the next after "Sheridan St." Turn Left on the street paralleling I-70 (only L or R are possible); this is either Marshal St. itself or its continuation beyond the traffic light some 500 metres from your turn then is; after passing the light, continuing straight ahead, the DAV is about 1//3 mile from the signal after about a 30 degree bend to the right.

We expect to have a goodly crowd to be edified by your program. Let us know if you require any special equipment.

Having given directions, I how hasten to offer an alternative. Club president Mahlon Ozmun, a delightful guy, has asked me to extend his invitation to you for dinner at his house prior to the meeting. He lives a scant five minute drive from the D.A.V. hall. Dinner to be a 6:00 pm or as soon thereafter as will suit your convenience. He has also invited me and perhaps one or two others. If you can accept this invitation, I will meet you and lead you to his house, meeting place to be at the next exit past Harlan (I think), "Ward Road." After turning right onto Ward Road I shall be parked as close as seems safe in my white 1972 Dodge Demon (identical to Plymouth Duster), Colorado License Plate #AP-1803. If there are any complications, my 'phone number is 861-1853, and Mahlon's are Res.: 421-3896 and Bus.: 424-5501.

On the subject of invitations, the WDTU Chapter is having its annual cold weather fishing trip on the first weekend in April, and I would like to have you as my guest for this fun and fishing affair. I note that your "Vitae" mentions two children. Such offspring as would enjoy the affair and who you would like to bring along, are included in the invitation. Please let me know on this as early as convenient, as arrangement/accomodations are rather tight.

We will be staying at the Basalt Motel near the confluence of the Roaring Fork and Frying Pan rivers. We will be driving up in several cars late Friday, fishing on Saturday and Sunday, returning late on Sunday, April 3. The evenings will be filled with talk and tales of fish and fishing and other tall stories, a certain amount of imbibing, and probably a poker game if that is your poison. We do hope you can come.

Looking forward to seeing you again, I am

Sincerely,

Koke

Charles Kofoid Winter
370 E. 11th Ave. #105
Denver, CO 80203

COPY:
M. OZMON

To demonstrate that fish preserve will not yield desired results and that Nev. F. & G. management program on E. Walker R. has been characterized by lack of planning and rational thought and by ~~incompetence~~.

– Establish Nev. Fish & G. statements on definition of fish preserve, its objectives and how success or failure of preserve will be determined.

* Must have valid baseline (before) data to detect change in populations and catch as result of preserve – and this they don't have! – creel census, marking and population estimates done in such unsystematic manner that future changes can not be detected with any significance (yet preserve concept developed in 1967). – No wild fish marked –

Statistical basis – expertise?

Premise – From their statement: Wild trout will increase in abundance and move out into open waters, thus increasing catch. – Define increase – 10%, 50%, 100%? – What increase will ~~be judged~~ effectiveness of preserve be judged? – How can increase be detected – with confidence limits – It can't!! {ex. No wild fish marked!}

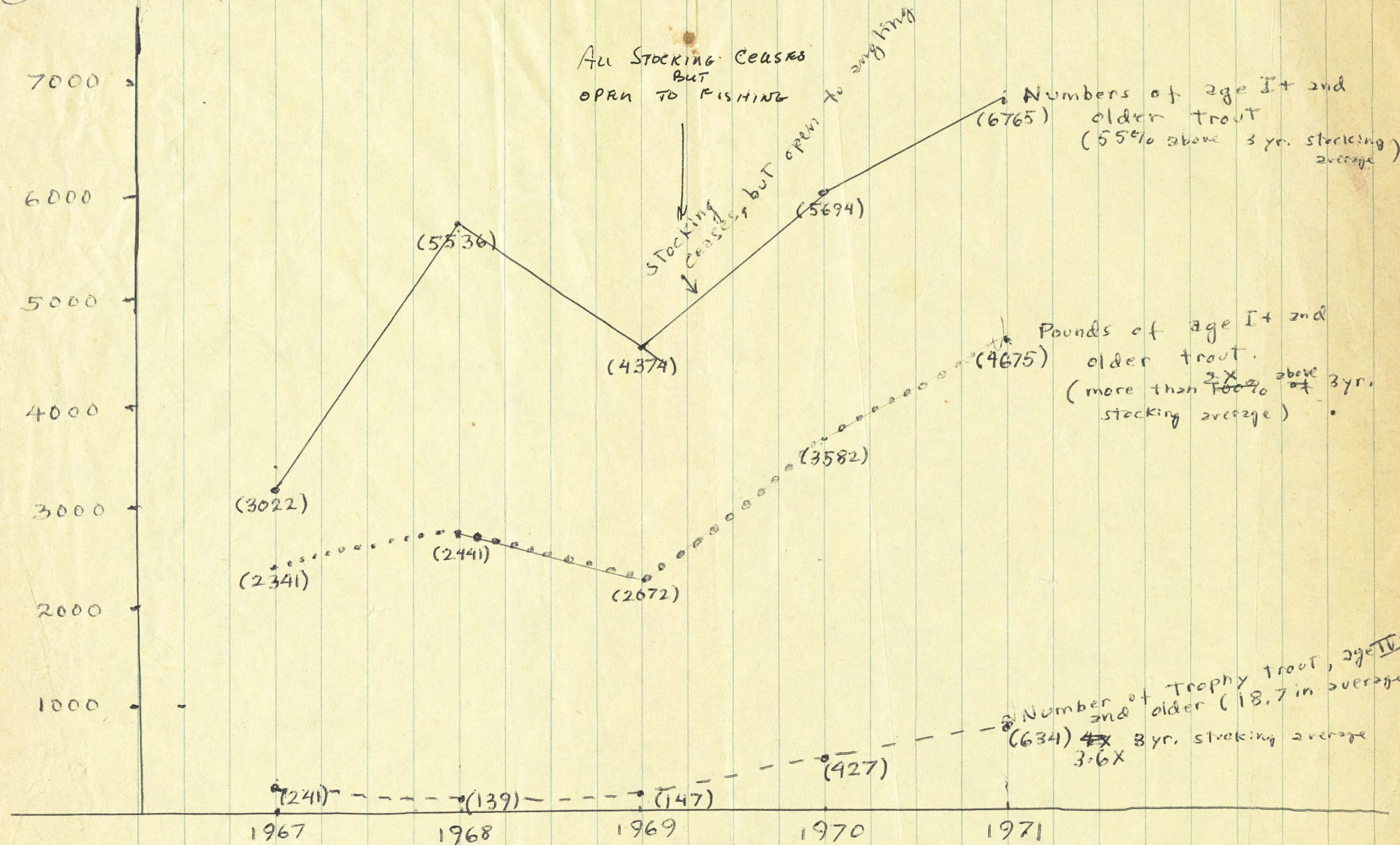
former stress on hatchery fish

– Necessary assumptions they must agree with if preserve will work: (1) In past, angling exploitation (removal of trout by fishermen) has ~~been~~ operated to keep wild brown trout population below carrying capacity on Rosaschi Ranch and elimination of angling will result in increased annual survival, total abundance and biomass to beyond carrying capacity with surplus trout moving out of Ranch into open waters. Do they

3.7 acres/mir. = 20 acres

30-50 lb. standing crop = ~ 800 lbs. on Rand,

prod. 1600 lbs. /yr ÷ 6.
10 lb. / day
- less than one wks prod.
6 days prod.



Fall populations of wild brown trout in 5 mile "Varney" section of Madison R., Mont. ~~8~~,000-10,000 catchable rainbow trout stocked (aprx. 4000 lbs. each year) in 1967, 1968, 1969 (~~aprx.~~ stocking density aprx. ~~200~~ 90 trout and 40 lbs. per acre). No stocking in 1970, 71

Abstracted fm: E.R. Vincent. Effect of stocking catchable trout on wild trout populations. Mont. Dept. Game & Fish. 1974.

340 mil - 12.1 gal.

54749 - Grd. Jct.

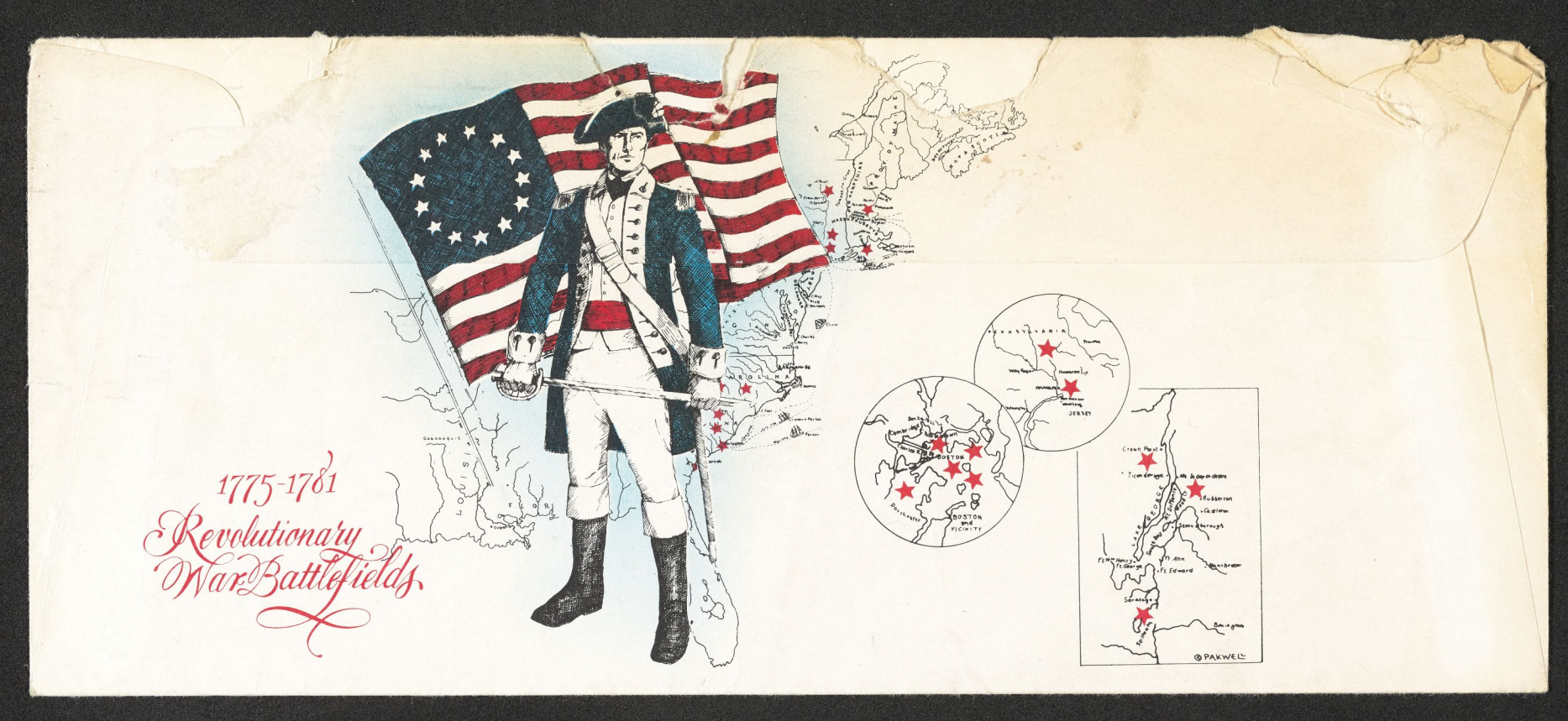
C.K. Winter
370 E 11th #105
DENVER 80203

Mr. Robert J. Behnke
3429 E. Prospect
Ft. Collins, CO 80521

White R,
Dry Pass R, Nat. Bnd.
Rocky Fork Cr
just below Rabbit
-all cutts.
- underground last
few miles -

DENVER, CO 802
PM
20 MAR
3-7

PROCLAIM LIBERTY THROUGHOUT ALL THE LAND
USA 13c


1775-1781
Revolutionary War Battlefields
PENNSYLVANIA
JERSEY
BOSTON
BOSTON and VICINITY
Crown Point
Ticonderoga
Hubbarton
Castleton
Stone Arabia
Ft Ann
Ft Edward
Saratoga
Bennington
LAKE CHAMPLAIN
LAKE GEORGE
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STATE OF CALIFORNIA—RESOURCES AGENCY EDMUND G. BROWN JR., Governor

DEPARTMENT OF FISH AND GAME
1416 NINTH STREET
SACRAMENTO, CALIFORNIA 95814
(916) 445-3531

June 17, 1977

Sr. Carlos Yruretagoyena
Depto. de Biologia.
Unidad de Ciencias Marinas.
Box 453
Ensenada, Baja California
Mexico

Dear Sr. Yruretagoyena:

This is in response to your letter of May 3, 1977 to Mr. Friedrichsen requesting 10 pair of Whitney rainbow trout for use in your fish culture laboratory.

In your letter you state that you are interested in introducing salmonids in new reservoirs within the Benito Juarez National Park, and that you are planning to evaluate trout populations in the streams of the San Pedro Martir Mountains with the objective of increasing their numbers. As I understand your letter, it is your intention to culture the trout we send you for stocking in these waters. If this is true, then I hope to dissuade you from using the Whitney trout, and to pursuade you to use a rainbow trout native to Baja California instead.

The streams of the San Pedro Martir, most notably the Rio Santo Domingo and the Rio San Rafael, contain a unique endemic rainbow trout subspecies which, through centuries of isolation, has adapted to the streams of the Baja California Mountains. This disjunct race of rainbow trout which is sometimes referred to as the Nelson rainbow trout, appears to have a greater tolerance for higher water temperatures and extended periods of drought than our California rainbow trouts. If a less adaptable California trout, such as the Whitney rainbow, were planted in the streams of the San Pedro Martir there is a distinct danger that hybridization between the two forms would occur and the distinctiveness and adaptability of your native rainbow trout would be destroyed.

In addition to being so well adapted to Baja California, the Nelson rainbow is perhaps one of the rarest of North American rainbow trouts. It is also an integral part of Mexico's national heritage. For these reasons, I suggest that you use the Nelson rainbow trout in your fish culture experiments rather than the Whitney rainbow or any other species of salmonid not native to Baja California. If you wish further information regarding the Nelson rainbow trout, Dr. Robert Miller (Museum of Vertebrate Zoology, University of Michigan, Ann Arbor, Michigan 48104),

Dr. Robert Behnke (Colorado State University, Fort Collins, Colorado 80521), or Dr. Carl Hubbs (Scripps Institute of Oceanography, La Jolla, California 92037), would be able to answer your questions about this subspecies. If you decide to use the Nelson rainbow trout in your fish cultural activities, the Department of Fish and Game would be pleased to provide whatever technical assistance you may need. Please feel free to call on Mr. Friedrichsen again at this address. I wish you success in your endeavor.

Sincerely,

COPY ORIGINAL SIGNED BY E. C. FULLERTON

Director

cc: Dr. Robert Rush Miller
Dr. Robert Behnke ✓
Dr. Carl Hubbs
Dr. Jorge Carranza Fraser

Wishing you

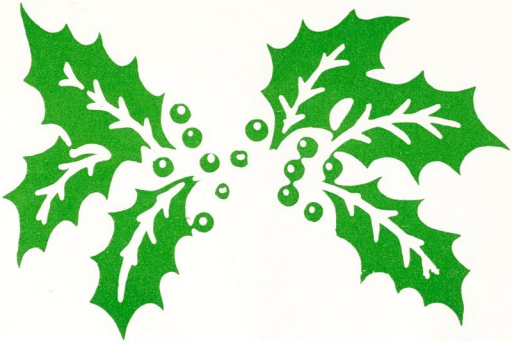
Peace and Happiness

at this Holiday and throughout the year

Sally, Robert and Cynthia Behnke

4351

MADE IN U. S. A.



WARM CHRISTMAS AND NEW YEAR GREETINGS 1977-1978

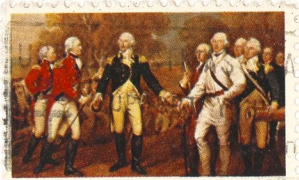
FROM THE HOME OF

LAURA AND CARL HUBBS

This joint portrait
was made by Sea World,
in preparation for the
Dedication of the
Hubbs – Sea World
Research Institute
(named for the two of us)
One of the most gratifying events
of the year for us.

MR. AND MRS. CARL E. HUBBS
2405 Ellentown Road
La Jolla, California 92037

SAN DIEGO, CA
PM
12 DEC
1977


Surrender at Saratoga 1777 by Trumbull
US Bicentennial 13 cents

Dr. Robert J. Behnke,
3429 E. Prospect St.,
Fort Collins, Colo.
80521

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COLLEGE OF AGRICULTURAL AND
ENVIRONMENTAL SCIENCES
AGRICULTURAL EXPERIMENT STATION
DEPARTMENT OF ANIMAL SCIENCE

DAVIS, CALIFORNIA 95616

14 September 1978

Dr. R.J. Behnke
Department of Fishery and Wildlife Biology
Colorado State University
Fort Collins, Colorado 80523

Dr. Behnke:

We won't have to argue any longer about reproductive isolation in Silver King Creek; it is obvious to me that my thinking was in error. The population structure I observed could easily have been generated by random mating. The fish would likely have all been amalgamated into a single population in time, without management agency intervention. I am indebted to you for calling me on this matter, which escaped my thesis committee and three seminar audiences. Your comments will obviously facilitate publication of the results. I hope to get my manuscripts written this fall, directly after completion of the Eagle Lake trout manuscript.

Don Campton brought down your lay monograph on Salmo, but I haven't been able to spend enough time with it to give you a reasonable critique; I hope to be able to do so within the next couple weeks.

I did notice while looking at your monograph that you seem to have a great deal of material at your disposal concerning early federal fish cultural operations. As I am currently writing a short account of the ancestry of California rainbow trout strains, the history of the operations at Bozeman, Montana; Springville, Utah; and Wytheville, Virginia; are of considerable interest to me. All three were stocked ostensibly with McCloud River rainbows, but the account of Dollar and Katz must be to some extent wrong, since the Bozeman hatchery could not have been stocked by direct shipment from Baird, if the hatchery was not established until 1898. So any material you could give me regarding the early days of these hatcheries would be greatly appreciated.

We counted about twenty cells from each of four aquilarum, and are confident that each had 58 chromosomes with an arm number of 104. The karyotype is indistinguishable from Gold's redband and golden karyotypes, and Thorgaard's rainbows. Although this is not exactly simple to interpret, it should safely finish off the rainbow x cutthroat origin hypothesis. Incidentally, did you know

this hypothesis is accepted as truth in the Eagle Lake trout status report being prepared by CDFG? From excerpts of it I have received from region one biologists, including the literature cited section, it appears the authors are not aware that anyone has discussed the origin of aquilarum since Hubbs and Miller.

I can tell you nothing of the life colors of aquilarum; I have not been observing trout long enough to have an appreciation for color variation present in Salmo. But here are the meristic results. The counts were made by our third author, Mike Bannon. We have not yet examined the teeth and would be grateful for any advice you could give us here. The counts are based on 25 specimens, probably domestics reared at Darrah Springs hatchery.

Character/Measurement	mean	variance	range
FL	211.8	237.83	185-249
L series	138.3	54.64	126-153
S above	27.4	1.99	25-31
Rakers	19.2	1.56	17-21
Caeca	55.0	214.13	13-74
L BO rays	10.9	0.33	10-12
Pect	14.3	0.48	13-15
Pelv	10.0	0.08	9-11
Vert	62.0	1.37	58-63
INeurals	13.4	0.33	12-14
IHemals	12.3	0.71	11-14

I present these without comment because I really haven't had time to think about them. I anticipate having the manuscript in complete enough form to send to you within two months. We'll probably submit it to Copeia.

One final thing. We have electrophoretic data on the Sheepheaven fish described by Gold, and they cannot be distinguished from rainbows. I should add that these were among the first fish our lab processed, so data is not available on as many systems as we process now.

Thank you again for your comments.

Sincerely,

Craig Busack

University of California

C. Busack

Dept. of Animal Science

Davis, California 95616

Calif. hatcheries
many sources - sources:
state • fed. US Fish Rep.
Biochem. Rep
CWT ?

Busack d

Eagle L. ms. chromosomes 58
H & M 48
gene lock - typical rainbow
25 spec. but no ss Sheepheaven Cr.
characters -
last. ser 138 10 pelvic rs
white mite(SE) - start
up?
Nicola thesis

calca 43-74 55
vert 58-63-620

Dr. R. J. Behnke
Department Of Fishery and Wildlife Biology
Colorado State University
Fort Collins, Colorado 80523

Send Great Basin section manager

SACRAMENTO, CA 958
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1978

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Thunderbird - Drake St.
226-2600
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Eagle L. trout
Sheephaven trout)

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COLLEGE OF AGRICULTURAL AND
ENVIRONMENTAL SCIENCES
AGRICULTURAL EXPERIMENT STATION
DEPARTMENT OF ANIMAL SCIENCE

DAVIS, CALIFORNIA 95616

July 21, 1978

Dr. R. J. Behnke
Cooperative Fisheries Unit
Colorado State University
Fort Collins, Colorado

Dear Dr. Behnke:

Gary Thorgaard and I are currently using cytological and electrophoretic analysis to research the origins of the Eagle Lake trout. Electrophoretically we are comparing Eagle Lake trout with two populations each of hatchery rainbows and Lahontan cutthroats at 20 gene loci. Cytologically we are making chromosome slides from white cell culture of 12 Eagle Lake trout, and intend to compare our results with published results for rainbows and cutthroats.

The electrophoreticdata has been partially analyzed, and I enclose a very preliminary genetic distance dendrogram. On this diagram the Eagle Lake sample is designated ELT; the other designations will be familiar to you, since those samples were included in the thesis I sent you a couple weeks ago. As you can see, ELT clusters handily with the other rainbow samples. From the actual frequency data the conclusion can be made that Eagle Lake trout are indistinguishable from other rainbow trout. There is no hint of clarki ancestry. It is too early to say anything about the chromosomes yet, but I'll keep you posted.

Since you have studied salmonids so extensively, your present thoughts about the origins of the Eagle Lake trout would be very helpful to us. We would appreciate reprints of any germane articles you have written which are not readily available. The hypothesis you present in your 1972 JFRBC paper is especially intriguing to us; we'd like to know more about it.

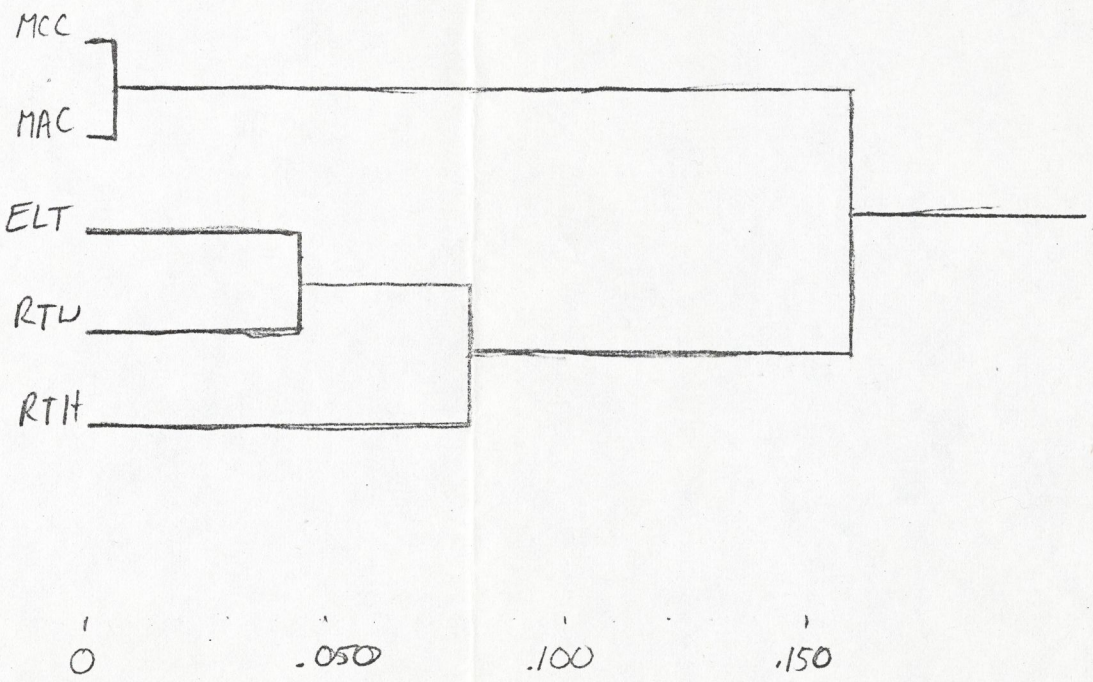
Thank you for your cooperation and your time.

Sincerely,

Craig Busack

Craig Busack

Nei's Standad Geetic Distance



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AFDELING NATUURBEWARING
NATURE CONSERVATION DIVISION

Navrae: Dr. P.F.S. Mulder
Enquiries:

48-

Tel:

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PRIVATE BAG }

PRETORIA,
0001, 2 NOV 1978 19

Department of Fishery and Wildlife Biology
Colarado State University
FORT COLLINS
Colorado
80523

GRASS CARP

Dear dr. Behnke,

Thank you very much for your letter and enclosed literature. This confirms what we have been suspecting for a long time namely that the grass carp has been branded a culprit on an emotional basis only. We have had the species for more than three years and are now going to decide on its future in our province. Your assurance will certainly play a major role in this. I am going to pass on your letter to our expert in this matter and Mr. Brandt will defenitely contact you in the near future for further details. One interesting matter that cropped up in your letter was the use of the species in canals. What was the speed of flow in the canals. We have the same problem with canals flowing at 0,5 metres per second. Please give my regards to prof. Swanson whom it was a great pleasure to meet and talk to.

Your sincerely

For: DIRECTOR OF NATURE CONSERVATION

PFSM/BH
1978-11-02

Department of Fishery and Wildlife Biology

Colorado State University
Fort Collins, Colorado
80523

2 October 1978

Dr. Pieter Mulder
Nature Conservation Division
Transvaal Provincial Administration
Pretoria, South Africa 0001

Dear Dr. Mulder:

Enclosed is the article mentioned by Dr. Swanson in the Arkansas Game and Fish magazine, spring, 1978, issue, re. grass carp.

Concerning further references on grass carp, there is an abundance of literature, most highly laudatory on the efficacy of this species for vegetation control.

A symposium on grass carp was held at the University of Florida in December, 1977. The symposium has not yet been published, but most of the participants also published papers in the Transactions of the American Fisheries Society, 1978, 107(1). About one half of this issue of the Transactions is devoted to papers on grass carp. It is the most up-to-date compendium available on the subject.

The Russians have been propagating and stocking grass carp for many years. Several papers have been published in the Russian journal Voprosy Iktiologii (Translated into English as Journal of Ichthyology). A 1976 paper in this journal by D. S. Aliyev (vol. 16 no. 2) claimed total yield from a reservoir was increased by two to four fold by the addition of three Far Eastern cyprinid species (grass carp, bighead, and silver carp) with no negative impact on the native fishes--in fact the production and growth of common carp was greatly increased.

I have had personal experience with grass carp while in Iran in 1974. Grass carp were stocked into two sections of the irrigation canals of the Dez Irrigation Project. We calculated the accumulation of biomass put on by the fish populations in the experimental sections during a six month period and estimated the production of vegetation during this period (sampling m^2 plots at weekly intervals). There is no doubt that the grass carp controlled the vegetation because the two sections with grass carp did not require manual chaining at any time; the other canals required chaining every two weeks from May to October. However, our calculations indicated that if all of the vegetation actually controlled by the grass carp was eaten, they would have had to consume about 1000 lbs. of vegetation per lb. of weight gain. What happened was that in flowing water, most of the plant was carried away in the current after the grass carp nibbled off the stem. This "wasteful" feeding allowed a modest biomass of grass carp to control enormous

vegetative production. They also selectively fed on the worst problem species because these species have softer parts. Each situation is likely to be different in the vegetative composition and the results of the Dez canals might not be duplicated in southern Africa. The grass carp have produced excellent control of vegetation all over the world, even as far north as Sweden.

An additional benefit derived from grass carp is the fact that they convert vegetation into just about the finest eating fish flesh I have ever tasted--they are truly a fine table fish.

Grass carp have been introduced into most parts of the world for many years and there are virtually no negative reports. They do not compete well with native fishes for food supplies except for macrophyte vegetation. Their precise spawning requirements makes natural reproduction unlikely.

Sincerely,

Robert Behnke

cc: Dr. Gustav Swanson

RB:kle

Encl.

Dear Dr. Behnke -

SALAM! Hope all is well with you and your family. I guess Mohammad has kept you all up to date about the Department. Things are not as pleasant any more. The only thing which keeps us going is the opportunity of getting out of the Department and Tehran for some fresh air!

Mohammad and I always talk about you and the fond memories that we both have from the States, although sometime it is hard. Really, it all sounds like a dream. Guess I better close. Please say hello to Mr. Behnke, Sintia, Dicky.

Sincerely Yours - Assad

- Appointment copy thanks
- Samad supplies for garden
- Barry

Dear Dr Behnke

It is almost three monthes which I was going to write you, but alwayes I was waiting to have the department final decision about me. First they didnot accepted my request for Transforming to Hamedan Unv. and finally after two months argument they increase my sallary up to 5000, Tomans per month, this is less than half The sallary which ussualy the universities pay to M.S. degree. but there is a hop for working here, they accepted with my projects on fish Taxonomy, even though they dont know what it means? they wanted a book whit color Picture and hard cover only to show off, It seams Jamshid wants his name on book some how. So I don't know how I can get together with these guys, I will try my best. We (Abzian group) started to work and since after Noruz we have bee on fild most the Time. We Surveyed the Neur lake, steel there are som fish left (about 10000-12000), and there are some evidence of vegetation on the lake Something which is very intresting is that, the vegetations are growing on the deepest part in the lake, and there is no sign of vegetation on shore till one meter deepth. and the amphipod population also is about 1/16 of last year, we're going to survey one or two Times more this year and I will wirte you the results.

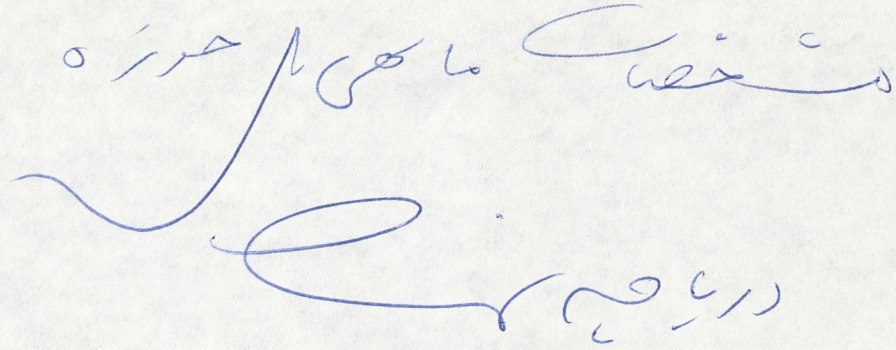
About my thesis, if you think we can started to published, Part by Part or all together, I will sent you the rest of information which we wanted for those question that came out.

Rcvd. 15

I will write you more, Give my best regards to your family

Mohamad

13-Jun-78



M. Saadati
P.O Box 1430
Department of Environment
Tehran IRAN

سفارشی

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308

Dr. R. Behnke
Dept. of Fish and wildlife CSU
Fort Collins, Co. 80523

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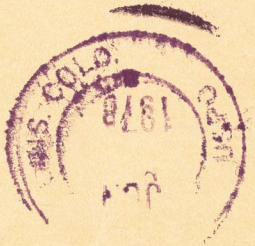
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1978
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24445 13th Ave So
Huntington Park
Kent 98031
July 15-1978

Dr. Robert J. Behnke
Dept of Fish and Wildlife Biology
Colorado State University
Fort Collins Colo. 80523

Dear Bob:

Your warm and welcome letter of July 4 was a pleasant surprise to me. I am glad you have a good sense of humor and are concerned enough to take the time to "put me straight" on the way things are. I learn the truth about things by bursting out with whatever is on my mind. It is often the hard way and sometimes lethal!

We still spend our winters in Trailer Village in Mesa AZ. This spring we enjoyed meeting old friends at the national wildlife conference in Phoenix - which I attended with my neighbor Larry Riordon - ret. former exec. of Colorado Fish and Game Dept. In April we stopped on our way north at Clear Lake CA to renew old acquaintances at the annual Pacific Fishery Biologists gathering. When the temp. gets up to 90 or 95 in Mesa I want out and am glad to return to the Pac N.W. until it cools down to 90 or 95 in Oct. when we go south "with the wild geese" I would have enjoyed a reunion with you and Jim Morrow - especially in view of your recent contributions to Balon's Monograph on Charrs. We could have stirred up a good (and much needed by me) exchange of ideas.

Yes, I was pleased that Eugene K. would adopt my preferred spelling of "charr" in what I believe is the first book ever written exclusively on charrs. It culminates 20 years of wasted energy of mine on such a trivial matter! Now if I can just get the wheels moving to rid our future fisheries literature of the ridiculous and meaningless name of Dolly Varden for our Pacific brook charr, S. malma, I'll feel that I have righted another wrong!

That brings up a point I have wanted to write to you about for some time. I have prepared a rough draft of a MS for The Salmon Trout Steelheader Mag on "Goodbye, Dolly!" However, I can't for the life of me locate the reference to Livingston Stone's original story of how this fish was really named for a post civil-war beer-hall singer who wore green dresses with big red polka dots.

I recall you once told me you had read the same thing. I went thru all the Fish Commission Annual Reports from 1870 to 1890 "with a fine-toothed comb" at the U of Wash Fisheries Library last week, but couldn't find it! If you have the reference I'd be happy to give you credit for it. Copeia & Trans AFS have turned down all my papers dealing with common names - so I turned to inventing for popular consumption. After all the general fishing public is the real body of readers most concerned with doing anything about common names!

I know very well what you mean about having only a week or two to make any revisions of that excellent and comprehensive paper of yours. - If I said it put me to sleep - it was because I am so damned lazy mentally that I have to read things like that several times to really comprehend. I'm glad there will be such a fine summary of all angles of charr taxonomy - and you are about the only one I know of who could do it. Frank Amato (Ed of STS) changed the title of my last effort from "Let's call a salmon a salmon, a trout a trout, and a charr a charr" to "How Pacific Coast Fishes got their Names"! - but in preparing that MS I cut my original MS from 25 to 10 pp by making up the chart I presented (Every editor screams about extra pagination and I was surprised he'd publish a chart or table in his sport-fishing magazine!) I'll try to enclose a set of my recent (reprints) efforts along this line - for your library.

Chereshnev's letter of June 4 with packet of reprints (same as he sent you) finally caught up with me last week. Do you have any means of getting translations made? I plan to call Eugene Maltzeff or Paul Macy to do so - or learn if Bed. Bd of Can has done them. His letter was a high-light of my charr career as he is the first scientist I know of that recognizes the importance of my accidental discovery on July 4, 1939. I was deeply hurt when Don McPhail never mentioned either his alpinus complex paper - and more so when Scott and Crossman (1973) gave Don full credit for just setting up the possible differences in malma + alpinus meristics! This Russian apparently reviewed all of the literature (as they usually do!) I have specimens of namaycush from L. Mich. and malma + alpinus from Karluk and Nerka (Wood R sys) Lakes he can have if we can get the proper export + import papers for an exchange from our respective F + W S enforcement boys. My mental identification of malma + alpinus was immediate from the photo he sent - even before reading the inscriptions on the back.

I was surprised to learn that you are in a semi-retired status, and that your charr studies - like mine - are really a hobby! Perhaps I should bring you

up to date on my physical status. About a year ago I developed a painful swelling of right testicle with a large hernia popping out above it. I wore a belt to "keep it in" until October when prostate trouble indicated surgery. We had just sold our home in Portland after 20 yrs in a beautiful 1-acre wood lot in west hills overlooking the city! We had rented it out almost every winter for a decade; the city was creeping in on us, wildlife getting less and less, with taxes higher & higher! I sold my Copeias - Trans AFS & Jour Fish Res Bd & other periodicals for almost $500 besides giving truckloads of stuff to Ore. State Com. & O. S. U. As Art Welander, curator of U. W. Fisheries Museum offered me space to work as a special student if I would donate my chaen collection to the University, we decided to move back to Seattle. I carted 2 U-haul loads of crocks & jars of chars up to the museum - where which I just finished "repotting" and cataloguing the Univ. collection the end of June. My material more than doubled theirs - so I have had a ball!

I begged to have my ureno-genital surgery put off so I could recuperate in the everlasting sunshine of Mesa (somehow the coldest - wettest winter in history the year!) Had 3 operations in Jan & Feb - the ultimate result of which proved that I was a walking museum of malignant tissue! Naturally it shook us up a bit! I did not have to submit to chemotherapy - they are holding it in abeyance with female hormones - estrogen and "taxe". Except for 1 week I have felt fit and fine. I now realize I have to work fast if I am going to finish my final "chaen paper" or papers. So between enjoying the freedoms of retirement and financial independence (at long last) I am now trying real hard to do my writing regularly - and am not doing too well at it!!

I wrote a short note to Ted Cavender last month asking for a reprint of his M.S. on S. confluentus in Calif & Nfor July — no word + it has not arrived at Univ Library yet. - I enjoyed his summary of a hell of a lot of osteological, morphometric meristic studies including Thymallus, Stenodus Hucho & Brachymystax, altho (except for his confluentus) I all just muddied up all my mental concepts of the possible natural relationships of chars more than ever. I have always known somebody would one day separate these inland "Dolly" from the coastal forms - but how? and why not S. spectabilis Girard instead of Sudsley's confluentus?

As you probably suspect, my final chaen paper will be largely influenced by my life-long "naturalist" background as an ardent ornithologist - and the anthropomorphic tendencies of my native American ancestors - and many many summers teaching young people to appreciate and to learn to love our natural heritage as a camp naturalist. I'm trying to offer an explanation of why the genus Salvelinus (like coregonus + maybe Salmo) has brought on more such headaches to systemists than any group I know of —

I also hesitate to clutter the salvelinid literature further with even more vagueries - but I believe my concept offers a "new approach" as McPhail and Wyman have put it - maybe it will work - maybe it will not - but I must try!

In contrast to Cavendar's + Marrow's and your examination of hundreds of museum specimens, my concepts are based on looking at thousands of live salmonids in America as well as surveying a few thousand salmon streams and about a hundred lakes and reservoirs in America and Alaska and only comparatively a few preserved specimens. I'll try to enclose a rough outline of how I'd like to do this. The title I've always wanted to use was "A Boy's Book of Salmon". One of my contemporary's sons once asked me to recommend a book on salmon for his edification - and with the thousands of papers on the subject I could not find him one book on just salmon!!! But how do I find a publisher?

Well - I guess this epistle will be my writing for today - but it should be one of my best for a friend I have watched develop from a young man so intensely interested in "trout" he would make it his life work — under the capable early guidance of our mutual old friend + teacher - the late Paul R Needham. In a lot of ways - he was a mess - like you and me - but when sober and with "nose to the grindstone" he was a real doer and inspirational guide + leader! Where can I find a good biographical sketch of him for my "Pacific Fishery Biologists I have known"

Keep your chin up and keep plugging - and keep me informed of what's cooking in our world of salmons, trouts, and charrs - and thanks so much for your patient understanding in our past discussions! Will you ever be coming out this way again - let me know

Sincerely yours

Mark Morton

DEPARTMENT OF ZOOLOGY

(406) 243-5122

University of Montana
Missoula, Montana 59812

June 26, 1978

Dr. Robert Behnke
Department of Zoology
Colorado State University
Fort Collins, Colorado 80523

Dear Bob,

I hope you find the time to come to Glacier this summer. I think we could have some interesting discussions, to say the least. I agree with your general reservations of biochemical methods in taxonomy. BUT, I strongly disagree with your presentation in the report you sent me. I think we both have much to gain by sitting down together and discussing the problems involved.

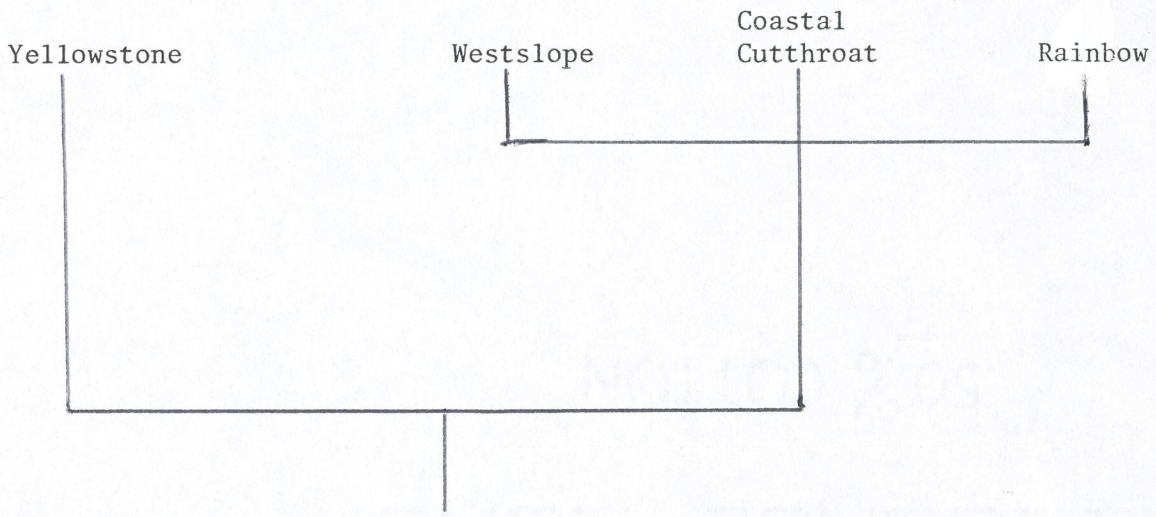
I would like to comment on your discussion beginning at the bottom of page 6:

(1) I disagree with your statement that selectively neutral genetic changes are not useful in taxonomy. I would argue that they are generally more useful than changes strongly influenced by natural selection. Selection can either bring about dramatic phenotypic changes in short periods of time (e.g., albino vs. normal colored trout) or maintain phenotypic similarity over tremendous periods of evolutionary time (e.g., Jim Shaklee's bonefish findings). In either case, selection can obscure the actual evolutionary/phylogenetic relationships among organisms. On the other hand, the constant rate of change observed with biochemical techniques allows reliable estimates of the time of evolutionary divergence between two taxa.

(2) Heterozygosity can be used to detect inbreeding and, therefore, to estimate the amount of genetic variation in a particular population (or species). The golden trout does not have the highest heterozygosity of all trout. The Gall and Gold work (which I assume was your basis) was extremely bias towards including only polymorphic loci. Golden trout have much less genetic variation estimated via electrophoresis than almost all rainbow trout stocks and also coastal cutthroat stocks. I agree heterozygosity is no magic number; however, the judicious use of heterozygosity estimates is potentially extremely valuable.

(3) The genetic distance between man and chimp has been estimated to be 0.62 (King and Wilson, 1975). This indicates they are distinct at approximately 50% of all electrophoretically detected loci. Genetic distances among subspecies of house mice is approximately 0.20 (Nei, 1975, p.184).

We have finished our comparisons of rainbow trout, coastal cutthroat trout, westslope cutthroat trout, and yellowstone trout on the basis of some 50 loci. The yellowstone cutthroat is very distinct; it is fixed for different alleles at approximately 8 loci in comparison to each of the other three. The rainbow, coastal cutthroat, and westslope cutthroat trouts are all similar to each other and equidistant from the yellowstone (see dendrogram).



Thus, it appears that the coastal and westslope cutthroat share a more recent common ancestor with the rainbow trout than with the yellowstone cutthroat. I certainly am anxious to get your opinion of the implications of these results. I feel that the present subspecies of cutthroat trout are grouped together on the basis of certain morphologic similarities which do not accurately reflect phylogenetic relationships.

I hope we can get together this summer to discuss this problem. I am leaving the first of August for the International Congress of Genetics in the USSR. I will be free any time before then to cooperate on the Glacier sampling and to discuss things in general.

I am delighted to hear you are interested in cooperating on the brown trout work. We will get you the samples as quickly as possible.

I am looking forward to seeing you this summer.

Best regards,

Fred

FRED ALLENDORF
Assistant Professor
of Zoology

FA/pjf

Fred Allendorf
Dept. of Zoology

University of Montana
Missoula, Montana 59812

MISSOULA MONT JUN 26 '78 U.S. POSTAGE .15 PB 033H21

forwd to:

Dr. Robert Behnke
~~Department of Zoology~~ Fisheries & Wildlife Biol.
~~Colorado State University~~ 427 Anat/Zool -
~~Fort Collins, Colorado~~ 80523

ANGLER

The Newsletter of the Colorado-Wyoming Chapter of the

AMERICAN FISHERIES SOCIETY

October 1978

THE VENT (President's Box)

As some members may know, the University of Wyoming Chapter has recently received its Charter. As might be expected, most members are students and, if the first meeting is an indication, the UW Chapter is going to be very active. They have a number of suggestions for the Aquatic Issues Committee of the Colorado-Wyoming Chapter and will be preparing a position statement relative to energy-related issues. Our March meeting will be a joint affair with the UW Chapter with those folks responsible for the set-up of the steak fry facilities on the 7th of March.

Since the last ANGLER, the Chapter has received additional impact statements for review. Again, these concern development of coal in Wyoming. We will be receiving the final impact statement for the Sandy Grazing allotment shortly. The business of impact statement review is certainly evolving into a very large order for the Chapter. To date the review has been handled by the Executive Committee and the Aquatic Issues Committee.

The Chapter also recently received input from the American Wilderness Alliance (Denver, Colorado) requesting information on the Huston Park Area of the Medicine Bow National Forest. Again the concern is for the Colorado cutthroat and, on a larger scale, the wilderness area proposals. I forwarded information concerning the Huston Park area and the resolution and position statement that the Chapter drafted relative to the issues. The Wilderness Alliance is considering "administrative appeal" against the Forest Service regarding the area.

During a conversation with a San Francisco-based official of Chevron Oil, information concerning developments along the over-thrust belt in western Wyoming surfaced. Apparently, there is great interest in oil deposits in the over-thrust belt. Significantly, the area is all mountainous, and great care will need to be exercised if the oil reserves are to be developed with as little harm to fisheries as possible. The primary purpose of the call was to obtain information relative to squawfish near Grand Junction. The gentleman was referred to other Chapter members working in that area.

Dr. Ray White (Guidelines for management of trout stream habitat in Wisconsin) recently spent 10 days in the Rocky Mountain area becoming acquainted with problems and needs for stream management. Ray was able to visit with several Chapter members during the sojourn and was able to view projects through about 3/4 of Wyoming.

Accompanying this newsletter is a call for papers for the annual meeting. John Baughman is working toward a very good program and I hope that we can get a good number of papers from people in the Chapter. I wish to particularly encourage fish culturists to prepare presentations, as John is planning a special session just to address those interests.

Development of the Chapter Operational Handbook has been slow but is progressing. The material should be available for membership approval at the annual meeting.

- Bob Wiley
President

Calls for Papers

The 1979 annual meeting of the Colorado-Wyoming Chapter of the American Fisheries Society will be held March 7 and 8 on the University of Wyoming campus in Laramie. We are anticipating a full agenda again this year, so those making presentations are encouraged to submit titles and abstracts as soon as possible. Persons wishing to contribute papers or posters should contact:

John Baughman
3535 CY Avenue
Casper, WY 82601
(307) 234-9185

OR

Bill McConnell
Coop Units Building, Room 107
Colorado State University
Fort Collins, CO 80523
(303) 491-1101

OR

Don Peterson
Wigwam Rearing Station
Tensleep, WY 82442
(307) 366-2217

The 1979 Annual Meeting (109th) of the American Fisheries Society will be held at West Yellowstone, Montana, on September 12-15, 1979. As in most previous years, this meeting will be held in cooperation with, and overlapping, the annual meeting of the International Association of Fish and Wildlife Agencies. Technical paper sessions will be emphasized, but proposals for symposia, modules, debates, and poster sessions to be convened by individuals or groups will be accepted until January 15.

The deadline for submission of formal abstracts to be considered for contributed paper sessions is March 15. Abstracts should be double spaced on plain paper and limited to a maximum of 250 words. They should include the reason for doing the study, the objectives, and the principal results and conclusions. Each abstract should carry a title and the full name and address of each author. Indicate if any of the authors is a student, and what visual aids will be needed. Authors will be notified of the status of their submission by late May.

All proposals, abstracts, and queries should be sent to:

Dr. Dean E. Arnold
AFS Program Chairman 1979
328 Mueller Laboratory
University Park, PA 16802

Those submitting abstracts should be aware that visual aids will be held to a high standard and are subject to approval by the Program Committee in advance. They would like to minimize problems by minimizing the use of aids other than 2 x 2 slides. With a little extra time, almost any material can be placed on a 2 x 2 slide. Authors of accepted papers will receive detailed information on presentation requirements.

News From CDW and WGF

Kerry Connell forwarded the following items from Mike Snigg and Allen Binns:

Mike Snigg reports that the major limiting factor for trout in the Green River below Fontanelle Reservoir is lack of cover. In an attempt to provide cover and increase the trout population, granite boulders will be placed in a half-mile section approximately 5 miles below the dam. The rocks range in size from 2 to 5 feet in diameter and will be placed in the river in early October through use of a large front-end loader. Sedimentary rock placement occurred farther downstream in 1976. This rock has exhibited severe fracturing on exposure to the elements but is holding up well when completely submerged. Electrofishing is currently being conducted in the existing and proposed rock sections in an effort to determine utilization of the structures by trout.

Allen Binns reports that, as part of a contract between the Wyoming Game and Fish Department and the U.S. Fish and Wildlife Service Instream Flow Group, the Aquatic Habitat Crew spent considerable time this past summer obtaining various habitat measurements on the Green, Encampment, Sweetwater and Belle Fourche rivers. Items measured included water velocity, water depth, stream substrate and channel configuration. These data will be plugged into the Incremental Analysis method being developed by the Ft. Collins-based Instream Flow Group. Hopefully, computerized approaches such as this will give fishery personnel a better weapon to combat future water development projects that threaten to destroy or degrade fluvial fish habitat. With the Pinedale Fish Management Crew, the Habitat Crew continued to evaluate trout habitat in the Thomas Fork Bear River drainage. For those of you who missed Terry Hickman's presentation at the last meeting, drainage is one of the few remaining strongholds of the rare Bonneville cutthroat trout (Salmo clarki utah). The Thomas

Fork drainage offers classic examples of the impact from long-term livestock overgrazing, irresponsible herbicide use and oil-gas exploration. Habitat Quality Index measurements were obtained to document and quantify habitat conditions in this drainage, especially with a view towards future habitat improvement work. For example, on Huff Creek, the HQI method predicted that a reasonable amount of habitat improvement work could raise the stream from its present low habitat value (1.6 trout Habitat Units) to 72 trout HU, a sizeable increase that might prove critical to the continued survival of this fish. As Wyoming personnel gear up for another legislative session and another run at legislative protection from stream channelization and alteration, fluvial habitat continues to be lost from these activities. One interesting (?) attitude was encountered recently that expresses opinions still held by many people. When asked about an extensive stream alteration project downstream from his land on the Little Snake River, one rancher said: "Man, that fellow is a hell of a cat operator, I am going to see if I can get him up here on my place." Cheers, and tears!

Colorado is initiating some new studies which Clee Sealing thought might be of interest, particularly to those of you in Wyoming. New CDW research includes a Fryingpan River catch and release evaluation, evaluation of sport fisheries potential in fluctuating streams, and rainbow trout spawning run investigations in Colorado waters. Details can be had by writing to Clee or the editor of the ANGLER. Mary McAfee submitted a report on a random stratified creel census done during the summer of 1978 to estimate fisherman use and harvest from three lakes in the Indian Peaks area of Colorado. The lakes were Brainard Lake (10 surface acres), Lefthand Park Reservoir (100 surface acres), and Red Rock Lake (5 surface acres). These lakes received heavy fishing during the three summer months. Use was about 1600 hrs/acre on Brainard Lake, 300 hrs/acre on Lefthand Park Reservoir and 900 hrs/acre on Red Rock Lake. About 82% of the total harvest from the three lakes was supplied by this year's plants of creel-size fish. Returns varied by plant and by lake but averaged 80% in Lefthand Park and 66% in Brainard and Red Rock.

News From the U's

Congratulations to the New University of Wyoming Chapter of AFS (see Bob's comments above). At its 10 October meeting, the UW Chapter established an award in memory of Mike Yakimovich (a recent M.S. graduate) to be given annually to the outstanding fisheries senior in the Zoology Department. Those interested in contributing are urged to contact Harold Bergman in the Department of Zoology at the University of Wyoming.

The CSU Chapter has held two meetings this fall and has established publicity, special programs, and education committees. Officers for 1978-79 are:

President:	Dave Wegner	(303) 226-0568	305 Aylesworth
Vice President:	Brad Caldwell	484-4206	318 Aylesworth
Treasurer:	Bob Stuber	493-5671	Coop Bldg.
Program Director:	Bill Andre	493-6395	
Secretary:	Marty Hayden	484-9895	
Faculty Rep:	Leo Lentsch	667-4402	
Govern. Bd. Rep:	Dave Jensen	482-8874	Coop Bldg.
Faculty Advisor:	Steve Flickinger		307 Ayelsworth

Clare Carlson and Darrel Snyder are in the process of establishing a laboratory for identification and study of larval fishes in CSU's College of Forestry and Natural Resources. Anyone needing help with little fish or with specimens to donate or exchange is urged to contact them.

Other News

Tom Jackson has informed us of a 2-day course on methods for identification and control of aquatic weeds being offered by the U.S. Fish and Wildlife Service. The course will be held November 28 and 29 in Denver. If you are interested, please write or call:

Tom Jackson
U.S. Fish and Wildlife Service
CNFRL Field Research Lab
Box 25007, Denver Federal Center
Denver, CO 80225
CODE 1522B
Tel. 303-234-5845 or 3603
FTS: 234-5845 or 3603

Thanks, Again, to Contributors

Another ANGLER will be sent to you in early February with final information on our annual meeting. Any other news you'd like to share should reach us by mid-January. Any comments you have on the ANGLER would also be appreciated.

Editor, "The Angler"
301 Aylesworth Hall
Dept. Fishery & Wildlife Biology
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Fort Collins, CO 80523

Robert Behnke
Fishery & Wildlife Biology
Colorado State University
Fort Collins, CO 80523

Box 40
4

16 January 1979

Dr. Robert Behnke
Department of Fishery and Wildlife Biology
Colorado State University
Fort Collins, CO. 80523

Dear Dr. Behnke,

During the summers of 1973 and 1974, John Clark and I conducted field research on sympatric strains of cutthroat trout in Montana, under a grant from you. I have been in contact with John and he informs me that he has not published our findings as of yet. Therefore, I am planning to present them at the 55th Annual Meeting of the Colorado-Wyoming Academy of Science on 25-28 April 1979. John has sent me the slides we took to use in my presentation. I do not have slides of either Westslope or Yellowstone cutthroat trout, and John suggested that you might have slides of them. I would greatly appreciate it if I may borrow or duplicate a slide of each for use in my presentation.

Thank you for your cooperation.

Sincerely,

Jim Dingman

James Dingman
Dept. of Biol.Sci.
Univ. of Denver
Denver, CO 80208

Colorado State University
Fort Collins, Colorado
80523

Department of Fishery and Wildlife Biology

12

23 April 1979

Dr. Brian Coad
National Museum of Canada
Ichthyology Section
Ottawa, Ontario
CANADA K1A 0M8

Dear Brian:

I was glad to hear that you returned safe and sound from Iran.

I am sure that an interlibrary loan of Saadati's thesis can be arranged between the museum library and C.S.U. library. I have only one copy, but if you can not obtain the original under interlibrary loan, I can have a xerox copy made for about ¢5 per page

After Saadati returned in January, 1978, I had some correspondence with the Conservation Department's museum director. Funds were to be budgeted to have Saadati's thesis published as a book. Last summer Saadati changed jobs, moving to Hammadan University. I haven't heard from him since and I worry about his present fate. He was violently anti Shah but also anti Islam.

Thus, I have done nothing with the Iranian fish data except to send excerpts to meet requests, such as a description of the new cichlid to the British Museum. I doubt the MMTT will ever do anything on Iranian fishes unless they hire Saadati or bring in another foreigner, which appears doubtful in the forseeable future.

It is likely that our collections would complement each other for publications. You can outline what publications you plan (list of species, collecting sites, drainage basins, etc.) and send it to me. I'll see if I could add significantly to the work. If so, we could coauthor.

I would like to see a copy of your paper on conservation of Iranian freshwater fishes. I do not have copies of any departmental reports, but am familair with most of the activities of stocking nonnative fishes (a fatheat minnow population still persists in a reservoir southeast of Tehran from a stocking of largemouth bass and bluegills [which all perished, evidently by winterkill]).

No name was proposed for the new cichlid. I have collections of fishes from Saudi Arabia and I thought this cichlid might turn up there, but it didn't. We do have Cyprinion (three undescribed species), Barbus and Garra in the Arabian collections.

Sincerely,

Robert Behnke

Apr. 27, 1979

Dear Bob,

I have been meaning to send you a reprint of the paper for a long time, but was reminded today by a phone call I had from Gary Thorgaard at Davis. He is doing some comparative chromosome work on rainbow trout and is interested in the Pauma Creek trout. I have only been up there one in the last several years so couldut give him much up to date information, but maybe we can get some samples for him to work on.

He didnt mention how he had gotten in touch with me, but he said that the Pauma crk. trout were mentioned in a publication (book?) of yours which he has read. Is that the manuscript you mentioned to me last year? If so is it available for sale? I would like to obtain a copy.

Have you had the chance to read the two volume TROUT by Ernie Schweibert and the curious taxonomy he has for the Western black Spotted trout? He has an article in the current issue of Fly Fisherman, Vol 10, No 5 on the Cutthroats and he has updated the taxonomy over what he had in the book.

Sincerely,

John Hewitson

John Hewitson
1033 San Abella Dr.
Encinitas, CA. 92024

SAN DIEGO, CA 921
PM
28 APR
1979

Reprint C.F.G.
rainbows in New Zealand

Dr. Robert Behnke
Dept. of Fishery and Wildlife Biology
Colorado State University
Fort Collins, Colo. 80523


11
FEB

June 23 1979

Dear Bob,

Many thanks for sending me the rest of the ms. and especially for the very helpful letter. For a long time I have been contented to accept our system as it is with little fretting about certain inconsistencies but your several papers began to cause my thought processes to rev up a little and then the Monograph really warmed things up again to the point that frustration set in. I think I misinterpreted some things to the degree that I imagined that I should clearly see the distinct species groupings that you were really only suggesting. I have been at your manuscript several times and in fact you suggest the doubtful aspects of the problem in several ways and places. Your letter to me really helped though, because it was condensed into a few paragraphs. From my position, that one area regarding the taxonomy of the Rainbow TROUTS was the only difficult place and your letter clears up my confusion. There probably is a further difficulty when considering trout from the standpoint of a biologist or as simply an observant angler. I like to think I combine the two views or at least I mean to.

If the monograph were to be a formal publication and you were not attempting a major taxonomic revision I am interested in knowing how you would consider forms as diverse as typical coastal rainbows and the interior rainbows? I was going to suggest the Golden trout, but the literature seems to have rejected Salmo gairdnerii aguabonita in favor of Salmo aguabonita. I assume that until more definitive evidence is at hand we will accept the rainbows that are obviously different as different species and those less so as subspecies. It is a little arbitrary but understandable. I suspect that we really want to understand each other so that confusion is reduced when we communicate. I am pleased to have some contacts who can keep me in touch with this particular aspect of the problem because I suspect you are going to find some more definitive things about the Rainbow TROUTS over the next few years.

Now to some more immediate things. Last Tues. June 19 I went with Gary Thorgaard some Cal Fish and Game people, Forest service people and some people to fish down into the West Fork of San Luis Rey river. I wont go into the details except that they laid on quite a Safari with a total of 10 people. I didn't fish because I suspected that the 5 who were planning to do that would be more than enough, but I was surprised by several things not the least of which was the long trip into this rugged piece of water. The other thing that surprised me was that there were many fish of relatively large size compared to Pauma Creek. The fish were mostly 8" to 10" and very easy to take. The stream starts on the back (Eastern side) of Mt Palomar only about

7 miles from Pauma creek on the West. The actual head waters of the two streams would be separated by less than a mile somewhere close to the top of the mountain. The distance across my circle would be roughly 11 miles and includes what could loosly be called Mt. Palomar and includes chaparral, a transition and spruce fir near the top. It is predominantly chaparral on all exposed slopes

and very rugged. The upper reaches of the San Luis Rey W. Fork flow through open valleys of Southern Oak woodland and a rare native Tussock grass. The stream is exposed and has a mud and sand bottom and dries up completely in dry years. There is a series of falls and it plunges into a very precipitous canyon with deep shaded pools, alders, oaks, large rocks and shingle in a few places. The stream is very different from Pauma Creek. I have marked the deep canyon part in black. It was a long 3½ miles of hiking down into the stream.

Now for the fish and they were a surprise! They are rainbows and the first impression when you see them is silvery, coarse scales, robust with very little color except greenish backs, silvery, black spots and typical parr marks on all sizes up to 11". None of the yellow nor the faint rosey, ventral shading that occurs on some of the Pauma creek fish.

They looked just like what you would expect if you dipped into an uncrowded hatchery race way and came up with healthy, vigorous 8" or 9" rainbows. They are not stocked fish obviously. There is a healthy reproducing population in about 2 miles of this stream and they look very healthy in the good stream flows we now have coming off the second year of heavy winter precipitation. My observations are superficial and we only looked at about 25 fish but they were a uniform looking lot. I noticed one other thing also, the parr marks were distinctly elongate vertically on a few that I looked closely at. We were working fast and I couldn't take a lot of time, but there you are. I wish now I had checked them all for the shape of the parr marks but didn't notice until we were nearly finished. There were fair numbers of Gambusia in the water above the falls and quite a few green sunfish Lepomis gibbosus in the deep pools with the trout.

There are some ponds on the top of the mountain which are private and are stocked with trout occasionally as well as sunfish and even L.M. Black bass. The trout as well as the others could be washed into the stream on high water. Undoubtedly that's where the sunfish came from. There is supposed to be documentation in the literature of heavy introductions of "McCloud" rainbows to these streams in 1906? but I haven't seen it. I do have a reference from Proceedings of U.S. Nat. Museum which I have mentioned to you before. It makes reference to Salmo irideus as one of three or four native species of fresh water fish known from ~~streams rising on Smith Mt.~~ Western slope of S.D. county. It was abundant apparently in 1880 ~~in~~ streams rising on Smith Mt. (Mt Palomar).

After we finished collecting specimens we were fortunate to get a lift out in a Forest Service helicopter. The rest of the group were going to spend another day checking on the lower end of the stream. I was lucky enough to get a ride out with Gary as my car was 60 miles away and I would have been stuck otherwise. The original plan was a 1 day trip which stretched to two days once they got up on the mountain. I would like to make a trip of my own in there and really look the stream over.

Gary has 22 fish and 22 blood samples, but it will take a couple of weeks to get his information. It will be interesting to see how it compares with the Pauma data. He has the 17 Pauma fish, but there is some difficulty in getting somebody to do the meristics on these samples. He said he would hopefully get it done on both lots. I have another 9 Pauma creek fish in preservative that were collected in three different lots from 1964 to 1974. The fish Gary has will go into Univ of Cal. collection. I assume you have the other 9. As far as I know those are the only specimens in existence. The original ones that Dr. Hubbs examined back in the 1930's were thrown out for some reason.

In passing Gary mentioned that they have found more differences between

some subspecies of S. clarkii than between some rainbows and red band trout and you make a similar observation on page 50 of the MS. On the face of it another complication is introduced by a technique which one would expect to give quite opposite result. I have no idea what the gene loci involved are with respect to the traits they affect so that part of the puzzle is not ~~part of the picture~~ something that can be easily observed.

I think I had better bring this to a quick close for now, but I did want to fill you in on the situation with the Mt Palomar trout. One more thing – one of the Cal Fish and Game people on the trip was John Deinstadt who is in charge of the native trout program, a different person than I wrote to originally about the Pauma creek fish. It was interesting that Sacramento has finally decided to have a look at this little area. I believe they are planning a look into Pauma creek also.

Thanks again for your thoughtful letter and the rest of the manuscript.

Sincerely,

John

P.S. Your remarks on Dr. Mason were most interesting. He used to appear in my life in most unusual ways. The first time he was brought to our home in Auckland, New Zealand by the head of the Fulbright Exchange program. It was thought I guess that we should help him become acclimatized before he went to the South Island. Actually Fulbright recipients are called upon to do many things and it was quite interesting to meet him. He tried to explain his system to me over a bottle of Whiskey into the wee hours. The next time he appeared at a course I was taking at Aspen on Plant and Animal Ecology and we renewed our aquaintance. He presented his system to the whole group under more sober circumstances and I at least understood what he was trying to do. When he was in N.Z. in 1959 he was on the very last part of his effort to rationalize the N.Z. Beeches with those of the Southern end of Chile. They apparently are nearly identical. I often wondered what happened to his system.

John Hewitson
1033 San Abella Dr.
Encinitas, CA. 92024

SAN DIEGO, CA 921
1 PM
25 JUN
1979

Dr. Robert Bchuke
Colorado State University
Dept. of Fishery and Wildlife Biology
FORT COLLINS, COLO. 80523

Lockbourn letter

W. Fk. San Luis R.

June 12, 1979

Dear Bob,

I was hoping I would hear more from Gary about the Pauma Creek trout but I haven't heard and it may be awhile. He promised in his last letter he would let me know as soon as they were finished. There is some guy there who will do the meristics and I wrote to have someone check for basibranchial teeth. I know that you found none and I have found none in the preserved specimens I have, but that is a relatively small number all together.

After I received the manuscript I sat down and read through all of it in a couple of days. I was fascinated with the information on the Cutthroat series. My knowledge of the group has always been pretty superficial having met them for the most part in an incidental way as an angler. I have taken them in the upper Bitterroot drainage on purpose and in Henry's Lake also but most other places they just happened to be where I was angling as on the West side of the Upper Roaring Fork in Colo. away from the Brook trout, the upper Gallitin, the Black Foot and other places. As a kid I caught a number from the upper Big Sur river in Calif. These were obviously Coastal Cutthroat and I can remember that they were relativily more colorful than the little rainbows I was catching which were baby steelhead, no doubt, even though that was back in about 1937. I doubt if that fishery would be so good now or if there would be any that far south. By the way the MS. as I have it goes from pg 1 — 59 then Sec. II goes from pg 1 — 43, then starts at pg 91 and goes through the Cutthroats to 172 and then Rainbow and Redbands from pg 173 — 296.

My greatest interest and concern is with the Red band and Rainbow group and in all honesty it leaves me confused. I know that you have commented on a lot of difficulties and less familiarity with the group than you have with the cutthroats so my confusion may be to some extent excusable. Actually I made myself some notes as I read and some are just questions about the taxonomy of the family Salmonidae in general. We try hard to make good clean rules to fit organisms into and we understand our rules, but organisms don't and then we are unhappy. It reminds me of a plant taxonomist I knew from Univ of Calif. by the name of Mason who was working on a system of mathematical systematics which was to solve these problems, but so far as I know his system never caught on.

I won't try to go into all the problems I have with the rainbow series because frankly I am not completely secure in my own mind just exactly where all the difficulties are, but there are a few I would like to mention and if they

are not clear after I get finished I think you will understand.

First of all I have a problem with just what we must understand a good biological species to be. A freely interbreeding group of related organisms that produce fertile off spring in the wild state is kind of nice, but then there is the question of why they are a separate group in the wild. They might be geographically isolated so that an exchange of genetic material would not be possible. Theoretically if they were isolated long enough and then were brought together with a related species there would be reproductive failure to the extent at least that there would be hybrid sterility. This doesn't always happen, I suppose because there is a broad spectrum of degree of isolation. Then we can have groups of the same species which are sympatric yet appear to maintain nearly perfect isolation yet showing virtually no taxonomic differences. They might maintain better separation than very different sorts ~~with great~~ resulting from long isolation if they are brought together. Of course sympatric species must have isolation so we find all kinds of behavioral or seasonal isolation working as strongly as geographical barriers. So far so good although I am starting to struggle a bit.

I must compare some apparently very distinct "trouts" at this point, not different species, but different genera such as Salmo and Salvelinus. No doubt that they are separate and clearly different at a level more profound than species, but ♀ Salmo trutta x ♂ Salvelinus fontinalis can produce a vigorous hybrid though one that is sterile physiologically. This can happen in the wild. OK this is a fluke they evolved a ~~continent~~ ocean apart and just happen to have some chromosome compatibility. Our western Salmo do not share this compatability either with European Salmo or our own charrs. Fair enough and with sub genera perhaps it looks a bit better, ie. Parasalmo, but by now I am distinctly distressed.

Just what differences justify different species of rainbow trout? I know you speak to this question and it is a major part of that segment, but it is still a very "fuzzy" place to be. I know that anyone can recognize a Golden trout even superficially as a very unique sort and some of its obvious traits are not environmental. There are many other shades of differences probably graduated in a diminishing way among other "rainbow trout" until the differences become so vague that we could be dealing with nothing more than individual differences. Somewhere in that last is the "nut" of what bothers me. Does the subspecies level not serve these differences better granting some very awkward spots with the extremes, ie. Salmo agua-bonito and Salmo gairdneri? I have for years been aware of finer scaled rainbows with somewhat brassier coloring and olivaceous backs as those from Rising River, CA. (upper Eel River drainage) or Henry's Fork of the Snake and Silver Creek, Idaho. One can travel only about 20 miles from Henrys fork over to the Madison drainage in the Yellowstone area and

voila, the rainbows are entirely different. They are silvery, greener on the back, somewhat coarser scaled and subtly different in other ways. I would even suggest that there is slight but noticeable difference in the head of these Snake River rainbows and I hesitate to say it but they are more cutthroat like. There are obvious reasons for this I know, but I am only stating those characters which seem to set them apart. I have seen old b/w photos of Klamath lake rainbows from early in this century and they show the configuration I am describing. Of course the Madison drainage rainbows are introduced and I suppose they were of coarse scaled "coastal" types. These are found throughout the Madison, Gallitin and lower Yellowstone. Are those of the Snake native rainbow or at least introduced from a different source? Can't Red-Band Rainbow trout that show unique adaptations say to dessicating habitats, high temperatures, high pH, and piscivorous eating habits show the same relationship to the rainbow series as Cutthroat with the same adaptations show to the Cutthroat series namely sub species? Or is there something of significance I am missing?

By this point I am looking for a way out and I feel most comfortable with a rainbow series Salmo gairdneri ssp. I know that is your comfortable ("conservative approach") position also, but there are all those nagging, "hang fires" that make a person want more. I guess there are more refinements needed than we have available, but it is fascinating. By the way it is interesting that Salmo mykiss should have preference. It would take some getting used to.

It occurs to me that some of the same problems exist with Salmo trutta in Europe. I have at hand a list sent me showing not only S. trutta trutta and fario and lacustris but quite a variety of local forms, but I will restrain myself from getting into this further other than to say that there are coarse and fine scaled etc. etc. forms and I am sure you ran into this when you were there.

If you have read this far you may be in pretty bad shape but Gary just called me from Davis and I will pass on what he told me. He could only get good chromosome information on six fish as follows:

One fish had 60
Four fish had 61
one fish had 62

The electrophoresis info from 17 fish showed 4 with unique protein (PHI-2) that they have not found in steelhead or any hatchery types studied. They have not made the collection from W. Fork San Luis Rey river just over the Mt. from Pauma Creek, but that is on for next week and I may go in with them. He hopes to make comparisons and if they are similar it should show relationships.

I think I had better close this down for now except to say that your manuscript really started me up. I found it stimulating and full of ideas, questions and a lot of the kind of thinking that I hope can stimulate

fisheries people to do some more thoughtful work. My comments are in no way negative criticism, but reflect some of my own confusion and limitations. I suspect that there are going to be some refinements and a lot of questions that can't be definitively answered all at once. I do appreciate the chance to read it and the thought processes it stimulated.

Sincerely

Jim Hewitson

P.S. I have taken two or three N.Z. rainbows with faint yellowy orange marks on their lower jaws. Not cutthroat marks with strong definition but the faint sort we sometimes see on rainbows. Oh well.

5/24/76

Bob

Many thanks for the info on European and Asian fishes. I was surprised that you trusted me with your originals but appreciated the opportunity to copy them.

We're just kicking around the possibilities of bringing in an exotic or two and don't know where it will lead. There are a number of species that appear to have potential for N. American and could be used to fill selected niches. We're going to try to collect all the pertinent info we can on several of these species and then perhaps try to get one next fall. The Russians ask for paddlefish or striped bass eggs.

Thanks again, Bob.

Take care

Jack

STATE OF WEST VIRGINIA
DEPARTMENT OF NATURAL RESOURCES
OPERATIONS CENTER
P. O. Box 67
Elkins, West Virginia. 26241

IRA S. LATIMER, Jr.

Telephone – Area 304
636-1767

October 14, 1976

Dr. Robert J. Behnke
Dept. of Fishery & Wildlife Biology
Colorado State University
Fort Collins, Colorado 80523

Dear Dr. Behnke,

I enjoyed your letter and very much appreciate the reprints relating to trout strain differences and management implications.

Your views on the preservation of wild stocks and genetic diversity were among the first to awaken me to the fact that fishery resource personnel were largely missing an area of exceptional fish management potential. Fisheries literature contains a great deal of material indicative of polytypic species diversity, but relatively little management use has been made of intraspecific differences. I am familiar with the work in California and British Columbia as it pertains to niche segregation and "stock" differentiation.

David Locke of the Maine Department of Fish and Game is in the process of trying to "catalogue" some of the strain differences among the salmonids for the Northeastern Salmonid Broadstock Committee. I can imagine what a monumental undertaking that must be, and unfortunately I have not received any material from him indicating much progress.

In working on project planning for West Virginia, it became readily evident that many fishes were available which might better suit our management needs. As a result, one of my jobs evolved into gathering data and writing project proposals for the evaluation of several promising salmonid strains and warm water fish hybrids. As of 1 July, 1976 three long-term projects were funded which will allow us to evaluate the esocid complex (northern pike, muskellunge and tiger musky), the striped bass X white bass hybrid and six trout strains for a period of up to eight years. The projects also allow lattitude for evaluating additional fishes should there be a need. We will be trial stocking the Coleman rainbow, McConaughy rainbow and Eagle Lake rainbow in our reservoirs in 1978. Salmonid stream introductions will involve a brown trout strain from Pennsylvania, a cross between our native and hatchery brook trout and attempts to transplant wild brown and rainbow trout which are established in West Virginia.

We have not begun the salmonid field work, but I am somewhat concerned over the lack of forage in our oligotrophic-mesotrophic reservoirs. Preliminary evaluation of the striped bass hybrid and the tiger musky are very encouraging, and I feel sure that these will be available to sport fishermen from now on. The strains of trout from which to choose seem almost unlimited, and I only wish we had more suitable water.

The note on the redband trout was very informative, and I'd appreciate hearing of any further management applications. I will contact Colorado Game, Fish and Parks on their work. I would expect definitive results on some of your waters.

It was good hearing from you, and I would enjoy spending some time with you should the opportunity arise.

Sincerely,

Charlie

Charles M. Heartwell
Fisheries Research Biologist

CMH/bs

STATE OF MONTANA

DEPARTMENT OF FISH AND GAME

Helena, Montana
May 23, 1975

Dr. Robert Behnke
Dept. of Fishery and Wildlife Biology
Colorado State University
Fort Collins, Colorado 80523

Dear Bob:

Thanks very much for loaning me the maps showing the sites of cutthroat locations. There are still four collections that we can not pinpoint. I have asked Hank McKirdy for information on these. If he can't give me the information, we will check back with you. Your original maps are enclosed. Also, I am sending a brand new BLM map. We had a few laying around here and I thought you might want one.

The progress on Dick Vincent's MS is slow but we still plan to have it published.

Best wishes,

George

GEORGE D. HOLTON
ASST. FISHERIES DIVISION ADMINISTRATOR

GDH/eb
Encls.

John Hewitson
1033 San Abella Dr.
Encinitas, CA. 92024

Paums Crk
Thorgzerd - ZN 60=1
61=4
62=1

4 of 17 of antigue PHI-2 protein - not found in steelhead or hatchery stocks

Dr. Robert Behnke
Dept. of Fishery and Wild Life Biology
Colorado State University
Fort Collins, Colo. 80523

SAN DIEGO, CA 921
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page missing

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Department of Fishery and Wildlife Biology

Colorado State University
Fort Collins, Colorado
80523

19 June 1979

Mr. John Hewitson
1033 San Abella Drive
Encinitas, CA 92024

Dear John:

Enclosed are pages 44-90 of the monograph. You now have the complete text. There are 16 pages of references after pg. 276.

Thank you very much for your questions and comments. These are the points in need of emphasis for the final edition. You seem to clearly comprehend the essence of the difficulties--nature and evolution can be exceeding complex and reality may often not fit into compartments devised by man striving for orderliness.

It may be helpful to conceive of phylogenetic branching through geological time. Once a branching occurs, separating one evolutionary line (common ancestor) into two evolutionary lines (and these in turn may subdivide and so on), the accumulation of genetic differences is, in general, related to the length of time since the branching point. Thus, the degree of differentiation between the present end points (living species) on the phylogeny is related to the distance in time of the branching points. For example, if the evolutionary separation leading to brown trout and Atlantic salmon on one hand and rainbow trout and cutthroat trout on the other (separation of subgenera Salmo and Parasalmo) is 10,000,000 years, and the separation of the branching point leading to cutthroat trout and rainbow trout is 1,000,000 years, then, it should be expected that the brown trout and Atlantic salmon (as a group) have 10 times the genetic differention when compared to either rainbow or cutthroat trout than does the rainbow and cutthroat compared to each other.

When two species have been separated from each other for sufficient time so that the differentiation has reached a degree causing sterility if hybridized, then there is no question regarding the validity of the species. In freshwater fishes, however, it is probably the rule rather than the exception that sterility barriers are lacking between species in the same genus. When living together (in sympatry), reproductive isolation is maintained by behavior and ecological differences.

The standard definition of a species--"a population or group of populations that actually or potentially interbreed among themselves but are reproductively isolated from other species" can not be consistently applied to species validity of salmonid fishes. This is because homing instinct allows reproductive isolation to be maintained between very closely related populations in sympatry. Some of these populations have only been separated from each other for a few thousand years. Situations

where the reproductively isolated populations are strikingly different in size or life history, such as resident rainbow, winter-run and summer-run steelhead, all living in the same river, and the "normal rainbow" and large Kamloops rainbow of Kootenay Lake, are well known. I have long suspected that sympatric, reproductively isolated populations of trout of the same species or subspecies are much more common than has been believed. Recently I examined brown trout from a Swedish Lake that represent two reproductively isolated populations and was informed of a lake in Ireland with three such populations of S. trutta that are now being detected by electrophoresis. Yet, I consider all of these as S. trutta trutta.

You are probably disturbed by my separation of "rainbow" trout into two species--one for coastal rainbow trout and one for the interior redband, Kamloops, and golden trout. Yet, I admit that I can not draw a line of demarcation between the two "species". This is an affront to our concept of species and to our mind's attempt to bring orderliness to nature. I mentioned that I would not make this drastic taxonomic revision if the monograph was a formal publication. I wanted to emphasize the tremendous diversity present in the trout we have called the rainbow trout and to facilitate the testing of my hypothesis that this diversity is associated with a major branching of evolutionare lines from a common ancestor (after branching from the primitive cutthroat trout line), one line leading to the interior redband trout and one line leading to the coastal rainbow trout. In twin, each line has subdivided into numerous diverse forms.

I do know that there is tremendous diversity among "rainbow" trout, but I do not know with much confidence, that my interpretation of that diversity as two, major evolutionary groups--an interior redband trout and a coastal rainbow trout, is the most correct interpretation or an accurate reflection of evolutionary reality.

It is more important to attain a more authoratative phylogeny of "rainbow" trout than to worry if one, two, or more species should be recognized. Your observations on distinctive appearing rainbow trout from the Pit River drainage and Silver Creek, Idaho (Wood R. system, trib. to Snake R.) are actually in reference to redband trout, as you'll note in the monograph. The Henry's Fork rainbows, however, are not native. The Henry's Fork enters the Snake River above Shoshone Falls and only cutthroat trout are native. It is likely, however, that the Henry's Fork rainbows were largely derived from Salmon or Clearwater river steelhead, which is a redband trout.

I wonder if the polymorphism in the chromosomes of Pauma Creek trout is natural or influenced by hatchery introductions? I suspect close relationships might exist between Pauma Creek trout and the Baja California rainbow of the Santo Domingo River. Let me know the results of the trip to collect specimens from the W. Fork San Luis Rey River.

The botanist, Herbert Mason, spent many summers at the University of California's trout research station on Sagehen Creek, where I got to know him. As you remember, Mason found it difficult to live with the inadequacies of our stnadard system of binomial nomenclature to accurately denote the nuances of genetic relationships and developed his own system

of classification based on the set theory of numbers. Making all specimens fit into preconceived units, pigeon holing them into a classification system, once occupied much of my time. I have learned to live with the fact that this is just not feasible with salmonid fishes and that large gray areas and unknowns will always exist.

Please send further comments and any corrections to errors you may come across. I can not make taxonomic complexities simple, I can only hope to make them understandable, and I'll try to improve on that point in my final revision.

Sincerely,

Robert Behnke

RJB:kle

Enclosure

Aug. 6, 1979

Dear Bob,

Your letter was here when I got back from my trip to Montana as was the note from Gary and the summary of his findings. I dont know if he sent you a copy yet, but I am enclosing one because I want to be sure you have a chance to look it over and I would like your interpretation. As you can see he mentions a reference to the stocking of Klamath river rainbows in Fanna creek before the turn of the century. Before Copco dam were there small scaled (Red band) Steelhead in the Klamath? He did not give the reference and I have asked him for it.

It is interesting that what to me was a quite obvious difference in the external look of the two populations turns out to have some confirmation in Gary's lab analysis. I mentioned the color and marking differences before.

Now to my trip, I fished many of my usual places, but due to a stimulated interest in Cutthroat I decided to go up to the Buffalo Ford below the lake and have a look at the pure Yellowstone Cutthroat and it was a revelation on more than one level. From a purely taxonomic standpoint they looked unlike any others I have ever caught including Henrys lake, but of course these were in the river and may have had spawning colors remaining. I caught a great many and most were around 17" so I observed a good sample. Their ground color was "coppery" to almost mahogany, very dark, with garish crimson to almost Chinese red pectoral and pelvic fins. The cutthroat mark was very pronounced! Spotting was variable but predominantly fore and aft. I took pictures of variations but I have not got them yet so will refrain from further comment just now on spotting. I was also impressed with the number that stood out clearly in the gin clear water very poorly protected by any sort of cryptic coloration. Others were nearly invisible swimming only a few feet away from me.

They did swim close too although none bumped into my legs as I had been warned they would do. I crossed the river, carefully, and found several groups of biggish fish from which I was able to take a number of specimens all around 17" to 18". I think I caught over 30 altogether. I did not go back to fish again because it did get a little boring and most of them were not very exciting to catch, but it was a truly amazing experience and I am impressed with what a few years of careful management and not killing any of these fish can do. It was an experience!!!

I reread your section on Salmo clarki bouvieri before I wrote this letter and I note you mentioned the Park's idea to use larger trout in the lake to control suckers. It looks like you believe they may be predatory (Pisciverous) enough to make an impact. Have any studies been made on bigger fish in the lake to evaluate their feeding habits in this respect?

Just before going to the Park I had caught 6 or 7 Salmo clarkii lewisi in the upper Blackfoot river, one about 14" and another 15" and they were certainly vastly different. Those in the Bitteroot (upper) are more heavily spotted and may be hybrids to a greater extent. This was the first time I had ever even seen the upper Yellowstone in 31 years. I had caught two or three cutthroats far downstream towards Livingston in past years

Your controversy with Nevada Fish & Game sounds interesting. It reminds me of a some what acrimonious debate I got into with Stochel in New Zealand years ago and it happened quite innocently, but I had touched a nerve which had been rubbed raw between he and K.R. Allen and I got a "rocket" for my troubles.

I don't know what the American Sportsmen's Club is, but I have never seen much evidence that Nevada was doing very much serious work with their fisheries. Perhaps they have been stimulated to do something worthwhile now. Did the American Sportsmans Club ever get their lease?

All The Best,

John Hewitson

Gary Thorgaard

Chromosome results

Chromosome counts could be made on 6 of the Pauma Creek samples, and on 9 of the W. Fk. San Luis Rey samples. These results, and those for rainbow trout from other locations throughout the species range, are provided in the attached table.

Both the Pauma Creek and West Fork populations were typical of coastal California populations in having fish with more than 60 chromosomes. There were no fish with more than 60 chromosomes sampled in this study anywhere outside California.

The question of whether the Pauma Creek and West Fork populations are native to the region is difficult to answer, and depends on what type of introductions might have been made into the streams. The low frequency of fish with more than 60 chromosomes from the upper Sacramento and Pit regions (see table, these conclusions are also supported by other studies on hatchery rainbow trout, which came from that area) suggests that Pauma Creek, and especially West Fork, probably didn't result solely from plants from those regions. West Fork was believed to have been planted with Pit River fish from the Sisson hatchery in the 1890's (Larry Bottroff, personal communication) and the chromosome results suggest that , although this could have had some impact, the fish there now aren't predominantly of that origin. Pauma Creek was planted with Klamath River steelhead from the Sisson hatchery in 1893 or 1894 (came across this reference recently), and has had hatchery rainbows planted in the headwaters. The lower chromosome numbers observed here are more like those from the northern California coast and the upper Sacramento system than like those of the nearest coastal steelhead I've counted (Fall Cr., which is a San Lorenzo R. tributary, and the Gualala R.).

Trout were present in the Mt. Palomar region at least as early as 1880, and it seems likely that they were native to the region. Based on the chromosome results, the West Fork population seems to predominantly like some other coastal California rainbows, and may well be made up, at least for the most part, of native rainbow to the region. This assumes that no unknown plants of rainbows from elsewhere on the California coast were made historically.

The Pauma Creek population might also contain some genetic background from native S. California rainbows, but seems more likely to be of an introduced (Klamath?) or hybrid origin on the basis of the history of the plants and the lower (60-62) chromosome numbers in this population.

Population	Hatchery (H) or Wild (W)	Type[t]	No. of Fish With Chromosome No. 58	59	60	61	62	63	64	3n
(Coastal Populations)										
arluk R., Alaska (1)	W	FS	10							
aha R., Alaska (2)	W	FS	7							
eogh R., B. C. (3)	W	WS		1						
ig Qualicum R., B.C. (4)	H	WS			7					
hambers Cr., Washington (5)	H*	WS		3	3					
" " "	"	"		7	9					
uinault R., Washington (6)	W	SS	8							
" " "	W	WS	12	1						
owlitz R., Washington (7)	H*	WS		3						
" "	"	"	10	13	3					
" "	H*	SS	2							
" "	"	"	5	1						
" "	H	LWS	23							
ashougal R., Washington (8)	H*	SS	9							
ig Cr., Oregon (9)	H	WS	20	1						
iletz R., Oregon (10)	H	SS	4							
lsea R., Oregon (11)	H	WS	2	1						
. Umpqua R., Oregon (12)	H	SS	10							
ogue R., Oregon (13)	H	SS	2	6	5					
" "	H	WS		2	3					
ilbert Cr., California (14)	W	WS(?)		2						
utte Cr., California (15)	W	R	4							
ad R., California (16)	H*	WS			1	3	1	1		1
" "	"	"				1			4	
ualala R., California (17)	W	WS							4	
all Cr., California (18)	W	WS							2	
auma Cr., California (19)	W*	R			1	4	1			
. Fk. San Luis Rey R., Calif. (20)	W*	R				1	3	2	3	
(Interior Populations)										
oon Lk., B.C. (21)	W	R	5							
olumbia R., Washington (Wells Dam) (22)	H*	SS	14	1	1					
nake R., Washington (Little Goose Dam)(23)	H*	SS	6							
learwater R., Idaho (24)	H	SS	2							
(Upper Sacramento Populations)										
it R., California (25)	H	R	4							2
cGill Cr., California (26)	W	R		3	3					
oosehead Cr., California (27)	W	R	5							
.F. Little Squaw Cr., California (28)	W	R			5					
attle Cr., California (29)	H*	FS		3	2	1				

* Indicates possible mixed origin of sample.

[t] Types FS fall-run steelhead
WS winter-run steelhead
LWS late winter steelhead
SS summer-run steelhead
R resident rainbow

POPULATION

		W. Fk. San Luis Rey n=22	Pauma Creek n=17	Gualala R. steelhead	San Lorenzo R. steelhead	Shasta Hatch. rb.	Hot Cr. Hatch. rb.	N. Fk Little Squaw
FREQUENCIES OF PROTEIN TYPES	IDH 60	.214	.059	.417	.342	.128	.127	.182
	100	-	-	-	.017	.103	.173	.351
	140	.786	.941	.566	.617	.744	.699	.459
	160	-	-	.018	.025	.024	.001	.007
	SOD 85	.115	-	.053	-	-	-	.013
	100	.862	.912	.885	1.000	.705	-	.973
	140	.023	.088	.062	-	.295	1.000	.013
	PGM 85	.341	.088	.299	.258	.08	.316	.286
	100	.659	.912	.684	.742	.920	.684	.716
	115	-	-	.018	-	-	-	-
	MDH 3,4 75	-	.103	.062	.274	-	-	-
	85	-	.103	.114	.033	.085	.001	-
	100	1.000	.794	.825	.685	.915	.999	1.000
	120	-	-	-	.008	-	-	-
	PGI-1 14	-	-	-	.025	-	-	-
	100	1.000	1.000	1.000	.975	1.000	1.000	1.000
	PGI-2 100	1.000	.882	1.000	1.000	1.000	1.000	1.000
	FAST	-	.118	-	-	-	-	-
	PGI-3 70	.069	-	-	-	-	-	-
	85	.046	.029	-	.041	-	-	-
	100	.770	.971	1.000	.951	1.000	1.000	1.000
	115	.115	-	-	.008	-	-	-
	LDH-4 80	-	-	.070	.105	NO DATA	NO DATA	-
	100	1.000	1.000	.930	.895			1.000

Abbreviations: IDH, Isocitrate dehydogenase, SOD, Superoxide dismutase, PGM, phosphoglucomutase, MDH, malate dehydrogenase, PHI, phosphoglucose isomerase, LDH, lactate dehydrogenase. The different alleles for the different protein systems are designated according to their relative mobility, with the most common type designated as 100. Exception IDH 140

It is interesting to note that, with one exception, the same allele for each locus is the most common allele in all the populations. (The exception is the high frequency of the SOD-140 allele in the Hot Cr. hatchery population.)

It's hard to draw any definite conclusions from the data. Pauma Creek and the West Fork San Luis Rey are clearly quite different from each other at several systems: MDH, PGI*2, and PGI-3, suggesting they may not be closely related (one might have been an introduced or heavily hybridized population, or perhaps there just wasn't much migration between them). The West Fork is unique among the populations in having the PGI-3 70 allele, while Pauma Creek is unique in having the fast PGI-2 allele.

Comparisons are provided with two steelhead populations from further north along the California coast, with two California hatchery rainbow strains which probably originated predominantly from McCloud River rainbow, and with one native rainbow trout population (N. Fk. Little Squaw Cr.) from a stream in the upper Sacramento system.

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Thorgaards chromosome + thanx results - met Gary in Mt.
- Yellowstone L. predation -
=
Amer. Sgt. Club - lawsuit - we won.

Gary Thorgaards data

Dr. Robert Behnke — chromosomes
— gene loci

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